ANIMAL BONE STUDIES ON BYZANTINE CITY OF THE AMORIUM

A THESIS SUBMITTED TO THE GRADUATE SCHOOL OF SOCIAL SCIENCES OF MIDDLE EAST TECHNICAL UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN THE DEPARTMENT OF
SETTLEMENT ARCHAEOLOGY

JUNE 2009

Approval of the Graduate School of Social Sciences

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ABSTRACT

Animal Bones Study on the Byzantine City of Amorium

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June 2009, 91 Pages

The aim of this study is to identify the preferred animal species at Byzantine city of Amorium and accordingly to find the spatial relationship between context and the purpose of animal use such as dietary habits, workshop activities, possible socioeconomic differentiation and subsistence economy as well as the ecology of Amorium environment.

The animal bones were examined in order to determine their species. The identified animal bones were assessed by calculating the frequencies of the each species. Thus, which species were the most essential for the diet, and the basic aims of the animal economy, could be determined. In addition to domestic animals, the wild fauna was also studied to answer the question of which species were chosen for exploitation and whether or not wild sources were of considerable portion, gathered by fishing and hunting. For the spatial analysis, the species compositions as well as the skeletal representation tables of each assemblage of each different context were studied. The species composition appeared similar amongst most of the contexts but the skeletal representation tables gave more information on the use of species, especially allowing the separation of contexts containing domestic refuse and the contexts that had an overwhelming proportion of bones elements that could have been used for industrial activities (bone working).

Keywords: Animal bones, Animal Economy, Ageing of Animal Bones, Amorium.

ÖZ

Amoryum Bizans Kenti Hayvan Kemiği Çalışması

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Haziran 2009, 91 Sayfa

Bu çalışma, Antik Bizans Şehri olan Amoryum'dan seçilen hayvan kemiklerinin tanımlanmasını ve bu buluntuların ele geçtiği açmalarla mekansal ilişkilerinin tespit edilmesini içermektedir. Ayrıca Amoryum halkının hayvanları hangi amaçlar için kullandıklarını ve buna bağlı olarak var olan hayvansal ekonomilerinin ortaya çıkarılmasını önermektedir.

Öncelikle, yüzyılları belirlenmiş Amoryum arkeolojik alanından ele geçmiş olan hayvan kemiklerinin türleri belirlenmiştir. Bu bilgi ışığında kemiklerin mekânlara göre bulunma sıklıkları ve yoğunlukları tespit edilmiştir. Böylelikle Amoryum halkının diyetlerinde hangi hayvanları çoğunlukla tercih ettikleri saptanmıştır ve dönemler arasında hayvansal ekonomi, yabanıl hayvan tercihi, balıkçılık ve avcılık aktiviteleri ortaya çıkarılmıştır. Mekânsal analiz çalışması için, iskelet element gösterim tablosundaki her bir element, türlerine ve açmalarda bulunma sıklılıklarına göre ele alınmıştır. Tespit edilen hayvan türleri açmalara göre çok farklılık göstermese bile, iskelet element tablosu hayvanların kullanım amaçlarına dair daha fazla bilgi edinmemizi sağlamıştır. Ayrıca, iskelet elementlerinin yoğunlukları her bir açma için ayrı ayrı hesaplanmıştır. Evcil hayvan atıkları tüm açmalara göre ele alınmış ve dönem insanlarının hayvan kemiklerini de kullanım amaçları belirlenmiştir.

Anahtar Kelimeler: Hayvan Kemiği, Hayvansal Ekonomi, Hayvan Kemiği Yaşlandırması, Amoryum.

ACKNOWLEDGEMENTS

I would like to express my gratitude to all those who gave me the possibility to complete this thesis. I am deeply grateful to my supervisor Assistant Professor Evangelia Pişkin whose help, stimulating suggestions and encouragement helped me in all the time of research for and writing of this thesis. I want to express my gratitude to Prof. Dr. Erksin Güleç, for her valuable advice and generous help. Her critiques in my work have been very helpful for this research.

I warmly thank Prof. Dr. Numan Tuna and Assoc. Prof. Dr. Burcu Erciyas for their valuable guidance and support.

I also would like to thank the many friends; Coşku Kocabıyık, Özgecan Yarma, Didem Özmen, Burcin Turkmenoglu who has made this happens.

I am very grateful Britt Starkovich, from Arizona University Department of Anthropology, for giving her time and support to read and edit my thesis.

Especially, I would like to give my special thanks to my dear family and my loving husband, İsmail Baykara, whose patient love enable me to complete this work.

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CHAPTER I

INTRODUCTION

1.1. Objectives of the Study

Firstly, I will compile a list of animal species that were utilized in Amorium during the Byzantine times. This information was obtained from the identified animal bones recovered from the Amorium excavations. This information was evaluated by calculating the frequencies of the species found and comparing the percentages of each species. In this way it could be determined which species were the most important for the diet, and the basic aims of the animal economy could be understood, that is what species were preferred for exploitation and whether or not wild sources were of significant portion, gathered by fishing and hunting.

Determination of the ages and sexes are quite important to understand animal husbandry. Amorium's animal bones were evaluated after their ages and sexes become definite, thus Amorium inhabitant's way of using animals could be stated. It could be determined whether they were only consuming animals for meat or whether they were using animals for secondary production as well such as milk, wool or traction. A dairy herd will be dominated by adult females, whereas a herd maintained largely for meat will include a high proportion of young animals being fattened, and also a stock for breeding. In order to obtain that information, different parts of the bones were studied for different aims; to determine the ages, the teeth and epiphysis were used. Age and sex estimation is also important to understand breeding slaughter cycles.

Related to spatial patterning, the data were analyzed context by context in order to see possible relationships between context and animal choices for consumption. By doing this the ancient Byzantine city's inhabitant's life style and diet could be better understood, in particular what they had consumed within contextual relationship to the places. Beyond this information, the main purpose was to clarify the social status by using animal bones. Since accessibility of the food resources was not equal in the society, finding uncommon or expensive/cheap food sources might reflect different status.

Furthermore spatial analysis will address questions related to animal resource management. Usage of the animals is associated with the urbanization and the marketing economies. There are differences in the sex and age, mortality patterns of livestock slaughtered in rural locations for local consumption, or in urban markets, compared to livestock raised and slaughtered in urban settings. Information obtained by animal bone data could shed light on these issues. In order to understand specialized areas for the carcass disposal and butchers the skeletal representation tables of the species utilized were analyzed.

CHAPTHER II

ZOOARCHAEOLOGY

Zooarchaeology refers to the study of animal remains from archaeological sites. The aim of zooarchaeology is to gain a better understanding of the relationship between humans and their environment, especially between humans and other animal populations. Zooarchaeologists have relied on combination of the natural and social science such as history and the humanities for concepts, methods and explanations. In addition, many studies derive from science practices and focus on zoogeographical relationships, environmental evolution, and the impact of humans on the landscape from the perspective of animal exploitation. It is also important to be familiar with animal behavior and ecology, especially with those concepts related to the predator-prey relationships, biogeography, ecosystems, population ecology and the habits and habitats of the animals with which human interact (Reitz and Wing, 1999:1).

Most animal remains show this complex human and non-human behaviors with resources in the environment, cultural perceptions of those resources and the technological development used to exploit them (Reitz and Wing, 1999). In addition, zooarchaeology is also study of the garbage of ancient peoples' meals. Remains of animals, which were used show different purposes through the time such as; transportation and decoration or which happened to co- exist with early humans (Davis, 1987:47).

Bones give clues about the ancient economies. When archaeologists specialize in earlier periods with little or no pottery, and certainly no written remains, the stones and bones' record has provided better information (Reitz and Wing, 1999:142).

2.1. Studying Methods of Zooarchaeology

Studying methods used for investigating of animal remains that were brought from archaeological sites are;

- Classifications of bones and teeth
- Estimation of sexes and ages
- Measurements
- Evaluation of datum.

From the results of the above investigations the following information can be obtained;

- Diet
- Animal species (used)
- Husbandry or hunting
- Estimation of climate and environment
- Domestication

2.1.1. Classification of Bones and Teeth

Bones provide the main support to the body, and areas for muscle attachment. In addition, bones protect the vital organs of head and chest, and enclose the bone-marrow where red blood cells are formed. There are mainly three types of bones, firstly cylindrical (long bones of the limbs), secondly, flat (skull, ribs), and finally, irregular (vertebrae) in shape.

A mammal's skeleton may be divided into the following functionally distinct regions: skull, vertebral column, rib cage, girdles, and limbs (Davis, 1987: 53-56).

- The skull is a composite structure containing both endochondral and dermal bones. It protects the brain, eyes, and ears, supports the mouth with its teeth and tongue, and provides attachment for the jaw muscles (Davis, 1987:53).

- A series of vertebrae constitutes the vertebral column or backbone. Each vertebra is a solid disc, the centrum, with a dorsal neural arch, through which passes the spinal cord (Davis, 1987: 53: 56).
- Each rib is attached at its dorsal end to thoracic vertebra. All of the ribs form a cage, which encloses and protects the heart and lungs; organs of the thoracic cavity (Davis, 1987:54).
- The fore-limbs and hind-limbs are attached to pectoral and pelvic girdles respectively. These girdles provide attachment for the limb muscles, and also connect limb to body. (Davis, 1987:55).
- Further down the limb, wrist or ankle, formed by a series of small bones (the carpals and tarsal respectively). To them are attached the metacarpals and metatarsals. At the end of each metapodia are attached the phalanx or finger bones (Davis, 1987:56).

2.1.1.1. Teeth

Teeth are highly variable structures. They are very closely adapted to the jobs which they have to do. For this reason, they are particularly useful for identification of mammal remains from archaeological sites (Davis, 1987:56).

Unlike fish and reptiles which continually replace their teeth, most mammals only replace theirs once. They have two sets of teeth, the deciduous and adult dentition. There are four basic kinds of tooth in the mammal, each located in a particular part of the jaw; 1-Incisors at the front of the mouth, 2- Canines 3- Premolars, and 4- Molars at the back of the jaws (Davis, 1987:56).

2.1.1.2. Sex

Most mammals show sexual dimorphism, which is males usually being larger than females. For some animals, such as goats and cows, dimorphism is great enough to allow us to estimate the sex ratio within a sample of

bones. However, there is a different situation for the younger animals. Because of the unfused epiphysis and incomplete bone structure, it is very difficult to determine their sexes (Davis, 1987:44).

Sex ratio can provide some clues about the economy of an early culture. Some parts of skeleton can be sexed and some parts of can not. For example, male antlers are larger than those of females. In general, mammalian mandibles and teeth display little or no sexual size dimorphism, so a comparison of tooth-row lengths or size of individual teeth will not give information on the sex ratio in the sample (Davis, 1987:43).

Sex is basic to many interpretations, especially those related to husbandry strategies, predator- prey relationships, and food preferences. It is also derived from morphological characteristics as well as the size of many processes and muscle attachments and it also varies from sex as well as age. More commonly, sex ratios are derived from relative differences in body size reflected in measurements. Large sample sizes and modern comparative data are essential to interpretations of archaeological data (Reitz and Wing, 1999:159).

2.1.1.3. Age

The age distribution of the sample is different to that expected of “natural” attrition of a population of that species (reason of death old age, disease and misadventure) and that deviation shows selection by hunters or farmers, and thus human decision- making (O’Connor,2000). Age data can reveal much about the economy: hunting capability, the origin of domestication and the mode of exploiting livestock. There are two kinds of ageing methods: **a)** epiphysial fusion (juvenile-adult distinction), **b)** dental age-classes (continuous distinction). Epiphysial fusion can occur at different ages; some around birth, most by the end of the juvenile period. As for, the dental age-classes that tooth wear is one of the oldest techniques for age determination, and is particularly applicable to large herbivores. There are some established criteria for assigning a given mandible to a particular age

class on the basis of dental eruption and the pattern on the occlusal (biting) surface. The rate of tooth wear, measured by the age when a tooth passes from one wear stage to the next, is affected by such factors as the coarseness of forage and the amount of sand in the soil. Another method of age estimation for herbivorous animal makes use of dental dimension which varies strongly with age: decreasing height of the tooth crown (Davis, 1987:39-43).

2.1.1.4. Measurements

Most mammal species can be characterized on the basis of their size. Sometimes size is the main criterion for distinguishing between closely related species. Therefore, the main reason for measuring bones is to aid their identification. Measuring also provides a good estimate of the actual average size of the whole population from which our sample came (Davis, 1987:37).

Biometrical data can also be both more sensitive and more objective than human judgment in determining whether a given specimen should be attributed to one taxon rather than another. Major topic to which biometric studies have made a contribution is in recognizing the early stages of animal domestication. A size reduction seems to have accompanied the domestication of many species (O'Connor, 2000:117).

2.1.1.5. Evaluation of Datum

Archaeofaunal species offer unique opportunities for biological and anthropological studies and reflect insights into relationship between human and their environments (Reitz and Wing, 1991:142).

One of the techniques for evaluating of datum is; counting of a specimen which refers simply to the number of specimens in a sample. That is one of the original quantification procedures and is extensively reviewed. The number of identified specimens (NISP), minimum number of individual

(MNI), and specimens weight are used to estimate relative frequencies of the taxa in faunal assemblage. Relative frequencies permit synchronic and diachronic exploration of environmental fluctuations; successions; taphonomic, recovery, and sampling biases; and cultural differences (Reitz and Wing, 1991:191-192).

The other technique is; Minimum number of individual (MNI), which defines as the smallest number of individuals that is necessary to account for all of the skeletal elements of a particular species found in the site. As with NISP, MNI is related to the number and identifiably of elements in each animal; site formation process; recovery techniques; and laboratory procedures (Reitz and Wing, 1999:191-192).

CHAPTER III

AMORIUM

The site of the Amorium is located in western Turkey, some where168km southwest of Ankara, and some 70km to the northeast of the modern provincial capital of Afyon. Part of the site is occupied by the Turkish village of Hisarköy, which lies within the administrative district of Emirdağ. The ancient city of Amorium lies in eastern Phrygia and it is best known as a typical site for the Byzantine period and, as major provincial capital, it offers answers to many of the questions asked about the history of urbanization in Asia Minor from Late antiquity to Middle Byzantine times (Lightfoot and Mücahide, 2007).

There are two main reasons why Amorium was recognized as an ideal type site, at which to carry out such an investigation. Firstly, as the capital of the Anatolikon, the largest and most powerful province of the Byzantine Empire, Amorium was probably one of the most important cities in Anatolia during the 7^{th} -9^{th} centuries. Secondly, since the site is now largely abandoned and it is not disturbed by modern occupation, it provides excellent conditions for carrying out large scale excavations. A subsidiary aim, of course, has been to find archaeological evidence for the Arab siege of A.D.838 to complement the well-known historical accounts. The retrieval of scientific data from destruction layers would not only allow them to be identified with the events of A.D.838 but would also provide a clear archaeological horizon from which to work both backward and forward. An absolute date in ninth century for certain stratigraphic deposits would provide a chronological framework that has until now been largely lacking in the archaeology of middle Byzantine period in Anatolia (Lightfoot and Ivison, 1997:292). Studying Amorium's animal bones are very suitable in order to reach dietary habits, workshop activities, socioeconomic situation, and

subsistence economy and its contribution to the understanding of the areas' ecological structures. The studying result would be much better understanding of the urban environment and cultural way of life in Byzantine world which is still poorly known (Lightfoot and Ivison, 1997:292).

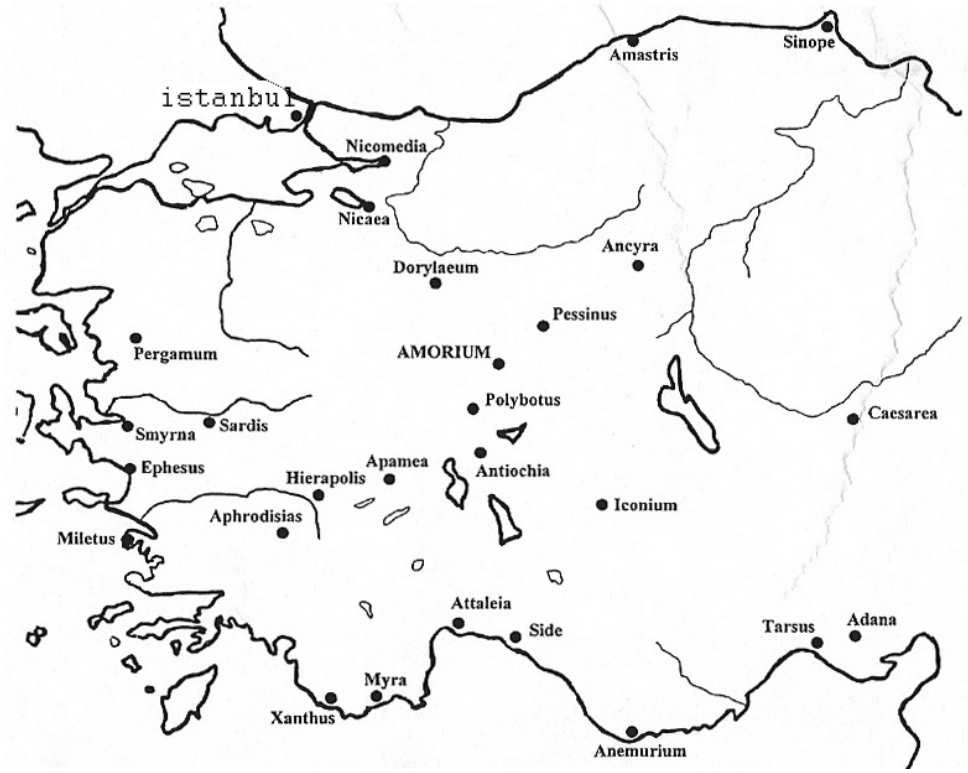

Figure 1: Sketch map of Asia Minor
Source: (Lightfoot and Mücahide, 2007).

The ancient site of Amorium comprises two main sectors, the Upper City, a man-made höyük that forms the nucleus of the site and a lower city. Upper city has an oval shape, covers an area of some 5 hectares and stands some 20 meters above the surrounding ground level. The lower city encompasses a much larger area, extending around the south and east sides of the mound. The whole of the site measures about 1.130meters from north-east to south-west and about 700 meters from north-west to south-east,

enclosing approximately 75 hectares. The primary aim of the excavations at Amorium is to investigate the nature of occupation in the city from the Roman to the Seljuk period. Amorium offers a unique opportunity to study the continuity of occupation at a site in central Anatolia during the troubled times of the Arab invasions and to follow its transition from Christian Byzantine settlement to a Moslem Turkish one. Modern archaeological research at Amorium began in 1987 under the direction of Prof. R. Martin Harrison of the University of Oxford; and it's continued by Christopher Lightfoot since 1993. The 2007 season marked the twentieth year of work at the site, which includes excavation, survey, conservation, and publication (Lightfoot and Mücahide, 2007).

3.1. The Upper City

In the Upper city, the trenches L, ST, TT and U are located. The most prominent structure still visible on its surface is a fortification wall which completely encloses the Upper City. Excavations in trenches TT, ST, and L indicate those 10^{th}-11^{th} centuries (Lightfoot and Mücahide, 2007).

3.1.1. The Trenches

3.1.1.1. The Large Building

The Large Building area is located in the southern part of the Lower City. Initially three trenches were opened D,E and F and later H,J,K,M,O,P,R,S,Q,U,X,Y and Z are added. The large building was dated as Late Roman. Reuse of the Large Building may be attributed to the middle Byzantine period (10^{th}-11^{th}) (Lightfoot and Mücahide, 2007).

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3.1.1.2. The Tower and Gateway (Trench AB)

The excavation in trench AB is on the south-west side of the Lower City. Trench AB is dated from the period between the 5^{th}-7^{th} centuries. The

second major phase of occupation occurred in the middle Byzantine period (10th-11th century) (Lightfoot and Mücahide, 2007).

3.1.1.3. Domestic Occupation (trench LC)

The north-western end of trench AB was extended to the north-east, flanked on its south-eastern side by a street that passes through the gate into the city. The whole complex can be dated no earlier than the late 10th century (Lightfoot and Mücahide, 2007).

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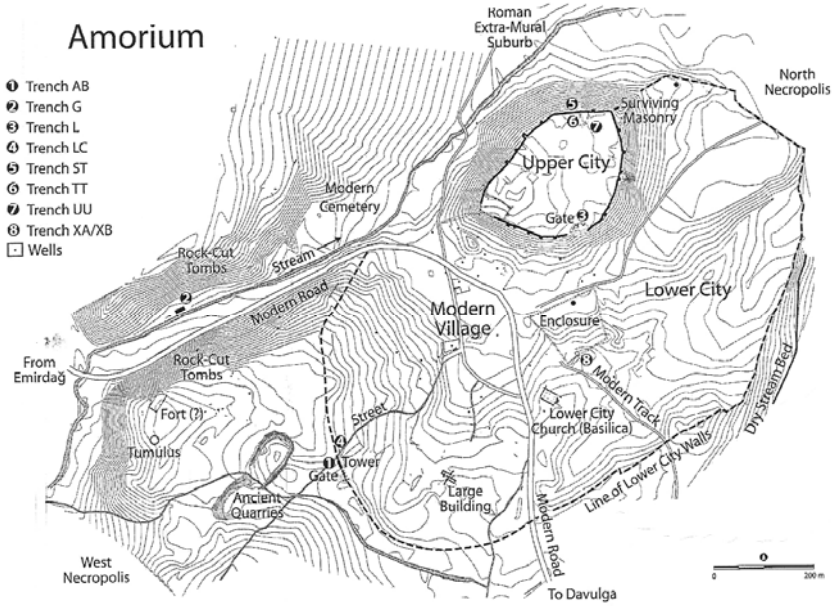


Figures 2: Topographic site plan, 2001

Source: (Lightfoot and Mücahide, 2007).

3.2. The Lower City Church

A massive fortification wall encloses the Lower City, the line of which can still be traced running around the site. It has been suggested that, by the early 8th century, the Lower City walls had already been abandoned and that only the Upper City was fortified. Within the walls, the Lower city can be divided into three distinct areas; a) modern village b) a number of fields that are still under cultivation c) the large building. These uninhabited and disused

areas show traces of buildings and streets and several large public buildings (Lightfoot and Mücahide, 2007).

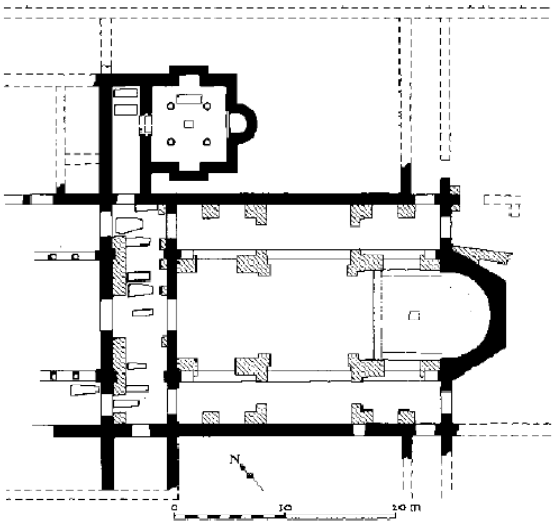


Figure 3: The 2002 Excavation Season

3.2.1. The Enclosure (Trenches XA/XB)

The excavation revealed a stretch of wall that had an obvious defensive purpose. Excavators dated this area as middle Byzantine. Walls indicate a possible date for its construction around the late 10th or early 11th century. The adjacent trench XA located outside the enclosure wall and it is dated early 9th to the late 11th century. The same is true of trench XB and it is dated from 10th-11th centuries (Lightfoot and Mücahide, 2007).

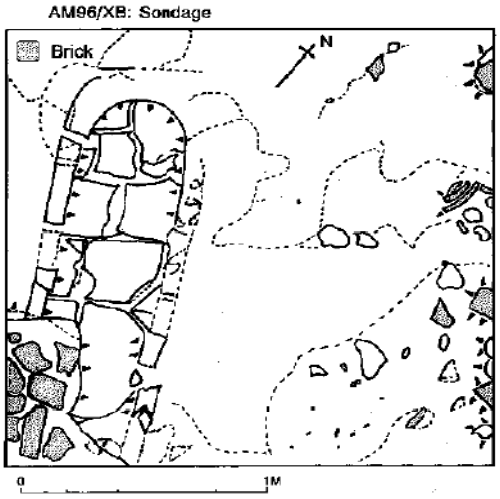


Figure 4: Plan of the excavated area inside the enclosure initial sondage

Source :(Lightfoot and Ivison, 2001).

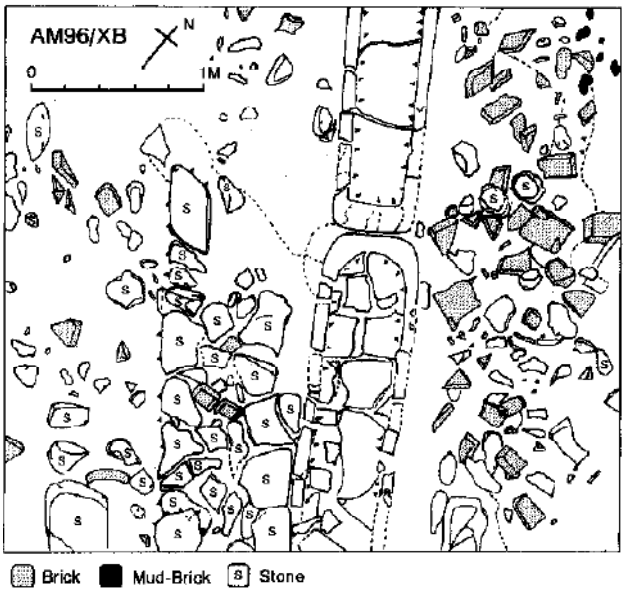


Figure 5: Plan of the excavated area inside the enclosure

Source :((Lightfoot and Ivison, 2001).

3.2.2. The Enclosure and Trench XE

Excavations within the area designated the Lower City Enclosure have confirmed the most successful so far in establishing an outline chronology for the development of Byzantine Amorium. Investigations since 1996 have shown that the archaeology of the southern sector of the Enclosure area is

largely undisturbed by modern activities and is easily accessible owing to the paucity of occupation after the late 11th century. The Enclosure extends over an area of 12,327 square metres, and by the end of the 2006 season some 2,100 square metres, or one sixth of this area, had been excavated down to early mediaeval levels and, in some places, even earlier. The depth and quality of the stratigraphy in this area, although complex, has provided an overview of the history of this central sector of the city between the 5th and 11th centuries. It has also been rich in finds of all kinds, particularly in terms of stratified pottery, which will provide a comprehensive guide to the ceramic chronology of the site. The excavations have also been fruitful as regards organic remains. Indeed, the faunal and floral finds from the Enclosure area are making a major contribution towards the interpretation of its history and features. Most importantly, however, the excavations have also revealed significant architectural remains that provide an insight into the layout of this central part of the city and its transformation during the course of the Byzantine period. They include a small bathhouse complex, built in the early Byzantine period, architecture of the 7th–9th centuries, with part of a main street, and middle Byzantine structures of the 10th and 11th centuries, of which the most impressive are the four defensive walls that surround and thus create the so-called Enclosure itself (Lightfoot and Ivison, 2001).

The first person to describe the structure later designated the Enclosure was probably the British traveller William J. Hamilton, who visited the site of Amorium in 1836. Looking south from the 'Acropolis' or Upper City, Hamilton wrote that 'to the S.S.E. are the ruins of a large oblong building, perhaps a gymnasium…' Modern survey has revealed a more trapezoidal than 'oblong' foot-print to the Enclosure, but perhaps one can recognise in Hamilton's 'gymnasium' the space enclosed by the Enclosure walls, which, according to some older villagers of Hisarköy, still stood to a considerable height in the mid-20th century. Indeed, the Enclosure was noted as a prominent landmark in 1955 when the scholar (and later Amorium team member) Michael H. Ballance visited Amorium. Like Hamilton before him, Ballance described the monument as a large, rectangular area located south of the Upper City, but likened its

shape to that of a military camp. The Enclosure was first planned at a scale of 1:1,000 by the Amorium Excavations Project as part of the initial survey in 1987, but ten years were to pass before the first exploratory excavations in 1996. The area was of interest because it lay at the very centre of the entire walled site, situated between the southern slope of the Upper City mound and the Lower City Church. Before excavation it appeared as a plot of open ground, roughly trapezoidal in shape, sloping unevenly from south to north and delimitated by a raised bank on all sides. Its configuration had given rise to speculation about its possible use as a Roman military camp, and the 1996 excavation was intended in part to test the validity of this hypothesis. Its central position also suggested that the area might conceal the main square or other important features of the early Byzantine or Roman city (Lightfoot and Ivison, 2001).

In 1996 a five-metre wide trench was laid out over the bank, running perpendicular to its axis. The trench was designated trench XA-96 outside or to the south of the bank and trench XB-96 to the north within the Enclosure. The excavation confirmed that the bank concealed a substantial rubble and mortar wall, faced on both sides with irregular courses of masonry and numerous pieces of *spolia*, including part of an early Byzantine Ionic impost capital. This wall, one of four massive walls that formed the Enclosure, later received the designation of Enclosure wall 40. It was immediately apparent that wall 40 and, consequently, the Enclosure itself was a late feature that had been imposed on the pre-existing layout of the site. Both were assigned a middle Byzantine date (10th–11th century), and the suggestion was made that the Enclosure could have served a military purpose as a secure compound for troops and supplies (Lightfoot and Ivison, 2001).

In 1998 the excavation team returned to the Enclosure, intent on opening a larger area just within the south wall. The new trench was designated trench XC-98, measuring 10 by 15 metres, and before the end of the season a smaller trench, XBC-98, was also opened, thereby connecting the new trench with old trench XB-96. These excavations gave some indication of the complex nature of the stratigraphy of the Enclosure area and

revealed parts of two solidly-built structures. A rectangular building in the northern quarter of trench XC-98 was designated ‘structure 1’, while the second building, then believed to be a square room or tower, became ‘structure 2’. Subsequent excavation in Trench XC revealed that Structure I was a bathhouse, built in the 6th century, which continued in use until the 9th century (Lightfoot and Ivison, 2001).

In 2002 further excavation was also carried out adjacent to trench XB-96, which was enlarged eastwards as trench XB-02 to reveal more of the inner face of the Enclosure wall. An extensive ash layer and signs of a major conflagration was found in this area. Trench XB-02 was enlarged eastwards in the following season to form trench XB-03 in the expectation that more of the same stratum could be uncovered (Lightfoot and Ivison, 2001).

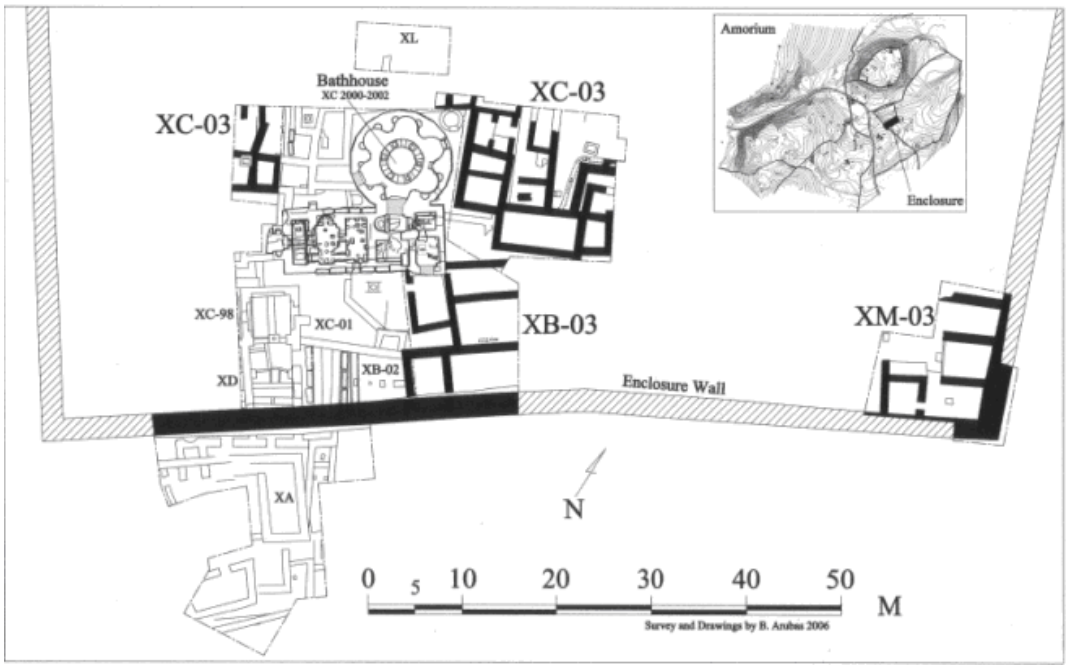


Figure 6: Trench XE

Source :(Lightfoot and Ivison, 2001).

In 2001 work was carried out immediately inside the Enclosure wall 40, in an area designated trench XE-01, located several metres to the east of

trench XB-96. The aim of the new trench was to find evidence for a gate in the centre of the Enclosure's south wall. This proved to be fruitless, and only a further stretch of the inner face of wall 40 was uncovered. As in previous years, attention was paid to the preservation of the exposed fabric of the wall, and during the course of its cleaning and consolidation a small hoard of six anonymous *folles* (dated 976?–*ca*. 1030/35) was uncovered in the wall's rubble and mortar core. The discovery provided unexpected but welcome confirmation of the Enclosure wall's middle Byzantine date. However, since the main purpose of trench XE-01 had not been realised, the trench was then left in an unfinished state (Lightfoot and Ivison, 2001).

Limited excavation of the Enclosure area was planned for the 2004 season as the Project devoted more of its attention and resources to the conservation of the Lower City Church. The main focus of work at the Enclosure was in the area of trench XE-01, where excavation had ceased at an early stage in 2001. This trench was reopened and extended to the north as XE-04. Fill was removed to a deeper level, revealing evidence for more of the destruction layer that had been encountered elsewhere (for example, in trench XB) in previous seasons. The work in 2004 meant that a considerable length of the inner face of the Enclosure wall 40 was now exposed, stretching from the west wall of EB structure 2 in trench XD-00, through trenches XB-96, XB-02, and XB-03, as far as the eastern balk of trench XE-04 (Lightfoot and Ivison, 2001)

By the start of the 2005 season there were serious doubts about the possibility of finding any sort of entrance or gateway along the south side of the Enclosure. Nevertheless, it seemed prudent to expose the rest of Enclosure wall 40, thereby linking trench XM-03 in the south-east corner to the other group of conjoining trenches (mentioned above). As a result, a new trench was opened as an eastern extension of trench XE-04 and renewed excavation in XE-04 also penetrated deeper to early Byzantine and Dark Age levels. The new work in trench XE produced impressive results, including the remains of a wine-press and, immediately to its east, a broad stretch of street, aligned roughly north-south. In order to achieve the objectives set out

in the previous year, work in 2006 extended the excavated area in two directions—to the west with trench XC-06 into the south-western corner of the Enclosure and to the east with trench XE-06 to link up with trench XM-03. As a result of these developments, by the end of the 2006 season the whole of the inner face of the south Enclosure wall had been exposed**.** The middle Byzantine occupation in trenches XC-06 and XE-06 was completely uncovered, and the underlying remains of Dark Age structures in trench XE-06 were partially exposed (Lightfoot and Ivison, 2001).

CHAPTER IV

MATERIAL and METHOD

4.1. Material

A total of 1330 bone fragments were studied from 91 contexts dating from 6th to Post Byzantine centuries. They come from mostly trench XE from the Lower City Enclosure area- trenches XC. As the materials were generally very well preserved and in a sound condition, the bones were routinely washed in water every day after collection and were then left to dry in an open but shaded part of the dig house's garden.

The bones were selected in the field. Some of bones were taken from Amorium to Ankara in 2007 for the further study in the bone laboratory of the British Institute at Ankara (BIA).

In recording, the diagnostic zone system published by Dobney and Rielly (1988) was followed. Featureless fragments were assigned to broader categories 'ox-sized', which potentially includes equids and deer fragments; 'sheep-sized' which may include roe deer, dog/canids, and young pigs; and finally, 'pig-sized', which may include very young cattle and similarly sized animals.

The preservation of the bones is exceptional and fragmentation is low, making them very good study materials. In contrast to the material from Pessinus, the other Roman-Early Byzantine site in the region where animal bones have been studied. There the bones are reported as being very fragmented and badly preserved. Nevertheless, some of the Amorium contexts remained uncertainly dated and several were in fact of such mixed origin that they could not be included in the discussion of animal husbandry scheduling without making specific allowances.

4.2. Method

4.2.1. Species proportions: NISP, MNI, Diagnostic Zones Methods

Quantification is an important part of the analysis of the animal bones samples as we need to transform raw data entries to meaningful counts in order to find an answer to these questions;

- Subsistence- related (what kinds of animals were utilized by occupants of the site, and how did this utilization change through time?)
- What kinds of animals were living in the area surrounding the site at the time that the faunal bone assemblage accumulated, what kinds of changes occurred in the living fauna through the time?) (Grayson D.K., 1984, pp: 16).

4.2.1.1. NISP (Number of Identified Species Proportion)

NISP and MNI are the quantitative techniques most commonly used in zooarchaeological studies. These two units make to measure clear (Lymann, 1994: 100).

NISP is defined as the number of identified specimens, per taxon. The taxon can be a subspecies, species, genus or family. In NISP usually all the identified bone fragments are counted but sometimes restrictions are imposed on which bones to count (Lymann, 1994: 100).

In NISP, even the smallest part of an element ‘count’ as an individual element, rather than a fragment. For example for limb bones, proximal and distal ends were counted separately, generally on the basis of counting articular surfaces. Some researchers will count only the complete bones and any other fragment that could possibly have been fragments of another bone represented by a larger specimen would have been removed. Nevertheless, those fragments usually would be counted into NISP data, but not included in

counts of skeletal elements, whether for body part analysis or for the more refined taxon quantification methods (O'Connor, 2000: 143-144).

The number of identified species (NISP) was used as the standard measure of taxonomic abundance within archaeological faunas. Bones from a given faunal assemblage were identified, numbers of identified specimens per taxon determined, and NISP values used to examine changing taxonomic frequencies through time and across space.

The numbers of identified specimens have been criticized because of;

- The potential interdependence of the units being counted. There is no way of demonstrating which bones and teeth and fragments of bones and teeth came from different individuals across entire faunal assemblages neither which bone fragments may have originated from the same bone. (Grayson D.K., 1984: 23)

4.2.1.2. MNI (Minimum Number of Individual)

MNI is defined as the minimum number of individual animals necessary to account for some analytical specified set of identified faunal specimens. The word 'identified' means that within any 'identified taxon', the abundance of each identified skeletal elements such as; humerus, tibia, thoracic vertebra (Lymann, 1994: 100).

The procedure of the MNI for calculating the rate of each taxon in the sample is as follows: the specimens of the most abundant skeletal element are sorted into left and right side. The higher of the left or right side counts and this number is then considered to be the smallest (minimum) number of individual animals which could account for the sample (O'Connor, 2000: 59).

Many analyses with such a focus use the quantitative unit MNE, or some origin thereof. The term MNE signifies the minimum number of a particular skeletal element or portion of a taxon, such as; the minimum number of bovid proximal humeri or, the minimum number of caprine thoracic sections of the vertebral column. This method depends on the form of data presentation to

make it clear that the MNE values are not necessarily the minimum number of anatomically complete skeletal elements, or some multi- skeletal element portion of a skeleton (Lymann, 1994: 102).

MNE is the minimum number of skeletal portions necessary to account because of;

- Reflecting how and why archaeological faunal remains differ from the set of skeletal element making up a complete skeleton (Lymann, 1994: 102).
- MNE is an analytical unit rather than an observational unit.

Another way of calculating minimum numbers is the MAU. MAU stands for the minimum number of animal units necessary to account for the specimens in a collection. MNI values of both left and right elements and not dividing their sum by two would be more appropriate than deriving MAU values. MAU values can be easily derived from frequencies of left and right elements; simply sum the left and rights, and divide by two (Lyman, 1994: 106).

Some researchers tried to identify left/right pairs of skeletal elements in order to clearly define which bones came from the same individual. Unfortunately, in most animals, the degree of left-right asymmetry within one individual is great enough to make this task very difficult. Because of the different ways used to calculate MNI, there has been lack of clarity about and therefore misuse of, the raw numbers produced in MNI estimation (O'Connor, 2000: 59).

- One of the important drawbacks of the MNI method is that rare taxa are always over estimated. A single specimen attributed to a rare taxon will give an MNI of one, while other taxa with the same MNI might be represented by ten or twenty bones each. Thus, MNI estimates for the rare taxa are over estimated (O'Connor, 2000: 60).
- Use of MNI only in the analysis of body part profiles seems to be mainly the result of concern over the problem of multiple counting of body parts as a result of fragmentation, and occurs in analyses focused on

questions of carcass transport and the nutritional utility of whole body parts (Marshall and Pilgram, 1999:262).

4.2.2. Diagnostic Zones

Using diagnostic zones relies on the principle that a skeletal element can be divided into a number of morphologically distinct zones that can be recorded only as present or absent. These zones, when complete, are by definition non-repeatable elements; i.e. they can be no more than once on a particular bone. Thus each archaeological bone fragment will consist of one or more these zones in a variety of possible combinations. An extremely accurate record of each fragment can therefore be achieved which doesn't rely on subjective estimation of the proportion of whole bone which is represented in that fragment (Dobney and Rielly, 1988: 80).

The system was devised to include all the economically important domestic animals which commonly occur on archaeological sites (cattle, horse, pig and caprines).Obviously the general principles could and should be readily adapted to include carnivores, birds and even fish. A series of drawings was prepared giving standard anatomical views of all major skeletal elements. Each zone is represented by a numerical code and is defined by a precise anatomical description (Figure7 and 8). The lowest numbers usually represent the articular surface of the proximal and the distal ends of the bones (Dobney and Rielly, 1988: 81).

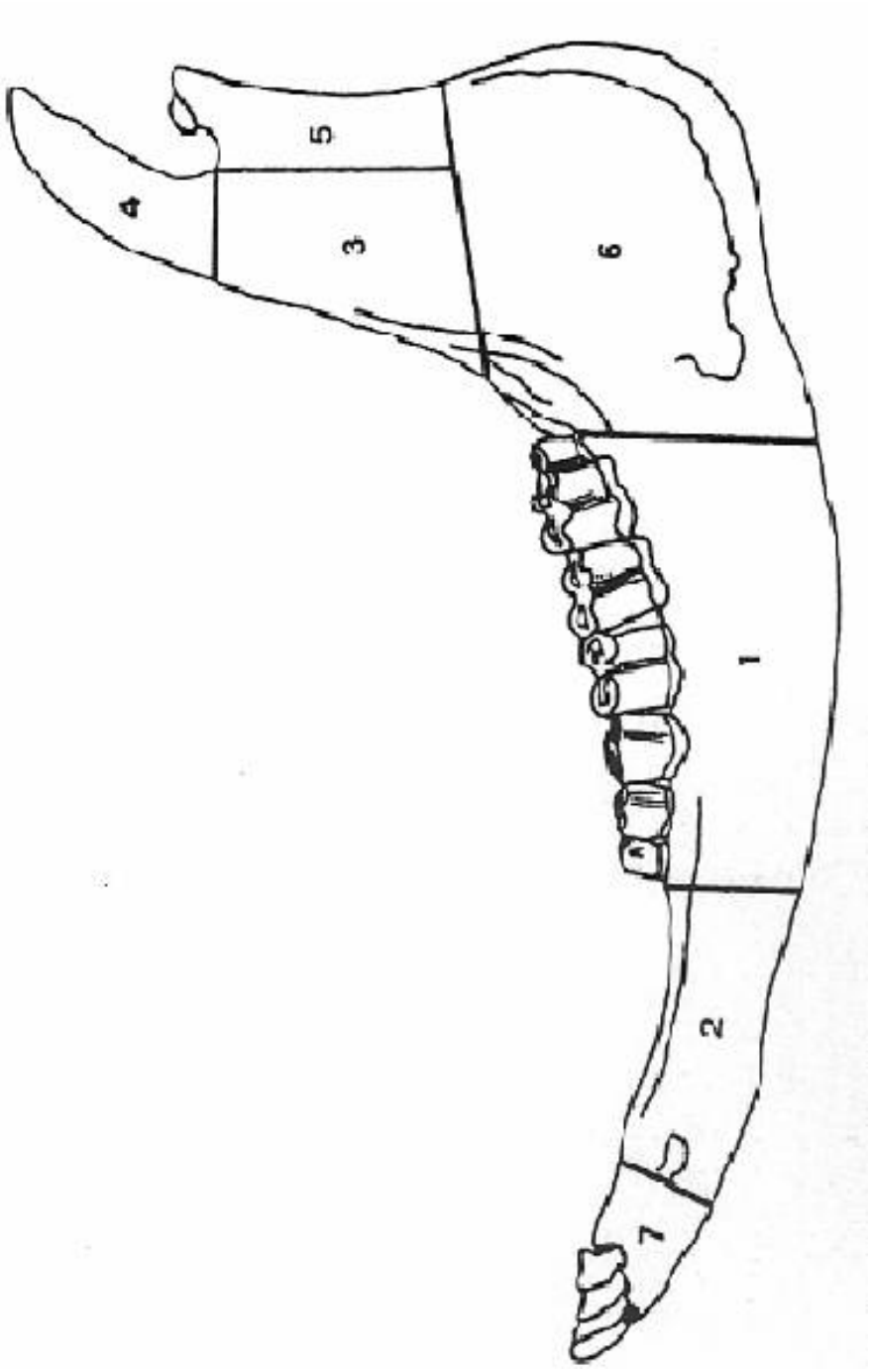


Figure 7: Mandibular Parts

Source: (Dobney and Rielly 1988:85)

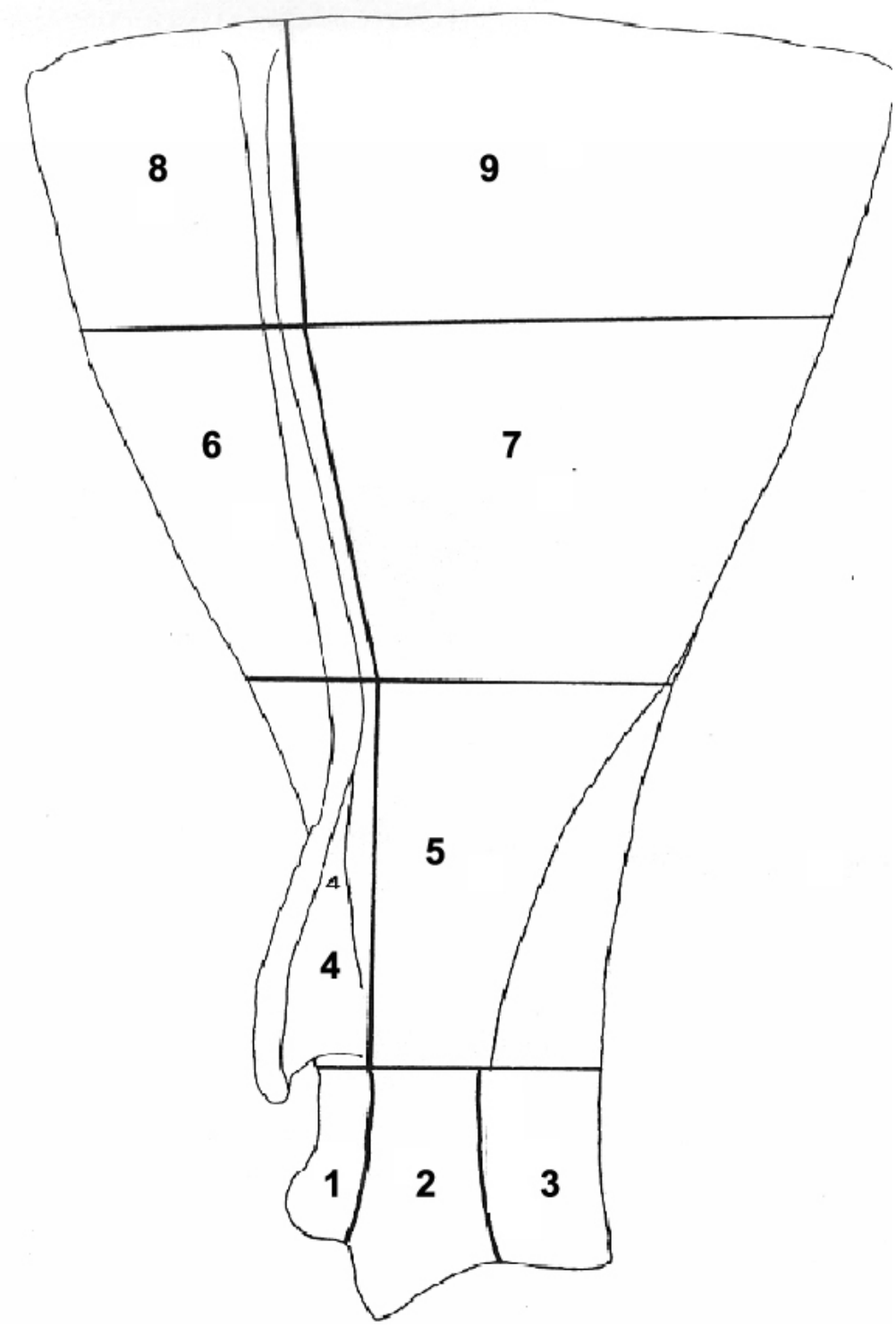


Figure 8: Scapular' Parts

Source: (Dobney and Rielly 1988:84)

4.2.2.1. How the Method is Applied

When the bone fragments had been assigned to species and element, each individual fragment was compared with the appropriate pattern to establish which particular zones were present. Each zone was assessed individually in order to establish whether more than 50% of that zone was present on the specimen (Dobney and Rielly, 1988:81). If more than 50% of that zone is present then it may be regarded as a non- repeatable element. Thus by totaling the frequencies of each zone for element per species, a MNI estimation can be made from the zone most frequently recorded as greater than 50% complete (Dobney and Rielly, 1988: 82).

4.2.2.2. Quantification Problems for All Methods

When calculating the NISP we have encountered some problems. One of these problems is the some species that have more bones in their bodies may be better represented than those which have fewer. For example, in many ungulates, such as, horse, cattle, and sheep, evolutionary changes have fused bones or bones have been lost to produce the characteristic single or double hoof. Such animals have fewer bones than are seen in other animals, for example dogs. To make a valid comparison, data should be adjusted (O'Connor, 2000: 71).

The NISP method is only valid if it is limited to describing the sample recovered from any excavated area, rather than the death assemblage from which it was derived, or the original living community (O'Connor, 2000: 54).

Some elements are more likely to survive than others. Even in animals with similar elements, these are not equally identifiable. Identifiably is a function of both the number of anatomically similar elements and therefore potentially misleading species in an assemblage and the degree of breakage or erosion suffered by each element. For example; because enamel preserves better than bone, animals with teeth have a better chance of being

recovered and identified then do vertebrates without teeth (Reitz and Wing, 2000: 192-193).

Transportation, processing, distribution, consumption and discard mean skeletal portions of carcasses are gradually dispersed over a wide area and a long period of time, only a portion of which is included in the excavation area. Food exchange and preservation are particularly important. Prior to, refrigeration, large quantities of meat had to be quickly distributed, or, preserved, so the meat did not spoil. For this reason, as well as to maintain social cohesion, food exchange is a property of human life. This is particularly likely for large bodied animals, as small animals might be consumed by an individual household. It is for these reasons that the relationship between MNI and NISP and any calculation unit of species proportions and the actual number of individuals used in the excavated activity area or at the site as a whole is unclear (Reitz and Wing, 2000: 197).

4.2.3. Age

The distribution of age at death for each species in the sample can be different to that expected for “natural” attrition of a population of that species (when reasons of death are old age, disease and misadventure) and that difference shows selection by hunters or farmers, and thus human decision-making (O’Connor, 2000:80). Age data can tell much about the economy: hunting capability, the beginnings of domestication and the mode of exploiting livestock. There are two kinds of ageing methods: **a)** epiphysial fusion (juvenile-adult distinction), **b)** dental age-classes (continuous distinction). Epiphysial fusion can occur at different ages; some around birth, most by the end of the juvenile period. It is thus possible to record for an archaeological sample how many specimens of a particular epiphysis were fused to the diaphysis at death and how many were unfused (O’Connor, 2000, pp: 84).

As for, the dental age-classes that tooth eruption and wear is one of the oldest techniques for age determination, and is particularly applicable to

large herbivores (Figure 9). There are established criteria for assigning a given mandible to a particular age class on the basis of dental eruption and the wear pattern on the occlusal (biting) surface. The rate of tooth wear, being a measurement of the age indicating when a tooth passes from one wear stage to the next, is affected by such factors as the coarseness of forage and the amount of sand in the soil.

The state of eruption of the permanent dentition is a useful guide to age at death up to the age at which all permanent teeth are fully erupted (O'Connor, 2000:85). In most mammals full eruption is reached well before the maximum age attained by that species. After full eruption, age at death attribution uses the fact that teeth are constantly being worn down to estimate age by assessing the degree of dental attrition. The degree of attrition can be assessed in two ways;

- Examination of the pattern of dentine exposure produced as the enamel of the occlusal surface is worn away (O'Connor, 2000: 85).

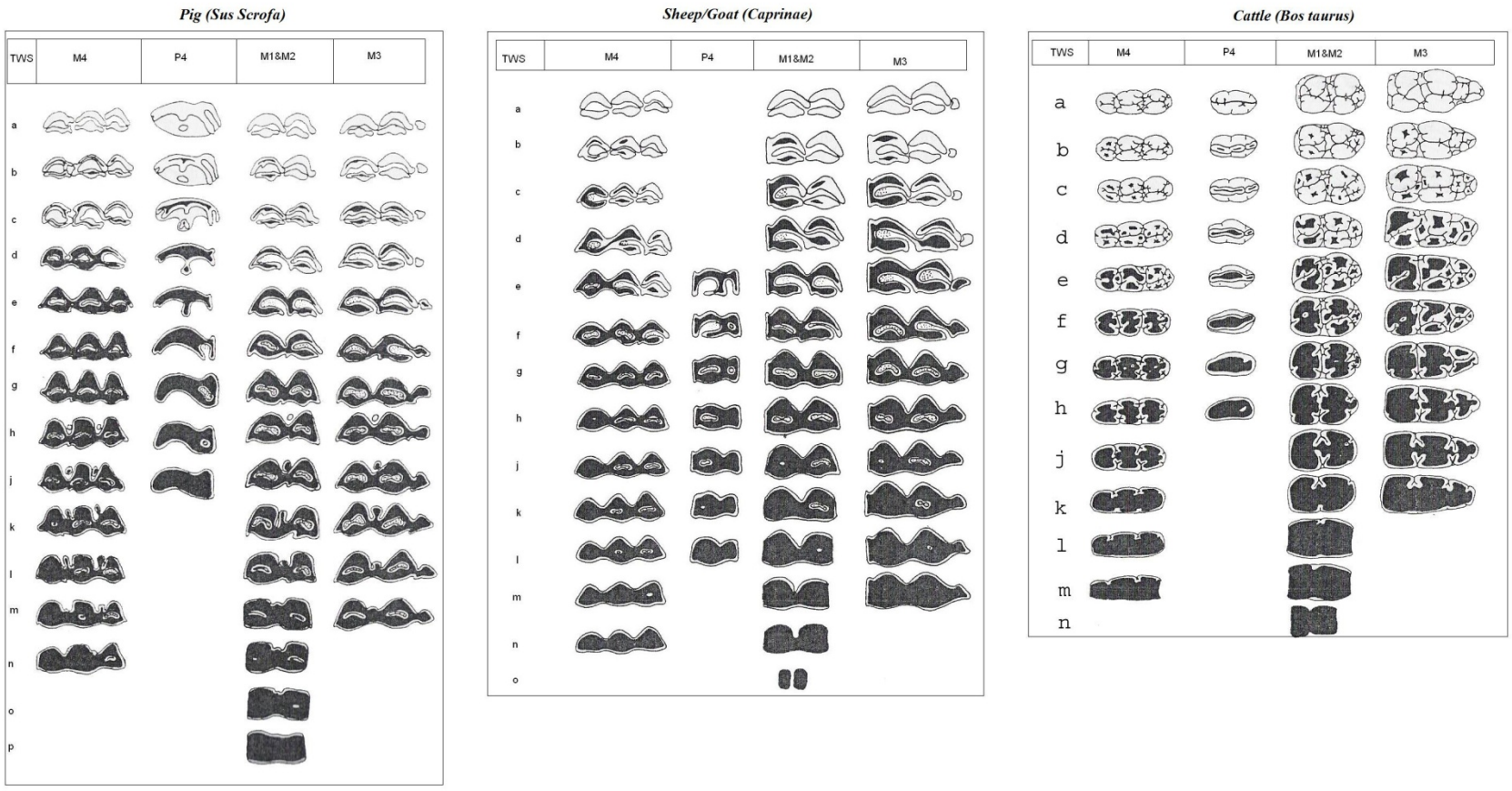
The chief disadvantage is that this attrition reflects the nature of the food eaten, especially the amount of grit consumed when eating, as well as the general nutritional well-being of the animal in question (Reitz and Wing, 2000:162). Deciding whether the tooth had, at death, erupted through alveolar bone of the maxilla or mandible, or decide whether it had grow far enough above the alveolar bone to have reached occlusal surface of the adjacent teeth, is quite important. Physiological process within the individual may affect eruption, or environment circumstances of a population may effect eruption, in all individuals in that population. Although dental eruption and attrition method has some problems, these two methods are both rapid and cheap to record. For these reasons such methods are widely used in archaeology.

- Direct measurement of the height of the tooth, crown height is related to tooth attrition and is used to estimate age at death (Reitz and Wing, 2000: 167).

This method of age estimation for herbivorous animals makes use of dental dimension which varies strongly with age. It is based on the principle

that the height of the tooth crown decreases with age (Davis, 1987). In this method the crown height of a given tooth is measured from the occlusal surface to the crown-root joint down one side of the tooth: this for the buccal (external) side of mandibular teeth and lingual (internal) side of maxillary teeth. Attrition tends to follow a negative exponential course, with rapid wear in young and slow wear in the old. Crown heights indicate the age composition animals killed (Davis, 1987: 43-44). The length of time that a deciduous tooth could be in wear was defined as the period from eruption to replacement by permanent teeth. The corresponding potential wear time for a permanent tooth was defined as the period from eruption to average age at death (Hillson, 1990: 213).

Figure 9: Mandibular tooth wear Stages (Reitz and Wing 2000: 163-165).



4.2.4. Skeletal Representation Tables

The simplest and main reason for quantifying the scale and content of bones samples at the intra-taxon levels is to asses variations in the recovery, and hence the interfered deposition, of different joints or cuts of meat. Different stages in the butchering and utilization of a carcass will generate distinctive debris of bone fragments where some parts of the skeleton are more abundant than others (O'connor, 2003: 143).

Skeletal element is a single complete bone or tooth in the skeleton of an animal. It is also, discrete, natural anatomical unit of a skeleton such as a humerus, tibia, a tooth, or a carpal (Figure: 10). Skeletal elements are anatomical units that may be represented by fragments or by whole bones; that is, skeletal elements may be partially or completely represented, respectively, by specimens (Lymann, 1994:289).

Skeletal representation tables include all animal species and number of each type of skeletal element of that particular animal which then will be compared to the number that these bones occur in a complete skeleton. This exercise will show whether or not we are dealing with complete animal skeletons or selected portions (O'connor, 2000:68).

When human farm or hunt animals, the utilization of the resource involves killing and dismembering the animal, and often involves the selective removal of some parts to a location other than the kill-site. Especially large ungulates, it might be removed carefully and the head and the feet may be left at the kill-site. These parts of the carcasses have very little meat value or fat compared to the shoulders or haunches. Thus, at the kill-sites large number of head and foot bones could be found. On the contrary, the home-base site would have an abundance of limb and griddle bones, and a lack of head and foot bones (O'Connor, 2000:68).

Explore ways that faunal assemblages can be used to interpret general characteristics of urban food systems is very important. Urban areas are characterized by a relatively high degree of productive specialization and the concentration of people who are not directly involved in producing their own food. The food supply system is all of the mechanisms that function to bring

resources into a city from the surrounding hinterland or more distant areas. Age strategies in the urban areas in general, control over production or the development of specialized production to provide meat to urban markets will tend to increase proportion of relatively young animals (Landon, 1997: 51-64).

The feet were more often removed from cattle carcasses by urban butchers, and there is better evidence for the skinning stage of butchery at rural farms. The age in which the slaughtering took place varied only between the urban and rural sites. The relation of an urban area to surrounding hinterland can be addressed partially by examining the movement of animal resource into the city, exploring the links between urban consumption and rural production. Within the city, body part representation, butchery patterns, and seasonal slaughter patterns, can all be used to clarify the operation of food exchange systems (Landon, 1997:51-64).

These issues are basic components of understanding and characterizing the economic basis and functioning of past urban areas (Landon, 1997:51-64).

However, the ways in which cultural processes such as carcass transport, food sharing and food processing, biological properties of bones such as density, and diagenetic process such as leaching and soil compaction influence body- part representation among archaeological faunas can be difficult to separate (Marshall and Pilgram, 1999:261). Bone density data have provided an essential framework for zooarchaeological interpretations of the subsistence activities of ancient populations. In particular, these data have allowed the assessment of the effect of density mediated destruction in shaping the skeletal element profiles of archaeological fauna's assemblages (Lam and et al. 1999: 343).

Body-part representation analysis can be used to address many important questions and the need for specific identification of patterns in body-part representation resulting from different taphonomic process, it is especially important. For this reason the basic quantitative techniques used to describe body-part frequencies are subjected to critical analysis. Quantitative data should contribute to clarity, rather than to the uncertainty

presently adjacent the interpretation of body-part representation from archaeological sites (Marshall and Pilgram, 1999:262).

Some problems will be encountered when constructing skeletal representation tables. The cattle distal humerus with cattle first phalanges cannot be compared directly, because, one individual will have only two distal humeri (one left and one right), but eight first phalanges (one per toe, two toes per foot; four feet) The simplest adjustment is to divide the raw count for a skeletal element by the number of times that element occurs in the skeleton of one individual. Thus eight phalanges with one distal humerus can be compared. For example, a body part analysis for roe deer would take the total number of distal metacarpals, and divide that total by two (two metacarpals per deer). In order to compare that information with wild boar in the same assemblage would need to adjust for the more complex anatomy of the boar foot. Pigs have four metacarpals per foot, two of which (the third and fourth) are very much larger than the others (the second and fifth). In order to obtain data which are directly comparable with those for roe deer, all boar metacarpals are counted and divided by eight. On the other hand, the large third and fourth metacarpals are only counted and the total is divided by four (O'Connor, 2000:68-71).

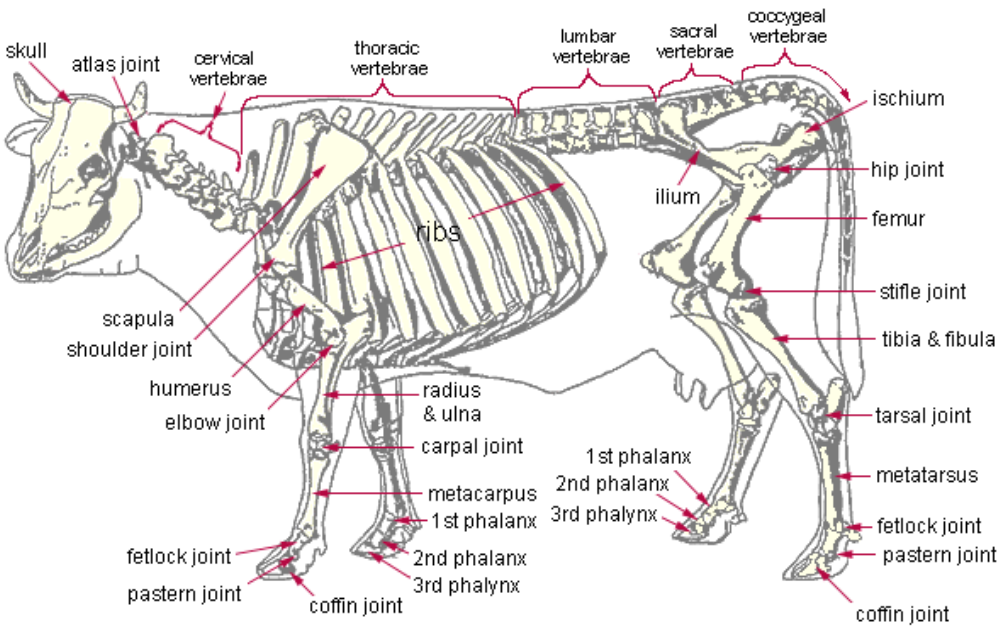


Figure 10: Skeletal Elements of Cattle (McCracken et all, 2006).

CHAPTER V

ANALYSIS and RESULTS

5.1. Amorium's Faunal Analysis

Faunal studies in archaeology are conducted on the assumption that animal bones are sources of information about the diet, technology, economy, and environment of the ancient inhabitants of a site. The goal of most faunal studies, in addition to identifying the species present, is to interpret the relative economic importance of each species (Gilbert et al., 1977: 331).

The study of faunal remains at Amorium began in 2007, and faunal remains for analysis were selected from materials excavated yearly between 2004-2005-2006 and 2007. The material taken from seven (6^{th} -7^{th} century, A.D.838, A.D.838 and after, 9^{th} -11^{th}, 10^{th}-11^{th}, 11^{th} and late and post Byzantine) periods, ranging from the 6^{th}-7^{th} century to post Byzantine periods. Selections of faunal samples from Amorium are involved in procedure. Samples for detailed documentation were taken from selected areas of the site. Since the research questions were directly related to archaeological problems, the archaeological context of the faunal remains was the most important criterion in selecting the samples to be analyzed. The assemblage includes, A.D.838 identifiable bones from the site and an additional 1175 unidentifiable bone fragments. Species percentages calculated on the basis of bone counts show the faunal assemblage to be dominated by sheep/goat (Ovis/Capra, 41.1%), followed, by cattle (*Bos taurus*, 11.3%) and goats (*Capra hircus*, 10.3%). Remains of sheep (*Ovis aries*, 8.6%), pigs (*Sus domestica* 9.3%), dogs (*Canis familaris*, 1.7%), horse (Equus caballus, 3.1%), donkey (Equus asinus,1.7%), cats (*Felis catus*, 0.7%), wolves (*Canis lupus*, 0.5%), camels (Camelus sp., 0.1%), deer

(Cervus sp., 0.4%), rodents (Rodentia indet, 2.7%), birds (Aves, 3.6%), fishes (3.7%), tortoise (0.5%) were also identified.

Table 1: Amorium Fauna: Identified Species

FAUNA	**LATIN NAME**		
A- HERBIVOROUS		**N**	**%**
I. DOMESTIC UNGULATES	Bos taurus	95	11,3
	Ovis aries	72	8.6
	Capra hircus	86	10.3
	Ovis /Capra	344	41.1
	Equus caballus	26	3.1
	Equus asinus	14	1.7
	Canis lupus	4	0,5
	Sus domesticus/scrofa	78	9,3
II. CARNIVOROUS	Canis familiaris	14	1,7
	Felis catus	6	0,7
III. WILD UNGULATES	Cervus sp.	3	0,4
	Camelus sp.	1	0,1
IV. RODENTS	Rodentia indet	23	2,7
	Lepus Europeus	7	0,8
V. BIRDS	Aves	30	3,6
VI. FISHES		31	3,7
VII. TURTLES		4	0,5
	Total	**A.D.838**	**100**

Table 2: Amorium Fauna: Unidentified Species

Size of Species	N	%
Ox Size (OS)	223	19,0
Sheep Size (SS)	848	72,2
Pig Size (PS)	56	4,8
Bird Size (BS)	48	4,1
Total	**1175**	**100,0**

5.2. Age Determination

There are a variety of techniques for the determination of age at death of animals derived from archaeological contexts, including epiphyseal fusion, closure of cranial sutures, tooth growth and replacement sequences, tooth wear, incremental structures and antler and horn development. Mandibular tooth wear and eruption sequences have highest probability for withstanding the various forces of destruction and would be the most accurate measure of age- death for animals (Greenfield and et al., 2007: 839).

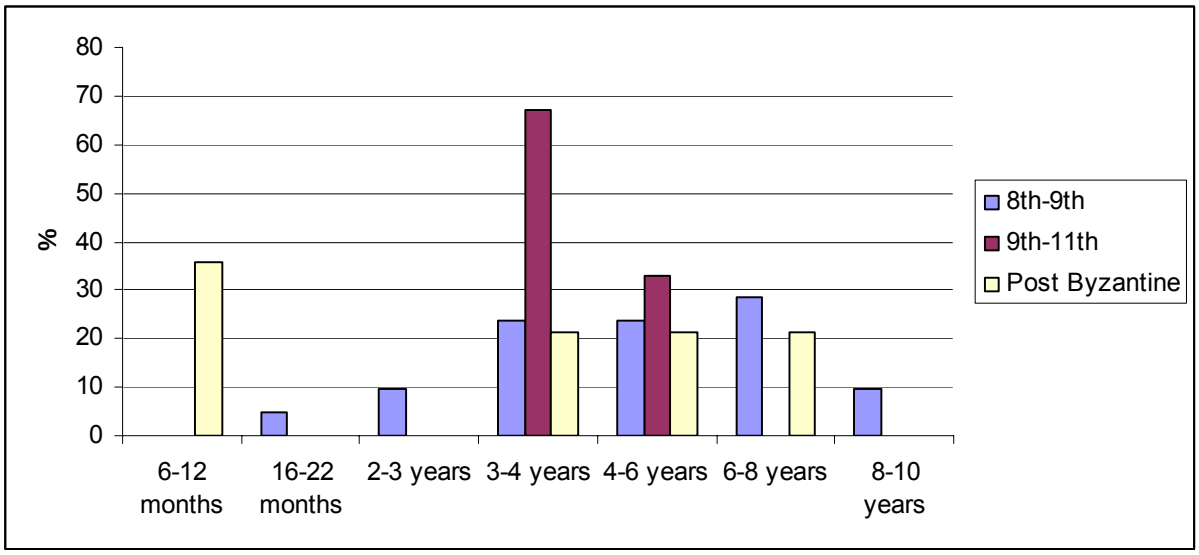
For this study the remains of three economically important domesticated taxa from the Amorium were examined; caprines (*Capra* and *Ovis*), cattle (*Bos*), and pigs (*Sus*). Remains are grouped as infant, juvenile, subadult and, adult. Grant's system (Grant, A., 1982), which is commonly used in zooarchaeological research, was based on material from British archaeology context. On the contrary, Payne's system (Payne, S., 1987) was originally based on archaeology from Turkey. Because of this reason Payne's system is used for this study. In addition, for the age determination only mandibular teeth are used.

Although 140 mandibles were studied, we can use 121 mandibles. Because only 121 remains were dated by archaeologists, the rest of the mandibles could not use for this studying. 18 mandibles could not be aged.

When we evaluate ageing studies; for the 6th-8thcenturies, there is only one adult sheep. There are twenty-one individuals sheep found in the 8th -9th century assemblage, all of which are adults. There are only three sheep represented in 9th-11th periods, all of them are aged as adults. As for the assemblage of Post Byzantine time; there are fourteen individuals represented in this period. Five of them are juveniles, and nine are adults. In addition, there is not any young sheep, except for the Post Byzantine period. There are five juvenile sheep in this period. According to table; there are thirty-nine sheep in our assemblages for all periods.

Table 3: Ageing of Sheep

Sheep	**6th-8th**		**8th-9th**		**9th-11th**		**Post Byzantine**	
	N	%	N	%	N	%	N	%
6-12 months	-	-	-	-	-	-	5	35,7
16-22 months	-	-	1	4,8	-	-	-	-
2-3 years	-	-	2	9,5	-	-	-	-
3-4 years	-	-	5	23,8	2	67	3	21,4
4-6 years	-	-	5	23,8	1	33	3	21,4
6-8 years	-	-	6	28,6	-	-	3	21,4
8-10 years	1	100	2	9,5	-	-	-	-
Total	**1**	**100**	**21**	**100**	**3**	**100**	**14**	**100**

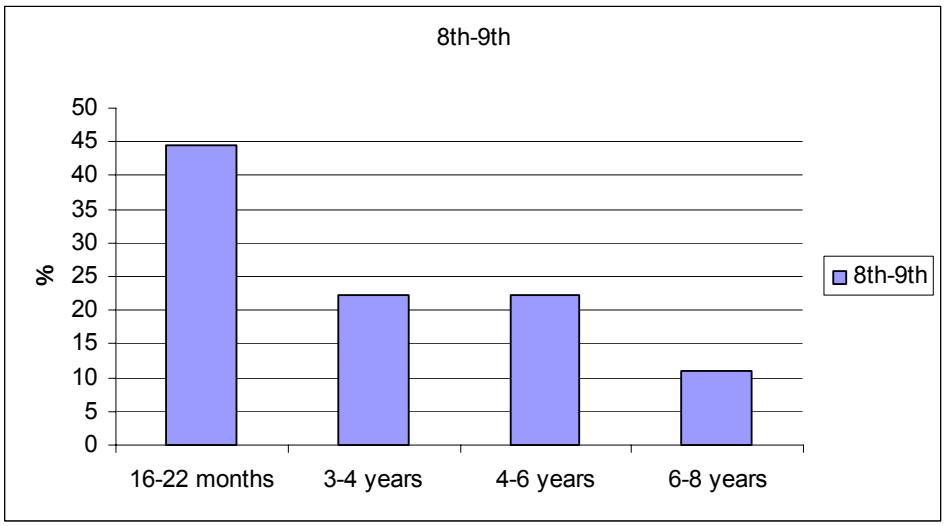


Graph 1: Sheep's age proportions

In 6th-8th centuries there is one adult goat. As for the assemblages, of 8th-9th century there are nine individuals in total. Five of the goats are adult and four are juvenile. As is shown in the table; adult and juvenile individuals are represented in almost equal numbers for the four periods. However, when we evaluated as a percentage, the 8th -9th periods is characterized by juvenile one. There are twelve individuals during all periods.

Table 4: Ageing of Goat

Goat	6th-8th		8th-9th		9th-11th		Post Byzantine	
	N	%	N	%	N	%	N	%
16-22 months	-	-	4	44,4	-	-	1	100
3-4 years	1	100	2	22,2	-	-	-	-
4-6 years	-	-	2	22,2	-	-	-	-
6-8 years	-	-	1	11,1	1	100	-	-
Total	***1***	***100***	***9***	***100***	***1***	***100***	***1***	***100***

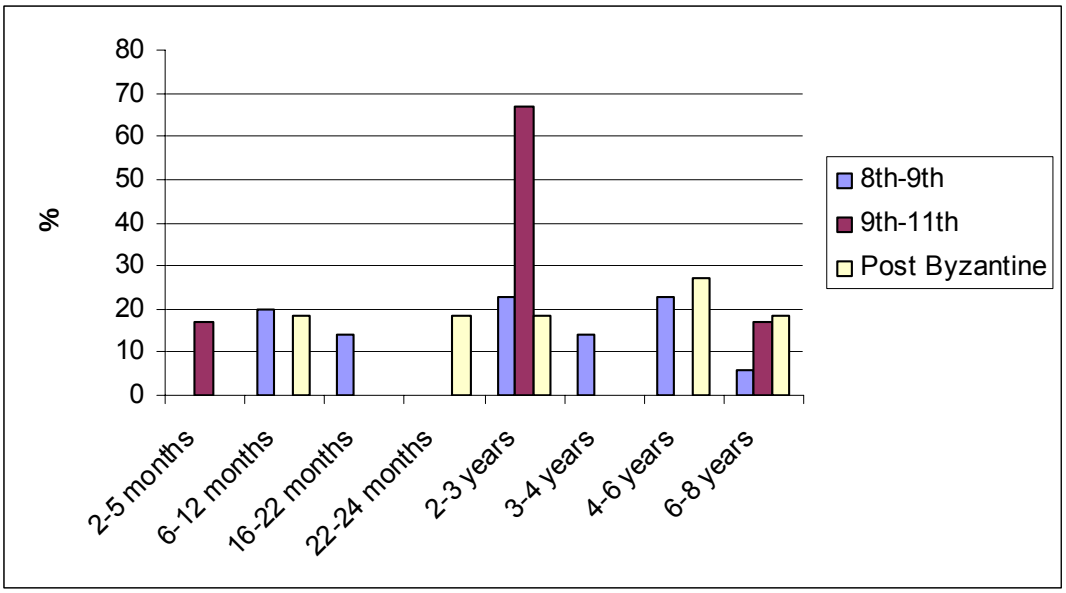


Graph 2: Goat's age proportions

For the assemblage of 8th-9th centuries there are thirty-five individuals aged. Although, this period is represented by adults, the juvenile group is not underestimated. In 9th-11th period, there are six sheep-goats represented. Five of them are adult, and one is juvenile in this period. As for the post Byzantine period there are eleven individuals in total, seven of adult, two of sub-adult and two of are juvenile. The total number of sheep-goat is fifty-three; sheep-goat is the most common category in our assemblage.

Table 5: Ageing of Sheep-Goat

Sheep-Goat	6th-8th		8th-9th		9th-11th		Post Byzantine	
	N	%	N	%	N	%	N	%
2-5 months	-	-	-	-	1	17	-	-
6-12 months	-	-	7	20	-	-	2	18,2
16-22 months	-	-	5	14,3	-	-	-	-
22-24 months	-	-	-	-	-	-	2	18,2
2-3 years	-	-	8	22,9	4	67	2	18,2
3-4 years	-	-	5	14,3	-	-	-	-
4-6 years	-	-	8	22,9	-	-	3	27,3
6-8 years	1	100	2	5,7	1	17	2	18,2
Total	***1***	***100***	***35***	***100***	***6***	***100***	***11***	***100***

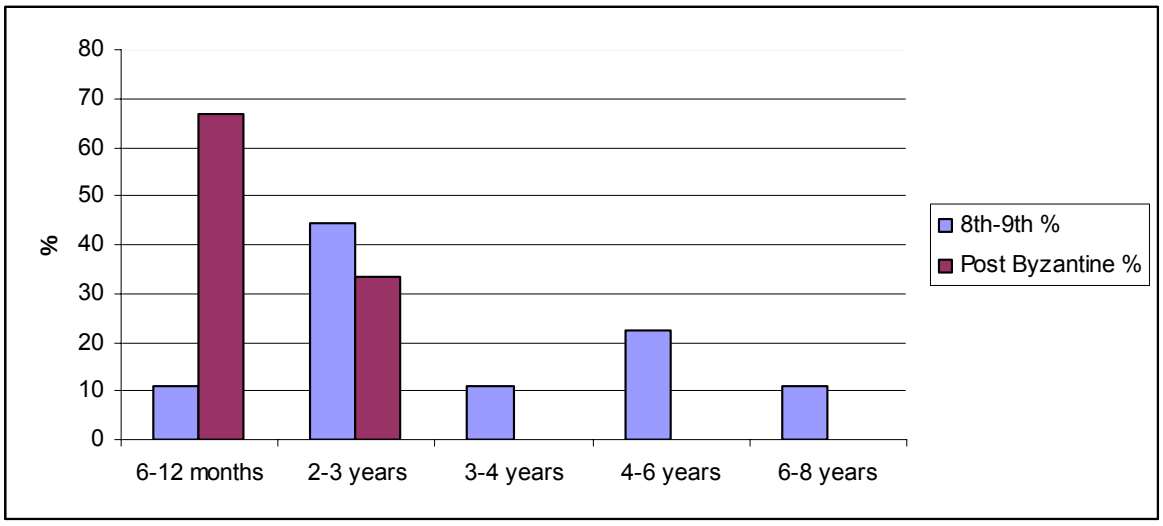


Graph 3: Sheep-Goat's Age Proportions

Finally the twelve pig mandibles are aged in the assemblages. In 8th-9th century there are nine individuals, four of adults, one juvenile and four sub-adults. In the post-Byzantine period there are three pigs represented and all them are aged as a juveniles.

Table 6: Ageing of Pig

Pig	6th-8th		8th-9th		9th-11th		Post Byzantine	
	N	%	N	%	N	%	N	%
6-12 months	-	-	1	11	-	-	2	66,7
2-3 years	-	-	4	44,4	-	-	1	33,3
3-4 years	-	-	1	11	-	-	-	-
4-6 years	-	-	2	22,2	-	-	-	-
6-8 years	-	-	1	11	-	-	-	-
Total	**-**	**-**	***9***	***100***	**-**	**-**	***3***	***100***



Graph 4: Pig's Age Proportions

Cattle are fairly rare in the assemblage and do not merit detailed analysis here. Nevertheless, the remains of one adult cattle from the 8th- 9th century are aged as an adult.

5.3. Subsistence Economy

As towns grew from Byzantine times onwards the economic organization of Anatolia began to change. The increasing urban population had to be sustained with crops and livestock from the surrounding countryside. Unlike a village, a town, with its middle class, cannot sustain itself. Zooarchaeological data from urban sites may provide 'mirror- images' of data from contexts as those animals eaten (Davis, 1987: 158).

During the 6th -7th century, while sheep NISP is 4.2% and MNI is 14.3%of the assemblage, for the goats NISP is 50% and MNI is 42.9%, Ovis/Capra NISP 8.3%, MNI 28.6%, and pig NISP is 2.1% and MNI 14.3% the faunal assemblages in the 6th -7th century characterized by more emphasis on goats. The proportion of goats shows about 42.9% by MNI and

50% by NISP of identified species in 6th -7th century. In addition cattle are not found in this period.

In the assemblages, from A.D. A.D.838, the proportion of the sheep is NISP 33.3% and MNI 34.3%, goats NISP is 17.0 % and MNI 18.6%, Ovis/Capra NISP is 34.6% and MNI 31.4%, cattle NISP is 7.2% and MNI 8.6% and pigs NISP is 7.8% and MNI 7.1%. The most common species in this period are both sheep and Ovis/capra. While the proportions of the sheep, ovicaprids, cattle and pigs are increasing, the goat's proportion is decreasing when we compare the 6th-7th century with A.D.838.

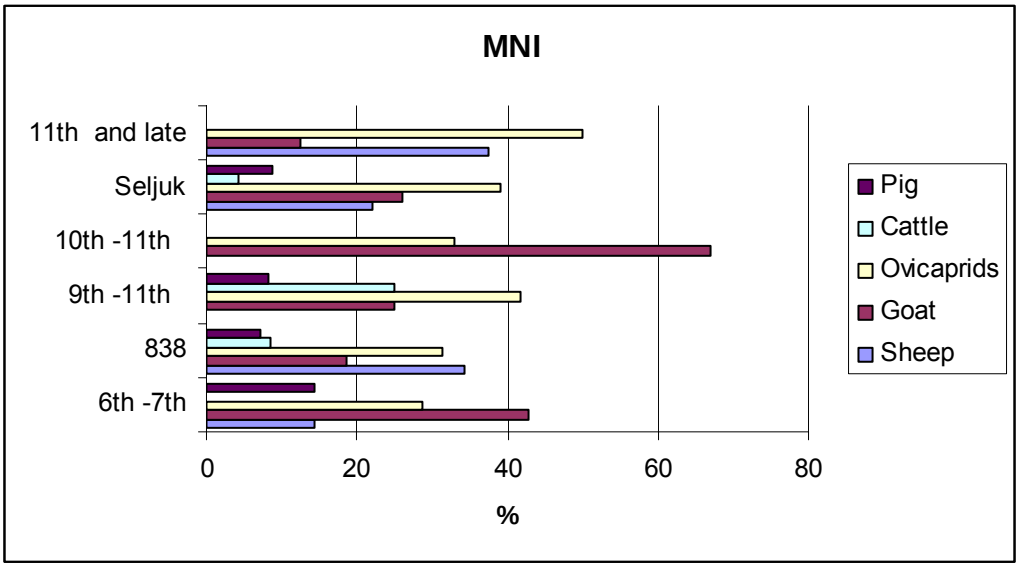
In the 9th-11th century materials; goat NISP is 13.0% and MNI 25.0%, O/C NISP 78.3% and MNI is 41.7%, cattle NISP is 4.3% and MNI is 25.0%, pig NISP is 4.3% and MNI 8.3%. The characteristic species of this period is again O/C. However; a remarkable point sheep is that disappears in this period. When we compare with the proportions of the A.D. A.D.838 assemblage; there is not very striking changes for goats, cattle and pigs. On the other hand; there is an increase for the O/C's proportion. On the contrary, compared with the 6th -7th century sheep, goat and O/c proportions are decreasing, but cattle and pigs' proportions increased.

Table7: Economy Among Periods.

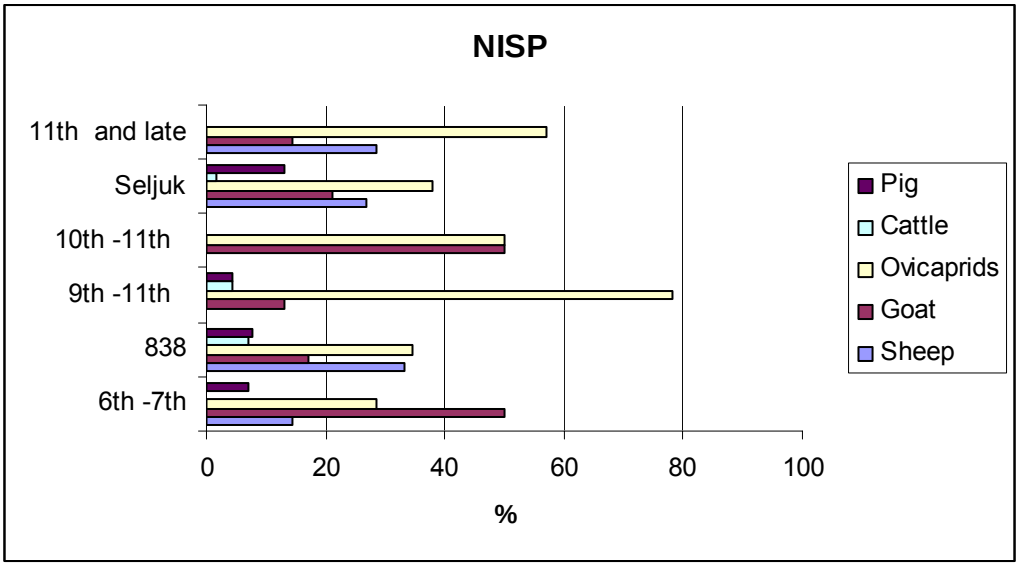
Species	*6th -7th*				*A.D.838*				*9th -11th*			
	NISP		**MNI**		**NISP**		**MNI**		**NISP**		**MNI**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Sheep	2	14,3	1	14,3	51	33,3	24	34,3	0	0,0	0	0,0
Goat	7	50	3	42,9	26	17,0	13	18,6	3	13,0	3	25,0
Ovicaprids	4	28,6	2	28,6	53	34,6	22	31,4	18	78,3	5	41,7
Cattle	0	0	0	0	11	7,2	6	8,6	1	4,3	3	25,0
Pig	1	7,1	1	14,3	12	7,8	5	7,1	1	4,3	1	8,3
Total	14	100	7	100	153	100	70	100	23	100	12	100

Species	*10th -11th*				*Seljuk*				*11th and late*			
	NISP		**MNI**		**NISP**		**MNI**		**NISP**		**MNI**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Sheep	0	0	0	0	15	27	5	22	4	28,6	3	37,5
Goat	2	50	2	67	12	21	6	26	2	14,3	1	12,5
Ovicaprids	2	50	1	33	21	38	9	39	8	57,1	4	50
Cattle	0	0	0	0	1	1,8	1	4,3	0	0	0	0
Pig	0	0	0	0	7	13	2	8,7	0	0	0	0
Total	4	100	3	100	56	100	23	100	14	100	8	100

In the assemblages from 10th-11th century, the proportion of goat NISP is 50 % and MNI is 67% and O/C NISP is 50% and MNI 33%. In this period the absence of sheep, cattle and pigs is notable. Although, the cattle are not found also during 6th-7th century, sheep and pigs are encountered throughout every period.



Graph 5: Species Proportions of MNI



Graph 6: Species Proportions of NISP

During the Seljuk period; sheep NISP is 27% and MNI is 22%, goat NISP is 12 and MNI is 26%, O/C NISP is 38% and MNI is 39%, cattle NISP is 1.8% and MNI is 4.3%, and finally pig NISP is 13% and MNI is 8.7%. Compared to the preceding period, while in the 10^{th} -11^{th} century assemblage

there were not any sheep, cattle and pigs, the numbers of those animal bones increased during the Seljuk period. The increase in the numbers of sheep and pig bones in particular are immediately apparent.

Finally, when we examine the assemblage from the 11th century and later, the proportions of sheep NISP is 28.6% and MNI is 37.5%, goat NISP14.3 is % and MNI is 12.5%, and O/C NIPS is 57.1% and MNI is 50%. In this period again cattle and pigs vanished. The number of cattle, sheep and pigs proportion is fluctuating in those three periods

5.4. Spatial Analysis Table

5.4.1. Street

Two streets are represented in the spatial analysis table. When we evaluate alteration between the number of o/c bones from streets during A.D. A.D.838 and after and the 9th -11th centuries, a big difference is observed. The number of o/c from A.D. A.D.838 street is remarkable. While the A.D.A.D.838 and after's street has 61 o/c, the street, from 9th -11th century, has only four o/c. Although o/c is frequently preferred in all periods, some contexts do not have any sample of o/c. It is important to find very high number of o/c in this place, because this may indicate that this was a rubbish area for the Ancient Amorium inhabitants. The residents may have been throwing their garbage into the street. In addition the A.D. A.D.838 street has different species such as goat, pig, ox, deer and rodents. (see Table20).

5.4.2. Destruction Layer

There are two destruction layer areas presented in the table below. The destruction layer from, the A.D. A.D.838 and after and the 9th -11th centuries have some similarities and differences. The numbers of sheep, goat and pig's bone are significantly different in two areas. The A.D.A.D.838 destruction layer has higher number of sheep, goat and pig than 9th -11th

century. The numbers of wild species are approximately same between two areas. The destruction layer can be described as a collapsed places structure, perhaps a room, shed or some part of building (see Table20).

5.4.3. Fill

The fill area is transported soil. This soil may have been accumulated from elsewhere by environmental processes (wind, rain, river and tectonics activities). Three fill areas are shown. There are not very remarkable differences between the fill areas. While the ox from the A.D. A.D.838 and after and the 9th -11th century is absent, there are small numbers during the 11th and later period. Because it is unclear whether the bones were *in-situ* (deposited) or were moved with the fill, it is difficult to be sure those bones were deposited by the inhabitants of Amorium inhabitants (see Table20).

5.4.4. Pit

The pit area may be defined as a garbage hole. Because pit areas have both large number of bones and different types of species, those areas are very important in archaeologically. However, large numbers of bones are not found in the pit area. There are two pit areas are shown, from A.D. A.D.838 and after and the 10th- 11th centuries. Although there are not big differences between the two periods of pits, there are some minor differences worth mentioning. While the pit from A.D. A.D.838 and after has sheep, sheep is not found in the 10th -11th century deposits. In addition the numbers of o/c also differ from A.D.838 and after and 10th -11th centuries (see Table20).

CHAPTER VI

DISCUSSION

6.1. Fauna

The majority of the remains come from domestic species, whether these are food or working animals. Bones of domesticates are dominant throughout the occupation of the site and comprise 85, 3% of the total numbers of identified fragments. Sheep, goats and cattle are the most common species in the sample. Deer, cattle and wolves are relatively common among the wild taxa. According to Amorium's faunal table Sheep/Goat is the most common domestic, followed closely by cattle, sheep and goats. Domestic animals are kept for many purposes, in most small-scale pastoral economies. Sheep and goats can provide milk, wool, horns, skins, and meat. Those highest numbers can indicate that Ancient Byzantine city of Amorium's inhabitants not only consumed sheep and goats but they may practiced also animal husbandry.

The second most common remains are cattle. Cattle probably became more important for traction and the contribution of cattle meat to the diet became greater, and which is probably related to the higher cattle ratio (*Bos taurus*, 11.3%). Because the cattle could not be raised at the backyard of the house, (not like pigs or chicken), they needed more area for grazing. In addition, the contribution of cattle meat to the diet has some difficulties. The slaughter process is more difficult than that of smaller ruminants.

Pigs are represented in very high numbers and they would seem to have made a large contribution to the diet of the inhabitants. Pigs can either be raised in the backyard, or they may also be hunted from the forest. However, there are not wild pigs in the assemblage so the Amorium inhabitants bred stock.

Donkey and horse bones are also found at Amorium. Both donkeys and horses were used for transport. While horses were used for long distance travel, the donkeys probably were probably used for shorter trips, and carried heavier loads than horses.

The dogs and cats were likely kept as pets. The dogs could also be kept as a working animal such as for guarding and hunting. The bones of wild animals that would not have been consumed were also recovered; this is the case of wolf. This might have been killed for its fur, but such predator would also have been hunted because wolf was considered a hazard to domestic animals.

Hunting appears to have played a very minor role in the accumulation of Amorium fauna, but the assemblage is diverse enough to include the occasional remains of birds, deer, fish, and rabbits. These animals would have provided an occasional variation to the diet rather than a regular supply of meat. The most commonly collected wild fauna; is fish followed by hares which are represented by only a few remains. Nevertheless, the small size of those animals may have caused it's under-representation in the assemblages. It is likely that fish, hares as well as birds were exploited more frequently than the record indicates. In addition, fish remains found in the church courtyard area may reflect religious exercise. When we take into consideration Byzantine religious activities and the location of the fish remains, the large numbers of fish bones can be readily associated with religious practices.

Wolf, deer, rabbits, and pigs prefer a landscape that still retained some woodland cover. Nevertheless, none of these species requires thick forests.

Rodents bones are found in the Amorium assemblage. However the rodent remains could not be identified to species.

6. 2. Ageing

Domestic animals are slaughtered either when it is no longer economical to keep them alive or when the maximum yield is expected by killing the animal and selling the products. When meat is the primary goal of

animal keeping, individuals may be slaughtered relatively young as soon as growth has begun to slow significantly, because as the animal approaches this adult size weight is not added as quickly. Animals used for their wool and hair may be kept until old age. If milk is important as a product, male animals may be killed quite young (Hongo H., 1997 and Payne, S., 1973). Also, animals of certain age groups might have been exported and thus contributed to the site's economy in different form than primary or secondary animal products.

The ageing pattern of Amorium is compared to other contemporaneous Anatolian sites; Sagalassos (De Cupere, 2001) and Pessinus (Devreker, J., 2003).

The ancient ruins of Sagalassos are situated 7 km from the town of Ağlasun in the province of Burdur. The city lies on Mount Akdağ, a spur of the Western Toros range. Human settlement in the area goes back to 12,000 BC, and Sagalassos itself reveal traces of settlement going back to 3000 B.C. (De Cupere, 2001). In antiquity, Sagalassos was a one of the cities of Pisidia. From 25 BC, Pisidia and thus Sagalassos were part of the Roman provincial of Galatia, which caused important changes in the region as the Romans assumed direct government (Vandeput, 1997).

Pessinus is situated centrally on the Anatolian plateau, about 150 km southwest of the Turkish capital Ankara. A major part of the ancient city is situated below the sleepy village of Ballıhisar. The nearest city is Sivrihisar. Ballıhisar lies in the valley of the Gallos with its many springs that in spring carries large volumes of water to the Sakarya (Sangarios) to the south (Devreker, J., 2003).

On the plateau mainly grain crops are grown, while in the valleys there are also pastures and orchards. Shepherds take their large flocks of sheep to the heavily grazed hills. Ballıhisar is a traditional agricultural village, with whitewashed farmhouses and a market place in its centre. At dawn and dusk the village is overrun by flocks of sheep which take turns at the well (Devreker, J., 2003).

6.2.1. Sheep - Sheep/Goat

Sheep played a major role throughout the history and zooarchaeological data indicate that sheep were also of major importance during Byzantine periods. Sheep can be kept and used for a wide variety of purpose including meat, milk and or wool, ageing data may provide information on the use.

This tooth eruption and wear study includes of total of 38 sheep and 49 o/c. These two species are the most common species in the sample. Most of the slaughter of sheep took place between 3-4 years for all periods but slaughter at 4-6 years is also common in all periods. In the sheep assemblage there are many more adults rather than young and far fewer juvenile-subadults. According to Payne's model; if meat production is the aim, most of the young males are killed when they reach optimum point in weight-gain, only a few being kept for breeding. If the animal is killed in second or third year, lamb meat often commands a higher price, and thus gives the farmer a better financial return. If milk production is the sole aim; the lamb's surplus to breeding stock requirements are killed as soon as the yield of milk is not endangered. Finally if wool production is the aim, the strategies is different, and emphasis shift to the adult animal. As the quality of wool is given by older animals fall off, adults may be killed rather younger (Payne, S., 1973:281). A relatively high proportion of the animals appear to have been killed between 3 and 6 years old, when in most terms it makes least sense to kill sheep or goats, and when they are not particularly prone to accident. It is possible that this reflects a concentration on the production of high-grade wool in ancient Amorium.

For sheep- goats at Sagalassos; the ovicaprines were slaughtered at an old age. About 4% was slaughtered at an age younger than 1 year and more than 50% at an old age than 4 years (De Cupere, 2001:144). When we examine on the Amorium ovicaprines; 37% are younger than 1 year and more than 81.1% at an older than 4 years. Thus, the age for the ovicaprines shows similarities between two Byzantine cities.

The opposite is observed in the case of Pessinus in that no cattle or ovicaprine juvenile and sub-adult animals were found there. That situation is quite extraordinary and it may be explained by bad preservation conditions or a recovery bias in Pessinus assemblages. Nevertheless, many fish and small animal remains were recovered, so the latter explanation may not be valid.

6.2.2. Pig

The pig's role is especially significant because pork is a valued source of protein. In addition pigs are also beneficial in helping to keep residential areas clean by eating feces and garbage. In addition, pigs are easily raised in the backyard. Unlike cattle and sheep which can be kept for a variety of secondary products including milk, wool and traction, pigs may be raised primarily for their meat. The kill-pattern of total of 12 pigs is consisted in all periods. There are different age groups in our assemblages however; the younger individuals are more common than the older. The pig herd maybe managed for a regular supply of meat, therefore the faunal record should show an age profile dominated by young individuals. The different age group may reflect a different purpose of pig husbandry. This may reflect the raising of the pigs. Young pigs may be selected for a supply of meat; we expect the age profile dominated by young individuals, given that these produce more efficient weight gains than older pigs. Among modern domestic pigs are that young pigs weighing up to 50 kg have the best food conversion efficiency, and that declines significantly among animals 70 kg or more (English et al.1988:380). Older pigs may be selected for reproduction.

Age profile of pigs at Sagalassos; indicates that almost 50% of the consumed animals did not exceed the age of one year, less than 20% was older than two years. It may reflect typical uses pattern of Roman sites where the pigs were kept for their meat (De Cupere, 2001:143). Amorium pig's age profile show that almost 66.7% younger than 1 year and 44.2% older than two years. When we compare both sites; there are similarities the pig age profiles.

Preserved fragments of teeth rows from pigs at Pessinus suggested that most of these animals were killed before they were two years old. Thus we can estimate the pigs have less importance than cattle and small findings.

6.2.3. Goat

While the vast majority of identifiable ruminant bones were those of sheep, small numbers of goat bones were identified in all periods. All of the goat remains are aged as adult and subadult. Sheep bones outnumber goat remains. At the rural sites, goats may have been sources of meat, milk and hair, but the samples of goat bones are too small to provide the detailed consumption patterns information that is necessary to document these other uses. The goats are also important for the production of milk. Another product of goat is their hair; this was annually cut and used to make, among others, clothes.

6.2.4. Cattle

Cattle are multi-purpose animals that can be kept for meat, milk and traction. The cattle remains were very few in number and do not provide useful information. Nevertheless, there is only one adult individual in here.

The slaughtering pattern indicated that the cattle were consumed at old age at Sagalassos. Cattle were not only kept for their meat but were also important other reasons. Cattle provided milk and were used for hard labor in tillage and transport (De Cupere, 2001:144). In addition cattle were slaughtered at an adult age at Pessinus. For the working animals like cattle, it was logical to have them slaughtered at an old age.

6.3. Subsistence Economy

Sheep & Goats and Sheep/Goat: Although husbandry may play an important economic role in Anatolia, there is a considerable time discrepancy for the sheep remains. Sheep remains can be found throughout all the time periods, however 9th -11th, 10th -11th centuries sheep bones remains are not detected. The highest proportion is in A.D.838 periods (NISP 33.3%, MNI 34.3%), followed closely by 11th and late (NISP 28.6%, MNI 37.5%), and Seljuk (NISP 27%, MNI 22%). The lesser proportion belongs to 6th -7th (NISP 4.2%, MNI 14.3%). Sheep and goats are useful for multiple products; wool, meat, milk and dung so; they are involved in the diet. Sheep meat, wool and other secondary products are also economically important. The absence of sheep for some periods is very thought-provoking. Because sheep bones may be found every place where the people state of existence, the reason of this absence may be explained by archaeologist's space selection.

The highest proportion of goat is in the 6th -7th centuries (*NISP 50%, MNI 42, 9%)* and goat is the most common species for this period. Goats have similar economic importance as sheep apart from the provision of wool. When we consider this period, the inhabitants preferred goats habitually. During 10th-11th goat's ratio is notable, (*NISP, 50%, MNI 67%).* Although those two time periods are not close each other, there are some similarities in consumption preference between the slaughter proportion is 11thand late.

Bone counts show the faunal assemblage to be dominated by sheep/goat (Ovis/Capra). The reason for this is the economic importance of those species, but also that the category includes two different species. The faunal assemblage in 9th – 11th centuries is characterized by more emphasis on the sheep/goat (NISP 78.3%, MNI 41.7%). When we compare other periods there are not very remarkable changes during 10th- 11th and 11th and late. However, there is remarkable decrease in frequency during the A.D. A.D.838 and Seljuk periods. The lesser proportion is in the 6th-7th centuries. Although there are large numbers of goats in this period, sheep and ovis/capra number are much less.

The production of wool from Sagalassos, must have been most important reason for keeping sheep until old age. Wool must take important place in Sagalassos' economy. Although sheep were relatively less abundant than goats, their importance should not be ignored (De Cupere, 2001).

Cattle: Cattle may used not only for traction, but are also exploited for both milk and meat. The faunal assemblage in 9^{th}–11^{th} centuries is characterized by more emphasis on (MNI 25%) cattle compared to the A.D. A.D.838 and Seljuk components. The proportion of cattle indicates that the butchery and cooking methods may have changed by the Seljuk period. Cattle probably became more important for traction and also the contribution of cattle to the diet became greater. As for the other periods; cattle bone remains are found in 6^{th}-7^{th}, 10^{th} -11^{th}, and 11^{th} and late.

Pig: The faunal assemblage of the Seljuk period is also characterized by a marked decrease of pigs. Pig bones, account for about 13%of the NIPS and, 8.7%of the MNI, of the identified fragments which is more common than in earlier periods. Pigs were intensively exploited for their meat. The ethnic and religious affiliations of the population in Amorium during the Seljuk period are still unknown, and the presence of pigs might indicate that the process of Islamization was gradual one or that a Christian population was present at the site (Hongo H., 1997).

Pigs are mainly meat providers, as has been indicated by their slaughter age. Most pigs were consumed young age at Sagalassos. Pig breeders sold animals that were not necessary for further breeding. As the remains of adult animals are lacking at Sagalassos, the tougher meat of old animals was probably consumed at the production sites and not sold in town (De Cupere, 2001).

6.4. Spatial Analysis

6.4.1. Spatial Evaluation Table within Contexts

The evaluation of spatial unit consists of three steps;

1. The animal bones separated according to their species,
2. Identified species were grouped by spatial units and centuries
3. All organized groups are evaluated according to their centuries, number of bones and their spatial units

Studying these animal bones gives us information about, life style of people inhabiting Amorium, habitation of diet and relationship between human and animals.

Table 8: Spatial Evaluation Table from Dump Area

CONTEXT	Date	Units	Sheep	S/G	Goat	Pig	Ox	Bird	Fish	TOTAL
AM XE 05 60	6-7century	**Dump**	2	16	7	1	2	1	1	**30**

Thirty animal bones were found in the 6-7th dump, most of which are sheep or goat. Pig, ox, bird, and fish are also in this dump. In light of that information, the 6-7th century dietary habit mostly depends on a sheep and goats. Because, the fragments of pig, fish and ox are relatively fewer than sheep/goat, they were probably not consumed systematically. Although there were very few fragments of these, those animals, they were still included in the inhabitant's Amorium's diets.

Table 9: Spatial Evaluation Table from Street Area

CONTEXT	Date	Units	Sheep	S/G	Goat	Pig	Ox	Deer	RO	TOTAL
AM XE 06 260	A.D.838 and after	**Street**		5		1	1			**7**
AM XE 05 95	A.D.838 and after	**Street**		4			2			**6**
AM XE 06 267	A.D.838 and after	**Street**		3		2			1	**6**
AM XE 05 81	A.D.838 and after	**Street**	1	8	2	1	3			**15**
AM XE 05 87	A.D.838 and after	**Street**		17	9	26	5	1		**82**
	Total		1	37	11	30	11	1	1	**92**

In this area there are 92 total numbers of elements of animals. The maximum numbers of bones belong to sheep or goat (37) and the subsequent highest numbers are also pigs (30). Those two highest numbers can indicate that Ancient Byzantine city of Amorium's inhabitants not only consumed pigs, sheep and goats but they can also practiced animal husbandry. In addition there are 11 of ox and 11 goats. The herbivores are mostly living in plain grasslands. Goats also live in hilly or mountainous regions. In ancient times, it is also valid situation present; oxen may have been used for traction or transportation.

Table 10: Spatial Evaluation Table from Courtyard Area

CONTEXT	Date	Units	Sheep	S/G	Goat	Pig	Ox	Bird	Deer	TOTAL
AM XE 05 114	A.D.838 and after	**Courtyard**				1	2		1	**4**
AM XE 05 63	A.D.838 and after	**Courtyard**	5	7	2	1	4	2		**21**
	Total	**Courtyard**	5	7	2	2	6	2	1	**25**

For the courtyard area, there are 5 sheep remains, 7 sheep/goat, 2 goats, 2 pigs, 6 oxen, 2 birds, and 1 deer. In this area the highest numbers of bones belong to artiodactyls (sheep, goat and pigs). In the case of the economically most important domestic artiodactyls can indicate livestock production. Determining the purpose of those animals are also important.

Because their meat, skins, and horns can be used many different ways this could, directly affect Amorium's economic structures. Only one deer fragment were found which can show environmental conditions, deer mostly live hilly and forest area in mild weather.

Table 11: Spatial Evaluation Table from Destruction Layer Area

CONTEXT	Date	Units	Sheep	S/G	Goat	Pig	Ox	Bird	Car	Deer	Do	RO	Eq	TOTAL
AM XE 06 270	A.D.838 and after	**Destruction Layer**	1	4	1		2		4					**12**
AM XE 06 264	A.D.838 and after	**Destruction Layer**	3	7	3	1	2						1	**17**
AM XE 06 225	A.D.838 and after	**Destruction Layer**	1	4	1		2							**8**
AM XE 05 44	A.D.838 and after	**Destruction Layer**	3	24	10	13	11				1		1	**63**
AM XE 04 29	A.D.838 and after	**Destruction Layer**		3			2						1	**6**
AM XE 04 19	A.D.838 and after	**Destruction Layer**	4	6	4		4			3		1		**22**
AM XE 04 16	A.D.838 and after	**Destruction Layer**	2	6	2	4								**14**
AM XE 04 22	A.D.838 and after	**Destruction Layer**		3				1						**4**
	Total	**Destruction Layer**	14	57	21	18	23	1	4	3	1	1	3	**146**

In this destruction area, there are 14 parts of sheep, 57 sheep or goat, 21 goat, 18 pigs, 23 oxen, 1 bird, 4 carnivores, 1 donkey, 3 deer, 1 rodent, 3 equids. Again the highest numbers belong to artiodactyls. The large number of pigs and oxen can give us clues about the about regional economic situation. In general the pigs are easily raised in the backyard, so finding large numbers of pigs not surprising. So, its meat is more valuable and expensive. There are also carnivores which might be related to the dogs and the need for security. This security can be for humans or herds. In addition, there are 3 equid bones and a donkey. Those animals were naturally used for traction and transportation. Finally although rodents are good environmental indicator, because those were not identified to species and there is too small of a sample to determine the environment.

Table 12: Spatial Evaluation Table from Mud-Brick Area

CONTEXT	Date	Units	Sheep	S/G	Goat	Pig	Ox	Fish	Deer	RO	Eq	TOTAL
AM XE 05 104	A.D.838 and after	**Mud Brick**	1	6	3	1						**11**
AM XE 04 17	A.D.838 and after	**Mud Brick**	3	9	7	1	5	1	1	1	2	**30**
AM XE 04 14	A.D.838 and after	**Mud Brick**	3	7	1		1			1		**13**
AM XE 04 18	A.D.838 and after	**Mud Brick**	5	8	4	1						**18**
AM XE 04 25	A.D.838 and after	**Mud Brick**									1	**1**
	Total	**Mud Brick**	12	30	15	3	6	1	1	2	3	**73**

According to this table; there are 12 parts of pigs, 30 sheep or goat, 15 goats, 3 pigs, 6 ox, 1 fish, 1 deer, 2 rodents, and 3 equids. The highest number is sheep/goat; but the frequency of goats is also higher than other artiodactyls. The goats differ from sheep in some aspects. Goats can live hilly lands and their horns can be used in workshop activities.

Table13: Spatial Evaluation Table from Fill Area

CONTEXT	Date	Units	S/G	Goat	Pig	Ox	Eq	TOTAL
AM XE 06 237	A.D.838 and after	**Fill**	32	1	3	3	2	**41**

In this fill, the highest numbers belong to again sheep and goat. ıt is likely that Ancient Amorium's inhabitants were breeding stocks.

Table14: Spatial Evaluation Table from Pit Area

CONTEXT	Date	Units	Sheep	S/G	Goat	Pig	Bird	Do	TOTAL
AM XE 05 70	A.D.838 and after	**Pit**	5		1				**6**
AM XE 05 48	A.D.838 and after	**Pit**	3	11	4	1	1	1	**21**
	Total	**Pit**	8	11	5	1	1	1	**27**

Pits are very important to determine regional dietary habitation. In this pit consist of 8 sheep, 11 sheep and goats, 5 goats, 1 pig, 1 bird, 1 donkey. In the pit, sheep and goats are more common than other animals. Thus; Amorium inhabitant's dietary habits were depend on ovicaprines.

Table15: Spatial Evaluation Table from Some Areas

CONTEXT	Date	Units	Sheep	S/G	Goat	Ox	Bird	TOTAL
AM XE 04 28	A.D.838 and after	**Fireplace**	3			1	2	**6**
AM XE 05 90	A.D.838 and after	**Well Stone**	4	5	1			**10**
AM XE 05 79	9th -11th century	**Street**	1	4				**5**

There are very few numbers of bones from these contexts so, it is very difficult to reach valid conclusion.

The assemblages of the A.D. A.D.838 and after period can be separated in five different units; destruction layer, mud-brick area, courtyard, street and pit. When we evaluate those five units, the destruction layer has the largest number of animal bones. The most common species in this layer is o/c. If we make a comparison according to species' number, o/c is also most common remains in all units. The frequency in the mud–brick and street assemblages is also considerable. Although other units have very few number of pig bones, there are 30 pig in the street unit. The mud-brick and destruction area has a higher frequency of goats than the other units.

The frequency of sheep remains is very variable. While some contexts have a high number of this species, some contexts do not have any sheep. For the remains from the street, the sheep is almost completely absent in all contexts. However when we examine other units almost all units have sheep remains. In addition, ox numbers are variable. While the street and destruction layer have high number of ox, the mud-brick and courtyard has few number of ox remains, and finally the ox does not exist in pit unit. Deer, rodent, bird and fish remains are rare in all units.

Table16: Spatial Evaluation Table from Destruction Layer Area in 9th-11th Century

CONTEXT	Date	Units	Sheep	S/G	Goat	Pig	Ox	Deer	Do	Eq	TOTAL
AM XE 04 11	9th -11th century	**Destruction Layer**		6	1	2	7		1	3	**20**
AM XE 04 15	9th -11th century	**Destruction Layer**	2	28	3	1	7	1		5	**47**
	Total	**Destruction Layer**	2	34	4	3	14	1	1	8	**67**

In this area there are 2 parts of sheep, 34 sheep or goats, 4 goat, 3 pigs, 14 ox, 1 deer, 1 donkey, 8 equids. Destruction layer consist of the destructed area. This area may have been a house, barn, or street, however the lack of information it is very difficult to say which. On the other hand; the highest numbers belong to ox and equids. This place may have collapsed when the animals were in here. It might have been a barn because; according to table there are not only one species animals but also eight kinds of animals.

The 9th-11th century consists of two units. When we compare them the destruction layer has a significantly higher number of bone remains than the fill units. The majority of the species is sheep/goat. While there are few sheep remains in destruction layers, the sheep remains do not exist in the fill unit. In addition, when we evaluate this situation is suitable for the goat assemblage for two units. The ox numbers are very different between two units, while there is 14 oxen in the destruction layer, this number, for the fill unit, is only three. In addition, other differences between two units are absence of donkey, deer and equids. Although, there are very few of those species in the destruction layer, those animal remains are not seen in the fill area. However, when we found rodent remains in the fill area, these are not found in the destruction area.

Table17: Spatial Evaluation Table from Fill Area in 9th-11th Century

CONTEXT	Date	Units	S/G	Pig	Ox	RO	TOTAL
AM XE 05 49	9th -11th century	**Fill**	3	1	2		**6**
AM XE 06 262	9th -11th century	**Fill**	6		1	2	**9**
AM XE 04 42	10th-11th century	**Fill**	1				**1**
AM XE 05 40	10th-11th century	**Fill**	1				**1**
	Total	**Fill**	11	1	3	2	

There are very few numbers of bones so, it is very difficult to reach valid conclusion.

Table18: Spatial Evaluation Table from Fill Area in 10th -11th Century

CONTEXT	Date	Units	S/G	Goat	Pig	Bird	TOTAL
AM XE 04 20	10th-11th century	**Drain**	4	1		1	**6**
AM XE 05 53	10th-11th century	**Pit**	4	1	1		**6**

This place's fragments are not very sufficient for make a determination.

Table19: Spatial Evaluation Table from Fill Area in 11th and late century

CONTEXT	Date	Units	Sheep	S/G	Goat	Ox	RO	TOTAL
AM XE 04 10	11th and late	**Fill**	4	14	2	4	1	**25**

For the fill, 4 parts of sheep, 14 sheep or goats, 2 goats, 4 oxen, and 1 rodent. Because the context is fill, these bones may have been transported from other areas.

Table20: Spatial Evaluation Table from Enclosure and Wall Area

CONTEXT	Date	Units	Sheep	S/G	Goat	Pig	Ox	Do	TOTAL
AM XE 05 59	11th and late	**Enclosure Area**	1	2					**3**
AM XE 06 242	Post Byzantine	**Wall**	9	52	14	13	2	2	**92**

In this area the highest numbers of bones belong to sheep or goats. In the post-Byzantine assemblage bone numbers were increased especially for the sheep or goats.

Another idea might be that during post-Byzantine time, breeding stock has been done out of city or near the walls, and because doing an animal husbandry in a big city is not very possible.

6.4.2 Spatial Analysis Table

Obviously some contexts have very few bones to provide valid conclusions (these are 6^{th} -7^{th} century's dump, the A.D. A.D.838 and after courtyard, pit, fireplace, well-stone, 9^{th}-11^{th} street, fill,10^{th}-11^{th} drain, pit,11^{th} and late fill and Enclosure Area) Nevertheless, I will discuss all of them keeping in mind the above limitation. There are very few bones found in those contexts and the majority of bones belong to domestic animals such as; sheep, goat, pig and ox. According to findings dump area and courtyards were used as a domestic garbage area. As for the pit area, we may have expected high number of bones, but very few of domestic animal bones are found there. According to this information the pit area was used for another purpose.

There are 692 bones from these areas in total (Table 20). During A.D. A.D.838 and after, the destruction layer has the highest number of bones. The destruction layer can be described as a collapsed place. In addition, this destruction layer may be happened because of Arab's A.D.838 conquests. This area may be a room, shed or some part of building. This area is represented by 146 bone fragments; the most common species are ovicaprids (hereafter o/c) (39%) and cattle (15.8%). When take into consideration the animal species and their proportions in this area, the destruction layer during A.D.A.D.838 and after may have been a barn, garbage or backyard. The second dense concentration of bones for the same period is found at the street in the A.D. A.D.838. There are 116 animal bones in total. The most commonly represented species in this area are o/c (52.6%), pigs (25.9%) in this place. It is important to find very high number of

o/c in this place, but this place also has a number of pig and cattle bones and this may disclose the disposal habits of ancient Amorium inhabitants. The residents may have thrown their garbage in the street regularly. The final context, for this period is the mud-brick area. This is an area of ruins which were made of mud-brick material. They could have belonged to a building, room, house, public place or other structure. There are 70 animal bones in this area. Once again the bone assemblage at this place is dominated by o/c (42.9%) and goat (21.4%).

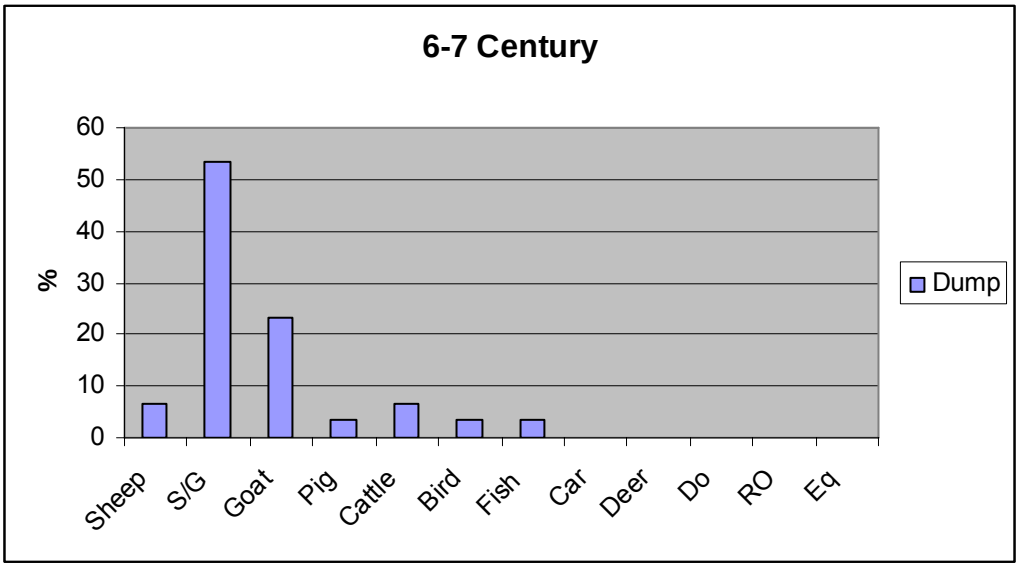
There are 89 bones from 9^{th}-11^{th} century context. In addition, the destruction layer has 67 numbers of bones. O/c (50.7%) and cattle (20.9%) are the most frequent species in the destruction layer. In all periods cattle, o/c, goat, pigs were indisputable animals stocks for the Amorium inhabitants.

Finally, there are 92 individual animals during the Post Byzantine time's walls. The most common species are o/c (56.5%), goats (15.2%) and pigs (14.1%). The wall contains a large amount of animal bone remains, because the transported soil to build up the wall contains those fragments. According to archaeologists, the soil came from somewhere else and the bone fragments were mixed in it. In this case, it is difficult to derive any spatial information from these bones as their original context is unknown.

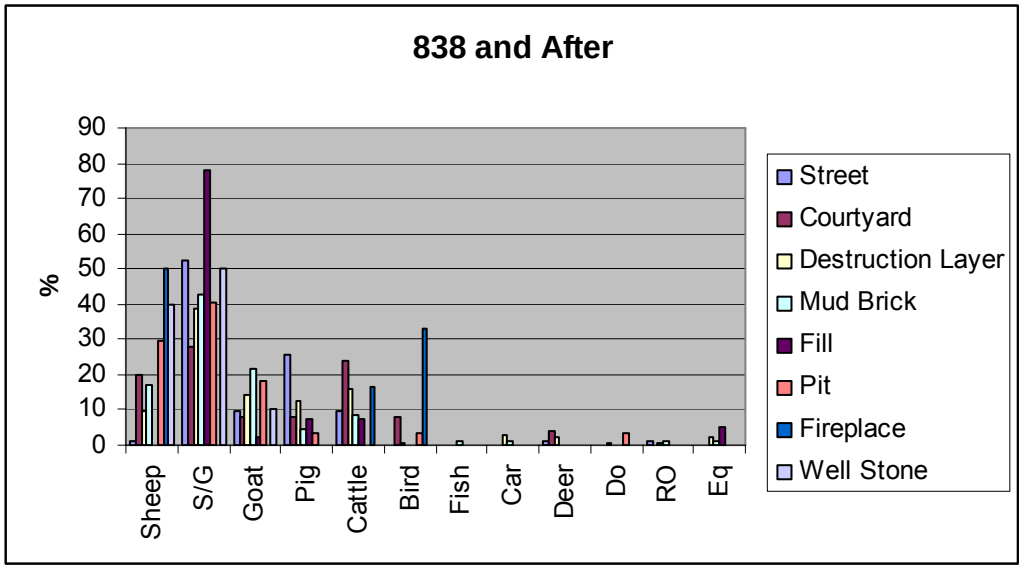
Table21: Spatial Analysis Table (Car: Carniv. Do: Donk., Ro: Rod., Eq: Equi)

			Sheep	S/G	Goat	Pig	Cattle	Bird	Fish	Car	Deer	Do	RO	Eq	Total
6-7 century	**Dump**	**N**	2	16	7	1	2	1	1						30
		%	**6,7**	**53,3**	**23,3**	**3,3**	**6,7**	**3,3**	**3,3**						100,0
A.D.838 and after	**Street**	**N**	1	61	11	30	11				1		1		116
		%	**0,9**	**52,6**	**9,5**	**25,9**	**9,5**				**0,9**		**0,9**		100,0
	Courtyard	**N**	5	7	2	2	6	2			1				25
		%	**20**	**28**	**8**	**8**	**24**	**8**			**4**				100
	Destruction Layer	**N**	14	57	21	18	23	1		4	3	1	1	3	146
		%	**9,6**	**39,0**	**14,4**	**12,3**	**15,8**	**0,7**		**2,7**	**2,1**	**0,7**	**0,7**	**2,1**	100
	Mud Brick	**N**	12	30	15	3	6		**1**	1			1	1	70
		%	**17,1**	**42,9**	**21,4**	**4,3**	**8,6**		**1,4**	**1,4**			**1,4**	**1,4**	100
	Fill	**N**		32	1	3	3							2	41
		%		**78,0**	**2,4**	**7,3**	**7,3**							**4,9**	100
	Pit	**N**	8	11	5	1		1				1			27
		%	**29,6**	**40,7**	**18,5**	**3,7**		**3,7**				**3,7**			100
	Fireplace	**N**	3				1	2							6
		%	**50**				**16,7**	**33,3**							100
	Well Stone	**N**	4	5	1										10
		%	**40**	**50**	**10**										100
9th -11th century	**Street**	**N**	1	4											5
		%	20	80											100
	Destruction Layer	**N**	2	34	4	3	14				1	1		8	67
		%	**3,0**	**50,7**	**6,0**	**4,5**	**20,9**				**1,5**	**1,5**		**11,9**	100
	Fill	**N**		11	1	3							2		17
		%		**64,7**	**5,9**	**17,6**							**11,8**		100
10th-11th century	**Drain**	**N**		4	1			1							6
		%		**66,7**	**16,7**			**16,7**							100
	Pit	**N**		4	1	1									6
		%		**66,7**	**16,7**			**16,7**							100,0

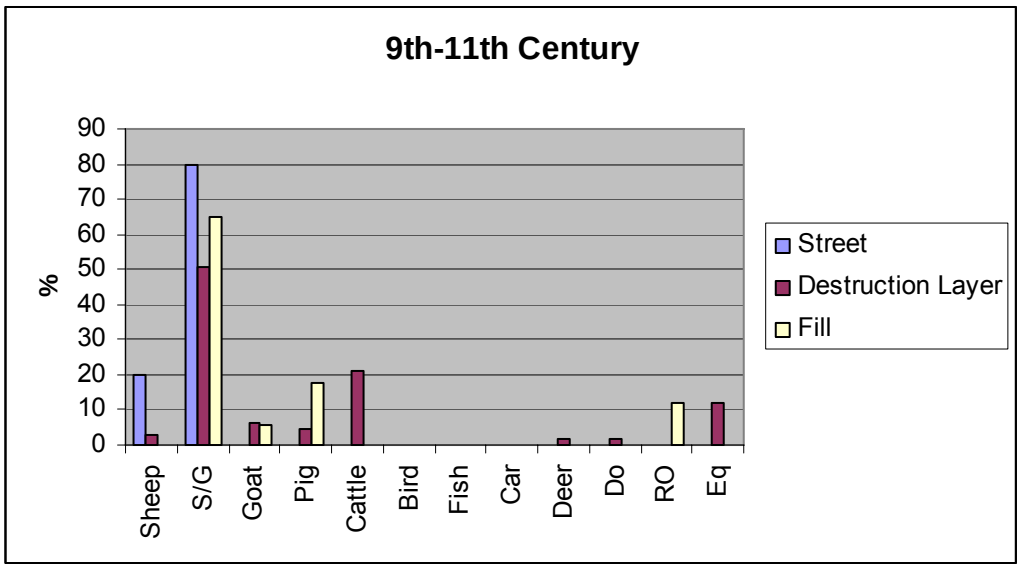
11th and late	**Fill**	**N**	4	14	2		4						1		25
		%	**16**	**56**	**8**		**16**						**4**		100
	Enclosure Area	**N**	1	2											3
		%	**33,3**	**66,7**											100,0
Post Byzantine	**Wall**	**N**	9	52	14	13	2					2			92
		%	**9,8**	**56,5**	**15,2**	**14,1**	**2,2**					**2,2**			100,0



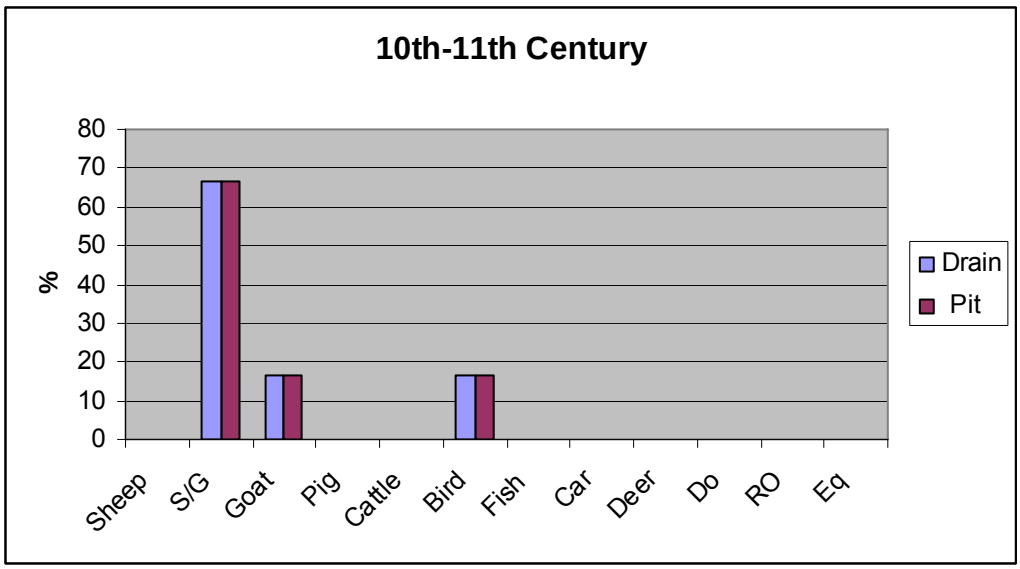
Graph 7: Spatial Analysis of Dump Area from 6th -7th centuries.



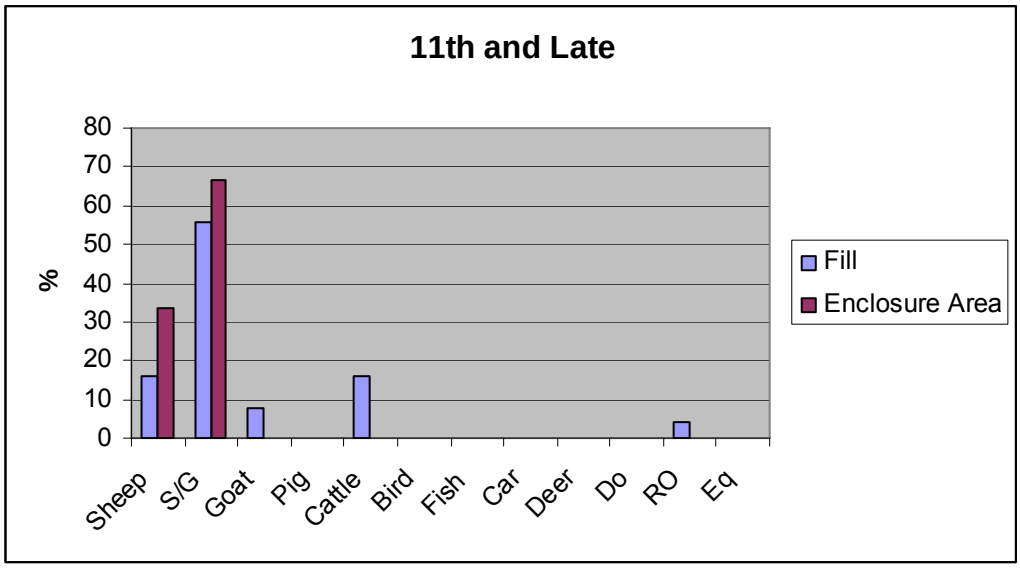
Graph 8: Spatial Analysis from A.D. A.D.838 and after.



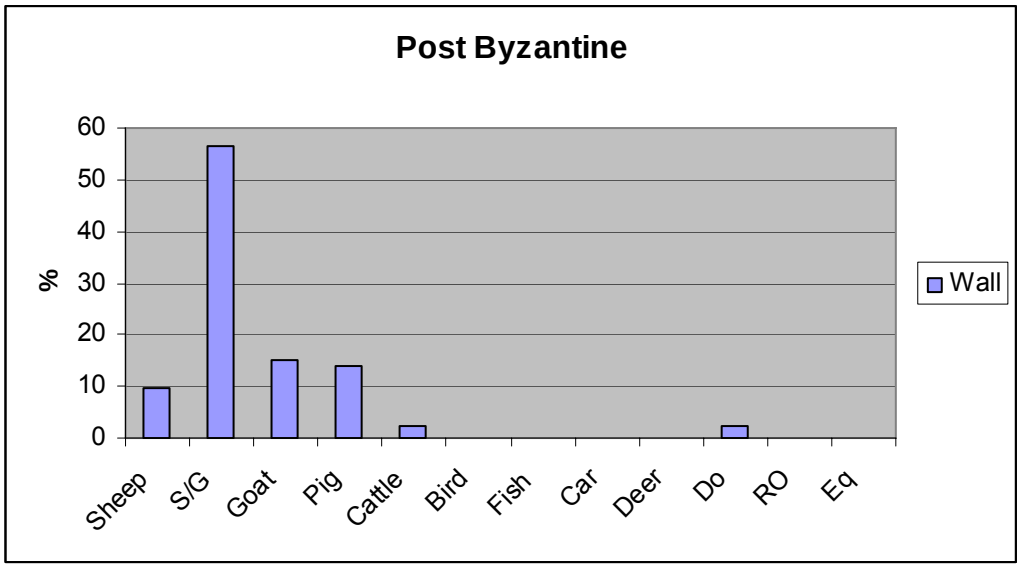
Graph 9: Spatial Analysis from 9^{th} -11^{th} centuries.



Graph 10: Spatial Analysis from10th -11th centuries.



Graph 11: Spatial Analysis from11th and Late.



Graph 12: Spatial Analysis from Post Byzantine time.

6.5. Skeletal Element Representation Table

A skeletal element is a discrete, natural anatomic unit of a skeleton, such as a humerus, tibia, a tooth, or a carpal; it is an 'anatomical organ'. Skeletal elements are anatomical units that may be represented by fragments or by whole bones; that is skeletal elements may be partially or completely represented, respectively, by bone specimens (Lyman, 1994).

The skeletal elements represent different consumption "values" according to how much meat, fat, grease they carry. Also, they can have different depositional and use histories according to: (1) the elements that are suitable for the bone-worker that is industrial waste and (2) the elements that may represent butchery waste (De Cupere, 2001: 149).

The data in table 21-38 clearly indicate that not all elements were found to the proportions that they should be found if we had complete skeletons. Flat bones are rare, while the long bones are much more numerous.

6.5.1. 6th -7th Century- Dump

Three right side of sheep, three left side of goat and three right side of o/c tibia found in this area. In addition, there are nine right side of o/c and one pig mandible is detected. As for the radius, three left side of goat and one sheep are found. The metapodia were the best represented bones in all the periods, especially in the 6th- 7thperiod there is a high number of these bones and it may provide useful evaluations. There are eight sheep metacarpal and thirty-five of goat's metatarsal in this dump area.

When this place is evaluated, it appears that this place has special function as it contains what we could typically call a butchery waste or bone working. The 6th -7th century dump area may be butchery or tool making places because of the frequencies of metacarpals, metatarsal and mandibles. These bones have low consumption values (cheap) and they are very suitable to make a tool.

This assumption is based on the elements of bones. In order to determine butchery waste area, the skull, mandible, metapodium, phalanges, astragalus and calcaneus should be found. As for the tool working area; the metapodium (metacarpal and metatarsal) and horns should be detected.

6.5.2. A.D.838-Street

There are eight right side of sheep and two left side of goat humerii. As for the tibia; nineteen right and six left side of the o/c and seven left and two right side of pig tibiae are detected. There are four right side of sheep, seventeen left and two right side of o/c, tree left and two right side of pig mandibles. There are few radii detected in the A.D. A.D.838 street area. Only two right side of o/c and two left side of pig's radii are found. As for the metacarpal and metatarsal, there are two o/c metacarpal and eight sheep metatarsal found. In addition there are five left side of sheep and three right side of the o/c femur detected in this period. The number of calcanei is

remarkable, there are three o/c and eighteen pig calcaneus. Finally three goat and three pig ulnae are identified.

As it is understood from the findings, this street area shows mixed domestic animals garbage's.

6.5.3. A.D.838- Courtyard

In this area the highest number of element is metacarpal. There are fifteen sheep's metacarpal and eight metatarsal and four ox metatarsal are found. There is also humerus, mandible and radius detected in A.D. A.D.838 courtyard but those elements are not very sufficient for make a determination. When we take into consideration findings, this place may be bone working area. The commonest element is metapodium and the rest are distinctly few.

6.5.4. A.D.838- Destruction Layer

The most common elements in this period are mandible and metapodium. There are twenty left and seventeen right side of o/c mandible is observed. As for the metapodium; eight goats and fifteen ox's metacarpal as well as fifteen goats metatarsal are found. Calcanei and humerii are not underrepresented; there are seventeen o/c's calcanei and ten left sheep humerii found in this layer (Table 24). In addition there are astragali represented in the table. Evaluating these findings we could say that this destruction layer contains mostly cheap cuts of meat with only few good parts of which all are from sheep. It might be the domestic waste of a poor household or a butchery waste area. However, as founding high number of metapodia and calcanei tool working activity may also have happened in this place.

6.5.5. A.D.838-Mud-Brick

The sheep of mandible, metcarpal and calcaneus are mainly represented in the mud-brick area. In addition femur is also found as a high

numbers. Appraising of those finding, this mud-brick area involves mostly cheap cuts of meat with some good parts of which are belong to sheep and o/c. This place might be the domestic waste of a medium or poor household or butchery waste area. However, as founding high number of metapodia and calcanei tool working activity may also have happened in this place.

6.5.6. A.D.838 –Fill

This place is mostly represented by sheep, ox and pig's humerus and astragalus. The number of astragali is remarkable. There are eleven o/c is found in fill area. When we make estimation about the A.D. A.D.838 fill area; this place may contain some domestic refuse (humerus) some together with butchery waste or other industrial activity or artifact making (astragalus).

6.5.7. A.D.838- Pit

This pit area is mostly represented sheep and goat's humerus, tibia, mandible, metapodium and astragalus. We may expect to found high number and varied bone of elements in the pit area, but this place cannot provide useful information because very few bone elements were found.

6.5.8. Seljuk Period-Wall

The finding elements from Seljuk wall are very striking. In this place elements both in a high number and species are also varied. The majority of the elements are tibia, humerus, mandible, metacarpal and femur in this period. The most represented species are also ovicaprines, cattle and pigs. According to these findings we make an assumption that this place may be reflect a mixed type of domestic animal refuse.

6.5.9. 9^{th}- 11^{th} –Destruction Layer

There are few humerii, tibiae mandibles, metatarsals and scapulae, but the most represented element is the radius of cattle and calcaenus of o/c.

When we consider all findings, this destruction layer contains mostly medium and cheap cuts of meat. In addition, the good parts of elements, which are humerus and scapula, are not disregarded. Those parts represent expensive cuts. Thus, this place might be domestic waste of medium household or butchery waste area. Nevertheless, tool working activity may also have happened in this place, because there are high number of metapodia and calcanei.

CHAPTER VII

CONCLUSION

The zooarchaeology discipline, examines animal remains from archaeological sites, studies humans and their environment. Many studies also focus on zoogeographical relationships, environmental evolution, and the impact of humans on the landscape from the perspective of animals. The site of the Amorium, which constitute of the thesis materials, is located in western Turkey, the northeast of the modern provincial capital of Afyon. In this thesis 1330 bone fragments were studied from 91 contexts dating from 6th to Post Byzantine centuries.

The majority of fauna from Amorium assemblage is formed by domestic species. Sheep, goats, pig and cattle are the most common species in the fauna. In addition, deer, equids, carnivore and fishes and wolves are relatively common among the wild taxa. Sheep and goats can provide milk, wool, horns, skins, and meat. The second most common remains are cattle. Cattle probably became more important for traction and may the contribution of cattle meat to the diet. Pigs are also represented in very high numbers and they would seem to have made a large contribution to the diet of the inhabitants. Donkey and horse bones are also found at Amorium. Both donkeys and horses were used for transport. The dogs and cats were more likely kept as pets. The dogs could also be kept as a working animal such as for guarding. The bones of wild animals that would not have been consumed were also recovered; this is the case of wolf. This might have been killed for its fur, but such predator would also have been hunted because wolf was considered a hazard to domestic animals. Hunting appears to have played a very minor role in the accumulation of Amorium fauna, but the assemblage is diverse enough to include the occasional remains of birds, deer, fish, and rabbits. These animals would have provided an occasional variation to the diet rather than a regular supply of meat.

Zooarchaeological data from urban sites may provide ‘mirror- images’ of data from contexts as those animals eaten (Davis, 1987: 158). Sheep and goat remains can found throughout all the time periods. Sheep and goat meat, wool and other secondary products are also economically important. Cattle may used not only for traction, but are also exploited for both milk and meat. The faunal assemblage of the Seljuk period is also characterized by a marked decrease of pigs. Pigs were intensively exploited for their meat. The ethnic and religious affiliations of the population in Amorium during the Seljuk period are still unknown, and the presence of pigs might indicate that the process of Islamization was a gradual one or that a Christian population was present at the site (Hongo H., 1997).

Spatial evaluation studies can provide information about inhabiting Amorium, habitation of diet and relationship between human and animals. The places can be grouped into four; street, fill, destruction layer and pit. The street area is characterized by ovis/capra. It is important to find very high number of o/c in street, because this may indicate that it was used as a rubbish area by the ancient Amorium inhabitants. The destruction layer has high number of sheep, goat and pig. The destruction layer can be described as a collapsed places structure, perhaps a room, shed or some part of building. The fill area is transported soil. This soil may have been accumulated elsewhere by environmental processes ((wind, rain, river and tectonics activities). It is difficult to be sure those bones were deposited by inhabitants contemporary with the structures or they were later additions. The pit area may be defined as a garbage hole. Because pit areas have both large number of bones and different types of species, those areas are very important in archaeologically. However, large numbers of bones are not found in the pit area at Amorium.

By using skeletal representation table, we may reach usage of bone elements and economic status of Amorium inhabitants. When 6^{th} -7^{th} Century- Dump place is evaluated, as to value of bones; this place has special function as it contains what we could typically call a butchery waste or bone working area. When the A.D. A.D.838 street area is analyzed and this area shows mix domestic animal garbage features. In the light of findings

from A.D. A.D.838 courtyard area shows that this place may be bone working area, because suitable elements for bone working are found in the courtyard area. As for the A.D. A.D.838 destruction layer contains mostly cheap cuts of meat with only few good parts of which all are from sheep. It might be the domestic waste of a poor household or a butchery waste area. However, as high number of metapodia and calcanei was found tool working activity may also have taken place there. When we evaluate the findings from A.D. A.D.838 mud-brick area, this place might be the domestic waste of a medium or poor household or butchery waste area. A.D. A.D.838 Fill place may be butchery waste area or may be leather workshop. The finding elements from Seljuk wall are very striking. In this place elements were found in a high number as well as in a variety of species. This area contains the typical food refuse. In the 9^{th}- 11^{th} –Destruction Layer, mostly medium and cheap cuts of meat were found. In addition, some of the meat bearing elements, which are humerus and scapula, are also recorded. This place might be domestic waste of medium household or butchery waste area. Nevertheless, tool working activity may also have happened in this place, because there are high number of metapodia and calcanei.

The kill-off patterns of Amorium assemblages is based on tooth eruption and wear stages. The ageing of sheep indicates 3-4 and 4-6 years is also common in all periods. In the sheep assemblage there are many more adults rather than young and far fewer juvenile-subadults. There are different age groups in pig assemblages. The younger individuals are more common than the older. Small numbers of goat bones were identified in all periods. All of the goat remains are aged as adult and subadult. The cattle remains were very few in number and do not provide useful information.

Deriving from those data we can make become informed about how the animals were utilized by the occupants of the site and how did this change through the time. In addition, we may also define what animals were living in this area at that time, how the faunal bone assemblage was accumulated, and, what is more; the faunal changes occurred through the time, animal resource management, and finally possible workshop activities.

The available excavation reports are the main resource for the literature review. In addition the bone materials were selected from specific areas in one summer only and were also limited in amount. The small number of usable (secure contexts and date) bones limited the Ageing, Subsistence Economy and Spatial Analysis' interpretations. When examining the spatial analysis the places and contexts were separated by periods, but the uncertainty of the origins and context of some of the findings was the major difficulty in that stage. Nevertheless, it was interesting to see that whilst the spatial analysis according to species has not given much differentiation of the spaces, the skeletal presentation has provided much more knowledge on both the use of space and the socioeconomic level of the people using this area of Amorium. It was found that this area is more likely a poor or medium at most neighborhoods with strong indications of possible industrial working related to animal by-products. A more extensive study both in total number of bones as well as across more areas of the city would have provided much useful results.

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APPENDIX

Table 22: 6th -7th Century/Dump Area

	humerus		tibia		mdt		radius		Metacarpal			metatarsal			femur		scapula			
6-7Century/Dump	left	rigth	left	rigth	left	rigth	Left	rigth	left	r/l	Right	left	r/l	rigth	left	rigth	left	rigth		
sheep				3						8									**MNI:1**	**NISP:2**
goat			3				3						35						**MNI:5**	**NISP:4**
s-g				3		9	1												**MNI:2**	**NISP:4**
pig						1													**MNI:1**	**NISP:1**

Table 23: A.D.838/ Street Area

	humerus		tibia		mdt		Radius		metacarpal			metatarsal			femur		scapula		ulna	calcaneus		
A.D.838 /street	left	rigth	left	rigth	left	rigth	left	Right	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth				
sheep		8				4							8								MNI:2	NISP:4
goat	2									2									3		MNI:1	NISP:2
s-g			6	19	17	2		2												3	MNI:6	NISP:15
pig			7	2	3	2	2												3	18	MNI:1	NISP:8

Table 24: A.D.838/ courtyard Area

	humerus		tibia		mdt		radius			metacarpal			metatarsal			femur		scapula		ulna	calcaneus		
A.D.838 /courtyard	left	rigth	left	rigth	left	rigth	left	r/l	rigth	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth				
sheep											15			8								MNI:4	NISP:2
goat					3																	MNI:1	NISP:1
s-g	2	2						5														MNI:1	NISP:2
ox														4								MNI:1	NISP:2
pig					4																	MNI:1	NISP:1
cattle		2																				MNI:1	NISP:1

Table 25: A.D.838/Destruction Layer Area

	humerus		tibia		mdt		Radius		metacarpal			metatarsal			femur		scapula		ulna	calcaneus	astragalus		
A.D.838 /destruction layer	left	rigth	left	rigth	left	rigth	left	rigth	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth					
sheep	10	4		3								2										MNI:3	NISP:9
goat	8			2	2					8			15									MNI:3	NISP:11
s-g		5	2		20	17									3					17	8	MNI:8	NISP:21
ox										15			2								8	MNI:2	NISP:12
carnivor					3										3							MNI:1	NISP:2
cattle				2																		MNI:1	NISP:1

Table 26: A.D.838/mud-brick Area

	humerus		tibia		mdt			radius		metecarpal			metetarsal			femur		scapula		ulna	calcaneus		
A.D.838 /mud-brick	left	rigth	left	rigth	left	l+r	rigth	left	rigth	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth				
sheep	5		8			12					8			4								MNI:4	NISP:9
goat			4	4					3		12									2		MNI:3	NISP:7
s-g	4		2		2																13	MNI:2	NISP:3
ox											4			4								MNI:2	NISP:2
pig					2		2															MNI:1	NISP:2

Table 27: A.D.838/Fill Area

	humerus		tibia		mdt		radius		metecarpal			metetarsal			femur		scapula		ulna	calcaneus	astragalus		
A.D.838 /fill	left	rigth	left	rigth	left	rigth	left	rigth	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth					
s-g	2		5		1	1															11	MNI:2	NISP:6
ox	4																					MNI:1	NISP:1
pig	2																					MNI:1	NISP:1

Table 28: A.D.838/Pit Area

	humerus		tibia		mdt		radius			metecarpal			metetarsal			femur		scapula		ulna	calcaneus	astragalus		
A.D.838 /pit	left	rigth	left	rigth	left	rigth	left	r+l	rigth	left	r/l	rigth	Left	r/l	rigth	left	rigth	left	rigth					
sheep		4									6			8									MNI:4	NISP:5
goat	2			8																			MNI:3	NISP:4
s-g					8	4		3														8	MNI:3	NISP:6

Table 29: A.D.838/Fire Area

	humerus		tibia		mdt		radius		metecarpal			metetarsal			femur		scapula		ulna	calcaneus	astragalus		
A.D.838 /fire	left	rigth	left	rigth	left	rigth	left	rigth	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth					
s-g																				2		MNI:1	NISP:1

Table 30: A.D.838/Stone Area

	humerus		tibia		mdt		radius		metecarpal			metetarsal			femur		scapula			
A.D.838 /well stone	left	rigth	left	rigth	left	rigth	left	rigth	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth		
sheep	2					6							4						MNI:1	NISP:2

Table 31: 9th -11th Century/Street Areas

	humerus			tibia		mdt		Radius		metecarpal			metetarsal			femur		scapula			
9-11 century/street	left	r/l	rigth	left	rigth	left	rigth	left	Right	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth		
goat			3																	MNI:1	NISP:1
s-g		2									8									MNI:1	NISP:2

Table 32: 9th -11th Century/Destruction Layer Area

	humerus			tibia			mdt		Radius			metacarpal			metatarsal			scapula			calcaneus	astragalus		
9-11 cntry destruction layer	left	r/l	rigth	left	r/l	rigth	left	rigth	left	r/l	Right	left	r/l	rigth	left	r/l	rigth	left	r/l	rigth				
goat				7	2											2							MNI:2	NISP:2
s-g	2					6	7	6					8									4	MNI:3	NISP:11
ox										10			2						3		5		MNI:1	NISP:3
pig							1																MNI:1	NISP:1
equus																							MNI:	NISP:
donkey	4																						MNI:1	NISP:1

Table 33: 9th -11th Century/ Fill Area

	humerus			tibia		mdt		radius		metacarpal			metatarsal			femur		scapula		ulna	calcaneus		
9-11 cntry/fill	left	r/l	rigth	left	rigth	left	rigth	left	rigth	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth				
s-g		4	2		3	1	1														5	MNI:1	NISP:5
rodent						7																MNI:1	NISP:1

Table 34: 10th -11th Century/ Fill Area

	humerus			tibia		mdt		radius		metecarpal			metetarsal			femur		scapula		astragalus		
10-11 cntry/fill	left	r/l	rigth	left	rigth	left	rigth	left	rigth	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth				
s-g			2																	4	MNI:1	NISP:2

Table 35: 10th -11th Century/ Drain Area

	humerus			tibia		mdt		radius		metacarpal			metatarsal			femur		scapula		ulna	calcaneus	astragalus		
10-11 cntry/drain	left	r/l	rigth	left	rigth	left	rigth	left	rigth	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth					
goat			2																				MNI:1	NISP:1

Table 36: 10th -11th Century / Pit Area

	humerus			tibia		mdt		radius		metacarpal			metatarsal			femur		scapula		ulna	calcaneus	astragalus		
10-11 cntry/pit	left	r/l	rigth	left	rigth	left	rigth	left	rigth	left	r/l	rigth	Left	r/l	rigth	left	rigth	left	rigth					
goat			2																				MNI: 1	NISP: 1

Table 37: 11th and Late Century/ Fill Area

	humerus			tibia			Mdt		radius		metacarpal			metatarsal			femur		scapula		ulna	calcaneus	astragalus		
11and late cntry/fill	left	r/l	rigth	left	r/l	rigth	left	Right	left	rigth	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth					
sheep			2	6											2									MNI:2	NISP:3
goat				3																	4			MNI:1	NISP:2
s-g		3			4		8	1																MNI:3	NISP:6
rodent								7																MNI:1	NISP:1

Table 38: 11th and Late Abandonment

	humerus			tibia		Mdt		radius		metacarpal			metatarsal			femur		scapula		ulna	calcaneus	astragalus		
11and late/abandonment	left	r/l	rigth	left	rigth	left	rigth	left	rigth	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth					
sheep				3																			MNI:1	NISP:1
s-g						4	3																MNI:1	NISP:2

Table 39: Seljuk/ Wall

	humerus			tibia			mdt		radius		metacarpal			metatarsal			femur		scapula		ulna	calcaneus	astragalus		
seljuk/wall	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth	left	r/l	rigth	left	r/l	rigth	left	rigth	left	rigth					
sheep			7	14			1		2			2										7		MNI:5	NISP:19
goat	3			10	2	6						8												MNI:6	NISP:18
s-g	12	16	4		5		5	16												3				MNI:16	NISP:29
ox													5											MNI:1	NISP:5
pig	2		4	2		4	4																	MNI:4	NISP:16