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Micro-Remains from the Mud Floor of a Communal Building of Early Bronze Age I, at Arslantepe, Malatya (Turkey)

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“science is built up of facts, as a house is built of stones, but an accumulation of facts is no more a science than a house is a heap of stones”

(H. POINCARÉ, Science and Hypothesis, 1905)

ABSTRACT

Distribution of cultural evidence contributes a great deal of information to archaeologist in different scales from large communities to small dwellings. Accumulation of large amounts of micro-remains put archaeologist in a big challenge of understanding a functionality of dwellings. Micro-debris pertains to short-term activities that occurred near the end of dwelling use or even after abandoning that. Micro-remain analyzing provides a great information in space distribution and activity patterns. While architectural approach in household studies is focusing on boundaries and plan, micro-remain analysis comprehend the interpretation of architecture and narrates the real story of house and dwelling. Arslantepe, during the end of 4th millennium witnessed dramatic changes in occupation and structure. The mudbrick building (Building36) dating Early Bronze Age I was rested on top of the large courtyard of the monumental hall belonged to the palace complex dating to phase VIA. Burning in a huge fire provided large amounts of in situ material from this building. This tragedy benefited archaeologists with lots of unique information. Floor micro-remain analysis of Building 36, is required to find out the specific activity pattern and space distribution. Building 36, consists of two separated rooms with noticeable amounts of in situ materials which required more details in explaining functionality of each room. Two separated room (A1000, A1369) and one storage space(A1374) demonstrated different functions. While A1369 provided the evidence of cooking activity and storage use, A1000 the main hall demonstrated ritual and ceremonial functionality. Comparison of the first phase of construction with second phase shows that although structure of Building 36 had been changed but the functionality of rooms did not vary significantly.

Keywords: Micro-remains, Micro-debris, Micro-fauna, Space Distribution, Micro Analysis, Micro-archaeology, Household, Household archaeology, Early Bronze Age, Arslantepe.

Introduction

“Micro raconteurs narrate house’s stories”

The dwelling and dwelling spaces have the attitude through which we confront the real surrounded world beyond them. The surrounded world has a potential to bring creativity in dwelling spaces, in the meantime dwelling spaces provide the formula to negotiate all relationships with surrounding world. With no doubt the form and pattern of dwelling can act as a medium through which that outside world can control the activity within. At the same time the physical structure provides means to separate all activities from the direct influence of outside world. For these reasons the architecture per se can never totally dictate the behavior within its space (Allison, P. M. ED, 1999).

Dwellings serve both “to reveal and display” and “to hide and protect” (Carsten and Hugh-Jonses, 1995). In order to record stories coming out of dwelling, archaeologists require more than architecture and feature. Solving the mysterious enigma by putting pieces of puzzles together is what archaeologists need to do to find out what dwellers had done as part of their social and cultural activities.

One important subfield of archaeology called “Household archaeology” deals with activities took place in dwellings as the cultural, social and economic life. However, archaeologists do not dig households and social units, but they do excavate domestic features which contain majorities of sociocultural information.

Archaeological interest in the household and domestic relations has evolved with attempts to develop the cross-cultural attitude of historical site by examining recovered materials. The importance of household activity comes from the concept that activities considered to be the “culturally recognized tasks” (Hendon, 1996) of the household which is varied cross-culturally.

Space distribution and activity patterns are considered as the components of household archaeology investigation. It deals with the type of information comes from the combination of architectural plan and retrieved materials. Besides all big artifacts which reveal the fundamental assumption about how dwellings were used and what social activity took place, there are micro-remains which complement the basic assumptions in household activities. While archaeological deposits are subjected to several factors such as displacement, looting and historical events, micro deposits are trampled on the floor and remain secured from external affecting reasons. Household archaeology requires micro-remains to fulfil ethnoarchaeological investigation in dweller's activity and functionality of physical structures.

To find out firsthand information which is not written in any records and no traces of them have survived in large archaeological materials, micro-remains play a key role. They can be paradoxically a detecting method which requires magnifier to be detected at first.

Micro-remain analyzing reveals the internal dynamic of house and the relationships of households and architecture in respect to the human activity patterns. Due to their micro size, they did not encounter processes that other historical material underwent. Consequently, they can reveal genuine information about spatial pattern ascribed to the fact that there is a high probability of retrieving them on the original location of their production and usage.

In the case of worldwide notable historical site, Arslantepe which is one of the main archaeological sites in Turkey, Malatya, varieties of scientific analysis are required due to its enormous size and long periodic time table. During Early Bronze Age, Arslantepe had different phases and witnessed several cultural contractures and inhabitants. After phase VIA which is well-known for a big palace with signs of the centralized political organization, phase VIB1 was a new settlement. The new inhabitants were not only varied in terms of settlement and construction but also with abrupt changes in ceramic culture (Siracusano, Palumbi 2014). Building 36 bears the testimony to this theory which should be investigated thoroughly. Building 36 was destroyed by a huge fire and all material remained in situ which was the beneficial tragedy for archaeologist to get the idea of its function. Although Building 36 provided a lot of in situ materials reinforcing all fundamental theories about functionality, but micro-remain analysis were required to comprehend the pattern of activity. Micro-remain analysis complete the interpretation of in situ material by providing visual patterns of activities.

In this dissertation floor micro-remains in Building 36, in Arslantepe is going to be analyzed as well as spatial pattern which will be presented in the form of heat map.

1.1 Household archaeology

"When the soil has been questioned it will answer"

Household archaeology is a new field which can be described as the combination of settlement analysis and activity area research. Settlement archaeology can range from the macro scale study of regional settlement patterns to the micro scale investigation of activities and spatial organization in a single room. In the macro and micro scale investigation, it is a crucial to focus on economic aspects of the household unit, using the organization of architectural structure combined with associated remained materials. All those economic activities can vary from production and consumption of food, division of labor and social stratification.

Household archaeology can be narrowly explained as a field that deals with the most elemental unit attributed to the socioeconomic structure where "the most primary functions of society" takes place (Sharer, Ashmore,2003).

The first introduction of the term "Household Archaeology" dates back to 1982 by Richard Wilk and William Rathje in their article "*Household Archaeology*" published in a special issue of American Behavioral Scientist. They theorized that household was the level at which social groups form with economic and ecologic process. Household was defined as a "common social component of subsistence, as the smallest and most abundant activity group" which was composed of three main elements: 1- social, including number and relationships of members, 2- material, as a dwelling, activity area and possession 3- behavioral, as an activity performed (Wilk, Rathje, 1982).Among recent decays household archaeology became known as the subfield in archaeology which sometimes referred as "Domestic Archaeology".

On the shore of no doubt study of house and household is a necessary part of understanding ancient society and daily life. The major Objective of household archaeology is the ability to see better the processes through which ancient people created and modified built environment. Moreover, it facilitates observing how processes change through time and space as a function of style, necessity, material, climate, social interaction, and economy (Ullah, 2009: 123).

A second objective of household archaeology can be summarized in to understanding the way people used their dwellings, how they arranged activities within them, and how the features of the dwellings shaped these patterns. (ibid)

In comparison to large artifact found on the house floor, micro-remains are like an asset for archaeologist to reconstruct the activities pattern. Since the larger one is not likely to be used in the same place during the life-cycle. In order to see long-term pattern of space usage, one must examine the small things that are left behind while all the larger items are removed.

Although households are the prime social and economic building block of activity, unfortunately they are considered of a little significance in traditional archaeologic and anthropogenic researches. Consequently, the interpretation of socio-cultural and socio-economic would not be reliable.

As Tringham succinct:

"we (archaeologist) write a lot about architecture, spatial patterns, buildings, dwellings, shelters, and we make inferences about houses. Only recently have we even begun to make explicit inferences about households (original emphasis)".

This may be partly due to ambiguity in defining the boundaries in physical structure of ancient houses. Terminology can be another reason of confusion which few people consider it. The shared activities of the household are often separate from the physical structure of the house which, in turn, is separated from the kinship relations among the family. Unfortunately, these three terms are often used indiscriminately and serve to confuse the form, function, and activities associated with each other (Rainville, 2001: 22). Consequently, there is a prime need to be careful and explicit in defining relevant term to not be confused while engaging in household archaeology.

1.2 House

Universally approved house is a place which serves different purposes, it is a shelter from different elements which can be climatically varied, a gathering space for social groups and communities, last but not least, it is a center for daily and economic activity. Despite the fact that houses are varied based on climate they are also different due to cultural preference for design and architectural form. Houses mostly contain different part of the private and public areas which are used for daily activity, socializing, storage and religious rituals. Maintaining of the house in most of the cultures were a chore that encompassed varieties of activities such as sweeping, trash disposal, rebuilding or even deleting and adding rooms.

In the last decade, scholars have attempted to "read" houses and domestic symbols as texts. They have tried to answer questions like "how does the use of space affect domestic architectural design and vice versa?" (Susan Kent, 1990:1). if these perspectives taken together, it can answer the dynamic of houses in ancient time.

1.3 Household

Whereas the definition of domestic structure can be clearly based on the structure, presence of specific artifacts (grinding stone, chips, cookware, pottery shred), features (hearths and middens), pattern and material (stone, mudbrick), defining household activity and household membership is more difficult. Some scholars define it as "composed of individuals that may or may not be genetically related and are only one aspect of human interrelationships and communities". One issue is that households are not static social, economic, or political groups (Moore, 1984).

The term "household" may refer to shared activities and residence, which might change seasonally, annually, or during life-cycle and at different type of time scales. All those activities which are shared can include production, transmission or reproduction of food, sharing it, rearing children, enculturation.

In addition, individuals and households can be connected more than one building and structure. Hammel synthesized the nature of the household as the "smallest social group that participates in the maximum number of functions." (Hammel, 1980: 251).

Archaeologically speaking the household is "the smallest social arrangement within the settlement pattern" (Rainville, 2001:24). Based on these definitions archaeological household data can be categorized in three level which can be recovered:

- Main daily activities (such as cooking, sleeping, craft making)
- Less frequent activities (such as burial and religious ritual activities)
- Size of domestic unit and spatial pattern (in term of physical structure and composition of household).

In order to prevent the confusion between family and household it's worth mentioning that while household can be composed of non-kin and kin, family is the social unit and group of people related by descent and marriage. It is the general definition of family and there might be exceptions which is not necessary to focus on in this thesis.

After demonstrating the concept and definition, the following sub-chapter will discuss about the new method of household archaeology, which is investigating micro, macro artifacts and debris.

1.4 New approach in household archaeology, Micro-Archaeology

Considering the fact that the main aspect of household archaeology is the identification and interpretation of activity areas, there are some problems regarding this aspect. The major issue with interpretation of spatial patterning is that due to cultural and natural site formation processes the objects may be secondarily deposited in places in which they were not used or originally deposited (Brooks and Yellen 1987). Early work on site formation processes quickly identified that, smaller artifacts may be less subject to disturbance by many site formation processes (LaMotta, Schiffer, 1997). Therefor micro-archaeology (study of very small cultural material) never considered as important as way to deal with the problem related to larger artifact in an activity analysis approach (Metcalfe and Heath 1990).

Since household archaeology is the growing and developing field, it is not possible to limit topical parameters. In the first step study of distribution of artifacts and features (hearth, storage pit and burial) in domestic room and in the second and more precise level the microscopic, micro artifact can complement fetures and give a detailed perspective about archaeological formation process and prehistoric sociopolitical and economic system

There is a controversial misunderstanding in micro-archaeology due to the ambiguity of the concept of what exactly is micro artifact, how much time and cost does it take? This uncertainty caused that this field has not been used in its fullest potential. In recent decades fruitful attempts were done to reveal the main issues of micro archaeology and answered to the main problems of what it entails and how difficult it is. More over recent publications proved the power of micro-archaeology usage in spatial analysis and archaeological interpretation without spending too much cost and efforts (Ullah, 2005).

1.5 What is micro-archaeology?

Although the question seems straightforward, the answers in the literatures are kind of conflicting, due to determination of the size of micro artifact. Because the lower size limit can potentially be at the molecular level, the main point of contention has been the delimitation of the upper size limit for micro artifacts (Ullah, 2005).

Scholars determined different measurement from 1mm to 3 cm in order to define the size of micro artifact, but all agreed on the basis, either implicitly or explicitly, that the term “micro artifact” should include larger size classes than microscopic artifacts and should be visible by naked eyes. We can classify micro artifact size definitions based on three criteria; limits of observers, sedimentology and effect of cultural and natural site formation process.

Regarding the limitation on size, it can be so narrow and bounded. It has been shown that, at least in certain cases, small size refuses that are larger than 1 or 2 mm, but smaller than 1 or 2 cm behave the same as the smaller (<1 or 2 mm) micro-refuses but with the added advantage of being easier to recover and analyze (Healan, 1995). However, this is not a universal phenomenon and it can vary depending on different factors, from physical properties to the substrate type and the amount and type of cultural and natural site formation processes. Therefore, it seems that the archaeologist needs to understand case-by-case the nature of all these factors at site before making a judgment of the most cost-effective upper and lower size limits of micro-refuse to collect from the site (Ullah, 2005).

Micro-artifacts also known as micro-refuse or micro-debris analysis can be used mostly to reconstruct spatially persistent activity over the life of a household, rather than just the last use, abandonment, or post-abandonment re-purposing of a space. To get this goal micro-debris requires to be collected, processed analyzed and interpreted based on spatial research goal set in mind.

1.6 Background of micro-archaeology

The study of micro-debris was first attempted in the early twentieth century with the detailed analysis of Californian shell middens. For instance, Gifford (1916) tested the proposition that small items may not be represented in larger sizes and thus must be collected separately (Rainville. 2001). Further study of micro-debris conducted only to the native American sites which few macro debris was preserved but micro artifact remained. During 1970 most of the micro artifact studies conducted by geologist and archaeologist. They analyzed micro ceramic and micro lithic to identify primary activity area and reconstruct the fact that was not visible in to archaeologist eyes.

To be specific, one of the first pioneers in micro archaeological study was Fladmark's (1982) investigation on activity areas and site formation processes using lithic micro-debitage[1] (Ullah, 2005). What Fladmark had done was followed by other studies with the focus on micro-debitage and activity area analysis.

In late 1980 and early 1990 other studies have been done by scholars such as Rosen 1986, Courty, Goldberg, and McPhail 1989[2] (Rayville, 2001). These studies were carried out by the approach of evaluating the feasibility of micro analysis. Moreover, new ideas were used for spatial analysis and site formation processes, and finally expanded from only lithic to use many different types of micro refuse in 2000 and afterward. Different reasons such as difficulty, cost and time consuming and lack of specialized knowledge caused that this type of micro archaeology has been misconstrued as too difficult to do and has been undertaken too rarely. It is worth to mention that beyond micro-debitage analysis, which is studying the lithic manufacture, micro botanical analysis has been historically separated from other type of micro archaeology studies since it was usually used for paleo-environment and seasonal reconstruction (ibid).

There are two other types of micro-archaeology related to soil science and geology, which go beyond the minimum size limit of the other type of analysis. Micromorphology looks for the structure and how cultural phenomenon affect that. However, molecular analysis pursues to find chemical pattern in the soil that results from cultural activity (Goldberg and Whitbread 1993).

The last two types of analysis can be useful tool for spatial analysis, but they must be developed, and the utility should be evaluated. In most of previous studies of micro artifact the place of anthropological interpretation is missing. The significant part of micro artifact and micro-debris studies is complementing the information about preservation, processing and patterning of micro

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1 Debitage is the material reduced during the lithic reduction and the production of chip stone tool.it is different kind of lithic flake and lithic blade.

2 Manzanilla and Barba 1990, Metcalfe and Heath 1990, Matthews 1992, Kemp et al. 1994, Manzanilla 1996, Matthews 1997, are the other scholars who worked on micro archaeology.

artifact with ethnoarchaeological and anthropological prospective to obtain the idea about past activities and space distribution in respect to architectural plane and features.

1.7 Advantages of micro artifact studies

As mentioned above studying micro-debris complements studying architecture and feature. There are three additional advantages in analyzing micro artifacts in comparison to larger one which can be summarized:

(1) Due to the difficulty in removing small debris with traditional cleaning methods, small items are the unintentional deposition. They demonstrate more reliable information about the real household activity not even the last time of using the space. Because site formation process commonly includes episodes of abandonment when the residents remove or “curate” anything usable from the premises and artifacts and debris which are less than 10 mm are rarely considered usable and often left behind. (Shiffer 1983).

(2) because of the small size micro-debris are less likely to post depositional factors such as cultural disturbance (removing shred to reuse them). There is another disturbance factor which is geologic and biogenic and includes wind erosion, water sorting and gravity movement. They all can be a reason to remove or replace bigger artifacts in comparison to micro and small one. However, there are some possibilities that micro-debris encounter post depositional disturbance like micro debitage which consist in macro remains, and their size is reduced due to chemical and physical weathering. In these cases, they represent the larger objects that have been decayed or removed.

(3) Micro-debris may provide information on activities that are rarely represented by larger artifacts (Rainville, 2001). These types of miniature activities include pierced shells, small mammal teeth, or fish scales and bead production.

None-cultural association such as those which are component of mudbrick (snails and pebble) as opposed to activity related by product like lithic and cutting.

By mentioning all advantages of micro-remain studies, in this thesis I did micro analysis of one of the most famous archaeological sites in Turkey, Arslantepe. The purpose of micro-remain study is to get the information about daily activity and provide the spatial pattern of two big rooms based on the retrieved micro-debris.

1.8 Case study: Arslantepe, Malatya, Turkey

Utilizing the main aspect of household archaeology and micro-debris analysis, we can address several main questions about the dynamic of ancient house. In this thesis a case study with the approach of micro analysis and spatial studies is Arslantepe, a worldwide famous site for its Late Chalcolithic occupation. It has a long sequence of occupation dating back at least to the 6th millennium BC and extending uninterruptedly to the 1st millennium. Investigations in this thesis, therefore deal with the level of a single settlement, a communal building of Early Bronze Age I namely Building 36 with two rooms (A1000) and (A1369). The excellent preservation of its floor and its role within the settlement, due to its large and most prominent position, makes it a perfect case for a detailed functional research.

The main purpose of micro artifact analysis and space distribution of this early Bronze Age communal building is answering these questions:

- What was the function of this large communal building of Arslantepe VIB1, a period in which the rest of the village was mostly made up of small huts and animal pens?
- Which kind of activities were carried out in the rooms A1000, A1369 of the building?
- How do the results of the micro analysis can be compared with the results of another master thesis on micro analysis that was carried out in another phase of the same building which is done by a previous master student[3].

The result of this micro analysis can be a step forward to start analyzing all excavation phases of Arslantepe in different time periods to encode the economic and social activities of the residence and builders of this important worldwide known site. In order to get the precise result in micro investigation of two rooms A1000, A1369 I examined relatively new archaeological method to

3 “lo studio dei micro-reperti nei battuti pavimentali come strumento per l’analisi funzionale degli ambienti. II caso studio di due strutture del Bronzo Antico I ad Arslantepe”. Susanna Cereda, Sapienza university di Rome, 2013.

provide a better viewpoint of space distribution of micro-debris to get the specific activity area in each room. All methods will be explained clearly in the methodological chapter.

Arslantepe

In this chapter I am presenting Arslantepe and a short history about the archaeological excavation carried out there as well as its geographic setting and environment. Furthermore, I try to explain the chronological frame work of the site and main archaeological phases, more specifically phase VI B1, the one which is dated the communal building that I am using as case study.

2.1 Greater Mesopotamia: an overview

Figure 1. Greater Mesopotamia and Arslantepe (adapted from Google Earth)

In the past fifty years Arslantepe has been given a prominent place in the debate on 4th millennium BC communities in an area generally referred to as Mesopotamia, despite only being in the northern outskirts of the region. The word ‘Mesopotamia’ (ancient Greek composite word meaning ‘between the rivers’) was originally used to indicate the region enclosed within the course of the Tigris and the Euphrates rivers, which roughly corresponds to the area covered now by the state of Iraq (Guarino 2014).

The expression “Greater Mesopotamia” includes all those regions to the north and the east of the Mesopotamian alluvium that shared important cultural traits over the millennia, since the Neolithic, and played a fundamental part in the cultural development of the whole area (Frangipane 1998, 195). Area of western Iran on the border of Iraq, north eastern in Syria and south eastern of Turkey, the whole mentioned part has been the location for intense human activity for several millennia. Arslantepe is located within the boundaries of Greater Mesopotamia, in the Malatya plain, along the upper course of the Euphrates river. The Malatya plain is surrounded by the Anti-Taurus Mountains.

The term Greater Mesopotamia then encompasses the range of natural ecosystems from the marshy plains of the southern Alluvium to the steppe of the Jazira and the Anti-Taurus Mountains. Accordingly, past communities settling in each of these regions were able to exploit different resources and faced different limitations and difficulties (Guarino, 20014: 27).

The specific climatic and environmental conditions present in the Mesopotamian Alluvium between the 5th and 4th millennia BC are explicable for creating an economic advantage for the southern Mesopotamian communities in relation to their neighbors (Frangipane, 1998).

It is clear that from the early beginning of human settlement, environmental aspects played the important role in the selection of subsistence strategies and developing economic organization, if we don’t consider it as a first and most important factor. Due to this important reason it is necessary to present the environmental condition of Malatya plain to highlight the natural resources available to Arslantepe community during the end of the 4th millennium.

2.2 Malatya plain

The plain at circa 900 meters above the sea level, stretches in a south-east north-west direction and is roughly 60 km long and 30 km wide (Palmieri 1978, 45). The south of the plain and upper Euphrates is divided by Anti-Taurus mountain from Jazira steppe of south-eastern Turkey and northern Syria. To the north the plain is bordered by the Euphrates that flows into the plain from north and exits the plain towards south-east (figure 2).

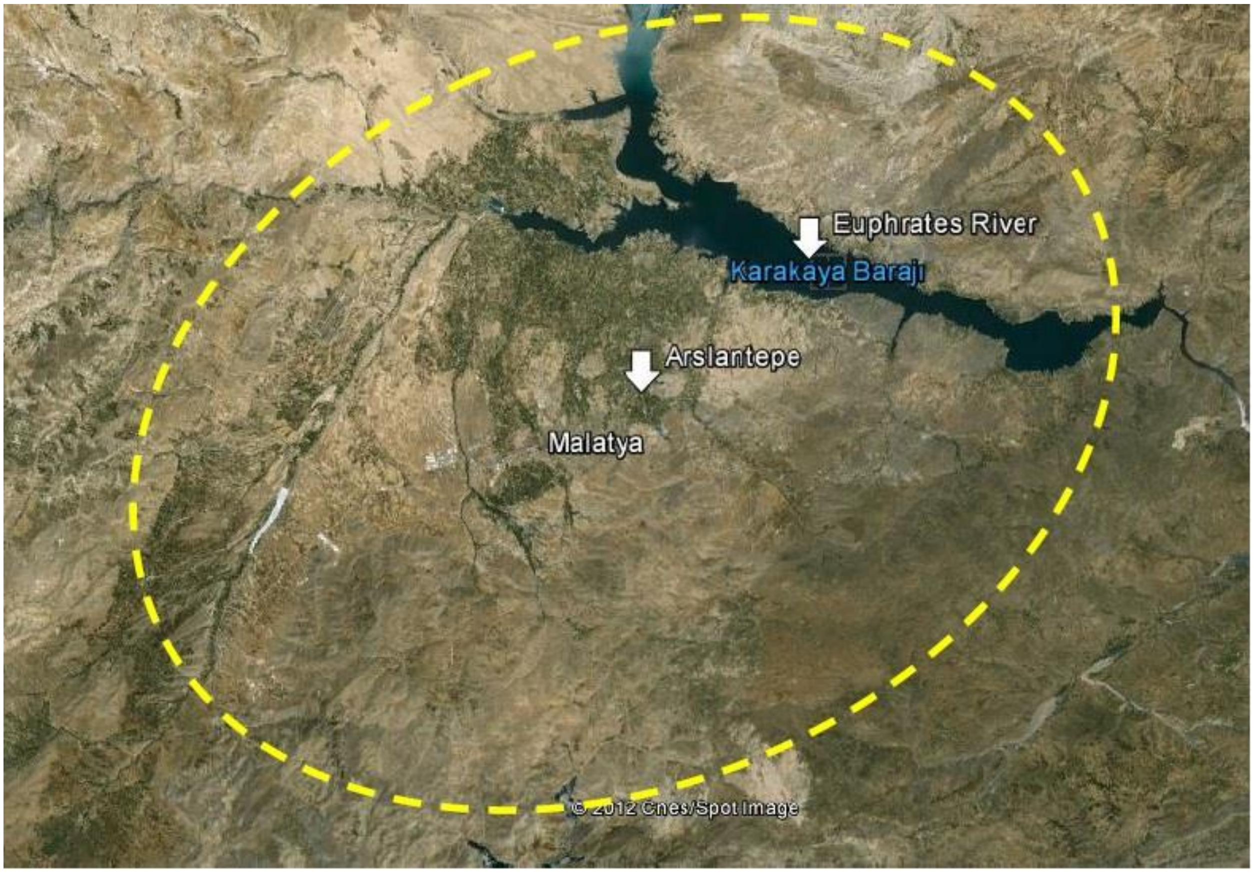

Figure 2. A satellite view of the plain of Malatya (adapted from Google Earth).

Numbers of tributaries, which cross the Euphrates plain in several directions, provide water for the plain. The Kuruçay in the northern part of the plain, the Tohma in the central section and the Sultan Suyu along the main axis of the Euphrates.

Based on the location and environment, community who lived in Arslantepe must have gotten a lot of advantages of living in the middle of fertile plain, relatively close to varieties of natural sources like obsidian, copper and timber. Moreover, about 15 kilometers close to Euphrates river might provide the opportunity of carrying and transporting goods and products to other regions crossed by the river (ibid).

Figure 3. the plain of Malatya from the mound of Arslantepe. The Euphrates River lies between the plain and the mountains in the background (photo from Guarini, 2009).

Due to the surrounding hills and mountains from the south to southeast, Malatya plain, had abundance of ground water which flows in the north and north west direction and provide fresh waters in the vicinity of in the shape of different springs (Marcolongo and Palmieri 1983).

The large quantity of water sources makes the plain of Malatya a particularly rich and fertile oasis in the otherwise steppe-like environment (Palmieri 1978).What Erinc analyzed about rivers and lake terraces in eastern Anatolia (Erinc 1980) demonstrated that the rainfall was more abundant than at the present days and "most of the area was occupied by forest-steppe and open forest" (Bököny 1983: 853).Consequently, on the paleo-environmental analysis of the area, ecological condition of the plain must have been even more flattering during prehistoric times.

In addition, according to Marcolongo and Palmieri during the Chalcolithic Euphrates' alluvial plain was probably wider than today and created even larger discharge area (Marcolongo and Palmieri 1983, 627).

2.3 The archaeological sequences of Arslantepe

The mound of Arslantepe (Figure 4), which covers circa 4 hectares, was gradually built up through the superimposition of several layers of human occupation; during the millennia successive structures at Arslantepe were constructed on the rubble of previous occupations; these were not cleared from the site but presumably leveled, compacted and used as a base for the new constructions. Because of this building practice, by the end of the human occupation of the site, it had reached the height of about 30 meters above the plain of Malatya (Guarino, 2014).

Figure 4. The plain of Malatya from the mound of Arslantepe. The Euphrates River lies between the plain and the mountains in the background (photo from Guarini, 2009).

Large occupational sequences in the site and large building with thick walls are quite common in near east. This settlement was occupied virtually without interruption, at least from the end 5th millennium BC until the Neo-Hittite phases and the most recent occupation so far detected is dated to the late Roman/Byzantine phase (ibid).

The archaeological sequences are summarized in the table (table 1). These are numbered successively from the latest archaeological horizon to the earliest; capital letters correspond to internal divisions within the horizon and mark significant differences in the material culture. The absolute chronology is based on a wide range of radiocarbon dates obtained from relevant contexts at the site of Arslantepe (Di Nocera, 2000)

Chronological Sequence	**Arslantepe Period**	**Absolute chronology**	**Contemporaneous phases in the Near East**
Late roman	I		
Iron age	II-III	1100-700 BC	Hittite New Kingdom
Late Bronze II	IV	1600-1100 BC	Middle Hittite Kingdom
Late Bronze I	VB	1750-1600 BC	Old Hittite Kingdom
Middle Bronze	VA	2000-1750 BC	Old-Assyrian Colonies
Early Bronze age III	VI D	2750-2500 BC	Early-Dynastic III b
Early Bronze age II	VI C	2750-2500 BC	Early-Dynastic II-III a
Early Bronze age I	VI B2	2900-2750 BC	Jamdet Nasr
Early Bronze age I	VI B1	3000-2900 BC	Jamdet Nasr
Late chalcolithic 5	VI A	3350-3000 BC	Late Uruk
Late chalcolithic 3-4	VII	3800-3350 BC	Early and Middle Uruk

Table 1, Arslantepe archaeological sequence and chronology (adapted from Frangipane (ed.) 2004, pp. 18)

specific details on Period VI B1, the case study of the thesis and room A1000, A1369 are discussed in following subchapter.

All this uninterrupted sequence which was reconstructed with an extensive excavation Strategy provided the great opportunity to study the diachronic pattern of occupation, as well as the development of a different characteristics of the settlement across the millennia (Frangipane 2002).

2.4 History of archaeological intervention at Arslantepe

Arslantepe first became known to Near Eastern archaeologists after the discovery of a Neo-Hittite gateway decorated with stone reliefs as well as the two large statues of lions from which the site's name originates (Arslan – Lion, Tepe– Hill: Hill of the Lion) (Guarino, 2014: 38). Between 1933 and 1940 the first archaeological excavation in Arslantepe carried out by French archaeologist Delaporte. This was concentrated on the exploration of the Neo-Hittite layers on the north-western slopes of the mound and uncovered the famous Neo-Hittite ‘Lion’s Gate’ (Delaporte, 1940). Due to the world war the excavation was interrupted and after war it was resumed. Claude Schaeffer between 1947 and 1952 carried out a series of deep trenches across the mound to pursue his aim of reconstructing the whole sequences of Arslantepe, but unfortunately the results of his work were never fully published (Schaeffer 1948).

In 1961, the excavation and management of the site was undertaken by an Italian expedition from Rome University “La Sapienza”, initially directed by Prof. P. Meriggi and S. Puglisi, then Prof. A. Palmieri and currently by Prof. M. Frangipane.

Meriggi focused the first efforts in the northern half of the mound to extend the area where Delaporte had found the ‘Lion’s Gate’. Excavation in this area resulted a sequence of Hittite town gates and fortifications (Pecorella, 1975).

In the eastern excavated area, the small number of rural villages discovered which was attributed to late Roman period. It could represent the most recent occupation phase in Arslantepe. On the other hand, on the north eastern slope of the mound, to the east of the Hittite gates, the excavation in sector C3 yielded a long sequence of prehistoric remains, mainly consisted of domestic contexts relating to the Chalcolithic occupation of the site (Palmieri 1969).

Excavations in this area led to the discovery of a sequence of several over-imposed villages attributed to the Early and Middle Bronze Age (Periods VI B, C, D and V A of Arslantepe chronology), dated between 3000 and 1750 BC (Frangipane and Palmieri 1983). Among the Early Bronze Age domestic context, in 1996, a so called “royal tomb” was discovered (Frangipane 2001b). The ‘royal tomb’ consisted of a rectangular stone slab-lined cist cut at the base of a larger sub-circular pit. The bodies of four young individuals had been laid in the larger pit around the stone slabs that covered the cist. This, in turn, contained the body of an adult man surrounded by an exceptional wealth of grave goods including several ceramic vessels, metal weapons as well as golden, silver alloy and copper ornaments such as diadems, air pins, bracelets, etc. (ibid).

This context which is dated to early third millennium BC, revealed the new viewpoint in the interpretation of the relationship between nomadic group and settled people in the Malatya Plain. Toward the end of the forth millennium BC, a palatial complex of period VIA was destructed and Arslantepe witnessed a different phase of installation with specific features. The previous phase followed by the period VIB with “flimsy architectural remains of wattle and daub huts associated with a ceramic culture clearly recalling the contemporary Kura-Araxes traditions of Eastern Anatolia and of the Southern Caucasus”. (Frangipane et al. 2017).

Recent excavations at Arslantepe have brought to light an imposing mud-brick building (Building 36) (the case study of this thesis room A1000, A1369 belongs to this building) dating to period VIB1. Building 36 rested on top of a large courtyard and of a monumental hall dating to the period VIA of the palace complex, thus highlighting a strong sense of continuity in terms of monumental architecture between periods VIA and VIB1. It was destroyed by a violent fire, burying a huge amount of materials in situ: 83 ceramic vessels, metals and stone tools (ibid).

To get acquainted with the entire excavated phases in Arslantepe, I give a brief explanation about the first phases of occupation, up to that of VI B1.

In the most ancient excavated period VIII, the excavation unearthed two main building phases. The main characteristic of both phases can be summarized as domestic structure, especially in the earlier phase a functional characterization of space can be argued due to the presence of ovens, cooking ranges and in some cases large concentrations of charred grains in the corner of the rooms (Balossi Restelli 2008, 23).

In both Periods VII and VIII at Arslantepe, the walls were plastered and decorated with painted patterns.

Material remains attributed to phase VII, demonstrated the evidence of common and elite dwellings as well as monumental public and ceremonial structures (Guarino, 2014).

During this phase the site reached its maximum expansion. The excavation on the western edge of the mound has unearthed several contexts attributed to four consecutive phases of Period VII, consisted of a complex of large buildings characterized by thick walls, rooms with internal columns and wall paintings.

In comparison to period VIII, period VIA is not known for its domestic structures but for a public and palatial complex (Frangipane 1997).

This includes two ceremonial buildings (the so-called temples A and B) a series of storage rooms and a long corridor that crosses the whole structure (mentioned above and will go in more detailed on following subchapter).

2.5 Period VIB1, A case study for micro analyzing

As mentioned in the previous subchapter, at the end of the forth millennium BC, the palatial complex of period VIA was destroyed by a fire that marked the distinctive collapse of the related power system (Frangipane 2012b and 2014). After a short period of probable abandonment, a new flimsy occupation of scattered wattle and daub huts, corresponding to the beginning of period VIB1, was built directly on top of the palace ruins that had been only roughly leveled by the period VIB1 settlers, without any serious building effort (Frangipane, et al 2017).

The VIB1 occupation consisted of the various stratified levels, which are not thoroughly investigated yet, but until now, no less than 5 sub phases have been identified (ibid). The two earliest levels show the evidence of temporary occupation due to the large spaces with a thick deposit of organic material accumulated on the surface and demonstrate the structures for animals and probably tent. (Palmieri and Cellai 1983).

Figure 5. Uneven surface leveled by the earliest settlers of period VIB1 (Frangipane, 2014)

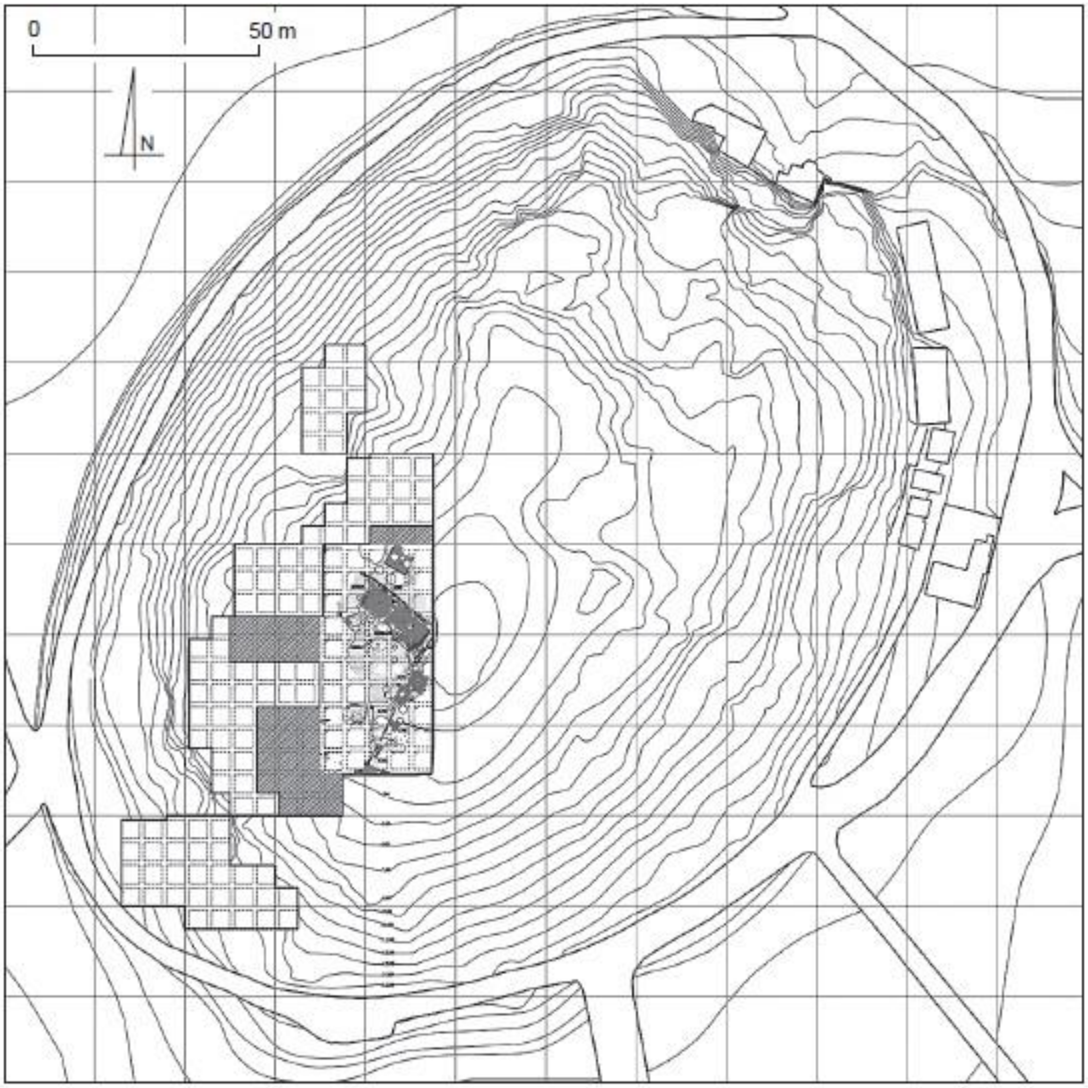

Figure 6. Plan of Arslantepe with the south western excavation area and remaines of period VIB1 (Frangipane, 2017)

The third level shows the construction of an imposing mud-brick hall (the first phase of Building 36) on the upper part of the mound (figure 5) (Frangipane 2014).

This building rested on top of the ruins of an earlier monumental building (Building 37) belonging to the period VIA palace complex, which has been discovered recently (ibid).

The large hall named A1000 was a large room of the Building 36, in the earliest phase which is characterized by quite large central rounded fireplace.

Room A1000 opened to open spaced area with two entrances on to the south (figure 6), there was also a lateral room to the west (A1369).

The entrances are symmetrically placed at both sides of a protruding wing (A1374) (Frangipane, 2014).

In a second construction phase, a quadrangular room (A1369) was added to A1000 on its western side and contained a large number of vessels as well as two copper spearheads (ibid) (Figure 7).

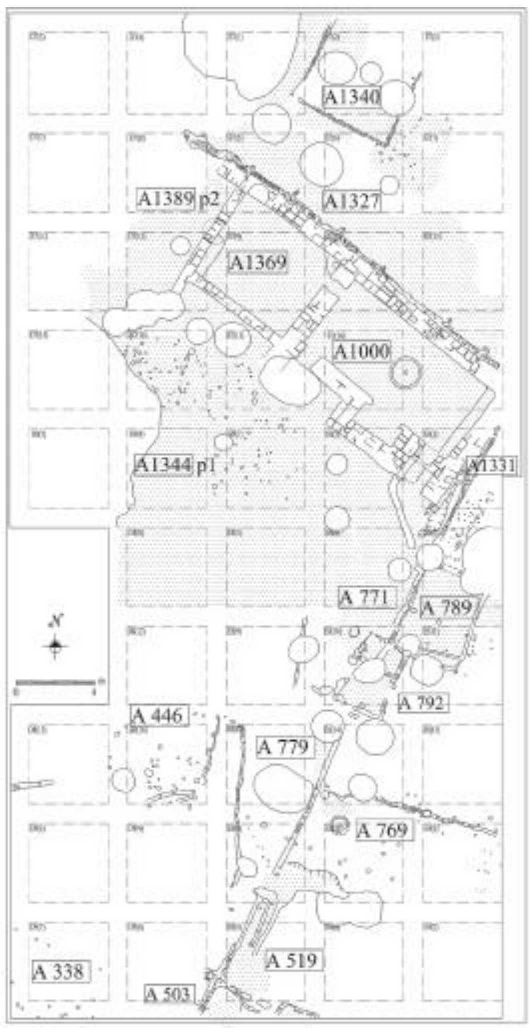

Figure 7. Plan of the settlement of period VIB1 contemporary

A huge fire destroyed Building 36 and burned considerable amount of materials in situ on the floors and in the collapse layers.

The occupation in VIB1, attributed to mobile communities with pastoral economy, due to the connection of occupation to the wattle and daub architecture. However, discovery of Building 36 in this phase opened the new perspective for the whole nature of occupation in period VIB1 (Frangipane, 2014).

2.6 Architecture of Building 36

In the second construction phase of Building 36, two communicative rooms located in an elongated rectangular shape (17.70×7.50 m) oriented northwest/southeast with a covered surface of 120^{m} (Frangipane et al. 2017). Larger elongated hall (A1000) and smaller square room (A1369) are adjacent to each other. The smaller room extended in western side of long room. (figure 8).

Figure 8. Building 36, room A1000 and room A1369.

Two entries lead both to the main hall A1000, and a window in the smaller room A1369 provided lighting and air. Middle/large sized stone foundations were employed for A1000-A1374, while small sized stones were used in A1369, which belongs to a second building phase. The thickness of the walls ranged from 1 m in A1000 to 0.50 m in A1369 with consequences in the size of the mud-bricks, which are large (0.50 by 0.35 m) and arranged in two regular rows in A1000-A1374 and consist of two smaller mud-brick rows with a single row of larger ones in room A1369 (ibid).

A large room (A1000) has a bench (0.30 m high × 0.50 m wide) along its eastern side. There was also a large fireplace, 1.60 m in diameter, which was in the middle of the long room, A1000, next to storage space A1374. Room A1000 was the largest room of the Building 36 and despite its large size it contained the smallest number of vessels. Eleven containers were in this room while only two of them were large.

It is worth mentioning that two copper awls were found respectively in room A1000 and A1374, as well as four rings made of copper sheets.

A1374 was a small space (2.40×1.17m), which was connected to the large room A1000 through the wide opening. This closet was divided vertically, while the bigger ceramic jars were located on the floor, the smaller ones were placed on top of the shelf, demonstrating the function as the storage space. Since it was closed to the unusually big fireplace in room A1000, scholars interpreted that the closet might have stored the jars, which have been used in a large ceremonial room. There was also another opening on the western wall of A1000, which had led outside of the building in the first phase and provided the access to room A1369.

A1369 with the size of 5.80×4.80m, had a small fireplace (diameter 0.50) located offset to the north. It contained largest amount of medium large jars and impressive quantity of 2000 liters of foodstuff or liquids that could have potentially been stored in the room. A low (0.10 m above the floor) curvy bench closed off the north-eastern corner of the room was located near the entrance. (Frangipane et al. 2017) (figure 9).

With the considerable amount of clay lid dimensions that fit with the mouth of most of the containers, the hypothesis of the storage room strengthens enough. Moreover, a large basalt grinding stone and 19 stone tools in this room suggests that food processing also took place in this room.

Building36 is a remarkable phenomenon due to its unique features. It was built with high architectural technique while all surrounded occupation was in a most primitive shape of “wattle and daub hut”. In addition, because of a big fire and huge amount of in situ remained material, as well as unusually strange big fire place in the middle of the large room, it requires through archaeological and anthropological studies. One of the influential researches which can be done, for the remarkable in situ material is micro-remain analysis which can reveal lots of information about activities carried out there and more importantly function of the building. In the next chapter the methods which were used to study micro-remains of this communal building will be explained.

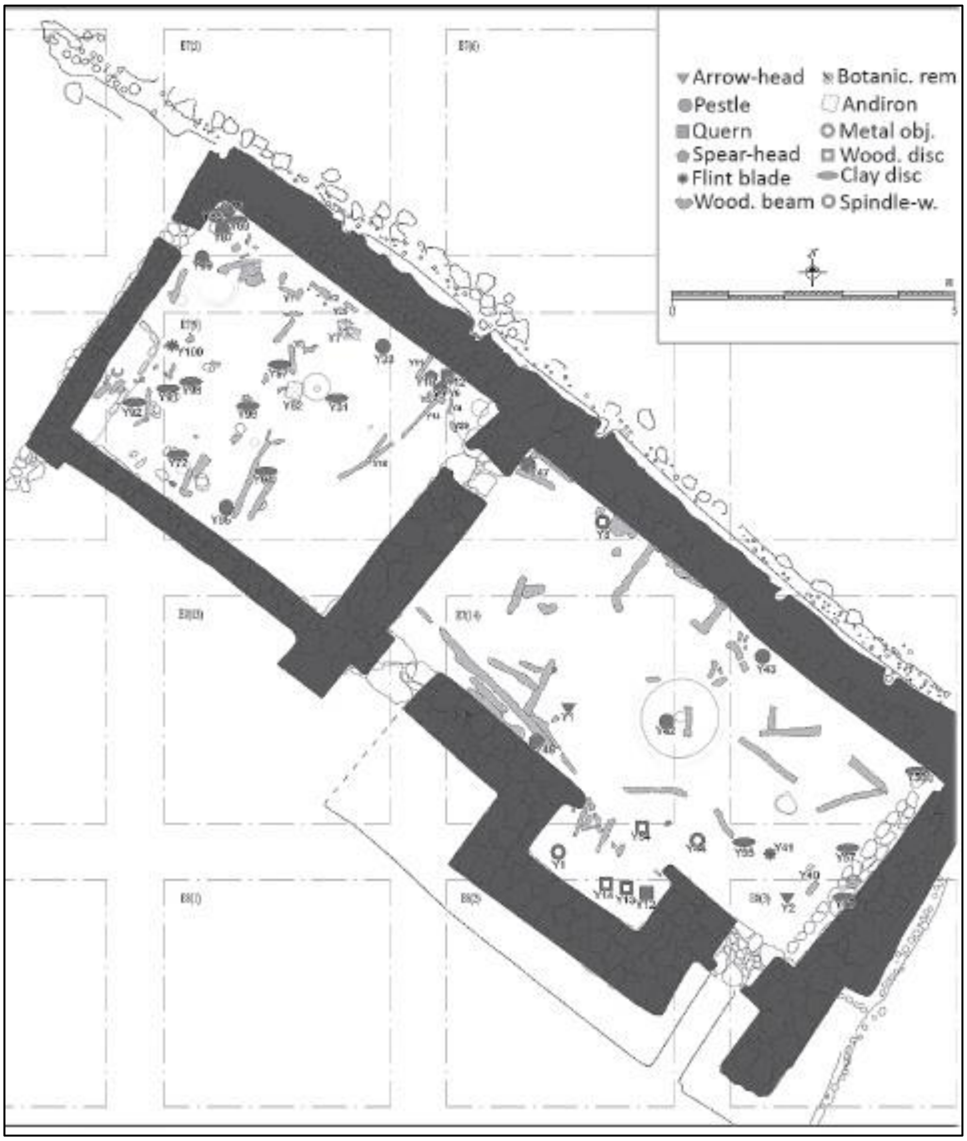

Figure 9. Plan of Building 36 with in situ materials

3 Methods and experimental analysis

This chapter contains methods employed to gather and analyze data related to the purpose of the thesis. The purpose of this thesis was to study the spatial distribution of micro-artifacts to identify activity areas and room use. To do this I had to compare the patterns of the distribution of micro-remains to get their specific signature. A spatial pattern has been visualized with the help of ArchGis software. I combined the result of micro-remain density with the architectural plan and fixed features of the building. The visual spatial pattern helps to understand and compare each room's function and usage. In this chapter I will explain the different step of this method in detail.

3.1 Methods of sampling: collecting micro-refuse samples

In the large systematic excavation, the floor was gridded for further research such as micro-remains, botanical analysis, soil analysis etc. Building 36 was not an exception and the floor was gridded 50 cm squares. Each sample's volume was measured, and sediments were put in bags and labeled with letters and numbers. After collection, the soil samples were floated, and heavy clays and extra sands sunk in the flotation tank, whilst heavy residue was collected with a net, dried, packed and labeled. Light residue was also collected for the analysis of botanical remains, but charred botanical remains proved to be very few. The Label consisted the name of the room, time of excavation and number of sample as well as the precise number of the square. Fortunately, the whole samples were weighted and recorded before floating during excavation and I had access the recorded list of volumes of debris per sample. The work I did was to pick through the heavy reside of each sample, in search for lithics, pottery, bone and any other archaeological debris. A few samples had already been counted by students during a laboratory work, which helped my counting process both in time and effort.

In this thesis to avoid oversampling and sample dubious I took systematic sampling method to get the spatial distribution of micro-remains.

Systematic sampling not only provides enough samples but also is a suitable way to document changes in densities of micro-remains across horizontal space. Grid was divided by excavation team in 50 cm squares across the surface of the building. (Figure 10)

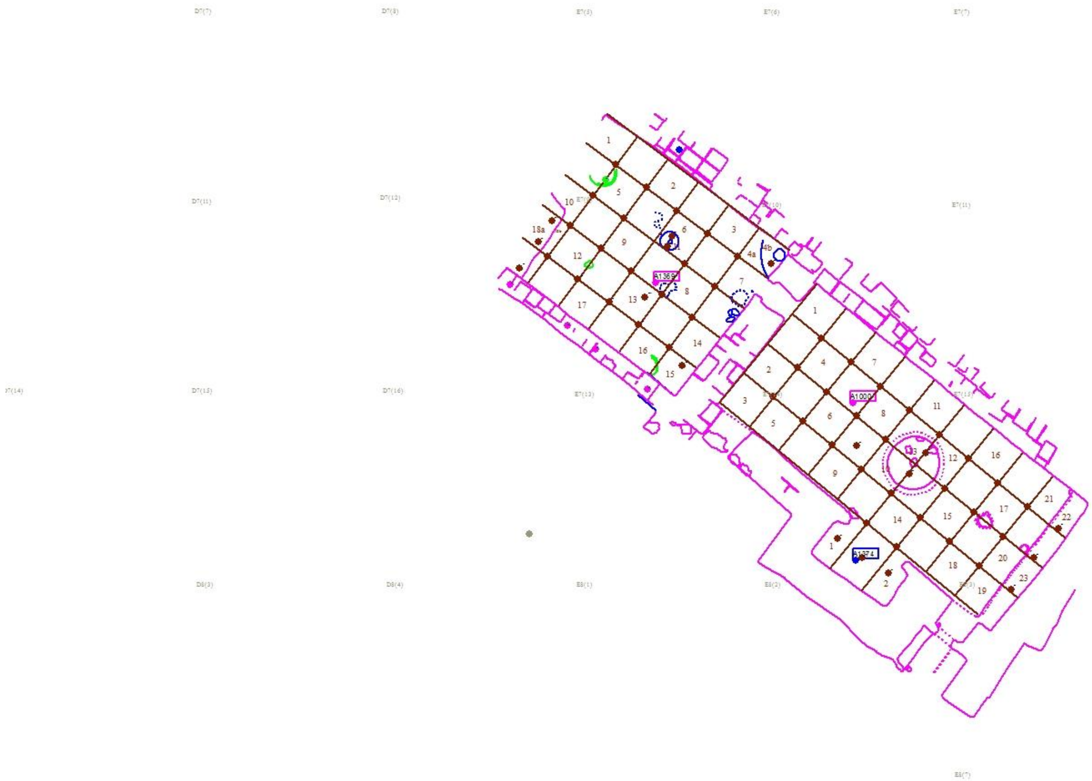

Figure 10. Building 36, plan with gridding pattern

Within features and hearth and bench I took representative samples, since they are an important part which should not be ignored.

3.2 Organizing data: counting and recording

After collecting samples, the next step of spatial micro refuse analysis was estimating the density of different types of micro-refuse collected from those samples. To do so, I had to find micro-remains first, which means they must be separated from the sediment matrix. For this purpose, micro and macro remains in Building 36 were limited to separate and count between 1, 3 and 6 mm in dimension. This approach enabled me to distinguish the densities between micro-remains in different sizes. More importantly data from architecture plan, features and benches as an architectural map were used to associate the micro-remains with their location. In the further step evaluating the pattern of micro-remains distribution carried out.

After choosing samples, materials were sieved through a series of 3 screens of variable meshes, 1, 3 and 6 mm. With the aid of tweezers and a large sorting tray and a brush to sweep and spread them on the tray, I picked micro-remains from the context. I tried to follow the most common micro-debris categories: ceramic, bone, chipped stone, shell, charcoal and obsidian. Consequently, based on my case, I picked out pieces of pottery, bone, shell (both aquatic and terrestrial) and egg, chipped stone, bead, charcoal, in some cases even when the amount of burned clay were considerable I collected them too. Bones were separated in two categories of burnt and unburnt which enables me to find out more about activity patterns of the building.

In the case of the 1 mm mesh, using a magnifying glass was required to distinguish what micro-remains are, since in the case of varieties of micro-remains naked eyes were not enough.

In this thesis since my focus was on micro-fauna and craft activities, I did not pay attention to potteries, because not only separating micro ceramics takes too much time and effort but also potteries were mostly from chalcolithic periods and few of them attributed to Early Bronze age I and mostly they were background noise.

After separating micro-debris, I counted them and put on an excel file each type of debris in each sifted size. The density calculation is based on dividing the number of counted micro-remains by the related total sample volume. In the next step of separating and counting I calculated the densities for each type of debris separately to produce a comparable density map.

Figure 11. 6mm micro-bone

Figure 12. 3mm micro-bone

Figure 13. micro-bone 1mm

Figure 14. micro-fauna 1mm

In addition, to get the accurate information related to micro-fauna, I sorted indistinguishable micro-fauna from those fragments that appeared to be best preserved, to show to the zoo-archaeologist. Thanks to professor Giovanni Siracusano, who kindly helped me to understand the micro-fauna types. He also noted the type of animal species based on the micro-fauna remains. All these useful notes reveled information about types of micro mammals which were lived and fed in the site (figure 14, 15).

Figure 15. digital microscopic photo of micro-fauna

Figure 16. Professor Giovanni Siracusano is diagnosing animal species based on micro fauna.

Figure 17. charcoal fragments, 3mm

Figure 18. shells separated from egg and then further separated between aquatic and terrestrial shells

Figure 19. chip stone 3 mm

For the micro-fauna and beads in order to get the better vision I took microscopic image by EFUTONPRO Loupe Digital Microscope Digital Camera, it is 2MP 8 LED Microscopic Magnifier Electronics Magnification 1000X 500X (Figure 20, 21).

Photos of bead are categorized based on the sample and square number and will be presented following chapter in more details (Figure 20).

Furthermore, since I have found a small fragment of gold sheet during separating and counting, I used the SEM (Scanning Electron Microscopy) to analyze golds fragments and beads to identify the qualitative and quantitative composition and identification.

Figure 20. microscopic photo of teeth

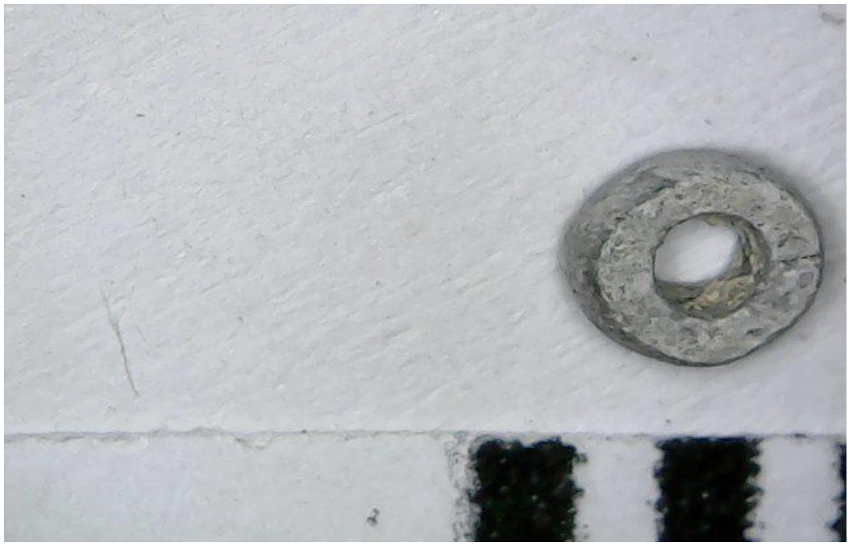

Figure 21. microscopic photo of bead

3.3 Analyzing spatial pattern in micro-remain density

The final phase of micro-remain analysis was the spatial analysis which informs us the the habitual use of space and activity area in the building. However, table of density dose not reveal any spatial information unless it becomes converted to the quantitative graphical images. In this case heat map is heuristically meaningful. I used ArcGIS software version 10.2 to create visually pleasant and understandable density map. ArcGIS software enables us to present different layer of Auto CAD plan and match the excel data to the different layer of geographic and architectural map. As I explained in previous subchapter, after I counted micro-remains I made the excel list with the densities of each category in 3 different sizes of 1mm, 3mm and 6 mm. Except for those types of micro-remains which could not be found in other mesh size, like bead that is recovered only in 3 mm, and charcoal in 1mm and 3 mm. In the excel density list I named the columns based on sample number (which was the combination of number and the year of excavation) and square number (which was based on grid map). In order to create layers attributed to each category of micro-remains I created the polygon layers based on sample number. Then, by joining the excel file which includes sample numbers densities, I created the heat map for each category (each layer corresponds to each category of micro-remains).

In the following chapter I will present the result and try to interpret the micro-remain distribution based on the visual pattern. Moreover, I will explain about the categories and compare my result in this phase with another phase of the building, the heavy micro-residues of which have been previously investigated by Susanna Cereda.[4] This comparison reveals important information about changes in two different phases of the building.

4 “lo studio dei micro-reperti nei battuti pavimentali come strumento per l’analisi funzionale degli ambienti. II caso studio di due strutture del Bronzo Antico I ad Arslantepe”. Master Thesis, Susanna Cereda, Sapienza university di Rome, 2013.

4 Results and discussion

Previously mentioned that analyzing micro-remains of the Building 36, required three main steps to get the result: collecting samples systematically, calculating the density and providing visual distribution map. In this chapter I represent the distribution map to discuss the dissemination of micro-remains.

In addition, each micro-remain was sorted to finer categories. Bones categorized in to burnt and non-burnt, shells to aquatic, terrestrial. For the case of chip stone corresponding to macro-lithic tool colors were considered (brown, black and gray). Beads were classified not only based on shape and material but also manufacturing technique. These qualitative classifications provide more thorough view point in household activities took place in Building 36.

In this chapter I am presenting the result of each category visually, based on the location of the retrieved micro remain. Moreover, I try to discuss patterns of the micro-remain distribution based on the density map as well as representing each category in more detail. In order to have an idea about volume of micro-remains in each category I provided diagram as well as final appendix relating to detail results.

4.1 Faunal and micro-faunal results

Faunal and micro-faunal data provide the most direct evidence on food procurement activities. These data may be representative of the types of foodstuff that the inhabitants of the various households subsisted on (Ozbal, 2006).

While most traditional writing on food and daily subsistence in archaeological or ethno-archaeological contexts have focused on dietary value, nutrition and ecology, (Watson 1979) the task of cooking, dinning and sharing food have been over looked. However, the process of dinning and sharing meal are called “communal activities” that are greatly influential in structuring and cultivating social relationships, societal customs and daily life (Wright 2000).

In communal Building 36, Separating burnt and non-burnt bone in the first attempt has been done to find out if meals leftovers show any evidence of how they had been prepared or eaten. Discovering more details in culinary activity which took place inside the building requires accessing to large amount of osteological accumulation, since micro and macro-fauna cannot provide specific details in cooking process due to the undistinguishable traits. Nonetheless dividing fauna remains to burnt and non-burnt seems to be significant regarding to post mortem deterioration. Fauna fragments which had exposed to high temperature show signs of burning. Anthropological evidence reveals that in most cases burning was a way to get rid of foul- smelling of organic remains (Wygnańska & Verlag-Wiesbaden 2014).

In total it was about 15256 non-burnt fauna fragments and 2255 burnt fauna. The ration of density is 12.76% burnt bone and 87.24% non -burnt which demonstrate clearly that majority of retrieved fauna remains were not burnt. (diagram 1) (table 2).

Table 2, Amount and percentage of bone

Catego..	Sub-Category	Amount	% of T..
Burnt Bone	1 Mill Burnt Bone	1,218	6.96%
	3 Mill Burnt Bone	982	5.61%
	6 Mill Burnt Bone	55	0.31%
Non-Burnt Bone	1 Mill Non-Burnt ..	8,539	48.76%
	3 Mill Non-Burnt ..	6,073	34.68%
	6 Mill Non-Burnt ..	644	3.68%

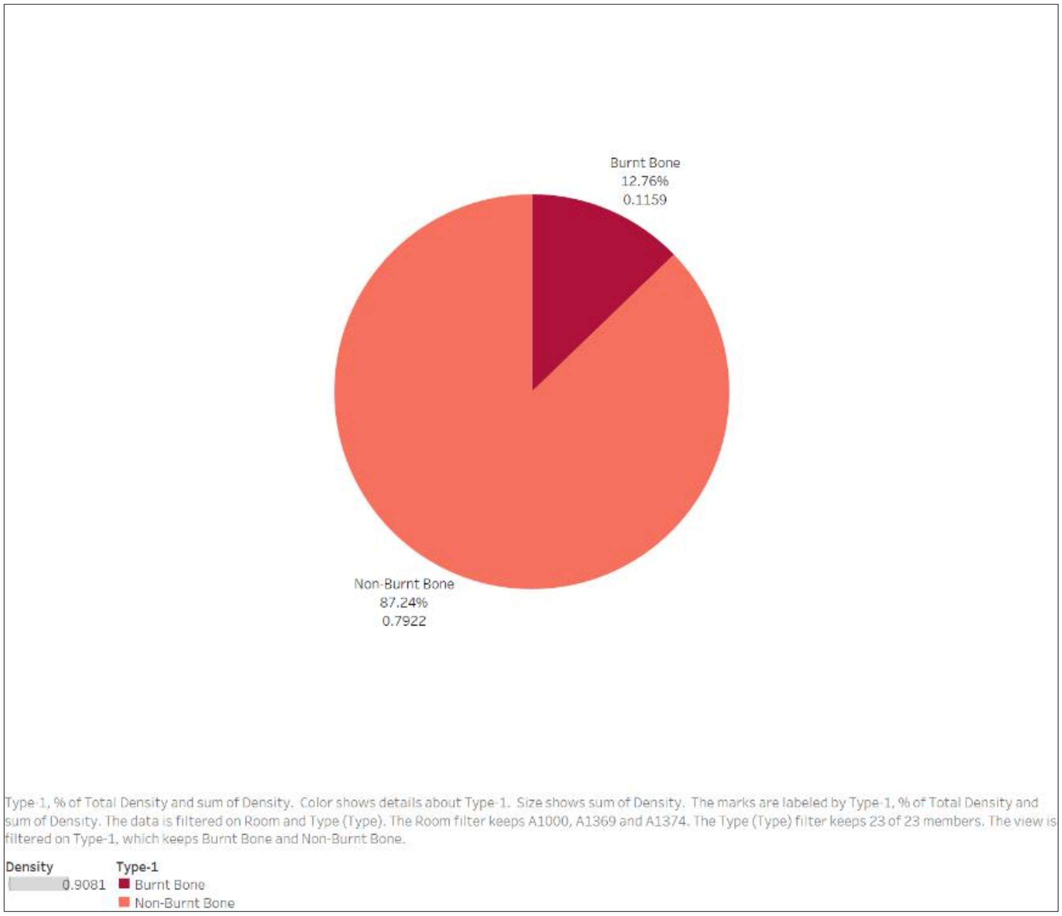

Diagram 1. comparison of burnt and non-burnt bone

Distribution of fauna remains has been shown entirely in burnt and non-burnt categories as well as 3 different sizes. The division is for getting more detailed view about pattern of cleaning and fragmentation (diagram 3).

Bones were distinguished by Professor Gianni as mainly fragments of ship and goat. There were also cattle bone with cut mark on it (room A1369, square 4a), demonstrating butchering and preparing food in lateral room. Moreover, discovering worn out tooth fragments of sheep or goat makes us think that they also consume aged sheep meat probably female for their meals. What is significant is that most of the ship and goat bone and more precisely cut posterior leg of cattle were found on the corner of lateral room A1369. This phenomenon reinforces the idea of swiping left over food and rubbish to the corner of room while cleaning the floor.

Based on visual map. Density of bones in the Building reveal the fact that lateral room (room A1369) witnessed food preparation. This room contained impressive amount of ceramic container, 59 vessels. (Palumbi, et al 2017). Moreover, the noticeable assemblage of burnt bone in lateral (A1369) room combined with the relative absence of them in large room A1000 support this assumption. Meanwhile, the concentration of bone in main hall A1000, located in front of the entrance of the smaller spaced part named A1374. It can indicate usage of small space room as storage for food or ceremonial material that might be used during ritual activities in room A1000 (Map 1).

Large size bone fragment (<10-30 mm) were very rare in comparison to small size (<6-1mm). It was only 693 fragments from total 17055 bone fragments. This ratio indicates that large bone fragments might be swept away or eaten by other scavenger while, small fragments were usually ignored due to their size and trampled on the floor.

This difference in amount and distribution of burnt bone and non-burnt bone indicate the post mortem activity with high temperature. Nevertheless, specific activity of burning bones and charring them took place in lateral room which emphasizes again the different function of two rooms.

Map 1. Density of total burnt bone

Map 2. Density of total non-burnt bone

Although map with total burnt density is more meaning full, in this thesis one of the main goals is spatial distribution of micro remain. Therefore, I present distribution of fauna in different sizes for more detailed spatial distribution map.

Map 3. Density of burnt bone 6mil

Map 4. Density of non-burnt bone 6mil

Map 5. Density of burnt bone 3mil

Map 6. Density of non-burnt bone 3mil

Map 7. Density of burnt bone 1mil

Map 8. Density of non-burnt bone 1mil

4.2 Micro-fauna

Micro archaeology provides us with evidence of small animals which are rarely represent in any faunal accumulation. Animal bones found in micro-debris samples range from small pieces of large animals (such as sheep's teeth) to the complete bones of small animals (such as rodent femurs, Coracoid of micro mammal) (figure 22, 23).

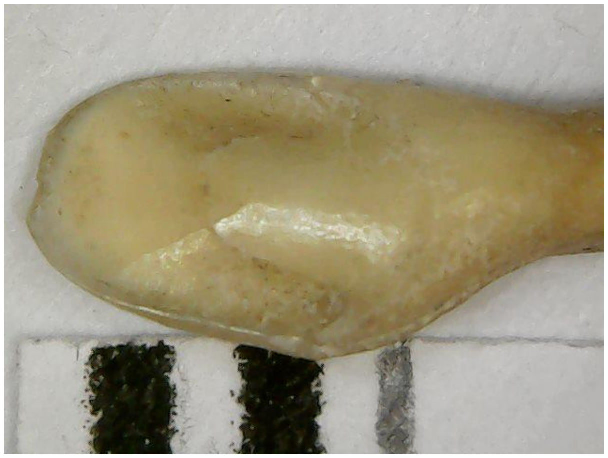

Figure 22, micro-fauna, tooth of sheep

Figure 23, micro-fauna, Coracoid of micro mammal

The majorities of these bones can only be sorted into general size and taxa categories based on morphology, size, and texture of the them. About 137 fragments of micro-fauna recovered from the floor (Table 2).

Table 3. Amount and percentage of micro-fauna

Catego..	Sub-Category	Amount	% of T..
Burnt Bone	1 Mill Burnt Bone	1,218	6.96%
	3 Mill Burnt Bone	982	5.61%
	6 Mill Burnt Bone	55	0.31%
Non-Burnt Bone	1 Mill Non-Burnt ..	8,539	48.76%
	3 Mill Non-Burnt ..	6,073	34.68%
	6 Mill Non-Burnt ..	644	3.68%

The large part of distinguishable micro-fauna in Building 36 belonged to micromammals who lived and nurtured there. Scapular of micromammals, ulua of porkpine, cranial fragments of rodent and mole as well as calcaneum and mandible of mole and rodents composed the main retrieved micro fauna. There were also signs of reptiles in the building more specifically frog due to large amount of frog's leg. The important point about micro-fauna is that there was no sign of burnt type, which clearly suggests the idea that these types of animals were lived and died there. They were not consumed by inhabitants and they did not undergo any kind of transition that other bones faced. There is also a high possibility that they even did not belong to the same period. Concentration of micro-fauna in room A1369 reinforces the idea that micromammals were lived and fed there, moreover the cluster of micro-fauna on the western part of room A1369 might be related to the huge amount of botanical volume recovered from the same portion. As excavation team declaims "An unusual pile of seed recovered in the western part of room A1369" (Palumbi, et al 2017).

Furthermore, impressive number of vessels -56 vessels in situ- in A1369 and higher rate of recovered micro-fauna strengthen the hypothesis about the function of room as a preparation meal room.

Map 9. Density of total micro fauna

Map 10. Density of micro-fauna 6 mil

Map 11. Density of micro-fauna 3 mil

Map 12. Density of micro-fauna 1 mm

As it is shown in the map the density of micro-fauna on the corners and storage space of building demonstrate the consumption of remained food by micromammals.

4.3 Charcoal

In micro-remain analyzing, charcoal is one of the most problematic material. Despite its importance, it can hardly be found among the context due to fragility. Subsequently, it is difficult to separate and requires careful and elegant operation. In some case their resemblance to burnt clay causes misinterpretation. In this thesis, few charcoals were obtained in 6 mm mesh and most of micro-remain charcoal was found in 3 and 1 mm sieving (table 4).

Table 4. Amount and percentage of charcoal

Catego..	Sub-Category	Amount	% of T..
Charcoal	1 Mill Charcoal	450.0	65.22%
	3 Mill Charcoal	233.0	33.77%
	6 Mill Charcoal	7.0	1.01%

In building 36 majority of founded charcoal is related to lateral room on the eastern corner as it is visible on the map (map 14). This amount of concentration on the corner possibly can be related to cleaning activity and swiping them to the corner. There is also another reason for concentration of charcoal density on the specified squares. On eastern and western part of room A1000 next to the small spaced storage A1374 there are high degrees of concentration which can be attributed to the collapsed burnt beam on that portion. Wooden beams were functioned as a shelve in the room A1374, and ceiling on the other part of the building. By comparing the charcoal density map (Map 14) with the exact position of in situ material in the communal building (Figure 9), connection between burnt wood beam and charcoal remains comes to mind.

The important aspect in the patterns of charcoal distribution is the degree of their concentration. It is due to charcoal fragility that smaller size charcoals could be residuals of the bigger ones.

Like fauna remains, differentiating in size dose not reveal a comprehensive visual result about the distribution of micro-remains. To avoid excessive details that prevent meaningful concluding results I represent the total charcoal in the first map (Map 14). For more details, I add two other charcoal density maps in different sizes.

Map 13. Density of charcoal

14. Density of charcoal 6mil

Map 15. Density of charcoal 3mil

The association, if any, between the distribution of charcoal and burnt bone must be determined. The eastern corner of room A1369 and western side of A1000 (next to entrance of A1374) clarify similarities in burning incident. However, based on the density degree, the association between charcoal and burnt bone requires more reliable evidence (compare Map 14 with Map 1).

Map 16. Density of charcoal 1mil

4.4 Bead

Micro archaeology is ideally suited to more comprehensive study of beads. Most Near Eastern beads have been recovered from burials or caches and are often associated with magical or ritual properties (H. Beck 1931, 1976). Moreover, ethnoarchaeological investigation revealed that beads were also used in daily secular reason with no respect to religion ritual activity and just for decoration and ornament. 16 beads retrieved from Building 36 which 11 of them was white beads (diagram 3). They were all circular disk shape and their size were approximately 2mm in length, 2 mm in diameter and 1 mm hole. All white beads were unglazed white stone except for one which had glazed appearance that turned it to yellowish or brownish color (Figure 24). High percentage of white unglazed bead reinforces the idea of mass production, which requires more detailed investigation.

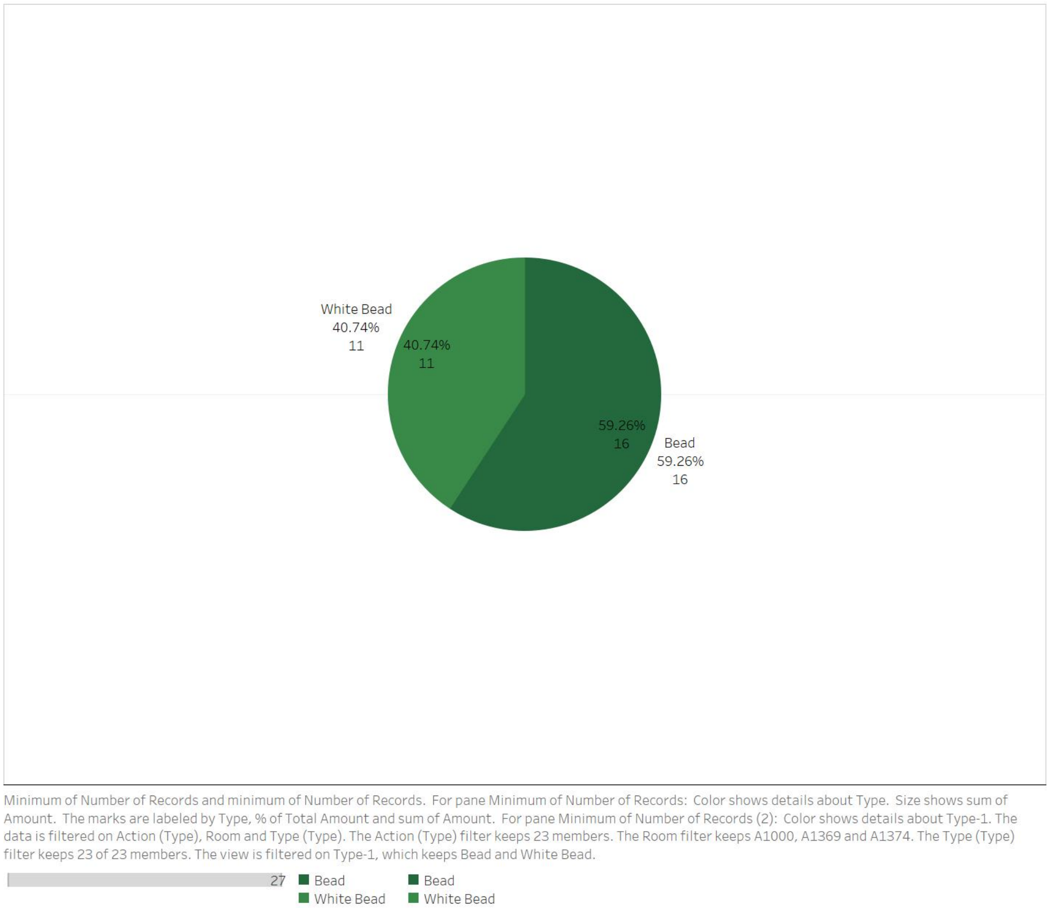

Diagram 2. Comparison of the amounts of beads with withe beads

Map 17: Density of Bead

Map 18: Density of White bead

In the first step of analyzing, beads were photographed with EFUTONPRO Loupe Digital Microscope Digital Camera, with the magnification of 1000X 500X (500X) to get visually documented.

Representative beads were selected for further analysis. Scanning Electron Microscopy equipped with Energy Disperse Spectrometer was used under supervision of professor Cristina Lemorini[5] in LTfapa laboratorio Dipartimento Scienze dell'Antichità [6].

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5 cristina.lemorini@uniroma1.it

6 http://www.antichita.uniroma1.it/LTFAPA/index.html

Figure 24. White bead, microscopic image

SEM-EDX imaging and analyzing of 6 representative beads were conducted with a SEM Hitachi Tabletop TM3000 equipped with EDX system SwiftED3000 to determine morphology and chemical composition of beads.

The archaeological samples were analyzed in total vacuum. The EDX analysis was carried out in Analy (15V) observation condition mode, accelerating time (s) 400.0, process time 5.

From each type of beads one sample has been chosen to be analyzed. Defining texture and structure as well as semi-quantitative chemical analyses of the different components of beads were considered.

SEM-EDX result as well as microscopic image of related bead are represented in following sub-chapter.

4.5 SEM.EDX results of beads

Despite the high rate of white beads from pale yellow to light gray in color, there were distinctive bead mostly from lateral room which were varied in shape, color and size. Many examples display surface cracking suggestive of exposure to high temperature followed by rapid cooling (Pickard, Schoop, 2013). Our attempt was analyzing one sample from each type as an archetype of other beads, nevertheless in some cases there was only one type which has been analyzed. The results are as follow:

Bead A1000.Sq 15. Sn 611/13 (I)

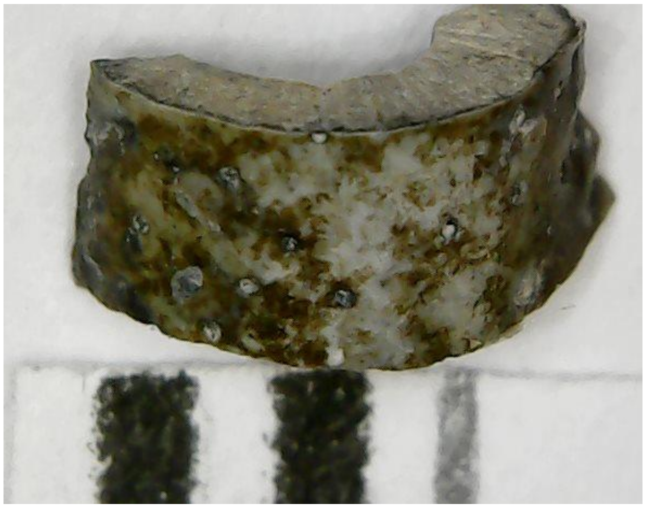

Figure 25. Microscopic image of greenish bead I

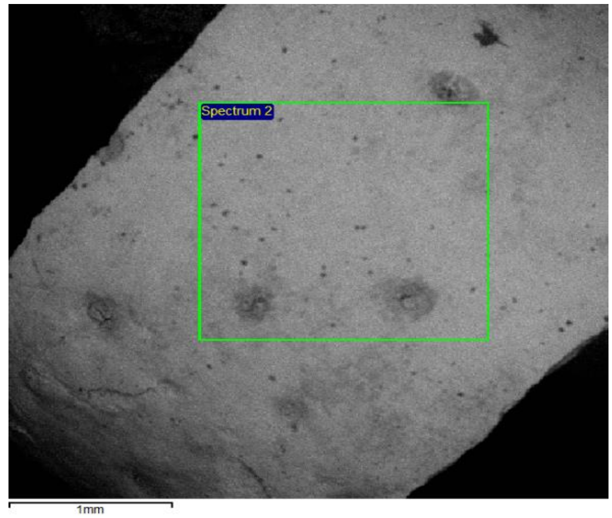

Figure 26. Electron image of bead I Width: 3.642 mm

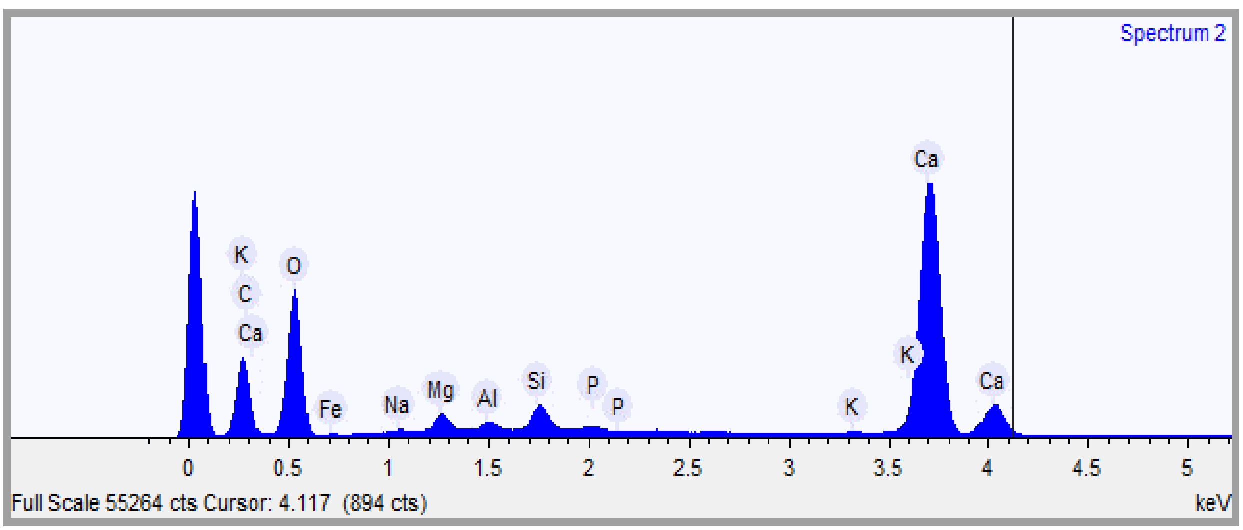

Figure 27. SEM spectra bead I, Acquisition time (s) 500.0, Process time 5, kV15.0

Element	Weight %	Weight % σ	Atomic %
Carbon	11.272	0.336	17.730
Oxygen	55.804	0.246	65.895
Sodium	0.200	0.025	0.164
Magnesium	1.189	0.024	0.924
Aluminum	0.485	0.018	0.340
Silicon	1.522	0.022	1.024
Phosphorus	0.327	0.019	0.200
Potassium	0.216	0.017	0.104
Calcium	28.670	0.142	13.514
Iron	0.316	0.037	0.107

Table 5. SEM quantification results of bead I, all elements normalized.

Bead A1369. Sq1.Sn 640/13 (II)

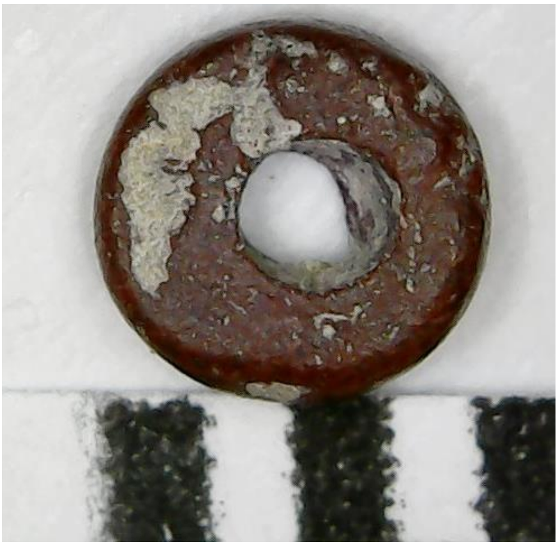

Figure 28. Microscopic image of bead II

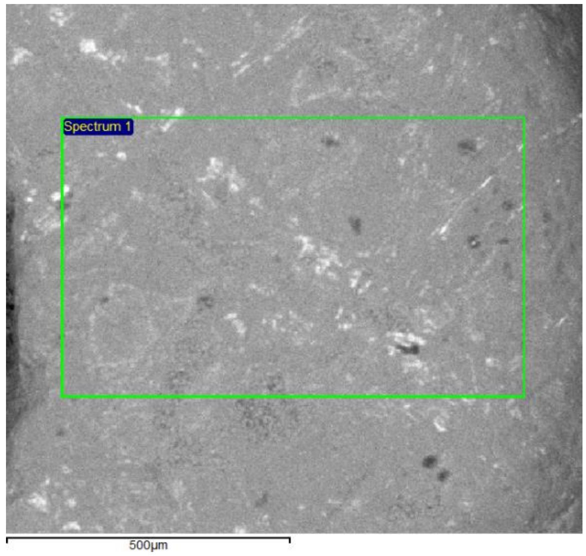

Figure 29. Electron image of bead II, image width 1.012 mm

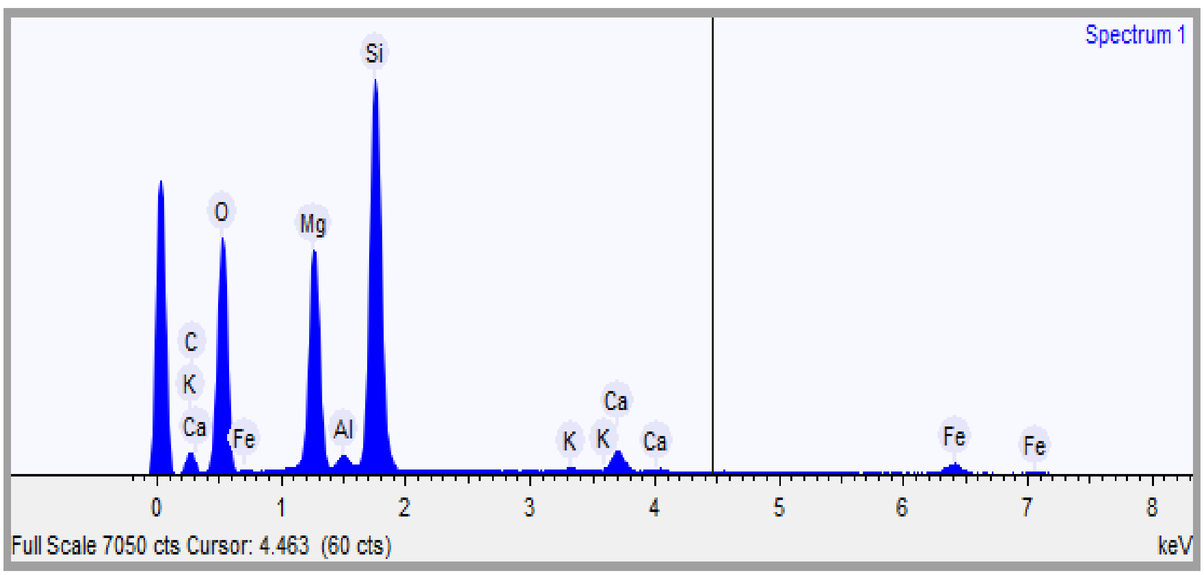

Figure 30. SEM spectra bead II, Acquisition time (s) 69.2, Process time 5, kV15.

Element	Weight %	Weight % σ	Atomic %
Carbon	4.422	2.073	7.297
Oxygen	48.347	1.092	59.885
Magnesium	13.897	0.335	11.328
Aluminum	0.731	0.067	0.537
Silicon	25.637	0.591	18.089
Potassium	0.325	0.060	0.165
Calcium	2.455	0.102	1.214
Iron	4.186	0.204	1.485

Table 6. SEM quantification results, all elements normalized.

Bead A1369. Sq 2. Sn 635/13 (III)

Figure 31. Microscopic photo of bead III

Figure 32. Electron image bead III, Image Width: 1.012 mm

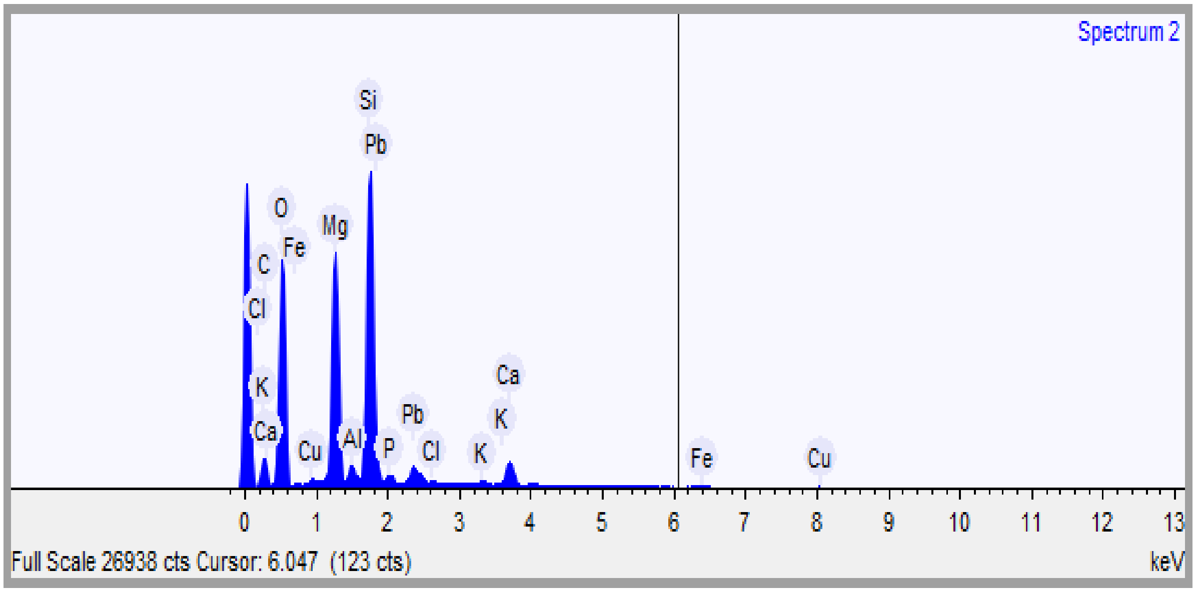

Figure 33. SEM spectra of bead III, Acquisition time (s) 263.8, process time 5, Kv 15.0

Element	Weight %	Weight % σ	Atomic %
Carbon	9.616	1.062	15.416
Oxygen	47.506	0.583	57.177
Magnesium	13.535	0.176	10.721
Aluminum	0.897	0.034	0.640
Silicon	19.095	0.242	13.092
Phosphorus	0.767	0.036	0.477
Chlorine	0.282	0.030	0.153
Potassium	0.374	0.029	0.184
Calcium	2.680	0.054	1.288
Iron	0.865	0.066	0.298
Copper	0.695	0.088	0.211
Lead	3.687	0.129	0.343

Table 7. SEM quantification results bead III, all elements normalized.

Bead A1369.Sq7. Sn 626/13 (IV)

Figure 34. Microscopic photo of bead IV

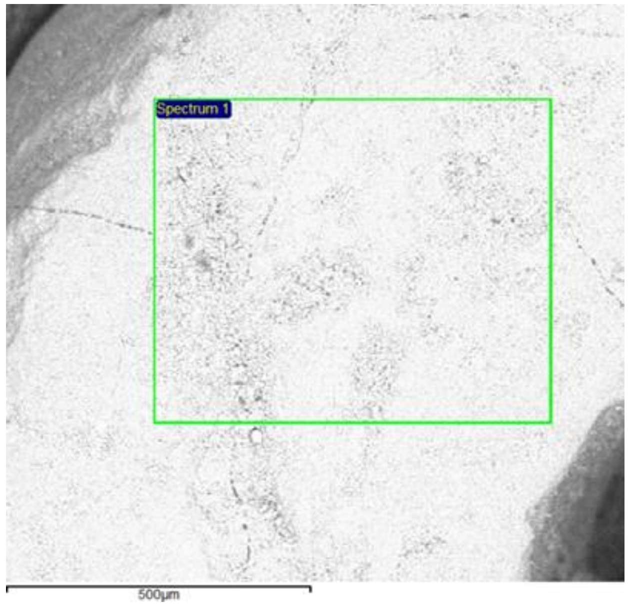

Figure 35. Electron image bead IV, Image Width: 1.012 mm

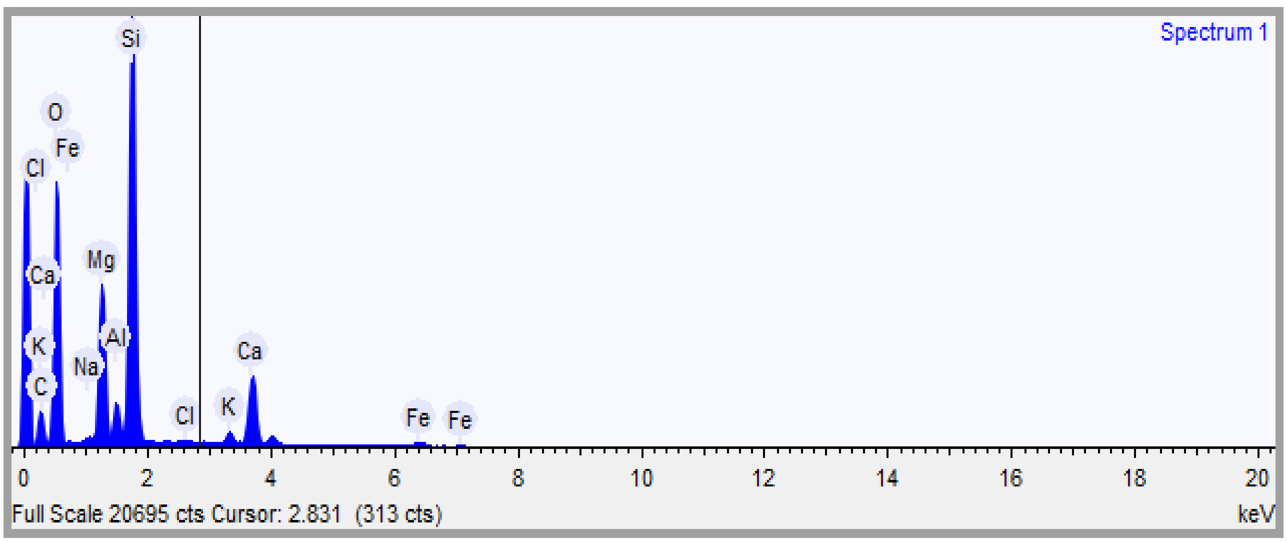

Figure 36. SEM spectra of bead IV, Acquisition time (s) 202.3, Process time 5, Kv 15.0.

Element	Weight %	Weight % σ	Atomic %
Carbon	9.251	1.066	14.478
Oxygen	51.102	0.620	60.041
Sodium	0.195	0.032	0.160
Magnesium	7.825	0.108	6.050
Aluminum	1.719	0.041	1.198
Silicon	21.065	0.264	14.099
Chlorine	0.173	0.025	0.092
Potassium	0.897	0.033	0.431
Calcium	6.316	0.093	2.962
Iron	1.456	0.069	0.490

Table 8. SEM quantification results of bead IV, all elements normalized.

Bead A1000.Sq 9. Sn 603/13 (V)

Figure 37. Microscopic photo of bead V

Figure 38. Electronic image of bead V. Image Width:303.5 µm

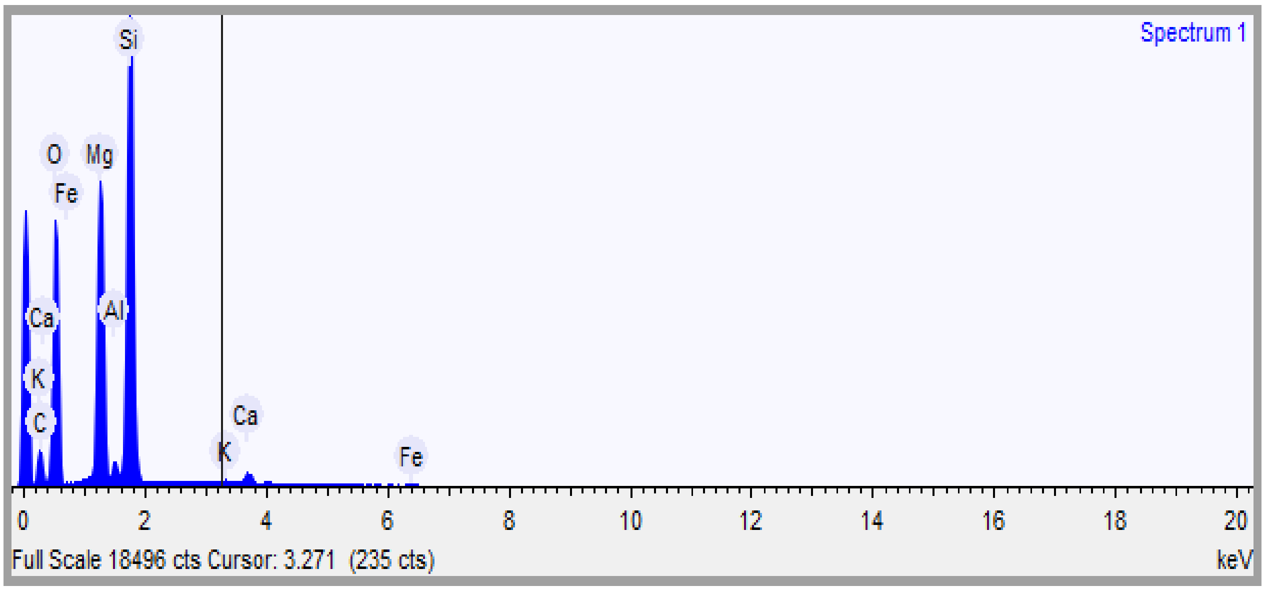

Figure 39. SEM spectra of bead V, Acquisition time (s) 166.9, Process time 5, kV 15.0

Element	Weight %	Weight % σ	Atomic %
Carbon	10.001	1.238	15.504
Oxygen	47.255	0.672	54.995
Magnesium	14.909	0.221	11.419
Aluminum	0.791	0.037	0.546
Silicon	25.356	0.366	16.810
Potassium	0.179	0.030	0.085
Calcium	1.052	0.041	0.489
Iron	0.456	0.065	0.152

Table 9. SEM quantification results of bead V, all elements normalized.

Bead A1369. Sq4a.Sn 625/13 (VI)

Figure 40. microscopic photo of bead [7]VI

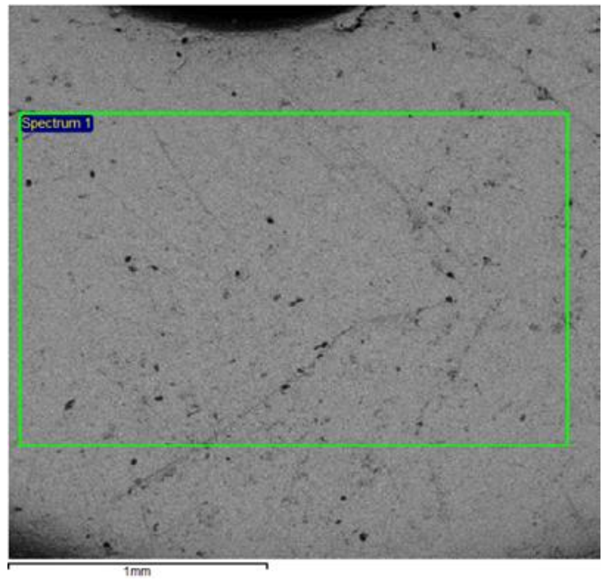

Figure 41. electron image of bead VI Image Width: 2.276 mm.

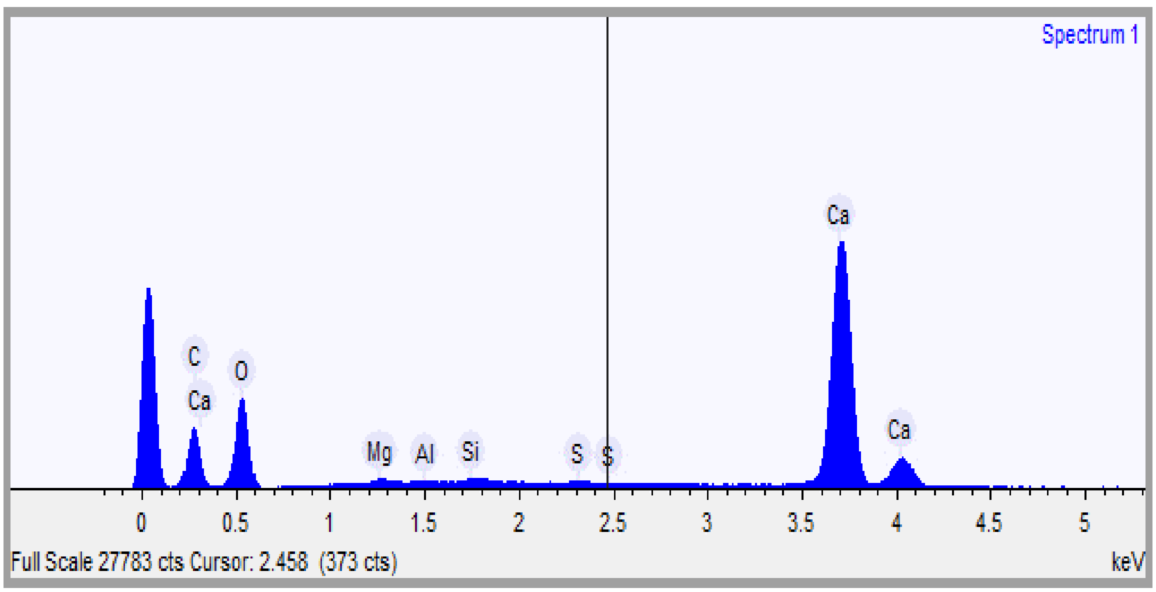

Figure 42. SEM spectra of bead VI, Acquisition time (s) 178.7, Process time 5, kV 15.0

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7. Unfortunately, I did not have ruler sign in this photo, since it is microscopic photo I did not add sign but its dimension is approximately 3 mm length at 3 widths, 1mm in diameter

Element	Weight %	Weight % σ	Atomic %
Carbon	16.721	0.174	26.067
Oxygen	49.503	0.243	57.933
Magnesium	0.366	0.030	0.282
Aluminum	0.128	0.025	0.089
Silicon	0.271	0.026	0.181
Sulfur	0.230	0.027	0.135
Calcium	32.780	0.174	15.314

Table 10. SEM quantification results of bead VI, all elements normalized.

SEM–EDS analysis of the micro-beads indicated that the chemical characteristics of the micro-beads fall into one of three categories:

(i) Two beads (II, V) were found to comprise predominantly Mg, Si and O and Fe. They were dark brown and black in color.

(ii) Two of beads (IV, III) display more complex components, they are composed of Si, Ca, Mg, Cl, Cu, and Pb. They comprise noticeable higher percent of Si in comparison with first category and the glazed one (bead III) consists of Pb and Cu which probably is due to lead and copper oxides glaze. They may have been added to micro beads to produce green or blueish surface glaze (ibid). Glaze might be directly applied to the surface of bead before firing or were mixed with bead past. There is also another way of glazing called cementation in which beads were buried in glazing mixture during firing (Tit, Bimson:1989). It requires more analysis techniques like XRD to get information about glazing techniques by comparing the chemical composition of interior core and the exterior surface of beads.

(iii) Two unusual beads (I, VI) Comprised predominantly Ca and less amount of Mg, Si. However, they contained small amount of Fe (I) and Su (VI) which is their main discrepancy in their composition. SEM spectra for bead VI, demonstrate Calcite.

However, soil contamination and superficial contamination make it difficult to diagnose. Just SEM results is not enough for precise chemical analysis and requires more technique such as XRD, Raman to get the surface degradation and contamination and mineral composition of the stone which beads were made of. It requires to analyze cross section of beads and other spots of them to get the explicit results. Due to the superficial contamination we encounter lots of similar solutions with these results such as amphiboles (e.g. kaersutite), pyroxenes, olivine. Nevertheless, based on obtained data one can conclude that they are made by mainly magnesium silicate minerals.

Micro-bead manufacture is a geographically widespread practice dating from the fifth millennium (Pickard, Schoop, 2013). The overall form and size of the micro-beads from Arslantepe phase VIB1 was like Steatite bead from Peqi'in Levant, Indus Valley (Harappa), Upper Egypt, Umm An-Nar Island and Samad Al Shan (Oman), northern Galilee, Pakistan, Jebel al Emalah -(UAE) (Panei, Rinaldi and Maurizio Tosi: 2005).

By comparing SEM-EDX results of retrieved beads from Building 36 in Arslantepe, with similar beads from mentioned sites, we conclude that they were made of Enstatite, a magnesium silicate ($Mg_2Si_2O_6$). Enstatite bead can be manufactured in two possible ways it can be synthetic or natural (Panei:2007) (Pickard: 2013). However, Enstatite is a hard mineral that is difficult to carve and shaped (hardness 5 or 6 in Mohs table) but synthetic Enstatite can be obtained from a soft and common magnesium bearing mineral, Steatite ($Mg_3Si_4O_{10}(OH)_2$) -massive talc- (hardness one in Mohs table) (Panei: 2005).

Scholars hypothesized that Steatite were used for manufacturing process of bead. There were several technologies to convert soft malleable Steatite to the hard-durable synthetic Enstatite under 1000 ^{O}C. They might have directly carved out of bulk Steatite, or they might have produced by reshaped powdered Steatite (past of powder and water) (ibid).

However, it is worth mentioning that among lithic categories, two circular fine abraded flakes were recovered which are probably unfinished bead (photo 19). These two beads located on the western corner of room A1000 and might be swept there during cleaning the floor.

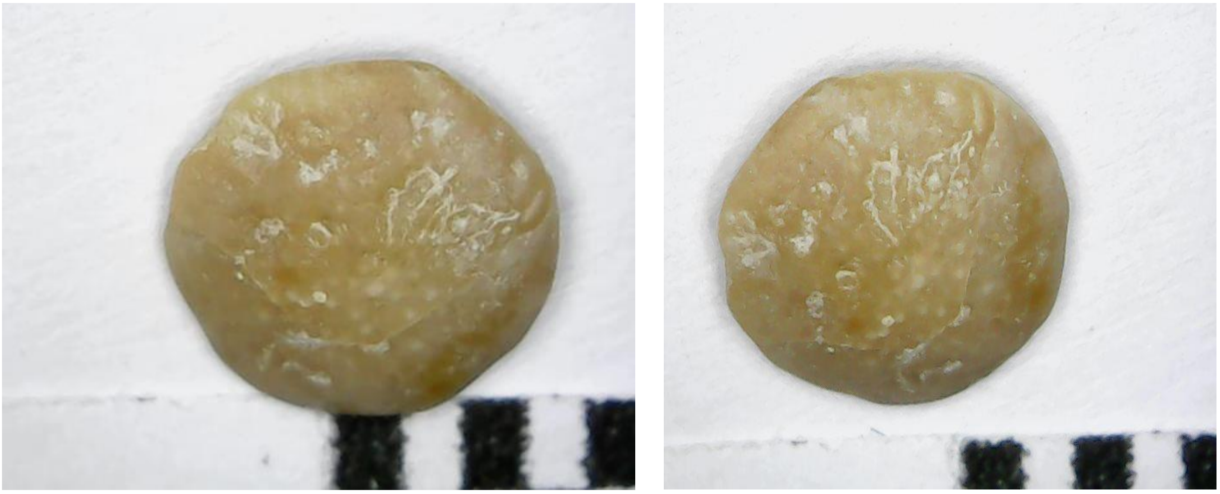


Figure 43. Unfinished beads

Based on diagram 3, 40.70% of beads are white beads which were mostly retrieved from room A1000 (table 11).

Table 11. Amount and percentage od beads

Type-2	Type-1	Type	Amount	% of T..
Bead	Bead	Bead	16.00	59.26%
	White Bead	White Bead	11.00	40.74%

Since beads in ancient time had ornamental and ritual value, the distribution of white beads in the large room reinforces the idea that people who were accessed in this room might belonged to higher social status and beads were just fell off from their cloths. There is also another explanation that white beads were used as decorative wall hanging and fell on floor during fire or collapsing the ceiling.

4.6 Chip stones

Although in Early Bronze age sites bronze implement use were common, chipped stone industries were also dominant. Most of these tools are cryptocrystalline material like flint (Rainvile, 2005). In Building 36 about 25 chip stones were found. Large number of them were in micro size. The absence of macro chip stone strengthens the idea that larger chipped stone debris were removed for safety reasons. Chip stone could be categorized based on color to brownish, blackish and grayish (figure 44). Separation corresponds to the chip stone tools.

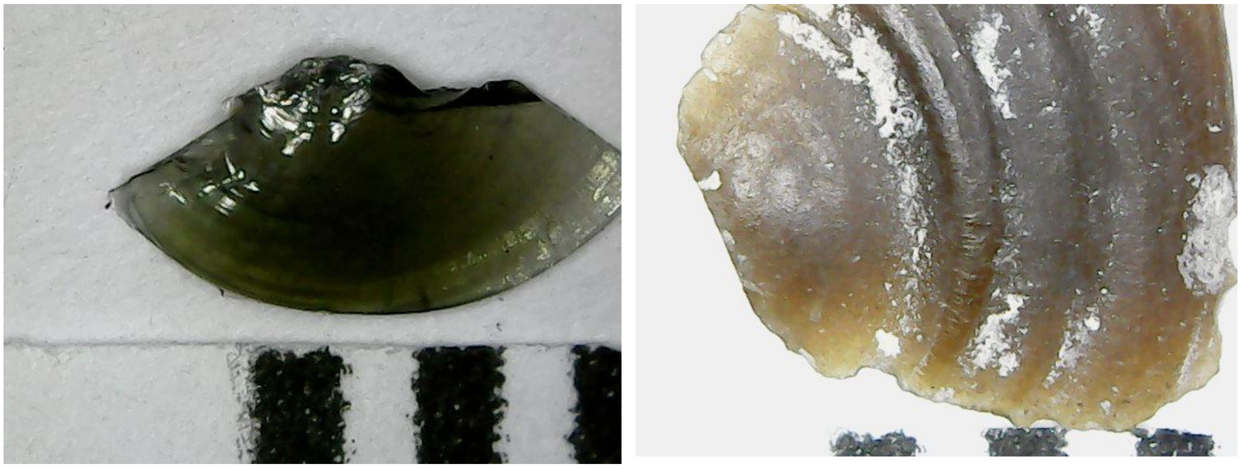
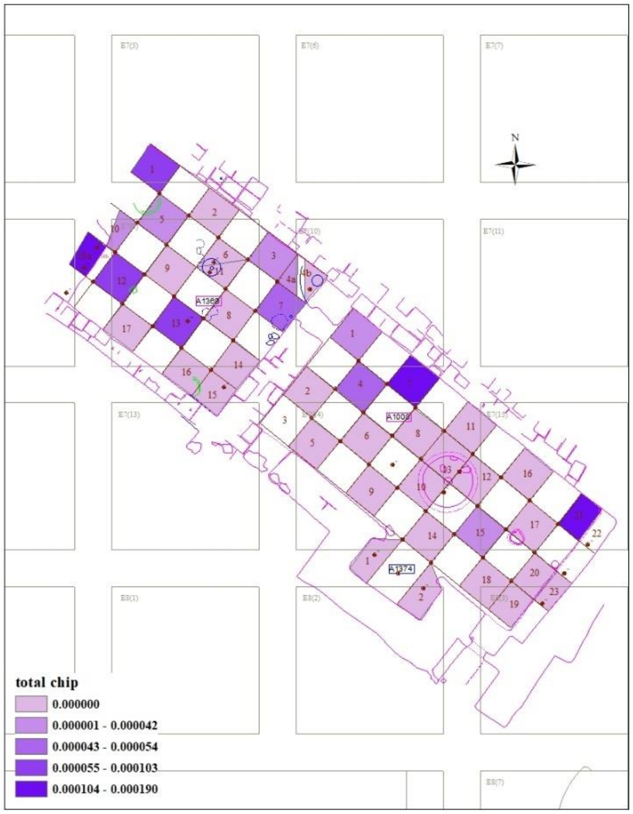
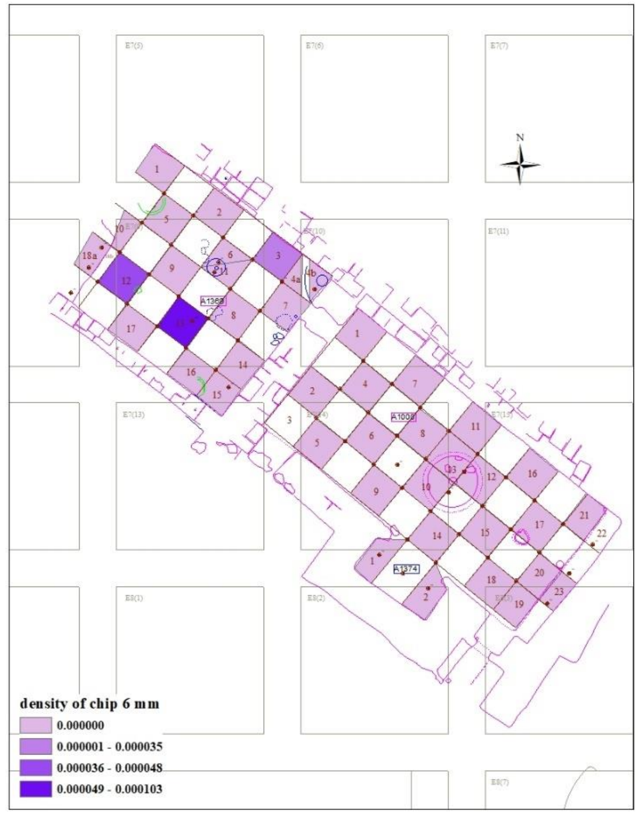


Figure 44. Micro-chip stone

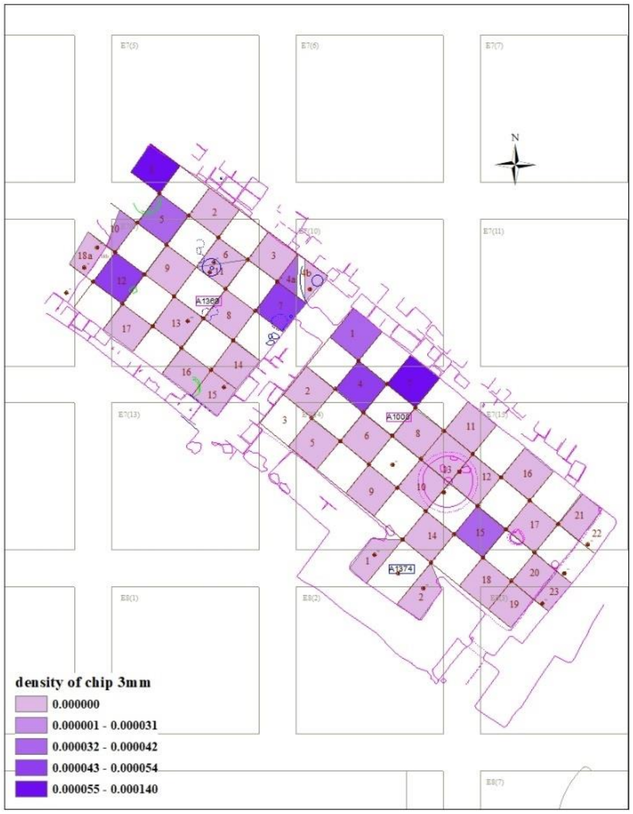
It is obvious that micro-chips can be fragments of the bigger chip stone, for this reason representing micro-chips in different size dose not reveal meaningful results. Nevertheless, I separated them based on the three different size in order to be precise in distribution patterns to find out about cleaning patterns.



Map 19. Density of chip stone



Map 20. Density of chip stone 6mil



Map 21. Density of chip stone 3mm

Map 22. Density of chip stone 1mm

Micro-chip stone distribution in the map suggests the sweeping pattern of floor. Like other small debris that accumulate on the corner, chip stones also assemble on the corners of rooms. I have separated chip stone from flint which might be found everywhere. They are not demonstrating human chipping activity, since they are natural fragments of bigger flint stone and can be found everywhere. What indicates trustful result about the act of chipping is chip fragments. Among the category of chip stone, I have separated Obsidian due to the fact that Obsidian was not a local stone and they were chipped on purpose to be used as a tool.

4.7 Obsidian

There is an obvious different between Obsidian and Flint in terms of material properties. Obsidian has an amorphous structure thus it is knapped more easily and has the capability of achieving sharper edge than Flint. Moreover, it has a smother and glossier surface than Flint which make it more attractive for people and artisans. On the other hand, Flint is harder and less brittle than Obsidian. Flint also has the larger number of sources and greater variability in its basic attributes, while Obsidian is limited in source and has restricted access (Rosen, Tykot, Gottesman,2005). These differences are reflected in archaeological records. It is clearly noticeable that what appeared to be a greater preference for obsidian although it was scarce and limited.

In Building 36 both Obsidian and Flint have been found, due to the reason that mentioned before that distribution of Flint dose not reveal chipping activity because of their large natural dispersion. Around 23 fragments of Obsidian have been found in Building 36 which were black in color (figure 45). Obsidian fragments were edge damaged, except one case they did not show any intentional retouch (figure 46).

Accumulation of Obsidian flakes in storage portion of Building 36 support the idea of chipping and retouching Obsidians western side of room. Although Obsidian flakes are dispersed which demonstrate retouching activity, but flake core is completely missing (Frangipane, 2017). However, retrieving considerable amount of obsidian micro flake in situ during flotation suggests the idea that retouching, and some part of finishing activities might have taken place (ibid). Furthermore, pattern of flake distribution reveals the swiping micro debitage to the corner like micro-chips and flint.

Figure 45. Obsidian fragments

Figure 46. Retouched obsidian

Map 23. Density of Obsidian

4.8 shell

Shells can provide information about diets of inhabitants in specific site. Furthermore, they represent about habitual food of people as well as revealing useful data on ecological and environmental analysis of place that they were retrieved.

Recovered shells in Building 36 were terrestrial snail and their distribution did not provide any information about habitual food and diet but background noise. They might be useful information in environmental and climatological research though. However, the relative high density of snail shells in floor suggest that they may unintentionally added to mudbrick and mud plaster. They might come from the closest rivers as a component of mudbrick. Yet, there were a complete not broken black shells which might demonstrate the pluvial weather on the time of living in the site (figure 48).

Among counting and separating shells, I have tried to distinguish eggshell which provide information about diet of inhabitants. A very limited number of eggshell fragments have been retrieved which were looked like Ostrich egg since they were thick and porous. (figure 49). It should be considered that few fragments of eggshell in the communal building indicate that inhabitants might collect and cleaned egg residues on purpose.

Eggshells are quite durable and “survive extremely well in alkaline and neutral soil conditions and can withstand some mechanical damage and charring” (Sidell and Schudder ,2005). Concerning that if they were accumulated in situ, they might had tolerated the temperature of huge fire that took place and could be retrieved from the context in some level.

There is also another explanation for eggshells that they might be resulted of domestication of birds in the building probably after fire.

It is good to mention also one pearl shell fragments in lateral room on the north east corner which might be used for decoration and ornamental purpose (figure 47).

Map 24. Density of shell

Map 25. Density of eggshell

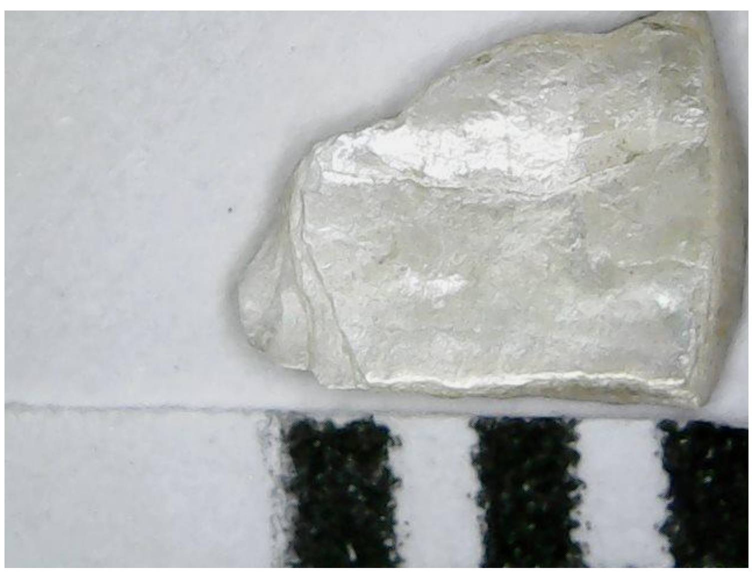


Figure 47. Fragment of pearl shell

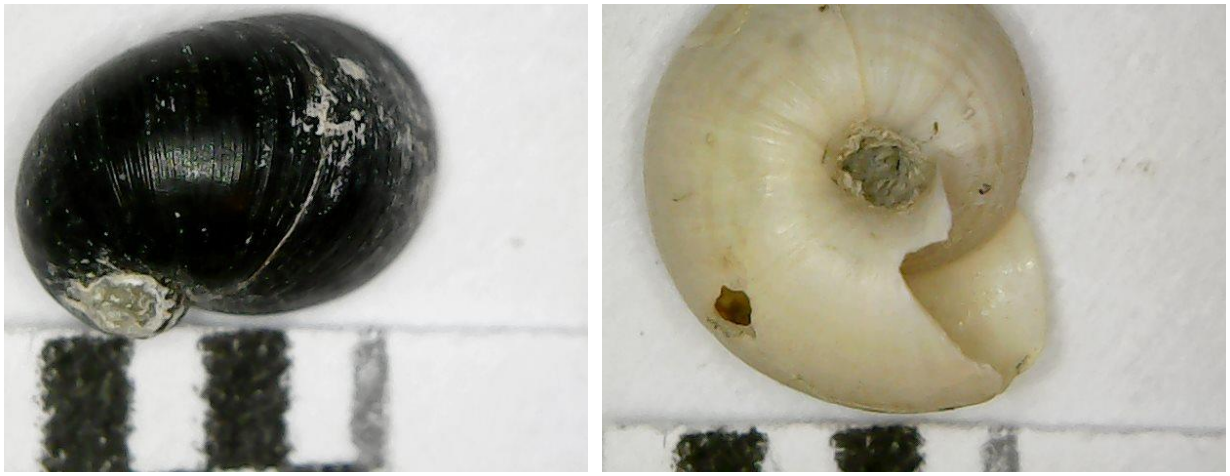


Figure 48. Terrestrial shells

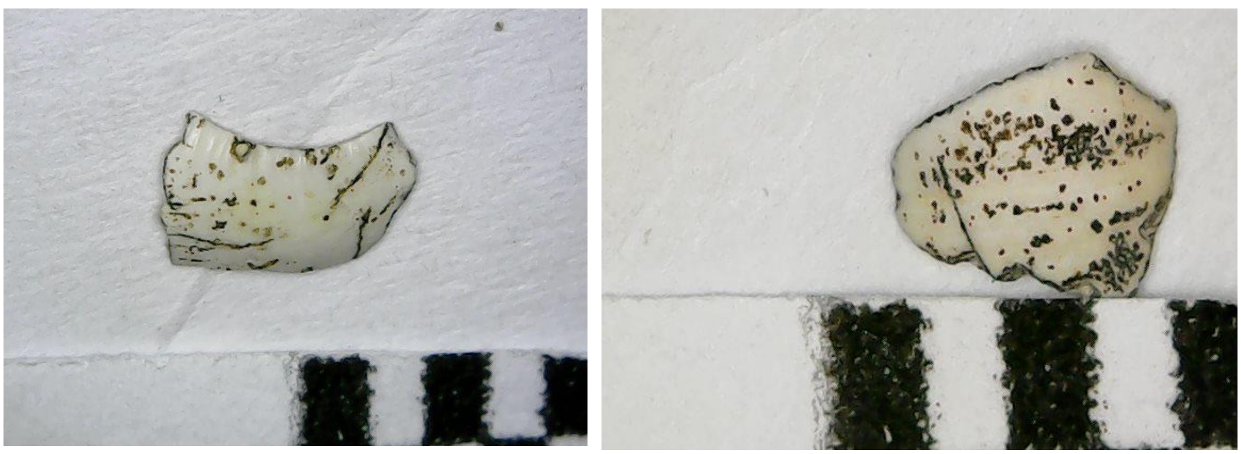


Figure 49. Fragments of eggshell probably Ostrich

There is an obvious fact that shell fragments are brittle and crumbling and probably smaller micro-remains are fragments of bigger shell. However, counting and separating them was carried out with the same method of separation. Although, total shell without any separation in size is fully promising in pattern of distribution., division in size might provide information about cleaning pattern of the floor. It demonstrates that those portion of room with low densities, were cleaned and swept carefully and probably more than other parts, like around hearths.

Map 26. Density of shell, 6mil

Map 27. Density of shell, 3mm

Map 28. Density of shell, 1mm

4.9 Ceramic

There is an abundance of micro ceramics remains in Building 36 while they don't belong to Early Bronze Age but late chalcolithic. Consequently, micro ceramics distribution in Building 36 does not provide any functional information about the activity took place there. They might be added to mudbrick for the floor construction due to high degree in density. Micro ceramics have mirrored mass production or standardized process of ceramic workshops in late chalcolithic. However, micro ceramics can be used to determine the degree of trampling within a given room if they belong to the same period of habitation. Furthermore, for other purposes like understanding firing temperature ceramic remains could be a useful source due to small size they can be utilized for destructive analysis techniques.

Although samples with high density of micro ceramic may indicate food production, food serving and food storage but in the case of Building 36 micro ceramics do not belong to inhabitation period and reveal any useful information but background noise.

In this dissertation I did not pay attention to ceramic distribution due to the mentioned issue. Although, few micro ceramics belonged to early bronze age, but I have used the data which were collected before by other students to provide the distribution map (map 26). The distribution map strengthens the idea that micro ceramic in Building 36 did not provide any specific information in respect to household and activities that took place.

Map 29. Distribution of micro ceramics

4.10 Other material

4.10.1 Fragments of gold sheet

The interesting part of micro-remain analysis is unpredictability, and the analyst might face to the tiny little unrecognizable material with no background information about it. What has happened in Building 36 micro-remain analysis was surprising too. Among sieving and collecting material, from room A1000 square 13A, which is around the fireplace, during 1 mm mesh sieving a fragment of gold sheet has been discovered.

Chemical analysis and identification technique were carried out by Scanning Electron Microscopy (SEM) coupled with Energy Dispersive X-Ray (EDX) analysis under supervision of Prof. Cristina Lemorini[8] , in LTfapa laboratorio Dipartimento Scienze dell'Antichità [9].

SEM-EDX analysis accomplished with a SEM Hitachi Tabletop TM3000 plus an EDX system SwiftED3000 and related software allowing semi quantitative analyses. The gold fragment was analyzed in total vacuum without coating. The EDX analysis was achieved in Analy (15V) observation condition mode, accelerating time (s) 400.0, process time 5 (image 1)

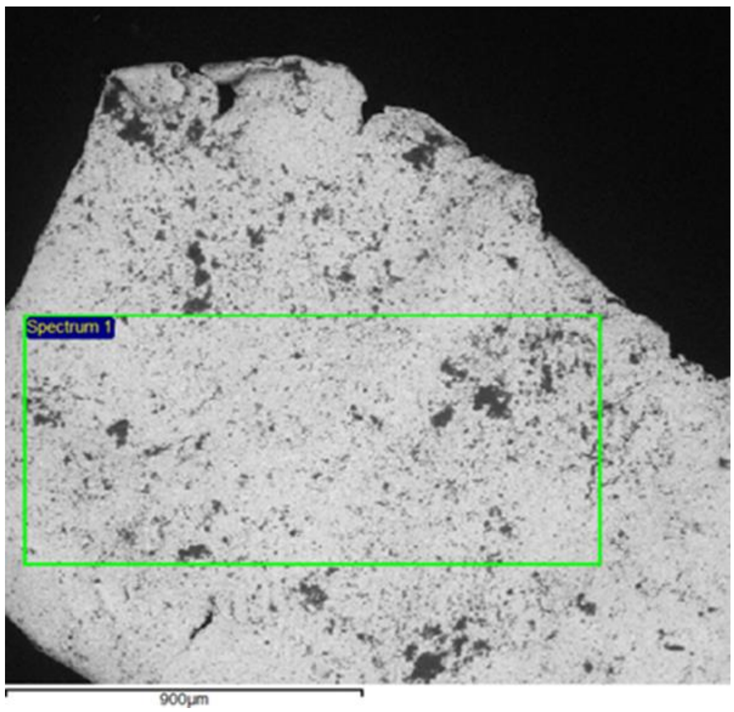


Figure 50. Backscattered electron image, Image Width: 1.821 mm

the SEM image was acquired with an acquisition time 5000 (s) and with 5 process time and Accelerating voltage (kV) 15.0. In the spectrum diagram gold and silver picks are dominant.

8. cristina.lemorini@uniroma1.it

9. http://www.antichita.uniroma1.it/LTFAPA/index.html

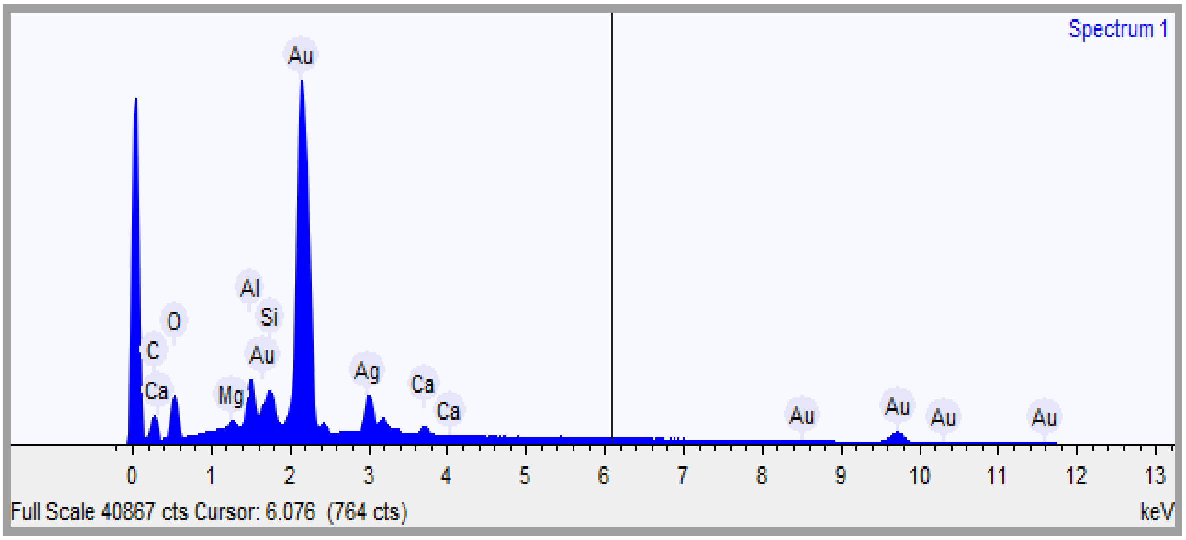


Figure 51. SEM/EDS spectra of micro gold

The quantification results are normalized and summarized in a table below.

Element	Weight %	Weight % σ	Atomic %
Carbon	9.736	0.170	35.466
Oxygen	14.432	0.183	39.466
Magnesium	0.439	0.025	0.790
Aluminum	2.175	0.029	3.526
Silicon	1.441	0.028	2.245
Calcium	1.008	0.034	1.101
Silver	9.194	0.112	3.729
Gold	61.576	0.210	13.678

Table 12. SEM-EDX quantification results of gold fragments.

Among metallurgical investigation in Arslantepe phase VIB1 just three kinds of metal composition were reported which can be categorized to:

- Silver-copper alloys, with silver contents ranging between 23 % and 65%
- Arsenical copper with as contents of 2 % or more and As/Ni ratios of 100 or higher
- Copper-arsenic-nickel component artifacts

All non-utilitarian, ornamental objects are made of silver (Hauptmann, et al 2002).

Although metallurgy have been developed in Early Bronze Age at Arslantepe and has been evidenced by various objects made of copper composite alloys with arsenic and lead, but a few items have been found in precious metals such as silver and gold (Frangipane, 2017).

Contrary to the previous phase of settlement VIA with uniformity of artifact in royal tomb, later phase VIB1 is more variable in chemical composition (Hauptmann et al 2002). In this phase ornamental objects are made of an enigmatic copper silver alloy with the high percentage of silver (average 47%). Based on publications it is a very rare phenomenon in ancient time (ibid). Unfortunately, there is no sign of gold alloy, yet the possibility of province studying, and isotopic comparing is unfeasible. What we can be sure about is impossible occurrence of native silver, scholars theorized that this Cu-Ag should be an intentional alloy made with silver gained from the cupellation of lead (ibid). This theory has some flaws which make it less acceptable such as high percentage of silver. Concerning about the high percentage of gold more than 60 % and no other gold artifact, interoperating of this precious micro-remain requires a lot of research.

4.11 **Comparison between first and second phase of Building 36**

The summary of density in all retrieved micro-debris from Building 36 in total demonstrate (diagram 4) that non-burnt bone is the most notable retrieved material from Building 36 with significant high density in respect with other material. Diagram 5 represent that room A1000 has the highest rate of non-burnt bone while room A1369 has highest rate of burnt bone which demonstrate the functionality of lateral room as the cooking and preparing meal. However, based on more detail diagram (diagram 6) the rate of burnt larger bone (<6mm) is significantly lower than micro bones which reinforce the idea of different approach in post mortem deterioration between micro bone remains and larger ones.

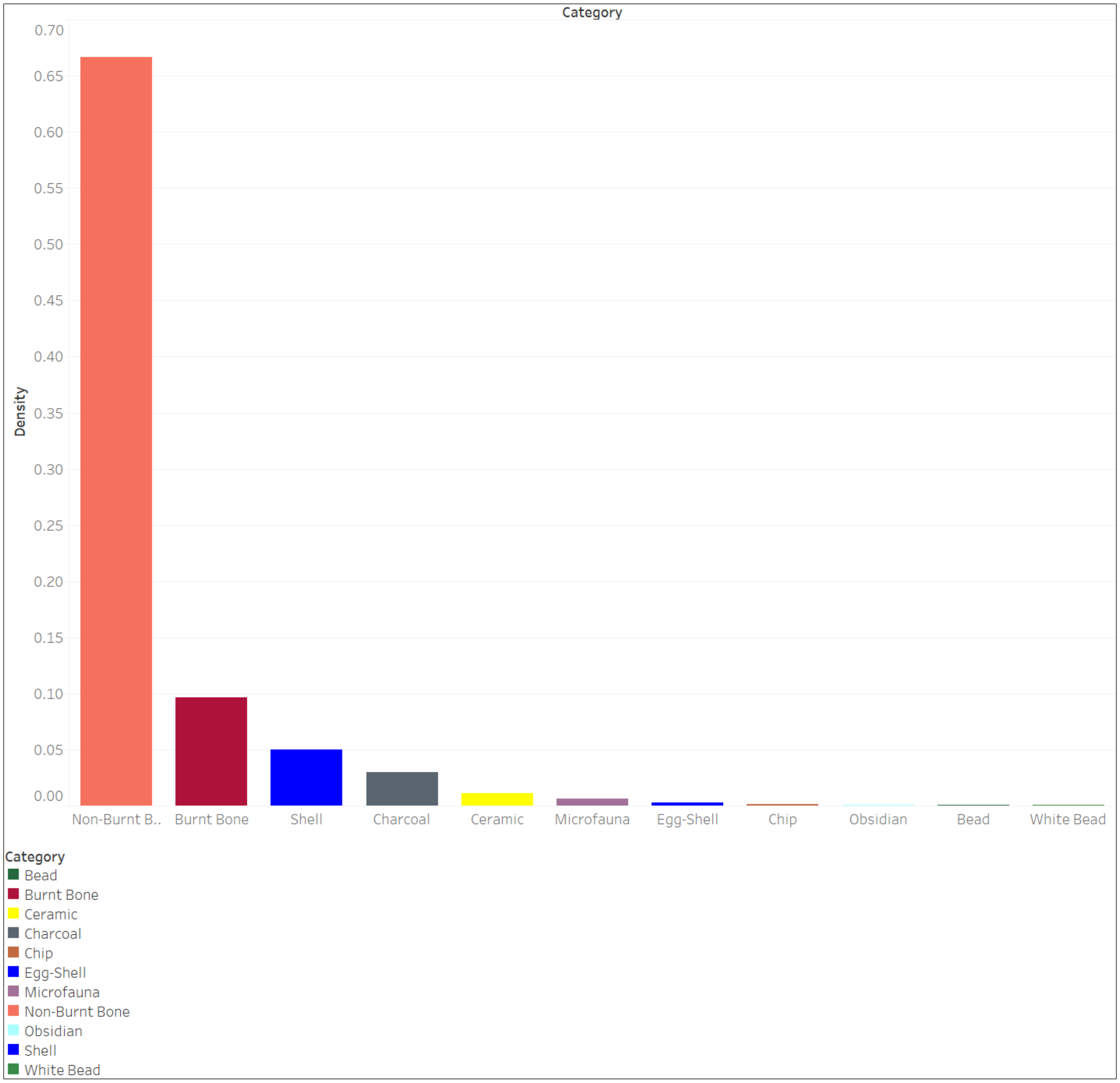


Diagram 3. Density of total micro-remains from Building 36

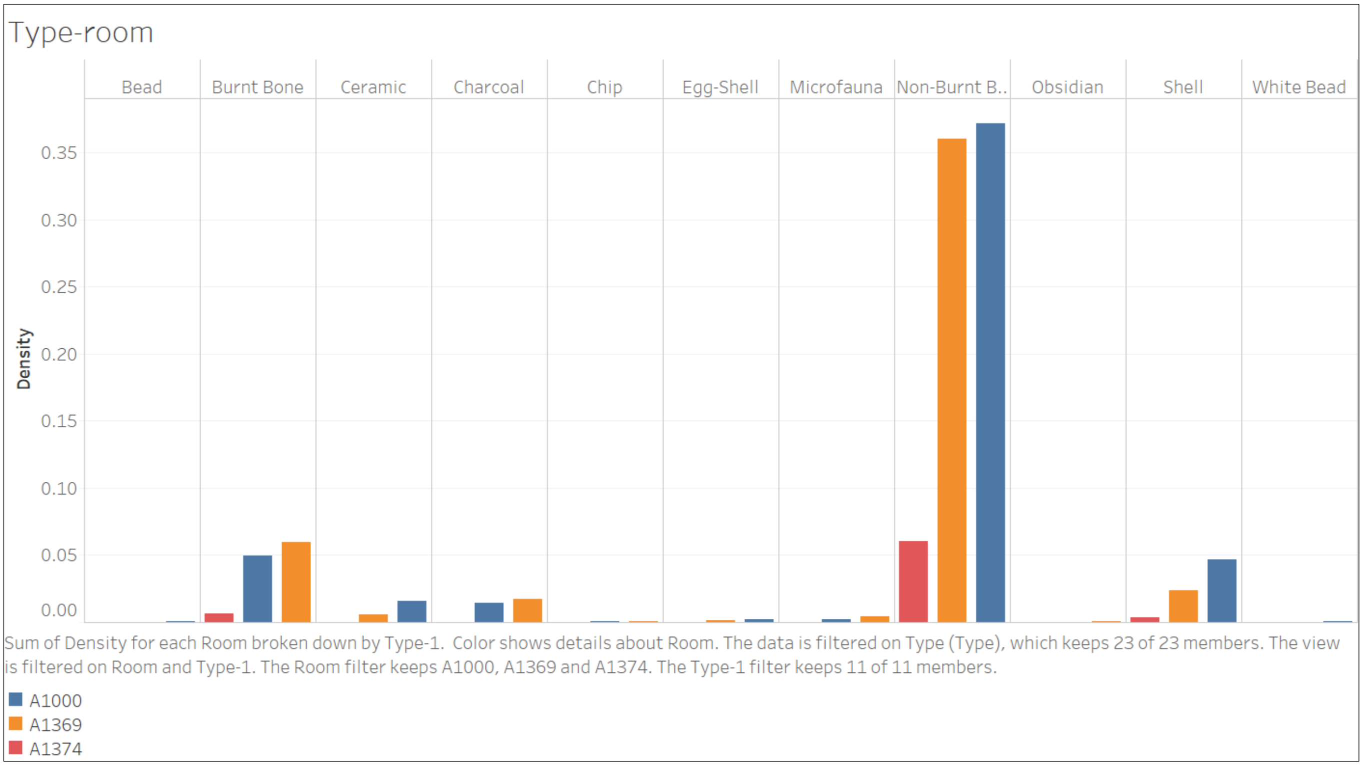


Diagram 4. Comparison of density of micro artifacts in Building 36

Comparison between two construction phases of Building 36 provides the opportunity to highlight different functionality-if any- of building through time. Fortunately, micro-remain analyzing of second phase of the Building 36 had been carried out by Sussana Cereda for the master thesis during 2012-2013. It was a well-done analysis of micro-debris distribution which explained the functionality and pattern of micro-remain distribution.

As mentioned in second chapter, phase VIB1 composed of five sub-phases, that each of them is different from the other in terms of architectural technique and layout. In second phase of Building 36, the construction changed dramatically. In the first phase two rooms A1000 and A1369 were connected to each other, while in second phase there were separated (Figure 52). As it is shown in figure 10, ceremonial room (A1000) separated from lateral room (A1369). The other transformation was adding another entrance room to ceremonial room on south west side. Although the architectural structure was changed but the concentration of fauna remains demonstrates that the function of two rooms has not significantly altered. The highest density of bone residues in room A1353 is related to fire place which reinforce the idea of cooking and preparing meal in this portion, which can be comparable with their previous phase room A1369 and high rate of burnt bone in this room. Despite the presence of fireplace in A1336 which correspond to previous structure A1000, density of fauna residue decreased (Cereda, 2013) which indicate the continuity of the same function. This similarity reinforces the idea that although huge fire destroyed the first phase, but the second phase continued with the same function but different structure.

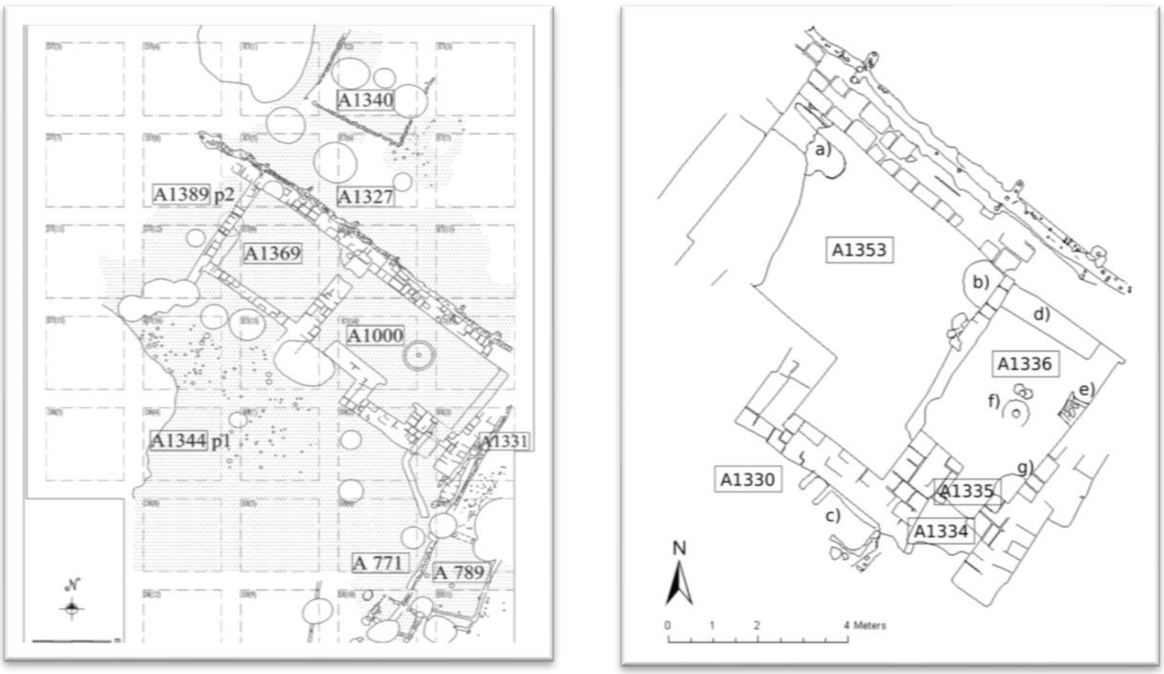


Figure 52, comparing two phases of construction.

Based on other type of micro residue such as lithics, eggshell, cereal in room A1353 and room A1330 especially around fireplace the idea of food processing is strong enough to conclude that previous pursuit had been carried out in new phase too. However, lack of meal related residue such as bone, lithic and pottery in room A1336 signifies the usage as a ceremonial purpose.

All in all, with no clear clue about the huge destructive fire if it was due to invaders or local people or even accidental, the conclusion could be straightforward, the functionality of Building 36 among two construction phases did not change.

Conclusion

Micro-debris analyzing provides the window in to artifact variability which is not observable in large size. Every day activities produce diversity of residues that are the key evidence for further investigations. Due to their size they were neglected and considered less important than big objects. However, the power of micro refuse is their size which provides the opportunity to observe details about activity area and demonstrate the type of activities that took place.

While large in situ artifacts can help to understand the functionality of space room, micro-residues demonstrate the original place of their production and usage. Contrary to big objects which might be transported or moved, micro artifacts trampled in their original position and provide the first-hand genius information due to their unobservable characteristics. Furthermore, they can provide useful information about cleaning and swapping the floor which might not be visible from the larger artifacts.

Investigating on floor micro-remains of Building 36, in Early Bronze Age I, manifested the space distribution and activity pattern of inhabitants. Building 36 consisted of two separated room which were connected to each other, there was also a small storage space (A1374) located on west side of main larger room (A1000). The main room A1000 was characterized with remarkable fireplace with made it unique in both functionality and features. The lateral room A1369 was considered as the storage room due to the large amount of in situ materials and vessels. Building 36 was destroyed by huge fire with all in situ materials.

Micro-remain analysis in this building revealed considerable amount of fauna remains. Macro and micro bone demonstrated the activates of cooking and serving food in a large amount. The distribution of micro bones was not homogenous and lateral room had the high degree of densities in burnt bone which suggests that majority of meal consumption and preparation took place in this area. Furthermore, the high degree of burnt bone density around the hearth in lateral room strengthens the idea of cooking food in this spot while the fireplace in main room is almost empty of any traces of cooking activity. It suggests that these two fireplaces have different functionality, the one in lateral room had cooking usage while the big one in main room had ceremonial and ritual application.

Retrieved micro-fauna from building 36 were different in two rooms, suggesting that micro-fauna that lived and feed accumulated in lateral room due to large amount of food there. Ceremonial room had fewer micro-faunae except the small storage space A1374 which indicate the storage usage. What is significant in micro-fauna remains is there were no sign of burnt micro-fauna which can be the evidence that they were not used by inhabitants and even they did not face to the huge fire which burned the whole Building 36.

Micro-remain investigation also provided different types of materials such as lithic, shells, beads, charcoals and fragment of gold sheet. Lithic and obsidian distribution not only prove that lateral room functioned as preparing and cooking room but also demonstrate the pattern of cleaning and swiping activities. It shows that accumulation of micro-chip stone and lithic on the corner, the bench and in storage room was the result of sweeping them to the corners.

Shells were mostly terrestrial snail shells which did not demonstrated any specific information but background noise. Beads were dispersed mostly in main room (A1000) and strengthen the idea of ceremonial functionality of room A1000. Considering the facts that they have ornamental and ritual usage they might have fell of folk's clothes or from the decorative objects hung on walls.

In brief, Building 36 had two separated rooms with different functionality, one (A1369) as storage and cooking place and the other (A1000) as ceremonial and ritual place. The small storage place (A1374) also was used as a storage of some kinds of food which might be used during ceremony. It is worth mentioning that in second construction phase of Building 36, the structure and architectural plan changed while the functionalities of two rooms did not varied.

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7 Appendices

sample number	Room	Square	Total Sample Volume	6mil non-burnt bone	6mil non-burnt bone density	6mil burnt bone	6mil burnt bone density	3mil non-burnt bone	3mil non-burnt bone density	3mil burnt bone	3mil burnt bone density	1mil non-burnt bone	1mil non-burnt bone density
597	A1000	2	27200	2	0.000074	2	0.000074	54	0.001985	6	0.000221	149	0.005478
598	A1000	1	25000	1	0.000040	0	0.000000	13	0.000520	3	0.000120	27	0.001080
599	A1000	5	26000	6	0.000231	0	0.000000	39	0.001500	7	0.000269	74	0.002846
600	A1000	4	18500	13	0.000703	0	0.000000	66	0.003568	28	0.001514	154	0.008324
601	A1000	7	28500	24	0.000842	6	0.000211	249	0.00873684	58	0.00203509	302	0.01059649
602	A1000	6	27600	47	0.001703	3	0.000109	449	0.016268	56	0.002029	669	0.024239
603	A1000	9	23300	8	0.000343	1	0.000043	98	0.004206	3	0.000129	86	0.017179
604	A1000	8	23750	0	0.000000	0	0.000000	125	0.005263	18	0.000758	408	0.013600
605	A1000	11	24800	19	0.000766	2	0.000081	153	0.006169	13	0.000524	128	0.005161
606	A1000	13	82000	18	0.000256	6	0.000085	180	0.002557	40	0.000568	238	0.003381
607	A1000	10	11000	5	0.000455	0	0.000000	46	0.004182	2	0.000182	21	0.001909
608	A1000	14	27100	13	0.000480	0	0.000000	144	0.003114	24	0.008856	178	0.006568
609	A1000	12	9000	7	0.000778	0	0.000000	37	0.004111	2	0.000222	45	0.005000
610	A1000	16	27500	11	0.000400	0	0.000000	208	0.007564	23	0.000836	423	0.015382

611	A1000	15	26300	7	0.000266	0	0.000000	74	0.002814	13	0.000494	93	0.003536
612	A1000	18	28300	14	0.000495	0	0.000000	140	0.004947	19	0.000671	218	0.007703
613	A1000	17	24700	7	0.000283	0	0.000000	94	0.003806	4	0.000162	131	0.005304
614	A1000	21	21000	3	0.000143	0	0.000000	138	0.006571	16	0.000762	270	0.012857
615	A1000	20	23800	4	0.000168	0	0.000000	56	0.002353	15	0.000630	51	0.002143
619	A1000	19	24500	20	0.000816	1	0.000041	139	0.005673	7	0.000286	117	0.004776
621	A1000	23	18000	3	0.000167	0	0.000000	65	0.003611	5	0.000278	75	0.004167
625	A1369	4a	23600	41	0.001737	0	0.000000	66	0.002797	28	0.001186	154	0.006525
626	A1369	7	20500	11	0.000537	0	0.000000	68	0.003317	1	0.000049	42	0.002049
627	A 1369	14	29000	18	0.000621	5	0.000172	183	0.006310	15	0.000517	247	0.008517
628	A1369	15	19300	7	0.000363	0	0.000000	43	0.002228	2	0.000104	52	0.002694
629	A1369	3	28300	59	0.002085	2	0.000071	525	0.018551	60	0.002120	712	0.025159
630	A1369	8	21000	27	0.001286	0	0.000000	183	0.008714	13	0.000619	211	0.010048
631	A1369	16	15800	16	0.001013	0	0.000000	179	0.011329	22	0.001392	160	0.010127
632	A1369	6	15000	14	0.000933	0	0.000000	123	0.008200	21	0.001400	120	0.00800
633	A1369	11	24300	11	0.000453	0	0.000000	99	0.004074	56	0.002305	87	0.003580
634	A1369	13	29000	28	0.000966	3	0.000103	307	0.010586	41	0.001414	830	0.028621
635	A1369	2	21700	8	0.000369	1	0.000046	132	0.006083	29	0.001336	192	0.008848
636	A1369	9	29300	31	0.001058	0	0.000000	177	0.006041	22	0.000751	149	0.005085

637	A1369	17	17500	11	0.000629	2	0.000114	92	0.005257	18	0.001029	149	0.008514
638	A1369	5	26400	7	0.000265	3	0.000114	117	0.004432	31	0.001174	66	0.002500
639	A1369	12	21000	26	0.001238	2	0.000095	257	0.012238	32	0.001524	351	0.016714
640	A1369	1	32300	12	0.000372	2	0.000062	170	0.005263	28	0.000867	78	0.002415
641	A1369	10	32500	18	0.000554	6	0.000185	134	0.004123	93	0.002862	125	0.003846
642	A1369	18a	5800	24	0.004138	3	0.000517	290	0.050000	50	0.008621	58	0.010000
643	A1369	4b	12000	6	0.000500	1	0.000083	38	0.003167	18	0.001500	23	0.001917
644	A1374	1	25500	0	0.000000	0	0.000000	0	0.000000	0	0.000000	124	0.004863
645	A1374	2	25700	37	0.001440	4	0.000156	323	0.012586	40	0.001556	752	0.029261

sample number	Room	Square	Total Sample Volume	1mil burnt bone	1mil burnt bone density	Non-burnt bone	Non-burnt bone density	burnt bone	burnt bone density	6 mil charcoal	6mil charcoal density	3mil charcoal	3mil charcoal density
597	A1000	2	27200	15	0.000551	205	0.0075368	23	0.0008456	0	0.000000	0	0.000000
598	A1000	1	25000	13	0.000520	41	0.0016400	16	0.0006400	0	0.000000	0	0.000000
599	A1000	5	26000	2	0.000077	119	0.0045769	9	0.0003462	0	0.000000	2	0.000077
600	A1000	4	18500	63	0.003405	233	0.0125946	91	0.0049189	0	0.000000	8	0.000432
601	A1000	7	28500	51	0.001789	575	0.0201754	115	0.0040351	0	0.000000	6	0.000211
602	A1000	6	27600	63	0.002283	1165	0.0422101	122	0.0044203	0	0.000000	12	0.000435
603	A1000	9	23300	1	0.000043	192	0.0082403	5	0.0002146	0	0.000000	5	0.000215
604	A1000	8	23750	43	0.001811	533	0.0224421	61	0.0025684	0	0.000000	0	0.000000
605	A1000	11	24800	4	0.000161	300	0.0120968	19	0.0007661	0	0.000000	4	0.000161
606	A1000	13	82000	43	0.000611	436	0.0053171	89	0.0010854	0	0.000000	3	0.000043
607	A1000	10	11000	0	0.000000	72	0.0065455	2	0.0001818	0	0.000000	8	0.000727
608	A1000	14	27100	29	0.001070	335	0.0123616	53	0.0019557	0	0.000000	5	0.000185
609	A1000	12	9000	2	0.000222	89	0.0098889	4	0.0004444	0	0.000000	0	0.000000
610	A1000	16	27500	23	0.000836	642	0.0233455	46	0.0016727	0	0.000000	8	0.000291
611	A1000	15	26300	9	0.000342	174	0.0066160	22	0.0008365	0	0.000000	5	0.000190
612	A1000	18	28300	26	0.000919	372	0.0131449	45	0.0015901	0	0.000000	0	0.000000
613	A1000	17	24700	11	0.000445	232	0.0093927	15	0.0006073	0	0.000000	5	0.000202

614	A1000	21	21000	38	0.001810	411	0.0195714	54	0.0025714	0	0.000000	7	0.000333
615	A1000	20	23800	6	0.000252	111	0.0046639	21	0.0008824	0	0.000000	4	0.000168
619	A1000	19	24500	11	0.000449	276	0.0112653	19	0.0007755	0	0.000000	4	0.000163
621	A1000	23	18000	8	0.000444	143	0.0079444	13	0.0007222	0	0.000000	2	0.000111
625	A1369	4a	23600	63	0.002669	261	0.0110593	91	0.0038559	0	0.000000	28	0.001186
626	A1369	7	20500	0	0.000000	121	0.0059024	1	0.0000488	1	0.000049	2	0.000098
627	A 1369	14	29000	39	0.001345	448	0.0154483	59	0.0020345	0	0.000000	0	0.000000
628	A1369	15	19300	2	0.000104	102	0.0052850	4	0.0002073	0	0.000000	0	0.000000
629	A1369	3	28300	84	0.002968	1296	0.0457951	146	0.0051590	6	0.000212	32	0.001131
630	A1369	8	21000	44	0.002095	421	0.0200476	57	0.0027143	0	0.000000	0	0.000000
631	A1369	16	15800	13	0.000823	355	0.0224684	35	0.0022152	0	0.000000	8	0.000506
632	A1369	6	12750	17	0.001133	257	0.0171333	38	0.0025333	0	0.000000	8	0.000533
633	A1369	11	24300	51	0.002099	197	0.0081070	107	0.0044033	0	0.000000	0	0.000000
634	A1369	13	29000	156	0.005379	1165	0.0401724	200	0.0068966	0	0.000000	0	0.000000
635	A1369	2	21700	9	0.000415	332	0.0152995	39	0.0017972	0	0.000000	25	0.001152
636	A1369	9	29300	34	0.001160	357	0.0121843	56	0.0019113	0	0.000000	1	0.000034
637	A1369	17	17500	15	0.000857	252	0.0144000	35	0.0020000	0	0.000000	4	0.000229
638	A1369	5	26400	18	0.000682	190	0.0071970	52	0.0019697	0	0.000000	14	0.000530
639	A1369	12	21000	29	0.001381	634	0.0301905	63	0.0030000	0	0.000000	7	0.000333

640	A1369	1	32300	16	0.000495	260	0.0080495	46	0.0014241	0	0.000000	7	0.000217
641	A1369	10	32500	68	0.002092	277	0.0085231	167	0.0051385	0	0.000000	6	0.000185
642	A1369	18a	5800	4	0.000690	372	0.0641379	57	0.0098276	0	0.000000	0	0.000000
643	A1369	4b	12000	10	0.000833	67	0.0055833	29	0.0024167	0	0.000000	3	0.000250
644	A1374	1	25500	12	0.000471	124	0.0048627	12	0.0004706	0	0.000000	0	0.000000
645	A1374	2	25700	73	0.002840	1112	0.0432685	117	0.0045525	0	0.000000	0	0.000000

sample number	Room	Square	Total Sample Volume	1mil charcoal	1mil charcoal density	charcoal	charcoal density	6mil shell	6mil shell density	3mil shell	3mil shell density	1mil shell	1mil shell density
597	A1000	2	27200	0	0.000000	0	0.000000	0	0	19	0.000699	21	0.000772
598	A1000	1	25000	0	0.000000	0	0.000000	0	0	3	0.000120	14	0.000560
599	A1000	5	26000	8	0.000308	10	0.000385	0	0	2	0.000077	13	0.000500
600	A1000	4	18500	12	0.000649	20	0.001081	0	0	22	0.001189	3	0.000162
601	A1000	7	28500	67	0.002351	73	0.002561	0	0.000000	3	0.000105	30	0.001053
602	A1000	6	27600	28	0.001014	40	0.001449	0	0	3	0.000109	52	0.001884
603	A1000	9	23300	0	0.000000	5	0.000215	0	0	2	0.000086	10	0.000429
604	A1000	8	23750	3	0.000129	3	0.000126	0	0	0	0.000000	36	0.001516
605	A1000	11	24800	3	0.000121	7	0.000282	0	0	1	0.000040	16	0.000497
606	A1000	13	82000	10	0.000142	13	0.000159	0	0	8	0.000114	35	0.000497
607	A1000	10	11000	20	0.001818	28	0.002545	0	0	0	0.000000	11	0.001000
608	A1000	14	27100	0	0.000000	5	0.000185	0	0	6	0.000221	62	0.002288
609	A1000	12	9000	5	0.000556	5	0.000556	0	0	0	0.000000	5	0.000556
610	A1000	16	27500	17	0.000618	25	0.000909	0	0	5	0.000182	26	0.000945
611	A1000	15	26300	0	0.000000	5	0.000190	0	0	2	0.000076	15	0.000570
612	A1000	18	28300	15	0.000612	15	0.000530	0	0	23	0.000813	46	0.001878
613	A1000	17	24700	0	0.000000	5	0.000202	0	0	0	0.000000	12	0.000486

614	A1000	21	21000	0	0.000000	7	0.000333	0	0	13	0.000619	32	0.001524
615	A1000	20	23800	9	0.000378	13	0.000546	0	0	3	0.000126	16	0.000672
619	A1000	19	24500	5	0.000204	9	0.000367	0	0	4	0.000163	10	0.000408
621	A1000	23	18000	0	0.000000	2	0.000111	0	0	8	0.000444	12	0.000667
625	A1369	4a	23600	54	0.002288	82	0.003475	0	0	8	0.000339	51	0.002161
626	A1369	7	20500	8	0.000390	11	0.000537	0	0	10	0.000488	27	0.001317
627	A 1369	14	29000	5	0.000172	5	0.000172	0	0	5	0.000172	31	0.001069
628	A1369	15	19300	0	0.000000	0	0.000000	0	0	1	0.000052	8	0.000415
629	A1369	3	28300	115	0.004064	153	0.005406	0	0	6	0.000212	23	0.000813
630	A1369	8	21000	2	0.000095	2	0.000095	0	0	3	0.000143	16	0.000762
631	A1369	16	15800	4	0.000253	12	0.000759	0	0	7	0.000443	21	0.001329
632	A1369	6	15000	3	0.000235	11	0.000733	0	0	0	0.000000	7	0.000467
633	A1369	11	24300	0	0.000000	0	0.000000	0	0	3	0.000123	13	0.000535
634	A1369	13	29000	5	0.000172	5	0.000172	0	0	8	0.000276	102	0.003517
635	A1369	2	21700	21	0.000968	46	0.002120	0	0	3	0.000138	21	0.000968
636	A1369	9	29300	0	0.000000	1	0.000034	0	0	6	0.000205	15	0.000512
637	A1369	17	17500	0	0.000000	4	0.000229	0	0	4	0.000229	17	0.000971
638	A1369	5	26400	8	0.000303	22	0.000833	0	0	1	0.000038	18	0.000682
639	A1369	12	21000	8	0.000381	15	0.000714	0	0	0	0.000000	59	0.002810

640	A1369	1	32300	0	0.000000	7	0.000217	0	0	7	0.000217	10	0.000310
641	A1369	10	32500	3	0.000092	9	0.000277	0	0	3	0.000092	17	0.000523
642	A1369	18a	5800	7	0.001207	7	0.001207	1	0.00017241	0	0.000000	0	0.000000
643	A1369	4b	12000	0	0.000000	3	0.000250	0	0	4	0.000333	7	0.000583
644	A1374	1	25500	0	0.000000	0	0.000000	0	0	0	0.000000	10	0.000392
645	A1374	2	27700	5	0.000250	5	0.000195	0	0	0	0.000000	59	0.002296

sample number	Room	Square	Total Sample Volume	6mil microfauna	6mil microfauna density	3mil microfauna	3mil microfauna density	1mil microfauna	1mil microfauna density	micro fauna	micro fauna, density	6mil chipstone	6mil chipstone density
597	A1000	2	27200	1	0.000037	0	0.000000	4	0.000147	5	0.000184	0	0.000000
598	A1000	1	25000	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.000000
599	A1000	5	26000	0	0.000000	0	0.000000	2	0.000077	2	0.000077	0	0.000000
600	A1000	4	18500	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.000000
601	A1000	7	28500	0	0.000000	4	0.000140	9	0.000316	13	0.000456	0	0.000000
602	A1000	6	27600	0	0.000000	0	0.000000	4	0.000145	4	0.000145	0	0.000000
603	A1000	9	23300	0	0.000000	1	0.000043	1	0.000043	2	0.000086	0	0.000000
604	A1000	8	23750	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.000000
605	A1000	11	24800	0	0.000000	2	0.000081	0	0.000000	2	0.000037	0	0.000000
606	A1000	13	82000	0	0.000000	2	0.000028	1	0.000014	3	0.000043	0	0.000000
607	A1000	10	11000	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.000000
608	A1000	14	27100	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.000000
609	A1000	12	9000	0	0.000000	0	0.000000	2	0.000222	2	0.000222	0	0.000000
610	A1000	16	27500	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.000000
611	A1000	15	26300	0	0.000000	3	0.000114	0	0.000000	3	0.000114	0	0.000000
612	A1000	18	28300	0	0.000000	1	0.000035	0	0.000000	1	0.000035	0	0.000000
613	A1000	17	24700	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.000000

614	A1000	21	21000	0	0.000000	0	0.000000	5	0.000238	5	0.000238	0	0.000000
615	A1000	20	23800	0	0.000000	2	0.000084	0	0.000000	2	0.000084	0	0.000000
619	A1000	19	24500	1	0.000041	2	0.000082	8	0.000327	11	0.000449	0	0.000000
621	A1000	23	18000	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.000000
625	A1369	4a	23600	0	0.000000	9	0.000381	2	0.000085	11	0.000466	0	0.000000
626	A1369	7	20500	0	0.000000	1	0.000049	0	0.000000	1	0.000049	0	0.000000
627	A 1369	14	29000	2	0.000069	0	0.000000	10	0.000345	12	0.000414	0	0.000000
628	A1369	15	19300	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.000000
629	A1369	3	28300	0	0.000000	1	0.000035	0	0.000000	1	0.000035	1	0.000035
630	A1369	8	21000	0	0.000000	3	0.000143	2	0.000095	5	0.000238	0	0.000000
631	A1369	16	15800	0	0.000000	0	0.000000	1	0.000063	1	0.000063	0	0.000000
632	A1369	6	12750	0	0.000000	1	0.000067	0	0.000000	1	0.000067	0	0.000000
633	A1369	11	24300	0	0.000000	0	0.000000	1	0.000041	1	0.000041	0	0.000000
634	A1369	13	29000	0	0.000000	8	0.000276	5	0.000172	13	0.000448	3	0.000103
635	A1369	2	21700	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.000000
636	A1369	9	29300	0	0.000000	2	0.000068	4	0.000137	6	0.000205	0	0.000000
637	A1369	17	17500	0	0.000000	0	0.000000	1	0.000057	1	0.000057	0	0.000000
638	A1369	5	26400	0	0.000000	0	0.000000	2	0.000076	2	0.000076	0	0.000000
639	A1369	12	21000	0	0.000000	0	0.000000	1	0.000048	1	0.000048	1	0.000048

640	A1369	1	32300	1	0.000031	4	0.000124	3	0.000093	8	0.000248	0	0.000000
641	A1369	10	32500	0	0.000000	1	0.000031	3	0.000092	4	0.000123	0	0.000000
642	A1369	18a	5800	0	0.000000	4	0.000690	5	0.000862	9	0.001552	0	0.000000
643	A1369	4b	12000	0	0.000000	0	0.000000	1	0.000083	1	0.000083	0	0.000000
644	A1374	1	25500	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.000000
645	A1374	2	25700	0	0.000000	0	0.000000	4	0.000200	4	0.000156	0	0.000000

sample number	Room	Square	Total Sample Volume	3mil chipstone	3mil chipstone density	1mil chipstone	1mil chipstone density	ceramic	ceramic density	obsidian	obsidian density	egg shell	egg shell density
597	A1000	2	27200	0	0.000000	0	0.000000	11	0.000404	0	0.000000	0	0.0000000
598	A1000	1	25000	1	0.000040	0	0.000000	0	0.000000	0	0.000000	2	0.0000800
599	A1000	5	26000	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.0000000
600	A1000	4	18500	1	0.000054	0	0.000000	0	0.000000	0	0.000000	3	0.0001622
601	A1000	7	28500	4	0.000140	0	0.000000	8	0.0002807	1	0.000035	0	0.0000000
602	A1000	6	27600	0	0.000000	0	0.000000	10	0.000362	1	0.000036	1	0.0000362
603	A1000	9	23300	0	0.000000	0	0.000000	4	0.000429	1	0.000043	0	0.0000000
604	A1000	8	23750	0	0.000000	0	0.000000	11	0.000366	0	0.000000	2	0.0000842
605	A1000	11	24800	0	0.000000	0	0.000000	7	0.000282	1	0.000040	2	0.0000806
606	A1000	13	82000	0	0.000000	0	0.000000	17	0.000963	1	0.000014	1	0.0000142
607	A1000	10	11000	0	0.000000	0	0.000000	1	0.000091	0	0.000000	0	0.0000000
608	A1000	14	27100	0	0.000000	0	0.000000	31	0.011439	0	0.000000	3	0.0001107
609	A1000	12	9000	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.0000000
610	A1000	16	27500	0	0.000000	0	0.000000	10	0.000364	1	0.000036	3	0.0001091
611	A1000	15	26300	1	0.000038	0	0.000000	0	0.000000	0	0.000000	1	0.0000380
612	A1000	18	28300	0	0.000000	0	0.000000	18	0.002933	0	0.000000	1	0.0000353
613	A1000	17	24700	0	0.000000	0	0.000000	4	0.000162	0	0.000000	3	0.0001215

614	A1000	21	21000	0	0.000000	4	0.000190	12	0.000571	2	0.000095	3	0.0001429
615	A1000	20	23800	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.0000000
619	A1000	19	24500	0	0.000000	0	0.000000	0	0.000000	0	0.000000	2	0.0000816
621	A1000	23	18000	0	0.000000	0	0.000000	5	0.000278	0	0.000000	2	0.0001111
625	A1369	4a	23600	1	0.000042	0	0.000000	11	0.000466	0	0.000000	2	0.0000847
626	A1369	7	20500	1	0.000049	0	0.000000	11	0.000537	0	0.000000	1	0.0000488
627	A 1369	14	29000	0	0.000000	0	0.000000	4	0.000138	0	0.000000	0	0.0000000
628	A1369	15	19300	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.0000000
629	A1369	3	28300	0	0.000000	0	0.000000	12	0.000424	2	0.000071	2	0.0000707
630	A1369	8	21000	0	0.000000	0	0.000000	8	0.000381	0	0.000000	0	0.0000000
631	A1369	16	15800	0	0.000000	0	0.000000	7	0.000443	1	0.000063	5	0.0003165
632	A1369	6	15000	0	0.000000	0	0.000000	3	0.000235	0	0.000000	1	0.0000784
633	A1369	11	24300	0	0.000000	0	0.000000	3	0.000123	0	0.000000	1	0.0000412
634	A1369	13	29000	0	0.000000	0	0.000000	23	0.0002793	3	0.000103	5	0.0001724
635	A1369	2	21700	0	0.000000	0	0.000000	4	0.000184	1	0.000046	1	0.0000461
636	A1369	9	29300	0	0.000000	0	0.000000	5	0.000171	0	0.000000	0	0.0000000
637	A1369	17	17500	0	0.000000	0	0.000000	10	0.000571	0	0.000000	2	0.0001143
638	A1369	5	26400	1	0.000038	0	0.000000	7	0.000265	1	0.000038	3	0.0001136
639	A1369	12	21000	1	0.000048	0	0.000000	7	0.000333	1	0.000048	2	0.0000952

640	A1369	1	32300	3	0.000093	0	0.000000	6	0.000186	2	0.000062	0	0.0000000
641	A1369	10	32500	1	0.000031	0	0.000000	8	0.000246	1	0.000031	3	0.0000923
642	A1369	18a	5800	0	0.000000	1	0.000172	0	0.000000	1	0.000172	3	0.0005172
643	A1369	4b	12000	0	0.000000	0	0.000000	2	0.000167	0	0.000000	0	0.0000000
644	A1374	1	25500	0	0.000000	0	0.000000	0	0.000000	0	0.000000	0	0.0000000
645	A1374	2	25700	0	0.000000	0	0.000000	4	0.0004086	2	0.00078	0	0.0000000

sample number	Room	Square	Total Sample Volume	chip	chip density	bead	bead density	white bead	White bead density
597	A1000	2	27200	0	0.000000	1	0.000037	1	0.000037
598	A1000	1	25000	1	0.000040	0	0.000000	0	0.000000
599	A1000	5	26000	0	0.000000	0	0.000000	0	0.000000
600	A1000	4	18500	1	0.000054	0	0.000000	0	0.000000
601	A1000	7	28500	4	0.000140	0	0.000000	0	0.000000
602	A1000	6	27600	0	0.000000	1	0.000036	1	0.000036
603	A1000	9	21500	0	0.000000	1	0.000043	0	0.000000
604	A1000	8	30000	0	0.000000	3	0.000126	3	0.000126
605	A1000	11	24800	0	0.000000	1	0.000040	1	0.000040
606	A1000	13	70400	0	0.000000	0	0.000000	0	0.000000
607	A1000	10	11000	0	0.000000	0	0.000000	0	0.000000
608	A1000	14	2710	0	0.000000	1	0.000037	1	0.000037
609	A1000	12	9000	0	0.000000	0	0.000000	0	0.000000
610	A1000	16	27500	0	0.000000	1	0.000036	1	0.000036
611	A1000	15	26300	1	0.000038	1	0.000038	0	0.000000
612	A1000	18	24500	0	0.000000	0	0.000000	0	0.000000

613	A1000	17	24700	0	0.000000	1	0.000040	1	0.000040
614	A1000	21	21000	4	0.000190	0	0.000000	0	0.000000
615	A1000	20	23800	0	0.000000	0	0.000000	0	0.000000
619	A1000	19	24500	0	0.000000	0	0.000000	0	0.000000
621	A1000	23	18000	0	0.000000	0	0.000000	0	0.000000
625	A1369	4a	23600	1	0.000042	1	0.000042	0	0.000000
626	A1369	7	20500	1	0.000049	1	0.000049	1	0.000049
627	A 1369	14	29000	0	0.000000	0	0.000000	0	0.000000
628	A1369	15	19300	0	0.000000	0	0.000000	0	0.000000
629	A1369	3	28300	1	0.000035	1	0.000035	1	0.000035
630	A1369	8	21000	0	0.000000	0	0.000000	0	0.000000
631	A1369	16	15800	0	0.000000	0	0.000000	0	0.000000
632	A1369	6	12750	0	0.000000	0	0.000000	0	0.000000
633	A1369	11	24300	0	0.000000	0	0.000000	0	0.000000
634	A1369	13	29000	3	0.000103	0	0.000000	0	0.000000
635	A1369	2	21700	0	0.000000	1	0.000046	0	0.000000
636	A1369	9	29300	0	0.000000	0	0.000000	0	0.000000
637	A1369	17	17500	0	0.000000	0	0.000000	0	0.000000
638	A1369	5	26400	1	0.000038	0	0.000000	0	0.000000

639	A1369	12	21000	2	0.000095	0	0.000000	0	0.000000
640	A1369	1	32300	3	0.000093	1	0.000031	0	0.000000
641	A1369	10	32500	1	0.000031	0	0.000000	0	0.000000
642	A1369	18a	5800	1	0.000172	0	0.000000	0	0.000000
643	A1369	4b	12000	0	0.000000	0	0.000000	0	0.000000
644	A1374	1	25500	0	0.000000	0	0.000000	0	0.000000
645	A1374	2	20000	0	0.000000	0	0.000000	0	0.000000