

ETHNOARCHAEOLOGICAL STUDY OF GRIND STONES AT LAKIA'A IN
ADWA, TIGRAY REGIONAL STATE, ETHIOPIA

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This is to certify that the thesis prepared by Gebre Teklu, entitled: Ethnoarchaeological Study of Grind stones at Lokia'a in Adwa, Tigray Regional State, Ethiopia and submitted in partial fulfillment of the requirements for the Degree of Masters of Arts (Archaeology) complies with the regulations of the University and meets the accepted standards with respect to originality and quality;

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Abstract

ETHNOARCHAEOLOGICAL STUDY OF GRIND STONES AT LAKIA'A IN ADWA, TIGRAY REGIONAL STATE, ETHIOPIA

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The Purpose of this study was to conduct an ethnoarchaeological study of grind stones at Lokia'a in order to generate ethnoarchaeologically based ideas which can help better understand grind stones in the archaeological record. Efforts have been made to address the research questions of this study using primary data and secondary sources. Simple random sampling and purposive method of sampling were employed to prepare a sample size for this study. Observation and interview methods were used to gather data from the sample and their grind stones, and grind stone quarry sites. The gathered data were analyzed and interpreted qualitatively and quantitatively. Correspondingly, the results of this study reveal that the society used grind stones of different raw materials across time. Men undertake practical raw material choice and initial stage of grind stone preparation at the quarry site while women participate in a consultation regarding raw material choice at home and prepare food for the quarry men. Women also perform exclusively the leveling work of grind stone production at home, hammerstone acquisition and the work of foodstuffs grinding. The grind stones are placed in the kitchen and are used to process wide range of foodstuffs. Grind stones are one of the best bridges that connect the people socially and economically. A grind stone and a mano can serve approximately 20-80 years and 4-7 years respectively. Grind stones are reused in the area for different uses after discard. The finding also shows that significant number of people take their useable grind stones with them while they change their settlement mainly due to cultural preference and the fear to take the risk of grind stone production. Furthermore, the finding shows that modern grinding machine could not replace traditional grind stones especially to process ceremonial foods. The results from Lokia'a are combined with the available archaeological data to strengthen the conclusions given by scholars about grinding equipments.

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Table of contents

Contents	pages
Abstract	iii
Acknowledgements	iv
List of Figures	viii
List of Tables	x
Chapter One: Introduction	
1. Statement of the Problem.....	1
2. Objectives of the thesis.....	2
2.1. General Objective.....	2
2.2. Specific Objectives	2
3. Significance of the thesis	3
4. Delimitation of the thesis.....	3
5. Methodology of the research.....	3
5.1. Data source.....	3
5.2. Sample size and sampling methods.....	4
5.3. Data collecting methods.....	5
6. Limitation of the thesis.....	5
7. Organization of the thesis.....	5
8. Description of the Study area	6
8.1. Landscape setting of Lakia'a.....	6
8.2. Climate, Demography, and Vegetation cover in Lakia'a.....	8

Chapter Two: Review of Related Literature

2.1. Introduction.....	13
2.2. Advent, development and cultural continuity of grind stones.....	15
2.3. Raw material type and efficiency of grind stones and manos.....	18
2.4. Production and spatial distribution of grind stones and manos.....	20
2.5. Morphology and function of grind stones.....	22
2.6. Grind stones as indicators of socio-economic status of a household.....	24
2.7. Plant food processing	25
2.7.1. Nature and consumption of plant food.....	25
2.7.2. Pounding and grinding plant food using appropriate processing equipments.....	26
2.8. Ethnographic data on gender roles in a society.....	28

Chapter Three: Data presentation

3.1. Field observations.....	30
3.1.1. Placement of grinding equipments and the work of foodstuff grinding.....	32
3.1.2. Observation on the discarded, reusable and reserve grinding materials.....	37
3.1.3. Grind stone and mano quarry sites.....	40
3.2. Interview of households.....	48

3.2.1. Raw material for, production, transportation of grind stones, mano and hammerstones, and gender roles	49
3.2.2. The nature of socio-economic aspects of the people	51
3.2.3. Mobility of people and the fate of grinding equipments	53
Chapter Four: Data Analysis and Interpretation	
4.1. Raw material procurement and production of grind stones and manos.....	54
4.1.1. Raw material procurement.....	54
4.1.2. Production of grind stones and manos	56
4.1.2.1. Methods of quarrying blanks for grind stones and manos	56
4.1.2.2. Shaping grind stones and manos	60
4.2. Position of grind stones in the household.....	66
4.3. Function of grind stones	68
4.4. The socio-economic interaction of the people and grind stones	73
4.4.1. The labor for food processing	74
4.4.2. Young-old established houses relationship in the use of grind stones.....	78
4.5. Approximate use life, and discard of grind stones	79
4.6. Settlement shift of households and grinding materials.....	84
4.7. Current trend of grind stone use	86
Chapter Five: Conclusions	88
Bibliography.....	95
Internet Sources.....	100
Appendix I	x

List of Figures	page
Fig.1.1. Location map of the study area.....	6
Fig.1.2. Detailed map of the study area.....	7
Fig.3.1. A grind stone and mano manufacturing man in Debresina quarry site measuring the length and width of the grind stones using his finger.....	31
Fig.3.2. Currently service giving syenite-phonolite grind stones.....	33
Fig.3.3. A sandstone grind stone and corresponding manos in use to grind finger millet photographed from the proximal end of the grind stone.....	34
Fig.3.4. A woman grinding a roasted maize for <u>medenden</u> (for cook).....	36
Fig.3.5. A woman soaking the dough of sorghum using small mano with back and forth direction.....	36
Fig.3.6. A working small mano (<u>wede medkos</u>) with intact edges found near the firebox of traditional oven.....	37
Fig.3.7. A small mano (<u>wede medkos</u>) in discard context lying upon animal manure and its edges are chipped away.....	37
Fig. 3.8. Wornout sandstone grind stone being reused as building material.....	38
Fig. 3.9. Used phonolite grind stone being reused as water container (<u>Gabla</u>)for hens.....	38
Fig.3.10. Transversally broken phonolite mano found in discard context together with stones...	38
Fig.3.11. An intact and reusable phonolite mano, but found in discard context together with other stones.....	38

Fig.3.12. A soaking quern (<u>melenkettie</u>) prepared from phonolite rock in discarded context found in the compound of the farmer’s house.....	39
Fig.3.13. Andesite hammerstone lying at the yard of a household.....	39
Fig.3.14. A quarry man (in Debresina quarry site) is showing to the researcher the refilled pit with chipped stones and flakes after the blank was acquired.....	41
Fig.3.15. Semi finished phonolite grind stone from Debresina quarry site with 44 cm length and 31cm width at the center.....	42
Fig.3.16. Syenite rock rich grind stone and mano quarry site in Goure.....	43
Fig.3.17. A semi finished syenite grind stone in Goure quarry site.....	43
Fig.3.18. The oldest syenite–phonolite rock quarry site in Maisheho.....	45
Fig.3.19. Grind stone quarry site with a plenty of flakes near the parent syenite-phonolite rock found some18m west of the oldest quarry site in Maisheho.....	45
Fig.3.20. A recent grind stone quarry site within the large Maisheho quarry site with large syenite-phonolite blank rock for grind stone.....	46
Fig.3.21. A sandstone dominated quarry site for grind stone and mano preparation.....	47
Fig.3.22. A rectangular blank sandstone for grind stone in Daerotaffa quarry site.....	48
Fig.4.1. A quarry man shaping grind stones and manos using small hammer in Debresina quarry site.....	64
Fig.4.2. Reestablished grinding stone placed at the yard of the household’s compound.....	67
Fig.4.3. A woman smashing soaked sorghum using portable grinding stone and small mano just placed temporarily at the compound of one household.....	67
Fig.4.4. Semi finished rectangular sandstone grind stone laid up on animal manure in newly founded household at Endaselafbelay.	79

List of Tables

page

Table 4.1: Rock types (observed) used for grind stones and manos in Lakia'a.....59

Table 4.2: Raw material distribution across villages in the study area60

Table 4.3: Shape of the working surface of the observed grind stones.....61

Table 4.4: Dimensions (in c.m) of the working surface area of grind stones in use context.....82

Chapter One: Introduction

1. Statement of the Problem

The studies of grind stones are some of the most indispensable lithic evidence which can reveal the life style of prehistoric people. Grind stones are one of the ground stone artifacts group which have long been recognized as the central feature in the development of early farming societies in the Near East (Wright 1991). Grind stones (manos and metates) are the most important artifacts to process mainly ceremonial foods in the American Southwest (Adams 1996). Furthermore, people mainly in the rural areas of Axum cultivate most crops, and process their foodstuffs using elongated grind stones in much the same way as the ancient Axumites did in the past (Phillipson 2001).

Most recent archaeological work has underscored on the analysis of variability in ground-stone assemblages' to conclude changes in the subsistence economy, particularly the intensification of agriculture (Stone 1994). But, the studies of grind stones found in the archaeological record may not be enough for the understanding of the prehistoric societies. Further clarifying studies such as ethnoarchaeological researches of grind stones are important for better understanding of grind stones in the archaeological record. Hence, an ethnoarchaeological work with grind stone can provide us with significant insights and can be a base to infer about the agricultural origins, division of labor, social interaction and other aspects of life of the people in the past.

Yet, although the use of traditional grind stones has persisted in rural areas and even in some urban centers of Ethiopia, no ethnoarchaeological studies of grind stone have been made. This initiated the researcher to conduct an ethnoarchaeological study of grind stones at Lokia'a in Adwa, Tigray Regional State, Ethiopia. Lokia'a was selected for two reasons: first, the society in

the area has continued grinding using traditional grind stones. Second, grind stones are found in archaeological context in northern Ethiopia (Dombrowski 1971; Phillipson 2001; Agazi 2001; Alemseged 2004). This thesis is, therefore, an attempt to establish ethnoarchaeologically based ideas which can help better understand grind stones in the archaeological record. This research addresses:

1. How does the society obtain the raw material, prepare and use grind stones?
2. How many grind stones does a household have?
3. What does the society grind with grind stones?
4. How long does a grind stone serve a household?
5. What does the society do after the grind stone is worn out? Does the society reuse it or dispose it? Where does a household put the used /discarded grind stone?

2. Objectives of the thesis

2.1. General Objective

The general objective of this thesis is to conduct an ethnoarchaeological research of grind stones at Lakia'a in Adwa, Tigray Regional State, Ethiopia in order to generate ethnoarchaeologically based ideas which can help better understand grind stones in the archaeological record.

2.2. Specific Objectives

This thesis has the following specific objectives;

1. To understand the raw material procurement, production and function of grind stones in Lakia'a.
2. To describe grind stones in relation to the socio-economic situation of the society.

3. To distinguish the life of grind stones from raw material obtainment through to disposal.
4. To identify the changing trend in the use of grind stones.
5. To examine gender roles in preparing and working with grind stone in the society.

3. Significance of the thesis

This research is expected to fill the evidence gap for archaeological investigations by providing ethnoarchaeologically derived ideas. The research would also save the evidence that one can get from traditional grind stones and manos, and mortars, which are on the way of extinction. Furthermore, the research would be a base for archaeologists and anthropologists to undertake further researches in the area. Finally, it would serve as a reference for students and scholars.

4. Delimitation of the thesis

It was the interest of the researcher to undertake an ethnoarchaeological study of grind stones that included as extensive area as possible. However, in the presence of limited time and lack of enough research resources it was difficult to hold a large scale research. As a result this ethnoarchaeological study was delimited to a single tabiya (village collectives) Lakia'a, in Adwa woreda, in the Central Zone of Tigray.

5. Methodology of the research

5.1. Data source

The primary source of data for this thesis was the selected people and their traditional grind stones together with quarry sites in Lakia'a and nearby localities. Furthermore, secondary

sources were also gathered through intensive reading of ethnographic documents, related books, archaeological journals, bulletins, and articles about grind stones.

5.2. Sample size and sampling methods

Several suggestions have been forwarded about the sample size for a certain research to be accurate and valid. Among others Nachmias and Nachmias (1987: 1995-1996 as cited in Esayas (2011) stated that a sample size should be made in a regular proportion usually at 5% from the total that the researcher wants to study (population). They further noted that an increase in the sample size will increase the precision of the sample result.

It is also suggested that sample size depends up on the nature of the population of interest of the data to be gathered and analyzed (Best et. al. 1983 as cited in Esayas 2011). A heterogeneous population will be harder to measure precisely than a homogeneous population. The higher the degree of variability in a population, the larger the sample size must be prepared to obtain the same level of precision (Watson n.d, <http://www.extension.psu.edu/evaluation/pdf/TS60.pdf>).

The degree of population variability in Lokia'a is, however, minimal. Keeping in mind, the nature of the population in Lokia'a, the expected response rate from the sample size, the available resource and time to conduct the research, the researcher prepared a sample size for this thesis based on the regular proportion of the total households found in Lokia'a. However, for the sake of maximizing the precision level of the research result I added some samples to the already proportionally sampled households.

Accordingly, 59 households were sampled using simple random sampling method and purposive sampling method from 857 total households in Lokia'a. 43 households of the total sample size (59 households) were sampled using simple random sampling method proportionally of the total

households while additional 16 households were selected using purposive method of sampling in order to support and increase the validity of the evidence gathered from the sample.

Note that in applying purposive method of sampling I set some parameters like age of the person of interest and relative age of the established household, proximity of the household to quarry sites and modern grinding machines, settlement shift experience of the household as well as economic power of the household. This sample was believed to be adequate and representative of the total households in the study area.

5.3. Data collecting methods

The data for this thesis was gathered mainly through: field observation and interview of people from the study area during the two month field work in Lokia'a. These methods were selected so as to gain first hand information from the sample size prepared for the study.

6. Limitation of the thesis

The rugged topography of the study area, the presence of dangerous dogs keeping the compounds of the farmers, made the field research difficult to the researcher. The absence of ethnoarchaeological studies of grind stones in Ethiopian context and limited foreign literatures about ethnoarchaeological studies on grind stones, budget and time constraints were also limiting factors in preparing this thesis.

7. Organization of the thesis

The thesis is organized in five chapters. Chapter one of the thesis highlights the introduction part: Statement of the problem, Objective of the thesis, Significance, Delimitation, Methodology of

the research, Limitation of the research and Description of the study area where as chapter two presents the Review of Related Literature about grind stones and associated ideas. Chapter Three presents the data collected from the field. Chapter Four is devoted only for the analysis and interpretation of the gathered data. Finally, Chapter Five finalizes the thesis with Conclusions.

8. Description of the Study area

8.1. Landscape setting of Lakia'a

This ethnoarchaeological study of grind stones was conducted at Lakia'a (a village collective) in Adwa, in Central Zone of Tigray (Figure 1.1).

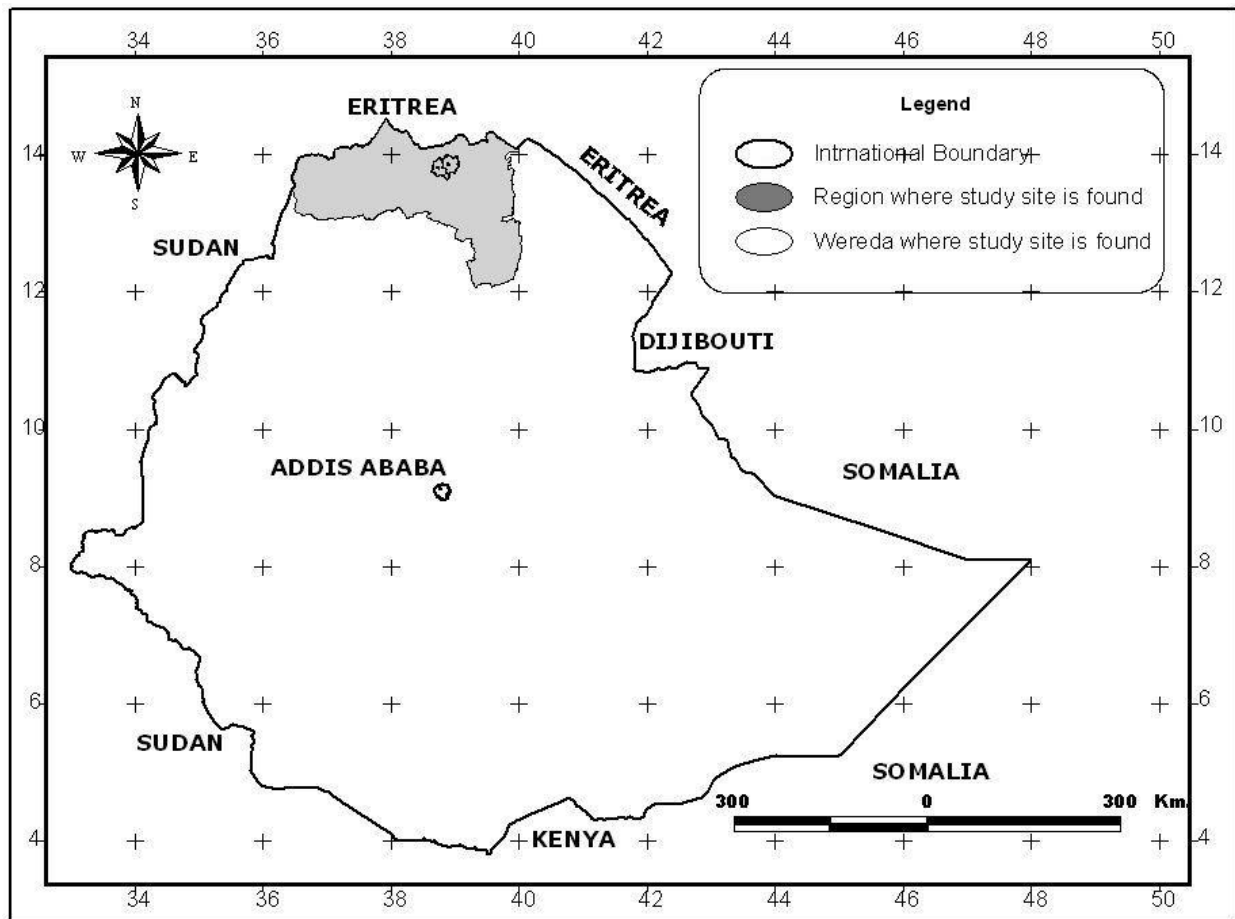


Figure 1.1 Location map of the study area.

The study area is located in the mid way between Adwa and Axum towns'; some 13 km east of Axum and west of Adwa towns. Lakia'a is bordered by tabiya Wuhidet in the northwest part, tabiya Bete Yohanes in the north east, east and south directions. It is also bordered by tabiya Maiwoynee in the south west direction (Figure 1.2).

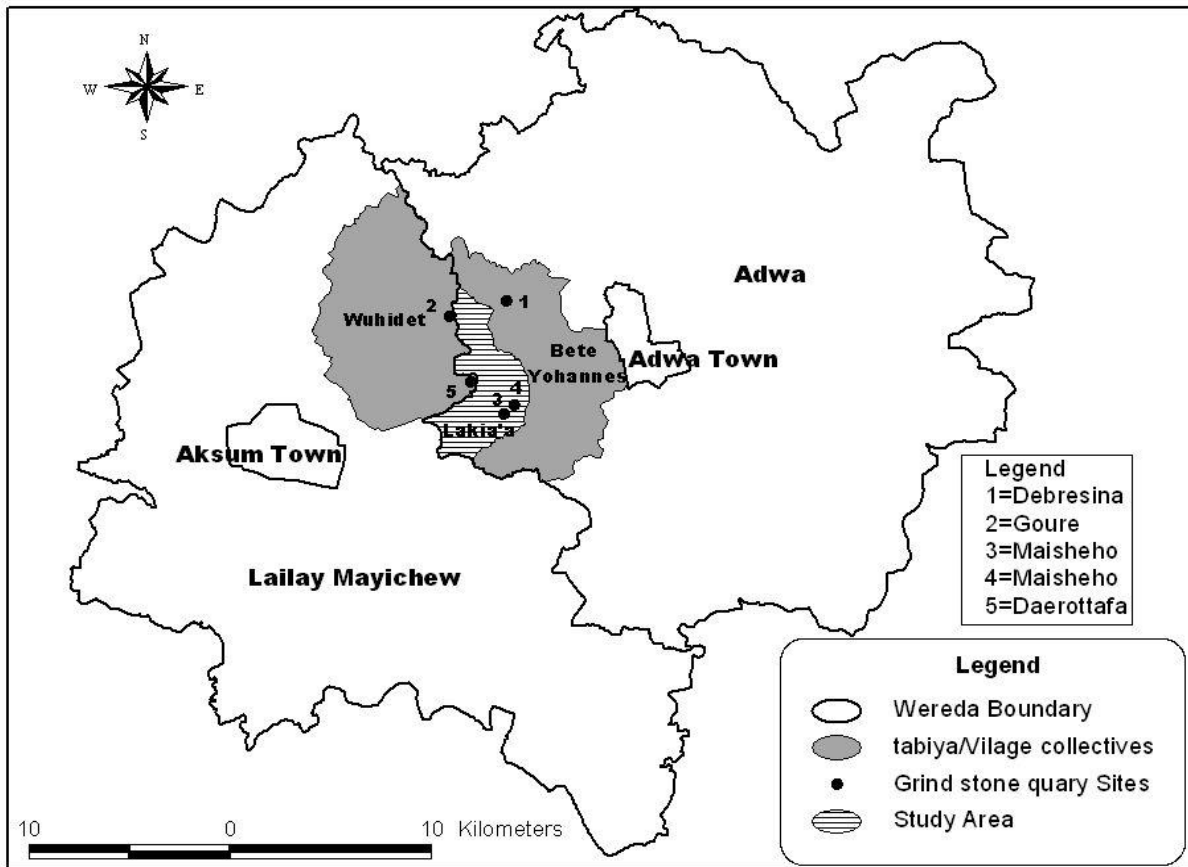


Figure 1.2 Detailed map of the study area.

Lakia'a is divided in to three villages (*kushet*) namely: Damo, Lakia'a, and Maisheho. The Adwa–Axum main vehicle road which passes through village Maisheho roughly divides the tabiya in to two. The villages are delimited by gorges and ancient established churches. Largely, the established households in village Lakia'a and Maisheho are better clustered to each other and these two villages are separated by the Saint Michael church and a gorge that runs down from

village Lakia'a and separates village Maisheho from villages administered in tabiya Bet Yohannes.

Village Damo is separated from the two villages (Maisheho and Lakia'a) by a large gorge called Mai Shaka. This village covers the north eastern expression of the tabiya and separates tabiya Lakia'a from tabiya Wuhidet which is found northwest of village Damo.

Physiographically, the villages in tabiya Lakia'a hold features such as rugged terrains, steep cliff which is largely dominant in Maisheho and Damo villages, large and small gorges having streams, dense eucalyptus and other plants, cultivated hills and plains on the top of plateau and small pasture lands more particularly situated in between village Damo and Maisheho at the bottom of the continuous gorge that separate the two villages.

The dominant soil types in Lakia'a are clay soil and silt soil. Clay soil is found exclusively in Lakia'a village where as the silt soil is found extensively in Damo and Maisheho villages. The hills and gorge flanks in Lakia'a are characterized by series terracing of stones and soil. The terracing are built in order to conserve the erodible soil by running water especially in times of rainy season and increase the available land for reforestation, and cultivation. The people in the study area have inhabited largely at the hills and on plains at the top of the plateau. Except the Maisheho quarry sites found in village Maisheho no grind stone quarry site is found within the study area and most of the grind stone quarry sites are located in the nearby tabiya (Figure 1.2).

The landscape of village Damo and Lakia'a do not have out crops useful for grind stones and mano manufacturing. Village Damo is characterized by silt soil, where as clay soils, basalt, and andesite, are plenty in village Lakia'a.

8.2. Climate, Demography, and Vegetation cover in Lakiya'a

Based on the National Atlas of Ethiopia, the climate of Ethiopia is more affected by altitude than latitude (Source; Ethiopian Mapping Agency: National Atlas of Ethiopia 1981). The relationship between altitude and temperature in Ethiopia results in five local temperature zones: "kur" in areas with altitude above 3300m and 10C⁰ or less mean annual temperature, "dega" in areas with altitude of 2300m-3300m and 10C⁰-15C⁰ mean annual temperature, "woina dega" in areas with altitude of 1500m-about 2300m and 15 C⁰-20C⁰ mean annual temperature, "kolla" in areas with altitude of 500m-1500m and 30C⁰, and "berha" in areas with altitude less than 500m and temperature 30C⁰-40C⁰ (Ibid).

Having presented the temperature zones of Ethiopia and looking into the measurement of altitude and temperature in Lakiya'a, the study area is found in sub-temperate (*woina dega*) agroecology with altitude of 1950m-2,290m above sea level, mean annual temperature that ranges from 17C⁰ – 25C⁰, and with mean annual rainfall of 650mm (Yesaq pers.com). The area is suitable for agriculture and has been supporting diverse plant species.

Lakiya'a is inhabited by Tigrinya speaking people who mainly subsist on mixed farming. The total population in the study area is currently 5,017. The people are clustered in 857 households (Yesaq pers.com).

The subsistence economy of the people is dependent on traditional ox-plow farming practice. The people cultivate different legumes such as; Pisum stivum (pea), Cicer arietinum (chick pea), Phaseolus vulgaris [common/fieldbean(English) *aâter bahâri* (Tigrinya) *baqela* (Amharic)], cereals; Triticum spp [wheat(English); *sirnai* (Tigrinya); *sindaa* (Amharic)], Hordeum vulgare [barley (English); *sgem* (Tigrinya); *gebis* (Amharic)], sorghum spp [sorghum (English); *meshela* (Tigrinya); *mashila* (Amharic)] Zea mays [maize (English) ; *mshelabâhri* (Tigrinya); *Bekollo*

(Amharic), Eragrostis teff [*taf* (Tigrigna) ; *tef* (Amharic)], Eleusine coracana [finger millet(English); *dagusha* (Tigrigna); *dagussa* (Amharic)], (Barnett 1999 note; Tigrigna names , Amharic names and italics are added), Rhamnus prinoides [*Gesho* (Tigrigna &Amharic name)], pepper [*berbere* (Tigrigna); *beriberi* (Amharic)], Guizotia abyssinica [*nuhig* (Tigrigna) ; *noog* (Amharic)] (Harlan 1969 note; Tigrigna names and *italics* are added) , intercropped barley and wheat [*hanfetse* (Tigrigna)] (Bedigian 2001), Ricinus communis [*Guli* (Tigrigna)] (Edward et. al. 1995), Linum usitatissimum [*entatiê* (Tigrigna); *telba* (Amharic)] and tubers: Rumex abyssinicus (*meqmoko*), Allium sativum (garlic), Allium cepa var aggregatum (red onion) (Bekelech 1999).

Some cereal crops such as naked two-row barley (*demhay*), white barley, white and black type barley (*âtsa*), finger millet (*dagusha*) are cultivated to date in small scale. Maize cultivation was also limited to mostly small fertile land near the compounds of households, because the land gets more animal dung and makes the maize productive. Furthermore, the interviewee mentioned durum wheat (*Kinkina*) as a type of crop which is no longer grown in the study area. However, they stated that it is currently introducing in tabiya Wuhidet a nearby village collective to the study area. Several factors like the presence of termite, striga weeds, delay of rain fall might have influenced for the discontinuity of durum wheat(*Kinkina*) and small scale harvest of the afore mentioned crops. Besides to crop production the people in Lakiya'a rear domestic animals like cattle, goat, sheep donkey and rarely horses.

Compounds of the farmers are surrounded with stone walls. Within it there are rectangular and circularly structured houses which are built with stones and roofed with different materials. The rectangular shaped houses are largely thatched with sheet metal (tin). Some of the structures are roofed with a combination of strong and durable woods, flat surfaced stones and mud. Such

houses are locally called *hidmo*. The dome shaped kitchen houses are roofed with Euphorbia abyssinica (*qolenqual*) trees (Edward et. al. 1995), grasses that look like savanna grasses and sorghum stalks. In the study area the main house within the compound is used to house foodstuffs stored in *koffo*, a traditional grain storage facility, and personal properties. Almost no difference was observed in the structure of houses from village to village in Laki'a. Nevertheless, the number of houses and the material that roofed the houses within the farmers' compound depends on the socio-economic power of the household.

With respect to the vegetation cover, the study area is covered with scattered plants. Anything resembling forest coverage is largely confined to the ridges, and piedmont areas, around the heads of gorges, near springs, within churches, monasteries and near settlement compounds.

The variety and extent of vegetation cover may be dependent on soil depth, geology, mountain slope, and the degree of protection (natural or man-made) from woodcutting and grazing afforded by the site. Although large parts of mountain flanks in Laki'a tend to be bare, some steep slopes exceptionally have good vegetation cover.

The study area is currently scarcely vegetated with plants mainly Eucalyptus globulus (*qelamitos*), Croton macrostachyus (*tambuk*), Euphorbia tirucalli (*qnchb*) (Edward et. al. 1995) Ficus vasta (*Daêro*), Acacia albida (*momona*) (Hedberg and Edward 1989), Cordia africana (*äquee*) (Bekelech 1999) used for the preparation of wooden mortars, Apparis micrantha (*ändiel*) and Opuntia ficus-indica (*kolenqual bahâri*) (Philips 1995), Buddlea polystachya (*metere*) (Hedberg et. al. 2003), rarely Phytolacca dodecandra (*shibti*) (Edward et. al. 2000) along the hill flanks facing to *tabiya* Wuhidet, amba flank facing to village Damo and, hills as well as around occupational areas and cultivable lands. Based on the evidence gathered from local informants, the study area was densely vegetated up to the last four decades. It is the recent memory of the

informants (especially old men and women) who suggested that almost all of the study area was a forested area during which time varieties of trees and shrubs had been covered the bare lands in the tabiya. They confirmed that it was easy to access different types of wild resources including fruits: Diospyros mespiliformis (*'aye*), Mimusops laurifolius (*Kummel*) varieties of uncultivated tubers: Ceropegia convolvuloides (*merequah*) (Hedberg et. al. 2003) and seeds of annual herbaceous taxa.

However, with the rapid population growth and eventual expansion of settlements in the area, the forests were cleared off for the purpose of arable land preparation and building materials extensively, especially up to the coming of sheet metal for roofing. Besides, livestock overgrazing and the cutting of woods for fuel as well as for sale was another facilitating factor for the rapid clearance of forests in the study area. Such factors played a devastating role for the reduction and clearance of forest cover in the area. Today, the people in the area are struggling to rehabilitate the area by soil and water conservation tasks, and successive reforestation and protection activities.

Chapter Two: Review of Related Literature

2.1 Introduction

In the field of archaeology, studying the present is helpful to interpret the past. Studying the present can be held through ethnoarchaeological research (London 2000). Stiles (1977) defined ethnoarchaeology generally as “encompassing all the theoretical and methodological aspects of comparing ethnographic and archaeological data, including the use of the ethnographic analogy and archaeological ethnography”. Ethnoarchaeology concerns the combination of ethnographic data and archaeological data and utmost it studies human behavior and the material culture, spatial and environmental context where it happened (Musalem-Perez 2009).

Ethnoarchaeologists, like ethnographers, study a contemporary society, but with the specific purpose of understanding insights of how such societies produce the material culture, use material culture, discard material culture, why they do their settlement where they do and the like (Renfrew and Bahn 1996). Ethnographic analogies between living societies and ancient societies can produce important evidence in order to framework relatively clear picture of the ancient societies and their functions (Shrotriya 2007). Beginning in the early 20th Century many ethnoarchaeological researches were made within living communities intended to understand prehistoric people and their cultures. However, these studies have largely emphasized on hunting and gathering peoples and their activities (Ibid). Despite ethnoarchaeology experienced rapid development in sub-Saharan Africa since the late 1980s, it made slow inroads into Ethiopia (D’Andrea et. al. 1999). The ethnoarchaeological works in Ethiopia has been tended to emphasize on pottery, hide-working and associated lithic tool production, and enset (*Enset ventricosum*) cultivation in southern Ethiopia (Ibid).

However, though potential ethnoarchaeological studies on grind stones in Ethiopia can provide us valuable insights to strengthen our interpretations of grind stones in the archaeological record, it seems that little focus has been given for this field.

The lithic nature of grinding materials made grind stones often to be the only artifacts in the archaeological record containing important evidence of food processing behaviors of ancient populations (Duffy 2011). “Food grinding tools are found archaeologically in many regions of both the Old and New Worlds and have been the object of study from the earliest days of the field (Bennett 1898)” (Ibid).

Viable archaeological evidence of grinding stones has been discovered from different sites in Ethiopia. Many grind stones were discovered through archaeological excavations at Natchabiet and Lalibela in Begemder province (Dombrowski 1971). Majority of the grind stones found at Natchabiet are manos while two grinding artifacts are broken pieces of lower grinding stones, a large pounder, and a grind stone on which cotton is put up to separate the seed from the fiber (medamecha). Largely the grinding materials from Natchabiet are made of fine grained hard rock. Six grinding artifacts are prepared from scoriaceous lava which is available around Bahir Dar and this raw material is manufactured into grinding stones, for sale at local market, by the Wayto people living around Lake Tana (Ibid).

Furthermore, Dombrowski uncovered 27 grinding stones from Lalibela. 18 of the grind stones are handstones (upper grind stones) where as six grind stones are lower or parts of lower grinding stones. Some of the grinding materials from Lalibela are identified for their respective function, as for example, an upper grind stone is specifically recognized as an indoit metacosha, a grind stone that serve especially for indoit root processing, and a grind stone for the purpose of fiber-seed of cotton separation (a similar function with a grind stone found at Natchabiet). In his

research regarding the Holocene Prehistoric Archaeology of Temben Region Agazi (2001) unearthed 34 upper and lower grinding stones at Ba'ati Ataro in Temben, Tigray Regional State. The lower grind stones from this site are prepared from sandstone. Besides Alemseged (2004) identified a grinding stone from the surface at Adi Bozet a site found in Shire, North Western Zone of Tigray. Adi Bozet might have been a good center of food producing society during the Dahthamai phase of the Ethio-Arabian style of rock art particularly around the early time of the first millennium B.C (Ibid).

Ethnoarchaeological observations on grind stones are very minimal in Ethiopia. Phillipson (2001) made brief observations on traditional grind stones in Axum. The brief observation was intended to strengthen the interpretation, and contextualize the discovered artifacts in Axum, particularly at Kidane Mihret, about 1 km north of Axum, where evidence of Axumite agricultural economy, grind stone, mortars, pestles, mullers and related artifacts were found through archaeological excavation.

But, well organized ethnoarchaeological research of grind stones was not conducted in Axum and in the nearby territories. Therefore, this thesis will describe the production of grind stones, use of grind stones, changes in grind stones morphology after use, disposal of grind stones, gender roles in the society together with subsistence economy of the people at Lakiya'a in Adwa and combine the evidence from Lakiya'a with archaeological data to help understand grind stones in the archaeological record.

2.2. Advent, development and cultural continuity of grind stones

Human beings consume foods of various types and styles. Before farming communities were established food gathering and meat eating were simple, but food processing became more

complex with the advent of agriculture due to the need for removal of inedible part of the seed from the edible one and grinding those to make flour using certain group of tools and techniques (Zhoa-Lin 1997). Processing pigments, cereals and other plant foods using grind stones and related artifacts by human beings dated back to prehistoric times. Despite grinding technology appears in early prehistory, its expansion seems to coincide with the event of transition from gathering-hunting societies to farming societies (Dubreuil 2001).

Grinding materials represent distinctive mode of action aimed at crushing, and grinding in to particles or powder. Grinding artifacts includes: lower grinding stones, handstones, pestles and mortars (Ibid). Lower grinding stone is stationary stone used with an upper and mobile handstones. It is used mainly for grinding purposes. A mortar is a lower, stationary stone used with an upper and mobile stone known as pestle. The mortar serves largely for pounding activities (Wright 1994).

Kraybill (1977) as cited by Duffy (2011) discovered some of the earliest none complex grinding stones in South Africa dated to 49ky B.P, and the early basin-type stones that belonged to the Upper Paleolithic from a site of Negev, Israel, Middle East.

However, Wright (1991) stated that the earliest ground stone implements appeared during the Upper Paleolithic phenomenon (45 ky-22 ky B.P). The archaeological evidence from Upper Paleolithic sites in southwest Asia had revealed the presence of assemblages with many small sized portable handstones and lower grinding stones. She further discussed that handstones in the early Upper Paleolithic mostly have ocher leftovers and are the same in artifact morphology and raw material to hammerstones. Around the fall of Upper Paleolithic grinding tools lacking ocher become more common perhaps indicating that these served diverse functions. “Residue studies

indicate that similar tools were used for processing tubers in late Paleolithic Wadi Kubbania (Egypt) at about 19,000 b.p” (Ibid). She added that direct evidence is not found whether Upper Paleolithic grinding tools were used for processing seeds in general and cereals in particular (Ibid). Nevertheless, Dubreuil (2004) as cited by Duffy (2011) noted that an increase in the working surface of Natufian grinding tools is particularly indicative for the increased consumption of cereals and legumes.

Grind stones that belong to the Pleistocene epoch are discovered in Australia and to date the culture of using grind stones has persisted in Australia (Duffy 2011). “In the New World, the native peoples of North America also used manos and metates perhaps as far back as the late Pleistocene (Ray 1940) and the pre-Paleo-Indian period in North America (Carter 1977:707)” (Ibid).

Adams (1996) presented that the earliest metates were used to grind wild nuts and seeds. New mano and metate designs accompanied with corn were said to have been appeared during the first years of 4th century A.D. She added that basin metates were used to process gathered seeds and nuts. It is also assumed that slab metates served the same function as basin metates did. Slab metates develop shallow basins if they are used for extended time with manos shorter than the working surface width of the metate (Ibid). Trough metates were part of an agricultural complex which was introduced into the American Southwest from Mexico around A.D. 300. They were designed with broad, straight-sided troughs to confine dried corn kernels, which were ground to flour with large manos (Ibid).

Phillipson’s (2001) ethnographic account made in Axum town and its adjacent areas show that people in the town and virtually in all rural areas persisted processing their foodstuffs on grind

stones which are almost identical in materials, shapes and sizes to the Axumite grinding artifacts uncovered from Kidane Mihret. She described that the lower grind stone is frequently relatively flat, plano-convex, and concavo-convex or, if used on both sides, biconcave in cross-section.

Today the users in the area name grind stones according to the use grind stones serve, which is identified partly by the roughness and hardness of the grind stone (Ibid). Likewise, different shapes of upper stones used with lower grind stones, are named not either by their shapes or by the back-and-forth motions, but they are simply named *wadi* (son of) the grind stone with which they are used (Ibid).

Adams (1996) noted that grind stones, today, are being used to process foodstuffs, more particularly ceremonial foods, that modern milling machine cannot accomplish. It is partly because of this that traditional grind stones have faced minimal influence from modern technologies in some places. Hence, technologies relating to food preparation have been the slowest to change, even when users have more efficient alternatives. This is particularly evident in the American Southwest where, even today, Native American women use stone manos and metates to grind corn meal, especially for ceremonial occasions as for example *piki* a special type of bread which is prepared on large stone slab over a hot fire in the modern pueblo villages of Hopi and Zuni (Ibid).

2.3. Raw material type and efficiency of grind stones and manos

Archaeological data show that, the Bladen communities in southeastern Maya mountains had used largely manos and metates made of volcaniclastic sedimentary rocks and from volcanic rocks in small scale during late-terminal classic period (Abramiuck and Meurer 2006). Grind stones made of silicified sandstone were dominant in Upper Egypt and Lower Nubia from 18,000 B.C to 11,000 B.C (Bloxam et. al. 2007). The evidence from some Axumite archaeological

sites indicates that coarser and harder stones were used, for grind stones (Phillipson 2001). Axumite grind stones were prepared from sandstone which is abundantly available near Adi Tsehafi, an Axumite site found about 5 km North West of Axum and even near Kidane Mihret in Axum (Ibid).

Availability, distribution, and quality of raw material influence tool technology, aspects of material procurement, manufacture, use and discard patterns (Stone 1994). Cost of production and transportation sometimes compels people to reuse so far served grinding artifacts around them. Ethnographic data shows that some people had been reusing grind stones around them instead of preparing grind stones of their own (Simmis 1983). This might be due to the discouraging influence of the costs of grind stone production. For example, in Australia, when Alyawara speaking Aborigines need to grind seeds, they often search left or hidden grinding materials from former settlement sites instead of producing new grind stones (Ibid). Besides, a demand to reduce transportation costs would also be another reason arouses people to reuse grinding stones from nearby sites. This was typically experienced among the Great Basin hunter-gatherers (Ibid).

Acquisition of raw material might initiate a trip to or exchange for raw material from a geologic source located at some distance from the residence (Adams n.d, http://www.archaeology.southwest.org/pdf/rn/rio_cienage_nuevo_ch09.pdf). People travel to procure raw material for grind stones not only in times of complete raw material scarcity near their settlement, but also they travel to distant quarry site in search of quality rock blocks, though rock blocks with moderate quality are available around their settlement (Ibid). Rowan and Ebeling (2008) presented that the Natufian populations of the Near East during 12,500–10,200 B.P used to

obtain more distant basalt sources rather than those material available near home, reasonably due to good qualities of the distant raw materials.

Grind stone efficiency is influenced by raw material type and the raw material used for grinding artifacts must be dense enough, hard and durable to process the foodstuffs effectively without wearing and tearing rapidly and lacks grit inclusion to the foodstuffs while processing (Stone 1994).

The study of raw materials provides insights for determining the type of end product, the pollution of the ground material, the rate of tool rejuvenating, and tool management in general (Dubreuil 2001). Yet, selection of raw materials should be considered in light with criteria's not only related to the grinding process, but also the accessibility of raw material, quality of blocks, and how easily it can be shaped. Comprehending material choice in archaeological contexts and defining its functional meaning indicates examining the potential source of the raw material availability and the like (Ibid).

2.4. Production and spatial distribution of grind stones and manos

Grind stones and manos are members of the broad artifact class of "ground stone" produced by combinations of flaking, pecking, pounding, striking, grinding and incising (Wright 1991). Time length in the preparation of grind stones is variable. According to Simmis (1983) an experiment made by students of the University of Utah shows that producing a metate can take from less than an hour to several days. This process could be influenced by the size and type of material used during production. Mano preparation can also take several hours after the blank is found. Contrary, some grinding stones are produced easily with little production cost (Ibid).

The degree of specialization can also affect the production of grind stones and manos. In studying specialized ground stone production in the Casas Grandes region of northwestern Mexico, Vanpool and Leonard (2002) stated that products produced by specialists have little morphological variation while products produced by general producers (non-specialists) have viable morphological difference.

Archaeological and ethnographic data indicates that useable grinding equipments passes through some stages of production and most of them undertake their entire and /or initial stage of production at the quarry site (Conlee 2000; Abramiuck and Meurer 2006). For example, considerable number of mortars and pestles abandoned in various stages of manufacture discovered at CA-SMI-503/504 quarry sites in San Miguel Island is an indicative that the process of manufacture took place at the quarry site. Early and most risky stages of production were undertaken at quarry sites so that if a tool failed, another could be easily started as well as to minimize transport cost of a semi finished grinding artifact (Ibid).

Wisdom (1940:31) as cited in Abramiuck and Meurer (2006) discussed that the Pokoman manufactured metates at the quarry site before metates were transported. The remoteness of a settlement from a quarry site can affect the size of grind stone and mano to be produced. With respect to this Stone (1994:11) has the following to say:

Metates made from locally available material are significantly longer, averaging 20.7cm, than metates manufactured from nonlocal material, averaging 15.3cm. Additionally, the grinding surface area of metates made from locally available material averages 266.7 square centimeters, while metates made from nonlocal material average 158.5 square centimeters. The smaller size of the metates made from nonlocal material is likely a result of an attempt to reduce transport costs associated with more distant resource procurement rather than the amount of foodstuff processed with the metate.

In historic period people were trading raw materials for grind stones with other artifacts. For instance, by the Roman period, basalt was exchanged for large grinding materials throughout the Eastern Mediterranean, the Adriatic areas as well as Southern Europe and North Africa (Rowan and Ebeling 2008). Abramiuck and Meurer (2006) stated that the Bladen communities in highland Maya had been supplying raw material for grinding equipments and manufactured manos and metates to communities throughout Maya lowlands during 600-900 A.D.

These processes are basically of great value to understand the use of material resources, distribution of items, and the important insights necessary to conclude patterns of socio-economic organization, social relations of people at inter-regional and intra-regional levels (Rowan and Ebeling 2008).

2.5. Morphology and function of grind stones

Grind stones vary in shape. The diversity of shape of grind stones raises the question of the function of these tools. The applications of different power of movement (motion) in order to process varieties of substance lead to the development of different shape of working surface morphology. Because various materials processed by a given human group may require different modes of grinding and the tool can be adapted to carry out this work in different ways (Dubreuil 2001). “The final form in which archaeologists discover an artifact is the product of a variety of processes, including intentional design, use modification, re-use and post-depositional alteration”(Rowan and Ebeling 2008). The diversity of morphology of grind stones in the archaeological record can demonstrate that there are tools served for various purposes (Dubreuil 2001). But, it is advisable to take in to account such influencing factors as raw material availability, shaping techniques, use, post depositional processes and the like so as to

comprehend morphological difference of artifacts in the archaeological record. Ethnoarchaeological researches can elaborate the role of morphological difference of grind stones in expressing variations in motion and types of materials ground by the tools (Ibid). Understanding the function of grinding stones is one way to investigate ancient economic activity (Liu et. al. 2010). Regarding the function of prehistoric grind stones, some scholars have forwarded that grinding materials were first used to process pigments and were then used to process vegetable matters. Although grinding materials of the Levant in Near East contain traces of pigments, direct evidence revealing the use of these grinding materials of the prehistoric period is yet not found (Wright 1994). In the Sahara grinding stones were used for plant processing as far back as the Last Glacial Maximum (Hassen 1998 as cited in Alemseged 2004).

The advent and development of different grinding materials during the Natufian in the Middle East shows extensive consumption of plants before sedentary life was began (Dubreuil 2001).

Grind stones grind wide range of grains in to flour and/or are also used to process tubers as well as extract oils from vegetables and peanuts (Goldstein 2008). “Different-shaped stones are used for different activities: round, flat or oblong stones are used to grind or mince, while spherical stones are used to tenderize meat” (Ibid).

Morphological changes of ground stones are witnessed through prehistory. This phenomenon is thought to correlate with changes in subsistence strategies (Conlee 2000). Several early archaeologists worked on the assumption that the shift from intensive wild plant consumption to the consumption of domesticated plants was noticed by changes in ground stone artifacts, especially grinding stones, handstones, mortars, pestles etc. An argument on such ground is logically reasonable, but has proven difficult to demonstrate, and variable according to region (Rowan and Ebeling 2008). Analytical studies of ground stone assemblages in most cases

framework the same assumption that artifact morphology directly expresses the function of an artifact (Ibid). However, Wright (1994), based on her experimental data and ethnographic data, has challenged the above stated assumption. She identified that tool morphology is not linked for particular use or diet. Considerable ethnographic and ethnoarchaeological studies provide cautionary tales that emphasizes the need to carefully understand the functions of grinding implements. The data from such ethnographic observations clearly indicate that tool use is often more complicated than scholars usually thought, and that many tools serve diverse function (Rowan and Ebeling 2008).

2.6. Grind stones as indicators of socio-economic status of a household

Grind stones can often clue about the households' life stage. Some households may have more than a grind stone while others are with no grinding equipments. Newly married couples do not always have their own grinding materials at the early time of their family foundation (Goldstein 2008). Despite the couple establishes their own home and start preparing their food, they do not often have grinding stones, and instead they process their foodstuffs on grind stones of their parents (Ibid). Economically, this is a right decision, because the newly founded households are with smaller family size and weak economic bases where as large households having organized foodstuff processing tool kit, and with multiple generations' have significant capacity to perform daily household activities. Processing foodstuffs using grinding stones needs considerable time and labor investment (Ibid). Dorsey (1899:741 as cited by Vanpool and Leonard 2002) described that Hopi women in the American Southwest, in historic period, spent 3-5 hours a day grinding corn and other seeds. This labor intensive work contributes for physical damage of the grinder labor. "Bone deformities associated with heavy grinding are found with both female and male skeletons in the Near East but grinding of grain and the technology of stone querns is associated

with women and found in women's graves in Europe as the technology spreads" (Brewer 2004). McCafferty and Mittler (1996 as cited by Vanpool and Leonard 2002) stated, based on skeletal evidence, that processing using metates was performed by female during prehistoric time in the Southwest. As I understood from several literatures, however, people as for example in the American Southwest, in Sukur, Nigeria, in Australia and in Axum areas still keep using traditional grind stone owing to cultural and economic reasons regard less of the labor and time investments that it requires. For instance, women in Sukur, Adamawa State, Nigeria, process their foodstuffs using traditional grind stones in times when they are unable to take their foodstuffs to modern grinding machine or lack cash to pay the miller (David 1998).

2.7. Plant food processing

2.7.1. Nature and consumption of plant food

Human beings have been consuming various plants which grow naturally and/or cultivated in diverse environmental and climatic conditions. The pre-Axumite societies have been cultivating plants which belong to the Near Eastern cultigens, in addition to teff which is local cultigen. During the Axumite period these cultigens together with other African plants such as African finger millets, sorghum, *noog*, and cotton are found (Moulins 2001, *Italics* is added). Today, mainly people in the rural areas of Axum continued cultivating and processing crops by the same food processing techniques and ways as was done two millennium or more years ago (Phillipson 2001). Bedigian (2001) presented that people in Ethiopia cultivate intercropped barley and wheat (*hanfetse* which means mixed) to minimize the fungal attack on wheat and maximize productivity. Regarding food processing, the intercropped barley and wheat are pounded and ground together to prepare bread (Ibid).

Wright (1994) described that toxic and husk covered plant foods needs processing using appropriate techniques. “Pounding and grinding serve four functions in processing plant foods: to remove fiber, to reduce particle sizes, to aid detoxification, and to add or remove nutrients” (Ibid). Archaeologically, in the Levant, Near East plant foods such as fruits (olive, fig, grape), nuts (pistachio, some types of acorns), tubers (beet, catstail), plants with edible leave (leek, lettuce) etc are examples of plant foods that did not need pounding or grinding. In contrast wild cereals, chenopods, and acacia seeds are examples of Levantine plants that need pounding or grinding processes (Ibid).

2.7.2. Pounding and grinding plant food using appropriate processing equipments

Basically, cereal dehusking needs pounding process to minimize and/or avoid husk from the edible part of the grain. Applying heavy force is not recommendable in times of cereal dehusking, because light pounding of cereals causes husks to rub off each other and leaves seeds relatively whole (Wright 1994). Experimental and ethnographic data shows that pestles and mortars made of wood are the most appropriate pounding equipments for cereal dehusking to date and were routinely used in ancient Mesopotamia for the same use (Ibid).

Genealogical research among the Li tribe in Hainan Province in Southern China indicate that during dehusking process the wooden mortar is placed in the courtyard. Grains are then put inside the mortar and pounded until the impurities are removed. A female hold the wooden pestle by her hands and pounds the grains with up and down movements. Sometimes more than one person can take part pounding work so as to facilitate the process of rice dehusking (Zhao-Lin 1997).

B. Grain grinding and efficiency of grind stones

Pounding and/or grinding using proper equipments reduces particle size of substances. In processing plant foods grinding unlike pounding produces fine and more homogeneous particles which allow consumers up take more nutrients (Wright 1994). In spite of the fact that the weight of processed grain remains the same, grain grinding into fine flour increases the volume of edible product (Foxhall and Forbes 1982:77 as cited by Wright 1994). The advent of flat querns during the historic period was instrumental for the production of fine flour having more nutrients and their development may well represent economic intensification (David 1998).

Grind stones have varying performances owing to several factors. Van pool and Leonard (2002) stated that the efficiency of metates is partly and largely by artifact morphology, size, raw material type, and the ability to retexture the working surface of a grinding material for extended use. Metates are efficient when they allow more material to be processed. Grinding materials with larger grinding surfaces enable the grinder process foodstuffs within short period of time, but with more grinding energy. Conversely, grinding materials with small working surface consume time to process a given foodstuff, but requires less grinding energy (Ibid).

Grinding dry seeds, kernels and wet (soaked or oily) are better achieved using trough and basin metates. Above all trough and basin metates are better than flat metates for grinding dry seeds or kernels mainly due to their morphology that help prevent the slipping off dry seeds and confine them on the working surface of the metate, a quality that flat metates did not possess (Ibid).

In processing small-grained foodstuffs, a grind stone with smooth surface, but lacking vesicles (cavity) is required to prevent seed loss and produces fine flour. Conversely, large grained foodstuffs are better processed with rough and vesicular material so that the grains are caught by both handstone and lower stone (Stone 1994).

Ethnographical data demonstrates that the working surface of grind stones with rough and vesicular quality is regularly rejuvenated with hammerstones and axes to increase its grinding efficiency. The trough metates and two hand manos in archaeological assemblages were often made of rough surfaced stones such as vesicular basalt (Ibid).

Grinding materials made of vesicular basalt allows dry seeds and kernels to be ground quickly, and limit the inclusion of grit to the flour. In contrast, grinding artifacts made of granular materials allow fine flour to be made, but also allow the inclusion of grit to the processed flour from the working surface of the grinding material (Vanpool and Leonard 2002).

Raw material type can also affect metate durability-the length of the metates' use life. Manos and metates can serve up to three decades when they are used for food processing (Abramiuck and Meurer 2006). In estimating the use life of the basin hollow in Sukur, Adamawa State, Nigeria, David (1998) stated that approximates of the use life of querns are potentially unreliable, especially since the use of grinding machines has been introduced and spread in to Sukur since the last quarter of the 20th century.

2.8. Ethnographic data on gender roles in a society

Ethnographic studies among foragers indicate that there is interdependence among men and women in accomplishing tasks (Roth 2006). “The division of labor most likely became more rigid as agriculture became increasingly important, and labor allocation and scheduling problems necessitated more clear-cut roles”(Ibid). In societies with mixed subsistence economy, women undertake such activities as plant gathering, cooking and preparing food, gathering shellfish, making baskets, pottery, and clothes while men participate in hunting aquatic and land fauna, and often, but not exclusively, perform trapping game and fishing activities. Men and women

help each other in tasks like soil preparation, hide working, hunting small terrestrial fauna, and construction of a house (Ibid). In their work in Tigray D'Andrea and Lyons (2003) stated that many tasks are not absolutely gendered. Nevertheless, ploughing is done exclusively by men while cooking is performed exclusively by women. Note that “Food processing is so strongly associated with Tigrian women that men are considered effeminate if they enter a kitchen” (Ibid).

Ethnographic data of Tohono O'odham in the Southwest in U.S.A indicate that young children are taught different activities based on their sex; with girls taught by women how to gather plant food, get wood, fetch water, grind corn, and make baskets where as boys are taught by men how to hunt and prepare soil (Roth 2006).

Chapter Three: Data presentation

3.1. Field observations

During the field work, the researcher had undertaken an observation on the sampled people's activity, on the grind stones, and grind stone quarry sites from which the people quarry grinding materials. In the work of observation the researcher first informed the head of the households about the aim and purpose of the observation. Then, the researcher conducted an observation on matters related to grind stones and foodstuff processing in the study area. The researcher recorded, measured the working surface of 90 grind stones in use context in the households of the subjects of this study during the field work. Length of the grind stones was measured along the long axis of the grinding surface between proximal and distal ends of the grind stone while width is the maximum measure that covers approximately the length of the corresponding mano. But, because of the less regularity of the shape of grind stones it was difficult to present exactly the length-width measure of the grinding surfaces of grind stones in the context of use. As a result, measurements were taken approximately. Furthermore, it should be considered that these measurements could not represent the original dimension of the grind stones and manos at time of manufacture in Lakia'a, because it is difficult to infer the original measurements of grinding materials. Boer-Mah (2008) stated that there is no perfect way of knowing the original dimension of an artifact at time of manufacture, although it is possible in some cases to see some symptoms that the tool was so far larger. This happen due to the fact that grinding equipments tends to erase (loss) their previous size and shapes by continuous modification and sharpening actions during and after function.

The researcher made an observation on where the grinding equipments both in discard and use contexts were placed, how the women undertake activities like de husking, pounding different foodstuffs such as Guizotia abyssinica (*nuhig*) lentil, barley using mortars and pestle, grinding cereal grains such as wheat, barley, maize, sorghum, protein grains (legumes); both roasted and unroasted beans, pea, chick pea, with their grind stones (*metthân*) and it's corresponding manos (*wede metthân* or son of the grind stone).

The researcher made also an observation on the four grinding stone quarry sites in the study area and nearby sites. Observations were undertaken on the way how the quarry men quarry and manufacture the grind stone and manos (Figure 3.1). Additional data regarding the manufacture of grind stone and manos were gathered from the elderly women and men in the study area and around each quarry site through interview method.



Figure 3.1 a grind stone and mano manufacturing man in Debresina quarry site measuring the length and width of the grind stones using his finger.

3.1.1. Placement of grinding equipments and the work of foodstuff grinding

Almost in all randomly and purposefully sampled households grind stones with their corresponding mano, small grind stone (*medkos*) and small mano (*wedimedkos* or son of small grind stone) were placed within the dome shaped kitchen houses and rarely around the courtyard. The kitchen houses are roofed with grasses, sorghum stalks and *Euphorbia abyssinica* (*qolenqual*) trees. The kitchen house not only hosts the grinding equipments, but also cooking materials, dough mixing equipments, hearth, ovens, and sleeping place (*medeb*) built for a woman to sleep on.

The grind stones are, generally, stationed at one side in the kitchen relatively opposite or facing to the oven and hearth. The stations, where grindstone is placed on, are built along the wall of the kitchen so that the wall prevents easily the slipping off grains. The heights of the stations are prepared depending on the height of the woman that grinds on it. The grindstones are set on the station contiguously side by side in a connected manner to each other. The side adjoining the grindstones is straight sided with thick mud of straw, soil and cattle's dung, in order to keep the slipping off grains within the limit and made them returnable with the hands of the grinder woman to the working surface of the grinding stone (Figure 3.2). For example large amount of finger millet near the grinding surface is placed to the well sided part of the grind stone so as to prevent seed loss during grinding (Figure 3.3).

Grinding features in the kitchen contains grind stone with its mano on the established stations and milling facilities put at the floor such as milling bins (*bukura*), and broom. The milling bins are floored with circularly shaped material made of clay (*tsahali*) which can be get rid of and replaced with new one if necessary. The broom is put at the hollow in between the central straight-side that separates the flour ground by the two grind stones, [and near to the rectangular

grind stone right] (Figure 3.2). Note that the manos are facing up after foodstuff processing and according to some informants; the people associate this act with certain belief. As was observed two grinding stones with their corresponding mano are erected at one setting, but each grind stone, as will be explained in detail in the analysis part, are largely assigned to grind some types of cereal grains.



Figure 3.2 currently service giving syenite-phonolite grind stones. These grind stones with rectangular working surface (right) and sub rectangular working surface (left) and corresponding manos with length of approx. 30cm each were photographed from above.

One of the two grind stones is devoted largely to grind coarse grained cereals (*tire ekli*) whereas the second grind stone is largely assigned to process small grained cereals (*bisul ekli*) and smash the coarsely processed flour of sorghum and maize after it is softened with water.

Besides grindstones, the kitchen also houses a small quern (*medkos*) and corresponding small mano (*wede medkos*) which are largely prepared from used grindstones and mano. However, it

does not mean that both small grindstone and small mano are always prepared from used grindstones and mano. They can be manufactured from fresh out crop. Outside the kitchen, I observed soaking grind stone (*medkos* or *melenkettie*) placed around the compound of the house in some households. This was due to the absence of enough space within the kitchen and the reduction in the rate of food processing by the household using that material. The grind stones are generally established sloping downward from the processer (Figure 3.3). This gives us a definite evidence for the direction of grinding. The grind stones are sloped downward in order to maximize the grinding power of the woman and to make easily push the flour down by the mano to the milling bin built in front of the grind stone.



Figure 3.3 a sandstone grind stone and corresponding mano in use to grind finger millet photographed from the proximal end of the grind stone. Just in the left side of the grind stone was basket (sefie) containing finger millet to be ground.

The women grind facing to their oven and hearth. This helps them easily to watch, without twisting their neck, additional and parallel works like cooking and baking injera within the kitchen. Since the grind stones are established side by side women and daughters stand and grind parallel to each other in the same direction. This manner of grinding promotes the daughter learn how to effectively grind from her mother's grinding performance and facilitates their interaction. This is mostly effective in households with double or triple grinding stones.

Very rarely there are two grind stones and a small grind stone (*medkos*) placed at the same side with enough standing space for the processors in the kitchen where women grind and groat in different directions (giving their back to each other). I asked the women why they set up it that way. All of them focused that it was set up in such a way so as not to narrow the available space to do other tasks within the kitchen. Generally, the grinding stones were positioned around the internal most part of the kitchen (*wushattae*). The processors use a petrol filled lighting equipment (*kuraz*) especially when they grind during night times. Women grinders had been grinding foodstuffs for about 5 hours per a day mostly from 3am-8am especially during summer and autumn seasons. Women informants stated that this laborious work damages the palm of both hands of the grinder woman, their back bone and their knee. Women in Lakia'a grind and soak (especially the dough of sorghum and maize) their foodstuffs in a motion with back and forth direction (Figures 3.4 and 3.5). They also process spices and salt with grindstones and small manos in back and forth direction as well as with wooden mortars and pestles in perpendicular direction.



Figure 3.4. A woman grinding a roasted maize for medenden (for cook).The hands of the woman is chained with a rope like material to keep the balance of her hands during grinding.The hammerstones are laid just below the roasted maize and near the wall that supports the grind stone.



Figure 3.5. A woman soaking the dough of sorghum using small mano (Figure 3.6) with back and forth direction.



Figure 3.6 A working small mano (wede medkos) with intact edges found near the firebox of traditional oven.



Figure 3.7 A small mano (wede medkos) in discard context lying up on animal manure and its edges are chipped away.

3.1.2. Observation on the discarded, reusable and reserve grinding materials

Several discarded, reusable grind stones, manos, small querns, and hammer stones were observed among the sampled population. Some grind stones were highly worn out and were no longer reusable while some grind stone were reusable. Furthermore, some manos and grind stones were in broken-discard context. The place of discarded manos (hand stones), grind stones, were, recorded and photographed with the support of the interviewees by walking in and around the house structure in the compound of the household. It was common to see both worn out and broken grind stones and manos being discarded or reused for different purposes. Moreover, it was common to see at least one semi finished reserve grind stone and several manos in the compounds of some farmers. Figures 3.8-3.13 show discarded manos, worn-out grind stone reused for different purposes, discarded hammer stone and the like.



Figure 3.8 Wornout sandstone grind stone reused as building material.



Figure 3.9 Used phonolite grind stone being reused as water container (Gabla) for hens.



Figure 3.10 Transversally broken phonolite mano found in discard context together with stones.



Figure 3.11 An intact and reusable phonolite mano, but found in discard context together with other stones.



Figure 3.12 A soaking grind stone (melenkettie) prepared from phonolite rock in discarded context found in the compound of the farmer's house. Note that it is lying by its working surface on the ground.



Figure 3.13 Andesite hammerstone lying at the yard of a household.

3.1.3. Grind stone and mano quarry sites

An intensive observation on the grind stone quarry sites, the artifacts found in each quarry site, the distribution of chipped stones and debris and their origins, the scope (extent) of the quarry sites, the deepness and approximate dimension of the trenches where the grind stones were quarried was made and recorded for each quarry site. Furthermore, an effort was made to identify the place of planning and manufacturing of the predetermined grind stone in each quarry sites. No workshop camp was observed in each quarry site. However, there are individual household houses near to each source material. Note that to observe the quarry sites in and near the study area, I have set some quarry site describing aspects as markers of quarry site based on Bloxam's et. al. (2007) parameters used to characterize a quarry site. For example, the presence of debitage, artifacts found in the quarries especially partly finished or broken products, infrastructure related to the quarrying site; such as the access to vital rocks, technology applied in quarrying, tools and quarry marks on the rock type or sub type.

The grind stones and manos in Lakia'a are, generally, manufactured from volcanic rocks such as phonolite rock, syenite rock, syenite-phonolite rock, and sandstones (sedimentary rock). These rocks are quarried from four quarry sites namely Debresina, Goure, Maisheho, and Daeroffa which are located within and outside Lakia'a tabiya. The quarry sites of Debresina and Goure are more remote to households found in Maisheho and Lakia'a villages than Damo village in Lakia'a

A. Debresina and Goure quarry sites

Debresina is the oldest grind stone and mano quarry site for the people in Lakia'a and nearby territories. It is located at 37P0481341, UTM1568707 and elevation 2059m above sea level. This quarry site has a dimension of approximately 60m wide X 150m length. It contains blocks of phonolite rock. The phonolite rock in Debresina is found on flat plains and is mostly quarried by

digging out the underground out crop as well as striking the surface of the important out crop to produce primary blank for grind stones and manos. Debresina quarry site (Figure 3.14) is found about 4.5 km far from village Damo in Lakiya the closet village to this quarry site. It is located within tabiya Bet Yohannes (Figure 1.2). This quarry site bear's semi finished grind stone (Figure 3.15) around deposited trench, several flakes scattered on the surface of the quarry site, but large amount of flakes were used as the building and conservation materials for the houses established directly near it.



Figure 3.14 A quarry man (in Debresina quarry site) is showing to the researcher the refilled pit with chipped stones and flakes after the blank was acquired. Note that it was done so in order to avoid the possible danger of the pit up on domestic animals and humans while walking through it.



Figure 3.15 *Semi finished phonolite grind stone from Debresina quarry site with 44 cm length and 31cm width at the center.*

Goure quarry site is another vital source of raw material for the manufacturing of grind stones and manos to the people in Laki'a. It is located at 37P0478486, UTM1567932, and elevation 1984m above sea level. It was discovered as a result of intentional work of raw material procurement for grind stone and mano, and has a dimension of about 40m wide X120m length (Figure 3.16).

This quarry site is located at tabiya Wuhidet (Figure 1.2) and close to the northern extremes of village Damo; the nearest village of tabiya Laki'a to tabiya Wuhidet. Syenite rock type is dominant rock in Goure quarry site. These blocks were quarried from the hillside which has almost similar landscape setting to the Maisheho quarry sites found in village Maisheho. Flakes, unfinished primary blanks, and semi completed grind stones were observed in Goure quarry site.



Figure 3.16 *Syenite rock rich grind stone and mano quarry site in Goure. The syenite blank for grind stone is first prepared from the hill side which is sparsely vegetated area and the grind stone preparation is undertaken in the small plain below and adjacent to the hill side.*



Figure 3.17 *A semi finished syenite grind stone in Goure quarry site.*

In general, Debresina and Goure quarry sites were the main quarry centers for the people in Lokia'a and still continued as the main quarry centers for these households in village Damo and partially to households in village Maisheho, and village Lokia'a.

B. Maisheho and Daerotffa quarry sites

Maisheho and Daerotffa quarry sites are located in close proximity to the whole Maisheho village, and households found in the southern extremes of village Damo and northeastern part of village Lokia'a, and these quarry sites are remote especially to households in the northern extremes of village Damo and western extremes of village Lokia'a.

Maisheho quarry site is located at 37P0481209, UTM1562944 and 2054m above sea level. The rock type found in Maisheho is syenite-phonolite blocks. Three quarry places within this large quarry site were identified and photographed. These quarry sites are found in chain, but gaped with some distances among themselves. The oldest quarry site, according to the informants, in Maisheho is found in between the two recent quarry sites and is relatively near the one quarry site found west of it. This quarry site has dimensions about 40m width X 60m length. Abundant flakes, dikes of trenched soil being terraced with stone, exposed outcrop largely due to natural factors, unfinished primary blank also exist in the site (Figure 3.18).



Figure 3.18 *The oldest syenite–phonolite rock quarry site in Maisheho. In this quarry site the flakes are currently used to conserv the soil;note the terraced place where the man is standing.*



Figure 3.19 *Grind stone quarry site with a plenty of flakes near the parent syenite-phonolite rocks found some 18m west of the oldest quarry site in Maisheho. This quarry site has dimensions about 22m width X37m length.*

According to local informants the most recent grind stone quarry site in Maisheho was begun at about 1976 E.C (Figure 3.20). It is located at 37P0481724, UTM1563439 and 2064m and is found about 200m far from the oldest quarry site in Maisheho.

The surface of this young quarry site held large phonolite rock with stricken mark which was stricken by humans for the preparation of grind stones. The informants sated that the people were quarrying by digging the underground of the out crop. This was confirmed by the surface features of this quarry site which had substantial amount of trenched out soils and flakes used for soil conservation around it.



Figure 3.20 A recent grind stone quarry site within the large Maisheho quarry site with large syenite-phonolite blank rock for grind stone. This quarry site has dimensions approximately 8m width X 15m length.

Generally, the syenite-phonolite rock type useful for grind stone and mano preparation in Maisheho quarry sites is extracted from the hill side where immediately above it, is a plateau. The eastern ward and the southern ward of these quarry sites is a steep slope.

Daerotaffa grind stone quarry site is located at 37P0479930, UTM1564462 and of 2048m above sea level. This quarry site was the fourth quarry site that was began during 1970s some years earlier to the recent quarry site in Maisheho. It uniquely contains sandstone blocks. This site, it can be said specifically, is beneficial to these households established in the southwestern sides of village Damo, northwestern parts of village Maisheho together with northern extremes of village Lokia'a especially since 1980s.

A sandstone block in Daerotaffa is covered with silt soil and gravel (Figure 3.21). Because of this, the people use digging as the primary method to unearth the necessary sandstone blanks for grind stone and manos. Originally, this site was a quarry site of building stones which was primarily sold to Adwa town due to the close proximity and accessible setting of the site to the main Adwa–Axum vehicle road. In advance the building stone quarry men identified that the sandstone from the site was strong enough to be used as grind stones and manos in the 1970s. Since then, the people near this place began and continued to exploit grind stones and manos from this site. As a result, the journey to Debresina and Goure quarry sites were reduced.



Figure 3.21 A sandstone dominated quarry site for grind stone and mano preparation. This is the most recently exploited quarry site not only for grinding materials, but also for building material sold especially to Adwa town.



Figure 3.22 *A rectangular blank sandstone for grind stone in Daerotaffa quarry site.*

Generally, the rock type in each quarry site, although varying in quality, is a rock type that can be knapped for making grind stones and manos. Concerning the waste product in the quarry sites, it was common to see flakes around the quarry sites. Some quarry sites (Debresina, Maisheho, and Daerotaffa) contains pits and trenches around the base of the out crop. Fragmented stones more particularly flakes, blanks and semi finished grind stones were similar with the parent rock in the quarry site where the artifacts were found. Exotic material was rare in and around the quarry sites.

3.2. Interview of households

The interview was held face to face with the informants by the researcher to gather both qualitative and quantitative data from the sampled population. The main interviewees were household heads. In male-headed households generally both partners were participated. The interviews were carried out in Tigrigna language (the language of the local people).

The interview was generally conducted to gather data on issues related to grinding equipments, gender roles, socio-economic aspect of the people, crops cultivated in the area, and mobility of people and the fate of grind stones.

3.2.1. Raw material for, production, transportation of grind stones, mano, hammer stones, and gender roles

Qualitatively the interview was made to obtain data on the origins of both discarded and currently in use grind stones, manos, hammer stones, the use of grind stone, the process of raw material identification and production of grind stones: their grind stone production strategies, the quarrying season, the social and gender context of production and transportation of grind stones and manos from the quarry site to settlement area, gender roles in grinding, exchange and extent of grind stones and manos distribution produced from the quarry sites, as well as the current trends in the use of grind stones.

The origins of most grind stones and manos, both the discarded ones and those in use contexts, is the four quarry sites mentioned earlier while three grind stones were identified that they were brought from areas of Adi-Tsehafi at the northern adjacent side of Axum and about 20 km away from Lokia'a, Adi-Asahatiya about 8 km far from Lokia'a, and Mai Bereq (basalt; a type of volcanic rock) 3 km away from Lokia'a.

Raw material identification and early stage of production of grind stones in Lokia'a is the work of men and they perform it by traveling to the source material with their quarrying equipment such as small and large metal hammer, hoe, plowshare, *melakino* (a rod type metal) and the like. But, women can take part in the selection of the raw material to grind stone and mano by consulting with their husbands at home and perform finishing activities of the semi-finished grind stone and manos at home. Grind stones are produced during February-April months, because of dry air condition, available time and labor force during these months. A grind stone could be produced either by an individual household or socially involving above three quarrying men. Besides, about 6-12 men participate to transport the semi finished grind stone to settlement

place. Most often manos are produced and transported by a man, because of its smaller size. In times of production and transportation of the grind stones ceremonial foods are prepared as a festivity for the work men by the household for whom the grind stones are produced.

The energy needed for the production and transportation of grinding equipments is variable based on the economic power and distance of the household from the quarry site. The quality of grind stones and manos vary from quarry site to quarry site. A grind stone could stay serving the household from about a quarter - more than three quarters of a century while manos can serve from about half of a decade-almost a decade. Most of the households in Lakiya have two grind stones with at least one corresponding mano in addition with wooden mortars and pestles.

Hammer stones (mostly andesite and rarely basalt) are acquired from the surface of areas with clay soil and along the gorges being transported by river action. Getting hammer stone in the area is the work of women. Hammer stones are naturally shaped stones and often used to rejuvenate the working surface of the grind stones. Besides to the data gained through observation, the data from the interview sustained that the work of grinding foodstuffs is solely assigned to women and their daughters. Women often teach methods of grinding cereals and other household tasks to their daughters. Currently women and their daughters process their foodstuffs using grind stones and manos to produce coarsely ground flours of legumes and cereals, to produce fine flours and to smash soaked (dough) coarsely ground maize and sorghum one of the steps for the preparation of injera.

The interviewees also mentioned that previously grind stones and manos had been exchanged to payments in kind and in cash. This culture has continued up to present. For example, some quarry men in Debresina quarry site have prepared grind stones and manos for sale to the people in Adwa and Adi Abune towns. The grind stone and mano sellers mentioned that grind stones

were exchanged in a barter system to the households in the nearby areas, remote areas (up to 25 km away from source material), and largely to Adwa and Adi Abune towns.

Nevertheless, today the grind stone manufacturers exclusively produce small grind stones and manos to the people in Adwa and Adi Abune towns. Four decades ago the cash price of a grind stone in the area was 5-12 Ethiopian birr where as currently a mano and grind stone is valued up to 35 and 80 Ethiopian birr respectively. The quarry men have been transporting the manufactured mano and grind stone to Adwa and Adi Abune towns through donkey back. It should be noted, however, the production and selling of grind stones and mano has diminished.

3.2.2. The nature of socio-economic aspects of the people

The social aspects of the people in Lakia'a are largely influenced by such factors as religion and economic power. Religiously, the entire people in Lakia'a are followers of the Ethiopian Orthodox Union Church. Most of the traditions and ceremonial systems, for example, funeral systems, memorial ceremony for the dead (*teskar*), wedding ceremony, Christian ceremony of baptism, and memorial ceremony for saints (*kisme*) etc. practiced in the area are highly influenced by the church. In Lakia'a foodstuffs for wedding ceremony, memorial ceremony for the dead (*teskar*) and Christian ceremony of baptism (rarely) up to recent time were processed socially by women, more specifically, by the relatives of the family who wanted to prepare the afore mentioned ceremonies, and by neighboring households. The role of men was distributing the foodstuffs to be processed to the neighboring houses and the woman grinders and processers in these houses take an amount of grains and spices that she could process. In return the household that distributed the grains then had to pay back its service loan by rendering the same processing service while neighbors that supported it prepare wedding, memorial ceremonies (*teskar*) some other time (Informants).

According to my informants, foodstuffs of some local feudal lords during the imperial regime were processed by regular women slaves. However, most households had not slaves and the labors in charge of grinding were the wife, her daughter/s, and wage grinders. The wage grinders, and pounders were paid about 5 kg raw cereal per 20 kg of processed cereal. Some wage grinders were local settlers and some others were seasonal migrants (mainly women) from E'daga Arbi, Cero, Feresmay, Enthcho and Gerhusernai. These migrant laborers (called by the local people as *Gullo* meaning servant) had been coming to the area mainly during autumn season to work as harvesters, gather the leftovers of cereal crops from the harvested field and threshing floor (*äwdee*). Furthermore, women migrants had been grinding during autumn and extensively in January (wedding month in Laki'a) and were given their wages in kind depending on the amount of the food grains ground, and the amount of red onion and Rhamnus prinoides (*gesho*) pounded by the woman. Besides to the migrant women, local widow women were grinding in the wealthiest households for wages in kind. This was conducted openly and secretly with and without the knowledge of the husband of the employer (it will be presented in detail in the analysis part).

Old and economically better off households had relatively large, more grind stones and manos, because they can employ more quarrying men along with quarrying equipments. Newly founded households are, most of the time, dependent on the parental house to process foodstuffs and produce grind stones. The local feudal lords and wealthiest households, during the imperial regime in Ethiopia, who demanded more grind stones to process more foodstuffs not only for the member of the house and servants, but also for guests as part of feasting, had been producing more grind stones and manos.

3.2.3. Mobility of people and the fate of grinding equipments

An interview was undertaken to gain valuable data about the degree of mobility of people and the fate of their grinding material while they change their settlement. Although it is a rare case currently, individual households had been moving from and to Lakia'a tabiya with their grind stones and other household logistics. The shift in settlement site was mostly from village to village and rarely from tabiya to tabiya. It is, most of the time, occurred due to the remoteness of cultivable lands that the household own and to heir (receive) the old house of their parents. In such circumstance households need and favor to transport their grinding equipments with them while they change their settlement site, even when they were changing their occupational site to places where raw material and workable grind stone and mano are available. The heads of the households were asked why they did choose the way they did and replied by saying that: 'it was obvious that the grinding tools create a logistical problem when we (they) want to transport it and we (they) choose to transport our (their) grinding equipments instead of engaging in cost full process of producing new grind stone and manos from the quarry sites'. Furthermore, women believed that the already in use grind stone and mano were accustomed with them and affirm that they have special favor to process with it.

Chapter Four: Data Analysis and Interpretation

4.1. Process of raw material procurement and production of grind stones and manos

4.1.1. Raw material procurement

The raw material quarried for grind stone and manos that serve the people in Lokia'a is identified based on three accustomed criteria's among the people in Lokia'a. The raw material is chosen if it has glinting sands on the surface of the rock, if it gives very thin sound (ring) and gives very small grit when it is hammered with hammer stone, and if it is rough enough when it is sensed with touching. The people in Lokia'a have been quarrying from four quarrying sites namely: Debresina, Goure, Maisheho and Daerotaffa.

Although no persuading evidence is yet not found on how, when and how much cost the first quarrying people to identify the quarry site of Debresina, the oldest quarry site (according to the informants), the people in Lokia'a have largely been quarrying from this place. This quarry site is found about 4.5 km far from village Damo. Later on, other quarrying site opportunities were discovered within the study area and adjacent areas. These quarrying opportunities include: Goure and Maisheho quarry sites which were discovered most probably by the farmers immediately close to these quarry sites, and Daerotaffa quarry site which was accidentally discovered by quarrying men who were quarrying building stones from this place (Informants). After the discovery of the above stated quarrying sites, people began to compare the quality of raw materials from the quarry sites and compare the cost of production grinding materials.

Such quarrying opportunities enable some households to use more than two types of raw materials for grind stone, for mano, for small grind stone and for small mano, because of the

perception that it would produce good finished product and it would prevent the rapid wear out of the grinding equipments. The use of different raw materials could lead to the formation of an archaeological record with tools of different raw materials. Provenance study of tools, help archaeologists understand the influence of natural forces like; volcano, river action, and human related factors such as the social interaction of the people and the economic exchange of the people up on the spatial distribution of raw materials in a certain place and time in human history. For this ethnoarchaeological study, however, it is the human related factors that played a great role for the wide spread distribution of different raw materials for grinding equipments across the people in Lakia'a. I have focused on the social affairs and economic exchange due to the fact that the people in Lakia'a are socially interrelated people who have been exchanging the raw material for payments in cash and in kind. Besides, the raw material for hammer stones (mostly andesite a type of volcanic rock) is distributed from its source not only by human related factor, but also by river action.

In Lakia'a, as the data gathered from the subjects of this study demonstrates, it is the duty of men to search raw material for grind stones and manos, and produce semi finished grind stones and manos at the source material. However, women can participate in raw material choice for grind stones and manos mostly from their continuous experience with the grind stones and manos they worked up on. Women have tremendous knowledge about the hardness, durability, the influence of raw material up on the finished product, the wear and tear of the grind stones and processing problems of some grains and consult their husbands at home regarding material choice, although they do not go practically to the geologic source. Moreover, women can also take part in the finishing activities of the unfinished mano and grind stone at home. On their part men had also an indispensable knowledge regarding the overall quality of the raw material for the grinding

equipments. Men travel to the source material and conduct the practical selection activities of the raw material based on the preliminary information they gathered from women and their own personal experience.

Having identified the raw material, men determine what technology should be applied to quarry and manufacture the required grind stones and manos with the available time and energy. Because, technology as Goucher et. al. (1998) stated, is “the totality of means used to create objects necessary for human survival and comfort”. Therefore, men decide and take important technique which includes, in the terms of D’Andrea and Lyons (2003), the material resources, tools, skill, operational sequences, knowledge, and modes of work co-ordination used to produce material objects.

The people in Lakia’a quarry largely during February, March and April months. It is because of two main reasons. Firstly, the dry air condition prevails during these months heat the surface of the rock and eases the shaping of the rock to the desired interest, and secondly, labor force and time for quarrying is available during these months. However, one should note that the society quarries not only during the stated months, but at any time when grinding equipments are needed to be produced (Informants).

4.1.2. Production of grind stones and manos

4.1.2.1. Methods of quarrying blanks for grind stones and manos

The People in Lakia’a use two methods of grind stone and mano quarrying. One method is to strike the surface of the outcrop at a certain angle with large metal hammer in order to produce the primary blank from which grind stones and manos are manufactured. Manageable pieces of stone break off with minimum effort. This method scarred the rock face and leaves scattered broken fragments around the outcrop. They sometimes use fire to heat and break the out crop at

times more of when it is difficult to strike with large metal hammer. Secondly, the people in the area quarry grind stones through digging around and under the outcrops to find strong buried stones. The purpose is to find manageable chunks of stone that are not weathered. Such diggings create pits and trenches and disclose the underground out crop. This may have potential evidence if archaeological investigation is held in such places.

The strength of the manually uncovered rock is tremendous compared to the one naturally occurring out crop. Nonetheless, it is quite laborious to produce primary blank from the newly unearthed rock. It questions the quarry men to have appropriate quarrying technology and more labor force who have the necessary power and skill to produce the primary blank by striking turn by turn at the critical side of the boulder rock with large metal hammer. Sometimes quarrying men heat the newly accessed out crop with fire so that it become percussion easy to produce the primary blank. This technique of acquiring the blank stone is, however, a rare one in Lakia'a. From this ethnoarchaeological evidence it can be forwarded that the people in the prehistoric time might had largely been quarrying grind stones from naturally surfaced out crop other than digging out blanks from the underground, because naturally surfaced out crop needs less time and energy. Furthermore, the availability of raw material could also be taken in to consideration while we study the method of quarrying grind stones. When the surfaced and quality full out crop is run out in a quarry site people begin to dig out the blanks and undertake cost full grind stone production. For example, the degree of using the above mentioned quarrying methods in Lakia'a varies from quarry to quarry and time to time as it was suggested by the informants. In Debresina quarry site people had been preparing primary blanks for grind stone and mano simply by striking the phonolite out crop around the surface. Minimum digging was required to disclose some soil covered parts of the large phonolite blank.

In the due course of time, however, the phonolite rock which was easily available on the surface in Debresina diminished due to the increasing pressure of users who quarried from this source material. Quarry men had been arriving to this quarry site from places as far as 20 km away from Debresina. Up to recent time almost all the oldest households in Lakia'a tabiya were obtaining their grind stone and manos from this site. Thus, quarrying became difficult and cost full in this place and people in later time began to intensively dig out underground block of phonolite rocks which resulted in the creation of pits and trenches. The same quarrying methods were applied for Goure and Maisheho quarrying sites where surfaced syenite and syenite-phonolite rocks are abundantly available. Hence, people produce primary blanks by striking the out crop with metal hammer. More particularly in Goure quarry site no pit and trenches were observed. However, people employ digging methods to unearthed strong underground syenite-phonolite blocks especially at the recent quarry site in Maisheho. This was confirmed by the later aggraded pits just near the quarry site (Figure 3. 20).

The main quarrying method in Daerotaffa quarry site was digging out the underground sandstone blocks. However, the degree of distribution of the sandstone from this quarry site to distant areas, with the exception of these building sandstones sold to Adwa, was limited to households closest to Daerotaffa, because it was a young quarry site and was not popular like the other quarry sites. Besides, people began to use petrol powered grinding machines (although in small scale) that influenced the degree of manufacturing grinding equipments in Lakia'a. Contrary to this, the phonolite rock is the most widely used and distributed rock for grinding materials across more distant areas. Syenite-phonolite rocks are also better used by the society compared to syenite, sandstones, and basalt, as shown in Table 4.1.

Table 4.1: Rock types (observed) used for grind stones and manos in Lakia'a

Rock type	Frequency	Percent
Phonolite	41	45.6
syenite-phonolite	24	26.7
syenite	18	20.0
sandstone	6	6.7
basalt	1	1.1
Total	90	100.0

As it is seen above the subjects of the study in Lakia'a have largely used materials made of phonolite rocks (45.6%) followed by syenite-phonolite (26.7%) and syenite rocks (20%). The age of the quarry sites, quality of the rock and the proximity of each quarry site to the people are most significant factors for the degree of raw material frequencies in Lakia'a. The phonolite rock, for example, got an upper hand in Lakia'a better than other rocks owing to its good quality of the rock as well as its long time familiarity for the people. Likewise, the syenite-phonolite rock is also more preferable among the people due to its relative good quality and its relative proximity to the people in the study area. Syenite-phonolite rocks are abundantly used in village Maisheho and village Lakia'a, because the syenite-phonolite quarry site is located at the heart of village Maisheho and close to village Lakia'a while phonolite rocks are largely used in village Damo (Table 4.2).

Syenite rocks (20%) and sandstone (6.7%) are sparsely used among the people in Lakia'a due to relative rapid use wear and recent discovery of the quarry sites respectively. Surprisingly enough, one basalt grind stone (1.1%) was identified in Lakia'a. Basalt rocks were less demanded in Lakia'a. The user of the observed basalt grind stone was found near the place where basalt rock is available. The evidence shows us there are few households in village

Lakia'a that quarried basalt rocks for reasons they are located near the basalt rock and have less capacity of production grinding materials of phonolite rock and other quality full raw materials.

Table 4.2: Raw material distribution across villages in the study area

Rock type	Observed			Total
	Damo	Lakia'a	Maisheho	
Phonolite	22	6	13	41
syenite-phonolite	2	9	13	24
Syenite	8	5	5	18
Sandstone	3	3	0	6
Basalt	0	1	0	1
Total	35	24	31	90

4.1.2.2. Shaping grind stones and manos

Once the primary blank is acquired through the quarrying methods, the quarry men begin shaping the blank either to useable grind stones or mano using shaping equipments such as small metal hammer and hammer stones.

The people design the form and size of grind stones and manos based on different influencing factors such as economic power, distance from the raw material source and the purpose that the grind stone will serve. Grind stones and manos are designed in the area to crush and grind a wide range of cereals in to coarse grained and fine flour, and soaking purposes. The lower and stationary grind stones have continuous use surface and are used together with their compatible manos for grinding and soaking purposes. The grind stones are elongated in plan with flat upper surface, generally rectangular, sub rectangular, sub ovate and concave in shape, and flat or concave(especially worn out grind stones) in cross section. The grinding materials in Lakia'a especially the shape of grinding surface, the worn out grind stones are the same with the Axumite grind stones discovered at Kidane Mihret in Axum by Phillipson (2001). By applying

principle of analogy this similarity can show us cultural continuity of the Axumite culture. Most of the observed grind stones serving the subjects of this study had sub rectangular and rectangular working surface (Table 4.3).

Table 4.3: Shape of the working surface of the observed grind stones

Shape	Frequency	Percent
Rectangular	32	35.6
Sub rectangular	52	57.8
Sub ovate	6	6.7
Total	90	100.0

As has been presented in Table 4.3, 57.8% (n=52) of the 90 observed and measured grind stones had sub rectangular shape of working surface where as 35.6% (n=32) of the 90 grind stones had rectangular shape of working surface. The rest (6.7%) had sub ovate shape of working surface. The grind stones with sub rectangular and sub ovate working surface were produced largely by most people who manufacture grinding materials for self consumption. On the other hand the grind stones with rectangular shape of working surface might had been produced by specialists particularly those quarry men found near the quarry site and who were and are persisted preparing and selling grind stones (Figure 4.1). Because these grind stones were more standardized in shape than the rest observed and measured grind stones in Lakia'a. Such phenomena is important indication for the socio-economic interaction of the people in a given area and time. The exchange was held in cash and in kind. The people had not only been exchanging grind stone, but also its compatible mano. Mano is the elongated upper stone that fits and lay up on the width of the working surface of the lower stationary stone. It is a mobile stone that move on the grind stone in a back and forth direction by the grinding woman, with flat surface and convex back (Plano-convex) cross-section, elongated in plan and has large areas of the blank where the hands rest up on.

In the process of manufacturing the quarry men design grind stones, manos and decide what type of strategy should be employed to the production of the designed artifact. When I say strategy in this thesis I used it in terms of its dictionary meaning that strategy is a carefully devised plan of action to achieve a goal. Thus, deciding the type of quarrying tools, the number of labor force required, the time when the production should be accomplished are some examples of the aspects of strategies performed by the people in Lakia'a. The presence of more and effective quarrying tools is vital in the production of blanks and transformation of the raw material in to the desired purpose by increasing human production capacity. The level of knowledge and skill of the quarrying men to the quarrying resource and in shaping the blank to the desired designed artifact are by far crucial in the process of production. In other words, there should be efficient management of the quarrying resources that the producers applied in the production of grind stones and manos.

Briz et. al. (2005) stated that the combination of various production processes brought about repeated and continuous changes up on the raw material in relation to their spatial contexts, their size and morphological particularities. This process starts at the quarry site and end up in the archaeological context from which the resulting effects of its transformation and use have been recovered.

I. Stages of shaping the grinding materials

A useable grind stones and manos pass through two stages of preparation before the blank rock is utilized as grind stone and mano. The grind stones are manufactured before they are transported, although it still needs the finishing activities that would be completed in the second stage of making the grind stones and manos useable to grind different foodstuffs. The quarry men undertake early stage of grind stone and mano production at the geological source of the raw

material for two reasons: the quarry men seek to reduce the transportation costs, and second reason is to get a broad opportunity of blanks in the raw material source when the former blank is broken during production. The early stages of grind stone making often occurred at the quarry site just after the chunk for grind stone and mano was acquired. In this stage men are the sole participants in shaping and manufacturing grind stones and manos. In the early stage of manufacturing grinding equipments more waste products are produced. These waste products are derived from the blank mostly deliberately by the producer for being they are not use full (Figure 4.1). Occasionally, however, there are flakes that removed away involuntarily of the manufacturer. Such situation can initiate the producers to change the already determined artifact to be produced. For example, when the quarry men intended to produce a grind stone from the grind stone blank and if a large amount of flake is trimmed off the blank in such a way that the blank could not produce the intended grind stone, the quarry men shape the remaining blank stone to produce a useable mano. Here I have used the terms and definitions given by Briz et.al. (2005) to describe the voluntarily and involuntarily trimmed off products. “A reject or rejected element is something that is surplus to the process of production and use of tools, which is voluntarily discarded. A by-product is something that is produced during the creation of the desired product” (Ibid).

Briz et. al. (2005) divided by product as: production by product and by product of use based on the time when these by products were created. For example, the flakes around the unfinished grind stones and manos in (Figure 4.1) are production by products. These by products were knowingly trimmed off the blank by the manufacturer during manufacturing. The byproducts produced during the early stage of production were added to the trenches and debris produced by quarrying and could also be used as conservation materials.



Figure 4.1 *A quarry man shaping grind stones and manos using small hammer in Debresina quarry site. The flaked stones scattered around the semi finished grinding equipments were trimmed off deliberately by the quarry man.*

The speed of manufacturing grind stones and manos at the geologic source could be influenced by factors such as socio-economic status of the household (it will present in detail in the consecutive topic). Wealthiest and well established households had the promising opportunities to procure raw material, and manufacture more grind stones and manos, while the lower income and newly established households were often dependent, if not completely, on the better off households. Producing a useable grind stone could take on average from one day up to two days. Grind stone production is highly determined by the amount of energy invested, the technique employed, the accessibility and knapability of the raw material, the distance of the individual household from the origin of the raw material and the like. On average 3-4 quarrying men

together with important quarrying techniques are employed to produce the semi-finished grind stone and mano at their geologic source.

Having completed the first stage of preparation of grind stones, the men shipped the grind stone and mano to the dwelling home of a household. Distance of the settlement area from the quarry site and size of the semi-finished grind stone determines the labor force that can transport the semi-finished grind stone and mano to dwelling home. The nearest the quarry site to the settlement area invites minimum energy from the quarry site while the furthest the quarry site from the settlement area to prepare and transport an equal sized grind stone requires more energy. However, as Stone (1994) stated, the size of grind stones (metates) quarried from remote area is often relatively small compared to the one quarried from the nearby areas to the occupational site. This is made in order to reduce the labor investment and other expenditure needed in time of preparation and transportation of grind stones.

In Lakia'a about 6-12 men participate transporting the semi-finished grind stone to settlement place. Household head (often man) organize able people to produce and transport the semi finished grind stone to settlement site where as the woman prepare ceremonial foods including *hilbet* for cook, bread, local drink (*siwa*) for the work men. After the semi finished grinding equipment is brought home the woman conducts the second stage of production which mainly includes the finishing activities (leveling the grind stone with its compatible mano) of the semi-finished grinding equipments in to useable grinding stones. Finally, the manufactured grind stone is established at the kitchen to serve processing foodstuffs. Then, the woman test the function of the newly established grind stone, the compatibility of the grind stone and the mano by processing primarily finger millet (*dagusha*) and sorghum. These cereals were selected by women as testing cereals, because they can be used to prepare *siwa* (a local drink in Tigray). The

women in the society believe that the grit produced from the fresh grinding materials during processing of finger millet (*dagusha*) and sorghum could be filtered during the preparation of the *siwa*. After certain assessment held on the grinding materials, the woman begins to process wide range of foodstuffs.

4.2. Position of grind stones in the household

The metates and manos uncovered in the American Southwest suggest that food grinding activities was performed at the specific place (room). This is strengthened by the ethnographic data taken from the people living in Pueblo (Adams 1996). In line with the stated idea grind stones of most people in Lakia'a are placed with in the kitchen up to their use life came in to being. The grind stones are placed in the kitchen so that the woman can perform joint activities like baking injera, cooking and grinding foodstuffs in a parallel manner. As a result, the grind stones are erected with in the kitchen at one side relatively opposite to the traditional oven and hearth which were established side by side. This indicates the role of the woman in the kitchen in performing household tasks. The assignation of the woman to the kitchen indicates that the presence of clear cut gendered division of labor among the people in Lakia'a. However, it should be note that men can enter the kitchen to consume a meal prepared by the woman.

Of the 90 observed and recorded grind stones in Lakia'a three grind stones were identified being placed and used elsewhere other than kitchens. All of the three grind stones were originally placed at the kitchen and later dislocated out of the kitchen so as to widen the floor of the kitchen. Two of them were erected: one with in the *hidmo* and one around the compound near the tin roofed house (Figure 4.2). These grind stones have been continued to grind, crush and rarely smash soaked flour. The third dislocated grind stone is still in use as a portable grind stone. It has largely been rendering to smash soaked maize and sorghum (Figure 4.3).



Figure 4.2 Reestablished grinding stone placed at the yard of the household's compound. It is mainly used to crush some food stuff like pea, bean etc. It was photographed while portion of the station sheltered by a tin roof and portion of it was exposed to sun light.



Figure 4.3 A woman smashing soaked sorghum using portable grinding stone and small mano just placed temporarily at the compound of one household.

Nonetheless, most of the rest observed grind stones have been placed at the kitchen, although their degree of use has been reduced. Given this, it can be deduced that the permanent place of

grinding, crushing, smashing activity in Lakia'a is at the kitchen, although there is current displacement of grind stones in households relatively near the modern milling machine.

Historically, however, the grind stones of some wealthiest and local lords households who had about 5-8 grind stones were placed side contiguously at shelter locally called *gabalaa* due to lack of enough space in the kitchen. Such experience was highly prevailed during the imperial period of Ethiopia when feudal system was strong. Based on this ethnoarchaeological evidence we can infer that the presence of more grinding stone tools in the archaeological record might had been serving prestigious and politically power full households, but we should consider the degree of scavenging the grind stones by other users.

4.3. Function of grind stones

The function of grind stones in Lakia'a is to crush, produce coarsely processed flour, to produce fine flour and to smash different soaked foodstuffs. Morphologically, the grind stones are basically the same in form throughout the study area, so are the manos. But, they vary in the degree of their use wear. Grind stones and manos also vary in size across households in Lakia'a. Small grind stones (quern) in the study area are utilized mainly for smashing soaked flour of maize and sorghum, smash different spices, smash pepper after it is pounded by wooden mortar and pestle, and grind salt.

To understand the function of grind stones it is by far better to diagnose the type and natures of substances processed with grind stones when we study the function of grind stones. Defining the material processed, the specific or multifunctional use of the tool, the preliminary work on the material before processed and identifying whether an additive was used are necessary in the

study of the function of the grind stones (Dubreuil 2001). The type and nature of the foodstuff processed is one of the influencing factors for the use life of a grind stones and manos.

In Lokia'a women and daughters are responsible to perform tasks such as the preliminary works for grains, pounding, grinding, and post grinding works up to baking and cooking. The degree and type of performing preliminary works depends on the type of the foodstuffs. Some cereals are boiled, dried, roasted, pounded and then ground while others are not. For example, cereals like wheat, barley, sorghum, bean, chick pea and maize require drying with the sun light before they are ground and can be roasted with metal griddle for *kollo* with the exception of bean and chick pea.

Barley needs more caution and more preparatory works than wheat for the same purpose for porridge, *kollo*, and muffin. The people in Lokia'a regarded barley as the queen of cereals, because barley has multipurpose better than other cereals. The people stated that it can be used for *kollo*, muffin, injera, *siwa*, and *boso*. Hence, this cereal needs different preliminary tasks dependent on the predetermined purpose it would serve. When the woman wants to prepare barley injera and barley muffin, she first separates the raw edible barley from its inedible part through pounding which would then grind with the grind stones and compatible mano in to fine flour. Furthermore, when the woman wants to prepare barley *kollo*, *boso*, she first clears the unnecessary material off the edible barley and pounds the barley to avoid the husks with wooden mortars and pestles. She then boils the barley for 15 minutes. The next step was drying the boiled barley for 10 minutes. However, the preparation of *kollo*, *boso* follow different paths after the boiled barley is partially dried with sun light. If it is for *kollo* the woman roast the slightly boiled and dried barley with metal griddle and then pound again with mortar and pestle to avoid already not removed husk from the edible part. If it is for *boso* the woman partially roasts (not as equal

as the roasted *kollo*) and grinds with grind stones and compatible mano in to fine flour. This shows that different energy is needed to grind the roasted and unroasted barley in to fine flour, and this, in turn, can influence the rate of use wear of the grind stone and mano. The unroasted barley requires more energy and well hammered working surface of the grind stone and mano to be ground in to fine flour.

This contributes for the rapid use wear of the grind stone and mano. Conversely, the roasted barley needs small energy to be ground, not necessarily well hammered working surface of the grinding material, but the traces of this carbonized grain can be well preserved on the surface of the grind stone and surrounding areas which is one of the vital aspect in the study of the function of the grind stones in the archaeological record.

The white barley together with finger millet (*dagusha*) and Rhamnus prinoides (*gesho*) primarily serve the people for the preparation of a traditional and local drink (*siwa*). The white barley is soaked with water in a small vessel for a day and the water is removed, but the soaked barley further stay being covered with Croton macrostachyus (*tambuk*) leaf up to it become barley malt. Then, it is dried and ground with grind stone with little energy and less textured working surface of the grinding equipments. Contrary to this, there are cereals such as maize that require more textured working surface of grind stone.

Ethnographic data show that dry grinding was the most common method of food processing, so archaeologists depended on this framework to understand prehistoric grinding materials Adams (1996). In Lafia's drying maize, sorghum, wheat, barley, etc simplifies processing the foodstuff with grinding materials. Maize (particularly) and sorghum seek more women energy to be processed and were ground first in to coarse grained flour. Then, the coarse grained flour of maize and sorghum are soaked with water to soft enough and be able to smashed with small

grind stone (*melenketi*). The beans and chick pea are roasted, crushed, and ground to prepare *kikē* and *shiro* (used for cook that can be eaten with injera). However, some cereals like Eragrostis teff (*taf*) and finger millet (*dagusha*) do not need drying or roasting to be processed with grind stone and mano.

Most people in Lokia'a have at least one grind stone and more manos and process foodstuffs for their daily life. The women use their grind stones by retexturing it with andesite and rarely basalt hammer stones (types of volcanic rocks). The frequency and rate of rejuvenation of the working surface of the grinding material vary from household to household. The working surface of the grinding stones has to be hammered sparsely when it is needed to process coarse grained cereals while well leveled rejuvenation of the grinding surface is required to process small grained grains like Eragrostis teff (*taf*) and finger millet (*dagusha*). The type of the raw material used for grind stone influences the rate of rejuvenation of the grind stones and manos. According to the gathered data from Lokia'a, for example, grind stones of phonolite rock (volcanic type of igneous rock) could serve for several times after it is hammered once in a week. Opposite to this, the grinding material of syenite rocks (plutonic type of igneous rock) reflects relatively rapid use wear.

Besides, the nature of the paired tools, the grind stone and the mano influence the use wear of the grinding material. In Lokia'a most of the paired grinding tools currently in use are of different types of raw material and women rejuvenate depending largely on the amount of food processed by the grinding materials which is largely related to the family size of the household. Households with single grind stone often rejuvenate their grind stone and use it as a multi functional tool more than those households with two and more than two grind stones. In Lokia'a grind stones with broad area of working surface are less frequently rejuvenated than grind stones

with small working surface. And grind stones in Lokia'a, initially, have a leveled surface and develop a shallow basin at their central part where women grinders exert more force while processing the grains with the manos. All in all, grind stones had/ have been serving the people to process wide range of foodstuffs: cereals, legumes, spices, and salt which support the daily life of the people. Thus, most grind stones in Lokia'a are multifunctional, although there are grind stones in well established households with more grind stones serving to process relatively specific group of foodstuffs. Such households' process coarsely grained, small grained and smash soaked foodstuff with three different grind stones. This was largely experienced in Lokia'a during the imperial regime of Ethiopia before 1966 E.C.

However, it should be noted that women in Lokia'a do not process oily seeds with their grind stones. Instead the oil seeds like Guizotia abyssinica (*nuhig*), Linum usitatissimum (*entatiê*), and Ricinus communis (*Guli*) are processed with wooden mortars and pestles.

Generally, the multi-functionality of grind stones in Lokia'a is in line with what Wright (1994) stated that tool morphology is not associated for specific function or diet. Schneider (1993 as cited by Duffy 2011) emphasized that grinding tools are mostly multifunctional and are servable for various processing works during their use-life time.

Furthermore, several ethnographic and ethnoarchaeological evidences focus the need to avoid oversimplification of the function of grinding implements (Rowan and Ebeling 2008). In other words, considerable ethnographic and ethnoarchaeological studies have been revealing that many tools are multi-functional. Besides, it is important to consider the degree of grind stone reuse (as was studied by Simmis 1983) by other users which contributes for the multifunctional aspect of the grinding tool. Thus, such evidence can be a base to say that a grind stone in the archaeological record might had largely been serving to process wide range of foodstuffs since

the Neolithic Revolution more than ever before, though further proofing studies should be made. Hence, it is very difficult to entirely link artifact morphology with specific function or service it had been rendered.

4.4. The socio-economic interaction of the people and grind stones

Archaeologically, social matters of a given people of the past are not fossilized like other remains. Briz et. al. (2005) stated that since social interaction of men and women during production and use of the artifacts as social agent are not found in the lithic remains themselves, an analysis of the place where these relations took place through ethnoarchaeology is vital to understand the social relation of the prehistoric people.

Hence, comprehensive understanding of the socio-economic affairs of the living society with traditional material culture is by far important to generate evidence about grind stones in use and their presence in the archaeological record. At least it is pivotal to investigate the role of social relations in the production and transportation of grind equipments to living sites, the labor in charge of grinding and pounding foodstuffs, the social interaction of the people in grinding foodstuffs for ceremonial purposes especially memorial ceremony for the dead person (*teskar*), wedding, Christian ceremony of baptism which demand more food stuffs to be processed to support family members and invited guests. Moreover, it can shed some ideas for how economic power of a household influences the acquisition of grind stones and inter household relations.

Socially, the people in Lakkia are influenced by such factors as religion and economic power of the household. Religiously, the entire people in Lakkia are followers of the Ethiopian Orthodox Union Church. The people prepare and celebrate wide range traditions and ceremonial systems largely linked to the church. Among others: funeral systems, wedding system, Christian ceremony of baptism, memorial ceremony for saints (*kismee*) etc are the major ceremonies

practiced in the area. Economically and socially better of households have been easily mobilizing the quarrying technique and quarrying men in times of production and transportation of grind stones.

The economic condition of the people has been influencing the nature of production especially size and number of grind stones that are found in the service of the household and social ties of the people in Lakia'a. In Lakia'a grind stones are produced socially. Nonetheless, there were and are people who produce grind stones alone either for themselves or for sale. Old established and economically better off households have had relatively well organized grinding materials, as they can employ more quarrying men along with technology. According to the local informants this had been reflected by the large sized family, wealthiest households, local feudal lords during the imperial regime who demanded more grindstones to process more foodstuffs not only for the member of the house and servants, but also for non household members as celebratory meal.

4.4.1. The labor for food processing

In Lakia'a food processing using grind stones, wooden mortars and pestles as well as cooking food is performed by women and daughters. Grinding foodstuff requires substantial time and labor investment. During the imperial regime of Ethiopia (before 1967 E.C.) foodstuffs of some local feudal lords in the study area was largely processed by the woman herself, wage grinders and slaves. Local widow women were also grinding the foodstuffs of the feudal lords for the sake of wages often given in kind. But they did not stay grinding as long as the slave women did. They had usually ground during day time while the slave women grinders did grind day and night for their owner. Furthermore, slave women had to accomplish additional household tasks such as cooking. Slave women who suffered laborious grinding foodstuffs and household tasks

more routinely are said to have expressed their resentment in melody like poem while they did grind, as local old women in Lakia'a narrated. The following are some of the melodies reflected by some slave women:

ወይ አኑ አይገድፎ ንል ምሻን
ወይ አበይ ወይ አደይ አይኾኑ ማን
ቀሽይ ደርሆ መዛር ብተይ መጥላን : :

The above Tigrigna poem was said to have been stated by a slave woman during grinding. Its rough English translation is: 'It was better either if I leave being a female or it was better if my parents were barren, my timer is the voice of the cock during night and I always communicate with the grind stone.'

Several Tigrigna poems were said to have been expressed by slave women who were librated by the support of the Italians during 1927-1928 E.C. The following is a good example:

እቲ መጥላን በዓልኺ ወቐርዮ
እቲ ስርናይ በዓልኺ ጠላንዮ
እቲ ዓተር በዓልኺ ፀጊይዮ
እቲ ልንቻጦ በዓልኺ ለንቕጥዮ
ሚያም አኸሉም ንጣልያን ሓገዝዮ : :

Roughly it means; 'Rejuvenate the grind stone by yourself [to the owner] grind the wheat by yourself [to the owner], crush the pea by yourself [to the owner], smash the soaked flour by yourself [to the owner], and please Saint Marry of Axum support the Italians.'

However, most households did not have slaves and the labors in charge of grinding were the wife and her daughter, and wage grinders of foodstuffs. When there was quarrel between couples

(especially in newly established household) the woman express her resentment and advice her husband while she grind this way:

ጥሕን ጥሕን ዳጉሻ ድራረይ

ከኸይድ እየ ናብ አደይ ማረይ: :

Roughly it means that ‘My work is grinding and my dinner is the food prepared from finger millet, I will go to my mother’. Such poem were used by women in the area as a forcing strategy up on their husbands and has the meaning that husbands have to respect and pay special care to their wives.

Women and daughters had also been aided by wage grinders in the processing of foodstuffs for daily and ceremonial consumption. Some wage grinders were local settlers and some others were seasonal migrant (mainly women) from E’daga Arbi, Cero, Feresmay, Enthcho and Gerhusernai all of them found in the east ward of Adwa town and Adwa woreda.

These migrants (called by the local people as *gullo* meaning servant) had been coming to the area mainly during autumn season to work as harvesters, gatherers of the leftover of cereal crops from the harvested field and *âwdee* (cereal crop threshing place). Furthermore, women migrants were grinding during autumn and extensively in January (wedding month in Lakiya’a) and were given some amount of cereals depending on the amount of the cereal grains, spices processed and pounded by the woman.

All migrants from the listed areas did not perform harvesting and grinding activities. There were some traders (mainly men) who came with their tuber product of red onion and Rhamnus prinoides (*gesho*) used by the local people for the making of *siwa* (local drink) to exchange for cereal grains harvested in Lakiya’a. During their stay in Lakiya’a, migrants accumulate certain

amount of products and left Laki'a to return home in spring season to meet and support their families.

Locally, households with weak economic basis, particularly women headed households have one or two grind stones, and widow women had been grinding in large sized family, and wealthiest houses for wages paid in kind. A wage grinder was paid about 5 kilo raw cereal grains per 20 kilo of cereal processed by the wage grinder. Wage grinding took place openly and secretly with and without the knowledge of the husband of the employer woman. In some situations when the woman grinding and cooking for the household got sick and during birth the husband hires wage grinders to grind foodstuffs for the family.

Woman grinder and cooks in small and medium sized family could process available foodstuffs by her for their family. However, it is difficult for women in large sized family to process and cook enough foodstuffs for the family especially during summer and autumn seasons where by the woman spent the day helping her husband in weeding activities and harvesting works during the stated seasons respectively. Particularly, the load became difficult to the woman to afford field and household tasks when the woman did not have able daughter supporting her mother in grinding and cooking. In such situation the husband invite wage grinders to support his wife in processing cereals for family consumption.

Yet, this was not consistent among all households, as husbands in some households were not willing to hire grinders unless their wives were sick or gave birth. Besides, there were some husbands forcing their wives to process foodstuffs by their own during autumn and summer seasons. To this end, a woman with large sized family had been conducting secret relationships with wage grinders without the knowledge of her husband. Then, wage grinder woman take

certain amount of cereal grains to her home and process it by her own grind stone and brought it back according to their agreement with the employer woman and receive her wage.

The foodstuffs for wedding ceremony, memorial ceremony for the dead person and Christian ceremony of baptism (rarely) up to 1990s E.C were processed socially by women, more specifically the relatives of the family who wanted to prepare the afore mentioned ceremonies, and by neighboring households. The head of the household (routinely a man), which prepare the ceremony, had been distributing the foodstuff to be processed by the woman in the neighboring houses. This demonstrates that grind stones in Lakiya especially before 1970s, had been serving to process more wide range of foodstuffs than the grind stones do in the period after the advent and spread of modern milling machine in the nearby towns and localities near to Lakiya. All in all, grind stones were and are one of the best bridges that socially and economically connect the people in Lakiya.

4.4.2. Young-old established houses relationship in the use of grind stones

Previously, grind stone was given by parents to marrying couples as dowry during their marriage so as to support them until they become economically strong enough either to produce or buy additional grind stones and manos. In this way, the couple had to depend on either their parent's grind stone or on the grind stones in the neighboring houses until they set up their own grind stones. This is because in the terms of Goldstone (2008) "younger" dwellings, whose members are far fewer, often rely on the efficiency of the larger, parent dwellings for every day necessities. This is partially reflected in tabiya Lakiya particularly at Endaselafbelay locality where younger houses are without grind stones, but kept close ties with their parents and well established neighbor houses to process foodstuffs mainly ceremonial foods, for local drinks and

cook foods. This includes crushing and grinding legumes, foodstuffs used to prepare *hilbet* (cultural cook eaten with injera), pounding Rhamnus prinoides (*gesho*), and grinding malt barley (*buqli*) while they take their cereal grains for injera and even for cook to the nearby modern milling machines. Currently, the young houses do not pay cash payments for using the grind stones of their neighboring house, but they co-operate each other in performing several tasks. Some younger houses have been still producing single grind stone at least to process ceremonial foods. Figure 4.4 shows a semi finished rectangular grindstone at the compound of one recently setup house at Endaselafbelay intended to be established and give grinding service.



Figure 4.4 semi finished rectangular sandstone grind stone laid up on animal manure in newly founded household at Endaselafbelay.

4.5. Approximate use life and discard of grind stones

The grind stones and manos in Lakkia'a are designed for extended use. Estimated average use life of grind stones and manos in Lakkia'a depends on factors such as the type of raw material, the nature of paired tools, the original size of the grind stone, rate of rejuvenation which is directly correlated with the type of cereal grains processed with and family size, size of the working

surface of the grinding materials, economic power of the household (recently influencing factor especially after the first modern milling machine appeared in the area) and number of grind stones possessed by the house hold.

Raw material type is one affecting factor to the use life of the grind stone and mano. Regarding this, Van Pool and Leonard (2002) affirmed that raw material affects the durability of metates and influences costs of production. As has been stated repeatedly, the people in Lokia'a widely use rocks of phonolite, syenite-phonolite, syenite, and sandstone blocks and very rarely basalt rock for grind stones and manos. The people in Lokia'a up to 1920s E.C were using grind stones of phonolite rocks in Debresina. The grind stones quarried from this quarry site are generally believed by the society as the most strong and durable, and they did not quickly wear out vertically compared to other grind stones made of sandstones, syenite, and syenite-phonolite rocks. For example, phonolite grind stones, quarried relatively at the same time with grind stones of sandstone or syenite, other factors like family size and economic power of the household remain constant, reflects little morphological changes of the working surface than the working surface of grind stones of either syenite or sandstones (informants). This indicates that phonolite grind stones serve longer than grind stone made of other rocks in the area.

Besides, the data from Lokia'a indicates that the use life of the grinding materials is relatively short, if the mano and the grind stone are of the same raw material, where as the mano and grind stone could have longer use life, if the mano and the grind stone are of different raw material. For example, the people in Lokia'a had been using manos and grind stones of the same phonolite raw material up to the discovery of alternative quarry site and some informants confirmed that it had been wearing rapidly. The estimated average use life of a single phonolite grind stone and phonolite mano ranged from 30-80 years and 6-9 years respectively. Nonetheless, with the

discovery of more quarry sites such as Goure, Maisheho, and Daerotaffa, the people began to use different raw materials for manos and grind stones and extend the use life of the paired tools.

Phonolite grind stones which had relatively the same size, thickness and weight could have different characteristic features in their form during discard. This is partly due to variations in the intensity of use of the grind stones from household to household. The phonolite grind stones serving households having the same number of grind stones, but with different family size reflect considerable difference in their working surface during discard. Households with large family size had more intensely used grind stones than the households with small family size do. Thus, the phonolite grind stone in the service of large family size wears out relatively faster than the phonolite grind stone serving the small sized family, because other factors remain the same, the grind stone was continuously hammered in order to grind more foodstuffs that can support the life of the family. This was one of the influencing factors that could determine the rate of use wear of grind stones before the coming of modern milling machines in the area. Grind stones of syenite and sandstone wear out relatively faster than other grind stones of phonolite and syenite-phonolite rocks mainly due to the nature of the raw material.

The number of grind stones in the service of a household is another influencing factor for the use life of the grind stones in Lafia'a. Households with single grind stones intensively use their grind stones by continuous retexturing the working surface of the grind stone. This situation shortens the use life of the grind stone. Contrary to this, households with two and more grind stones use their grind stones alternatively; thereby extend the use life of their grind stones.

Working surface area of grind stones is also very important for the understanding of the use life of grinding materials. The smaller the working surface area of the grind stone, the shorter use life

it will have. The opposite is true for grind stones with large working surface area which lets it to wear out slowly. The observed grind stones of the subjects of this study in Lokia'a had different working surface area (Table 4.4).

Table 4.4 Dimensions (in c.m) of the working surface area of grind stones in use context

N	Minimum	Maximum	Mean	Std. Deviation
90	884	2405	1762.69	347.806
90				

Table 4.4 shows us that there are grind stones with small and large working surface area in Lokia'a. Grind stones with small working surface, other factors remaining constant, relatively wears out faster than those grind stones with large grinding surface. Because grind stones with small working surface have to be hammered more often to be effective to process more foodstuffs. The small grind stones are mostly found in old established households as an additional processing material and were prepared largely from used grind stones. These grind stones are less efficient. Contrary to this grind stones with large working surface area wear out slowly and are more efficient than the small surfaced grind stones. In line with this Van pool and Leonard (2002), for example, stated that metate efficiency is partly proportionally related with working surfaces. Similarly, Duffy (2011) stated that grinding tools with larger working surfaces were increased so as to ground more foodstuffs to support the expanded sedentary societies in the American Southwest.

The proximity of the household to modern milling machine is the current influencing factor that influences the use life of grind stone in the study area. Grind stone in some households near modern grinding machine shows relatively leveled working surface. These grind stones are more limited to serve crushing some legumes and grind foodstuffs for ceremonial foods. However,

grind stones in households found far from the modern milling machine shows frequent use to process wide range of foodstuffs. Hence, there is a relative difference in the use life of these grind stones. Generally, owing to the above stated factors and other related situations causes a grind stone and a mano to serve approximately 20-80 years and 4-7 years respectively. Given the approximate use life of grinding materials from Lokia'a it is quite relative to expect more hand stones than lower grind stones at the archaeological record. As I observed practically it is the manos which are discarded or reused more than the lower grind stones. Besides worn out grind stones are reshaped for manos. This evidence is help full to strength our understanding regarding the numerical imbalance of lower grind stones and manos uncovered through archaeological investigations in the American Southwest by Adams (1996), at Natchabiet and Lalibela in Ethiopia by Dombrowski (1971). Hence, the rapid wear out of manos compared to lower grind stones and grind stones can be reshaped in to manos should also be considered in addition to the portability and scavenge of grind stones in an attempt to understand the possible reasons for the numerical discrepancy between manos and lower grind stones in the archaeological record.

Regarding the general discard condition, the people in Lokia'a discard or reuse the grind stones and replace them with new grinding materials. The worn out grind stones in Lokia'a could be prepared for small grind stone and manos. Otherwise, they are discarded within (largely) and outside of the compound of the household. Furthermore, they could be used as building material, pounding materials not for human diet, but for traditional medicine that cure ill animals, drinking materials for hens etc (Figure 3. 9). These all processes could complicate the function of grind stones after it is discarded.

4.6. Settlement shift of households and grinding materials

As the data indicates people were undertaking settlement shift mostly experienced from village to village and rarely from tabiya to tabiya owing to the remoteness of cultivable land that the household owns and the interest to receive the old house of their parents. When the household's largest cultivable land is remote from where the household is actually found, the household had to change its settlement and set up new occupational site near the largest cultivable land.

Moreover, the household abandoned its former occupational site when the heads of the household are offered to inherit the old house of their parents. Furthermore, there were occasions that the household changed its settlement if it felt uncomfortable and insecure especially the attack from wild beasts to their children and domestic animals. Such circumstances initiate households to shift their settlement. During their shift of settlement the heads of households take their useable grinding materials with them even if the household moving to old established house with useable grind stone and mano.

Size of grind stones creates logistical problems up on the moving people. The large sized grind stone in Lakia'a weigh about 70-85 kg while the so called medium and small sized grind stones weigh 55-65 and 35-45 kg respectively when the grind stones were manufactured. After certain use, the change in the weight of the original size of grind stone should be considered to understand the logistical problem of the moving household. On theoretical basis it can be said that the small sized grind stones are more portable than the large sized one. With respect to the transportation of grind stone by the moving people Goldstine (2008) stated that migrating populations leaving a site had to take in to account the practicality of transporting these heavy stones; if the grinding stones were in fact shipped, regard less of their weight, then this may shows a cultural preference, and we would not expect to get many of these implements at left sites.

The data from Lokia'a shows that grind stones which were useable irrespective of their size were transported by people who changed their settlement site to elsewhere. But discarded grind stones, worn out manos and broken manos were left at the abandoned settlement sites in Lokia'a. The people like to retain the grind stone and manos in the context of use as long as possible and abandoned processing with it when it is worn out, and use it for other purposes or discard it around the yard. The heads of the households were asked why they did choose the way they did and replied that they do not like to involve in works of production before the formerly produced grind stone is worn out or broken in some cases. Even in some households it is observed that grind stones are used continuously by resetting the unworn part of the grinding surface on the station. Expressing in other way grind stones in some households are used by reset where by the distal end (unworn part) becomes the proximal end. This behavior is agreeable with what David (1998) stated regarding the wear of querns. The repeated use of grind stones by resetting the unworn part on the station in some households may be good clue about the influence of costs of production grind stones.

Particularly, women believed that the already in use grind stone and mano were accustomed with them and affirm that they have special affection to process with it. According to them leveling out the working surface of the newly prepared grind stones is quite time consuming and laborious. This is why women choose the already serving grinding materials. Therefore, cultural preference of women to the grind stones in use and the cost of production for new grind stones were the forcing factors that compel the settlement shifting households in Lokia'a to take their grinding stones and manos with them. This evidence can shed some light on the degree of portability of ancient grind stones, cultural preference to grind stones, the cost of production of grind stones in prehistoric time and site function.

It can aid one to predict, for example, that archaic abandoned occupational sites with rare traces of grinding stones, might have once been settlement sites of people who processed their food with grinding tools, but later abandoned this site by taking their usable food processing materials with them. On one hand people might had been taking of grinding equipments, in the ancient time, with them might be influenced by, based on the ethnoarchaeological evidence, the fear to take the risk of cost of production and the cultural preference of grinders to their usable grind stones and manos instead of adopting new ones.

4.7. Current trend of grind stone use in Lakia'a

The people in Lakia'a generally continued processing their ordinary foodstuff for daily consumption and particularly ceremonial foods (such as hilbet, buqli (barley malt)) using their traditional grind stones. This is because the people in the study area have largely been believed that the foodstuffs processed by traditional grind stones were very delicious and increases the volume of processed flour whereas the foodstuffs processed by modern machine were not delicious, because the nutrient content of the flour was burned by electric current of the milling machine.

However, women although on limited scale have been taking ordinary foodstuffs to be processed by modern milling machine while the household prepare wedding ceremony, Christian ceremony of baptism etc that seek more foodstuffs. Currently, the degree of use and caring the grind stones, generally increases, as one go farther from the place where modern milling machine is found.

This was affirmed, first thing, by directly observing the working surface of the grind stones found in households far from and near the modern milling machine. Almost all the observed grind stones far from the modern grinding machine had newly redressed working surface and the women working with these grind stones reported that they rejuvenate their grind stones roughly

once per a week while these grind stones near modern grinding machine had working surfaces being hammered once per two weeks.

Most people in Lakia'a are currently not producing new grind stones and manos as ever before, because, the people are adopting the modern milling machine. However, although modern milling machine in Lakia'a are currently reliving women by supporting process ordinary foodstuffs, modern milling machine could not replace traditional grind stones to process ceremonial foods consumed in Lakia'a. This is one of the factors that initiate the society to continue to process their foodstuffs using traditional grind stones. This is quite similar with what Adams (1996) stated that technologies relating to food preparation have been the slowest to change, even when users have more efficient alternatives. This is particularly evident in the American Southwest where, even today, Native American women use stone manos and metates to grind corn meal, especially for ceremonial occasions (Ibid).

Chapter Five: Conclusions

The people in Lakia'a use igneous rocks (regarding artifact numbers) and sedimentary rock for grinding materials from four quarry sites. Up to 1920s the people had almost been using a single raw material type (phonolite rock), although there were some inclusions of raw materials brought from other areas. Yet, since 1920s the people in Lakia'a began to use different raw materials coherent for grinding materials. Such circumstance invites for the formation of archaeological record with tools of different raw material types when the tools encounter little or no displacement with natural and human related factors to remote areas.

Although, women take part in a discussion for raw material choice at home, it is men who conduct practical selection of raw materials for grind stones at the source material. Women solely accomplish the acquisition of hammer stones from gorges and lands with plenty of andesite; the most widely used hammer stone in Lakia'a.

Men take quarrying techniques with them to quarry and produce grind stones largely during February, March, and April months. The people in Lakia'a quarry blanks for grind stone either by striking the surface of the outcrop at a certain angle with large metal hammer in order to produce the primary blank or by digging underground outcrops to find strong buried chunks.

The first method of quarrying is common in quarry sites where plenty of surfaced out crop is found where as the second method of quarrying is largely common in quarry sites where there is scarcity of strong surfaced outcrop. The second method of quarrying is much cost full for the quarry men. Such circumstance might had been forcing ancient population to scavenge grinding stones from abandoned areas or transport already served grind stones with them while they left their former settlement. Besides it is reasonably possible to say partly ancient populations were quarrying grinding materials largely from surface out crop, because it requires little quarrying energy. In Lakia'a, usable grind stones and manos pass via two stages in the process of

production. The first stage of production is performed by quarrying men at the source material for two main reasons: to reduce the transportation cost and to get a broad opportunity of blank at the material source when the former blank is broken during production. This evidence is consistent with what (Conlee 2000), Wisdom (1940:31) as cited in Abramiuck and Meurer (2006), Stone (1994) and Briz et. al. (2005) stated regarding lithic artifact production. The second stage of production is finalized at settlement area by women. In this stage of production women suite the working surface of the grinding materials to each other and establish the finished grind stones with in the kitchen. Then, the woman tests the function of the newly founded grind stone by grinding finger millet (*dagusha*) and sorghum. Thus, the grinding place in Lakia'a is a specific place almost entirely in the kitchen. This evidence is similar with the archaeological data in the American Southwest and the ethnographic data from Pueblo presented by Adams (1996).

Note that, the grind stones are placed in the kitchen so that the woman can perform joint activities like baking injera, cooking and grinding foodstuffs in a parallel manner. This indicates the role of the woman in the kitchen in performing household tasks. The association of the woman to the kitchen indicates that the presence of gendered division of labor among the people in Lakia'a. As elsewhere in Tigray food processing in Lakia'a is so strongly associated with women and their daughters, and men are insulted and ridiculed if they try performing household tasks and even if they stay more time in the kitchen after they consume food.

Nevertheless, historically, grind stones of some wealthiest households and local lords who had about 5-8 grind stones were placed side by side at the shelter locally called *gabalaa* due to lack of enough space in the kitchen. Such behavior was experienced during the imperial regime of Ethiopia. This evidence is potential for archaeological investigation and the presence of more

grind stones at the same place in the archaeological record may indicate among others that the grind stones were serving well established household, communal society or politically powerful princes.

The people in Lakia'a use grind stones which are stationary, elongated in plan with flat upper surface, generally, with rectangular, sub rectangular, sub ovate working surface and flat or concave (especially the worn out grind stones) in cross section. The mano used in Lakia'a is an elongated upper stone that fits and lay up on the width of the working surface of the lower grind stone. It is a mobile stone that move on the grind stone in a back and forth direction, with flat surface and convex back (Plano-convex) in cross-section, and elongated in plan.

Morphologically, the grind stones are basically the same in form, so are the manos. But, they vary in the degree of their use wear. Grind stones and manos also vary in size across households in Lakia'a. All grinding materials are hammered with andesite and basalt (rarely). These grinding materials from Lakia'a are coherent with the Axumite examples excavated At Kidane Mihret in Axum by (Phillipson 2001) which shows cultural continuity of the Axumites.

The function of grind stones in Lakia'a is to crush, produce coarse and fine flour, and to smash soaked foodstuffs. Although few households used their grind stones to process relatively specific group of foodstuffs particularly before 1967 E.C, the grind stones in most households in Lakia'a are generally multifunctional. The multi-functionality of the grind stones in Lakia'a is in line with what Wright (1994) stated regarding tool function. Most grinding tools are multifunctional to process wide range of materials during their use life Schneider (1993 as cited by Duffy 2011). Besides, ethnographic and ethnoarchaeological evidences advice for the care full understanding of the function of grind materials (Rowan and Ebeling 2008).

Curious studying and interpretations of the degree of grind stone reuse (as was studied by Simmis 1983) by other users and the socio-economic relations of the people is of great value in order to create relatively clear picture about grind stone use in the ancient time. Thus, these evidences can be a base to infer that a grind stone in the archaeological record might had largely been serving to process wide range of foodstuffs since the first farming societies were founded more than ever before. Hence, it is reasonably very difficult to entirely link artifact morphology with specific function or service it had been serving for human beings.

Grind stones are one of the best bridges that socially and economically connect the people in Lakia'a during the production of grinding stones and food processing activities. Newly founded houses are dependent on the old established and well organized houses to produce grind stones and even to process daily foodstuffs. Grinding foodstuffs requires substantial time and labor investment. Since the work of grinding causes physical damages on the grinder woman, it is also equally important to conduct bone analysis in studying the division of labor and the work of grinding in the past time. The labor for processing foodstuffs using grind stones in Lakia'a is women and daughters. Before 1967 E.C foodstuffs of some local feudal lords were largely processed by women slaves, wage grinders and the woman herself. Most households, however, had not slaves and the labor in charge of grinding was the wife and her daughter together with wage grinders of foodstuffs. Most of the ceremonial foods in Lakia'a were processed socially by women in the neighboring households. Men were distributing the foodstuffs to be processed in the neighboring households. Yet this culture has been reduced after the coming of modern electrical grinders and currently the labor for food processing is the woman and her daughter.

Grinding materials in Lakia'a are designed for long use. Estimated average use life of grinding materials in Lakia'a is influenced by such factors as the type of raw material, the nature of paired

tools, the original size of the grind stone, rate of rejuvenation which is directly correlated with the type of cereal grains processed with and family size, size of the working surface of the grinding materials, economic power of the household and number of grind stones owned by the house hold. These factors cause a grind stone and a mano to serve approximately 20-80 years and 4-7 years respectively in Lakia'a. This demonstrates that upper grind stones wear out more quickly than lower grind stones. In this way it reasonably right to assume the presence of more manos than lower grind stones in the archaeological record. Besides, lower grind stones are reshaped to produce different sized manos and small grind stones and hence such situation can cause for the presence of limited number of lower grind stones in the archaeological record. This information encourages our understanding regarding the numerical imbalance of lower grind stones and manos uncovered through archaeological researches as for example in the American Southwest by Adams (1996), at Natchabiet and Lalibela in Ethiopia by Dombrowski 1971 and may be in other areas. Finally, the rapid wear out of manos compared to lower grind stones, and the idea that grind stones can be reshaped in to manos should also be considered in addition to the portability and scavenge of grind stones that possibly causes numerical discrepancy between manos and lower grind stones in the archaeological record.

Worn out grind stones in Lakia'a are used for different purposes and/or they are discarded within (largely) and outside of the compound of the household. These all processes complicate the function of grind stones after discard.

Moving people in Lakia'a take their grinding materials with them irrespective of the logistical problem that grinding materials create. This is mainly due to cultural preference of women to the grind stone in use and the fear for the cost of production new grind stones. This evidence provide insights about the degree of portability of ancient grind stones, cultural interest to grind stones,

the cost of production of grind stones in the past. Although it should be studied (proved archaeologically), it is reasonably possible to say, for example, that sites with rare traces of grinding stones might have once been settlement sites of people who processed their food with grinding tools, but later abandoned this site by taking their usable food processing materials with them. On the other hand people might have been taking grinding equipments, in the ancient time, with them due to, based on the ethnoarchaeological evidence, the fear to take the risk of cost of production and the cultural preference of grinders to their usable grind stones and manos other than producing new grind stones. Today, the people in Lakia'a generally continued processing their ordinary and ceremonial foods using their traditional grind stones. Generally, the degree of intensive use of grind stones is strong in households far from modern milling machine. But, most people in Lakia'a are currently not producing new grind stones and manos as ever before. Besides, the size of currently produced grinding materials is small compared to the grind stones produced some 30 or more years ago, because the people are adopting modern milling machine.

Although modern milling machine in Lakia'a are currently helping women in processing ordinary foodstuffs, modern milling machine could not replace traditional grind stones to process ceremonial foods consumed in Lakia'a. This is why the people prefer largely grinding foodstuffs using traditional grind stones to modern electrical grinders. Such circumstance let traditional grinding materials to be slowly replaced by modern milling machine.

Despite this study emphasizes the ethnoarchaeological study of grind stones in Lakia'a, the ideas and the stated conclusions in this thesis will have certain implications for better understanding of the grind stones unearthed from and found in the archaeological record. Therefore, it is quite sound full for archaeologists to undertake further and organized archaeological, and

ethnoarchaeological researches on grind stones in societies that keep using traditional grind stones. Moreover, it is also advisable especially for ethnoarchaeologists to study and document the ethnoarchaeological evidence in a manageable manner that can help archaeologists' to have broader scope of information indirectly about the grind stones which were served by proto historic societies and historic societies, and indirectly about the agricultural intensification, division of labor together with the socio-economic interaction of the people. The rapid spread of modern milling machines is facilitating the traditional materials like grind stones to decline and to disappear. Such conditions present, in the terms of Shrotriya (2007), responsibility for archaeologists and anthropologists to record those traditional technologies that have survived and applying them for the study of prehistoric societies.

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Appendix I; List of Informant Interviews

No	Name	Sex	Age	Place of interview	Date of interview	Remark
1	<i>Ato</i> Tafere Gebre-Egziabeher	M	56	Home	Dec.15,2011	Found far from modern grinding machine. The household of this man has three grind stones.
2	<i>Qeshi</i> Tetamqe Gebru	M	76	Home	Nov.30,2011	Knowledgeable about how to quarrying grind stones and the chronology of the quarry sites.
3	<i>Ato</i> Berha Gebre-Hiwot	M	79	Home	Jan.5,2012	Knowledgeable about the wage grinders.
4	<i>Woyzero</i> Zewditu Tekle	F	82	Home	Jan.8,2012	She was wage grinder. She knows about the quality of raw materials and uses different raw materials for grinding equipments.
5	<i>Ato</i> Berhe Worqneh	M	72	At quarry site	Nov.28, 2012	He knows more about the extent of raw material distribution from Debresina quarry site. He also knows the chronology of the quarry sites in the area.
6	<i>Ato</i> Desta Berhe	M	45	At quarry site	Jan.15,2012	He sells grind stones to the people in Adwa town. He knows more how to quarry blanks and prepare grinding materials.
7	<i>Woyzero</i> Tsehaynesh Giday	F	50	Home	Nov.30,2011	She knows about the process of second stage grind stone production. She is also a member of a household that undertook settlement shift.
	<i>Woyzero</i> Mtslal Fisaha	F	55	Home	Dec.16,2011	She knows about the second stage of grind stone production as well as the approximate use life of grinding materials of sandstone and of

						phonolite rock.
8	<i>Ato</i> Mokonen Nega	M	42	Home	Dec.18,2011	Settlement shift experience.
9	<i>Ato</i> Negash Sayou	M	68	At quarry site	Dec.20,2011	He knows more about how to quarry and manufacture grind stones. And found far from modern grinding machine.
10	<i>Woyzero</i> Hiwot Geberwahid	F	30	Home	Dec.10,2011	Near modern grinding machine and has settlement shift experience.
11	<i>Qeshi</i> Gebrewahid Kifle	M	42	Home	Dec.10,2011	Found near modern grinding machine.
12	<i>Ato</i> Mengstu G/her	M	31	Home	Jan.19,2012	Head of the newly founded household with no grinding material.
13	<i>Ato</i> Yibrah Birhane	M	33	Home	Jan.22,2012	Newly married couple in old house with many reserved grind stones.
14	<i>Ato</i> Teklyhaymanot Gebremikael	M	33	Home	Jan.22, 2012	Head of the newly established household with no grind stone.
15	<i>Woyzero</i> Biraha Gebremedhin	F	35	Home	Dec.12, 2011	Household head with one grind stone and two manos.
16	<i>Ato</i> Gebremariyam Gebrehiwot	m	65	Home	Jan.19, 2012	Household and knowledgeable about the wage grinders.
17	<i>Ato</i> Birhane Hagose	M	58	Home	Dec.9, 2011	Knows about the social interaction of quarry men during transportation of the semi finished grind stone to settlement site.
18	<i>Ato</i> Yesaq Asefa	M	32	At his office	Nov.27, 2011	Natural science expert in <u>tabiya</u> Lakkia'a.

DECLARATION

I, the undersigned, declare that this thesis is my work and all sources of material used for the thesis have been fully acknowledged.

Name: Gebre Teklu

Signature: _____

Date: July 2012

Addis Ababa University