The Later Stone Age and Iron Age in the Southern Highlands of Tanzania: An Examination of Interaction and Material Culture

by

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Abstract

In this dissertation, I examine the relationships that emerged when Later Stone Age (LSA) hunter-gatherers and Iron Age (IA) agropastoralists met for the first time in the Southern Highlands of Tanzania. Specifically, the study aims at testing a prolonged scholarly debate: if during IA expansion there was displacement or absorption of autochthonous LSA hunter-gatherers or not? What timeframe that demarcates the IA from LSA in the Southern Highlands of Tanzania? The study also aimed at testing if the intermediate culture referred as the Pastoral Neolithic (PN) existed in the Southern Highlands of Tanzania or not? It also examined the Iron Age period and its material culture specifically ceramics in order to understand ceramic traditions, chronology, classifications (Early and Later Iron Ages), the distribution (intra/interregional interactions) and if the prehistoric IA ceramic production can be linked to the contemporary ethnic groups in the study area. The study employed primary and secondary data generated from archaeological survey, excavation, reviews of the museum collections, desktop reviews, and ethnographic interviews to address the above raised issues for both cultural periods. Using the Iringa Region as a point of reference, the current study considers that the timeframe that demarcates IA from LSA is between 36,881 BC and 168 BC. The PN culture is not chronologically supported by the dated samples, however, ceramic evidence collected by previous scholar indicates the presence of Narosura PN ceramics. It came to the conclusion that despite of contact between LSA and IA people around 168 BC, LSA tools and other behavior continued practiced together with IA until Later Iron Age (LIA)/historic period in the study area. In other word, the LSA people were integrated into IA cultures through acculturation or demic diffusion. Various IA traditions have been recorded by this study ranging from Early Iron Age (EIA) 168 BC to LIA 1277 AD and above. Such traditions align with others within and beyond the region signifying the knowledge flow through trade, intermarriages, and technological transfer. The ethnographic data generated from ceramics has indicated the continuity and discontinuity of some technology in the contemporary ethnic groups/individuals as well as developed unique technologies that differentiate one ethnic group from another despite of shared some traits.

Dedication

This dissertation is dedicated to my lovely father Ta Philemon Katto and Ma Edith Kokuletage for their commitment on my education journey. It is also dedicated by my family including my wife Jovina and my beloved daughters, Pamela K. Katto and Philberta K. Katto.

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List of Abbreviations and Acronyms

AD - Anno Domini

ABSC - Animal Body Size Class

AGES - Alberta Graduate Excellence Scholarship

AMGC - African Minerals and Geosciences Centre

BIEA - British Institute in East Africa

BC - Before Christ

BP - Before Present

COSTECH - Commission on Science and Technology

DNA - Deoxyribonucleic Acid

DP - Datum Point

DOA - Director of the Antiquities Division

DoAHS - Department of Archaeology and Heritage Studies, University of Dar es Salaam

EARVS - East African Rift Valley System

EIA - Early Iron Age

EIA - Environmental Impact Assessment

EIW - Early Irom Working

ESA - Early Stone Age

FGSR - Faculty of Graduate Studies and Research, University of Alberta

GPRS - Geographically Projected Reference System

GSA - Graduate Student Association, University of Alberta

GSES - Graduate Student Engagement Scholarship

IA - Iron Age

IAPM - Iron Age Package Model

IDS - Institute of Development Studies, University of Dar es Salaam

IRAP - Iringa Region Archaeological Project

ITCZ - Inter-Tropical Convergence Zone

KHPP - Kihansi Hydroelectric Power Project

LGM - Last Glacial Maximum

LDB - Lunsemfwa Drainage Basin of Zambia

LIA - Later Iron Age

LIW - Later Iron Working

LSA - Later Stone Age

LSS - Land Snail Shell

MAU - Minimum Number of Animal Units

MCT - Material Culture Theory

MEZR - Meteorological Equator Zone Range

MG-Magubike site

MLS-Mlambalasi site

MNE - Minimum Number of Elements

MNI - Minimum Number of Individuals

MSA - Middle Stone Age

NISP - Number of Identified Specimens

NP - Neck Punctating

NMT - National Museums of Tanzania

OES - Ostrich Eggshells

ORAU - Oxford Radiocarbon Accelerator Unit

PA - Petrographic Analysis

PCC - Ceramics Chronological Classification

PIW - Pre-Iron Working

PN - Pastoral Neolithic

PW - Plain Ware

REB - Research Ethics Board

RGM - Rodent Gnaw Marks

SASES - Standard African Site Enumeration System

SSHRC - Social Sciences and Humanities Research Council

SNPs - Single Nucleotide Polymorphisms

SW - Swahili Ware

STPs - Shovel test pits

SUA - Sokoine University of Agriculture

TP - Test Pit

TIW - Triangular Incised Ware

TRG - Thematic Research Grant

UDSM - University of Dar es Salaam

URT - United Republic of Tanzania

XRD - X-Ray Diffraction

CHAPTER 1: RESEARCH PROBLEM AND ITS CONTEXT

1.1 Introduction

The term Iron Age (IA) can be defined as the third stage in prehistory that was proceeded by the Bronze and Stone Ages (Wells 2011). Contrary to Eurasia, in sub-Saharan Africa the IA emerged after the Later Stone Age (LSA) or Pastoral Neolithic period (PN) because the Bronze Age didn't exist in most parts of the continent (Mapunda 2002; Alpern 2005; Killick 2009, 2015; Holl 2020). In sub-Saharan Africa, it has almost been six decades since scholars started to study the IA (Posnansky 1968; Sutton 1994-5; Ashley 2010). The focus has been trying to answer questions of the origin, technology, chronology, distribution, and outcomes of iron production in Africa (Schmidt 1997; Alpern 2005; Killick 2009, 2015; Holl 2020; Mapunda 2010; Lyaya 2013; Iles 2017). The IA in that part of Africa has also been associated with the spread of agriculture, and the replacement or absorption of autochthonous Later Stone Age (LSA) hunter-gatherers (Phillipson 1993, 2005; Diamond and Bellwood 2003; Skoglund et al. 2017). In eastern and south-central Africa, iron working is said to be introduced by the Bantu-agropastoralists communities who trace their origin to modern Cameroon in West Africa (de Filippo et al. 2012; Bostoen 2018; Lipson et al. 2020; Prendergast 2022; Fortes-Lima et al. 2024). Despite the many studies about the IA / Bantu migration, some issues are still not resolved. What happened when Bantu-agropastoralists met LSA hunter-gatherers for the first time? What characterizes IA-Bantu traditions? When, where, and how IA related activities spread in sub-Saharan Africa? What about the issue of plant and animal domestication in relation to Bantu people? These questions have remained important and are discussed by archaeologists, historians, and linguists. The intent of this study, which focused in Southern Highlands of Tanzania, was to expand further knowledge on this debate by focusing on the relationship between LSA hunter-gatherers and IA agropastoralists and the material culture characterization. The study also focused on the Pastoral Neolithic (PN) period/cultures as the intermediate period between the LSA and IA periods.

1.2 Background to the Study

The data for my doctoral research was taken from archaeological evidence of late Pleistocene and early Holocene LSA hunter-gatherers and IA-agropastoralists in the Southern Highlands of Tanzania. The study also focused on the PN cultures (if any) in the Southern Highlands of Tanzania and find out if the culture relates with those already reported in other parts of eastern Africa (Odner 1972; Chami 2001b; Chami and Kwekason 2003; Prendergast et al. 2013, 2014, 2021; Grillo et al. 2018, 2020 a, b; Ombori 2021; Fitton et al. 2022). In eastern Africa the PN cultures occur immediately after the LSA and followed by the IA cultures due to Bantu expansion (*ibid*.). The PN cultures have been located in East Africa mainly central and southern Kenya and northern Tanzania (ca. 5000-1200 BP) not the southern corridor for the reasons provided in section 1.6 for hypothesis III and 2.4 for more details about PN (Grillo et al. 2018, 2020a, b; Prendergast et al. 2019; Goldstein 2021; Ombori 2021; Robertshaw 2021; Fitton et al. 2022). Talking about IA cultures the current theory, deeply rooted in linguistic, genetic, and archaeological evidence, suggests that the Bantu language family developed over successive generations in the Nigeria-Cameroon border region around 4,000 years ago (Phillipson 1977; Vansina 1990; Chami 1999; Kessy 2005; Russell and Steele, 2009; Mapunda 2008, 2010; de Filippo et al. 2012; Currie et al. 2013; Russell et al. 2014; Grollemund et al. 2015; Ashley and Grillo 2015; Nielsen et al. 2017; Bostoen 2018; Crowther et al. 2018; Semo et al. 2020; Prendergast et al. 2019; Prendergast 2022; Fortes-Lima et al. 2024). From there, the Bantu speakers dispersed and occupied the Congo rainforest before spreading out to the rest of the subcontinent (see section 2.8 discussing the routes for Bantu expansion), and these groups are thus associated with the spread of agriculture and iron working technology into various parts of sub-Saharan Africa (*ibid*.).

Some earlier and recent scholars (Huffman 1970; Phillipson 1976a; Collett 1982; Landers and Steele 2009; Ashley 2010, 2013; Crowther et al. 2018; Bostoen 2018; Fredriksen 2023), maintain that one of the major preoccupations of those dealing with the archaeology of the Early Ironworking (EIW) period was to try to explain how the tradition spread throughout sub-Saharan Africa. Their explanation has been predicated on the theory of population movement. It is believed by most scholars (Johnston 1913; van der Merwe 1980; Pilgram et al. 1990; Phillipson 1993, 2005; Diamond and Bellwood 2003; Skoglund et al. 2017) that members of Bantu communities migrated from their ancestral land to central, eastern, and southern Africa replacing the LSA hunter-gatherer communities that they met. They did this by imparting their technology, language and/or transforming foragers to their own farming economy and sedentary lifestyle (van der Merwe 1980; Phillipson 1983, 1993; Diamond and Bellwood 2003). Phillipson (1993:7) maintains that "there is good evidence that the Bantu-speaking peoples have expanded from a north-western area into the sub-equatorial latitudes during the course of the few last thousand years. In significant parts of this region these populations replaced or absorbed people who spoke languages of the Khoisan family, such as still survive in the south-western most parts of the continent." (see also Skoglund et al. 2017:59).

Another concern of scholars working on the IA in Africa is to answer questions related to the origin, chronology, and the models/routes for the spread of iron technology (Mapunda 2002; Alpern 2005; Killick 2009, 2015; Iles 2017; Chirikure 2018; Holl 2020). In Chapter 2 (section 2.7) I explain the origin and model of spread/dispersal of iron working in sub-Saharan Africa. For example, while it is suggested that the spread of iron working in sub-Saharan Africa was associated with the Bantu migration from West Africa, at the same time there are some areas in East Africa (for example in Rwanda and Burundi) that show evidence of iron working dating to around 3,500-2,800 years ago (see van Grunderbeek 1992; Mapunda 2002; Craddock et al. 2007; Killick 2009). The same issue is seen in the Katuruka iron working site in Buhaya along Lake Victoria. That site dates to the sixth century BC (Schmidt 1997; Killick 2009; Clist 2017); close in age to the Taruga iron working site in the high savanna of northern Nigeria (Van der Merwe 1980). Based on such closer dates and wider distance the debates about independent or diffusion of technology emerge (section 2.7). Despite the earlier debates it is still agreed that that the iron technology practiced in eastern, central, and southern Africa was independently invented in West Africa and subsequently spread to the other parts of sub-Saharan Africa by Bantu-speaking people (Mapunda 2010; Lyaya 2013).

The identification of IA communities is another area of interest (Mapunda 2002; Kessy 2005; Russell and Steele, 2009; de Filippo 2012; Currie et al. 2013; Russell et al. 2014; Grollemund et al. 2015). Determining this identity has been related to what referred as the "Iron Age Package Model" (IAPM). The IAPM contains iron working technology, ceramics, and agriculture, domestication of cattle, goat and sheep, house structure made of mud and wattle (Soper 1971b; Hall 1990; Phillipson 1993; Mapunda 2002; Lander and Russell 2018; Crowther et al. 2018). For a long time, this model has been used by researchers as a tool for Bantu identity apart from being challenged by some scholars (Mapunda 2002; Lander and Russell 2018; Crowther et al. 2018). For example, data from both archaeology and linguistics show that the Bantu package itself was not as tightly packed as once thought, with traits such as iron-working and cereal agriculture only being acquired after these groups left their homeland, as part of a multi-phase process (Ehret 1998; de Maret 2013). Linguistic data now suggest that Bantu-speaking agriculturalists obtained sorghum and pearl millet and possibly iron-working from Nilotic-speaking groups in the northern Great Lakes/southern Sudan region before dispersing southwards and eastwards towards the Indian Ocean coast (Ehret 1998; Bostoen 2006-07, 2018). Additionally, Mapunda (2002) maintains that the model takes the easier components of the package and makes the whole Bantu history similar with no differences. The model considers that all iron working objects found in a certain context were made by people of the same origin, language, and domestication. Moreover, people have been judging the presence of Bantu at a certain geographical area even on the expense of one side of evidence, for example, pottery (*ibid*.).

The issue of the Bantu as agents for the spread of agriculture in eastern and southern Africa has been also criticized (Chami and Kwekason 2003; Fuller and Boivin 2009; Fuller et al. 2011; Crowther et al. 2018). Based on archaeological evidence retrieved in some sites along the coast of Tanzania, its immediate hinterland, and the deep-sea islands of Zanzibar and Mafia, it was suggested that those areas were settled by people who had knowledge of agriculture and pottery making probably from 3,000 BC (*ibid*.). Some studies (Fuller and Boivin 2009; Fuller et al. 2011; Crowther et al. 2018) suggests that a variety of biological species, including a range of domesticates around the Indian Ocean were introduced from Asia instead of brough by IA agropastoralists. Thus, there is a very complex scenario of farming arrivals on the eastern African coast (Crowther et al. 2018:108). According to Chami and Kwekason (2003), the introduction of iron technology and beveled/fluted pottery, usually associated with Bantu speakers, was just another stage in the cultural evolution of people of eastern and southern Africa, but not the beginning of settled, farming/domesticating communities. Chami and Kwekason (2003) suggest that the contact between LSA with other cultures did not start during the EIA; rather there were other early contacts/transformation to other cultures, mainly the PN (Kessy 2005:71). Therefore, apart from focusing on LSA and IA interaction, this study was also interested to find out if PN cultures existed in Southern Highlands of Tanzania prior EIA contacts and how it is connected to other parts of the country where the PN cultures dominated.

The forces or factors which could have caused the Iron Age Bantu migrations have also been proposed by some scholars (Oliver 1966; Huffman 1970; Collett 1982; Chami 1999; Mapunda 2002; Bostoen 2018). According to Bostoen (2018), the driving forces behind what is the principal linguistic, cultural, and demographic process in Late Holocene Africa are still a matter of debate, but it is increasingly accepted that the climate-induced destruction of the rainforest in West Central Africa around 2,500 years ago gave a boost to the Bantu Expansion. The earlier scholars have also provided the factors that would have caused Bantu migration. One idea is that population growth and social stress at the nucleus was the main cause (Oliver 1966; Huffman 1970; Collett 1982). This model is known as "cataclysmic discontinuous-spread" (Collett 1982). The second position, advocated by Soper (1971b, 1982) considers the growth of population at the center exceeded carrying capacity of the land as the main cause. According to him, such growth would necessitate community fission, pushing some people to the adjacent unoccupied areas. This model is known as "continuous wave-of-advance" (Collett 1982). Chami (1999) maintains that the strength of the first model lies in its ability to explain how the spread of the EIW tradition took about 300 years to go 3,000 km from the interlacustrine region to South Africa. This is contrary to the second model in which computer simulations found that, in order for it to work, it would have taken the EIW people a millennium to cover that distance - a time period long enough to make the material culture at the final destination quite different from that of the nucleus area. However, the strength of this model is that it lies in the pottery analytical attributes which have established variants within the EIW traditions, for example Urewe, Lelesu, Kwale, Matola, Nkope and Kapwiribwe. (For descriptions of these traditions, see Chapter 2 section 2.3; Appendix II). This forms the strength of this model (Phillipson 1993; Chami 1999).

Finally, the issue regarding the contact situation/relationship between LSA hunter-gatherers and IA agropastoralists has been a concern (Phillipson 1993, 2005; Denbow 1999; Kusimba, 2003; Kusimba and Kusimba, 2005; Kusimba 2005; Kessy 2005, 2013; Lane et al. 2007; Siiri€ainen et al. 2009; Prendergast 2008, 2010; Ashley 2010; Skoglund et al. 2017; Crowther et al. 2018; Prendergast et al. 2019; Lipson et al. 2020; see Section Chapter 2: 2.11). This issue is explained by various emerged competing theories/models whereby scholars are working to prove their efficacies (*ibid*.). Such models/theories include: demic expansion and population replacement/displacement, an assimilation/absorption, demic diffusion/acculturations/adoption, and cultural diffusion (Lwango-Lunyiigo 1977; Gramly 1978; van der Merwe 1980; Phillipson 1993; Vansina 1995; Chami 2001; Ehret 2001; Robertson and Bradley 2000; Diamond and Bellwood 2003; Kessy 2005, 2013; Patin et al. 2014; Skogland et al. 2017; Prendergast et al. 2019; Prendergast 2022; Fortes-Lima et al. 2024; see Chapter 2 sub-section 2.6.2 for elaboration of those theories).

In Tanzania the earliest IA evidence comes from west of Lake Victoria and dates to around the middle of the last millennium BC (Schmidt 1997; Ashley 2005, 2010, 2013; Ashley and Grillo 2015). By considering chronology, material culture, and other related lines of evidence, various scholars (Soper 1967a, 1967b; Odner 1971; Schmidt 1997, 1981; Mapunda 1995, 2008, 2010; Chami 1999; Msemwa 2001; Kessy 2005, 2013; Lyaya 2012, 2013; Lyaya and Mapunda 2014) have tried to reveal various issues related to the IA in Tanzania. That technology has been divided into two phases, namely EIA and Later Iron Age (LIA; see also

Chapter 2 section 2.3 for the elaboration). The first phase covers the period between 500 BC and 1,000 AD (Chami 1994, 2001; Lyaya and Mapunda 2014; Ashley 2010, 2013; Lander and Russell 2018). LIA covers the period between 1,500 AD and 1,950 AD and it has received less archaeological research compared to EIA period (Lyaya and Mapunda 2014). Chronologically, archaeological sites with EIA technology in Tanzania include Rugomora Mahe, KM2, and KM3 in the Kagera region; Limbo, Kwale, and Mwangia in the Coast Region; Dakawa in the Morogoro region; Ntuha in the Mbinga, Ruvuma Region; Usambara Mountains; and Magubike in Iringa Region (Chami 2001; Lyaya and Mapunda 2014). The LIA sites are found almost every region (*ibid*.).

Despite of such distribution and diversity of IA archaeological evidence across the country, still some areas particularly the Southern Highlands of Tanzania has received less attention notwithstanding of its archaeological potential (Mapunda 2008; Willoughby 2012; Lyaya 2013; Biittner et al. 2017; Katto and Willoughby 2021). The area has yielded archaeological evidence spanning from the Early Stone Age to Iron Age and recent time (Msemwa 2001; Biittner et al. 2007; Willoughby 2012; Miller et al. 2020). Various archaeological studies have been conducted in that region with different thematic and temporal focuses. For example, while some scholars (Willoughby 2007, 2012; Biittner et al. 2007, 2011; Bushozi 2011; Masele 2017) have focused on lithic technology and ancient hominin behavior, little has been reported on Pastoral Neolithic (Msemwa 2001:43). In turn, while most Iron Age researchers (Mapunda 1995, 2003, 2010; Mapunda and Lyaya 2009; Lyaya 2012, 2013) have focused mainly on the technology of metal production and use. This has left little understanding on some important issues such as the LSA versus IA interaction situation and others matters regarding to intra/inter regional interaction, distribution and ethnic identities/affiliation based on material culture. Due to such research gap, general issues about the mentioned cultures become less connected or understood as far as the country or entire region is concerned. It is against this background the study intended to address such important issues in the Southern Highlands of Tanzania.

1.3 Statement of the Problem

Despite over 80 years of archaeological research in Tanzania, some areas and themes remain less studied or covered (Mturi 1998; Masao 2005; Phillipson 2005:212; Biittner et al. 2017). A good example is the Southern Highlands of Tanzania, which has received less archaeological research compared to other regions (Lyaya 2013; Biittner et al. 2017). Such uneven research is evidenced not only on other themes but also to the nature of PN and Iron Age cultures elsewhere in the country (Masao 2005; see also Phillipson 2005:212). Although archaeological research on the Iron Age in the Southern Highlands of Tanzania has been carried out by scholars (Mapunda 1995, 2008, 2010; Msemwa 2001; Lyaya and Mapunda 2009; Lyaya, 2012, 2013), most of them have been focusing on metallurgical/technological point of view. This has left some important aspects such as the relationship between the LSA-hunter-gatherers versus IA farmers, traditions, distributions (regional interactions), and ethnic/identity/affiliations. These issues are important for broader understanding of LSA, PN, and IA issues in Tanzania, and this is what this study intended to address.

1.4 Research Objectives

1.4.1. Main objective

The main objective of this study was to examine the relationships that emerged when LSA hunter-gatherers and IA agropastoralists met for the first time. The study also aimed at examining whether or not the PN culture existed in the Southern Highlands of Tanzania. Both possible PN and IA material cultures were examined using evidence from cultural traditions, geographic distribution (intra/interregional interaction). IA pottery was further compared to the contemporary produced ceramics in the study area in order to determine if there are affiliations to different ethnic groups that could tell us about cultural continuity or discontinuity over time.

1.4.2. Specific objectives

The specific objectives of this study were:

1. To establish the stratigraphic layer/chronology that demarcates/separates the LSA, PN (if any) and IA in the Southern Highlands of Tanzania. Based on the law of superposition, the stratigraphic layers were carefully recorded while considering the chronology and material culture.
2. To analyze and select a proper model (s) (from the existed models see Chapter 2 sub-section 2.6.2) in order to explain the contact situation of LSA and IA in the study area and to come up with a wider comparison from other studies in the country and other parts of eastern and south-central Africa (e.g., Musonda 1987; Lane et al. 2007; Kessy 2005, 2013; Kusimba 2005; Crowther et al. 2018).
3. To characterize the archaeological evidence of LSA hunter-gatherers, IA agropastoralists and PN (if any) in the study area and determine the traditions, distribution (intra/interregional interactions/connections) and ethnic identities/affiliations. The focus was on IA material culture, mainly pottery. The PN material culture (if any) was to be compared with other evidence reported in the country especially along the Indian Ocean coast and its islands (Chami 2001b, 2009; Kwekason 2011; Chami and Kwekason 2003)

and northern part (Ordner 1971, 1972; Mturi 1986; Bower 1991; Prendergast et al. 2013, 2014, 2021; Grillo et al. 2018, 2020 a; Ombori 2021). Such evidence intended to contribute to the knowledge on the debate over the origin of domestication in eastern and southern Africa and the issue of migration and interactions in the prehistoric times.

4. To situate the results of this study to the broader understanding of anthropological models with regards to the issue of migration and interaction over time and space. From a thorough reviews of various literature, I intended to examine how the current study fits to other global anthropological research that have addressed the issue of migration, trade and interactions over time and space.

My study used a mixed approach of both quantitative and qualitative (Chapter 4) and therefore, hypotheses were used for a quantitative part of the study particularly to address the research objective 1, 2, and to test if the PN cultures exist in the Southern Highlands of Tanzania or not in the objective 3. The qualitative part uses the research questions to address the research objectives 3 and 4. While making a clarification on a mixed research design Creswell (2009:138) maintains that "a strong mixed methods study should start with a mixed methods research question, to shape the methods and the overall design of a study. Because a mixed methods study relies on neither quantitative nor qualitative research alone, some combination of the two provides the best information for the research questions and hypotheses. To be considered are what types of questions should be presented and when and what information is most needed to convey the nature of the study."

1.5 Research Questions

The qualitative part of this study was guided by the following research questions:

1. What characterizes the archaeological evidence of LSA hunter-gatherers and IA agropastoralists (Bantu people) in the Southern Highlands of Tanzania during the Late Pleistocene and Holocene periods?
2. How does IA evidence inform issues such traditions, interactions, and ethnic identities/affiliations (in relation to contemporary IA working related communities in the region)?
3. How does the data from Southern Highlands of Tanzania contribute to broader understanding of anthropological research on migration and interaction over time and space? In other words, does the data from Southern Highlands of Tanzania align/not with other global anthropological research which have focused on prehistoric and historic migrations and interactions over time and space?

1.6 Hypotheses and Test Expectations

According to Creswell (2009), if hypotheses are used, there are two forms: null and alternative. A null hypothesis represents the traditional approach: it makes a prediction that in the general population, no relationship or no significant difference exists between groups on a variable. The alternative or directional hypothesis; the investigator makes a prediction about the expected outcome, basing this prediction on prior literature and studies on the topic that suggest a potential outcome.

The tested hypotheses by the current study are as follows:

Alternative Hypothesis I: "There is a specific timeframe already established that demarcates IA from LSA in the Southern Highlands of Tanzania." Previous scholars (Bushozi 2011; Biittner 2011; Willoughby 2012; Biittner et al. 2017; Miller et al. 2020) who have researched in the areas like Iringa Region asserted that the IA of that region starts around 3,000 ya while LSA sites range from 3,000 to 30,000 ya. While addressing on the timeline for the IA of Iringa Region located on the Southern Highlands of Tanzania, Willoughby (2012:4) argued that "the Iron Age record extends from historic times back to around 3,000 years ago. It represents the material culture of the earliest farmers in southern Tanzania. Members of the Bantu language family, their sites have evidence of the first domesticated animals and plants, the earliest ceramics, metal tools and settled village life. Prior to this, only LSA hunter-gatherers are present. LSA sites range from around 3,000 to 30,000 years old, and are associated with stone artifacts made of quartz or quartzite, rock crystal and/or crypto crystalline silica."

Willoughby (2012:12) draws data from some excavation units/Test Pits (Tps) example Tp# 3 for Magubike rockshelter. Here an Accelerator Mass Spectrometry (AMS) radiocarbon date was obtained from an Achatina shell which came from 20 to 30 cm below the surface; the uncalibrated age is 2,990 ± 60 BP (TO-13423). The current study calibrated that date which ranges (1401 - 1048 cal BC; Table 5.1 Appendix IX). Based on this date, the current study believe that this could be the earliest date for emergence of IA cultures in Tanzania as compared to what has been already established earlier which is Kagera Region dating to about 2,500 BP or 500 BC (Schmidt 1997). Such dates fall within the timeframe of other East African countries (for example in Rwanda and Burundi) that show evidence of iron working dating to around 3,500-2,800 years ago (see van Grunderbeek 1992; Mapunda 2002; Craddock et al. 2007; Killick

2009). This study therefore, aimed at digging deeper by analyzing the context, material culture associated, and perform other chronometric dating of ceramic samples obtained from Magubike Tp# 3 (20-30 cm) to see if that material really represents the IA of Iringa Region? Or it represents something else?

Null hypothesis I: "There could be another specific time frame that demarcates IA from LSA in the Southern Highlands of Tanzania contrary to what has been already established by above previous mentioned scholars." This study believes that because the previous mentioned scholar did not concentrate on IA, the material culture obtained on what referred as IA context could have meant other things. The already established dates (that is 2,990 ± 60 BP) or (1401 - 1048 cal BC) it could be the transitional towards Early Iron Working (EIW) in the region represented by other cultures such as PN which has not yet clear established in that part of the country. The study believes that by conducting a thorough analysis of context, associated material culture, and dating of other samples like ceramics I would have come up with the same or another conclusion on such matters as per those previous scholars.

Alternative hypothesis II: "The LSA hunter-gatherer communities were totally replaced by the IA agropastoralists." This argument was to be tested through studying the sequences and composition of artifacts in the stratigraphy. Here it was likely to see evidence of sudden disappearance of the LSA culture (expressed in terms of fauna and lithics) after the introduction of IA cultures (expressed in terms of pottery, iron working products, fauna of domesticated animals, daubs, wood impressions, and postholes from mud/wattle houses or *daga*). I would not expect to find a mixture of these two different cultural traditions in the same stratigraphic contexts, hence portraying support for the replacement/displacement theory.

Null hypothesis II: The LSA hunter-gatherer communities were not totally replaced by the IA agropastoralists when they met for the first time; instead, one of the following would have occurred:

1. *The LSA hunter-gatherers maintained a separate identity and were not replaced by the IA agropastoralists*. Here I expect to see the continuation of LSA culture without or with very limited mixture of utilitarian objects from the IA agropastoralists culture until recent times. An example of this can be seen on the current Hadza hunter-gatherer and Maasai nomadic pastoralist communities of northern Tanzania who have resisted engaging in agriculture apart from being surrounded by agricultural communities. According to Kessy (pers. comm) "although hunter-gatherers can maintain a separate identity, they will sometime share some important products through exchange. The difference is that in the hunter-gatherer communities like the Hadza you will not find the primary industries like iron smelting industrial byproducts (such as *tuyeres*, slag, furnace) but probably utilitarian products like iron spear and arrow head."

2. *Assimilation/absorption of IA agropastoralists cultures over LSA-hunter-gatherers*. Based on the claim of assimilation model (Chapter 2) I therefore expect that at the initial stage of contacts between two communities to see almost a balance of LSA and IA materials, however, the LSA materials will not persist for a long time because the LSA culture will in a short run be overwhelmed/dominated by the IA, because the IA community arrived in large number so absorbing the LSA population and their culture.

3. *There could be admixture (adoption/acculturation) of LSA-hunter-gatherers, IA agropastoralists or other cultures.* It is possible (ref. acculturation/diffusion model in sub-section 2.6.2) that both cultures continued after the contact/through diffusion without replacement or absorption of one by the other. Therefore, it was likely to get the consistent admixture of material cultures for both cultures from the time of contact to more recent. Since there is no cultural domination, there will be a tendency for one cultural community example LSA to slowly and slowly select (adopt) only "important" materials (only materials that add "value" to their culture). As such the process of inclusion of new materials will be slow but with continuous growth. Therefore, the materials of the LSA people will be replaced very slowly. As such I expected materials belonging to LSA to persist and take long before they disappear in the stratigraphic sequences. In the other words I expect to see the materials in a broader band of stratigraphic layering with the LSA materials at some point dominant at the mixture but decreasing at a slow rate in time. I expected the primary IA industries to appear letter (at the middle of the journey) when the hunter-gatherers are fully settled, not in the beginning. The reason for the broader band of LSA material dominant at the stratigraphic layer is provided by some scholars (Kessy 2005, 2013). According to Kessy (2005), the quantity of LSA materials increased after the contact of IA agropastoralists because the LSA-hunter-gatherers came together in a settled kind of life while beginning exercising the EIA related activities such as agriculture. Since the LSA-hunter-gatherers were now settled they were dropping every piece of manufactured artifacts in one area instead of scattering them along the landscape. So even if they were producing less, the act of being less mobile and doing their artifacts production in one location, caused the materials to be concentrated in one place, hence appearing as if there

were an increase of population or production, while however, that is not the case, but a result of less mobility.

Alternative hypothesis III: “PN cultures existed in Southern Highlands of Tanzania.” This assumption came following two main issues. First the chronometric dates (2,990 ± 60 BP) or (1401 - 1048 cal BC) presented on the context that was described as IA at Magubike rockshelter (Willoughby 2012) call for further investigation considering that such a date looks too early for the EIA of Southern Highlands of Tanzania. Msemwa (2001:42-43) claims that he found PN pottery in the Upper Kihansi area in Southern Highlands of Tanzania. However, such evidence has received less archaeological attention. If such a culture existed in Southern Highlands of Tanzania, I expect to encounter PN material culture in association only with LSA artifacts instead of with IA ones (see section 2.4 for the criteria which defines PN). Because the PN involved nomadic pastoralism and interaction, I expect to see some similarities in terms of material culture with other reported PN evidence across the region (Chami 2001b; Chami and Kwekason 2003). Additionally, I argue that if the PN culture are found in the study area, it is going to disapprove the previous notion that PN cultures were not acquired by stone tool using peoples of inland regions south of the Serengeti Plain (see Sutton 1969; Horton 1990; Phillipson 2005). Here Phillipson (2005) is quoted saying that “although the archaeology of central and southern Tanzania remains poorly investigated, there are no indications from sites of the first millennium BC that domestic animals were ever acquired by the stone-tool-using peoples of inland regions to the south of the Serengeti Plain” (Phillipson 2005:212). Another view is quoted from Grillo et al. (2018:102) that “during the Pastoral Neolithic (ca. 5000–1200 B.P.), herders spread through southern Kenya and northern Tanzania areas previously occupied only by hunter-gatherers eventually developing the specialized forms of pastoralism that remain vital in this region today." Other scholars who raised their doubt include Sutton (1969:11-12), Horton (1990:96), and Wright (2018:7).

Null hypothesis III: "The PN cultures did not exist in the Southern Highlands of Tanzania." Various factors may support this hypothesis. For example, it has been maintained that the presence of tsetse fly would have been affected a wider spread of pastoralism to some areas in Africa during PN (Smith 1984, 2021). According to Smith (2021:1) "cattle spread across the Sahara as the environment was conducive to pastoralism, being well watered at this time. This lasted until after 5000 BP when the Intertropical Convergence Zone (ITCZ) retreated and the Sahara dried up to its present condition. The tsetse barrier also retreated at this time, allowing pastoralists to move south into West Africa and, via the Ethiopian highlands, to East Africa, arriving *c*.4500 BP, although it took another 1,000 years for them to fully adapt to the grasslands of southern Kenya and Tanzania. Domestic stock then went on to southern Africa via a tsetse-free corridor, arriving around 2000 BP." Smith (2005, 2006, 2021) is also arguing that nomadic pastoralists leave few visible archaeological or it could be the problem in preservation of faunal remains, which makes it difficult to identify what animal species were present (Masele 2017). Other scholars believe that lack of well-dated archaeological evidence in the areas southern Tanzania and neighbouring region could be the reason for the unreported PN cultures. As stated by Wright (2018:7) "The lack of archaeological evidence for a southward expansion of Neolithic pastoralists from 3,000 to 2,000 years BP into in the areas that now include southern Tanzania, northern Malawi, northern Mozambique, and eastern Zambia may be as a result of the dearth of well-dated archaeological assemblages from this time period." Therefore, the current study considered absolute dating as important aspect to prove the presence of PN or not in the Southern Highlands of Tanzania.

1.7 Significance of the Study

The study contributes to our understanding of the prehistoric African cultures based in the Southern Highlands of Tanzania. By bringing together evidence of LSA and IA cultures, some important questions were answered about intra/interregional interaction, geographic distribution, and identities through material culture. Additionally, the study has added to a regional understanding of Iron Age migrations and its impacts on other societies. It has also contributed to reducing the uneven research gap in Tanzania noted by scholars (Masao 2005; Mapunda 2008; Willoughby 2012; Lyaya 2013; Biittner et al. 2017). By comparing the results from Southern Highlands of Tanzania together with other secondary data of other research done globally on the same topic of prehistoric and historic migration and interactions, the study contributed on the broader knowledge on anthropological topic (s) related to trade, migrations and interactions over time and space.

1.8 Dissertation Organization

This dissertation has ten chapters. Chapter 1 outlines the background information, statement of the problem, research objectives, research questions, hypotheses, and significance of the study. The statement of the problem focuses on debate related to Iron Age migrations and the consequences posed to the LSA hunter-gatherers. It also highlights the debate on the pastoralist expansions during 4,000-1,000 BP in Eastern Africa.

Chapter 2 provides what is already known from the previous studies related to the current study. It covers the conceptual framework that focuses on the IA traditions in east and southern

Africa, PN and LSA cultures of East Africa. This is followed by the theoretical framework related to IA migrations and its outcomes to LSA hunter-gatherers and the material culture theory. The review covers other issues such as the origin of IA cultures/technology, the concept of Bantu migration and the spread of IA cultures/technology. This considers the routes and evidence considered to understand the migrations. The chapter has also focused on the trend of IA research in the region. The previous archaeological research on LSA and IA interactions in eastern and south-central Africa as well as previous archaeological research in the Southern Highlands of Tanzania.

Chapter 3 provides where exactly the study was conducted, in the Southern Highlands of Tanzania, by detailed highlighting its profile. This covers climate, geology, soil, relief, vegetation, and peopling of the area in terms of demographic profile and the current ethnic group comprises the region. It specifically focuses on the Iringa and Njombe Regions. Other regions in the Southern Highlands are Mbeya, Rukwa, Songwe, Rukwa, and Ruvuma. Each entity in the profile has been given a justification of why it was chosen in relation to the focus of the current study. The chapter starts by reviewing the modern environment and people of East Africa, the upper Pleistocene environment and the archaeological occurrences in East Africa, and the Holocene environment and the archaeological occurrences in East Africa.

Chapter 4 presents the research methodology that was employed to carry this study. It begins by showing the phases passed to conduct the study, followed by the research design. The sample, sample size, sampling procedures, and methods of data collection are presented in this chapter. The chapter explain how both primary and secondary data were incorporated in this study with a clear justification regarding to selection process of such data.

Chapter 5 provides in details the site descriptions by considering issues such as material cultural components, their occurrences (that is stratigraphic considerations), and chronology. The main sites discussed here are Magubike, Mlambalasi, and Mgera that contains LSA and IA material evidence. This chapter is significant considering that it describes the stratigraphy that can help to understand different cultural occurrences through time. As presented in Chapter 6, it is through stratigraphic description of lithic artifacts the nature of interaction between LSA and IA people is understood. This is complemented by the chronology done through both absolute and relative dating, as well as the nature of material culture.

Chapter 6 covers the lithic material culture specifically for the LSA and IA periods. It presents the lithics as material culture by covering the analytical methods and results. Three major issues are considered here are lithic raw material, the linear dimensions of lithics, the description of lithic tool type by considering the stratigraphic levels in order to understanding the nature of lithics occurrences or disappearances through time, and finally the lithic tool type against the cultural designations in order to affiliate which culture a certain tool type belong? And how those material differs from one culture to another.

Chapter 7 covers the faunal remains. It begins by presenting the analytical methods, followed by the results and interpretation. The focus was placed mainly on the LSA and IA cultures specifically for Magubike and Mlambalasi rockshelters for the reasons provided in the specific chapter. Like other material evidence, faunal remains are important for the current study considering that they offer the behavioral understanding of LSA, PN, or IA people. The fauna assemblage contains information related to substance behavior, animal species, and how are related to human cultures. The chapter examines if there have been any changes in terms of animal species or behavior especially when LSA hunter-gatherers interacted with IA agropastoralists.

Chapter 8 is all about ceramic material culture. It covers the nature of ceramics of Iringa and Njombe Regions. It begins by presenting the analytical methods following the scheme developed from some scholars worked on east and south-central Africa. The results are based on attributes characterization and the chronological considerations. In this chapter the possible PN and IA ceramics of the Southern Highlands of Tanzania is detailed covered in terms of physical and mineralogical compositions. This has held to situate the ceramic traditions of the study regions to other neighboring areas and beyond. The interpretation of ceramic material cultures in terms of production process/procedures has been made following the ethnographic interviews and observations covered in Chapter 9.

Chapter 9 uses the contemporary pottery makers in the Southern Highlands of Tanzania, specifically from Njombe and Iringa Regions, in order to interpret the ceramics in the archaeological record. The chapter presents the results following analysis of the production process performed by the Hehe and Bena tribes. The similarities and differences in terms of production process helps to define or identify what makes a uniqueness between cultures, ethnic groups, or individual as far as the technology is concerned.

Chapter 10 provides a general discussion of the research findings presented in Chapters 6-9. The summary and suggestions for further research directions is also covered by this chapter. The discussion is done in reference to the specific objectives, hypotheses, and research questions.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In this section I review the literature relating to the current study. The section begins by conceptualizing on what we know about IA agropastoralists and their associated traditions in East and southern Africa, as well as the PN, and LSA hunter-gatherer cultures in East Africa. It also covers the theoretical framework which informs the current study on how those cultures have been understood in terms of transitional debates and material culture characterization or studies. The review covers also issues pertaining to the origin of ironworking technology in sub-Saharan Africa, Bantu migration routes, and the evidence considered in studying the Bantu migration and their impacts. The chapter also covers the trend of archaeological research of IA in the region. Finally, the previous research works over the topic which have been undertaken in Africa including the current study area have been reviewed.

2.2 Conceptual Framework.

Figure 2.1 below summarizes how the current study is framed. The study is informed by the variables that were tested to address the research problem. Since the study focuses mainly on two communities with distinctive culture (IA agropastoralists and LSA hunter-gatherers) the variables are established to test the ideas about the impact of one community (that is IA agropastoralists) on the other (LSA hunter-gatherers). For that case, the IA agropastoralists is an independent variable because it has been claimed to replace, displace, or absorb the LSA hunter-gatherers when they met under Bantu migration phenomenon (Vansina 1994-95; Diamond and Bellwood 2003; Skogland et al. 2017). LSA hunter-gatherers count for the dependent variable because their absorption or replacement depended on the forces from Bantu people. The PN evidence (if any) is counted as intermediate variable since it appears between LSA and IA cultures. The study is also informed by attributes in terms of archaeological evidence which defines those communities. For example, the Iron package for Bantu people/IA agropastoralists is comprised of EIA and LIA pottery, slag, *tuyeres*, furnaces, fauna of domestic animals such as cows, goats, and sheep. Objects such as microlithic, beads, and fauna of wild animals are used to define the LSA hunter-gatherers. These attributes were used to answer the research questions and testing hypotheses. Sub-section 2.6.2 below provides an explanation regarding the Bantu migration models mentioned in the conceptual framework (Figure 2.1).

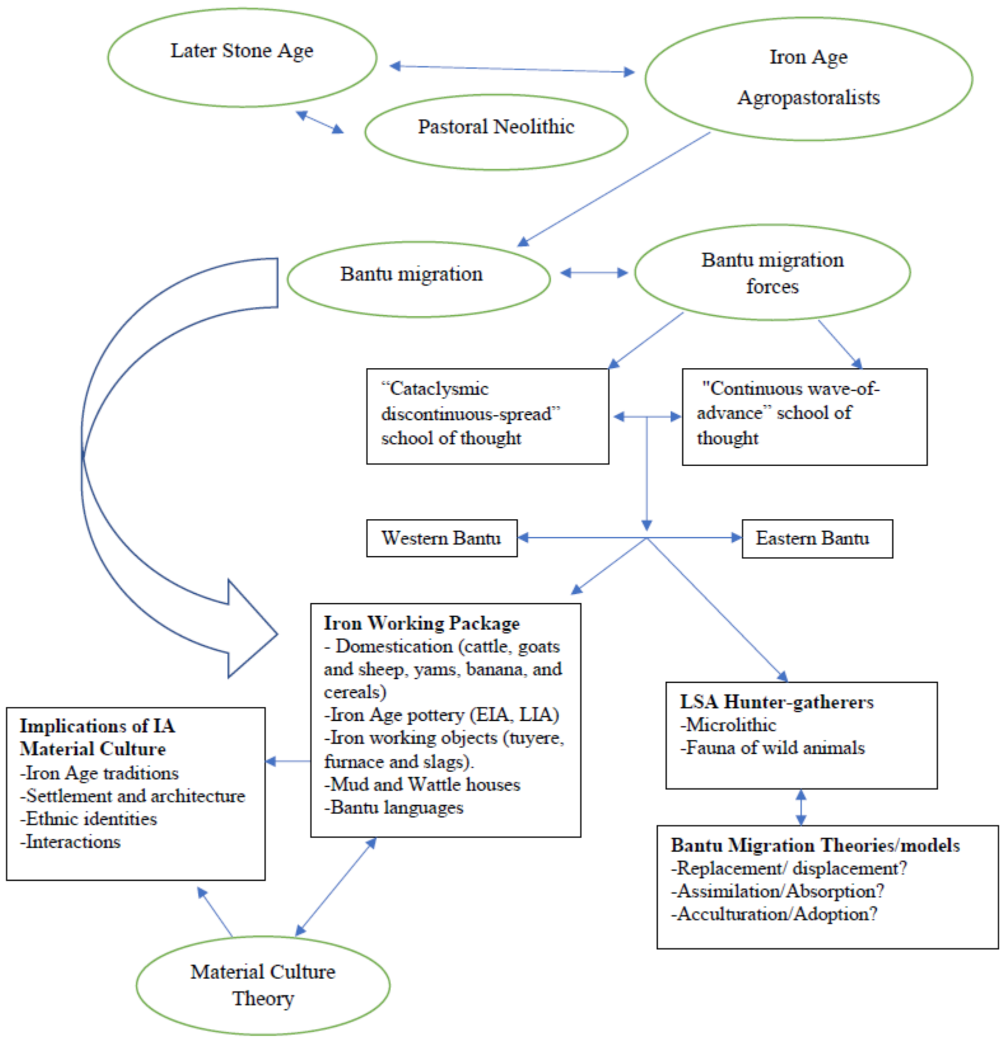


Figure 2.1: A Conceptual Framework Informing the Current Study.

2.3 Iron Age Traditions in Eastern and Southern Africa

According to Hall (1983:52) the concept of *tradition* means "the development of a particular assemblage through time or the time depth of a type of decoration." Thus, for the Bantu-speaking world there is a general consensus that ceramic style units relate to differences in language, through which traditions and social practices were learned and communicated (Fredriksen 2023). Ceramic style is therefore considered a reliable indicator of broad cultural identities (Soper 1967a, b; Huffman 2007; Chami 2006; Ashley 2010; Ashley and Grillo 2015). The Bantu migration hypothesis has been structured almost entirely around ceramic distribution, which illustrates just how common style analysis is in African archaeology (Ashley 2013). The IA period of east and southern Africa containing pottery traditions and other material has been divided into the Early (EIA) and Later Iron Ages (Huffman 2007; Russel and Steele 2009; Ashley 2010; Russel et al. 2014; Lander and Russel 2018). The former appears around 500/300C in the Lake Victoria region and 400/300 AD in South Africa (see Figure 2.2 and 2.3 for the earlier map by Phillipson 1977 and recent map by Russel and Steele 2009).

The earliest classification of EIA ceramics and chronological distribution in east and southern Africa was done by scholars (Soper 1967a, b; Huffman 1970, 1980, 2007; Phillipson 1968a, 1977), however, more research has continued since then. For example, recently, scholars (Russel and Steele 2009; Lander and Russel 2018) have generated a database contains geo-referenced and radiocarbon-dated archaeological evidence for farmers and pastoralists from 206 sites (Table 2.1) dating to between 550 BC to AD 1050 in southern Africa (Figure 2.3). Data were sourced from a combination of published articles, personal collections and institutional databases. Appendix II presents in detail each IA tradition, its characterization/attributes, location, and the time period. The EIA has been characterized by small houses made of *daga* (puddled mud), distinctive pottery, Bantu languages, iron smelting, and domestication of cattle, goats and sheep, and cultivation of yam, sorghum, and millet (Shoemaker 2018; Crowther et al. 2018; Lander and Russell 2018; Prendergast et al. 2019). However, as I presented in the background section such package has received some criticism (Ehret 1998; Bostoen 2006-07, 2018; de Maret 2013). The LIA presents the same characteristics but with new modifications following various factors like trade and interactions.

Table 2.1: African sub-Saharan EIA database; showing the breakdown of the database according to the number of EIA sites, dates, and geo-referenced sites (Source: Data used by Russel and Steele 2009:332).

Country	No. of sites	No. of sites with co-ordinates	No. of dates	No. of sites with co-ordinates and dates
Angola	11	10	10	10
Botswana	6	3	7	3
Burundi	3	3	8	3
Cameroon	16	16	43	16
Central African Republic	2	2	3	2
Republic of Congo	2	2	2	2
Democratic Republic of Congo	21	13	54	12
Kenya	21	12	38	12
Malawi	28	7	42	8
Mozambique	7	5	20	5
Namibia	4	4	4	4
Nigeria	3	3	7	3
Rwanda	11	7	15	8
South Africa	368	368	75	27
Sudan[1]	1	1	1	1
Swaziland	2	1	4	2
Tanzania	15	10	36	15
Uganda	6	2	14	3
Zambia	50	26	141	38
Zimbabwe	38	24	63	32
Total	**615**	**519**	**588**	**206**

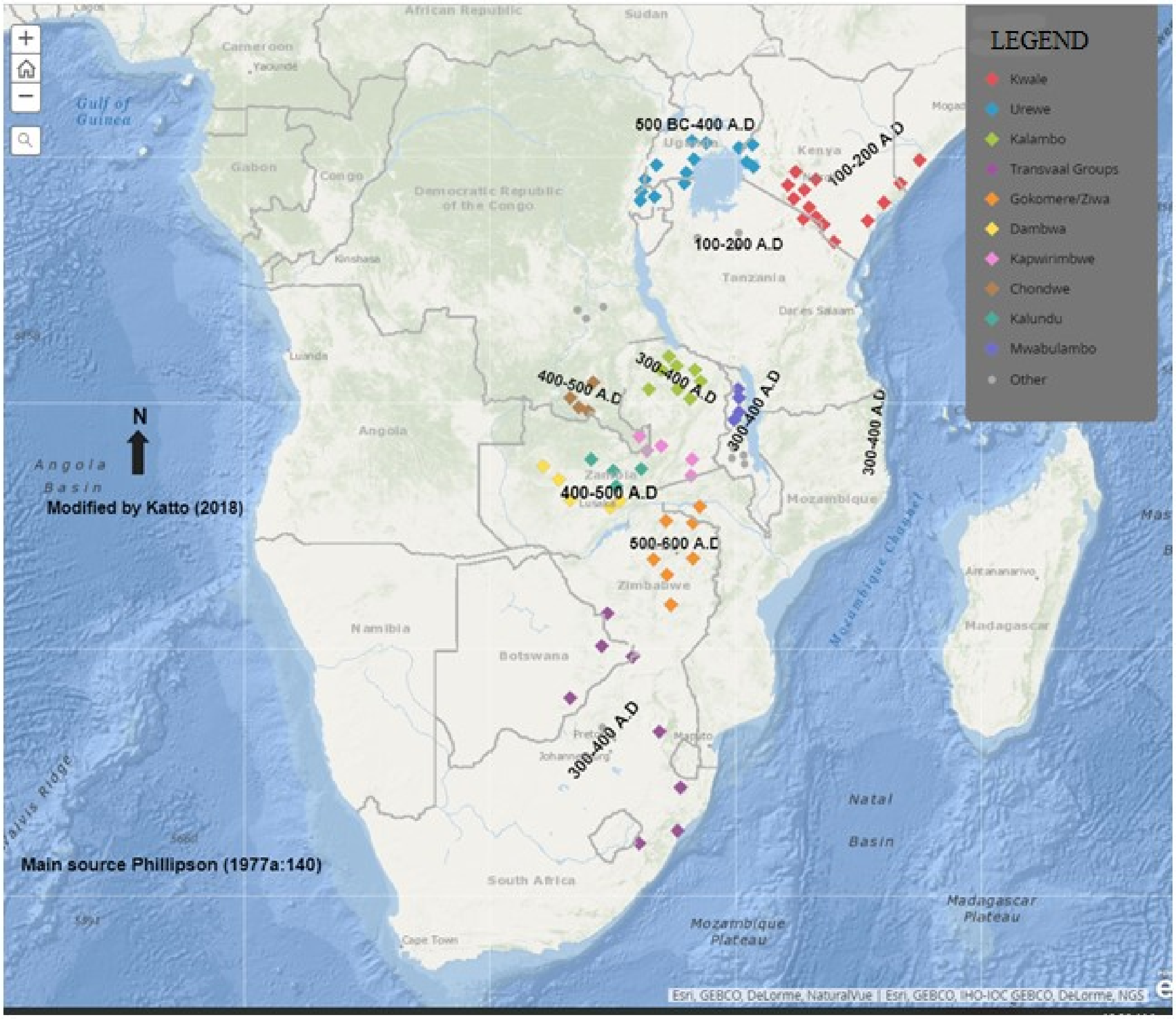


Figure 2.2: A map to illustrate the chronological spread of the Early Iron Age Industrial Complex (Modified after Phillipson 1977:141).

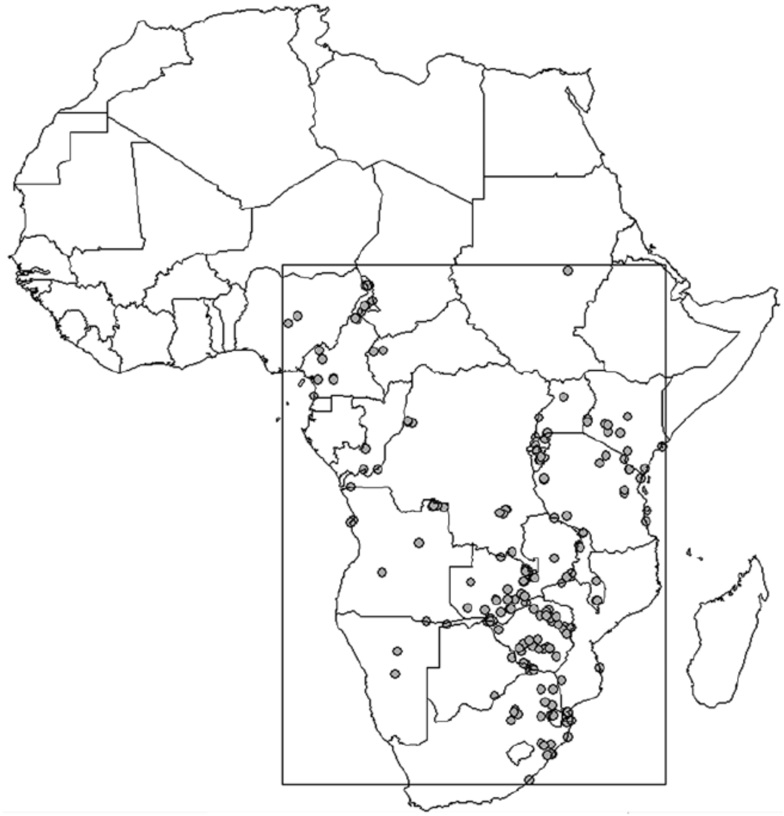


Figure 2.3: Distribution of Early Iron Age sites in the database that have both co-ordinates and radiocarbon dates after (Russel and Steele 2009:333).

2.3.1 Early Iron Age Traditions

The EIA pottery traditions (Figure 2.4 and 2.5) in east and southern Africa are divided into two streams; the eastern and western streams (Huffman 1970, 2007; Phillipson 1977; Ashley 2005, 2010; Russel and Steele 2009; Shoemaker 2018; Fredriksen 2023). The Figure 2.4 is according to Phillipson (1977) which I modified the map through GIS software. Figure 2.5 is according to Huffman (2007) but the map was taken from the recent published article by Fredriksen (2023:6). The eastern stream is comprised of traditions such as Urewe, Lelesu, Kwale, Mwabulambo, Nkope, Gokomere/Ziwa, Zhigho, Transvaal groups and Dambwa (Soper 1967a; Robinson and Sandelowsky 1968; Robinson 1970, 1973, 1976; Phillipson 1977;

Pawlowicz 2011, 2013; Ashley and Grillo 2015; Clist 2017; Ekblom et al. 2023; Fredriksen 2023; Figure 2.6-2.7 below). The traditions which form the western stream are Lugwebungu, Mlongo, Chondwe, Kalundu, and Kapwirimbwe (Fagan 1967; Phillipson 1968a; Mapunda 2008; Chami 2006; Pawlowicz 2011, 2012; Kwekason 2013; Figure 2.9 below). Between these two streams there is one tradition named as Kalambo group (Clark 2001; Barham et al. 2015; Figure 2.8). Although the chronology for these traditions differs from one after another, the earliest tradition has been named as Urewe dating around 500 BC - 800 AD and latest is Transvaal groups recorded in south Africa around 300-400 AD (Schmidt 1997; Phillipson 2005; Ashley 2010; Ashley and Grillo 2015; Lander and Russel 2018). This section discusses in detail all major EIA traditions in east and southern Africa.

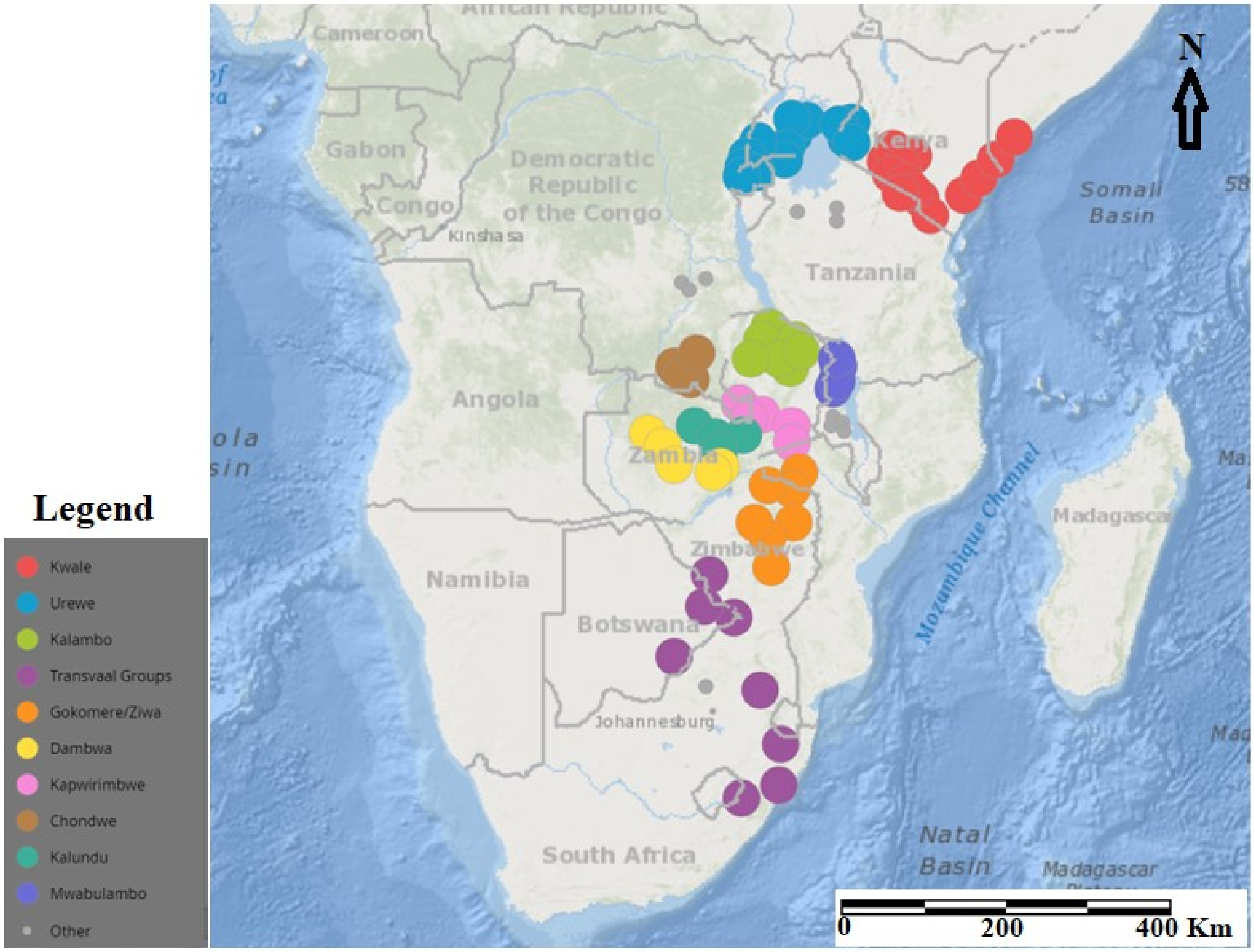


Figure 2.4: The Distribution of the Early Iron Age Industrial Complex for East and Western Streams (Modified by the Author after Phillipson 1977:140).

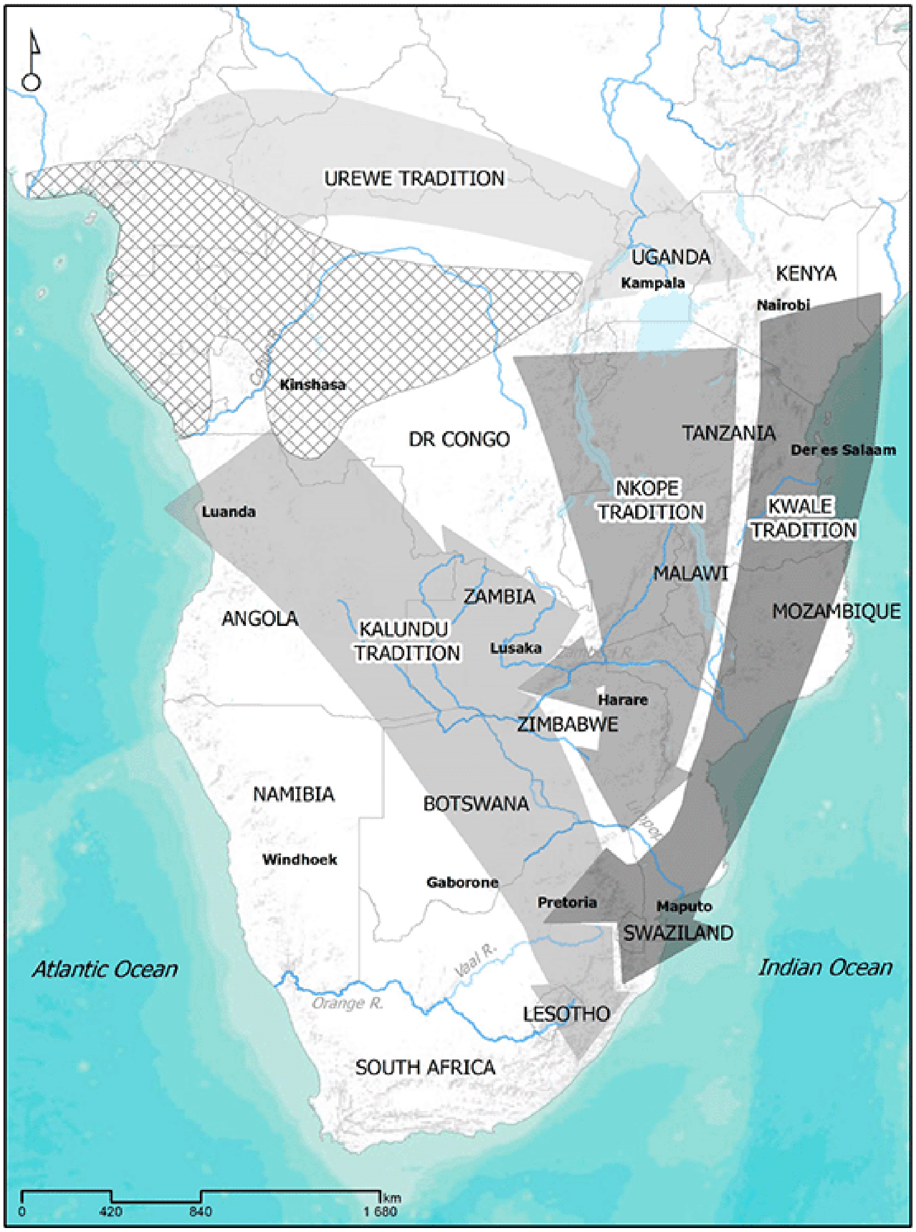


Figure 2.5: Map showing the main routes for early thick wares into southern Africa. (Taken from Fredriksen 2023:6 mainly sourced after Huffman 2007).

The Urewe Group

This, the most extensive group, covers the Lake Victoria basin, extending to the south-west into Rwanda and adjacent parts of Congo (Ashley and Grillo 2015; Clist 2017). The Urewe ware was first recognized near the north-eastern corner of Lake Victoria, around the Winam (Kavirondo) Gulf of Kenya (Schmidt 1997). Urewe ware seems to be closely associated with knowledge of iron-working, with sites dating from c.2500 BP, and in Uganda and western Kenya from c. 1800-1200 BP (Schmidt 1997; Lane et al. 2006; Ashley 2010; Ashley and Grillo 2015; Clist 2017). The tradition was characterized by dimple base after the thumb-sized impressions often left on the vessels' bases, necked vessels, and shallow bowls (Chami 1994, 1998; Schmidt 1997; Ashley 2010; Ashley and Grillo 2015; Figure 2.7). The necked vessels have externally thickened rims with fluted lips, often accompanied by incised decorations on the rim-band (Ashley 2005, 2010; Pawlowicz 2011; Kyazike 2013). Grooved designs on or near the shoulder are frequently elaborate, with pendant loops, triangles, concentric circles, and other motifs. The majority of bowls bear horizontal grooving below the rim, sometimes integrated with further bands which pass under the base of the vessel to produce an overall star-like design (*ibid*.).

The Lelesu group

As it was introduced before, from the north-western region, the EIA derived from Urewe group was established in north-central Tanzania to the south of the territory occupied by the stone-tool-using pastoralists named as Lelesu (Prendergast 2008; Kessy 2013; Crowther et al. 2018). Some scholars suggest that Lelesu pots could have been a trade good used by some combination of foragers and Savana Pastoral Neolithic herders (Crowther et al. 2018:114). Moreover, fauna associated with Lelesu ceramics on the Serengeti Plains and particularly in the

Lake Eyasi basin indicate reliance on wild resources (Prendergast 2008). Lelesu was named after the site of Lelesu, an open site in Usandawe originally investigated by Ludwig-Kohl-Larsen in 1943. Lelesu's potteries show affinities both with Urewe ware and Kwale (Kessy 2005, 2013; Pawlowicz 2013; Figure 2.7).

The Kwale group

This is a third EIA group which has been investigated in East Africa. It is named after the site of Kwale, located by Robert Soper 1966 in the Shimba Hills some 30 kilometres south-west of Mombasa, Kenya. The radiocarbon date indicated that the Kwale ware dates to the third century AD (Soper 1967a; Chami 2006; Rødland 2021; Wynne-Jones 2023). Kwale ware (Figure 2.7) is characterized by very many bowls with in-turned fluted rims and flattened or slightly concave bases. Shouldered pots with incised or grooved decoration are also present. Rims are generally thickened and fluted. Kwale wares have been discovered in different parts of East Africa, mainly in south-eastern Kenya, and the Tanga, Kilimanjaro, and many sites along the Swahili coast and Islands in Tanzania (Soper 1967b; Chami 1998; Pawlowicz 2011; Rødland 2021). The EIA technologies spread further south and here various traditions emerged which continued to lose some features but still maintaining some of Urewe and Kwale traditions (Pawlowicz 2011, 2017). In northern Malawi, there is a tradition called Mwabulambo ware (Figure 2.7) named after a site on the Lufilya River and in the south, Nkope ware (Figure 2.7) which was named from a locality on the western shore of Lake Nyasa (Kwekason 2013). The distribution of Nkope was extending eastwards across the watershed into the greater part of south-eastern Zambia, and adjacent parts of Mozambique (Kwekason 2013; Pawlowicz 2011, 2013; Fredriksen 2023).

Mwabulambo ware (Figure 2.7) shows some affinities to Kalambo ware (Figure 2.8). It is characterized by undercoated vessels particularly bowls. Rims of all vessels are generally undifferentiated or slightly thickened (Pawlowicz 2011, 2013; Barham et al. 2015). On Nkope vessels the decoration is more elaborated and the thickening of rims is more pronounced. It was noted that the features of these vessels match with Kwale ware from south-eastern Kenya (Soper 1967b). It is more probable, however, that makers of Kwale-like pottery penetrated southwards through the less archaeologically explored country to the east of Lake Nyasa and hence inland to influence the ceramic styles at the south end of the lake (Kwekason 2013; Pawlowicz 2013).

The EIA pottery akin to Nkope ware has been recorded from two sites in the Tete Province of Mozambique. Cultural continuity across this part of the Zambezi valley, strongly indicted the presence of closely related pottery in eastern, southern, and central region of the modern countries of Zambia and Zimbabwe (Robinson 1973; Huffman 2007; Pikirayi 2001, 2016; Fredriksen 2023). The EIA pottery of the latter regions has been divided into two groups: 'Gokomere and Ziwa' (Phillipson 1977; Huffman 1980, 2007; Pawlowicz 2013; Ekblom et al. 2023). Huffman (1971, 2007) has shown that the distinction between these two-pottery types is relatively close related to the Mwabulambo and Nkope wares of Malawi. The distribution of 'Ziwa' sites appears on the eastern Highlands around Inyanga, whereby it extends both westwards towards Salisbury and southwards along the Mozambique border area into the Sabi valley (Manyanga and Shenjere 2012). 'Gokomere' ware is widely distributed in the south-central area around Fort Victoria; while further to the south-west in the Bulawayo area a more distinctive EIA pottery type known as Zhigo ware is also recognized (Russel and Steele 2009; Pikirayi 2016; Ekblom et al. 2023; Fredriksen 2023).

The EIA technologies, particularly the Gokomere and Ziwa traditions (Figure 2.6), continued to expand and sprit further south and reached Mashona and Matabele land in Zimbabwe (Huffman 1980, 2007; Pikirayi 2001, 2016; Manyanga and Shenjere 2012; Mtetwa 2017; Ekblom et al. 2023). The Iron Age settlement at Gokomere is dated to between the third and seventh centuries AD. The EIA occupation of Great Zimbabwe Hill dated to between the third and fifth AD which forms an example of the so-called Phase 1 of the Gokomere/Ziwa pottery tradition (Huffman 2007; Mtetwa 2017). The Phase 2 in the development of that tradition show a general modification of more features, while the use of hematite and graphite finishes is introduced. The spread of the EIA industrial complex south continued to further inland towards area such as Botswana and in Matakoma and Klein Africa in the northern Transvaal (Prinsloo 1974; Waarden 2018; Lander and Russel 2018). Other EIA evidence including Bambata tradition continued to dominate southern Africa in the Limpopo River Valley dating from 3^{rd} to 7^{th} century CE (Fredriksen 2023:14). Bambata has been identified to belong to Kalundu and are decorated with comb-stamping (*ibid*:14). Pottey belonging to EIA continued further South Africa in the northern and coastal regions of Natal.

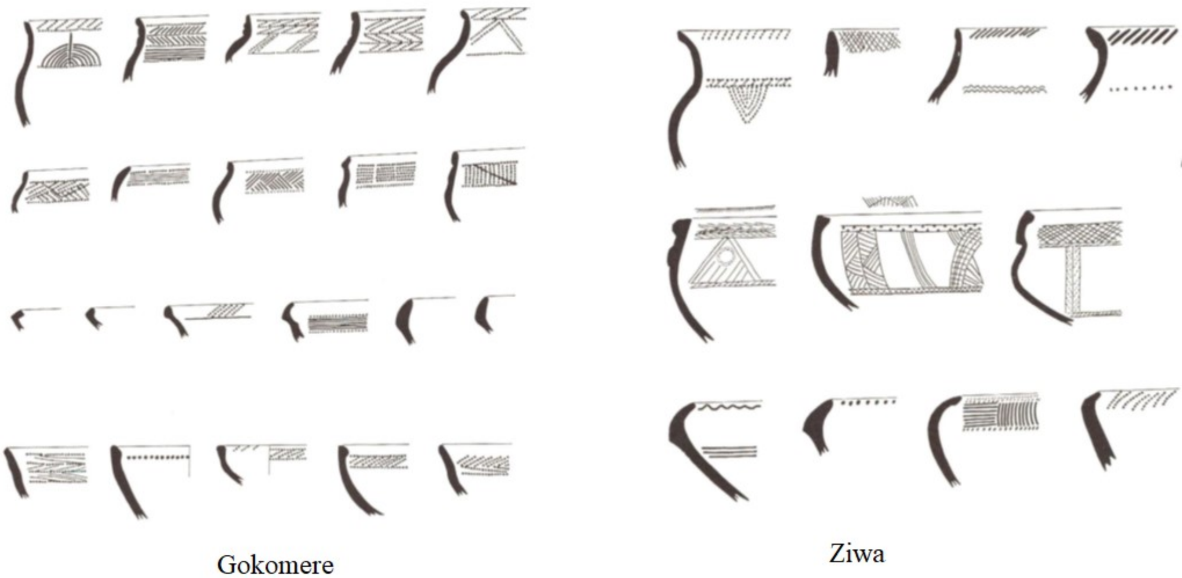


Fig 2.6: Early Iron Age pottery from South Africa (Modified after Huffman 1980, 2007; Pawlowicz 2011:208-9).

The Dambwa group

One of the areas which have received more EIA archaeological researches in Southern Africa is Zambezi valley immediately upstream of the Victoria Falls (Phillipson 1977, 2005; Lander and Russel 2018; Fredriksen 2023). The EIA of this area has been named the Dambwa group (Figure 2.7) after a site lying on the outskirts of the town of Livingstone (Phillipson 1968a). The Dambwa ware is characterised by the slightly necked vessels with externally thickened rims. The decorations are produced by comb-stamping or incision (Figure 2.7). It has been noted that the Dambwa group inhabitants of the Zambezi valley share affinities with their contemporaries and counterparts both in Zimbabwe and on the Batoka Plateau of southern Zambia.

The Dambwa EIA group conclude the survey of EIA technology from south-eastern Kenya, through all those parts in Tanzania where EIA settlements have been recorded, into parts at least of northern Zambia (Phillipson 1968a; Lander and Russel 2018; Fredriksen 2023). Phillipson has continued insisting that, the areas mainly east of Lake Nyasa (a part of southern Tanzania) has not received archaeological research to test the EIA spread. However, recently some scholars (Mapunda 2001, 2004; 2008; Katto 2016) has conducted research along Lake Nyasa in southern Tanzania, despite further studies are needed.

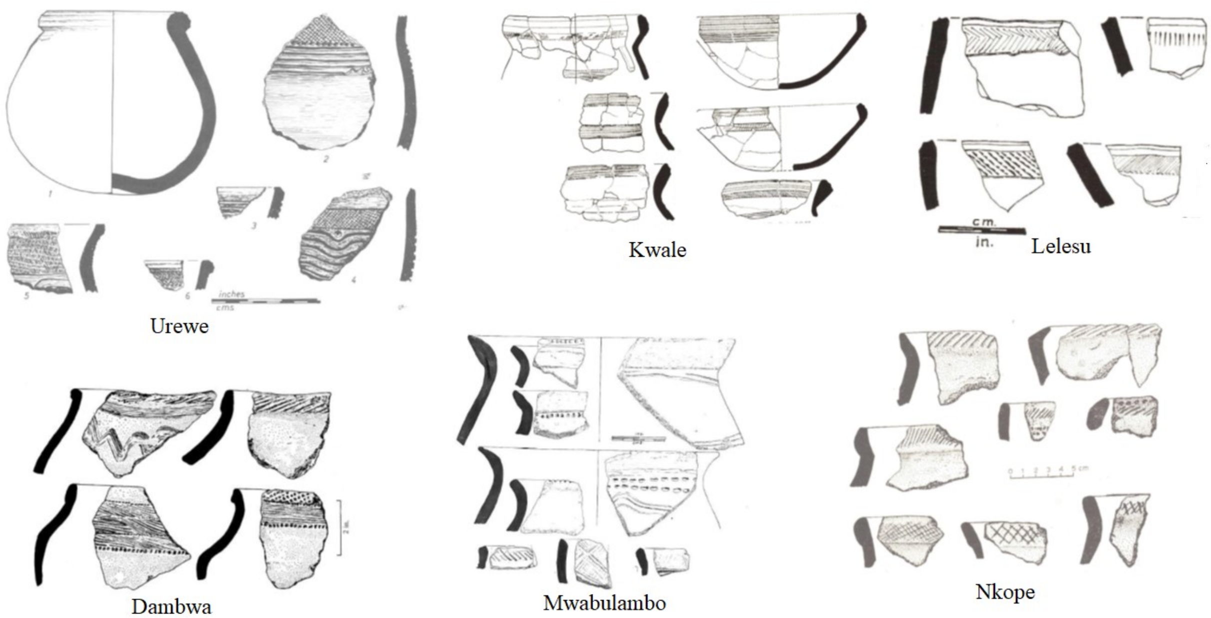


Figure 2.7: A sample of Early Iron Pottery Traditions from East and Southern Africa representing the Eastern Stream discussed above (Modified after Robinson and Sandelowsky 1968; Robinson 1973; Soper 1967a; Phillipson 1977; Pawlowicz 2011).

Between the eastern and western streams there is another EIA tradition, the Kalambo group (Clark 1974, 2001; Barham et al. 2015; Figure 2.8). Pottery of this type has been discovered in the Northern and Luapula Provinces of Zambia. These share affinities with both eastern and western streams and therefore it is reasonable to conclude that the area was settled from both directions. The pottery (Figure 2.8) is characterised by undecorated open bowls, rims are undifferentiated or externally thickened; the necked vessels are often decorated with bands of oblique comb-stamping. Lips are frequently bevelled and may bear horizontal groove, there is also comb-stamped or false-relief chevron design. A few vessels have concave ‘dimple’ bases reminiscent of those of Urewe ware (Clark 1974, 2001). The Radiocarbon date suggest that the Kalambo falls site were occupied perhaps from early as fourth century AD until the early in the present millennium or later (*ibid*.).

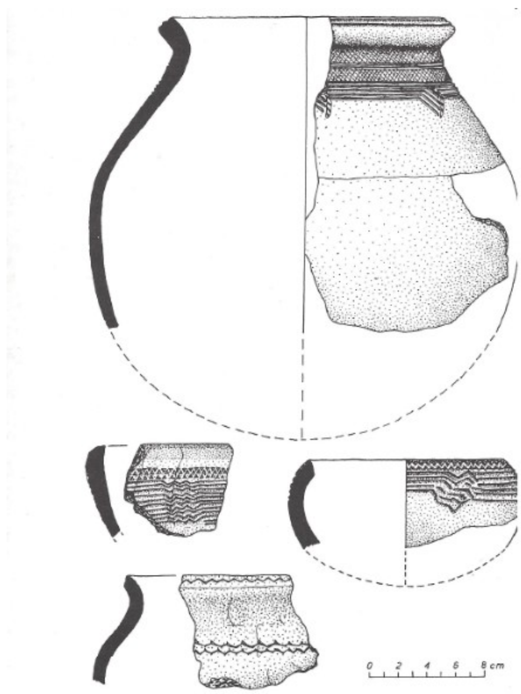


Figure 2.8: Early Iron Age Pottery from Kalambo Falls (Adapted from Clark 1974, 2001).

The EIA of the western stream has been far less archaeologically investigated than that of eastern stream (Pawlowicz 2011; Fredriksen 2023). As noted by Fredriksen (2023:2) “ceramics have had a central role in debates of when, how, and why various groups with different lifeways and languages entered and dispersed in southern Africa. However, the geographic distribution of research is highly uneven. The eastern parts of the subcontinent have received much more attention than the rest, and the coverage of Bantu-speaking farmers remains far better compared to that of other language groups with different lifeways.” However, the central Zambia and a single small area of Shaba have received more archaeological research that was pioneered by Phillipson since 1960's. Other sites such as Katoto and Sanga in the country exhibit the evidence of EIA potteries. The vessels are characterised by dimple bases, elongated vertical necks and ring-based cups. Various EIA traditions have been recorded within western stream (Phillipson 1968a; Huffman 2007; Fredriksen 2023). They include Lungwebungu tradition ware, Mlongo ware from Lake Kisale and Red slip ware obtained from Sanga site in Zambia. There is also Chondwe traditions in Central Zambia (Figure 2.9). Further to the south, on the land adjacent to Lusaka plateau, several EIA villages have yielded EIA potteries attributed to Kapwiribwe group (Phillipson 1968a; Figure 2.8). The pottery of this area during the first millennium shows many affinities with Chondwe group with some degree of differences (*ibid*.). Kapwirimbwe potteries are decorated with false-relief chevron stamping of bowls with exaggerated internal thickened of rim. Some pottery traditions like this tradition have been reported in southern Tanzania from the Indian coast to far interior to Lake Nyasa area, suggesting long term coast-interior connection (see Msemwa 2001; Mapunda 2008; Chami 2006; Katto 2016).

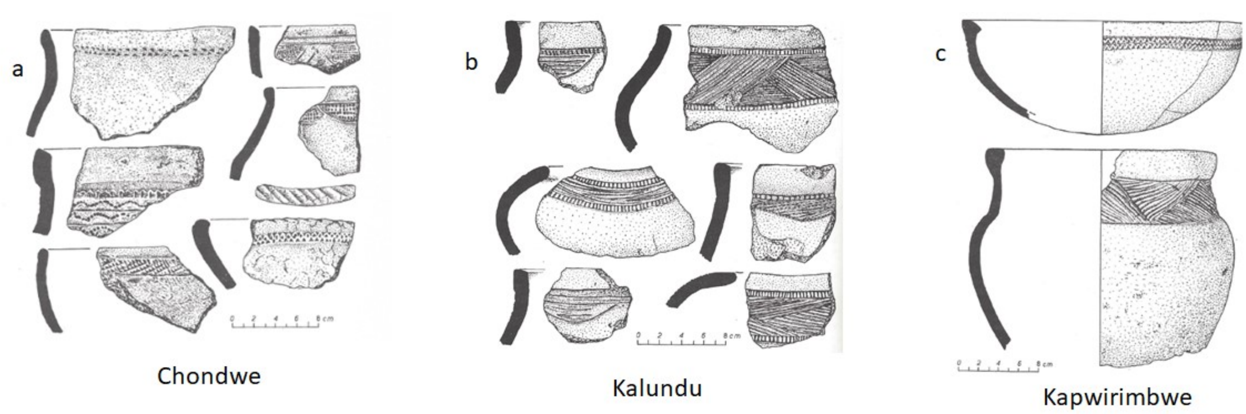


Figure 2.9: A sample of Early Iron Pottery Traditions from Southern Africa representing the Western Stream discussed above (Modified after Fagan 1967; Phillipson 1968a).

2.3.2 The Later Iron Age Traditions (LIA)

The LIA is a period which has received less archaeological research compared to EIA period (Chami 1998; Lyaya and Mapunda 2014). This period has been recorded from 1,000 AD to present times (Huffman, 2001; Ashley 2005, 2010, 2013; Russel and Steele 2009; Nkirote 2021). Huffman (2001) argues that there is no consensus for the emergence of LIA tradition. According to him, some archaeologists believe that a single ceramic tradition and new economy spread over virtually the whole subcontinent at ca AD 1,000, others believe that unrelated changes occurred at different times and places, or alternatively that relations of production changed without any population movement. Scholars (Chami 2006; Fleisher and Wynne-Jones 2011; Wynne-Jones 2023; Fredriksen 2023) reviewed the LIA traditions into regions mainly the East African coast, the interior of East Africa, as well as southern Africa.

On the Swahili coast the LIA tradition has been found to be in interaction with foreign traders particularly Arabs from 11th century AD (Chami 2006; Croucher 2006, 2007; Fleisher and Wynne-Jones 2011; Wynne-Jones 2023; Fredriksen 2023). Such trade has been described in early chronicles, mainly the *Periplus of the Erythrean Sea* (Chittick 1974; Chami 2006). Local pottery mainly carinated vessels, imported blue glazed vessels, spindle whorls, local and imported beads forms many of cultural objected recorded in East African coast during LIA period (*ibid.*). The Triangular Incised Ware (TIW) is a prominent LIA tradition dominated the Swahili prehistoric communities (Chami 1994, 1998, 2006; Kusimba and Kusimba 2005; Fleisher and Wynne-Jones 2011). The tradition succeeded that of EIA along the coast during the late first millennium, c. AD 600–900 (Chami 1998; Kwekason 2011; Pawlowicz 2011; Fleisher and Wynne-Jones 2011). Fleisher and Wynne-Jones (2011:254) presents the calibrated ranges of various TIW sites along the Swahili coast, near inlands, and Island. For example, some sites at

Dakawa have dated to (650–770 cal AD, 665–880 cal AD). According to Fleisher and Wynne-Jones (2011), Dakawa has become an important reference point, it is one of the key sites at which ceramic evolution from Kwale Ware is postulated. The decorative elements of triangular panels have been used to characterise the tradition (*ibid*.). Other LIA traditions dominating the Swahili coast are Plain Ware (PW), and Neck Punctating (NP) or Swahili Ware (SW) (AD 500–1500). Those kind of pottery traditions have been reported in different parts of the East African interior, including southern Tanzania (Mapunda 2001, 2003, 2009).

Various LIA traditions have been recorded in the interior of East Africa. In Uganda and western Tanzania, the LIA pottery is characterized using cord rouletted pottery (Figure 2.10 below) this tradition which was attributed to the period between the thirteenth and fifteenth centuries AD marked the time of completely absence of EIA traditions in the region (Posnansky 1969; Phillipson 1977; Ashley 2010; Kyazike 2013). This is noted from Ashley (2010:136) "in particular, ceramic evidence is used as a chronological diagnostic, and it is no exaggeration to state that ceramic variation largely defines the later prehistory of the Great Lakes, with the transition from the 'Early Iron Age' (EIA; c. 500 BC to ad 800) to the 'Late Iron Age' (LIA; c. ninth AD onwards) identified by the shift from incised Urewe ceramics to the roulette decorated ceramics of the latter period." The pottery tradition named as Chobi ware is the one which marked the end of EIA tradition in the lake regions (Soper 1971b; Kyazike 2013; Figure 2.10 below).

In southern and central Tanzania, in the areas such as Ivuna and Lake Rukwa, none of rouletted pottery have been recovered instead there is a wide variety of decorative techniques including incision, grooving, comb-stamping and the use of applied bosses or ribs (Fagan and Yellen 1968; Mapunda 2010, 2017; Figure 2.10). The rouletted pottery in southern Tanzania has been reported in Uvinza dating as early as twelfth century A.D (Sutton and Roberts 1968). For a log time the LIA of southern Tanzania, remains virtually unknown until recent times (Mapunda 2004, 2008, Kwekason 2011; Pawlowicz 2011, 2017). Sutton (1973c) investigated a number of sites in Southern Highlands and recorded some traces of rectangular mud-built houses associated with pottery but with completely absence of roulette sherds. Other LIA traditions which have recorded in southern Africa are Kalomo tradition in Zambia which could have descended from Dambwa EIA group. Others are Luangwa, Lugwebungu and Linyanti traditions both from Zambia (Fagan 1967; Phillipson 1974; Pawlowicz 2011, 2017; Figure 2.10).

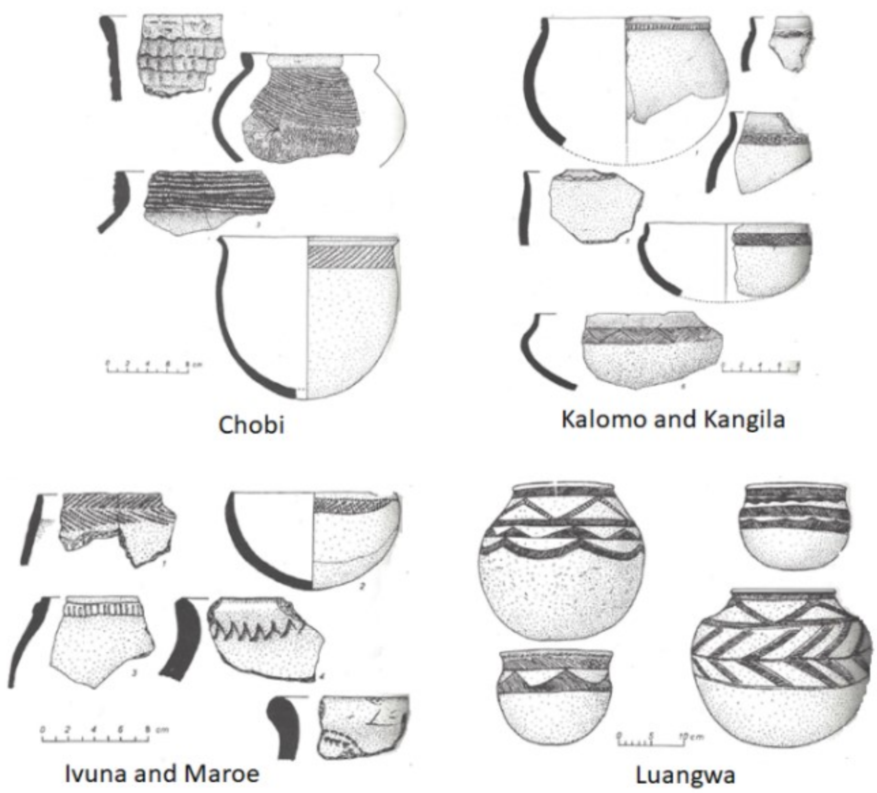


Figure 2.10: A sample of LIA traditions from east and southern Africa (Modified after Fagan and Yellen 1968; Odner 1971; Phillipson 1974).

2.4 Pastoral Neolithic Traditions in East Africa

Pastoral Neolithic (PN) refers to the period in East Africa, mainly central and southern Kenya and northern Tanzania (ca. 5000-1200 BP), that marks the beginning of domestication, particularly cattle and sheep/goats (Grillo et al. 2018, 2020a, b; Prendergast et al. 2019; Goldstein 2021; Ombori 2021; Robertshaw 2021; Fitton et al. 2022). PN residential sites (in contrast to monumental and mortuary sites, which are also documented in this region) are characterised by large, dense middens of domestic refuse, which include pottery, lithic tools and debris, and remains of cattle, sheep, goat and occasionally donkey (Robertshaw 2021; Fitton et al. 2022:300). The early pastoralists in East Africa used also Later Stone Age technologies, but they relied economically on domestic cattle and sheep/goats as well as pottery production and use (Grillo et al. 2018, 2020 a, b; Ombori 2021; Robertshaw 2021; Smith 2021).

Bower (1988, 1991) referred the PN as an evolutionary stage intermediate between the LSA (lacking domesticates), and the Pastoral Iron Age (EIA), in which a reliance upon domestic livestock co-occurs with metallurgy. Similarly, Russel (2018:2) asserts that "conventionally, livestock bones and pottery found within a Later Stone Age context (i.e. without iron tools) in the western half of southern Africa are understood to be the remnants of herders (who may or may not be related to autochthonous hunter-gatherers and who spoke languages related to the Khoe language group), whilst pottery (and later, iron tools, livestock and cereals) found on the eastern side of southern Africa is interpreted as having an agro-pastoralist origin, and is linked to the movement of Bantu-language speakers."

In eastern Africa, ceramics made by early Holocene hunter/gatherer/ fisher communities have been found in multiple areas, including near Lake Turkana and Lake Victoria (Grillo et al.

2020 b:1; Goldstein 2021). According to Robertshaw (2021) the first East African pastoralists arrived at the shores of Lake Turkana soon after the end of the African Humid Period, about 5,000 years ago. In the preceding millennia of the Holocene, fishing economies characterized East Africa (see also Prendergast et al. 2019, 2021; Grillo et al. 2020 b:1; Goldstein 2021; Smith 2021). This has been also stated in Grillo et al. (2020 b:2) "as the African Humid Period waned in the fifth millennium BP, pastoralists herding cattle, sheep, and goats moved into the Turkana Basin of northwestern Kenya, marking the beginning of time period in eastern Africa known as the Pastoral Neolithic (PN, c. 5000–1200 cal BP) and a pastoralist presence in the region that continues today (Wright et al. 2015)." Here domestic cattle, sheep, and goat are represented at three sites on the north-east shore of Lake Turkana. Other associated evidence is pottery referred as Nderit and Ileret fishing remains, and the microlithic (Barbour and Wandibba 1989; Grillo et al. 2020 b). The earliest herders around Lake Turkana are archaeologically associated with a distinctive type of ceramics – intricately decorated basketry-like bowls, sometimes with internal scoring – referred as "Nderit ware" (Grillo et al. 2020 b: Figure 1, 5:3 and 12; Robertshaw 2021: Figure 6:13). Other evidence signifying the PN cultures are stone bowls, shells ground and grindstones. PN cultures are also found in south-central Kenya, Uganda, and Tanzania (Bower 1988, 1991; Grillo et al. 2018; Prendergast et al. 2019, 2021; Ombori 2021; Robertshaw 2021; Fitton et al. 2022).

According to Robertshaw (2021) the domestic animals of the early pastoralists were not indigenous to East Africa, nor did they spread through the region simultaneously. Pastoralism expanded further south through East Africa was a two-stage process, probably because of the challenges posed by the presence of diseases fatal to livestock (*ibid*.) First, caprines spread south and appear to have been integrated into existing forager subsistence systems. Then, starting toward the end of the 2nd millennium BCE, specialized pastoralism began to be established across central and southern Kenya and into northern Tanzania. This two-stage process has aptly been termed the “trickle and splash” model of herding origins (Bower 1991). The former model considers of pastoralist origins in the Lake Victoria Basin is evident from the appearance of caprines within the long-established Kansyore tradition (Robertshaw 2021). The latter model considers that cattle arrived and there was a subsequent shift to specialized pastoralism in some areas across central and southern Kenya and into northern Tanzania (*ibid*.).

Archaeological research in the 1970s and 1980s were marked by intensive research at such sites, which came to be collectively called “Pastoral Neolithic” (Grillo et al. 2018:112-13). Excavations revealed PN mortuary and settlement sites dating to ca. 4500–1200 B.P. along the Rift Valley and adjacent plains, stretching from Lake Turkana to Lake Eyasi. Fitton et al. (2022) also maintain that some scholars (Bower 1988, 1991; Barbour and Wandibba 1989) conducted earliest research on PN focused on the necessary work of building basic cultural sequences for the region. This is also presented by Grillo et al (2018:104) that previous research focused on the necessary work of building a basic PN regional chronology, mainly informed by ceramic styles, lithic technology, and limited radiocarbon dates. For example, scholars (Collett and Robertshaw 1983; Ambrose 1984) classified various stages of PN based on ceramic and lithic artifacts (see Table 2.2). Appendix II presents in detail each PN tradition, its characterization/attributes, location, and the time period. More recent scholars (Prendergast et al. 2013, 2014, 2019, 2021; Grillo et al. 2018, 2020a, b; Wright et al. 2015; Ombori 2021; Robertshaw 2021; Fitton et al. 2022) have continued researching the PN in Kenya and Tanzania by expanding the topic both thematically and geographically. The new researchers on PN are employing advanced methods, and new themes on aspects such as diet, through molecular and isotopic evidence (Grillo et al.

2020a), genetic studies (Muigai and Hanotte 2013; Prendergast et al. 2019), new chronometric dating (Prendergast et al. 2014), and geospatial, geoarchaeological and ethnoarchaeological research (Shahack-Gross et al. 2003, 2004; Fitton et al. 2022).

In reference to Robertshaw (2021), the early PN northern Tanzania is not well-known. Instead, most archaeological research has been concentrated in the Lake Eyasi Basin and the Serengeti, with domestic animal bones and sherds of the Nderit tradition found at sites in the latter region, but not satisfactorily dated (see also Bower and Chadderdon 1986). Generally, in Tanzania PN cultures have been recorded, mainly in the north (Ordner 1972; Mturi 1986; Bower and Chadderdon 1986; Bower 1991; Prendergast et al. 2013, 2014, 2021; Grillo et al. 2018, 2020 a; Ombori 2021; Fitton et al. 2022) and some sites along the Indian Ocean's Swahili coast and its islands (Chami and Kwekason 2003; Chami 2001b, 2009). The PN sites are like Maua on the slopes of Kilimanjaro and Serengeti Plain in northern Tanzania, where domestic faunal have been dated to between 4200 BP and 1500 BP (Mturi, 1986; 1998; Prendergast et al. 2013), as well as Eyasi Basin, the Ngorongoro Crater Burial Mounds in northern Tanzania, and the Luxmanda site in north central Tanzania (Prendergast, et al. 2013, 2021; Grillo et al. 2018; Fitton et al. 2022). The recent discovery of Luxmanda site has also produced evidence of animal domestication, dating to between ca. 3000–2900 CAL B.P. (Grillo et al. 2018:115; Ombori 2021; Prendergast et al. 2021). Robertshaw (2021) maintains that Luxmanda is well dated to approximately 1000 BCE. As such it reveals that the "splash" of specialized pastoralism reached into northern Tanzania, the southern limit of the PN as currently known, earlier than previously thought and perhaps very shortly after its debut in central and southern Kenya (Grillo et al. 2018).

While PN evidence has not commonly been reported in the interior southern parts of the country, Msemwa (2001:42-43) has described possible evidence in Southern Highlands (Mtera, Lower and Upper Kihansi area) based on pottery. Such pottery was compared with the Narosura tradition reported from the Rift Valley of Kenya/Tanzania and Kilimanjaro (Ordner 1972; Mturi 1986:60; Prendergast et al. 2013; Ombori 2021:27). Ordner (1972:62) describes Narosura assemblage as being mainly characterised by comb-stamping or line incisions, which are occasionally crossed by horizontal lines or divided by zigzags, and narrow-mouthed bowls, bowls with slightly everted rims and beaker-like vessels. Although Msemwa has reported important findings both of PN and EIA, his research was not intensively done considering that it was reconnaissance in nature to the extent that it was done as a rescue operation following the development projects that required a quick assessment of the cultural heritage (Msemwa 2001: 41). That is why Msemwa (2001:41) calls for a full analysis of pottery, particularly that from Mtera and the Lower Kihansi area, where stone tools and potsherds were presented. He is also providing a suggestion that excavations at Mpanga, the Ifinga mission and Mgala sites need to be undertaken in order to clearly understand the early cultural history of the Upper Rufiji catchment area (Msemwa 2001:51). Building on what Msemwa has presented, the current study believed that more evidence is needed to justify the presence of a PN in the Southern Highlands of Tanzania. Such evidence can be used to answer a research gap/debate left by some scholars such as Sutton (1969:11-12) who argued that "One might wonder whether these Late Stone Age food-producers extended into Southern Highlands with their expenses of goods grasslands for cattle and fertile unforested land easy for early cultivators. Without archaeological support the point can not be pressed". Such statement by Sutton came following the long prevailing notion that the LSA-food producers in Eastern Africa were confined in the Highlands and the Rift Valley of

Tanzania and Kenya (Horton 1990; Robertshaw 2021; Smith 2021). Chami and Kwekason (2003:68) have reported the same issue along the Swahili coast. Horton (1990) is refuting Casson's (1989) who concluded that the people of the coast of East Africa, then Azania, had practiced agriculture before incorporated with Bantu agro-pastoralists.

> …… could these 'tillers of the soil' have derived from the 'Pastoral Neolithic' populations of East Africa? While it has been argued that there was a substantial agricultural component in some interior PN communities, there is scant evidence for such sites close to the coast, indeed east of the Rift Valley and the region of Kilimanjaro. Indeed, the direction of current thinking is against a major agricultural component in the PN economy (Horton 1990:96).

Table 2.2 Ceramic and Lithic Entities of the Pastoral Neolithic (Adapted from Bower 1991:65).

Wandibba[a]	Collett/Robertshaw[b]	Ambrose[c]
Akira		SPN/Eburran
Maringishu		SPN/Eburran
Remnant (Elmenteitan)	Elmenteitan	Elmenteitan
Narosura	Oldishi	SPN/Eburran
Kansyore	Oltome	
Nderit	Olmalenge (includes Maringishu)	SPN/Eburran

[a] Ceramic classification (Wandibba, 1977, 1980); see Figs. 5–8.
[b] Ceramic classification (Collett and Robertshaw, 1983b).
[c] Lithic classification (Ambrose, 1984a); SPN, Savanna Pastoral Neolithic.

2.5 LSA cultures in East Africa

The term Later Stone Age (LSA) was initially defined by Goodwin and van Riet Lowe (1929). The LSA is differentiated from MSA based on typology and technology (Kessy 2005, 2013; Skinner et al. 2003; Gliganic et al. 2012). Technologically the MSA is defined by

Levallois and disc core methods as opposed to LSA that is dominated by the blade technology (Bipolar technology) as per (Mehlman 1989:5-6; Díez-Martín et al. 2009; Willoughby 2012). According to Willoughby (2012) the MSA are associated with the first Anatomically Modern Humans in African continent and composed of flake tools struck from radial or circular (peripheral) cores. Retouched pieces are referred to as tools, and in the MSA, consist mainly of scrapers, points and denticulates. Other artifacts are made on Levallois cores, and include flakes, blades, and points; these are removed from a core ready to use without further modification (although some could also be retouched), and represent an attempt to standardize tool production, possibly for hafting on to handles as the earliest composite tools. MSA sites range between around 300,000 and 30,000 years ago. Towards the end of this period, people started manufacturing tools on blade or bladelet cores. Many of these are backed and were used to make inserts for composite tools. Backing involves applying 90^0 retouches to at least one longitudinal edge to blunt the tool for insertion into a wooden or bone handle. Backed tools can include geometric microliths: crescents (also called segments or lunates), triangles, and trapezes, as well as truncations (pieces backed perpendicular to the long axis of the tool). These belong to the Later Stone Age or LSA, and in sub-Saharan Africa, LSA sites can range in age from 50,000 to 3,000 years ago. The end date is associated with the appearance of farming or pastoralist societies (either Neolithic or Iron Age). Chapter 6 provides more details about LSA in terms of features and its distribution in East Africa.

2.6 Theoretical Framework

The current study was informed/guided by Material Culture Theory (MCT) and migration and interaction models/theories as follows:

2.6.1 Material Culture Theory (MCT)

"Material culture" typically refers to objects and perhaps buildings and other types of physical structures (Miller 2005; Wynne-Jones 2013, 2016; McDonnell 2023). However, recently scholars from various disciplines have added issues on the discipline (*ibid*.). The term now may refer to any kind of human artifact ranging in scale from isolated objects to landscapes. According to McDonnell (2023), one cannot account for the effects of culture without understanding cultural objects. The cultural objects have been defined by Griswold (1986) as "shared significance embodied in form," meaningful expressions that are materially perceptible by others. This includes what we usually think of as material objects (e.g., artifacts in the world like books, tables, or cars) and people's bodily expressions (e.g., a whispered phrase, a hand gesture, or a wink). As these are all perceptible, they are material. As externalized manifestations of ideas, cultural objects make it possible to share meaning and therefore culture (McDonnell 2023). There is a difference between material culture and materiality. The material culture research examines what people do with objects, and studies of materiality examine what objects do with or for people (McDonnell 2023). Studies of material culture tend to examine the systems of meaning that stabilize around specific categories of objects, usually artifacts such as vinyl records (Bartmanski and Woodward 2015). Equally, studies of materiality (Miller 2005; Griswold et al. 2013) focus on the material qualities of objects and the contingent ways those qualities shape the meaning and use of those objects. Archaeologists (Hodder 1987, 2012; Ashley 2010, 2013; Ashley and Grillo 2015) working in Africa have adopted the MCT to understand how meanings are ascribed to things and places and their role in shaping social values. Studying material culture can be used to understand issues related to age, gender, class, ethnic identities, and social interactions between groups (Plog 1976; Oestigaard 2004; Ashley 2010; Hodder 2012).

The similarities in material culture have been used by archaeologists to infer the degree of social interaction between cultures or group of people, however, this case could be different in some occasions (Plog 1976). A good example is presented by Hodder's (1982:13-57) study among the Tugen, Pokot, and Ilchamus around Lake Baringo, Kenya which indicated that, despite frequent interactions between the three groups, their material culture exhibited a number of stylistic differences. In addition, Hodder (1982:9) maintains that "if it is impossible to examine the relationship between interaction and cultural similarity in an archaeological context, it is necessary to turn to ethnoarchaeology." The ethnoarchaeology is both a sub-discipline of archaeology and a methodological tool providing analogies and interpretations (Oestigaard 2004). The practice of ethnoarchaeology is based on studying the present and past in relation to each other using both archaeological and ethnographic techniques within a frame strongly committed to ethical considerations (Hodder 2012). The aim of ethnoarchaeological work is not only to examine the relationship between people and culture, but to also find out if cultural similarities reflect interaction, and if not, what other factors could be (Hodder 1982, 2012). For example, it could be society's adaptation to its physical and social environment (see Flannery 1972). "Knowing about how pottery can be made and how different cooking methods require different amounts of fuel is of importance to interpretation of the past. But the material culture approaches are also necessary so that the complex ways in which material culture can be manipulated to achieve social ends are also taken into accounts" (Hodder 2012:9).

Archaeological and other related studies on materialism are believing on the idea that material cultures are not static because they carry information based on the makers or users of those objects even if they are found in archaeological records. This is proved by Jerolmack and Tavory (2014) who maintain that attention to materiality moves us away from treating objects as static carriers of symbols and inert sites of people's projections to viewing objects as contingent participants in meaning-making and action. Therefore, some approaches like ethnoarchaeology are tools for attaining such goals relating to giving material culture meaning and interpretation.

The MCT was selected for this study because it informs and provides a direction on how to approach the issue related to social interactions, migrations, and ethnic identities based on material culture. The same idea is supported by Barbour and Wandibba (1989:5) who maintain that "scholars are becoming more aware of the importance of material culture in supporting a group's sense of identity." MCT also offers a direction on how the consideration of context is very important in studying past based on material culture (Moore 1982; Ashley and Grillo 2015). In due regard, material culture especially of ceramics in Southern Highlands of Tanzania was analyzed to understand issues related to traditions, regional interactions, and ethnic affiliations/identities based on the aspect of Bantu migration. Both ceramics in the archaeological records and the living communities were considered under "ethnoarchaeological approach".

In addressing the issue of ethnic identity through material culture, archaeologists have long questioned whether a correlation exists between material culture and identity and whether artifact variability provides a key to interpretation of past social boundaries (Jones 1997). According to Mayor (2010) in the past 20 years ethnoarchaeologists have addressed the subject of identity and material culture through studies of ceramics, which are one of the best represented materials at archaeological sites since the LSA. In particular, ceramic researchers have focused on describing the learning processes and diversity in pottery manufacturing processes and variability in products, in order to understand better the meaning of technical and stylistic choices (*ibid*.). This subject of ethnicity has been noted has a controversial area of study in the contemporary archaeology (Jones 1997). Thus, the identification of ‘cultures’ from archaeological remains and their association with past ethnic groups is now seen by many as hopelessly inadequate. Yet such an approach continues to play a significant role in archaeological enquiry, and in the legitimation of modern ethnic and national claims (*ibid*.). The issue of ethnicity initially has been associated with traditional archaeology that focused of description of cultures. The emergence of new paradigm in archaeology namely “processual or new archaeology” did not regard the ethnicity as an important focus in the archeological enquiry (Olsen and Kobylinski 1991). The new archaeologists provided a number of challenges that goes with affiliations of material culture with a certain ethnic group or community. For example, colonialist and imperialist archaeologies, in the various attempts by the Rhodesian colonial regime to attribute the construction of Great Zimbabwe to allochthonous peoples (Hall 1995), or archaeologists’ denial of any ongoing relationship between living Australian Aborigines and their past which was defined as ‘prehistoric’ and ‘dead (Jones 1997). Another example drives from the attempt to use material cultural approach for political manipulation of the past in Nazi Germany. The attempt made to delineate the descent of the Nordic, Aryan, Germanic super-race to the Indo-Europeans (or ‘Indo-Germans’) (*ibid*.). The similar issue has been raised by Kusimba and Kusimba (2005:393) who maintain that “European colonization has influenced the way archeologists have approached the study of mosaics in Africa.” Anthropological works participated in the colonial task of labeling and describing African cultural diversity as a patchwork of bounded ethnic groups or tribes. An ethnic group was confidently assigned a set of descriptors: a language family affiliation, a social system, an ecology, an economy, a religion, and a legal system. Then through such labels, African cultures became known to the European world (Kusimba and Kusimba 2005).

The new archaeologists, such as Binford (1965), focused on cultural systems, functionalism, and institutions in the study of particular cultures. This goes with the idea that culture is a multivariate rather than a univariate (Jones 1997). Despite of the critiques raised by the new archaeologists over traditional archaeologists, new archaeologists continued to accept the idea that some bounded archaeological distributions, if only in the domain of stylistic variation, correlate with such groups (*ibid*.). For instance, Binford (1962:220) stated that 'stylistic variables are most fruitfully studied when questions of ethnic origin, migration, and interaction between groups are the subject of explication." However, more recently, the assumption that a one-to-one relationship exists between variation in any aspect of material culture, stylistic or otherwise, and the boundaries of ethnic groups has been questioned (Jones 1997:108). This has been taken as a challenge on new or processual archaeology that failed to address the relationship between the normative variation in material culture and ethnicity (*ibid*).

Other approaches to study ethnicity in the line of material culture during the processual archaeology is based on an ecological analogy developed by Barth (1969) for understanding ethnic mosaics. According to Barth (1969), the ecological diversity of a region set the range of possibilities and the boundaries for social groups and their relationships. Barth (1969) argued that ethnic identities were themselves a by-product of interaction in these mosaics, and that ethnicity is a consequence of a group's believing itself distinct against others. This outlook has had some influence in African anthropology and archaeology, suggesting that ethnic identity has less to do with cultural content than with the signaling of negotiable distinctions (Kusimba and

Kusimba 2005). An alternative hypothesis is that ethnicity emerges internally within a culture as people create beliefs and practices (*ibid*.). Kusimba and Kusimba (2005:398) has raised some challenges on Barthian perspective on regional distributions of material culture: "Our intention in the following case studies is not to deny the usefulness of this approach, but rather to point out some shortcomings and continued anomalies of the approaches we examine." The main problem is that archaeological cultures or traditions are found over much larger areas than are usually occupied by modern ethnic or linguistic group. In Africa for instance, due to Berlin conference (1884-1885) there was impacts on ethnic boundaries because of an abstract division of African continent. It is common in Africa to find various ethnic groups who share some cultural similarities (like language) situated in different countries.

Recently, ethnicity, along with nationalism, have become increasingly important at archaeological conferences and the literature focusing on the use of the past in the construction of the contemporary identities is expanding rapidly (Jones 1997). This has been linked to post-processual archaeology as stated by Jones (1997:6) "it can be argued that post-processual archaeology, as a disciplinary movement, has in part set the context, and provided important critical perspectives, for exploring the nature of archaeology as a contemporary practice involved in the construction of cultural identity." The idea that culture is a multivariate rather than a univariate phenomenon resulting from many different factors has been accepted by many archaeologists, and sophisticated methods of data analysis appropriate to such a theoretical stance have been developed. Since the 1960s up to present, studies have revealed that the boundaries of ethnic groups and the identification of individuals may change through time, and from place to place, often as a result of the strategic manipulation of identity with relation to economic and political relations. Building on post-processual paradigm, it has been widely recognized in anthropology and sociology that a one-to-one relationship between ethnic identity and cultural similarities and differences cannot be assumed, and ethnic groups have been conceptualized as self-defining entities. Moreover, a large body of recent research has suggested that the communication of ethnicity is an active process involved in the manipulation of economic and political resources (Jones 1997:113). Jones points that despite of critiques evidenced in both traditional and processual archaeological approach to ethnicity, still it is possible to reconsider the interpretation of ethnicity in archaeology. Accordingly, the sensations of ethnic affinity are based on the recognition, at both a conscious and subconscious level, of similar habitual dispositions which are embodied in the cultural practices and social relations in which people are engaged (*ibid*.). Such structural dispositions provide the basis for the perception of ethnic similarity and difference when people from diverse cultural traditions come into interaction with one another, leading to forms of self-reflexive cultural comparison. Building on Jones' (1997) approach of ethnicity, scholar (Mayor 2010) uses the ceramic material culture from West Africa (in the Niger Bend) to address the issue of ethnicity and identities in the past. Mayor insists on the study of systemic links in the present between ceramic traditions, their meanings and interpretation. "The study of systematic links established in the present between ceramic traditions and their meaning enriches the interpretation of the regional archaeological record and makes it possible to propose models for population history. Specifically, I will propose an archaeological "interpretative tool" in the domain of ceramics, based on studies of the present, capable of addressing the material expression of processes of identity construction and social interactions in ceramic assemblages from the past" Mayor (2010:6). In order to determine whether variability in material culture reflects socio-cultural boundaries require the use and comparison of data from three different disciplines. They include an *ethnoarchaeological* *analysis* of correlations between current material features and ethnolinguistic identities, at the level of production, use, and diffusion of pottery. Second, review of *ethnohistorical sources*, and third, an *archaeological analysis* of sites, occupation chronology, main techno-economic and cultural features, as well as ceramic characteristics. The currents study considered the above discussed approaches and dynamics towards the study of ethnic identities in the archaeological records based on material culture specifically ceramics.

2.6.2 Human Migration and Interaction Models/theories

One of the underlying concerns posed by scholars (Stringer 1992; Cavalli-Sforza et al. 1993) researching on human migration and interaction over time and space is on the efficacy of theories or models involved. Such models include demic expansion/population replacement/displacement model, acculturation /cultural diffusion, and an assimilation/absorption. These models have been used to explain the issue of Bantu migration and its impacts on LSA hunter-gatherers in sub-Saharan Africa (Mapunda 2002; Kessy 2005, 2013; Russell et al. 2014). In turn, they have been subject to criticism and debates. Table 2.3 below summaries each model/theory by showing the type of interaction assumed and the potential material correlates a particular theory or indicators considered in addressing each model/theory.

i. Demic Expansion and Population Replacement Model vs Demic Diffusion Model

The *Demic expansion and population replacement model* maintains that some socio-economic and political changes of a certain society are/were caused by the physical movements of people or cultural group who radiate and replace the pre-existing communities across the landscape (Cavalli-Sforza et al. 1993). Replacement model is opposed by the so-called *Demic* *diffusion model*. This is a demographic term referring to a migratory model, of population diffusion into and across an area that had been previously uninhabited by that group. They may possibly, but not necessarily, displace, replace, or intermix with a pre-existing population (Cavalli-Sforza et al. 1993). Both Demic/replacement and Demic diffusion models allows physical movement of people however, the former involves replacement of indigenous people while the latter does not. Demic diffusion entails the spread of a population and their culture, including language and other material culture which can be adopted and co-exist together with the indigenous or local community (*ibid*.). Demic diffusion model sometimes can be referred as acculturation/adoption model. Demic diffusion model is opposed by the so-called *Cultural diffusion model* which focuses on the spread of idea, knowledge, and technology without physical movement of people (Fix 1999).

The Demic models seek to explain the issue pertaining to human population growth and how it may result to innovation, expansion, and movements. Expansions and movements have been recorded in various time periods, such as the Paleolithic, Neolithic, and Post-Neolithic periods (Cavalli-Sforza et al. 1993; Appendix I). A good example is the expansion of *Homo erectus* out of Africa soon after 2 million years ago and a similar movement of anatomically modern *Homo sapiens sapiens* around 50,000 years ago (*ibid.*).

Scholars (Ammerman and Cavalli-Sforza 1984; Cavalli-Sforza et al. 1993) have tried to test the efficacy of these two models (Demic expansion and population replacement model vs Demic diffusion model). Here a comparison was made between the geographic maps of the spread of agriculture to Europe, based on comparing the archaeological date of first arrival of farming in various regions of Europe with maps of the distribution of genetic data (Ammerman and Cavalli-Sforza 1984). Based on that study, it was concluded that the spread of farming from

Middle East to Europe was a movement of farmers with their languages which gradually evolved formed new languages and agricultural societies (demic diffusion/acculturation) instead of the wave of total replacement (Ammerman and Cavalli-Sforza 1984). This scenario was explained as a wave-of-advanced model (*ibid*.).

These two models have been useful in explaining the Bantu migration (Kessy 2005, 2013; Russell et al. 2014; Grollemund et al. 2015; Crowther et al. 2018). Some scholars (Johnston 1913; van der Merwe 1980:480-82; Phillipson 1983, 1993:188; Diamond and Bellwood 2003) believed that the spread of Bantu peoples south of the equator resulted in the dislocation or eradication of LSA-hunter-gatherers. According to Kessy (2005:116, 2013:227) this model accounts for why original LSA population is totally represented by scattered groups of minorities. Alternatively, the *demic diffusion model* was adopted contrary to replacement model. This model allows for the spread of Bantu people and their cultures and technology, but rejects the theory of a grand Bantu migration conquest and replacement (Musonda 1987; Vansina 1994-5:19-20; Denbow 1999; Bellwood 1996, 2009; Kessy 2005, 2013; Lane, 2004; Kusimba 2003; Kusimba and Kusimba 2005; Kusimba 2005; Crowther et al. 2018). The model considers this process as gradual expansion, possibly stimulated by population pressure, bringing small bands of Bantu people on the move into contact with other groups. In their studies, Musonda (1987) and Kessy (2005, 2013) argued that not every LSA hunter-gatherer group totally accepted what was brought to them by Bantu farmers. New cultures-fusions (acculturations/adoption) of Bantu farming communities and local elements (LSA hunter-gatherers) emerged through, intermarriage and diverse types of social and economic interchange (Stock 2013). This aspect is supported by other scholar (Dale and Ashley 2010; Prendergast 2010) who's their studies noted that the terminal LSA foragers were, far from homogenous, attesting to cultural and economic variation and would likely have reacted to the arrivals of food producers in diverse ways (see also Crowther et al. 2018). The similar scenario is presented in Phillipson (1993) that despite spreading of metal-using farmers, with their technologies and lifestyle, these were not rapidly or totally accepted by indigenous populations. It has been found that in several areas, indeed, there is plentiful evidence both from archaeology and from oral traditions for the survival of people who continued practicing the old microlithic technology long after the appearance of metallurgy. In other words, acculturation model maintains that IA peoples involved in the formative period in most areas of Eastern and Southern Africa were descendants of LSA hunter-gatherers (Kessy 2013). Between the two, the demic expansion/model of population replacement seems to be supported by many scholars (Russel et al. 2014).

ii. Cultural Diffusion Model

This is another model emerged to explain the cause of cultural dynamics in human life. Contrary to demic diffusion, this model maintains that, the dynamics and changes in some communities resulted from the spread of ideas and items without any movement of people (Fix 1999). Scholars such as Sikora et al. (2011) consider the spread of the Bantu related culture in sub-Saharan Africa to be the by-product of cultural diffusion that originated in different parts of Africa. So here the supports of this model believe that physical migration is not only possible explanation for the wide range of Bantu languages (Stock 2013). The fragmentary archaeological linguistic and genetic evidence that is available does not always support the concept of a single migration sweeping across the continent and bring multifaceted change (*ibid*.). In general diffusion models have been challenged based on number of reasons; firstly, it is more ethnocentric in nature by ranking some societies inferior over others. For example, it has been noted that for a long time some scholars have been considering Bantu agropastoralists communities as superior over LSA hunter-gatherer communities (Vansina 1994-95). As Stock (2013:170) commented, "diffusion theory has been criticized for portraying indigenous people as primitive and passive, and thus failing to recognize their potential to achieve cultural change from within or new environment." Secondly, it does not provide a convincing explanation of why some cultures do not show any sign of the culture origins (like Egypt). Lastly some studies indicated that 'societies can adjoin one another without exchanging cultural traits' (Scupin and DeCorse 2012:284). These kinds of critics align with the historical particularism theory developed by Franz Boas, which maintain that each society must be understood as a product of its own history (*ibid*.).

iii. Assimilation or Absorption Model

This model is derived from the term assimilate which simply means to become part of a group, society, or country. With reference to the Bantu issue, the assimilation model suggests that by the early first millennium AD most LSA-hunter-gatherers were absorbed by the more technologically sophisticated EIA herders and farmers, who are identified in the region by pottery and evidence of iron-working (van der Merwe 1980:480-82; Phillipson 1993). For that case at the beginning of interaction the consistence of two culture can be evidenced and suddenly one culture became dominant over another. Therefore, the higher amount of IA material cultures in the stratigraphic sequence(s) against the less amount of LSA material cultures may signify the presence of assimilation or absorption.

Table 2.3: A Summary of Migratory Theories/Models informed the Current Study.

Migration theory/Model	**Type of interaction assumed**	**potential material correlates a particular theory/indicator considered**
Demic expansion and population replacement	Replacement of one community by other (example LSA by IA)	-Sudden disappearance of material that identifies one community/population replaced by the totally new cultures by the new community or population. -One cultural group that causes impact on others will have been originated somewhere and moved to the affected group (Demic) -In archaeology this model/theory can be determined by analyzing the stratigraphy and the associated material culture.
Demic diffusion/acculturation/ adoption	There is migration and interaction between communities having different cultural identities or practices but no sudden replacement among them. Instead, concurrently practicing a separate cultural practice for a long period of time until one culture is adopted to one another.	-Observed mixture of cultural practices. This can be in different forms such as material culture, languages, etc. -In archaeology, this can be tested in the stratigraphy where by cultures of different communities persists for a long time and disappear slowly. -Contextual analysis to understand the origin.
Cultural diffusion	No migration or replacements but acquisition of some cultural traits from other cultures that are incorporated in one's culture	-Analysis of cultural traits between populations. -Assessments of context including the distance between the group that shares some cultural traits. -Study of chronology or time to determine the origin of cultures. -Using various line of evidence such as archaeological, biological, or

		linguistic evidence to determine the nature of cultural acquisition that is either by physical or knowledge flows?
Assimilation/absorption	There is replacement but not sudden/abrupt.	-Almost balance of material culture between the interacted groups at the initial stage of contact. In archaeology this can be done through analysis of stratigraphy and the associated material culture. -It doesn't take much longer time for one culture to be overwhelmed and assimilated or becoming part of another culture. In archaeology the quantity of material culture will be counted or assessed. Here one culture (e.g. IA) which is dominant will exhibits higher amount of material culture as compared to other culture (e.g. LSA) in a stratigraphic layer and continuously the material culture of the dominated culture will disappear in the upper layers.

2.7 The Origin of Ironworking Technology in sub-Saharan Africa

Bantu speaking communities have been considered as the agents of the spread of farming, Bantu languages and iron working technology present in different parts of eastern, central, and southern Africa (Crowther et al. 2018). However, for a long time the issue of the origin and the spread of agriculture, as well as iron technology, throughout sub-Saharan Africa has been debated to among scholars, particularly archaeometallurgists interested in African prehistory (Schmidt 1997; Mapunda 2002; Lyaya and Mapunda 2004; Killick 2009; Stock 2013; Lyaya

2013; Chirikure 2013, 2018; Holl 2020). Killick (2009:405) stated that "the origin of iron smelting in sub-Saharan Africa has been the subject of intense controversy over the last 60 years, with proponents of independent invention battling with those who favor diffusion of the technology from various other regions (Egypt, Phoenician North Africa, Arabia, or all of these)."

The earlier archaeometallurgists (Tylecote 1975; Kense 1985) believe on diffusion model, while others including more recent scholars (Andah 1981; Schmidt 1997; Mapunda 2002; Alpern, 2005; Holl 2009, 2020; Chirikure 2013, 2018) support the independent invention model. Early followers of the former model consider Middle East as a source. From there the technology moved to sub-Saharan Africa through one or more than the following routes 1) through Kathage (Morocco) crossing Saharan Desert up to West Africa; 2) through Meroe, Sudan, then to West Africa and finally East Africa; 3) through Aksum, Ethiopia directly to East Africa; and 4) the way through ocean directly to Central Africa to East Africa (see Mapunda 2002, 2013). Mapunda (2013) has indicated that efforts to uncover direct evidence to support those routes continue to meet with little or no success. For example, while Carthage was founded in the late 9th century BC, iron did not gain regular usage there until the 3rd century BC. Killick (2009) maintains that no evidence for the antiquity of metallurgy in sub-Saharan regions was available until the 1960s, when radiocarbon dating first began to be widely applied in Africa. This could be the reason for the diffusion proponents. Those who believe in independent invention provide various explanations to supports their arguments. First, there are no direct similarities in terms of technologies among those of provider (Eurasia) and receiver (sub-Saharan Africa). For example, the absence of a three-stage process of iron production in Eurasia strengthens the proposition of independent invention of iron technology in sub-Saharan Africa (Lyaya and Mapunda 2014). A good example is iron working technology in Kagera, northwestern Tanzania which does not relate to that of Eurasia (Schmidt 1997; Lyaya 2013). From ethnoarchaeological study conducted in Buhaya, Kagera Region during 1970s it was found that the Haya people practiced an iron-smelting technology that employed the preheating of air blast. According to Schmidt and Avery (1983:421) that technology was highly efficient and formed massive steel altogether different from that known in the European tradition of Iron production. Based on that scientific observation the two scholars concluded that "these discoveries affirm that one of the most advanced technologies in the ancient world developed in Africa independent of European influence" (*ibid*:421). The second argument is based on the availability of iron ores in sub-Saharan Africa. Mapunda (2002, 2013) believes that it is possible iron working technology would have been attained in that region without practicing bronze or brass technology. The iron ores could have been used in activities such as decorating pottery, houses, and human bodies (Mapunda 2002; Iles 2017; Chirikure 2018). The third reason is based on chronometric dating, as presented by Killick (2009) that the late 1960s a number of surprisingly early radiocarbon dates on current calibration, between 2700 and 4000 cal BC were published for iron working sites in Buhaya, northwestern Tanzania, by Peter Schmidt and in Rwanda and Burundi by Jean Hiernaux and Francis van Noten. Such dates were accepted by many Africanists including Bruce Trigger who concluded that iron working in central Africa was earlier than that at Meroe, and must therefore have been independently invented (Killick 2009:405).

According to Lyaya and Mapunda (2014), using information from Tanzania, it is extremely difficult to declare that iron production in Tanzania was introduced elsewhere outside Africa. The technology of Early Iron Age (EIA) in Tanzania is so different from the known European and Asian evidence, which makes its reasonable to suggest that the technology of iron production in Tanzania has an independent origin in sub-Saharan Africa (*ibid*.). The difference is also evidenced between sub-Saharan and northern African iron technology as presented by Chirikure (2018:1) “owing to their cultural and geographical location, Egypt, the Sudan, North Africa, and the Horn of Africa share some very broad similarities in their metallurgical histories. This in some cases sharply differs from that of many regions such as West, central, East and southern Africa.” Currently, the debate is almost closed considering that the independent invention has been accepted (Alpern 2005; Holl 2009, 2020). According to Alpern (2005:41) maintains that “judging from a number of recent publications, the long-running debate over the origins of iron smelting in sub-Saharan Africa has been resolved...in favor of those advocating independent invention.” Evidence is generated from chronometric dating and the nature of iron technology in sub-Saharan Africa that do not relates with Middle East that have been claimed to be the origin of iron technology (Lyaya 2013; Killick 2009, 2015). Holl (2020) insists that the discoveries from the northern margins of the Equatorial rainforest, North-Central Africa, in the northeastern part of the Adamawa Plateau radically falsify the “iron technology diffusion” hypothesis. Instead, Iron production activities are shown to have taken place as early as 3000–2500 BCE at those areas of Africa. Alpern (2005:89) maintains that doubt that sub-Saharans invented iron smelting has at times almost been equated with racism.”

2.8 Bantu Migration Routes/Models of Expansion/Spread

2.8.1 The General Routes

According to Semo et al. (2020), the Bantu expansion, which started in West Central Africa around 5,000 BP, constitutes a major migratory movement involving the joint spread of peoples and languages across sub-Saharan Africa. One of the debates about Bantu migration is how migration took place. What was the mode of expansion (de Fillipo et al. 2012; Fourshey et al. 2018)? Here two hypotheses have emerged to explain such scenario: the "deep /early split" hypothesis and "an alternative riverine/littoral/late split hypothesis (Russell et al. 2014; Prendergast 2022; Figure 2.11 below). The former suggests that an early-branching eastern Bantu stream spread around the northern boundary of the equatorial rainforest. This involved the early split of western and eastern branches within the Bantu heartland, into separate migration route (Patin et al. 2017; Prendergast 2022).

The latter hypothesizes that rivers and coastlines facilitated the migration of the first farmers/horticulturalists, with some extending this to include rivers through the rainforest as conduits to East Africa (Russell et al. 2014). This route is sometimes referred as Congo rainforest or southern route. This route has been supported by the genetic, linguistic, and archaeological evidence (Grollemund et al. 2015; Prendergast 2022; Fortes-Lima et al. 2024). Fortes-Lima et al. (2024) used the so-called climate-informed spatially explicit model to test the Bantu migration hypothesis. The results support the late-split hypothesis, in agreement with recent linguistic, archaeological and genetic evidence and highlight the importance of the Congo rainforest in the initial expansion of the Bantu Speaking Population (Patin et al. 2017; Bostoen 2018; Semo et al. 2020). Accordingly, current-day Zambia and the DRC seem to be important crossroads or interaction points for the expansion of the Bantu Speaking Population (*ibid*.). This was observed following the genetic diversity amongst Bantu-speaking populations which declines with distance from western Africa, with current-day Zambia and the Democratic Republic of Congo as possible crossroads of interaction (Fortes-Lima et al. 2024:540). Another genetic evidence supporting the southern route is comes from Patin et al. (2017:343) who argued that "We generated genomic data for 1318 individuals from 35 populations in western central Africa, where Bantu languages originated. We found that early Bantu speakers first moved southward, through the equatorial rainforest, before spreading toward eastern and southern Africa."

The linguistic evidence shows that the early Savanna Bantu, as they spread eastward across the southern savanna fringes of the rainforest, gave rise to five notable sub-branches of the Bantu language family by around three thousand years ago. From west to east, these are the Njila (or West Savanna Bantu), Central Savanna Bantu (or Lubans), Botatwe (Ila, Tonga, Lenje), Sabi (Bemba and related groups) and Mashariki [(Eastern Bantu) Fourshey et al. 2018; Bostoen 2018]. Shum Laka area in north-western Cameroon, dating to perhaps as early as 7,000 BP is considered the place where Western Bantu emerged and settled at west of the Sangha River, in the Democratic Republic of Congo (Lipson et al. 2020).

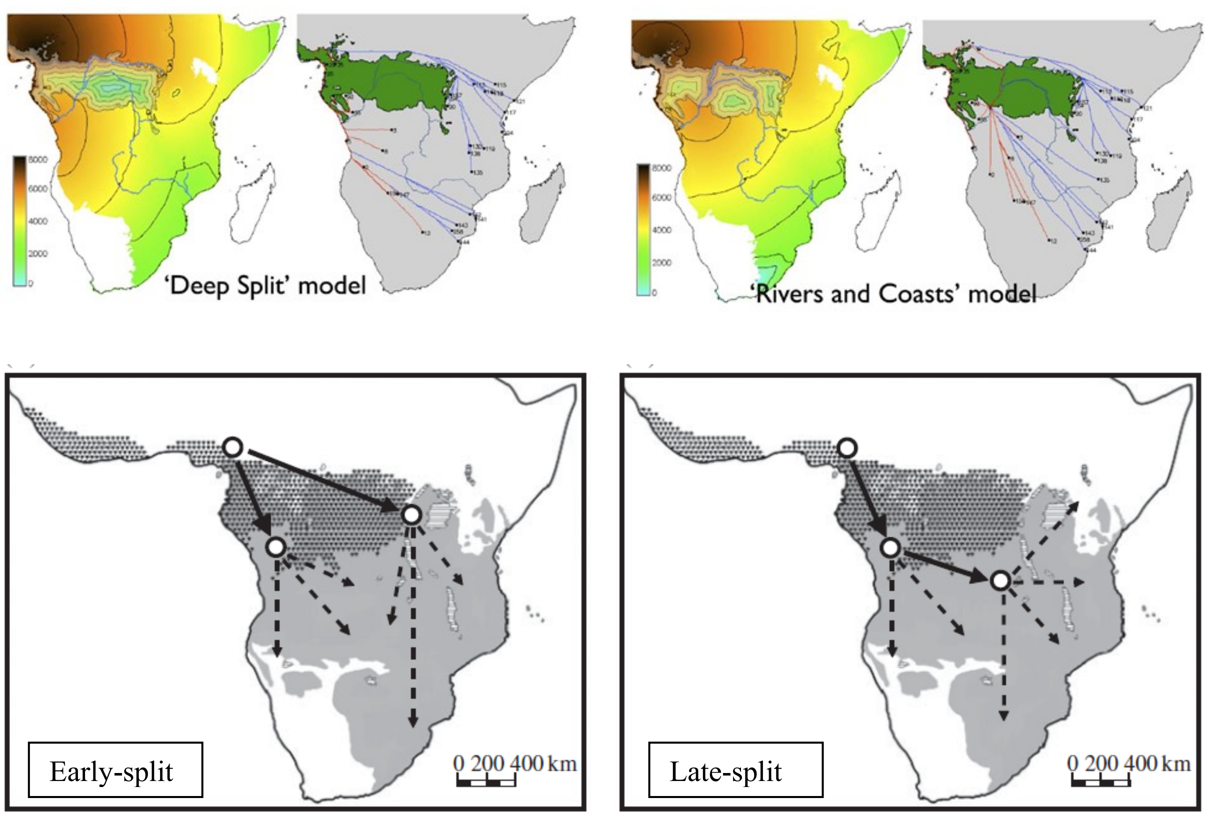


Figure 2.11: Models for the Spread of Bantu (Modified after de Filippo et al. 2012:3257; Russell et al. 2014:5-6).

2.8.2 Bantu Migration Routes in Eastern and Southern Africa

Genetic, linguistic, and archaeological evidence have all been used to explain how Bantu speaking people expanded in eastern and southern Africa (Fuller and Hildebrand, 2013; Grollemund et al. 2015; Skoglund et al. 2017; Bostoen 2018; Prendergast et al. 2019; Wang et al. 2020; see section 2.9 below for detailed argument and evidence by each scholar). Through wide-genome data conducted by Prendergast et al. (2019) it indicated that ancient East Africans show the archaeological complexity during the spread of herding and farming which is reflected in genetic pattens. This shows that there was a multiple movements and gene flow among the distinct ancestrally groups of people. The issue of multiple movements is also supported by Wang et al. (2020) through genetic data. Thus, the two Iron Age individuals from the Kakapel site near Lake Victoria (southern Kenya) document a more extreme (and near-complete) increase in Nilotic-related ancestry, possibly related to the arrival of the Luo, than the five previously published Iron Age individuals from the Central Rift Valley (see Prendergast et al. 2019). This made Wang et al. (2020:8) to conclude that "our findings for the Iron Age, much like our findings for the PN, are consistent with multiple groups with different subsistence systems entering eastern Africa along different geographical routes."

As presented earlier in sections 2.4 and 2.5, it should be understood that prior the arrival Iron Age-agropastoralists in East Africa, there was LSA and PN activities existing in that region. The arrival of Bantu speaking people (from West Africa) led to the admixture with northeastern people of present-day Tanzania and Kenya (Prendergast et al. 2019; Prendergast 2022). Iron-working first entered eastern Africa via the Lake Victoria Basin ~2500 BP and spread toward the coast by 2000 BP (Crowther et al. 2018:101; Figure 2.12). This may have brought early IA farmers thought to have spoken Bantu languages originating in equatorial western Africa into contact with PN herders, although iron-working is not widely attested among herders until ~1200 BP at Pastoral Iron Age sites (Lane 2004).

It has been noted that the earlier iron-using communities of eastern and southern Africa show a very remarkable degree of homogeneity, to the extent that archaeologists generally attribute them to a single complex, referred as "Chimfumbaze Complex" (Phillipson 2005; Bostoen 2018; Crowther et al. 2018). An eastern stream of Bantu-language speakers, who can be traced to a proto-Bantu 'homeland' in Cameroon, seem to have moved into the Great Lakes/southern Sudan region c.2,500 years ago (Lane 2015; Figure 2.12). The records show, after reaching the West of Lake Victoria around the middle of the last millennium B.C, Bantu people who had already developed iron working technology, agriculture, domestication of cattle, goat and sheep and kingship migrated to southern part through two main routes (Phillipson 1993; Mapunda 2002). The first route was through the eastern Democratic Republic of Congo, which took people to northern Zambia and Malawi around 1,800-1,700 years ago (*ibid*.). It has been said that on the course of their movements they started to develop other forms of technology and dropped some aspects of their original technology. For example, they stopped manufacturing the dimple-based pottery. The pottery produced obtained in the new area was different from that of Urewe and is given other names such as Kalambo and Mwabulambo, depending on the region where they are found (Clark 2001; Phillipson 2005; Fredriksen 2023).

The second route of migration was east towards the coast of the Indian Ocean, and then turned south (Fuller and Hildebrand 2013; Grollemund et al. 2015; Crowther 2018; Figure 2.12). According to Crowther et al. (2018:101) the Indian Ocean, eastern Africa was not only a major corridor on one of the proposed Bantu routes to southern Africa, but also the recipient of several migrations of pastoral groups from the north. It is said that this route passed through the central part of the country and left some evidence in terms of pottery: examples being Lelesu and Sandawe pottery (Phillipson 1993; Mapunda 2002; Kessy 2005; Prendergast 2008; Crowther et al. 2018). These pottery types dropped the dimple base but retained the rim shape and decorations of Urewe. The makers of Lelesu pottery continued east toward the area northeast of Kenya, at areas such as Kwale between 1,800–1,700ya. There were big changes in Kwale and Lelesu pottery and it is believed that from Kwale, the Bantu continued south (Figure 2.12). After crossing the Ruvuma River, they split into two groups. The first group migrated south to the area called Matola, Zitundo, and Maputo, located south of Mozambique (Hall 1990; Pawlowicz 2011; Fredriksen 2023). Another group moved around the southern Nyasa River and settled near northwestern Mozambique and Southern Malawi. The pottery obtained in these areas has been named Nkope because of the prominent area used to produce such pottery (Kwekason 2013). The Bantu continued to extend further south while changing their pottery's technological attributes.

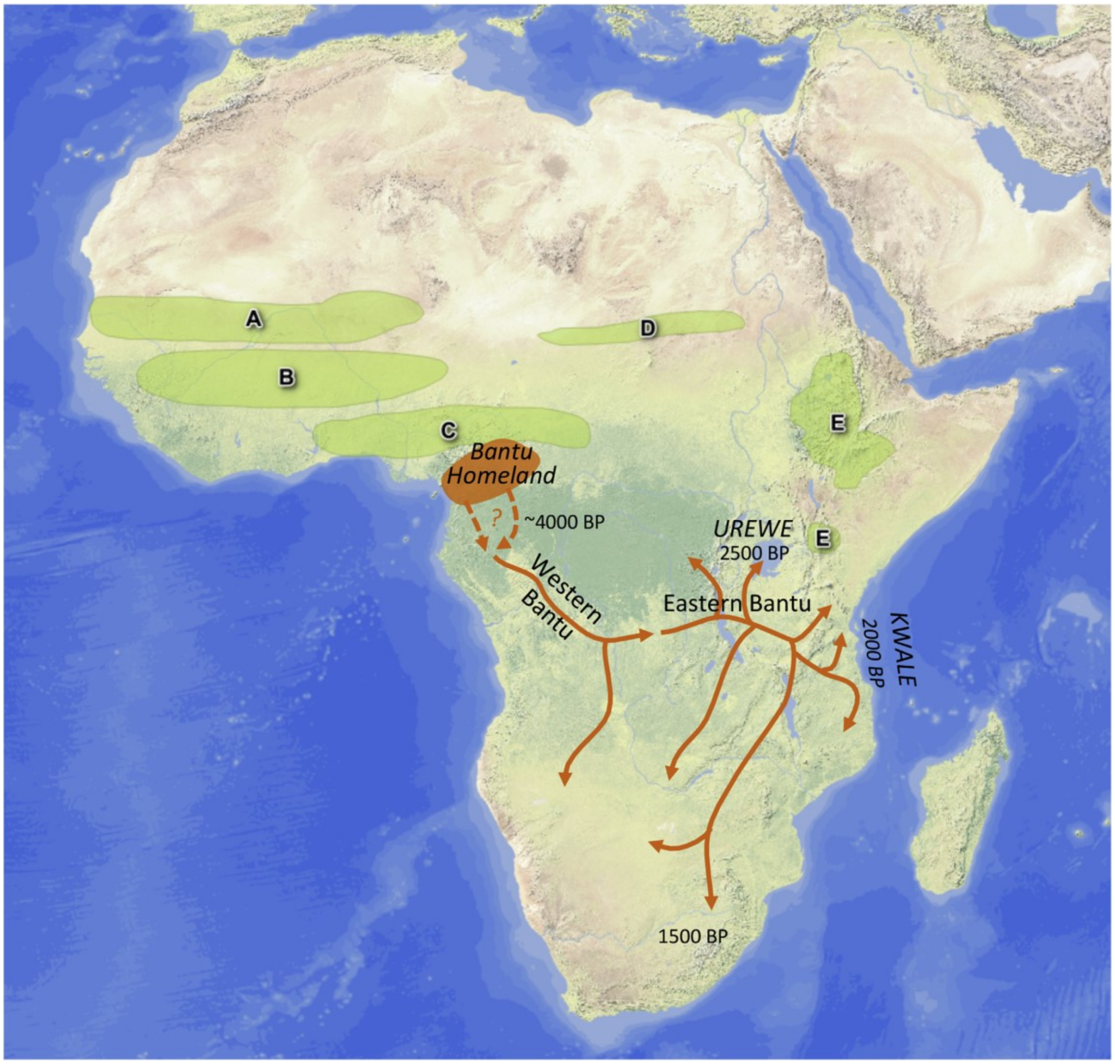


Figure 2.12: Map of Africa showing the Bantu homeland and the routes following Eastern and Western Bantu streams (after Fuller and Hildebrand 2013) and hypothesized routes of Bantu dispersal from Nigeria-Cameroon to eastern and southern Africa (orange arrows) (after Grollemund et al. 2015). Taken from Crowther et al. (2018:103).

2.9 Evidence Considered in Studying the Bantu Migration and their Impacts

Various studies have been conducted to justify the nature of the Bantu migration and its associated activities. Evidence derived from archaeological, historical linguistic, comparative ethnography and biological research has contributed to an understanding of Bantu migration history (Huffman 1970; Phillipson 1993; Hall 1990; Vansina 1990; Schmidt 1997; Nielsen et al.

2017; Skoglund et al. 2017; Bostoen 2018; Fourshey et al. 2018; Prendergast et al. 2019; Prendergast 2022; Wang et al. 2020; Fortes-Lima et al. 2024). By taking together those multidisciplinary evidence a comparative approach has been adopted by those scholars researching on Bantu migration history (Bostoen 2018; Fourshey et al. 2018). This sub-section discusses what entails for each category of evidence with examples.

2.9.1 Archaeological Evidence

For about six decades, archaeological research in eastern and southern African Iron Age has been focusing on what Phillipson (2005) named as "Chimfumbaze Complex" (Mapunda 2002; Kessy 2005; Russell and Steele, 2009; Currie et al. 2013; Russell et al. 2014; Bostoen 2018; Crowther et al. 2018). The evidence provided here are iron working remnants such as *tuyeres*, furnaces, bellows, iron ores and iron implement like arrows and spears. Other associated material includes pottery, houses made of *daga* (puddled mud, often derived from anthills), flora (such as oil palm (*Elaeis guineensis*), bush candle tree (*Canarium schweinfurthii*), and pearl millet (*Pennisetum glaucum*) and fauna evidence (Soper 1967b; Phillipson 1977; Russell and Steele, 2009; Bostoen 2018). For the case of pottery, various attributes have been considered mainly decoration, surface finishing, vessel shape, as well as the size and direction of the rim (Soper 1971c; Huffman 1989; Mapunda 2002, 2010; Kessy 2005; Ekblom 2023). Apart from the current criticism from genetic evidence the spread of livestock and agriculture has been attributed to Bantu migration (Hall 1990; Lander and Russell 2018). Therefore, archaeologists have been using fauna evidence of cattle, sheep, and goats, as well as flora evidence to justify the presence of Bantu at a certain area (Mapunda 2002; Russell et al. 2014; Lander and Russell 2018). All archaeological evidence especially ceramics associated with Bantu speakers have been covered thoroughly on section 2.3 above starting from Urewe in the Lake Victoria Regions to Transvaal traditions in South Africa.

2.9.2 Genetic Evidence

Genetic evidence has been used to understand the diversity and structure of African populations. Bantu speaking people have been traced genetically in terms of origins, dispersals and the activities involved during their expansion (section 2.8 above). The relatively low Y-chromosome diversity in current-day Bantu-speaking populations provides the most conclusive evidence for the fact that the Bantu Expansion was a major demic diffusion (Alves et al. 2011). The Y-chromosomal haplogroups E1b1a8 (also known as E-U175) and E1b1a7a (also known as E-U174), which are actually subgroups of E1b1a (also known as E-M2) and E1b1a7 (also known as E-M191), respectively, are very prominent among both Bantu speakers and Niger-Congo–speaking populations from West Africa as opposed to communities speaking languages belonging to one of Africa's other major phyla (Pakendorf et al. 2011). Y-chromosomes are inherited solely from fathers to sons and can therefore inform us on the prehistory of the paternal half of a population (Bostoen 2018). The following are some genomic studies conducted in Africa presenting about Bantu and the expansion of pastoralism towards southern Africa:

According to Scheinfeldt et al. (2010), although Africa is the origin of modern humans, the pattern and distribution of genetic variation and correlations with cultural and linguistic diversity in Africa have been understudied. Recent advances in genomic technology, however, have led to genome wide studies of African samples. Currently researchers have managed to tackle genetic variations on the Y chromosomes, the sex chromosome passed from father to son that encodes maleness (Digitale 2008). For the case of African migrations, Digitale (2008) maintain that previous research suggested that prehistoric people in eastern and southern Africa had little contact with only two migrations between the regions about 30,000 and 1,500 years. After Bantu-language speakers migrated from eastern to southern Africa 1,500 years ago, agriculture took off in southern Africa. The challenge remained that the timing of Bantu migration did not match the 2,000 years old anthropological evidence for the appearance of the first sheep and cattle herds in southern Africa. So, the anthropologists were unsure whether the region's agricultural knowledge came as demic expansion or diffusion of knowledge and ideas. This kind of contradiction has been addressed through genetic studies, for example, Digitale (2008) presents that the genetic techniques were used by the team of scientists from Stanford University, California. The team which was headed by Peter Underhill used the Y chromosome to trace evidence of migration patterns in Africa. The team found that animal-herding methods arrived in southern Africa 2,000 years ago on a wave of human migration, rather than by movement of ideas between neighbours. However, their conclusion received some challenges from other scholars (such as Sikora et al. 2011).

The issue regarding the source of pastoralism in southern Africa is also presented by Skoglund et al. (2017) whereby the Savanna Pastoral Neolithic of East Africa is considered as a source. Accordingly, Skoglund et al. (2017) maintain that they used modeling framework to show that the South Africa (1200 BP) pastoralist individual from the western Cape is consistent with being a mixture of just two streams of ancestry relative to non southern African populations, with 40.3% ± 2.3% ancestry related to the Tanzania (Luxmanda 3100 BP) individual (54% ± 7% when restricting analysis to sequences with postmortem damage) and the remainder being related to the South Africa ~2,000 BP hunter-gatherers. This supports the hypothesis that the Savanna Pastoral Neolithic archaeological tradition in eastern Africa is a plausible source for the spread of herding to southern Africa.

Skoglund et al. (2017), assembled genome-wide data from 16 prehistoric Africans. Thus N-15 data aimed at reconstructing African population structure prior to the spread of food production. They include 3 individuals from the western Cape of South Africa dated to (~2,300–1,300 BP), 12 individuals from eastern and south-central Africa (including 4 individuals from the coastal region of Kenya and Tanzania dated (~1,400–400 BP), 1 from interior Tanzania dated to ~3,100 BP), and 7 from Malawi (ranging over ~8,100–2,500 BP). The genetic cline correlates to geography, running along a north-south axis with ancient individuals from Ethiopia (~4,500 BP), Kenya (~400 BP), Tanzania (both ~1,400 BP), and Malawi (~8,100–2,500 BP), showing increasing affinity to southern Africans (both ancient individuals and present-day Khoe-San). Regarding the spread of food production, the results found that the spread of farmers from West Africa involved a complete replacement of local hunter-gatherers in some regions. Population replacement by incoming food producers appear to have been nearly complete in Malawi, where they detected little if any ancestry from the ancient individuals who lived ~8,100–2,500 BP. Instead, present-day Malawian individuals are consistent with deriving all their ancestry from the Bantu expansion of ultimate western African origin. Another individual analyzed was from Zanzibar archipelago (~600 BP) and have got a genetic profile similar to present-day Bantu speakers. The individual has even more western-African-related ancestry than the present-day Bantu speakers which analyzed from Kenya, who also derive some of their ancestry from lineages related to Dinka and Tanzania-Luxmanda 3100 BP (Skoglund et al. 2017:63). By using the so-called "linkage disequilibrium" Skoglund et al. (2017) estimated that that this admixture between western- and eastern-African-related lineages occurred an average of 800–400 years ago. This suggests a scenario of genetic isolation between early farmers and previously established foragers during the initial phase of the Bantu expansion into eastern Africa (Crowther et al. 2018). However, this process of delayed admixture did not always apply in Africa, as is evident in the absence of admixture from previously established hunter-gatherers in present-day Malawians.

Prendergast et al. (2019) analyzed genome-wide aDNA from 41 individual in East African context (Tanzania and Kenya) to examine the genetic impacts of the spreads of herding and farming. Three individuals buried in sites associated with the LSA, 31 belongs to the Early Pastoral and PN, 1 to the IA, and 6 to the Pastoral IA. The results show that the LSA individuals are part of the same foragers stretching from Ethiopia to South Africa. In comparison with present-day groups, the Early Pastoral and PN individual are more closely related to present-day speakers of Afro-Asiatic languages. This supports the hypothesis that the initial large-scale expansion of pastoralism in eastern Africa was linked to the spread of Afro-Asiatic languages. The Pastoral Iron Age individuals are related to present speakers of Nilotic languages and are associated with an influx of Sudan (Dinka)-related ancestry. And lastly, the IA young boy buried at Deloraine Farm-the site with the earliest direct evidence of farming in the Rift Valley (Ambrose et al. 1984) shows affinity to western Africans and speakers of Bantu languages (both genome-wide and on the Y chromosome). This is the earliest documentation of western African-related ancestry in eastern Africa, in a region where today such ancestry is widespread and the majority of people speak Bantu languages (Tishkoff et al. 2009). Their wide-genome data indicated that ancient East Africans show the archaeological complexity during the spread of herding and farming which is reflected in genetic pattens. This shows that there was a multiple movements and gene flow among the distinct ancestrally groups of people while rejecting models of minimal admixture with foragers and of genetic differentiation between makers of distinct PN artifacts. Their results support a multi-phase model in which admixture between northeastern African-related peoples and eastern African foragers formed multiple pastoralist groups, including a genetically homogeneous PN cluster. They also find that additional admixture with northeastern and western African-related groups occurred by the Iron Age.

Wang et al. (2020) used food production strategies as sampling tool to present the analysis of genome-wide data from 20 ancient sub-Saharan Africans. The aim was to reconstruct the patterns of population interaction, migration, admixture, and replacement. The data involves: Southern Kenya (N=10 individuals dated to ~3900-300 BP including N=3 East African forager, N=5 PN contexts, and N=2 from IA contexts), Uganda (N=1 individual dated to ~400-600 BP), Botswana (N=4 individuals dated to ~1300-1000 BP), and the Democratic Republic of Congo (DRC) (N=5 individuals dated ~795-200 BP). They used a sampling strategy that follows a transregional approach to investigating population-level interactions between key groups that were identified previously as being involved in changes of food production strategies in a chronological order as follows: 1. the Eastern and Southern forager groups, 2. Eastern African PN groups, 3. the IA groups, and lastly 4. the IA groups related to present-day Bantu-speakers. The analysis highlights the contraction of diverse once continuous hunter-gatherers' population and early admixture between pastoralists and foragers that predates Bantu ancestry in East Africa. Overall, these data point to eastern Africa as a nexus of population-level interactions between groups with ancestries associated with western, southern, and eastern African foragers. Deep divergences between these ancestries suggest either that admixture was minimal over a long period or that it occurred relatively recently. This poses interesting possibilities for more dynamic expansion and contraction of ancient African hunter-gatherer populations than have been postulated to date. Their data also suggest that periodic admixture between herders and hunter-gatherers, or populations predominantly carrying ancestry derived from them, may have continued into the PN. The data also reveal that this interaction between herders and foragers was very imbalanced, with hunter-gatherer ancestry entering pastoralist populations, but little flow in the other direction. It is not clear what forms of social systems between herders and foragers may have resulted in this one-way admixture. Regarding the IA and PN, it was found the IA population represented by this single individual resulted from admixture between PN-related herders and incoming Nilotic agropastoralists, rather than resulting from a major migration of people with West African–related ancestries. Wang et al. (2020:8) further maintain that "our findings for the Iron Age, much like our findings for the PN, are consistent with multiple groups with different subsistence systems entering eastern Africa along different geographical routes."

2.9.3 Linguistic Evidence

Leaving Bantu speakers in the diaspora out of consideration, the Bantu language family stretches today between Cameroon's South-West region (4°8'N and 9°14'E) in the North-West, southern Somalia's Barawe (Brava) area (1°6'N and 44°1'E) in the North-East, and Cape Agulhas (34°48'S and 20°E), the continent's southernmost tip in South Africa's Western Cape province (Bostoen 2018). Bantu is the prevalent language family in Central, Eastern, and Southern Africa. The remainder of the Niger-Congo phylum, also known as Atlantic-Congo, prevails in sub-Saharan Western Africa, but has a distribution area which represents no more than a third to a half of the Bantu area (*ibid*.). The earlier classification of Bantu languages was done mainly by Wilhelm Bleek around 1850 (Bostoen 2018; Fourshey et al. 2018). In the year 1885 is when the term "Bantu" was coined by Wilhelm Bleek to mean (*ba-ntu,* plural of *mu-ntu*, human being) (see de Maret 2013). Later on, other by scholars followed mainly (Guthrie 1962;

Greenberg 1963). Greenberg's (1963) placed Bantu languages (Niger-Congo family) in the far north-western part within present-day Cameroon. Greenberg's classification was followed by counter-argument that the Bantu languages were derived from a nucleus in the central savanna belt that lies to the south of the equatorial forest (Guthrie 1962). The new analyses of linguistic evidence have been led by scholars such as (Ehret 2011; Currie et al. 2013; Bostoen 2018; Fourshey et al. 2018).

According to Fourshey et al. (2018), each language has a history. To uncover the history of language an academic field called linguistics has been developed. Like all languages, Bantu languages hold clues about their history in the words comprising their vocabularies (Ehret 2011; Grollemud et al. 2015; Bostoen 2018; Fourshey et al. 2018). The reconstruction of the history of words falls under an approach called comparative historical linguistics (*ibid*.). Here a comparative grammatical and semantic from related modern-day language is done in order to systematically establish their relationship to each other. In reconstructing language history, the historian linguists establish a time line or chronology by proposing the approximate chronology of a particular language family. This method is called glottochronology (de Filippo et al. 2012; Bostoen 2018; Fourshey et al. 2018). This method was developed after Morris Swadesh (1909-1967) who developed a standard for estimating when language divergence occurred (see Fourshey et al. 2018). Swadesh maintained that as speakers of a language have decreasing or increasing contact, over long spans of time influences and similarities would be captured in the way language changed. So, when change in a word for meaning in the core vocabulary took place, the changes would be adopted everywhere in the community. At the same time, reduced contact among speakers leads to increased dialect differences. Other method considered by historian linguists is lexicostatistic glottochronology; here scholars consider issues like sound change, pronunciation, and reflexes. In reference to Bostoen (2018), there is high linguistic diversity among Bantu languages especially the Western Bantu branch. This diversity is in line with the assumption that the earliest phases of the Bantu Expansion were characterized by a rather slow and small-scale dispersal of Bantu languages and speech communities. The Bantu area is occupied by only four major branches, which emerged after the initial diversification of the family in the North-West. Three of them consist of languages spoken in the western half of the Bantu domain: (1) "Central-Western," aka "North Zaire" or "Congo," (2) "West-Western," aka "West-Coastal," and (3) "South-Western." All Bantu languages spoken in Eastern and South-Eastern Africa belong to a single "Eastern" branch (see also Grollemud et al. 2015). The Western Bantu domain is thus linguistically much more diverse than the Eastern part (Bostoen 2018).

2.9.4 Historical Evidence

The question of Bantu stories has been understood by using historical evidence (Vansina 1990; Bostoen 2018). Much focus is on oral tradition and ethnography as historical evidence. Oral traditions modify the knowledge that scholars cull from linguistic and archaeological data (Fourshey et al. 2018). Family stories, songs, fables, proverbs, myths, and personal testimony have been used to reconstruct the genealogies and get to know the origin and spread of Bantu language speakers. Oral societies often employ short sayings, proverbs, and riddles to educate (Vansina 1985; Fourshey et al. 2018). Therefore, a comparative analysis of such phrases contributes to broader understanding of values where orality prevails. Many Bantu communities attest similar proverbs and riddle which have together with other evidence to study Bantu history (Vansina 1990). For the case of ethnography, through sustained and careful observation, anthropologists and local informants have been able to produce a large body of ethnographic work in Bantu-speaking regions (Fourshey et al. 2018). Historians then use the comparative approach by testing the ethnographic data against archaeological and linguistic evidence to study the Bantu history (*ibid*.). Like what we see from other disciplines, there is no final conclusions agreed by historians about Bantu history. It should be also understood that historians face some challenges like the limitation when it comes to chronology. Therefore, historians have been also relying on other disciplines like archaeology, linguistics, and biology in reconstructing the Bantu history (Bostoen 2018; Fourshey et al. 2018). However, some historical evidence such as oral traditions recorded in some places such as Lake Victoria, have indicated how most of the society in that region share the similar historical history associated with IA (Hartwig 1971, 1974; Schmidt 1978, 2006). Such oral traditions include things like genealogies, place names, short saying, riddles, proverbs, the socio-political lineages, and symbolic practices (*ibid*.).

2.10 The Trend of Research on Iron Age in Eastern and South-Central Africa: A Historiographic Review

In reference to Mapunda (2010) there are four broad patterns or historiographies regarding the trend of archaeological research on Iron Age and Iron Metallurgy in eastern and south-central Africa (that is Kenya, Uganda, Tanzania, Burundi, Rwanda, eastern Democratic Republic of Congo, Zambia, Northern Zimbabwe, Malawi, and northern Mozambique). They include colonial historiography (1880s-1960s); neo-colonial historiography (1960s-mid-1970); Africanistic historiography (mid-1970s-1980s) and pluralistic historiography (1990's to present).

2.10.1 Colonial Historiography (CA. 1880-1960 AD)

The history of archaeological research in eastern and south-central Africa, and indeed in the whole of Africa, began with colonial occupation (Sutton 1994). It was noted that throughout the colonial period archeological research in the region, with the exception of the coast, concentrated primarily on the Stone Age; the Iron Age was peripheral concern (Mapunda 2010). Iron Age research along the coast however began relatively early (e.g., Freeman-Grenville 1958) because researchers were interested with monumental architecture and they wanted to understand the source of that civilization based on what referred as diffusionism. It was therefore important for the colonial historians and archaeologists to know and identify with their fellow Caucasians who came before them (Mapunda 2010). The field research pertaining to iron technology was virtually absent in the region during this time period until the late 1970s (see Schmidt 1997, 1981; Van der Merwe 1980). It seems that eastern and south-central Africa lacked the kind of stimuli for metallurgical research than other regions had. For example, it was evidenced that most of research concentrated upon North Africa, since the area was considered the origin for the spread of Iron technology in Africa through diffusion (Kense 1985). Such consideration came because the North Africa is located closer to the Middle East, the world's earliest ironworking center. Under this assumption, West Africa was believed to have bridged the technological diffusion between northern Africa and sub-equatorial Africa (*ibid*.).

The early rise of research interest in the Iron Age and iron technology in southern Africa has been attributed to political factors (Kiyaga-Mulindwa 1993). The Iron Age research was needed to demonstrate that the presence of black Africans (especially Bantu-speakers) there was recent and, therefore, both whites and Bantu-speakers had an equal right in occupying the land since both were new comers. According to Kiyaga-Mulindwa, the apartheid regime of South Africa played a key role in the discouraging research on the Iron Age. It was also noted that Iron Age research was also used by colonial anthropologists and archaeologists to prove that the Zimbabwe ruins were not built by Africans but by a "superior race" or Caucasians (Mapunda 2010).

2.10.2 Neo-Colonial Historiography (1960s to Mid-1970s)

This time was marked by an exploration of interest in Iron Age research in the region and notable expansion into the interior (Mapunda 2010). It was time which involved the transition from colonial to liberal (neo-colonial) thoughts. Some of the notable researches of Iron Age conducted during this time are (Posnansky 1968; Soper 1967a). It was argued this pressure can be attributed to the emergence of C-14 dating technique, as well as pressure from historians who wanted to expand African history beyond the bounds of colonial period (Posnansky 1965:1 cited in Mapunda 2010). Such pressure was also attributed to decolonization struggles in Africa which were at the climax during that period. In that case the freedom gave a room to historians to expand their research beyond the bound of colonialists. Archaeological and linguistic research were conducted and most of the theme concentrated on Bantu migration, monumental architecture, and pottery (see Murdock 1959; Guthrie 1962; Greenberg 1963; Oliver 1966; Chapman 1967; Soper 1967a, b). Such research was also accelerated by the establishment of the British Institute in Eastern Africa based in Nairobi, Kenya (Mapunda 2010). In 1966 the institute established the journal called *Azania* through which historian and archaeologists were able to disseminate their results (see Fagan 1967; Robinson 1970). The institute also funded various project related to Iron Age including "The Bantu Studies Research Project", which dealt specifically the origins and early migration of Bantu (Soper 1971a:1). Pottery on other hand interested Iron Age researchers during this time because of its good preservation (Robinson 1970, Soper 1971b). Moreover, according to Mapunda (2010:43) pottery was (and still is) used to answer questions related to ethnicity, language, and population distribution in space and time (see also Soper 1971 b, c). While doing research on Iron Age, little was paid on iron metallurgy which deals directly with technological aspect of iron. According to Mapunda, ironically, pottery typologies, rather than metallurgical relics such as slag or *tuyere* fragments, have often been used as proof of ironworking.

2.10.3 Africanistic Historiography (mid-1970's-1980)

This time was featured by the emergence of systematic research on iron metallurgy *per se*; not indirect evidence as before (Mapunda 2010). Examples include the work of Schmidt and his fellow (Schmidt 1981; Schmidt and Avery 1978) in the interlacustrine. The period was characterized by the temporal expansion of African history beyond mid-nineteenth century; the limit imposed by colonial historians, and moves back at least two millennia. The chronometric dates from excavated sites in the interlacustrine region showed that iron technology started there more than 2,000 years ago (Van Grunderbeek 1980). Such finding challenged the diffusion theory which used before to explain the origin and development of iron technology in the region and African continent in general (Mapunda 2010). It was earlier maintained that iron technology in eastern and central Africa diffused from Meroe (Shinnie 1967). However, the research in the interlacustrine region challenged this allegation after proving that ironworking began there earlier than at Meroe. Such differences were also evidenced in terms of smelting techniques, for example, smelters at Meroe used domed, slag tapping furnaces (Shinnie 1985) whereas, in northwestern Tanzania, they used low shaft, non-slag tapping furnaces (Schmidt 1997). Generally, this period was characterised by scientific research on technology in Africa.

2.10.4 Pluralistic Historiography (Post-1980s)

Metallurgical research in the 1990s and 2000s has continued to expand in the region and the whole of sub-Saharan Africa (Mapunda 2010). Some of that research include (e.g., Kusimba 1993; Mapunda 1995, 2002; Lyaya 2007, 2013). Research on Iron Age is conducted intensively recently however they don't marginalise the past research. An ethnographic inquiry into former smelters continues to receive attention (Barndon 2001). There is also a new direction of research which incorporated some other themes on iron technology. Such themes include social impact (Mapunda 2002), Symbolism (Barndon 2001), and bio-metallurgy (Mapunda and Lyaya 2009). Apart from researching on technological aspects of African archaeometallurgy, recent scholars (Mapunda 2010; Schmidt et al. 2016; Schmidt 2017) are trying to engage local community in preserving the heritage associated with iron technology. Through the community-based approach, the local people are getting awareness of about their heritage and the values associated with. This section has presented the trend of research on IA in Eastern and South-Central Africa based on historiographic review. The next section presents the empirical studies conducted in the same region and beyond addressing the LSA and IA interaction situation.

2.11 Previous Archaeological Research on LSA and Iron Age Interactions in Eastern and South-central Africa

Various archaeological studies conducted in Eastern, South-central Africa have presented different results regarding the LSA and EIA contact situation (Miller 1969; Denbow 1999; Kusimba 2003; Lane 2004; Kusimba and Kusimba 2005; Kusimba 2005; Kessy 2005, 2013; Lane et al. 2007; Prendergast 2008, 2010; Ashley 2010; Dale and Ashley 2010; Crowther et al. 2018). According to Crowther et al. (2018) the spread of agriculture across sub-Saharan Africa has long been attributed to the large-scale migration of Bantu-speaking groups out of their west Central African homeland from about 4000 years ago. These groups are seen as having expanded rapidly across the sub-continent, carrying an ‘Iron Age’ package of farming, metal-working, and pottery, and largely replacing pre-existing hunter-gatherers along the way. Crowther et al. (2018) draws new botanical and faunal evidence from recent excavations at a range of hunter-gatherer and early farming sites on eastern Africa's coast and offshore islands, and with comparison to inland sites. They examined the timing and tempo of the agricultural transition, the nature of forager farmer pastoralist interactions, and the varying roles that elements of the 'Bantu package', pastoralism, and non-African domesticates played in local economies. Their results support a very complex scenario of farming arrivals on the eastern African coast. Thus, the study demonstrates no clear, consistent, or straightforward association between standard cultural entities (e.g., LSA, EIA, Middle Iron Age) and subsistence patterns. They concluded that their data permit important insights into eastern Africa's transition to agriculture, and help challenge orthodox models of cultural replacement, despite their limitations. From their study a number of potentially significant patterns stood out from the dataset concerning the timing, tempo, and processes involved in the farming transition. Firstly, it is apparent that crops and livestock did not spread to the coast through 'Iron Age package'. Instead, sites show wide temporal and spatial variation in the importance of domesticates relative to other foods (marine fauna, wild plants and animals), as well as to each another. They noticed the absence of some crops mainly finger millet from the offshore islands as compared to its consistent presence at our hinterland sites as well as sites in the interior. Secondly, they found that farming does not replace foraging when it is introduced. Indeed, well into the Middle Iron Age period. Fishing, and the hunting and trapping of wild fauna, continue to have economic significance, even at major trading settlements such as Unguja Ukuu. Thirdly, the sites in southeastern Kenya suggest that there was a protracted period of interaction between Iron Age groups and forager populations during which domesticated plants (among other items of material culture) were exchanged. These findings challenge linear models for the rapid replacement of foragers by farmers during the agricultural transition, supporting more recent models arguing that people practicing both strategies coexisted in eastern Africa for centuries.

The matter pertaining to replacement during agricultural transition has been criticized by other scholars (Kusimba 2003; Kusimba and Kusimba 2005; Kusimba 2005; Shipton et al. 2013) and supported by Crowther et al. (2018) that, rather than chronologically bounded cultural groups replacing one another in progression, as implicit in the traditional Bantu migration model, evidence suggests that there existed an ethnically and economically diverse frontier in which groups interacted at different spatial and temporal scales in relationships involving competition, conflict, exchange, symbiosis and/or assimilation. For instance, Kusimba (2005:346) argued that "the most widespread model of forager-food producer interaction has emphasized the symbiosis between hunting societies and the herding and farming societies in their interstices. Strategies of symbiosis include coresidence, intermarriage, and intensive exchanges of labor and food with allied farmers." Kusimba provides example that the hunter-gatherers of the central African rainforests have been the most important models of symbiosis. They include more than 12 ethnic groups of central African hunting societies who are allied with village-dwelling farmers. They often share many aspects of culture and belief but in many cases refer to themselves as farmers and hunters, demonstrating that their economic differences have a lot to do with maintaining situational boundaries (*ibid.*). Denbow (1999) has also maintains that the presence of stone tools and wild faunal remains at farmer towns in the Kalahari such as Nqoma and Toutswe suggests forager trade or labor as hide workers. Likewise, at White Paintings Rockshelter, hunter-gatherer exchange with nearby farmers was identified by the presence of ceramics and iron artifacts; semiprecious rock may have been mined for exchange, and hidescraping may have taken place for exchange (Murphy et al. 2001). The issue of ecological parameter has been considered for influencing the nature of interaction among LSA and IA, as well as other preexisting groups. In fact, the eastern Africa's wide environmental diversity would have promoted the co-existence of different subsistence groups (Lane 2004; Shipton et al. 2013).

Another evidence indicating lack of displacement of LSA hunter-gatherers by IA agropastoralists is presented from Lake Victoria Basin (Lane et al. 2007; Prendergast 2008; Ashley 2010; Dale and Ashley 2010). Here, faunal and other data indicate degrees of continuity despite clear material culture shifts from Kansyore (LSA) and Elmenteitan (PN) to Urewe (EIA) occupations. According to Crowther (2018), this suggests that the appearance of Urewe ceramics, while linked to Bantu languages and crops, does not necessarily imply population displacement. The similar conclusions were reached on the nearby Mara plains, where changes in lithic technology and raw materials did not coincide with ceramic shifts (Siiri€ainen et al. 2009).

The issue of LSA and IA contact situation has been studied in Zambia since 1960's. The results have indicated that the situation differed from region to region (see Miller 1969). It was noted that on the southern Zambian plateau and extending eastward to the Lusaka area the EIA replaced the LSA fairly quickly (Miller 1969). Because of soil fertility and light savannah woodland made the region suitable for agriculture and therefore hunter-gatherers were soon absorbed into new economy or forced into less desirable territory. The case was different in Nachikufu Shelter whereby the LSA deposit immediately above 1.5 m is accompanied by potsherds and furnace lying immediately above from 0.6 to 1 m dated to 77–544 cal AD. Such co-existence indicated the continuation of LSA culture such as hunting even after introduction of iron. Through archaeological investigations conducted in the Lunsemfwa Drainage Basin (LDB) of Zambia, Musonda (1987) came up with archaeological evidence used to test the views about the nature of culture contact between hunter-gatherers and agriculturalists. That site seemed to have pottery in the LSA context. He wanted to understand, first the process which brought Iron Age materials to LSA sites and second, whether any cultural changes occurred in the hunter-gatherer tradition. After conducted archaeological survey, excavation and dating Musonda came up with results. The dates show a gap of more than four centuries between the first appearance of pottery in LDB and its occurrence at LSA sites. This suggests lack of regular contacts between the two communities. It was also observed that LIA pottery which is contemporary with a microlithic industry is rare in LSA context. This suggests that LSA peoples continued to process their technology several centuries after being interacted with food producers.

The conclusion reached by Musonda's (1987) study match with that of (Phillipson 1976b:196; Phillipson 1993:202-3) who presented the same situation in some parts of south and central Africa in some site such as Makwe and Thandwe rock shelters. There EIA and LSA materials are found in association suggesting a certain kind of exchange to have been taken between those two communities. This kind of observation reached by Musonda and Phillipson was also supported Kessy (2005) which together put challenges over the earlier arguments associated with the theory of replacement and absorption (Johnston 1913; Oliver 1966).

Pilgram et al. (1990) conducted archaeology research in the Lamek-Mara region of south-western Kenya. This area forms a part of the Serengeti. The major aim of their research was to establish a culture-stratigraphic sequence for the later prehistory of the region and to investigate the archaeology of prehistoric pastoralism. They conducted archaeological survey before excavations which led to the discovery of 150 sites. By relying on Radiocarbon and obsidian-hydration they were able to establish a tentative chronological sequence of an area. The sequence is composed of LSA sites without pottery, sites belonging to the Oldishi tradition, sites of the Elmenteitan tradition, and other LSA sites without pottery and finally, Iron Age sites. In answering their question of when prehistoric pastoralism began in that area, Pilgram and others believe that around 400 BC during Elmenteitan tradition, pastoralists penetrated and settled in the Lamek Valley. This has been associated with the arrival of iron-working farmers in the area.

Talking on the nature of interaction between LSA and Iron Age people in the area, Pilgram and others maintain that the post-Elmenteitan occupation and the transition to the Iron Age was poorly understood at that time. However, their study recorded the radical differences among traditions that constitute the Lamek-Mara regions. From there they concluded that "the beginnings of Elmenteitan settlements around 400 BC in the Lamek valley, and somewhat latter on the Mara plains, were due to the migration of people who replaced, or absorbed into their culture, their Oldishi predecessors" (Pilgram et al. 1990:45).

This study by Pilgram and his colleagues (1990) is relevant for the current research on different ways. First it shows how the stratigraphic sequence can be used to study the migration and interactions over time. This can be done through observing material culture as they appear on the stratigraphy as well as reconstructing the absolute chronology. Secondly, their study offers the methodological approach on how to undertake studies related to human migration and interaction over time. Methods such as archaeological survey, excavation and dating are concern. Apart from the relevance of their study, the conclusion reached by Pilgram and his colleague which are replacement and absorption cannot be used to generalize other areas in east and southern Africa where Bantu settled. This is proven by others studies (Musonda 1987; Phillipson 1976b, 1993; Kessy 2005, 2013) by scholars who believe in the acculturation of LSA and IA people instead of the wave of replacement or absorption.

Kessy (2005, 2013) conducted archaeological research in Pahi division of Kondoa district central Tanzania. His research aimed at establishing the nature of relationship that developed between Pahi Later Stone Age (LSA) and Iron Age (IA) people when they interacted. His research came out following the quest emerged to test the reality of Bantu migration models which are displacement or absorption of LSA population. Kessy employed extensive systematic land walkover, shovel test pits (STPs) and intensive trench excavation. The results of Pahi research indicated that the sequence of archaeological remains from the Pahi STP survey strongly supported those of trench excavations. The results from STPs and trench excavations indicated that lower Pahi stratigraphic sequences consisted of both LSA and IA artifacts dating around (787–479 cal BC) and (895–1154 cal AD) respectively. It is from that stratigraphic sequence Kessy maintained that despite the early adoption of IA (from IA agropastoralists) by the local LSA populations, lithic production continued to be practiced along with iron-working until recent times when the former was abandoned. In other words, apart from being interacted with IA agropastoralists around (895–1154 cal AD) the LSA people were not replaced instead, they incorporated IA cultural elements into their LSA culture. This process was also referred by as acculturation (Kessy 2013). Kessy (2005: iv) concluded that "these findings call into question earlier assumptions, generally applied to sub-Saharan Africa, that LSA people were replaced or absorbed by IA agropastoralists (see also Kessy 2013:225).

Kessy's research is very useful for the current study in different ways. First it draws example from East African context focusing especially on eastern Bantu where Southern Highlands of Tanzania belongs. The presence of LSA and IA reported sites (Msemwa 2001; Willoughby 2007, 2012; Mapunda 2008; Sawchuk 2012; Lyaya 2013) sites in Southern Highlands of Tanzania call for the study like that of Kessy (2005, 2013). Kessy's study offers both methodological and theoretical approaches which have been useful for the current study. The current study recognises Kessy's conclusion regarding his methodology and theories however, his conclusion cannot be used to generalize other parts of the country where LSA and IA people interacted. The assumption is that, depending on the context and human behavior it is likely that the similar or different reaction could happen among different communities. Therefore, the current study emerged in order to develop a broader understanding on this topic.

Genetic research on Bantu origins and their relationship to LSA-hunter-gatherers has continued to be done in Africa (Digitale 2008; Sikora et al. 2011; de Filippo et al. 2012; Busby 2016; Skoglund et el. 2017; Prendergast et al. 2019; Lipson et al. 2020; Wang et al. 2020). In trying to test the Bantu migration theories, Sikora et al. (2011) analysed the genotyping data for 2841 Single Nucleotide Polymorphisms (SNPs) in 12 sub-Saharan African populations, including a previously unsampled region of southeastern Africa (Mozambique). This kind of study focused on previous genetic evidence and the conclusion reached regarding replacement of hunter-gatherer communities by Niger-Congo populations. Having studied those genetic samples, the spread of Bantu languages from West Africa to southeast Africa (that is Mozambique) does not appear to be a demographically homogeneous migration with population replacement in the southernmost part of the continent, but acquired more divergence, likely because of the integration of pre-Bantu people. The results contradict with other genetic studies (Digitale 2008; de Filippo et al. 2012; Skogland et al. 2017) that supported the replacement and absorption models. Scholars (Skogland et al. 2017; Wang 2020; see also sub-sect. 2.9.2) supports the replacements or minimal admixture among LSA hunter-gatherers and Bantu agropastoralists.

Other scholars (Lipson et al. 2020) have recently reported the Deoxyribonucleic Acid (DNA) results of four buried children from Shum Laka (Cameroon), one of the earliest known archaeological sites within the probable homeland of the Bantu language group. Two of them were buried approximately 8,000 years ago which is the end of LSA and other two 3,000 years ago which is the beginning of the IA. They also compare other data from ancient DNA and genotype data from 63 individuals from 5 present-day Cameroonian populations. Although, those four buried children belong to different time period, surprisingly the results indicated the genetic similarity across a span of almost 5,000 years suggesting a long-term presence of related peoples who used the rock shelter for various activities including burying their dead. Such observation by those scholars challenges the notion regarding extinction or replacement of LSA-hunter-gatherers by Bantu language speaking group as both of them seems to exist together. Despite that linguistic and genetic evidence points to western Cameroon where Shum Laka is located as the most likely area where Bantu language speakers originated, their current genetic data came with a different result as they point that "the genetic profile of our four sampled individuals-even by 3,000 BP, when the spreads of Bantu languages and of ancestry associated with Bantu-speakers were already underway-are very different from those of most speakers of Niger-Congo languages today, which implies that these individuals are not representative of the primary source population (s) that were ancestral to present-day Bantu-speakers" (Lipson et al. 2020:5). They concluded that these results neither support nor contradict a central role for the Grassfields area in the origin of Bantu-speakers, and it may be that multiple, highly differentiated populations formerly lived in the region with potentially either high or low levels of linguistic diversity.

2.12 Archaeological Research in Southern Highlands of Tanzania

As Masao (2005) maintained, archaeological research in Tanzania have been unevenly conducted whereas areas such as northern-crater highland and the Swahili coast have received more attention than other parts of the country. The reasons behind have been due to funding priorities and thematic preferences mainly those related to human evolution and Swahili civilization (*ibid*.). The Southern Highlands of Tanzania are among of those areas which have received less archaeological research (Lyaya 2013; Biittner et al. 2017). Below are examples of such studies derived from regions mainly Iringa Rural, Njombe, Rukwa (Sumbawanga), Mbeya, Ruvuma (Figure 2.13).

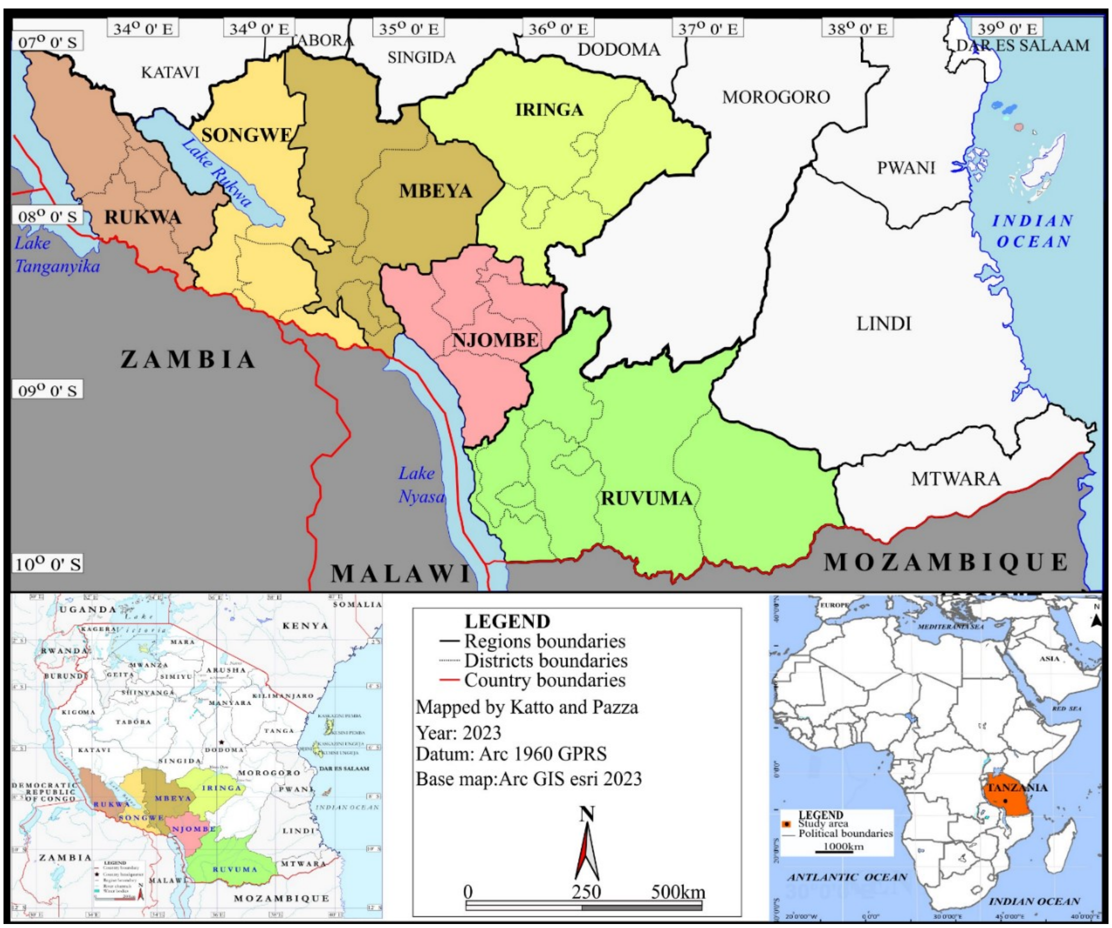


Figure 2.13: A map of Southern Highlands of Tanzania Regions Mentioned above.

Early archaeological research in Iringa Rural focused on the Isimila Stone Age site where determining age and the cultural sequence was the focus (Hansen and Keller 1971). Other than Isimila, there are Mlambalasi and Magubike rock shelters (all in the Kalenga administrative division) with MSA and LSA occupations (Willoughby 2007, 2012; Biittner et al. 2007; Bushozi 2011). Apart from MSA and LSA cultures, the rock shelters revealed other archaeological potential spanning the Holocene period (Biittner et al. 2007; Bushozi 2011). There are many 'Iron Age' artifacts including iron slag, pottery, and grindstones in and around the rock shelters, but these have received no due weight in part because the previous researchers focused on Stone Age technology (Lyaya 2013).

In Njombe Region, most of archaeological research began during post-colonial period. Scholars (Sutton 1985; Msemwa 2001; Lyaya 2007, 2013; Mapunda 2010) have sporadically and respectively written on the Bena iron smelting and smithing process. Besides this information, no one has examined the general relationship of LSA and IA communities. In the Rukwa Region most archaeological research has been focused on Fipa metallurgy (Lyaya 2013; Mapunda 1995). The microscopic and macroscopic analyses of Fipa Iron technology have been conducted at different time. From this kind of analysis Mapunda (1995) was able to document two iron technologies in the region namely Katukutu and Malungu. The former was characterized by relatively short furnaces, 80-120cm high, globular in shape, decorated with punched (dolly) holes using a stick or a finger, and operated by natural-draft air supply mechanism as indicated by the lack of flared *tuyere*. The latter was featured by the use of limonite iron ore, and truncated and tall natural-draft furnaces ranging from 2.3-4m high. Not only iron technology, the region has yielded some EIA pottery matching with Kalambo tradition as well as Triangular Incised

Ware (TIW). Because TIW is largely seen as a coastal tradition, Mapunda (2003) argues that it may have spread to Ufipa possibly through trade interaction between the coast and the interior.

The Ruvuma Region has received less archaeological research, when compared to other southern Tanzanian localities (Lyaya 2013). Most of research works have been focusing on establishing the coast-interior pre-historic and historic interactions, as well as archaeometallurgy (Mapunda 2001, 2008; Lyaya 2013; Katto 2016). Apart from presenting archaeometallurgy of the region (mainly Mbinga District), Mapunda (2001) was able to report the presence of TIW pottery in the region signifying coast interior interaction. The same observation was made by (Mapunda 2008; Katto 2016) who have reported the presence of early and Later Iron Age cultural materials in the region. Those materials are in terms of pottery, slags, and *tuyere*. According to them most of EIA and LIA pottery bares similarities with those reported by (Phillipson 1968b; Robinson and Sandelowsky 1968; Chittick, 1974; Chami 2001; Msemwa 2001; Croucher 2006; Kwekason 2011; Pawlowicz 2011) along the Swahili coast and islands, immediately interior as well as the neighboring countries of Zambia and Malawi named as Kapwirimbwe and Mwaburambo traditions. The research conducted in Southern Highlands of Tanzania calls for further investigation on various issues mainly the interaction situation between LSA-hunter-gatherers and IA Bantu farmers, the PN culture and intensive characterization of material culture for those periods. These issues are very important but have remained partially understood.

2.13 Synthesis and Research Gap

This section has reviewed literature relating to the current study. It has tried to address the research problem by conceptualizing what entails about Bantu Iron Age farmers and their associated traditions based on ceramics distributed in east and southern Africa, PN cultures in East Africa, LSA cultures in East Africa. The theories regarding the interaction situation between LSA-hunter-gatherers and IA Bantu farmers have been covered. Other issues covered are pertaining to the origin of iron working technology in sub-Saharan Africa, Bantu migration routes, and evidence taken to explain Bantu migration have been presented. The section has also covered the trend of archaeological research of IA in the region and finally, previous research works over the topic which have been undertaken in Africa including the study area has been reviewed.

Generally, it is noted that Southern Highlands of Tanzania has received less archaeological research on various themes compared to other parts of the country mainly the North and Indian coast (see Masao 2005; Lyaya 2013). Moreover, most of archaeological research conducted in the current study area has focused on lithic technology, hominid behavior, and/or IA technology/metallurgy (Willoughby 2007; Biittner 2007, 2011; Bushozi 2011; Mapunda 2010; Lyaya 2013; Masele 2017). This has left a little understanding on some important issues that could contribute to the general prehistory of the region. Among of them are issues related to transition situation from LSA to IA and the intermediate period referred as PN as well as IA material culture characterization and how does they inform issues related to ethnicity and regional interaction and connectivity.

CHAPTER 3: THE PROFILE OF THE STUDY AREA

3.1 Introduction

This chapter provides an overview of the Southern Highlands of Tanzania in terms of climate, geology, soil, relief, vegetation, and peopling of the area. It specifically focuses on the Iringa and Njombe Regions. Other regions in the Southern Highlands are Mbeya, Rukwa, Songwe, Katavi and Ruvuma (Figure 3.1). Understanding the profile of the study area is important so that cultural changes in relation to environment can be understood during the Later Pleistocene and Holocene periods. Previous scholars (Biittner 2011; Bushozi 2011; Willoughby 2012; Lyaya 2013) who have worked in the Southern Highlands of Tanzania have covered this topic extensively, so provide a good foundation for the current study. This study is using the same information to link with the research problem; specifically, how the geological compositions such as soil, mineral, and drainage systems in the Southern Highlands supported Bantu related activities like agriculture, iron, and pottery production.

Figure 3.1 Map of Tanzania showing the Southern Highlands (shaded) with district boundaries. Adapted from Kangalawe 2012:51).

3.2 The Modern Environment and People of East Africa: Southern Highlands of Tanzania

The modern landscape and hydrological system of much of East Africa, including the Southern Highlands of Tanzania, is deeply influenced by the East African Rift Valley System (EARVS). Two branches of the EARVS were created in East Africa following the Pleistocene volcanic activities that took place between 2.0 and 1.5 million years ago and are characterized by mountain ranges, a series of plateaus, lowlands, lakes, and river basins (Hamilton 1982; Bushozi 2011). They include the eastern branch or Gregory Rift and the western branch. The former starts in central-northern Tanzania and extends northwards through Kenya and Ethiopia to the Red Sea and Jordan Valley in the Middle East. It features the Great Rift Valley system and other major mountain formations including Mount Kilimanjaro (5895 m) in Tanzania, Mount Kenya (5199 m) in Kenya, and Mount Ruwenzori (4127 m) in Uganda. The latter branch is where the current study belongs, it dominates most of the large and deep lakes in the region such as Lakes Nyasa, Tanganyika, and Edward as well as Mount Ruwenzori (Aidan 2004). Highlands and plateaus receive substantial precipitation and they are generally cooler than lowlands and coastal plains (*ibid*.).

3.2.1 Climate

In East Africa, the modern climate is influenced by the air mass circulation, the monsoon winds, and the Inter-Tropical Convergence Zone (ITCZ) or Meteorological Equator Zone Range (MEZR). The ITCZ is a low-pressure zone where the northeast and southeast trade winds or monsoons of the two hemispheres meet (Hamilton 1982; Willoughby 2007; Bushozi 2011). These seasonal winds bring heavy rainfall in the adjacent coastal and hinterlands. Monsoon winds from the Atlantic Ocean bring precipitation to the western portion of Lake Victoria, while winds from the Indian Ocean provide moist to most parts of the East African coast (Bushozi 2011). The heavy rainy seasons within the equatorial zone and the western part of the Lake Victoria basin are mainly associated with lake water evapotranspiration, hydration and dehydration, a process that results in convection rains. The annual precipitation here ranges from 1200 to 1270 mm per year. The same trends characterize the northern part of Lake Malawi and Tanganyika, including the Southern Highlands of Tanzania, which receives rainfall of ≥1000 mm annually (Hamilton 1982:13).

3.2.2 Geology and Mineralogy

The geology of Tanzania dates back to approximately 3700 million years (my) old, this is based on the most ancient rocks (Dodoman system), (Schlüter 1997). There are other rock systems that occur in Tanzania important for the current study. They include (1) the Ubendian Belt dating between 2,050 and 1,800 my, (2) the Usagaran Belt, (3) sedimentary rocks of the Kibaran Belt or Karagwe-Ankolean rock systems dating between 1,400 and 976 my, (4) the Bukoban rock systems dating between 1,000 and 650 my and providing the earliest unquestionable fossil record in East Africa (Schlüter 1997), (5) the Mozambique Belt rocks representing by far the longest zone of crystal mobility in the African continent and dating between 845 and 478 my (Schlüter 1997), and (6) the Karoo dating between 285 and 187 my (Schlüter 1997:143).

Iringa and Njombe Regions are located within the Usagaran Belt or System (Figure 3.2). The Usagaran Belt (1.9-2 Ga, Figure 3.2) occurs to the south and east of the Archean craton and consists of metamorphic rocks. Their geological formation is composed of Precambrian migmatites, granite and Konse group outcrops, formed during the late Archean and late Neoproterozoic eras (Harpum 1970; Harris 1981). The granite rock outcrops comprise a sedimentary assemblage of quartz, quartzite, metamorphic, low grade micaceous schists; these form many of the rock-shelters and overhangs (Harpum 1970). The rock-shelters and overhangs were exploited by MSA and LSA foragers, as well as by their descendants (Bushozi 2011). The presence of iron oxide (hematite/magnetite) in the study area supported a lot in iron smelting for Iron Age agropastoralists.

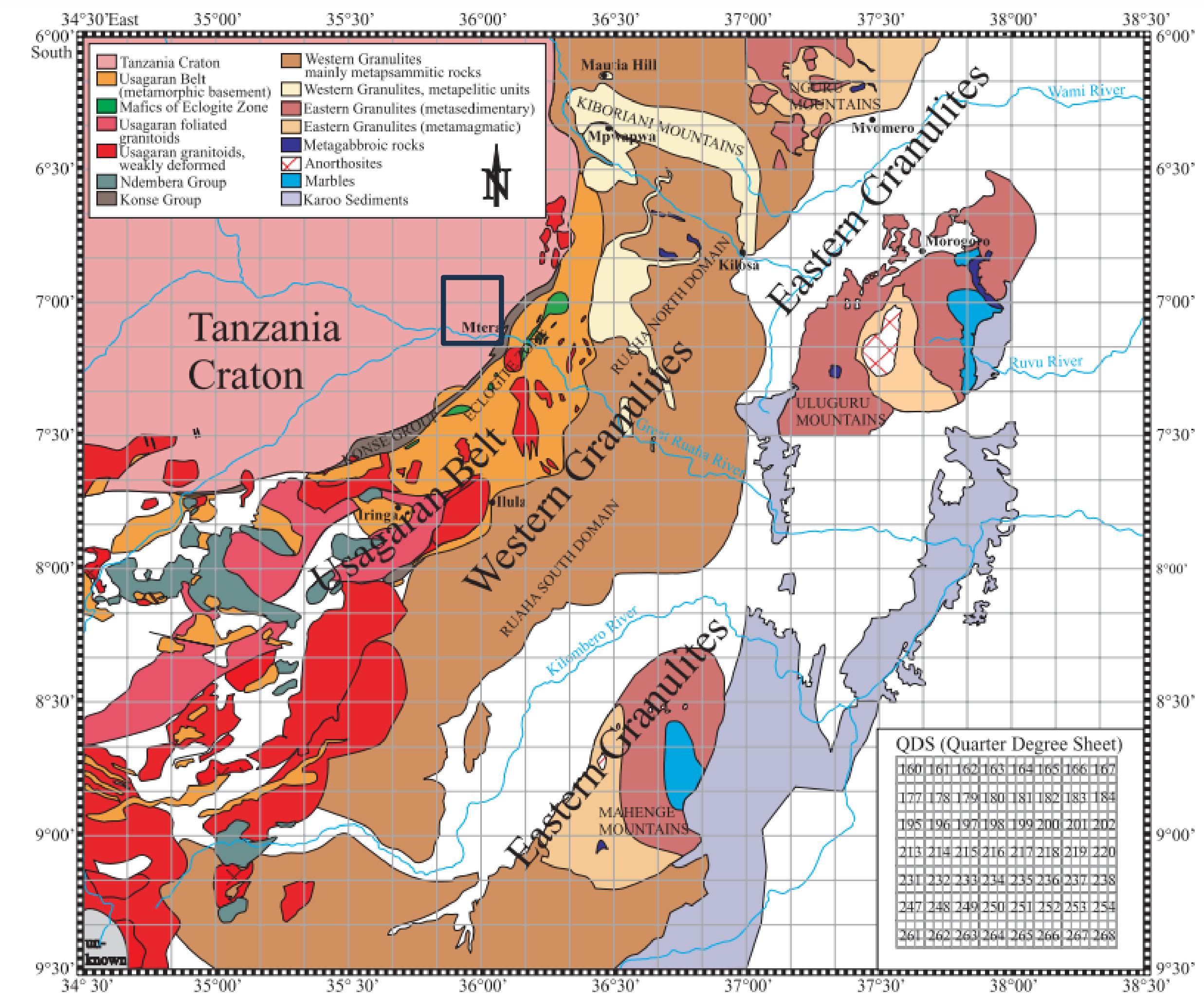


Figure 3.2: Lithological units for central Tanzania (Adapted from Fritz et al. 2005:2, Figure 1a). The box represents the approximate location of the study area.

3.2.3 Relief

The Southern Highlands is one of four upland zones in Tanzania (Lyaya 2013). It is a line of high country that extending from north of Lake Nyasa to the north of Morogoro (Berry 1971). The relief is not constant instead, there is a great disparity of the altitudes in this zone (Figure 3.3). Despite of few areas with lower altitudes, the Southern Highlands generally rise above 1,500 m (Berry 1971; see Figure 3.3 for variabilities in terms of altitudes). Lyaya (2013:50) argues that “It appears very much that iron and steel production activities in the region were patterned with the altitude as well: (1) the Fipa (Sumbawanga) and Nyiha (Mbozi) people worked in the plains (medium altitudes in the areas), (2) the Matengo (Mbinga) and Hehe (Iringa) people preferred to work in the mountains (high altitudes in the areas), and (3) the Bena (Njombe) people preferred to work in the river valleys (low altitudes in the area).” Lyaya (2013) continued arguing that the variation in preferences of where they worked iron and steel could have been accidental, but it is known that smelting scenes were often carefully selected for technical and socio-cultural reasons. Although Lyaya (2013) is talking about the technology of iron smelting in the Southern Highlands of Tanzania, it is relevant for the current study that deals with other component of iron activities that is pottery and the related evidence that justify the presence of Iron-Age agropastoralists in the region.

Some of the most striking features of the Iringa and neighbouring regional landscape are granitic inselbergs and steep ravines, both of which hold useful archaeological information. The inselbergs are of the bornhardt variety, broken down into castle kopjes (Buckle 1977). These result in rocky outcrops (called *mapango* in Swahili) that provided natural shelters and are commonly associated with cultural materials. The erosional gullies (*makorongo* in Swahili) expose ancient archaeological materials that would otherwise lie deep underground. These ravines are created when ephemeral streams flow down steep sided hills during the wet season. As such, they are typically located along the bases of the Udzungwa Mountains and foothills in Iringa.

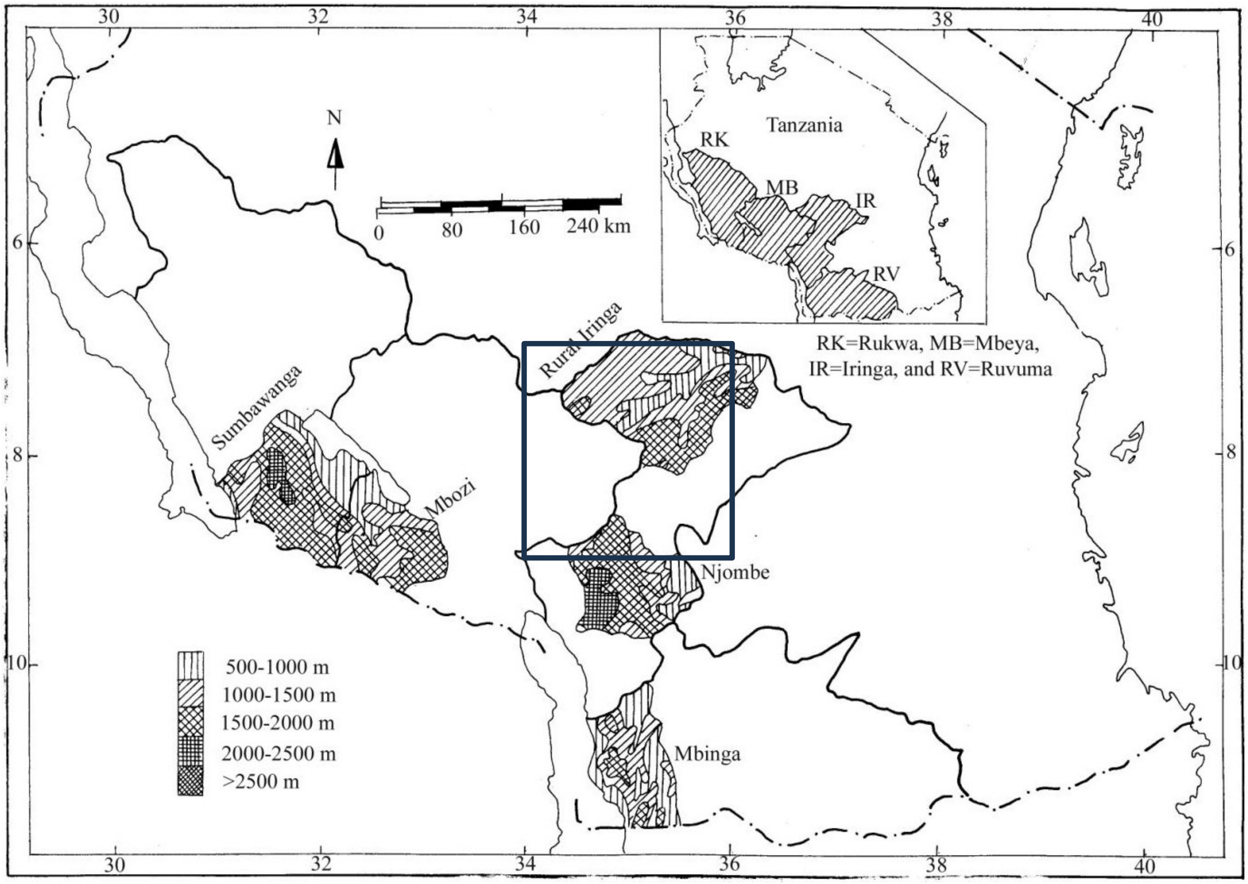


Figure 3.3: Relief of the research area districts. Consider that box areas were the focus of the current study (Modified from Berry 1971).

3.2.4 Soils

The soils of southern Tanzania can be divided into three categories (Moore 1971b:28; Table 3.1). They include eluvial (leached soils occurring on well drained humid sites), illuvial (soils in which transported leached minerals or the direct products of rock decomposition in situ accumulate), and catenas (associations of soils, both eluvial and illuvial, in a repetitive sequence determined by relief and drainage) (Lyaya 2013). Each of the groups has been divided into sub-groups to reflect the nature of the clay mineral composition (Table 3.1). The sub-groups have been used to classify the soils of the research area (Figure 3.4). The soil in the Iringa, Njombe and other neighbouring regions is fertile. This allows agriculture and other economic activities to take place. Such areas would have attracted domestication that can be traced from the PN to recent historic times. It could have also supported other innovations such as iron smelting and smithing to be used in agricultural activities. In addition, the soils of the research area were generally appropriate for the manufacturing of the technical ceramics (furnaces, tuyères, and pottery). According to Lyaya (2013:52) "It is difficult to believe that one would make tuyères and pottery from very sandy soils, without clay plasticity quality."

Table 3.1: The Soil Categories of Southern Tanzania (Source: Moore 1971b).

Soil category/group	**Sub-category/group**
1. Eluvial	The eluvial soils are split into (1) skeletal, (2) skeletal to montmorillonoid, (3) montmorillonoid to kaolinoid, (4) kaolinoid brown soils, (5) kaolinoid red-earth soils, (6) sesquioxidic-kaolinoid, and (7) unweathered residuum or excessively sandy soils.
2. Illuvial	The Illuvial soils are split into (1) skeletal soils, (2) skeletal montmorilloid soils, (3) skeletal montmorilloid soils with ironstone concretions, and (4) sesquioxidic-kaolinoid with a depositional horizon of massive ironstone (murram) (Moore 1971b:28).
3. Catenas	The catenas are split into (1) grey or black calcareous clays, (2) kaolinoid red-earth catena with a black calcareous lower member, intermediate soils have murram concretions, (3) calcareous bottom member dominant, (4) kaolinoid red-earth, calcareous bottomlands sequence, (5) kaolinoid red-earth, non-calcareous bottomlands sequence, and (6) sesquioxide catena (Moore 1971b:29).

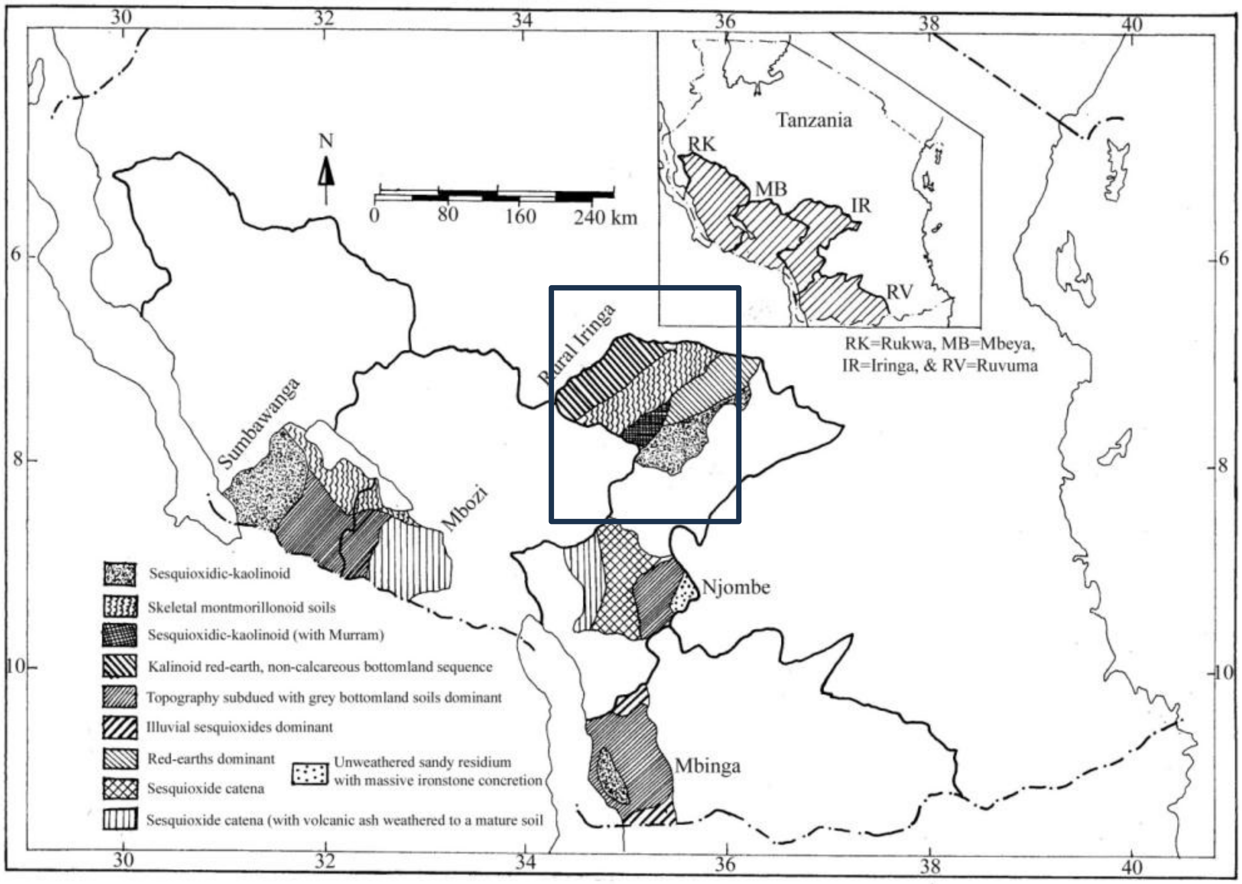


Figure 3.4: Soils of the Southern Highlands of Tanzania. Consider that box areas were the focus of the current study (Modified after Moore 1971b).

3.2.5 Vegetation

The present vegetation patterns of East Africa might have been influenced by volcanism and climate change during the Tertiary and early Quaternary (Bushozi 2011). It has also been presented that the modern vegetation and rainfall distribution patterns in East Africa have existed for a long time (Livingstone 1975). Other recorded factors, such as anthropogenic causes and increased population rates, may have also shaped the present vegetation in East Africa (Bushozi 2011). In case of Tanzania the classification has been done on a large-scale by Moore (1971a:30-31). It groups vegetation associations of Tanzania into (1) forest, (2) woodland, (3) bushland and thicket, (4) wooded grassland, (5) grassland, (6) swamp, and (7) desert and semi-desert.

The landscape of Iringa and the neighbouring regions are covered by the open grassland, shrubs, woodland, and riverside forests (Figure 3.5). Woodlands and forests are mostly located in the highlands and within river catchments, while discontinuous grasslands and shrubs are mainly found in the lowlands (Kashaigili et al. 2007). This pattern suggests that there is a close relationship between the vegetation prototypes, drainage systems, annual precipitation, soil types and topography. As previously noted, the annual precipitation in this region varies depending on the topography, whereby the upland areas receive almost 500 mm annually more than the lowland areas. The effect of rainfall and topography on vegetation type is obvious. The highlands are dominated by tropical woodlands composed of combination of the *miombo* trees (Hamilton 1982). The lowlands and river basins are composed of bushes, grasses, waterlogged-clay, and poorly drained soils with marshes (*ibid*.). During the rainy seasons, the lowlands and river basins are subjected to flooding and seasonal waterlogged plains locally known as *mbuga* (Howell et al. 1962). The term mbuga has been used by Howell et al. (1962) to refer plains and grasslands. *Mbuga* is notable for poorly drained black clay soil that becomes a quagmire in the rainy seasons and mostly found in the lowland plains with less rainfall (Cole and Kleindienst 1974:349). *Mbuga* areas are used for grazing in dry seasons (Bushozi 2011). *Mbuga* grasses include *Sporabolus consimilis*, *Themada trandra* and *Hyparrhenia setaria* (Cole and Kleindienst 1974:349).

Understanding the vegetation of the study area is important because the settlement and activities during LSA all the way to Iron Age have been influenced by vegetation. Taking example about iron smelter had to select a certain special tree species for technical and cultural purposes including wood for charcoal production, bellow accessories, rituals, and medicines (Lind and Morrison 1974). From the interview conducted by Lyaya (2013) indicated that out of

28 tree species recorded in Uhehe only eight tree species were said to be selected by the Hehe iron smelters for charcoal production. Msemwa (2004) also argued that the vegetation has been modified by various human activities by citing notion that the uncontrolled usage of trees started earlier, between 3,000 and 2,000 years ago, the period in which farming and smelting communities (Bantu language speakers) moved into the region.

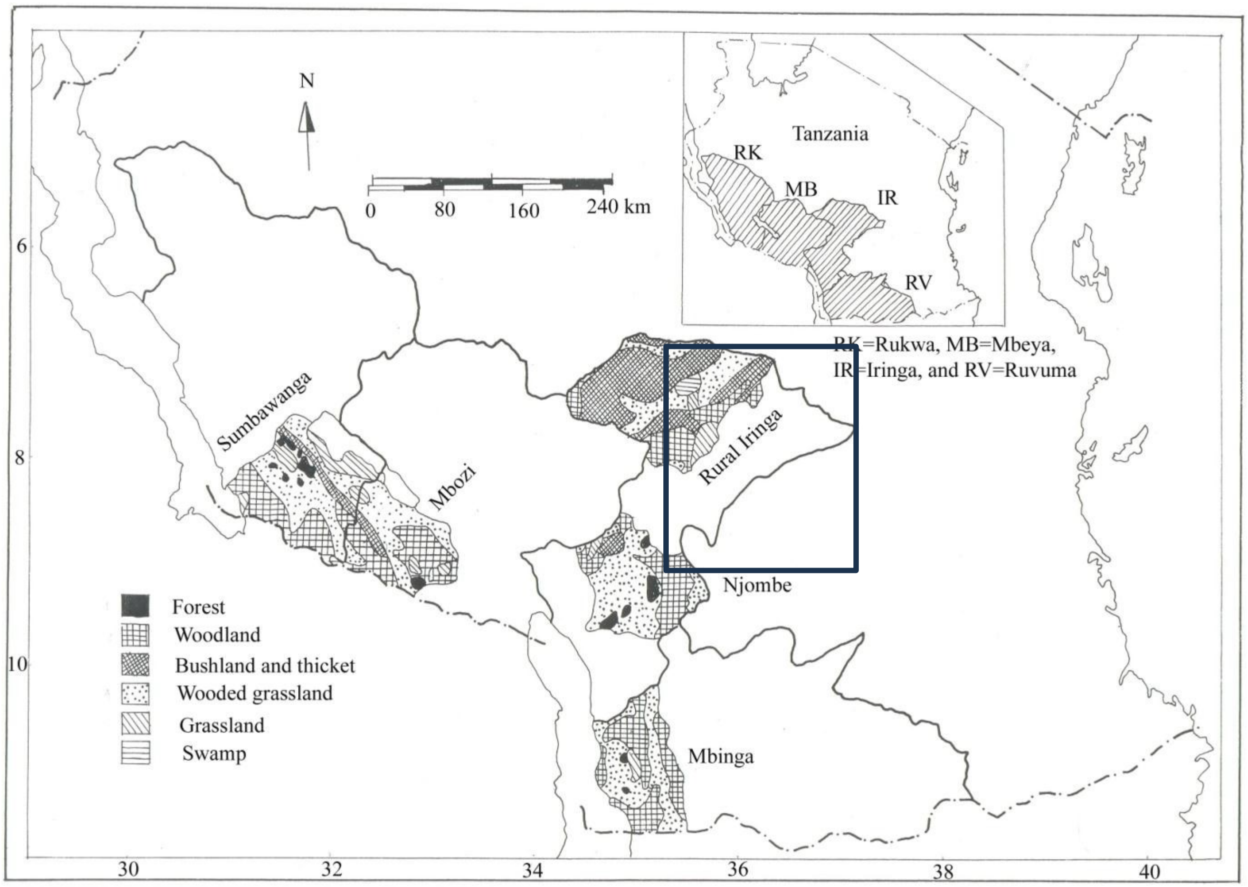


Figure 3.5: The Vegetation of the Southern Highlands of Tanzania. Consider that box areas were the focus of the current study (Modified after Moore 1971a).

3.2.6 Fauna

The Southern Highlands of Tanzania hosts several animals, both wild and domestic. According to Noe (2015), various large and small parks such as the Selous Game Reserve and the Ruaha National Park are in the Southern Highlands. These host a diverse number of wild animals including the African elephant (*Loxodontha africanus*), black rhinoceros (*Diceros bicornis*), wild hunting dog (*Lycaonpictus*) and hippopotamus (*Hippopotamus amphibius*). The Selous Game Reserve is Africa's largest and oldest game reserve and one of favourite game viewing areas in Africa. The reserve, which covers 43,600 square kilometres, extends up to Ruvuma region (Creel et al. 2002). Unlike most regions in the country, livestock keeping is not a common economic activity among various ethnic groups in the region (URT 1997). Although recently there has been an influx of pastoralists migrating and populating the southern Tanzania. Understanding of fauna was important for the current study that focuses on the aspects of PN and IA that depended on domestication or hunting of wild animals. Such games and national parks would have supported those activities. This has been reflected on the fauna assemblage discussed on Chapter 7.

3.2.7 Drainage system

Iringa and Njombe Regions are endowed with many natural springs and river channels (Figure 3.6). The Great Ruaha River, which is a main river channel of Iringa, supports many irrigation schemes, as well as two hydro-electric power stations at Mtera and Kidatu (Bushozi 2011; Miller et al. 2020). Both ephemeral and permanent spring channels run from the highlands, and are connected to the Great Ruaha River, a major source of the Rufiji River that ultimately flows into the Indian Ocean. Places drained by the ephemeral springs are characterized by eroded gullies, gravel, alluvial and colluvial sediments (Bushozi 2011; Biittner et al. 2011, 2017). The

Great Ruaha River catchments cover almost 475 km², but the total catchment area in combination with tributaries is about 68,000 km² 150. In its lower courses, the Great Ruaha River is characterized by wetland grasses and riverside forests. This trend suggests that the Ruaha River and its tributaries played a significant role in supporting human life since Middle, Upper Pleistocene, and recent times. Some activities such as hunting and foraging during LSA could not have been possible with the absent of water sources like Ruaha River. Similarly, the Iron Age settlements followed where the water sources were reliable to support agriculture and iron smelting.

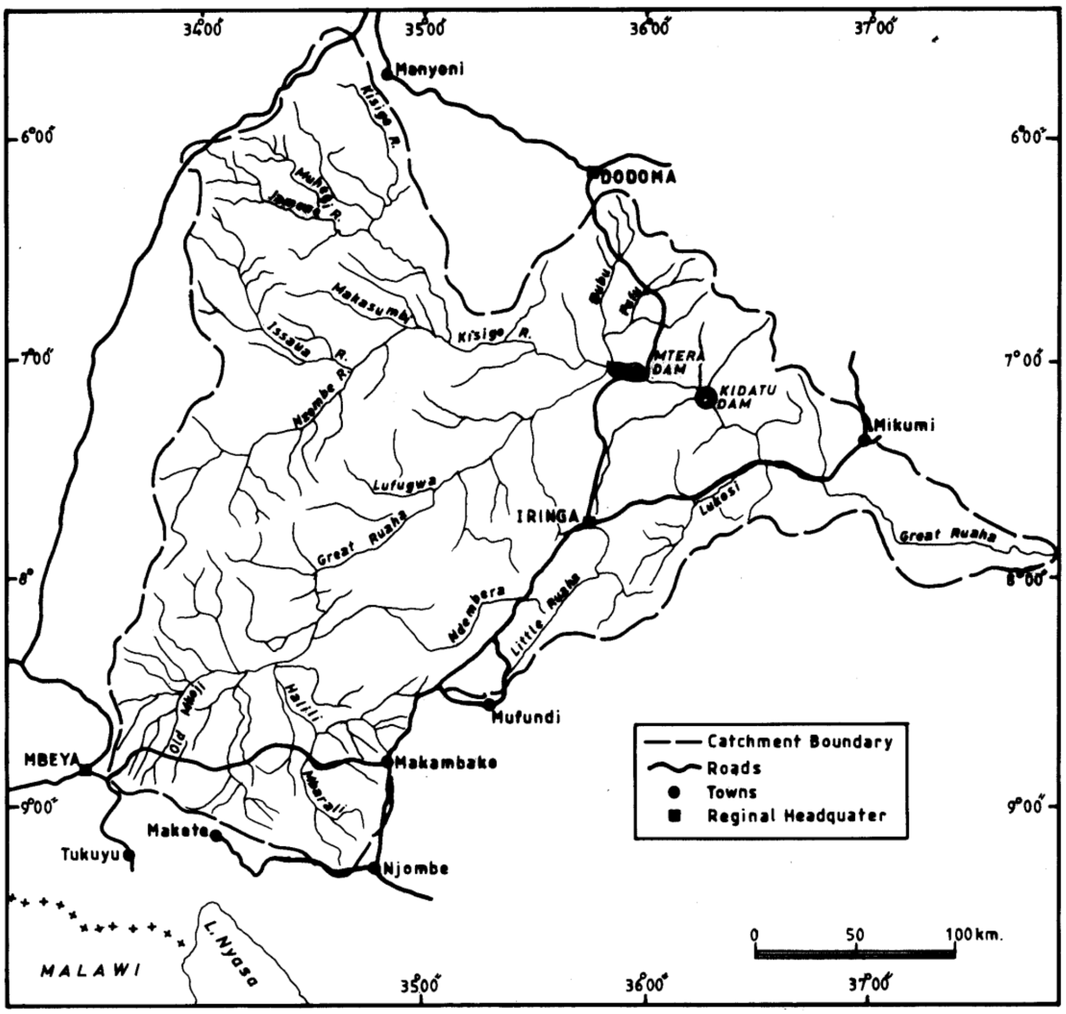


Figure 3.6: The drainage system of Iringa and Njombe Regions (Adapted from Bushozi 2011:155).

3.2.8 Peopling, History, and settlement

According to the United Republic of Tanzania (URT) demographic census of 2022, the Southern Highlands regions are currently occupied by about 7,619,909 people (URT 2022:2). The regions comprise of Ruvuma (1,848,794), Iringa (1,192,728), Njombe (889,946), Mbeya (2,343,754), and Songwe (1,344,687). There are more than 25 ethnic groups in the Southern Highlands of Tanzania. The dominant groups are Bantu speakers including Fipa, Hehe, Nyakyusa, Wamatengo, Wangoni, Wayao, Wanyasa, Wandendeule, Wamakua, Wapoto, Wamanda, Wanindi, Wamatambwe, Wabena, Wakinga, and many others (Mapunda, 2004; Lyaya 2013). Other non-Bantu groups, such as the Maasai, have moved from north to the Southern Highlands mainly seeking for the pasture for their cattle. Iringa and Njombe Regions have 11 ethnic groups. The former comprised of mainly Hehe in the Iringa Rural, Urban, Kilolo, and Mufindi Districts, as well as Mbunga and Ndamba in the Kilolo District. The latter is comprised of Bena located mainly in Njombe and Wanging'obe Districts, Kinga, Kisi, Mahanji, Magoma, and Wanji in the Makete District, Manda, and Pangwa in the Ludewa District.

Historically, the region has been affiliated to some major events including the ivory and slave trade, Maji Maji war (1905-1907) especially at Ruvuma Region, colonial intrusion, major resistance (Mkwawa resistance 1800's), and other recorded long and short distance trades that have influenced interactions over time and space. As in most other regions in the country, the modern settlement patterns were determined by the Villagization Programme (or *ujamaa*) launched in 1973/74 (URT 1997; Doerr 1998). This refers to the relocation of communities to create centralized villages where services could be better delivered to the people in rural areas (Miller et al. 2020). Most villages are located along main roads or in areas accessible by road. However, recently, a few people have tended to go back to their old settlements (URT 1997).

And finally, the rockshelter is said to have been used as a hiding place by the local people during the 1970s to escape the Ujamaa policy of forced villagization (Miller et al. 2020).

3.3 The Upper Pleistocene Environment and the Archaeological Occurrences in East Africa

Eastern Africa during the Middle–Late Pleistocene offered a wide range of habitats, and deposits of this age are rich in human fossils and archaeological remains (Willoughby 2007; Roberts et al. 2020). Environmental conditions triggered biological and cultural transformations recorded during that period. For example, between 57,000 and 24,000 years ago, climatic conditions remain unstable. East African lakes received slightly more precipitation indicated by sediments from fresh water lakes in the western branch of the EARVS (Bushozi 2011). Changes in lake levels in Lakes Nyasa, Tanganyika, Rukwa, Kivu, Edward and Albert suggest that these lakes experienced the highest level of precipitation. They were in the highest stand at the beginning of the Last Glacial between 32,000 and 25,000 years ago, followed by period of drought that reduced water balance during the Last Glacial Maximum (LGM) between 24,000 and 12,000 years ago (Hamilton 1982; Cohen et al. 2007; Scholz et al. 2007). Using sediments from Lake Massoko in southern Tanzania, dated by uranium series to between 45,000 and 25,000 years ago, suggest that most parts of southern Tanzania faced periods of humidity, which increased lake levels before the commencement of the Last Glacial Maximum or LGM (Garcin et al. 2006; Scholz et al. 2007).

The LGM represents a transitional period between the end of the Pleistocene and the start of Holocene (Clark 1980; Cohen et al. 2007; Willoughby 2007; Roberts et al. 2020). In tropical Africa, this period was extremely cold and arid, and was associated with the expansion of deserts and grasslands where forests once existed. During the LGM, most of the rift valley lakes dried up or reached their lowest levels and rivers were reduced. Lake core sediments suggest that the episode of cold climate began at the last phase of OIS 3 about 20,000 years ago and continued to the end of OIS 2 (Oxygen Isotope Stage 2) at 12,000 years ago (Hamilton 1982; Willoughby 2007). In Lake Tanganyika, water levels dropped from 400 m to 350 m between 21,700 and 12,700 years ago, but the lake overflowed again between 13,000 and 12,000 years ago (Willoughby 2007:92). Evidence from Lake Victoria suggests that the lake apparently dried up or nearly dried up during the LGM 24,000 years ago (Hamilton 1982; Willoughby 2007:92). At that period, the lake level dropped by 65 m below the present point (Livingstone 1975:261). However, the changes were not such intense in the Southern Highlands as highlighted by Willoughby (2012:4) that "so, it appears that the Southern Highlands do not show the radical vegetation and climate changes of lowland areas in the East African Rift Valley, where major lakes dried up completely. If this is the case, then Iringa becomes an extremely important area for testing models of modern human biological and behavioural evolution. It also offers the potential to link the better-known archaeological records from northern Tanzania, Kenya, and Ethiopia with those from further south in Zambia, Zimbabwe, and South Africa." Generally, the modern situation for most East African rivers and lakes commenced at the beginning of the Holocene between 12,500 and 9,500 years ago (Clark 1980; Hamilton 1982). At that time there were no great changes in human culture; the LSA assemblage continued in most areas, but with more emphasis on local raw materials (Hamilton 1982; Shipton et al. 2021).

The environmental changes during the Upper Pleistocene have implications for both biological and cultural changes on human lives (Hamilton 1982; Willoughby 2007; Bevan et al. 2017). In that case the study like this must consider material culture in the line of environmental stimuli as well as prehistoric human behaviour and technological variations/changes. Hunting behavior that intensified during Middle Pleistocene continued by incorporating other periods including the upper Pleistocene where LSA cultures emerged. Approximately 50,000 years ago, MSA technology began to be replaced by that of the LSA in both the tropics and subtropics (Clark 1980; Díez-Martín et al. 2009; Gliganic et al. 2012; Shipton et al. 2021; Bader et al. 2022) and between 30,000 and 20,000 BP, the replacement of MSA by LSA technology appears to have been general throughout Africa (*ibid*.). Elsewhere, in the later part of the Pleistocene (c. 20,000-10,000 BP), fully microlithic assemblages make their appearances. They are well seen in the Lake Victoria basin at 15,000 BP, Lake Nakuru basin at c.12,000 BP, in east-central Ethiopia c.4,000 BP, in Zambia at 16,000 BP, at Olduvai Gorge c.19,000 BP, and in central Tanzania by c.30,000 BP.

3.4 The Holocene Environment and the Archaeological Occurrences in East Africa

In East Africa/African in general the large-scale climatic periods during the Late Quaternary were interrupted by abrupt oscillations and rapid transitions (Hassan 1997; Bevan et al. 2017). The magnitude and direction of climatic changes show distinct regional variation. However, in the monsoon-domain areas, abrupt drought events occurred conspicuously at ca. 12,000-11,500, 8,500, 7,500, 4,500, 4,000-3,700, and 2,000 uncalibrated radiocarbon years BP. But more recent environmental research has shown that glacials in Africa were periods of heightened aridity, and lakes were only enlarged in warmer periods, notably the early Holocene (Willoughby 2007). MIS stage 5e represents the warmest and possibly wettest conditions prior to the Holocene. African forests are extensive, and modern deserts were almost completely covered with vegetation (Willoughby 2007). The last 13,000 radiocarbon years represents MIS stage 1 or the Holocene. At this time, temperature and moisture increased throughout most of Africa. In the early Holocene (Figure 3.7), the rain forest shows its greatest extent and the Sahara was completely vegetated; afterward, conditions became more arid, like present. During Holocene period it is when the environment became wet allowing agriculture that triggered permanent settlement hence emergence of some technologies such as pottery manufacturing. There was increased in utilization of aquatic resources (Ashley and Grillo 2015; Bevan et al. 2017; Roberts et al. 2020).

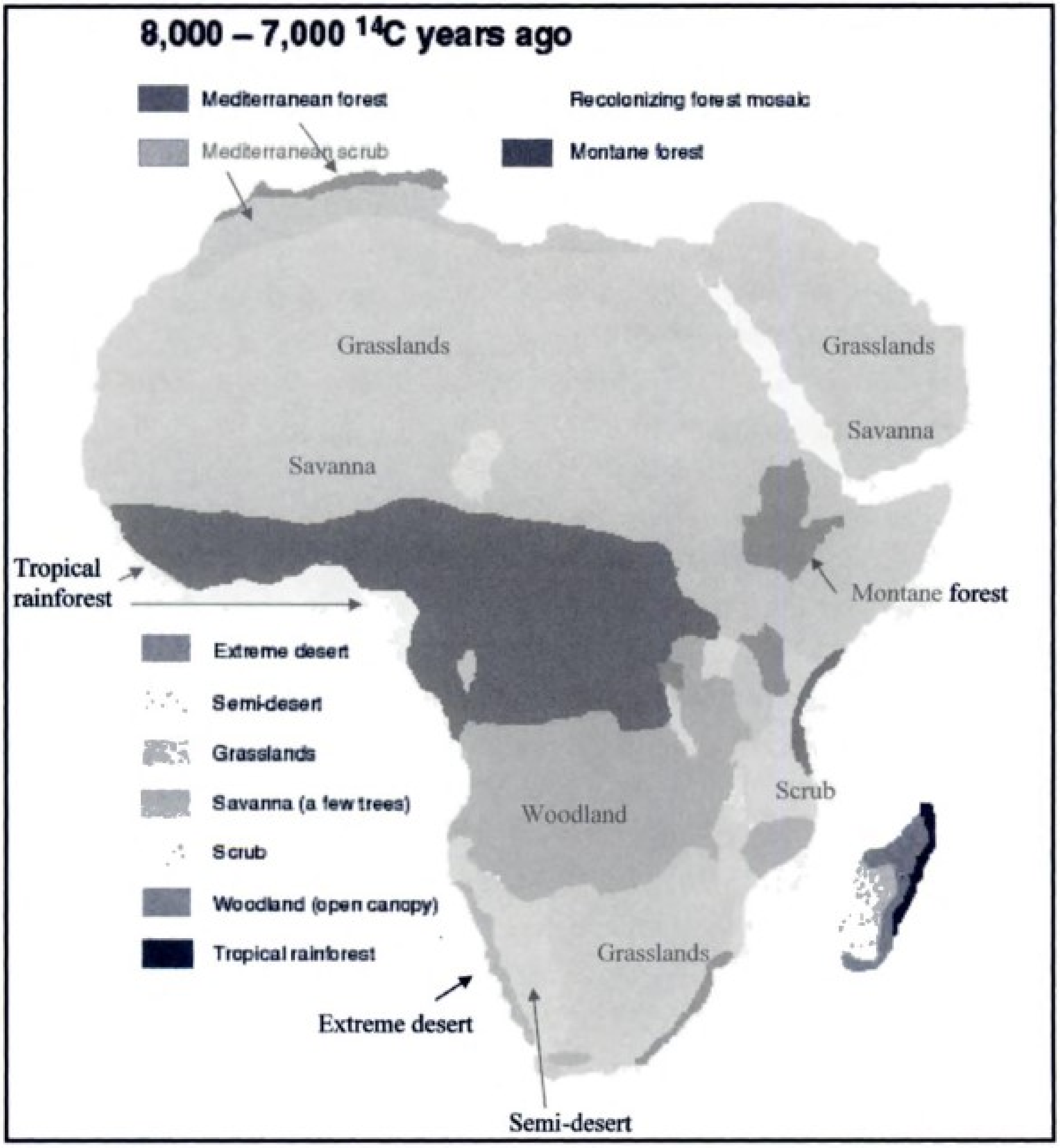


Figure 3.7: Africa in the Early Holocene (Adapted from Adams and Faure 1997).

3.5 Chapter Summary

This chapter has presented the environmental parameters of East Africa by focusing in the Southern Highlands of Tanzania. Specific attention has been given to Iringa and Njombe Regions. It has highlighted the significant issues mainly the climate, geology and minerals, soil, relief, vegetation, fauna, drainage systems, and peopling of the area. The discussion has focused in two categories that is past and modern environment and how are they connected to current study. Both parameters have had influence on past and present human settlement and socio-economic transformations. For example, the presented of wild animals that are observed currently on some places like the Ruaha National Park, the Selous Game Reserve, and Mikumi National Park would have attracted the hunting activities that can be traced from the MSA towards IA periods. Similarly, to the present of water sources such as the Great Ruaha River, Ruhuhu, and other tributaries would have supported settlement, agriculture, and other activities developed at different period. All are reflected on the following chapters presenting the material culture including fauna of both wild and domestic animals, ceramics reflecting the nature of soil, and lithics considering geology and minerals of the study area in relation to raw material.

CHAPTER 4: RESEARCH METHODOLOGY

4.1 Introduction

This chapter presents the research methodology that was employed to carry this study. It begins with the study plan and research design, and is followed by discussions of research approach, sample and sample size, sampling procedures, and methods of data collection. The chapter ends by providing a concluding summary.

4.2 Study Plan

The current study was conducted in five phases. Each phase accomplished a specific task and led to certain outcomes. For example, the publication resulted from 2018 and 2019 preliminary study was used to guide the actual research and therefore was taken to ensure the validity of the study. Initially, I intended to begin with the field work in Iringa Region, but due to the challenge caused by Covid-19 pandemic, I decided to begin with museum research. The research began in September 2020 after obtaining the research permit ref. No. LB.72/278/01/'A'/2 ext. ref. No. LA.72/278/01'/A/79 from the National Museum of Tanzania (NMT). The field research followed during June 2021 after obtaining the research/excavation permit No. 2/2020/2021 from the Director of the Antiquities Division, Tanzania (DOA) on May, 2021. Other phases followed in 2022 and 2023 involving ethnographic reviews, data analysis, and dissertation writing.

4.3 Research Design

This study uses both the quantitative and qualitative research design. A quantitative research design has been adopted for accomplishing some scientific processes of the study. For example, stratigraphic and cultural sequence analysis were guided by fundamental laws or axioms. Here the law of superposition was taken into consideration. The law states that in a series of layers or interfacial features, as originally created, the upper units of stratification are younger and the lower are older (Harris 1979). This helped to understand the culture history and process of LSA and IA agropastoralists, and the intermediate culture of PN. Culture history is a goal of archaeology, which relies on description of phenomena. This involves focusing on stylistic, shape and size of objects over time. Cultural process involves providing explanations why those changes occurred over time or space. The stratigraphic sequence offers cultural changes over time by analysing the material culture such as pottery, lithics and fauna that occurs at the stratigraphic layers.

To understand the stratigraphic sequence excavation was conducted as part of quantitative methods (see sub-section 4.6.2). Excavation was conducted on new sites such as Mgera and Uhafiwa in order to complement the secondary data in which some of them were already analyzed by IRAP and were extracted from SPSS data files and used for this study. Some were not yet analyzed and therefore were reviewed and analyzed at NMT by the current study. The review of already excavated material aimed at addressing the following issues. First, to be familiar with that material like lithics and ceramics especially those belonging to LSA and IA periods. Second, to analyse some material such as fauna and ceramics that were not yet analyzed. Third, to review and analyze the ceramic collections collected previously by Dr. Paul Msemwa. Another quantitative aspect considered was absolute dating methods, such as C-14 dating of both charcoal and ceramics was carried out. Petrographic analysis (PA) was also conducted in order to identify the actual fabric contents of a particular potsherd or sediment. The qualitative research design has been adopted in ethnographic inquiries, which went with semi-structured interviews and observations under the umbrella of an "ethnoarchaeology approach." Apart from ethnographic inquiries, qualitative issues were considered also in analysis and interpretations of some data, such pottery decoration attributes.

In terms of approach, the study has used a deductive approach. In this kind of research, the researcher begins by reviewing the literature, generating a conceptual framework, developing a hypothesis, and then testing the hypothesis by gathering data (Steinberg and Steinberg 2006). Deductive means reasoning from general to particular (*ibid*.). Through this approach the outcome of the test, and thus confirming or rejecting the theory. As presented before, the study was mainly intended to test the existing models that explain the interaction situation between LSA hunter-gatherers and IA agropastoralists (Bantu) in the Southern Highlands of Tanzania (Chapter 2, sub-section 2.6.2). Therefore, expectations of this study were informed by those theories and derived conceptual framework. All hypotheses and research questions for this study have been stated in Chapter 1, sections 1.5 and 1.6 which guided this study. The opposite of a deductive approach is inductive approach which moves from particular to general. It fits for a researcher who wants to deal especially with cognitive activities (Feeney and Heit 2007).

4.4 Sample and Sample Size

4.4.1 Sample

A total number of 15 archaeological sites provided data for this study (Table 4.1). Nine of them (Figure 4.1) provided data for the preliminary study of 2018-2019, which was published in

2021 (Katto and Willoughby 2021). Such results and the previous research in the study area indicated the presence of LSA and/or IA material in Iringa and neighbouring regions located in the Southern Highlands of Tanzania. Other sites (Figure 4.2) namely Magubike rockshelter, Mlambalasi rockshelter, Ikula, Msosa, Mlangali site (HwJg-105 (S7˚45.357’ 35˚33.220’E), Mgera site (HwJg-106 (S 07^0 43’ 26.4’’ E 035^0 36’ 26.1’’), Utinde Mkoga, and Uhafiwa site in the Upper Kihansi area (8˚31’ 27” S, 35˚51’ 10”) are in the Iringa Region. They were initially studied by Paul Msemwa, the former Director General of the NMT, by Archaeological Project (IRAP) members, and/or I in the years 1997, 2002, 2006, 2008, 2010, 2012, 2018, 2019, and 2020-21. Mgala-Isitu and Ikombe sites are located at Njombe Region and were surveyed by Paul Msemwa in 1997; their collections are stored in NMT (Figure 4.2). For ethnographic inquiries, a sample of respondents was taken from two major ethnic groups (Hehe and Bena) that still make pottery in Iringa and Njombe Regions.

Table 4.1: Study sites indicating data source, cultural components, and other information.

Site Name	SASES	Coordinates	Site Type	Cultural components				Year	Source
				ESA	MSA	LSA	IA		
Mlambalasi rockshelter	HwJf-02	7° 35′ 27.773″ S, 35° 30′ 1.696″E	Shelter		√	√	√	2002, 2006	Msemwa (NMT)
Magubike rockshelter	HxJf-01	7° 45′ 23.158″ S, 35° 28′ 22.804″ E	Shelter		√	√	√	2006	IRAP
Magubike Tobacco site	HxJf-19	7°45'22.69" S, 35°28'23.05" E	Open-air			√	√	2019	IRAP
Mlangali	HwJg-105	7° 39′ 42.131″ S, 35° 37′ 42.784″E	Open-air		√	√	√	2018, 2019, 2021	IRAP-FIELD
Mgera site	HwJg-106	7° 43′ 26.4″ S, 35° 36′ 26.1″E	Shelter & Open-air		√	√	√	2021	IRAP-FIELD
Utinde-Mkoga			Open-air			√	√	2002	Msemwa (NMT)
Ulonge Korongo	HxJh-1	7° 46′ 53.308″ S, 35° 47′ 35.515″E	Gulley				√	2018	IRAP
Kigonzile-Korongo-1	HwJh-1	7° 44′ 33.810″ S, 35° 45′ 24.264″E	Gulley	√	√		√	2018	IRAP
Kitisengwa-Korongo-3	HxJg-114	7° 46′ 36.900″ S, 35° 38′ 52.260″E	Gulley	√	√		√	2018	IRAP
Kitwiru-Mosi	HxJg-126	7°50'243" S, 35°40'019" E	Hill site			√	√	2019	IRAP
Uhafiwa HP Camp Site	-	8° 31′ 15.6″ S, 35° 5105.3″ E	Hill site		√	√		2021	IRAP-FIELD
Msosa	-	7° 32′ 57.12″ S, 36° 31′ 45.12″E	Open-air				√	1997	Msemwa (NMT)
Mgala-Isitu	-	9° 32′ 11.04″ S, 35° 14′ 25.44″E	Open-air				√	1997	Msemwa (NMT)
Ikombe	-	9° 16′ 12″ S, 34° 01′ 1.92″E	Open-air				√	1997	Msemwa (NMT)
Ikula	-	7° 31′ 39.36″ S, 36° 26′ 34.08″E	Open-air				√	1997	Msemwa (NMT)

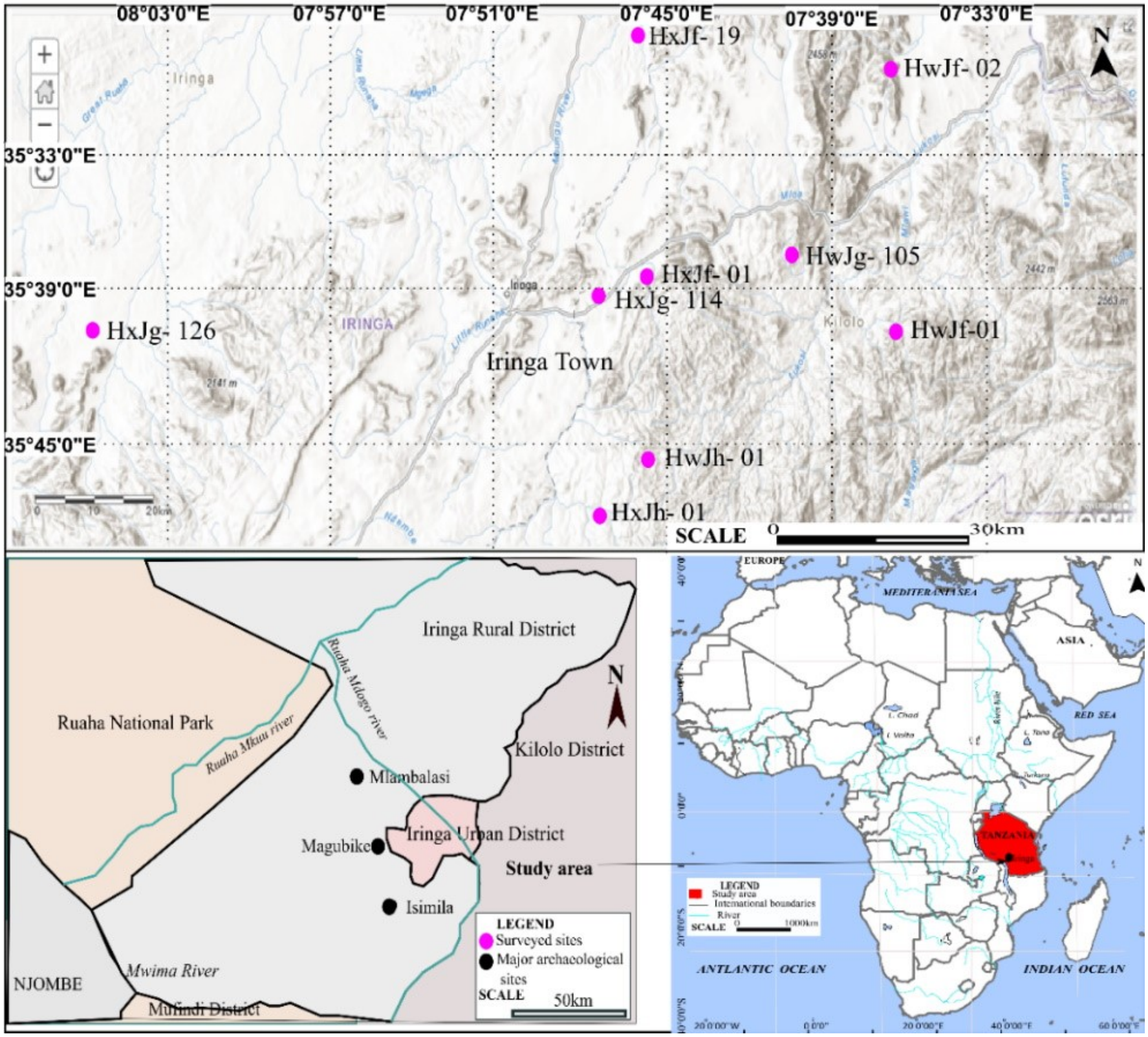


Figure 4.1: A map showing 2018-2019 preliminary study sites (Mapped by Katto and Pazza 2020; Adapted from Katto and Willoughby 2021).

Figure 4.2: A map showing the 2021 study sites.

In 1997, Msemwa conducted an archaeological survey in Iringa which at that time included what is now the separate Njombe Region. He did so as part of Environmental Impact Assessment (EIA) following the Kihansi Hydroelectric Power Project (KHPP). Msemwa was able to report the discovery of a variety of archaeological materials, specifically pottery, lithics, slag, and tuyeres in Upper and Lower Kihansi areas (Msemwa 2001). Initially, these two regions were originally both part of Iringa Region, before being divided in the year 2012 (United Republic of Tanzania, URT 2012). All materials from both regions are stored at NMT-Dar es Salaam. All data from the Njombe Region was collected from the surface by Paul Msemwa in 1997 and were selected by this study for understanding the ceramic traditions but not the stratigraphic/cultural sequences considering that material was not obtained from excavations and therefore lacked a proper chronological sequence.

In 2002 Msemwa conducted another archaeological survey and excavations at Mlambalasi rockshelter and Utinde-Mkoga both in Iringa (Msemwa 2002). The study aimed at unravelling the existing connectivity between the people of Iringa and the Swahili coast. Later, member of IRAP under the directorship of Prof. Pamela Willoughby begun intensive research in Iringa in 2005, which has carried out up to present. Ms. Joyce Nachilema (by then, District Cultural Officer for Iringa Rural (or *Iringa Vijijini*), who showed Pamela Willoughby several granite rockshelters in 2005, all of which appeared to have substantial evidence of past human occupation (Willoughby 2005). The first excavations were carried out in 2006. Two 1 m^2 test pits were dug at Mlambalasi rockshelter and three at Magubike. Some publications and theses have resulted from 2006 research (Collins 2009; Collins and Willoughby 2010; Biittner 2011; Bushozi 2011; Willoughby 2012). Test pits (Tp) 4 and 5 were excavated in 2008.

In 2010, more extensive excavations were carried out at Mlambalasi rockshelter by Willoughby and her then graduate students namely Katie Biittner, Pastory Bushozi, Frank Masele, Jennifer Miller, and Elizabeth Sawchuk. This involved the expansion of excavation of a LSA human burial remans of which had been uncovered in 2006 (Sawchuk 2012; Biittner et al. 2017). Associated ostrich eggshell beads were radiocarbon dated to between 18,000 and 22,000 years old, giving an age for the skeleton (Lipson et al. 2022).

In 2012, test pits 6-12 were excavated and yielded many finds as well. Some PhD theses and publications (Masele 2017; Werner and Willoughby 2018; Miller and Wang 2022) have used some data from that year. The 2018 fieldwork was undertaken by Willoughby, Biittner, Miller, and Werner who conducted survey and managed to documents many sites in Iringa. Another survey and test pits excavations were conducted in 2019 by Biittner and I with the support of other students from MacEwan University; preliminary results of this fieldwork, focusing on pottery, was published in 2021 (Katto and Willoughby 2021). In 2021 and 2022, I conducted the principal field research for my PhD thesis that covered Iringa and some parts of Njombe.

As presented in Chapter 5, material from IRAP's previous research was selected based on excavation units/Tp that had well-defined chronological sequence (LSA and IA) especially Mlambalasi Tp# 1, Unit I-11, Magubike Tp# 1 and 5, and Mgera trench# 2. Other Test pits and trenches lacking LSA material were considered for Iron Age/historic periods specifically Tp# 3, 6-12 at Magubike. Much focus was put on lithic, fauna, and pottery belonging to LSA or IA period.

4.4.2 Sample Size

In this sub-section I first address archaeological sample size considered by the current study, followed by samples for chronometric dating, soil samples, and ethnographic samples. For the archaeological samples, a total number of 57,785 of artifacts forms the sample size of the current study (Table 4.2). Such material are mainly lithics, fauna, and ceramics. Additional material such as daubs, tuyeres, slag, grinding/ground stones, shaped bones, and wood are briefly presented in Chapter 7 and 10 to complement the IA material cultural evidence, but were not a major focus for the current study.

Table 4.2: Sample size for Lithics, Fauna, and Pottery.

	Cultural Material			**Total**
Site Name	**Lithics**	**Fauna**	**Pottery**	
Magubike Rockshelter	35,935	2,169	377	**38,481**
Mlambalasi Rockshelter	7,025	9,747	1,018	**17,790**
Mgera	432		533	**965**
Mlangali			22	**22**
Uhafiwa	187			**187**
Utinde Mkoga			70	**70**
Msosa			83	**83**
Ikula			63	**63**
Mgala-Isitu			39	**39**
Ikombe			85	**85**
Total	**43,579**	**11,916**	**2,290**	**57,785**

Other samples, such as charcoal and potsherds, were used for dating. The former was taken for the purpose of stratigraphic and material cultural chronological determination (Table 4.5). The latter were sampled for C-14 dating (Table 4.4) in order to confirm the previous chronologies established from previous studies as well as the existence or not of Pre-Iron Working/PN cultures. For example, the previous dates (1401-1048 cal BC) obtained from *Achatina* shells for Magubike TP# 3 level 3 seems to be very older dates for pottery of the

Southern Highlands of Tanzania. Therefore, dating of pottery sample was considered to justify the presence or absence of PIW/PN in that area. Such kind of dating was also conducted to some potsherds that provide some decoration features specifically cuneiforms and internal grooves that are more dominant to PIW/PN cultures (see Chapter 8). Uncalibrated dates obtained from the lab were calibrated using OxCal v4.4.4 Bronk Ramsey (2021); r: 5; Atmospheric Data from Reimer et al. (2020). (See Appendix IX). The program is free online through Oxford Radiocarbon Accelerator Unit. This also involved recalibration of dates obtained previous from Magubike by previous scholars (Table 5.1).

A total number of 16 respondents (ceramic makers) were selected representing various ethnic groups of Iringa and Njombe Regions as detailed presented in Chapter 9. Two of respondents operate in group form and the rest works as and individual. The ethnographic works involved observation and recording the entire pottery making process from raw material selection (clay soil) to final process of distribution and discards. During observation of raw material selection, I was able to collect five bags of soil samples measuring (500 g) each were taken from clay sources per each respondent except respondent 5 and 6 for understanding the clay mineralogical contents and variations per area. This could help to understand the issue about temper and interpret the ceramics in the archaeological records (Table 4.3). Petrographic Analysis (PA) for ceramics and X-Ray Diffraction (XRD) methods were done at the African Minerals & Geosciences Centre (AMGC) located in Dar es Salaam, Tanzania.

A total of 23 ceramic samples were selected for PA (Table 4.3). This aimed to answer various questions including the pottery forming techniques and the fabric (including temper, colour, and texture) present in the sample. To some extent sample selection considered stratigraphy for determining if there were changes in terms of fabric through time, variations among cultures/traditions, and the source of raw materials (if primary or secondary). If there is intra site variations/similarities within Iringa and neighbouring regions like Njombe. Here, three Test pits/trenches were selected including HxJf-01 Tp-5, HwJf-02 1-11, and HwJg-106 Trench 2 (Table 4.3). Other samples (Table 4.3) were taken from different sites like the Swahili coast, Uvinza, Songwe, and Njombe for establishing intra and inter-community interactions (if any) and determines the nature of such interactions if by diffusion or physical movement of people. The establishment of pottery traditions (such as Nkope, TIW, and Ivuna) from the study area was done first which guided the selection of potsherd samples from each tradition to be submitted for PA. This was latter compared by other samples beyond the study area like Swahili coast that falls within a particular tradition for the reason presented above. Those samples were borrowed from NMT and some individual researchers. Both diagnostic and undiagnostic potsherds were submitted for PA involving mainly body sherds and other parts of the vessel. Another sample (N=30) was taken for faunal species identification (Table 4.6) and it is discussed in details in Chapter 7. The faunal samples were taken to understand the animal species found in the LSA and IA context and assess if there have been any changes occurred over time between the two cultures. In other word, are the animal species found in the LSA persists in the IA period? By combining other analytical attributes discussed in Chapter 7, it could have been able to understand human behavior on identified animal species in relation to specific cultural period. For example, does hunting behavior of the LSA persists in the IA? Which animal species are represented in the assemblage?

Table 4.3: Pottery sample selected for PA, and Soil for X-RD*S=Surface.

PA					Soil sample		
Site	Unit/Tp/ Trench#	Level (cm)	#Sample	Area	#Respondent	#Bag	Weight (g)
				Isimila	1	1	500
Mlambalasi	I-11	1-4, 9	5				
Magubike	5	2 to 7	6	Kalenga	2	1	500
Mgera	2	2, 4, and 6	3				
Msosa		S	1	Mapanda	3	1	500
Ikula		S	1	Rungemba	4	2	600
Mnaida	7	3	1				
Ikombe		S	1				
Ivuna (Songwe)			1				
Uvinza (Pwaga)			1				
Pemba S(Nkope)			1				
TIW (Swahili coast)			2				
TOTAL			**23**				

Table 4.4: Samples Taken for C-14 dating of ceramic artifacts.

C-14 (Ceramics)									
Site	**Unit/Tp#**	**Level (cm)**	**SPSS Code No.**	**#Sample**	**Reason**	**Weight (g)**	**Lab.#**	**Uncalibrated date (BP)**	**Uncalibrated date (BP)**
Magubike	3	1 (0-10)	-	1	EIA /LIA?				
		2 (10-20)	-	1	EIA?				
		3 (20-30)	9	1	PIW?				
	5	4 (30-40)	119	1	PIW?				
Mlambalasi	Room 1	Surface	38	1	PIW?				
	Slope	Surface	100	1	PIW?				
	J-10	2 (10-20)	424	1	PIW?				
Utinde	1	Surface	370	1	PIW?				
Uhafiwa	-	Surface	791	1	PIW?				
Mgera	2	1 (0-30)	580, 632	2	EIA?				
TOTAL				**11**					

*PIW-Pre-Iron Age Working; EIA-Early Iron Age; LIA-Later Iron Age.

Table 4.5: Charcoal samples taken for C-14 dating.

Site	**Depth cm**	**Sample**	**Weight (g)**	**Lab. number**	**Uncalibrated date (BP)**	**Calibrated date ranges**
HwJg-106 Trench 2; Iron Age?	0-30	Charcoal				
HwJg-106 Trench 2; Iron Age?	40 – 50	Charcoal				
HwJg-106 Trench 2; Iron Age?	50-60	Charcoal				
HwJg-106 Trench 2; LSA?	70-80	Charcoal				
Uhafiwa Tp# 3; Neolithic/LSA?	0-20	Charcoal				
TOTAL # Samples		**5**				

Table 4.6: Sample of bones for species identification.

Site	Unit	Quadrant	Level (cm)	Year	# Sample	Sample type	Cultural designation	Species
HwJf-2	I-10	NE	2 (10-20)	2010	1		IA	
HwJf-2	J-10	NE	2 (10-20)	2010	1		IA	
HwJf-2	J-9	NE	3 (20-30)	2010	1	tooth	IA	
HwJf-2	J-9	NW	2 (10-10)	2010	1	Mandible flag	IA	
HwJf-2	J-10	SE	3 (20-30)	2010	3		IA	
HwJf-2	J-11	NE	3 (20-30)	2010	1		IA	
HwJf-2	J-10	SE	Surface	2010	1	Mandible	Historic	
HwJf-2	I-11	SW	5 (40-50)	2010	2	Craw & long bone	IA	
HwJf-2	I-9	SW	Surface	2010	1		Historic	
HwJf-2	J-11		7 (60-70)	2010	3	Teeth	LSA	
HwJf-2	J-10	SW	1 (0-10)	2010	1	Mandible	IA	
HwJf-2	J-10		2 (10-20)	2010	1		IA	
HwJf-2	J-10	NW	4 (30-40)	2010	1	Tooth	IA	
HwJf-2	J-10	SW	1 (0-10)	2010	1		IA	
HwJf-2	J-10	NW	3 (20-30)	2010	2		IA	
HwJf-2	I-11		1 (0-10)	2010	2	Mandible & tooth	IA	
HwJf-2	J-11	NE	3 (20-30)	2010	1	Mandible	IA	
HwJf-2	J-10	SW	2 (10-20)	2010	2	Teeth & long bone	IA	
HwJf-2	J-11	SE	2 (10-20)	2010	1		IA	
HwJf-2	J-11	NE	2 (10-20)	2010	1	Long bone	IA	
HwJf-2	J-10	SE	2 (10-20)	2010	2	Mandible & teeth	IA	
HwJf-2	I-10	SE	3 (20-30)	2010	1		IA	
HwJf-2	J-11		6 (50-60)	2010	3		LSA	
HxJf-1	Tp# 7		4 (30-40)	2012	1	Mandible with teeth	IA	
HxJf-1	Tp# 8		2 (10-20)	2012	1	Long bone	IA	
HxJf-1	Tp# 8		4 (30-40)	2012	1	Phalanx	IA	
HxJf-1	Tp# 8		5 (40-50)	2012	2	Phalanx & tooth	IA	
HxJf-1	Tp# 12		5 (40-50)	2012	1	Tooth	IA	

4.5 Sampling Procedures

The study used purposive and snowball sampling as part of non-probability sampling. The former is also known as judgemental or selective sampling. It is a form of non-probability sampling that involve strategy in which a particular settings, person or events are selected deliberately in order to provide important information that cannot be obtained from other choices (Taherdoost 2016). It is where the researcher includes cases or participants in the sample because they believe that they warrant inclusion (*ibid*.). This kind of sampling procedures have been selected because the study was directly targeting those sites having the LSA, Iron Age, and PN (if any) evidence to answer the research questions and hypothesis.

The secondary data (particularly lithics) that were already analyzed by IRAP members were stored in the SPSS database, and ranges from MSA to IA. I used the same software (SPSS) purposely to extract the targeted data specifically those of LSA and IA context. The first step was extraction of a particular site by following steps: data>site=code No. of a particular site>data=code No. of particular cultures. This enabled to develop a new SPSS data file having a sample of a particular data required by the current study. Other secondary data like fauna was purposely sampled based on the IRAP's reports and publications. Through those written information I was able to notice that most of fauna material from LSA and IA context were not analyzed with exception of 2006 collections from Magubike and Mlambalasi rockshelters that were analyzed by (Collins 2009; Collins and Willoughby 2010). Therefore, the current study targeted the LSA and IA fauna material from 2010 and 2012 collections from Magubike and Mlambalasi rockshelters. For the ceramic material all of them from the study sites collected by IRAP, Msemwa, and I were included in the study because they were not yet studied. Purposive sampling was also applied in the selection of samples for dating (for ceramics) and fauna species identification. For the ceramics the issues such as context, previous reported dates, and the specific attributes like decorations were considered. For the fauna, the specimens with pronounced anatomical structures such as articular surfaces, condyles, ridges, grooves, and foramina, were considered for species identification.

Snowball sampling is another form of non-probability sampling that uses a few cases to help encourage other cases to take part in the study, thereby increasing sample size (Taherdoost 2016). This kind of sampling allows research participants to suggest other potential participants familiar to the research problem. This kind of sampling was used particularly in selecting respondents for ethnographic inquiries. A focus was placed on the ethnic groups or communities that are still practising pottery making in the study area. One respondent was familiar with other people who are expert in pottery making hence their suggestion helped to select or consider other respondents subject to abiding the ethical guidelines. During the interview process, the interviewees were able to relate what they are doing with other people or community. Sometimes even other people were able to make a reference to a particular people or individual as a right person to offer what the interviewer wanted. For example, in this study many people were making a reference to one place called Rungemba which later was incorporated in this study and provided the key information.

4.6 Data Collection Methods

The current study used both primary and secondary data. The primary data was collected by author in the year 2019, 2021-2022. They involved archaeological and ethnographic data collected from Iringa and Njombe Regions. The secondary data involved the review of museum collections and desktop reviews. Some data especially lithics were extracted directly from the

SPSS database analyzed by the previous IRAP members. Those extracted data are currently stored at the National Museum of Tanzania (NMT) and were reviewed by the author for the reasons provided in section 4.3 above. However, not all data collected by IRAP were studied by them, and therefore, the current study analyzed them as far as the focus of the study is concerned (see Chapters 6-8). The museum collection reviews involved also ceramic material that were collected by Paul Msemwa from Iringa and Njombe stored at the NMT as well. The following sub-sections provide in details the data collections methods involved for the current study:

4.6.1 Survey Methods

Two non-probabilistic approaches were employed as a survey method that resulted the data used for this study. The method has been employed by IRAP since 2005 in Iringa Region (Miller et al. 2020). First, involve the engagement of local people who shared their knowledge about the history and landscape of the region. This approach has been a significant in Iringa research to the extent that the beginning of 2006 research was due to the knowledge of local people who showed Prof. Willoughby the rockshelter in 2005 (Willoughby 2012). Second, employment of remote sensing technologies, specifically satellite imagery from Google Earth. The approach has helped IRAP to identify natural exposures and unique topographic features and solving the challenge of limited time in the field (Miller et al. 2020). A general archaeological survey was carried out in 2008; this produced numerous archaeological sites spanning the time period from the Acheulean to present (Willoughby 2012; Miller et al. 2020). Surface samples were taken from all recorded sites. Survey continued to other years including 2010, 2012, 2018, 2019, and 2021 as already presented in section 4.4 above. Following such survey IRAP has managed to identify about 67 archaeological sites (Figure 4.3). Miller et al. (2020:276-77) summarised all sites by indicating their coordinates, Standard African Site Enumeration System

(SASES) number, site description, site type, and cultural designation. These sites, have archaeological potential that ranges from Early, Middle, and Later Stone Age, the Iron Age, and the historic period (Miller et al. 2020).

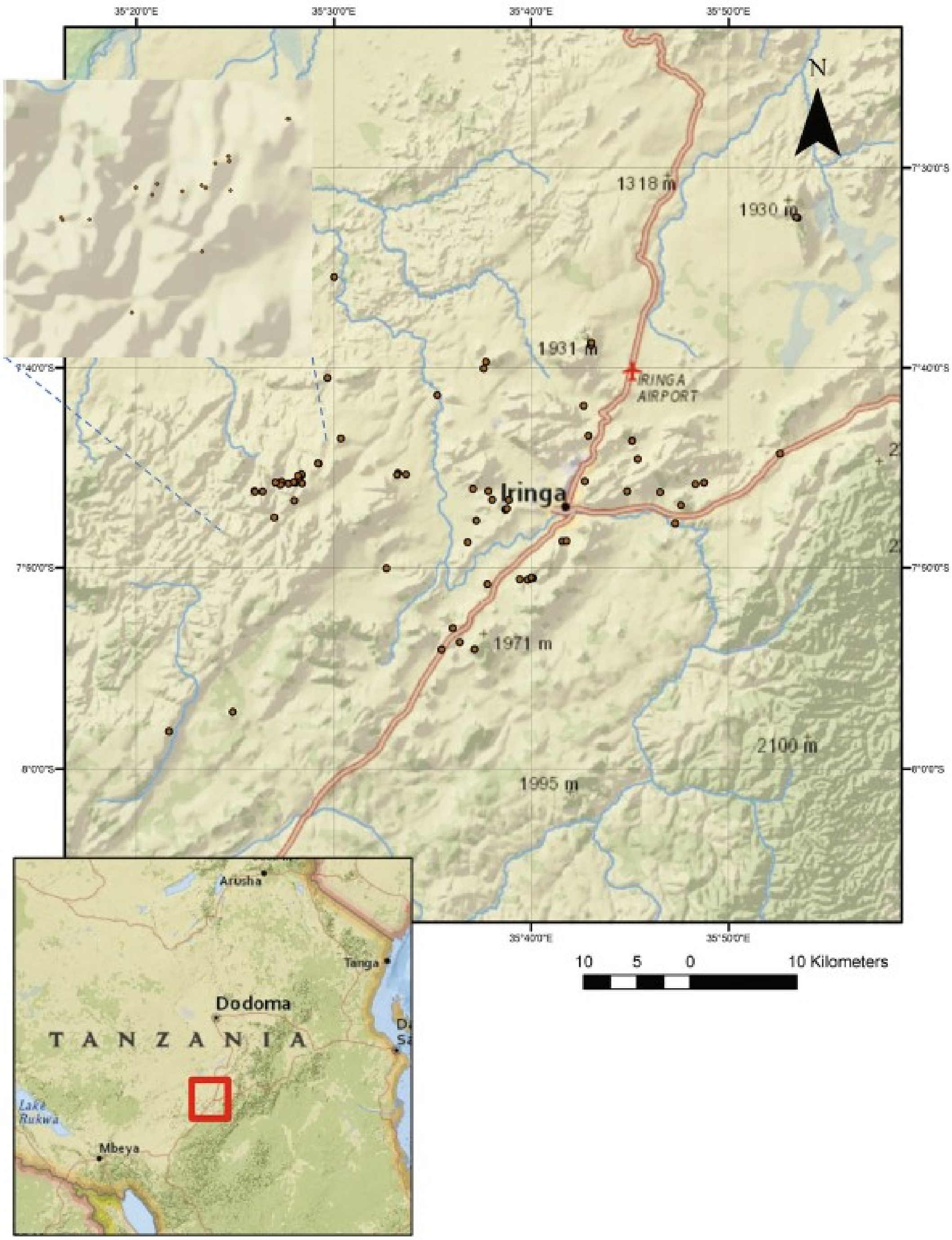


Figure 4.3: Site Identified in Iringa Region (Adapted from Miller et al. 2020).

During June to July 2021, I conducted another random archaeological survey at Iringa region. Three sites were visited including Mlangali, Mgera, and Uhafiwa. The first site was selected following the IRAP's 2018 survey and 2019 preliminary study. Located ~22 km from Iringa town and ~6 km from Mgera village centre, the site was recorded to contain a scatter of lithics and Iron Age debris (such as tuyere, furnace, slags), and some potsherds (Miller et al. 2020; Katto and Willoughby 2021). Surface and sub-surface survey was employed by establishing three test pits which noted the absence of material below the surface (Table 4.7). The site was affected by soil erosion following anthropogenic activities such as tree cutting and charcoal firing. Following such observation, the site was abandoned by looking the new site.

Table 4.7: Inventory for the Mlangali Site.

MLANGALI	**Depth (cm)**	**Pottery**		**Slag**	**Lithics**	**Tuyere**	**Total**
		DG	**UDG**				
Survey		-	2	1	7	1	
S 07^{0} 39.530' E 035^{0} 37.772'	Surface	1	2	-	-	-	
S 07^{0} 39.874' E 035^{0} 37.751'		1	2	-	-	-	
S 07^{0} 43.351' E 035^{0} 36.591'		1	3	-	-	-	
S 07^{0} 43.35' E 035^{0} 36.591'		2	7	-	-	-	
S 07^{0} 39.530' E 035^{0} 37.772'		1	0	-	-	-	
TOTAL		**6**	**16**	**1**	**7**	**1**	**31**

Under the direction of the Mgera Village Chairman (VC), survey was conducted to another site located ~7 km south of Mgera village centre. The new site (7° 43′ 26.4″ S, 35° 36′ 26.1″E) was discovered and give a SASES # HwJg-106. Chapter 5 provides more description of the site. Survey was conducted in different direction following the established Datum point (DP). Various materials especially potsherds were recorded almost everywhere that is North East (NE), North West (NW), and South East (SE) (Table 4.8). Coordinates were taken at each direction where materials were found. The NE recorded a lot of lithic artifacts especially along the abandoned road. Two Test Pits of 1x1 m and 50x50 cm were established at NE and SE of the DP. The former was established at the suspected abandoned wattle house due to the concentration of potsherds and daubs at the surface (Figure 4.4). Excavation was done there up to 60 cm deep. The first level that goes up to 40 cm (considering the slope) yielded potsherds and daubs. After that no any other material were recorded apart from charcoal. The later TP was established to test how deep material are present in SE. Apart from recording the potsherds on the surface, nothing was observed in deep inside except 20 cm depth.

Figure 4.4: Daub concentration where Tp# 1 was established (Photo by the Author 2021).

Table 4.8: Inventory for Mgera site (Survey).

Mgera Site	Depth (cm)	Pottery		Slag	Lithics	Daub	Other	Total
		DG	UDG					
Survey								
NW	-	2	9	-	-		-	
NE	-	13	48	5	19	1	1 pottery surface smoothing stone 1 Ground stone	
SE	-	35	35	-	1	1	1 Ground stone	
SW	-	-	-	-	38	-		
Tp # 1	Surface	8	14	-	-	5	-	
	0-40	7	11	-	-	20	Charcoal for C-14	
	40-50	-	-	-	-	-	-	
	50-60	-	-	-	-	-	-	
STP # 1	0-50	6	18	4	1	1	-	
TOTAL		**71**	**135**	**9**	**59**	**28**	**3**	**306**

Archaeological survey was also conducted at Uhafiwa village particularly at the camp site (Figure 4.5) that was used during the construction of Kihansi Hydroelectric Power (8° 31′ 15.6″ S 35° 5105.3″ E). The site was first reported by Msemwa (2001) following his research pertaining to Environmental and Cultural Impact Assessments as already presented in the section 1.6. The current study considered Uhafiwa as a potential site for testing hypothesis III.

Figure 4.5: Kihansi Hydroelectric Power Camp Site (Photo by the Author 2021).

Ten days were spent conducting intensive survey which involved climbing up and down the hill where the camp site is located and beyond. Survey involved also walking along the road and river cut down the camp site. Along the road cut there was an observation of the lithic artifacts protruding on the wall ~20 cm from the sloped surface. Such stratigraphy was taken as a yard stick following the expected Test Pits that intended to be established at the camp site. After conducting a thorough survey, three test pits of 1x1m (Figure 4.6) were established. Test Pit 1 was excavated up to 50 cm deep. Only stones of gravel-like in reddish color were obtained at level 1 and 2 (0-10, 10-20 cm). The rest levels yielded nothing. TP# 2 was established at the foot hill of the camp site following the observed little potsherds. Little material was observed at two first levels and nothing to the rest. Tp# 3 was established ~ 6 m beside Tp# 1 following the observed lithic artifacts on the surface. Excavation for Tp# 3 followed the interval of 20 cm and went up to 60 cm deep. Only lithic artifacts were recorded up to 40 cm and nothing below. Four shovel test pits were conducted surrounding the camp site and nothing was recorded. Based on survey and excavations at the camp site and nearby areas the only observed material were lithics and very little potsherds at the foot hills of the camp site (Table 4.9). Following those results the site was left for further research activities at other places.

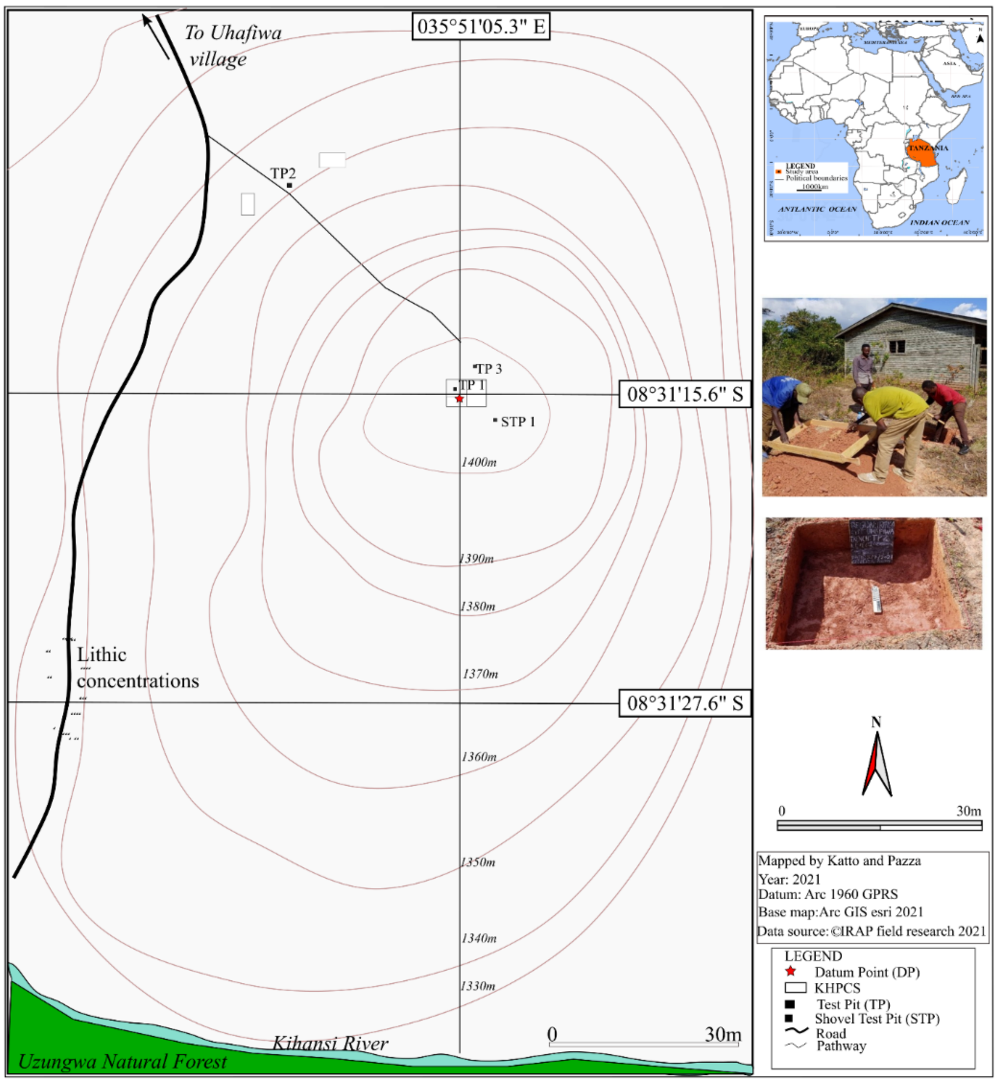


Figure 4.6: A map of Uhafiwa site showing surveyed sites and TPs.

Table 4.9: Inventory for Uhafiwa Site.

Uhafiwa Site	**Depth (cm)**	**Pottery**		**Lithics**	**Other**	**TOTAL**	**Cultural designation**
		DG	**UDG**				
Survey							
SW	-	-	-	33	-		
NW	-	1	3	-	-		
TOTAL		**1**	**3**	**33**		**37**	
TP # 1	0-10	-	-	23?	-		
	10-20	-	-	2?	-		
	20-30	-	-	-	-		
	30-40	-	-	-	-		
	40-50	-	-	-	-		
TOTAL				**25**		**25**	
Tp # 2	Surface	1	3	6	-		
	0-10	-	1	1	-		
	10-20	-	-	-	-		
	20-30	-	-	-	-		
	30-40	-	-	-	-		
TOTAL		**1**	**4**	**7**		**12**	
TP# 3							
	Surface	-	-	24	-		
	0-20	-	-	151	Charcoal for C-14 4 Fossilized charcoals?		
	20-40	-	-	7	1 Fossilized charcoal?		
	40-60	-	-	-	-		
TOTAL				182	5	187	
GRAND TOTAL		**2**	**7**	**247**	**5**	**261**	

4.6.2 Excavation Method

The 2021 and other IRAP previous excavations were carried out using arbitrary levels, or spits of 5, 10, or 20 cm. Trowels and brushes were mainly used in excavation except when compacted fauna, human remains or datable materials were encountered it necessitated the use of dental picks or soft brushes (Figure 4.7). During excavation, the stratigraphy was recorded including the associated cultural phenomena. Each excavation trench and level were assigned its own numbers such as test pit 1, level 1 (0 – 10 cm). All collections were bagged according to their levels and trench numbers. There was careful examination of sample condition, context, and associated materials before collecting all artifacts and ecofacts. Changes in tool types and cultural sequences were observed and noted as excavation proceeded.

Stratigraphy, artifacts, features, and additional contextual information, were recorded on sketch maps, scale plans, profiles, excavation forms, field notebooks, and photographs. Munsell colours were recorded for sediments and arbitrary levels. Charcoal was collected wherever possible for dating purposes. With exception of test pit 1 at Mlambalasi, all other excavation units were taken down to sterile level, usually bedrock. Test pit 1 at Mlambalasi ended at about 120 cm below the surface due to the presence of numerous rock boulders (Biittner 2011; Bushozi 2011; Willoughby 2012). The results pertaining to excavation are covered site by site in Chapter 5.

2006 (Biittner 2011: 27) 2019 (Photo by Masam) 2021 (Photo by Katto)

Figure 4.7: Excavations conducted in 2006 at Mlambalasi rockshelter, 2019 at Kitwiru-Mosi, and 2021 at the Mgera sites.

4.6.3 Museum collections

The museum study involved ceramics analysis (Figure 4.8), whereby other material such as fauna which were not previously studied by IRAP members were analysed at UDSM following the collection movement permit (ref. LB.72/278/01/A'/2) obtained at NMT. The 2021 data (lithics, fauna, pottery, ethnographic data, and daubs) were analysed at UDSM and at the University of Alberta for the 2022 ethnographic data while the previous IRAP data particularly lithic material was already analysed at the University of Alberta by the IRAP members. As I introduced earlier in section 4.3, my research at the museum provided an opportunity to familiarize myself on those already analyzed collections by IRAP which I incorporated into this study.

Figure 4.8: Analysis and illustration of pottery in progress at NMT (Photo by Emmanuel Ngowi 2021). Left side: Katto and Samwel sorting material; right side; Pazza illustrating potsherds.

4.6.4 Ethnographic inquiries

Ethnographic inquiries (Figure 4.9) that involved semi-structured interviews and observation were conducted in order to address research question number 2 that directly targeted the contemporary pottery makers in the study area in connection to the potsherds from the archaeological records. The inquiries were conducted in accordance to ethical guidelines of the University of Alberta after being approved on May 22, 2020 by the Research Ethics Board (REB) #1 for the project ID No. RES0033388. It involved obtaining the consent from the respondents (see Appendix VI) and abide all health guidelines with regards to Covid-19 pandemic. Tools, mainly voice and video recorders, were used in collecting data. The research instruments such as interview and observation guides (Appendices VII and VIII) were approved by REB and UDSM prior beginning of research. The observation of pottery manufacturing processes was done following the *chaîne opératoire* framework adopted and modified from Wayessa (2011) who did an ethnoarchaeological study of Oromo potters in the Southwest Highland Ethiopia to study the pottery in the ethnic groups of Iringa and Njombe Regions. The process includes:

- *raw material selection*: here the question was on where and how the raw material (such as clay soil, water, and temper) are obtained? How the colour and texture of clay was determined? Is there any social or ideological behavior like ritual practises that is involved in raw material procurement? Location of the raw material (that is swamp, river, or anthill), distance from the manufacturing area, reasons for clay selection, socio-cultural/ideologies associated with raw material procurement and division of labour in raw material procurements.

- *Paste preparatio*n: number of days for paste storage, fabric/temper, ratio of paste against pottery function.
- *Fabric practic*e: shaping technique/manufacture, surface finishing, surface outside colour, rim diameters, rim thickness, wall thickness, vessel height, vessel width, rim shape/direction, vessel form/shape.
- *Applied decoration*s: reasons for decoration, kind of decorations, decoration placement, decoration technique, decoration orientation/patterns.
- *Drying vessel*: drying condition, associated socio-cultural taboos.
- *Pre-firing and firing*: pre-firing duration, firing fuel, firing duration, types of firing, firing conditions.
- *Post firing treatmen*t: post firing practices.

- *Distribution and uses*: pottery use, vessel specialization, gender position in marketing, market segmentation.
- *Discard*: reasons for pottery vessel breakaway and reasons for pottery vessel's abandonment. More details about ethnographic inquiries and results are covered in Chapter 9**.**

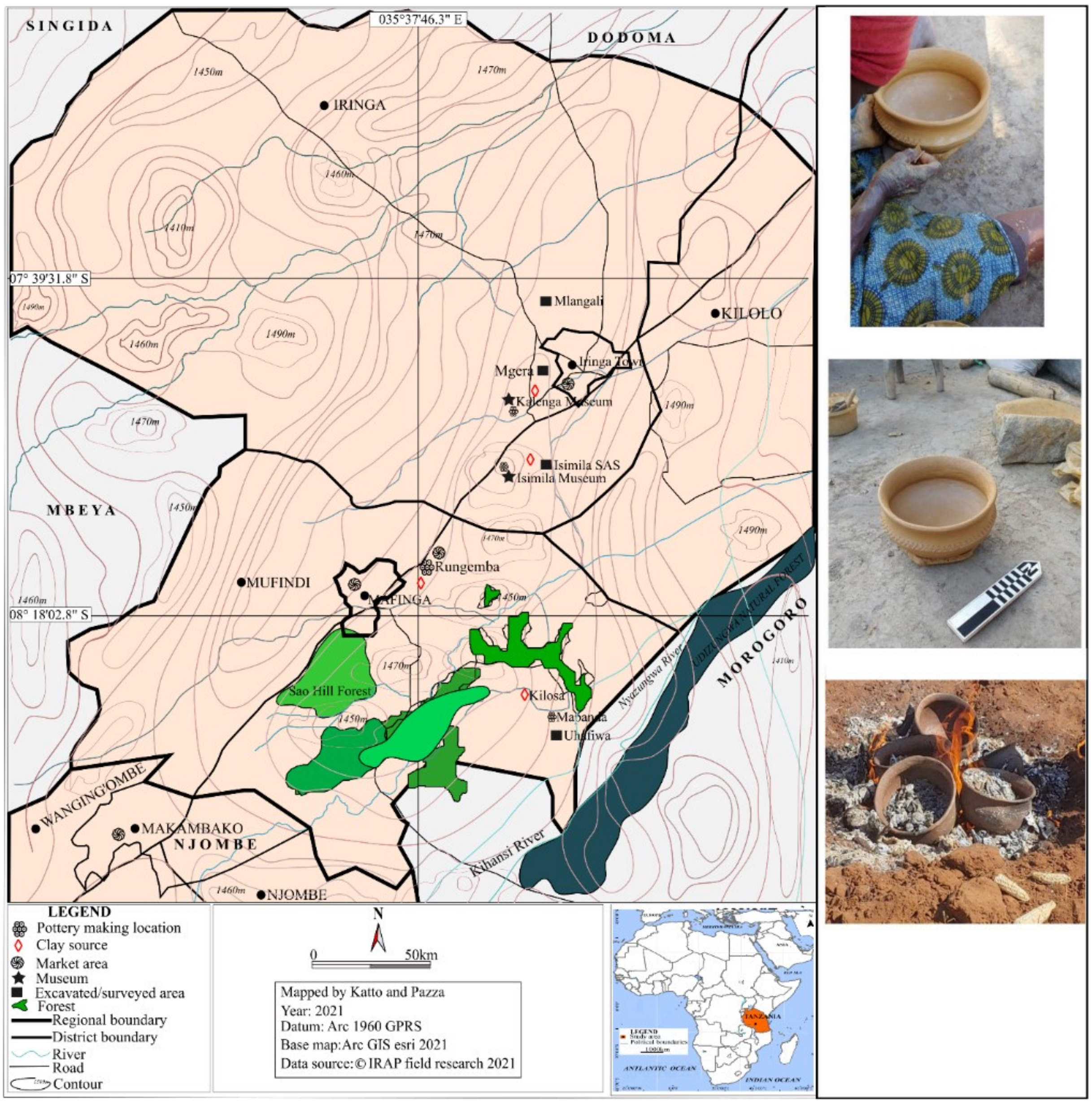


Figure 4.9: A map showing areas where ethnographic inquiries were conducted.

4.6.5 Desktop reviews

Intensive literature review was done from secondary sources comprising of books, journal articles, and internet material that relate to the study. Apart from developing a research gap, the review was useful in answering the research questions specifically research question 3 that aims to situate the results of the study to the broader understanding of anthropological models with regards to the issue of migration and interaction over time and space. The review took place at various academic institutions including the University of Dar es Salaam (UDSM) Main Library, Department of Archaeology and Heritage Studies-UDSM library, and Rutherford Library-University of Alberta.

4.7 Chapter Summary

Various issues have been covered by this chapter pertaining research methodology. Five phases have been described clearly indicating what and when a certain activity was conducted in accomplished the current study. The study has further shown step by step the entire process considered in collecting data, processing, analyzing, and dissemination of results. Such processes are covered on the research methodology aspects where every section has been justified why it was selected as far as the research questions/hypotheses are concerned. The methodology encompasses the study plan, research design, sample and sample size, sampling procedures, and data collection methods. The chapter justifies what, when, why, and how a certain aspect (s) was/were considered significant for the current study. The next chapter covers in detail the descriptions of sites, stratigraphy, dating, and material sequences for those sites mainly Magubike, Mlambalasi, and Mgera which had well-defined chronological sequence (LSA and IA). It also considers some Tps and trenches lacking LSA cultures for Iron Age/historic periods considerations specifically Tp# 3, 6-12 at Magubike.

CHAPTER 5: SITE DESCRIPTION, STRATIGRAPHY, DATING, AND MATERIAL CULTURAL SEQUENCE

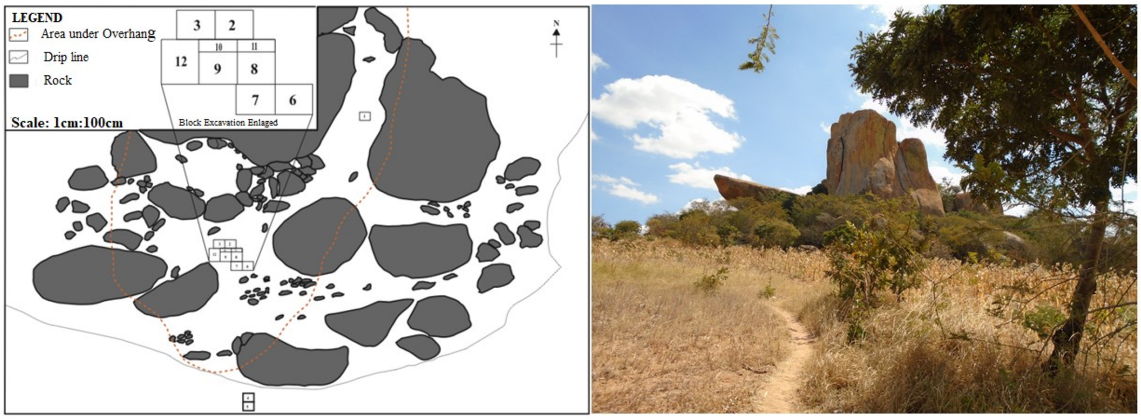
5.1 Introduction

This chapter presents the descriptions of the Magubike, Mlambalasi, and Mgera sites. As already introduced in the previous chapter, these sites are considered for this chapter because they have some test pits/excavated trenches having a well-defined stratigraphy having both a LSA and an IA material cultural sequence. To some extent the chapter considers some test pits that lack LSA but still retains the MSA and IA cultures. The IA context was selected against MSA as far as the scope of this study is concerned. Apart from providing the LSA material dating to (36881–27184 Cal BC), the Uhafiwa site have a very short stratigraphy (0-40 cm deep) lacking IA, therefore it was not considered for this chapter. The remaining sites such as Msosa, Utinde-Mkoga, Ikombe, and Ikula lacked a stratigraphic context to be considered for this chapter. The chapter therefore, provides a description of the site including the location and historical background, stratigraphy, dating, and material cultural sequency by starting with the Magubike rockshelter, the Mlambalasi rockshelter, and the Mgera site.

5.2 Magubike Rockshelter Site

Magubike Rockshelter (HxJf-01) is located at 7° 45′ 23.158″ S, 35° 28′ 22.804″ E, in the Southern Highlands of Tanzania near a village of the same name (Figure 5.1). Magubike was excavated in three field seasons by the IRAP members that is 2006, 2008 and 2012. The site was first identified by Prof. Willoughby in 2005. Initially the rockshelter was test excavated in 2006 and extended in 2008 and 2012 whereby 12 test pits were excavated inside and outside of the rockshelter (Miller and Willoughby 2014; Masele 2017). A total of 4.5 m^2 and 3.4 m^2 of sediments were excavated in 2006 and 2008 while that of 2012 were in different sizes (1x1, 0.35, and 1x1.35 m^2). During the 2006 field season, three $1m^2$ test pits were excavated in 10cm arbitrary levels within the two main chambers. Tp# 1 was excavated inside chamber to a depth of 180cm, where bedrock was reached. This test pit revealed a cultural sequence of IA (0-50cm), LSA (50-70cm), possibly mixed LSA and MSA (70-100cm) and MSA (110-180cm). There were no fauna remains recovered below 70 cm; however, differences can be observed between MSA and LSA lithics (Bushozi 2011). Tp# 2 was excavated in the other chamber and produced a cultural sequence of IA (0-50cm) and MSA (50-60cm), before the excavation had to be suspended due to the presence of a large rock. Tp# 3 was then initiated adjacent to Tp# 2 and excavated to bedrock, producing a sequence of IA (0-60cm) and MSA (60-210cm), with no intervening LSA levels.

The 2008 excavation at Magubike involved excavation of Tp# 4 and 5. They were both excavated in artificial 10 cm thick levels. Tp# 4 was excavated up to 90 cm while Tp# 5 was excavated up to 250 cm. It was noted that the cultural sequence of Tp# 1 and 5 looks similar in the manner that there is historic/modern period, IA, small LSA (Holocene), Large LSA (Pleistocene) and MSA. The 2012 excavation was concentrated on the central part of the rockshelter. Seven test pits (6-12) were established. While Tp# (6-9) measured 1 x 1 m^2, Tp# 10 and 11 measured 0.35 x 1 m and 1 x 1.35 m for Tp# 12. Both test pits were arbitrary excavated at the intervals of 10 cm.



Test pits layout

Outside view

Figure 5.1: Magubike Rockshelter Outside View and Test Pits Layout (Modified after Masele 2017:155).

5.3 Magubike Stratigraphic Sequence

There is very little visible stratigraphy at Magubike (Miller and Willoughby 2014). The matrix is primarily made up of unconsolidated aeolian silts with disintegrating bedrock present throughout the lowest levels. Some layers are visible in the IA levels due to smelting and or blacksmithing activity (Figure 5.4). These sediments are dark in color and fine grained (Munsell 10YR 2/1). The IA levels range from 0-50 cm (Figure 5.2). Below this level there are only slightest changes in color and texture of the sediments and that is where the MSA level begins (Figure 5.3-5.4). The upper MSA levels tend to be reddish brown (5YR 4/4) or brown (7.5YR 4/4), and the percentage of gravel increases with depth. Toward the bottom, just above bedrock, the sediments are red (10 R 4/6) with a high density of gravel or decaying bedrock. Due to the lack of discernible stratigraphy, the site was excavated in arbitrary 10 cm spits.

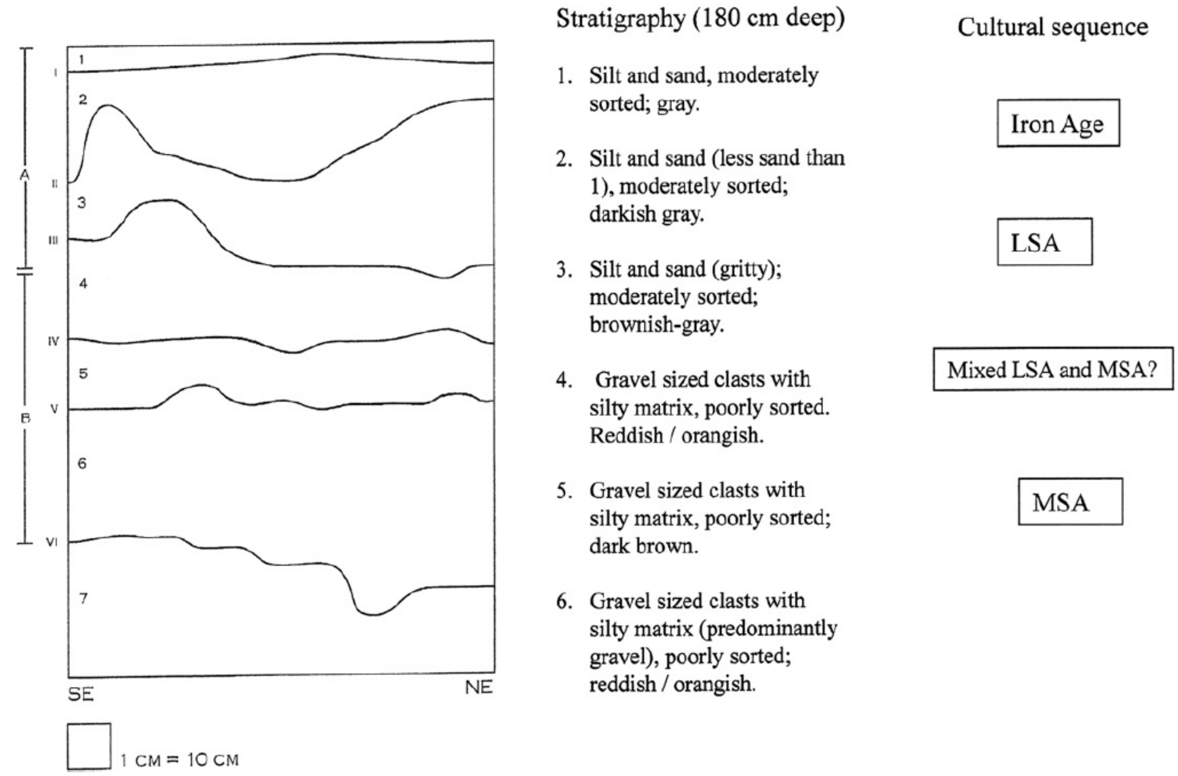


Figure 5.2: Test Pit 1 at Magubike-stratigraphic profile and cultural sequence-eastern wall (Adapted from Biittner 2011:34).

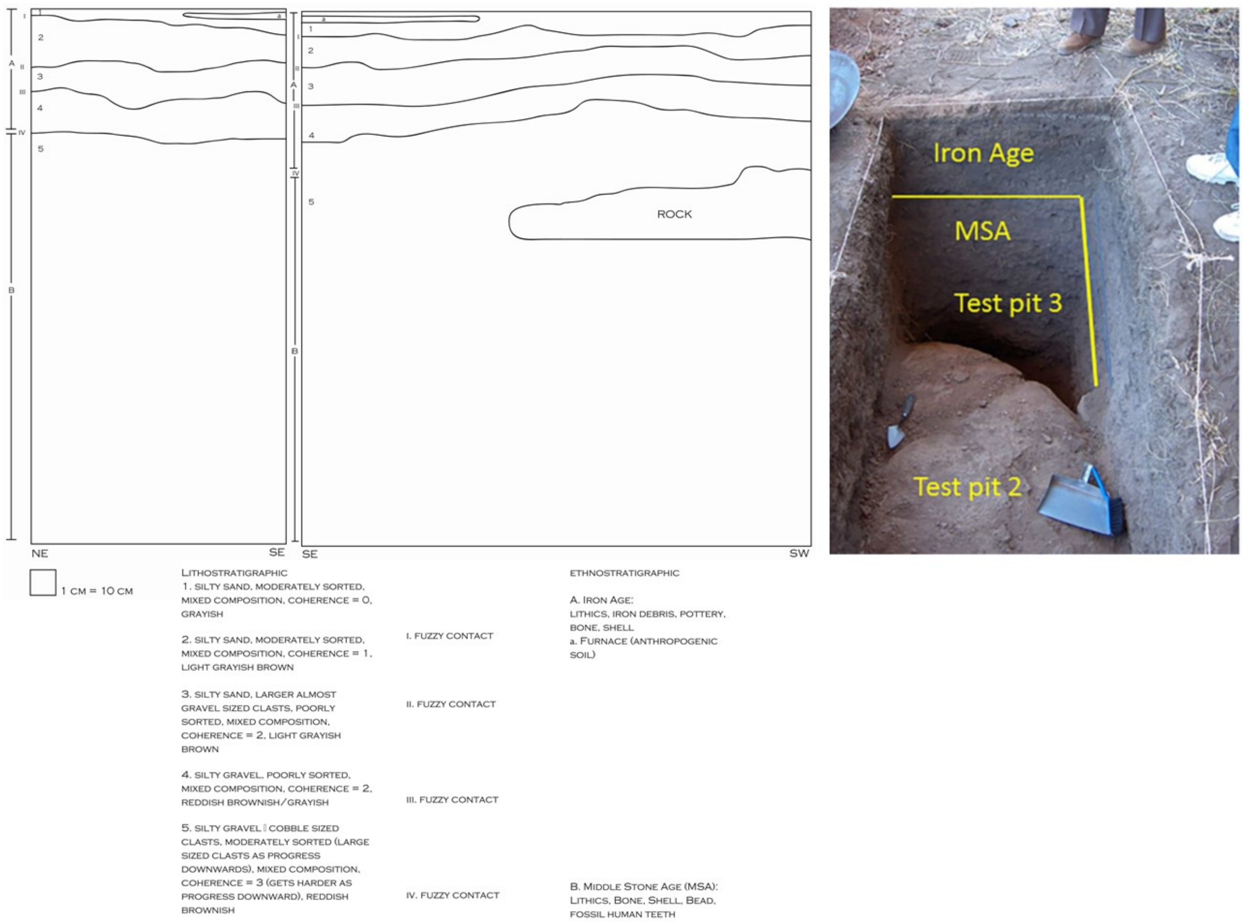


Figure 5.3: Stratigraphic Profile of Magubike Tp# 2 and 3 (Adapted from Biittner 2011:35).

Seven lithostratigraphic units of varying thicknesses and colors were defined. The archaeological sequence and are summarized below (Figure 5.4).

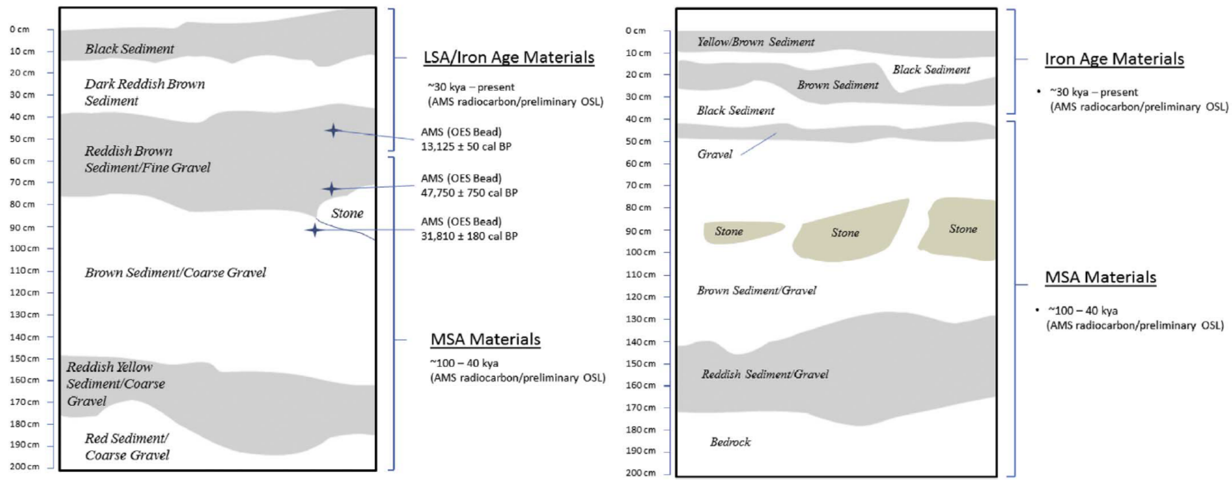


Figure 5.4: Stratigraphic Profiles of Test Pit 12 (left) and 9 (right) (Adapted from Werner and Willoughby 2018:143).

5.4 The Chronology of Magubike Rockshelter

Dating was made in 2007 and 2012 at IsoTrace Radiocarbon Laboratory, at the University of Toronto and OES artifacts was sent to the Oxford Radiocarbon Accelerator Unit (ORAU) for direct dating (Miller and Willoughby 2014). The dates samples (Table 5.1, 2) involved charcoal, *Achatina* shell/Land Snail Shells (LSS), and Ostrich Egg Shells (OES) (Bushozi 2011; Biittner 2011; Willoughby 2012; Miller and Willoughby 2014; Miller et al. 2018). It has been noted that OES beads have remain well represented in LSA and IA deposits, and continued in in the current linguistically and culturally diverse communities (Chittick 1975). At Magubike rockshelter both OES and non-OES shell beads are present in the deposits; however, the latter are only found in the uppermost levels. Glass beads are also present in the historic levels (Miller et al. 2018).

Excavations at Magubike in 2012 recovered 39 OES beads/preforms (Miller and Willoughby 2020). A sample of OES was submitted for dating. Calibrated dates were generated using Oxcal (v4.2) of C. Bronk Ramsey, using the 'INTCAL09' dataset (*ibid*.). All artifacts come from Test Pit 12 except for specimen #1 and #5, which come from Test Pit 7 and 11 respectively (Miller and Willoughby 2014; Table 5.2). For those five OES artifacts that were taken for dating, two of them were whole beads (# 2 and #5), one partial bead (#1), one bead that was broken during the manufacturing process (#4), and one shaped disc (#3). Unexpected dates were observed on Samples #1 and #2 considering their archaeological context. They both date to the LSA, but were found associated with Iron Age deposits (Miller and Willoughby 2014). Sample #2, at (16,481–15,256 cal BP) was found at the bottom of the Iron Age deposit, and was therefore expected to be much younger. The date clearly lies within the LSA range, but as presented before the stratified LSA occupation is lacking in the main part of the rockshelter. Another observation by Miller and Willoughby (2014) was on sample #4, which is from 70 to 80 cm below the surface (49,355–46,368 cal BP), is older than sample #3 (80-90 cm) which is from the next level down in the same test pit (36,748–36,189 cal BP). The reason could be due to some slight stratigraphic movement, or because of arbitrary excavation spits cross-cutting depositional layers (Miller and Willoughby 2014).

Apart from OES beads, other dates were generated on LSS (Miller et al. 2018). Here, four samples of LSS beads from IA levels at Magubike were dated and yielded direct dates ranging from 250–403 Cal AD (UOC-4739) to 1454–1631 Cal AD (UOC-4741) (Miller et al. 2018:362). At this site the LSS beads were recovered in central excavation bloc (n=58) and toward the rear of the shelter (n = 3). Those at the central bloc were excavated in 2012 and were found between 10 and 50 cm below the modern ground surface (Miller et al. 2018). The beads were associated with lithic, ceramic sherds, and iron slag (*ibid*.). The remaining beads were excavated in 2016 from the depth of approximately 20-25 depth cm. After C-14 dating of LSS sample it was found that the three beads from the central unit have similar dates ranging from 1,455 to 1,632 cal AD which is LIA. The bead toward the rear of the shelter, which differs in size and morphology, is significantly earlier: 327–414 cal AD which is EIA. It was noted that while these LSS beads do date at least to the IA in Iringa, their use may well have continued into the recent period. LSS beads appear only in the late Holocene and are almost exclusively found in IA contexts (Miller et al. 2018). N=61 potential LSS beads were reported at different parts of the rockshelter (Miller et al. 2018).

Table 5.1: Date results for some Test Pits at Magubike Rockshelter (Taken from Bushozi 2011; Willoughby 2012; Miller et al. 2018).

Site	**Depth cm**	**Sample**	**Weight (g)**	**Lab. number**	**Uncalibrated date (BP)**	**Calibrated date ranges (95.4% prob.)**
HxJf-1 TP 3; Iron Age	20 – 30	*Achatina* shell	505	TO-13422	2,990 ± 60	1401– 1048 BC
HxJf-1 TP 3; MSA	130 – 140	*Achatina* shell	782	TO-13423	41,790± 690	43835 – 41376 BC
HxJf-1 Tp 7; LSA (#1)	30-40	OES	-	OxA-27629	6465 ±33	5481–5362 BC
HxJf-1 Tp 12; LSA (#2)	40-50	OES	-	OxA-27625	13,150±50	14,012–13,666 BC
HxJf-1 Tp 12; MSA (#3)	80-90	OES	-	OxA-27627	31,810±180	34,607–33,716 BC
HxJf-1 Tp 8; 1A	20-30	LSS/*Achatina shell*	-	UOC-4740	403±23	1,440 – 1,620 AD
HxJf-1 Tp 8; 1A	20-30	LSS/*Achatina shell*	-	UOC-4741	371±23	1,454 – 1,631 AD
HxJf-1 Tp 8; 1A	30-40	LSS/*Achatina shell*	-	UOC-4742	397±23	1,442 – 1,621 AD

Note: I recalibrated the date using OxCal v4.4.4 Bronk Ramsey (2021); r: 5; Atmospheric Data from Reimer et al. (2020). The program is free online through oxford radiocarbon accelerator unit (see Appendix IX).

Table 5.2: Recovered OES artifacts by depth, and Test Pit number (2012 field season) (Taken from Miller and Willoughby 2014:120).

Depth below surface (cm)	Test Pit#							Totals
	6	7	8	9	10	11	12	
0–10		1	1	1	2		1	**6**
10–20	5	1	1					**7**
20–30			38			2	1	**41**
30–40*		1	24					**25**
40–50*			3				4	**7**
50–60		1		1	1		1	**4**
60–70								**0**
70–80*							1	**1**
80–90*							1	**1**
90–100*						1		**1**
Totals	**5**	**4**	**67**	**2**	**3**	**3**	**9**	**93**

Levels marked with an asterisk (*) had a sample sent for radiocarbon dating.

5.5 Magubike Material Cultural Sequence

The occupations evident at Magubike encompass the recent, IA, LSA and MSA periods/cultures (Miller and Willoughby 2014). Recent implies the historic and modern period, while IA refers to the archaeological signature of Bantu-speaking farmers. Typical artifacts from this time are iron tools, iron slag, potsherds and flaked lithics. Not all test pits at Magubike have provided a complete cultural sequence having MSA, LSA, IA, and recent. Thus, with exemption of Tp# 1, 4, and 5 (Table 5.3 and 5.5) which has a complete sequence, Tp# 2, 3, 6, 7, 8, 9, 10, 11, and 12 had a completely lack of LSA components instead only IA and MSA are present (Table 5.4, 6-8). Until recent it is not clear whether the are LSA elements inside the rockshelter (Masele and Willoughby 2021). There is a suggestion by Werner and Willoughby (2017) that LSA material are either mixed with IA or have been eroded by water. On other hands, there is hypothetical view that Magubike was probably deserted during LSA period however the reasons for such scenario are not yet given (Masele 2017:152; Masele and Willoughby 2021). As presented earlier, despite lacking enough evidence of the LSA inside the rockshelter, the radiocarbon dates of OES fragments and beads provide dates that fit well with LSA timeframe (Miller and Willoughby 2014; Table 5.1).

Table 5.3: Material culture for HxJf-01 Tp# 1 (2006 Excavation after Willoughby 2012:11).

Depth below surface	Number of stone artifacts: Tools (*T*), cores (*C*), debitage (*D*) and ground stone (*G*)				Numbers of other cultural material recovered: Iron/slag (*I*), pottery (*P*), animal bone (*B*), shell (*S*) and ostrich eggshell beads (OES)					Cultural designation
	T	*C*	*D*	*G*	*I*	*P*	*B*	*S*	OES	
0–10 cm	123	35	113		4 + 1 ochre	10		177		Iron Age
10–20 cm	56	8	19	2		6	48	89		Iron Age
20–30 cm	48	12	24			3	38	68		Iron Age
30–40 cm	74	45	62		2 ochre		30	37		Iron Age
40–50 cm	154	52	113	1		1	71	14		Iron Age
50–60 cm	202	101	116		1		91	21		LSA
60–70 cm	227	89	143		1 ochre		26	1		LSA
70–80 cm	33	10	33	2						Mix of MSA and LSA – transitional?
80–90 cm	7	5	6							Mix of MSA and LSA – transitional?
90–100 cm	22	6	14							Mix of MSA and LSA – transitional?
100–110 cm	9	8	19							MSA
110–120 cm	132	50	254							MSA
120–130 cm	304	67	355							MSA
130–140 cm	689	117	711							MSA
140–150 cm	466	86	597							MSA
150–160 cm	220	48	263							MSA
160–170 cm	66	13	136							MSA
170–180 cm	5		3							MSA
Total	2837	752	2981	5	9	20	304	407		

Table 5.4: Material culture for HxJf-01 Tp# 3 (2006 Excavation after Willoughby 2012:13).

Depth below surface	Number of stone artifacts: Tools (*T*), cores (*C*), debitage (*D*) and ground stone (*G*)				Numbers of other cultural material recovered: Iron/slag (*I*), pottery (*P*), animal bone (*B*), shell (*S*) and ostrich eggshell beads (OES)					Cultural designation and radiocarbon/ESR dates
	T	*C*	*D*	*G*	*I*	*P*	*B*	*S*	OES	
0–10 cm	35	6	48		147	35	21	9		Iron Age
10–20 cm	69	45	97		132	76	84	44		Iron Age
20–30 cm	70	31	50	1	1	33	166	164		Iron Age 2,990 ± 60 BP (TO-13422)
30–40 cm	45	26	59	1	1		92	80		Iron Age
40–50 cm	70	47	74				127	49		Iron Age
50–60 cm	61	35	98	1			94	52		MSA
60–70 cm	121	68	182				61	11		MSA
70–80 cm	231	92	405			1	58	12		MSA
80–90 cm	140	28	316				53	22		MSA
90–100 cm	265	98	404				37	8		MSA
100–110 cm	190	84	383				34	7		MSA
110–120 cm	176	45	475				59	38		MSA
120–130 cm	226	97	502				180	176		
130–140 cm	173	71	658				282 + 4 human teeth	288		MSA 41,790 ± 690 BP (TO-13423) *Also initial ESR date of 150,000 to 234,000 BP (Anne Skinner, personal communication)
140–150 cm	75	27	263				36	97		MSA
150–160 cm	115	41	482				54 + 2 human teeth	23		MSA
160–170 cm	104	92	509				39	27		MSA
170–180 cm	168	163	828	1			57	43		MSA
180–190 cm	116	97	1065				154	114	1	MSA
190–200 cm	69	95	648				305	49		MSA
200–210 cm	5	7	49				46	8		MSA
Total	2524	1295	7594	4	281	180	2039 + 6 human teeth	1321	1	

Table 5.5: Material culture for HxJf-01 Tp# 5 (2008 Excavation).

Site and level	Pottery	Iron / slag	Stone artifacts	Bone	Shell	Other	Cultural Designation
0-10		24	142		11	2 clays	Iron Age
10-20	2	21	313		3		
20-30	6	70	734	4	3		
30-40	15	231	1450	8	9	1 clay	
40-50	13	117	1584	21	2	1 charcoal sample	
50-60	4	35	947	10	3		
60-70	4	13	587				
70-80	4		1690		6		LSA
80-90			2062		2		
90-100	1	5 + 1 ochre	3173		1		
100-110		5 ochres	6735		4		
110-120		5 ochres	4670	2	3		
120-130		1 ochre	4626	2			
130-140			4030				LSA and MSA
140-150			1352				
150-160			2012				
160-170			2056				MSA
170-180			1049				
180-190			942				
190-200			266				
200-210			155				
210-220			73				
220-230			213				
230-240			247				
240-250			81				
TOTAL	**49**	**528**	**41189**	**47**	**47**	**4**	

Table 5.6: Material culture for HxJf-01 Tp# 7 (2012 Excavation).

Square and level (cm)	Pottery	Iron / slag	Stone artifacts	Bone	Shell	Bead	Other	
0-10	8	81	43		5	2		IA
10-20	26	223	140	11	36	9		
20-30	7	65	316	49	312	2		
30-40	3	10	188	93	286	1	Broken shell sample for ESR dating	
40-50	2		166	83	127			
50-60			416	64	187		2 whole shells for dating	MSA
60-70			346	45	183	1 glass	2 whole shells for dating	
70-80			214	53	213		5 whole shells for dating	
80-90			251	63	133		4 whole shells for dating	
90-100			286	77	359			
100-110			1000	58	147			
110-120			551	58	95		1 whole shell for dating	
Cleaning			35	19	47			
120-130			380	24	64			
TOTAL	**46**	**379**	**4332**	**697**	**2194**	**15**		

Table 5.7: Material culture for HxJf-01 Tp# 8 (2012 Excavation).

Square and level cm	Pottery	Iron / slag	Furnace fragments	Stone artifacts	Bone	Shell	Bead	Other	
0-10	7	7	128	76	2	5	6		IA
10-20	22	116	1	54	1	8	6		
20-30		3		33	20	35	39	1 grindstone	
30-40		3	2	89	64	76	23.5	Broken shell	
40-50		1		154	112	47	3		
50-60				208	44	31			MSA
60-70		9	1	237	89	365			
70-80				327	68	150			
80-90				177	34	158		2 whole shells	
90-100				415	193	890		5 whole shells	
100-110				528	172	757		2 whole shells	
110-120				648	127	439		2 whole shells	
120-130				674	65	183		3 whole shells	
130-140				1096	56	238		1 whole shells	
140-150				1013	47	166		3 whole shells	
150-160				347	23	88		1 whole shell	
160-170				396	42	56			
170-180				226	9	49			
180-190				230	20	35			
190-200				122	5	23			
TOTAL	**29**	**139**	**132**	**7050**	**1193**	**3799**	**77.5**		

Table 5.8: Material culture for HxJf-01 Tp# 12 (2012 Excavation).

Square and level	Pottery	Iron / slag	Stone artifacts	Bone	Shell	Bead	Other	
0-10	49	640	457	75	90			IA
10-20	23	37	317	101	161			
20-30	13	5	160	72	142	1 OES		
30-40	4	4	298	118	112			
40-50	6	7	975	423		3.5 OES	6 deciduous teeth, human	
Furnace 0-50	4	100	180	61	40	1 OES		
50-60			757	105	113	1 OES	1 deciduous incisor, human	MSA
60-70		1	767	217	155			
70-80			1274	109	108	1 OES broken		
80-90			1220	176	334		Teeth #8 for dating;	
90-100			2431	731	1499		#8 shell for dating; 2 possible human premolars	
100-110			922	338	781			
110-130			2000	154	38		Tooth #9- 110-120 cm – bovid tooth or teeth for dating; also shell #9 right at 110 cm	
130-140			1148	195	12		Tooth #10 – Bovid tooth for dating	
140-150			990	307	38		Tooth #11- 2 bovid? Teeth and 1 shell for dating	
150-160			861	339	45			
160-170			408	209	90			
170-180			185	18	65		Tooth #12 for dating	
180-200			48	31	10		2 molars and bone fragment (maxilla?), possibly human	
TOTAL	**99**	**794**	**15398**	**3779**	**3833**	**9**		

5.6 Mlambalasi Rockshelter Site

Mlambalasi rockshelter (HwJf-02) (7°35.458'S; 35°30.142'E) is located at an elevation of about 1029 m (Bushozi 2011; Sawchuk 2012; Willoughby 2012; Biittner et al. 2017), at the distance of 50 km west of Iringa town, on the road to Ruaha National Park. It is a place where Chief Mkwawa of the Wahehe or Hehe people was buried. The chief is historically well-known based on his strong resistance on the German Colonial rule in 19th century (Willoughby et al. 2019; Brockmeyer 2020). It has been noted that rather than surrendering his power to Germany authority, Mkwawa left his capital of Kalenga and hid out at Mlambalasi. Eventually, Chief Mkwawa shot himself rather than being captured, and his head was cut off and then ended up at the Bremen Anthropological Museum in Germany (Biittner et al. 2007). His skull was later returned to his family in Tanzania in 1954, and now rests in the Chief Mkwawa Memorial Museum in Kalenga. The Mlambalasi rock-shelter is located on the hill above the burial site under two large overhangs that separate the chambers labelled as room 1 and 2 by IRAP researchers (Bushozi 2011; Willoughby 2012; Biittner et al. 2017). The surface of both chambers contains materials of IA and/or historical materials such as pottery, iron, slag, grindstones, and stone artifacts. The rock shelter complex consists of three sites with the SASES numbers HwJf-01, HwJf-02, and HwJf-02 RS (Sawchuk 2012). HwJf-01 is the burial place of Chief Mkwawa (Figure 4.14) while the main rockshelter which is located several hundred meters uphill from the monument and is designated HwJf-02 (Sawchuk 2012). HwJf-02 RS is a large granite outcrop just outside the main shelter with rock art featuring anthropomorphic, abstract images in red pigment.

Figure 5.5: The tomb of Chief Mkwawa at Mlambalasi Iringa (Photo by the Author 2019).

Before IRAP 2006 excavations, Paul Msemwa, the former General Director of the NMT, conducted archaeological excavation at Mlambalasi in 2002 (Willoughby 2012; Sawchuk 2012; Figure 5.6). His collections are currently stored at NMT-Dar es Salaam. This study has studied those collections together with the one collected by IRAP members. In 2006 IRAP researchers conducted further research at Mlambalasi that involved surface survey and collection of data at room 1 and 2. Then two test pits of 1 m^2 were excavated. Tp#1 was established inside the rock-shelter in room 1 (Figure 5.6). Tp# 2 was excavated on a slope just outside the rock-shelter northeast of Tp# 1. It was noted that because Tp# 2 was located on the hill slope, and surface runoff associated with rainwater affected the depositional processes. Therefore, excavation at this test pit goes at the depth of 160 cm below the surface where bedrock was observed. Excavation of this test pit was also made difficult due to the numerous underlying rock boulders (Bushozi 2011; Willoughby 2012; Biittner et al. 2017). The stratigraphy was not apparent and the cultural sequence appeared in mixed contexts, indicating that it was disturbed by post-deposition processes. Moreover, dated samples from Tp# 2 provided contradictory results, suggesting that they were collected from secondary deposits. Therefore, like other previous studies (Bushozi 2011; Biittner 2011) artifacts from Tp# 2 at Mlambalasi were excluded from further analysis in this study. On the other hand, Tp# 1 had a well-defined *in situ* stratigraphy (Figure 5.7) and therefore it could answer the research questions and hypothesis I of this study. Analysis was also paid on pottery collected from the surface collection of Room 1, 2, and slope.

In 2010 further excavation was conducted at Mlambalasi rockshelter having the main goal of determining if the human remains recovered in 2006 were part of a single LSA burial, and whether or not it belonged to the Late Pleistocene (Sawchuk 2012; Willoughby 2012). Another goal was to relocate Msemwa's 2002 test pit, and to see if his human remains were part of the same individual that had been discovered (*ibid*.). Six units (Figure 5.6 a) of 1 m^2, resulting in a 2 x 3 m trench, were excavated in 10 cm levels to a maximum depth of 110 cm below the rockshelter floor before encountering bedrock.

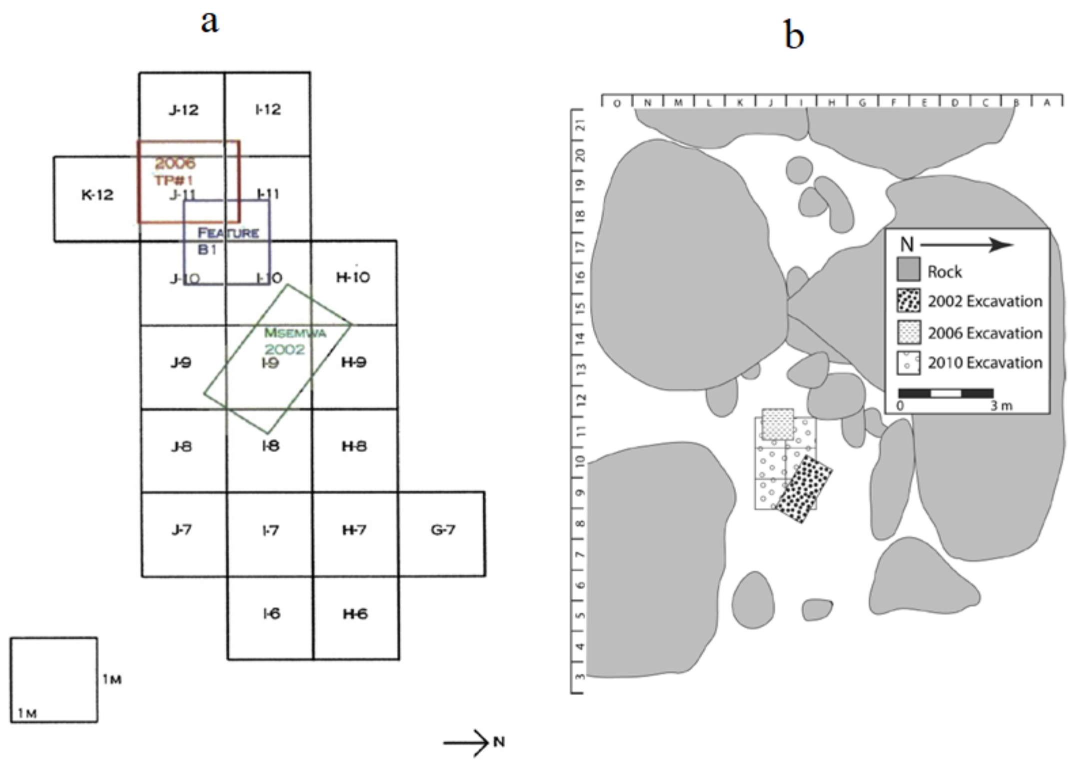


Figure 5.6: Mlambalasi rockshelter: a) A Plan View of Excavation (Adapted after Willoughby 2012:6) (b) A Map of rockshelter showing location of the 2002, 2006, and 2010 excavations (Adapted from Biittner 2017:280).

5.7 Mlambalasi Stratigraphic Sequence

Mlambalasi possesses a long stratigraphic sequence from the Pleistocene (that is 20,000ya) LSA to the recent IA and historic period (Willoughby 2012; Biittner et al. 2017). Thus, the oldest occupation represented under the shelter roof at Mlambalasi appears to have accumulated during the final stages of the Pleistocene (Biittner et al. 2017). It has been noted that despite of having a consistence of large number of artifacts, the Stone Age stratigraphy at Mlambalasi is ambiguous (Biittner et al. 2017). Its sediments are comprised of homogenous fine sand and silts, with varying percentages of gravel and disintegrating bedrock. The clear visible stratigraphy is on the historic/IA layers of the site. This is a layer where the smelting of iron appears to have been responsible for a discontinuous, ashy horizon (an anthropogenic sediment) captured as ash features. Figure (5.7) describes the stratigraphic sequence of Tp# 1.

Based on the 2010 excavation, Biittner et al. (2017) use the excavation unit 1-11 to describe the Mlambalasi stratigraphy (Figure 5.8) in the following ways: Lithostratigraphic unit A is comprised of poorly sorted sandy silt (10 YR 3/2 very dark grayish brown). Units B and C are poorly sorted silty sand separated only by presence of some pebble- to cobble sized inclusions in C, as they are very similar in color (10 YR 5/2 grayish brown and 10 YR 4/2 dark grayish brown, respectively). The pit feature (D) has a distinct boundary between it and lithostratigraphic unit C and contained several large rocks; however, C and D are otherwise difficult to distinguish, macroscopically, in terms of color and texture. Lithostratigraphic unit E is a lens of silty sand, lighter in color (10 YR 5/4 yellowish brown) than the other units; it also contains rootlets.

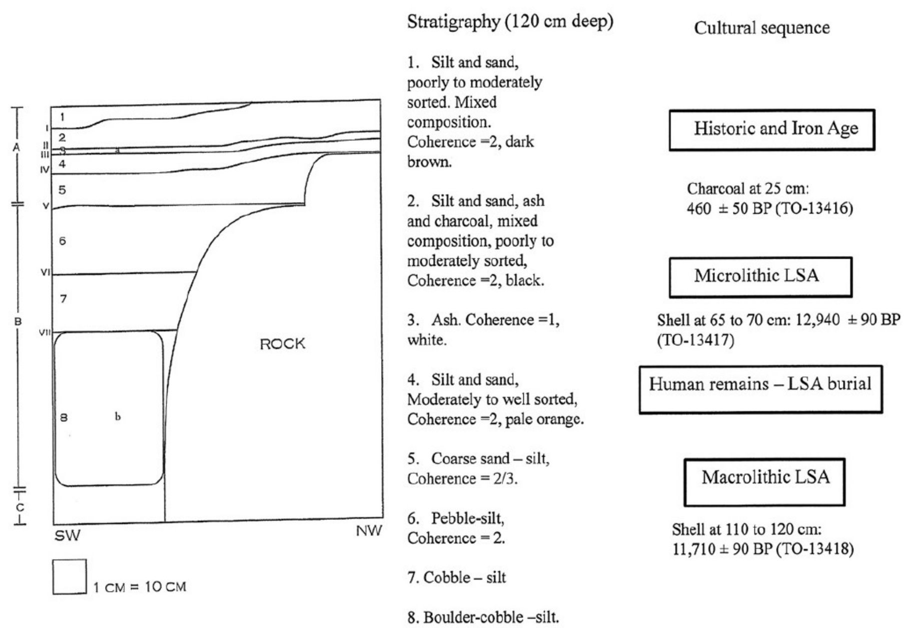


Figure 5.7: HwJf-02 Tp# 1-Stratigraphic profile and cultural sequence (Adapted from Willoughby 2012:7, drawn by Biittner 2011).

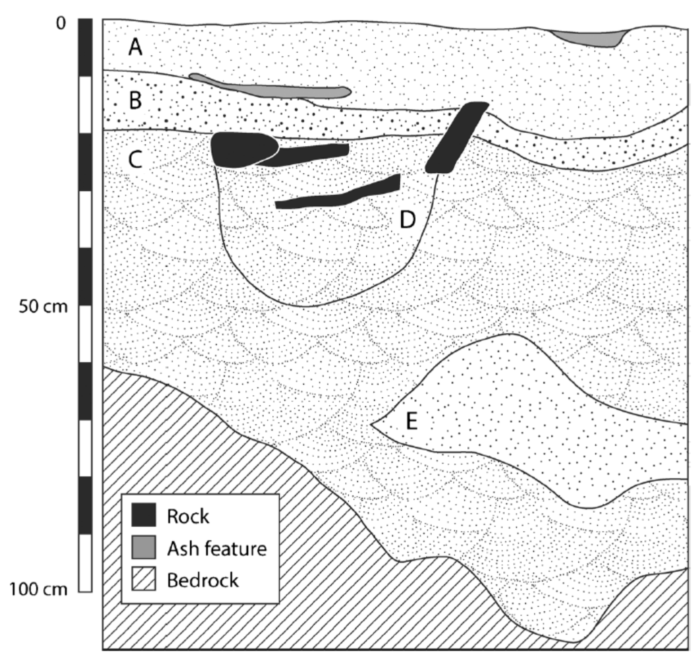


Figure 5.8: Stratigraphic profile of unit I-11, north wall (Adapted from Biittner et al. 2017:281).

5.8 The Chronology of Mlambalasi Rockshelter

The age of Mlambalasi deposits have been determined by dating material from charcoal, *Achatina,* OES (Bushozi et al. 2011; Biittner 2011; Willoughby 2012; Biittner et al 2017) and potsherds (by the current study). In doing so for example, a series of 14 radiocarbon samples were collected from excavations within room 1 for dating purposes (Biittner et al. 2017; Table 5.9). Direct dates on *Achatina* shells and OES beads were also considered. The results suggest that the earliest occupation levels excavated at Mlambalasi, which are associated with human burials, are terminal Pleistocene in age (Biittner et al. 2017). Such dates were reached after submitting three OES beads for dating recovered near burial 1. One bead was recovered in 2006 near the right wrist of the individual while the rest were recovered in 2010 field season (Biittner et al. 2017). All three dated beads were recovered between 75 and 90 cm below surface, and the dates range from 15,550 to 18,200 cal BC (Table 5.10). These results reinforce the interpretation that the earliest occupation levels below the shelter overhang at Mlambalasi are terminal Pleistocene in age (Biittner et al 2017). Other dating samples are of *Achatina* shells and charcoal that involved some top-middle-lower levels (Table 5.9 and 5.10). Although, some samples for Tp# 2 were taken for dating (Bushozi 2011), they were not considered for this study has they were obtained from the mixed context/materials that lacked a clear stratigraphy.

Table 5.9: Uncalibrated and calibrated dates at Mlambalasi (HwJf-02) (Adapted from Bushozi 2011:193).

Site	Depth cm	Sample	Weight (g)	Lab. number	Uncalibrated date (BP)	Calibrated date ranges
HwJf-2 TP 1; Iron Age	25	Charcoal	424	TO -13416	460 ± 50	1,420 – 1,450 AD
HwJf-2 TP 1; LSA	65 – 70	*Achatina* shell	655	TO - 13417	12,940 ± 90	13,490 – 13,160 BC
HwJf-2 TP 1; LSA	110 – 120	*Achatina* shell	578	TO 13418	11,710 ± 90	11,745 – 11,480 BC
HwJf-2 TP 2; mixed deposit	20 – 30	*Achatina* shell	607	TO-13419	1,860 ± 60	75 – 235 AD
HwJf-2 TP 2; mixed deposit	110 – 120	*Achatina* shell	540	TO-13420	3,050 ± 60	1,4405 – 1,260 BC
HwJf-2 TP 2; mixed deposit	150 – 150	*Achatina* shell	884	TO-13421	6,090 ± 70	5,070 – 4,930 BC

Table 5.10: Dates obtained on charcoal, *Achatina* sp. shell, and OES beads recovered under the shelter overhang at HwJf-02- 2010 excavation (Taken from Biittner et al. 2017:282).

Depth (cm)	Unit	Reference number	Material	Uncalibrated years BP	Calibrated age (95.4% prob.)
4	I-11	OxA-24622	Charcoal	151 ± 24	1470–1635 AD
12	I-11	OxA-24623	Charcoal	342 ± 24	1667–1950 AD
20	I-11	OxA-24619	Charcoal	189 ± 24	1655–1954 AD
25	TP1	TO-13416	Charcoal	460 ± 50	1405–1490 AD
40	I-11	OxA-24642	Charcoal	398 ± 24	1438–1620 AD
48	I-11	OxA-24618	Charcoal	267 ± 25	1521–1798 AD
65–70	TP1	TO-13417	*Achatina*	12,940 ± 90	13,705–13,035 BC
70	I-10 (feature B-1)	OxA-24620	Charcoal	12,765 ± 55	13,660–12,925 BC
73	**I-11**	**OxA-24617**	**Charcoal**	**182 ± 24**	**1660–1954 AD**
75	**J-11 (feature B-1)**	**OxA-24621**	**Charcoal**	**372 ± 24**	**1448–1632 AD**
75–80	TP1	OxA-27621	OES bead	14,115 ± 55	15,556–14,956 BC
80–90	I-11	OxA-27623	OES bead	14,275 ± 55	15,718–15,703 BC
90-100	I-9/J-9	OxA-27624	OES bead	16,690 ± 65	18,203–17,606 BC
110–120	**TP1**	**TO-13418**	***Achatina***	**11,710 ± 90**	**11,820–11,395 BC**

Note: TO dates were calibrated using INTCAL04 Terrestrial Radiocarbon Age Calibration (Reimer et al. 2004). OxA calibrations were generated using the Oxcal computer program of C. Bronk Ramsey, using the "INTCAL09" dataset (Bronk Ramsey 2009; Reimer et al. 2013). Data in bold indicate intrusive samples

5.9 Mlambalasi Material Cultural Sequence

The 2002, 2006 and 2010 excavations at Mlambalasi have yielded the material culture that belong to LSA, IA, historic periods (Tables 5.10-5.12). In reference to Tp# 1 and the quadrants/units for 2010 excavations the cultural sequence of Mlambalasi is comprised of historic, IA, a microlithic LSA, and a macrolithic LSA associated with the rest of the original human skeleton. LSA period is comprised of macrolithic artifacts, fauna, OES, Land Snail Shells (LSS), and some few potsherds (Table 5.12-5.13). The IA is constituted of microlithic artifacts, pottery, fauna, iron slags, tuyere, furnace fragments, LSS. LSA at Tp# 1 was recorded at level (45-120 cm) and level (0-45 cm) for IA. The LSA levels were comprised of a microlithic (Holocene) LSA component, followed by a partial human burial, followed by a macrolithic LSA component. Test pit 1 had to be suspended at 120 cm due to the presence of many large rocks (Sawchuk 2012; Willoughby 2012; Biittner et al. 2017).

Table 5.11: Material culture collected at Mlambalasi Rockshelter by Msemwa 2002 (Taken from Msemwa 2002:12; see also Sawchuk 2012:70).

Depth Level (cm below surface)	**Pottery**		**Lithics***	**Shells**	**Bones**	**Beads**	**Metal**	**Slag**
	Decorated	**Undecorated**						
0-10	11	11	6	7	6	-	-	12
10-20	15	16	Cobbles (5), 38 (45)	8	90	1	1	27
20-30	-	1	21 (73)	3	76	-	-	2
30-50	-	-	Bored stone 1, 58 (10)	6	13	-	-	-
50-60	-	-	15 (53)	2	3	-	-	-

* Numbers in parentheses represent artifacts not collected.

Table 5.12: Material culture for HwJf-02 Tp#1 2006 excavation (Adapted from Willoughby 2012:7).

Depth below surface	Number of stone artifacts: Tools (*T*), cores (*C*), debitage (*D*) and ground stone (*G*)				Numbers of other cultural material recovered: Iron/slag (*I*), pottery (*P*), animal bone (*B*), shell (*S*) and ostrich eggshell beads (OES)					Cultural designation and radiocarbon dates
	T	*C*	*D*	*G*	*I*	*P*	*B*	*S*	OES	
0–5 cm	18	3	10		115	26	11			Historic/Iron Age
5–10 cm	48	8	12		230	20	17	8		Historic/Iron Age
10–15 cm	54	11	25		78	11	24	43		Historic/Iron Age
15–20 cm	95	15	31		88	3	25	31		Historic/Iron Age
20–40 cm	123	24	43	2	38	5	32	60	1	Historic/Iron Age 460 ± 50 BP (TO-13416)
40–45 cm	86	14	29		9	2	20	37		Historic/Iron Age
45–55 cm	223	48	39	1	4		57	69	1	LSA
55–60 cm	72	15	8				14	21		LSA
60–65 cm	119	19	18				19	24		LSA
65–70 cm	159	40	45				64	64		LSA 12,940 ± 90 BP (TO-13417)
70–75 cm	128	28	42	1			76	52		LSA
75–80 cm	79	12	13		2		3	5	1	LSA
80–85 cm	102	37	34	1						LSA
Human skeletal remains								9		LSA *New date for charcoal associated with additional human remains excavated in 2010 = 12,765 ± 55 BP (OxA-24620)
90–100 cm	213	75	89	2	1	1	41	7		LSA
100–110 cm	32	11	14		3			1		LSA
110–120 cm	171	64	61		4		3	5		LSA 11,710 ± 90 BP (TO-13418)
Total	1722	424	513	7	572	68	406	436	3	

Table 5.13: A summary of Material Culture recovered by level from HwJf-02 during the 2010 excavation (Adapted from Biittner et al. 2017:283).

Level and depth below surface (cm)	Lithostratigraphic unit	Pottery	Iron tools/ slag/furnace fragments	Lithics	Fauna	*Achatina* shell (g)	Glass, plastic, and OES beads; beadmaking materials (modified OES)
Surface	A	84	605	743	264	325.1	2
1 (0–10)	B	268	4,730	5,778	2,422	1,148.6	25
2 (10–20)	C	154	2,416	6,487	3,005	1,484.5	18
3 (20–30)	C	114	1,679	7,517	2,938	1,141.5	22
4 (30–40)	C	39	968	7,029	2,475	451.2	10
5 (40–50)	C	13	415	5,306	1,680	223.8	9
6 (50–60)	C	25	478	3,975	1,676	381	10
7 (60–70)	C	15	178	2,863	644	131.7	2
8 (70–80)	C	4	82	2,723	330	25.5	3
9 (80–90)	C	1	78	1,876	573	7.4	5
10 (90–100)	C	0	25	642	113	0	0
Totals		717	11,654	44,939	16,120	5,320.3	106

5.10 The Mgera Site

The Mgera site or HwJg-106 (7° 43′ 26.4″ S, 35° 36′ 26.1″E) is located ~22 km northwest of Iringa Municipal. In terms of administrative structure, the site is counted under Kiwere Ward, Iringa District Council. According to 2022 Census, Kiwere had a population of 11,296 whereby 5,526 were Male and 5,770 were female (URT 2022). Ethnically, the area is populated by a mixed tribe but dominated by Hehe. The Mgera site is divided into three landscapes: the mountain which has got some small rockshelters having iron slags near the shelter; the slope having potsherds, lithics, and iron slags; the open-air site on the northern site leading to the village center having abandoned wattle house (remains of daubs with wood impressions), ground stones, potsherds, and slags (Figure 5.9). The northern side is currently used for cultivation of maize but there are no houses for settlements instead the local people from the village centre are the owners of those farms.

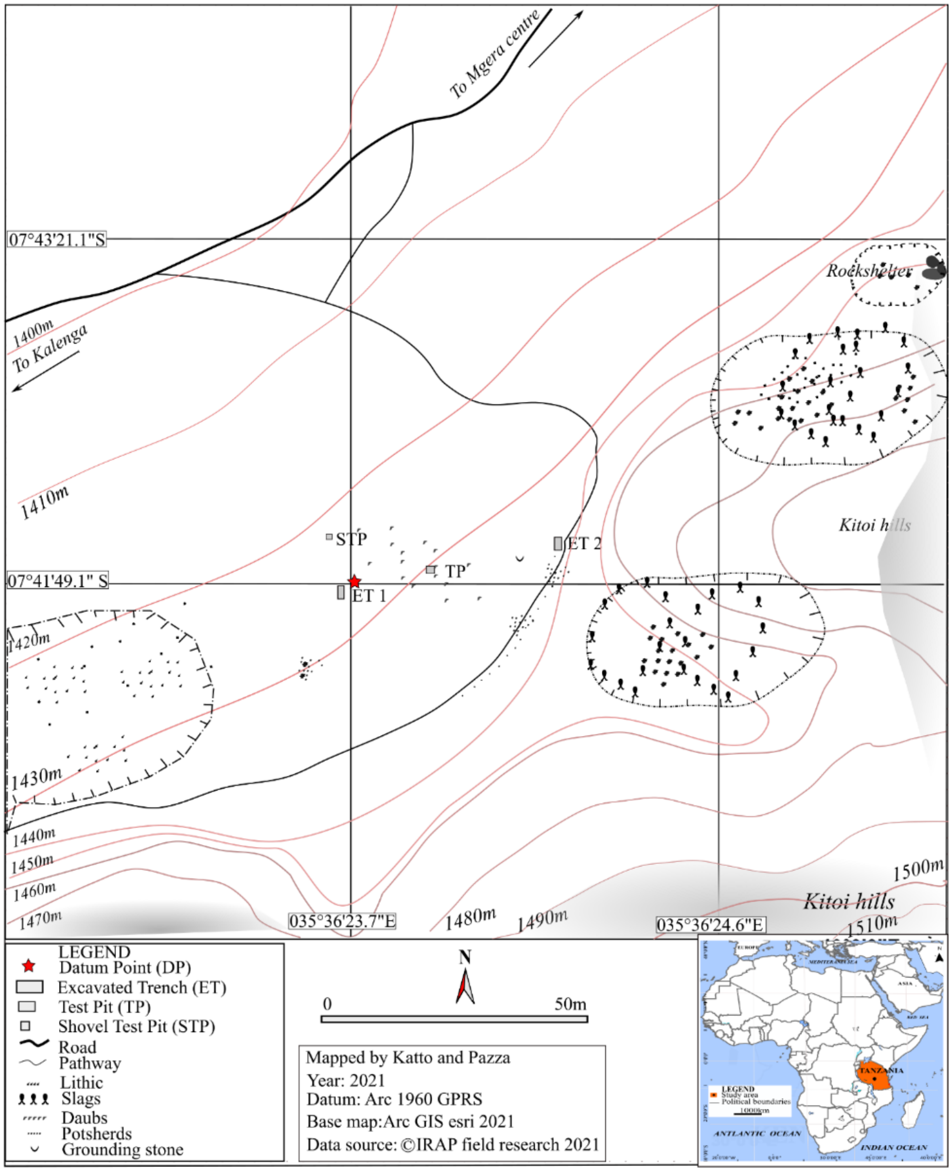


Figure 5.9: A map of the Mgera site.

5.11 Mgera Stratigraphic Sequence

The Mgera site contains a stratigraphic sequence that start with LSA, IA, and recent/historic period. The historic and IA period starts from 0-70 cm and the LSA starts from 70 cm to the bedrock (110 cm deep). Lithostratigraphic unit of the site is presented by the soil profile of trench # 2 below (Figure 5.10).

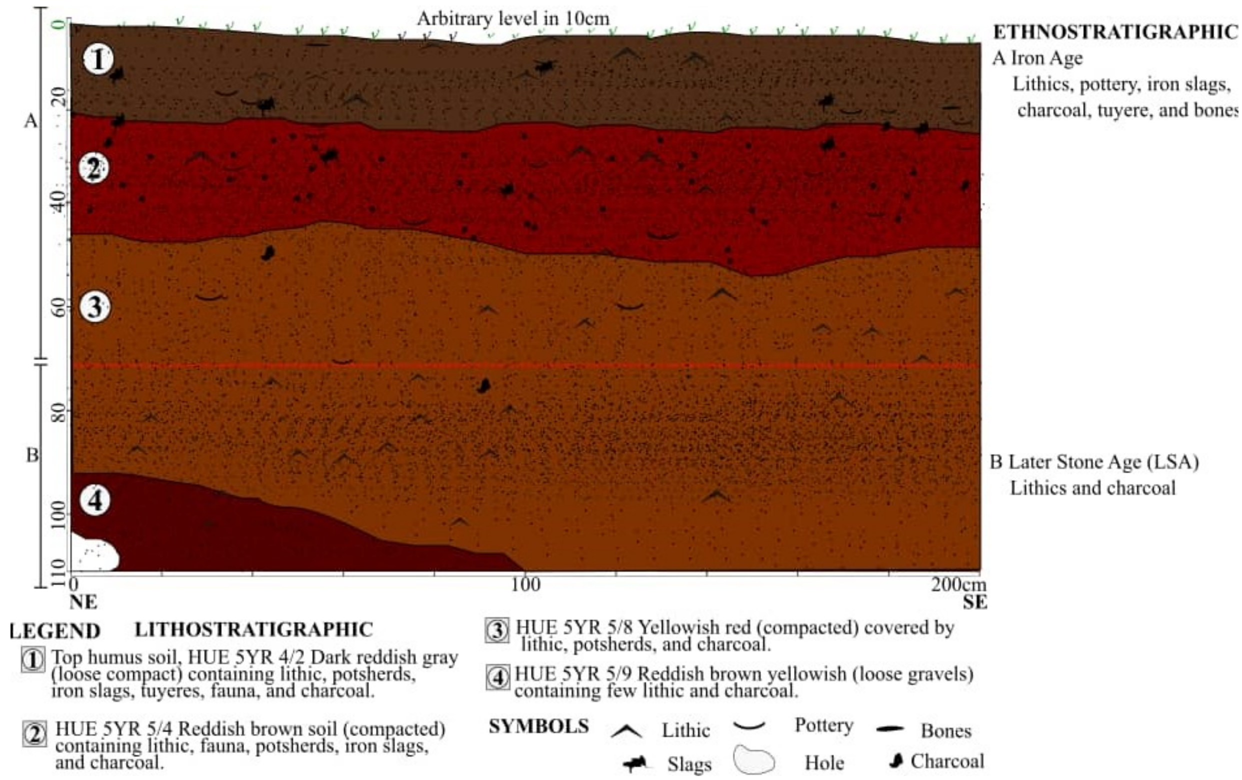


Figure 5.10: The Stratigraphic Profile of the Mgera site Trench # 2.

5.12 The Chronology of the Mgera Site

The age of the Mgera deposits have been determined by dating material from charcoal. Four charcoal samples were taken from four levels (Table 5.14 and 15). The results show that Mgera has a cultural sequence of recent historic period spanning from level 0-80 cm (between 1472–1800 cal AD) comprised of microlithic, potsherds, iron slags, and tuyeres. The rest 80-110 cm have got on LSA microlithic and macrolithic artifacts. Such chronology indicates that Mgera site was continuously occupied during the LSA period but not the EIA period. The site was later reoccupied during the Late/historic Iron Age period.

Table 5.14: Mgera Trench 2 Charcoal Dating Results.

UCIAMS #	Sample Depth	fraction Modern	±	$D^{14}C$ (‰)	±	^{14}C age (BP)	±	Calibrated date ranges (95.4% prob.)
261241	0-30cm	0.9607	0.0042	-39.3	4.2	320	40	1472–1650 AD
261242	0-30cm	0.9677	0.0023	-32.3	2.3	265	20	1535–1795 AD
261243	0-30cm	0.9860	0.0016	-14.0	1.6	115	15	1691–1921 AD
261244	40–50cm	0.9727	0.0017	-27.3	1.7	220	15	1646–1800 AD
261245	70-80cm	0.9683	0.0017	-31.7	1.7	260	15	1529–1795 AD

Note: Date were calibrated using OxCal v4.4.4 Bronk Ramsey (2021); r: 5; Atmospheric Data from Reimer et al. (2020). The program is free online through oxford radiocarbon accelerator unit (see also Appendix IX)

5.13 Mgera Material Cultural Sequence

Both surveys and excavations revealed various material culture ranging from lithics, pottery, grounding stones, tuyere, slags, daubs, and metal. Trench # 2 provided a good stratigraphic cultural sequence as presented in Table 5.16. Material cultures recorded on other trenches ended on above levels (Table 5.15) but they were very significance in understanding the spatial distribution of material culture and settlement analysis of the site as presented in Figure 5.9.

Table 5.15: Cultural material for the Mgera: Trench # 1 & Unit # 1.

Mgera New Site	**Depth (cm)**	**Pottery**		**Other**	**Total**	**Cultural designation**
		DG	**UDG**			
Trench # 1 (2’x2’m)	Surface	8	12	-		
	0-10	8	13	-		
Unit # 1 (2’x1’m) West	10-20	-	-	1 Metal Charcoal for C-14		
	20-30	-	-	-		
	30-40	-	-	Charcoal for C-14		
	40-50	-	-	-		
TOTAL		**16**	**26**	**1**	**43**	

Table 5.16: Inventory for the Mgera Site: Trench # 2.

Trench # 2 (Mgera NS)	Depth (cm)	Pottery		Slag	Lithics	Bones	Tuyere	Other	TOTAL	Cultural Designation
		DG	UDG							
	0-30	61	128	5	26	20+ fragile	14	1 Pottery smoothing stone Charcoal for C-14	**255**	Later IA/Historic (1472–1921 cal AD)
	30-40	8	37	3	2	-	-	Charcoal for C-14	**50**	
	40-50	8	24	2	36	-	-	Charcoal for C-14	**70**	
	50-60	-	11	-	89	-	-	Charcoal for C-14	**100**	
	60-70	-	7	-	29	-	-	-	**36**	
	70-80	-	1	-	22	-	-	Charcoal for C-14	**23**	
	80-90	-	-	-	35	-	-	-	**35**	LSA
	90-100	-	-	-	134	-	-	-	**134**	
	100-110	-	-	-	56	-	-	-	**56**	
TOTAL		**77**	**208**	**10**	**429**	**20**	**14**	**1**	**759**	

5.14 Chapter Summary

This chapter has presented the descriptions of the Magubike, Mlambalasi, and Mgera sites. It covers the overview about the site including location and historical background. The stratigraphy begins with MSA for some test pits/trenches however, for the case of the current study much emphasis was from LSA and IA context. Various line of evidence used in dating have been presented including charcoal, achatina, OES, and potsherds. The material cultural sequencies ranging from LSA to historic period. The chapter covers the integrations of previous IRAP, other researchers' data who have worked in the study area together with the current data in answering the research questions/hypotheses. How and why those data were selected are parts of the chapter as well. Generally, the chapter paves the way towards the following chapters that are related to material cultural analysis.

CHAPTER 6: LITHIC MATERIAL CULTURAL EVIDENCE

6.1 Introduction

Like other material culture, such as fauna and ceramics, lithics were examined in the current study for LSA and IA characterizations. They were also considered in addressing hypothesis II of the current study (*The LSA hunter-gatherer communities were totally replaced by the IA agropastoralists*) and research question 1 on lithic material culture characterization. Only test pits or excavation units that contain a mixture of LSA and IA, or separate LSA, or IA occupations were taken into consideration. The LSA material from Uhafiwa site was also considered for characterization. The IA lithic artifacts were considered for some trenches that lacked LSA material culture and vice versa as presented earlier in Chapter 5. Previous studies in the Iringa Region have shown a lithic cultural sequence that ranges from the ESA to the LSA. However, not all excavation units/test pits have presented a continuous cultural sequence. For example, while MSA, LSA, and Iron Age occupations have been recorded at Magubike Tp# 1 and 5, it is different for TP# 3, 4, as well as 6-12 where only MSA and IA have been recorded (Bushozi 2011; Biittner 2011; Willoughby 2012). This is different from the Mlambalasi rockshelter and the Mgera site which have both the LSA and IA cultural sequence represented. This chapter, therefore, presents the lithics as material culture by covering the analytical methods and results for lithics collected by me in 2021 from Mgera and Uhafiwa sites. The chapter also presents the methods I used to obtain data already analyzed by IRAP members that were included in this study. The results cover some main attributes selected to answer hypothesis II and research question 1. They include raw material, tool types per cultural designations, and depth per cultural designation. Finally, the chapter provides a summary and interpretation.

6.2 Lithic Analytical Methods

Lithic artifacts recovered by the current study in 2021 at the Mgera and Uhafiwa sites (Table 6.1) were sorted and catalogued by basic general artifact category using the system developed by Michael Mehlman (1989) for the Mumba and Nasera rockshelters in northern Tanzania. The code book for this has been previously developed and used by IRAP members led by Pamela Willoughby (Appendix IV). In this system, a stone artifact is either a retouched/trimmed pieces (or "tool"), a core, a piece of debitage, or a ground stone item/non flaked tool (Willoughby 2012). I used SPSS software to extract data from the previous IRAP's database and run the attributes that were concerned with my study. The extracted lithic data were those belonging to LSA and IA for the Tp# 1, and 5 for Magubike rockshelter, Tp# 1 and Unit I-11 for Mlambalasi rockshelter (Table 6.1). On other hand, the IA lithic data from Tps having MSA and IA context were extracted from the Magubike database. They include Tps # 3, 8, and 12 (Table 6.1).

The following two paragraphs refer to Willoughby's (2012: 5) use of the Mehlman's system. Retouched tools include scrapers, backed pieces, points, burins, bifacially modified pieces, becs, composite tools, *outils écaillés* and others. Scrapers are unifacially retouched, usually on the dorsal or outside surface of a flake. They exhibit one or more retouched edges with an angle of 30º to 80º from the ventral (or bulb of percussion) side of a flake. Mehlman originally defined 23 kinds of scrapers, depending on where the retouched edge is located (side, end), and what was the shape of the retouched edge (convex, concave, straight, etc.). Bifacially modified tools are retouched on both sides of the same edge, resulting in a sinuous pattern. Backed pieces are retouched parallel or perpendicular to the long axis of a piece; retouch is on a side edge at a 90º angle relative to the ventral surface; as a result, finished tools are triangular in cross-section. Projectile points are triangular in shape and can be unifacial or bifacial, or produced through Levallois methods. Burins show a chisel end, while becs are retouched to produce a small projection or nipple. Composite tools combine more than one type, and *outils écaillés* are flaked pieces with fish scale retouch produced by removal from a bipolar core.

Cores are larger pieces of stone from which flakes or blades are removed. Willoughby noted that LSA cores are generally supposed to be prismatic, meaning cone or cylinder shaped. This produces parallel sided flakes which are more than twice as long as wide; these are called blades or bladelets, depending on size (with bladelets less than 14 mm in width). But when small quartz pebbles are used as the raw material, as is the case in Iringa, bipolar methods are usually employed. Here the pebble is put on a stone anvil, and the opposite end is struck by a hammerstone. This results in the removal of flakes which show evidence of crushing of both ends. Bipolar cores and flakes show little evidence of standardization. But given how hard it is to break up small quartz pebbles, even the production of blades and bladelets may start with bipolar core reduction. However, produced, the detached flakes are then retouched into a variety of tools. Mehlman's debitage category includes whole flakes and blades (including bladelets), as well as chips and chunks, the shatter produced by stone tool manufacture. Levallois flakes, pieces removed from carefully shaped cores, are also counted as debitage. Ground stone tools include hammerstones, anvils, mortars, and pestles, and any other polished or abraded item. Other than hammerstones, these are only common in LSA and later assemblages.

For the purpose of the current study more focus was placed on four main attributes that is *tool type, linear dimensions (mm*) for both length and breadth in order to characterize the LSA and IA lithic artifacts. The third was *depth* (levels) for demarcating changes through time. The fourth one was cultural designations (that is LSA or IA). Running together *depth vs cultural* *designation* through cross-tabulations process in the SPSS the study was aiming at testing the interactions models between LSA autochthonous and IA agropastoralists (that is Hypothesis II). Another minor attribute of *raw material* was also considered for the purpose of recording changes (if any) in lithic raw material per cultural designation over time.

6.3 Lithic Analytical Results

6.3.1 General Lithic Assemblage

A total number of 43,579 lithic artifacts counts for the four sites: Magubike, Mlambalasi, Mgera, and Uhafiwa (Table 6.1). The majority of these artifacts were recorded from Magubike N=35,935 (82%) rockshelter followed by Mlambalasi rockshelter N=7,025 (16%). Mgera and Uhafiwa yielded relatively few numbers of artifacts N=432 (1%) and N=187 (<1%) respectively. Despite such discrepancies, the overall assemblage is represented by the all of the general artifact categories mentioned above (Table 6.2 and Figure 6.1). They vary between sites and excavation units. Debitage and tools (trimmed pieces) are generally frequent at Magubike and Mlambalasi rockshelters. Moreover, occurrence of cores is negligible at Magubike and Mlambalasi rockshelters. The tools at the Mgera and Uhafiwa sites are very few and this is also reflected on the general artifact category (Table 6.2).

Table 6.1: A Quantity of Lithic assemblage used in the current study.

Site	Excavation unit	Cultural Designations			Total
		LSA	LSA and IA	IA	
Magubike (HxJf-01)	Tp# 1		√		1,819
	Tp# 3			√	969
	Tp# 5		√		31,595
	Tp# 8			√	244
	Tp# 12			√	13,08
Total					**35,935**
Mlambalasi (HwJf-01)	Tp# 1		√		2,666
	I-11		√		4,359
Total					**7,025**
Mgera (HwJg-106)	Trench# 2		√		**432**
Uhafiwa	Tp# 3	√			**187**
General total					**43,579**

Table 6.2: The type of lithic artifacts by Site.

	Tool General Category				
Site	**Trimmed pieces**	**Cores**	**Debitage**	**Ground stone**	**Total**
Magubike	4,196	1,418	30,307	14	**35,935**
Mlambalasi	1,764	604	4,649	8	**7,025**
Mgera	65	51	316	0	**432**
Uhafiwa	61	28	98	0	**187**
Total	**6,086**	**2,101**	**35,370**	**22**	**43,579**

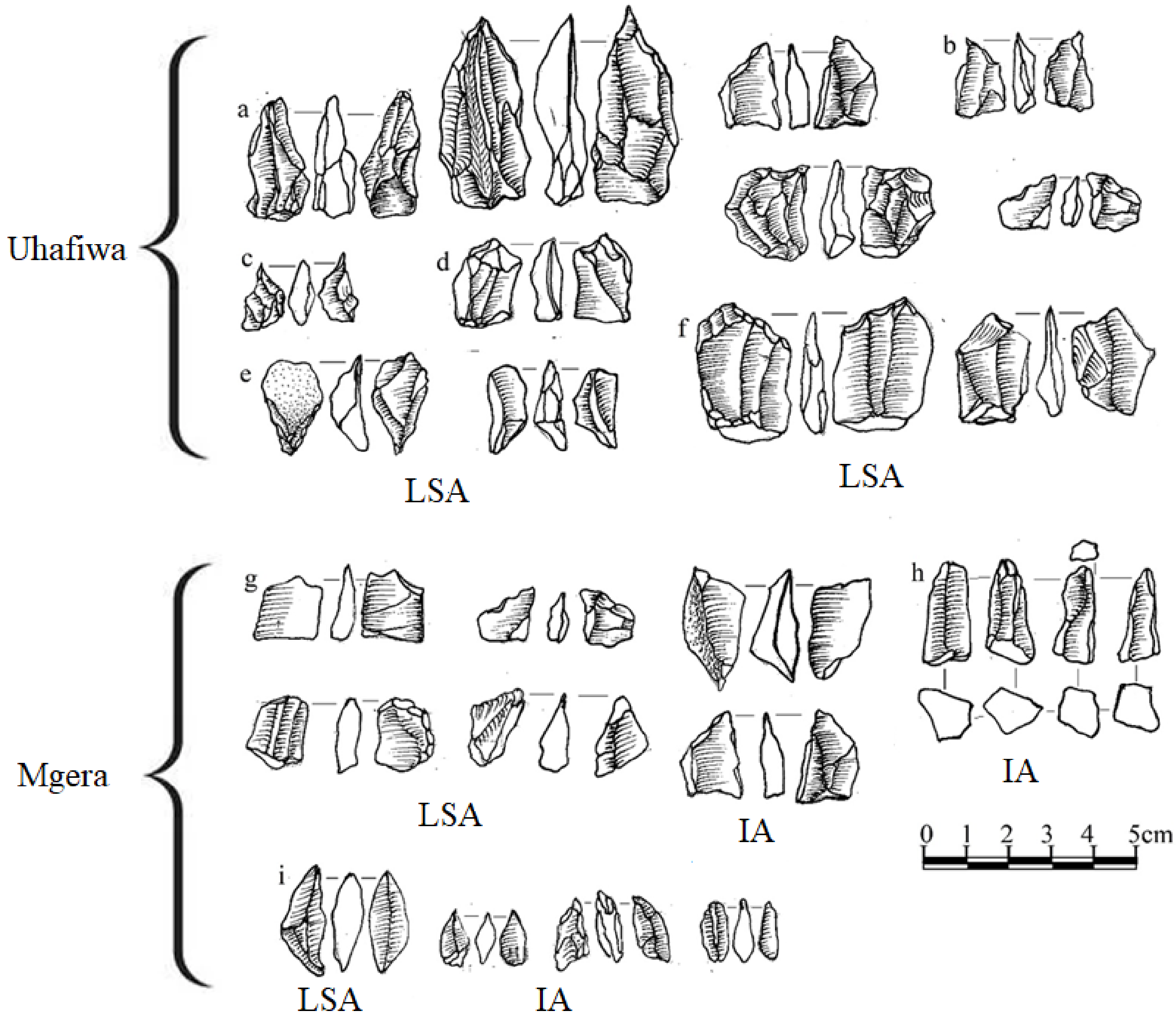


Figure 6.1: LSA and IA tool types identified by the current study at Uhafiwa and Mgera sites: a) Points; b) triangle; c) awls; d) angle backed pieces; e) diverse backed pieces; f) straight backed pieces; g) burins; h) cores; i) drills. Source: IRAP 2021 field research, illustrated by Hitson Pazza 2022.

6.3.2 Lithic Raw Material

A variety of lithic raw materials are generally presented by the current study for the combined four sites in which the majority, 37,597 (or 85%) are quartz, 2,431 (5%) are rock crystal, 1,833 (4%) chert/flint, 941 (2%) other metamorphic, and 664 (1%) quartzite. The rest include 66 granite, 26 volcanic, 6 mudstone, 5 other sedimentary, 3 sandstone, 1 basalt, and 4 others; all of these make up <1% of the total each (Tables 6.3 and 6.4). However, not all raw materials present at one site/excavation units are cutting across others. In other word, some raw material occurred in some site/excavation units and absent for others (Tables 6.3 and 6.4). For example, mudstones and sand stones were only reported at Magubike rockshelter Tp# 12 which is the IA context (Table 6.3). Similarly, basalt was only evidenced at Mgera site trench# 2. Granite was only recorded at Mgera and Uhafiwa sites at the IA context (for Mgera) and LSA context (for Uhafiwa) but with high quantity at latter site. The issue of lithic raw material of Iringa Region including their images has been presented in detail by Biittner (2011:398-438). With regards to diachronic changes, the results indicate the continuous dominance of quartz from LSA to IA.

Table 6.3: The quantity of lithic raw material for Magubike Rockshelter.

	Unit					**Total**
	Tp# 1	Tp# 3	Tp# 5	Tp# 8	TP# 12	
Raw Material	**Frequency**					
Quartz	1282	693	27947	174	970	**31066 (86%)**
Rock crystal	158	70	1797	4	26	**2055 (6%)**
Chert/flint	103	86	1177	35	98	**1499 (4%)**
Other metamorphic	49	85	590	18	173	**915 (3%)**
Quartzite	227	35	80	13	29	**384 (1%)**
Mudstone					6	**6 (<1%)**
Other sedimentary			4			**4 (<1%)**
Sandstone					3	**3 (<1%)**
Granite					2	**2 (<1%)**
Others					1	**1 (<1%)**
Total	**1819**	**969**	**31595**	**244**	**1308**	**35935**

Table 6.4: The quantity of lithic raw material for the Mlambalasi, Mgera, and Uhafiwa sites.

Site							
Mlambalasi				**Mgera**		**Uhafiwa**	
	Unit				Unit		
	Tp# 1	Quad I-11			Trench# 2		Tp# 3
Raw material	**Frequency**		**Total**	**Raw material**	**Frequency**	**Raw material**	**Frequency**
Quartz	1993	3994	**5987 (85%)**	Quartz	**417 (97%)**	Quartz	**127 (68%)**
Quartzite	236	42	**278 (4%)**	Quartzite		Quartzite	**2 (1%)**
Chert/flint	154	174	**328 (5%)**	Chert/flint	**6 (1%)**		
Volcanic	26		**26 (<1%)**	Basalt	**1 (<1%)**		
Other sedimentary	1		**1 (<1%)**	Granite	**8 (9%)**	Granite	**58 (31%)**
Rock crystal	256	120	**376 (5%)**				
Other metamorphic		26	**26 (<1%)**				
Others		3	**3 (<1%)**				
Total	**2666**	**4359**	**7025**	**Total**	**432**	**Total**	**187**

6.3.3 Magubike Rockshelter: Tool types per Cultural Designation

The lithic tool type analyzed by the previous IRAP team from Magubike rockshelter yielded an interesting diversity of stone tools enough to characterize them per cultural designation for the interest of the current study. Magubike Tp#5 contains the highest frequency of lithic material recovered from the entire site (Table 6.1, 6.5). This test pit yielded 31,595 lithic items. Of these N=22,814 (72%) belong to an LSA context and N=8781 (28%) to an IA context. Angular fragments dominate (84%) the total count of lithic on LSA context and the same patterns N=72% is consistent on the IA context. The remaining tool type category exhibits some similarities and differences. The frequency of flakes, backed pieces, scrapers, and bipolar core is higher on both LSA and IA context. However, considering the total assemblage of these tool per Test pit, the percentage of these tool type is higher on IA compared to LSA context. Magubike Tp# 1 contain the second highest number of lithic artifacts N=1819 (Table 6.6). No significant differences on the frequency of lithic artifact between LSA and IA context. Contrary to Tp# 5, the general frequency of angular fragments is low: N=158 (18%) for LSA and N=190 (20%) for IA context. Instead, baked pieces are ubiquitous in the LSA: N=349 (38%) and N=393 (42%). Flakes on LSA account for N=90 (10%) and N=117 (12%) in the IA. Moreover, for Tp#1 scrapers on LSA context are N=58 (7%) and N=39 (4%) in the IA levels. The remaining tool type are represented with less than 2% in both LSA and IA (Table 6.6).

Table 6.5: Lithic tool types per cultural designation for Magubike rockshelter Tp# 5.

Tool type	Culture		Total
	LSA	Iron Age	
scraper	225 (1%)	142 (2%)	**367**
backed pieces	1156 (5%)	1088 (12%)	**2244**
points	19 (<1%)	15 (<1%)	**34**
burins	12 (<1%)	23 (<1%)	**35**
bifacially modified pieces	5 (<1%)	2 (<1%)	**7**
becs	7 (<1%)	1 (<1%)	**8**
outils écaillés	112 (<1%)	51 (1%)	**163**
heavy duty tools	0 (0%)	1 (<1%)	**1**
peripheral core	2 (<1%)	0 (0%)	**2**
patterned platform core	5 (<1%)	14 (<%)	**19**
intermediate core	2 (<1%)	1 (<1%)	**3**
bipolar core	407 (2%)	365 (4%)	**772**
amorphous core	2 (<1%)	0 (0%)	**2**
angular fragment	19137 (84%)	6284 (72%)	**25421**
specialized flake	97 (<1%)	36 (<1%)	**133**
flake	1526 (7%)	703 (8%)	**2229**
blade	100 (<1%)	50 (1%)	**150**
sundry ground stone	0 (0%)	5 (<1%)	**5**
Total	**22814**	**8781**	**31595**

Table 6.6: Lithic tool types per cultural designation for Magubike rockshelter Tp#1.

Tool Type	Culture		Total
	LSA	Iron Age	
scraper	58/878 (7%)	39/941 (4%)	**97**
backed pieces	349/878 (38%)	393/941 (42%)	**742**
points	0 (0%)	3/941 (<1%)	**3**
burins	2/878 (<1%)	4/941 (<1%)	**6**
bifacially modified pieces	2/878 (<1%)	5/941(1%)	**7**
becs	2/878 (<1%)	3/941 (<1%)	**5**
outils écaillés	16/878 (2%)	8/941 (1%)	**24**
peripheral core	11/878 (1%)	3/941 (<1%)	**14**
patterned platform core	2/878 (<1%)	6/941 (1%)	**8**
bipolar core	176/878 (2%)	143/941 (15%)	**319**
amorphous core	1/878 (<1%)	0 (0%)	**1**
angular fragment	158/878 (18%)	190/941 (20%)	**348**
specialized flake	8/878 (1%)	9/941(10%)	**17**
flake	90/878 (10%)	117/941 (12%)	**207**
blade	3/878 (<1%)	15/941(2%)	**18**
pestle rubber	0 (0%)	2/941 (<1%)	**2**
sundry ground stone	0 (0%)	1/941 (<1%)	**1**
Total	**878**	**941**	**1819**

Magubike Tps # 3, 8 and 12 (Table 6.7-6.9) lack LSA context instead only MSA and IA are present. The current study presents analytical results on IA context as they occur per levels as per previous IRAP analysis. Tp# 12 yielded a total number of 1,132 lithic items (Table 6.9). Besides angular fragments N=919 (81%), flakes 205 (18%), bipolar cores N=65 (6%), and backed pieces N=57 (5%) is the most frequent tool type on the assemblage per levels. The remaining tool type are represented with less than 2%. The similar trend is evidenced on Magubike Tp# 3 that produced N=969 lithic artifacts. Backed pieces N=248 (26%), angular fragments N=246 (26%), bipolar cores N=171 (18%), whole flakes N=156 (16%), and scrapers N=52 (5%) are the most common tool types recorded in Magubike Tp# 3 IA lithic assemblages (Table 6.7). Magubike Tp# 8 IA context produced relatively few lithic artifacts, for a total of 244 (Table 6.8). Unlike Tp#12 and 3, Magubike Tp# 8 tool type diversity are limited. Angular fragments outnumber (N=179, 73%) the rest of the tool types. Flakes and bipolar cores are fairly represented on both levels (Table 6.8).

Table 6.7: IA lithic tool type frequency per levels Magubike Tp# 3.

	Level (cm)						**Total**
Tool type	**0-10**	**10-20**	**20-30**	**30-40**	**40-50**	**50-60**	
scraper	4	15	10	6	6	11	**52 (5%)**
backed pieces	28	37	51	34	55	43	**248 (26%)**
points	0	2	4	2	2	1	**11 (1%)**
burins	1	3	0	0	1	0	**5 (1%0**
bifacially modified pieces	0	1	0	1	1	2	**5 (1%)**
becs	0	4	1	2	0	0	**7 (1%)**
outils écaillés	2	7	4	0	5	4	**22 (2%)**
peripheral core	1	2	0	4	0	1	**8 (1%)**
patterned platform core	0	4	2	1	3	1	**11 (1%)**
bipolar core	5	39	29	21	44	33	**171 (18%)**
angular fragment	37	51	31	38	40	49	**246 (26%)**
specialized flake	0	1	1	0	1	2	**5 (1%)**
flake	10	39	15	19	30	43	**156 (16%)**
blade	1	6	3	2	3	4	**19 (2%)**
pestle rubber	0	0	0	1	0	0	**1 (<1)**
sundry ground stone	0	0	1	0	0	1	**2 (<1%)**
Total	**89**	**211**	**152**	**131**	**191**	**195**	**969**

Table 6.8: IA lithic tool type frequency per levels Magubike Tp# 8.

	Level (cm)				
Tool type	**0-10**	**10-20**	**20-30**	**30-40**	**Total**
scraper	0	0	0	1	**1 (<1%)**
backed pieces	1	3	0	0	**4 (2%)**
outils écaillés	1	2	2	2	**7 (3%)**
bipolar core	3	4	0	8	**15 (6%)**
angular fragment	64	35	20	60	**179 (73%)**
specialized flake	0	1	0	0	**1 (<1%)**
flake	9	4	9	10	**32 (13%)**
blade	0	0	1	3	**4 (2%)**
sundry ground stone	0	0	1	0	**1 (<1%)**
Total	**78**	**49**	**33**	**84**	**244**

Table 6.9: IA lithic tool type frequency per levels Magubike Tp# 12.

Tool type	Level (cm)				Total
	0-10	**10-20**	**20-30**	**30-40**	
scraper	3	3	4	0	**13 (1%)**
backed pieces	27	14	1	5	**57 (5%)**
points	0	0	0	1	**1 (<1%)**
burins	0	1	0	0	**1 (<1%)**
bifacially modified pieces	0	0	1	5	**6 (1%)**
outils écaillés	2	3	3	3	**11 (1%)**
heavy duty tools	0	2	0	0	**2 (<1%)**
peripheral core	2	0	2	0	**4 (<1%)**
patterned platform core	0	2	0	1	**3 (<1%)**
bipolar core	23	4	4	21	**65 (6%)**
amorphous core	1	0	0	0	**1 (<1%)**
angular fragment	262	221	118	199	**919 (81%)**
specialized flake	2	0	0	1	**3 (<1%)**
flake	67	49	16	46	**205 (18%)**
blade	7	0	1	3	**15 (1%)**
manuport	0	0	0	2	**2 (<1%)**
Total	**396**	**299**	**150**	**287**	**1132**

6.3.4 Mlambalasi Rockshelter: Tool types per Cultural Designation

A total number of 7,025 lithic artifacts were extracted from the previous IRAP's analyzed data for the Mlambalasi rockshelter. Over half (62%) were recorded from quadrant I-11 and the remaining (48%) were recovered from Tp# 1. The former produced 4,211 lithic artifacts. There is no significant difference on the frequency of tool type for LSA and IA context. The overall assemblage from this unit is dominated by angular fragments on both LSA and IA levels (Table 6.10). Backed pieces made up 65 (or 3%) of the IA lithics. The remaining tool types have yielded even percentages for both LSA and IA levels. The latter unit (Tp# 1) yielded a total number of 2,666 lithic items that were analyzed. The LSA context yielded the highest frequency, producing 2015 (or 76%) of the total lithics compared to IA, where there were 651 (or 24%). Overall, backed pieces are dominant on both LSA and IA. Bipolar cores (13%), and scrapers (7%) are fairly represented. Other tool types (Table 6.11) are present but in a lesser frequency.

Table 6.10: Tool type per cultural designation for Mlambalasi rockshelter Quadrant I-11.

Tool type	Culture		Total
	LSA	Iron Age	
scraper	9/2164 (<1%)	19 (1%)	**28**
backed pieces	27/2164 (1%)	65 (3%)	**92**
points	2/2164 (<1%)	2 (<1%)	**4**
burins	6/2164 (<1%)	3 (<1%)	**9**
bifacially modified pieces	1/2164 (<1%)	0	**1**
outils écaillés	11/2164 (1%)	14 (1%0	**25**
peripheral core	1/2164 (<1%)	3 (<1%)	**4**
patterned platform core	3/2164 (<1%)	2 (<1%)	**5**
bipolar core	87/2164 (4%)	84 (4%)	**171**
angular fragment	1948/2164 (90%)	1909 (87%)	**3857**
specialized flake	2/2164 (<1%)	4 (<1%)	**6**
flake	59/2164 (3%)	79 (3%)	**138**
blade	7/2164 (<1%)	11 (1%)	**18**
hammerstone	1/2164 (<1%)	0 (0%)	**1**
Total	**2164**	**2195**	**4359**

Table 6.11: Tool types per cultural designation for Mlambalasi rockshelter Tp# 1.

Tool type	Culture		Total
	LSA	Iron Age	
scraper	147/2015 (7%)	41/651 (6%)	**188**
backed pieces	1054/2015 (52%)	252/651 (39%)	**1306**
points	16/2015 (1%)	4/651 (1%)	**20**
burins	21/2015 (1%)	9/651 (1%)	**30**
bifacially modified pieces	40/2015 (2%)	16/651 (2%)	**56**
becs	7/2015 (<1%)	3/651 (<1%)	**10**
composite tools	3/2015 (<1%)	0 (0%)	**3**
outils écaillés	7/2015 (<1%)	0 (0%)	**7**
heavy duty tools	3/2015 (<1%)	0 (0%)	**3**
peripheral core	28/2015 (1.4%)	7/651 (1%)	**35**
patterned platform core	45/2015 (2%)	9/651 (1%)	**54**
intermediate core	1/2015 (<1%)	1/651 (<1%)	**2**
bipolar core	272/2015 (13%)	58/651 (9%)	**330**
amorphous core	3/2015 (<1%)	0 (0%)	**3**
angular fragment	184/2015 (9%)	168/651 (26%)	**352**
specialized flake	13/2015 (1%)	9/651 (1%)	**22**
flake	141/2015 (7%)	66/651 (10%)	**207**
blade	22/2015 (1%)	6/651 (1%)	**28**
Levallois flake	3/2015 (<1%)	0 (0%)	**3**
hammerstone	0 (0%)	1/651 (<1%)	**1**
anvil stone	1/2015 (<1%)	0 (0%)	**1**
pestle rubber	2/2015 (<1%)	0 (0%)	**2**
stone disc	1/2015 (<1%)	0 (0%)	**1**
sundry ground stone	1/2015 (<1%)	1/651 (<1%)	**2**
Total	**2015**	**651**	**2666**

6.3.5 The Mgera site: Tool types per Cultural Designation

All lithic tools from Mgera were recovered from trench# 2, representing both LSA and IA context (Table 6.12). There is no significant difference on the frequency of tools on LSA and IA context. Backed pieces, bipolar cores, and scrapers are the most common stone artifacts in both the LSA and IA levels (Table 6.12).

Table 6.12: Lithic artifact types against cultural designation for the Mgera site Trench# 2.

Tool type	Culture		**Total**
	LSA	Iron Age	
Scraper	7 (29%)	17 (71%)	**24**
backed pieces	9 (43%)	12 (57%)	**21**
Points	0 (0%)	5 (100%)	**5**
Burins	7 (78%)	2 (22%)	**9**
heavy duty tools	2 (40%)	3 (60%)	**5**
peripheral core	0 (0%)	1 (100%)	**1**
patterned platform core	0 (0%)	1 (100%)	**1**
bipolar core	16 (44%)	20 (66%)	**36**
amorphous core	1 (100%)	(0%)	**1**
Flake	0 (0%)	2 (100%)	**2**
Blade	1 (100%)	0 (0%)	**1**
Total	**43**	**63**	**106**

6.3.6 The Uhafiwa site: Tool types per Cultural Designation

All lithic artifacts at Uhafiwa sites trench #3 fall under LSA cultural context. Various tool types are containing the LSA assemblage of Uhafiwa site including blades, flakes, scrapers, burins, cores, and points (Table 6.13). The higher frequency N=160 (86%) of those tools dominates at 0-20 cm and diminished at 20-40 cm. Based on C-14 dating from the charcoal samples taken from level 0-20 cm, it provided the dates of (36881–27184 cal BC) which signifies a LSA cultural context and the earliest date for the LSA sites in the Southern Highlands of Tanzania.

Table 6.13: LSA lithic tool type frequency per levels at the Uhafiwa site TP# 3.

Tool type	**Level (cm)**			**Total**
	Surface	**0-20**	**20-40**	
scraper	11	3	1	**15**
backed pieces	2	9	0	**11**
points	0	3	5	**8**
burins	2	8	0	**10**
patterned platform core	0	10	0	**10**
bipolar core	0	18	0	**18**
angular fragment	1	95	2	**98**
flake	2	14	0	**16**
blade	1	0	0	**1**
Total	**19**	**160**	**8**	**187**

6.3.7 Lithic Linear Dimensions

Understanding the linear dimensions of lithic artifacts was so important for this study in order to differentiate the size of lithics between LSA and other later periods specifically the IA. In reference to Willoughby (2012), the linear dimensions of LSA tools varies depending on time period whereby those at Holocene period are small while those that fall in Pleistocene are larger. This was mainly recorded at Mlambalasi Tp# 1 and repeated in Tp# 1 and 5 for Magubike. The linear dimensions results of the current study consider length and breadth per cultural designation (that is LSA and IA) for the reason introduced above, specifically for Mlambalasi Tp#1, Magubike Tp# 1 and 5, and Mgera Trench #2 having LSA and IA context. Appendix X presents the attached lithics measured data as well as the statistical significance per each considered Test pits for both length and breadth (LSA and IA). The statistical significance was tested through SPSS software and the interpretation based on statistical inferences indicating the strength of the evidence corresponding to different values of p according to Singh (2013:203) (see the Appendix X). Generally, the linear dimensions results indicate the lower size in terms of minimum and maximum measurements for IA lithics compared to LSA for both test pits (Figures 6.2-6.4; Table 6.14). Mlambalasi Tp# 1 provided a best clear dimension between LSA and IA

(Figure 6.2) whereby the minimum measures for LSA length are 5.2 mm, maximum 124.7 mm, mean 21.39, standard deviation 10.8007. For the IA, the minimum length is 7.1 mm, maximum 59.8, mean 18.621, standard deviation 7.4979. Such differences for LSA and IA length recorded at Mlambalasi Tp# 1 is statistically significance at 95% Confidence Interval of the difference *t*-test $p < .001$ (see Table 6.14; Appendix X). The breadth for LSA measures 1.7 mm for minimum, 71.6 mm for maximum, mean 17.662, standard deviation 8.6212. The breadth for IA measures 4.6 mm for minimum, 52.1 mm for maximum, mean 15.206, standard deviation 6.3937. Such differences for LSA and IA breadth recorded at Mlambalasi Tp# 1 is statistically significance at 95% Confidence Interval of the difference *t*-test $p < .001$ (see Table 6.14 and Appendix X).

For Magubike Tp# 1 the clear dimensions between LSA and IA is presented (Figure 6.3) whereby the minimum measures for LSA length are 8 mm, maximum 51.5 mm, mean 20.657, standard deviation 6.5875. For the IA, the minimum length is 6.7 mm, maximum 75.1mm, mean 18.283, standard deviation 6.737. Such differences for LSA and IA length recorded at Magubike Tp# 1 is statistically significance at 95% Confidence Interval of the difference *t*-test $p < .001$ (see Table 6.14 and Appendix X). The breadth for LSA measures 1.1 mm for minimum, 49.7 mm for maximum, mean 16.13, standard deviation 6.3385. The breadth for IA measures 2.8 mm for minimum, 68.7 mm for maximum, mean 14.631, standard deviation 5.9322. Such differences for LSA and IA breadth recorded at Magubike Tp# 1 is statistically significance at 95% Confidence Interval of the difference *t*-test $p < .001$ (see Table 6.14 and Appendix X). Table 6.14 presents the linear dimension results for other units including Magubike Tp# 5 and Mgera Trench# 2 (see also Appendix X).

Table 6.14: Lithic linear dimension for the site having LSA and IA context

				Length									
		Sample size		Min		Max		Mean		Stdv		P-Value	
Site	Unit	LSA	IA	LSA	IA	LSA	IA	LSA	IA	LSA	IA	LSA	IA
	Tp# 1	878	941	8	6.7	51.5	75.1	20.657	18.283	6.5875	6.737	<.001	<.001
Magubike	Tp# 5	3827	7705	8.5	1	68.5	153.1	17.97	14.641	5.883	5.978	<.001	<.001
Mlambalasi	Tp# 1	2015	651	5.2	7.1	124.7	59.8	21.39	18.621	10.8007	7.4979	<.001	<.001
Mgera	Trench# 2	26	39	11.2	3.9	58.9	73.8	21.308	22.382	12.156	15.3233	<.001	<.001

				Breadth									
		Sample size		Min		Max		Mean		Stdv		P-Value	
Site	Unit	LSA	IA	LSA	IA	LSA	IA	LSA	IA	LSA	IA	LSA	IA
Magubike	Tp# 1	878	941	1.1	2.8	49.7	68.7	16.13	14.631	6.3385	5.9322	<.001	<.001
	Tp# 5	3827	7705	1	1	58.7	70	14.917	11.154	5.0355	4.8389	<.001	<.001
Mlambalasi	Tp# 1	2015	651	1.7	4.6	71.6	52.1	17.662	15.206	8.6212	6.3937	<.001	<.001
Mgera	Trench# 2	26	39	5.6	5.3	40.8	63.8	14.462	17.674	8.7302	13.0685	<.001	<.001

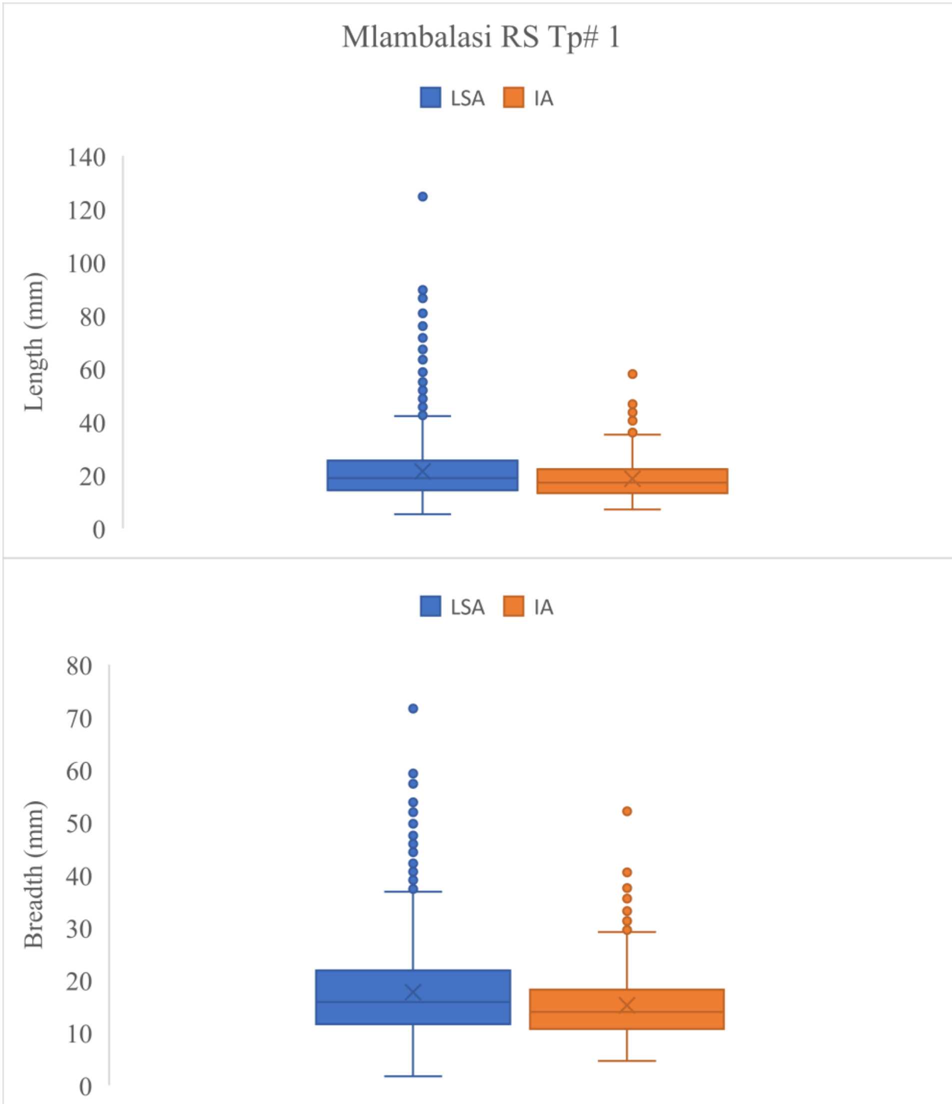


Figure 6.2: Lithic linear dimensions (length and breadth) for Mlambalasi Tp# 1.

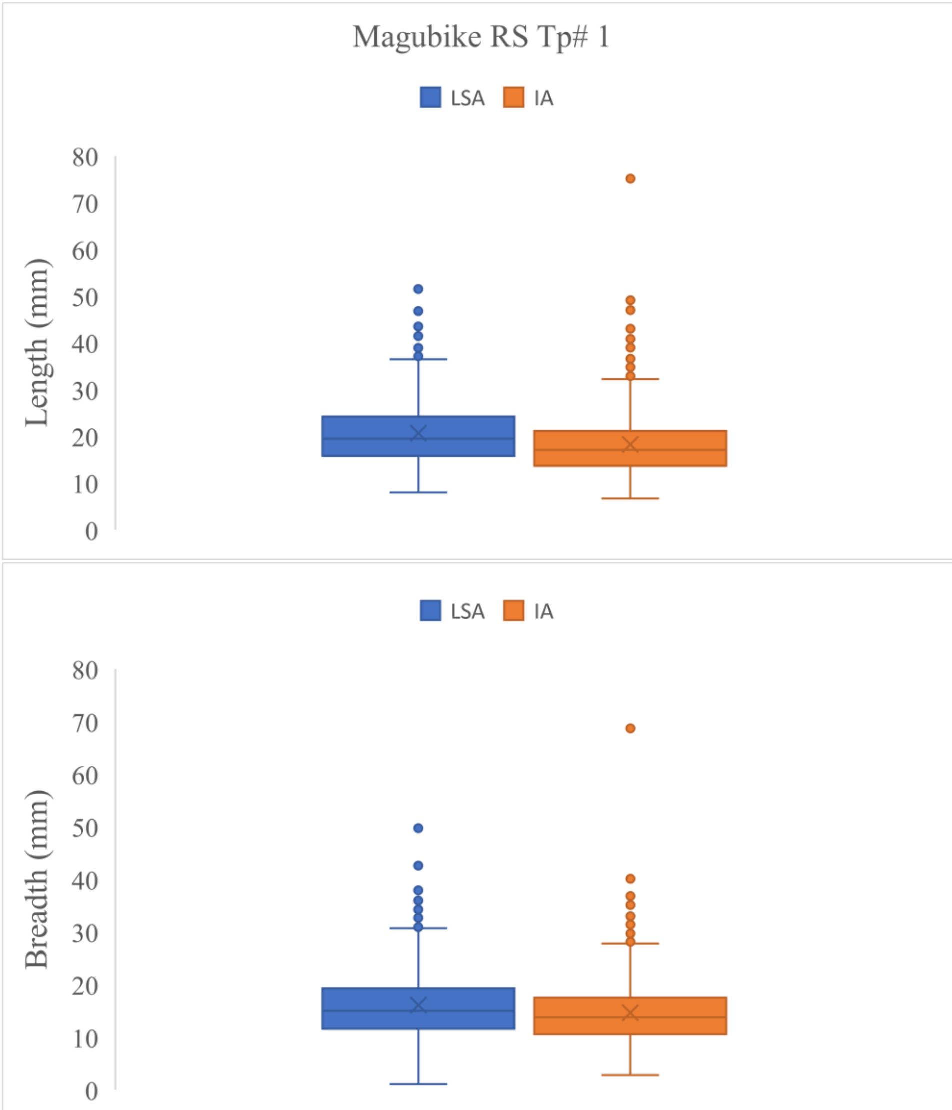


Figure 6.3: Lithic linear dimensions (length and breadth) for Magubike Tp# 1.

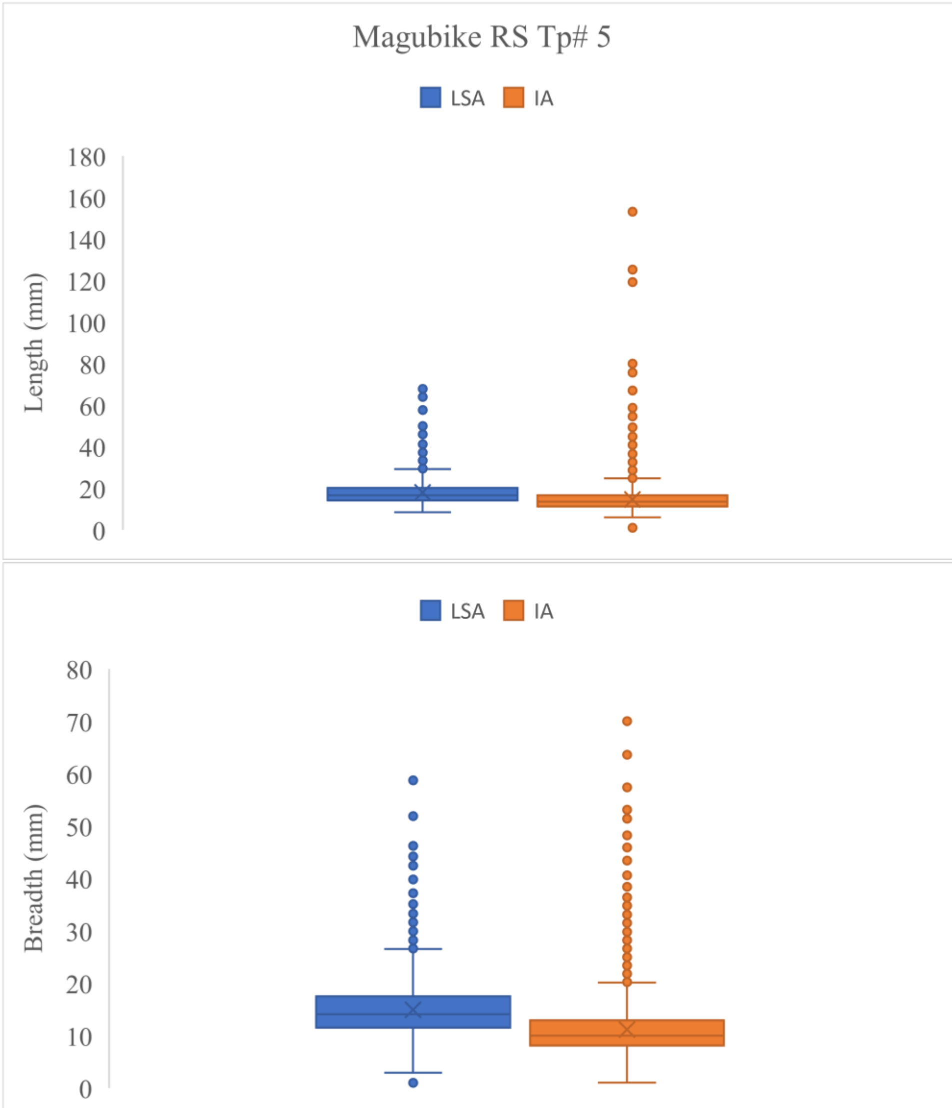


Figure 6.4: Lithic linear dimensions (length and breadth) for Magubike Tp# 5.

6.3.8 LSA and IA Contact situation: Termination and Continuity

In order to test Hypothesis II (*The LSA hunter-gatherer communities were totally replaced by the IA agropastoralists*), the study focused at the excavation levels (depth) against cultural designation. This yielded interesting results for both Magubike, Mlambalasi, and Mgera sites. Generally, all sites that contained LSA and IA artifacts indicated the continuous production of lithic artifacts from LSA towards the entire IA time period. However, the production of lithics prolonged in the LSA context compared to IA context. There was also fluctuation in terms of lithics over time per all cultures evidence through arbitrary levels (Figures 6.5-6.8).

The study noted the sharp increase of lithic quantity at the time approaching to the contact towards or at the termination points between LSA and IA cultures for most of units (Figures 6.5-6.8). Such observation is mostly recorded at the depth of ranging between 45 to 55 cm for site such as Mlambalasi Tp# 1 and Magubike Tp# 1 (Figures 6.5-6.7). This observation, however, is not uniform across all test pits or trenches. For example, some units such as Magubike Tp#5 recorded a sharp increase of lithic quantity at level 11 (100-110 cm) which is 20 cm interval prior the contact with IA context that is 80 cm below the surface (Figure 6.7). Moreover, the contact indicated almost the similar number of lithic artifacts between the two cultures that is N=3002 (80-90 cm) for LSA and N=2644 (70-80 cm) for IA (Figure 6.7). The similar scenario was observed at Mgera site trench# 2 whereby at the end of LSA (80-90 cm) N=35 of lithics were recorded not much different from N=22 (70-80 cm) observed at the beginning of IA period (Figure 6.8).

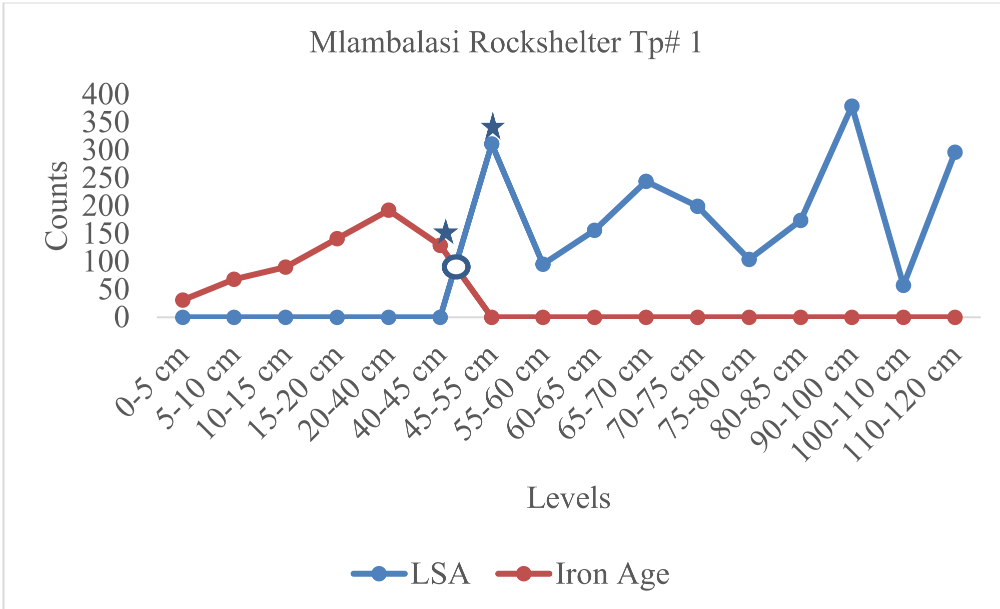


Figure 6.5: The frequency of lithic artifacts for cultural designation per depth. The star indicates the end of LSA and the beginning of IA cultures. The round indicates the meeting/termination point.

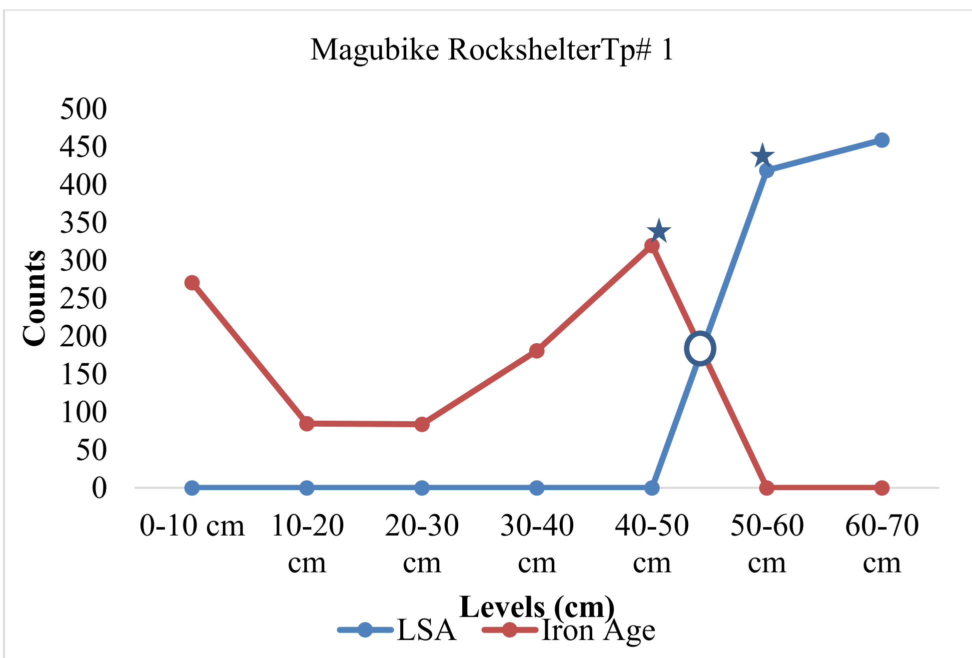


Figure 6.6: The frequency of lithic artifacts for cultural designation per depth. The star indicates the end of LSA and the beginning of IA cultures. The round feature indicates the meeting/termination point.

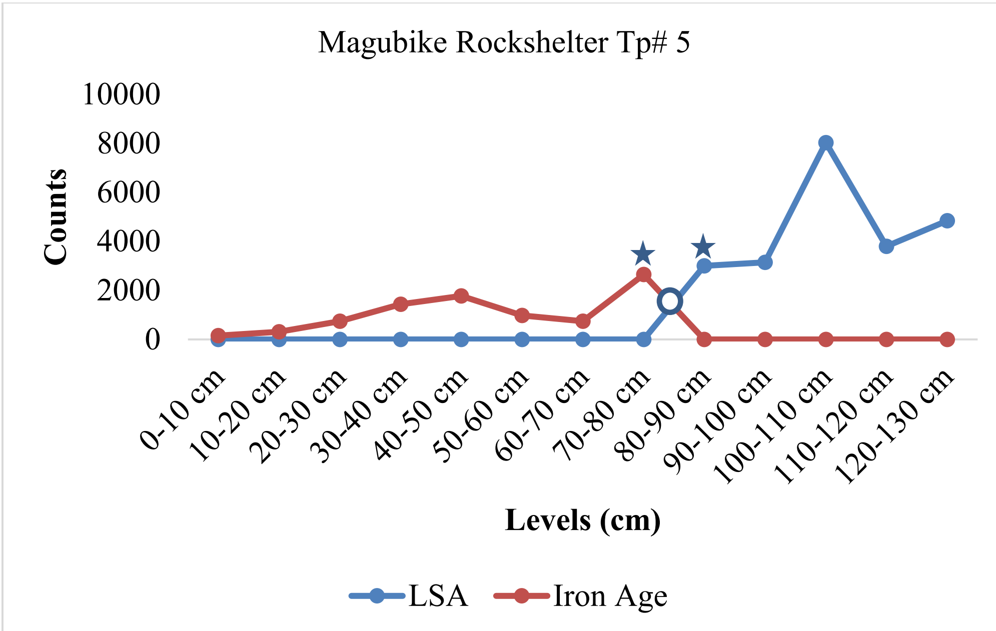


Figure 6.7: The frequency of lithic artifacts for cultural designation per depth. The star indicates the end of LSA and the beginning of IA cultures. The round feature indicates the meeting/termination point.

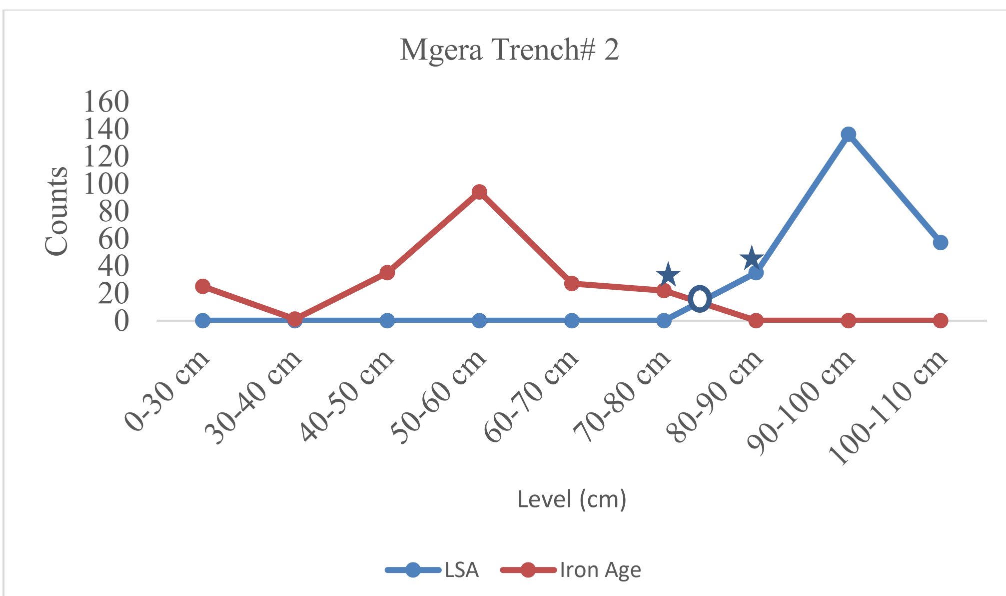


Figure 6.8: The frequency of lithic artifacts for cultural designation per depth. The star indicates the end of LSA and the beginning of IA cultures. The round feature indicates the meeting/termination point.

After the IA took over from LSA the study shows there was a gradual increase of lithic quantity from the termination point (LSA-IA contact point) that persists to ~30-50 cm before starting inclination towards where IA cultures ends. This formed the slopy feature specifically for Mlambalasi Tp# 1, Magubike Tp# 5, and Mgera Trench# 2 (Figures 6.5, 6.7, and 6.8). It should also be understood that not all units had such trends. Thus, some had inconsistent trend of sharp increase and decrease of lithics per levels as evidenced at Magubike Tp# 1, 3, 8 and 12 (Figure 6.6, 6.9-6.11).

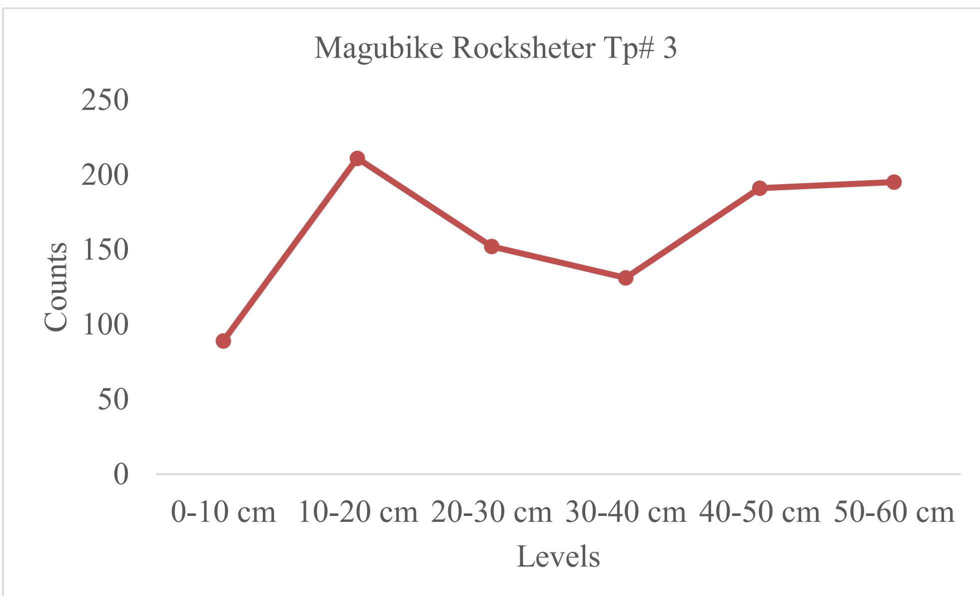


Figure 6.9: The trend of lithic artifacts per levels/depth (IA culture).

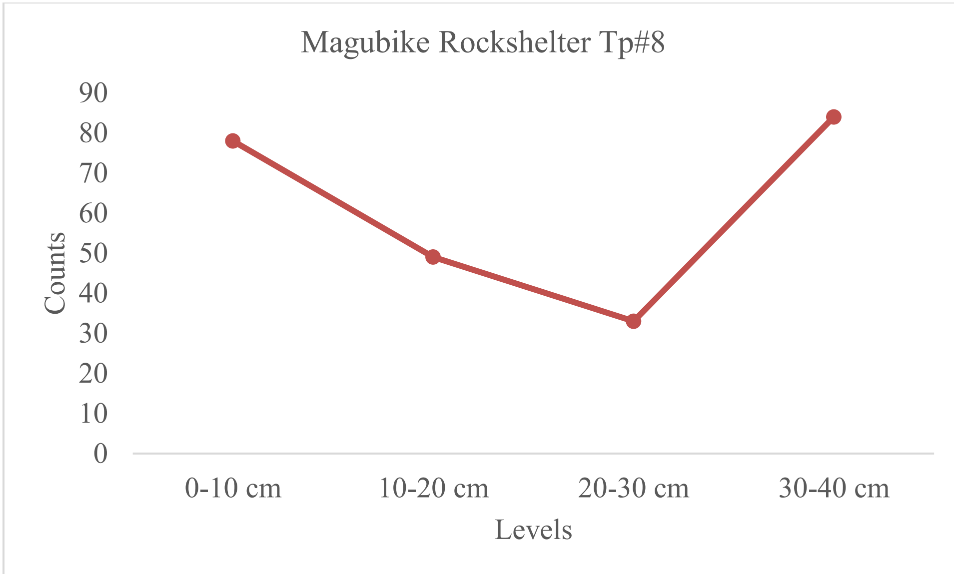


Figure 6.10: The trend of lithic artifacts per levels/depth (IA culture).

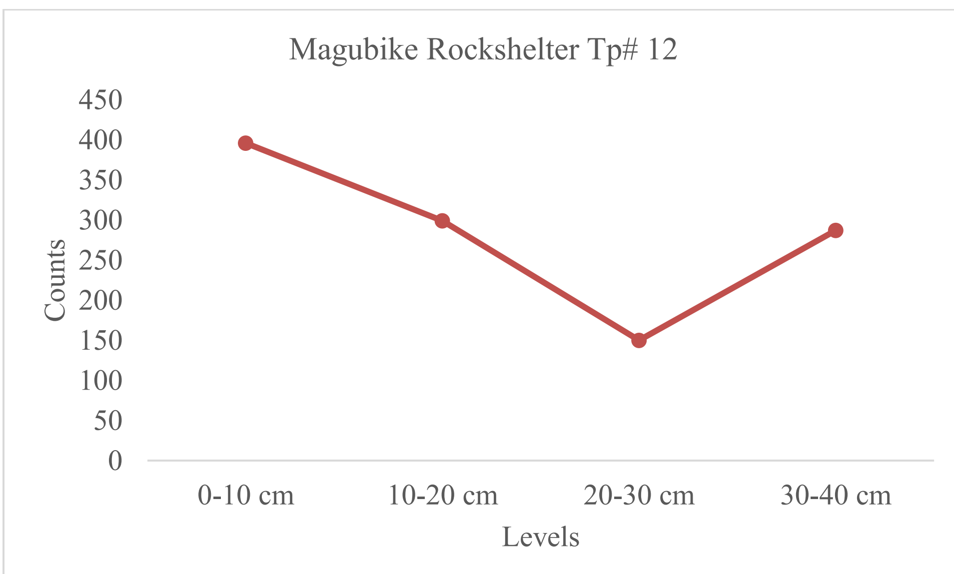


Figure 6.11: The trend of lithic artifacts per levels/depth (IA culture).

6.4 Interpretation

The differences in lithic frequencies per site/units observed by the current study may be affiliated to variations in excavation unit sizes, depositional factors, and depth. This aligns with some scholars (Andrefsky 2008; Blinkhorn and Grove 2021) who have pointed that a range of factors may influence the composition of stone tool assemblages. They include: first, different approaches to the practice of archaeology can affect the composition of stone tool assemblages. For example, artifact assemblages from surface surveys may differ in composition for those recovered by systematic excavations, whilst larger excavations or more systematic survey protocols may recover larger stone tool assemblages with a chance of sampling greater behavioral diversity. Whilst partly governed by depositional processes and factors of preservation, as well as past behaviors, the examination of caves and rock shelters in contrast to open-air sites is also a choice that features in archaeological fieldwork design. Second, geographic factors, such as altitude and roughness of terrain, can significantly impact patterns of mobility amongst human populations. The above factors are useful when it comes to the current study that involved excavation units of different sizes, context (rockshelters vs open-air sites), and geographical altitude differences.

The dominance of quartz in Iringa and other neighboring regions has been presented earlier (Biittner 2011; Bushozi 2011; Willoughby 2012). Elsewhere in Tanzania specifically the Kondoa-central region, quartz was found to dominate the assemblage by over 99% (Kessy 2013). Biittner (2011) however pointed that quartz and quartzite are difficult to characterize because it is difficult to determine first, if the fracture has been intentionally produced and second, what type of percussion was used in the reduction. And therefore, Biittner (2011) excluded quartz and quartzite in her technological and raw material analyses. Instead, they were considered in terms of the entire assemblage composition. In line with Biittner, the current study also noted that apart from higher quantity of quartz and quartzite in the lithic assemblages of the current study still were not commonly used in tool production. Instead, other raw materials such as chert and other metamorphic rocks were considered. Although chert is not indicated on any geological map for Iringa or surrounding regions, it is commonly found at the archaeological sites throughout Iringa and Tanzania (Biittner 2011:201).

Despite of differences in frequency, almost all tool types recorded in LSA culture were present in IA culture except few of them like amorphous core. This may signify the continuation in terms of technology from LSA to IA. The difference could be in other attributes like size (length and breadth) as presented in the next paragraph. The more or less observation was made by scholars (Willoughby 2012; Biittner et al. 2017) for Iringa LSA and IA assemblage. Elsewhere in Tanzania specifically the central region a related observation was also made by (Kessy 2005, 2013).

The observed linear dimensions could have implications on settlement, population density, and resource utilization. Thus, it is possible that as the LSA people transformed to permanent settlement in response to IA interactions there is a possibility of use and reuse of the same tool/raw material. This may have led to more reduction of size of tools compared to that of LSA hunter-gatherer people. This is also reflected on the small sized LSA tools recorded during Holocene period when people were less mobile compared to large sized LSA tools recorded on the Pleistocene period where people are more mobile.

The persistence of lithic artifacts production from LSA to IA periods symbolises the smooth transformations from one technology to another. From the termination or meeting point between two cultures there is no abrupt abandonment of lithic production instead there is sharp increases of lithics at the time approaching/during contact (Figures 6.6-6.8). Such scenario could signify the less mobility of LSA people causing accumulations of many artifacts at one point compared to when they were scattered (Kessy 2005, 2013). The production was later reduced gradually as time goes during the IA period. This is evidenced in some excavation units which has produced the simple line graphs having inclination/slope (Figures 6.5, 6.7-6.9). This may signify the slowly abandonment of stone tools in favour of other technologies developed during IA and later periods. However, not all units have indicated the inclination instead there is increased production at the first levels (Figures 6.6, 6.10-6.11). This may be caused by various factors including the location of the excavation unit and the nature of deposition that may determine the quantity of artifact accumulation over time.

6.5 Chapter Summary

The lithic material cultural evidence presented above offers a great opportunity to tackle various issues pertaining to the current study. The lithic frequency variations have been recorded per site/excavation units following various reasons provided in the sub-section of interpretation. Through lithics it has been realised that the LSA people were transformed slowly into IA cultures through the acculturation process. Through this chapter the characterization of lithic artifacts in relations to cultures has been attained. This is indicated by some attributes presented above such as linear dimensions, raw material, and tool types.

CHAPTER 7: FAUNAL REMAINS

7.1 Introduction

The current study presents the faunal analytical results from the secondary data previously excavated by IRAP members currently housed at the NMT that were not yet analyzed. While the author excavated archaeological material from Mgera site in 2021, (trench 2) the faunal material was too fragile and fragmented and therefore excluded in the analysis. Therefore, the faunal assemblage (falls under LSA and IA context) analyzed in this study was excavated by IRAP members between 2006 and 2012, for Magubike and Mlambalasi rockshelters. While the MSA fauna was extensively analyzed by Frank Masele (2017; Masele and Willoughby 2021), the initial analysis of LSA and IA fauna from Magubike and Mlambalasi rockshelters were completed by Collins (2009) as well as Collins and Willoughby (2010). The latter authors' analysis focused on material from Tp# 1 and 2 for the Mlambalasi rockshelter and Tp# 1, 2 and 3 for the Magubike rockshelter (Figure 5.1, 5.6). The current study analyzed fauna from Magubike excavated in 2012 (Tp# 6-12; Table 5.6-5.8), as well as Mlambalasi fauna excavated in 2010 (from 6 units: I-9 to I-11 and J-9 to 11; Table 5.13).

The faunal analysis was very important for the current study in various aspects including: First, to identify what animal species are present in the faunal assemblage for both cultures such as LSA, PN (if any), and IA in order to answer hypothesis II, III, and research question 1. To find out if those species continuously utilized from LSA to IA context in order to answer the hypothesis II. To identify animal sizes, their ages, and how are they represented in both cultural contexts, and to unravel the human behaviors exhibited through faunal material across cultures. This chapter therefore, presents the faunal analytical methods and results. Finally, the chapter provides an interpretation and the summary.

7.2 Faunal Analytical Methods

Having granted permission to loan material from the National Museum of Tanzania (NMT) to the University of Dar es Salaam (UDSM) (refer to Chapter 4), the necessary data preparation was carried out at the Department of Archaeology and Heritage Studies (DoAHS). The initial activities involved cleaning and sorting (Figure 7.1b). Specimens adhering calcium carbonate ($CaCo_3$) concretions, particularly those of Mlambalasi, were cleaned using acetic acid (CH_3COOH), a similar method used in Masele (2017:158) but not used by Collins (2009) who have both worked on fauna from Iringa Region. This was done by immersing specimens in a dilute CH_3COOH (<5%) between 1 and 3 hours in order to remove the concretion matrices that appeared on the cortical surfaces (Figure 7.1a). Afterwards, they were washed using clean water to remove salts and were then left to air-dry slowly. Throughout this process, careful observation of context was considered to ensure no mixture of material. The archaeofaunal material was then analyzed, following the adapted and modified codebook developed by Masele (2017; see Appendix III). The basic information of the assemblage including site name, year of excavation, cultural designation, and context was recorded first for each specimen. Only specific variables were considered in relation to the objectives of the current study as described below.

- Identifiability
- Bone fragmentation
- Skeletal element Quantification
- Taxon – e.g. species, genus, or artiodactyls or mammal class
- Animal Body Size Class e.g. size 1, 2
- Aging criteria
- Long bone Portion – e.g., proximal, distal, shaft, etc.

- Weathering stage
- Surface modification–e.g., burnt, cut mark, gnaw, etc.

Figure 7.1: (a) faunal remains immersed in Acetic acid b) Sorting of fauna material at UDSM (Photo by Lucas Said 2021).

7.2.1 Identifiability

The question of identifiability of each specimen was considered first before it was taxonomically quantified. Thus, all specimens missing diagnostic features were classified as unidentified and vice versa. The specimens were then identified to skeletal parts such as humerus, mandible, and femur following Rikki Walker's (1985) guidebook. Long bone elements were grouped into four category including proximal epiphysis, mid-shaft, distal epiphysis, and complete element following scheme developed by Domínguez-Rodrigo (1997, 2009). For mid-shaft section, attempts were done to identify skeletal elements by using morphological features and anatomical landmarks (e.g., foramina, muscle attachments), shaft cortical thickness, cross-sectional geometry, and properties of the medullary cavity (Barba and Domínguez-Rodrigo 2005; Masele 2017). Any mid-shaft portion that lacked the aforementioned criteria were generally categorized as 'mid-shaft' (see Appendix III). For all specimens, the maximum linear dimension was recorded by using Mituyoyo Digital Vernier Caliper (mm). This was done in order to understand the completeness and the rate the fauna fragmentation.

7.2.2 Quantification of Taxonomic Abundance

Zooarchaeologists measure a variety of variables in order to assess taxonomic abundance on archaeofaunal assemblage (Gifford-Gonzalez 2018:185). These methods include Number of identified Specimen (NISP), Minimum Number of Elements (MNE), Minimum Number of Individual (MNI) or Minimum Number of Animal Unity (MAU) (Lyman 1994). Often one or more methods can be used depending on the nature of faunal material recovered from the archaeological records and the comparative methods used (Biginagwa 2012; Gifford-Gonzalez 2018:185). To this end, faunal specialist does not use similar technique and standard when working on the faunal specimens that differs on the degree of identifiability. The NISP and MNI has gained a sound appreciation for many faunal specialists (Klein and Cruz-Uribe 1984; Lyman 1994; Gifford-Gonzalez 2018:185). NISP is an observable unit for defining the number of Identified Specimens per taxon (Lyman 1994). On the other hand, MNI is defined as the quantification of the total number of individuals necessary to account for all the skeletal material identified for each taxon (Klein and Cruz-Uribe 1984).

Although NISP and MNI have been widely used by several faunal specialist, each method has its strength and weakness summarised by (Klein and Cruz-Uribe 1984; Marshall and Pilgram 1993; Lyman 1994; O'Connor 2000; Gifford-Gonzalez 2018). NISP, for example, lack one-to-one correspondence between specimens and whole bones resulting in multiple counting

(Marshall and Pilgram 1993; O'Connor 2000). The MNI method is sensitive to sample size and have the tendency of disregarding uneven distribution of skeletal parts on the archaeofaunal sample (Marshall and Pilgram 1993; O'Connor 2000). Nonetheless, Marshall and Pilgram (1993) as well as O'Connor (2000) stress that the shortcoming of using MNI is more serious. It often relies on the values of NISP count before applied (O'Connor 2000). After weighing the strength and weakness of the two methods, the current study employed NISP method to quantify the taxonomic abundance of the faunal assemblage from Magubike and Mlambalasi sites. Quantification of the NISP was done by simply counting all skeletal elements that could be assigned securely to the respective taxonomic group.

The taxon of identified skeletal parts was identified using the comparative samples at DoAHS (Figure 7.2). This task was accomplished under the guidance of Dr. Masele who is an archaeofaunal specialist (UDSM). Some selected faunal sample was analyzed at the Department of Veterinary Anatomy at Sokoine University of Agriculture (SUA) specifically for species identification. This department contains a large faunal comparative sample that allow fine identification of taxa and species. This task was accomplished by Prof. Gabriel Mbassa, a specialist in veterinary science. Species identification involve examination of anatomical structures; bones, processes, articular surfaces, condyles, ridges, grooves, trochanters, borders, foramina, surfaces, extremities marched to species by phyla and sizes. Skeleton composed of axial and appendicular parts each with know number of bones and locations as well as shapes and sizes.

Figure 7.2: Some comparative fauna sample used for skeletal part and taxa identification at UDSM–DoAHS. (Photo by the Author 2021).

7.2.3 Animal Body Size Class (ABSC)

The ABSC was analyzed following the method highlighted in Brain (1981) and Bunn (1982). The aim was to establish which animal per size dominates the LSA/IA assemblage. The comparison made following this method is based on the specimen recorded from live-weight of animal species. A summary of these is provided on the Table 7.1 below.

Table 7.1: ABSC description as per Brain (1981) and Bunn (1982).

Size Class	Weight	Example
1	<50 lbs/25 kg	Gazelle
2	50-250 lbs/25-115 kg	Impala, Warthog
3	250-750 lbs/115-340 kg	Topi, Wildebeest, Zebra
4	750-2000 lbs/340-900 kg	Eland, African Buffalo
5	>2000 lbs/900 kg	Hippopotamus, Rhinoceros, Giraffe

7.2.4 Mortality Profile

The age profile of the faunal sample was reconstructed using dental evidence and state of long bone epiphysis fusions. The aim of was to establish the mortality patterns of animals consumed during LSA and IA. The two are discussed below:

Dental Evidence

Stages of teeth eruption and wear patterns provide is a good variable to estimate age of an animal. Different variable controls suitability of the two methods. For instance, a jaw with a complete raw of either deciduous or permanent teeth is a good candidate for age estimation based on the stage of tooth eruption. This is in contrast when the assemblage contains high number of isolated teeth from different individual. This was the case for Magubike and Mlambalasi teeth remains. Thus, estimation of age profile was established by scoring the occlusal surface wearing pattern following (Gifford-Gonzalez 2018:131-133). This method was applied to Artiodactyla and Perissodactyla teeth remains. The former includes antelopes, cattle, sheep, goats, and pigs among others (Feldhamer et al. 2007; Gifford-Gonzalez 2018). The later, on the other hand, include donkeys or zebra (Feldhamer et al. 2007; Gifford-Gonzalez 2018). These mammals consume plant food particularly leafy vegetation or combination of leaf with other plant resources throughout their life span. The tooth crowns of these mammals continue to wear over an herbivore's life, on account of the abrasives in plant tissues and grit of the vegetation they consume. Also, plant leaves have high silicon minerals that contribute to the wearing down of the cusps and crown height of herbivore premolar and molar teeth. It should, however, be noted that Gifford-Gonzalez (2018:125) pointed out that age estimation based on the dental evidence are of low resolution but accurate. In this study, age estimate was calculated by assessing whether the premolar and molar exhibits light, medium or heavy wearing stages.

Ideally, tooth with light wear was considered to be from a juvenile, medium wear from an adult, and substantial wear from an old individual.

Long Bone Epiphyseal Fusion

Proximal and distal end epiphysis of long bone element fuse at different stage on animal growth (Greenfield 2015). The juvenile often has unfused distal and proximal epiphysis. Moreover, distal end of some skeletal elements tends to fuse early to support body structure. Similarly, some skeletal elements proximal epiphysis such as femur fuse late. Thus, body physiology is related to body growth. Thus, complete fusion of an element represents final stage of growth for an individual. Magubike and Mlambalasi site, long bone elements were examined to establish whether they were unfused, partially, or fully fussed. These variables were then used to estimate the age of animal recovered from the study area.

7.2.5 Weathering

In order to understand the state of faunal preservation at the sites, weathering stages of the faunal remains were assessed following Behrensmeyer's (1978) bone weathering stages. These include stage 0=bone surface shows no cracking or flaking greasy; soft tissue present. Stage 1=bone surface show cracking, usually longitudinal, fat, skin and other tissue absent/cracking confined to the outermost layer of the bone**.** Stage 2=bone surface shows flaking, usually along the edges of cracks, crack edges are angular, with no rounding; exfoliation started. Stage 3=bone surface shows roughened patches resulting from the flaking of the surface bone. Fibrous texture, weathering only 1.0 to 1.5 mm deep and crack edges rounded. Stage 4=bone surface is rough, with loose splinters. Cracks are wide, with roughened or actively splintering edges; weathering penetrates to inner cavities; cracks open. Stage 5=bone is disintegrating into splinters and the original shape may no longer be apparent. Bone mechanically falling apart into pieces, very fragile.

7.2.6 Bone Surface Modification

The current study explored bone surface modification into two groups namely human and non-human induced modifications. The goal was to verify whether there is a continuity of human subsistence behaviour across LSA and IA context, and the role of other agent (if any) on the accumulation of faunal assemblage recovered from the site. For human modification, cut marks, percussion marks, and traces of burning were recorded. Identification of these marks followed the morphological criteria published by various scholars (Pott and Shipman 1981; Bunn 1981; Blumenschine and Selvaggio 1988; Blumenschine 1995; Stiner et al. 1995). Magubike and Mlambalasi produced fauna from LSA and IA context. Thus, cut marks follow the standard description developed by Potts and Shipman (1981:588) and Olsen (1988).

Herein, the conventional definition of cut marks that is an elongated grove with a V shaped, is maintained (see: Potts and Shipman 1981). This conclusion is because both cut marks made by stone and metal blade produce V shaped grooves and notable difference are the size of marks. The author is aware that crocodile tooth marks can potentially mimic cut marks. However, these reptiles have never been reported around Magubike and Mlambalasi sites. Induced cut marks were inspected using a 10x hand lens. Observed cut marks were further subjected to binocular microscope for more verifications (Figure 7.3). Cut marks were recorded based on bone section (proximal end, mid-shaft, and distal end) following Domínguez-Rodrigo (1997) and Domínguez-Rodrigo et al. (2009). Percussion marks were described following Blumenschine and Selvaggio (1988) and Blumenschine (1995). These were recorded in forms of percussion pit or notch and associated microstrains.

Traces of burning were examined using macroscopic appearance and color; this follows the method of Stiner et al. (1995). Burning was grouped into six categories representing different stages. These include: Stage 0=not burned (cream/tan), stage 1=slightly burned; localized and half carbonized stage, stage 2=> 50% carbonised/lightly burned, 3=fully carbonized (completely black), stage 4=localized half carbonized (more white than black), stage 5=> 50% calcined/more white than black, and stage 6=fully carbonized (completely).

Non-human modification marks, such as rodent gnaw marks and carnivore tooth marks, were described following (Brain 1981; Bunn 1981, 1982; Blumenschine 1995). In contrast to cut marks, carnivore tooth marks are elongated grove with U shape, and they are technically wider in cross section (Pott and Shipman 1981; Blumenschine 1995).

Figure 7.3: Bone surface modification examination by Dr. Frank Masele at UDSM and Photographed using a Dino-Lite Premier AM5018MZTL (Photo by the Author 2021).

7.3 Fauna Analytical Results

7.3.1 General Assemblage

A total number of 11,916 faunal remains from Mlambalasi-HwJf-02 and Magubike-HxJf-01 were analyzed (Table 7.2). Out of 11,916, N=9747 (81.8%) were recorded at Mlambalasi and N=2,169 (18.2%) at Magubike rockshelter. The faunal remains from Magubike were recovered from seven test pits and six units from Mlambalasi (Table 7.2).

Table 7.2: Number of faunal assemblages of the current study per each site and unit/test pit.

Site Name	Unit/TP	Frequency	Percent
Magubike rockshelter	TP-6	7	0.1
	TP-7	247	2.1
	TP-8	235	2.0
	TP-9	573	4.8
	TP-10	321	2.7
	TP-11	25	0.2
	TP-12	761	6.4
Mlambalasi rockshelter	1-11	3356	28.2
	J-10	344	2.9
	1-9	850	7.1
	J-9	669	5.6
	I-10	876	7.4
	J-11	3652	30.6
	Total	**11,916**	**100.0**

7.3.2 Identifiability

Overall, 18% of all faunal remains recovered from Magubike and Mlambalasi were identified to a skeletal part representation (Table 6.3). The majority (13.7%) of identified specimens were recorded at Mlambalasi site compared to Magubike (4.6%).

Table 7.3: Faunal identifiability.

Identifiability				Total
Identifiable (NISP)			Unidentifiable	
Site Name	Magubike rockshelter	544 (4.6%)	1625 (13.6%)	2169 (18.2%)
	Mlambalasi rockshelter	1628 (13.7%)	8119 (68.1%)	9747 (81.8%)
Total		**2172**	**9744**	**11916**
Percentages		18.20%	81.80%	100%

7.3.3 NISP Fragmentation Condition

Magubike and Mlambalasi faunal remains are highly fragmented with most specimens measuring between 0-40 mm (Figure 7.4). Specimens measuring above 40 mm are rare.

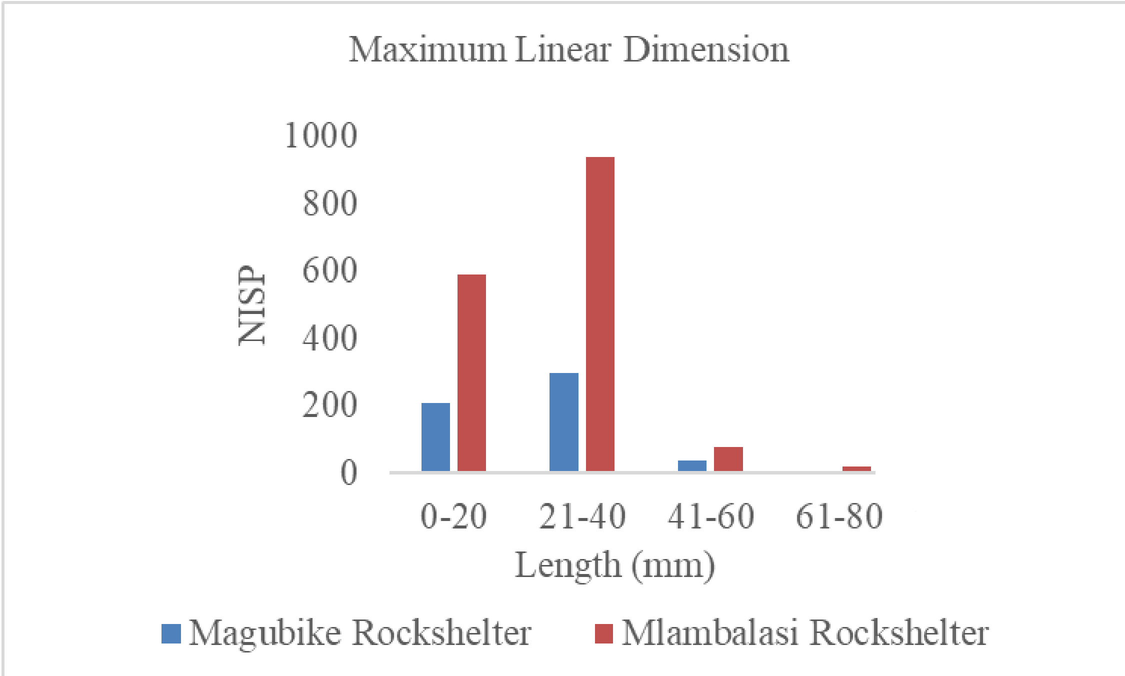


Figure 7.4: NISP Fragmentation condition for Magubike and Mlambalasi rockshelters.

7.3.4 Bone Weathering

Faunal assemblage from Magubike and Mlambalasi exhibit different weathering stages. Majority falls under stage 2 and 3 (Table 7.4). Only a few belong to stages 1, 4 and 5. This pattern is consistency when considering a specific site. Despite the effort to remove concretions from the faunal assemblage, only 50-75% was removed from the specimen. As such, some concretion persisted on the specimen. At Magubike site a total of 204 (or 37.5%) and Mlambalasi 454 (or 28%) specimens displayed evidence of calcium concretion.

Table 7.4: Bone weathering stages according to Behrensmeyer (1978).

Behrensmeyer's 1978 Bone Weathering Stages	**Site Name**		**Total**
	Magubike Rockshelter	**Mlambalasi Rockshelter**	
Stage 1	69 (13%)	16 (<1%)	**85 (4%)**
Stage 2	425 (78%)	964 (59%)	**1389 (64%)**
Stage 3	37 (7%)	647 (39%)	**684 (31%)**
Stage 4	13 (2%)	0	**13 (<1%)**
Stage 5	0	1 (<1%)	**1 (<1%)**
Total	**544**	**1628**	**2172**

Weathering has different impact on the cortical condition of the faunal remains from Magubike and Mlambalasi rockshelters (Figure 7.5). Majority of faunal remains at both site N=1199 (66.2%) exhibit good to moderate/fair cortical preservation, while some N=612 (33.8%) exhibits bad/poor cortical preservation.

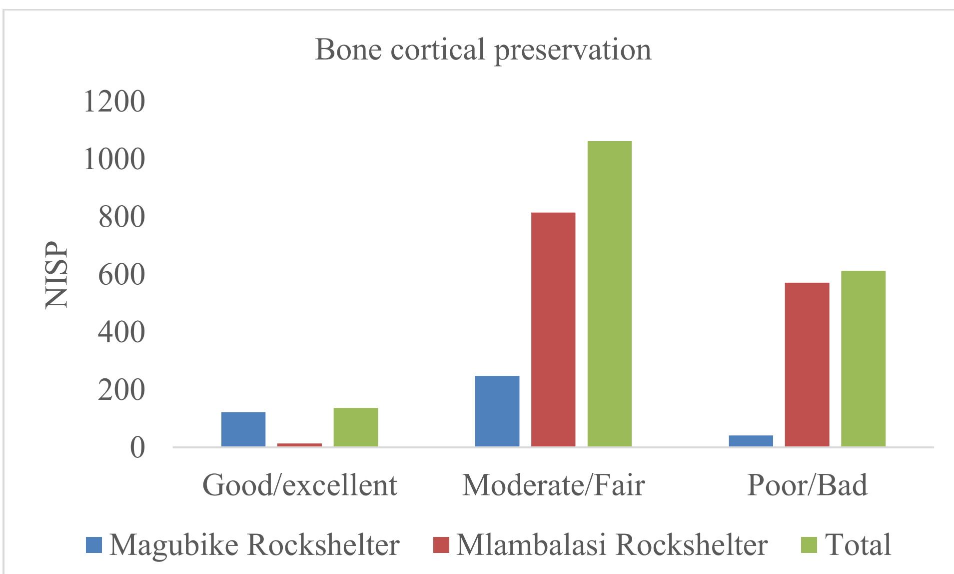


Figure 7.5: Bone cortical preservation in the Magubike and Mlambalasi faunal assemblages.

7.3.5 Skeletal Element Representation

The faunal assemblage from Magubike and Mlambalasi comprise a representation of almost all skeletal elements (Table 7.5). Over half of the assemblage are mid-shafts. Ribs N=349 (16%) have the second highest count in the assemblage. Long bones such as humerus, femur, tibia, and phalanges fall between 2-4%. Teeth remains N=58 (3%) are also fairly represented. The remaining skeletal elements accounts between <1 to 1% each. There is an observable difference on the skeletal element representation per site. The majority of identified elements such as horns, crania, teeth vertebra and ribs have higher count at Mlambalasi as compared to Magubike.

Table 7.5: Skeletal element representation per site.

Skeletal element	Site Name Magubike Rockshelter	 Mlambalasi Rockshelter	Total
Horn/Horn core	3 (<1%)	10 (1%)	13 (1%)
Cranium	1 (<1%)	30 (2%)	31 (1%)
Maxilla	0	6 (<1%)	6 (<1%)
Mandible	5 (<1%)	22 (1%)	27 (1%)
Teeth	23 (4%)	35 (2%)	58 (3%)
Atlas	2 (<1%)	2 (<1%)	4 (<1%)
Cervical Vertebra	1 (<1%)	0	1 (<1%)
Thoracic Vertebra	1 (<1%)	2 (<1%)	3 (<1%)
Lumbar Vertebra	1 (<1%)	13 (1%)	14 (1%)
Sacral Vertebra	1 (<1%)	1 (<1%)	2 (<1%)
Vertebra	0	36 (2%)	36 (2%)
Rib	131 (24%)	222 (14%)	353 (16%)
Scapula	6 (1%)	10 (1%)	16 (1%)
Sternum	0	1 (<1%)	1 (<1%)
Humerus	26 (5%)	49 (3%)	75 (4%)
Radius	7 (1%)	9 (1%)	16 (1%)
Ulna	2 (<1%)	4 (<1%)	6 (<1%)
Radius+Ulna	2 (<1%)	1 (<1%)	3 (<1%)
Scaphoid	2 (<1%)	0	2 (<1%)
Lunate	1 (<1%)	1 (<1%)	2 (<1%)
Pisiform	0	1 (<1%)	1 (<1%)
Trapezium	0	1 (<1%)	1 (<1%)
Trapezoid	0	1 (<1%)	1 (<1%)
Hamate	1 (<1%)	0	1 (<1%)
Metacarpal	16 (3%)	0	16 (1%)
Sesamoid	1 (<1%)	3 (<1%)	4 (<1%)
Pelvis/Innominate	5 (1%)	9 (1%)	14 (1%)
Ilium	0	1 (<1%)	1 (<1%)
Acetabulum	1 (<1%)	1 (<1%)	2 (<1%)
Ischium	2 (<1%)	0	2 (<1%)
Femur	26 (5%)	36 (2%)	62 (3%)
Tibia	24 (4%)	19 (1%)	43 (2%)
Tarsal	1 (<1%)	0	1 (<1%)
Astragalus	2 (<1%)	6 (<1%)	8 (<1%)
Calcaneum	1 (<1%)	3 (<1%)	4 (<1%)
Navicular-Cuboid	0	1 (<1%)	1 (<1%)
Metatarsal	11 (2%)	1 (<1%)	12 (1%)
Phalanx 1	6 (1%)	0	6 (<1%)
Phalanx 2	12 (2%)	22 (1%)	34 (2%)
Phalanx 3	2 (<1%)	9 (1%)	11 (1%)
Premaxilla	35 (6%)	51 (3%)	86 (4%)
Mid-shaft	183 (34%)	1009 (62%)	1192 (55%)
Total	**544**	**1628**	**2172**

7.3.6 Long Bone Portion per Skeletal Element

Magubike and Mlambalasi long bone portions are dominated by mid-shafts followed by proximal epiphyses and distal epiphyses. Complete elements are represented with a few specimens (Table 7.6). Considering the specific skeletal element portion, femur N=46 and humerus N=45 have the highest number of mid-shafts. This is followed by humerus N=25 proximal epiphyses and distal epiphyses N=5. Other long bone skeletal element portions are represented but in a minimal number (Table 7.6).

Table 7.6: Long bone skeletal element portions per site.

Long bone portion	Element	Site Name		Total
		Magubike Rockshelter	**Mlambalasi Rockshelter**	
Proximal epiphysis	Humerus	9	16	25
	Radius	2	7	9
	Ulna	2	3	5
	Metacarpal	9	0	9
	Femur	5	6	11
	Tibia	2	1	3
	Metatarsal	0	1	1
	Phalanx 1	1	0	1
	Phalanx 2	3	0	3
Total		**33**	**34**	**67**
Mid-shaft	Humerus	16	29	45
	Radius	4	1	5
	Radius+Ulna	2	0	2
	Metacarpal	6	0	6
	Femur	20	26	46
	Tibia	20	9	29
	Metatarsal	10	0	10
	Phalanx 1	1	0	1
	Phalanx 2	0	1	1
	Mid-shaft	183	1009	1192
Total		**262**	**1075**	**1337**
Distal Epiphysis	Humerus	1	4	5
	Radius	1	1	2
	Ulna	0	1	1
	Metacarpal	1	0	1
	Femur	1	1	2
	Tibia	2	8	10
	Metatarsal	1	0	1
	Phalanx 1	1	0	1
	Phalanx 2	3	1	4
Total		**11**	**16**	**27**
Complete	Radius+Ulna	0	1	1
	Femur	0	1	1
	Phalanx 1	2	0	2
	Phalanx 2	4	0	4
Total		**6**	**2**	**8**

7.3.7 Animal Body Size Class

The overall faunal remains from Magubike and Mlambalasi rockshelters are represented with smaller, small, and medium-size mammals (*sensu* Bunn 1982; Dominguez-Rodriguez 1997, 2009). Small mammals (mammal size class 1A, 1, and 2) are the most dominant at both sites. Medium-size mammals (mammal size 3) are present but in a less frequency. Lager mammals (mammal size 4>) are rare in the assemblage (Figure 7.6). Notably, there is a difference in terms of mammal sizes between Magubike and Mlambalasi rockshelter. The latter has the highest number of animal size classes for all categories (Figure 7.6).

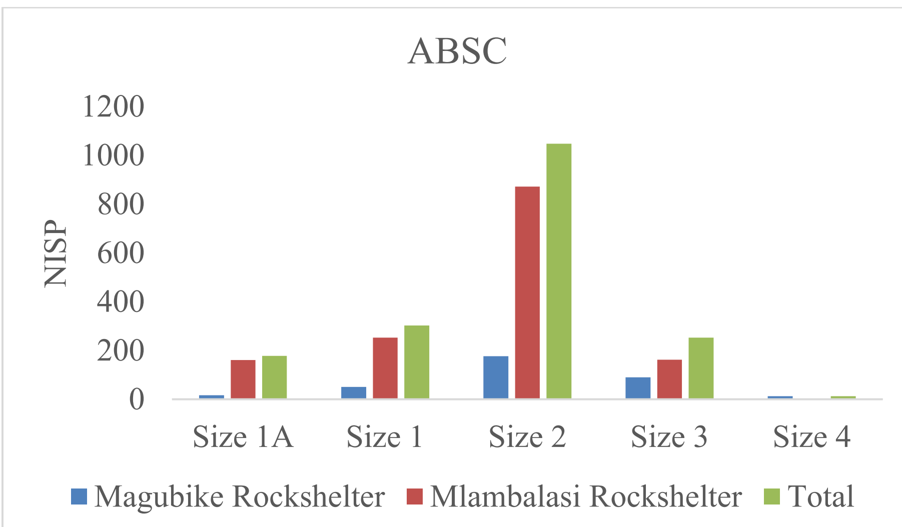


Figure 7.6: NISP Taxa for Mlambalasi and Magubike faunal sample.

The faunal remains from Magubike and Mlambalasi rockshelters constitute a variety of taxa (Table 7.7). The majority of NISP counts N=1844 (84%) were not classified to a taxa level. Of the remaining, bovids are the most dominant N=449 (20. 6%) and rodent account for N=14 (1%). The remaining taxa, such as suids, equids, reptiles, carnivores, rodents, fish, and birds are represented with <1% each. Three (<1%) shell remains were also recorded on the assemblage. In terms of site, Mlambalasi rockshelter has the highest frequency N=239 (53%) of bovid compared to Magubike rockshelter N=210 (47%). This pattern is consistency for reptiles, carnivores, and birds (Table 6.7). However, both sites provide the equal frequency of suid remains.

Table 7.7: NISP Taxon per sites.

Vertebrate Class				
Magubike rockshelter			**Mlambalasi rockshelter**	
Taxon	**Frequency**	**Percent**	**Frequency**	**Percent**
Bovid	210	38.6	239	15.0
Suid	5	0.9	5	0.3
Equid	0	0	2	0.1
Reptile	3	0.6	7	0.4
Carnivore	0	0	6	0.3
Rodent	9	1.7	5	0.3
Aves (Bird)	0	0	3	0.2
Fish	4	0.7	1	0.1
Procavia	0	0	6	0.3
Indeterminate	313	57.5	1354	83.0
Total	**544**	**100.0**	**1628**	**100.0**

7.3.8 Mammal Species Representation

Following N=30 sub-sample of faunal remains analyzed at SUA a diversity of species was represented at Magubike and Mlambalasi rockshelters, spanning from LSA to IA period. These species represents both domestic and wild mammals (Table 7.8). Small wild ruminants such as dik-dik (*Madoquane) duiker (*Cephalophinae) as well as a larger ruminant (Buffalo) were on the faunal sample. Small and large domesticated mammals such as sheep and goats *(Hircus capris and Ovi capris),* cattle (*Bos taurus*) and donkey were also identified on the fauna sample. Smaller mammals such as rock hyrax, rats, rabbit, squirrel, and hedgehog were also identified. Aves including chicken and small birds were recorded on the faunal sample. All domestic mammals were recorded from IA context while wild animal appears on both LSA and IA context. Smaller mammals are most dominant on Mlambalasi site (Table 7.8).

Table 7.8: Results of faunal samples analyzed at species levels.

Site Name	Context	Cultural Designation	Anatomical features found	Animal of origin according to anatomical features
Magubike	TP8: Level 5 (40-50 cm)	IA	Two samples 1. Distal part of long bone (medial and lateral articular condyles) bone is right humerus	1. Small ruminant such as goat
			2. Molar tooth 1 upper jaw left maxilla bone	2. Cattle
Magubike	TP8: level (10-20 cm)	IA	One specimen. Rough thick hard broken bone appearing triangular. Smooth articular surface on concave side, muscular ridges on convex side. Appears occipital bone of large mammal	Buffalo
Magubike	Tp7: level 4 (30-40 cm)	IA	Left mandible with molar teeth	Small wild antelope dik-dik (Madoquinae)
Magubike	TP8: level 4 (30-40 cm)	IA	Phalanx II (middle phalanx of right foreleg (three sided)	Antelope (impala of gazelle)
Magubike	TP12: level 5 (40-50 cm)	IA	Tooth: three sided narrow rostrally, tall lateral table of crown, Premolar tooth 4 from left mandible	Cattle
Mlambalasi	J-9 NE: Feature 1, Level 1 (0-10cm)	IA	M^3: irregularly triangular? three roots, two cusp units each with crescentic infundibulum	Cattle
Mlambalasi Mlambalasi	I-11 SW level 5 (40-50 cm)	IA	Claw: curved and flattened longitudinally (axial-abaxially), dorsal has articular surface proximally. Distal end is pointed. This is phalanx III of digit 2 of left leg of wild small carnivore mammal	Squirrel
			Long bone: large specimen is piece of long bone having olecranon fossa and supratrochlear foramen. It is distal end of humerus of small carnivore	Squirrel
Mlambalasi	J-11 NE: level 3 (20-30 cm)	IA	Upper jaw: it contains two teeth, crowns are taller on lateral side, and therefore it is upper jaw. It is not elongated centrally therefore not a carnivore. Bone is piece of maxilla of ruminant	Young Madoquinae (dik-dik)

Mlambalasi Mlambalasi	Site HwJf 02, yr 2010 level 2 (10-20 cm) two sample teeth and long bone	IA	Upper jaw: the jaw has M^1 with three roots. It has a long lateral crown surface. It belongs to a small ruminant.	Duiker
			Long bone: The specimen is a proximal end of a forelimb (left ulnar). It has expanded olecranon process, trochlear notch, and coronoid processes. This specimen belongs to a small carnivore.	Squirrel
Mlambalasi	J-10 SE: level 3 (20-30cm)	IA	M^1 fragment: the tooth is broken into 2 pieces with two roots and lateral sharp crown surface. It belongs to a small wild ruminant mammal.	Dik-dik
			Long bone: This specimen is a humerus having supratrochlear foramen. It belongs to a small carnivore.	Squirrel
Mlambalasi	J-10: Level 2 (10-20cm	IA	Right lower Molar tooth: the tooth is 4 cm long with a fused crown part. It is an equid tooth.	Donkey
			Right mandible: Long flat bone has spaces for teeth. It is mandible for a small ruminant.	Duiker
Mlambalasi	J-10 SE: Surface	IA/Historic	Left maxilla: it has 3 molar teeth each with four roots. The jaw belongs to a smaller mammal.	Rat
Mlambalasi	J-11: level 2 (10-20 cm)	IA	Lumbar vertebra	Fish
Mlambalasi	J 11 NE: level 2 (10-20 cm)	IA	Right scapula: it belongs to small avian	Bird
Mlambalasi	J-10 SW: Level 5 (40-50 cm)	IA	Mandible: It has premolar and molar teeth belonging to a small mammal	Hedgehog
Mlambalasi	J-11NE: level 3 (20-30 cm)	IA	Mandible right side	Hedgehog
Mlambalasi	I-11: level (0-10 cm,)	IA/Historic	Mandible right side	Hedgehog
			Part of molar tooth	Goat
Mlambalasi	J-11: Feature 2, Level 3: (20-30 cm)	IA	Vertebra	Fish
			Incisors	Rat
Mlambalasi	J-10 NW: Level 1-3 (10-30 cm)	IA	1. Curve thick bone with medial and lateral surfaces, cranial and caudal borders vertebral and sternal extremities = first rib	Rabbit
			3^{rd} of Phalanx 1: proximal and distal extremities with articular surfaces. It belongs to a chicken	Chicken
Mlambalasi	I-10 NE: level 2	IA	Molar tooth: Very strong tooth having partial crown and root.	Goat/sheep

	(10-20 cm)			
Mlambalasi	I -10 SE: Level 3 (20-30 cm)	IA	Left and right mandible: It shows animal has two incisor teeth on each side. This specimen belongs to *Procavia*	Rock hyrax
Mlambalasi	J-10 NW: Level 4 (30-40 cm)	IA	Very small tooth	Mouse
Mlambalasi	J-10: level 15 (140-150 cm)	LSA	Mandible with teeth premolars and molars	Dik-dik (Madoquinae)
Mlambalasi	J-10 SW: Level 1 (0-10cm)	IA/Historic	Maxilla bone with teeth (upper jaw premolars) of a small ruminant	Dik-dik
Mlambalasi	I-9: Surface	Historic	Compact bone: Bone with a process and rounded articular ridge i.e. tarsal bone of proximal row (*os tarsi tibiale*) of a small ruminant	Dik-dik
Mlambalasi	J-11: Level 7 (60-70cm)	LSA	Smallest tooth has 4 roots = 3rd molar tooth from upper jaw	Rat
			M^3: The tooth has 3 roots and belongs to a tiny ruminant	Dik-dik/duiker
			Maxilla bone with two four root molar teeth 1 to 3	Rat
Mlambalasi	J-11: Feature 2, Level 6 (50-60cm)	LSA	Right mandible with molar 2 tooth	Hedgehog
			Right mandible: it has several teeth very wit a little diastema between premolar and incisor teeth.	Hedgehog
			Small pieces of bones	Possibly rodents and hedgehog
Mlambalasi	J-10NE: Level 2 (10-20 cm)	IA	Long bone: it is 1 cm long, narrow cylindrical. Proximal end has articular concave surface with lateral and medial condyles. Distal end has articular surface separated by ridge. The bone is metatarsal III right side of a small mammalian carnivore	Squirrel
Mlambalasi	J-9 NW: Level 2 (10-20 cm)	IA	Rib from left chest	Rat
			Pieces of mandible with teeth	Rat
			Pieces of mandibles	Rabbit
Mlambalasi	J-10 + I-10: Level 2 (10-20cm)	IA	Right mandible with molar teeth	Rock hyrax

7.3.9 NISP Counts of Taxa per Cultural Designation

Table 7.9 summarizes the cultural designation of the taxa recorded at Magubike and Mlambalasi sites. Overall Mlambalasi yielded material from LSA to IA. The LSA faunal assemblage contains bovids, reptiles, carnivores, rodents, and fish, but in fewer numbers. The IA constitutes the highest frequency of taxa at Mlambalasi and Magubike sites. Nonetheless, bovids outnumber other taxa for both sites. There is a notable difference in the IA faunal representation between Mlambalasi and Magubike sites. For instance, bovid occurs in higher number N=210 (77%) at Magubike compared to Mlambalasi N=62 (33%). On other hands, equids, carnivores, and birds are represented at Mlambalasi only.

Table 7.9: NISP counts of Taxa per cultural designation.

CDs			Site Name Magubike Rockshelter	 Mlambalasi Rockshelter	Total
LSA	Vertebrate Class	Bovid		3 (0.2%)	3
		Reptile		1 (0.7%)	1
		Carnivore		1(0.7%)	1
		Rodent		1(0.7%)	1
		Fish		1(0.7%)	1
		shell Fragment		3(0.2%)	3
		Indeterminate		123 (92.4%)	123
	Total			133	133
IA	Vertebrate Class	Bovid	210 (38.6%)	62 (4%)	272
		Suid	5 (1%)	5 (<1%)	10
		Equid	0 (<1%)	2 (<1%)	2
		Reptile	3 (1%)	6 (<1%)	9
		Carnivore	0 (<1%)	5 (<1%)	5
		Rodent	9 (1.6%)	4 (<1%)	13
		Ave (Bird)	0 (<1%)	3 (<1%)	3
		Fish	4 (0.7%)	0 (<1%)	4
		Indeterminate	313 (58%)	1408 (86.4%)	1721
	Total		**544**	**1628**	**2172**

7.3.10 Age profile

Long bone epiphyseal fusion and the order of tooth eruption indicates the following results related to a faunal age profile. For both Magubike and Mlambalasi, majority of NISP long bones N=1657 (76.2%) could not be identified for the epiphyseal states because they either missed proximal or distal ends (Table 7.10). For both site long bone elements with fused proximal and distal end accounts between 3-1% respectively. Proximal fused, intermediate, and fully fused long bone elements were recorded on the LSA context for Mlambalasi only. As for the IA, there are some similarities of long bone fusions for both sites (Table 7.10). Age profile as per teeth ($M_1 – M_3$) was from the IA context only for both Mlambalasi and Magubike site (Table 7.10). Majority N=11 (79%) is adult. Of these N=9 (82%) is from Mlambalasi. Similarly, all juvenile teeth come from Mlambalasi.

Table 7.10: Long bone fusion status per site and cultural designation.

Cultural Designation	**State of Epiphyseal fusion**	**Age**	**Site Name**		**Total**
			Magubike Rockshelter	**Mlambalasi Rockshelter**	
LSA	Proximal fused	Adult		2 (<1%)	2 (<1%)
	Not applicable/ unknown	NA		22 (1%)	22 (1%)
	Fully Fussed	Aged		1 (1%)	1 (<1%)
	Intermediate			95 (6%)	95 (4%)
IA	Proximal fused	Adult	17 (3%)	18 (1%)	35 (2%)
	Proximal unfused	Juvenile	4 (1%)	3 (<1%)	7 (<1%)
	Distal fused	Adult	10 (2%)	2 (<1%)	12 (1%)
	Distal unfused	Juvenile	0 (0%)	7 (<1%)	7 (<1%)
	Not applicable/ unknown		2 (<1%)	415 (25%)	417 (19%)
	Early fusion	Adult	0 (0%)	1 (<1%)	1 (<1%)
	Fully fussed	Aged	4 (1%)	7 (<1%)	11 (1%)
	Intermediate		507 (93%)	1055 (65%)	1562 (72%)
Total			**544**	**1628**	**2172**

7.3.11 Bone Surface Modification

The overall good-moderate/fair bone surface preservation of Magubike and Mlambalasi faunal assemblage made it possible to record the human and non-human bone surface modifications.

Human-induced modifications

The human-induced surface modifications in the Magubike and Mlambalasi faunal assemblages are attributable to different stages of carcass reduction and processing into consumable parts. They include cut marks, percussion marks, and burning. A total number of 137 faunal remains had human-induced modification of either cut mark, percussion marks, or burning (Table 7.11). Majority N=85 (62%) display traces of burning followed by cut marks N=39 (28.4%), and percussion marks N=13 (9.5%). Variation observed between sites whereby majority of human-induced modifications recorded more at Magubike rockshelter compared Mlambalasi rockshelter (Table 7.11, Figure 7.7).

Table 7.11: The frequency and percentages of Human-induced modification per site.

Modification type	**Magubike**	**Mlambalasi**	**Total**
Cut mark	31 (28.4%)	8 (29%)	39 (28.4%)
Percussion marks	9 (8.2%)	4 (14.2)	13 (9.5)
Burning	69 (63.3%)	16 (57.1%)	85 (62%)
Total	**109**	**28**	**137**

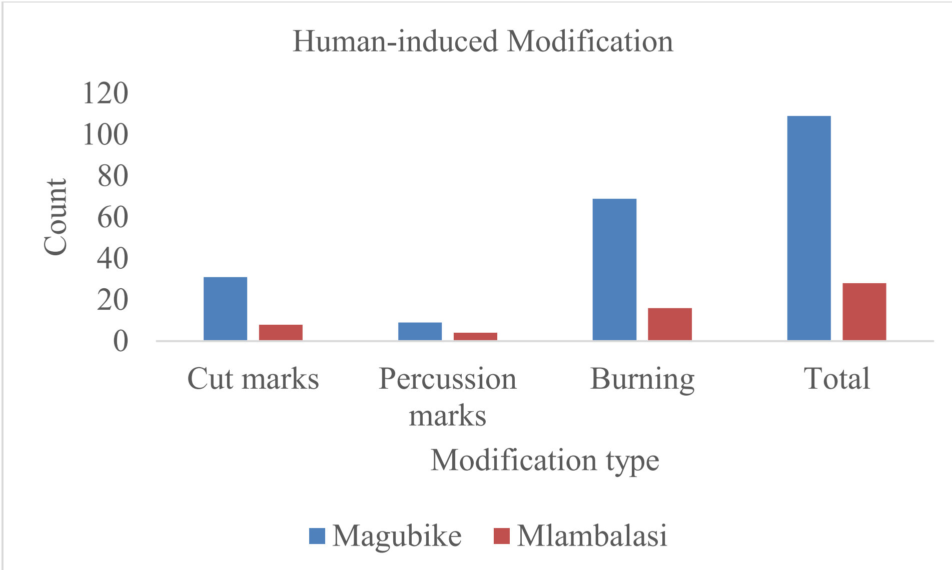


Figure 7.7: The frequency of Human-induced modification per site.

Cut marks

Cut marks were recorded on various skeletal elements with most occurred on the mid-shafts N=12 (31%) and ribs N=11 (28%) (Table 7.12). Metatarsals account for the third most abundant having N=4 (10%) of cut marks. Other elements having cut marks are summarized in Table 7.12. In terms of cultural designation all cut marks were recorded on the IA context for both sites. The recorded cut marks were placed on different position of an element (Figure 7.8 and 7.9). Majority N=11 (58%) was recorded on the mid-shafts, followed by N=11 (35.4%) on the near epiphyseal and N=2 (7.6%) on the epiphyseal for Magubike site. Mlambalasi site produced even distribution of cut marks N=4 (50%) each on the near epiphyseal and mid-shaft.

Table 7.12: Cut marks on skeletal element per site.

Skeletal Element	Site Name		Total
	Magubike Rockshelter	**Mlambalasi Rockshelter**	
Cranium	-	1 (12.5%)	1 (2.6%)
Mandible	1 (3.2%)	-	1 (2.6%)
Rib	6 (19.3%)	5 (62.5%)	11 (28.2%)
Scapula	2 (6.4%)	-	2 (5%)
Metacarpal	1 (3.2%)	-	1 (2.6%)
Ilium	-	1 (12.5%)	1 (2.6%)
Femur	1 (3.2%)	-	1 (2.6%)
Tibia	1 (3.2%)	-	1 (2.6%)
Astragalus	1 (3.2%)	1 (12.5%)	2 (5%)
Metatarsal	4 (13%)	-	4 (10%)
Phalanx 1	2 (6.4%)	-	2 (5%)
Mid-shaft	12 (39%)	-	12 (31%)
Total	**31 (100%)**	**8 (100%)**	**39 (100%)**

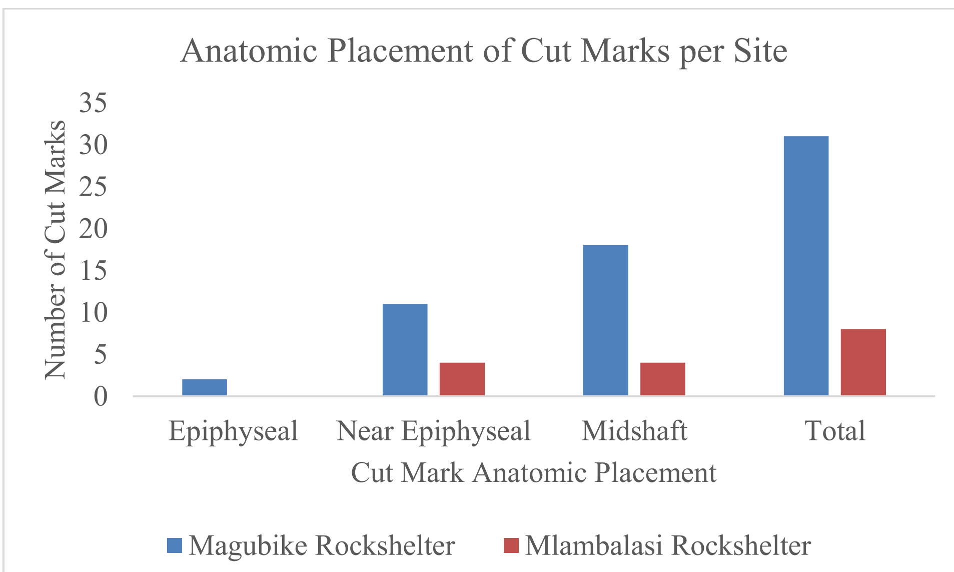


Figure 7.8: Anatomic placement of cut marks per site.

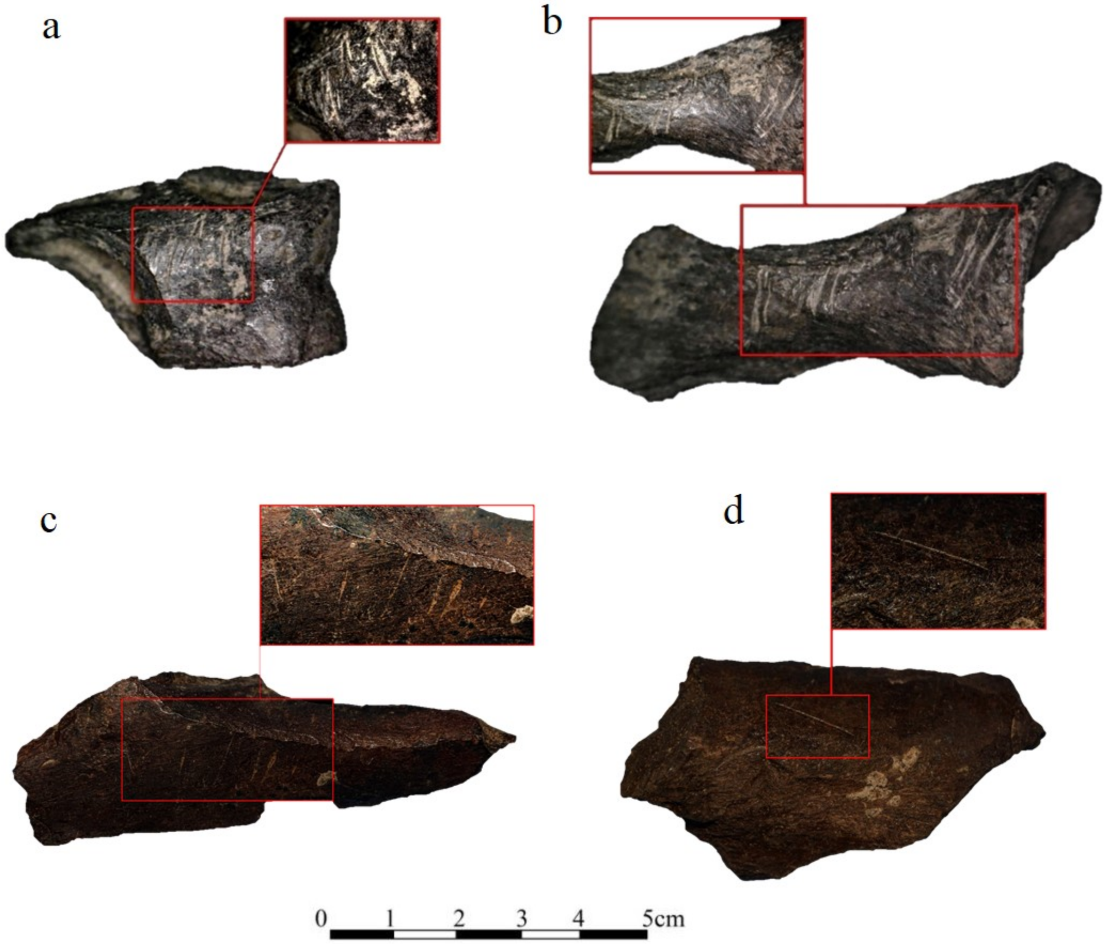


Figure 7.9: a) Cut marks on near-epiphyseal region of phalanx (b) Cut marks on near-epiphyseal and mid-shaft section of the phalanx (c-d) Cut marks on the mid-shaft section of long bones (Magnification 50x).

Frequency of Cut marks per Animal Body Size Class

Cut marks were recorded on both small and large mammals (Figure 7.10). Majority N=13 (42%) was recorded on the small mammals (size 1 and 2), followed by large mammals (size 3 and 4) N=9 (29%) for Magubike faunal assemblage. Further, a total number of 9 (29%) cut marks were recorded on undetermined ABSC bone specimens at the same site. For the case of Mlambalasi site all cut marks N=8 (100%) was inflicted on small mammals (size 1 and 2).

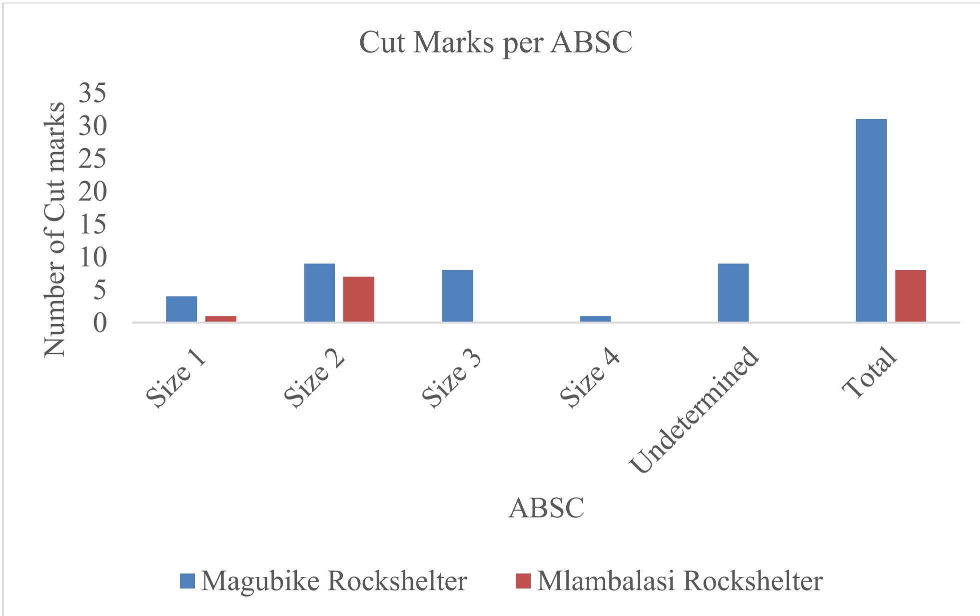


Figure 7.10: Cut marks per ABSC for Magubike and Mlambalasi rockshelters.

Percussion Marks

Figure 7.11 presents a summary of percussion marks recorded at Magubike and Mlambalasi rockshelters. Like cut marks, all percussion marks were recorded on the IA context. All the percussion mark only occurs on mammal size 2 N=8 (62%) and size 3 N=5 (38%). Considering site specific, Magubike has a total number of N=9 (69%) of percussion marks representing N=6 (67%) for size 2 and N=3 (33%) for size 3. Mlambalasi rockshelter produced N=4 (31%) of percussion marks, whereas mammal size 2 and 3 are represented with 50% each.

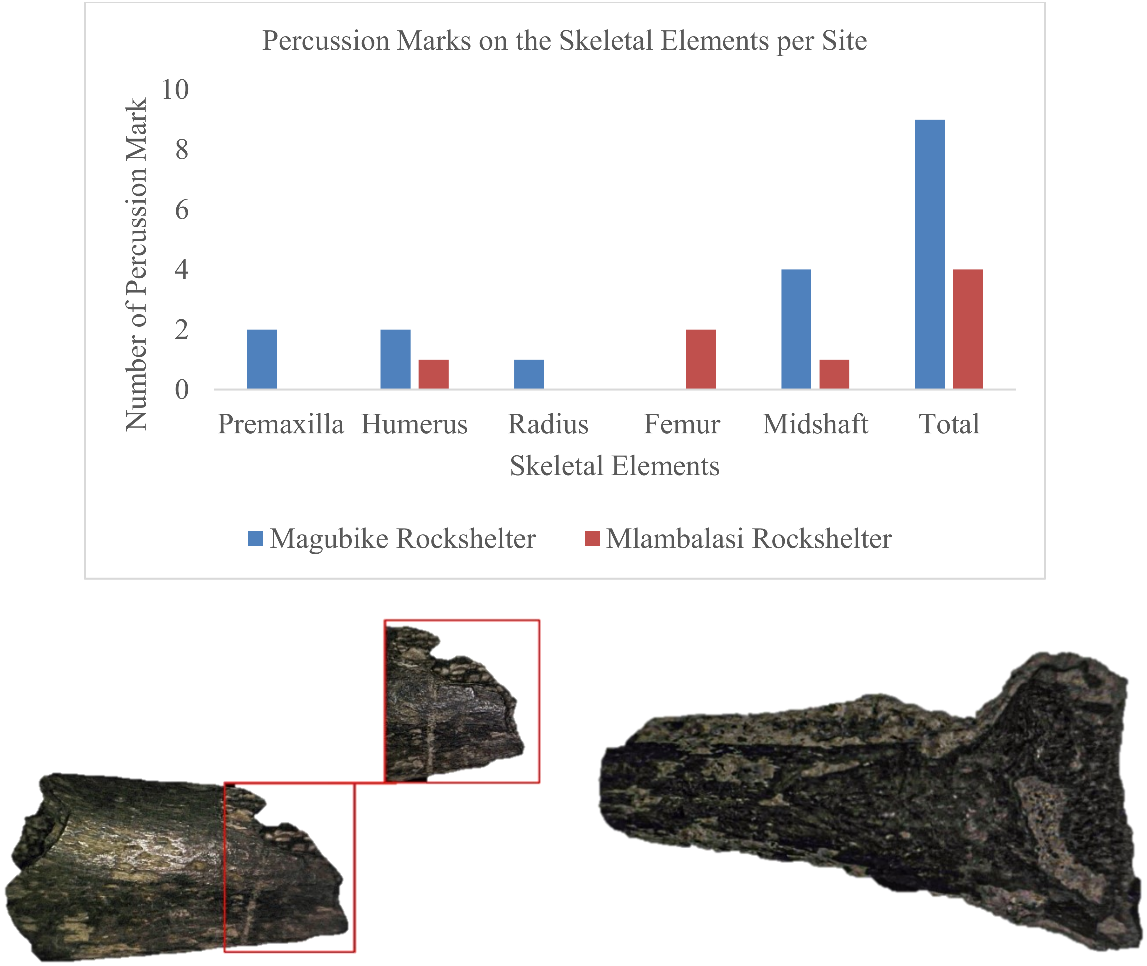


Figure 7.11: The frequency of percussion marks and their placements.

Burning

Burning occurs at both LSA and IA context. Five (5) stages of burning in reference to Stiner et al. (1995) were recorded at both sites. While the variation of burning was less visible at Mlambalasi, the opposite was recorded at Magubike (Table 6.13, Figure 6.12). Stage 5 of burning was dominant at Magubike N=33 (48%) (Table 7.13) as opposite to Mlambalasi rockshelter whereby burning stage 1 N=6 (38%) outnumbers other stages (Table 7.13). Notably, burning is most dominant on animal size 2 and 3 at both sites. The LSA burning stage 1 and 2 was recorded mainly at Mlambalasi fauna assemblage at few numbers.

Table 7.13: Burning stages at Magubike and Mlambalasi fauna assemblage in quantity and percentage.

Burning Stages	**Site Name**		**Total**
	Magubike Rockshelter	**Mlambalasi Rockshelter**	
Stage 1	15 (22%)	6 (38%)	21 (25%)
Stage 2	7 (10.1%)	3 (16%)	10 (12%)
Stage 3	2 (3%)	1 (6.2%)	3 (4%)
Stage 4	12 (17.3%)	4 (25%)	16 (19%)
Stage 5	33 (48%)	2 (12.5%)	35 (41.1)
Total	**69**	**16**	**85**

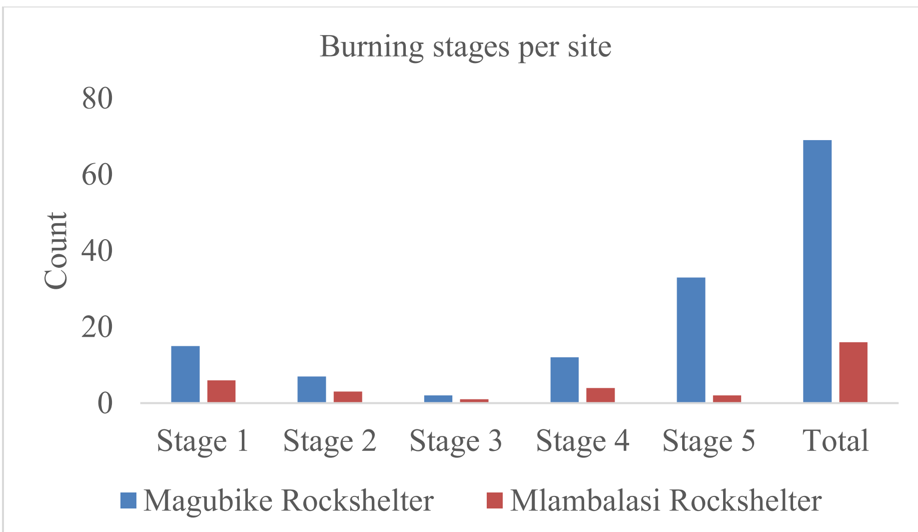


Figure 7.12: Burning stages.

Nonhuman induced modifications

Magubike and Mlambalasi faunal assemblage contains a wide range of non-human bone surface modifications that including tooth marks, root-etching, rodent gnaw marks (RGM), and Ragged Edge Chewing (Figure 7.13). Both LSA and IA exhibit non-human induced modifications, however, there is some observed variation on the type of modification between the two (Table 7.14). For the LSA, the non-human modifications occur on premaxilla and ribs for mammals belonging to size 1 and 2. Nonhuman modifications on IA context are present on various skeletal elements including vertebra, scapula, premaxilla, femur, ribs, and mid-shafts. Majority of them occurs on mammal size 2 and 3 respectively. Other mammal sizes, such as 1A and 1, are represented in IA context but in few numbers (Table 7.14). The general observation is that Magubike rockshelter contains the highest number N=26 (70%) of non-human modifications than Mlambalasi rockshelter N=11 (30%).

Table 7.14: Non-human modification marks on the Magubike and Mlambalasi faunal assemblages.

				Site Name		
CDs	**ABSC**	**SE**	**BSM**	**Magubike Rockshelter**	**Mlambalasi Rockshelter**	**Total**
IA	Size 2	Vertebra	RGM		2	2
LSA	Size 2	Rib	Root Mark		2	2
	Size 3		Score Mark	1		1
			RGM	2	0	2
			Root Mark	1	0	1
IA	Size 1A	Scapula	Ragged Edge Chewing		1	1
	Size 3	Femur	RGM	1		1
	Size 1	Premaxilla	RGM	1		1
LSA	Size 2		Root Mark		1	1
IA	Size 1A	Premaxilla	Ragged Edge Chewing		1	1
	Size 1		RGM	1	0	1
	Size 2		RGM	0	1	1
			Root Mark	1	0	1
	Size 3		Score Mark	1		1
			RGM	7	1	8
			Root Mark	1	1	2
	Size 2	Rib	Tooth Mark	1		1
		Premaxilla		2		2
		Mid-shaft		5	1	6
	Size 3	Rib		1		1
Total				**26**	**11**	**37**

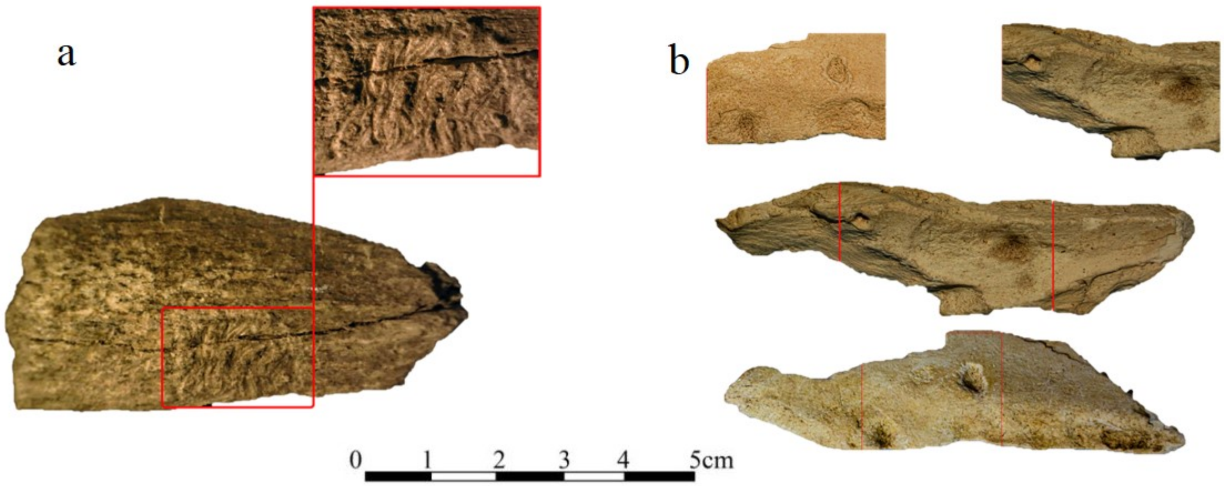


Figure 7.13: a) RGM and b) Tooth marks.

7.4 Interpretation

Most of the faunal material recovered from Magubike and Mlambalasi are highly fragmented. The overall high fragmentation rate at those sites poses difficulties for the identification of skeletal and taxonomic representation on the assemblage. This could be caused by fragmentation as a results of human bone processing considering that Magubike and Mlambalasi are rockshelters sites with direct evidence of human activities (Collins 2009; Collins and Willoughby 2010; Bushozi 2011; Willoughby 2012; Masele 2017). Faunal material recovered from archaeological sites is often related to human subsistence strategies. In this case, consumption of faunal material involves, among other thing, reducing a carcass into a manageable portion (Bunn 1982, 1986). This process involves bone fragmentation (White 1952; Bunn 1982). It is possible faunal remains from the two sites were fragmented as part of human feeding behaviour (Collins 2009; Collins and Willoughby 2010; Bushozi 2011; Willoughby 2012; Masele 2017). However, this does not rule out other factors.

Elsewhere, different scholars (Badenhorst et al. 2019; Reynard & Henshilwood 2018; Reynard et al. 2014) report that in MSA and LSA rockshelters and cave sites faunal specimens are often quite small (also see: Badenhorst et al. 2019; Clark and Plug 2008). Gifford-Gonzalez (1989) pointed out that repeatedly use of cave contributes to bone fragmentation. Magubike and Mlambalasi rockshelters have evidence of human occupation dating back to MSA (Willoughby 2012; Biittner et al. 2017). Collins (2009:101) initial analysis of the faunal remains from same sites maintains that majority of specimens indicate diagenetic breakage, clear evidence for post depositional breakage. Thus, is likely that occupants' daily movements on the two shelters, over time, may have contributed to the fragmentation of subsurface faunal remains. This is since the majority of specimens exhibit dry breakage (Collins 2009:101-102). At Sibudu Cave, Collins (2015) is reporting that majority of dry breaks on the faunal assemblage occurred when bones were dry and likely repeatedly exposed to fire. Nonetheless, this pattern is not supported at Magubike and Mlambalasi site because, unlike Sibudu cave, faunal remains from Magubike and Mlambalasi have a relatively few specimens exhibiting evidence of burning. Moreover, Gifford-Gonzalez (1989) noted that the Dassenach communities from Turkana Basin in Kenya break long bones to fit into a cooking pot. It is possible that this is one of the reasons for high fragmentation of faunal material recovered from the IA context at Magubike and Mlambalasi rockshelters.

Magubike and Mlambalasi faunal remains are fairly weathered (*sensu* Behrensmeyer 1978). Most of the specimens from these sites, particularly those of deeper layers, are carbonate coated. This stand to a reason that weathering was not found to be significant within this faunal assemblage for those deep layers. Caves site and rockshelters is an ideal excellent area for good preservation of archaeological materials (Behrensmeyer 1978). These set-ups are not only protected, but also allow rapid burial of archaeological remains (Behrensmeyer 1978; Collins 2009).

In addition to the overall fair weathering recorded on Magubike and Mlambalasi rockshelters faunal remains, many specimens exhibited fair/good cortical surface preservation. This result is in accordance with the previous analysis carried out by Masele (2017, 2021). However, this result is in contrasts with Collins (2009) who observed that most specimens at Magubike and Mlambalasi had poor cortical surface condition. The reason for this discrepancy could be attributed to the fact that Collins did not remove carbonate coating that would have exposed the cortical surface of the bone instead material was analysed on its original condition. Accordingly, Collins (2009:104-105) asserts that "a test was performed using a weak solution of HCl and it was found that the length of time the carbonate coating to be removed varied from five minutes to over thirty minutes. The conclusion was reached that such an investment of time would be better spent on analysing the sample in its current condition." It is from those faunal remains having good cortical preservation the issue of surface modifications was determined.

Skeletal part representation at Magubike and Mlambalasi rockshelters indicate that almost majority of the skeletal elements are for small mammals and there are huge discrepancies for the remains of large mammals similarly to some previous studies (Collins 2009; Collins and Willoughby 2010; Masele 2017). It appears that most of small mammals were slaughtered at the site, since all skeletal elements are present in varying degree. For instance, small and compact elements such as carpals, tarsals, phalanges, and teeth, are best preserved at both sites. This representation suggest that complete small mammals were transported and processed at the site. However, it was noted that there is a relatively low representation of large mammal remains in both IA and LSA context for both sites.

Both Magubike and Mlambalasi faunal remains suggest that human exploited otherwise interacted with a variety of mammalian taxa. Several wild species were recorded on LSA context including a range of small ruminant mammal such as dik-dik and duiker. Smaller mammals such as rats, squirrel and hedgehog were also recorded. It should, however, be noted that these LSA mammal reported in this study were recorded from Mlambalasi rockshelter only. Selected test pits and excavation units analysed for this study did not encounter LSA material from Magubike rockshelter. However, Collins (2009) reported a handful of LSA faunal remains from Magubike Tp# 2. Nonetheless, this material could not be identified taxonomically because they were poorly preserved (Collins 2009:137). Collins (2009) also reports the presence of Buffalo from LSA context at Mlambalasi rockshelter hitherto not present on the faunal assemblage of the current study.

Duiker (*Syvicapra grimmia*) and dik dik are widely distributed in many parts of Tanzania. They are primarily live in a bush environment (Skinner and Chimimba 2005:674). Essentially, bush environment provides shelter and shades, leaves, twigs, and flower that constitute their main food (Skinner and Chimimba 2005). Magubike and Mlambalasi set-up support the presence of these small mammals. Thus, those mammals may have been hunted and consumed by LSA people at Magubike and Mlambalasi sites. Buffalo mainly lives in savanna and open grassland, and equatorial forests especially in open areas such as those along watercourse (Skinner and Chimimba 2005). Magubike and Mlambalasi site are relatively close to Ruaha National Park. This is the largest park in Tanzania occupied with a wide range of species including Buffalo. Based on the combination of evidence from Collins (2009) and the current study, it is tempting to suggest that hominin at Mlambalasi rockshelter were hunting small and large mammals during and even before.

The IA people at Magubike and Mlambalasi consumed both wild and domestic mammals. Similarly, LSA people at the site consumed small and large ruminants such as dik-dik, duiker, and buffalo. Thus, it is convincing to suggest that this behaviour persisted from LSA to IA period. Other wild mammal species found at the site include rock hyraxes, suids and rabbits. Rock hyraxes usually occurs on specific environment characterised by outcrops of rock in the form of krantzes, rocky koppies, or rocky hillsides, or piles of loose boulders associated with bushes and tree species that provide browse, a major part of their diet (Skinner and Chimimba 2005). This description resembles Magubike and Mlambalasi rockshelters (Collins 2009; Collins and Willoughby 2010, Bushozi 2011; Willoughby 2012; Biittner et al. 2017). Thus, it is possible to conclude that these mammals occur naturally on the area surrounding the study area. In southern Africa, there is strong evidence suggesting that these mammals were hunted and consumed by MSA, LSA, and IA people (Badenhorst et al. 2014). According to (Cruz-Uribe and Klein 1998; Badenhorst et al. 2014) high proportion of post crania element compared to crania element as well as traces of burning could be used as direct evidence to support that rock hyraxes were hunted and consumed by human. Unfortunately, this proposition cannot be made for Magubike and Mlambalasi fauna now. This is because, only a few jaws and teeth remain are present on the assemblage and they both lack evidence of burning. Therefore, it could be assumed that these mammals died naturally close to the rockshelters, and their bone accidentally got in base of rockshelters. Like Rock hyraxes, hare remains was also recorded at site only. They belong to the Family Leporidae (Skinner and Chimimba 2005) and are widely distributed in various part of Tanzania.

Further, Magubike and Mlambalasi yield evidence of warthog (*Phacochoerus africanus)* remains. In the current study, warthogs are represented with teeth remain only. This species is particularly associated with open woodland and bushland, shorter grassland, floodplain, vleis around waterholes and pans (Skinner and Chimimba 2005). They are among the aggressive and dangerous animal to hunt. In this regard, they require a special or specific method to hunt them. For example, among the !Kung of the Kalahari Desert, warthogs are hunted when they run to ground by flushing them from their holes using lighting fire at the entrance and then speared when trying to escape (Yellen et al. 1976:39). Only a few specimens were recovered at Magubike and Mlambalasi rockshelters. Thus, it is difficult to make a definitive interpretation for this. However, given that these materials were found on the IA context, the most parsimonious interpretation is that these mammals were probably hunted.

As presented in the introductory chapter, IA people are known to keep cattle (*Bos taurus*) and ovicaprines (sheep and goats) and they often use these mammals to supplement other plant food (Von Den Driesch and Deacon 1985; Landers and Russell 2018). Magubike and Mlambalasi rockshelters are richly endowed with bovid size class two faunal remains. A sub-sample of selected bones for species identification suggest that these mammals were, indeed, goats. The high frequency of small bovids suggest that these mammals were highly consumed during the IA period at Magubike and Mlambalasi rockshelters. Considering domestic animal, it was of no exception to find cattle remains at the two sites. Of interesting to note was that both Magubike and Mlambalasi yield a relatively few cattle remain. This suggests that IA community of this region kept few cattle (*Bos taurus*), or they preferred to consuming goat *(Capra hircus*) (Collins 2009). This trend is still observed until today whereby prior the migration of Maasai pastoralists in the Iringa region and neighbouring areas, cattle keeping was low compared to other parts of the Tanzanian mainland. The statistics places Iringa number 15 regional wise (Tanzania Mainland) in terms of cattle keeping in the year 2007/08, having a total number of 475,031 cattle (URT 2012).

Wadley (2010) proposed that people probably used snares and traps to capture small mammals as far back as the MSA period. However, snares and traps are difficult to identify and recognize from archaeological sites because they are generally made from materials that do not preserve well (Wadley 2010). Uses of snares have been well documented in central and some part of southern Africa (Steyn 1971; Yellen 1977; Silberbauer 1981; Kent, 1995; Noss 1998; Lupo and Schmitt 2005; Wadley 2010). However, this hunting technique is poorly documented in eastern Africa (Wadley 2010). Ethnographic studies carried out among the Hadza, the present-day hunter-gatherer, of northern Tanzania have shown that they rarely use snare and traps during hunting (Bunn et al. 1988). Smaller mammal such as rock hyrax, birds as well as large games are hunted using bow and arrow (Bunn et al. 1988; Hawkes et al. 2001).

The MSA/LSA people at Magubike probably hunted mammal using stone tool point that were hafted on wooden stick (Bushozi 2011). According to Bushozi (2011) stone tool points were modified on their proximal ends to provide a suitable binding portion for hafting as well as for aerodynamic movement (Figure 10.1). He also adds that the point exhibits technological skills, abstract thinking and developed behavioural repertoire like those of other modern foragers (Bushozi 2011). As well, stone points were recorded on IA context at both sites and may have been used for hunting. Thus, it is likely that this behaviour repertoire continued from MSA to IA period. Hunting behaviour during the IA period may have been completed using arrow and bow. Unfortunately, neither metal arrowhead nor bow were recovered from the site.

Evidence of shaped bones and wooden objects (Figure 10.1) recovered at Mlambalasi IA context provide new insight into hunting behaviour comparable to hafting technology reported by Bushozi (2011). Shaped woods and bone recovered from this site resemble bone point/ needle, and they have not been reported in this region before. Similar evidence has been documented in south Africa MSA, LSA, and IA context (Henshilwood et al. 2001; Jacobs et al. 2006; d'Errico and Henshilwood 2007; Backwell et al. 2008). Mlambalasi shaped bone together with shaped woods recorded on IA context were intentionally modified into projectile points that suggest the use of bow and arrow for hunting.

Clark (1977) has built a sound understanding on the type of traditional arrow used among the Bushman in southern Africa. In the late eighteenth and early nineteenth centuries, Bushman used different raw material to make, at least, four types of arrows for hunting (Clark 1977). Type 1 arrows are made with stone segments or microliths mounted with mastic on shaft bone or wood. Type 2 arrows are wooden tipped with thick cylindrical heads (with or without a triangular tip) and were used to hunt birds. Type 3 and for are tipped arrow with reversible fore-shaft (Clark 1977). Mlambalasi bone and wooden point align with the type 2 point describe in Clark (1977). Thus, it is possible to suggest that Mlambalasi IA people hunted birds or small mammal using bow and arrow made with bone and wooden projectile points.

Whether or not the faunal remains recovered from archaeological site were accumulated by human or non-human agent, bone surface modification is one of the important factors to consider. Cut marks on the faunal assemblage provide the direct and definitive evidence of meat consumption by humans (Merritt 2012; Plug 2004; Blumenschine et al. 1996; Blumenschine 1995; Bunn 1981). Indeed, butchery marks were recorded on Mlambalasi and Magubike rockshelters. However, these marks are present on IA context only, making it difficult to compare frequency of LSA and IA on the studied sample.

Macro and micro analysis of cut marks inflicted with metal prove to be different from stone tool induced cut marks (Maté-González et al. 2018; Leenen 2011; Greenfield 1999; Blumenschine 1996; Olsen 1988; Walker and Long 1977). Walker and Long (1977) used depth and width to distinguish metal and stone tool cut marks. According to (Greenfield 2008; Olsen 1988; Walker and Long 1977), frequency of cut mark made by metal knives and stone tools vary significantly. Leenen (2011) add that this variation even occurs within the same tool type used. Greenfield (2008) has shown that butchered marks with stone tools from some archaeological sites appear in high percentage than those caused by metal knives. Stone tools were recovered from IA context at Magubike and Mlambalasi, but there is no metal knives or metal blade recovered from this context. Frequency of cut marks recorded on the entire sample is overall very few. It is possible that metal objects were used for butchery during the IA phase at the two sites. However, high resolution quantitative data is needed to determine this.

The overall incidence of low frequency of cut mark recorded on Magubike and Mlambalasi rockshelter faunal remains could be due several factors. Butchery process destroy traces cut marks (White 1952) because some of the elements are often smashed beyond recognisable fragments (White 1953:162). High rate of fragmented bones at Magubike and Mlambalasi together with the impact of carbon coated on faunal material could be one of the factors that obscured traces of cut marks on the fauna sample (Clark 2019). Use of metal knives for butchering during the IA phase could have substantially reduced the traces of cut marks on Magubike and Mlambalasi fauna (Olsen 1988; Walker and Long 1977). As pointed out by several scholars (Bunn 1982), in most cases, the butcher devoid direct contact of butchery tool with animal bone. This is to maintain the sharpness of the tool. Therefore, this might have been the case for Magubike and Mlambalasi IA people.

For both Magubike and Mlambalasi, most cut marks were inflicted on small mammal size. This result is to be expected because, as it has been presented earlier, small mammal sizes are ubiquitous at the two sites. High incidence of cut mark on small mammals support the argument that IA people consumed large quantities of small mammals as compared to medium and larger size mammals. The two sites have significant remains of smaller mammals. However, no traces of cut marks were recorded on these mammals. This does not rule out the possibility that smaller mammals were hunted and eaten by IA people (Yellen 1991). Smaller mammals are sometimes hunted and cooked as whole, and their bones may be completely chewed. This leaves no room to investigate traces of butchery. Medium and large mammal size were probably slaughtered occasionally at Magubike and Mlambalasi rockshelter, resulting into a very few skeletal remains and cut marks recorded on the fauna sample. Quite possible, IA people at Magubike and Mlambalasi rockshelters may only have obtained cattle meat occasionally, perhaps through exchange. The same is true for Buffalo.

Early human settled at Magubike and Mlambalasi may have used fire to cook their meat. The current study recorded evidence of bunt bone on LSA and IA context. Burnt bone were also reported by Collins (2009; Collins and Willoughby 2010).

Evidence of carnivore involvement on the current assemblage is relatively low. Although these marks are few, they occur on both LSA and IA context for both sites. This result correlates previous study on the faunal material recovered from the same sites (Collins 2009; Collins and Willoughby 2010). When the results of the two studies are combined, they suggest that humans at the two-site interacted with mammalian carnivores at the area. Notably, for both sites, no evidence of large carnivore such as hyena involvement on the faunal material. One tooth damage recorded on IA context is relatively small. It is likely that it was produced by domestic dogs as compared to that seen when larger carnivores damage bones (Blumenschine 1988, 1995; Brain 1981). This rule out the possibility that faunal material at Magubike and Mlambalasi rockshelters were accumulated by carnivore. Jackals and wild dogs are rare in the area. Smaller carnivore remains are evident on the sample assemblage, and among the identified sample indicate that smaller carnivore at the site include squirrel. Studies on how smaller carnivore such as how squirrel modify and accumulate bones are rare. Moreover, the tooth mark recorded on the fauna sample is beyond the magnitude of smaller carnivore modification mark. Thus, it may be possible that the inflicted tooth mark was left by domestic dogs (*Canis familiaris*).

Rodent modification marks are another important non-human modification marks recorded on the faunal material. Rodent such as porcupines accumulates, dislocate, or modify bones (Brain 1981). Their trace in the archaeological record gives an insight about taphonomy and site formation process. Of all the rodents, the role of porcupines on site formation process have received considerable attention and their resulting feature has been well documented (Brain 1981). Magubike and Mlambalasi rodent modifications marks differ significantly from those produced by porcupine. The gnaw marks on the studied faunal material were inflicted with small rodents' teeth, perhaps rat or mice. Rats often lives near human settlements. It is possible that they were present around the two rockshelters and gnawed animal bones after they were discarded. This assumption could be supported by the large remains of rats faunal discovered on the assemblage.

There are two plausible reasons for the presence of rodent remains in the Magubike and Mlambalasi fauna remains. First, it is possible that rodents surrounding the two rockshelters died naturally in the sites. In this case, their bone remains would have been added in the faunal assemblage recovered from the sites. However, one problem with this assumption is that rodent remains were found in direct association with another mammal remains that were likely consumed by human. Rodent that died naturally in the human settlement would occurs in less frequency across time and space. Second, rodent remains were probably consumed at Magubike and Mlambalasi rockshelters. The growing body of literature have shown that smaller mammals have contribute substantial food resource to various past communities. This is likely the case for Magubike and Mlambalasi. Smaller mammal remains are ubiquitous in the LSA and IA context. Small mammal such as rat and mouse could have been easily hunted and consumed on the study area.

Root damage left recognizable traces on the faunal assemblage on the Magubike and Mlambalasi rockshelters. Currently, there are shrubs and trees on the immediately area surrounding entrance and the base of the rockshelters. It come to a reason that traces of roots on the faunal assemblage are inevitable. It is, therefore, reasonable to assume that shrubs and tree roots grew on the surrounding of the rockshelter after it was abandoned have affected archaeological material in these rockshelters.

7.5 Chapter Summary

Faunal material evidence presented by the current study from two rockshelters (Magubike and Mlambalasi) offers opportunity to answer various issues related to LSA and IA cultures. Various attributes including skeletal elements, taxon, bone modifications, and others were taken into considerations. Based on the reason provided in the interpretation section, most of faunal material were highly fragmented with good/fair cortical condition. Almost all skeletal elements are present in the assemblage representing majority of small animal class 1A, 1 and 2. The bone modification indicates various human behavior including the subsistence strategies during LSA and IA. Some behaviour, including hunting large animals like buffalo, seems to dominate the LSA context. The hunting behavior continued to persists from LSA to IA. The study has also noted that the IA people consumed both wild and domestic animals.

CHAPTER 8: CERAMIC MATERIAL CULTURE

8.1 Introduction

As I presented earlier in Chapter 4, all ceramic material obtained from the site or at the museum had not previously been analyzed by anyone. Therefore, this chapter covers the analysis of ceramic assemblage from nine (9) sites namely Magubike, Mlambalasi, Mgera, Mgala-isitu, Ikombe, Msosa, Ikula, Utinde-mkoga, and Mlangali. Ceramics are among the most durable archaeological materials available for study. They appear in sites ranging from the early Holocene period to recent past farming communities (Ashley 2005, 2010; Ashley and Grillo 2015; Fredriksen 2023). According to Feliu et al. (2004), ceramic production is one of the older and extended human activities in all civilizations. Archaeologists have relied on ceramic attributes such as rim profiles, vessel shapes, decorations, and others in order to characterise and to differentiate technological variations/similarities among communities over time. Provided that pots and sherds have enough diagnostic features to indicate décor patterns and vessel shape, trained eyes can get an instant and literally cost-free peek into past movement and interaction (Fredriksen 2023). This is among of many other significances that ceramics offer to ceramic technologists (Shepard 1956, 1971). Methods such as petrography allow ceramicists to identify a number of features of interest including fabric composition. This chapter therefore, presents the methods used in analysis, results, interpretation, along with a summary.

8.2 Analytical Methods

Despite a sophisticated literature, such as Shepard (1956, 1971) and Rice (1987), methods of ceramic attribute analysis vary among scholars depending on the nature of their research problems (Kwekason 2011). For example, Soper (1971) selected a wide range of attributes of shape, rim morphology, base shape, surface finish, decoration techniques and motifs in order to explain the EIW ceramics of East Africa. Huffman (1980) focused on the structure of the motifs and decoration placements to classify the ceramics of southern Africa. Kwekason (2011) used decoration, shape, rim morphology, motif placements, and decoration techniques to define different assemblages from the southern coast of Tanzania. He wanted to find out how these attributes could be used to differentiate one assemblage from another with respect to time and space. Pawlowicz (2011, 2017) focused on decorative motif, placement of decoration (for rims), rim form, rim thickness, body thickness, part of vessel, temper, paste color, exterior color, and surface treatment. Pawlowicz (2011) maintains that it was important to determine whether certain decorations or surface treatments or thicknesses were associated with particular rim and vessel forms or with one another. Such relationships provide a better foundation for comparison between the ceramics of different sites and different regions than combinations of percentage scores within the aggregate of an entire assemblage (Pawlowicz 2011:322). Recently especially in southern Africa, some research on ceramics has moved from physical attribute analysis to material science approach/chemical analysis (Ashley and Grillo 2015). For example, petrology and clay chemistry have been used to source ceramics from Botswana in order to explore regional patterns of production and exchange (Wilmsen et al. 2009). Additionally, the mineralogical composition of ceramic paste (mass, tempers, and inclusions), is one of the parameters that contributes to characterize a certain production and, therefore, to identify a certain society or culture (Feliu et al. 2004:241). In Tanzania, mineralogical analysis of ceramics has been conducted by a number of other scholars including Ombori (2021).

The study began by preparing material through washing, sorting, and bagging. Ceramics stored at the NMT were already cleaned, while those collected in 2021 were washed and dried at the UDSM. All ceramics were grouped in two categories: diagnostic and undiagnostic potsherds.

The former involves patterns that carries information about forming, size and surface finishing of the vessel (Thér 2020). The latter involves patterns in ceramics that does not offer direct information based on the nature of their breakage. Most of them are body sherds. The current study concentrated on the former; however, to some extent, the latter provided some data especially on fabric analysis. Undiagnostic potsherds were only counted for providing the quantity of ceramics assemblage.

Both physical and mineralogical attributes of ceramics were considered in this study. The physical attributes were useful in identifying traditions. They were also useful for intra and inter-regional comparisons in combination mineralogical analytical results (that is PA). The PA was employed for determining the raw material sourcing, ceramics forming technique, major clay composition and fabric.

8.3 Physical Attribute Analysis

Table 8.1 summarises the physical attributes that were selected by this study. While referring to Wandibba (1982) and other specialists (Phillipson 1976b; Chami 1994; Kwekason 2011) this sub-section has conceptualized each attribute and how they inform the study.

Table 8.1 Attributes considered in ceramic analysis.

For All Sherds	**For Sherds with Decorations**	**For the Rim Sherds**
Part of the vessel	Decorative motifs	Rim form/profile
Fabric	Decoration placements	Rim thickness
Wall thickness	Vessel-type	Vessel form/type
Sherd/ceramics class (i.e. PIW, EIA, or LIA	Sherd/ceramics class (i.e. PIW, EIA, or LIA	Rim-diameter
	Ware-type	Ware-type

Vessel part

It refers as a portion that form a vessel shape. Vessels appear in different shapes (Phillipson 1976b, Figure 8.1). In ceramic analysis, the identification of vessel part is very important because it is a foundation of a vessel. The accumulation of each piece makes a vessel shape. The vessel part can be determined by looking on the morphology of the vessel (See Figure 8.1). The parts are rim, neck, shoulder, body, and base. As shown in (Figure 8.1) not all vessels have the similar components of those parts, some have rim, body, and base or rim, shoulder, body, and base. It is through those variations the different vessel shapes can be formed/determined.

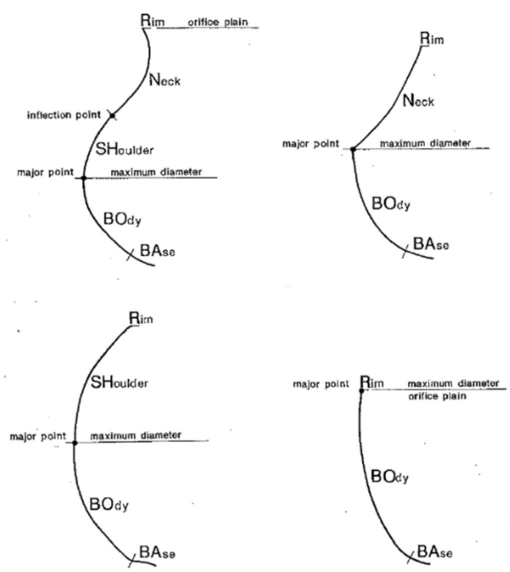


Figure 8.1: Various vessel parts as presented in different vessel shapes (Adapted from Chami 1994:78).

Vessel shape/form/type

It simply refers to the morphology or outlook of the vessel. Several models are used for determining the shape of ceramic vessels (Kwekason 2011:119). According to Chami (1994:74) the contours of various parts of the vessels, for example shoulder and neck are important in determining in which category of ceramic vessel should be included. Shepard (1956, 1971) developed one model that came with two groups of vessel forms that is restricted and unrestricted shape. The former involves those ceramics with the maximum diameter occurring elsewhere rather than at the orifice while the latter involves those with maximum vessel diameter occurring at the orifice. In eastern and southern Africa, another slightly model was developed for ceramic analysis/reconstruction (Soper 1971b; Phillipson 1976b; Huffman 1980). This model adopted shape classes like necked pots, open bowl, narrow-mouth globular vessel, and carinated forms. Some scholars working in East Africa (Mapunda 2008; Kwekason 2011; Pawlowicz 2011; Biginagwa 2012) have adopted the second model in order to categorize the ceramics forms. However, Chami (1994) is arguing that both models are more or less the same. The current study has borrowed the second model particularly by referring to Phillipson's (1976b) study of ceramics in Zambia and Pawlowicz's (2011) study of ceramics in Mikindani, on the southern Swahili coast of Tanzania. Phillipson described eight different vessel forms that is open bowl, in-turned bowl (or closed bowl), necked vessel, pot with up-turned rims, globular vessel, convergent mouth pot, beaker, and carinated vessel (Figure 8.2).

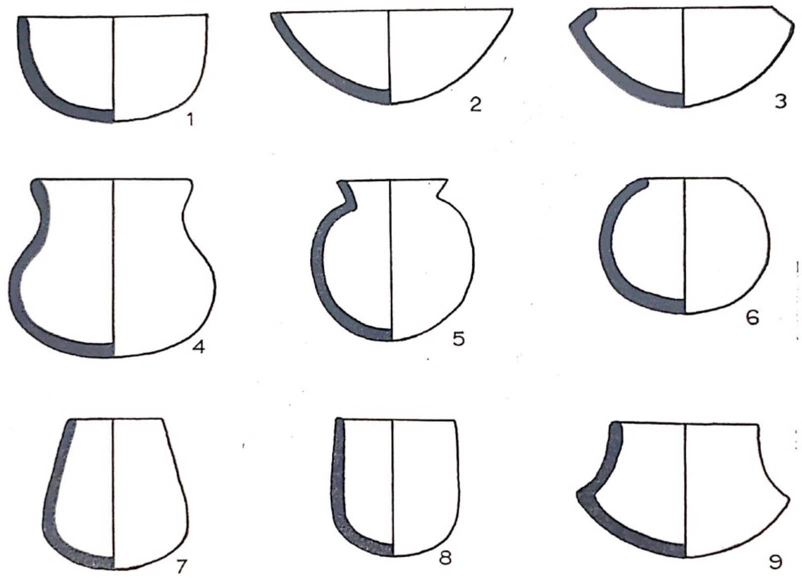


Figure 8.2: Ceramics vessel forms: 1, 2-open bowls; 3-in-turned bowl; 4-necked vessel; 5-pot with up-turned rim; 6-globular vessel; 7-convergent-mouthed pot; 8-beaker; 9-carinated vessel (Adapted from Phillipson 1976 b:21).

Phillipson presents the definitions of those vessel forms as follows:

Open bowls**:** these are bowls, which have no concavity or carination in their external profile. The maximum diameter is at the rim.

In-turned bowls**:** are distinguished from open bowls by the presence of sharply inverted rims. The rim may be differentiated from the body of the bowl by an angle of almost ninety degrees.

Necked vessels**:** have rounded shoulders, externally concave necks, and a slight eversion above the neck. Their maximum diameter is at or slightly below the shoulder.

Pots with up-turned rims**:** these are pots with near globular bodies that are constructed just below the rim. The rim is approximately vertical or slightly everted, and is defined by a sharp angle.

Globular vessels**:** are approximately spherical in overall shape. The rim diameter is appreciably less than the maximum body diameter. The rim is in-turned and does not interrupt the globular profile of the vessel.

Convergent-mouthed pots**:** have approximately semi-spherical bases and straight convergent sides.

Beakers**:** are similar to convergent-mouthed pots, but have vertical sides, so that the rim diameter approximately equals the maximum body diameter. The maximum diameter rarely greatly exceeds the vessel height.

Rim forms and lip profiles

Rim forms and lip profiles are considered important because they usually define the vessel shape than the body sherds. According to Pawlowicz (2017), ceramics having rims are important for intra-interregional comparison. The rim forms and lip profiles of the current study were determined using Wandibba (1982) and Phillipson (1976b:21) schemes (see Figure 8.3). Wandibba has combined both rim forms and lip profiles by calling them a *rim shapes*. Accordingly, Wandibba came up with seven rim shapes, which are direct, everted, reverted, bevelled, fluted, swelled, and milled. The definition of each term is provided after (Figure 8.3 below). By bringing together the two schemes, the current study considered the direction of rim to mean the rim forms, which involves direct, everted, reverted, and flared. The outlook of the lip was considered in categorizing the lip profiles in accordance to both scholars' schemes.

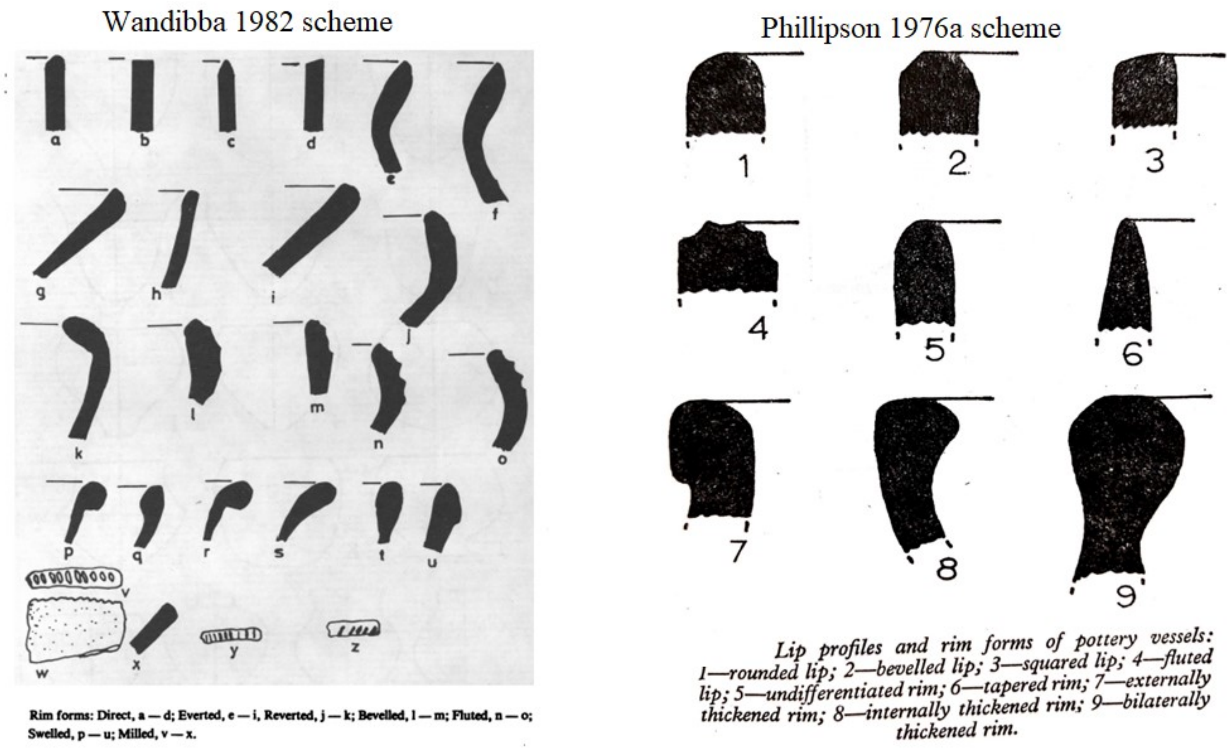


Figure 8.3: Left-Rim forms (Adapted from Wandibba 1982:178), Right-Lip profiles and rim forms (Adapted from Phillipson 1976 a:22).

Direct-the lip may be either rounded, squared, or slanting, or slightly pointed. Everted — direction of deviation is outwards. Reverted — direction of deviation is inwards. Bevelled — the lip and upper part of the rim have a series of flat faces, show in section a series of straight facets (Soper, 1971a:16). Fluted — the flutes are similar to bevels but with a concave cross-section (Soper, 1971a:16). Swelled — the swelling can be either external, internal, or indeterminate. Milled — has milling on the lip. Phillipson's scheme has divided them in which the lip profiles include rounded, bevelled, squared, fluted while the rim forms include undifferentiated, tapered, externally thickened rim, and bilaterally thickened rims.

Analysis of rims involved also measurement of rim thickness and rim diameters. The former was measured in millimetres (mm) using the Mitutoyo Vernier Caliper. The latter was performed using the vessel diameter template in cm (Figure 8.4). For the rim thickness, the analysis categorized rims into minimum (0-6 mm) for the very thin rims, moderate (7-12 mm) for moderate thick rims and maximum (13-19 mm) for the thick/very thick rims.

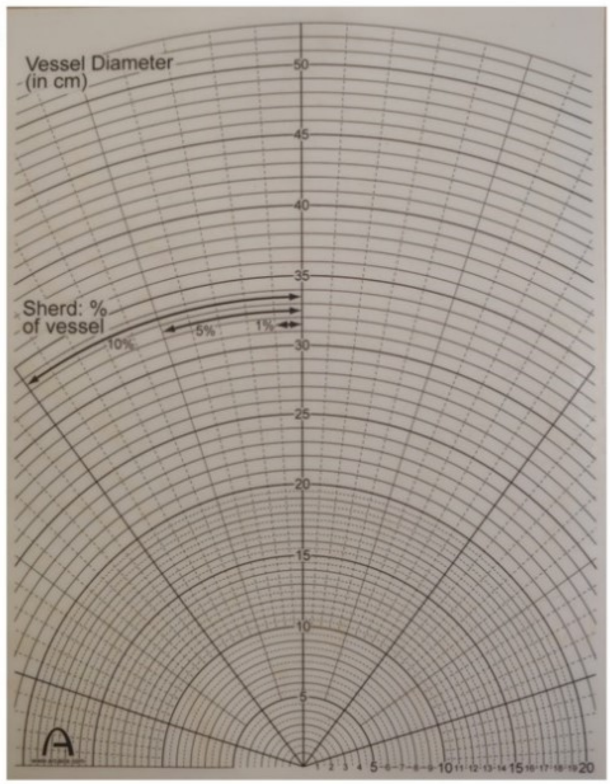


Figure 8.4: Rim diameter measurement form.

Fabric

In reference to Wandibba (1982), fabric is a composite attribute that includes colour, hardness, paste composition and texture, and feel. Colour is considered important in ceramic studies since it provides information regarding the clay and methods of firing (for example atmosphere, temperature, and duration) are most influential factor for ceramic colour. However, other factors resulted from post firing can influence colour of ceramics. Such factors are like, abrasion of strains during uses, deposition of substance from soil after discard, leaching by soil waters and accidental reheating (Shepard 1956:103). Apart from informing the clay and firing methods, colour can be used to distinguish ceramics belonging to different wares (Wandibba 1982). The section of fabric for the ceramics of the current study was performed through PA at African Minerals and Geosciences Centre (AMGC) located at Dar es Salaam, Tanzania.

Decoration attributes/patterns, placements, and functional elaborations

According to Wandibba (1982), decorative techniques can be grouped into five classes: graphic, plastic, colour, burnishing, and shipping. Graphic techniques include incising, grooving, dragging, stamping, stabbing, punching, and pressing. Within the plastic technique, two methods can be identified: applying and moulding. Applying involve the application of clay pellets to the outer surface of the pot to create a projection which are known as bosses or knobs. When ridges or bosses are raised from the body of the clay during shaping of the vessel, is known as moulding. Graphite goes with colours such as slipping and burnishing. Functional elaborations include things like handles, spouts, and perforations. Spouts and handles are mainly characteristic of Later Iron Age assemblages but perforations are an early feature (Wandibba 1982:176). Therefore, the above-mentioned decoration techniques were considered in ceramic analysis of the current study.

8.4 Physical Attributes Analytical Results

8.4.1 General assemblage

Through SPSS, a total of 2,290 potsherds were analyzed for nine sites namely Magubike, Mlambalasi, Mgera, Mgala-isitu, Ikombe, Msosa, Ikula, Utinge-mkoga, and Mlangali. A total of 913 (or 40%) are diagnostic, while 1,377 (or 60%) are undiagnostic. The body parts 364 (or 40%) dominate the diagnostic ceramic assemblage embedded with other diagnostic features such as decorations. The percentages of other parts are presented in (Figure 8.5).

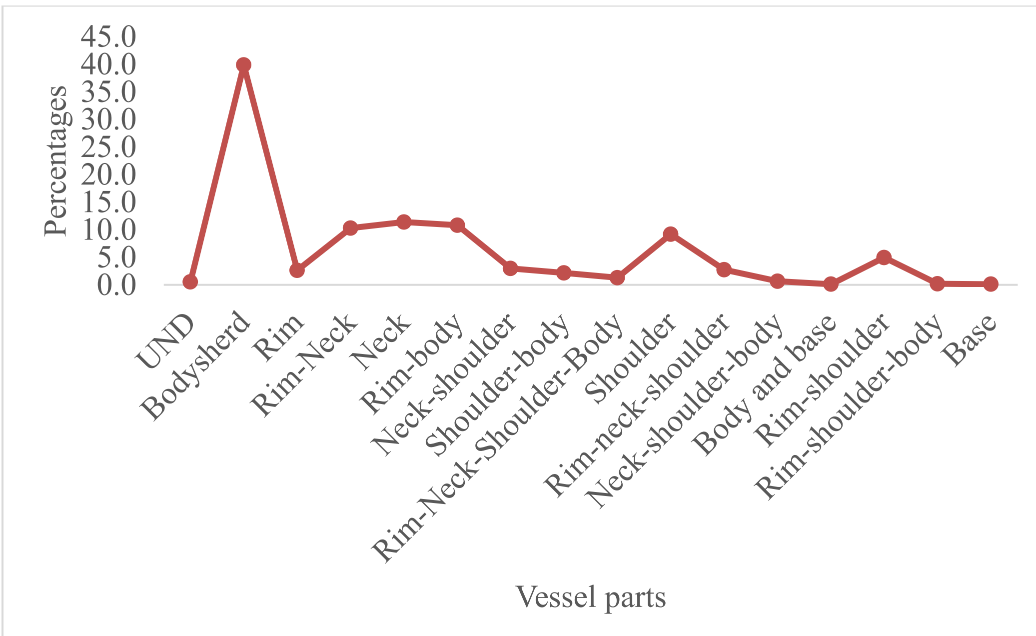
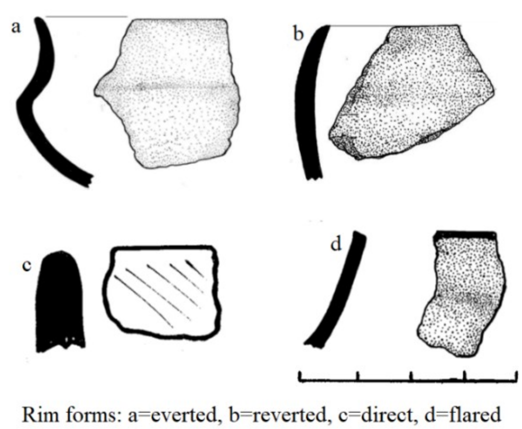


Figure 8.5: The frequency and percentage of vessel parts.

8.4.2 Rim forms and lip profiles

The 300 potsherds presented rims in four forms: everted, reverted, direct, and flared. Analytical results of each category per site are presented in Table 8.2. The results show that majority of rim forms, 173 (or 58%) are everted, 73 (or 24%) are reverted, 38 (or 13%) are direct, 6 (or 2%) are flared, and 10 (or 3%) are undetermined (Figure 8.6). That signifies the presence of many open vessels in the ceramic assemblage of the current study represented either by large or small pots. The study has also recorded 6 categories of lip profiles including rounded, pointed, flattened, thickened, bevelled, and fluted (Figure 8.6). Analytical results of each category per site are presented in Table 8.2. The results show that majority of lip profiles 134 (or 45%), are rounded, 78 (or 26%) are flattened, 45 (or 15%) are thickened, 34 (or 11%) are pointed, and 9 (or 3%) are fluted/bevelled. In terms of site specific the fluted and bevelled rimed vessels are only recorded at Magubike TP# 5 level 5 (40-50 cm) and Mgala on the surface. Ceramics of this kind are important for identification of EIW traditions in East and southern Africa (sub-section 8.6.2 provides more details).

The recorded rims vary in terms of thickness and diameters as per site specific (Table 8.3). Regarding the rim diameters, the majority 99 (or 33%) range from 11 to 20 cm, 79 (or 26%) range from 21-30 cm, 62 (or 21%) from 0-10 cm, 6 (or 2%) from 40-50 cm, 3 (or 1%) are 50 cm or greater. A total of 21 (7%) are undetermined. On the case of rim thickness, 182 (or 61%) range from 7-12 mm are moderately thick, 62 (or 21%) have thin rims ranging from 0-6 mm, and 56 (or 19%) range from 13-19 mm thick, what counts as very thick rims (Figure 8.6 a-e).



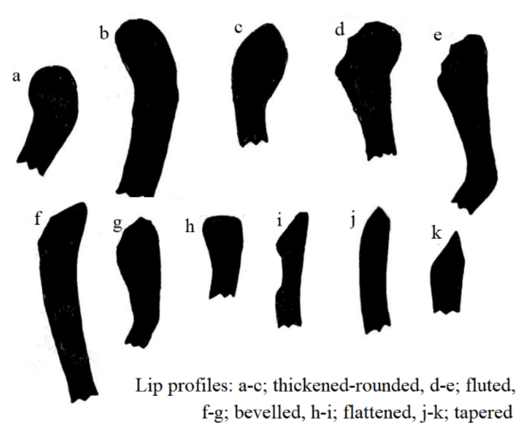


Figure 8.6: Rim forms and lip profiles recorded on the ceramic assemblage of the current study.

Table 8.2: Frequency and percentages of rim forms and lip profiles per site.

	Site									
	MGB	**MLB**	**MGR**	**MGL-Isitu**	**Ikombe**	**Msosa**	**Ikula**	**UT-MKG**	**Mlangali**	**Total**
Rim forms	**Frequency**									
Everted	10 (42%)	25 (48%)	23 (66%)	12 (52%)	28 (60%)	39 (59%)	23 (77%)	10 (63%)	3 (50%)	**173**
Reverted	10 (40%)	16 (31%)	-	5 (22%)	11 (23%)	20 (30%)	6 (20%)	5 (32%)	-	**73**
Direct	5 (20%)	8 (15%)	3 (9%)	6 (26%)	7 (15%)	4 (6%)	1 (3%)	1 (5%)	3 (50%)	**38**
Flared	-	3 (6%)	-	-	1 (2%)	2 (3%)	-	-	-	**6**
UND			9 (26%)	-	-	1 (2%)	-	-	-	**10**
Total	**25**	**52**	**35**	**23**	**47**	**66**	**30**	**16**	**6**	**300**
Lip profiles	**Frequency**									**Total**
Rounded	19 (79%)	24 (46%)	22 (63%)	6 (26%)	15 (32%)	24 (36%)	14 (47%)	7 (44%)	3 (50%)	**134**
Tapered	3 (13%)	14 (27%)	1 (3%)	1 (4%)	6 (13%)	8 (12%)	1 (3%)	-	-	**34**
Flattened	1 (4%)	14 (27%)	4 (11%)	7 (30%)	21 (45%)	15 (23%)	6 (20%)	9 (66%)	1 (17%)	**78**
Thickened	1 (4%)	-	8 (22%)	1 (4%)	5 (11%)	19 (29%)	9 (30%)	-	2 (33%)	**45**
Fluted/bevelled	1 (4%)	-	-	8 (35%)	-	-	-	-	-	**9**
Total	**25**	**52**	**35**	**23**	**47**	**66**	**30**	**16**	**6**	**300**

Note: MGB=Magubike, MLB=Mlambalasi, MGR=Mgera, MGL-Isitu=Mgala Isitu, UT-MKG=Utinde Mkoga

Table 8.3: Rim diameter and thickness per site.

	Site									
	MGB	**MLB**	**MGR**	**MGL-Isitu**	**Ikombe**	**Msosa**	**Ikula**	**UT-MKG**	**Mlangali**	**Total**
Diameter (cm)	**Frequency**									
0-10	2 (8%)	18 (35%)	11 (31%)	-	5 (11%)	2 (3%)	10 (33%)	14 (88%)	-	**62**
11-20	15 (60%)	17 (33%)	8 (23%)	7 (30%)	19 (40%)	18 (27%)	13 (43%)	1 (6%)	1 (17%)	**99**
21-30	6 (24%)	11 (21%)	2 (6%)	10 (43%)	18 (38%)	23 (35%)	7 (23%)	-	2 (33%)	**79**
31-40	2 (8%)	4 (8%)	2 (6%)	5 (22%)	3 (6%)	14 (21%)	-	-	-	**30**
40-50	-	1 (2%)	-	1 (4%)	2 (4%)	2 (3%)	-	-	-	**6**
50+	-		-	-	-	3 (5%)	-	-	-	**3**
UND	-	1 (2%)	12 (34%)	-	-	4 (6%)	-	1 (6%)	3 (50%)	**21**
Total	**25**	**52**	**35**	**23**	**47**	**66**	**30**	**16**	**6**	**300**
Thickness (mm)	**Frequency**									**Total**
0-6	6 (24%)	27 (52%)	7 (20%)	2 (9%)	3 (6%)	7 (11%)	-	10 (63%)	-	**62**
7-12	16 (64%)	24 (46%)	20 (57%)	12 (52%)	34 (72%)	45 (68%)	21 (70%)	6 (37%)	4 (67%)	**182**
13-19	3 (12%)	1 (2%)	8 (23%)	9 (39%)	10 (22%)	14 (21%)	9 (30%)	-	2 (33%)	**56**
Total	**25**	**52**	**35**	**23**	**47**	**66**	**30**	**16**	**6**	**300**

8.4.3 Vessel shape/form/type

By considering attributes such as necks, rim forms and lip profiles, the current study was able to identify four kind of vessel forms (Figure 8.9). The most common, 248 (or 58%) are necked vessels having long or short necks, 80 (or 19%) are open bowls, 80 (or 19%) are closed bowls, 6 (or 1%) are carinated pots, and 17 (or 4%) have undetermined vessel forms. The variations in terms of vessel form frequencies were reflected for each site and excavation unit (Figure 8.7; Table 8.4). However, Magubike provided almost the similar frequency of necked vessels, open and closed pots (Figure 8.7; Table 8.4). The remaining sites seems to be dominated by necked vessels with exception of Utinde-Mkoga site that provided 50% of necked vessels and open bowls respectively (Figure 8.7). The necked vessels vary in terms of length of a neck some with long or short neck (Figure 8.8). From the ethnographic inquiries conducted by the current study, most of log-necked vessels are large and serves various uses especially for storage or brewery. While the short-necked vessels are mostly normal pots used for cooking.

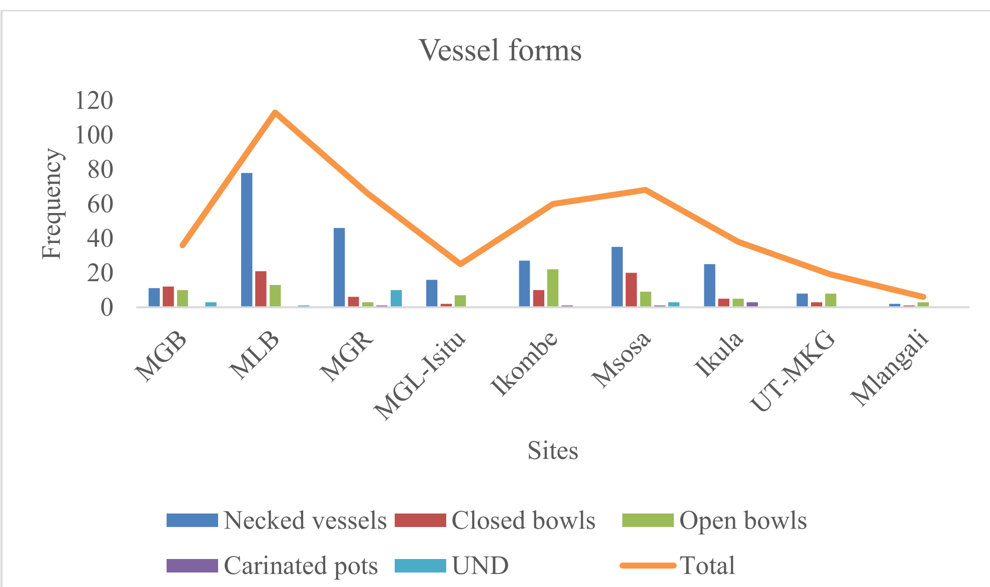


Figure 8.7: The frequency of Vessel forms per site.

Figure 8.8: Long and short necked vessels recorded at Mapanda Ward in Iringa Region (Photo by the Author 2021).

Table 8.4: The quantity of vessel shapes per Excavation units.

Site	Unit	Vessel shapes				
		UND	Open bowls	Closed bowls	Necked vessels	Total
Magubike (HxJf 01	TP# 3	3	4	3	2	12
	TP# 5	0	0	1	2	3
	TP# 8	0	1	1	1	3
	TP# 9	0	0	1	1	2
	TP# 10	0	0	4	0	4
	TP# 12	0	5	2	5	12
Sub-total		**3**	**10**	**12**	**11**	**36**
Mlambalasi (HwJf-02)	Room 1	0	3	8	26	37
	Slope	0	0	0	3	3
	Room 2	0	0	3	1	4
	TP# 1	0	0	0	7	7
	Trench 1 (2002)	1	0	1	2	4
	I-11	0	1	2	5	8
	J-10	0	2	2	9	13
	I-9	0	3	0	8	11
	J-9	0	0	0	2	2
	I-10	0	3	1	3	7
	J-11	0	1	4	12	17
Sub-total		**1**	**13**	**21**	**78**	**113**
Mgera (HwJg-106)	Trench #2	7	0	6	23	36
	Trench 1	1	1	0	4	6
	TP# 1	0	0	0	7	7
	STP 1	0	0	0	2	2
Sub-total		**8**	**1**	**6**	**36**	**51**
TOTAL		**12**	**24**	**39**	**125**	**200**

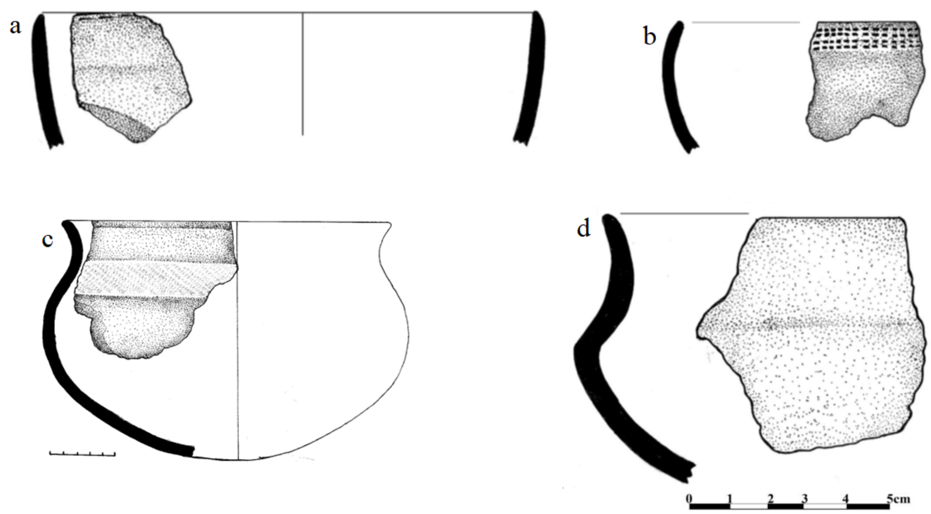


Figure 8.9: Vessel forms/shapes of the current study: a-open bowl; b-closed bowl; c-necked vessel; d-carinated vessel (Illustrated by Hitson Pazza 2020/2021).

8.4.4 Decoration attributes/patterns and placements

Out of 913 diagnostic potsherds, 340 (or 37%) had no decoration, while the rest (573 or 63%) had decorations of various kinds. Fourteen decoration categories were recorded by this study (Table 8.5). They include grooved lines (GL), incisions, wavy lines (WL), impressions, stamps, roulettes, flutes, applique/relief, carination, zigzag lines (ZL), herringbones, drill/perforation, crescents, red slip (RS). Each category is comprised of other motifs, which appears in different forms, for example, thick/bold horizontal grooved lines & oblique lines, cross-hatching & nail incisions. The majority 156 (or 28%) of decorated potsherds are incised having various motifs and orientations whereby horizontal incisions dominate by 12.3% (Table 8.5; Figure 8.10 Category B). This was followed by 142 (or 25%) GL having many motifs and orientations whereby horizontal grooved lines or channels dominates by 16.8% (Table 8.5; Figure 8.10 Category A). Other decoration attributes of the currents study are roulette 97 (or

17%) dominated by Twisted String Roulette (TGR) (6.7%) and singular motif of roulette (6.3%), red slip 44 (or 8%), stabs 38 (or 7%) dominated by dotted stabs (DS) (4.4%). Others are wavy lines (WL) 32 (or 6%) dominated by singular/multiple wavy motifs (4.4%), applique 22 (or 4%) dominated by build lip incisions (2%), impressions 20 (or 3%) dominated by cuneiforms (2%), flutes 6 (or 1%), bevels 5 (or 1%), crescents 6 (or 1%), zigzag lines 2 (or 0.3%), herringbone 1 (or 0.2%), and drill/perforation 1 (or 0.2%).

Table 8.5: The decoration percentages of ceramic assemblage of the current study.

SN	Main decoration	Abbreviation	Sub-category & motifs	Abbreviation	Percentage
0	Un Decorated	UD	-	-	37%
	Undetermined	UDT	-		0.2%
1	Grooved Line	GL			
			Oblique/Diagonal Grooved Lines	OGL	2%
			Oblique & Horizontal grooved lines	OHGL	1%
			Oblique dashed lines & Horizontal grooved lines	ODL & HGL	0.2%
			Horizontal Grooved lines/Channels	HGL	17%
			Vertical grooved lines	VGL	0.3%
			Thick/Bold Horizontal Grooved Lines & Oblique lines/incisions	THGL & OL	1%
			Thick/Bold Horizontal Grooved Lines	THGL	1%
			Random Grooved Lines	RGL	1%
			Horizontal grooved line & Thumb impression	HGL & TI	0.2%
			Horizontal & Vertical grooved lines	HVGL	1%
		Total			**24%**

2	Incisions		Horizontal Incisions	HI	12%
			Triangular Incisions & Dotted Stamps	TI & DS	0.1%
			Cross-hatching Incisions	CHI	2%
			Cross-hatching & Nail incisions	CHI & NI	
			Vertical incisions	VI	1%
			Vertical and horizontal incisions	VI & HI	1.6%
			Horizontal incisions & Grooved lines	HI & GL	0.3%
			Horizontal & Oblique incisions	HOI	0.3%
			Random incisions	RI	3%
			Oblique incisions	OI	2%
			Oblique incisions & Grooved lines	OI & GL	0.3%
			Cross-hatching & Horizontal grooved lines	CH & HGL	1%
			Triangular cross-hatching with grooved lines above	TCGL-above	1%
			Triangular cross-hatching with grooved lines below	TCGL-below	2%

			Triangular cross-hatching with grooved lines above & below	TCGL-above & below	0.3%
			Cross-hatching incisions & Stepped line	CH & SL	0.2%
			Oblique triangular lines	OTL	0.2%
			Archical incisions	AI	0.2%
			Oblique incisions, Grooved lines and bevels	-	0.2%
		Total			**28%**
3	Wavy lines	WLs	Single/multiple wavy lines	WL	4.4%
			Wavy lines & Grooved lines	WL & GL	1%
			Wavy lines & Stamp impressions	WL & SI	0.2%
			Dashed-wavy grooves	DWG	0.3%
			Wavy & Red slip	WRS	0.3%
	Total				**6%**

4	Impressions		Nail Impressions	NI	0.3%
			Cuneiform impressions/stamps	CS	2%
			Cuneiforms & incisions/grooves	CI	1%
	Total				**3%**

5	Stabs		Dotted stabs grooves	DSG	0.3%
			Dotted stabs impressions	DSI	4%
			Dotted stabs impressions & Horizontal grooved lines	DSI & HGL	0.2%
			Dotted double stabs & Parallel lines	DDS & PL	1%
			Polygon stabs	PS	0.2%
			Rectangular stabs	RS	1%
	Total				**7%**

6	Roulette		Singular roulette	-	6%
			Thick Grooved Lines, incisions, & roulette	TGL & IR	0.3%
			Twisted String Roulette & Horizontal Grooved Line	TGR & HGL	2%
			Twisted String Roulette	TGR	7%
			Roulette & finger impressions	RFI	0.2%
			Roulette & Horizontal grooved lines	RHGL	0.3%
			Rouletted Tringles	RT	0.2%

			Twisted String Roulette, Horizontal Grooved Line & Paint		0.2%
	Total				**16%**

7	Flutes		Single/multiple flutes		1%
			Flutes, horizontal & oblique grooved lines	FHOGL	0.1%
			Flutes & Oblique grooved lines	FOGL	0.1%
			Flutes & Horizontal grooved lines	FHGL	0.2%
	Total				**1%**

8	Applique/relief		Single motif of Applique	-	2%
			Build lip incisions/impressions	BLI	2%
			Applique & Random incisions	ARI	0.2%
	Total				**4%**

9	Zig-zag		Zig-zag Lines	ZLs	0.2%
			Zigzag & Dotted stamps	ZDS	0.2%
	Total				**0.4%**
10	Herringbone	0.2%			
11	Drill/perforation	0.2%			
12	Crescents	1%			
13	Red Slip (RS)	7.4%			

14	Bevels		Oblique incisions, grooved lines and bevels	OI, HGL & Bevels	0.2%
			Oblique grooved lines and bevels	OGL & Bevels	0.3%
	Total				**1%**

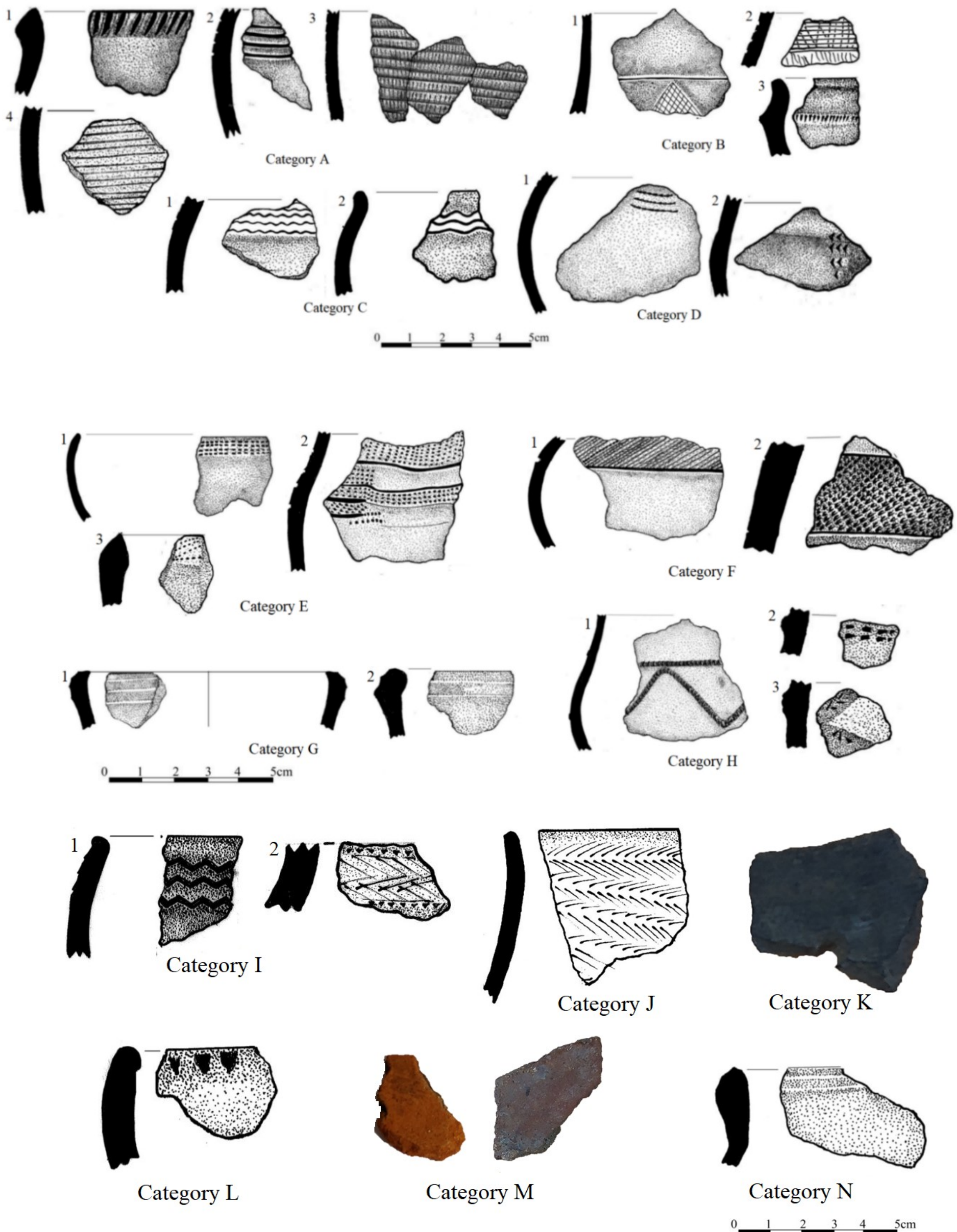


Figure 8.10: Categories of Ceramic Decorations: Category A: 1=OGL, 2=HGL, 3=HGL & VGL; Category B: 1 & 2=TIW, 3=VI; Category C: 1 & 2=WLs; Category D: 1 & 2= CS/CI; Category

E: 1 & 3=DSI, 2=DSI & HGL; Category F: 1=TGR & HGL, 2=Roulette & HGL; Category G:=Flutes; Category H: 1-3=Applique/relief; Category I: 1=ZLs & 2=ZDS; Category J=Herringbone; Category K= drill/perforation; Category L:=Crescents, Category M=Red slip/paint, and Category N=bevels (Illustrated by Hitson Pazza 2021/22).

As per site specific, the study has observed variations in terms of decoration occurrences per specific site (Figure 8.11). For example, incisions, GLs or channels occurred more at Magubike, Mlambalasi, and Mgera sites. The roulette motifs were only recorded at Mlambalasi, Mgera, Mlangali, Utinde-Mkoga, Msosa, and Ikula for Iringa region. However, Majority of them 47 (or 53%) and 35 (or 39%) is from Mlambalasi and Mgera sites respectively. This is to say Magubike site did not yield any rouletted vessel. The opposite is also evidence on other decorative motifs such as doted stabs and flutes, which occurred more at Magubike than other Iringa sites by 41%. Those differences have implications when it comes to site settlement, technology, and the IA categorization as highlighted in section 8.9. In general, some decorations were confined to a certain site. For example, the bevels and flutes were recorded more at Mgala-Isitu site in Njombe Region by 91% for the entire ceramic assemblages of the current study. The rest 9% counts for Magubike site.

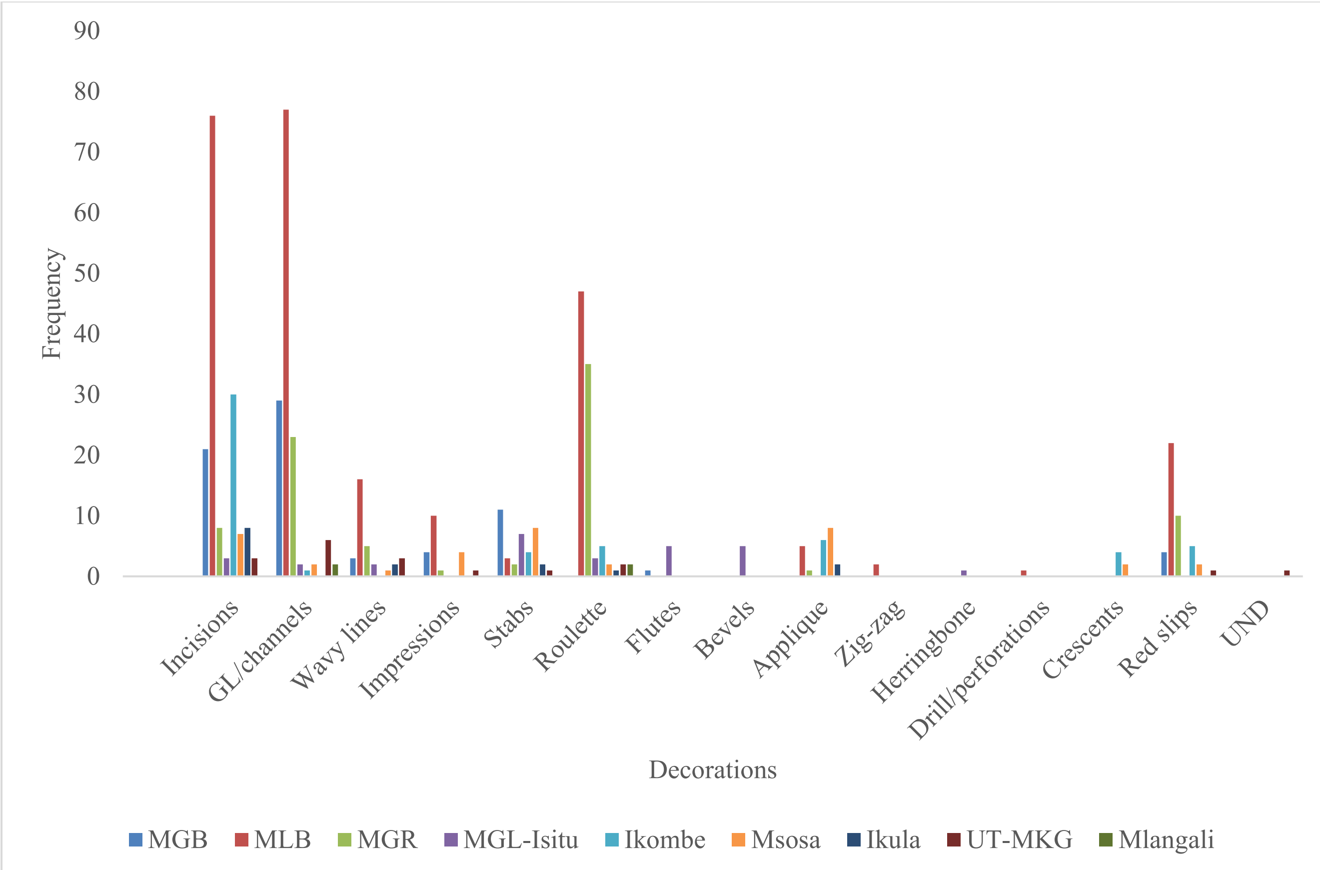


Figure 8.11: The frequency of decorations per site.

Regarding to decorations per excavation unit, the study has noted that the HI, HGL, and DS dominated the Magubike assemblage specifically at TP# 3, 8, 9, and 12 (Figure 8.12). Contrary to Magubike, some wider similarities in terms of decorations were observed for Mlambalasi and Mgera sites. Such decorations are HI, HGL and roulette that dominates the room 1, TP# 1, I-9, and I-10 for Mlambalasi and trench #2 for the Mgera sites (Figure 8.13). Other test pits or excavation units yielded the similar decorations but, in less frequency.

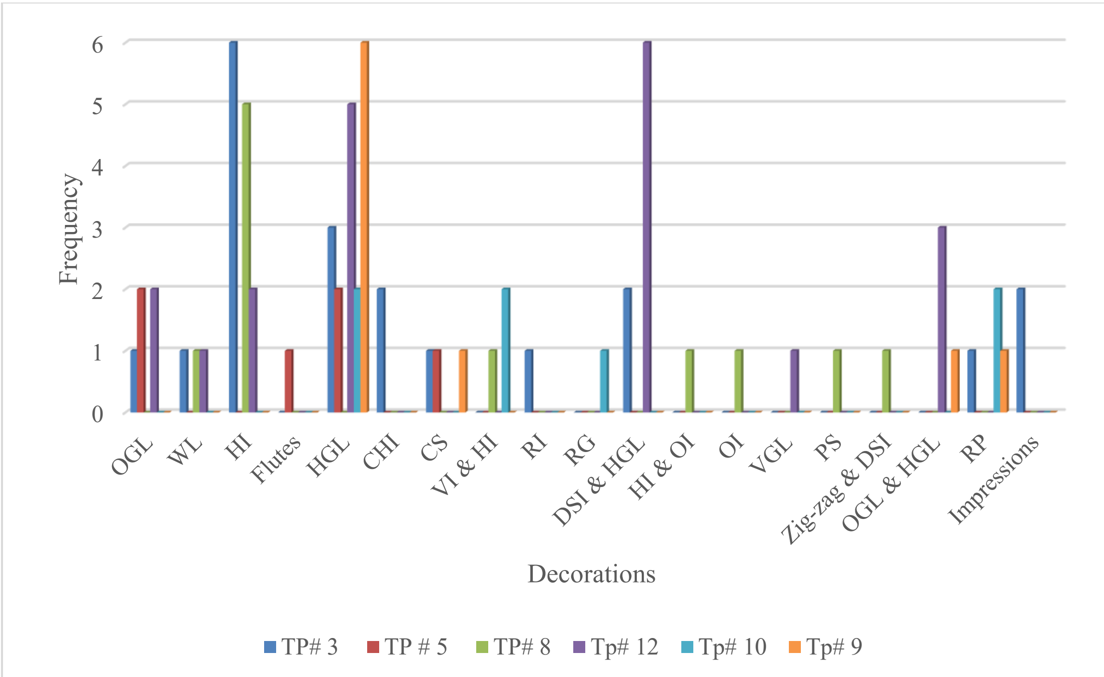


Figure 8.12: The frequency of decoration attributes per excavation unit for Magubike site.

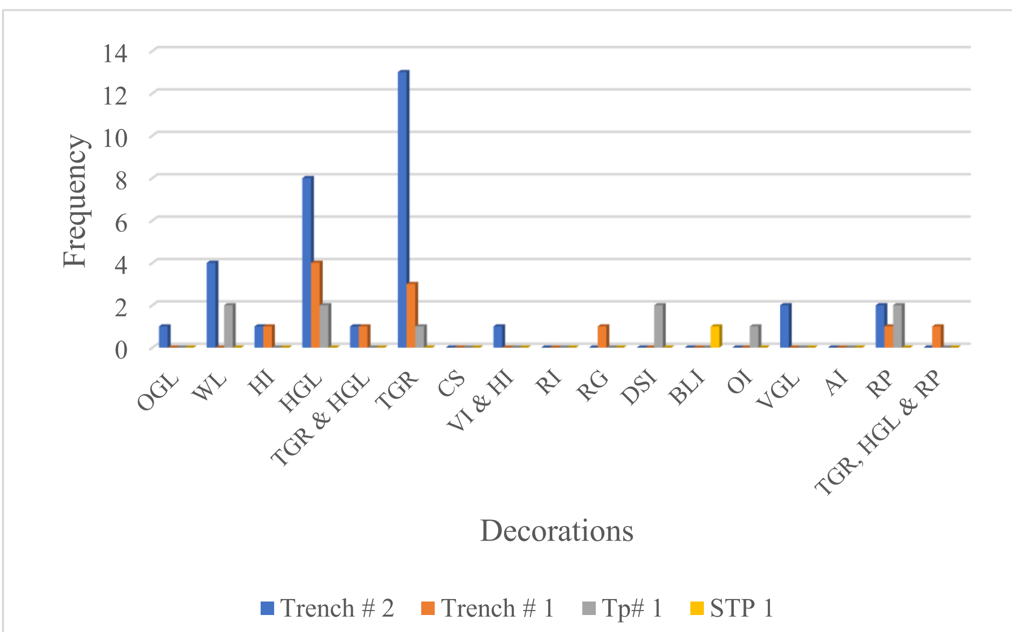


Figure 8.13: Decoration frequency per Excavation unit for Mgera.

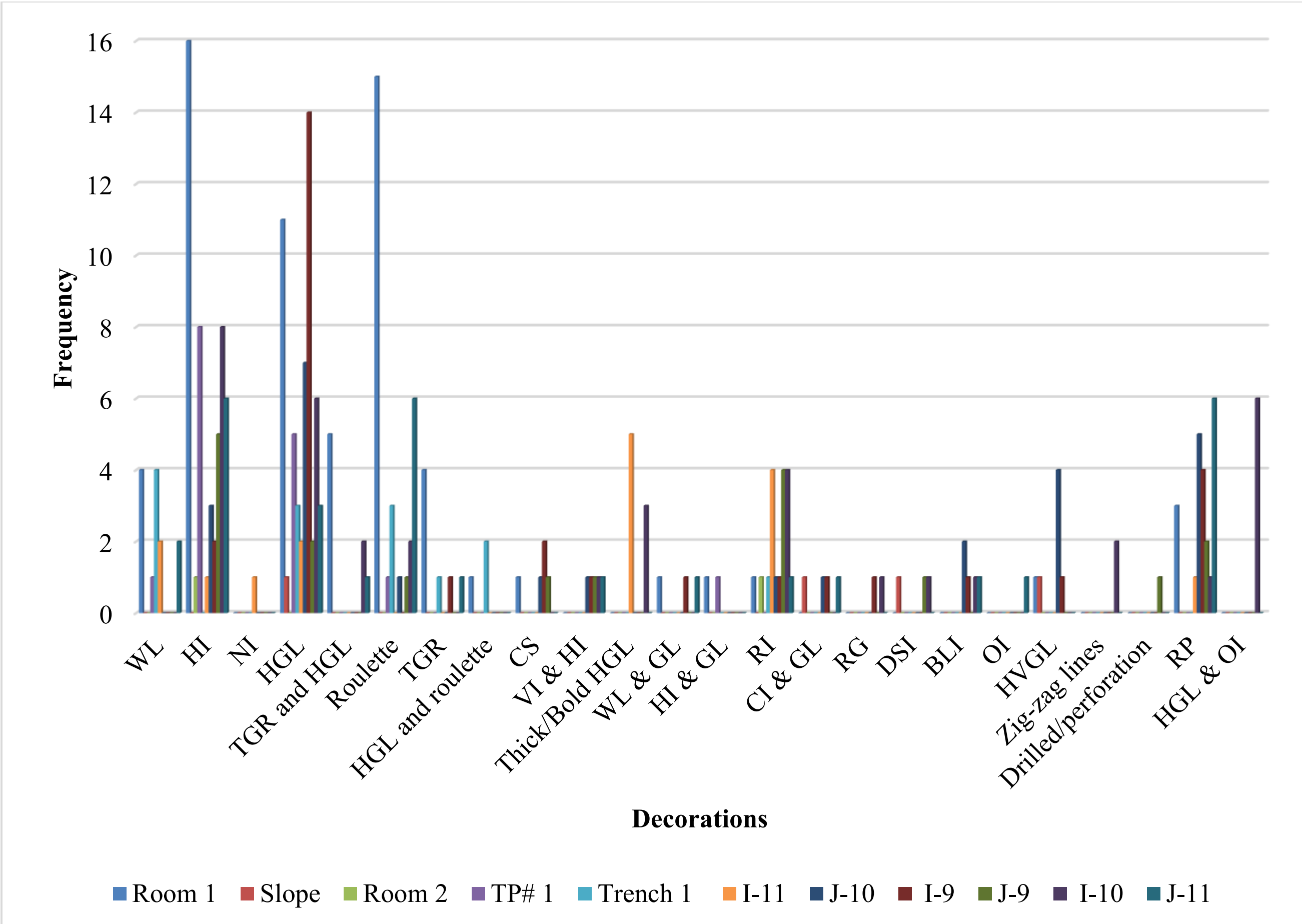


Figure 8.14: Decoration frequency per Excavation unit for Mlambalasi.

Considering to decoration placements, the current study has noted that majority 275 (or 48%) are placed on the body having higher frequency at Mlambalasi by 57% (Figure 8.15; Table 8.6). This was followed by 116 (or 20%) placed on the shoulder having higher frequency at Mlambalasi as well (Figure 8.15). Placement on the lips 48 (or 8%), 48 (or 8%) on the neck. The former appeared more at Msosa, Ikombe, and Mlambalasi ceramic assemblage while the latter dominates more the Mlambalasi assemblage. Other decoration placements for the current study occurs in less frequency as presented in (Figure 8.15).

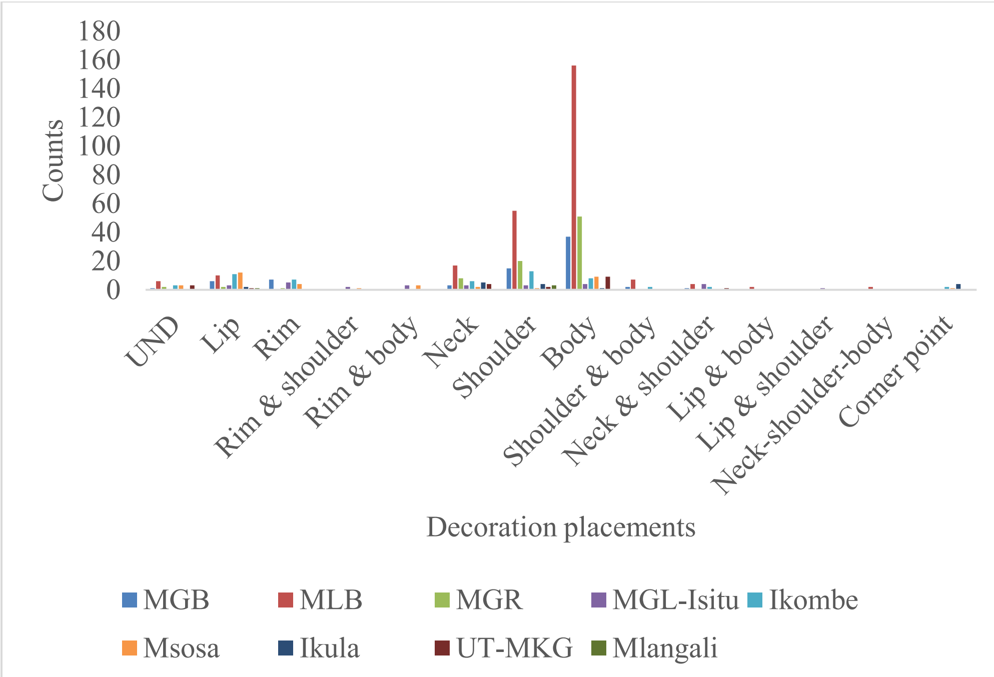


Figure 8.15 The Frequency decoration placements per site (in figure form).

Table 8.6: The Quantity of Decorations Placements per sites (in table form).

Decorations	Site									
	MGB	**MLB**	**MGR**	**MGL-Isitu**	**Ikombe**	**Msosa**	**Ikula**	**UT-MKG**	**Mlangali**	**Total**
	Frequency									
UND	1	6	2		3	3		3		**18**
Lip	6	10	2	3	11	12	2	1	1	**48**
Rim	7		1	5	7	4				**24**
Rim & shoulder				2		1				**3**
Rim & body				3		3				**6**
Neck	3	17	8	3	6	2	5	4		**48**
Shoulder	15	55	20	3	13	1	4	2	3	**116**
Body	37	156	51	4	8	9	1	9		**275**
Shoulder & body	2	7			2					**11**
Neck & shoulder	1	4		4	2			1		**12**
Lip & body		2								**2**
Lip & shoulder				1						**1**
Neck-shoulder-body		2								**2**
Corner point					2	1	4			**7**
Total	72	259	84	28	54	36	16	20	4	**573**

8.5 Ceramic Chronological Classification (PCC)

Based on C-14 dating generated from charcoal and some potsherds (Table 8.7; Figure 8.16-18) previous dates done in my study area, and those obtained from the related region (Table 8.8; Figure 8.19-8.20), the current study has been able to group ceramics into two chronological class order, that is the EIA and LIA/historic (Table 8.9). The 141 EIW pieces (15%) have dates ranging from 168 cal BC to 236 cal AD at Magubike site (Figure 8.16-18). The 732 LIW/historic pieces (80%) date to between 1,277 cal AD and 1,921 cal AD at Mlambalasi and Mgera respectively (Figure 8.16-18) and the remaining 40 pieces (5%) are indeterminate.

The EIA ceramics of the current study is composed of 40 short-necked vessels (33%), 15 (12%) closed bowls, 11 (9%) open bowls, and 56 (46%) undeterminable pieces. Thickened rims also dominate them by over 40% ranging between 13-17mm. Some of the lip profiles of the EIA ceramics contains flutes/bevels (Figure 8.29 a-g). Various decoration attributes describe the EIA ceramics of the current study in which the HGL/channels dominates by 14%. Decorations are placed in different parts of the vessels especially on the body and shoulders. The majority of EIA ceramics (70 or 57%) are from Magubike, followed by 25 (20%) each from Mgala-Isitu and Msosa and 2 (2%) from Mlangali. Few potsherds N=19 from Magubike Tp# 3 and Tp# 12 (level 3: 20-30 cm) show distinctive features from those of typical EIA ceramics. The sherds have got reverted thin rims ranging between 6-8 mm and thin walls (8-10 mm). Most of them are reverted/closed bowls decorated with doted/rectangular stabs and incisions placed on either body or below the rims (Figures 8.22 and 8.23).

All ceramics (100%) recorded at Mlambalasi, Mgera, Ikombe, Ikula, and Utinde-Mkoga fall under LIA period (Table 8.7 and 8.9; Figure 8.17). Other sites such as Magubike, Mgala-Isitu, Msosa, and Mlangali presented LIA evidence but not 100% (Table 8.9). For the 732 LIA/historic potsherds identified in the current study, necked vessels were most abundant (N=191 or 26%), followed by closed bowls (55 or 8%), open bowls (53 or 7.3%), carinated vessels (5 or 1%), and 424 (58%) were of undetermined vessel type. About 61% of the LIA ceramics in the current study have the everted rim form and 46% a rounded lip profile. Around 60% of the LIA ceramics have rim thicknesses ranging between 7-12 mm. Twenty-four percent range from 0-6mm, and 14% lie between 13-16 mm. In terms of decoration and decoration placement, the majority (93 or 20%) of the LIA ceramics has roulette decorations placed on the shoulder. The motifs of grooved lines and incisions oriented differently made up 21% of the LIA assemblage. Other decoration attributes of the LIA recorded by the current study are presented in sub-section 8.6.3.

Figure 8.16: Some ceramics submitted for radiocarbon dating.

Table 8.7: C-14 dating results for selected samples from the current study.

UCIAMS #	**Site**	**Sample**	**Depth (cm)**	**fraction Modern**	**±**	**$D^{14}C$ (‰)**	**±**	**^{14}C age (BP)**	**±**	**Calibrated date ranges (95.4% prob.)**
261233	Magubike TP# 3	Ceramics	0-10	0.9625	0.0016	-37.5	1.6	305	15	1516–1645 AD
261234	Magubike TP# 3	Ceramics	10-20	0.7744	0.0029	-225.6	2.9	2055	35	168 BC– 55 AD
261235	Magubike TP# 3	Ceramics	20-30	0.7913	0.0027	-208.7	2.7	1880	30	81– 236 AD
261236	Magubike TP# 5	Ceramics	30-40	0.7899	0.0018	-210.1	1.8	1895	20	80– 215 AD
261237	Mlambalasi Rm 1	Ceramics	Surf	0.9196	0.0031	-80.4	3.1	675	30	1277– 1391 AD
261238	Mlambalasi Slope	Ceramics	Surf	0.9567	0.0020	-43.3	2.0	355	20	1465– 1633 AD
261239	Mlambalasi J-10	Ceramics	10-20	0.9480	0.0026	-52.0	2.6	430	25	1426– 1492 AD
261240	Uhafiwa	Ceramics	Surf	1.0705	0.0018	70.5	1.8	Modern		
261241	Mgera Trench #2	Ceramics	0-30	0.9607	0.0042	-39.3	4.2	320	40	1472–1650 AD
261242	Mgera Trench #2	Ceramics	0-30	0.9677	0.0023	-32.3	2.3	265	20	1525–1795 AD
261243	Mgera Trench #2	Charcoal	0-30	0.9860	0.0016	-14.0	1.6	115	15	1691–1921 AD
261244	Mgera Trench # 2	Charcoal	40-50	0.9727	0.0017	-27.3	1.7	220	15	1646–1800 AD
261245	Mgera Trench # 2	Charcoal	70-80	0.9683	0.0017	-31.7	1.7	260	15	1529–1795 AD
261246	Uhafiwa TP#3	Charcoal	0-20	0.0302	0.0072	-969.8	7.2	28100	1900	36881–27184 BC

Note: Date were calibrated using OxCal v4.4.4 Bronk Ramsey (2021); r: 5; Atmospheric Data from Reimer et al. (2020). The program is free online through Oxford Radiocarbon Accelerator Unit (see also Appendix IX).

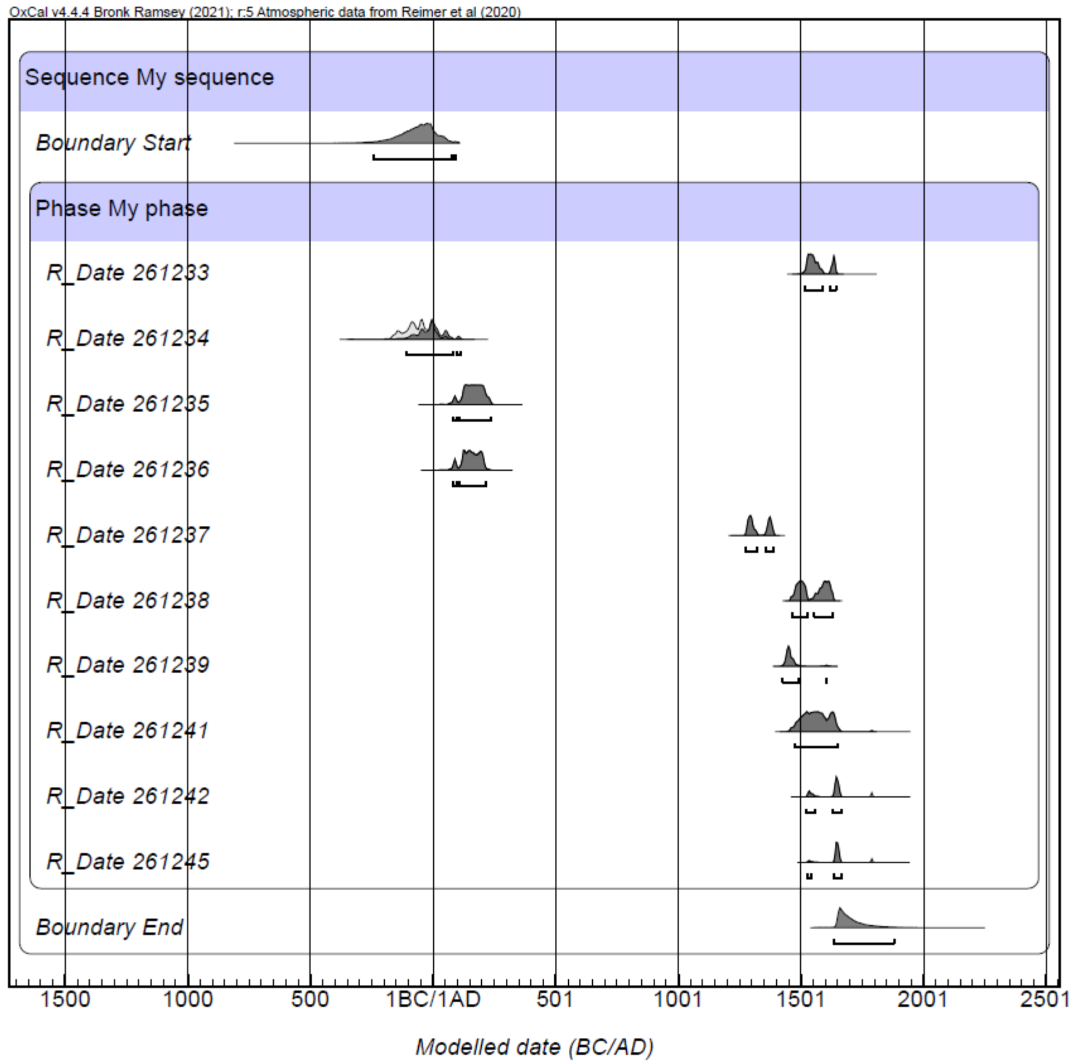


Figure 8.17: Showing a probability distribution of modelled dates (IA) of the current study (based of Table 8.7 above excluding Uhafiwa LSA dates).

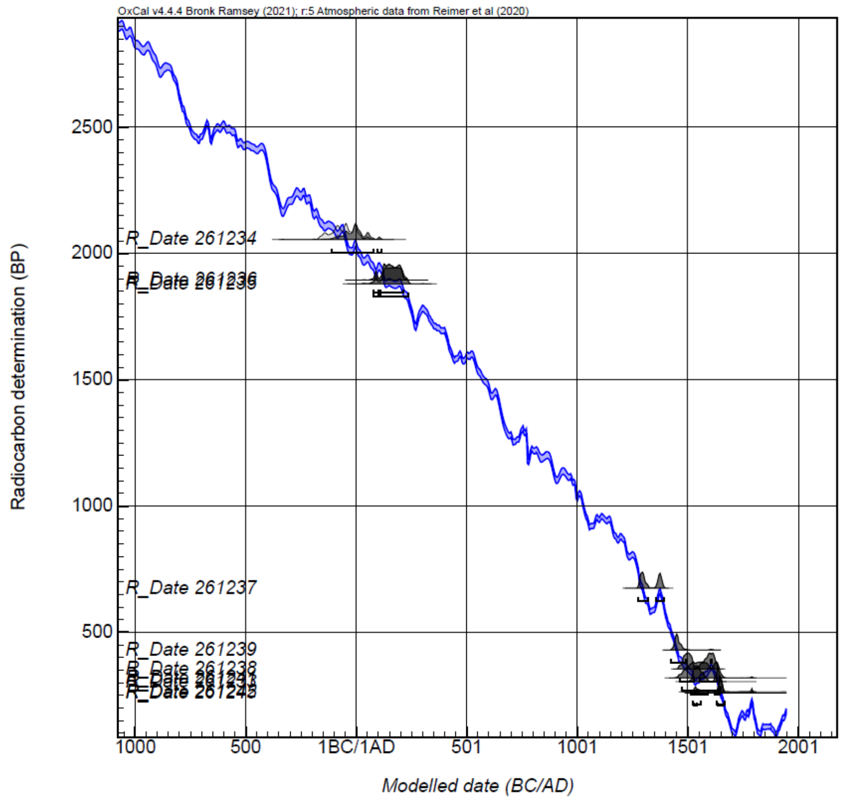


Figure 8.18: The curve showing the modelled dates for the IA context.

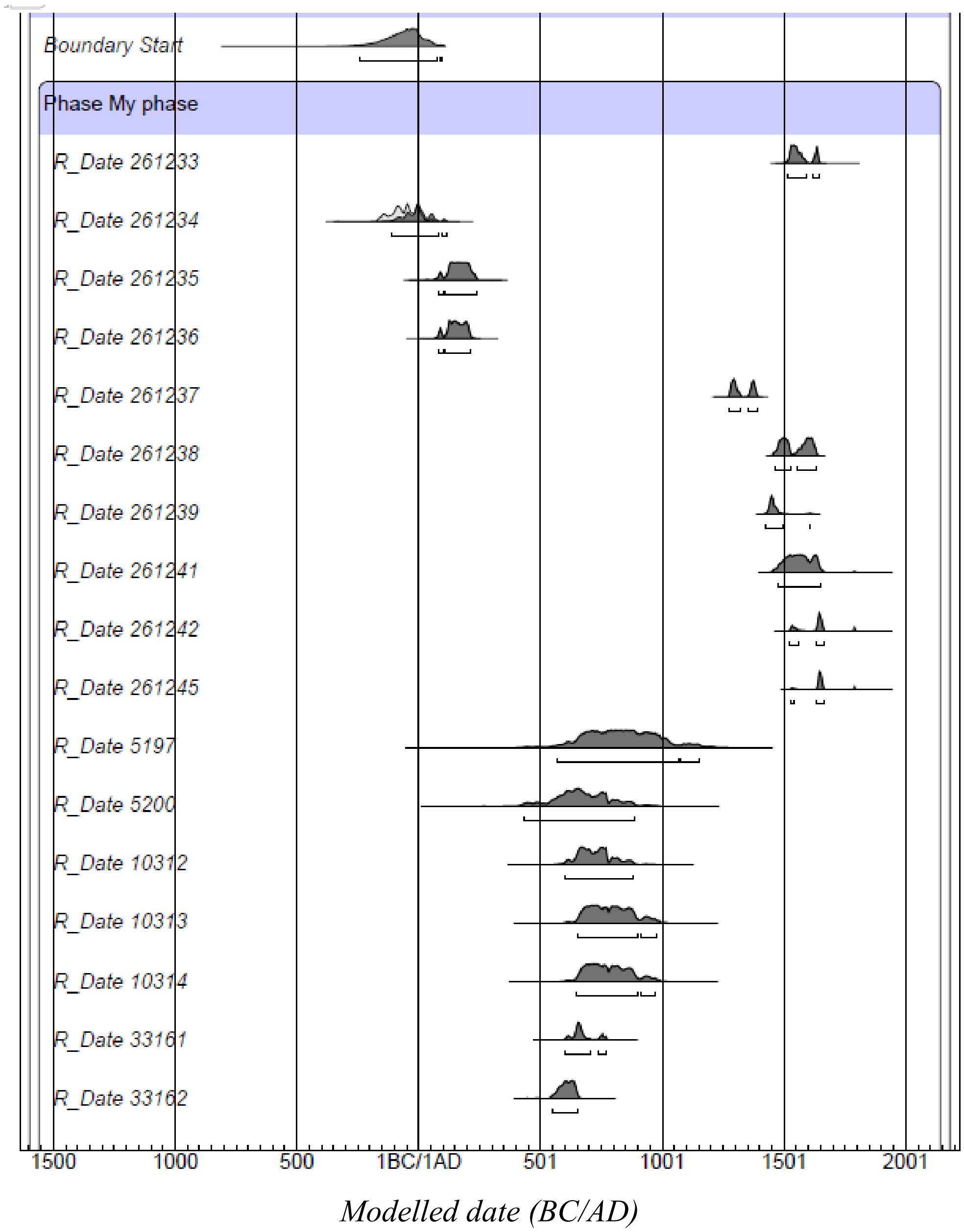
In order to develop a broader comparison between the chronology of the current study and other cultures reported in the region and beyond, some samples (date in form of BP) were incorporated generated from the published literature (Table 8.7 above). The current study calibrated those dates and compared with the current study through chronological modelling done through using OxCal v4.4.4 Bronk Ramsey (2021); r: 5; Atmospheric Data from Reimer et al. (2020) and the date sequence generated through multiplot function. The program is free online through Oxford Radiocarbon Accelerator Unit. The sites considered are from the Swahili coast (Kwekason 2013; Fleisher and Wynne-Jones 2011). The dates and traditions are mainly PIW-Mnaida, Late Urewe, Nkope, and TIW (Table 8.8). Other sites include Limpopo Valley

Mozambique whereby ceramics belonging to Gokomere or Zigo are presented (Elblom et al. 2023). Kalambo, Zambia also was considered having EIA-Kalambo tradition (Barham et al. 2015), and Pahi site in Central Tanzania (Kessy 2013). The dates from Uhafiwa falls within the early LSA while those from Mnaida (Kwekason 2003) falls within the PIW, therefore they were excluded on the comparison (Tables 8.7-8.8). The probability modelled dates indicate the time range (that is the boundary start and end boundary end; Figure 8.19). The EIA sites from Magubike dates earlier compared others (Figure 8.19). The potsherd sample (Lab # 261234 from Magubike Tp# 3 level 2 168 cal BC–55 cal AD) dates earlier for the entire modelled dates (Figure 8.19). Followed by other two samples from Magubike (Lab# 261235 Tp# 3 level 3, 81–236 cal AD) and (Lab# 261236 Tp# 5 level 4, 80–215 cal AD) (Figure 8.19). The plot curve for the entire modelled dates indicates that most of sites are falls within (501–1001 cal AD) signifying longer sites occupations for this period that falls within Middle Iron Age (MIA) to early LIA (Figure 8.19-20). Another concentration is followed on the LIA towards historic period (1501–1795 cal AD; Figure 8.19-8.20).

Table 8.8: Calibrated date ranges from other sampled sites in the Region.

Data source	Site and Tradition	Tradition	Lab#	^{14}C age BP	±	Calibrated date ranges (95.4% prob.)
Fleisher and Wynne-Jones (2011)	Unguja Ukuu	TIW	5197	1210	150	570–1157 AD
		Late Urewe/TIW	5200	1380	110	431–887 AD
	Dakawa	TIW	10312	1320	70	604–878 AD
			10313	1250	80	650–975 AD
			10314	1260	80	646–975 AD
Kwekason (2013)	Mikindani, Pemba	EIA-Nkope	33161	1366	38	603–774 AD
	Mikindani, Pemba	EIA-Nkope	33162	1456	43	549–655 AD
	Mikindani, Pemba	Mnaida-PIW	33163	2225	59	400–112 BC
	Kilwa	EIA-Nkope	33164	1456	43	549–655 AD
Ekblom et al. (2023)	Limpopo Valley, Mozambique	EIA-Gokomere/Zigo	52987	1508	25	483–639 AD
			52898	1554	29	430–579 AD
			54559	1219	28	702–887 AD
			52899	1396	29	602–667 AD
Barham et al (2015)	Kalambo Falls, Zambia	EIA-Kalambo	395	1400	150	267–978 AD
			3189	370	50	1446–1638 AD
Kessy (2013)	Pahi, Central Tanzania	EIA-LIA	2881	1160	100	656–1115 AD
		LIA	2883	460	40	1401–1615 AD
Lane et al. (2006)	Usenge 3, Lake Nyanza, Kenya	EIA-Urewe	190746	1560	40	421–588 AD

Note: Date were calibrated using OxCal v4.4.4 Bronk Ramsey (2021); r: 5; Atmospheric Data from Reimer et al. (2020). The program is free online through Oxford Radiocarbon Accelerator Unit.



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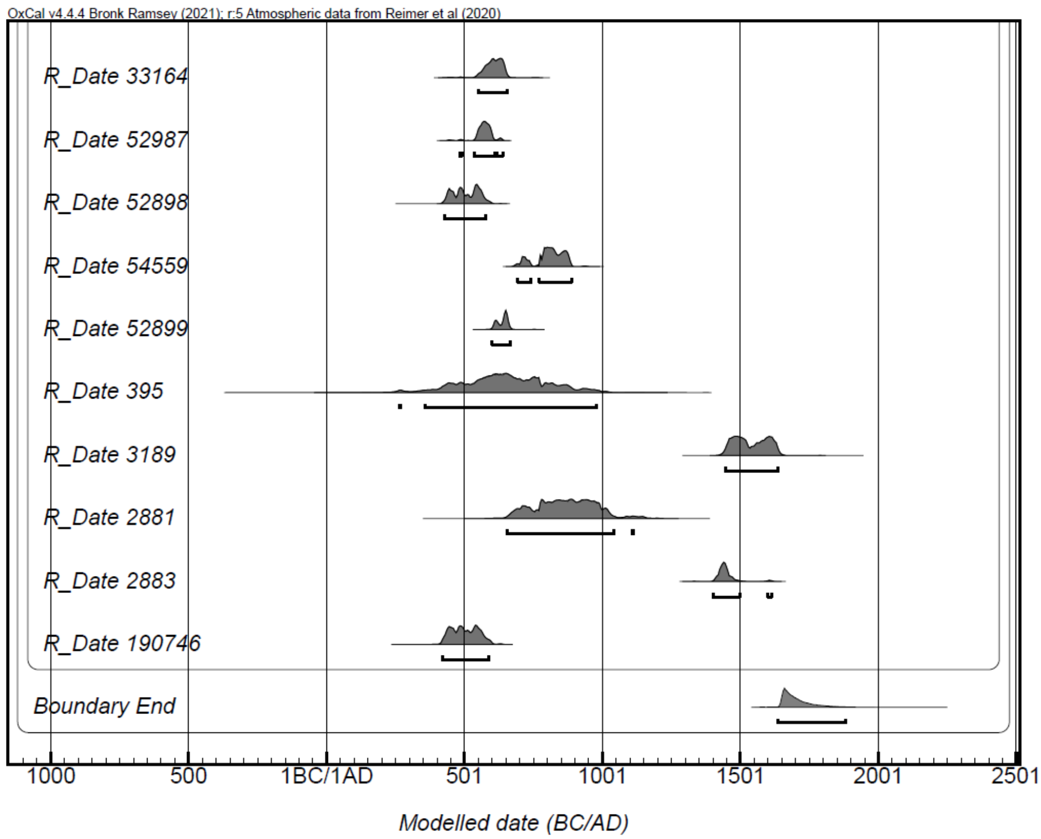


Figure 8.19: Probability distribution of modelled dates for regional comparisons (my site and other related sites based on Table 8.7 and 8.8 above).

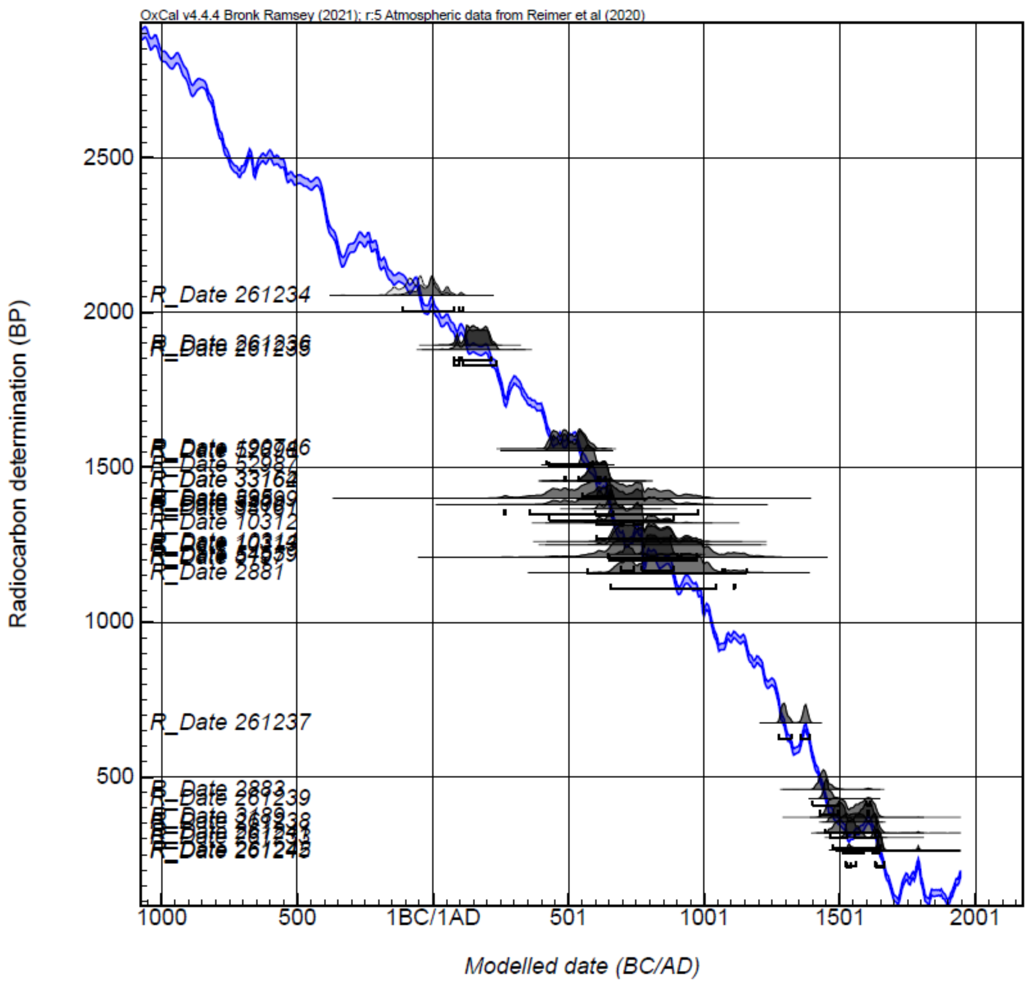


Figure 8.20: The curve showing the modelled dates (IA sites) in the region.

Table 8.9: The quantity of PCC per site.

	Site									
	MGB	**MLB**	**MGR**	**MGL-Isitu**	**Ikombe**	**Msosa**	**Ikula**	**UT-MKG**	**Mlangali**	**Total**
PCC	**Frequency**									
EIA	89	0	0	25	0	25	0	0	2	**122**
LIA	5	379	156	7	69	42	34	38	2	**732**
UND	0	0	0	0	11	13	10	2	4	**40**
Total	**94**	**379**	**156**	**32**	**80**	**80**	**44**	**40**	**8**	**913**

8.6 Ceramic Traditions/Ware Types

Having characterized the physical attributes up to PCC, the current study was abled to come up with eight ware-types/traditions (Figure 8.21). The majority (203 or 41%) are Ivuna, 100 (20%) are rouletted ware, 65 (13%) are TIW, 60 (12%) are Nkope/Kamnama/Gokomere, 29 (6%) are Limbo ware, 10 (2%) are Magubike/Urewe ware, and 6 (1%) are carinated ware (Figure 8.21). The 19 (4%) from Magubike Tp# 3 and Tp# 12 were named as EIA-Thin ware following the distinctive thin walls and rims they have. The remaining 421 potsherds were not possibly identified to a specific tradition/ware type. Table 8.10 presents the frequency of those ware types per sites. The detailed analytical characterization of those wares is presented in the next sub-section.

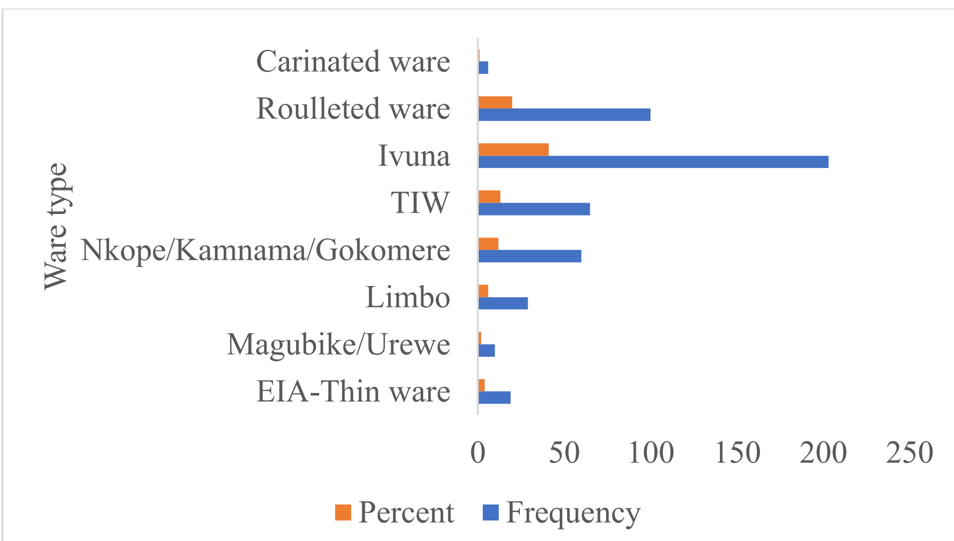


Figure 8.21: The frequencies and percentages of ware-types recorded by the current study.

Table 8.10: The quantity of Ware-type per site.

	Site									
	MGB	**MLB**	**MGR**	**MGL-Isitu**	**Ikombe**	**Msosa**	**Ikula**	**UT-MKG**	**Mlangali**	**Total**
Ware type	**Frequency**									
Magubike ware	10									**10**
Limbo				17		12				**29**
Nkope/Kamnama	46			5		7			2	**60**
TIW				5	43	4	13			**65**
Ivuna		134	4		10	24	3	30		**205**
Rouletted ware		55	33		5	2	1	2	2	**100**
Carinated ware		1	1			2	2			**6**
EIA-Thin ware	19									**19**
UND	19	189	118	5	22	29	25	8	4	**419**
Total	94	379	156	32	80	80	44	40	8	**913**

8.6.1 PN/PIW Traditions

In the way of testing the presence of PN or not in the Southern Highlands of Tanzania, a number of issues were considered. First, pottery sample from Magubike Tp# 3 (level 3: 20 cm) were dated (Figure 8.16). This was done following the earlier date by (Bushozi 2011; Willougby 2012) from Achatina dated to (1401–1048 cal BC). Second, some ceramics from Tp# 5 Magubike (30-40 cm) having internal groves were submitted for dating. Other dated potsherd samples were from Mlambalasi rockshelter having internal grooves and cuneiform incisions below the rims. Third, excavation of Uhafiwa site that was previously reported to have PN pottery associated with LSA lithic artifacts (Msemwa 2001).

The current study came with the following results:

(i) The thin wall and rims potsherds from Magubike Tp# 3 level 3 (Figure 8.22-23) do not fall within the chronological time-frame of PN in East Africa. Instead, they fall within the typical EIA timeframe of East Africa (reference to the modelled dates presented above; see also Crowther et al. 2018, Table 1:105). The C-14 dates generated from potsherd falls within EIA context (81–236 cal AD) contrary to the previous dates generated from *Achatina* (1401–1040 cal BC). Despite that the morphology and decoration of potsherds are not related to other typical EIA of Eastern Africa still the chronology falls within Urewe (500 BC–800 AD), Lelesu (100-200 AD), and Kwale (100–200 AD) (more details on Chapter 10 for discussion). The pottery similar to that of Tp# 3 have been found at Magubike Tp# 12 on the same level like that of Tp# 3. Above level 3, (10-20 cm) the pottery belonging to typical EIA are emerged having doted stabs on the thickened rims (Figure 8.24). Such ceramics dates (168 cal BC–55 cal AD). This date falls typically on Urewe chronology. In terms of sequence material from level 2 dates older than level 3 (Figure 8.17-20). The top level (0-10 cm) has potsherds dating to the LIA/historic period (1516 –1645 cal AD) (Figures 8.17, 8.20, and 8.24).

Figure 8.22: EIA-Thin Ware from Magubike RS Tp# 3: Level 3 (20-30 cm).

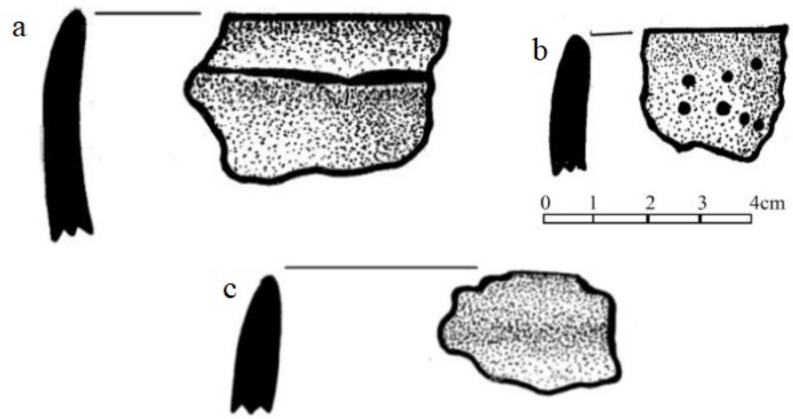


Figure 8.23: EIA-Thin Ware from Magubike Tp# 12: Level 3 (20-30 cm).

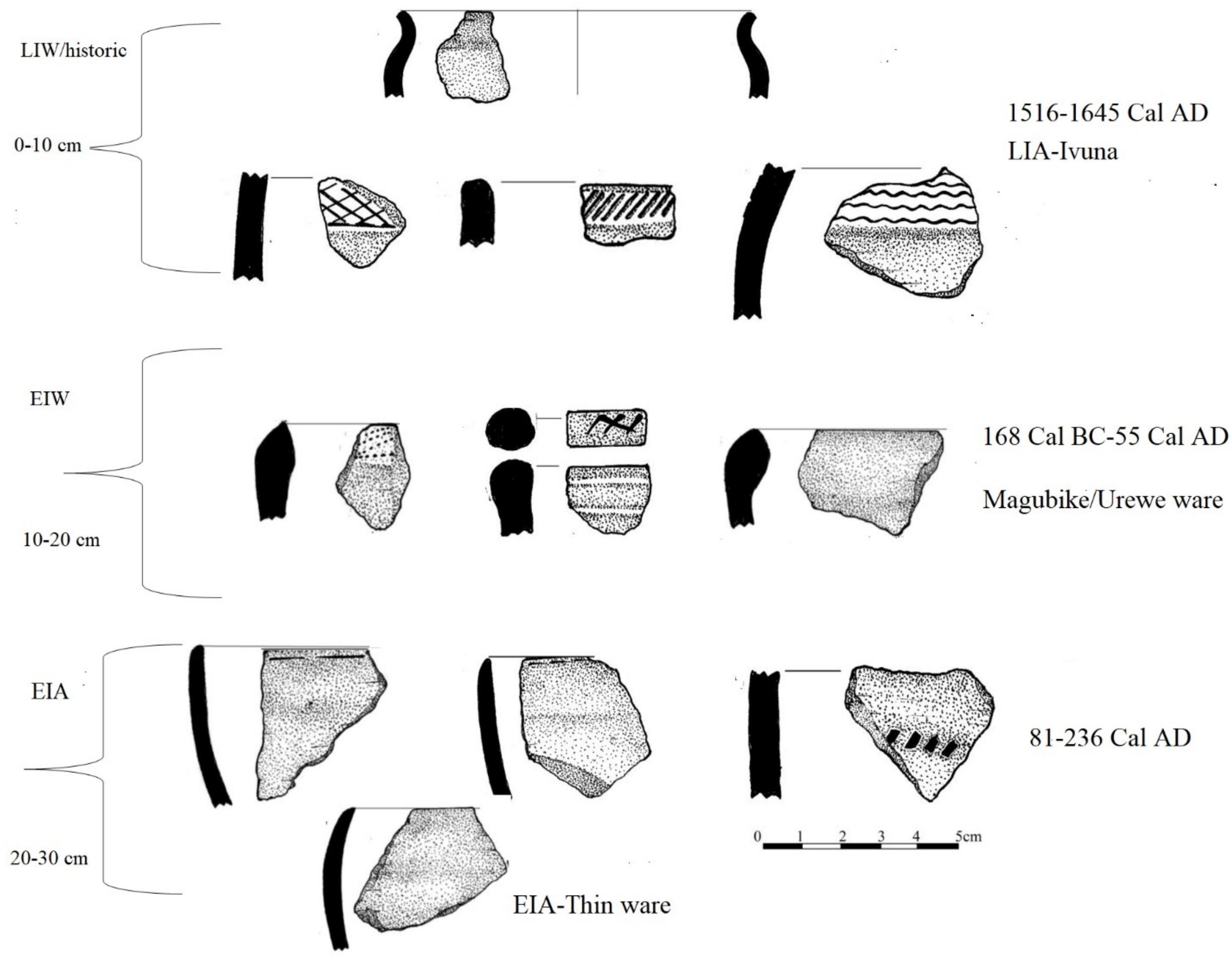


Figure 8.24: The chronology of ceramic artifacts at Magubike TP# 3 per levels.

Beside the chronometric dates and the physical attributes, the context of level 3 (20-30 cm) for TP# 3 is associated with small lithics N=152 of LSA type. They include 51 backed pieces (34%), 31 angular fragments (20%), 29 bipolar cores (19%), 15 flakes (10%), 10 scrapers (7%), 4 points (3%), 4 outils écaillés (3%), 3 blades (2%), and single bec, specialized flake, and sundry ground stone. Other associated material are fauna and a single intruded slag from the upper level. The fauna analysis done by Collins (2009) from the same context (described as MG-A1) has indicated the presence of both domesticate and wild animals. Collins (2009:131) maintains that “the identifiable taxa present in MG-A1 consist of one bovid identified as *Bos taurus,* one indeterminate caprid and three goats (*Capra hircus*). Microfaunal remains consist of one turtle, one reptile, one small carnivore and two birds”. Similarly, to Magubike Tp# 12 (20-30) have got microlithics and both domestic and wild animals including antelope (impala/gazelle) and cattle (*Bos taurus*) following the fauna taxa identification done at the SUA. In terms of chronology Magubike Tp# 12 (20-30 cm) falls within the same range to that of Tp# 3 (20-30 cm) and Tp# 5 (30-40 cm).

(ii) The potsherd sample from Magubike Tp# 5 (30-40 cm) dated to (80–215 cal AD). This is again a timeline like that of Magubike Tp# 3 level 3 (81–236 cal AD) which falls within Urewe, Lelesu, and Kwale chronological timeframe. This implies that the stratigraphy of IA at Magubike rockshelter (20-50 cm) falls within the EIA time period. Other dated potsherd samples from Mlambalasi rockshelter having internal grooves and cuneiform incision below the rims fall within LIA period/historic that (1277–1391 cal AD) for Room 1, (1465–1633 cal AD) for the slope, and (1426–1492 cal AD) for J-10 as indicated on the modeled dates.

(iii) Regarding Uhafiwa site, the current study recorded only lithic material belonging to LSA dating to 36,881–27,184 cal BC found at the depth of 0-20 cm (Figure 8.27). This is contrary to Msemwa, who reported the presence of both lithics and fragmentary ceramics belonging to Narosura traditions (Figure 8.25, 26). The current study did not encounter any ceramic material as previously reported. Instead, the study revisited those ceramics stored at the Isimila Stone Age site museum (Figure 8.25) that were collected by Msemwa. Those ceramics are looking similar with the Narosura ceramics by Odner (1972:61 and 63) based on physical attributes described above. Similarly, the Narosura ceramics have been reported at Luxmanda site-North-Central Tanzania (ca. 3000-2900 B.P) Mbulu Plateau (Prendergast et al. 2013; see also Ombori 2021:27).

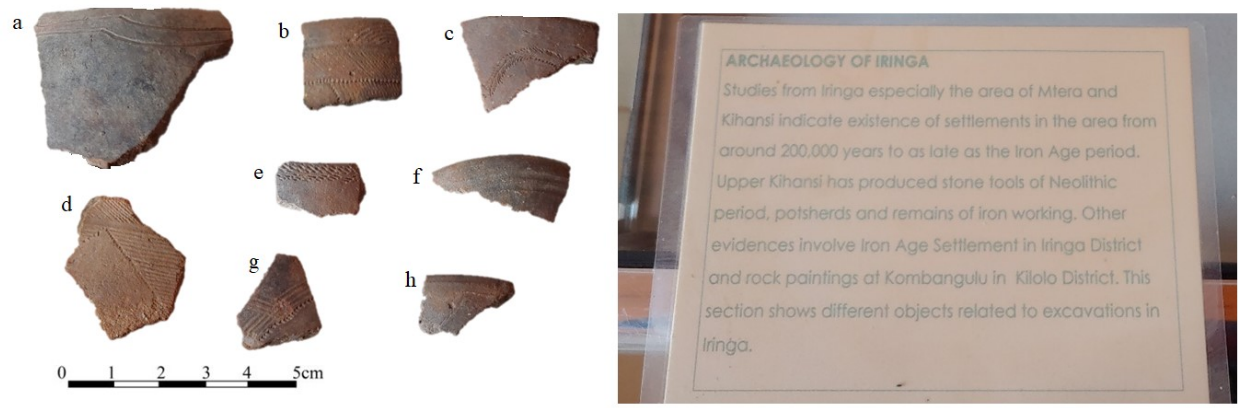


Figure 8.25: Neolithic Ceramics reported from Mtera and Upper Kihansi (Uhafiwa Camp Site) area reported by Paul Msemwa (2001). Stored at Isimila Stone Age Site Museum (Photo by the Author 2021).

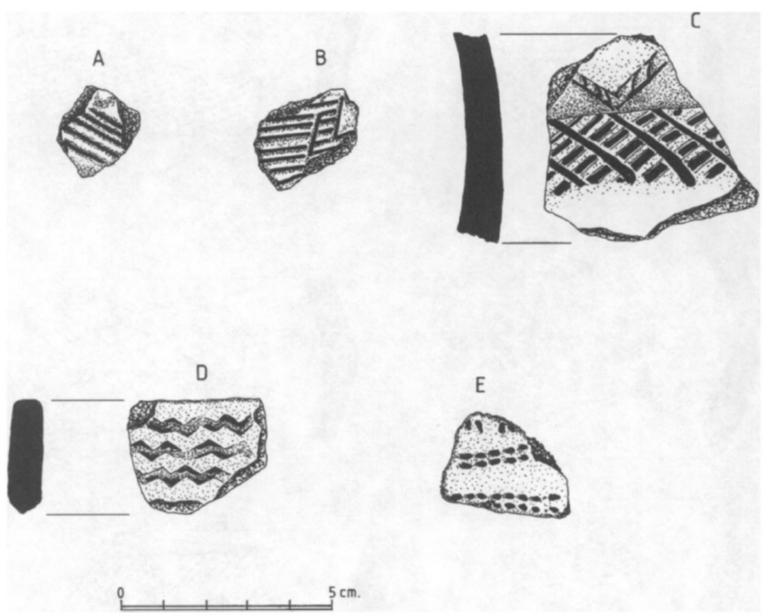


Figure 8.26: Upper Kihansi Neolithic Ceramics after Msemwa 2001 (Adapted from Chami and Kwekason 2003:72).

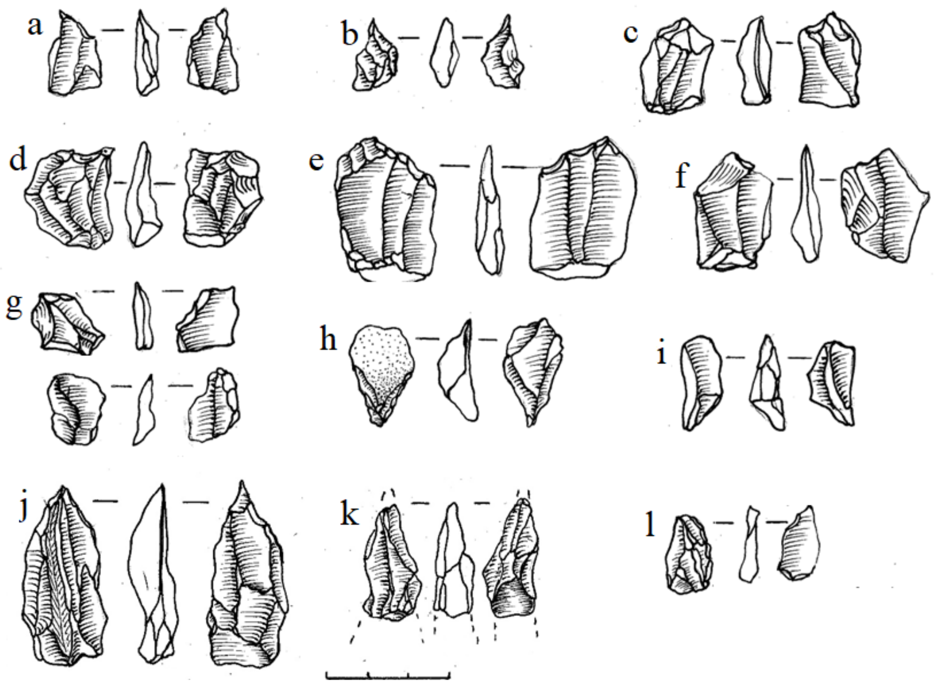


Figure 8.27: LSA lithic artifacts from Uhafiwa Camp site reported by the current study: a-tringle; b-owl; c-d angle backed pieces; e-f: straight backed pieces; g-i diverse backed pieces; j-k points; l-backed piece. (Illustrated by Hitson Pazza 2022).

8.6.2 EIA Traditions

The EIA ceramic traditions of the current study include the Magubike/Urewe, Limbo, and Nkope/Kamnama. All N=29 (100%) recorded at Magubike falls within Urewe, Lelesu, and Kwale timeframe. However, only N=10 recorded at Tp# 3 level 2 dates closer to Urewe than others (168 cal BC–55 cal AD) and therefore classified as Magubike/Urewe ware (Figure 8.28). They are mainly characterized by the reverted tapered/rounded lips (Figure 8.28 a, b) having a minimum of 11 mm and maximum of 14 mm rim thickness similarly to other EIA traditions like Urewe, Lelesu, and Kwale in East Africa. Some few ceramics especially at Magubike TP# 5 (40-50 cm) have the fluted rim/lip profiles (see Figure 8.10 Category G 1) similar to those mentioned traditions. In terms of decorations, they are more related to Kwale ware in which doted stamps impressions and cross-hatching placed on the rims counts (Figure 8.28 b, c).

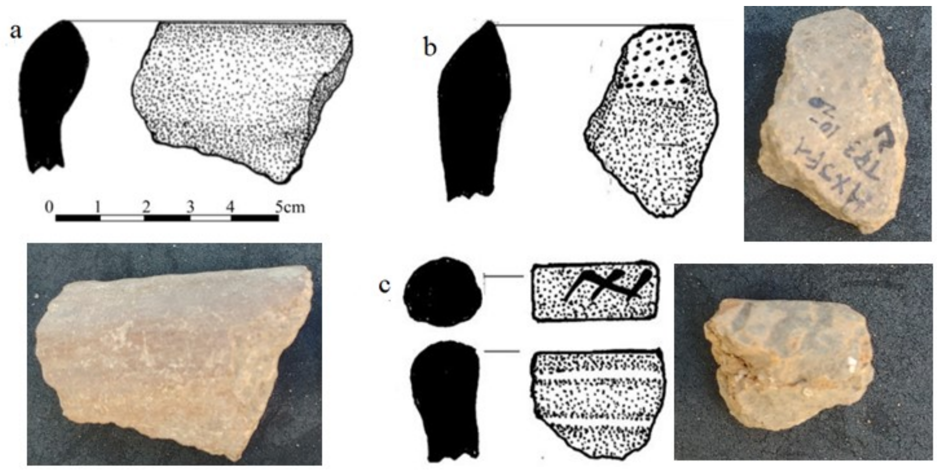


Figure 8.28: EIW Urewe from Magubike TP# 3 level 2 (10-20 cm).

The Nkope/Kamnama/Gokomere traditions of the current study observed at Magubike are represented by ceramics having oblique/diagonal grooved lines placed on the flattened rims of the necked vessels (Figure 8.30-31) mostly recorded at level 1 (0-10 cm) of TP# 12. Others are horizontal and interlocking grooved lines placed on the body (Figure 8.30 TP# 10 i-j); Horizontal grooved lines placed on the body (Figure 8.30 TP# 9). Dotted stamp impressions placed on the shoulder or rims (Figure 8.30 TP# 8 c & TP# 9 e). Based on the calibrated dates and modelled dates presented earlier (Table 8.8 and Figure 8.19), Nkope tradition has been reported especially along the Swahili coast stretching further interior southern Tanzania and other countries of Zambia and Mozambique dated to (549–655 cal AD at Mikindani-Pemba based on Kwekason 2013). Nkope is a variant of Kamnama/Gokomere or Ziwa reported at Mozambique dated to (483–639 cal AD by Ekblom et al. 2023). Phillipson (1974:4, 5 Figure 2:

8, 3: 1, 3, 6 and 7; Msemwa 2001:47, Figure 5.5) has reported ceramics of this kind. Generally, Nkope's EIA tradition stretches from the 4th century to around 1000 AD (Phillipson 1976; Barham et al. 2015). This tradition has originally been recorded in the southern tip of Lake Malawi stretching towards the Zambezi River, west into Zambia, and east into the northwest (Robinson 1970; Phillipson 1976; Barham et al. 2015; Ekblom et al. 2023) and the Swahili coast in Tanzania (Kwekason 2011; Pawlowicz 2013).

According to Chami (1992) the Limbo traditions dates to the early part of the first millennium AD. As for those presented from Limbo site (Chami 1992), the similar ceramics from Mgala and Msosa sites were observed by the current study. They are characterized by rim thickness ranging from 13-17mm and horizontal and oblique lines dominate the decorations (Figure 8.29). Bevels and flutes are also dominant decoration attributes for the Limbo tradition. Chronologically, Limbo is followed by potsherds belong to Nkope/Gokomere/Kamnama tradition. While former was mostly recorded at Mgala and Msosa sites, the latter was mostly recorded at Magubike rockshelter.

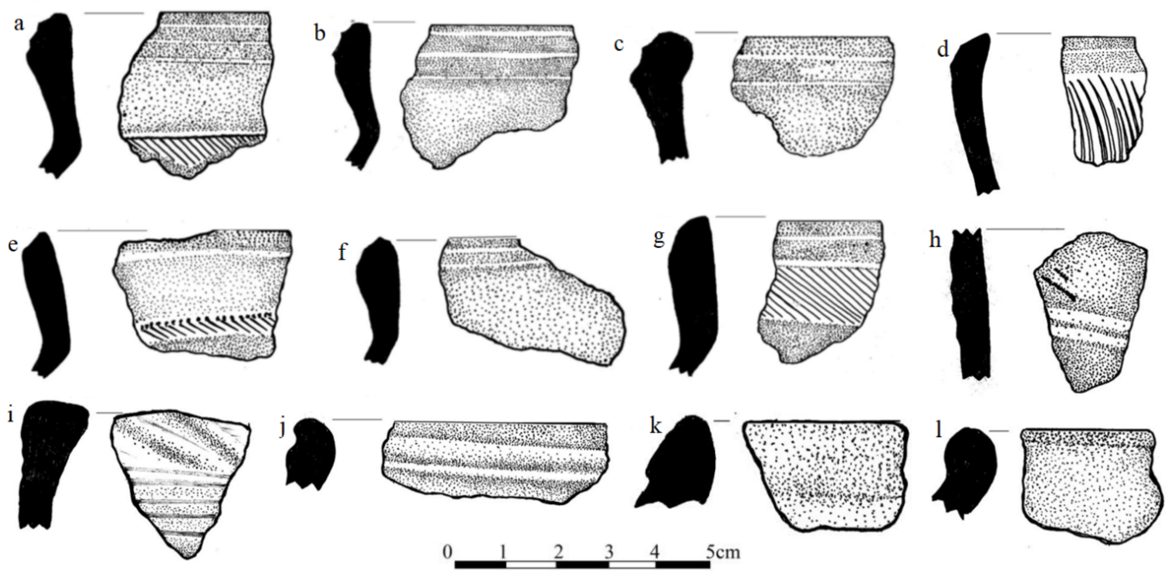


Figure 8.29: EIW Limbo ceramic tradition from Mgala and Msosa sites.

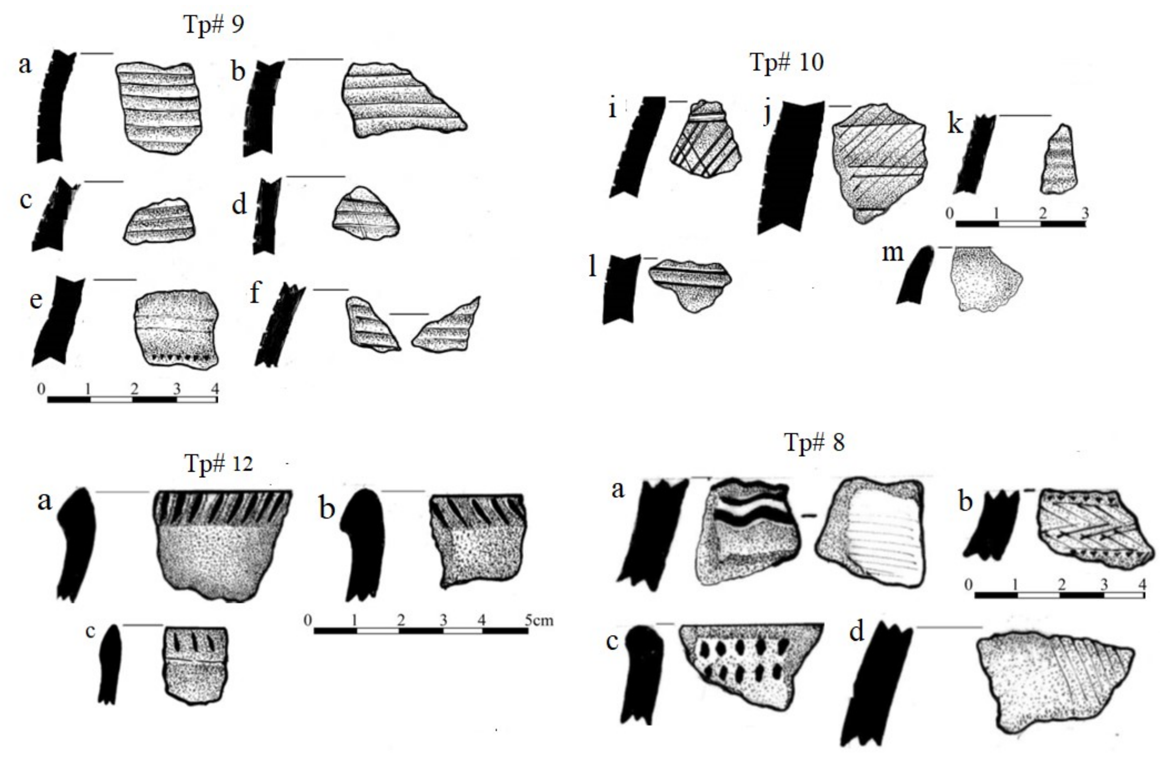


Figure 8.30: EIW Nkope/Kamnama ceramic traditions at Magubike rockshelter.

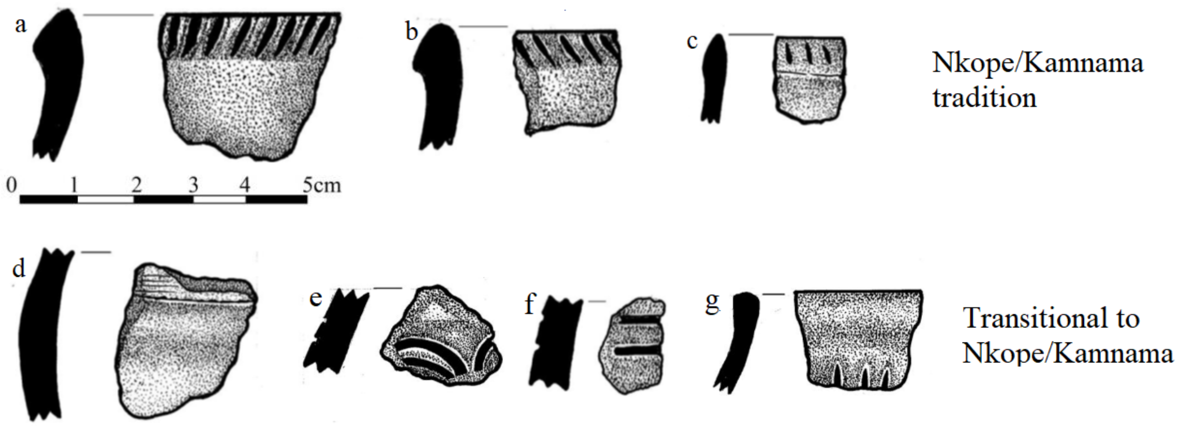


Figure 8.31: The ceramics traditions recorded at Tp# 12 showing transitional to Nkope/Kamnama, and typical Kamnama.

8.6.3 LIW ceramic traditions

The LIW ceramic traditions of the current study include the TIW, Ivuna, Rouletted ware, and carinated ware. TIW/Tana Tradition (Figure 8.32) dates from 600–1,200 AD (Chami 1994; Pawlowicz 2011; Fleisher and Wynne-Jones 2011). Based on the calibrated dates and modelled dates presented earlier (Table 8.8 and Figure 8.19), some site with TIW along the Swahili Coast-Island, and hinterland include Unguja Ukuu (570–1157 cal AD) and Dakawa-Morogoro (604–878 cal AD) (data taken from Fleisher and Wynne-Jones 2011). Originally, the tradition was known as Tana but later was renamed to TIW following the dominant incisions decorations that forms the triangles (Chami 1994; Figure 8.32 a, b, c). Some other decoration motifs found in TIW traditions are bevels, flutes, cross-hatching, and oblique incisions (Figure 8.32). This tradition is more dominant at the Indian Ocean Swahili coast and the adjacent hinterlands. The 43 TIW (or 66%) sherds in the current study were mostly recorded at Ikombe (Njombe Region). Thirteen (20%) came from Ikula, 5 (8%) from Mgala, and 4 (6%) from Msosa.

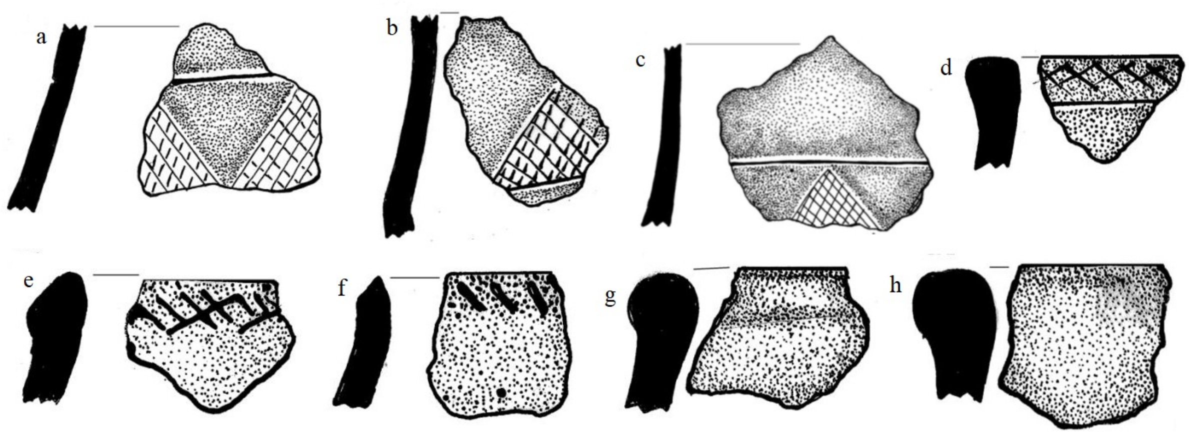


Figure 8.32: Some TIW recorded by the current Study.

Ivuna ceramic traditions in this current study are dominated by large and small necked vessels. Thirty-nine (20%) are decorated with roulette and horizontal grooved lines or only roulette placed on the shoulder (Figure 8.33 g-h). Twenty-three bowls (11%) are decorated mostly by applique/relief, crescents and incisions placed on the rim or lips of the vessel (Figure 8.33 b, c, e, f). Some other decorations like grooved/channels are placed on the body of the vessel. The tradition was originally recorded in Lake Rukwa basin and dated to between 1200 and 1400 AD (Fagan & Yellen 1968: 17-27, Figures 6-16; Mapunda 2010, 2017). Based on the current study majority of Ivuna are recorded at Mlambalasi and Mgera sites dated to (1277–1391 cal AD, 1465–1633 cal AD for Mlambalasi).

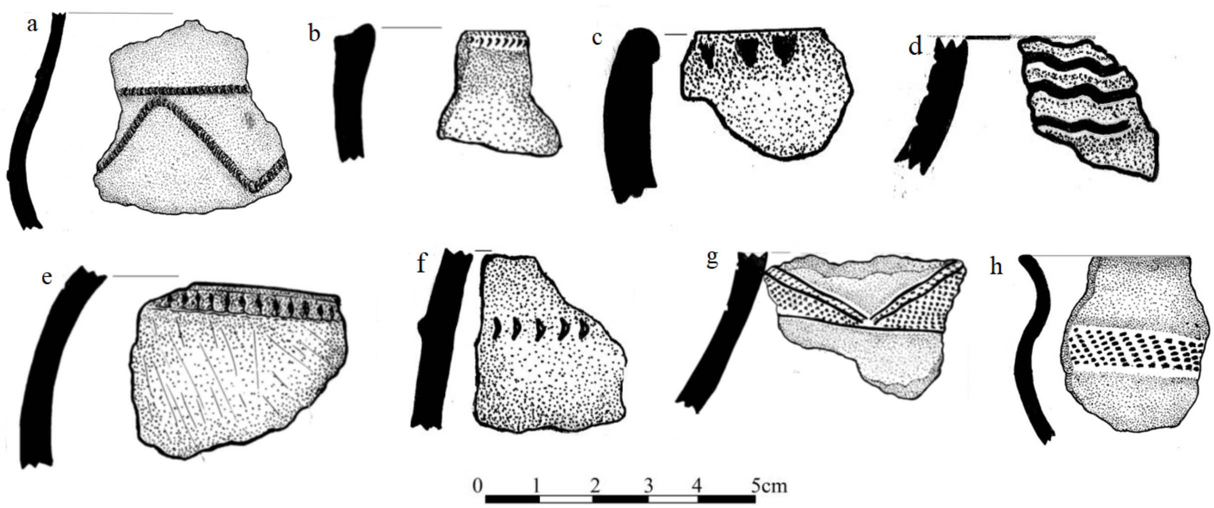


Figure 8.33: Some LIA-Ivuna ware recorded by the current study.

As presented previously rouletted wares are among of LIW ceramics that dominated the ceramic assemblage of the current study. According to Soper (1985), a roulette is a roughly cylindrical object usually small that is rolled over the surface of wet clay to leave a continuous band of impressions that repeat themselves at each revolution. Soper has classified four categories of roulette and provided the meaning and examples of each category (see Soper 1985: 31-40). They include unmodified objects, rigid roulettes (carved wooden and carved stones), flexible roulettes (string and strip) and composite roulettes. Most of the rouletted potsherds recorded by the current study falls under flexible roulettes and specifically the TGR are common (Figure 8.34). However, from the ethnographic point of view, the use of natural objects (unmodified objects) in rouletting was observed in some communities at Njombe region. Flexible string roulette is made from a round-sectioned strand formed of fibres of various kinds or a grass/reed stem. Rouletted tradition is said to dominate Tanzania/Kenya during the early second millennium AD (Ashley 2010; Kyazike 2013) and they mark the beginning of LIA ceramics (Chapter 2). As observed during ethnographic interviews, rouletting technology has continuously dominated the contemporary communities in Tanzania specifically, the Southern Highlands. The calibrated dates for the rouletted pottery of the current study falls within the LIA/historic that is (1525–1795 cal AD at Mgera site).

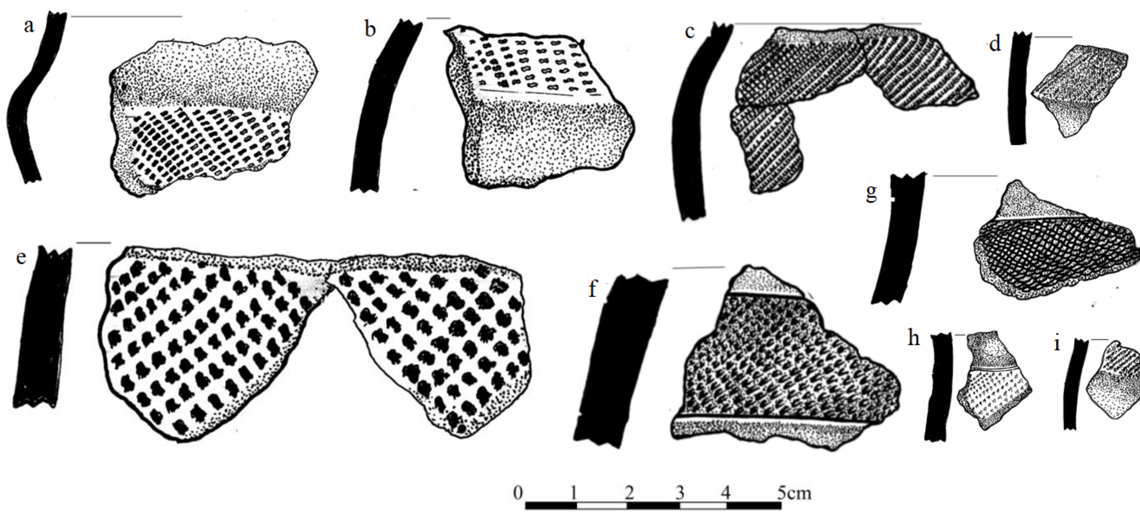


Figure 8.34: LIA-Rouletted ware of the current study.

Although they are less represented, the carinated wares are present in the assemblage decorated with cuneiforms, cross-hatching incisions, archical incisions placed at the corner point of the vessel (Figure 8.35). According to Shepard (1971), ceramics of this kind are termed as dependent restricted vessels because the maximum diameter (major point) lies on the body that separate the vessel into upper and lower part. Ceramics having carination and arc incisions are commonly reported along the Indian Ocean Swahili coast and its islands (Chittick 1974; Chami et al. 2004; Croucher 2006, 2007, Figure 3:316). Such ceramics are more of historic period dated between 1700 and 1900 AD (*ibid*.).

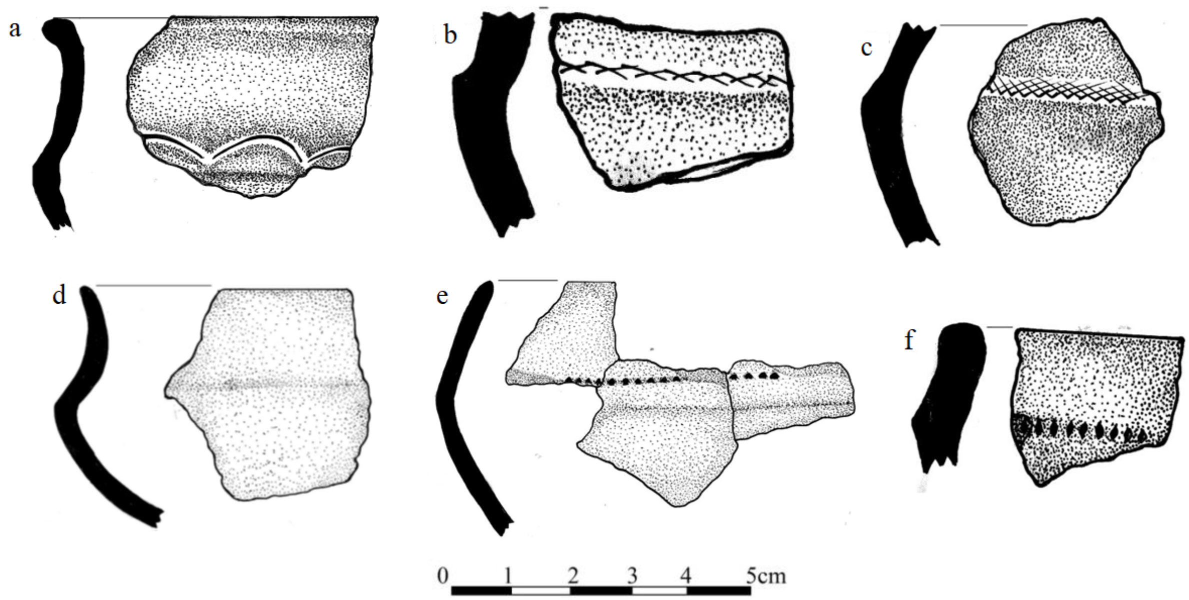


Figure 8.35: LIA/historic-Carinated wares/forms.

8.7 Mineralogical Analytical Methodology

Standard petrographic ceramics thins section (30 microns) were prepared from each sample submitted to AMGC laboratory in Dar es Salaam, Tanzania. The thin sections were analyzed using a Leica DM 750P polarizing light microscope. The focus of the study was on the nature of clay matrix and more conspicuous aplastic inclusions in order to detect composition and alterations. These are, important microstructural and textural features that assist in determining the geological sources of the raw materials and the forming technique used to manufacture the ceramics. The images were taken at 100x magnification. Each sample was examined in terms of clay soil percentage, matrix, and inclusions. This was done for across the selected sites (Magubike, Mlambalasi, and Mgera); per selected excavation units and levels, and other samples from the selected sites outside Iringa and Njombe Regions for the reason presented in Chapter 4.

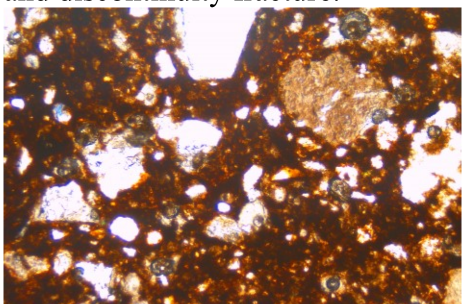
8.8 Mineralogical Analytical Results

8.8.1 General Results

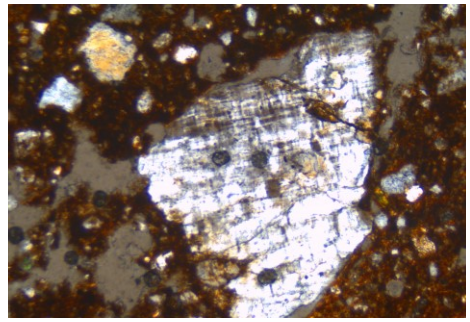
The PA analytical results for both sites Magubike, Mlambalasi, and Mgera were almost similar based on three attributes. They include the major composition and the fabric, forming technique, and ceramics fabric features. The only observable differences were in terms of clay percentages and color. Such results occur between sites and levels per selected excavation units. By referring to (Figures 8.36-37) the samples at Magubike, Mlambalasi, and Mgera have the following major composition and fabric:

- Poorly sorted fine to medium quartz grain
- Sericitized, Perthitic K – and plagioclase feldspar
- Partially metamorphosed limestone as temper of the ceramics (limestone fabric)
- Ferruginous minerals such as hematite
- Ore minerals such as magnetite
- Muscovite, epidote, microcline, and biotite
- Mineral (grog) fragments

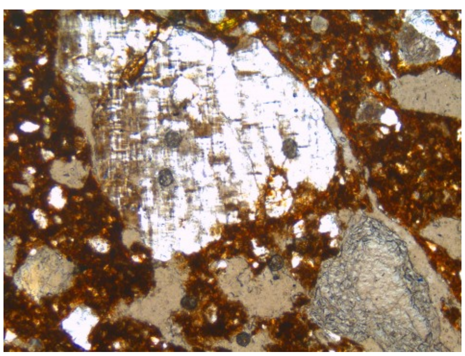
1A: Quartz stained with iron oxide, poorly sorted fine to medium quartz grains, void, brown biotite, and discontinuity fracture.



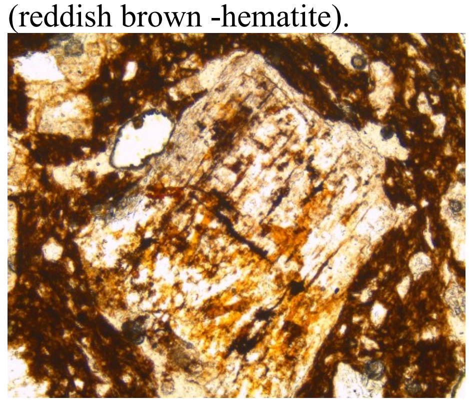
1B: Perthitic K-Feldspar stained with iron oxide, silt to sand sized quartz grains.



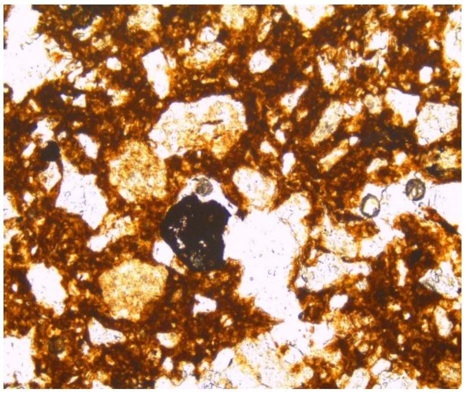
1C: Microcline with strings of iron oxide (hematite) cutting across the exsolution lamellae.



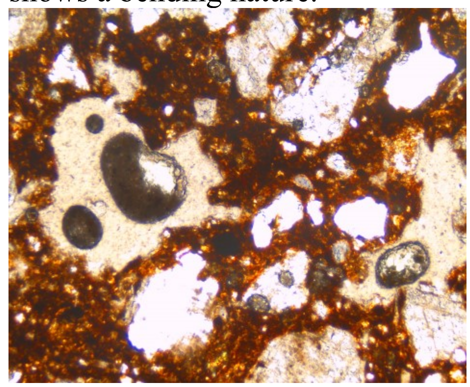
1D: Sericitized feldspar with crisscrossing strings of iron oxide (reddish brown -hematite).



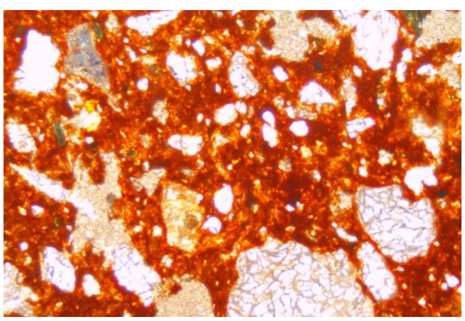
1E: Grog of pre – existing ceramics composed of iron oxide (hematite / magnetite) and weathered feldspars. (XPL).



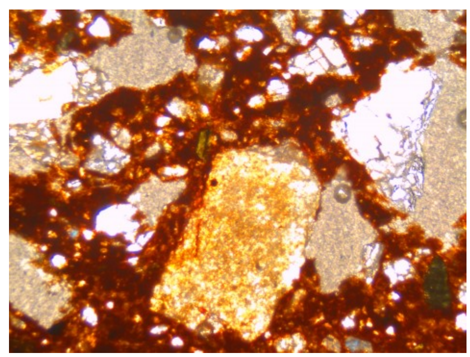
1F: Anhedral weathered feldspar with voids filled with iron oxide (black to brown red). The void shows a bending nature.



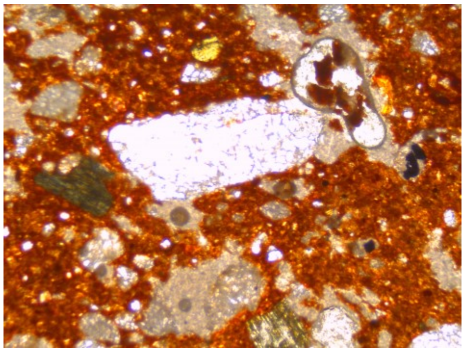
2A: Sericitized feldspar highly weathered perthitic K-feldspar, discount fractures. It is invaded with iron oxide melt.



2B: Subhedral weathered feldspars, stained with iron oxide.



2C: Void filled with fragments of weathered plagioclase and iron oxide.



2D: Epidotization of feldspar, iron oxide (Reddish Brown).

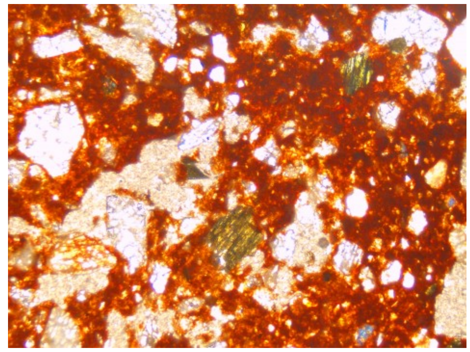
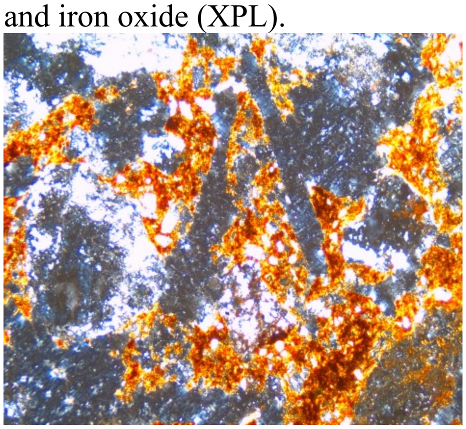


Figure 8.36: Major clay composition and fabric for Magubike ceramic sample 1 and 2.

6D: Highly weathered feldspar, A – Shaped limestone temper, voids and iron oxide (XPL).



6E: Highly weathered feldspar, A – Shaped limestone temper, voids and iron oxide (PPL).

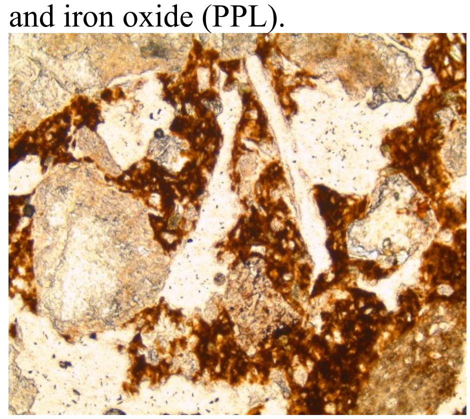


Figure 8.37: Major clay composition and fabric for Mlambalasi ceramic sample 6.

Ceramics forming technique

The petrographic analysis indicates that there are different forming techniques used in the production of ceramics for both three sites. This is due to the presence of parallel and non-parallel orientation of the clay platelets, discontinuity fractures, inclusions, and voids. The presence of different grog fragments such as limestone, rock fragments and pre-existing ceramics were added as tempers to the ceramics as modification of the clay the properties of as per the evidenced obtained from the petrographic analysis.

Raw material sourcing

The raw material used to produce ceramics appear to be obtained from both primary geological sources as indicated by the angularity of most of the grains and from secondary sources derived from pre-existing rocks by weathering, redistribution, and deposition. Round to sub round nature of some of the grains is also the evidence of the secondary source. A pre-existing granitic (primary) source is due to the presence of perthitic K-feldspar and microcline feldspar especially in Magubike sample 2. Presence of secondary epidote indicates alteration process. Epidotization is an alteration during which secondary epidote or zoisite is formed at the expense of plagioclase and amphibole. In this case, it is the plagioclase feldspars which are altering to epidote. Sericitization of feldspars is an indication of hydrothermal-metasomatic processes from an igneous or metamorphic source.

8.8.2 Regional Comparative PA Results

The PA comparative analysis from ceramic samples of Iringa/Njombe regions and those selected from other regions yielded the following results:

Possible PIW/PN tradition

The comparison made from the PIW/PN Swahili coastal sites mainly Mnaida-Mikindani (400–112 cal BC from Kwekason 2011, 2013) and that from the study area (Magubike TP# 3 level 3-Ethin ware 81–236 cal AD). The Magubike Tp#3 pottery was compared to other PIW/PN traditions following the previous dates from *Achatina* that pre-dates the EIA context as already presented (1401–1048 cal BC). The results indicate that Mnaida (Level 3) has the description of 40-50% clay, poorly sorted angular to sub angular silt to sand sized inclusions. The inclusions are up to 4mm. The matrix is dark to pale brown, voids, discontinuity fractures in parallel and non-parallel orientation. The inclusions are mainly of weathered feldspar subordinated with very fine quartz, biotite, and iron oxide. The EIA-Thin ware from Magubike Tp# 3 (Level 3) has the description of 40-45% Clay, reddish brown iron oxide inhomogeneous, mainly very fine sand size angular fine to large inclusions up to 1.5mm. Matrix is reddish brown, discontinuity fractures, Iron oxide showing flowing texture. Grogs of pre-existing pottery composed of felspar and quartz grains. The flow texture is also exhibit by the rest of the grain inclusions. Inclusions are mainly of highly weathered perthitic K-feldspar, plagioclase feldspar subordinated with very fine green epidote, muscovite, and biotite Sericitization of feldspars. Another comparative PA results is evidenced from Narosura pottery samples of Luxmanda by Ombori (2021:56-60). About 60% of samples tested indicated the 50-60% of matrix derived to clay minerals having an inclusion largest up to 4 mm similarly to that of Mnaida sample but different in clay percentage.

By observing on the above results, its likely to say the mineralogical composition is different among that distant community signifying there was no any exchange or trade among those communities that could involve the physical exchange of products.

Nkope tradition

The comparison made from the Magubike site TP# 5 (10-20 cm) and that from Pemba site-Mikindani (Swahili coast 549–655 cal AD from Kwekason 2013) yielded the following results. The former has 35-45% Clay, inhomogeneous, poorly sorted angular to sub angular, round to sub round silt to sand sized inclusions. The largest inclusions are up to 3mm. The inclusions are mainly of quartz with strained extinction, microcline, perthitic K-feldspars and plagioclase feldspar, subordinated with fine to medium grains of sericitic feldspar, limestone temper, and sericitization of feldspars. The latter has almost similar inclusions but differing in minor extent in terms inclusion size and clay percentage (30-40%). The raw material for the former was obtained from both primary and secondary context while the latter was from the primary context only.

TIW tradition

The comparison made from the TIW Swahili coastal sites and that from the study area (Ikombe site). The results indicate that Ikombe site (Njombe Region) has got 35-45% Clay, inhomogeneous, mainly fine sand size angular fine to large inclusions up to 3.5mm. The matrix is pale brown, some areas showing dark brown spot, fabric outlined by color bands, discontinuity fractures system flowing within the bands. The flow texture is also exhibit by the rest of the grain inclusions. The inclusions are mainly of highly weathered perthitic K-feldspar, plagioclase feldspar subordinated with fine green biotite and sericitization of feldspars. For the side of Swahili coast about 45-55% Clay, inhomogeneous, poorly sorted angular to sub angular, round to sub round silt to sand sized inclusions were observed. The largest inclusions are up to 2mm. The matrix is dark brown, clay (limestone), discontinuity fractures, voids. The inclusions involve mainly of quartz with strained extinction, microcline, perthitic K-feldspars and plagioclase feldspar, subordinated with fine to medium grains of sericite feldspar, Limestone, and clay temper, and sericitization of feldspars. Limestone is common mineral in the Swahili coast, the current study believed that if there was trade and exchange of physical objects, therefore the TIW of Njombe could have composed of limestone instead this has not happened signifying the spread of idea between those communities.

Ivuna tradition

The comparison made from the Ivuna site (Rukwa) and that from the study area (Mlambalasi and Mgera sites). The results show that the Ivuna (IV) site has 25-35% clay, poorly sorted angular to sub angular silt to sand sized inclusions. The largest inclusions are up to 5mm. The matrix is dark brown to reddish brown, discontinuity fractures, void. The inclusions are mainly of quartz subordinated with highly weathered perthitic K-feldspar and plagioclase feldspar and Limestone temper (Figures 8.38-39). To large extent the Ivuna inclusions are not far from those of Mlambalasi and Mgera displaying limestone used as temper for both sites. The temper is mostly reddish brown iron oxide hovever, Mlambalasi and Mgera samples show epidote grain pink and blue birefringent colours (Figures 8.38-39). This has implications when it comes to the issue of independent vs dependent inventions of Ivuna ware types as explained in the next sub-section.

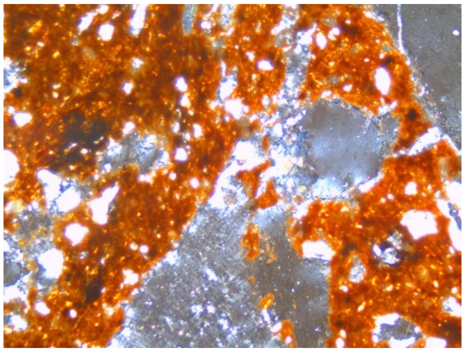
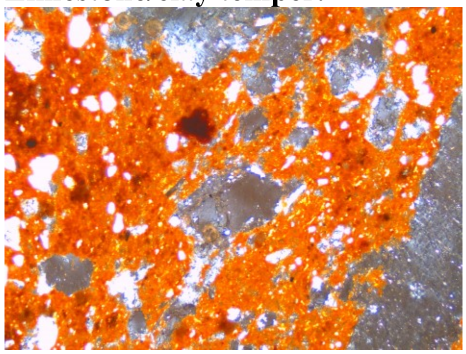
2C: Void filled with fragments of weathered plagioclase and iron **oxide Limestone temper.** 	2E: Voids filled with iron oxide, hematite grain **(reddish brown) Limestone/clay temper.** 

Figure 8.38: Iron oxide Limestone temper at Ivuna IV site.

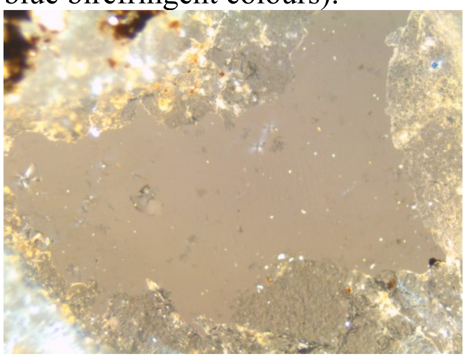
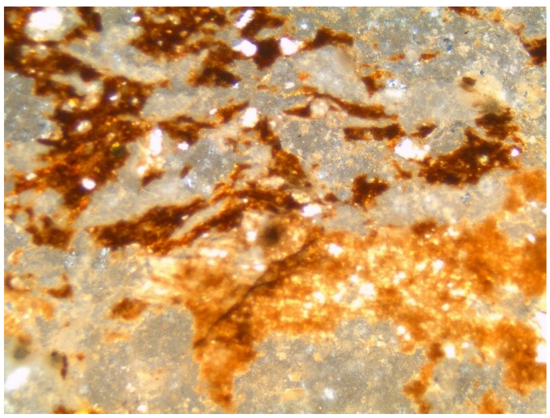
2E: **Limestone temper** with fine grained quartz and feldspar inclusions, fibrous texture, iron oxide and epidote grain (pink and blue birefringent colours). 	2F: Colour band fabric, medium to fine grain quartz, weathered feldspar, iron oxide showing flow texture. 

Figure 8.39: Limestone temper recorded at Mlambalasi site (Unit I-11) level 1: 0-10 cm.

8.9 Interpretation

The ceramic physical and mineralogical attribute analysis performed by the current study has opened a room to detailed understand the ceramic of Iringa and Njombe region. The abundance of body sherds over other vessel parts was expected because in most cases this part takes a big space of the vessel shape especially in the case of the current study that is dominated by the necked vessel type. The study has noted the dominance of necked vessels persists in the contemporary ceramic production as observed during ethnography. Most of such vessel type belong to LIW/historic. The opposite is that the previous ware-types such as EIW ceramics of Iringa and Njombe regions appear mostly in bowl shape. Some bowls are closed having the thin walls and rims found in the EIA context contrary to those of typical EIW. For example, as opposed to LIW ceramics, the EIW ceramics are characterized by thicken rim having bevels and flutes. This has been the case to other similar ceramics reported elsewhere in East Africa (Soper 1967a, b; Chami 1998; Ashley 2005, 2010, 2013; Lane et al. 2006; Kyazike 2013; Pawlowicz 2013; Ashley and Grillo 2015). While some decorations such as roulettes defines the LIW ceramics and appears mostly at Mlambalasi and Mgera as opposed to other decorations such as doted stabs, bevels, flutes, and grooved lines that appear on EIW ceramics of Magubike and other Njombe sites. Such observed technological differences from those time periods informs about the societal technological dynamic that occurred time to time. Such dynamics could have been influenced by both internal and external factors. The factors could be the nature of ceramic uses, migration and interactions, and community preferential demands.

The issue of settlement in Iringa and Njombe Regions is revealed through ceramics, similarly to other material culture such as lithics, fauna, and beads (Bushozi 2011; Biittner 2011;

Willoughby 2012; Miller et al. 2020). The ceramic evidence of the current study has shown spatial-temporal variations within and between sites in those region as revealed through the modelled dates (Figure 8.17 and 8.19). The stratigraphy of Iringa indicates some areas like Magubike to have a long settlement history that spans from EIW to historic (excluding lithics). There is a big gap to time from EIA to LIA/historic for some Test pits like Tp# 3. The stratigraphy for Magubike (20-50 falls within the EIA period that ranges) while (0-10 falls in the LIA period). This could be interpreted that after EIW people abandoned Magubike site it was later reoccupied by the recent historic people expressed through ceramics. Such issue of site abandonment and resettlement is also evidence during Stone Age. At Magubike while some areas were continuously settled from MSA to IA, some were not settled during LSA instead MSA-EIA-historic. At Mlambalasi and Mgera sites, there is a different story to tell. Contrary to Magubike, the sites date back to LSA then LIA/historic. There is no any evidence of EIA ceramics at Mlambalasi and Mgera. This has implications that other Iron Age group of people migrated and settled to some areas at Iringa later. Such group continued to make ceramics and utilized the lithic tools. At that time, some communities who lived in hunting and gathering were still there because of LSA lithics together with wooden and bone tools observed at Mlambalasi together with LIW evidence. This also disapproved the replacement model as claimed in Bantu migration event.

The ceramic evidence of the current study offers evidence of intra-inter regional interactions expressed through trade or knowledge exchange. The chronological modelling presented earlier indicates how most of these sites falls within related/same chronology. This can help to support this idea of interactions indicated in various traditional distributions across the region. This can be traced since the EIA period. For example, during the EIW period four traditions developed in Iringa and Njombe regions including Magubike/Urewe, Limbo, Nkope/Kamnama/Gokomere, and Ivuna. Both of those traditions have been recorded elsewhere in East and southern Africa informing how the EIW communities transformed their technologies through time and interacted each other as presented below:

The Limbo tradition locates its name from the Limbo site (70º 2''S, 39º 0''E) found in the present Kisarawe District of the Pwani Region of Tanzania (Chami 1992, 2006; Pawlowicz 2013). The tradition has been affiliated to that of Kwale that dominates the Swahili coast dating to the third century A.D (Soper 1967a; Chami 2006; Rødland 2021; Wynne-Jones 2023). Following the reported similar tradition by the current study (at Njombe region) indicates the long-term connectivity between the Indian Ocean Swahili coast and the interior Southern Highlands of Tanzania. Limbo and Lelesu are mostly closely related to Urewe ware (Chami 1992, 2006; Pawlowicz 2013). Lelesu was recorded in the central Tanzania having related attributes like Urewe ware reported at Magubike site by the current study. Such links could be possible considering that Magubike is located in Iringa Region closer to central regions where Lelesu was reported earlier (see sub-section 2.3.1 of this thesis).

Similarly, the Nkope/Kamnana tradition stretches from the 4th century to around 1000 AD (Robinson 1973; Phillipson 1976; Huffman 2007; Russel and Steele 2009; Fredriksen 2023). This tradition has originally been recorded in the southern tip of Lake Malawi stretching towards the Zambezi River, west into Zambia, and east into the northwest (Robinson 1970; Phillipson 1976; Huffman 2007; Pikirayi 2001, 2016; Lander and Russel 2018; Ekblom et al. 2023; Fredriksen 2023) and the Swahili coast in Tanzania (Chami 1998, 2006; Pawlowicz 2011, 2013;

Kwekason 2011, 2013). Nkope, Kamnama, Gokomere, and Mwabulambo are variants of Mwangia tradition (*ibid*.). The Mwangia extents from Dar es Salaam through southwestern Tanzania to Mozambique, Zimbabwe, and South Africa. Considering the PA results, the flow of knowledge could have favoured acquiring of such variety of technology in east-southern Africa.

The Ivuna tradition offers also an aspect of connectivity among EIA/LIA communities. However, the tradition has originally been recorded in Lake Rukwa Basin dated to between 1200 and 1,400 AD (Fagan and Yellen 1968, Figures 6-16:17-27). The similar kind of ceramic has been reported by Mapunda (2010, Figure 6.5:94) in the Ufipa in large quantity at sites Hvlk-11-15 and -58. Other ceramics having ribs applications/motifs has been reported at Matumbi hill about 62 kms from southern Tanzanian Swahili coast (Mapunda 2017: 10, Figure 4 comparable with ceramics of this study Figure 8.28: b and f). At Mgera and Mlambalasi sites Ivuna tradition dated to 1277–1391 cal AD, 1465–1633 cal AD). In addition, the ceramics has also been reported by Soper (1967: Plate IV). Such ceramics, dating to 360 AD, were classified in Group D (Usambara Mountains) and were decorated with raised pimples (ribs that occur immediately below the rim of the vessel). Ivuna potsherds has been said to resemble the channel-decorated ceramics from Kalambo Falls, some 240 km to the south-west of Ivuna (Fagan 1965:54; Clark 1974, 2001; Barham et al. 2015). The sequence at the Kalambo site has been radiocarbon dated between AD 267 and 1,380 (Clark 1974, 2001; Barham et al. 2015). The channel-decorated ceramics has been also recorded in the southern part of Zambia (Fagan 1966a; Barham et al. 2015). Based on the data taken from Barham (et al. 2015) the calibrated dates for Kalambo tradition from Zambia is (267–978 cal AD). Based on that observation, Fagan (1966b:106) argued that “it can be said that the Kalambo finds provide a definite typological link between the earliest ceramics of East and South-Central Africa". It is also noted that while the channel-decorated ceramics persisted until the 16th century AD, it was replaced in southern Zambia by a completely different type of ceramics known as Kalomo ware (Fagan 1966a; Huffman 2007; Pawlowicz 2013). As far as the higher percentage of ceramics described under this study are grooved or channeled it offers a chance to think about the relationship between people of Rukwa, Zambia and those of Iringa (Katto and Willoughby 2021). One could think about the possibility of economic advantage such long and short distance trade could have facilitated the connection among those EIA communities (*ibid*.).

The issue of connectivity continued from EIW to LIW whereby by ceramics belonging to TIW, rouletted ware, and carinated ware are more of concerned. As already presented the TIW has been reported in different parts of East Africa specifically along the Swahili coast (Chami 1994; Kwekason 2011; Pawlowicz 2011, 2017; Fleisher and Wynne-Jones 2011; Wynne-Jones 2023). In the interior of southern Tanzania, scholars (Mapunda 2001; Msemwa 2001; Katto 2016) have encountered the similar traditions in Njombe, Lake Nyasa, and other parts of Ruvuma Region. The petrographic analysis of the current study over some TIW samples from Njombe indicates the locally obtained temper during the ceramics manufacturing. This indicates they were independently produced and used in a vast area as supported by (Fleisher and Wynne-Jones 2011; Wynne-Jones 2023). The rouletted wares are mainly reported at Mlambalasi and Mgera sites. The technology has been practised since the second millennium AD in East Africa until today (Soper 1985; Ashley 2010; Kyazike 2013) and it can be found in various areas such as Rukwa, Ruvuma, and Kigoma in the Southern Highlands of Tanzania. Based on observation made during ethnography, it has truly to say the rouletted technology is a great identity of contemporary ceramic producers in Njombe and Iringa region. This signifies the continuity regarding this technology from the second millennium AD.

Ceramics with carination and arc-incisions are commonly reported along the Indian Ocean Swahili coast and its Islands (Chittick 1974; Chami et al. 2004; Croucher 2006, 2007). Arc-incised carinated vessels have been reported to date between 1700 and 1900 AD (*ibid*.). The presence of such ceramics in Iringa offers also an opportunity to think the relationship that could have developed between the people of the Swahili coast, Islands and those of the interior during eighteenth to nineteenth century. A lot of historical events appered in southern Tanzania during nineteenth century including the ivory and slave trade, colonial conquest by German resulting into resistance by Mkwawa and Majimaji war. Those events caused a lot of impacts. For example, there was an influx of coast-interior connectivity that accelerated exchage of goods. Therefore, the observed arc-carinated incised ceramic of Swahili coast in Iringa region could be resulted by some of those events. In Ruvuma region closer to Iringa the similar ceramic was reported (Katto 2016).

8.10 Chapter Summary

The physical and mineralogical analysis performed by the current study have answered various aspects intended by the study. It came to understand that the production of ceramics in the Southern Highlands of Tanzania begun earlier as Urewe time range all the way to Kwale than it was thought. Both early and later Iron Age communities settled in this region and produced ceramics of different physical attributes. By combining both physical and mineralogical analytical results, the issue of intra and interregional relations that developed since EIA to recent historical periods have been presented in this chapter.

CHAPTER 9: ETHNOGRAPHY OF CERAMIC PRODUCTION

9.1 Introduction

Studies of contemporary pottery production have great potential in the interpretation and understanding of potsherds collected from the archaeological record. Through careful study of pottery making processes and uses, it has been possible to make analogy between past and contemporary communities. Although there might be some changes in terms of tools and uses, those changes can be understood as we learn the process through time. This chapter presents the ethnographic study conducted in Iringa and Njombe Regions in order to compare the contemporary production processes and uses among the ethnic groups/individual in the Iringa and Njombe Regions. The results have been used to interpret the potsherds in the archaeological assemblage presented in Chapter 8. It has also enabled to understand the uniqueness in pottery production that identifies a certain ethnic group or individual or the shared traits among them. The chapter starts with analytical methods and results that covers the entire pottery manufacturing process.

9.2 Ethnographic Analytical Methods and Results

The analysis focuses on the content as far as the production process is concerned (see Chapter 4 sub-section 4.6.4). It begun by transcription of data from Swahili to English. Then the analysis followed by grouping themes that started with demographic profiles of the respondents and ended with the pottery manufacturing processes or stages. These were compared between respondents in order to capture the issue of similarities and differences (if any) among individual or ethnic group as well.

9.3 Demographic Profiles of Respondents

As presented in Chapter 4, 16 respondents form the sample size for this ethnographic study (Table 9.1). Six people were interviewed and observed individually. Ten individuals participated in two groups; individuals within the groups were treated collectively because the observed process and answers given by them were the same. As such, six people plus two group of people formed eight (8) “respondents” (Table 9.1). The first group (treated as respondent 4) named as Juhudi na Maarifa (*Effort and Knowledge* in English) is based at Rungemba Ward, Iringa Region. It is a group of 18 people comprised of many youths collaborating with other middle and aged groups to manufacture many vessels (Figure 9.1). Only 7 were interviewed for this study, because the others were absent during interview. The group is officially registered by the local government authority of Mafinga and operates in modern ways. They obtain some loans from the government and member of the parliament in their constituency. The second group is based at Njombe Region, Wanging’ombe District, Ilulu Village. The group is composed on 8 members mostly women. The women are partly working under a registered group named as Ninamu Technology which manufacture the beehives by using clay. During the interview only three people were present two old women and one man.

Most respondents are female (n=14 or 88%) and the rest are male (n=2 or 12%). Seven (n=7 or 44%) are between 65-85 years old, 5 (or 31%) are between 41-64, and 4 (or 25%) are between 25-40 years old. This suggests, pottery making in the region is done by old (41+ years old women). The youth are few, as will be subsequently discussed, seem to engage in this activity mainly for commercial purposes. This is contrary to aged women who produce pottery in low quantity targeting few customers and as part of their inheritance from their ancestors.

Table 9.1: Demographic profiles of Respondents.

		Gender			**Location**			
Resp#	**Tribe**	**M**	**F**	**Total**	**Region**	**District**	**Ward**	**Village**
1	Hehe		1	1	Iringa	Iringa DC	Mseke	Tanangozi
2	Hehe		1	1	Iringa	Iringa DC	Kalenga	Kalenga
3	Hehe		1	1	Iringa	Mufindi	Mapanda	Mapanda
4	Mixture	1	6	7	Iringa	Mufindi	Rungemba	Njiapanda
5	Kinga		1	1	Njombe	Makambako TC	Mjimwema	Polisi
6	Bena		1	1	Njombe	Makambako TC	Makambako	Sokoni
7	Bena		1	1	Njombe	Wanging'ombe	Imalinyi	Ilulu
8	Bena	1	2	3	Njombe	Wanging'ombe	Imalinyi	Ilulu
Total		**2**	**14**	**16**				

Figure 9.1: Large quantity of pottery at Rungemba ready for Sale (Photo by the Author 2021).

9.4 Pottery Production Processes/stages

Pottery (*Vitonga/Kitonga*-Hehe language or *Fivya*-Bena language) in Iringa and Njombe Regions is usually made during the dry season (June-November) in order to prevent breakage that may be caused by rain. The production process is almost the same for all ethnic groups recorded from clay sourcing/raw material selection to the final stage of distribution (Chapter 4). However, still there are some differences on conducting that process and that make an identity of a particular person, group, or community hence the main target of the current study identifying these individual vs group distinctions in practice. The following series of paragraphs present those processes by providing explanations that were given by respondents. Such kinds observations are useful to interpret the ceramics in the archaeological records presented in Chapter 8.

Stage 1: Raw material selection

Several factors determine the selection of clay mainly color, accessibility, and workability (Figure 9.2). This is shown by variations in terms of clay processing as demonstrated by some respondents. For example, while responding a question which factors do you consider in clay selection? Respondent #1 answered that, “most of people prefer this soil (local clay) because it is easy to work and we do not need to mix it with anything else. It is just soaking the soil for some days ready for pottery manufacture.” This is contrary to other areas in the same region (Iringa) whereby respondents # 2 and 4 collect sands/graved clay to be added to the clay as temper. According to respondent #3, who travelled about 12 hours in search of quality clay,” clay color is important to determine the quality of soil.” For them, the clay in black colour is considered of good quality and do not need additional temper. To understand scientifically the clay variations, x-ray diffraction results were collected (Tables 9.2-9.4) and interpreted as follows: A clay sample from Mapanda (provided by respondent #3) happened to be of high quality compared to those from other respondents. It is comprised of various major mineral components led by kaolinite $Al_2Si_2O_5(OH)_4$ by 35% (Table 9.4; Figure 9.3). This is contrary to the clay soil collected by respondent #1 and 2 that have lacked the kaolinite but retaining other major minerals (Table 9.1-2).

Figure 9.2: Clay collection from various sources in the Iringa Region by respondents #1 and #2 (Photo by Emmanuel Ngowi 2021).

Table 9.2: Mineral components for Clay sample from Respondent #1.

S/n	Sample Name	Major Components	Minor Components
1	**Isimila Resp 1**	Albite $NaAlSi_3O_8$ **17.0%** Sanidine $kAlSi_3O_8$ **17.0%** Chloritoid $(FeMgMn)_2Al_4Si_2O_{10}(OH)_4$ **10.0%** Bavenite $Ca_4Be_2Al_2Si_9O_{26}(OH)_2$ **9.0%** Clinochlore $(MgFe)_5Al(Si_3Al)O_{10}(OH)_8$ **8.8%** Chlorite $(MgFeAl)_6(SiAl)_4O_{10}(OH)_8$ **8.0%** Paragonite $NaAl_2(Si_3Al)O_{10}(OH)_2$ **6.7%** Lizardite $Mg_3Si_2O_5(OH)_4$ **5.1%**	Laumontite $Ca(AlSi_2O_6)_2 \cdot 4H_2O$ **2.9%** Siderophyllite $kFe_2Al(Al_2Si_2)O_{10}(FOH)_2$ **2.8%** Muscovite $kAl_2(AlSi_3O_{10})(F,OH)_2$ **2.0%** Spodumene $LiAl(SiO_3)_2$ **1.8%** Biotite $K(MgFe)_3(AlSi_3O_{10})(FOH)_2$ **1.7%** Atelestite $Bi_8(AsO_4)_3(OH)_5O_5$ **1.5%** Quartz Si_2O **1.4%** Housleyite $Pb_6CuTe_4O_{18}(OH)_2$ **1.3%** Epidote $Al_2Ca_2FeH_2O_{13}Si_3$ **1.1%** Elpidite $Na_2 ZrSi_6O_{15}$ **0.46%** Richterite $Na(CaNa)(MgFe)_5[Si_8O_{22}](OH)_2$ **0.4%** Pargasite $NaCa_2(Mg_4Al)(Si_6Al_2)O_{22}(OH)_2$ **0.4%** Natrolite $Na_2Al_2Si_3O_{10}$ **0.2%** Rhodonite $(MnFeMgCa)SiO_3$ **0.09%**

Table 9.3: Mineral components for Clay sample from Respondent #2.

2	**Kalenga Resp 2**	Labradolite $(CaNa)(SiAl)_4O_8$ **14.9%** Fluorophlogopite $(Mg_3K[AlF_2O(SiO_3)_3])$ 14.8**%** Hemimorphite $H_6O_9Si_2Zn_4$ **10.1%** Montmorillonite $Al_2H_2O_{12}Si_4$ **9.0%** Anorthite $CaAl_2Si_2O_8$ **8.5%** Bornite Cu_5FeS_4 **6.3%**	Montebrasite LiAl(PO4)(OHF) **5.6%** Gillespite $BaFeSi_4O_{10}$ **5.3%** Enstatite $MgSiO_3$ **5.0%** Margarite $CaAl_2(Al_2Si_2)\ O_{10}(OH)_2$ **5.0%** Microcline $kAlSi_3O_8$ **4.7%** Sepiolite $Mg_4Si_6O_{15}(OH)_2$ **3.1%** Nontronite $Ca_{.5}(Si_7Al_{.8}Fe_{.2})(Fe_{3.5}Al_{.4}Mg_{.1})O_{20}(OH)_4$ **2.5%** Clinoferrosilite $Fe_{1.5}Mg_{0.5}Si_2O_6$ **2.5%** Kalsilite $kAlSiO_4$ **1.6%** Argentopyrite $AgFe_2\ S_3$ **1.2%**

Table 9.4: Mineral components for Clay sample from Respondent #3.

Sample Name	**Major Components**	**Minor Components**
Mapanda Resp 3	Kaolinite $Al_2Si_2O_5(OH)_4$ **35.0%** Muscovite $kAl_2(AlSi_3O_{10})(FOH)_2$ **12.3%** Montesommaite $(kNa)_9Al_9Si_{23}O_{64}$ **9.1%** Nacrite $Al_2Si_2O_5(OH)_4$ **9.0%** Enstatite $MgSiO_3$ **7.8%** Hyalophane $(kBa)[Al(SiAl)Si_2O_8]$ **7.2%** Microsommite $(NaK)_6(SO_4)$ **5.0%**	Biotite $K(MgFe)_3(AlSi_3O_{10})(FOH)_2$ **4.4%** Microcline $kAlSi_3O_8$ **3.5%** Lakebogaite $CaNaFe_2H(UO_2)_2(PO_4)_4(OH)_2(H_2O)_8$ **3.3%** Dickite $Al_2Si_2O_5(OH)_4$ **1.7%** Pargasite $NaCa_2(Mg_4Al)(Si_6Al_2)O_{22}(OH)_2$ **0.7%** Laumontite $Ca(AlSi_2O_6)_2 \cdot 4H_2O$ **0.7%** Lautarite $Ca(IO_3)_2$ **0.6%** Sepiolite $Mg_4Si_6O_{15}(OH)_2$ **0.15%**

Figure 9.3: A sample of clay taken from respondent #3-Mapanda (Photo by the Author 2021).

Stage 2: Paste preparation

The paste preparations differ among respondents in Iringa and Njombe Regions despite of some similarities. For example, while paste storage (Figure 9.4) takes about 2 to 3 days for every respondent, still some observed variations occur in the paste preparation. A good example is on the issue of temper and pounding of clay. Here while some potters such as respondent #1 and #3 do not add temper on the clay while the rest do. During pounding, some potters (ref. respondent 1-3) use paste to pound a lump of clay on the grounding stone (Figure 9.4 a, b) while some (ref. respondent #4 and #8) pound the paste on the ground (Figure 9.4c). Pounding on the ground is triggered by a mass production of pottery that require high volume of clay.

Figure 9.4: Paste preparation stages recorded at Iringa and Njombe Regions (Photo by the Author 2021).

Stage 3: Fabric practice

This stage/process involves shaping technique/manufacture and surface finishing. The current study recorded the similarities and variations of those parameters in the pottery manufactured by respondents or those observed at the market and other production areas. This process begins by preparing all equipment required for fabrication, which are mostly obtained naturally but dedicated to perform a particular function; these tools include broken coconut shell, maize cob, stone cobbles, and other materials for decorations (Figure 9.5). Due to the high demand for pottery by customers, at Rungemba (respondent #4), there is an improvement in terms of the tools adopted to make pottery, such as rotating stands and plastic pipes, as compared to traditional tools used by most of other respondents (Figure 9.5).

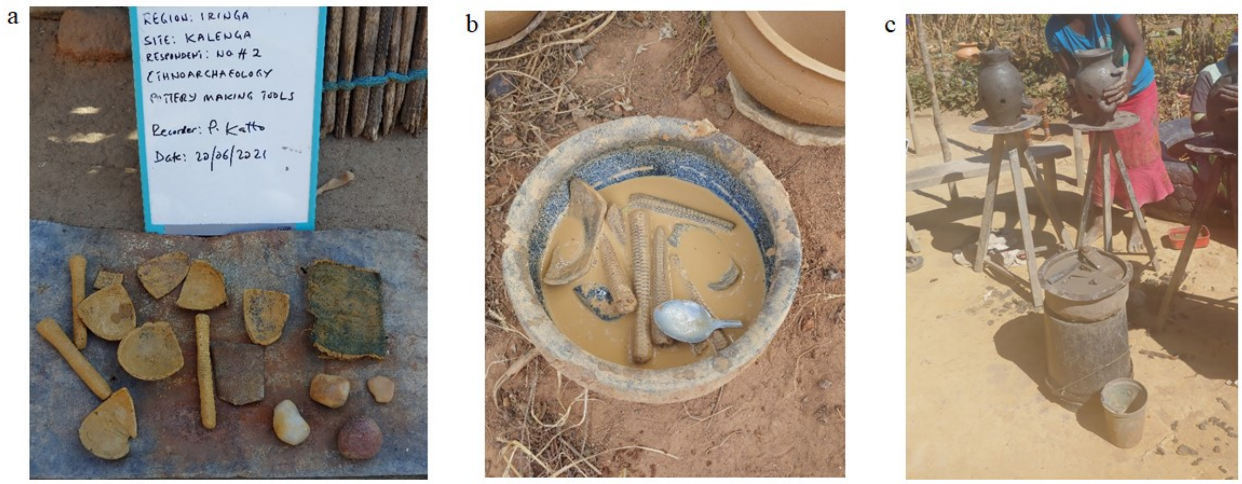


Figure 9.5: Some pottery making equipment used by the Iringa and Njombe respondents: a=respondent #2; b=respondent #7; and c=respondent #4 (Photo by the Author 2021, 2022).

In Iringa and Njombe Regions, potters use mostly the pinching technique to manufacture pottery. According to Thér (2016) pinching is a technique that uses a continuous pressure whereby a hole is pushed in a lump of clay and then the walls are progressively thinned by squeezing the clay between the fingers and thumb, or between the fingers of opposing hands (Figure 9.6). Other methods such as coiling and modeling are practiced in Iringa Region. This could have been inherited from the past considering that the PA analytical results of ceramics from archaeological records have shown different forming technique presented in Chapter 8.

Figure 9.6: Pinching technique at the initial stage of fabricating pottery for respondent #1 (Photo by the Author 2021).

At Rungemba, both pinching, coiling, and modeling technique are employed. Pinching begins at the initial stage of vessel fabrication, followed by coiling that is applied above the pinched base; this preliminary shaping technique tends to be used especially when making the convergent-mouthed vessels (Figure 9.7). Coiling is a spiral placement of the rolls, whereas they are laid as a succession of rings by many pottery-making peoples (Fewkes 1944). In modeling technique people in Iringa makes a model or cast that produce a desired shape by putting a lump of clay especially in production of stoves.

Figure 9.7: Coiling in progress at Rungemba (Photo by the Author 2021).

Before commencements of fabrication, the potter is supposed to decide on what kind pottery form is going to be manufactured. While responding to the question “what criteria do you consider to manufacture a certain form of vessel over other?” different answers were provided, such as the demand of customer and the uses, or functions of vessels. In answering the question “what determine the shape of cooking vessels?” respondent #1 replied that “pottery of Iringa has reverted rims to help easier carrying especially during cooking.” The size also matters. The large vessels (*mitungi*) (length of 31 mm-above) are made purposely for storage or preparation of local beer (*uwigimbi*). This is contrary to other pottery used for cooking or food serving, which are small (length 0-17 mm). Due to economic and social demands dynamics, some potters fabricate clays for other uses. For example, the group of respondents #4 makes pots for raising chicks, stoves, and growing of flowers (Figure 9.8). On other hand, the group of respondents #8 are making hives out of clay soil (Figure 9.8).

After pottery forming the next activities follow including surface finishing. Here different activities are done including scraping and smoothing. A stone cobble and piece of cloth are used in smoothing the outside surface of the vessel. This allows other process to take place like painting and decorations as presented in the next paragraph.

Figure 9.8: Modern uses of material made of clay: a-stoves, b=chicken growers, and c-d=beehives (Photo by the Author 2021, 2022).

Stage Four: Applied decorations

Decoration is an important stage in pottery manufacture. Its where potters capture the attention of customers by beautifying their products. However, not all pottery is subjected to decorations. For instance, the storage vessels are usually not decorated. According to respondent #2, decorations (*nyaagi* in Hehe language) are placed to for beauty reasons. Wandibba (1982) has grouped decorations into five classes that is graphic, plastic, colour, burnishing and shipping (refer to Chapter 8). In Iringa and Njombe, both graphic and graphite technique are useful. For the former rouletting, incisions, and grooving are common decorating technique in Iringa and Njombe Region. Roulette is applied through twisting a string obtained from shrubs (*rusisi*) which are rolled on the vessel surface specifically for Hehe potters (Figure 9.9 c, d). The shrubs are mainly grown at the river and are also used to make mats. For the Bena potters, roulette is done by using seeds obtained from specific trees available in their farms scientifically known as *Casuarina equisetifolia*. Other decoration technique includes incisions and grooving by using a sharp tool mainly a piece of stick. The latter involves red painting that is done by grinding red ochre and apply to the surface of the vessel (Figure 9.9 a, b). This was mainly recorded at Rungemba site (respondent #4).

Figure 9.9: Decorations in process: a-b=paints; c-d=roulette (Photo by the Author 2021).

Stage Five: Drying vessels

In Iringa and Njombe Regions before the actual firing of pottery, various activities are undertaken including drying the vessel. Drying is always done in the “controlled light”; this is the right that is not directly exposed to the Sun. It can be on the shed or inside the house to avoid cracking of pots. That process was observed in Iringa and Njombe for respondents. There is no any recorded taboos or intangible practices recorded during drying process. Instead, they were seen mainly prior firing by some potters as presented below.

Stage Six: Pre-firing and firing

Pre-firing involves arrangements of all material responsible for firing. They include fuel and firing place. The common fuel used in Iringa is firewood and maize cobs. The fuel is collected by respondent using the help of children and other family members. For respondent #2 acquiring of fuel involves buying from other people who sell firewood. Pre-firing involves taboos/traditional practices for some respondents. This was recorded mainly in Iringa whereby according to respondent #2 the temporarily fence must be made to prevent strangers, especially pregnant women, from accessing the pots as that may cause breakage. Respondent #2 also puts some herbs on the firing place prior firing for a similar reason i.e., to prevent breakage (Figure 9.10). Pre-firing involves also the preparation of a specific place where the process will take place. This is where the type of firing process is determined. In Iringa three main type of firing were observed-pit, open, and kiln firing, while at Njombe only pits and open firing were observed.

Figure 9.10: Some traditional practices before firing takes place for respondent #2. Building of fence (left) and medicine (herbs) for firing (right) (Photo by the Author 2021).

Pit firing in Iringa and Njombe Regions is done by digging a pit whereby firewood and vessels are put together while considering the space between vessels to avoid collisions. Then more firewood including the maize cobs are placed above to make a mountain-shape like structure ready for firing. According to respondent #1, pits prevent fire from exploding and burn the farm and other neighboring properties. The time taken for completing firing depends with the nature of firewood and the quantity of pottery intends to be fired. After firing, the pots are placed beside the pits for cooling. For the open firing category, pots are placed parallel between the firewood surrounded by piece of metal sheets (Figure 9.11). The difference observed between pottery fired by pits and those of open firing is that pottery fired by the former method are ending with more soot compared to the later. This could be related to the amount of air pumped in or the nature of firewood used.

Figure 9.11: Pit firing (resp #1 the first left) and Open firing (resp #2 two second right) Iringa Region (Photo by the Author 2021).

Kiln firing is practiced in Iringa Region, especially by respondent #4. This is due to mass production of pottery for selling. The kiln is made of bricks and has two open areas where the fire woods are placed (Figure 9.12). The kiln is quite similar with that used by the same community in firing the bricks. Various ceramics of different forms are located inside the big kiln and arranged by considering space to avoid collision during firing.

Figure 9.12: Kiln firing in Rungemba (Photo by the Author 2021).

Stage Seven: Distribution

Selling of pots occurs in two ways. Some customers place an order directly with the potter and specify which kind of vessel they want. Or the potters, in assistance with her family member will sell the products at the market. Mostly the small vessels are taken to the market and are sold to about 2,000 Tshs or ~one CAD according to respondent #1. The large vessels (*mitungi*) do not have many customers therefore, they are made for home uses or for a special order. In case of high demand, they are sold to about 5,000 Tshs or ~three CAD. In term of uses, the small pots are mainly used for cooking while the larger one is used for cooking or storage purposes especially the local alcohol (*Uwigimbi*). Not all pottery sellers are involved in pottery production. Some for example, respondent #5 and 6 are the business women specialized on buying pottery from the potters and selling them to customers. While explaining the source of her products (pottery) respondent # 5 indicated that she usually orders pottery from Bena (Njombe Region) and from Nyakyusa people (Mbeya Region). She has been doing this business since 2003. Her tribe is Kinga (Njombe Region) and she maintained that Kinga people are not producing pottery because the clay soil is not good for making pottery. Therefore, the Kinga rely much on pottery from Mbeya Region. She was able to differentiate the Bena pottery from the Nyakyusa whereby the former is reddish painted having a rouletted decorations and carinated in shape while the latter is whitish painted looking like a cooking pan and closed bowls (Figure 9.13).

Figure 9.13: Pottery of Bena (reddish) and Nyakyusa (Whitish) sold at Makambako Town by the respondent # 5 (Photo by the Author 2021).

9.5 Interpretation

Like other documented areas in East Africa, pottery production in Iringa and Njombe Regions passes through various processes that is from raw material selection to distribution. The technology has been passed through from generation to generation, in which some continuous/discontinuous practices/traits are observed in comparison with the pottery in the archaeological assemblage. Although the regions are settled by more than one indigenous ethnic groups (mainly Hehe, Bena, and Kinga), the pottery production is done by the two (Hehe and Bena) for the reasons provided earlier. Between Hehe and Bena ethnic groups, there is a similarities and variations in the production process, which trickle down at the individual levels.

This is caused my many factors such as the nature of raw material, specialization, exposure (interactions), customer's demands, and economic dynamics. The differences are evidenced for example, in firing technique, taboos, and specialization. This has an implication on the similarities and variations that the current study observed for pottery observed in the archaeological assemblage. Not every pottery recorded in a certain area is necessarily to be produced by the residents in the areas instead, they could have purchased from other places through trade and exchange and vice versa. This is reflected on pottery from Mbeya that are sold at Mkambako (Njombe Region) instead of being produced at Njombe. This provides an insight into what we see in archaeological records whereby pottery recorded at other regions like Rukwa, Swahili coast, and Zambia are present in Iringa and Njombe Regions. However, the material sourcing/components is very important to trace the origin.

The material sourcing (mainly clay) differs among potters in Njombe and Iringa. While some acquires clay near the homestead, others travel very far in search of clay. Some potters add temper while others not. In the archaeological record, this was evidenced through PA whereby some potsherds indicated no temper added compared to others. Despite of such material source variations, the production of ceramics is similar in terms of shape and decoration. This does not seem to be affected by distances between potters (respondents) as well. This implies the knowledge exchange through diffusions than the physical movements. This is reflected in the archaeological assemblage of the currents study for some pottery traditions. For example, despite of dominating the Swahili coast, TIW ceramics at Njombe lacks the Swahili coastal mineral components such as limestone instead retaining the locally obtained temper/fabric. This provides a good example of knowledge flow through diffusions instead of physical exchange of the products among those prehistoric societies.

A variety of pottery forms mainly necked vessels, carinated, bowls, and pots are continuously produced in the regions, which reflects what the current study has observed in the archaeological records. However, some vessel forms including those having thickened rims are no longer produced in the contemporary societies. The similar issue is seen in decorations in which some patterns such as roulette that dominates the Iringa pottery assemblage are continuously practiced in the contemporary communities. The rouletted ware has been recorded in East Africa dating to about 1,200 AD and are more dominate in the Southern Highlands of Tanzania. Such technology extends to western parts of the country incorporating areas like Rukwa and Kigoma where Ivuna and Uvinza pottery traditions have been reported. Although Iringa and Njombe Regions are closer to Mbeya and Ruvuma Regions, still the rouletted wares are more dominant to Hehe and Bena ethnic groups.

In terms of uses, the current study has recorded both large, small vessels having long and short neck as well as small pots and bowls in the archaeological assemblage. The contemporary communities of Njombe and Iringa are also producing the same shaped vessels including those having carination. Although we might not understand the uses of pottery in the archaeological record, contemporary knowledge offers clue on those uses ranging from storage, cooking, decorations, and food serving. Pottery having carnations are produced more by Bena people than Hehe. This could be due to potters/customer preferences based on uses of those vessels. The pottery style and uses may change time to time depending on various number of factors. For example, despite of colonial and other foreign interactions that reduced the pottery making technology in Africa, still the contemporary generation is reviving that technology because of different factors. For example, at Rungemba both youth and adults are using more advanced equipment compared to the past for utilizing the opportunities resulted by modern economic transformations. For instance, pottery objects are used to raise chickens by providing heat, growing flowers, decorations, and cooking using a stove made of clay. This reflects the observed changes both in the contemporary and archaeological records whereby some technologies perish and come back over time.

9.6 Chapter Summary

The study of contemporary pottery makers in the Iringa and Njombe Regions is vital for filling the gap emerged by having pottery in the archaeological records that requires a deep interpretation and understanding. Through recording the pottery making process referred, as *chaîne opératoire* the current study has been able to compare various traits that makes a uniqueness or identity between ethnic groups or individual in the Iringa and Njombe Regions. The study has also managed to use those traits to understand where those group or individual converge. Taking together the data from ethnographic study, together with potsherds from the archaeological records, and PA, the general picture about the pottery technology in Iringa and Njombe Regions has been attained.

CHAPTER 10: DISCUSSION AND CONCLUSION

10.1 Introduction

This chapter provides a general discussion of the research findings presented in Chapters 6-9. The chapter is more about strengthening what have already presented in the interpretation sections of those chapters. It also covers the summary and provides suggestions for further research directions. In the discussion, the specific objectives, hypothesis, and research questions are addressed in reference to LSA versus IA interactions in the Southern Highlands of Tanzania. It also covers the intermediate period of the discussion about the status of PN in that region. In the general conclusion of this study, I maintain that despite of previously reported PN evidence in forms of pottery by Msemwa (2001) and hypothesis III posed for Magubike, the C-14 dates obtained from ceramic doesn't fall within the PN period. Instead, my data are represented by LSA, EIA, and LIA/historic evidence. The LSA and IA material continuously practised together until LIA/historic period through acculturation model.

10.2 IA and LSA Timeframe of Southern Highlands of Tanzania

This section discusses about hypothesis I on the timeframe that demarcates IA from LSA in the Southern Highlands of Tanzania. The discussion draws on the methods and findings presented in Chapter 4, 5, 7 and 8. The Alternative Hypothesis I state that there is a specific timeframe already established that demarcates IA from LSA in the Southern Highlands of Tanzania. As stated earlier this came following previous scholars' (Bushozi 2011; Biittner 2011; Willoughby 2012; Biittner et al. 2017; Miller et al. 2020) research on areas like Iringa Region whereby the IA starts around 3,000 ya while LSA sites range from 3,000 to 30,000 ya. The null hypothesis I states that there could be another specific timeframe that demarcates

IA from LSA in the Southern Highlands of Tanzania contrary to what has been established already by previous scholars.

Drawing from the same test pits used by previous scholars, that is Tp# 3 for Magubike (level 3: 20-30 cm; Table 5.1), the current study supports null hypothesis I. The previous date from *Achatina* range (1401-1048 cal BC) which falls within the PN period of East Africa (see Crowther 2018: 105; Grillo et al. 2018, 2020a, b; Prendergast et al. 2019; Goldstein 2021; Ombori 2021; Robertshaw 2021; Fitton et al. 2022 and section 2.4). Additionally, such date (1401–1048 cal BC) is too old for the EIA of Southern Tanzania considering that even the Kagera Region where the earliest evidence of IA was recorded dated to (c.2500BP or 500 BC) (see Schmidt 1997; Killick 2009; Ashley 2010; Ashley and Grillo 2015). Therefore, the current study was looking for other dates that could tell when IA period could have been started in the Southern Highlands of Tanzania. Based on C-14 dates of ceramic samples, the current study has reported the earliest IA dates from the same test pit (Tp# 3) supplemented by Tp# 5 (Table 8.7; Figure 8.17). The results have indicated that the earliest IA period of Iringa Region is 168 cal BC dated at Magubike Tp# 3 (level 2 168 cal BC–55 cal AD). For the case of LSA, the study supports the previous chronology of 30,000 ya. This came following the earliest LSA dates (36881–27184 cal BC) dated at Uhafiwa site in the Iringa Region (Table 8.7). Based on these dates we can get a picture of the timeframe that demarcates the LSA and IA of Southern Highlands of Tanzania in reference to Iringa Region to be (36881 BC for LSA and 168 BC for the IA).

The earliest EIA chronology of Iringa (168 cal BC– 55 cal AD) given by the current study puts attention on the prolonged debate about the way EIW spread in east and southern Africa (ref to Chapter 1 section 1.2 and Chapter 2, section 2.7). It also offers a room to question the efficacy of Bantu migration route in East Africa (Chapter 2 sub-section 2.8.2). It is said the earliest EIA practices started at the Lake Victoria Regions having ceramic tradition named as Urewe (500 BC–800 AD ref. Appendix II), then Lelesu tradition (100–200 AD) recorded at north-central Tanzania, then Kwale (100-200 AD) at East Africa Indian Ocean coast. Thereafter, the EIW traditions emerged in the interior southern parts. The attention is now on (168 cal BC– 55 cal AD) ceramic recorded at Magubike that predates Lelesu/Kwale hence falls under Urewe time range reported at Lake Victoria (see Table 10.1 below). The first evidence of Urewe has been reported at Kagera Region at Katuruka and Kemondo bay dated to 575 BC–200 AD at Kemondo Bay (Schmidt 1997; Clist 2017; Table 10.1). Based on the location of Iringa, there is a need to reassess the nature of EIA spread. It is likely to say EIW ceramics emerged earlier in Iringa as compared to north central and east coast of Tanzania. This has been clearly indicated to the modelled dates between sampled sites across the region that is Swahili coast, immediate interior all the way to Zambia and Mozambique (Table 8.7-8; Figures 8.19-20). That chronology indicates how far Magubike dates early compared to those connected areas. However, despite of such chronological differences the EIA ceramics described as Magubike/Urewe tradition in this study shares affinities with those Lelesu and Kwale EIA traditions in terms of decorations and rim morphology. This may indicate same people sharing cultural-technological practices but moving in a multiple direction. Such conclusion is supported by genetic evidence from (Prendergast et al. 2019; Wang et al. 2020 see sub-section 2.8.2 and 2.9.2 of this thesis). Both scholars have concluded that ancient East Africans show the archaeological complexity during the spread of herding and farming which is reflected in genetic pattens. This shows that there was a multiple movements and gene flow among the distinct ancestrally groups of people. Another issue to consider is on features/attributes considered to characterize the EIA ceramics of East and Southern Africa. Most of ceramics are characterized with thicken rims having bevels and flutes (Appendix II). Unfortunately, some potsherds N=19 recovered at Magubike Tp# 3 (level 3) lacks those features despite of falling withing the EIA timeframe (81–236 Cal AD). This could be taken as a unique ceramic at Magubike, however more evidence is needed on this.

Table 10.1: Various sites in Tanzania (Lake Victoria Region) showing the Urewe chronology (Adapted from Clist 2017:44).

lab. number	lab. date (1)	dendro. date	site	reliability
N. 437	400 ± 235 ad	55-795 AD	Yala Alego (Kenya), 00°01'35"S., 34°19'50"E.	D. 01
N. 784	290 ± 125 ad	70-585 AD	Chobi (Uganda)	C. 00
N. 890	450 ± 115 bc	785-215 BC	Katuruka (Tanzania)	B. 11
N. 891	60 ± 115 ad	155 BC-255 AD	Katuruka (Tanzania)	B. 11
N. 892	120 ± 110 ad	15 BC-405 AD	Katuruka (Tanzania)	B. 11
N. 894	1250 ± 120 bc	1710-1275 BC	Katuruka (Tanzania)	B. 11
N. 895	550 ± 115 bc	820-400 BC	Katuruka (Tanzania)	B. 11
N. 897	1080 ± 110 bc	1550-915 BC	Katuruka (Tanzania)	B. 01
N. 898	170 ± 100 ad	15-440 AD	Katuruka (Tanzania)	B. 11
N. 899	1470 ± 120 bc	1980-1555 BC	Katuruka (Tanzania)	C. 00
N. 900	985 ± 100 ad	885-1245 AD	Makongo (Tanzania)	B. 01 (?)
N. 901	910 ± 100 ad	790-1215 AD	Makongo (Tanzania)	B. 01 (?)
N. 902	40 ± 100 ad	160 BC-245 AD	Makongo (Tanzania)	B. 01 (?)
RL. 405	610 ± 100 bc	875-415 BC	Katuruka (Tanzania)	C. 00
RL. 406	520 ± 110 bc	810-395 BC	Katuruka (Tanzania)	B. 11
RL. 1008	340 ± 130 ad	60-625 AD	Buyozi (Tanzania)	B. 01 (?)
RL. 1009	150 ± 230 bc	575 BC-230 AD	Kemondo bay (Tanzania)	B. 10 (?)
RL. 1010	150 ± 110 ad	−1/+1-425 AD	Kemondo bay II (Tanzania)	B. 01 (?)
RL. 1011	80 ± 130 ad	170 BC-425 AD	Kemondo bay II (Tanzania)	B. 01 (?)
RL. 1012	10 ± 150 ad	370 BC-360 AD	Kemondo bay II (Tanzania)	B. 01 (?)
RL. 1013	200 ± 210 bc	750 BC-220 AD	Kemondo bay II (Tanzania)	C. 11 (?)
RL. 1014	540 ± 110 ad	435-785 AD	Kemondo bay (Tanzania)	C. 01
RL. 1015	300 ± 140 ad	45-610 AD	Kemondo bay II (Tanzania)	C. 01

10.3 Interaction model between LSA hunter-gatherers and IA-agropastoralists in the Southern Highlands of Tanzania

This section discusses the hypothesis II based on the findings presented in Chapter 6 and 7 of the current study. Alternative hypothesis II states that the LSA hunter-gatherer communities were totally replaced by the IA agropastoralists. This came following the long-term existing debate about the nature of interaction between IA agropastoralists and LSA hunter-gatherers presented in the background section of Chapter 1. The Null hypothesis II states that the LSA hunter-gatherer communities were not totally replaced by the IA agropastoralists when they met for the first time instead one of the following issues could have occurred: first, the LSA hunter-gatherers maintained a separate identity and were not replaced by the IA agropastoralists. Second, assimilation/absorption of IA agropastoralists cultures over LSA-hunter-gatherers and third, there could be admixture (adoption/acculturation) of LSA-hunter-gatherers, IA agropastoralists or other cultures.

Thus, the evidence presented in the current study supports null hypothesis II and refutes alternative hypothesis II. The study has noted that the model of interactions between those communities in the Southern Highlands of Tanzania was in form of acculturation/demic diffusion/adoption (refer to Chapter 2 sub-section 2.6.2 for clarification about the model). Mixing LSA cultures with IA ones continued up to the LIA period, having diffused or acquired some cultural element which later were abandoned slowly. The study noted that up to LIA/historic periods recorded at both test pits of Magubike, Mlambalasi, small lithics of LSA types continued to be produced in the Iringa Region. This indicates the continuation of hunter-gatherer activities even after the interaction with LIA communities (ref. Chapter 6: Figures 6.5-

6.11). As I presented in the interpretation section of Chapter 6, the persistence of lithic artifacts production from LSA to IA periods indicates the smooth transformations from one technology to another. From the termination or meeting point between two cultures there is no abrupt abandonment of lithic production instead there is sharp increases of lithics at the time approaching/during contact (Figures 6.6-6.8). Such scenario could be interpreted as less mobility of LSA people causing accumulations of many artifacts at one point compared to when they were scattered (Kessy 2005, 2013). The production was later reduced gradually as time goes during the IA period (Figures 6.5, 6.7-6.9). This may signify the slowly abandonment of stone tools in favour of other technologies developed during IA and later periods. The study has noted the tools sizes differences between those recorded in the LSA and IA context (Figure 6.2-6.4). Thus, the former was large compared to the latter. This could have implications on settlement, population density, and resource utilizations. Thus, it is possible that as the LSA people transformed to permanent settlement in response to IA interactions there is a possibility of use and reuse of the same tool/raw material.

Apart from lithics the fauna evidence detailed in Chapter 7 indicates a continuous substance strategy from LSA to IA whereby both wild and domestic animals (small and large) were continuously consumed at Magubike and Mlambalasi rockshelters. This is also reflected on the shaped wood and bones (Figure 10.1) discovered by the current study and detailed interpreted in Chapter 7. The shaped wood and bones discovered in this study indicates the hunting behavior which is not only traced in the IA time period but in the MSA period as well. For example, the distal ends of shaped wood and bones of the current study (Figure 10.1) are looking similar with the MSA pointed tools (Figure 10.2) reported by Bushozi (2011:242) at

Magubike and other northern sites of Mumba and Nasera signifying the continuous possible behavior of hafting technologies used in hunting from MSA all the way to IA period.

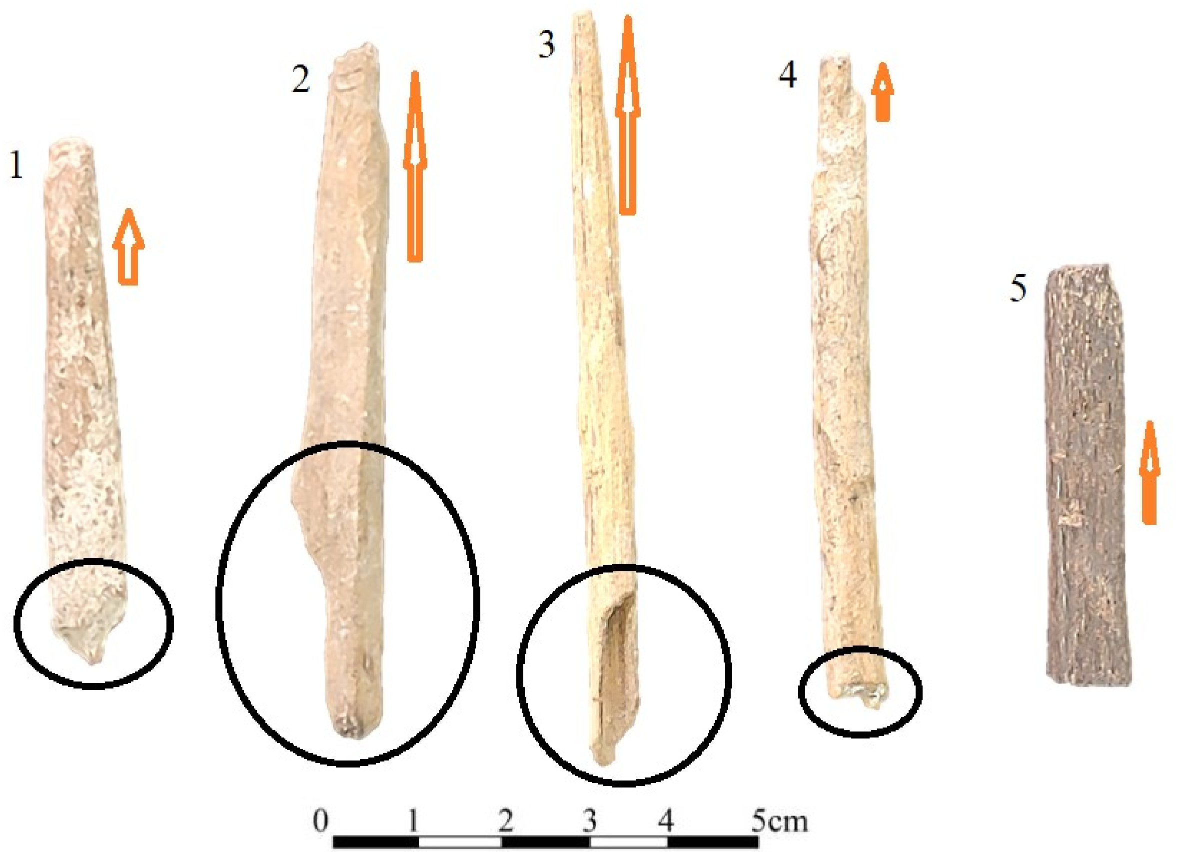


Figure 10.1: Bone and wooden tools recorded at Mlambalasi rockshelter on the Iron Age context: 1=bone tool; 2-5=wood tools. The black circles show the distal ends shaped for hafting. The reddish arrows show the proximal ends shaped to make a point tool.

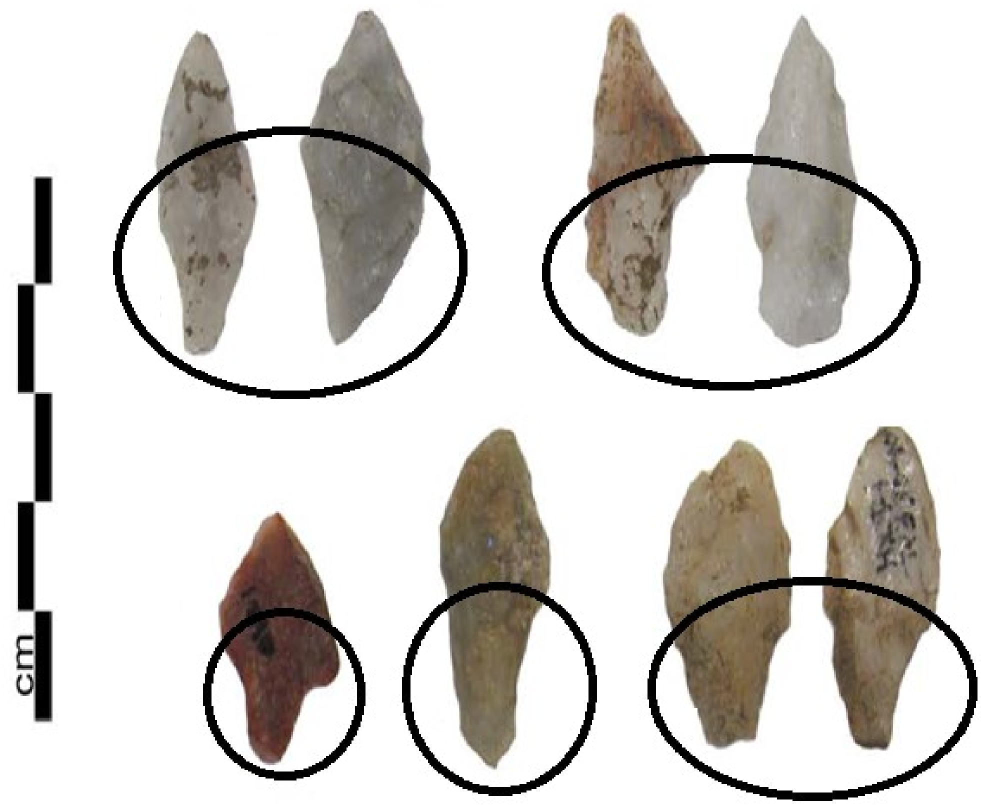


Figure 10.2 MSA point tools shaped at the distal ends in black circle indicating evidence for possible hafting technology (Adapted from Bushozi 2011:242).

10.4 The PN Culture of Southern Highlands of Tanzania: Is it present or not?

This section discusses about hypothesis III based on the finding presented in Chapter 8 section 8.5 and 8.6 that complement the stratigraphic analysis of Magubike Tp# 3 (Chapter 5, Table 5.4) and Tp# 12. The alternative hypothesis III states that PN cultures existed in Southern Highlands of Tanzania based on the assumptions made on that hypothesis (refer to Chapter 1 section 1.6). The null hypothesis III maintains that the PN cultures did not exist in the Southern Highlands of Tanzania based on the factors provided supporting this hypothesis (refer to Chapter 1 section 1.6). The finding of the current study supports the null hypothesis III but also consider the alternative hypothesis based on the previous finding presented by other scholars mainly Msemwa (2001). Thus, based on the C-14 dates the ceramic sample dated to (81–236 cal AD) the context of Tp# 3 (level 3) does not fall in the PN time period (see Crowther 2018, Table 1:105). As I presented on Chapter 8, the Tp# 3 and 12 contains the potsherds having morphology and decoration patterns like those of PN ceramics and the earlier dates from *Achatina* placed that context to (1401–1048 cal BC). The sherds have got reverted thin rims ranging between 6-8 mm and thin walls (8-10 mm). Most of them are reverted/closed bowls decorated with doted/rectangular stabs and incisions placed on either body or below the rims (Figures 8.22 and 8.23). Despite that the morphology and decoration of potsherds are not related to other typical EIA of Eastern Africa still the chronology falls within EIA timeframe as presented previously. By looking on that sequence, material from level 2 (typical EIA 168 cal BC–55 cal AD) dates older than level 3 (81–236 cal AD hypothesized to be of PN). This doesn't bring logic that EIA predates the PN material, and therefore led to the conclusion that the Tp# 3 level 3 and other related context at Magubike rockshelter does not fall within the PN time period instead they fall on the EIA period.

The presence or not of PN in the Southern Highlands of Tanzania was also tested through Uhafiwa site (Chapter 4) following the reasons provided in Chapter 1 and 8. The study recorded only lithic artefacts dating to LSA period (36,881–27,184 cal BC). This is contrary to previous study conducted by Msemwa (2001) that reported both LSA and few ceramics which he classified as Narosura. My 2021 field research at Uhafiwa site noted that the site has been disturbed especially by the Kihansi Hydroelectric Power Project. Despite the current study did not find the ceramics at Uhafiwa site, still the Msemwa's collection are curated at Isimila

Museum in the Iringa Region and I was able to observe the collections (see Figure 8.25). Msemwa placed those ceramics to Narosura PN tradition. Such ceramics are mainly closed bowls having thin walls and rims. They are decorated with motifs ranging from oblique incisions, triple stabs, dots, triple zigzag incisions, and cross-hatching. Such attributes concede with PN ceramics reported in other parts of Eastern Africa (Odner 1972; Bower 1991; Chami 2001b; Chami and Kwekason 2003; Prendergast et al. 2013; see also Ombori 2021:27). Ordner (1972:62) describes Narosura assemblage as being mainly characterised by comb-stamping or line incisions, which are occasionally crossed by horizontal lines or divided by zigzags, and narrow-mouthed bowls, bowls with slightly everted rims and beaker-like vessels. Narosura ceramics tradition dates (2,800–2,300 BP) in the Southern Kenya Highlands. The tradition has also been reported in Western Kilimanjaro, Tanzania by Mturi (1986) and Luxmanda-North-Central Tanzania as already presented in Chapter 2 and 8 (Prendergast et al. 2013; see also Ombori 2021:27). Narosura ceramics shares most similarities with Maringishu (1,700 BP) and Akira (1,900–1,300 BP) (*ibid*.) (see Appendix II that for those PN traditions). The PN ceramics reported by Msemwa in Southern Highlands of Tanzania joins with other reported Neolithic evidence along the southern Tanzania Swahili coast (Chami 2001b; Chami and Kwekason 2003:71). Chami (2001b) recovered six potsherds of Narosura tradition or LSA at the Tendaguru dinosaur site. Such potsherds were compared with those reported in northern Tanzania as well as those of Msemwa (see Figure 8.25 and 8.26). Using the Msemwa's ceramics which are connected to those reported in south-east of Tanzania and north one could interpret that the nomadic nature of pastoral communities could have extended to southern areas. This can also be proved by the current nomadic pastoralist of Maasai tribe who have migrated from north to south including Southern Highlands of Tanzania.

10.5 The LSA and IA of Southern Highlands of Tanzania: Material Culture Characterization

This section discusses the research question 1 which asks that what characterizes the archaeological evidence of LSA hunter-gatherers and IA agropastoralists (Bantu people) in the Southern Highlands of Tanzania during the Holocene period. Chapter 2 and 6 provides explanations about the features and broader chronology of the LSA in East Africa by considering lithic material culture. Further features are viewed in terms of substance behavior expressed through fauna evidence in Chapter 7. As already established by the previous scholars researched in the Southern Highlands of Tanzania, prior to LSA the region contains archaeological evidence that can be traced from ESA. However, based on archaeological variabilities the chronology is not uniform between and within region. Some regions like Iringa have provided earliest archaeological evidence traced from the ESA at Isimila Stone Age Site as opposed to other regions like Ruvuma that traces its chronology from the MSA. As presented in section 10.2 the earliest LSA material culture of the current study dates to about (36,881–27,184 cal BC) from Uhafiwa-Kihansi site, followed by other sites like Mlambalasi and Magubike having LSA material dating between 18,000–3,000 BP (Willoughby 2012; Biittner et al. 2017). Willoughby (2012) is classifying the LSA of Iringa Region as small (Holocene LSA) and later (Later Pleistocene LSA) lithics especially for some test pits. The former appears between 45-85 cm where tools and cores are quite small dating to (13,799–13,266 cal BC) based on *Achatina* snail shells as opposed to the latter dating to (11,835–11420 cal BC), that appears between 86-120 cm and where tools and cores are large compared to the former. This appears especially for Mlambalasi Tp# 1, Magubike Tp#1 and 5 and are supported by current study whereby the length and width for both LSA and IA lithics differs and are statistically significance at 95% Confidence Interval of the difference *t*-test $p < .001$ (Table 6.4, Figures 6.2-6.4; Sing 2013; Appendix X). LSA cultures have been reported elsewhere in east and southern Africa including central Tanzania dating to about 18,190 BP (Masao 1979; Kessy 2005, 2013). At northern Tanzania, sites such as Nasera (22,000–8,000 BP), the Mumba and Naisiusiu Beds at Olduvai Gorge (Skinner et al. 2003; Bushozi 2011; Díez-Martín et al. 2009). This is cutting across other parts of Tanzania and elsewhere in East and southern Africa where LSA have been reported falling within Southern Highlands LSA chronological framework.

Above MSA/LSA, the EIW material is observed specifically for Magubike Rockshelter as presented in section 10.2 above. Chapter 2 and 8 provide more details about IA characterization and chronology. Like other areas, the Iron Age of Southern Highlands of Tanzania is divided into EIA and LIA/historic (Chapter 2 and Chapter 8). Some sites seem to have ended with EIA and lacked the LIA and vice versa for other sites like Mlambalasi and Mgera. Considering the IA period, it is clear to say that the EIA agropastoralists occupied Magubike first (see Table 8.7; Figure 8.17) and would have migrated (demic) and interacted with other EIA people at Njombe, Rukwa, Swahili coast, and other neighboring countries like Zambia and Malawi evidenced through modelled dates from other related region (Figures 8.19 and 8.20) following the related traditions such as Kamnama/Nkope/Gokomere, Kalambo, and TIW traditions across other regions and neighbouring countries of Zambia, Malawi, and beyond. Factors such as trade, intermarriages, and migrations could have contributed to those interactions. This is expressed by the presence of EIA pottery traditions presented in Chapter 8 sub-section 8.6.2 and its interpretation. The big gap of 1,280 years from the last date of EIA (i.e.

236 AD) and the beginning of LIA/historic period (i.e. 1,516 AD) at Magubike signifies the abandonment of the site by the EIA people before being reoccupied by the LIA/historic people. The issue of demic diffusion has been supported genetically by scholars (Alves et al. 2011; Busby et al 2016; Prendergast et al. 2019; Prendergast 2022; see sub-section 2.9.2 and section 10.7 below).

The emergence of LIA/historic people at Magubike and other site of Mlambalasi and Mgera may significance the so-called second Bantu migration 1,000 AD. The lack of EIA evidence at Mlambalasi and Mgera sites indicates the absent of the first migration instead the LIA people would have come later and occupies those area. Although there is no consensus about the model of spread for LIA people, some scholars believe that a single ceramic tradition and new economy spread over virtually the whole subcontinent at AD 1,000, others believe that unrelated changes occurred at different times and places, or alternatively that relations of production changed without any population movement (Huffman 1989, 2007; Digitale 2008; Sikora et al. 2011; Bostoen 2018). This has been evidenced through petrographic analytical results of the current study whereby the IA people seems to acquire technology through cultural diffusions (see Chapter 2 sub-section 2.6.2 for the clarification of model). A good example is expressed through TIW recorded at Njombe having made from the local/primary raw materials even though the TIW is mostly recorded along the Swahili coast.

10.6 Ceramic traditions, Interactions in the Archaeological Records and Contemporary ethnic groups in the Southern Highlands of Tanzania

This section discusses about research question 2 which asks that how does IA evidence inform issues such traditions, interactions, and ethnic identities/affiliations (in relation to contemporary IA working related communities in the region)?

The issue of ceramic traditions of the Southern Highlands of Tanzania have been presented in Chapter 8 followed by the interpretation. Additionally, the section 10.5 above has discussed those traditions which are divided into EIW and LIW. It goes further to discuss how those traditions informs the issue pertaining to intra and inter connectivity within and between regions. The petrographic analytical results have informed the model of interaction to be either by physical movement of people or diffusion of idea or knowledge. This section considers much the issue of ceramics in the archaeological records in relation to the contemporary ceramic producers in the study area following the results presented in chapters 8 and 9. It tries to capture the aspects related to continuity and discontinuity in the technology of pottery production and how can it be affiliated to a certain ethnic group as part of the identity.

As I presented on Chapter 2 on material culture, ethnicity and identity, there has been a long-term scholarly debate about associating a certain material culture with a specific ethnic group (Jones 1997; Kusimba and Kusimba 2005; Mayor 2010; Wynne-Jones 2013, 2016). Such debates emerged more from 1960s under the processual archaeological approach that challenged the traditional archaeology (Jones 1997). Despite of such debates and criticisms, scholars have continued focusing on this topic of ethnic identities through material culture in archaeological studies (*ibid*.). Similarly, to the current study the application of ethnoarchaeological approach on material culture such as ceramics has provided data for understanding more on this matter. The similar statement has been made by Mayor (2010:38) that “after the debates of the past thirty years between processualists and post-processualists, general and direct historical analogies, or ecological and historic-cultural determinisms, ethnoarchaeology is now presented as eclectic.” It is clear through ethnography of pottery production at Iringa and Njombe Regions one could be able to differentiate pottery of two or three tribes that is Bena, Hehe and Nyakyusa (Ref. to Chapter 9). Such can be traced even at individual levels. This does not surpass the observed differences highlighted in Chapter 9. Although it might be difficult to directly associating pottery to a certain ethnic group in the archaeological records but through the ethnographic studies like the current one it can be possible to have an interpretation on variations evidenced on the archaeological records through understanding the contemporary production process. This statement aligns with Mayor (2010:6) who maintains that “in particular, ceramic researchers have focused on describing the learning processes and diversity in pottery manufacturing processes and variability in products, in order to understand better the meaning of technical and stylistic choices.” The current study has evidenced some differences in the entire process of ceramic making for the two main ethnic groups that is Bena of Njombe Region and Hehe of Iringa Region. Those differences provide a unique identity that differentiate one ethnic group from another despite of shared entities. For example, while roulette decorations are common for the Hehe, the carinated vessels are common for the Bena. These two ethnic groups are not very far in terms of geographical occupation. They are trading each other, intermarriage, and other shared socio-economic, and political affairs but still each ethnic group has maintained some uniqueness in ceramic production. This is similar to the Hodder’s (1982:13-57) study among the Tugen, Pokot, and Ilchamus around Lake Baringo, Kenya which indicated that, despite frequent interactions between the three groups, their material culture exhibited a number of stylistic differences. Using example from Oromo people of western Wallaga in the highlands of southwestern Ethiopia, Wayessa (2011:301) maintain that "the Oromo pottery production in the region is passed down through family lines, and these potters use specific technical styles, which are distinct in material properties and production processes from the surrounding non-Oromo communities." Similarly, through ethnoarchaeological approach that employed *chaînes opératoires* Mayor (2010) recorded the cultural identity on the contemporary 12 ethnic groups that produces or purchase pottery in the central Mali (West Africa). Three patterns made possible to for cultural identity including: first, shaping techniques and aesthetic properties of pottery define traditions that reflect the identity of the producers. Second, pottery within a housing unit reflects the identity of the occupants, and third, the spatial distribution of a ceramic tradition reflects the settlement structure of the producing group. This results by Wayessa on Oromo people and Mayor on central Mali are similarly to what the current study has recorded over Bena and Hehe of the Southern Highlands of Tanzania, signifying technological identities that differentiate one ethnic group or an individual from another.

Regarding the aspect of continuity and discontinuity, the current study has observed the continuity of pottery production of LIA traditions that can be traced from 1277–1391 cal AD from Mlambalasi and 1646–1800 cal AD from Mgera site. The rouletted ware and carinated vessels which are still practiced by Hehe and Bena date back to 1,200 AD and 1,800 AD in the archaeological record (Soper 1985; Chami et al. 2004; Ashley 2005, 2010; Kyazike 2013). In reference to Chapter 2, rouletted pottery marks the end of EIA and beginning of LIA in East Africa (*ibid*.). The current practices of those technologies by the mentioned ethnic groups signifies the continuity of technology that has survived in those communities for more than 700 years. On other hands, there is a discontinuity or perishing of some technologies which are recorded in the archaeological context but no longer practiced in the contemporary communities. Most of those technologies are based on the EIA traditions presented in the Chapter 8.

10.7 The Current Study and other Related Local and Global Anthropological Studies on Human Migrations and Interactions

This section discusses about research question 3 which asks that how does the data from Southern Highlands of Tanzania contribute to broader understanding of anthropological research on migration and interaction over time and space? The underlying debates, models of interactions, and empirical reviews have been presented in details in Chapter 2 of the current study. Therefore, this section is trying to relates the results of the current study pertaining the models of interactions between the LSA hunter-gatherers and IA agropastoralists in the Southern Highlands of Tanzania together with those empirical studies of the similar or related results. The results of the current study align with other Tanzanian, East African, African, and global studies on prehistoric migrations and interactions models (refer to Chapter 2 sub-section 2.6.2, 2.9.2, and section 2.11). Within Africa, archaeologists (Musonda 1987; Denbow 1999; Kusimba 2003; Lane, 2004; Kusimba and Kusimba 2005; Kusimba 2005; Kessy 2005, 2013; Crowther et al. 2018; Chapter 2 section 2.11) consider that the IA peoples involved in the formative period in most areas of Eastern and Southern Africa integrated the LSA hunter-gatherers into IA related systems/cultures through acculturation/adoption instead of absorption or replacement has per previous claims (Johnston 1913; van der Merwe 1980; Pilgram et al. 1990; Phillipson 1993, 2005; Diamond and Bellwood 2003). Their arguments have been demonstrated by archaeological study of material cultures such as lithics, botanical and faunal evidence, chronology, and stratigraphic analysis. A good example is Lunsemfwa Drainage Basin (LDB) of Zambia, central and Swahili coast of Tanzania respectively as stated clearly in Chapter 2 of the current study. The current study which relies on lithics, fauna, and stratigraphic analysis presented in the Chapter 4-7 provides the similar conclusion regarding the model of interactions between the autochthonous LSA hunter-gatherers and IA agropastoralists in the Southern Highlands of Tanzania. Kessy and Msonda are presenting their argument basing on the consistently production of lithic artifacts even after the interaction with Bantu agropastoralists. Such production persists until LIA. The similar case is evidenced for the current study. Crowther et al. (2018) draws evidence from botanical and faunal of hunter-gatherer and early farming sites on eastern Africa's coast and offshore islands, and with comparison to inland sites. They reached a conclusion that was based on three main considerations (see section 2.11). One of it was that farming does not replace foraging when it is introduced. Indeed, well into the Middle Iron Age (MIA) period, fishing, and the hunting and trapping of wild fauna, continue to have economic significance, even at major trading settlements such as Unguja Ukuu. The conclusions reached by those scholars is supported by others (Phillipson 1993; Denbow 1999; Kusimba 2003; Lane, 2004, 2007; Siiri€ainen et al. 2009; Kusimba and Kusimba 2005; Kusimba 2005; Dale and Ashley 2010; Prendergast 2008, 2010; Stock 2013) who believe on demic diffusion/acculturation instead of replacement or assimilation (see section 2.11). The combination of data from the current study together with the above studies the issue of LSA vs IA interactions debate can be addressed in the east and southern Africa.

Globally, the similar model (acculturation) has been used to explain the spread of agriculture in Europe from Middle East by scholars such as Ammerman and Cavalli-Sforza (1984) detailed in Chapter 2 sub-section 2.6.2. According those scholars, the spread of farming from Middle East to Europe was a movement of farmers with their languages which gradually evolved formed new languages and agricultural societies (demic diffusion/acculturation) instead of the wave of total replacement (Ammerman and Cavalli-Sforza 1984). In the North America, the issue of cultural change as the result of acculturation has been taken into consideration. This has been noted by Cabana (2011:24) that "among archaeologists of the U.S. Southwest in particular, migration is no longer viewed as population replacement but a population mixing." This conclusion is also supported by Clark (2011:87) who maintains that "while displacement of one group by another is possible, archaeological studies in the precontact U.S. Southwest indicate that migrations more often resulted in the co-residence of different immigrant and local groups within communities, settlements, and even houses."

Regarding other lines of evidence, although the current study did not focus on genetic evidence to address the issue of interactions between the two mentioned groups still some genetic studies on migration support the conclusion reached by the current study that relied on archaeological evidence (Patin et al. 2014; Busby et al. 2016; Prendergast et al. 2019; Lipson et al. 2022; Prendergast 2022; Fortes-Lima et al. 2024) covered in Chapter 2 section 2.8, sub-section 2.9.2, and section 2.11). Both scholars support the presence of demic expansion and admixture between Bantu and the local population such as LSA hunter-gatherers and other pastoralists groups. According to Prendergast (2022) genetic research on West and central Africa has highlighted the demographic histories of hunter-gatherers; expansions of speakers of Bantu languages; and evidence for admixture between these groups and other genetically distinctive groups. Speakers in eastern, central, and southern Africa are weakly genetically differentiated, reflecting a recent shared ancestry (Busby et al. 2016). This demonstrates that the distribution of Bantu speakers today is the result of demic diffusion, that is, movement of people along with words and ideas (Prendergast 2022).

As Bantu speakers moved south through the rainforest, they admixed with autochthonous peoples in ways that reflect certain social dynamics. For example, analyses of the uniparental markers (mtDNA and the Y chromosome) revealed sex-specific patterns of mixture in modern Bantu-speaking populations (Prendergast 2022). Specifically, ancient female hunter-gatherers had children with Bantu-speaking agriculturalist men far more often than the reverse (Prendergast 2022; citing Patin et al. 2014). This is of Bantu admixture with hunter-gatherers has been explained by Patin et al. (2014:1). “Here we report genome-wide Single Nucleotide Polymorphisms (SNP) data from these populations located west-to-east of the equatorial rainforest. We find that hunter-gathering populations present up to 50% of farmer genomic ancestry, and that substantial admixture began only within the last 1,000 years.” This forager-agriculturalist admixture also conferred advantageous genetic mutations to admixed populations, resulting in many Bantu speakers across Africa today having malarial resistance inherited from their rainforest hunter-gatherer ancestors (Prendergast 2022). The West-African-related ancestry found in Bantu speakers in eastern and southern Africa today is admixed in variable proportions with lineages associated with rainforest hunter-gatherers, southern African Khoe-San foragers, and eastern African pastoralists speaking Afro-Asiatic and Nilo-Saharan languages (*ibid*.).

Another conclusion is made by Fortes-Lima et al. (2024:546) "Our study supports a large demic expansion of Bantu Speaking Population with ancestry from western Africa spreading through the Congo rainforest to eastern and southern Africa in a serial-founder fashion. This finding is supported by patterns of decreasing genetic diversity and increasing F_{ST} (means the proportion of the total genetic variance contained in a subpopulation) from their point of origin, as well as admixture dates with local groups that decrease with distance from western Africa." Similarly, Lipson's et al. (2020) study at Shum Laka-northwest Cameroon (refer Chapter 2 section 2.11) does not support the replacement from the genetic evidence of the recorded buried four children belonging to different time periods, instead indicates the persistence of similar genetic from LSA to IA about 5,000 years. As I stated previously on Chapter 2, Such observation by those scholars challenges the notion regarding extinction or replacement of LSA-hunter-gatherers by Bantu language speaking group as both of them seems to exist together.

10.8 Conclusions

This study has examined three prehistoric periods mainly LSA, PN, and IA in the Southern Highlands of Tanzania. The study was guided by three hypotheses and three research questions. Based on hypothesis I that aimed at testing addressing the timeframe that demarcates LSA from IA periods in Southern Highlands of Tanzania, the current stand provides the earliest date from Uhafiwa site, Iringa Region that is (36,881–27,184 cal BC) for LSA. Such date falls within the Second Intermediate Industry (50,000-25,000 BP) in sub-Saharan Africa which involve the transition from MSA to LSA or early LSA (Mehlman 1989; Díez-Martín et al. 2009; Gliganic et al. 2012; Bushozi et al. 2020). They are widely characterized with macro-micro lithics; symbolic revealing artefacts; platform and bipolar cores. In Tanzania, similar industries have been reported in northern and central parts of the country, in particular at Mumba, Nasera, and Kisese rockshelters (*ibid*.). The study has recorded the EIA to begin at Magubike rockshelter, Iringa dated (168 cal BC–55 cal AD). This date falls within the Urewe timeframe in East Africa (500 BC–800 AD). The study has also examined the relationships that emerged when LSA hunter-gatherers and IA agropastoralists met at the first time (for hypothesis II). The results found that the two cultures coexisted until the historic period through the acculturation process (Chapter 6, 7). The similar observations have been reached by other scholars within and outside Africa who have researched on human migrations and interactions over time (Chapter 2 and section 10.7 above). The study also aimed at examining whether the PN culture existed in the Southern Highlands of Tanzania (for hypothesis III). The results based on C-14 dates of ceramic samples do not supports the presence of PN at sampled site of Magubike, however, based of ceramic evidence reported by previous scholar (Msemwa 2021) in the Upper Kihansi area, there is possible evidence of PN Narosura tradition in the Iringa Region (sub-sect 8.6.1). The IA material cultures were examined using evidence from cultural traditions, geographic distribution (intra/interregional interaction). The results indicate the vast similarities and some differences that could be interpreted in form of knowledge exchange triggered by some activities such as trade and intermarriages (Chapter 8 and 10). This has also examined through ethnographic inquiries on pottery production in the Iringa and Njombe Regions (Chapter 9) whereby the result indicates the uniqueness and similarities among contemporary pottery makers for Bena and Hehe tribes of Southern Highlands of Tanzania.

10.9 Limitations of the Study

The current study was not able to absolutely address the debate about the existence or not of PN in the Southern Highlands of Tanzania. However, more research is needed especially at Magubike and Uhafiwa/Kihansi site regarding the PN. Some ceramic evidence presented in Chapter 8 characterized by reverted thin rims and wall, need further attention as far as the EIA cultures is concerned. Regarding Uhafiwa site, little coverage was done by the current study on that area due to poor accessibilities, dense trees, bushes, and logistical issues. Additionally, the site was disturbed by the KHPP. The issue of Covid 19 pandemic had a negative impact on the current study. It affected the schedule for the timely beginning of field works due to travel restrictions and limitations of in-personal related researches like interviews. To solve that challenge the study had initially relied on museum collections. However, some of the collections like that of Msemwa lacked the stratigraphic information because they were collected on the surface despite of carrying important archaeological information for the current study.

10.10 Future Research Direction

In the future, I would like to focus on the following issues in order to widen an understanding of LSA, PN, and IA of Southern Highlands and beyond. As recommended above there is a need to conduct intensive survey and excavation at Uhafiwa and Magubike sites. Additional approaches and methods such as residual analysis of ceramics are important for establishing the cuisine of prehistoric and historic people of the region. More research is to be placed on Msemwa's 2001 sites such as Miharawa, Mgala, Zanziberi, Msosa, and Utinde Mkoga in order to develop the stratigraphic context of the EIA material culture. Some archaeological material such as pottery of the current study shares some affinities with others from some neighboring countries and beyond. Future research has to focus more on petrographic analysis by taking some samples from those countries in order to develop the nature of interactions.

Table 10.2: A summary/mapping of key issues raised by the current study.

Key focus/problem	Indicators/material and methods	Results
1. What is the IA and LSA timeframe of the Southern Highlands of Tanzania?	-Stratigraphic analysis and material culture compositions -Chronometric dating (charcoal, beads, ceramics)	-The earliest dates for LSA context are recorded at Uhafiwa site in the Iringa Region (i.e 36881–27184 cal BC). This falls within the transitional industry of East Africa (i.e. from MSA to LSA) -The earliest evidence of Iron Age context is recorded at Magubike Tp# 3 (i.e. 168 cal BC–55 cal AD). This is earliest EIA chronology of East Africa, central-southern Africa with exception of Urewe at the Lake Victoria Regions.
2. What is the Interaction model between LSA hunter-gatherers and IA-agropastoralists in the Southern Highlands of Tanzania?	-Replacement/displacement (sudden disappearance of LSA-hunter-gatherers materials e.g. lithics, wild faunal, beads, etc.) replaced by IA material culture e.g. ceramics, domesticated faunal remains, slags, tuyere, furnace etc. -Demic diffusion/acculturations/adoption (continuous/parallel practices of two cultures, long-time persistence of both cultures, one culture will be dropped slowly in favor of another culture).	No replacement/displacement recorded. The study has noted that the LSA and IA communities of Southern Highlands of Tanzania were interacted in form of acculturation/demic diffusion/adoption. Thus, mixing LSA cultures with IA ones continued up to the LIA period, having diffused or acquired some cultural element which later were abandoned slowly.

	-Assimilation/absorption There is replacement but not sudden/abrupt. There is almost balance of material culture between the interacted groups at the initial stage of contact. It doesn't take long time for one culture to be overwhelmed and assimilated or becoming part of another culture. -Cultural diffusion No migration or replacements but acquisition of some cultural traits from other cultures that are incorporated in one's culture.	No assimilation/absorption recorded. There are elements of diffusion observed through Petrographic Analysis of ceramics in the Southern Highlands of Tanzania.
3. Is there PN cultures in the Southern Highlands of Tanzania or not?	-Analysis of Magubike stratigraphic composition (e.g. Tp# 3 level 3 following the previous dates obtained from Achatina i.e. (1401–1048 cal BC). -Nature of material culture and associated evidence e.g. ceramics, faunal remains, etc. -Dating of associated materials e.g. potsherds. -Survey and excavation of new sites i.e. Uhafiwa following the previous report by Msemwa (2001).	-The dates i.e. (81–236 cal AD) obtained from ceramics of Magubike doesn't fall within the PN timeframe of East Africa instead it falls within the typical EIA. However, the ceramic morphology looks like those of PN. -PN evidence are presented in terms of ceramics as per previous Msemwa's study. Ceramics classified as Narosura have been reported from Uhafiwa and stored at Isimila Museum, Iringa.
4. What characterizes the LSA and IA material culture of Southern Highlands of Tanzania?	-Attributes analysis e.g. technologies, tool type, linear dimensions, association, chronology for LSA material culture. -For IA material culture: IA debris, context, potsherd forms, rim/lip morphology, decorations, chronology, dimensions.	-Backed tools including geometric microliths: crescents, blade or bladelets, triangles, and trapezes, as well as truncations, bipolar cores and flakes. -Ground stone tools=Hammerstone, pestle rubber, anvil, pebbles, and stone disc. These characterizes the LSA context all the way to IA context. -EIA: Chronology: 168 cal BC–1,277 Cal AD. The former at dated at Magubike and latter at Mlambalasi. The EIA ceramic traditions of the current study include the Magubike/Urewe, EIA-thin ware, Limbo, and Nkope/Kamnama. -LIA: 1,277–1,921 Cal AD at Mlambalasi and Mgera respectively: The LIA ceramic

		traditions of the current study include the TIW, Ivuna, Rouletted ware, and carinated ware.
5. How does IA evidence inform issues such traditions, interactions, and ethnic identities/affiliations (in relation to contemporary IA working related communities in the region)?	-Interactions (intra/interregional connectivity) considers physical and chemical attributes analysis (PA). -Ethnic identities/affiliations: ethnoarchaeology following the *chaîne opératoire* framework	-There were intra/interregional interactions which imply technological transfer, movement of ideas-i.e. material was locally made instead of trading objects. The connectivity cuts across East-central and southern Africa reflected on ceramic traditions of IA in particular. -In the contemporary society there is differences and similarities in the entire process of ceramic making for the two main ethnic groups that is the Bena of Njombe Region and the Hehe of Iringa Region. Some technologies have disappeared while others e.g. roulette persists from 1200 AD until today.
6. How does the data from Southern Highlands of Tanzania contribute to broader understanding of anthropological research on migration and interaction over time and space?	-Focus on desktop reviews.	-East and South-central Africa (Musonda 1987; Kessy 2013; Crowther et al. 2018) are supporting acculturations by refuting absorption or replacement has per previous claims (Diamond and Bellwood 2003; Skogland et al. 2017). -At global scale, demic diffusion/acculturation used to explain the model for the spread of agriculture in Europe from the Middle East (Ammerman and Cavalli-Sforza 1984). In the North America, among archaeologist of U.S. Southwest in particular, migration is no longer viewed as population replacement but a population mixing (Cabana 2011; Clark 2011). Genetic admixture is recorded for IA and indigenous community) e.g. Shum Laka-northwest Cameroon (Lipson et al. 2022). Others (Prendergast et al. 2019; Prendergast 2022; Fortes-Lima et al. 2024).

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APPENDICES

Appendix I: Major Prehistoric Expansion

Table 1. Major prehistoric expansions.

Center of origin	Area of expansion	Time*	Technologies
Africa (*H. erectus*)	Old World	>1 Ma	Stone tools
Africa (*H.s.s.*)	Entire world	100 to 30 ka	New tools, more advanced language, and navigation
Middle East	Europe, North Africa, and Southwest Asia	10,000 to 5,000 ya	Farming and domestication (wheat, barley, goats, sheep, and cattle)
North China	North China	9,000 to 2,000 ya	Farming and domestication (millet and pigs)
South China	Southeast Asia	8,000 to 3,000 ya	Farming and domestication (rice, pigs, and buffalo)
Central America and North Andes	Americas	9,000 to 2,000 ya	Farming (corn, squash, and beans)
West Africa†	Sub-Saharan Africa	4,000 to 300 ya	Farming (millet, sorghum, cowpea, and gourd)
Eurasian Steppes	Eurasia	5,000 to 300 ya	Pastoral nomadism (horses and warfare)
Southeast Asia or Philippines	Polynesia	5,000 to 1,000 ya	Oceanic navigation
Greek colonization	Mediterranean	4,000 to 2,400 ya	Navigation and trade

*Abbreviations: Ma, million years ago; ka, thousand years ago; ya, years ago. †Includes the Bantu expansion.

Source: Modified from Cavalli-Sforza et al. 1993:665).

Appendix II: PN and IA Ceramic Traditions Recorded in East and Southern Africa: Summarizing their Types/Categories, Period, Location, and Features/Characteristics.

S/N	PN/IA Category			Tradition	Period	Attributes	Regional/country found (Origin)	References
	PN	EIA	LIA					
1	√			Nderit	4,000-3,000 BP	Both Nderit and Kansyore wares are decorated by means of single impressions, but the Nderit impressions are angular and interiors of vessels are often deeply scored	East African region e.g. between the Lake Turkana Basin and Serengeti Plain	Bower 1991; Grillo et al 2020; Robertshaw 2021
2	√			Narosura	3,000-2,300 BP	Sherds are often burnished and decoration usually consists of bands of incised cross-hatching or hatched comb-stamping just below the rim	East Africa: Rift Valley of Kenya/Tanzania and Kilimanjaro, Lake Naivasha, Lake Eyasi, Mara River, Swahili coast region and Zanzibar Island, some parts of interior southern Tanzania e.g. Upper Kihansi	Odner 1972; Msemwa 2001; Chami and Kwekason 2003 Prendergast et al. 2013 Ombori 2021
3	√			Remnant Elmenteitan	3,000 BP	Handles, spouts, and lugs are found only in Elementeitan pottery	East Africa: Mt. Eburu, Lake Nakuru, Gogo falls, and Ngamurick	Bower et al 1977; Smith 2021; Goldstein 2021
4	√			Maringishu	1,700 BP	The ware includes motifs and techniques that are reminiscent of Narosura pottery and fauna assemblage from Maringishu site, though meager, contains only domestic cattle in its identifiable fraction	East Africa: Maringishu site	Wright 2015; Robershaw 2021; Ombori 2021
5	√			Akira	1,900-1300 BP	Akira pottery shares various traits of Narosura ware, including exterior surfaces and a high incidence of incised, hatched, and cross hatched decoration. Akira ware is generally associated with predominantly wild fauna. Akira lithic assemblage contains diagnostic elements of the Elmenteitan lithic industry such as large blades	Karamoja District-Northern Uganda, Serengeti sites, In the Turkana Basin and the Rift valley	Bower 1991; Prendergast et al. 2013

6		√		Urewe	500 BC-800 AD/ Early 1st Millenium	Dimple base, necked vessel, shallow bowl, thickened rims, fluted lips-incised decorations on rim bands, grooved design on/near the shoulder	Lake Victoria Regions	Schmidt 1997; Phillipson 1977; Ashley 2010; Ashley and Grillo 2025
7		√		Lelesu	100-200 AD/Early 1st Millenium	Lelesu's potteries show affinities both with Urewe ware and Kwale. The most common Lelesu vessel form was the in-turned bowl, though open bowls were also common and globular vessels were produced. Rim fluting and beveling was also common.	North-central Tanzania (Usandawe land)	Phillipson 2005; Prendergast 2008; Crowther et al. 2018
8		√		Kwale	100-200 AD/ Early 1st Millenium	Many bowls with in-turned fluted rims and flattened or slightly concave bases. Shouldered pots with incised or grooved decoration are also present. Rims are generally thickened and also fluted.	East Africa: Indian Ocean Coastal Regions mainly in south-eastern Kenya, and the Tanga and Kilimanjaro regions in Tanzania	Soper 1967a; Soper 1967b; Chami 2006; Rødland 2021; Wynne-Jones 2023
9		√		Kalambo	300-400 AD /4th century CE to the beginning of the second millennium	The most common vessel form was the Necked pot though globular and open bowls were also used. Horizontal grooving at the shoulder, oblique or crosshatched incisions or comb-stamps at the rim. False-relief chevrons were also common, and often occurred in conjunction with other motifs. Many rims were thickened, and beveling was also used	Western Tanzania near Lake Tanganyika extending southward into northeastern Zambia	Clark 1974, 2001; Huffman 2007; Barham et al. 2015
10		√		Dambwa/ Shongwe	Between the 5th and 8th centuries AD	Slightly necked vessels with flat, externally thickened rims. Beakers and carinated vessels were also made and open bowls were present but rare. The most common decorative motif was one or more bands of diagonal incision or comb-stamping at the rim, often set within two horizontal comb-stamp bands,	Zambezi river valley upstream from Victoria Falls and extending southwards into Zimbabwe	Lander and Russel 2018; Fredriksen 2023

						sometimes accompanied by a band of straight or wavy dragged lines on the body		
11		√		Kapwirimbwe, Chondwe	400-500 AD/Early 1st Millenium	Decorated with false-relief chevron stamping of bowls with exaggerated internal thickened of rim.	Zambia, southern Tanzania	Phillipson 1968a; Huffman 2007; Fredriksen 2023
12		√		Kamnama (Nkope/ Gokomere/ Nkazi/ Mwangia	400-600 AD/ Early 1st Millennium	Necked vessels, bowls with in-turned rims, bowls of vessel type are thickened, lips are beveled and fluted, comb stamping or incisions. Horizontal grooving, sometimes interrupted, is not common and occurs generally on bowls. Less frequent motifs include wavy-line incision and impressions of a rectangular or triangular stamp, while incised chevron lines and diagonal grooves are seen on the lips of some in-turned bowls.	Swahili coast, Interior southern Tanzania, Zambia, Mozambique, Zimbabwe	Kwekason 2013; Huffman 1980, 2007; Pikirayi 2001, 2016
13		√		Nampula	1st Phase 2rd-5th centuries CE 2nd Phase 2rd-5th centuries CE 3rd Phase 2rd-5th centuries CE	-necked jars with everted rims and other vessels with constricted necks and in-turned rims. bands of incised lines, both oblique and vertical -the jars with constricted in-turned rims and in-turned bowls. Decoration: dentate/comb-stamped motifs. -Mostly necked jars with vertical or everted rims, rather than in-turned rims plus various bowls. Decoration typically consisted of a dentate band below the rim and multiple bands of punctates or vertical incisions.	Nampula province, Zambezi Valley (Mozambique)	Pawlowicz 2011; Fredriksen 2023).
14		√		Matola	Early to mid-first millennium CE	Matola ceramics showed affinities with Kwale ceramics from much further North. In-turned bowls and up-turned rim pots, the latter with beveled	Southern Mozambique	Pawlowicz 2011; Ekblom et al. 2023

						Rims, carinated vessels and open bowls. Simple decoration, with punctate bands or incised lines at shoulder and occasional dentate motifs or incisions on the bevels.		
15		√		Mwabulambo ware	300-400 AD or 3rd, 5th and 6th centuries CE	Shows some affinities to Kalambo ware. It is characterized by undercoated vessels particularly bowls. Rims of all vessels are generally undifferentiated or slightly thickened. Typical decorative motifs included horizontal grooving at the neck or shoulder, and some oblique or crosshatched incisions located near the rim, though undecorated wares were relatively more frequent than in other contemporaneous EIA ceramic types	Malawi	Phillipson 1977; Robinson and Sandelowsky 1968; Russel and Steele 2009; Barham et al. 2015

S/N	**PN/IA Category**			**Tradition**	**Period**	**Attributes**	**Regional/country found (Origin)**	**References**
	PN	EIA	LIA					
16		√		Gokomere and Ziwa	400-500 AD	Relatively close related to the Mwabulambo and Nkope wares of Malawi. Necked pots and open bowls, though in-turned bowls, carinated bowls and globular vessels. Gokomere ceramics were usually decorated (Vogel 1978), often on the rim-band. Oblique or parallel dentate stamping was the most common decorative motif, though bands of oblique or horizontal incisions were also fairly common. The rims of Gokomere vessels were	Zimbabwe, Southern Mozambique and Northern South Africa	Phillipson 1977; Pawlowicz 2011; Lander and Russel 2018

						often thickened, especially those of the necked jars, but beveling was infrequent.		
17			√	Transitional Urewe	Later First Millennium	Distinguished from the earlier Urewe type by coarser fabrics, less beveling, and poorly executed decorations. Bowls were the dominant vessel type and decorations tended to be widely-spaced versions of the earlier Urewe horizontal grooving and incised crosshatch, though the horizontal grooves were often not perfectly parallel. Many vessels continued to exhibit the characteristic dimple base, but the dimple itself tended to be less pronounced and the base flatter	Lake Regions	Lane et al. 2006; Ashley 2010, 2013; Kyazike 2023; Clist 2017

S/N	PN/IA Category			Tradition	Period	Attributes	Regional/country found (Origin)	References
	PN	EIA	LIA					
18			√	Early Kitchen Ware, Wenje ware, Pare Group C, Tana Tradition Ceramics/Triangular Incised Ware	Second half of the first millennium	The most common vessel form was the necked pot, though in-turned bowls, carinated vessels and open bowls were also produced regularly. Occasionally the rims were beveled, especially with the in-turned bowls, but more often they were thickened, and the thickened rim frequently served as a platform for decoration. “Triangular-Incised Ware,” (TIW) many decorations on these ceramics were incised triangles, though bands of oblique or horizontal	East African coast (from Somalia to Mozambique) and a way inland. Zanzibar Island	Chittick 1974; Chami 1994; Håland and Msuya 2000; Pawlowicz 2011; Fleisher and Wynne-Jones 2011; Wynne-Jones 2023

						incisions near the rim were also common.		
19			√	Zhizo	The Zhizo phase began in the 7th century AD	The ceramics of the Zhizo phase were distinguished from the earlier phases of Gokomere and Ziwa by a general modification of the more elaborate elements of earlier pottery and less decoration. The decorative motifs, particularly reliance on comb stamping and placement in the rim-to-shoulder region, were retained however. Zhizo ceramics were mostly comprised of necked vessels, but open and spheroidal bowls were also common and carinated vessels were used	Near Zhizo Hill in Zimbabwe	Robinson 1966; Phillipson 1977; Huffman 2007
20			√	Chobi Ware originally called "*boudiné*" pottery	Early second millennium	Chobi vessels were primarily bowls and widemouthed necked pots with thickened rims. The most diagnostic characteristic of these ceramics is the textured upper body of the vessels resulting from a lack of postconstruction smoothing. The most common decorations on these ceramics were fingernail impressions and finger impressions.	Lake region, Uganda, near the Chobi River	Phillipson 1977:162-164; Ashley 2005, 2010; Kyazike 2013
21			√	"Roulette-decorated pottery" traditions including: - Entebbe ware - Bigo ware (13th and 15th centuries)	Were made and used as early as the 8th century CE	Roulette-decorated ceramics typically postdated the Chobi type and they continued to be produced throughout the second millennium, but some roulette-decorated wares. Entebbe ceramics were distinguished from many	Lakes Region, Uganda	Posnansky 1969; McMaster 2005; Ashley 2010

						other roulette-decorated by their internally thickened rims. Their interiors were also frequently scored using a comb. The most common Bigo vessel form was an up-turned rim pot with a globular body, though open bowls and necked vessels were also made. Most Bigo vessels were decorated, with 85% of reconstructed vessels at the type site bearing decoration. Decoration typically consisted of knotted-string roulette placed near the rim, which was often thickened by rolling.		
22			√	“Neck-Punctated Ware” or “NP”	Early second millennium	The full description of the proposed NP type (Chami1998: 212) focused on novel but relatively uncommon vessel forms such as carinated vessels and those with a vestigial neck, neither of which comprised as much as 5% of coastal assemblages, over better represented forms such as open bowls and globular pots.	East African coast	Chami 1998, 2006 Pawlowicz 2011, 2017
23			√	Uvinza	Uvinza dating of twelfth century AD	Rouletted-decorated e.g. Twisted String Roulette (TGR), Carved Roulette	East Africa: South, western Tanzania: Pwaga site	Sutton and Robert 1968:56; Soper 1985; Mapunda 2010
24			√	Ivuna	Between 1200 and 1400 AD	Decorated with dots or stamped motifs/Applied bosses around the shoulder. Sometimes	East Africa: Rukwa, Kalambo falls	Fagan and Yellen 1968; Mapunda

						chevron, deep crescent-shaped punctates, or pronounced roulette applications are applied on top of the ribs		2010: 94 Barham et al. 2015;

S/N	PN/IA Category			Tradition	Period	Attributes	Regional/country found (Origin)	References
	PN	EIA	LIA					
25			√	Plain Ware (PW	Early second-millennium	PW is largely defined by a lack of decoration, except for rare punctate bands or lip notching, and common vessel forms included necked vessels with long, flared rims and open and globular bowls.	East African coast	Chami 1994, 1998, 2006; Kusimba and Kusimba 2005; Croucher 2006
26			√	Maore Ware	Late first to early second millennium	It consisted of thick, short-necked pots, open bowls, and globular vessels. Burnishing occurred on some of the globular vessels and several had an added collar at the rim. Decoration occurred mostly on necked vessels and the most common decorative motif, occurring on more than half of the decorated vessels, was a double row of impressions made by walking a two-pronged instrument along the pot. Other motifs included bands of vertical, oblique or horizontal incisions.	Coastal hinterland of southern Kenya and northern Tanzania	Odner 1971; Soper 1967b; Pawlowicz 2011
27			√	Pahi ware	The early second millennium/13th and 14th centuries	A shift away from the in-turned bowls of the Lelesu type to necked pots without beveled or fluted rims. They were made of fine clay, and were often slipped and burnished. The most common decorative motif was comb-stamping, which occurred all over the body but was especially prevalent around the rim, and bands of walked, rocked, and	Central Tanzania	Kessy 2005, 2013; Pawlowicz 2011, 2017

						fingernail impressions were also common. Incised decorations, such as zigzags, also occurred, but rarely.		
28			√	Lumbo Tradition	The early second millennium	Unrestricted open bowls and the proportions of necked vessels that were common in the first-millennium Nampula Tradition decreased notably, though some continued to be made. Common design motifs included areal stamping, where the stamped impressions fill delineated areas of the vessel, and shell impressions.	Mozambique	Chami 1992, 2006; Kwekason 2010; Pawlowicz 2011
29			√	Mwamasapa	11th century along the Rukuru River	Were predominantly gray to reddish-brown necked or open bowls, though some globular vessels were present as well. They were also thinner than the earlier Mwabulambo vessels, and some rims were tapered. The most common decorative motif was bounded, comb-impressed areal stamping. These decorations were done using sorghum grains in some instances. Notched rims were also common.	Malawi	Robinson and Sandelowsky 1968; Pawlowicz 2011; Rødland 2021
30			√	Kapeni	10^{th} and 14^{th} century CE	Has been found associated with Nkope ceramics in the 10th century and expressed similarities to both Nkope and Mwabulambo in terms of vessel forms and decoration, so some have classed this as a terminal EIA type (Pawlowicz 2011). vessel forms included slightly flared necked pots, shallow bowls, and in-turned bowls-often employed polychrome burnish. Decoration-most prominent	Malawi	Robinson 1976; Kwekason 2013; Pawlowicz 2011, 2013

						on the necked pots, consisted of modified EIA motifs, usually coarsely incised. Common motifs included bands of vertical incisions, horizontal grooving, incised zigzags and triangles, and punctate bands.		

S/N	**PN/IA Category**			**Tradition**	**Period**	**Attributes**	**Regional/country found (Origin)**	**References**
	PN	EIA	LIA					
31			√	Longwe	11th century	Mostly bowls, trending from open through hemispherical to globular depending on the level of rim restriction, and some carinated vessels also occurred. Typically, heavily decorated with closely set point and comb-stamped impressions, but deep channeling occurred on some of the carinated vessels	Malawi	Pawlowicz 2011, 2013
32			√	Mawudzu ceramics	12th and 13th centuries but were more common after the 15th	Showed affinities with the older Longwe type, but they have few associations with Kapeni and Nkope ceramics. The most common vessel forms were open bowls and globular bowls, though necked vessels and beakers were produced as well. Mawudzu ceramics had tapered rims and thin walls. Graphite burnish and polychrome burnish occurred rarely. The most common decorative motifs were incised forms, including arcs, meanders, filled bands, and filled humps. Other motifs such as incised areas, ribbons filled with dentate stamping, and nicked rims		Mgomezulu 1981; Phillipson 2005

						evidenced a degree of decorative similarity to the northern Mwamasapa ceramics		
33			√	Namoso	Early second-millennium	It consisted of mostly globular and open bowls, but had quite a few necked and carinated forms. Decoration was common, occurring on more than 90% of vessels in some assemblages, which distinguished Namaso from the Mawudzu type.	Southern Malawi	Davison 1991; Huffman 2007
34			√	Luangwa	11th century	Necked pots and shallow bowls were common and widespread. Rims were tempered. The most common decorative motifs were comb-stamped patterns, often arranged into bands but also into ribbons and triangles. Incised motifs were less common and mostly consisted of crosshatching.	West of southern Malawi in northeast Zambia	Phillipson 1975; Fredriksen 2023
35			√	Kalomo	Early second millennium	Three phases of a Kalomo Tradition have been identified, covering over 500 years. The earliest Kalomo ceramics were pots and spherical bowls decorated with bands of oblique or hatched incisions, comb-stamping, or with alternating triangles of grooved decoration	Southern Zambia	Fagan 1967; Pawlowicz 2013
36			√	Leopard's Kopje ceramics	Early second millennium	Most common vessel forms was the necked pot, often with tapered rims, though novel vessel forms for the region such as beakers, beaker bowls, and globular pots. Incised decorative motifs were most common, sometimes including loops and triangles, and decorations became more	Zambia across the Zambezi River	Huffman 2007; Russel and Steele 2009;

						restricted to the neck, in contrast to the comb-stamped decoration occurring over the whole rim-shoulder area.		

S/N	**PN/IA Category**			**Tradition**	**Period**	**Attributes**	**Regional/country found (Origin)**	**References**
	PN	EIA	LIA					
37			√	Swahili Ware	Between 1300 and 1500 CE	Characterized in part by the extension of the neck-punctated pottery from the northern coast to the southern coast	East African coast	Chami 1998, 2006; Croucher 2006
38			√	Sancul Tradition	Between the 15th and 18th centuries	The characteristic decorative motif of these ceramics was a raised appliqué decoration as well as a variety of incised and impressed motifs	Mozambique	Sinclair 1991; Pikirayi 2001, 2016; Fredriksen 2023
39			√	Mpata	Developed after 1500 CE	Dominated by open bowls, many of which were burnished. The rims were mostly rounded and tapered. The most common decorative motifs were finely incised crosshatching, scoring, and sometimes mamilations	Northern Malawi	Robinson 1982
40			√	Khami ceramic type	These ceramics were associated with Rozvi kingdom of the 15th-18th centuries CE	The most common vessel form was the necked pot. Decoration it typically consisted of incised or stamped lines forming geometric patterns. The undecorated pottery was often burnished or graphite burnished and thin, though a thicker untreated ware also existed	Zimbabwe and Southern Mozambique	Garlake 1974; Pikirayi 2001, 2016; Fredriksen 2023

Appendix III: Codebook for Archaeofaunal Remains Analysis.

A. Basic Faunal Assemblage Information

1. Site Name
1= Magubike **2=**Mlambalasi **3**=Utinde Mkoga

2. Cultural Designation
1=ESA **3**=LSA **5**=IA

2=MSA **4**=PN **6**=Historic

3. Year Excavated
1=2008 **2**=2010 **3=2**012 **4**=2002

4. Excavation Unit/Test Pit
1=5 **3**=7 **5**=9 **7**=11 9=I-11 10=J-10 11=1-9 12=J-9 13=1-10 14=J-11 15=1

2=6 **4**=8 **6**=10 **8**=12

5. Quadrants
1=NE **2**=NW **3**=SW **4**=SE

6. Level
1=0 to 10 cm **5=**40 to 50 cm **9=**80 to 90 cm **13=**0-20 cm

2=10 to 20 cm **6=**50 to 60 cm **10=**90 to 100 cm

3=20 to 30 cm **7=**60 to 70 cm **11=**100 to 110 cm

4=30 to 40 cm **8=**70 to 80 cm **12=**110 to 120 cm

7. **Weight** *(in gms by level)*

8. **Maximum Linear Dimension** (in mms)

9. Bone type
1=Diaphyseal Bone 2=Epiphysis cancellous 3=Axial/cancellous

10.Bone Fossilization Level
1=Heavy 2=Light 3=None *(Recent - white in colour)*

Specimen Identification

10. Identifiability
1=Identifiable **2=**Unidentifiable

11. Vertebrate Class
1=Bovid **4=**Reptile **7=** Ave (Bird) **10=** Indeterminate **11**=Microfauna/insects

2=Suid **5**= Carnivore **8**= Fish

3=Equid **6**= Rodent **9**=Shell **12**: Others

12. Skeletal Element Completeness

1=Complete **2**=Fragment

13. **Shaft Lengths Relative Proportion**s (*Long Bones Only*)

1=L1 (< 0.25 of the original length – here refers to shafts only the articular ends not taken into account)

2=L2 (< 0.5 - between 0.25 and 0.5 of the original length)

3=L3 (< 0.75 - between 0.5 and 0.75 of the original length)

4=L4 (> 0.75 of the original length)

5=L5 (Complete)

14. Unidentifiable Specimens to Broader Anatomical Fragment Segment

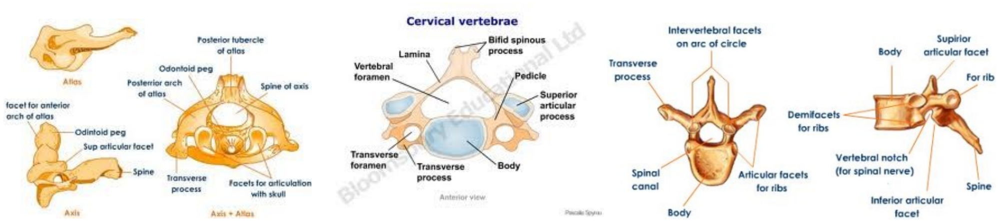
1=Cranial Frag	**4**=Rib Frag	**7**=Misc/scraps	**10**=Shell Frag
2=Tooth Frag	**5**=L/Bone Frag	**8=**OES Frag	**11=**Tortoise frag
3=Vertebrae Frag	**6=**Bone Flake	**9=**Fish Frag	**12**=Trabecular piece

13=Shaft frag with evidence of medullary cavity or muscle marking

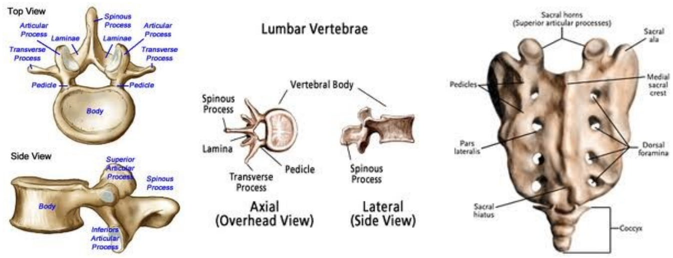
15. Skeletal Element

Bone of the Head

1=Horn/Horn core	**6=**Tooth	**11=**Sacrum Vertebra
2=Cranium	**7=**Atlas	**12=**Caudal Vertebra
3=Hyoid	**8=**Cervical Vertebra	**13=**Coccygeal Vertebra
4=Maxilla	**9=**Thoracic Vertebra	**14=**Indeterminate Vertebra
5=Mandible	**10=**Lumbar Vertebra	**15=**Rib



Atlas Cervical Vertebra Thoracic Vertebra



Lumber Vertebra Sacral

Figure 2: The Vertebrae.

Fore Limb

16=Scapula **18**=Clavicle **20**=Radius **22**=Radius+Ulna

17=Sternum **19**=Humerus **21**=Ulna **23**=Carpal (8 bones max)

Proximal Row

24=Scaphoid *(Radial-most medial)* **27**=Pisiform *(Accessory Carpal)*

25=Lunate *(Intermediate Carpal)* **28**=Magnum

26=Triquetrum (Ulnar)

Distal Row

29=Trapezium *(First)* **31**=Capitale *(Third)*

30=Trapezoid *(Second)* **32**=Hamate *(Fourth)*

33=Metacarpal

34=Sesamoid *(in many animals)*

Hind Limb

35=Pelvis/Innominate **38**=Pubis **41**=Patella

36=Ilium **39**=Ischium **42**=Tibia

37=Acetabulum **40**=Femur **43**=Fibula (Lateral Malleus)

44=Tarsal *(7 bones max)*

Proximal Row

45=Astragalus **46**=Calcaneum/Calcaneus

Central Row

47=Navicular-Cuboid *(Central)*

Distal Row

48=1st Cuineform *(First Tarsal)* **50=**3rd Cuneiform *(Third Tarsal)*

49=2nd Cuneiform *(Second Tarsal)* **51=**Cuboid *(Fourth Tarsal)*

52=Metatarsal

The Phalanges (Proximal, middle and Distal)

53=Phalanx 1 **54=**Phalanx 2 **55=**Phalanx 3 56=Metarpodial

For Birds

56=Premaxilla **60=**Synsacrum **64=**Tarso-metatarsus

57=Mand(Dentary) **61=**Pygostyle **65=**Digit I

58=Coracoid **62=**Tibio-tarsus **66=**Digit II

59=Furculum **63=**Carpo-metacarpus**67=**Digit III

68=Digit IV

16. Vertebrae Fragments/Complete

69=Spinous Process **73=**Caudal Articular Process

70=Transverse Process **74=**Vertebral Foramen

71=Body **75=**Indeterminate Articulating Facet

72=Cranial Articular Process **76**=Complete

17. Side/Symmetry

1=Right Side **3=**Indeterminate

2=Left Side **4=**Not Applicable *(Axial or Not Applicable)*

18. Long Bone Portion - (FE, HU, RA, TB, UL, MC, MT) (Figure X)

1=Proximal End *(Proximal Articular Area)*

2=Proximal-Shaft/Near-Epiphyseal (*the 0.3 of shaft below the Proximal End)*

3=Medial/Mid-Shaft *(the 0.3 of the shaft between Proximal and Distal Shafts/Mid-Shaft with no Epiphysis)*

4=Distal-Shaft/Near-Epiphyseal *(the 0.3 of the Shaft above the Distal End)*

5=Distal End *(the Distal Articular Area)*

6=Complete

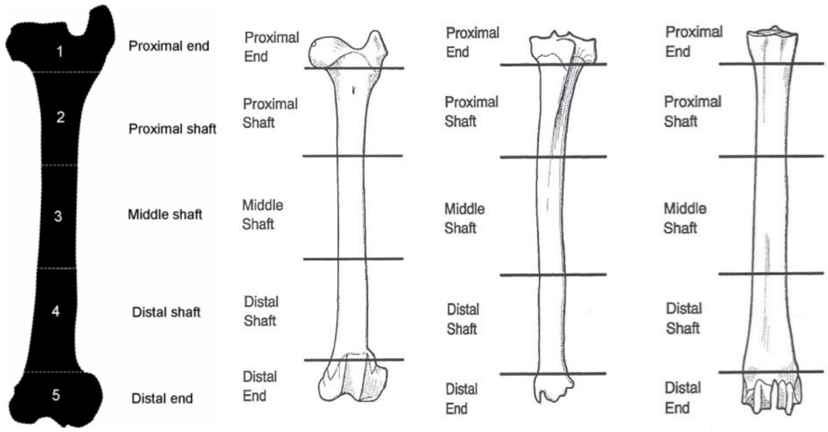


Figure 3: Femur, Tibia and Metatarsal.

19. Long Bones Representation by Portion

1=Proximal Epiphysis **2**=Mid-Shaft **3**=Distal Epiphysis **4=**Complete

20. Bone Shaft Circumference Preservation (For Long Bones Only)

1=Type 1 *(Shaft preserves <50% of the original completeness)*

2=Type 2 *(Shaft preserves between 50-75% of original completeness)*

3=Type 3 *(Complete 100%)*

21. Animal Body Size Class (Brain, 1981; Bunn, 1982, 1986)

0=Size 1A (Less than 20 kgs - *Hyraxes and Hares, Rodent*) (VERY SMALL)

1=Size 1 (10-20 kgs - *Dik dik, Thompson Gazelle*) (SMALL SIZE)

2=Size 2 (20-100 kgs – *Grant's Gazelle, Antelope, Reedbuck, Warthog, Impala, Springbuck*) (SMALL SIZE)

3=Size 3 (100-300kg - *Wildebeest, Hartebeest, Waterbuck, Topi, Kudu*) (MEDIUM)

4=Size 4 (300-1000kg - *Zebra, African Buffalo, Eland*) (LARGE SIZE)

5=Size 5 (>1000kg - *Giraffe, Hippopotamus, Rhino, Elephant*) (VERY LARGE)

FRAGMENTATION ANALYSIS (Postdepositional Fragmentation)

22. Completeness Index Simplified (*Sensu* Villa et al. 2004)

1=Complete **2**=Almost Complete **3=**Fragmented

23. First and Second Phalanges Fragmentation,

1=Complete **2**=Fragmented

24. Mode of Fragmentation of Phalanges (1st & 2nd) 3rd
1=Longitudinally Split (broken along the Midline) **2**=Transversely Split

MORTALITY

25. State of Epiphyseal Fusion (AT, AX, PVs, SC, HU, RA, UL, FE, TB, FB, MP, PH 1st & 2nd)
1=Proximal Fused **3=**Distal fused **5=**Not applicable/unknown

2=Proximal unfused **4=**Distal unfused **6=**Fussing

7=Early fusion **8=**Fully Fused **9=** Neonatal

10=Intermediate

26. Tooth Type
1=Incisor **3=**Premolar **5=**Indeterminate

2=Canine **4=**Molar

27. Tooth Marks Eruption
1=Observed erupting M_1

2=Erupting M_3

3=Less than 50% of original height

28. Eruption and Tooth Wear Stages (Grant 1982; Hilson 1986:205-256)
1=Deciduous or unworn teeth (dp_4 or unworn M_3);

2=Retaining more than 50% of original height (Lower dP4, M_3 or P_4);

3=Less than 50% of original height

29. Tooth Wear Pattern (Chapman, et al. 2005)
1=No Wear **4**=Medium Wear

2=Light Wear **5**=Medium to Advanced Wear

3=Light to Medium Wear **6**=Advanced Wear **7**=Complete Wear

Fig. 7.3 Payne's occlusal wear stages for first and second lower molars of domestic goat, wear stage above and shorthand notation below (From Deniz and Payne 1982:162, Fig. 4), used with permission of authors and BAR Publishing)

30. Type of Cortical Tissue

1=Compact-for Adult **2**=More Porous-For Young

31. Age

1=Fetal **3**=Juvenile/Immature **5=**Senile

2=Neonatal **4**=Mature/Adult **6=**Indeterminate

A. Post-Depositional Alterations

32. Surface Cracking/Bone surface Conditions

1=Present **2**=Absent

33. Cracking Morphology

1=Transverse

2=Longitudinal – as would be observed in the case of the natural sub-aerial exposure

34. Reason for Cracking

1=Weathering **2=**Excavation – during which affect bone during excavation

35. Bone Cortical Preservation (Prendergast 2008:114-115)

1=Good/excellent *(surface cortical well preserved/cortex clear visible 100%)*

2=Moderate/fair *(surface cortical show some light cracking or pealing or is partially obscured/75% of the cortex clear visible)*

3=Poor/bad *(little to no preservation of the original surface)*

36. Surface Condition and Alterations (coating, cracking and exfoliation - After Morin, 2012)

1=Intact Surface (Fresh) *(No damage is recorded; skeletal features and muscle attachments are undamaged)*

2=Slightly Damaged Surface/Fresh to Slightly Abraded *(Show superficial damage, bone locally eroded/damaged, but morphological features are visible as cut marks, gnaw marks (when initially present). Sometimes, only a portion of the bone surface shows damage but the rest of the bone is intact*)

3=Damaged Bone Surface/Abraded *(Significantly altered the surface. Muscle attachments and other skeletal features are faint. Bone surface modifications when present are difficult to detect and shallow marks may be completely eroded)*

4=Extensively Damaged Surface/Heavily Abraded *(Cortical surface considerably damaged and is basically useless for the study of bone surface modifications)*

37. Behrensmeyer's 1978 Bone Weathering Stages

0=Stage 0-Bone surface shows *no cracking or flaking* greasy; soft tissue present

1=Stage 1- Bone surface *show cracking, usually longitudinal*, fat, skin and other tissue absent/*cracking confined to the outermost layer of the bone*

2=Stage 2-Bone surface *shows flaking, usually along the edges of cracks*, crack edges are angular, with no rounding; exfoliation started

3=Stage 3-Bone surface shows *roughened patches* resulting from the flaking of the surface bone. Fibrous texture, weathering only 1.0 to 1.5 mm deep and crack edges rounded

4=Stage 4-Bone surface is *rough, with loose splinters*. Cracks are *wide*, with roughened or actively splintering edges; weathering penetrates to inner cavities; cracks open

5=Stage 5-Bone is disintegrating into splinters and the original shape may no longer be apparent. Bone mechanically falling apart into pieces, very fragile

38. Bone Cortical Surface Quality/Readability (*Cortical, Fracture and Medullary*)

1=0-25%, **3**=51-75% **5**=100%

2=26-50% **4**=76-99%

39. Reasons for Bone Cortical Surface Damage (Why-Reason for "Unreadability")

1=Weathered/Weathering **5**=Mechanical rounding (may include polish)

2=Adhering matrix/Carbonate Crusts**6**=Root marking

3=Exfoliation **7**=Water etching

4=Chemical Corrosion/weathering **8**=Immature

9=Biochemical pitting

10=Cracking

11=Concretion – cemented sediments heavily attached to the fossils.

12= Acid-etching from travelling through a digestive tract of either birds of prey or carnivores.

40. Abrasion/Surface Edge Damages

1=Fresh/Sharp **2**=Slightly Abraded/Dull **3**=Smoothed/Well rounded

41. **Carbonate/Concretion Coating**
1=Present **2**=Absent

42. **Carbonate/Concretion Coating Coverage/Proportion of bone surface covered by matrix/**
1=0-25%, **3**=51-75% **5**=100%

2=26-50% **4**=76-99%

43. **Criterion A** (Fracture Angle)
0=Specimen shows fresh fracture (Fragment has no fracture at 90° to the cortical surface)

1=Some unfresh features are present (40% of the fracture are 90° to the cortical surface)

2=Unfresh feature dominate (50% or more fracture are 90°)

44. **Criterion B** (Fracture Outline)
0=Only helical fracture present

1=Mixture of fracture outlines present

2=Helical/curved/spiral fracture completely absent

45. **Criterion C** (Fracture Edge)
0=Smoothed edge present and jagged/rough edge absent;

1=Some jagged/rough edge present but mainly smooth

2=Jagged/rough edge largely dominate

B. BONE SURFACE MODIFICATIONS

46. **Surface Modification Visibility**
1=Conspicuous **2**=Inconspicuous

47. **Cut Mark**
1=Present **2**=Absent

48. **Number of Cut Marks** (in #)

49. **Cut Mark Arrangements**
1=Single **3**= Isolated **5**=Crossed

2=Sparsely Spaced/Scattered **4**=Closely Spaced/Clustered/grouped

50. **Cut Mark Orientation**
1=Transverse (perpendicular) to main axis

2=Longitudinal (parallel to main axis)

3=Diagonal (oblique) to main axis

51. **Cut mark depth**
1=Very light **2**=Medium **3**=Deep

52. Anatomical Position of Cut Mark (*sensu* Blumenschine 1995)

1=Epiphyseal **2=**Near-Epiphyseal **3=**Midshaft

53. Anatomical Position of Cut Mark by Bone Section (For long bones only- *sensu* Dominguez-Rodrigo)

1=Proximal Epiphyseal **2**= Diaphyseal/Mid-Shaft 3=Distal Epiphyseal

4=Both epiphyseal and midshaft

54. Type of Cut Mark

1=Incisions **2**=Scrap Marks **3=**Chop Marks

55. Stage of Butchering Activity (See Summary from Saladié et al. 2011:431)

1=Beheading **4=**Disarticulation/Dismembering (through chopping)

2=Skinning **5=**Defleshing/Deboning/Filleting

3=Evisceration/Visceral Removal 6=Marrow Extraction

7=Exploitation of the palatine

8=Tongue removal

56. Percussion Mark

1=Present **2=**Absent

57. Percussion Mark Types

1=Percussion Pit

2=Striae fields/anvil scratches

3=Impact/Percussion Flake *(Possess a platform at the "impact point" and a bulb of percussion below the platform. It lacks any attached epiphyseal portion and its complete original diaphyseal circumference/the ventral and dorsal faces lack the outer cortical bones and/or displaying an impact cone. These flakes result from breakage)*

4=Percussion Notch

5=Shaft Splinters *(shaft fragments > 1 cm in max. diameter that lack any attached epiphyseal portion and technical attributes of* ***"impact flake"*** *and retains < 100% of their original diaphyseal circumference)*

6=Adhering flake (Diez et al. 1999; Fernando-Jalvo et al. 1999)

7=Peeling (White 1992)

8=Longitudinal split of MTC and MTT – produced by heavy blows to the proximal part of the bone. It is likely that such marks result from human extraction of marrow (Acheulian book pg. 760).

58. Impact Mark Location

1=Single Face **2=**Both Faces

59. Percussion Mark Anatomical Placement (For long bones & MTs)

1=Proximal **2**=Medial **3**=Distal Shaft

60. Notch Type

1=A **2**=B **3=C** **4**=D

61. Percussion Marks on flat Bones

1=Present **2=**Absent

62. Burning

1=Present **2=**Absent

63. Burning Stages (After Stiner et al., 1995)

0=Stage 0 *(Unburned, cream/tan)*

1=Stage 1 *(< 50% carbonised/black/Slightly burned; localized and <half carbonized)*

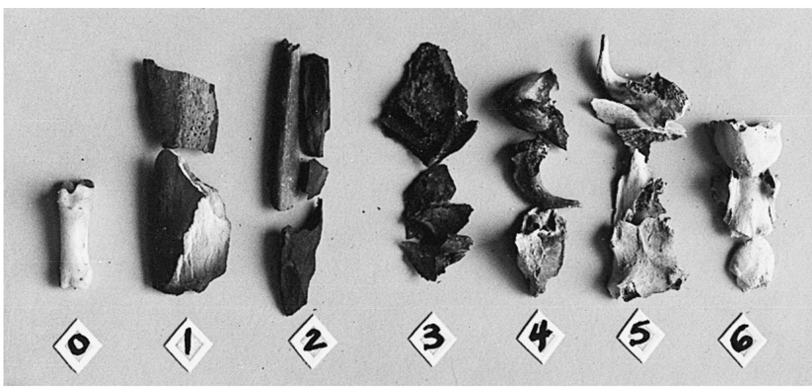
2=Stage 2 *(> 50% carbonised/Lightly burned; >half carbonized)*

3=Stage 3 *(Fully carbonised/completely black)*

4=Stage 4 *(< 50% calcined/white/Localized <half calcined more black than white)*

5=Stage 5 *(> 50 % calcined/more white than black)*

6=Stage 6 *(Fully calcined/completely white)*



Burning color codes 0–6. Light shades on left are cream-colored and represent fresh or lightly burned bone; light shades on right instead are pure white and represent the calcined (most advanced) phase of burning, at which point bones are most easily reduced to powder.

64. Burning by Colour

1=Unburned **3=**Black **5=**White

2=Brown **4=**Grey **6=**Localized or partial burning

65. Burning Traces Location

1=Exterior 2=Interior 3=Both surfaces

66. Distribution of Burning Damage

1=Epiphysis **2=**Shaft **3=**Both whole bone **4=**Other specify

67. Tooth Mark

1=Present **2**=Absent

68. Type of Tooth Mark
1=Tooth Pit **2**=Score Mark **3**= Puncture Mark

69. Anatomical Position of Tooth Mark (*sensu* Blumeschine)
1=Epiphyseal **2**=Near-Epiphyseal **3**=Midshaft

70. Tooth Mark Anatomical Placement by Bone Section (For long bones only-*sensu* Dominguez-Rodrigo)
1=Proximal Epiphyseal **2**= Diaphyseal/Mid-Shaft 3=Distal Epiphyseal

4=Both epiphyseal and midshaft

71. Bone Surface Modifications ***(Run ALL on Present Absent Basis)***

1=Cut Mark

2=Percussion Mark

3=Percussion Pit

4=Striae fields/anvil scratches

5=Impact/Percussion Flake

6=Percussion Notch

7=Shaft Splinters

8=Adhering flake

9=Peeling

10=Burning

11=Excavator Mark

12=Puncture Mark

13=Score Mark

14=Tooth Pit

15=Furrows/Scooping or Hollowing out

16=Ragged Edge Chewing

17=Crenulated Edges

18=Insect Damage

19=Rodent Gnaw Marks

20=Porcupine Gnaw Marks

21=Root Mark

22=Biochemical Mark

23=Trample Mark

24=Digestion Mark/Gastric etching

25=Pathology

26=Gypsum crystal formation

27=Manganese/Iron Oxide Staining

28=Oxide staining

72. Trample Marks Distribution
1=Isolated **2**=Clustered

73. Trample Marks Anatomical Location
1=Midshaft **2**=Edge of the fracture

Appendix IV: Codebook: Pottery artifact analysis

1. Site /Square
    1) Magubike RS (HxJf-01) (TP# 3, 5, 8, 12)
    2) Mlambalasi RS (HwJf-02) Room 1; Room 2; Slope; TP# 1; I-9, I-10, I-11, J-9, J-10, J-11; Trench 1 (Msemwa)
    3) Mgala Isitu
    4) Ikomba
    5) Msosa
    6) Utinde Ukoga

2. Level
    0. Surface
    1. 0 to 10 cm
    2. 10 to 20 cm
    3. 20 to 30 cm
    4. 30 to 40 cm
    5. 40 to 50 cm
    6. 50 to 60 cm
    7. 0 to 5 cm
    8. 5 to 10 cm
    9. 10 to 15 cm
    10. 15 to 20 cm

3. Pottery Classifications

(1) Unidentified
(2) PIW/PN
(3) EIA
(4) LIA

4. Pottery part
    0. Undetermined
    1. Bodysherd
    2. Rim
    3. Rim-neck
    4. Neck
    5. Rim-body
    6. Base
    7. Neck-shoulder
    8. Shoulder-body
    9. Rim-Neck-Shoulder-Body
    10. Shoulder
    11. Rim-neck-shoulder
    12. Neck-shoulder-body
    13. Body and base

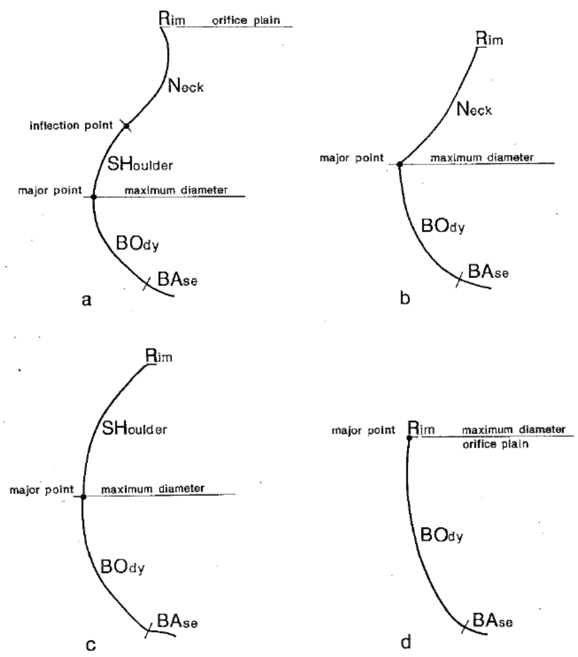


Fig. 22. Pottery vessel shape models.
a = independent restricted vessel, b. depend
restricted vessel, c = restricted bowl, d = op
bowl.

Chami, F. (1994).

5. Rim direction

1 Out-turned/everted

2. In-turned/reverted

3. Straight

4. Flared

6. Rip profile/(Cross sectional view)

1. Rounded

2. Flattened

3. Pointed

4. Thickened

5. Fluted

6. Bevelled

7. Swelled

Wandibba (1982);

14. Rim thickness in mm

1. (0-6) Minimum
2. (7-12) Moderate
3. (13-Above) Maximum

15. Rim diameters in cm

1. (0-10 cm)
2. (10-20 cm)
3. (20-30 cm)
4. (30-40 cm)
5. (40-50 cm)
6. 50 cm-above

16. Wall thickness

1. (0-6) Minimum
2. (7-12) Moderate
3. (13-Above) Maximum

17. Height

1. (0-15 mm) Minimum
2. (16-30 mm) Moderate
3. (31 mm-above) Maximum

18. Width

1. (0-15 mm) Minimum
2. (16-30 mm) Moderate
3. (31-60 mm) Maximum

19. Vessel type/form (Phillipson 1976: 21)

0. Undetermined
1. Open bowl
2. Closed/in-turned bowl
3. Necked vessel
4. Pot with up-turned rims
5. Globular vessel
6. Convergent mouthed pot
7. Beaker
8. Carinated vessel

21. Base profile (Cross sectional view)

1. Flat
2. Convex
3. Concave

4. Knobbed

5. Ringed

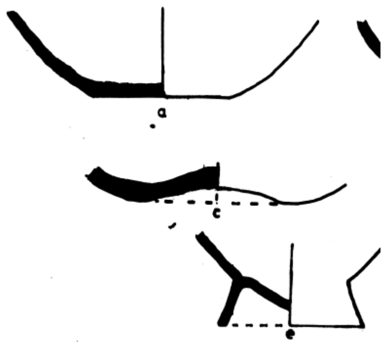


Fig. 3. Basal forms: Flat; a; Convex, b; Concave, c; Knobbed, d; Ringed, e.

22. External surface finish

1. Smooth
2. Burnish
3. Rough
4. Painted
5. Sliped

23. Internal-surface

1. Smooth
2. Rough
3. Burnish
4. Scraps

24. Outside colour

1. Greyish
2. Redish-brown
3. Brownish
4. Darkish-Grey
5. Darkish-brown
6. Darkish
7. Darkish-sooted
8. Red
9. Darkish-brown-sooted
10. Reddish-brown-sooted

25. Inside colour

1. Greyish
2. Redish-brown
3. Brownish
4. Darkish-Grey
5. Darkish-brown
6. Darkish
7. Darkish-sooted
8. Red
9. Darkish-brown-sooted
10. Reddish-brown-sooted

5. Decoration

0. No decoration
1. Oblique grooved lines
2. Wavy lines
3. Horizontal incisions
4. Nail incisions
5. Triangular incisions with doted stamps within
6. Flutes
7. Horizontal grooved lines/channels
8. Cross-hatching incisions
9. Cross-hatching and nail incisions
10. Combined thick horizontal grooved line, incisions, roulette
11. TGR and Horizontal grooved line
12. Roulette
13. TGR
14. Horizontal grooved lines and roulette

15. Cuineforms
16. Combined vertical and horizontal incisions
17. Bold horizontal grooved line
18. Wavy lines and grooved line
19. Horizontal incisions and grooved line
20. Random incisions
21. Cuineforms and incisions
22. Doted horizontal line, oblique grooved lines and flutes
23. Roulette and finger impressions
24. Flutes and oblique grooves
25. Oblique incisions, grooved line and bevels
26. Flutes and Horizontal grooved line
27. Random grooving
28. Cross-hatching and horizontal grooved line
29. Doted stamp-grooves
30. Appliqué/relief
31. Dotted stamp-impressions
32. Build-lip incisions
33. Triangular cross-hatched incisions with horizontal grooved line above
34. Triangular cross-hatched incisions with horizontal grooved line below
35. Triangular cross-hatched incisions with horizonatal grooved line below and above
36. Horizontal and oblique incisions
37. Oblique incisions
38. Carination and incisions
39. Vertical incisions
40. Thumb impression and horizontal grooved lines
41. Parallel applique dots/stamps
42. Vertical grooved lines
43. Appliqué/relief with random incisions
44. Stepped line with cross-hatching
45. Horizontal and vertical grooved lines
46. Carination
47. Wavy lines and stamp impressions
48. TIW and opposed horizontal incised lines above
49. Oblique lines forming triangle
50. Horizontal doted stamps and parallel grooved lines
51. Roulette and horizontal grooved lines
52. Carination and horizontal doted-grooved line
53. Herringbone
54. Rouletted Triangles
55. Zig-zag lines
56. Polygon stamp
57. Cross-hatching and doted stamps
58. Oblique and horizontal grooved lines
59. Dotted stamp impression and horizontal-vertical lines
60. Comb-stamping
61. Drilled/perforation

6. Decoration placement
   0. Undetermined
   1. Body
   2. Rim
   3. Internally
   4. Lip
   5. Internal and External
   6. Shoulder
   7. Shoulder and Body
   8. Below rim
   9. Neck and shoulder
   10. Neck-shoulder-body
   11. Rim and Shoulder
   12. Neck
   13. Rim and Body
   14. Corner point
   15. Rim, neck, shoulder
   16. Lip and shoulder

29. Ware type (Traditions)

   0. Undetermined
   1. Narosura
   2. Magubike/Urewe
   3. Limbo
   4. Nkope/Kamnama/Gokomere
   5. TIW
   6. Ivuna
   7. Rouletted ware
   8. Carinate ware punctated ware)

30. Fabric, pottery forming technique, and colour (done through PA at the lab)

Appendix V: Codebook: Stone artifact analysis.

Variable # Variable Name Value Labels

---

1 Site

Mgera-HwJg 106 (27) Trench #2

(29) Survey NE

(30) Survey SE

(31) Survey SW

Mlangali (33) Survey

Uhafiwa (34) Survey SW

(35) TP# 2

(36) TP# 3

2 Level (00) surface

(01) 0-10 cm

(02) 10-20 cm

(03) 0-30 cm

(04) 20-40 cm

(05) 30-40 cm

(06) 40-50 cm

(07) 50-60 cm

(08) 60-70 cm

(09) 70-80 cm

(10) 80-90 cm

(11) 90-100 cm

(12) 100-110 cm

4 Cultural Designation (Culture) (00) not known

(01) ESA

(02) MSA

(03) LSA

(04) Neolithic

(05) Iron Age

(06) ESA + MSA

(07) MSA + LSA

(08) LSA + Neolithic

(09) LSA + Iron Age

(10) Neolithic + Iron Age

(11) LSA, Neolithic + Iron Age

(12) MSA, LSA, Neolithic + Iron Age

(13) MSA and Iron Age

(14) MSA, LSA and Iron Age

5	stone raw	(1) quartz
	material	(2) quartzite
	(Rawmat)	(3) chert/flint
		(4) Granite
		(5) volcanic but not obsidian
		(6) obsidian
		(7) other metamorphic
		(8) other sedimentary
		(9) rock crystal

Note: variables 6 to 8 taken from Mehlman 1989:111-157

6	stone artifact	
	general category	(1) trimmed pieces=tools
	(Gencat)	(2) core
		(3) debitage
		(4) non flaked stone
		(inc. ground stone)
7	tool type	TOOLS
	(subset of v6)	(01) scraper
	(Tooltype)	(02) backed pieces

(03) points/perçoirs

(04) burins

(05) bifacially modified
pieces

(06) becs

(07) composite tools

(08) outils écaillés

(09) heavy duty tools

(10) others

CORES

(11) peripherally worked core

(12) patterned platform

(13) intermediate

(14) bipolar

(15) amorphous

DEBITAGE

(16) angular fragments

(17) specialized flakes

(18) flakes

(19) blades

(20) Levallois flakes

NON-FLAKED

(21) hammerstones

(22) anvil stones

(23) pestle rubbers

(24) polished axes

(25) stone discs

(26) sundry ground/polished

(27) manuports

8	tool subtype	(000) not applicable
	(subset of v7)	(001) small convex scraper
	(Subtype)	(002) convex end scraper
		(003) convex double end scraper
		(004) convex end and side scraper
		(005) circular scraper
SCRAPERS (01)		(006) nosed end scraper
		(007) convex side scraper
		(008) convex double side scraper
		(009) nosed side scraper
		(010) sundry end scraper
		(011) sundry double end scraper
		(012) sundry end and side scraper
		(013) sundry side scraper
		(014) sundry double side scraper
		(015) concave scraper
		(016) concavity
		(017) notch
		(018) sundry combination scraper
		(019) convex end + concave combination scraper
		(020) convex side + concave combination scraper
		(021) divers scraper
		(022) convergent scraper
		(023) scraper fragment
BACKED PIECES		(024) crescent
(02)		(025) triangle
		(026) trapeze
		(027) curved backed piece
		(028) straight backed piece
		(029) orthagonal truncation

	(030) oblique truncation
	(031) angle-backed piece
	(032) divers backed
	(033) backed awl/drill/perçoir
	(034) backed fragment
POINTS (03)	(035) unifacial point/perçoir
	(036) alternate face/edge pt/perçoir
	(037) bifacial point
BURINS (04)	(038) dihedral burin
	(039) angle burin
	(040) mixed/other burin
BIFACIALLY MODIFIED PIECES (05)	(041) discoid
	(042) point blank
	(043) bifacially modified piece
BECS (06)	(044) becs
COMPOSITE TOOLS (07)	(045) sundry composite tool
	(046) burin + other composite tool
	(047) backed + other composite tool
	(048) scraper + other composite tool
OUTILS ECAILLES (08)	(049) outils écaillés
HEAVY DUTY TOOLS (09)	(050) core/large scraper
	(051) biface/pick
	(052) core chopper
OTHER (10)	(053) sundry modified
	(054) cutting edge
	(055) bulbar thin/talon reduced
	(056) tool fragment

CORES

PERIPHERALLY WORKED (11)	(057) part-peripheral core
	(058) radial/biconic core
	(059) disc core
	(060) Levallois core
PATTERNED PLATFORM (12)	(061) pyramidal/prismatic single platform core
	(062) divers single platform core
	(063) single platform core/ core scraper
	(064) opposed double platform core
	(065) opposed double platform core/ core scraper
	(066) adjacent double platform core
	(067) adjacent double platform core/ core scraper
	(068) multiple platform core
INTERMEDIATE (13)	(069) platform/peripheral core
	(070) platform/peripheral core/ core scraper
	(071) platform/bipolar core
	(072) platform/bipolar core/ core scraper
	(073) bipolar/peripheral
BIPOLAR (14)	(074) bipolar core
	(075) bipolar core fragment
AMORPHOUS (15)	(076) amorphous/casual

DEBITAGE

ANGULAR	(077) core fragment
(16)	(078) angular fragment
	(079) trimmed/utilized angular fragment
	(080) blade segment-medial or distal
	(081) trimmed/utilized blade segment
SPECIALIZED FLAKES	(082) plain burin spall
(17)	(083) tool spall
FLAKES	(084) whole flake
(18)	(085) trimmed/utilized flake
	(086) flake talon fragment
	(087) trimmed/utilized flake talon fragment
BLADES	(088) whole blade
(19)	(089) trimmed/utilized blade
	(090) blade talon fragment
	(091) trimmed/utilized blade talon fragment
LEVALLOIS FLAKES	(092) Levallois flake
(20)	(093) trimmed/utilized Levallois flake

NONFLAKED STONE

HAMMERSTONES (21)	(094) hammerstones
ANVIL STONES (22)	(095) edge anvil
	(096) pitted anvil
	(097) edge and pit anvil
PESTLE RUBBERS	(098) pestle rubber
(23)	(099) dimpled rubber
POLISHED AXES	(100) lobed axe

(24) (101) other axe

STONE DISC (102) pecked disc
(25) (103) dimpled disc

SUNDRY (26) (104) sundry ground/shaped item

MANUPORTS (27) (105) manuports

For all stone pieces measure: (1 decimal place)

9 length (L)(mm.)
10 breadth (mm)
11 thickness (mm.)

for cores: length ∃ breadth ∃ thickness

12 weight (gm.) 1 decimal place
16 abrasion/ (1) fresh
rolling (2) worn
(Abrasion) (9) missing

For cores or core tools measure

For non-cores: put in value of 9 in each column for missing data (not applicable) for variables 17 to 18.

17 cortex (%)

18 # flake scars
(Flakscar)

For whole flakes and blades, as well as blade and flake tools, measure:

For others, put in value of 9 in each column for missing data (not applicable) for variables 19 to 30.

19 Toth flake # (1) I

	(Tothnum)	(2) II
	(Toth 1982:73-75)	(3) III
		(4) IV
		(5) V
		(6) VI
		(7) VII (includes missing for tools)
		(9) Missing
20	platform length (PL)	
21	platform breadth (PB)	
	(mm.) PB (Platbred)	
25	flake area (B x L)	1 decimal place
26	platform area)	
27	# dorsal flake scars	(0) none
	(dorscars)	(1) 1
		(2) 2
		(3) 3
		(4) 4
		(5) 5
		(6) 6
		(7) 7
		(8) 8 or more
		(9) missing
28	dorsal scar pattern	(0) unknown
	(scarpat)	(1) radial
	(McBrearty 1986:183)	(2) same platform, simple
		(3) same platform, parallel
		(4) opposed platform
		(5) transverse

(6) plain

(7) none (=cortical)

(9) missing/not applicable

29	planform (McBrearty 1986:198-199)	(1) convergent (2) parallel (3) divergent (4) intermediate (5) circular (6) unknown (9) missing/not applicable

For retouched tools only:

30	angle of retouch (anglreto) (to side retouch released from)	
31	type of retouch (retouch) (Clark and Kleindienst 1974:85)	(1) marginal (2) semi-invasive (3) invasive (9) none/missing

Appendix VI: Information Letter and Consent Form.

Title of the study: The Later Stone Age and Iron Age in Southern Highlands of Tanzania: An Examination of Interaction and Material Culture

Research Investigator: Philbert M. Katto
13-15 Tory Building
Edmonton, Alberta, T6G 2H4

Supervisor:
Pamela R. Willoughby
13-15 Tory Building
Edmonton, Alberta, T6G 2H4

Background

Invitation to Participate: You are invited to participate in this research study about the Later Stone Age and Iron Age in Southern Highlands of Tanzania: An Examination of Interaction and Material Culture. This is because you have experience of pottery making technology in your community. Before you make a decision, one of the researchers will go over this form with you. I encourage you to ask questions if you need any further clarifications. I will give you a copy of this form for your records.

Purpose

The study seeks to examine the general processes of pottery making technology. I will spend 60 days and your participation will range between 3 to 5 days per each individual or group.

Study Procedures

I expect to sample at least 16 groups or individuals from 4 ethnic groups in your region (4 participants @ each 4 ethnic groups). I will spend 60 days for accomplishing this activity.

I will be using some equipment such as note books, camera, to write, recording voice and videos. You will be able to review photos and video during the interview before I use them in any publication. After interview and before I include data in the final report, I will share with you a summary of my observations in case you have further clarifications or corrections.

Benefits

1. I will be able to document the process of making pottery making in the Iringa region, Tanzania.
2. You (participant) will be recognized for your participation in research, if required.
3. It is also possible that you may get no benefits from participating in this study.

Risks

The following risks are possible:

- Risk of psychological or emotional discomforts: During the interview you may feel a sense of embarrassments in the course of explaining about your skills or misjudged depending on any circumstances.
- More inconveniences: Despite we are not intending to affect your daily routine, unfortunately you may reduce or sometimes stop your productive time in the course of talking with us.
- Social consequences: you may be socially or culturally misjudged by any of our research team which my affect your reputation or social position/status.

How I will address these risks?

- The risk of psychological or emotional discomforts will be addressed by considering and respecting or creating good and safe environment during the interview. Every step abiding the agreed consent will be considered to avoid those risks while making a thorough follow up during and after the interview in order to settle some cases that may happen.
- The risk of inconvenience to your daily routine including the risk of economic inconveniences will be addressed by providing compensation for any resources and time that was/were spent during the interview progression.
- The risk of social-cultural consequences will be addressed by considering the current consent as far as the issue of privacy and confidentiality are concerned.

A serious decisions/measures will be taken by eliminating any one participating in the study if:

- He/she harasses any member of the research team or any other participants in the study.

Cost of Participation
The study may directly affect your daily routine as sometimes you will be required to stop some of your daily activities to participate in this study.

Reimbursement or Remuneration
You will be financially reimbursed for any raw materials used and any pottery made while participating in the study. The reimbursement will include also some costs encored during research such as telephone voucher and transportation. You will be cash paid daily $18 @ day (per individual) and $38 @ group for those days you will participate in this study (that is 3 to 5 days).

Voluntary Participation
It is not a mandatory to participate in this study. You have an option to decide either to participate or not based on whatever reasons. It is also your rights to withdraw yourself from the study at any time you want without any restrictions (including penalty or fines). However, when the study will be at analysis stage you will not be able to withdraw your information. Please let me know at any time if you want to withdraw any of your information before reaching the analysis stage. Additionally, you have the rights and you may request that the video and/or voice recorder be turned off at any time you want. Furthermore, you have the right to ask that certain materials, or methods not be captured on film (including video or photos).

If you decide to withdraw both yourself and the information before beginning of data analysis, all your information will be deleted from where they will be stored and from the devices that captured them.
Note: Whether you decide to participate or not will have no effect on your daily life activities [e.g., employment, class standing, access to services] or how you will be treated.

Confidentiality & Anonymity

- The data collected will be used for producing a report which will be in terms of thesis, articles publications and conference presentations. If you allow your names will be mentioned in the section of acknowledgement but if you don’t want you be collectively acknowledged without mentioning your name(s).
- If you want to remain anonymous/unidentified, I will summarize any quotations from the interview, use pseudonyms and modify any other issues that may be connected to your identity including not using any photo or video of yours.
- Please note that even if your identity is anonymous, I will have to record your names on the receipt for compensation.
- Anonymity would not be required if you request to be recognized/identified in the research subject to signing a consent form that states the terms of the release of your identifying information.

- The recorder and the notes taken from the interview will be kept by the researcher during periods of research and will be properly stored in a locked hotel room when they are not in use.
- The data will be transcribed and referred to answer the intended research question and/or develop questions for further research.
- The data will be stored on the password protected computer, with the file encrypted and they will be only accessed by the principal invigilator (me) and his supervisor. The data/information will be kept for no less than five years before destroying them (if required) according to the University of Alberta's Research Policy.
- When the data is no longer required, the data will be destroyed according to the University of Alberta's Research Policy.

Follow up

To get results from the study, contact or email me or my supervisor as shown on the front page. If you want copies of any publications (including paper or digital) I will provide you through the municipal and village offices at your area as well as through other government and non-government institutions such as Tanzania Commission for Science and Technology (COSTECH), Antiquities Division, the Regional Cultural Office, and Museums and/or cultural centers e.g., Isimila Visitor's Center, Fahari Yetu.

Questions or Concerns about Ethical Conduct

The plan for this study has been reviewed by a Research Ethics Board at the University of Alberta. If you have questions about your rights or how research should be conducted, you can call (780) 492-2615 or +255762252174. This office is independent of the researchers.

Consent Statement

I have read this form and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told whom to contact. I agree to participate in the research study described above and will receive a copy of this consent form. I will receive a copy of this consent form after I sign it.

____	_______________
Participant's Name (printed) and Signature	Date
____	_______________
Name (printed) and Signature of Person Obtaining Consent	Date

Appendix VII: Interview Guide.

My name is Philbert M. Katto as PhD Student at the University of Alberta, Canada. I am here to conduct research (refer the title above) for my PhD purpose.

1. Are you aware about the contemporary societies which are still practicing the IA cultures in Southern Highlands of Tanzania? (For example, pottery making and iron smelting or smithing).

2. Which ethnic group is responsible on that culture/technology?

3. Do you know the history/trend of such technology? (In terms of where, when and how such technology emerged)

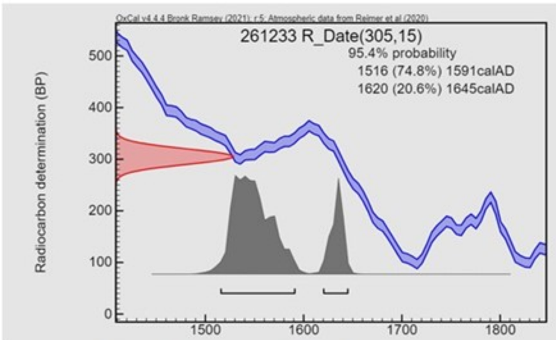
4. What technique are you using to make pottery? (In terms of manufacturing process and finishing).

5. Is there any different uses of pottery depending on their shape, size and decorations?

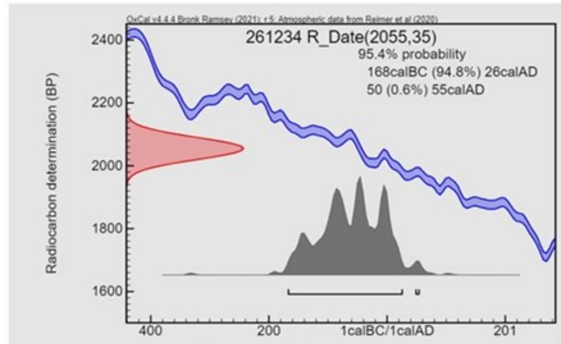
Appendix VIII: Observation Guide.

Technology type	Community type/ethnic group	Observed patterns	Archaeological evidence (from the study)	Interpretations

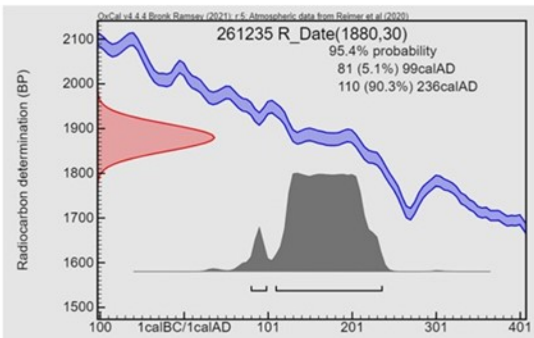
Appendix IX: Dating calibration results (source: OxCal v4.4.4 Bronk Ramsey (2021); r: 5; Atmospheric Data from Reimer et al. (2020). Oxford radiocarbon accelerator unit)



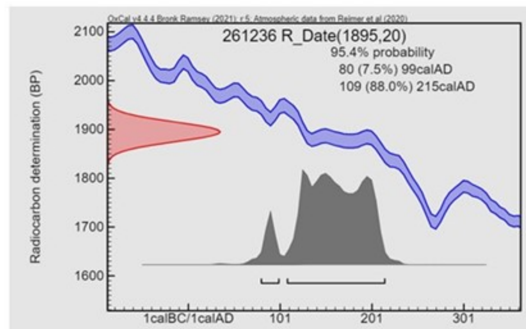
Magubike Tp# 3: Level 1 (0-10 cm)



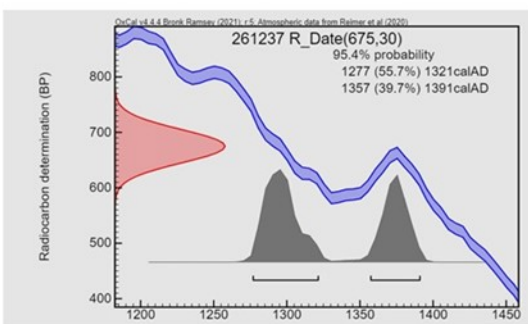
Magubike Tp# 3: Level 2 (10-20 cm)



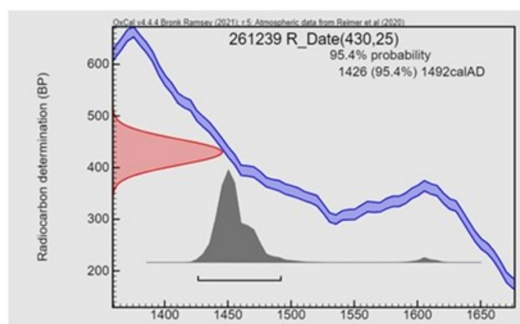
Magubike Tp# 3: Level 3 (20-30 cm)



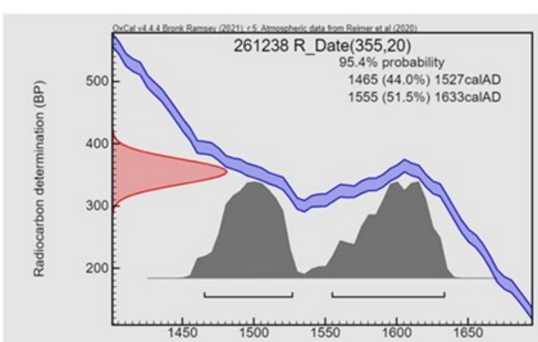
Magubike Tp# 5: Level 4 (30-40 cm)



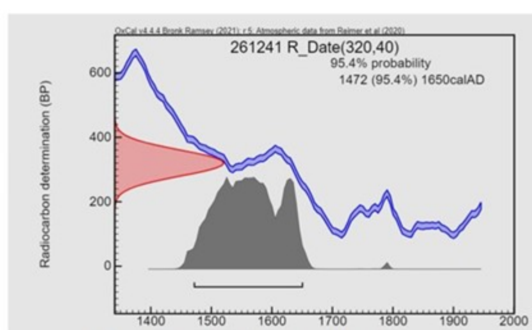
Mlambalasi Room #1: surface level



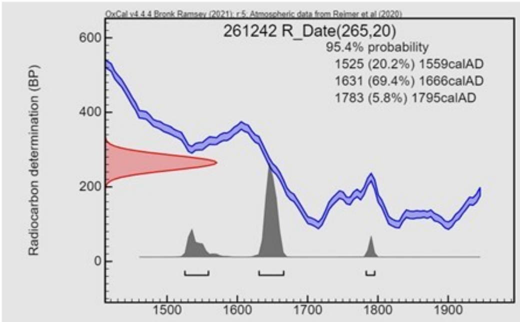
Mlambalasi J-10: level 2 (10-20 cm)



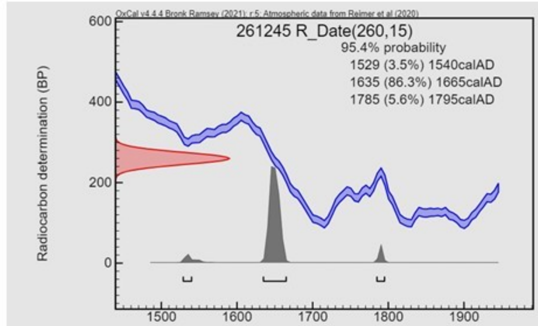
Mlambalasi slope: surface level



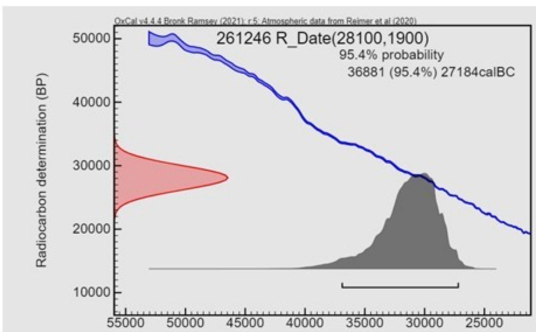
Mgera Trench #2: level 1 (0-30 cm)



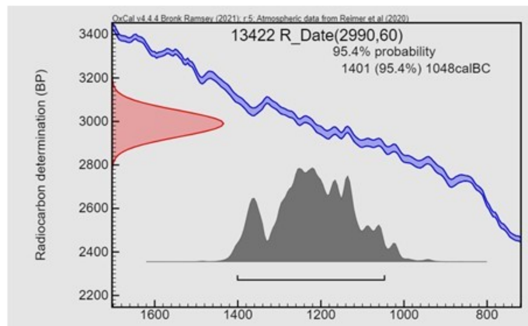
Mgera Trench #2: level 1 (0-30 cm)



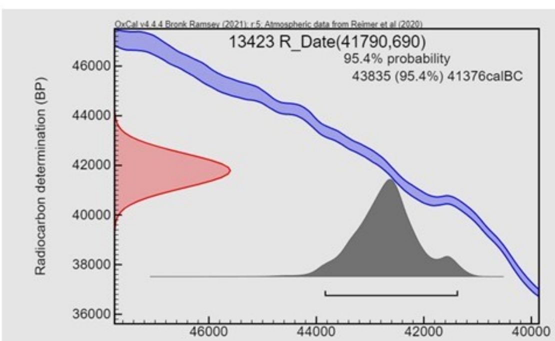
Mgera Trench #2: Level 6 (70-80 cm)



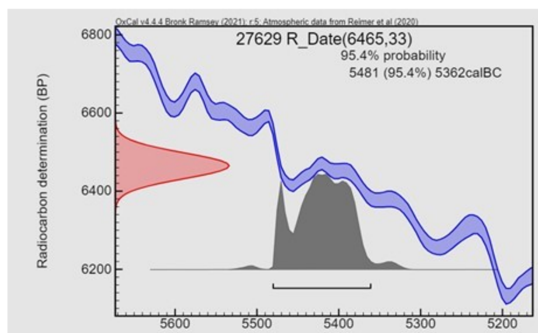
Uhafiwa Tp# 3: level 1 (0-20 cm)



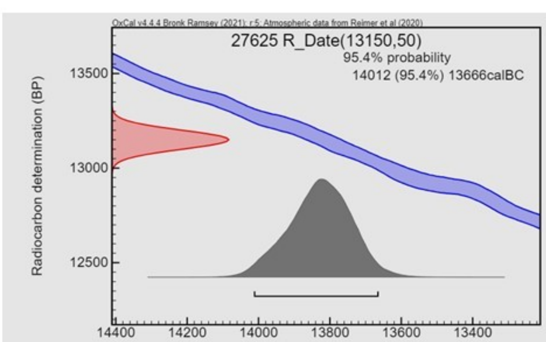
Magubike Tp# 3 (20-30 cm) Willoughby (2012)



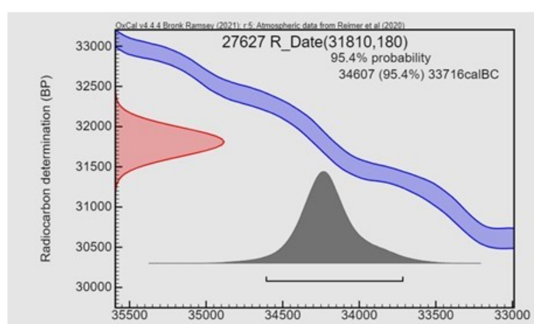
Magubike Tp# 3 (130-140 cm) (Bushozi 2011)



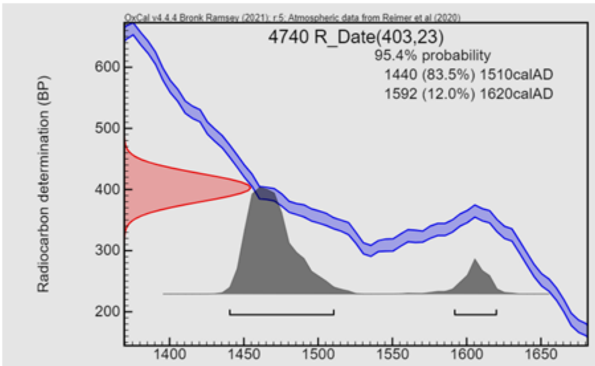
Magubike Tp# 7 (30-40 cm) (Miller et al. 2014)

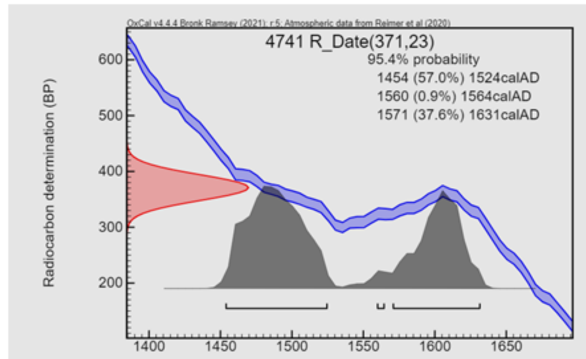


Magubike Tp# 12 (40-50 cm) (Miller et al. 2014)

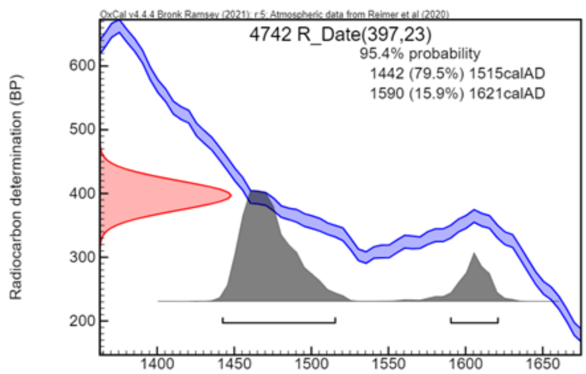


Magubike Tp# 12 (80-90 cm) (Miller et al. 2014)





Magubike Tp# 8 (20-30 cm) (Miller et al. 2018)



Magubike Tp# 8 (30-40 cm) (Miller et al. 2018)

Appendix X: Lithic Linear Dimension Data and Statistical Significance Results

Note Testing of Statistical Significance was tested as follows: **Steps in SPSS:** Analysis>compare means and Proportions>One Sample t-test.

Interpretation of Statistical significance based on Statistical inferences indicating the strength of the evidence corresponding to different values of p according to Singh (2013:203) (see the figure below taken from Singh 2013: 203)

Reference: Singh, P. (2013). P Value, Statistical Significance and Clinical Significance Journal of Clinical and Preventive Cardiology 4: 202-204

Values of *p*	**Inference**
$p > 0.10$	No evidence against the null hypothesis.
$0.05 < p < 0.10$	Weak evidence against the null hypothesis
$0.01 < p < 0.05$	Moderate evidence against the null hypothesis
$0.05 < p < 0.001$	Good evidence against null hypothesis.
$0.001 < p < 0.01$	Strong evidence against the null hypothesis
$p < 0.001$	Very strong evidence against the null hypothesis

Conventionally, $p < 0.05$ is referred as **statistically significant** and $p < 0.001$ as **statistically highly significant**. When presenting p values it is a common practice to use the asterisk rating system.

1. Magubike Tp# 1

Length (Data)

length * CULTURE Crosstabulation				
Count				
		CULTURE		Total
		LSA	Iron Age	
length	6.7	0	2	2
	7.1	0	1	1
	7.2	0	1	1
	7.3	0	1	1
	7.5	0	1	1
	7.7	0	1	1
	7.8	0	1	1
	8.0	1	0	1
	8.1	0	1	1
	8.3	0	1	1
	8.5	0	2	2
	8.6	0	1	1
	8.8	0	2	2
	8.9	0	2	2
	9.1	0	2	2
	9.2	0	4	4
	9.3	1	0	1
	9.4	0	4	4
	9.5	1	4	5
	9.6	0	6	6
	9.7	1	2	3
	9.8	0	2	2
	9.9	0	4	4
	10.0	0	3	3
	10.1	3	3	6
	10.2	0	2	2
	10.3	0	1	1
	10.4	1	3	4
	10.5	1	1	2
	10.6	1	5	6

	10.7	1	3	4
	10.8	2	4	6
	10.9	0	5	5
	11.0	0	4	4
	11.1	3	6	9
	11.2	1	5	6
	11.3	1	3	4
	11.4	3	9	12
	11.5	1	6	7
	11.6	0	3	3
	11.7	3	3	6
	11.8	3	8	11
	11.9	1	3	4
	12.0	2	6	8
	12.1	5	4	9
	12.2	3	5	8
	12.3	3	7	10
	12.4	3	4	7
	12.5	3	8	11
	12.6	6	4	10
	12.7	3	10	13
	12.8	8	9	17
	12.9	3	9	12
	13.0	1	7	8
	13.1	2	8	10
	13.2	6	4	10
	13.3	1	7	8
	13.4	5	2	7
	13.5	9	6	15
	13.6	7	7	14
	13.7	11	7	18
	13.8	5	7	12
	13.9	5	7	12
	14.0	5	6	11
	14.1	4	9	13
	14.2	3	5	8

	14.3	0	9	9
	14.4	2	5	7
	14.5	8	5	13
	14.6	4	4	8
	14.7	8	8	16
	14.8	7	10	17
	14.9	10	5	15
	15.0	3	6	9
	15.1	4	14	18
	15.2	9	6	15
	15.3	8	9	17
	15.4	6	7	13
	15.5	3	7	10
	15.6	9	5	14
	15.7	5	6	11
	15.8	10	7	17
	15.9	7	8	15
	16.0	5	6	11
	16.1	8	7	15
	16.2	6	3	9
	16.3	2	8	10
	16.4	7	7	14
	16.5	5	9	14
	16.6	3	8	11
	16.7	5	6	11
	16.8	1	4	5
	16.9	6	6	12
	17.0	9	12	21
	17.1	9	8	17
	17.2	8	7	15
	17.3	11	6	17
	17.4	7	6	13
	17.5	4	10	14
	17.6	9	7	16
	17.7	6	4	10
	17.8	5	6	11

	17.9	4	2	6
	18.0	4	6	10
	18.1	6	7	13
	18.2	11	7	18
	18.3	3	7	10
	18.4	1	8	9
	18.5	9	6	15
	18.6	7	10	17
	18.7	8	5	13
	18.8	5	8	13
	18.9	3	6	9
	19.0	7	7	14
	19.1	6	6	12
	19.2	4	9	13
	19.3	5	11	16
	19.4	4	4	8
	19.5	2	6	8
	19.6	9	3	12
	19.7	1	7	8
	19.8	8	3	11
	19.9	6	5	11
	20.0	3	6	9
	20.1	7	6	13
	20.2	5	4	9
	20.3	3	4	7
	20.4	8	3	11
	20.5	3	3	6
	20.6	4	5	9
	20.7	4	6	10
	20.8	6	5	11
	20.9	5	4	9
	21.0	10	1	11
	21.1	6	2	8
	21.2	7	4	11
	21.3	4	2	6
	21.4	2	2	4

	21.5	3	3	6
	21.6	5	7	12
	21.7	3	4	7
	21.8	5	4	9
	21.9	3	4	7
	22.0	3	4	7
	22.1	5	1	6
	22.2	7	0	7
	22.3	2	3	5
	22.4	5	1	6
	22.5	4	0	4
	22.6	7	2	9
	22.7	7	4	11
	22.8	2	7	9
	22.9	2	2	4
	23.0	4	3	7
	23.1	4	3	7
	23.2	3	3	6
	23.3	8	2	10
	23.4	11	0	11
	23.5	3	1	4
	23.6	4	2	6
	23.7	2	1	3
	23.8	3	3	6
	23.9	3	4	7
	24.0	5	3	8
	24.1	1	2	3
	24.2	4	2	6
	24.3	3	1	4
	24.4	4	3	7
	24.5	3	3	6
	24.6	3	4	7
	24.7	5	1	6
	24.8	2	2	4
	24.9	2	2	4
	25.0	1	4	5

	25.1	4	2	6
	25.2	4	2	6
	25.3	5	1	6
	25.4	4	1	5
	25.5	2	1	3
	25.6	1	3	4
	25.7	2	4	6
	25.8	3	3	6
	25.9	3	2	5
	26.0	3	2	5
	26.1	6	3	9
	26.2	6	0	6
	26.3	5	3	8
	26.4	2	2	4
	26.5	1	0	1
	26.6	2	4	6
	26.7	3	3	6
	26.8	1	1	2
	26.9	3	2	5
	27.0	4	1	5
	27.1	2	2	4
	27.2	5	1	6
	27.3	1	2	3
	27.4	2	2	4
	27.5	4	0	4
	27.6	2	2	4
	27.7	1	2	3
	27.8	2	2	4
	27.9	4	1	5
	28.0	2	0	2
	28.1	1	4	5
	28.2	1	1	2
	28.3	0	4	4
	28.4	2	1	3
	28.5	3	1	4
	28.6	3	2	5

	28.7	3	1	4
	28.8	2	0	2
	29.0	1	0	1
	29.1	3	2	5
	29.2	1	1	2
	29.3	3	1	4
	29.5	2	1	3
	29.7	0	3	3
	29.8	2	1	3
	29.9	3	0	3
	30.0	0	1	1
	30.1	2	2	4
	30.3	4	1	5
	30.4	1	0	1
	30.5	1	2	3
	30.6	1	1	2
	30.7	0	1	1
	30.8	1	0	1
	31.1	4	2	6
	31.2	0	2	2
	31.3	1	1	2
	31.4	3	1	4
	31.5	2	1	3
	31.6	0	2	2
	31.7	1	0	1
	31.8	1	2	3
	31.9	2	0	2
	32.0	1	0	1
	32.1	1	0	1
	32.2	2	4	6
	32.3	2	0	2
	32.6	1	0	1
	32.9	0	1	1
	33.0	2	0	2
	33.1	2	0	2
	33.3	0	1	1

	33.6	2	1	3
	33.8	0	1	1
	33.9	0	1	1
	34.0	1	2	3
	34.1	2	1	3
	34.2	0	1	1
	34.3	0	1	1
	34.4	1	0	1
	34.5	1	0	1
	34.6	1	0	1
	34.7	1	0	1
	34.8	0	1	1
	35.0	2	0	2
	35.3	1	0	1
	35.4	0	1	1
	35.5	1	0	1
	35.8	2	0	2
	36.0	0	1	1
	36.1	1	1	2
	36.2	1	1	2
	36.4	1	1	2
	36.5	1	0	1
	36.6	0	1	1
	37.1	2	0	2
	37.2	1	0	1
	37.6	1	1	2
	37.7	2	0	2
	38.0	1	1	2
	38.7	1	0	1
	38.9	1	0	1
	39.0	0	1	1
	39.2	0	1	1
	39.9	2	0	2
	40.1	1	0	1
	40.8	0	1	1
	40.9	0	1	1

	41.4	1	1	2
	41.7	1	0	1
	43.0	0	1	1
	43.1	1	1	2
	43.5	1	1	2
	43.8	1	0	1
	43.9	1	0	1
	44.0	1	1	2
	44.7	1	0	1
	46.8	1	0	1
	47.0	0	1	1
	47.5	1	0	1
	49.1	0	1	1
	49.7	0	1	1
	51.5	1	0	1
	75.1	0	1	1
Total		878	941	1819

Report		
	LSA_length	IA_length
Mean	20.657	18.283
N	878	941
Std. Deviation	6.5875	6.737

Magubike Tp# 1 Statistical Significance Results for the Length measurements

One-Sample Test									
	Test Value = 0								
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference			
			One-Sided p	Two-Sided p		Lower	Upper		
LSA_length	92.918	877	<.001	<.001	20.6573	20.221	21.094		
IA_Length	83.249	940	<.001	<.001	18.2833	17.852	18.714		

2. Magubike Tp# 1 (Breadth) Data

breadth * CULTURE Crosstabulation				
Count				
		CULTURE		Total
		LSA	Iron Age	
Breadth	1.1	1	0	1
	2.4	1	0	1
	2.8	0	1	1
	3.4	0	1	1
	3.6	0	1	1
	3.8	0	1	1
	3.9	0	1	1
	4.3	0	2	2
	4.4	0	1	1
	4.6	0	1	1
	4.7	1	0	1
	4.8	0	1	1
	5.5	1	3	4
	5.6	0	1	1
	5.7	0	1	1
	5.8	0	1	1
	5.9	1	0	1
	6.0	2	1	3
	6.1	0	3	3
	6.2	0	5	5
	6.3	0	2	2
	6.4	0	1	1
	6.5	0	1	1
	6.6	2	3	5
	6.7	1	1	2
	6.8	1	1	2
	6.9	1	4	5
	7.0	2	4	6
	7.1	2	5	7
	7.2	3	3	6
	7.4	2	5	7

	7.5	3	5	8
	7.6	3	4	7
	7.7	3	4	7
	7.8	3	9	12
	7.9	1	4	5
	8.0	3	1	4
	8.1	3	5	8
	8.2	2	3	5
	8.3	10	9	19
	8.4	2	5	7
	8.5	2	3	5
	8.6	7	3	10
	8.7	6	6	12
	8.8	3	10	13
	8.9	4	8	12
	9.0	2	6	8
	9.1	3	8	11
	9.2	3	8	11
	9.3	4	5	9
	9.4	4	5	9
	9.5	3	8	11
	9.6	5	6	11
	9.7	9	7	16
	9.7	0	1	1
	9.8	4	8	12
	9.9	5	4	9
	10.0	5	0	5
	10.1	9	5	14
	10.2	4	6	10
	10.3	6	9	15
	10.4	5	4	9
	10.5	6	4	10
	10.6	3	11	14
	10.7	7	7	14
	10.8	10	8	18
	10.9	7	4	11

	11.0	4	12	16
	11.1	9	6	15
	11.2	5	8	13
	11.3	8	11	19
	11.4	8	4	12
	11.5	3	4	7
	11.6	10	10	20
	11.7	7	4	11
	11.8	5	1	6
	11.9	5	9	14
	12.0	6	9	15
	12.1	4	5	9
	12.2	7	11	18
	12.3	11	7	18
	12.4	5	7	12
	12.5	5	7	12
	12.6	3	10	13
	12.7	7	8	15
	12.8	5	16	21
	12.9	5	6	11
	13.0	6	8	14
	13.1	11	3	14
	13.2	11	10	21
	13.3	13	13	26
	13.4	2	7	9
	13.5	9	5	14
	13.6	5	5	10
	13.7	5	5	10
	13.8	6	10	16
	13.9	8	7	15
	14.0	7	6	13
	14.1	4	9	13
	14.2	2	8	10
	14.3	11	5	16
	14.4	9	9	18
	14.5	6	6	12

	14.6	6	8	14
	14.7	6	8	14
	14.8	7	5	12
	14.9	1	2	3
	15.0	5	10	15
	15.1	7	5	12
	15.2	4	8	12
	15.3	4	7	11
	15.4	3	1	4
	15.5	5	4	9
	15.6	7	6	13
	15.7	9	7	16
	15.8	14	8	22
	15.9	3	5	8
	16.0	4	6	10
	16.1	5	6	11
	16.2	8	11	19
	16.3	6	8	14
	16.4	7	5	12
	16.5	9	6	15
	16.6	6	6	12
	16.7	7	5	12
	16.8	6	4	10
	16.9	3	3	6
	17.0	1	2	3
	17.1	9	8	17
	17.2	4	5	9
	17.3	3	6	9
	17.4	1	6	7
	17.5	3	10	13
	17.6	8	2	10
	17.7	5	2	7
	17.8	6	1	7
	17.9	1	3	4
	18.0	10	6	16
	18.1	5	9	14

	18.2	3	4	7
	18.3	5	1	6
	18.4	5	2	7
	18.5	2	5	7
	18.6	9	8	17
	18.7	4	5	9
	18.8	2	3	5
	18.9	1	2	3
	19.0	2	7	9
	19.1	4	3	7
	19.2	6	3	9
	19.3	5	4	9
	19.4	4	6	10
	19.5	4	2	6
	19.6	1	5	6
	19.7	5	4	9
	19.8	2	3	5
	19.9	3	3	6
	20.0	5	2	7
	20.1	5	3	8
	20.2	0	2	2
	20.3	4	5	9
	20.4	2	2	4
	20.5	1	1	2
	20.6	3	6	9
	20.7	5	3	8
	20.8	3	0	3
	20.9	3	2	5
	21.0	1	4	5
	21.1	2	1	3
	21.2	3	4	7
	21.3	2	3	5
	21.4	3	1	4
	21.5	3	1	4
	21.6	0	1	1
	21.7	2	1	3

	21.8	2	4	6
	21.9	2	1	3
	22.0	1	1	2
	22.1	7	2	9
	22.2	1	4	5
	22.3	6	3	9
	22.4	2	1	3
	22.5	2	1	3
	22.6	0	2	2
	22.8	4	4	8
	22.9	0	1	1
	23.0	4	2	6
	23.1	3	1	4
	23.3	1	6	7
	23.4	4	1	5
	23.5	3	3	6
	23.6	1	2	3
	23.7	1	2	3
	23.8	3	4	7
	23.9	1	1	2
	24.0	1	2	3
	24.1	1	0	1
	24.2	3	0	3
	24.3	3	1	4
	24.4	4	0	4
	24.5	2	1	3
	24.6	4	2	6
	24.7	1	0	1
	24.9	3	1	4
	25.0	1	0	1
	25.1	4	1	5
	25.4	2	0	2
	25.5	1	2	3
	25.6	1	1	2
	25.7	2	1	3
	25.8	0	1	1

	25.9	2	1	3
	26.2	1	0	1
	26.4	1	1	2
	26.5	2	1	3
	26.6	0	1	1
	26.7	1	0	1
	26.9	1	0	1
	27.0	3	0	3
	27.1	1	1	2
	27.4	0	1	1
	27.5	1	0	1
	27.6	0	1	1
	27.7	1	0	1
	27.8	2	1	3
	27.9	1	0	1
	28.1	2	1	3
	28.2	0	1	1
	28.3	2	0	2
	28.4	1	0	1
	28.5	2	1	3
	28.7	1	0	1
	28.9	1	0	1
	29.0	2	1	3
	29.1	1	1	2
	29.2	2	2	4
	29.4	1	0	1
	29.5	2	0	2
	29.6	1	0	1
	29.7	0	1	1
	29.8	1	0	1
	29.9	0	2	2
	30.0	2	0	2
	30.2	1	0	1
	30.7	1	0	1
	30.8	0	1	1
	30.9	2	1	3

	31.0	1	1	2
	31.1	0	1	1
	31.2	1	0	1
	31.3	2	0	2
	31.4	0	1	1
	31.5	1	0	1
	31.8	1	0	1
	31.9	1	0	1
	32.2	1	1	2
	32.3	1	0	1
	32.7	3	0	3
	32.9	0	1	1
	33.0	0	1	1
	33.6	0	1	1
	34.2	0	1	1
	34.3	1	0	1
	35.0	1	0	1
	35.1	0	1	1
	35.2	1	0	1
	36.0	1	0	1
	36.1	1	1	2
	36.2	0	1	1
	36.3	1	1	2
	36.8	0	1	1
	37.3	1	0	1
	37.9	1	0	1
	38.0	1	0	1
	38.6	1	0	1
	39.0	1	0	1
	40.1	0	2	2
	40.3	0	1	1
	42.6	1	0	1
	44.1	1	0	1
	49.7	1	0	1
	68.7	0	1	1
Total		878	941	1819

Report		
	LSA_Breadth	IA_Breadth
Mean	16.13	14.631
N	878	941
Std. Deviation	6.3385	5.9322

Magubike Tp# 1 Statistical Significance Results for the Breadth measurements

One-Sample Test										
	Test Value = 0									
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference				
			One-Sided p	Two-Sided p		Lower	Upper			
LSA_Breadth	75.406	877	<.001	<.001	16.1304	15.711	16.55			
IA_Breadth	75.659	940	<.001	<.001	14.6311	14.252	15.011			

3. Magubike Tp# 5 Length measurements (Data)

length * CULTURE Crosstabulation				
Count				
		CULTURE		Total
		LSA	Iron Age	
length	1.0	0	1	1
	1.7	0	2	2
	5.9	0	4	4
	6.0	0	2	2
	6.1	0	2	2
	6.3	0	3	3
	6.4	0	3	3
	6.5	0	2	2
	6.6	0	5	5
	6.7	0	6	6
	6.8	0	3	3
	6.9	0	5	5
	7.0	0	7	7
	7.1	0	7	7

	7.2	0	9	9
	7.3	0	6	6
	7.4	0	7	7
	7.5	0	12	12
	7.6	0	9	9
	7.7	0	18	18
	7.8	0	21	21
	7.9	0	16	16
	8.0	0	20	20
	8.1	0	16	16
	8.2	0	20	20
	8.3	0	31	31
	8.4	0	32	32
	8.5	1	31	32
	8.6	2	45	47
	8.7	0	35	35
	8.8	2	33	35
	8.9	1	52	53
	9.0	1	43	44
	9.1	1	42	43
	9.2	0	55	55
	9.3	0	43	43
	9.4	1	53	54
	9.5	4	46	50
	9.6	0	46	46
	9.7	3	64	67
	9.8	2	79	81
	9.9	4	52	56
	10.0	4	73	77
	10.1	7	68	75
	10.2	10	68	78
	10.3	7	73	80
	10.4	8	69	77
	10.5	9	83	92
	10.6	7	85	92
	10.7	0	1	1

	10.7	7	74	81
	10.8	15	84	99
	10.9	13	85	98
	11.0	13	78	91
	11.1	12	72	84
	11.2	21	74	95
	11.3	13	71	84
	11.4	16	89	105
	11.5	14	76	90
	11.6	15	81	96
	11.7	16	88	104
	11.8	26	90	116
	11.9	0	1	1
	11.9	18	81	99
	12.0	19	86	105
	12.1	25	83	108
	12.2	35	86	121
	12.3	28	86	114
	12.4	27	89	116
	12.5	17	79	96
	12.6	37	94	131
	12.7	40	67	107
	12.8	26	69	95
	12.9	29	74	103
	13.0	28	73	101
	13.1	31	102	133
	13.2	29	83	112
	13.3	35	90	125
	13.4	39	79	118
	13.5	37	84	121
	13.6	41	86	127
	13.7	39	81	120
	13.8	26	90	116
	13.9	46	59	105
	14.0	36	79	115
	14.1	32	81	113

	14.2	29	73	102
	14.3	39	85	124
	14.4	38	65	103
	14.5	44	60	104
	14.6	40	80	120
	14.7	27	76	103
	14.8	48	70	118
	14.9	40	56	96
	15.0	48	83	131
	15.1	0	1	1
	15.1	51	63	114
	15.2	40	51	91
	15.3	43	65	108
	15.4	43	53	96
	15.5	34	55	89
	15.6	40	50	90
	15.7	47	53	100
	15.8	41	52	93
	15.9	0	1	1
	15.9	38	43	81
	16.0	33	38	71
	16.1	30	42	72
	16.2	39	58	97
	16.3	27	39	66
	16.4	0	1	1
	16.4	24	56	80
	16.5	37	38	75
	16.6	39	47	86
	16.7	33	46	79
	16.8	27	47	74
	16.9	30	36	66
	17.0	30	35	65
	17.1	33	37	70
	17.1	1	0	1
	17.2	37	41	78
	17.3	36	40	76

	17.4	29	33	62
	17.5	26	47	73
	17.6	29	37	66
	17.7	32	42	74
	17.8	33	40	73
	17.9	23	26	49
	18.0	22	29	51
	18.1	33	27	60
	18.2	26	35	61
	18.3	34	18	52
	18.4	32	23	55
	18.5	17	19	36
	18.6	36	24	60
	18.6	1	0	1
	18.6	0	1	1
	18.7	29	21	50
	18.8	21	31	52
	18.9	21	16	37
	19.0	22	25	47
	19.1	27	23	50
	19.2	18	31	49
	19.3	23	21	44
	19.4	14	30	44
	19.5	26	22	48
	19.6	19	24	43
	19.7	25	19	44
	19.8	23	22	45
	19.9	22	25	47
	20.0	14	25	39
	20.1	18	17	35
	20.2	20	15	35
	20.3	16	16	32
	20.4	17	18	35
	20.5	20	20	40
	20.6	12	24	36
	20.7	21	19	40

	20.8	13	16	29
	20.9	13	8	21
	21.0	22	12	34
	21.1	14	14	28
	21.2	17	12	29
	21.3	11	16	27
	21.4	14	18	32
	21.5	14	15	29
	21.6	15	14	29
	21.7	13	7	20
	21.8	10	12	22
	21.9	13	12	25
	22.0	11	14	25
	22.1	13	9	22
	22.2	15	11	26
	22.3	9	9	18
	22.4	6	11	17
	22.5	12	8	20
	22.6	14	10	24
	22.7	17	7	24
	22.8	13	6	19
	22.9	12	12	24
	23.0	12	7	19
	23.1	10	14	24
	23.2	9	7	16
	23.3	8	5	13
	23.4	13	11	24
	23.5	5	13	18
	23.6	10	11	21
	23.7	7	5	12
	23.8	8	11	19
	23.9	6	5	11
	24.0	8	10	18
	24.1	8	4	12
	24.2	9	11	20
	24.3	3	3	6

	24.4	10	7	17
	24.5	6	5	11
	24.6	6	5	11
	24.7	11	8	19
	24.8	7	5	12
	24.9	6	3	9
	25.0	9	6	15
	25.1	7	8	15
	25.2	9	6	15
	25.3	8	8	16
	25.4	7	3	10
	25.5	9	9	18
	25.6	3	7	10
	25.7	5	3	8
	25.7	0	1	1
	25.8	10	6	16
	25.9	4	12	16
	26.0	5	6	11
	26.1	9	3	12
	26.2	5	5	10
	26.3	3	8	11
	26.4	7	7	14
	26.5	9	3	12
	26.6	3	7	10
	26.7	7	4	11
	26.8	8	2	10
	26.9	1	0	1
	26.9	5	9	14
	27.0	6	4	10
	27.1	6	3	9
	27.2	5	3	8
	27.3	1	4	5
	27.4	5	8	13
	27.5	3	8	11
	27.6	3	7	10
	27.7	3	3	6

	27.8	3	1	4
	27.9	3	3	6
	28.0	4	2	6
	28.1	6	4	10
	28.2	10	6	16
	28.3	4	2	6
	28.4	4	6	10
	28.5	3	6	9
	28.6	4	3	7
	28.7	2	3	5
	28.8	5	4	9
	28.9	5	3	8
	29.0	1	2	3
	29.1	6	4	10
	29.2	6	4	10
	29.3	3	2	5
	29.4	2	1	3
	29.5	3	6	9
	29.6	4	3	7
	29.6	0	1	1
	29.7	4	1	5
	29.8	1	2	3
	29.9	1	2	3
	30.0	1	5	6
	30.1	4	1	5
	30.2	4	0	4
	30.3	2	5	7
	30.4	5	0	5
	30.5	2	4	6
	30.6	3	1	4
	30.7	3	1	4
	30.8	3	3	6
	30.9	5	2	7
	31.0	6	2	8
	31.1	2	1	3
	31.2	3	2	5

	31.3	4	1	5
	31.4	0	1	1
	31.5	2	3	5
	31.6	2	2	4
	31.7	0	1	1
	31.8	0	3	3
	31.9	3	1	4
	32.0	3	1	4
	32.1	1	1	2
	32.2	4	1	5
	32.3	1	2	3
	32.4	1	0	1
	32.5	2	0	2
	32.6	1	3	4
	32.7	2	0	2
	32.8	2	2	4
	32.9	1	0	1
	33.0	2	0	2
	33.1	1	2	3
	33.2	1	5	6
	33.3	3	1	4
	33.4	3	0	3
	33.5	0	1	1
	33.6	1	0	1
	33.7	1	1	2
	34.0	3	2	5
	34.1	0	3	3
	34.2	4	0	4
	34.3	2	1	3
	34.4	2	1	3
	34.5	1	0	1
	34.6	2	0	2
	34.8	4	1	5
	34.9	1	0	1
	35.2	0	1	1
	35.4	0	1	1

	35.5	0	2	2
	35.6	1	1	2
	35.7	1	0	1
	35.8	0	1	1
	36.0	1	1	2
	36.1	1	1	2
	36.3	1	1	2
	36.4	1	0	1
	36.5	2	0	2
	36.6	1	1	2
	36.7	1	1	2
	36.8	1	0	1
	36.9	0	1	1
	37.1	2	0	2
	37.2	1	0	1
	37.5	1	1	2
	37.6	3	0	3
	37.7	2	0	2
	37.8	2	0	2
	37.9	0	1	1
	38.5	2	0	2
	38.6	1	0	1
	38.8	1	1	2
	38.9	1	1	2
	39.1	1	0	1
	39.4	1	1	2
	39.6	1	0	1
	40.1	2	0	2
	40.4	1	0	1
	40.8	2	1	3
	40.9	0	1	1
	41.1	1	2	3
	41.5	1	0	1
	41.6	2	1	3
	42.0	1	0	1
	42.5	0	1	1

	42.7	1	1	2
	43.4	1	0	1
	44.1	1	0	1
	44.8	1	1	2
	45.2	0	1	1
	45.9	1	0	1
	46.0	1	0	1
	47.1	0	1	1
	47.3	1	1	2
	48.9	1	0	1
	49.4	1	1	2
	50.0	1	2	3
	50.5	0	1	1
	50.9	1	0	1
	52.4	1	0	1
	52.6	0	1	1
	52.7	1	0	1
	54.5	0	1	1
	55.5	0	1	1
	55.7	0	1	1
	56.0	0	1	1
	57.7	1	0	1
	57.8	1	0	1
	58.7	1	1	2
	59.6	0	1	1
	60.5	1	0	1
	63.9	1	0	1
	67.1	0	1	1
	67.7	0	1	1
	67.8	1	0	1
	68.5	1	0	1
	75.7	0	1	1
	76.2	0	1	1
	80.0	0	1	1
	119.3	0	1	1
	125.2	0	1	1

	153.1	0	2	2
Total		3827	7705	11532

Report		
	LSA Length	IA Length
Mean	17.97	14.641
N	3827	7705
Std. Deviation	5.883	5.978

Magubike Tp# 5 Statistical Significance Results for the Length measurements

One-Sample Test										
	Test Value = 0									
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference				
			One-Sided p	Two-Sided p		Lower	Upper			
LSA_Length	188.96	3826	<.001	<.001	17.9697	17.783	18.156			
IA_Length	214.975	7704	<.001	<.001	14.6406	14.507	14.774			

4. Magubike Tp# 5 Breadth measurements (Data)

breadth * CULTURE Crosstabulation				
Count				
		CULTURE		Total
		LSA	Iron Age	
Breadth	1.0	1	1	2
	1.2	0	1	1
	1.3	1	0	1
	1.4	0	1	1
	2.1	0	1	1
	2.2	0	1	1
	2.3	0	1	1
	2.7	0	1	1
	2.9	1	3	4
	3.1	0	3	3
	3.3	0	1	1
	3.4	0	5	5

	3.5	1	1	2
	3.6	1	2	3
	3.7	0	2	2
	3.8	0	1	1
	3.9	0	4	4
	4.0	0	10	10
	4.1	0	6	6
	4.2	1	9	10
	4.3	0	10	10
	4.4	0	10	10
	4.5	0	12	12
	4.6	0	7	7
	4.7	0	8	8
	4.8	0	1	1
	4.8	0	15	15
	4.9	0	22	22
	5.0	0	12	12
	5.1	2	12	14
	5.2	2	22	24
	5.3	3	28	31
	5.4	0	32	32
	5.5	3	23	26
	5.6	3	36	39
	5.7	3	26	29
	5.8	1	30	31
	5.9	5	40	45
	6.0	2	31	33
	6.1	2	57	59
	6.1	0	1	1
	6.2	6	43	49
	6.3	5	37	42
	6.4	2	61	63
	6.5	2	61	63
	6.6	6	55	61
	6.7	5	47	52
	6.8	4	62	66

	6.9	7	69	76
	7.0	9	76	85
	7.1	4	80	84
	7.2	6	85	91
	7.3	8	91	99
	7.4	6	65	71
	7.5	6	87	93
	7.6	7	76	83
	7.7	10	90	100
	7.8	14	118	132
	7.9	10	102	112
	8.0	9	100	109
	8.1	9	105	114
	8.1	0	1	1
	8.2	8	111	119
	8.3	9	86	95
	8.4	9	81	90
	8.5	15	96	111
	8.5	0	1	1
	8.6	17	109	126
	8.7	19	113	132
	8.8	18	103	121
	8.9	17	94	111
	9.0	20	87	107
	9.1	14	106	120
	9.2	15	91	106
	9.3	20	106	126
	9.4	23	82	105
	9.5	25	97	122
	9.6	22	109	131
	9.7	20	98	118
	9.8	16	112	128
	9.9	27	91	118
	10.0	20	86	106
	10.1	25	92	117
	10.2	16	89	105

	10.3	28	68	96
	10.4	21	73	94
	10.5	0	1	1
	10.5	24	73	97
	10.6	37	85	122
	10.7	32	66	98
	10.8	35	76	111
	10.9	36	65	101
	11.0	33	71	104
	11.0	0	1	1
	11.1	28	73	101
	11.2	30	77	107
	11.3	28	75	103
	11.4	36	76	112
	11.5	55	69	124
	11.6	35	67	102
	11.7	29	70	99
	11.8	32	62	94
	11.9	31	64	95
	12.0	43	63	106
	12.1	44	56	100
	12.1	0	1	1
	12.2	39	73	112
	12.3	34	47	81
	12.4	45	45	90
	12.5	46	51	97
	12.6	41	70	111
	12.7	0	1	1
	12.7	35	43	78
	12.8	34	48	82
	12.9	41	30	71
	13.0	41	43	84
	13.1	30	43	73
	13.2	36	46	82
	13.3	33	36	69
	13.4	30	38	68

	13.5	0	1	1
	13.5	42	41	83
	13.6	35	42	77
	13.7	48	41	89
	13.8	30	26	56
	13.9	35	35	70
	14.0	38	39	77
	14.1	28	49	77
	14.2	31	36	67
	14.3	39	30	69
	14.3	1	0	1
	14.4	41	31	72
	14.5	38	30	68
	14.6	0	1	1
	14.6	33	24	57
	14.7	33	27	60
	14.8	34	38	72
	14.8	0	1	1
	14.9	28	29	57
	15.0	29	37	66
	15.1	31	21	52
	15.2	23	29	52
	15.3	36	25	61
	15.4	29	29	58
	15.5	23	21	44
	15.6	31	22	53
	15.7	23	23	46
	15.8	23	21	44
	15.9	16	16	32
	16.0	28	25	53
	16.1	31	20	51
	16.2	25	15	40
	16.3	25	25	50
	16.4	26	25	51
	16.5	0	1	1
	16.5	0	1	1

	16.5	25	16	41
	16.6	30	15	45
	16.7	20	27	47
	16.8	32	19	51
	16.9	31	24	55
	17.0	30	21	51
	17.1	26	11	37
	17.2	25	15	40
	17.3	26	14	40
	17.4	28	16	44
	17.5	20	18	38
	17.6	26	15	41
	17.7	27	11	38
	17.8	24	11	35
	17.9	19	15	34
	18.0	26	17	43
	18.1	17	13	30
	18.2	15	10	25
	18.3	1	0	1
	18.3	26	8	34
	18.4	19	13	32
	18.5	0	1	1
	18.5	20	5	25
	18.6	20	8	28
	18.7	23	15	38
	18.8	16	10	26
	18.9	19	10	29
	19.0	12	12	24
	19.1	17	10	27
	19.2	12	8	20
	19.3	9	17	26
	19.3	1	0	1
	19.4	0	1	1
	19.4	10	14	24
	19.5	14	11	25
	19.6	18	8	26

	19.7	14	6	20
	19.8	6	14	20
	19.9	10	10	20
	20.0	19	7	26
	20.1	10	15	25
	20.2	9	15	24
	20.3	4	10	14
	20.4	13	14	27
	20.5	10	7	17
	20.6	14	8	22
	20.7	3	7	10
	20.8	14	7	21
	20.9	8	1	9
	21.0	11	4	15
	21.1	12	2	14
	21.2	6	8	14
	21.3	8	4	12
	21.4	15	4	19
	21.5	16	4	20
	21.6	7	4	11
	21.7	10	3	13
	21.8	7	5	12
	21.9	7	6	13
	22.0	6	7	13
	22.1	2	2	4
	22.2	6	5	11
	22.3	7	3	10
	22.4	8	4	12
	22.5	7	2	9
	22.6	3	4	7
	22.7	6	7	13
	22.8	11	4	15
	22.9	8	4	12
	23.0	9	7	16
	23.1	8	1	9
	23.2	4	5	9

	23.3	11	4	15
	23.4	9	4	13
	23.5	4	3	7
	23.6	6	4	10
	23.7	6	3	9
	23.8	6	3	9
	23.9	4	0	4
	24.0	6	5	11
	24.1	4	2	6
	24.2	2	2	4
	24.3	1	1	2
	24.4	2	1	3
	24.5	3	2	5
	24.6	4	3	7
	24.7	4	1	5
	24.8	4	2	6
	24.9	4	3	7
	25.0	6	1	7
	25.1	5	5	10
	25.2	3	2	5
	25.3	6	3	9
	25.4	7	2	9
	25.5	2	1	3
	25.6	2	1	3
	25.7	2	3	5
	25.8	5	1	6
	25.9	2	2	4
	26.0	4	4	8
	26.1	1	3	4
	26.2	2	3	5
	26.3	4	3	7
	26.4	1	1	2
	26.5	3	2	5
	26.6	1	2	3
	26.7	0	3	3
	26.8	4	1	5

	26.9	3	3	6
	27.0	2	2	4
	27.1	3	5	8
	27.2	1	0	1
	27.3	2	1	3
	27.4	2	1	3
	27.5	1	4	5
	27.6	5	0	5
	27.7	0	1	1
	27.8	2	3	5
	27.9	1	2	3
	28.0	1	2	3
	28.1	1	1	2
	28.2	1	3	4
	28.3	1	1	2
	28.5	1	1	2
	28.6	1	0	1
	28.7	2	2	4
	28.8	1	0	1
	28.9	0	1	1
	29.0	3	1	4
	29.2	3	1	4
	29.3	1	0	1
	29.4	2	0	2
	29.6	0	1	1
	29.7	1	0	1
	29.8	0	1	1
	29.9	2	0	2
	30.1	0	1	1
	30.2	3	2	5
	30.3	0	1	1
	30.4	1	1	2
	30.5	0	1	1
	30.6	0	1	1
	30.7	3	2	5
	30.8	1	2	3

	30.9	1	0	1
	31.0	1	1	2
	31.2	0	1	1
	31.3	1	1	2
	31.5	0	2	2
	31.6	1	0	1
	31.7	1	0	1
	31.8	0	1	1
	31.9	1	0	1
	32.1	1	1	2
	32.2	1	0	1
	32.3	1	1	2
	32.5	1	0	1
	32.6	1	0	1
	32.8	1	0	1
	32.9	1	1	2
	33.1	1	1	2
	33.2	0	1	1
	33.3	1	1	2
	33.4	0	2	2
	33.6	1	0	1
	33.8	0	2	2
	34.0	0	1	1
	34.2	1	0	1
	34.3	1	1	2
	34.5	1	0	1
	34.6	0	1	1
	34.8	0	1	1
	35.0	0	1	1
	35.1	1	0	1
	35.4	0	1	1
	35.5	2	0	2
	35.8	1	1	2
	36.0	0	1	1
	36.4	1	1	2
	36.7	0	1	1

	37.2	1	0	1
	38.1	1	0	1
	38.4	0	1	1
	38.9	0	1	1
	39.0	0	1	1
	39.2	0	1	1
	39.4	0	1	1
	39.5	0	1	1
	39.8	1	0	1
	40.5	1	0	1
	40.6	0	1	1
	41.1	1	0	1
	41.2	1	1	2
	42.4	1	0	1
	43.4	0	2	2
	43.5	1	0	1
	44.2	1	0	1
	44.6	0	1	1
	45.9	0	1	1
	46.2	1	0	1
	46.7	0	1	1
	48.2	0	1	1
	48.5	0	1	1
	49.1	0	1	1
	49.7	0	1	1
	51.4	0	1	1
	51.9	1	0	1
	53.1	0	1	1
	53.3	1	0	1
	54.4	0	1	1
	57.4	0	1	1
	58.7	1	0	1
	63.6	0	1	1
	70.0	0	1	1
Total		3827	7705	11532

Report			
	LSA_Breadth	IA_Breadth	
Mean	14.917	11.154	
N	3827	7705	
Std. Deviation	5.0355	4.8389	

Magubike Tp# 5 Statistical Significance Results for the Breadth measurements

One-Sample Test										
	Test Value = 0									
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference				
			One-Sided p	Two-Sided p		Lower	Upper			
LSA_Breadth	183.259	3826	<.001	<.001	14.9168	14.757	15.076			
IA_Breadth	202.333	7704	<.001	<.001	11.1538	11.046	11.262			

5. Mlambalasi Tp# 1 Length measurements (Data)

length * CULTURE Crosstabulation				
Count				
		CULTURE		Total
		LSA	Iron Age	
length	5.2	1	0	1
	5.3	1	0	1
	5.8	1	0	1
	6.3	1	0	1
	6.5	1	0	1
	6.8	3	0	3
	6.9	1	0	1
	7.1	0	1	1
	7.2	1	0	1
	7.3	2	0	2
	7.6	1	0	1
	7.7	1	1	2
	7.8	2	1	3
	7.9	3	1	4
	8.2	0	1	1
	8.3	4	1	5
	8.4	3	0	3
	8.5	1	0	1
	8.6	1	3	4
	8.7	2	3	5

	8.8	4	2	6
	8.9	2	1	3
	9.0	4	3	7
	9.1	6	2	8
	9.2	6	1	7
	9.3	10	1	11
	9.4	7	2	9
	9.5	3	2	5
	9.6	4	3	7
	9.7	7	2	9
	9.8	6	1	7
	9.9	8	3	11
	10.0	10	6	16
	10.1	5	4	9
	10.2	4	2	6
	10.3	6	1	7
	10.4	9	3	12
	10.5	4	4	8
	10.6	10	3	13
	10.7	10	4	14
	10.8	7	3	10
	10.9	3	2	5
	11.0	7	4	11
	11.1	9	2	11
	11.2	13	5	18
	11.3	8	2	10
	11.4	7	3	10
	11.5	8	8	16
	11.6	8	1	9
	11.7	10	6	16
	11.8	10	4	14
	11.9	14	4	18
	12.0	7	3	10
	12.1	10	7	17
	12.2	5	4	9
	12.3	11	4	15
	12.4	5	4	9
	12.5	9	8	17
	12.6	12	6	18
	12.7	12	6	18
	12.8	13	4	17

	12.9	14	4	18
	13.0	8	4	12
	13.1	14	2	16
	13.2	15	1	16
	13.3	9	3	12
	13.4	9	4	13
	13.5	10	4	14
	13.6	13	2	15
	13.7	10	4	14
	13.8	10	1	11
	13.9	15	1	16
	14.0	16	3	19
	14.1	11	9	20
	14.2	10	6	16
	14.3	8	3	11
	14.4	10	5	15
	14.5	14	7	21
	14.6	19	6	25
	14.7	8	5	13
	14.8	6	6	12
	14.9	7	7	14
	15.0	8	4	12
	15.1	12	8	20
	15.2	14	2	16
	15.3	13	1	14
	15.4	15	8	23
	15.5	10	4	14
	15.6	8	1	9
	15.7	12	3	15
	15.8	10	3	13
	15.9	19	3	22
	16.0	14	1	15
	16.1	13	2	15
	16.2	10	6	16
	16.3	11	5	16
	16.4	18	12	30
	16.5	14	2	16
	16.6	14	7	21
	16.7	7	5	12
	16.8	6	7	13
	16.9	7	1	8

	17.0	13	1	14
	17.1	11	8	19
	17.2	10	7	17
	17.3	12	5	17
	17.4	18	3	21
	17.5	10	2	12
	17.6	12	3	15
	17.7	9	6	15
	17.8	7	5	12
	17.9	7	2	9
	18.0	7	2	9
	18.1	6	1	7
	18.2	17	7	24
	18.3	13	5	18
	18.4	6	4	10
	18.5	8	1	9
	18.6	10	1	11
	18.7	15	1	16
	18.8	10	5	15
	18.9	11	1	12
	19.0	11	3	14
	19.1	6	4	10
	19.2	11	10	21
	19.3	12	1	13
	19.4	6	5	11
	19.5	10	3	13
	19.6	4	6	10
	19.7	19	2	21
	19.8	5	4	9
	19.9	10	0	10
	20.0	13	2	15
	20.1	5	2	7
	20.2	9	5	14
	20.3	15	0	15
	20.4	7	3	10
	20.5	10	3	13
	20.6	9	2	11
	20.7	5	1	6
	20.8	6	2	8
	20.9	7	1	8
	21.0	7	2	9

	21.1	15	2	17
	21.2	10	4	14
	21.3	10	3	13
	21.4	8	5	13
	21.5	8	2	10
	21.6	9	4	13
	21.7	10	1	11
	21.8	6	3	9
	21.9	7	3	10
	22.0	8	2	10
	22.1	8	2	10
	22.2	6	3	9
	22.3	6	1	7
	22.4	13	2	15
	22.5	6	2	8
	22.6	8	2	10
	22.7	8	2	10
	22.8	6	1	7
	22.9	6	3	9
	23.0	4	2	6
	23.1	4	2	6
	23.2	6	1	7
	23.3	8	3	11
	23.4	6	0	6
	23.5	5	4	9
	23.6	6	2	8
	23.7	10	1	11
	23.8	3	2	5
	23.9	12	2	14
	24.0	4	4	8
	24.1	3	0	3
	24.2	6	1	7
	24.3	6	1	7
	24.4	4	0	4
	24.5	6	3	9
	24.6	5	2	7
	24.7	4	2	6
	24.8	3	4	7
	24.9	4	1	5
	25.0	7	2	9
	25.1	7	1	8

	25.2	8	3	11
	25.3	8	3	11
	25.4	6	1	7
	25.5	10	2	12
	25.6	3	2	5
	25.7	6	1	7
	25.8	8	1	9
	25.9	4	2	6
	26.0	2	1	3
	26.1	8	1	9
	26.2	7	1	8
	26.3	3	2	5
	26.4	4	0	4
	26.5	6	2	8
	26.6	4	2	6
	26.7	8	2	10
	26.8	1	1	2
	26.9	4	0	4
	27.0	6	3	9
	27.1	2	0	2
	27.2	1	4	5
	27.3	5	3	8
	27.4	6	1	7
	27.5	6	0	6
	27.6	5	1	6
	27.7	4	3	7
	27.8	3	2	5
	27.9	1	1	2
	28.0	6	1	7
	28.1	4	0	4
	28.2	2	1	3
	28.3	4	3	7
	28.4	0	1	1
	28.5	3	2	5
	28.6	5	3	8
	28.7	3	0	3
	28.8	4	0	4
	28.9	4	0	4
	29.0	4	1	5
	29.1	3	0	3
	29.2	2	0	2

	29.3	7	0	7
	29.4	3	2	5
	29.5	2	0	2
	29.6	3	0	3
	29.7	1	0	1
	29.8	5	1	6
	29.9	5	0	5
	30.0	4	0	4
	30.1	4	0	4
	30.2	6	3	9
	30.3	2	0	2
	30.4	4	0	4
	30.5	3	0	3
	30.6	5	0	5
	30.7	3	2	5
	30.8	3	2	5
	30.9	1	2	3
	31.0	2	1	3
	31.1	1	1	2
	31.2	2	0	2
	31.3	3	1	4
	31.4	6	1	7
	31.5	4	0	4
	31.6	3	0	3
	31.7	3	0	3
	31.8	3	0	3
	31.9	2	1	3
	32.0	2	0	2
	32.1	1	0	1
	32.2	3	1	4
	32.3	2	3	5
	32.4	3	0	3
	32.5	1	0	1
	32.6	2	0	2
	32.7	6	1	7
	32.8	2	2	4
	32.9	3	0	3
	33.0	3	0	3
	33.1	5	1	6
	33.2	2	0	2
	33.3	3	0	3

	33.4	1	1	2
	33.5	4	1	5
	33.6	3	0	3
	33.8	0	1	1
	33.9	2	0	2
	34.0	0	1	1
	34.1	1	1	2
	34.2	2	0	2
	34.3	1	0	1
	34.4	1	1	2
	34.6	1	0	1
	34.7	1	1	2
	34.8	2	0	2
	34.9	5	0	5
	35.0	3	0	3
	35.1	1	1	2
	35.2	1	1	2
	35.4	3	0	3
	35.5	1	0	1
	35.8	4	0	4
	35.9	2	1	3
	36.1	2	0	2
	36.2	4	0	4
	36.3	2	0	2
	36.4	1	0	1
	36.5	2	0	2
	36.6	1	0	1
	36.7	2	0	2
	36.8	4	0	4
	36.9	2	0	2
	37.1	3	0	3
	37.3	1	0	1
	37.4	2	0	2
	37.5	3	0	3
	37.6	2	1	3
	37.8	1	1	2
	38.2	3	1	4
	38.3	1	0	1
	38.5	2	0	2
	38.6	1	0	1
	38.7	1	0	1

	38.8	1	0	1
	38.9	2	0	2
	39.2	2	0	2
	39.3	2	0	2
	39.6	1	0	1
	39.8	1	0	1
	39.9	1	0	1
	40.1	2	0	2
	40.2	1	0	1
	40.3	1	0	1
	40.4	3	1	4
	40.5	1	0	1
	40.8	1	0	1
	40.9	1	0	1
	41.0	1	1	2
	41.1	1	0	1
	41.2	2	0	2
	41.3	1	0	1
	41.6	2	0	2
	41.8	0	1	1
	41.9	1	0	1
	42.0	1	0	1
	42.1	1	0	1
	42.5	1	0	1
	42.8	3	0	3
	42.9	2	0	2
	43.1	0	1	1
	43.2	1	0	1
	43.4	1	0	1
	43.5	0	1	1
	43.8	1	0	1
	44.2	1	0	1
	44.5	1	0	1
	44.6	1	0	1
	44.8	0	2	2
	45.0	1	1	2
	45.1	2	0	2
	45.2	2	0	2
	45.3	1	0	1
	45.6	1	0	1
	45.7	1	0	1

	45.8	1	0	1
	46.0	1	0	1
	46.1	0	1	1
	46.4	1	0	1
	46.6	0	1	1
	46.7	1	0	1
	46.8	1	0	1
	46.9	1	0	1
	47.0	2	0	2
	47.1	1	0	1
	47.2	2	0	2
	47.3	2	0	2
	47.8	1	0	1
	48.0	1	0	1
	48.3	1	0	1
	48.4	1	0	1
	48.7	2	1	3
	48.9	1	0	1
	49.1	1	0	1
	49.3	2	1	3
	49.5	2	0	2
	49.6	1	0	1
	49.7	1	0	1
	50.2	3	0	3
	50.8	1	0	1
	51.1	2	0	2
	51.5	1	0	1
	51.6	1	0	1
	51.7	2	0	2
	51.8	1	0	1
	52.1	2	0	2
	52.3	1	0	1
	53.1	1	0	1
	53.5	1	0	1
	53.6	1	0	1
	54.0	1	0	1
	54.2	1	0	1
	54.4	1	0	1
	55.0	1	0	1
	55.3	1	0	1
	55.5	1	0	1

	55.6	1	0	1
	56.0	2	0	2
	56.2	1	0	1
	56.5	1	0	1
	56.6	1	0	1
	56.7	1	0	1
	57.9	0	1	1
	58.7	1	0	1
	58.9	1	0	1
	59.4	1	0	1
	59.7	1	0	1
	59.8	0	1	1
	59.9	1	0	1
	60.5	1	0	1
	60.6	1	0	1
	61.3	1	0	1
	63.4	1	0	1
	64.9	1	0	1
	67.2	1	0	1
	67.7	1	0	1
	68.2	2	0	2
	70.0	1	0	1
	71.5	1	0	1
	72.1	1	0	1
	73.9	1	0	1
	76.0	1	0	1
	80.8	1	0	1
	86.4	1	0	1
	86.5	1	0	1
	89.6	1	0	1
	124.7	1	0	1
Total		2015	651	2666

Report	Mlambalasi Tp# 1	
	LSA_Length	IA_Length
Mean	21.39	18.621
N	2015	651
Std. Deviation	10.8007	7.4979

Mlambalasi Tp# 1 Statistical Significance Results for the Length measurements

One-Sample Test										
	Test Value = 0									
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference				
			One-Sided p	Two-Sided p		Lower	Upper			
LSA_Length	88.899	2014	<.001	<.001	21.3898	20.918	21.862			
IA_Length	63.364	650	<.001	<.001	18.6207	18.044	19.198			

6. Mlambalasi Tp# 1 Breadth measurements (Data)

breadth * CULTURE Crosstabulation				
Count				
		CULTURE		Total
		LSA	Iron Age	
breadth	1.7	1	0	1
	2.5	1	0	1
	2.7	1	0	1
	3.6	1	0	1
	3.7	1	0	1
	3.8	1	0	1
	4.1	3	0	3
	4.5	3	0	3
	4.6	1	1	2
	4.7	1	0	1
	4.8	1	0	1
	4.9	1	0	1
	5.0	1	0	1
	5.1	2	0	2
	5.2	3	1	4
	5.3	4	0	4
	5.4	1	0	1
	5.5	1	0	1
	5.6	1	0	1
	5.7	1	0	1
	5.8	2	1	3

	5.9	1	0	1
	6.0	2	0	2
	6.1	3	1	4
	6.2	2	2	4
	6.3	4	2	6
	6.4	4	0	4
	6.5	6	5	11
	6.6	4	1	5
	6.7	4	5	9
	6.8	9	1	10
	6.9	6	3	9
	7.0	4	2	6
	7.1	11	2	13
	7.2	9	4	13
	7.3	3	3	6
	7.4	6	3	9
	7.5	5	6	11
	7.6	9	2	11
	7.7	4	6	10
	7.8	9	3	12
	7.9	8	3	11
	8.0	3	4	7
	8.1	9	5	14
	8.2	9	1	10
	8.3	2	3	5
	8.4	8	5	13
	8.5	13	5	18
	8.6	11	6	17
	8.7	8	2	10
	8.8	8	0	8
	8.9	11	5	16
	9.0	9	2	11
	9.1	10	4	14
	9.2	7	3	10
	9.3	8	2	10
	9.4	10	6	16
	9.5	14	5	19
	9.6	15	2	17
	9.7	11	2	13
	9.8	6	3	9
	9.9	8	2	10

	10.0	11	8	19
	10.1	9	5	14
	10.2	13	7	20
	10.3	11	5	16
	10.4	12	2	14
	10.5	9	5	14
	10.6	8	3	11
	10.7	11	6	17
	10.8	10	6	16
	10.9	10	3	13
	11.0	5	8	13
	11.1	13	5	18
	11.2	7	4	11
	11.3	13	7	20
	11.4	17	6	23
	11.5	10	4	14
	11.6	13	6	19
	11.7	16	3	19
	11.8	12	1	13
	11.9	7	6	13
	12.0	8	6	14
	12.1	12	3	15
	12.2	8	4	12
	12.3	16	9	25
	12.4	13	1	14
	12.5	7	8	15
	12.6	18	5	23
	12.7	14	6	20
	12.8	14	3	17
	12.9	8	5	13
	13.0	15	3	18
	13.1	8	3	11
	13.2	14	3	17
	13.3	12	3	15
	13.4	9	4	13
	13.5	16	7	23
	13.6	18	12	30
	13.7	13	9	22
	13.8	11	4	15
	13.9	6	6	12
	14.0	16	6	22

	14.1	12	6	18
	14.2	14	3	17
	14.3	5	3	8
	14.4	12	6	18
	14.5	11	5	16
	14.6	21	4	25
	14.7	11	3	14
	14.8	6	4	10
	14.9	7	4	11
	15.0	16	5	21
	15.1	15	5	20
	15.2	11	2	13
	15.3	12	5	17
	15.4	16	3	19
	15.5	8	2	10
	15.6	12	4	16
	15.7	10	6	16
	15.8	11	1	12
	15.9	12	5	17
	16.0	12	1	13
	16.1	9	6	15
	16.2	6	1	7
	16.3	10	4	14
	16.4	10	5	15
	16.5	15	2	17
	16.6	11	2	13
	16.7	14	0	14
	16.8	10	1	11
	16.9	9	4	13
	17.0	14	3	17
	17.1	9	6	15
	17.2	10	6	16
	17.3	7	8	15
	17.4	8	3	11
	17.5	6	4	10
	17.6	8	3	11
	17.7	8	2	10
	17.8	12	3	15
	17.9	6	5	11
	18.0	13	5	18
	18.1	9	3	12

	18.2	11	4	15
	18.3	12	2	14
	18.4	4	6	10
	18.5	4	3	7
	18.6	8	2	10
	18.7	12	2	14
	18.8	7	1	8
	18.9	8	1	9
	19.0	6	3	9
	19.1	9	4	13
	19.2	5	2	7
	19.3	7	1	8
	19.4	6	0	6
	19.5	11	5	16
	19.6	13	0	13
	19.7	15	2	17
	19.8	8	1	9
	19.9	5	3	8
	20.0	5	2	7
	20.1	8	4	12
	20.2	8	2	10
	20.3	10	2	12
	20.4	9	5	14
	20.5	9	5	14
	20.6	9	1	10
	20.7	9	2	11
	20.8	3	0	3
	20.9	4	2	6
	21.0	10	1	11
	21.1	4	0	4
	21.2	3	3	6
	21.3	11	1	12
	21.4	6	0	6
	21.5	3	0	3
	21.6	8	2	10
	21.7	4	3	7
	21.8	3	1	4
	21.9	3	0	3
	22.0	6	1	7
	22.1	7	1	8
	22.2	6	3	9

	22.3	9	0	9
	22.4	5	4	9
	22.5	8	1	9
	22.6	9	0	9
	22.7	5	1	6
	22.8	6	0	6
	22.9	6	0	6
	23.0	4	2	6
	23.1	5	2	7
	23.2	5	1	6
	23.3	8	0	8
	23.4	5	0	5
	23.5	7	0	7
	23.6	3	0	3
	23.7	4	2	6
	23.8	6	1	7
	23.9	6	1	7
	24.0	7	2	9
	24.1	6	2	8
	24.2	7	1	8
	24.3	4	0	4
	24.4	6	0	6
	24.5	5	1	6
	24.6	6	0	6
	24.7	3	1	4
	24.8	9	0	9
	24.9	3	3	6
	25.0	3	2	5
	25.1	6	0	6
	25.2	4	0	4
	25.3	2	1	3
	25.4	5	0	5
	25.5	5	1	6
	25.6	5	0	5
	25.7	5	1	6
	25.8	5	2	7
	25.9	3	1	4
	26.0	5	0	5
	26.1	1	1	2
	26.2	2	0	2
	26.3	2	0	2

	26.4	6	2	8
	26.5	4	2	6
	26.6	4	1	5
	26.7	2	0	2
	26.8	3	1	4
	26.9	4	5	9
	27.0	5	1	6
	27.1	3	0	3
	27.2	1	0	1
	27.3	1	0	1
	27.4	3	2	5
	27.5	4	1	5
	27.6	3	0	3
	27.7	6	0	6
	27.8	3	1	4
	27.9	3	1	4
	28.0	4	1	5
	28.1	2	0	2
	28.2	1	0	1
	28.3	0	1	1
	28.4	2	0	2
	28.5	1	1	2
	28.6	3	0	3
	28.7	1	0	1
	28.8	5	0	5
	28.9	3	0	3
	29.0	2	2	4
	29.1	2	2	4
	29.2	1	0	1
	29.3	3	0	3
	29.4	2	0	2
	29.5	2	1	3
	29.6	5	1	6
	29.8	2	1	3
	29.9	0	1	1
	30.0	2	1	3
	30.1	3	0	3
	30.2	2	0	2
	30.3	5	0	5
	30.4	1	1	2
	30.5	1	0	1

	30.6	0	3	3
	30.7	1	0	1
	31.0	1	0	1
	31.2	3	1	4
	31.3	1	0	1
	31.4	2	0	2
	31.5	3	0	3
	31.6	1	1	2
	31.8	5	0	5
	31.9	3	0	3
	32.1	1	0	1
	32.2	1	0	1
	32.4	4	0	4
	32.5	1	0	1
	32.6	6	0	6
	32.7	3	0	3
	32.8	1	0	1
	32.9	1	0	1
	33.0	4	0	4
	33.1	2	1	3
	33.2	2	1	3
	33.3	0	1	1
	33.4	1	0	1
	33.5	2	0	2
	33.6	1	0	1
	33.7	1	0	1
	34.0	2	0	2
	34.3	2	0	2
	34.4	2	0	2
	34.5	1	0	1
	34.6	1	0	1
	34.8	1	0	1
	34.9	2	0	2
	35.0	4	0	4
	35.2	1	0	1
	35.3	2	0	2
	35.4	2	0	2
	35.5	3	1	4
	35.6	2	1	3
	35.8	1	0	1
	35.9	1	0	1

	36.0	1	1	2
	36.2	1	0	1
	36.3	2	0	2
	36.4	1	0	1
	36.5	1	0	1
	36.6	1	0	1
	36.7	3	0	3
	36.8	3	0	3
	37.3	1	0	1
	37.5	2	1	3
	37.7	0	1	1
	37.9	2	0	2
	38.0	1	0	1
	38.1	2	0	2
	38.2	1	0	1
	38.3	1	0	1
	38.4	0	1	1
	38.6	1	0	1
	38.7	2	0	2
	38.8	3	0	3
	39.0	1	0	1
	39.3	2	0	2
	39.4	1	0	1
	39.6	1	0	1
	39.7	2	0	2
	40.0	1	0	1
	40.2	1	0	1
	40.5	0	1	1
	40.6	2	0	2
	40.9	0	1	1
	41.0	3	0	3
	41.1	1	0	1
	42.2	1	0	1
	42.3	1	0	1
	42.5	2	0	2
	43.5	2	0	2
	43.7	1	0	1
	44.3	1	0	1
	44.4	1	0	1
	44.6	1	0	1
	45.1	1	0	1

	45.2	1	0	1
	45.9	1	0	1
	46.4	1	0	1
	46.7	1	0	1
	46.8	1	0	1
	47.0	1	0	1
	47.5	1	0	1
	47.6	1	0	1
	48.2	1	0	1
	48.6	1	0	1
	48.7	1	0	1
	49.7	1	0	1
	50.1	1	0	1
	51.0	1	0	1
	51.9	1	0	1
	52.1	0	1	1
	52.2	1	0	1
	52.5	1	0	1
	53.0	2	0	2
	53.3	1	0	1
	53.8	1	0	1
	55.2	1	0	1
	57.3	1	0	1
	57.7	1	0	1
	57.9	1	0	1
	59.3	1	0	1
	71.6	1	0	1
Total		2015	651	2666

Report			
	LSA_Breadth	IA_Breadth	
Mean	17.662	15.206	
N	2015	651	
Std. Deviation	8.6212	6.3937	

Mlambalasi Tp# 1 Statistical Significance Results for the Breadth measurements

One-Sample Test										
	Test Value = 0									
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference				
			One-Sided p	Two-Sided p		Lower	Upper			
LSA_Breadth	91.963	2014	<.001	<.001	17.6621	17.285	18.039			
IA_Breadth	60.682	650	<.001	<.001	15.2061	14.714	15.698			

7. The Mgera Trench# 2 Length measurements (Data)

length * CULTURE Crosstabulation				
Count				
		CULTURE		Total
		LSA	Iron Age	
length	3.9	0	1	1
	9.0	0	1	1
	11.2	1	1	2
	11.4	1	0	1
	12.1	1	0	1
	12.3	0	1	1
	12.4	1	1	2
	12.6	0	1	1
	13.0	1	0	1
	13.1	1	0	1
	13.4	0	1	1
	13.6	1	0	1
	13.8	0	1	1
	14.1	0	2	2
	14.3	2	1	3
	14.9	1	1	2
	15.4	0	1	1
	15.6	0	1	1
	15.8	1	0	1
	16.0	0	2	2
	16.2	1	1	2
	16.7	0	1	1
	17.3	0	1	1
	17.5	1	0	1
	17.8	1	0	1

	17.9	0	1	1
	18.1	2	0	2
	18.7	0	1	1
	19.2	0	1	1
	19.3	0	2	2
	19.4	0	1	1
	19.8	1	0	1
	20.0	1	0	1
	20.5	0	1	1
	21.7	0	1	1
	22.5	0	1	1
	23.0	0	1	1
	23.8	1	0	1
	24.0	0	1	1
	24.2	1	0	1
	24.4	1	0	1
	25.6	0	1	1
	26.3	0	2	2
	26.6	0	1	1
	27.6	0	1	1
	28.8	1	0	1
	29.8	1	0	1
	35.9	1	0	1
	54.6	1	1	2
	58.9	1	0	1
	59.6	0	1	1
	67.8	0	1	1
	73.8	0	1	1
Total		26	39	65

Report		
	LSA_Length	IA_Length
Mean	21.308	22.382
N	26	39
Std. Deviation	12.156	15.3233

The Mgera Trench# 2 Statistical Significance Results for the Length measurements

One-Sample Test										
	Test Value = 0									
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference				
			One-Sided p	Two-Sided p		Lower	Upper			
LSA_Length	8.938	25	<.001	<.001	21.3077	16.398	26.218			
IA_Length	9.122	38	<.001	<.001	22.3821	17.415	27.349			

8. The Mgera Trench# 2 Breadth measurements (Data)

breadth * CULTURE Crosstabulation				
Count				
		CULTURE		Total
		LSA	Iron Age	
breadth	5.3	0	1	1
	5.6	1	0	1
	6.2	1	0	1
	6.8	1	0	1
	7.1	1	0	1
	7.4	0	1	1
	8.0	1	0	1
	8.3	0	1	1
	8.4	1	0	1
	8.7	1	0	1
	8.8	0	1	1
	8.9	1	0	1
	9.1	0	1	1
	9.2	0	1	1
	9.5	1	0	1
	10.0	0	1	1
	10.5	1	0	1
	10.8	1	0	1
	10.9	1	0	1
	11.4	0	1	1
	11.6	1	1	2
	11.7	1	0	1
	11.9	0	1	1
	12.0	0	1	1

	12.2	1	0	1
	12.3	1	0	1
	12.6	0	1	1
	12.7	1	1	2
	12.9	0	1	1
	13.0	0	1	1
	13.4	0	2	2
	13.7	0	2	2
	13.8	0	1	1
	14.1	1	1	2
	14.3	0	1	1
	14.5	0	2	2
	14.8	0	1	1
	15.2	0	1	1
	15.3	0	1	1
	15.6	0	1	1
	16.6	0	1	1
	16.8	0	1	1
	17.3	0	1	1
	17.8	1	0	1
	17.9	1	0	1
	18.3	0	1	1
	19.3	2	0	2
	20.0	0	1	1
	21.1	0	1	1
	21.2	0	1	1
	22.6	1	0	1
	27.9	1	0	1
	34.4	1	0	1
	40.8	1	0	1
	46.9	0	1	1
	47.6	0	1	1
	57.2	0	1	1
	63.8	0	1	1
Total		26	39	65

Report			
	LSA_Breadth	IA_Breadth	
Mean	14.462	17.674	
N	26	39	
Std. Deviation	8.7302	13.0685	

The Mgera Trench# 2 Statistical Significance Results for the Breadth measurements

One-Sample Test										
	Test Value = 0									
	t	df	Significance		Mean Difference	95% Confidence Interval of the Difference				
			One-Sided p	Two-Sided p		Lower	Upper			
LSA_Breadth	8.447	25	<.001	<.001	14.4615	10.935	17.988			
IA_Breadth	8.446	38	<.001	<.001	17.6744	13.438	21.911			