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Reconstructing Food Systems from the Late Holocene Context of Mochena Borago Rock shelter, Wolayta, Southern Ethiopia

Medhanit Tamerat Asmare

Addis Ababa University

Addis Ababa, Ethiopia

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Reconstructing Food System from the Late Holocene Context of Mochena Borago Rock shelter, Wolayta, Southern Ethiopia

By: Medhanit Tamerat Asmare

Supervisor: Alemseged Beldados (PhD)

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This is the thesis presented by Medhanit Tamerat entitled: Reconstructing Food System from the Late Holocene Context of Mochena Borago Rock shelter, Wolayta, Southern Ethiopia submitted in partial fulfillment for the degree of Master of Arts in Archaeology, in the department of Archaeology and heritage Management, complies with the regulations of the University and meet the accepted standards with respect to originality and quality.

Signed by the examining committee

Examiner_____ Signature_____ Date_____

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Abstract

Mochena Borago rock shelter is a very rich archaeological site with one of the most complete late Pleistocene cultural sequence in the Horn of Africa. Despite the rich cultural sequence, the pre-history and historic period of human and plant interaction and ecological history of this site are poorly documented and reconstructed. The objective of this study was to reconstruct food systems of the ancient inhabitants of Mochena Borago rock shelter in the Late Holocene period. Archaeobotanical investigation was conducted on a 27 soil sample bags of 2000 and 2001 French Field seasons at the Laboratory of the ARCCH (Authority for Research and Conservation of Cultural Heritage).For the better interpretation of the archaeaobotanical materials and data, ethnoarcheological studies were undertaken in the five Kebeles of Sodo Zurea Woreda. Based on this, a total of 64 plant spices were documented and 112 seeds and fruit stones were identified by the Archaeobotanical investigation which included Sapindaceae cf. Deinbollia type (n=55), Myrtaceae cf. Syzigium guineense type (n=33), Plectranthus edulis (n=9), Euphorbiaceae Croton sp. (n=7), Cordia cf. africana (n=2), Ebenaceae cf. Diospyros (n=1), Olea europaea sub sp. cuspidate (n=1) and the rest four were unidentified. The ethnobotanical documentation reveled that five plant types that were used as food, medicine and raw materials to be similar with the plants recovered by Archaeobotanical investigation. Among the identified botanical remains, Plectranthus edulis which is an indigenous crop for the study area, Cordia cf.africana and Olea europaea sub sp. cusipdata are reported for the first time in archaeobotanical context in the whole region of Ethiopia.

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the Study

Wolayta is located within the Southern Nations, Nationalities, and Peoples Regional State of Ethiopia. Sodo is its capital city, which is found at the southern foothills of Mount Damota. This mountain is situated 3 kilometers far from the site of Mochena Borago which is a rock shelter (Fisher, 2010).

As Fisher (2010) stated, in the local Wolayta language, the rock shelter takes its name from Moche Borago who was among the first owners of the land around the rock shelter and his name also commands a unique place among the history of the people. According to oral traditions, Moche, and perhaps his father Borago, were advisors to King T'ona who was the last king of Wolayta. In accordance with informants, researchers who initiated work at the site previously recorded the name as "Moche Borago". However, the new updated official records and local residents confirm the correct name of the rock shelter as "Mochena Borago" (Brandt *et al*., 2012) which is also used in this study.

Mount Damota is a volcanic complex which has parallel crystal that reaches its pick at 2908 m (Lesur *et al*., 2007; Brandt *et al*., 2012). At this point, it forms the boundary between the Southwest Ethiopian Highlands to the west and the Southern Main Ethiopian Rift Valley to the east.

To the distant north, the slope of Mt. Damota provide striking views of the Central Main Ethiopian Rift Valley lakes, to the east the Bilate River and the Southern Main Ethiopian Rift Valley to the south west, and the Wolayta highlands to the west. The town of Sodo lies at the southern foot of the mountain (Brandt *et al.,* 2012).

As Lesur, *et al.,* 2007 stated, the site is located halfway up a 20 m high cliff of a steep-sided valley. On this cliff, a waterfall emerges from a torrent springs in the mountain and flows down. Behind the waterfall, the site of Mochena Borago is seen on a large platform. Its floor is relatively flat and would have allowed occupation by a large human group.

For the first time, the vast rock shelter of Mochena Borago has been revealed for Scientific Research by Nanterre, France GEPCA (Groupe d'etude de la Protohistoire dans la Corne de I'Afriqu) (the Proto historic study Group in the Horn of Africa), in 1995 (Gutherz *et al*., 2000 and 2001).

According to Gutherz *et al*., 2000 and 2001, the main focus of this project was to study the origins and processes of plant and animal domestication in the Horn of Africa during the Neolithic period. In addition to this, they tried to analyze how these developments are related to underlying environmental changes.

In 1998 under the leadership of Xavier Gutherz, from the University of Montpelier, France, the first excavations at Mochena Borago were undertaken. Later on the excavation was also continued on January and February of 2000 and December 2001 *(*Gutherz *et al*., 2000 and 2001).

Moreover, archaeological excavations are still underway, since 2006, on the rock shelter of Mochena Borago by the South West Ethiopia Archaeological Project (SWEAP) under the direction of Steven Brandt, from the University of Florida (Fisher, 2010).

The focus of the research is assessing the context of the stratigraphical and archaeological sequences as of the late Pleistocene (Fisher, 2010). Testing the "Refugium Theory" which states that the South West Ethiopian Highlands were a major environmental refugium during the Last Glacial Maximum (LGM), extreme cold and arid phases. The site was also a preferred occupational area within the last 70,000 years (Brandt *et al*., 2012).

The environmental setting of Mochena Borago rock shelter is attractive for investigating human cultural evolution given the large size of the cave, the presence of river valley nearby and the rich vegetation composition. The rock shelter site of Mochena Borago has a potential for archaeological and archaeobotanical researches. It is a site with rich cultural sequences ranging from Holocene to Pleistocene in terms of paleoenvironmental reconstruction.

In the research, I have reconstructed food systems from the study area, from the Holocene context by using archaeobotanical and ethnoarchaeological approaches. The result of the analysis provided a good amount of data to understand the ancient food systems and paleoenvironmental aspect of the region. Since the region lacks botanical data for reconstruction of the past through direct recovery of carbonized grains or botanical remains by archaeobotanical methods, the result of this research is a valuable addition.

1.2. Theoretical Background

In this part, a discussion of some of the previously formulated hypotheses and/or theories on the site of Mochena Borago rockshelter is made. This prominent site has plenty of recovered evidences that can help us to have a clear understanding of its occupational sequences. The detailed laboratory analysis and investigations which is presented in chapters three and four have been carried out to assess for some of the hypotheses. Different articles, related with the hypotheses, were also reviewed. Hence, the following discussion tries to scrutinize the various hypotheses set on the basis of the rock shelter of Mochena Borago.

Between 70 and 50 Ka BP, anatomically modern human dispersed out of Africa. The dispersals of Homo sapiens out of Africa ~70 and 50 Ka BP were landmarks in human history. This is because this event is responsible for the world's present genetic and cultural diversity. Excavations at Mochena Borago rock shelter have yielded the first securely dated archeological sequence for later periods of the dispersal. Though, the site is a land mark for the dispersal, it also continued to serve as a settlement site all the way from mid Pleistocene to late Holocene and historic period (Gutherz *et al*., 2000; Brandt *et al*., 2012). The presence of Late Holocene and Historic period cultural occupation is well attested by this research (See Chapter Four).

Examining the cultural process and environmental contexts of the dispersal of modern humans from Africa to Europe during the late Pleistocene is key to exploring the issues like what kind of African environments had shaped human experiences before leaving and for the understanding of the technological and social capabilities that humans had developed. Mochena Borago rock shelter presents one of the most complete records of human occupations in eastern Africa during this critical time period (Gutherz *et al*., 2000; Brandt *et al*., 2012).

The second hypothesis that go in line with this research and the site of Mochena Borago states that the SW Ethiopian Highlands were a major environmental refuigum during cold, arid periods within the last 70,000 years (Brandt *et al*., 2012). First, the SW Highlands are a " hot spot" of human genetic diversity today which indicating that they may have been a source area for population radiation in prehistoric times (Tishkoff and Verrelli, 2003). Second, they are near to both hypothesized dispersal corridors: the Bab al Mandeb and the Nile Valley (Van peer, 1998; Petraglia, 2007). Third, during the prehistoric time the SW Highlands have received more rainfall than the surrounding regions of northern Africa and the horn. This is because of the SW Highlands are close to the center of Inter-Tropical Convergent Zone (ITCZ) movements, and thus receive moisture from both Atlantic and Indian Ocean systems (Umer *et al*., 2004); and they capture high orographic rainfall. If these combined circulation patterns allowed the SW Highlands to maintain higher rainfall than surrounding regions throughout the Late Pleistocene, this area in general and the rock shelter of Mochena Borago in particular could have provided a refugium for plants, animals, and humans during extended hyper-arid and post hyper arid periods (Brandt *et al*., 2012).

The recovery of many botanical remains in the settlement area of the site through archaeobotanical methods is a case in point here.

Human behavioral response to regional environmental changes in Ethiopia and the Horn of Africa during the Late Pleistocene period are poorly known. This is because of sites which can test this are few and securely dated sites are even few (Brandt, 1986). However, recent excavation at Mochena Borago rock shelter has established the first well-dated archaeological sequence in the Horn of Africa. The lowest excavated deposits in Mochena Borago correspond to the latest possible period of initial modern human movement out of Africa (Brandt *et al*., 2012). Therefore, the rock shelter of Mochena Borago stands as a prime pre- historic archeological site which can give clue to "The Refigum Theory".

In addition to the above two hypotheses, the rock shelter of Mochena Borago have yield archaeobotanical data to contribute to the different theoretical frameworks about the beginning of early food production in Ethiopia.

Researches proposed various hypotheses and model on the origin of early food production. These are broadly classified in to two; indigenous development model and migration/ diffusion model. Some of the earlier researchers who conducted study on the beginning of early food production include Murdock (1959), Purseglove (1976), Brandt (1984), and Clark (1988). Including Christopher Ehret (based on linguistic approach), Vavilov (based on plant genetics), Carl Sauer (on the basis of plant geography), and Porters (distribution of edible crops) recognized the highlands of Ethiopia as the oldest and independent center of cultivated edible crops (Vavilov 1951; Sauer, 1952).

According to Vavilov (1926), plants were domesticated in restricted geographical centers which were determined by the distribution and genetic diversity of modern plant crops. Ehert proposed indigenous development model for the origin of food production in Ethiopia based on the analysis of linguistic geography. According to his study, prior to 7000 years BP the proto-Cushitic speaking peoples of the highlands of Ethiopia were practicing the cultivation of *teff* and finger millet. He also mentioned that, Omotic peoples in South west Ethiopia were responsible for the domestication of *enset* (Ehret, 1979). In the contrary, scholars such as Seligman (1930), Clark (1976), Purseglove (1976) and Dogget (1989) came up with the diffusion theory. Their theory states that the beginning of early food production in the Horn of Africa is a result of the diffusion of the same culture from outside.

According to Harlan (1971) and D'Andrea (2008) the presence of edible wild progenitors in a given area and its continuous utilization indicates an indigenous food production tradition. In line with the same argument, the result of the archaeological and ethnoarcaeological study in the rock shelter of Mochena Borago, which are presented in Chapters three and four demonstrates an indigenous food production and exploitation process (example the utilization of *Plectranthus edulis*)

1.3. Statement of the Problem

There are very limited researches conducted on the topic of early food production in Southern part of Ethiopia. As Tekle (2003) and Alemseged (2004) described, there are few researches carried out in the region as far as the rock art analysis of cattle motifs and their implications on the beginning of pastoralism is concerned.

For example, in rock art sites like Akrsa, Chabe, Galma, Gesuba, Dalato Gongolo, etc. there are indications of the presence of animal husbandry.

Systematic study on the reconstruction of ancient food systems based on direct recovery of botanical remains from archaeological sites in the Southern parts of Ethiopia is almost absent. The absence of archaeobotanical researches in the region and the dearth of data on the literatures happened to be a limitation while reviewing previous works.

The rationale for choosing this site has thus, to do with the absence of research concerning the beginning of food production in the area. Although in 2000 and 2001, French researchers conducted excavation; the result is incomplete without the analysis of plant materials that were uncovered from the site. The research which continued at Mochena Borago following the French mission by American and German missions did not pay attention to the pre-historic economy unlike the previous. This is because the primary research objective of the GEPCA (Groupe d'etude de la Protohistoire dans la Corne de I'Afriqu) (the Proto historic study Group in the Horn of Africa), team was to recover evidence for early food production in the Horn of Africa. Therefore, this research is expected to analyze data on the late Holocene subsistence pattern by analyzing carbonized botanical remains from soil samples and ethnoarchaeological study.

With this research gap and background the researcher will attempt to synthesize and analyze the archaeological data based on the evidence on botanical remains and ethnoarchaeological methods, so as to reconstruct the beginning of early food production with the environmental context of Mochena Borago rock shelter.

1.4. Review of Related Literatures

The first attempt to document a Neolithic site in Ethiopia was undertaken by the British colonel, Moysey in 1943 at a site of Lake Tana. Until its revival by Desmond Clark and David Phillips on in the late seventies century, Neolithic research in Ethiopia was under investigated. However, still it is difficult to fully understand the status of early food production in Ethiopia due to the fragmentary nature of Neolithic research (Alemseged, 2004).

With the exception of the rock arts documented across the region, there are limited researches on the beginning of early food production in the Southern part of Ethiopia. Hildebrandt (2003) and Meseret (2014) tried to address the problem through ethnoarchaeological approaches. Both of these works are reviewed in the ethnoarchaeological related literature of this sub-topic. To give a wider context for the topic and the period under discussion, the archaeological and etnoarchaeological literatures are reviewed below.

1.4.1. Archaeological Researches in Ethiopia

To test the hypothesis that Ethiopia played a major role in the introduction of domesticated plants in to Africa, Dombrowski (1971) in his PhD dissertation work, 'Excavation in Ethiopia: Lalibela and Natchabiet Caves, Begemeder Province', tried to analyzed archaeological findings from these two caves. He used surface survey and excavation in both of two caves. As he stated, these two caves represent similar especially in phase II (containing three strata).

The upper part of phase I, as he said, represent a people utilizing domesticated plants and animals. At this point Iron is present along with the use of some percussion- flaked stone tools. On the other hand, the lower part of phase I have no iron represented, and show an increasing quantity of percussion-flaked lithic material. He mentioned that the sequence did not go back far enough to determine Ethiopia's that role in transmitting the idea of domestication of plants to the rest of Africa. Howe ever, based on the data, he conclude that the introduction of domesticated plants (barley and chick pea) and animals to the central highland region around Lake Tana occurred since at least 500 B.C.

Barnett (1999) in her work entitled 'The Emergence of Food Production in Ethiopia' focuses on both indigenous development and external contact. She states that the humid condition of the early Holocene, especially in the early seventh millennium Bp. allowed the vegetation cover to revive. Such amelioration in the environmental condition encourages a move towards sedentary life by exploiting the available resource. She explained the absence of evidence in the archaeological recorded of such an exploitation by the beginning of an arid phase in the late 7th millennium Bp. or by an overshadow of a new culture from outside. Thus, according to her, domestication of animals might go as far back as the 6th millennium Bp. and the arrival of that of Middle Eastern plant items as far back as the 5th millennium Bp.

However, the archaeological record is devoid of evidences of both animals and plants in the above-specified period. The appearance of Middle Eastern crops did not exceed the third millennium Bp. and evidences for animal domestication are not earlier than the fourth millennium Bp. (Hildebrand, 2003).

Agazi (2001) in his PhD dissertation, 'The Holocene Prehistoric Archaeology of the Temben region, northern Ethiopia', attempted to reconstruct the cultural chronology of the Temben region of northern Ethiopia that has yielded sites with artifactual and faunal remains. He documented archeological occurrences by using reconnaissance survey and excavation (by 1x1m grid squares and 5cm unit levels). As a result, 1697 faunal specimens were studied from five stratigraphic layers at Daneil Kawlus. And a total of 1633 faunal specimens were studied from three cultural stratigraphic units at Baati Ataro. Theses both sites rely on small wild animals especially hyrax. However, there are differences between the sites in taxa used. According to him, these differences may relate to environment and mammalian abundance during periods of occupation. Theses rock shelter provides an important record of the beginning and development of herding in northern Ethiopia.

The Kafa Archeological project (2004-2006) excavated ten caves and rock shelters in different environments in Southwest Ethiopia. The objective of this archeological project according to the article, The Holocene archaeology of Southwest Ethiopia: New Insights from the Kafa archaeological project which is written by Hildebrand et al., in 2010, is to obtain a Holocene chronology and compare this context with its adjacent regions. Their methodology is based on building a cultural chronology, reconstructing subsistence and investigation of diachronic changes in technology and subsistence. At Kumali rockshelter, as stated in this article, mid-Holocene deposits show the use of a microlithic industry, and macro botanical remains reveal that changes in plant use from 4, 700 14C bp to the present in the region.

In addition to this, Ceramic and domestic animals appear at Kumali and Koka by ~2,000 14C Bp, suggesting that herding and pottery making appeared late in this region.

Almseged (2004) studied the beginning of food production entitled 'The Impact of Environment on the Evolution of food producing societies in Mid- Holocene and After in Ethiopia'. The objective of the study was to see the influence of past environment in the beginning of food producing societies in the country. He documented most sites which beer evidence for the Neolithic evolution and see their corresponding environmental condition. In the study, he also documented new sites at Adi Bozet which rendered data with evidence of early food production. The study showed that the beginning of food production in Ethiopia could be associated with the global climatic change of ca. 4200 BP.

Another work which discussed about food production in the Holocene period in this study area is the article entitled Exploitation of wild mammals in South west Ethiopia during the Holocene (4000BC- 500AD): the finds from Moche Borago Shelter (Wolayta) which was written by Lesur *et al*., in 2007. The Objective of the study is to see the relationship between human groups and their environment during the Holocene period of significant climate change. As a method the researcher used morphological and osteometric criteria for taxonomic distinctions especially for suids, carnivores, lagomorphs, hyraxes (*procaviidae*) and monkeys (*primates*). And they also used the method of PR (Percentage of Representation of Skeleton parts). According to this article, the occupants of Mochena Borago exploited, mainly for food, a wide spectrum of mammal species, especially bovides.

As noticed by this article, there is no evidence for any husbandry in this rock shelter. This suggests that, because of the topographic location, natural richness of the wildlife and cultural inertia, the adoption of animal husbandry was very much delayed when we compared it to other parts of the Horn of Africa. In general, the rich and diverse environments of Wolayta favored the development of a specialized society that mastered the exploitation of wild animals.

In Fisher's PhD dissertation (2010), Late Pleistocene Technological change and hunter Gatherer Behavior at Moche Borago Rockshelter, Sodo-Wolayta, Ethiopia: Flaked stone Artifacts from the Early OIS 3 (60-43 KA) Deposits , a study is made to understand the impact of environmental changes in the behavior of Hunter gatherer at the rockshelter of Mochena Borago, Wolayta. The general goal of this dissertation is to provide data at the local scale which contribute to a better understanding of human behavioral adaptation during OIS 3 (Oxygen Isotope Stage 3). This dissertation focuses on the analysis of stone tools from the lower deposits at Mochena Borago during ~54-43 Ka. Based on the findings, Fisher suggested that the inhabitants living in and around Mochena Borago may have altered their behaviors in response to ecological changes which brought on by monsoonal flux during OIS 3. Moreover, his interpretation of the flaked stone artifacts from the T- Group suggests that while hunter-gatherers developed new technologies to perform activates required of unstable climates and variable resources.

The article, Early MIS 3 occupation of Mochena Borago rockshelter, Southwest Ethiopian Highlands: Implications for Late Pleistocene archaeology, Paleoenviroments and modern human dispersals, by Brandt *et al*., in 2012 is written based on the archaeological study conducted in the South West Ethiopia in the rock shelter of Mochena Borago. According to the article, the objective of the research is to test the hypothesis that the Southwest Ethiopian Highlands as a major environmental refugium during cold and arid periods of the last 70, 000 years. In addition, to examine the cultural processes and environmental contexts of the dispersal of modern humans from Africa to Europe during the late Pleistocene is also another goal of the research. The excavation method that they used was based on unit levels by 5cm interval. Their dating method is based up on radiocarbon dating and additionally used OSL, 40Ar/39Ar and ESR dating methods. However, none of these three additional dating methods were successful. According to this article, although analyses are still ongoing, the evidences from Mochena Borago rock shelter have the potential to tell us about modern human dispersals across and out of Africa in several ways. First, by refining the chronology for the horn of Africa back into early MIS 3 or possibly MIS 4. Second, by furnishing the first chronologically secure and detailed early MIS 3 environmental sequence for an area near a dispersal corridor. And, finally, by documenting changes in technology, landscape use, and other aspects of human behavior around the time of range expansion of the L3, M and N haplogrouls out of Africa.

1.4.2. Ethnoarchaeological Researches on Food Production in Ethiopia

It is trough ethnoarchaeological research that the link between crops, the society that cultivate and use them, and ecology in which they grow, could be established. Based on the understanding of present day, archaeologists could develop hypothesis to explain the past (D' Andera 1999; Hildebrand, 2003).

Archaeobotanical investigation by itself cannot provide clues as to when and which plants selected for further manipulation and cultivation in the past. This is because of the absence of a crop's very first domesticated individual in archaeobotanical records (Hildebrand, 2003). However, ethnoarchaeology can explain the process of selection that may have been carried out during the domestication. Through direct observation and information gathering from traditional farmers, the selection process that can affect the plant morphology can be understood (Harlan, 1989; Hildebrand 2003).

Based on the direct observation, archaeobotanists were able to identify the sequence of events in crop processing and correlating with the plant material composition in archaeological context. By observing the traditional crop processing and recording, the frequencies of the crop plants and wild plants associated with threshing, winnowing, hand sorting, sieving, parching, storing, etc, archeobotanists were able to built a predictive model which can help in identifying the different activities using excavated archeological plant remains (Hillman, 1984; Hastorf, 1996).

Ethnoarchaeological investigations are important ways in understanding human's strategies and decisions taken in order to adapt to their environment. So, in the next paragraphs ethnoarchaeological researches on Food production in Ethiopia are reviewed.

D' Andrea et al., (1999) undertook ethnoarchaeological study of traditional farming systems in northern Ethiopia, Tigrai Regional State, on a small farming community at a locality called Adi Ainawalid, Northwest of Mekelle. The objective of their study were observing features of traditional farming activates with the intention of formulating testable models on the characteristics and evolution of ancient farming communities in the area. Interview and observation of crops processing of some cereals and legumes, documenting domestic architecture and craft technology were the methods they employed in their study. As a result, the study indicates that the temporarineous of kitchen buildings and the presence of portable stoves at Adi Ainawalid resulted in limited and fragmentary accumulations of charred plant residues in living quarters. In addition, charred plant body parts that can be preserved in residential areas are results of sweeping and discarding.

Hildebrand (2003) conducted a research in Southern parts of Ethiopia. Enset, Yams, and honey: Ethnoarcheaological approaches to the origins of horticulture in southwest Ethiopia is the research topic. Their central topic is the variable interactions between humans and wild and domestic forms of enset (*Ensete Ventricosume*) and yams *(Dioscorea cayenensis*) and related species. The main objective of the thesis is to examine the resources of southwest Ethiopia and modeling their probable distribution during prehistoric periods. It also aims to illuminate contexts in which humans and two crops: yams and enset would come into close proximity. This thesis takes an ethnoarchaeological approach. The result of this research indicated that the probable highland context of early enset and yam manipulation, and the depletion of productive lowland savanna environments during the early Holocene.

The study suggested that early manipulation of yams and enset was undertaken by indigenous Ethiopian people before the advent of major population movements out of the Sahel. In the final analysis Hildebrand try to single out climate, environment and seasonality as push factor that may lead to plant domestication in Southwestern Ethiopia.

Lyonas and D' Andrea (2003) conducted an ethnoarchaeological comparative study on the use of ovens and griddles and the preservation of gluten ingredients in bread. A griddle is large circular utensil which is very common in Ethiopia and Eritrea for baking bread and *injera*. In their study they argued that unlike wheat and barley, African indigenous crops like Sorghum, *teff*, finger millet and pearl millet lack gluten substances. Based on the analyses of technology, they proposed that before the introduction of Middle Eastern crops, indigenous plants were already in use in the highlands of Ethiopia.

An ethnoarchaeological study was conducted on the production and use of noog (*Guizotia abyssinica* (L.) Cass.) and mech (*Guizotia scabra* (Vis) Chiov) as conducted by Hiruy (2004). The purpose of the study was to understand the beginning of traditional agricultural system in highland Ethiopia. The study has recorded the technological, cultural, economic and social aspects related to this oil plant. The research has revealed that the tools used in the processing of the plant do not show evidence for the presences of noog in the archeological record. The charring experiment demonstrate that noog require a lower temperate than most plants demand which is between 250 to 350oc under oxidized atmosphere and 300 to 350oc under reduced condition.

In an attempt to have an idea on the origin of agriculture in Ethiopia, Abawa (2009) studied the cultivation of *teff* in Gojam highlands of Northwestern Ethiopia based on erthnoarchological methods. Through the ethnographic studies, he documented the processes involved in the cultivation and consumption of *teff* in the area. He has also compared the process observed in *teff* with other major cereals growing in the region. The result of his study demonstrates that there are deep rooted cultural and ritual practices associated with the cultivation of *teff*. These firmly established cultural and ritual aspects on indigenous edible plants of Ethiopia predate the introduction of crops from outside.

Tsehay (2012) made an ethno archeological and experimental studies on agricultural activities of Finger Millet (*Eleusine coracana*) (L.) in Northwestern parts of Ethiopia, west Gojjam of Amhara Regional State, and Metekel Zone of Benishangul Gumuz Region. The purpose of her study was to document traditional agricultural techniques and technologies and indigenous edible crops before its complete disappearance and to show its archaeological importance. In her study, Tsehay conclude that those tools and techniques which were used during the process of dagusa cultivation and consumption have their own important archeological implication.

Mesert (2014) conducted an ethnoarchaeological study of Wild plant exploitation in Hidiyya Zone, Southern parts of Ethiopia. The aim of this study is to describe wild edible plants and their categories. Moreover, to know indigenous people knowledge and behavior about the value of consumption on three selected wild edible plants: *Syzygium guineese*, *Toddalia asiatica* and *Carissa spinarum*. In order to achieve these research objectives; the researcher used Qualitative data analysis method. As a result, in the study area, these three wild edible plants do not preserve and processed.

But, the societies in this study area consumed these wild edible plants fresh and raw. This tells according to the researcher probably since the remote past Hadiyya people used to consume this wild edible plants in raw. In general, the exploitation of wild edible plants has been continuing until today in Hadiyya zone. However, the degree of exploitation decreases from time to time because of the introduction of agriculture and marketable fruits like Avocado, Orange, and Lemon and so on.

The above reviewed literatures though fragmentary give us the status of Neolithic researches in Ethiopia. Most of the researches are based on ethnoarchaeological approaches. While some others based on documenting rock arts, grinding stones, pottery fragments and micro-lithic tools. What is missing is the archaeobotanical evidence. This thesis will contribute its share based on archaeobotanical data.

1.5. Objectives of the Study

In an attempt to gain a clear understanding of the food system of Mochena Borago and its environs, I have set the following general and specific objectives;

1.5.1. General Objectives

- To reconstruct food systems of the inhabitants of the rock shelter of Mochena Borago between Mid and Late Holocene through archaeobotanical and ethnoarchaeological approaches.

1.5.2. Specific objectives

In addition to the above general objective, this research addressed the following specific objectives;

- ❖ To single out edible crops such as cereals and root crops of the inhabitants at the rock shelter of Mochena Borago and its environs,
- ❖ To reconstruct the vegetation history of the study area,
- ❖ Documenting on the evolutionary history of some identified plant species.
- ❖ To describe change and continuity in the environment of the study area through time,
- ❖ To compare the evidence from archaeobotanical data with the ecological data.

1.6. Research questions and goals

In order to gain greater understanding of the topics, the following are selected as research questions;

- What are the edible and non-edible plants that existed in the site during the period under investigation?
- Are the species identified indigenous to the region or introduced from outside?
- Is there any resemblance between the past and present food systems of the study area?
- What was the paleoenvironmental condition of the study area during the Late Holocene? Is it different from the current environmental set up?

1.7. Methodology

Methodology plays a significant role in addressing the set of goals and objectives established above. Therefore, in this study, I employed different methods that can help me accomplish the research objective. The method that I used in this research is divided in to data acquisition and data analysis technique. In the data acquisition technique, both pre-field and on field data collection were undertaken.

1.7.1. Data collection techniques

In dealing with the topic of this research, it is necessary to collect data that are appropriate. In order to conduct this study, data were acquired and collected from both primary and secondary sources (from field and pre-field surveys).

1.7.1.1. Pre- field Work

Consulting documentary sources is the first important task that was accomplished. Thus, I obtained data by consulting both published and unpublished secondary sources such as books, articles, journals and unpublished reports and researches from Addis Ababa university libraries, Institute of Ethiopian Study, Authority for Research and Conservation of Cultural Heritage (ARCCH), the French Center for Ethiopian Studies, and other places where I can get important information about the research topic. I also used various internet sources to develop this study.

The reason why I consult documentary sources is because it offers valuable opportunity to know the study area better. This helped me to identify the gap and problems of the study area.

In relation to the topic of this study, consultations of documentary sources give important information concerning the cultural and historical context and geographical location of the study area. Consultation of documentary sources before the field work provides basic direction to the survey (Drewett, 1999).

1.7.1.2. Field Work

The second data acquisition method was fieldwork. Through the fieldwork, primary data were collected through survey. Therefore, in the following part I am going to deal on the survey methods that I employed in this study.

1.7.1.2.1. Archaeological Survey

Archaeological surveys are the principal source of data and it is a productive research tool (Schiffer *et al*., 1978; Drewelt 2006). Accordingly, in this study, I conducted reconnaissance survey to identify the location of the study area after the concerned offices at Wolayta Zone and Sodo Woreda. During the reconnaissance survey, informants from the study area were systematically selected with the help of the concerned officers of culture and tourism office of Wolayta zone and Sodo Woreda.

1.7.1.2.2. Field Observation

Observing and understanding the present day plant habitat can be used to better understand and reconstruct former environments and food systems of the past societies (Evan, 1978). Ethnoarchaeology is the study of living cultures from archaeological perspective. It is a research strategy to understand the relationships of material culture to culture both in the living context and the archaeological record. It is also an approach to improve archaeological interpretation (David and Kramer, 2001). Therefore, ethnoarchaeological study (observing the ethno-botanical and current ecological features of the site and its environs) of the area was employed in this study. This ethnoarchaeological data were collected from February 2- 22/ 2015 on direct field observation and interviews in the study area.

1.7.1.2.3. Photography

Photography is an important element of documenting archaeological site in the field. Thus, by careful selection of viewing point, time of day, and weather and light conditions, samples were documented through photography in this study. A digital photo camera is used during the field work in the study.

1.7.1.2.4. Interview

To recover indigenous knowledge of the inhabitants and to collect data about the study area, officers of cultural and tourism office of Wolayta Zone and Sodo Woreda and the peoples who live in and around the study area were interviewed.

For this qualitative or experimental study, purposive sampling was employed for the selection of informants in a stratified manner. In this sampling method, informants who have the knowledge about the issue are employed (Jones and Bartlrtt, [n.d.]). Five *kebeles* from Sodo Woreda were selected randomly except Damota Waja *kebele* which was purposively selected. This is because it is a place where Mochena Borago rock shelter is found I selected it purposively to conduct interview.

By the help of culture and tourism office experts of Wolayta Zone and Sodo Woreda, selection of informants was conducted based on age and gender. The number of informants depends on the number of population living in and around the study area. Before the interview, the objective and other general description of the research was explained to the informants. And important information was collected from the informants through field note.

1.7.2. Laboratory Data Collection and Analysis Techniques

The second part of the research method was material and data analysis which is done through laboratory work. In the laboratory work, the main part of this research, to recover macro and micro botanical remains, archaeobotanical investigation was applied. Archaeobotany is the analysis and interpretation of plant remains recovered from archaeological sites. It is the "application of botanical methods and theory to archaeological problems and archaeological remains" (Fuller, 2009). In the archaeobotanical method, macro and micro botanical remains illuminate the economic and ecological pre-history.

For instance, they can clarify from diet to household economic activities to social values and understanding of paleoenvironmental. So, in the laboratory at ARCCH, carbonized seeds and fruit stones were analyzed through different techniques (dry sieving, flotation, examining under microscope and image taking (Images of the carbonized grains and fruit stones were taken by a Dino-Lite digital microscope (magnification up to 220x variable of 2014 production) and SEM (Scanning Electron Microscope). And also identification of botanical remains made based on comparing their external morphology with the reference collection of Archaeology department and National Herbarium of Addis Ababa University.

1.7.2.1. Soil sieving Methods

In order to recover micro and macro botanical remains, sieving the soil is very essential. Hence, I try to use two techniques to recover these materials from archaeological deposits. These are flotation and dry sieving.

Therefore, 27 soil samples of the 2000 and 2001 French field seasons from the archeological deposits of Mochena Borago rock shelter were analyzed in the laboratory of Authority for Research and Conservation of Cultural Heritages (ARCCH). Out of the 27, 9 belong to the 2000 field season and the remaining 18 were from 2001. Floated carbonized remains (3.6 Kilograms) and soil samples (4.8 Kilograms) were subjected for Archaeobotanical investigation. In the sieving method, meshes which have 0.1mm and 0.5 mm size were used.

A. Dry sieving

In the dry sieving technique, the sampled soil from each excavation unit levels is placed in the sieve, the fine sand grains are sifted through and archaeological materials are collected as residue remaining in the sieve. It is effective to recover higher amounts of plant body parts.

B. Flotation

Flotation involves using water to separate tiny plant remains from the bulk of the soil. In this process, dried soil is placed on a screen, and water is gently bubbled up through the soil. In this process, seeds, charcoal and other light material (the light fraction) flat off and tiny pieces of remains (heavy fraction) are left behind (Hageman and Goldstein, 2009).

In the laboratory work weighing the volume and recording each and every soil samples based on their context, sorting of carbonized grains and fruit stones, microscopic photography, and observing changes in morphology of the identified botanical remains were conducted.

1.8. Scope of the Study

As it is mainly a laboratory work, the research depends on investigation of carbonized seeds from the soil sample of 2000 and 2001 field seasons of the French mission. This research is planned to extract as much useful information as possible from the collection available at ARCCH. In terms of time span, it covers the period between the mid and late Holocene.

1.9. Significance of the Study

The importance of the study primarily sets on the current state of knowledge of the analysis of the ancient inhabitants' food system of Mochena Borago rock shelter and its environs. Although the site is still under investigation, its paleoenvironmental and economic history is not yet reconstructed. Archaeobotanical studies through the direct recovery of carbonized seeds from soil samples in the Southwestern highlands of Ethiopia in general are absent. Thus, the result of this study can provide a significant source of data in terms of subsistence and vegetation history. The archaeobotanical study of Mochena Borago during the late Holocene period is important to know the origin and process of plant domestication in the Southern Ethiopia Region.

CHAPTER TWO

2. Description of the Study Area

2.1. Physiography of the Study Area

Wolayta is located within the Southern Nations, Nationalities, and People's Regional State (SNNPRS) of Ethiopia. It is roughly located between 6.40 -7.10 N & 37.4 0 -38.20 E. It is bordered by Kambata Tambaro in the North, Sidama Zone in the East, Gamo Gofa Zone in south and Dawro Zone in the west. The zone has 12 rural woredas and 3 town administrations (Wolayta Zone Finance and Economic Development, 2012/2013). Lesur-Gebremariam (Fisher, 2010) stated that this region is currently one of the most densely populated areas of Ethiopia, which includes a diverse collation of spoken languages and culture. Sodo is the capital city of Wolayta which is found at the Southern foothills of Mount Damota. The location of Wolayta, between the lowland Rift valley and lake country and Southern Ethiopian Highlands, cerate variation in elevation, temperature and rainfall. All of these elements create a series of altitudinal ecological zones that provide an abundant source of plant and animal resource.

Mochena Borago archaeological site (370 45' 17.8'' E 60 53' 49.7'' N) is located ~320 Km South of Addis Ababa. The area of this pre-historic Archaeological site belongs to the Damote Waje *Kebele* of the Sodo Zuria District (Fig.2) (Lesuer *et al*., 2007; Fisher, 2010; Brandt *et al*., 2012).

The rock shelter site is situated within the Southwest Ethiopian Highlands on the Southwestern flanks of Mount Damota (2908 masl), which is a trachytic volcano (Brandt *et al*., 2012).

Mochena Borago rock shelter is located in the middle of a high cliff in a steep sided valley. This valley cuts Mount Damota to its base in the South. Seasonal water is pouring from the upper valley and this form a big water fall at the mouth of the rock shelter and flowing down into ravine (Fig.2). The archaeological site of Mochena Borago rock shelter is characterized by big flat platform situated behind the seasonal water fall (Lesur *et al*., 2007; Brandt *at al*., 2012).

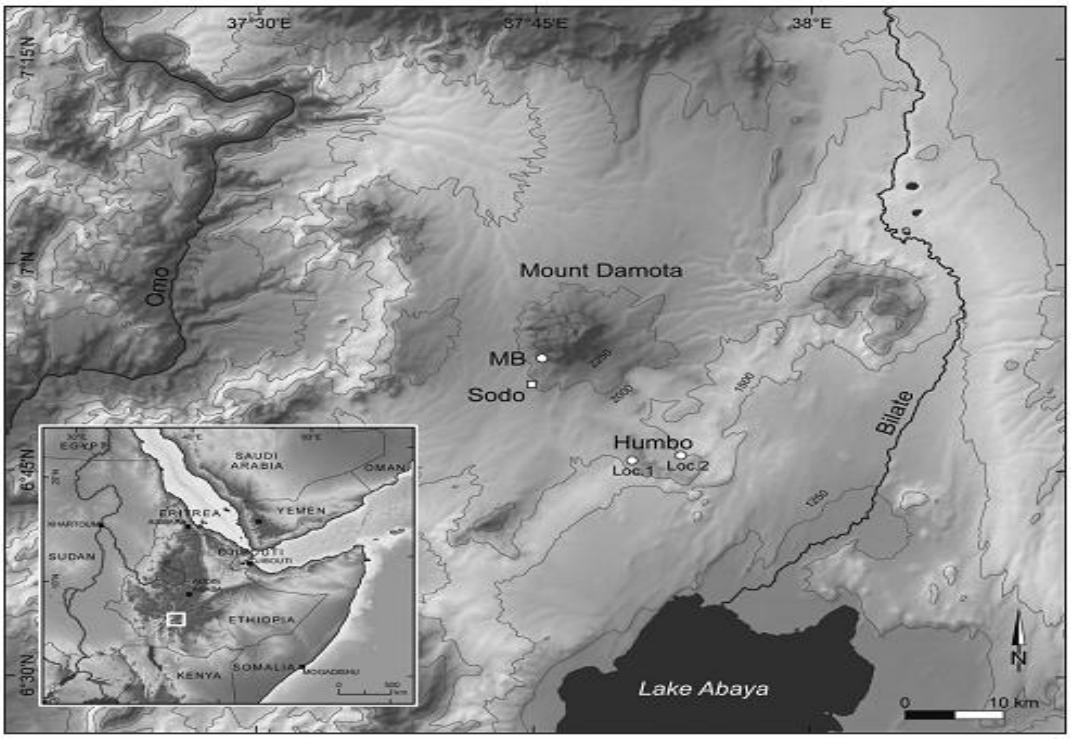

Fig.1 Location of Mount Damota, Mochena Borago Rock shelter (MB) (from Brandt *et al*., 2012)

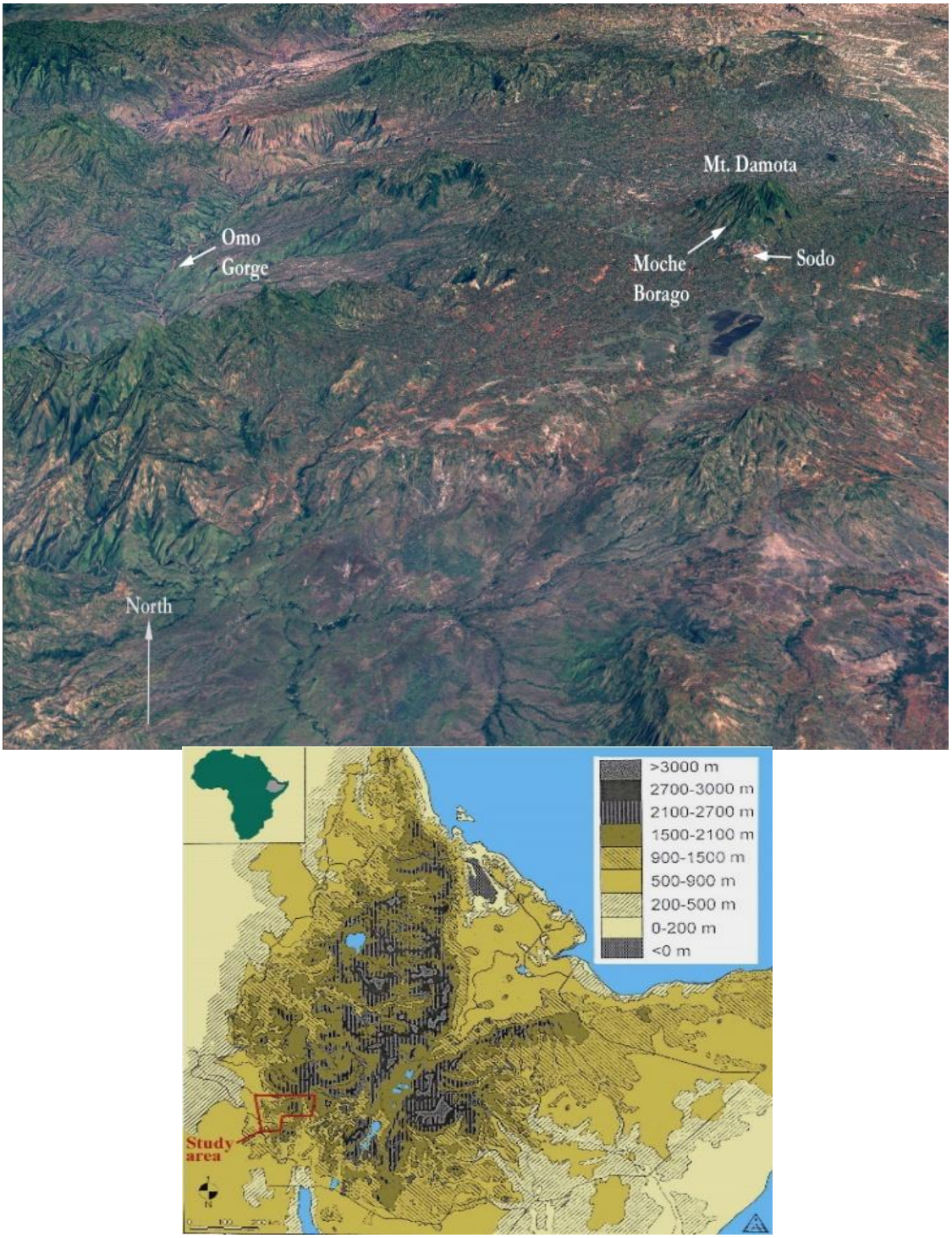

Fig. 2 Mochena Borago rock shelter within Mt. Damota complex and the view of Mochena Borago rock shelter (from SWEAP and CRC 806/ SWEAP sources)

Mochena Borago rock shelter is oriented roughly to the South west with a southern exposure and steep ravine to the foot of the mountain. The rock overhang is about 20 meters high at the mouth and then decrease at the rear of the shelter. The shelter (~600m2) is around 70 meters wide, 12 meters high and ~20 meters deep (Fig.3). The ceiling of the shelter is high and open on the east side than the west (Lesur *et al*., 2007; Brandt *et al*., 2012). Further to the South east, the surface of the shelter is approximately semi-circular, narrow and elongated. The floor behind the seasonal water fall is moderately flat and decreases its level towards the south (Fig.3) (Minassie, 2014).

Fig.3 Top view of Mochena Borago rock shelter and its floor (from Brandt *et al*., 2012)

Mochena Borago rock shelter was formed within three distinct layers of volcanic rock (Fig.2). The base of the rock shelter is a mafic lava flow while the bottom of the rock shelter is basalt. However, the basalt is still unknown in thickness and age. And it was overlain by an unconsolidated debris flow of around 12 m thickness. The top of the rock shelter was recapped again by another mafic lava flow of around 10 m thick (Brandt *et al*., 2012). The mouth of Mochena Borago rock shelter is wide and up to 20 m high with a maximum height at the northeast back of the rock shelter. On the floor of the rock shelter large boulders are buried and visible which suggest that it might be fallen from the roof through tectonic activity (Minassie, 2014).

One possible model of rock shelter formation process suggests that the middle soft debris flow gradually collapsed and then formed a rockshelter cavity through greater exposition to fluvial activities. Some evidence also suggests that waterfalls led both to mechanical and chemical erosions of the middle layer debris flow. The roof and walls of Mochena Borago rock shelter have chunks of hydrated debris flow below the top mafic lava flow (Fig.2). Based on indirect dating and comparison to other volcanic events in the region, the age of the debris flow is estimated around 3.16 ma (Brandt *et al*., 2012).

The rock shelter is dry even during the raining season. And at the peak of the rainy season between June-September, water from the north eastern top of the cliff seeps through towards the northeast back of the rock shelter. The season's waterfall at the mouth of the shelter is frequently spraying on the south and southwest part of the shelter. Its size, the dry and flat surface and the easy accessibility made Mochena Borago rock shelter an ideal place for occupation for a large human group.

The recent evidence has also suggested that the area around Mochena Borago rock shelter within Damota complex had offered abundant natural and adopted faunal and floral resource for wide exploitation in the past and present (Lesur *et al*., 2007 ; Brandt *et al*., 2012).

2.2. Climate and Vegetation of the Study Area

As part of the South west Ethiopian Highlands, Mount Damota receives greater amount of rain fall than the surrounding Ethiopian Rift valley of Omo River valley and Lake Regions. The climate of Mount Damota is characterized by a unimodal precipitation pattern which caused by the Equatorial Atlantic and the Indian Ocean climatic systems (Brandt *et al*., 2012).

Mount Damota falls under three major agroecological Zones of Ethiopia: *Dega* (highland), *Woynadega* (mid- latitude) and *Kolla* (lowland). The relative position of Mount Damota between the eastern limit of southern Highlands and Main Ethiopian Rift valley resulted in receiving the highest mean annual rainfall around 1400mm (Brandt *et al*., 2012).

The natural vegetation of Mount Damota and the surrounding areas would be the Ethiopian Afromontane forests, including different wild edible plants. The upper part of Mount Damota (~2900-2600asl) has still reserved some Afromontane vegetation such as shrubs and representatives of coniferous forests of podocarpus and juniperus. The mid-latitude agro ecological zone around Mochena Borago rock shelter is dominated by bamboo trees and other Afromontane forest (Fisher, 2010; Brandt *et al*., 2012).

The natural vegetation of Damota including Mochena Borago rock shelter are have long been altered and changed in to farming and eucalyptus (*Eucalyptus globules*) plantation (Minassie, 2014).

2.3. Geology of the Study Area

The Ethiopian Rift Valley System stretches from NE-SW to N-S direction from the Afar depression southwards to the Turkana depression. The Ethiopian Rift forms a funnel shape which decrease in width to the south from more than 100 to about 40 Km. It further subdivided into the Afar Rift and the Main Ethiopian Rift (Tesgaye, 2000). The peripheries of the Ethiopian Rift Systems are dominated by tectonic uplift which form the western and Southwest Ethiopian Highlands (Fisher, 2010).

The Sodo area latitudes between ~70 10'N and ~60 30'N) is located on the Western margin of the Southern MER. It is close to the transition zone with the Central MER, between the major escarpments of Chencha and Fonko-Guraghe to the South. It extends from the northern coast of Lake Abaya up to the town of Durame, to the north. Most of the rift floor and margins in the Sodo area are covered by volcanic and volcano-sedimentary rocks associated with the main rifting events (Corti *et al*., 2013).

The Mount Damota complex is located at the periphery of the Ethiopian Rift Valley System at the Southwest Ethiopian Rift between the Southwest Ethiopian Highlands and the Southern Main Ethiopian Rift Valley.

It is the most conspicuous elevation and forms a boundary between the Highlands in the west and the Rift Valley in the east, the Central Main Ethiopian Rift Valley in the distance north, Bilate River and the Southern Main Ethiopian Rift Valley in the north east, Lake Abaya in the South and Omo River Valley and Wolaita Highlands in the west (Fig.2) (Brandt *et al*., 2012).

Mount Damota is a dormant volcanic mountain and characterized by trachytic volcanic complexes of the rifts margin. It comprises volcanic layers of trachyte, basalt and volcanic tuffs representing the past 75 million year's tectonic activities in the Southwest region of Ethiopia (Fisher, 2010; Brandt *et al*., 2012). Thus, the successive flow of basalt in Mount Damota especially has a major contribution on the formation of complex natural drainage system (Brandt *et al*., 2012).

2.4. Language

According to Lamberti and Sottile, 1997 (in Fisher, 2010), today Omotic and Chustic language are the only indigenous language families found in the Wolayta region. Amharic (a Semitic language) is the primary language today for commerce and trade across Ethiopia in general and the Wolayta Zone in particular. The Wolayta language is part of the Ometo sub- branch of the Omotic language family. To the west, northwest, and east of Wolayta, there are highland Cushitic speakers (Kambaata, Haddiya, and Sidamo, respectively). To the south and west, the Gamo and Gofa peoples share a similar Omotic language with the Wolayta.

2.5. Political History

Until the late 19th century, as part of the Gibe Kingdom that included the Sidamo, Kafa, and Jimma sates, the Wolayta region was a feudal kingdom. Records indicate that Wolayta was a subsidiary of the kingdom of Kafa. Trade was an important economic system at that time for the Wolayta kingdom (Cerulli, 1956; Lamberti and Sottile, 1997 as cited by Fisher, 2010).

The Wolayta kingdom of the Damot Dynasty was established in the mid-13th century. The second Dynasty, Wolaitamola, as stated by Shinn and Ofcansky, 2004 (as cited by Fisher, 2010) dealt with repeated Islamic invasions. In the mid-16th century, the third dynasty founded in Tigray (now located in northern Ethiopia). Kawo (king) Damota (1835-1845) of the Tigray Dynasty shares the same name as the volcanic mountain of Damota on which Mochena Borago rock shelter is located (Beckingham and Huntingford ,1954 (as cited by Fisher, 2010) ; Chaiatti, 1984).

2.6. Local History of Mochena Borago Rock shelter

According to local history, the rock shelter of Mochena Borago and surrounding land was purchased by Mochena Borago from Ato Wara and Wyzero K'arare. Ato Mochena, and perhaps his father Ato Borago, was an advisor to the last Wolayta king T'ona. Mochena and Borago were members of the Maka clan of the Dogala branch of the Wolayta. The rock shelter may have been unnamed before either Mochena or Borago received the area (Fisher, 2010).

As stated by Fisher (2010), before Mochena Borago purchased the land around the rock shelter, it might have been used as a sacred place for ritual sacrifices of goat and sheep. In the Wolayta region, according to Fisher, ritual sacrifice is recorded in Cerulli (1956) who noted that the practice was most common to Talehe which was the spirit of the Omo River.

Although the rock shelter was purchased, it is unclear if Mochena Borago ever inhabited the rockshelter or not. Remnant wall foundations have survived on the south side of the rock shelter. However, these are widely believed to date to the 19th century when Menelik occupied the area, or to the 1930s and 1940s during the Italian occupation (1936-1941) of Ethiopia (Fisher, 2010).

2.7. French Archaeological Research at Mochena Borago Rock shelter

In 1995, the centre National de la Recherche Scientifique (National center for scientific Research) in Nanterre, France, formed the Groupe d'etude de la protohistorire dans la corne de l'Afrique (GEPCA) (the protohistoric study Group in the Horn of Africa). The focus of this project was to study the origins and process of plant and animal domestication in the Horn of Africa during the Neolithic period and how these developments related to the underlying environmental changes (Gutherz *et al*., 2000).

The project was subdivided into multiple components such as rock art and megalithic monuments in the region and archeological excavations in Djibouti and Ethiopia of which Mochena Borago rockshelter was one element (Fisher, 2010).

I. GEPCA Excavations: 1998 and January- February 2000

In 1998, the first excavations at Mochena Borago were undertaken under the leadership of Xavier Gutherz of the University of Montpelier (France). And again the second excavation was conducted in January and February of 2000 (Gutherz *et al*., 2000). Between these two field seasons, the GEPCA's team took geological samples from the rockshelter floor and walls. In addition to this, they also created three 4 m2 test excavation areas. From these geological samples, the team was able to know the presence of volcanic deposits in and around the site (Fisher, 2010).

Excavations in three areas revealed stratified archeological deposits which contains abundant pottery, burnt and unburnt bone, "MSA and LSA" lithics (blade and flake debitage) within stratified sandy and salty deposits and numerous well- defined hearth features (Gutherz *et al*., 2000).

The findings in Test pit 1 were particularly rich, and this area was subsequently expanded to 6 m2 during the 2000 field season. Excavation in Test pit 2 revealed fluvial activity and reworked deposits with interstratified volcanic layers (Fisher, 2010).

In unit G10 of Test pit 1, GEPCA's team excavated a narrow 0.5mx1m sondage from approximately 1.5 to 1.8 m below the current cave floor. The sondage excavations stopped after hard rocky deposits, which the team believed to be bedrock. Radiocarbons samples take below tephra 11 deposit were dated to 28,700+- 1, 100 Bp (31,184+- 906 cal. Bp, using cal.pal Hulu). The Holocene sequence above tephera 11 dated from 4,370+-70 Bp (3, 062+-124 cal. Bp) to 1, 480 +-60 Bp (852+-67 cal.Bp) (Fisher, 2010).

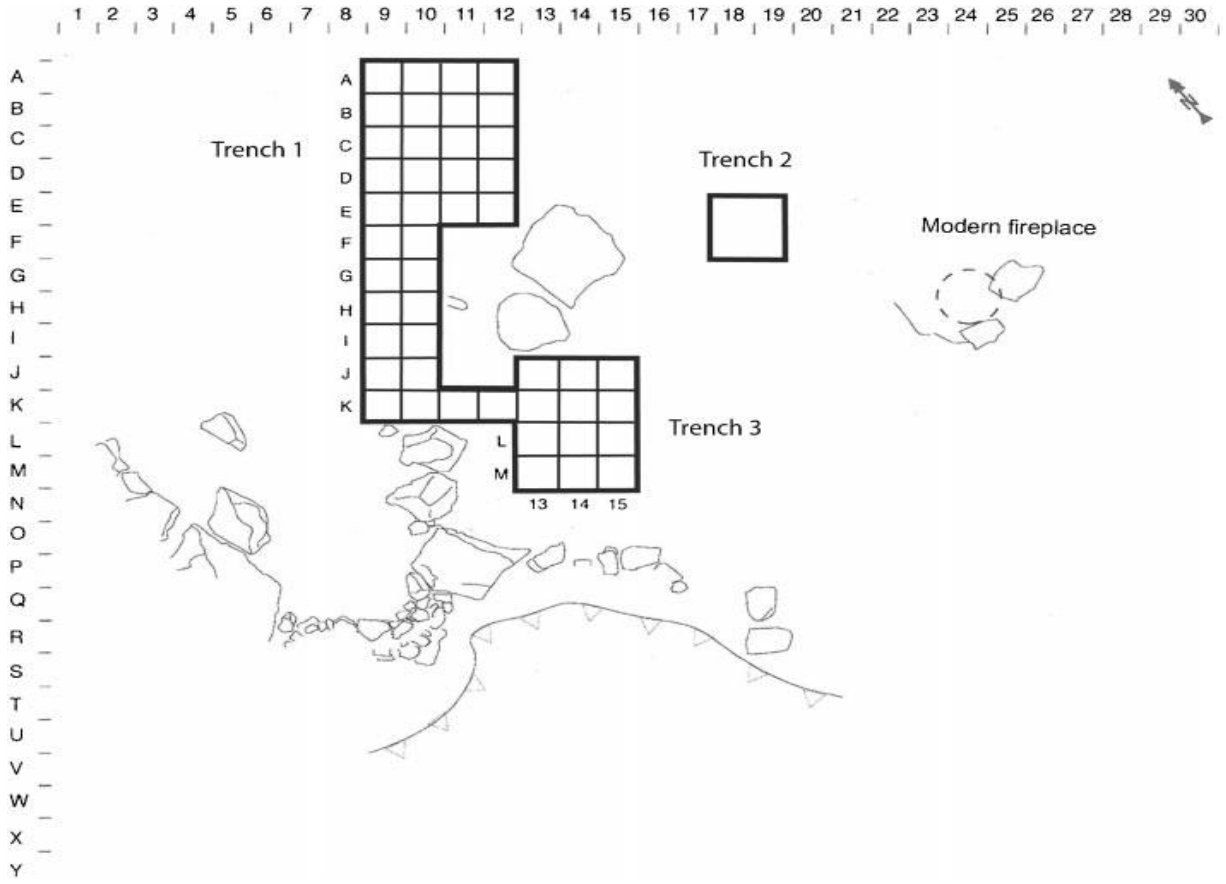

Fig.4 Location of three Trenches excavated by GEPCA French team during the 1998, 2000a, 2001b and 2001 (from Lesur *et al*., 2007).

II. **GEPCA Excavation: November 2000**

As stated by Sordoillet and Pouzolles, 2000 (in Fisher, 2010) a third excavation in November 2000 focused on stratigraphic and sedimentlogical analysis of the Holocene deposits. This also includes correlations between various profiles in the excavation areas. For instance, they try to correlate the Post hole structures of Holocene deposits of Test pit 3 with a ring of post holes structure of Test pit 1, which may date to the first millennium (Jallot and Pouzolles, 2000 as cited by Fisher, 2010). A large amount of charcoal was recovered near this area (Fisher, 2010).

The 2000 season GEPCA also included a micromorphology analysis that found phytoliths, carbonized and uncarbonized plant remains and carbonized seeds in the Holocene deposits (Gutherz *et al*., 2001). Faunal materials from these deposits included a large percentage of bovine remains but also artiodactyls and carnivore remains including panther pardus, colobus guereza, and Dendrohyrax arboreyeus, Crocodiles, fish, and shellfish were also recovered (Lesur, 2000).

The November 2000 excavation analysis suggested that there was a ceramic Holocene occupation at the site which overlie curvilinear decorations, which is dated via radiocarbon on charcoal to 4, 370+-70 Bc (3, 062+-124 cal.Bp) (Gutherz et al., 2001). Traditional ceramic *jebena* (coffee pot) and *Cha'ati* (spice jars) fragments were recovered in the upper most deposits of the rockshlter (Jallot and pouzolles, 2000 as cited by Fisher, 2010).

III. **GEPCA Excavation: December 2001**

During the final excavation in December 2001, Test pit 1 and Test pit 3 were connected in order to clarify ambiguities between the strtigiraphic profiles of these areas (Gutherz *et al*., 2001). This correlation also helped to resolve the stratigraphic lateral associations of a rich bone and ash layer discovered in Test pit 3. This layer contained two third of the total faunal material has been relatively dated through stratigraphic correlation to approximately the early 5th millennium BC (Fisher, 2010).

Lesur (Gutherz *et al*., 2001) noted that the faunal samples are dominated by Bovidea, especially buffalo (*Syncerus caffer*), but a distinct *Bovidae* components uncovered which includes *Gazella*, *Tragelaphis*, and possibly *Robus*.

Lesur found domestic cow (*Bos Taurus*) in the upper and most recent layers at the site. Lesur's (Gutherz *et al*., 2001) impression of the Holocene fauna is that the fauna reflects a predominant hunting subsistence strategy focused on *Bovidea*, especially buffalo, and that domesticated animals, such as cow, arrived in this area only within the last millennium.

Other faunal remains include primates (*Papio cynocephalus, colobus guereza*), hyena (*crocuta crocuta*), suides (*potomocheroerus larvatus* and *phacochoerus africanus*), and hyrax (*Heterohyrax brvcei*). Most faunal remains have been fire-altered. Several human teeth also found in the deposits. In general, the diversity of fauna remains also indicates the exploitation of two distinct biomes during the Holocene period: the humid plains along the Weja River below Mt. Damota and a forest biome (Gutherz *et al*., 2001).

CHAPTER THREE

3. ETHNOARCHAEOLOGY AT MOCHENA BORAGO ROCK SHELTER AND ITS ENVIRONS

Ethnoarchaeology is a fieldwork methodology carried out among the living peoples for analyzing and better understanding of ancient artifacts and material culture (London, 2000). According to Stiles (1977), ethnoarchaeology is the application of ethnographic data as a tool for archaeology which encompasses all the theoretical and methodological aspects of comparing ethnographic and archaeological information. Ethnographic analogies with the past societies help to understand the pre-historic life of ways. This method has been used by pre-historical archaeologists to reconstruct the pre- historic human behavior, environmental and cultural patterns since the early 20th C. They applied ethnographic data in to their study to interpret and explain things that have been exercised and made by the pre-historic human beings (Stiles, 1977; David and Kramer, 2001).

3.1 Ethnobotany at Mochena Borago rock shelter and Its environs

Ethnobotany is a multidisciplinary science which embraces different field of studies such as botany, anthropology, economics, sociology, ecology and linguistics among others. It has a vital role in helping us to have a clear understanding about the societies' interaction with their environment, specifically with plants (Martin, 1995; Zemede, 1997; Hamilton *et al*., 2003).

The source of ethnobotanical data is the indigenous people, particularly the elders. They have an accumulated dependable knowledge, beliefs, and practices through the processes of cultivation, production, harvest, storage, preparation, utilization, and management of plants during their life time as well as the knowledge transferred from generations (Martin, 1995; Fruze *et al*., 1997).

Human beings have employed natural vegetation as sources of food, energy, and medicine for a long period of time (Rastogi *et al*., 1998). Selective domestication and cultivation of wild plants for food, medicine, and for many other activities have remained as part of human history from the beginning. Such practices are believed to have a great endeavor for the diversification and evolution of domesticated plants with their environmental changes (Abreham, 2010).

According to the World Health Organization (WHO) estimate, about two- thirds (2/3) of the world's population uses herbal or traditional medicines (Swallow and Ochola, 2006). Various parts of plants (leaves, roots, barks, etc) are used to make medicinal products (FAO, 2001). Like many other countries, the majority of Ethiopians are active participants on the manufacturing of traditional medicines, most of which are made from plants (Seid, 2008). The diverse socio-economic, ethnic, linguistic and cultural background of the people has put positive influence for the diversification and development in the use and management practices of indigenous medicinal plants (Abrham, 2010).

The total number of plant species documented from five *kebeles* of Sodo woerda (*Gurmo Wyedea, Warza Lasho, Kokatea Maracharea, Gurum Koysha* and *Damote Waja*) was 64 in number. Out of these, the family Fabaceae comprised 10 species (15.62%); Poaceae 5 species (7.81%); Lamiaceae and Solanacea 4 species (6.25%) each; Rosaceae, Myrtaceae and Brassicaceae 3 species (4.48%) each; Alliaceae, Apiaceae, Boraginaceae, Musaceae, Rubiaceae 2 species (3.13%) each and the rest twenty one (21) families consists 1 species (1.56%) each (See Appendix I). Out of the total plant species, 31 (48.43%) are Herbs, 18 (28.12%) are trees, 14 (21.87%) are shrubs and 1 (1.56%) is climber. Among the 64 plants listed from the study area, 42 species (65.62%) are the cultivated or semi-cultivated and 22 species (34.37%) are the wild or semi wild taxa.

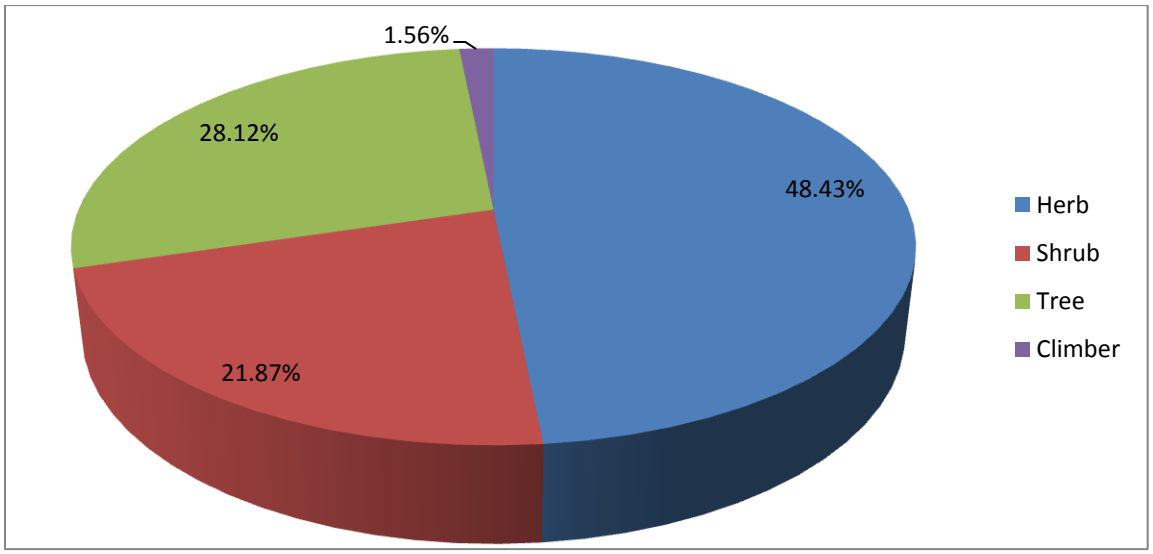

Fig.5 Percentage of plants in Mochena Borago rock shelter and its environs

3.2. Indigenous Knowledge of the inhabitants on the local vegetation

3.2.1 Food Plants of Mochena Borago rock shelter and its environs

3.2.1.1. Cultivated edible Plants

The food plants cultivated by these communities constitute cereals, vegetables, fruit crops, stimulants, root or tuber crops, Sugar and pulses which were 25 in number (39.06%) (Table1). The people who live in and around the study area cultivate all these plants for both market purposes and for their own households. From the entire cultivated plants, documented in this study, *Ensete ventricosum*, *Plectranthus edulis*, *Ipomoea batatas*, and *Colocasia esculenta* are root crops continuously used by the local peoples as their staple food.

Ensete ventricosum

This is a perennial crop plant which belongs to the Musaceae family (Lye and Edwards, 1997). It is widely distributed in eastern and southern Africa. For thousands of years, it has been used as a food crop in Ethiopia (Smeds, 1955). It is an important staple crop for more than 20 % of the Ethiopian population living in the Southern and Southwestern parts of the country like Wolayta, Gurage, Hadiya, Kambata, Gamo and Sidama (Brandt et al., 1997).

A mature *enset* plant has a height of 8-10 meters. The basal diameter of its dilated pseudostem is up to 1 meter. The pseudostem has a length of 1 to 2 m. The inflorescence grows from the center of plant, and fruits are small with a large black non-edible seeds (Bizuayehu, 2002). It is cultivated within latitudes of 1100-3300m above sea level.

The areas which have a mean temperature of 10-25^{0}c and annual rainfall of 1000-1800 mm are favorable for its cultivation (Admasu, 2002).

Fig.6 *Enset* plant at the left side of the house (after Talemos, 2007)

The major foodstuffs obtained from *enset* were locally called *uu'nccaa*, *i'timaa* and *uu'ttaa*. The people use the above terms to indicate either the direct products of *enset* plant or food items prepared from those products.

For example, the term *uu'nccaa* stands both for the scrapped and fermented dough like product from *enset* pseudostem or corm part and also pancake like bread prepared from the product. The term *uu'ttaa* stands either for the whole plants, the raw corm or boiled *enset* corm.

Uu'nccaa, the major food product in terms of quality, is locally classified as *golaa* and *goddiyaa*. *Golaa* is the one obtained from pseudostem part and with lower quality while *goddiyaa* is obtained from the corm part and with higher quality (Aberham, 2007).

The term *I'timaa* stands both for the high quality which is white powder *enset* product made by squeezing the prepared food from it. The product can be prepared in the form of a pancake, porridge, or dumpling. The local people add butter and spices to *enset* made foodstuffs and feed with milk or vegetables like cabbage or preparing a pancake by mixing *uu'nccaa* with flour of cereals such as maize, sorghum (Aberham, 2007). In addition to its uses as a food crop, its fibre is used to make sacks, bags, ropes, mats, construction materials and sieve. Fresh *enset* leaves are also used as food wrappers, serving as plates and for stall feeding of cattle.

Plectranthus edulis

It is large, erect, coarse and aromatic herb which has up to c1m high and 12x5 cm rounded leaves. The inflorescence is 10-20 cm long which elongating and interrupted in flower and fruit. This species is commonly cultivated for its edible tubers, also occurring in marshy areas, 1300-2600m. It is common in East Africa and in Democratic Republic of Congo. Economically, it is one of the most crucial tuber crops of the genus Plectranthus. It grows in the mid and high altitude areas of Ethiopia (Hedberge *et al*., 2006) (See Chapter 4 for detail).

Ipomoea batatas

This is perennial herb with underground yellow or reddish edible tubers. Its leaves are blade triangular to broadly ovate, 4.5-14x3.5-16cm. The inflorescence pertaining to peduncle 3-18 cm long, 1-to several- flowered and pedicels 3-12 mm long. It is widely cultivated in the abandoned fields of 1450-2400m. The origin of the plant is from South America, and currently it is widely cultivated throughout the tropics. Like *Plectranthus edulis* this sweet potato cultivated for its edible tubers. The leaf stems are used as forage (Hedberge *et al*., 2006).

Colocasia esculenta

It is a tropical plant grown primarily for its edible corms. It is very variable robust herb, with leaves up to 2 m tall. Stem reduced to a tuber rich in starch. Its leaves peltate and petiole stout is over 1 m long. Inflorescence rarely found in this species and its peduncles are much shorter than petioles. It cultivated or naturalized near streams or water falls 500-2000 (-2400) m. It is cultivated in wet places for its starch rich tubers, which are ground to give a kind of flour, known as “taro”. The species may have had its origin in South-East Asia or on the Hawaiian Islands (Edwards *et al*., 1997).

Fig. 7 Different uses of *enset* (after Talemos, 2007)

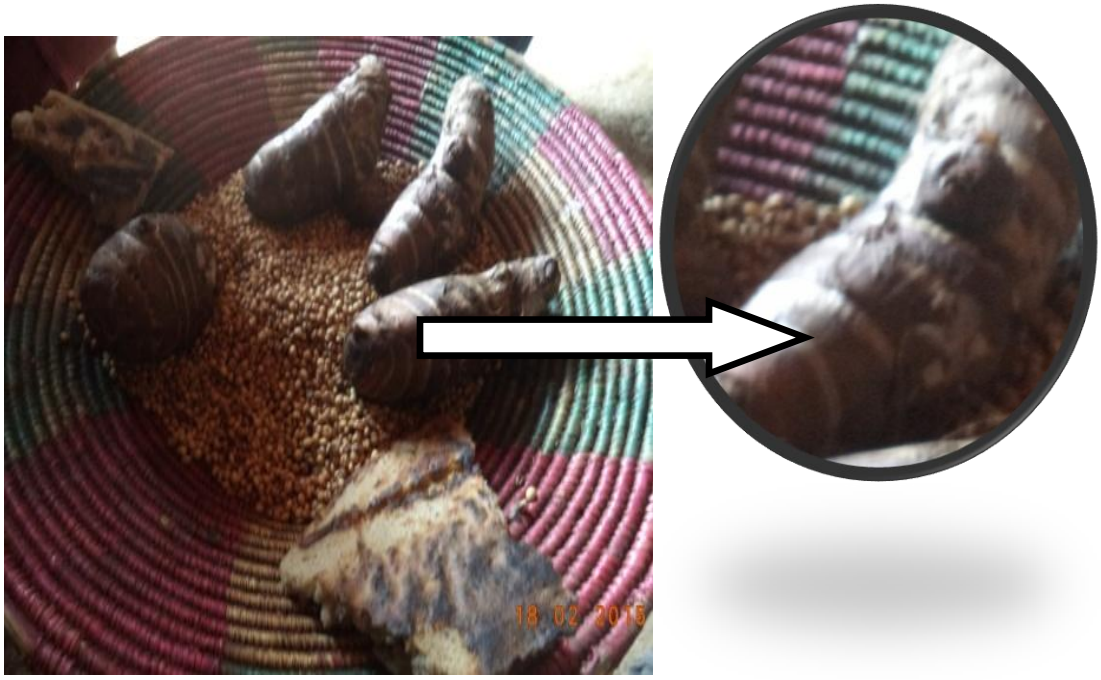

Fig. 8 *Colocasia esculenta* (Photo by Medhanit T. Wolayta, 2015)

3.2.1.2 Wild edible plants

Around 12 (18.75%) wild or non- cultivated edible plants which serve as an additional source of food were documented (See Table 2). All of these wild edible plants are used as a source of food during the time of drought for all of the local peoples. Most of them are root plants and fruits. According to my interview with the informants (See Fig.9), from the documented wild edible plants, some plant species like *Syzygium guineense*, *Cordia africana* and *Ficus sur* are replanted again in their own home garden. The reason why the local people select these wild edible plants and replanted it in their own home garden, according to the informants, is these species have a multipurpose. They used, for example, as a source of food, for shade, construction, to protect the soil of their garden from degradation and for fodder for their livestock's.

Table 1 List of food plants cultivated by the inhabitants of Mochena Borago rock shelter and its environs

No.	Scientific Name of the Plants	Family	Parts Consumed
1	*Allium cepa*	Alliaceae	Bulb, leaves
2	*Allium sativum*	Alliaceae	Bulb, Leaves
3	*Annona squamosa*	Annonaceae	Fruit
3	*Beta vulgaris*	Chenopodiaceae	Root/tuber
4	*Brassica carinata*	Brassicaceae	leaves
4	*Brassica oleracea*	Brassicaceae	Leaves
5	*Cicer arietinum*	Fabaceae	Grain
6	*Coffea arabica*	Rubiaceae	Beans
7	*Colocasia esculenta*	Araceae	Root
8	*Cucurbita pepo*	Cucurbitaceae	Leaves, fruit
9	*Daucus carota*	Apiaceae	Tuber
10	*Ensete ventricosum*	Musaceae	Stem, corm, leaves
11	*Hordeum vulgare*	Poaceae	Grain
13	*Linum usitatissimum*	Linaceae	Grain
14	*Mangifera indica*	Anacardiaceae	Fruit
15	*Musa x paradisiaca*	Musaceae	Fruit
17	*Persea americana*	Lauraceae	Fruit
18	*Pisum sativum*	Fabaceae	Seed
19	*Plectranthus edulis*	Lamiaceae	Root/tuber
20	*Psidium guajava*	Myrtaceae	Fruit
21	*Saccharun officinarum*	Poaceae	Stem
22	*Solanum tuberosum*	Solanaceae	Root/ tuber
23	*Triticum aestivum*	Poaceae	Seed
24	*Vicia faba*	Fabaceae	Seed
25	*Zea mays*	Poaceae	Seed

Table 2 List of non-cultivated edible or wild edible plants used by people living around Mochena Borago rock shelter

No.	Scientific Name of the plants	Family	Habit	Edible Part	Mode of Consumption
1	*Cajanus cajan* *	Fabaceae	Shrub	Root	Raw
2	*Carissa spinarum*	Apocynaceae	Shrub	Fruit	Raw
3	*Cordia africana*	Boraginaceae	Tree	Fruit	Raw
4	*Embelia schimperi*	Myrsinaceae	Shrub	Fruit	Raw
5	*Eriosema cordifolium*	Fabaceae	Herb	Root	Raw
6	*Ficus sur*	Moraceae	Tree	Fruit	Raw
7	*Oncoba spinosa*	Flacourtaceae	Shrub	Fruit	Raw
8	*Rubus apetalus*	Rosaceae	Shrub	Fruit	Raw
9	*Rubus steudneri*	Rosaceae	Shrub	Fruit	Raw
10	*Solanum corymbosum*	Solanaceae	Herb	Fruit	Raw
11	*Syzygium guineense*	Myrtaceae	Tree	Fruit	Raw
12	*Ximenia americana*	Olaccaceae	Shrub	Fruit	Raw

* escape from cultivation

Fig. 9 The interview Sessions (2015, Wolayta)

3.2.2 Medicinal plants

A total of 22 plants (34.37%) medicinal plants associated with ethno-botanical practices (part used, method of preparation and type of disease treated) were documented in and around the study area (See Table 3 and Appendix II).

One of the major challenges of rural mountainous inhabitants is lack of adequate modern health care services (Korner and Ohsawa, 2005). They managed it through life long developed indigenous ethno-veterinary medicines.

According to the informants' response, one herbal medicine prepared from a single or more species can be used to treat various human and/or livestock ailments. Traditional medicines in the study area were prepared from leaf, seeds, fruit, bark bulb, tuber and sap and flower, root and corm and pseudostem. The informants, further, added that the indigenous knowledge of using plants as a medicine transmits from their ancestors.

Based on the data obtained from Sodo Town health center and Sodo Zuria Woreda veterinary clinic, most of the disease treated by traditional medicines are also detected and diagnosed by modern health center services.

3.3.3. Plants as Raw materials

An attempt is also made on realizing the uses of plants as raw materials for different purposes. Among the documented plants, about 15 (23.43%) are used as a raw material for the local peoples of Mochena Borago rock shelter and its environs (Table 4). The wood of these plants is utilized in carpentry for the making of furniture, carving, and is a good source of fire wood. The wood is also used as pillars or wall supports while houses are built. Branches are used for the fencing of residential quarters and farming plots.

Table 3 List of Medicinal plants of Mochena Borago rock shelter and its environs

No.	Scientific Name of the Plants	Family	Habit	Occurrence
1	*Albizia anthelmintica*	Fabaceae	Tree	Wild
2	*Allium cepa*	Alliaceae	Herb	Cultivated
3	*Allium sativum*	Alliaceae	Herb	Cultivated
4	*Artemisa abyssinica*	Asteraceae	Herb	Wild
5	*Artemisia afra*	Asteralceae	Herb	Cultivated
6	*Brucea antidysenterica*	Simaroubaceae	Shrub	Semi wild
7	*Combretum adenogonium*	Combretaceae	Shrub	wild
8	*Coriandrum sativum*	Apiaceae	Herb	Wild
9	*Cynoglossum amplifolium*	Boraginaceae	Herb	Wild
10	*Embelia schimperi*	Myrsinaceae	Shrub	Wild
11	*Erythrina abyssinica*	Fabaceae	Tree	Semi cultivated
12	*Eucalyptus globulus*	Myrtaceae	Tree	Cultivated
13	*Hagenia abyssinica*	Rosaceae	Tree	Semi cultivated
14	*Juniperus procera*	Cupressaceae	Tree	Semi cultivated
15	*Lepidium sativum*	Brassicaaceae	Herb	Cultivated
16	*Leucas deflexa*	Lamiaceae	Herb	Wild
17	*Ocimum basilicum*	Lamiaceae	Herb	Cultivated
18	*Pentas schimperiana*	Rubiaceae	Herb	Wild
19	*Rumex abyssinicus*	Polygonaceae	Herb	Semi wild
20	*Ruta chalepensis*	Rutaceae	Herb	Cultivated
21	*Solanum adoense*	Solanaceae	Shrub	Wild
22	*Solanum dasyphyllum*	Solanaceae	Shrub	Cultivated

Fig. 10 Making basket by using *Arundinaria alpina* (Photo by Medhanit T. 2015, Wolayta)

Table 4 List of plants for Construction and Household purposes of Mochena Borago rock shelter and its environs

No	Scientific Name of plants	Family	Habit	Part Used	Uses
1	*Acacia abyssinica*	Fabaceae	Tree	Stem	Furniture, carving
2	*Acacia etbaica*	Fabaceae	Tree	Stem	Furniture, carving
3	*Agarista salicifolia*	Ericaaceae	Shrub	Stem	Firewood, carving, furniture
4	*Albizia anthelmintica*	Fabaceae	Tree	Stem	Furniture and shade
5	*Arundinaria alpina*	Poaceae	Herb	Stem	Construction, ornamental, mat, beehive
6	*Cordia africana*	Boraginaceae	Tree	Stem	Furniture, shade, carving
7	*Dodonaea angustifolia*	Sapindaceae	Tree	Stem	Shade, carving, furniture
8	*Embelia schimperi*	Myrsinaceae	Shrub	Stem	Firewood, live fence
9	*Eucalyptus globulus*	Myrtaceae	Tree	Stem	Construction,furniture, timber
10	*Ficus sycomorus*	Moraceae	Tree	Stem	Furniture, shade
11	*Juniperus procera*	Cupressaceae	Tree	Stem	Timber, furniture, construction, live fence
12	*Millettia ferruginea*	Fabaceae	Tree	Stem	Construction, furniture, live fence, firewood
13	*Olea europaea* ssp. *cuspidata*	Oleaceae	Tree	Stem	Shade, carving, furniture
14	*Podocarpus falcatus*	Podocarpaceae	Tree	Stem	Construction, timber, pole, furniture
15	*Syzygium guineense*	Myrtaceae	Tree	Stem	Construction,furniture,shade, carving

CHAPTER FOUR

4. Archaeobotanical Data from the Soil Samples: Analysis of collections from Field Seasons of 2000 and 2001

Archaeobotany is a branch of environmental archaeology that deals about botanical remains recovered from archaeological contexts. The intention of this discipline is studying human-plant interaction and the environment in which it took place. The study is expected to incorporate vegetation distribution and indigenous knowledge of the locality. Archaeobotanical remains can be microscopic like pollen and macro remains like large seeds or grains, stone of fruit, leaves, charcoals and wood. Both of these remains can be accumulated in to an archeological spot due to natural and cultural processes. These botanical remains are "identified on the bases of their external morphology by comparing them with references collection manuals, and by sorting types, size, measurements, shape and surface texture" (Magid, 2004; Alemseged, 2015).

In the study of the beginning of agriculture, archaeobotany is recently obtaining an important place. Its methods: Sieving and flotation enabling the researchers to understand the biological transformations that came along with agricultural revolution (Fuller, 2009).

The primary focus of this discipline is on the reconstruction and understanding of past populations and substance. Understanding of past substance will include the type of food that human beings ate, the way they acquired their food, and the technologies they employ to process it, collect and store their food. This field of study has contributed a lot for our knowledge in the evolution, utilization, early agriculture and domestication of edible plants.

In addition, archaeobotany also try to appreciate past environment, rituals, trade and construction materials (Renfrew, 1973; Magid, 1989).

The major plant remains identified through archaeobotanical investigation include *Sapindaceae cf. Deinbollia* type, *Myrtaceae cf. Syzigium guineense* type, *Ebenaceae cf. Diospyros* type, Cordia *cf. africana* type, *Plectranthus edulis*, *Euphorbiaceae Croton* sp., *and Olea europaea* sub sp. *cuspidata*.

4.1 Archaeobotanical investigation of samples from Mochena Borago rock shelter

Out of the 112 identified seeds and fruit stones 55 (49.10%) were *Sapindaceae cf. Deinbollia* type, 33(29.46%) were *Myrtaceae cf. Syzigium guineense* type, 9 (8.03%) were *Plectranthus edulis*, 7 (6.25%) *were Euphorbiaceae Croton sp.*, 2(1.78%) were *Cordia cf. africana*, 1(0.89%) were *Ebenaceae cf. Diospyros*, 1 (0.89%) were *Olea europaea* sub sp. *cuspidata*. The remaining 4 (3.57%) fruit stone fragments were unidentifiable (See Fig.11 and Appendix III)

Except *Cordia cf. africana* and *Olea europaea* sub sp. *cuspidata* which are listed on preliminary identification of field report from Mochena Borago by Clare in 2003 (not published), the rest are discovered for the first time from an archaeological context in Ethiopia.

The carbonized botanical remains are all found from excavation squares of K-9, K-11, K12, K13, K-14, KL-13, K-L/13-14 and KU 3. Charcoal fragments from this excavation squares are dated to 4370±70 (3330-2787 cal. BC) (GIF 11246).

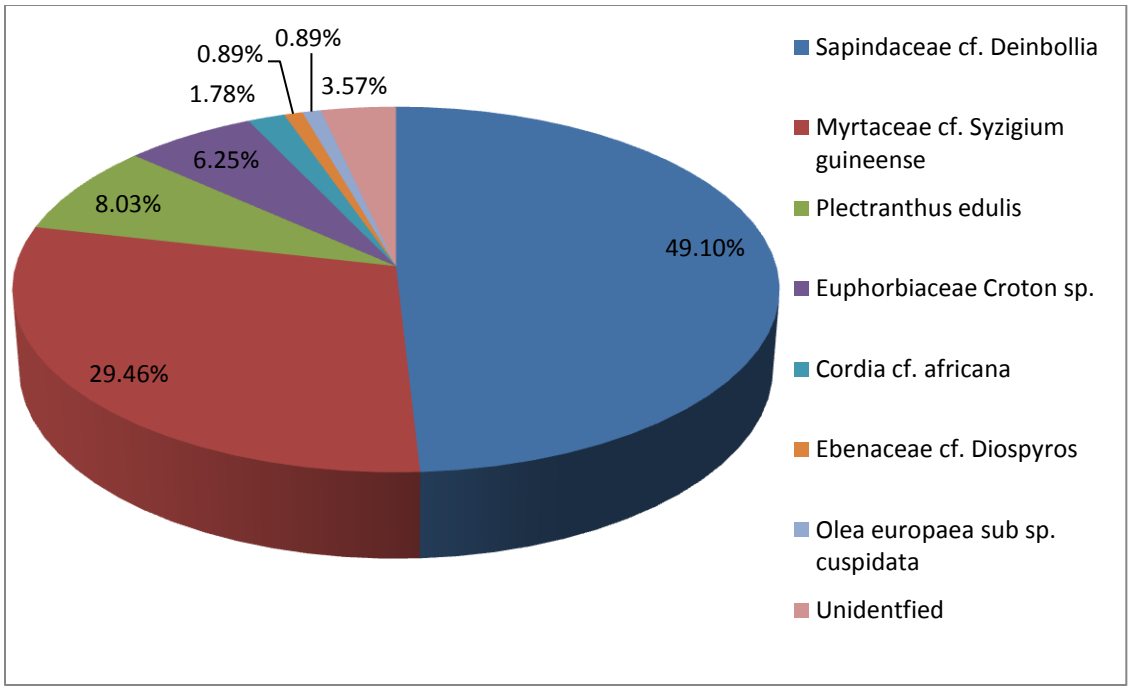

Fig. 11 Proportion of archaeobotanical investigation from Mochena Borago rock shelter

4.2 Biological identification of plants and their usage

Sapindaceae cf. Deinbollia

A total of 55 carbonized grains were recovered among the charred remains and soil samples. It constitutes the largest share among the findings. Deinbollia is a genus within Sapindaceae family. About 147 genera and 2000 species grow in tropical Africa, Asia and America. Most of the species under this genus are cultivated for their edible fruits. People consume the fruits and leaves of this plant.

The leaves in particular are eaten as spinach. The seeds produce foams and hence they are used as soap to wash clothes (Beentje, 1988).

Deinbollia kilimandscharica var. adusta (Radic.) and *Deinbollia killimandscharica Taub Var. killimandscharica* are reported from Ethiopia. *D. Killimandscharica* is basically a tree or a shrub with unbranched trunk. The tree can grow 12-8-12 m. The leaves, 20-80 cm in length, have a flower shape and dark brownish color (Hedberg and Edwards, 1989).

The species grows between the altitudinal ranges of 600-2600 m.a.s.l along rivers and gorges. It is an evergreen moist or dry forest. Outside of Ethiopia, it is reported from the tropical areas of Kenya, Tanzania and Uganda (SANBI, 2012).

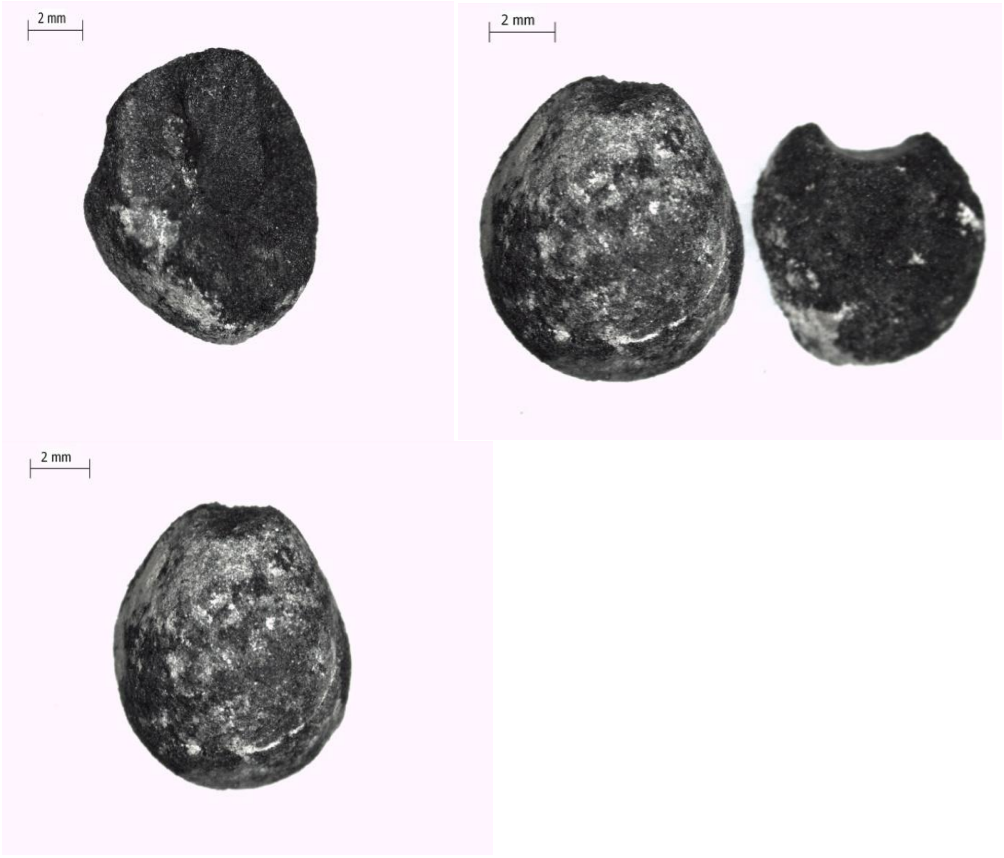

Fig. 12 SEM image of *Sapindaceae cf. Deinbollia*

Myrtaceae cf. Syzigium guineense

Syzigium guineense belongs to the Myrtaceae family. It grows in different parts of Africa as both wild and domesticated. The plant can grow between 10 and 25 m. The trunk is large with a smooth bark at a younger stage of growth and rough and darker when it becomes older. Its branch bends down wards at full maturity. The leaves are shiny and smooth in both sides. The younger leafs have a purple reddish color and they change their color to dark green at maturity. The flowers produce an attractive odor that attracts insects (Guinand and Dechassa, 2000).

In southern Ethiopia, *Syzigium guineense* is preferred from other trees for its shades. The wild plants grow at an elevation of 2100 m.a.s.l. Substantial amount of water and wet soil condition are conducive for its growth. During the time of failure of harvest productivity this plant is taken as a solution for famine by the farmers. It is because its fruits and leaves are consumable. It is known in different names among the different communities in the country; Dokma (in Amharic), Donke (in Ari), Baddessa (in Afan oromo), Ocha (in Wolayta). In English, it is commonly called water pear (Guinand and Dechassa, 2000).

Myrtaceae cf. Syzigium guineense carbonized grains recovered from Mochena Borago rock shelter constitutes among the second in terms of abundance (n=33). The same species was reported by Clare (2003) from Mid-Holocene context of Mochena Borago rock shelter.

Fig. 13 SEM image of *Syzigium guineeanse*

Plectanthus edulis

From the site at Mochena Borago a total of 9 carbonized seeds belonging to *Plectanthus edulis* species were identified. It is an annual plant in the Laminacea family. It is known as *Wolayita dinch* (in Amharic language). It is composed of two terms; *Wolayita* is a zone in Southern Ethiopia and dinch means potato. It is also locally known as *Dinicha Oromo, Wolayita dono, Gamo dinich, Gurage dinich, Agaw dinich,* and etc. It is an indigenous plant to Ethiopia and is cultivated for its edible tubers. Initially the tuber is boiled before it is being consumed.

The leaf is also cooked and eaten in western parts of Ethiopia (Kefa area, for example) (Zemede and Zerihun 1997; Mulugeta 2008).

Plectranthus edulis has a long tradition in Ethiopia. It grows in North, South and Southwest parts of Ethiopia in mid and high elevations. The overall structure of this plant is similar with that of the Irish potato. The constituents of the plant include fruits, roots, stolons, the seed tubers, seeds, stem, branches, leaves and inflorescences (Mulugeta, 2008).

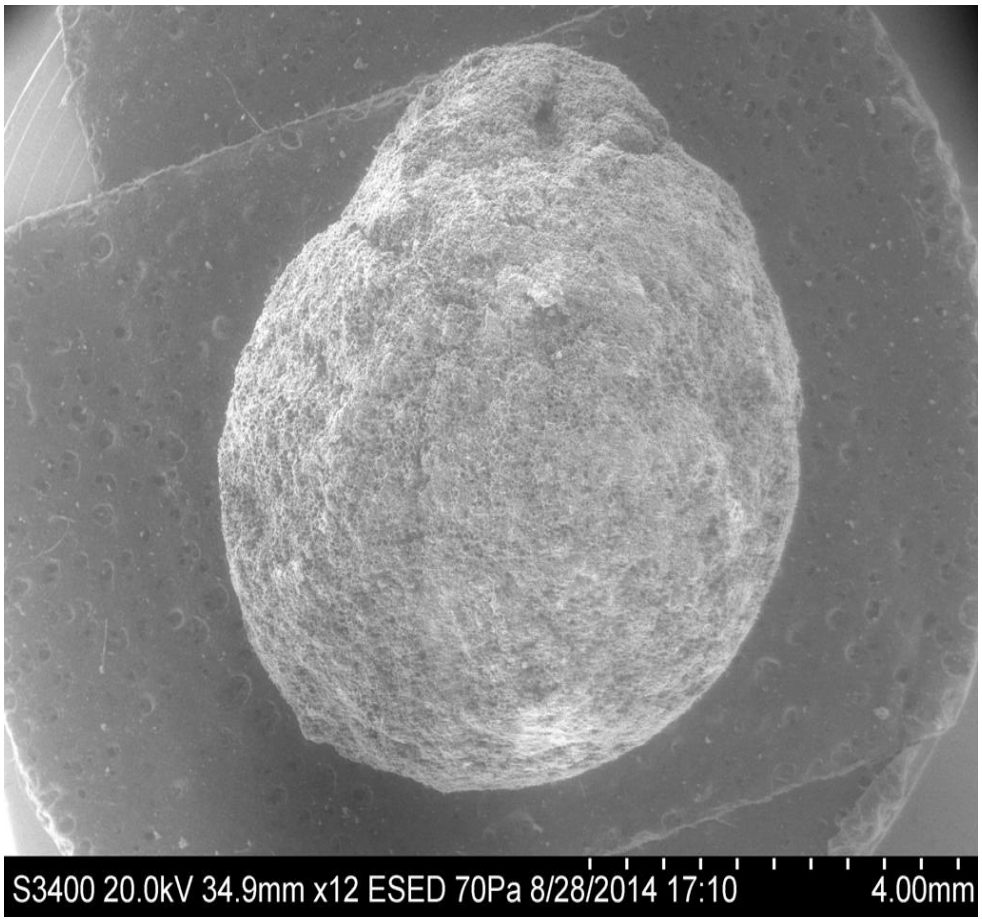

Fig.14 SEM image of carbonized fruit stone of *P. edulis*

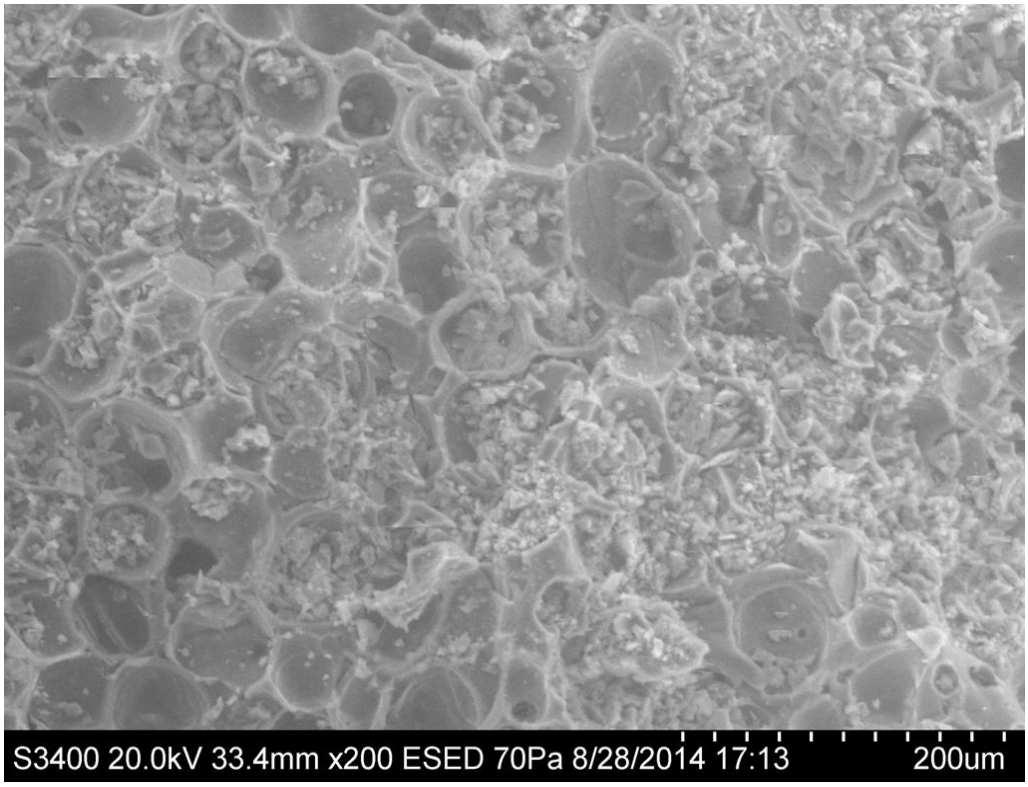

Fig. 15 SEM image of the internal cell structure of *P.edulis*

***Euphorbiaceae Croton* sp.**

The *macrostachyus Hochst* species of genus Croton is known as *bissana* or *bessena* in Amharic language. It grows in all regions of Ethiopia. It adapts well in the highland areas with altitudinal range of 1400 to 2500 m.a.s.l, along mountain slopes, along lakes and rivers and fringes of cultivated fields. The fruits of this plant usually mature from March to October. It is an evergreen plant that can grow between 25 and 30 m tall. The stem has a cylindrical shape with a diameter of 50-80 cm. The bark is grayish, has no smooth surface rather demonstrate cracks. The leaves are dominantly light brown, simple and can grow up to 15x0.5mm.

The seeds have a pointed top, light brown and grayish brown, fleshy. The maximum size of the seed is between 6-9x4-6 mm (Jansen, 1981).

In Ethiopia the powdered bark of this plant is used as a helpful medicine for constipation. People also treat themselves against venereal diseases by drinking the powdered bark and the root with milk and tea. Drinking the juice of the leaf will relief pain of women during labour and it also gives a remedy for headaches (Amare, 1976).

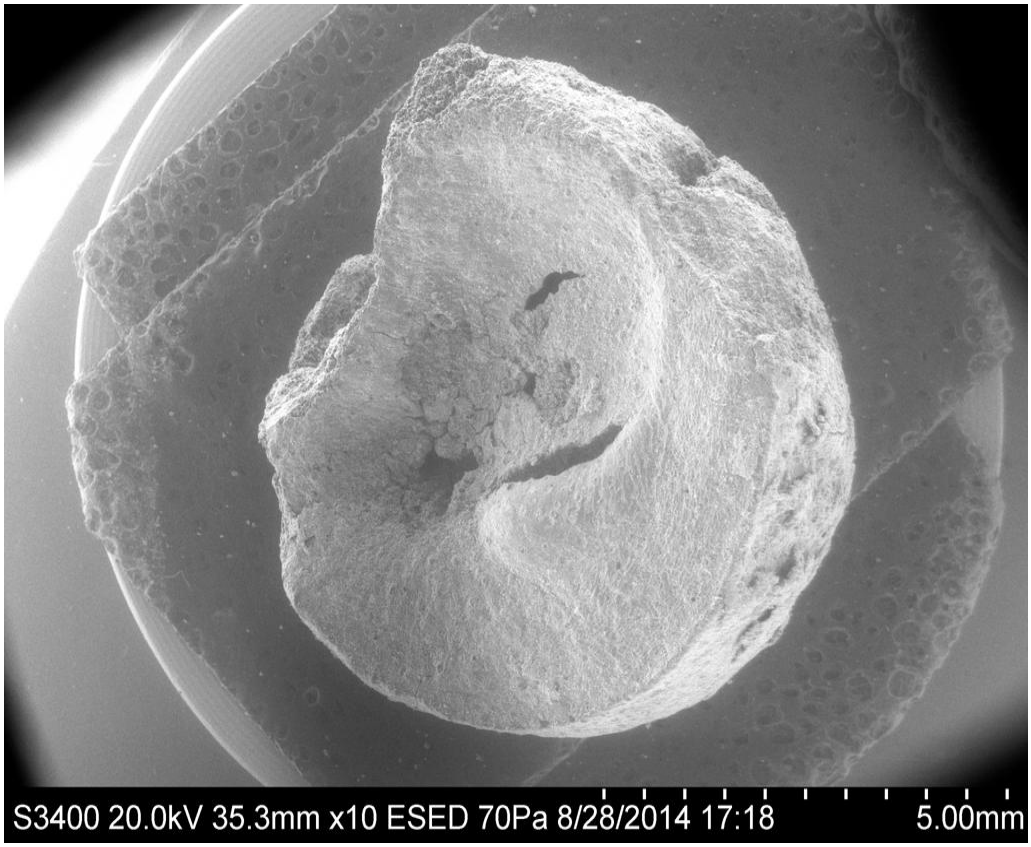

Fig. 16 SEM image of *Euphorbiaceae Croton* sp.

Olea europaea sub sp. *cuspidata*

Olea europaea sub sp. *cusipdata* is a species within the Oleacea family. Its synonym is Olea africana. It is commonly known as African olive and wild olive. Its origin is expected from places ranging from Africa to China. It is an ever green plant that can grow up to 10 m high. Its crown is rounded. It grows well in Mediterranean type of climate with fertile soil and abundant water, along river valleys and bush lands (Plants of Africa, 2002).

The leaves are shiny and gray green, dorsal side may have yellowish and green color, elliptical shape, 5-10 cm long and 10-25 mm wide. The fruits are round with sharp tip at the top, 10-25 mm in length and 6 mm in diameter, fleshy and with green and blue color. The seed is brown and has 1 to 1.5 cm long (Plants of Africa, 2002).

The leaves of this plant can be served as a tea. The wood is utilized in the production of furniture. Ink color can be produced from the juice of the fruit. The various body parts of this plant are also used for different medicinal purposes including lowering blood pressure, to provide remedy for kidney mal-function, to treat sore throat, and etc (Plants of Africa, 2002).

Only 1 carbonized fruit stone of *Olea europaea* sub sp. *cuspidata* was recovered among the samples. This species was not reported by Clare (2003) among her preliminary identifications. The identification of the species is the first of its kind from Mochena Borago and the whole region of Southern Ethiopia.

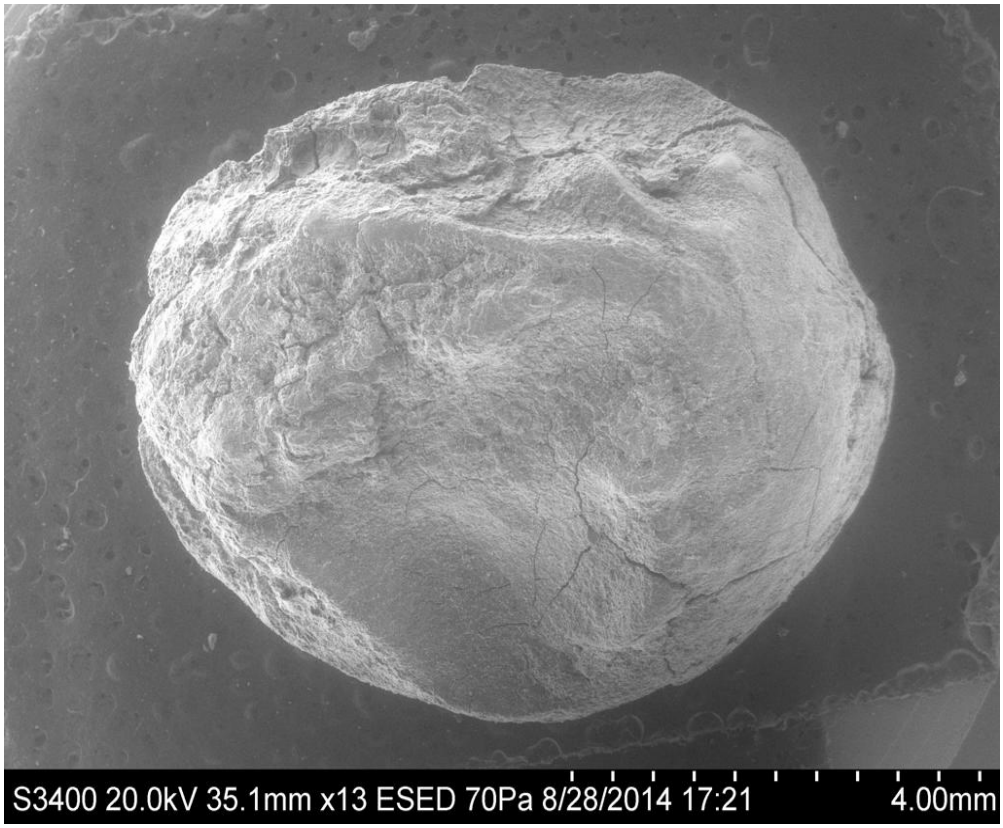

Fig. 17 SEM image of *Olea europaea* sub sp. *cuspidata*

Cordia cf. africana

Though widely grown in the highlands of most parts of Ethiopia (Bruce, 1970), the carbonized fruits and wood fragments of this plant are rarely reported from archaeological contexts in the country. The archaeobotanical identification of the charred fruit from Mochena Borago is, therefore, the first of its kind.

The name *Cordia africana* is derived from two words as composed by Linnaeus. Cordia is named after the medieval German botanist V. Cordus and 'africana' is from the Latin word 'africanus' or African.

This plant is also known by the following synonyms; *Cordia sebestena var.* B (africana), *Cordia abyssinica*, *Varonnia abyssinica*, *Calyptracordia abyssinica*. In Amharic, the official language of Ethiopia, it is known as *Wanza* and in the local *Wolayta* language, it is called *makota, mokota* (Jansen, 1981).

In Ethiopia it is a familiar tree and it is known almost in all provinces. It can be found along rivers, in the fringes of forested areas and mountain slopes. It also commonly grows in the tropical zones of Africa; from Sudan to Guinea and in Southern part of the continent from Angola to Malawi. Outside of Africa, the plant adopts well in the tropical region of Arabia. It is an evergreen tree that can grow up to 25m high. The common height of the tree is between 5-10 m. The stem has a dark gray bark, the trunk is 5-10 m long and the diameter is between 50 - 100 cm. The leaves change their color depending on seasons and growth periods between brown, light green and yellow green. The younger leaves have brownish color. They grow between 1-11 cm in length. The fruits have egg-like shape, 10-13 mm long and 9-11 mm in diameter, commonly taper at the top, fleshy and sweat when ripe, and have yellow-brown color. The fruit has four cavities, each having 0-1 seeds (Jansen, 1981).

In East Africa, the leaf is consumed by the Masai in Kenya as a medicine for stomach worms. In Ethiopia, a number of medicinal uses of the plant are reported by Amare (1976). According to Amare, fried leaves with butter can be used for all kinds of injury. The ash from the wood is also mixed with butter for skin disease locally known as ‘spider disease’.

Only 2 carbonized grains of this species were identified from the site. Like *Olea europaea* sub sp. *cusipdata,* it is reported for the first time with in the whole region of Southern Ethiopia.

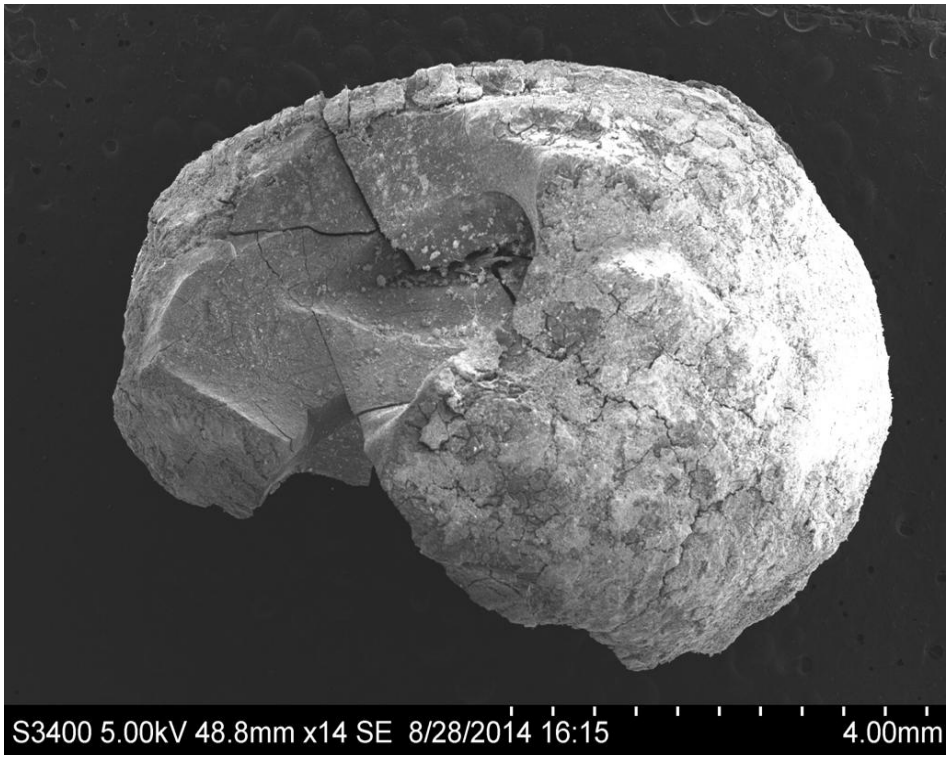

Fig. 18 SEM image of *Cordia africana*

Ebenaceae cf. Diospyros

Diospyros is a genus within the Ebenaceae family. In Ethiopia, the most commonly grown species is *Diospyros abyssinica*. Its synonym is *Maba abyssinica Hiern*. It widely grows in Africa from Eritrea and Ethiopia in the East to Guinea and Mali in the west and to the south all the way to Angola and Mozambique.

It can be found in a wide diversity of forest lands and woodlands in elevation ranging from 200 to 2500 m.a.s.l. and rainfall conditions varying between 650 and 2050 mm (Beentje, 1994).

It is an evergreen tree that can grow up to 30-40 m. The trunk does not produce branches and is straight and thinner. Its diameter can be measured to 60-70 cm; bark is smooth when young and becomes rough later. Leaves are elliptical in shape with 4-16 cm x 1-6 cm. The wood is currently used for construction of houses and furniture. It has also medicinal value. The bark and roots are exploited as a remedy for various diseases. Smashed leafs and roots can be used to treat malaria, dysentery and wounds. The smashed roots are also used for healing leprosy (Bekele, 2007).

Only 1 carbonized remain of this plant is recovered from Mochena Borago. The same botanical remain was reported among the preliminary identification list of Clare (2003).

Fig. 19 SEM image of *Ebenaceae cf. Diospyros*

CHAPTER FIVE

5. Discussion and Conclusion

From 27 bags of soil smaples, a total of 112 carboinzed seeds and fruit stones were recovered by investigating 3.6 Kilograms of charred fragments and by floating 4.8 Kiolgrams of soil samples retrived from the Late Holocene context of Mochena Borago Rock shelter. Out of the total identified samples, 55 were *Sapindaceae cf. Deinbollia* type, 33 *Myrtaceae cf. Syzigium guineense* type, 9 *Plectranthus edulis*, 7 *Euphorbiaceae Croton* sp., 2 *Cordia cf. africana*, 1 *Ebenaceae cf. Diospyros* and 1 *Olea europaea* sub sp. *cusipdata*.

The 112 identified plants from archaeobotanical context are categorized in to seven (7) plant species. Out of the seven, five (71.42%) plant species were found on the current vegetation of Mochena Borago rock shelter and its environs. These are *Syzigium guineense* (n=33), *Plectranthus edulis* (n=9), *Euphorbiaceaea Croton* sp. (n=7), *Cordia cf. africana* (n=2) and *Olea europaea* sub sp. *cuspidata* (n=1).

Among those, two of them are still cultivated by the farmers of the area. These are *Plectranthus edulis* and *Olea europaea* sub sp. *cuspidata*.

Plectranthus edulis, an indigenous crop for Ethiopia, is widely known in the study area, and have various types of names depending on the area where it grows. For instance it is called *dinicha* in *Oromiffa and dono* in *Wolayta*. Around Gamo, Guraghe and Agaw the crop has one common name which is *dinich.*

It is, however, recovered for the first time in archaeobotanical contexts in the study area. Currently this plant is widely cultivated for its edible tubers in many parts of Ethiopia.

Plectranthus edulis is not only a plant species that is used as a food (usually consume) for the local people but also the sole crop which is cultivated in Wolayta. Therefore, the existence of this species in both archaeobotanical and ethnobotanical contexts in the study area suggest that both the current and past societies of Wolayta were consuming and are consuming this plant species as a source of food. This indirectly entails that there is continuity in the food system of the area.

Olea europaea sub sp. *cuspidata* was not reported from any archaeological sites in the whole area of Ethiopia. Researchers in the field of palaeobotany and archaeobotany argue that this species was only cultivated in Mediterranean region of Europe in the past. The recovery of this species in Mid-late Holocene context opens a new dimension in the study of the evolution and propagation of this plant.

Cordia cf. africana is a wild plant species around Mochena Borago rock shelter. However, now the local people re-planted it in their home garden. They utilize its fruit as a source of food especially during the time of famine. In addition, its wood is used as a source of raw material to make different kinds of cultural objects and used as a shade.

Syzigium guineense constitutes 33 (29.46%) from the archaeobotanical investigations. It is a wild plant species (now the people re-planted it in their home garden) which is used as a famine food and raw material for the present local peoples.

Euphorbiaceae Croton sp. is also another wild plant species which has both medicinal and source of raw material values. According to the local informants, the leaves and its roots are very helpful to treat wounds and tetanus as well.

Depending on their biological characteristics, plants do have a special preference to certain environmental condition. The amounts of rain fall or local hydrology, sunlight and soil types are the main factors that dictate plant growth (Alemseged, 2015).

The degree of the availability of these resources differs from region to region and from one climatic zone to the other. Therefore, we can say that there is a direct relation between plant growth and environmental setting (Alemseged, 2015).

On the bases of this fact, an attempt is done to comment on the mid and late Holocene paleo- environment of Mochena Borago rock shelter and its environs. The table below (Table 5) presents the type of plants identified from the soil samples in terms of their ecological preference.

Table 5 Ecological preference of the major plants in the study area

No.	Plant types	Ecological preference
1	*Cordia cf. africana*	Tropical
2	*Diospyros cf. Ebenaceae*	Tropical and sub-tropical zone
3	*Euphorbiaceae Croton* sp.	Tropical and Sub-tropical zone
4	*Myrtacece cf. syzigium guineense*	Sub-tropical
5	*Olea europaea* sub.sp *cusipdata*	Sub-tropical
6	*Plectranthus edulis*	Tropical and Cool zone
7	*Sapindaceae cf. Deinbollia*	Tropical

According to the above table on plant preference to a certain ecological condition, the dominant type of setting is tropical and sub-tropical zone of Ethiopia. Currently, all of the above ecological preferences are found on Mt. Damota where Mochena Borago rock shelter is found.

According to Hamilton (1982), mid Holocene climate and vegetation are mostly identical with the present day. Thus, the evidence from Mochena Borago rock shelter tells us the fact that the mid to late Holocene climatic condition is almost similar with the present day.

To conclude, Mochena Borago rock shelter is a very rich site with one of the most complete late Pleistocene cultural sequences in the Horn of Africa. The cultural remains recovered from this site range in time between 53ka cal BP to 1480 BP (between 447 and 662 A.D).

Despite the rich cultural sequence pre-historic and historic human-plant interaction and the ecological history of the site are poorly documented and reconstructed. This particular work is a contribution in this regard.

This is also true for most archaeological and paleo-anthropological sites in Southern Ethiopia. This particular study based on the investigation of carbonized seeds and fruit stones from the Mid-late Holocene context of Mochena Borago partially demonstrate the subsistence pattern and past ecology of the study area and open up a research on a rather neglected and understudies field of study. According to the archaeobotanical data, plant species like *Sapindaceae cf. Deinbollia, Myrtaceae cf. Syzigium guineense*, *Plectranthus edulis, Euphorbiaceae Croton* sp., *Cordia cf. africana, Ebenaceae cf. Diospyros* and Olea *europaea* sub sp. *cusipdata* were therefore the benefit of the inhabitants during the late Holocene at Mochena Borago.

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Appendix I: List of Specimens collected from the Study Area

Note: **Md**:medicinal, **Ld**:Local drink, **Eo**:Edible Oile, **Tm**:Timber, **Lf**: Live fence,
Tc: Tuber crop, **Pl**: Pulse, **St**:Stimulant, **Cr**:Craft, **Bh**:beehive, **Sp**:Spice, **Ic**:Income

Wf:Wild food, **Fd**: Fodder, **Sh**:Shade, **Cn**:Construction, **Fr**: Fruit, **Vg**:Vegetable, **St**:Stimulant, **Po**:Pole, **Or**:Ornament

No.	Scientific Name of the Plants	Family	Vernacular Name (Wolayta)	Habit	Occurance	Use
1	*Acacia abyssinica* Hochst. Ex Benth.	Fabaceae	Odooruwaa	Tree	Semicultivated	Cr
2	*Acacia etbaica* Schweinf.	Fabaceae	Odooruwaa	Tree	Semicultivated	Cr
3	*Agarista salicifolia* (Comm.ex Lam.) Hook.f	Ericaaceae	Canqquuuwaa	Shurb	Wild	Cr, Fw
4	*Albizia anthelmintica* (A.Rich.) Brogn.	Fabaceae		Tree	Semicultivated	Md, Cr, Sh
5	*Allium cepa* L.	Alliaceae	Sunkkuruutuwaa	Herb	Cultivated	Md, Sp, Ic
6	*Allium sativum* L.	Alliaceae	Tuumuwaa	Herb	Cultivated	Md, Sp, Ic
7	*Annona squamosa* L.	Annonaceae	Gishxaa	Tree	Cultivated	Fr
8	*Artemisa abyssinica* Schi.Bip. EX A. Rich.	Asteraceae	Cuqquniyaa	Herb	Wild	Md
9	*Artemisia afra* Jacq. ex Willd.	Asteralceae	Naatraa	Herb	Cultivated	Md
10	*Arundinaria alpina* K. Schum	Poaceae	Woyishshaa	Herb	Semiwild	Cr, Or, Bh, Cn
11	*Beta vulgaris* L.	Chenopodiaceae	Qeysirya	Herb	Cultivated	Vg, Ic
12	*Brassica carinata* A.Br.	Brassicaceae	Danqqala	Herb	Cultivated	Vg, Ic
13	*Brassica oleracea* L.	Brassicaceae	Maaxe santtaa	Herb	Cultivated	Vg, Ic
14	*Brucea antidysenterica* J.F.Mill	Simaroubaceae	Shurushudhdhiya	Shurb	Semiwild	Md
15	*Cajanus cajan* (L.) Millsp.	Fabaceae	Kafo-ataraa	Shurb	Wild	Wf
16	*Carissa edulis* L.	Apocynaceae	Ladieyea	Shurb	Wild	Wf
17	*Cicer arietinum* L.	Fabaceae	Suumbuuraa	Herb	Cultivated	Pl, Ic
18	*Coffea arabica* L.	Rubiaceae	Tukkiyaa	Shurb	Cultivated	St, Ic
19	*Colocasia esculenta* (L.) Schott	Araceae	Boynaa	Herb	Cultivated	Tc
20	*Combretum adenogonium* Steud.ex A.Rich.	Combretaceae		Shurb	Wild	Md
21	*Cordia africana* Lam.	Boraginaceae	Moqottaa	Tree	Wild	Wf, Cr, Sh
22	*Coriandrum sativum* L.	Apiaceae	Deebuwaa	Herb	Cultivated	Md,Sp, Ic
23	*Cucurbita pepo* L.	Cucurbitaceae	Lellehiyaa	Climber	Cultivated	Vg
24	*Cynoglossum amplifolium* Hochst. ex A.Dc. in Dc.	Boraginaceae	Qarccochchaa	Herb	Wild	Md

25	*Daucus carota* L.	Apiaceae	Kaarootiyaa	Herb	Cultivated	Vg, Ic
26	*Dodonaea angustifolia* (L.f.)	Sapindaceae		Tree	Semicultivated	Sh, cr
27	*Embelia schimperi* vatke	Myrsinaceae	Honqqooquwaa	Shurb	Wild	Md,Wf, Fw, Lf
28	*Ensete ventricosum* (Welw.) Cheesman	Musaceae	Uuttaa	Shurb	Cultivated	Tc, Fd
29	*Eriosema cordifolium* A.Rich	Fabaceae	Bido	Herb	Wild	Wf
30	*Erythrina abyssinica* Lam. ex Dc.	Fabaceae	Borttuwaa	Tree	Semicultivated	Md, Sh, Lf
31	*Eucalyptus globulus* Labill	Myrtaceae	Botta Zaafiyaa	Tree	Cultivated	Md, Cn, Tm
32	*Ficus sur* Forssk.	Moraceae	Ettaa	Tree	Wild	Wf,Sh, Cr
33	*Hagenia abyssinica* (Bruce)	Rosaceae	Kosso-mitta	Tree	Semicultivated	Md,
34	*Hordeum vulgare* L.	Poaceae	Banggaa	Herb	Cultivated	Ed, Ic
35	*Juniperus procera* K. Schum	Cupressaceae	Wolaytta Xiiddaa	Tree	Semicultivated	Md, Tm, Cn, Lf, Cr
36	*Lepidium sativum* L.	Brassicaaceae	Sifikkaa	Herb	Cultivated	Md, Sp
37	*Leucas deflexa* Hook.f.	Lamiaceae	Kirikiisuwaa	Herb	Wild	Md
38	*Linum usitatissimum* L.	Linaceae	Talbaa	Herb	Cultivated	Ed, Ic
39	*Mangifera indica* L.	Anacardiaceae	Mangguwaa	Tree	Cultivated	Sh, Fr, Ic
40	Millettia ferruginea (Hochst.) Bak.	Fabaceae	Zagiyaa	Tree	Wild	Lf, Fw, Cn, Cr
41	*Musa x paradisiacal* L.	Musaceae	Muuziyaa	Herb	Cultivated	Fr
42	*Ocimum basilicum* L.	Lamiaceae	Keppuwaa	Herb	Cultivated	Md, Sp
43	*Olea europaea* L. *ssp. cuspidata* (Wall.ex G. Don) Cif.	Oleaceae	Wogaraa	Tree	Cultivated	Sh, Cr
44	*Oncoba spinosa* Forssk.	Flacourtaceae	Hagilaa	Shurb	Wild	Wf
45	*Pentas schimperiana* (A. Rich.)Vatke	Rubiaceae	Dambbursaa	Herb	Wild	Md
46	*Persea* americana Mill.	Lauraceae	Afukaduwaa	Tree	Cultivated	Fr, Sh, Ic
47	*Pisum sativum* L.	Fabaceae	Ataraa	Herb	Cultivated	Pl, Ic
48	*Plectranthus edulis* (Vatke) Agnew	Lamiaceae	Wolaaytta donuwaa	Herb	Cultivated	Tc
49	*Podocarpus falcatus* (Thunb.)	Podocarpaceae	Ziigaa	Tree	Cultivated	Cn, Cr, Tm, Po
50	*Psidium quajava* L.	Myrtaceae	Zayttooniyaa	Tree	Cultivated	Fr, Sh, Ic
51	*Rubus apetalus* Poir.	Rosaceae	Henjeeraa	Shurb	Wild	Wf
52	*Rubus steudneri* Scheweinf.	Rosaceae	Henjeeraa	Shurb	Wild	Wf
53	*Rumex abyssinicus* Jacq.	Polygonaceae	Coodhiya	Herb	Semicultivated	Md
54	*Ruta chalepensis* L.	Rutaceae	Xalotiyaa	Herb	Cultivated	Md

55	*Saccharun officinarum* L.	Poaceae	Shonkooruwaa	Herb	Cultivated	Ic, Ld
56	*Solanum adoense* Hochst. ex Rich.	Solanaceae	Wora buluwaa	Shurb	Wild	Md
57	*Solanum corymbosum* Jacq.	Solanaceae	A'inaa	Herb	Wild	Wf
58	*Solanum dasyphyllum* Schumach	Solanaceae	Santta buluwaa	Shurb	Cultivated	Md
59	*Solanum tuberosum* L.	Solanaceae	Donuwaa	Herb	Cultivated	Ic, Tc
60	*Syzygium guineense* (Willd.) Dc.	Myrtaceae	Ochchaa	Tree	Wild	Wf,Cn, Cr, Sh
61	*Triticum aestivum* L.	Poaceae	Gistiyaa	Herb	Cultivated	Ic, Fd
62	*Vicia faba* L.	Fabaceae	Baaqeelaa	Herb	Cultivated	Pl, Ic
63	*Ximenia americana* L.	Olaccaceae	Mullowa	Shurb	Wild	Wf
64	*Zea mays* L., Var. inermis Hochst.	Poaceae	Badalaa	Herb	Cultivated	Fd, Ic

	Appendix II: List of species used in Ethnoveterinary Medicine					
No.	**Name of Species**	**Family**	**Method of preparation**	**Applied to**	**Type of Disease**	**Part Used**
1	*Albizia anthelmintica*	Fabaceae	Water of the leaf when it broken, grinded its cover part	Human	Wound, tetanes	Leaf and its cover part
2	*Allium cepa*	Alliaceae	Ground, mixed with other food st	Human	Common Cold	Bulb
3	*Allium sativum*	Alliaceae	Ground, mixed with other food stuffs	Human	Common Cold and infulinzea	Bulb
4	*Artemisa abyssinica*	Asteraceae	Rubbing	Human and Livestock	Eye disease	Leaf and young shoot
5	*Artemisia afra*	Asteralceae	Ground, mixed with water	Human	Stomach /intestinal disorder	Leaf and young shoot
6	*Brucea antidysenterica*	Simaroubaceae	Grinded and mixed with water, Rubbing	Human and Pack animals	Skin disease	Leaf
7	*Combretum adenogonium*	Combretaceae	Grinded	Pack animals	Intestinal disorder	Root
8	*Coriandrum sativum*	Apiaceae	Rubbing	Human and Livestock	Stomach disease	Leaf and seeds
9	*Cynoglossum amplifolium*	Boraginaceae	Grinded,mixed with water	Human (Childrens)	Intestinal parasities	Root
10	*Embelia schimperi* vatke	Myrsinaceae	Crushed, mixed with water	Human	Intestinal parasities	Fruit
11	*Erythrina abyssinica*	Fabaceae	Grinded, mixed with water	Pack animals	Intestinal disorder	Cover of its wood
12	*Eucalyptus globulus*	Myrtaceae	Boiled, grinded, mixed with water	Human	Coomon Cold, *Birddea*	Leaf and young shoot
13	*Hagenia abyssinica*	Rosaceae	Crushed, mixed with water	Human	Intestinal parasities	Flower

14	*Juniperus procera*	Cupressaceae	Grinded , mixed with water	Human	Stomach disease	Leaf
15	*Lepidium sativum*	Brassicaaceae	Rubbing, crushed, mixed with wat	Human	Stomach disease	Leaf and seeds
16	*Leucas deflexa*	Lamiaceae	Ground, mixed with water	Human and Livestock	intestinal parasities, Gen	Leaf
17	*Ocimum basilicum*	Lamiaceae	Grinded, mixed with water	Human	Stomach disease	Fruit, Leaf
18	*Pentas schimperiana*	Rubiaceae	Crushed, mixed with water	Human	Broken bone	Young shoot
19	*Rumex abyssinicus*	Polygonaceae	Grinded, mixed with water	Human	Hepatitis	Its cover
20	*Ruta chalepensis*	Rutaceae	Rubbing,ground, mixed with wate	Human	Intestinal disorders, Evile spirit	Young shoot
21	*Solanum adoense*	Solanaceae	Grinded, mixed with water, warm	Human	Common Clod	Young leaves
22	*Solanum dasyphyllum*	Solanaceae	Grinded, mixed with water, warm	Human	Common Cold	Young leaves

Appindiex III: Summary of the identfied botanical reamins of Mochena Borago rock shelter

No	Excavation square	Sample no.	Identification in no.								
			Sapindaceae cf. Deinbollia	**Myrtacece cf. Syzigium guineense**	**Cordia cf. africana**	**Diospyros cf. Ebenaceae**	**Plectarthus edulis**	**Euphorbiaceae Croton sp.**	**Olea europaea sub sp. cusipdata**	**Unidentifiable**	**Total**
1	K11-K12	1010	5						1		6
2	K11-K12	1011	6					2			8
3	K11-K12	1024								1	1
4	K11-K12	1031								3	3
5	K11-K12	1039	3								3
6	K11-K12	1040		11							11
7	K11-K12	1049	3								3
8	K11-K12	1060		1				2			1
9	K11-K12	1063	1					1			3
10	K11-K12	1076	6								7
11	K9-12	1077	6								6
12	K11-K12	1082	4								4
13	K11-K12	1083	2					2			4
14	K9-12	1090				1					1
15	KL-13	3001		3							3
16	KU3	3002	6	2	2						10
17	KL-13	3006	4								4
18	K-L/13-14	3010	9	16			9			4	34
Total			55	33	2	1	9	7	1		112

Appendix IV: List of Informants

No	Name	Sex	Age	Locality	Profession
1	Adelio Achono	M	30	Damotte Waja Kebelea	Farmer
2	Alaro Aseliea	M	79	Damotte Waja Kebelea	Farmer
3	Amarech Dayu	F	27	Kokatea Maracharea	House Wife
4	Assefa Toma	M	32	Kokatea Maracharea	Farmer
5	Bapitea Bocho	F	40	Damotte Waja Kebelea	House Wife
6	Belayensh Balcha	F	30	Damotte Waja Kebelea	House Wife
7	Belete Balcha	M	40	Gurum Koysha	Farmer
8	Bergenea Berdo	M	55	Kokatea Mara Charea	Farmer
9	Berhanu Toma	M	28	Kokatea Mara Charea	Farmer
10	Bertukan Beltea	F	25	Gurum Koysha	House Wife
11	Bogalch Anjelo	F	35	Gurum Koysha	House Wife
12	Branesh Nega	F	45	Kokatea Maracharea	House Wife
13	Dafe Dalea	M	60	Warza Lasho Kebelea	Farmer
14	Dalegetea Dana	F	50	Kokatea Maracharea	House Wife
15	Daniel Dado	M	26	Damotte Waja Kebelea	Farmer
16	Data Bafena	M	56	Damotte Wajja Kebelea	Farmer
17	Demqe Sata	M	35	Kokatea Maracharea	Farmer
18	Dubbaba Bafena	M	80	Damotte Waja Kebelea	Farmer
19	Elefensh Hiriboro	F	40	Damotte Waja Kebelea	House Wife
20	Feleqech Haiela	F	27	Gurmu Koysha	House Wife

21	Genet Bergenea	F	22	Kokatea Maracherea	House Wife
22	Hirut Wada	F	37	Warza Lasho Kebelea	House Wife
23	Jura Adeama	M	65	Warza Lasho Kebelea	Farmer
24	Kassa Sherfo	M	40	Damotte Waja Kebelea	Farmer
25	Matusalhe Mada	M	27	Damotte Waja Kebelea	Agricultural Agent
26	Mihert Yaqob	f	24	Kokatea Maracherea	House Wife
27	Munuhea Adema	F	40	Warza Lasho Kebelea	Farmer
28	Petros Adndabo	M	45	Warza Lasho Kebelea	Farmer
29	Samuaeal Balcha	M	35	Gurmu Koysha	Farmer
30	Satea Kuchlo	M	40	Kokatea Maracharea	Farmer
31	Shanka Gobena	M	60	Gurimo Weydea	Farmer
32	Tadelech Naba	F	35	Gurimo Weydea	House Wife
33	Tegist Doniso	F	27	Gurimo Weydea	House Wife
34	Tema Aseliea	M	85	Damote Waja Kebelea	Farmer
35	Tesfayea Sahanka	M	30	Gurimo Weydea	Farmer
36	U’fayesea Seyoum	F	30	Kokatea Mara Charea	House Wife
37	Wagas Munea	M	60	Warza Lasho Kebelea	Farmer
38	Yemserach Weyesa	F	25	Gurimo Weydea	House Wife
39	Yohanes Heamacho	M	40	Damotte Waja Kebelea	Farmer
40	Zerihun Toma	M	25	Kokatea Maracharea	Farmer

Appendix: V Semi-Structured questions for the Interviewing Informants in the Study area

It is a guided interview to be presented by the investigator to collect information on the vegetation cover of Mochena Borago rockshelter and its environs. The approach is preferred to establish free discussion ground between the investigator and the informants.

Kebele _____ Name_____

Sex_____ Age_____

Occupation_____ Educational Background_____

Marital Status_____ Year of residence in the area_____

1. Is there a Wild edible plant in your surroundings?
2. If there is, can you mention them bay name?
3. What type of plants are they? Is there root plants, cereals, or others?
4. How do you consume them?
5. When do you consume them?
6. When do these plants give fruits?
7. Are these famine foods?
8. Who consume them?
9. Do you replant them in your home garden?
10. If you replant them, what kind of wild edible plants do you bring and replant in tour home garden?
11. Why you choose these wild edible plants to replant in your home garden?

Appendix :V Continued

12. Do you have medicinal plants in your surrounding areas?
13. Which plants serve for which skins?
14. Which part of the plants do you use treat? Are you using the root, fruits, leaves, or other parts of the plants?
15. Where do you get these plants? Is that from your home garden or forest?
16. Who process the depth of medicinal knowledge concerning these plants? Is that from elders, traditional hillers, religious leaders or others?
17. Are those plants which you used for medicinal treatment available in market?
18. Which type of crops do you cultivate in your area?
19. When do you cultivate them in terms of seasons?
20. Which type of plants cultivate? Root crops, cereals, vegetables or others?
21. Do you cultivate them for home uses and /or market purpose?
22. Do you have plants which are only cultivated in your area?
23. What kinds of food do you use usually?
24. What are plants that have other uses in addition to food and medicinal uses in your areas?

Appendix: VI Direction, Maximum and Minimum Elevation of the Study Kebeles

Kebele	**Direction**	**Altitude**	
		Minimum	**Maximum**
Damote Waja	South west	2100 m	2907 m
Gurmo Wyedea	West	1987 m	2878 m
Gurmu Koysha	North west	1950 m	2600 m
Kokatea Moracharea	South east	2230 m	2810 m
Warza Lasho	West	1965 m	2700 m