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CICLO XXIII

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Exploitation of animals resources from the Pre-Pottery Neolithic Tell AbuSuwwan site in Jordan: "an Archaeozoological perspective"

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Thanks all …….

I will be glad to give my theses with all my love to my father and mother, all my brothers for their helps since I came to Italy until I got this degree.

I am glad because I am one of Dr. Ursula Thun Hohenstein students. I would like to thanks her to her help and support during my research.

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CONTENTS

Ch. 1. INTRODUCTION

The Neolithic revolution was a result of many interactive variables: human culture, environment and time. It covers different stages and includes various cultures. Neolithic revolution was mainly presented by start of farming plants and domestication of animal followed by industry of ceramics.

Archaeologists consider the Near East as the main origin of Neolithic revolution. Many archaeological excavations and scientific researches' were carried out in the Near east to collect possible evidences of Neolithic revolution. A variety of chronological dating was suggested to reconstruct the Neolithic chronology. Archaeologist presented at first Neolithic period in two phases, Pre-pottery Neolithic and Pottery Neolithic by the presence/absence of pottery. Latter on new evidences were discovered so new chronologies were established to the Neolithic period.

Jordan is located in the Fertile Crescent, the area in which vegetable and animal domestication begun. The Jordanian Neolithic sites are referable to different Neolithic stages, related to the oldest domestication of animals in the world. Due to the Jordanian geographical location in the Near East and also the different geographical zones presented, archaeological researchers take attention to the Jordanian Neolithic sites.

Jordanian Neolithic sites contain different common characteristics with the other Neolithic sites in the Near East. Also excavations recover a regional specialization within the Jordanian Neolithic site.

In this case study the faunal assemblages presented in this thesis are coming from Tell AbuSuwwan Neolithic site in Jordan. Tell AbuSuwwan present one of the Neolithic mega-farming sites. Radiocarbon dating views a continuous occupation since the Pre-pottery Neolithic A until the Pottery Neolithic.

Excavations in Tell AbuSuwwan recover high quantities of archaeological remains, Neolithic structures, high quantities of lithic tools and faunal remains.

Faunal assemblages from Tell AbuSuwwan are coming from different Neolithic phases. Faunal remains studies in this thesis are coming from Area B in the site. Faunal remains were distributed within the inner and outer spaces of Tell AbuSuwwan Structure in area B.

First archaeozoological preservation of Tell AbuSuwwan faunal remains view presence of possible domestic sheep/goat faunal remains. While during the excavation in Tell

AbuSuwwan some particular faunal assemblages were presented in particular position within the structures spaces.

Archaeozoological and taphonomical analysis were applied to understand the pale-economy and environment Tell AbuSuwwan. Archaeozoological results were used also to construct culture activities in relation to the faunal assemblages with the site and surrounded environments.

Faunal remains contain high quantities of unidentified specimens which required a taphonomical analysis to reconstruct the natural and anthropical modification of the faunal assemblages.

Bibliographical research was used to understand the evolution of the Neolithic period in the Near east and particularly in Jordan. Published archaeozoological results from different Jordanian sites and surrounded area were used to compare with Tell AbuSuwwan faunal assemblages.

During the faunal assemblages study a variety of osseous instruments were found. These instruments presented different osseous instruments categories. Archaeozoological analyses were applied to classify these instruments. Later on scientific experimental work was organized to reconstruct the fabrication processes of Tell AbuSuwwan osseous instruments.

Ch. 2. AIMS OF THE RESEARCH

This research is based on faunal assemblages collections from the Pre-Pottery Neolithic site Tell AbuSuwwan in Jordan. Bibliographical data of the analyzed Neolithic faunal assemblages coming from other Neolithic sites in Jordan and in Near East were taken in consideration during my work.

The main aims of the project are:

1. To reconstruct the main characteristics of the Neolithic Paleo-environments in Tell AbuSuwwan and surrounded environment. Animals represent the environment that is used by the occupants. This gives an evidence of the paleo-environment surrounding the site.
2. To contribute to identifying the main characteristics of the Neolithic cultural behaviors and economic change during the different phases of Neolithic occupation in Tell AbuSuwwan from the Pre-pottery Neolithic A until the Pottery Neolithic. This would also help in studying human behavior and practices related to animal hunting and herding during this period.
3. To understand hunting practices and animal husbandry during the Neolithic period; which species were hunted or herded, which habitats were exploited by hunters, and if livestock were exploited for their secondary products.
4. To understand the interaction between human behavior and environment: how this affected his culture over the time and how they could have affected the revolution of animal husbandry in the Neolithic period.
5. Particular study will be focused to analyze of osseous industry assemblages: to understand the context of the bone tools in relation to the sites; to identify the raw material (species, skeletal elements) and to study the sequence of the manufacturing process with particular attention to the technology applied and the use of these bone tools (Knives, Awl, Flesher, Ritual tools, etc…).
6. Tell AbuSuwwan represents a Neolithic mega-farming village: the results of this study will be helpful in studying structural space use. This archaeozoological results would help to understand human activities within the structures and surrounding areas related to my case study. Spaces were used to butchering activities or cooking spaces or symbolic offers within the site.

7. Bibliographical researches about the Neolithic sites in Jordan and Near East were done to collect possible data about the Neolithic evolution characteristics. Published archaeozoological results from different Neolithic sites in Jordan and surrounded area were used to compare the archaeozoological results from Tell AbuSuwwan.

Ch. 3. NEOLITHIC PERIOD IN NEAR EAST

Researchers take attention to the rise of farming and domestication villager societies during the Neolithic period. A variety of archaeological excavation and scientific researches have been carried out to analyzes all the characteristics of the Neolithic phases.

At first Neolithic period was subdivided to Pre-Pottery Neolithic and Pottery Neolithic. Latter on new chronological division have been appeared as results of more field excavations and different cultural characteristics development. New chronological subdivision depends on the different cultural lithic technologies and architectural typologies. Neolithic period has been subdivided to different chronological cultural phases. These new chronology help to understand the sequences of the Neolithic farming evolution and the start of animals domestication (Kuijt and Goring-Morris 2002; Kuijt 1994; Rollefson 1998).

3.1. Pre-Pottery Neolithic A (PPNA) in Near East

The Pre-Pottery Neolithic A was comprised in Near East between 10,500/10,200-9,600/9,200 BP. The PPNA culture, which was first presented by the Khiamian culture, has a short duration from 10,500 to 10,000 BP. The Neolithic sites distribution in that period were less than the Natufian sites one during the Mesolithic. These sites were distributed along the Jordan River and Damascus basin and the Euphrates River. PPNA sites were found in the western desert of Jordan, but their distribution was not so intensive as the sites beside rivers basins. The Neolithic sites that were firstly discovered in the Dead Sea basin, had been interpreted as temporary sites, giving a preliminary false interpretation that the Neolithic settlement located in the arid Levant zones were only small camp site. Recent archaeological excavations revealed the presence of Neolithic sites with architectures in the arid zones like Dhra and Wadi Finan 16. These new excavated sites show that not all the sites in arid Levant are temporary mobile campsites but also contain permanent PPNA villages (Fig. 3.1) (Kuijt and Goring-Morris 2002; Rollefson 1998).

In the northern east Iraq (which is called as the wings of the Fertile Crescent) the PPNA sites like Nemrik 9 and Qermiz Dere indicate distinct PPNA entities within the Nemikian culture zone. In this zone, three contemporary traditions were present: Nemrikian culture, Trialetian culture and the Khiamian culture (Kuijt and Goring-Morris 2002).

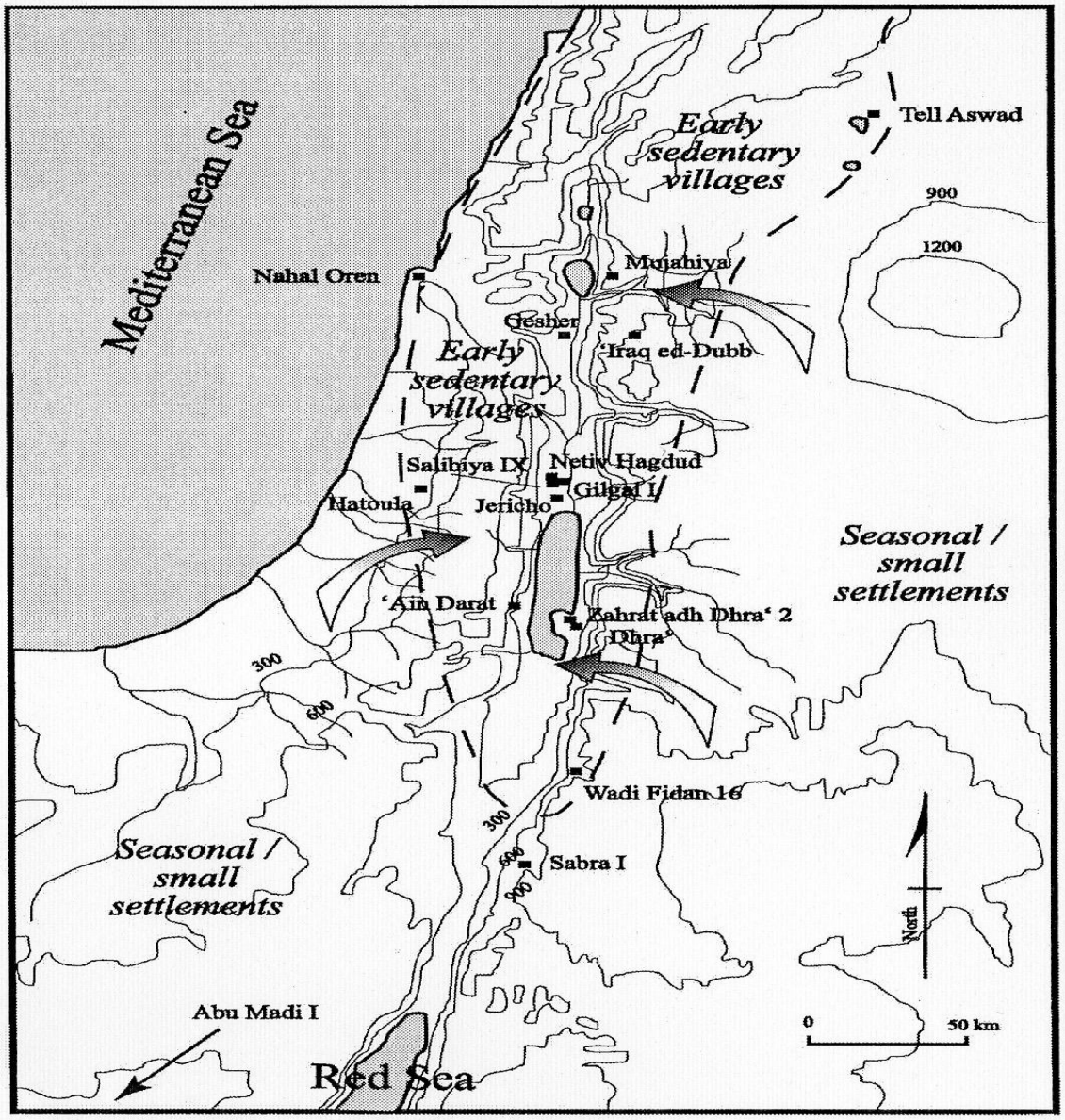

Fig. 3.1: PPNA sites in Levant (Kuijt and Goring-Morris 2002).

Although the PPNA culture contains some continuous chipped stones from the Natufian period, it has its own particular developments. The Khiamian culture in the southern Levant had strong microlithic industries that included small lunates and sickle blades and khiam points. On the other hand, the bifacial tools were rarely used. The khiam points were interpretated as projectile points, this theory, however, is not acceptable anymore for all cases. This is due to the fact that excavation in architectural Neolithic sites like Dhra shows very large number of khiam points, which could be used for perforation or drills rather than projectile points (Kuijt and Goring-Morris 2002; Kuijt 1994; Rollefson 1998).

The Sultanian culture has different morphological shaped artifacts that are similar to tipped arrows. Examples of their lithic industries are the sickle blades on large blade, unretuoched sickle blades and many perforation and burins on small blades and flakes.

Ground stone is intermediate between the Natufian culture and Neolithic cultures with some particular characteristics. The PPNA ground stone is cruder and less decorated than Natufian ground stone (Fig. 3.2).

The PPNA people used the grinding slabs and small hand stones for bulk food stuff that could be used with small pestles for processing limited food quantities (Wright 2000).

Human figurines during the PPNA became more common while animal representation became limited. Female figurines were often presented in different manner. It did not include breasts, navel or genitalia. Many examples were found in PPNA sites like seated females from Netiv Hagdud and Dhra. In Mureybat, they found eight female figurines made of stone and baked clay (Kuijt and Goring-Morris 2002).

Domestic architectures were characterized by the presence of ground stones, oval or semicircular storage features and fire hearths. General size of PPNA structures were between 5 m-8 m like Jericho and Netiv Hagdud. Some structures contains one large room, while others have two rooms with small installations around them. Most structures in PPNA have a minimum number of preparations of the floor by using clay. Sometimes they overly the mud with stone cobbles. While the entrance were from one gab in the end of the structures wall (Fig. 3.3; Fig. 3.4) (Kuijt and Goring-Morris 2002).

Studying people behavior and life during PPNA is one of the main objectives of this thesis. Many studies have been conducted to estimate number of people lived in the PPNA villages. Mellaart suggested that 2000 people or more lived in Jericho (Mellaart 1975) while Kuijt and Morries predicted that a smaller number of 735 people lived there. In both theories, the estimated number is large (Kuijt and Morries 2002).

These are complex communities that have internal interaction and variations in work processes and religious or ritual believes. Agriculture became cereal farming seasons. Subdivisions within the internal groups for nuclear families did not change significantly. While the main shift occurred at later periods between PPNA to PPNB (Kuijt and Goring-Morris 2002).

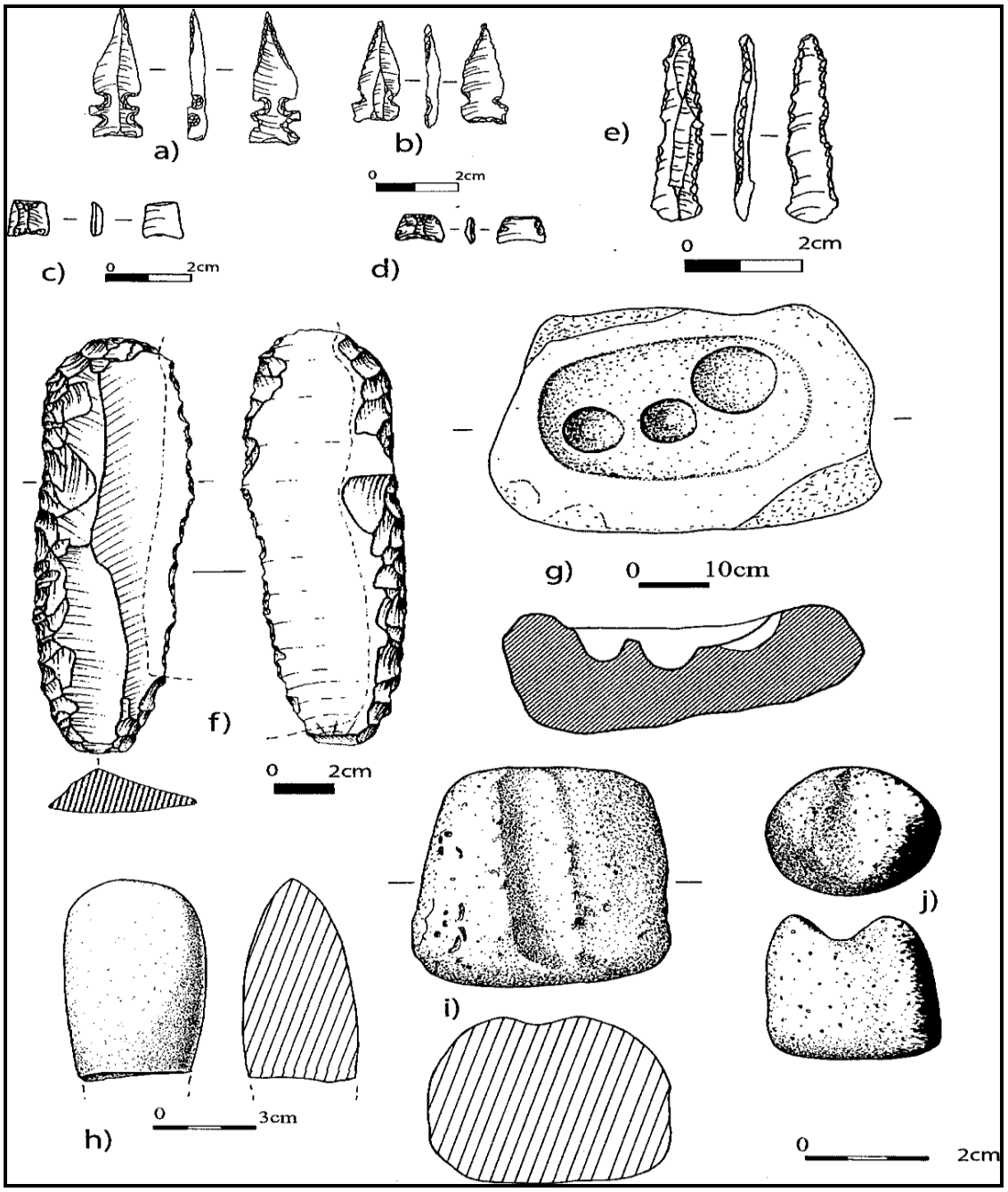

Fig. 3.2: PPNA; Stone tools from the southern Levant: (a-b) El-Khiam projectile point. (c-d) Hagdud truncation. (e) Borer/Awl. (f) Beit Tam knife. (g) Cuphole. (h) Polished axe. (i-j) Shaft streightener (Kuijt and Goring-Morris 2002).

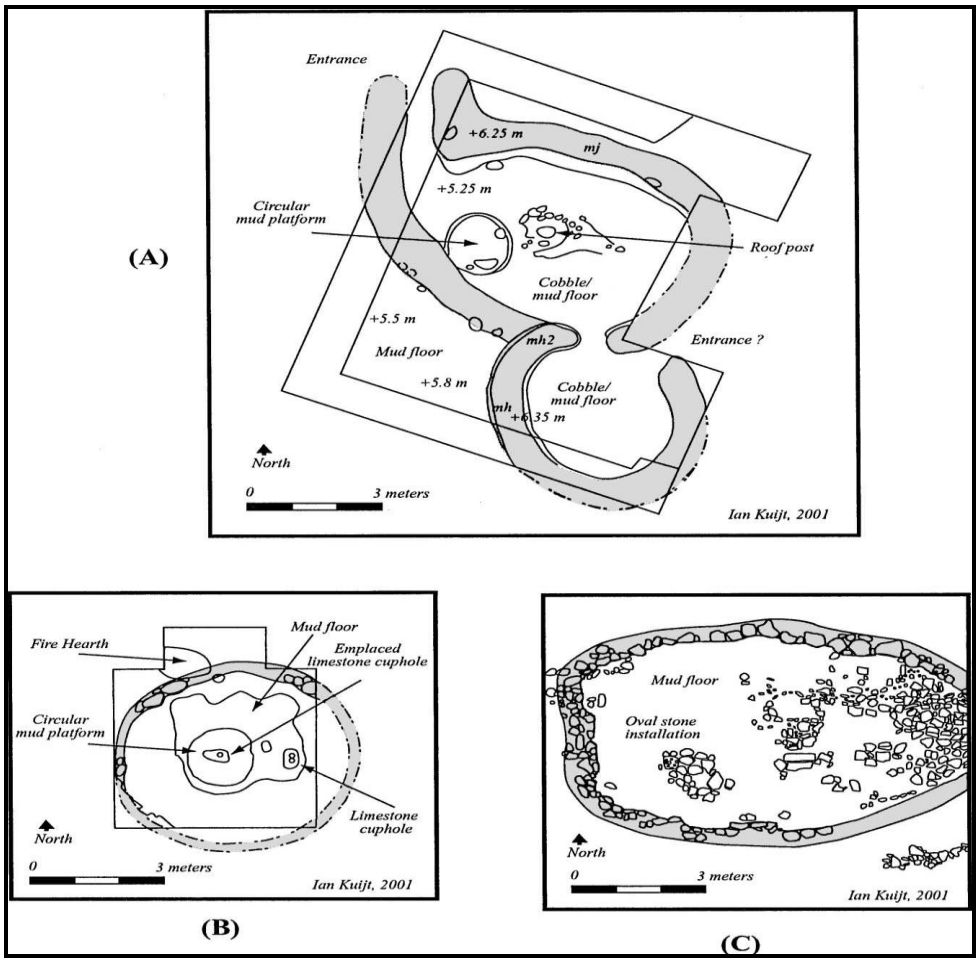

Fig. 3.3: PPNA; Plan view of residential architecture from (A) Jericho. (B) ‘Iraq ed-Dubb.(C) Netiv Hagdud (Kuijt and Goring-Morris 2002).

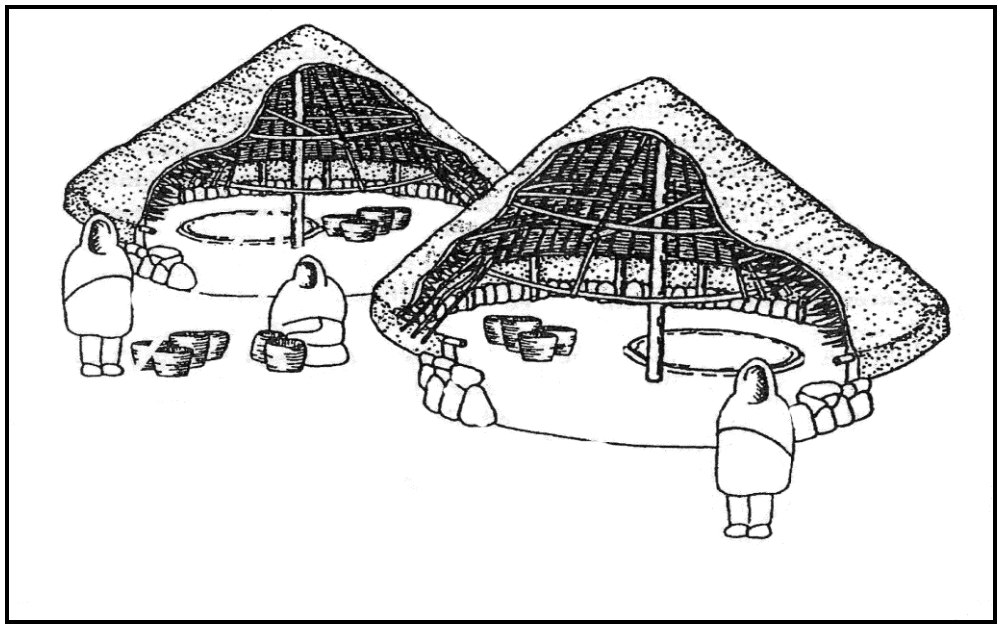
Fig. 3.4: PPNA; Dwelling structures (Kuijt and Goring-Morris 2002).

3.2. Pre-Pottery Neolithic B (PPNB) in Near East

PPNB sites were attested in the Near East from 9,500 BP to 7,500 BP. The PPNB period has been subdivided in four sub phases Early PPNB, Middle PPNB, Late PPNB and Final PPNB. This chronology has been modified to change the Final PPNB to be PPNC for the period 8,000 PB to 7,500 BP (Kuijt and Goring-Morris 2002; Rollefson 1998).

The PPNB in the Near East have a general characteristic of inhomogeneous culture distribution that could reflect the system of "Tribal" or "ethnic" identities (Bar Yosef 2002). PPNB have been subdivided, as mentioned earlier, according to the development of lithic industries. Other characteristics that contributed to these subdivisions will be described for each sub period.

3.2.A. *Early PPNB*

It is estimated that this period started in 10,500 BP and ended around 10100 BP as suggested by Kuijt and Goring-Morris (2002); it is based on new archaeological excavations and recent datings of Neolithic sites in Near East. The previous chronology, as proposed by Bar-Yosef and Rollefson (1998) ranged from 9,600 to 9,200 BP.

Early PPNB sites in Near East were well distributed geographically in the zones of Middle Euphrates, while they were rarely represented in the rest of the Near East zones. Some sites were found in Damascus basin like Mureybat, Dja'de and Abu Hurreyra 2 dated to 9400-7000. Another few sites were recorded in the basin of Jordan (er-Rahib) and Palestine (Horvat Galil) (Fig. 3.5).

There are a general argue that the early PPNB extended to northern Levant in northern Syria and south east Turkey like Göbekli and Cayönu. While in northeast Iraq it was located in Qermiz Dere.

The EPPNB presents a very important shift in settlement organization and architecture. Structures changed from the oval or semicircular structure in the PPNA to sub rectangular structures in the EPPNB. The structures were built by local stones and mud brick piers. The presence of colored lime plaster for the pavement was covered in different sites like Aswad and Horvat Galil.

In some particular sites in the desert basin the circular structures continued to be used like Beida and Ain Abu Nakhayla in southern Jordan. The lithic technology in the EPPNB presents a transition from PPNA to MPPNB that have a particular characteristic. It's

particularly characterized by presence of ubiquitous preference for the chalcedony and other fine grain stone, which are not local origin raw materials. Another evidence also present of the intentional techniques of heat treatment of the stone. Pyramid cores were used to produce retouch projectile points from fine and elongated blade blanks using opposed platform naviform techniques. These techniques came from the Euphrates basin to the south west of Levant together with the Helwan points. Polished axes started to appear while the perforation points became less common and less standardized than the PPNA perforation points (Fig. 3.6) (Kuijt and Goring-Morris 2002; Rollefson 1998).

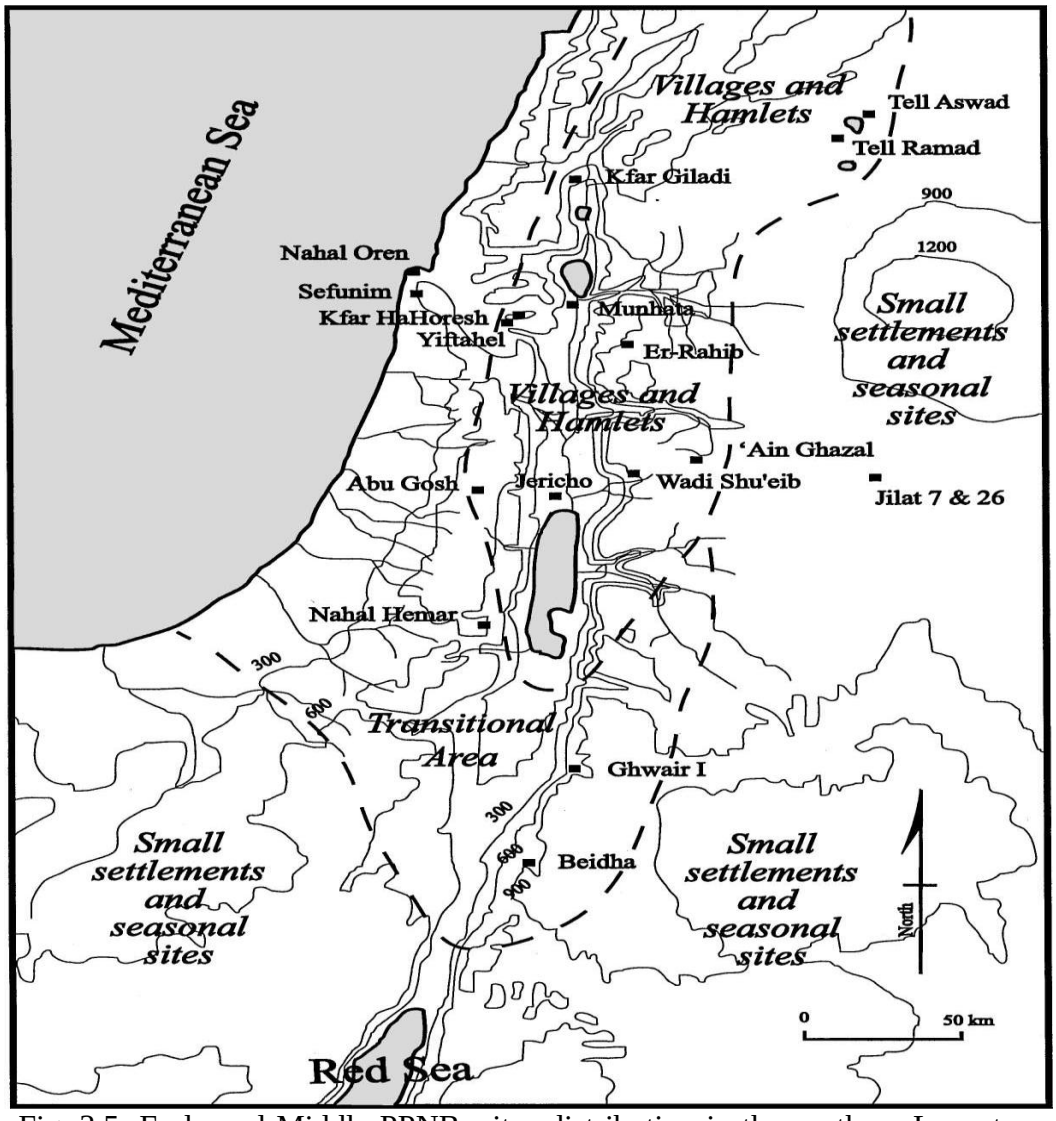

Fig. 3.5: Early and Middle PPNB; sites distribution in the southern Levant (Kuijt -Morris 2002).

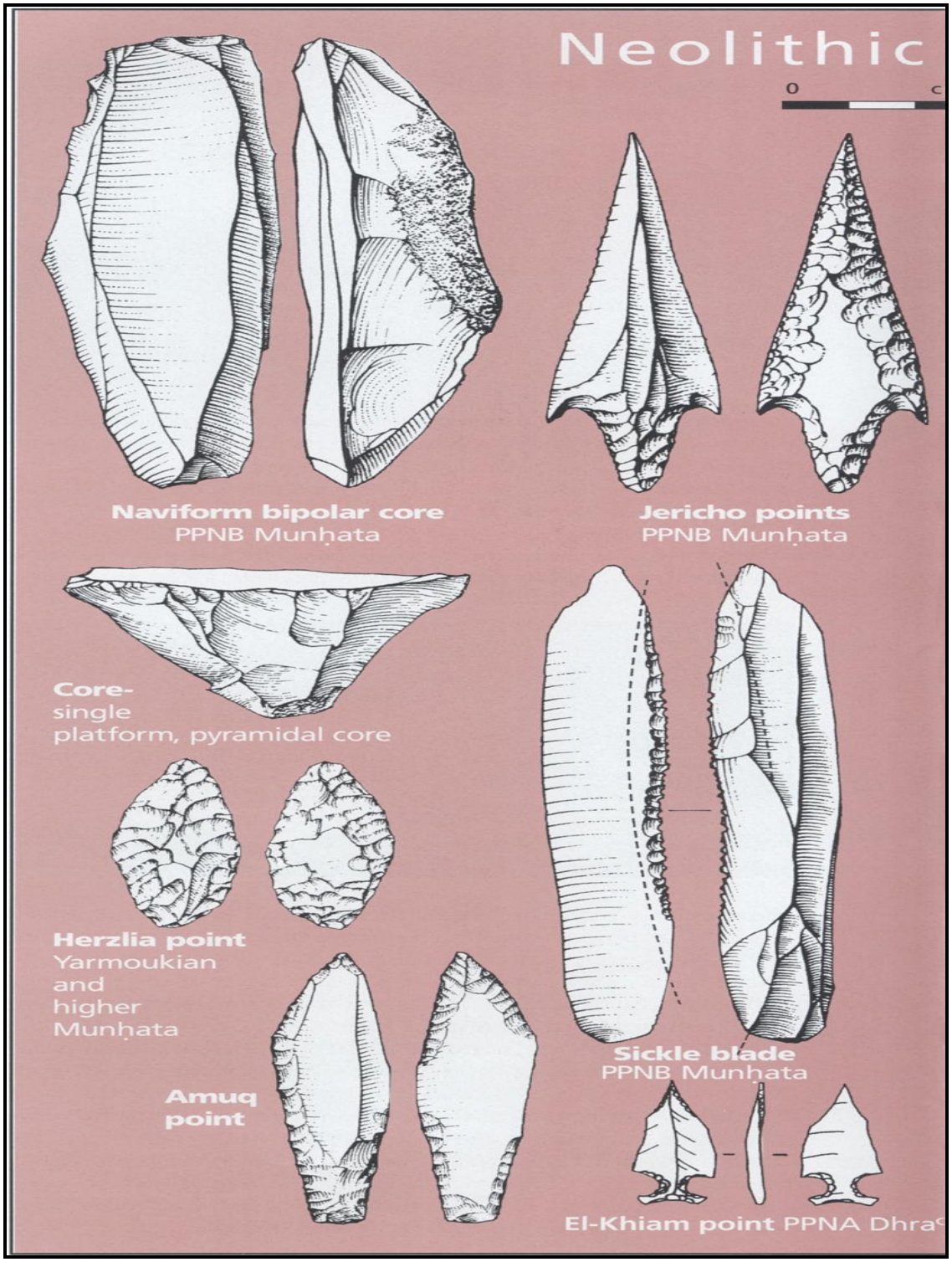

Fig. 3.6: PPNB; Cultural Lithic industries (Banning 1998).

3.2.B. *Middle PPNB*

The Middle PPNB has been testified in the period from 9,300 BP to 8,300 BP. It is characterized by presence of farming megasites. Many particular developments were achieved in this period that was more than accomplished in the previous period. Many PPNA site were reoccupied in this period (Fig. 3.5).

Specialization within the local region is one of the main characteristics of the Middle PPNB. Lithic industries is an example that shows reduction of the sickle blades and increase in the percentage of projectile points and burins. Craft specialization in naviform core production has been found at regional level in Ain Ghazal (Kuijt and Goring-Morris 2002; Kuijt 1994; Rollefson 1998; Simmons 2007).

During the Middle PPNB farming villages were established and characterized by rectangular structures with multirooms. It became more stable and developed in techniques of building, which is evident by good preservation of these sites until date. These structures reflect the high social organization and economical resources development. Structures became more specialized even for residential or ritual structures. The architectures were rectangular or sub-rectangular with one entrance with internal space opposite to the entrance with possibility of central hearth. Walls were made of field stones filled by mud and small irregular stones. Floors were made of thick plasters painted by red, pink or white colors. The arid sites continued to have the oval or semicircular structures through maintenance or rebuilding of the previous period structures.

The mega-villages structures present many variables of the social organization of the people during the Middle PPNB that showed an increase of the inside spaces and good preparation of the floor inside the structures. Many argued that this could be justified by increase of population size and presence of multi-family occupation of these structures. Not all of these structures were prepared for religious activities; it is also related to the possible development of daily life activities. Also ritual activities have a close relation with death. This is clear from the presence of the burials under the floors within the internal spaces of the structures (Fig. 3.7) (Kuijt and Goring-Morris 2002; Simmons 2007).

Ground stones during the Middle PPNB show various saddles as grinding slabs, stone bowls and platters of limestone, chalk, basalt and sandstones.

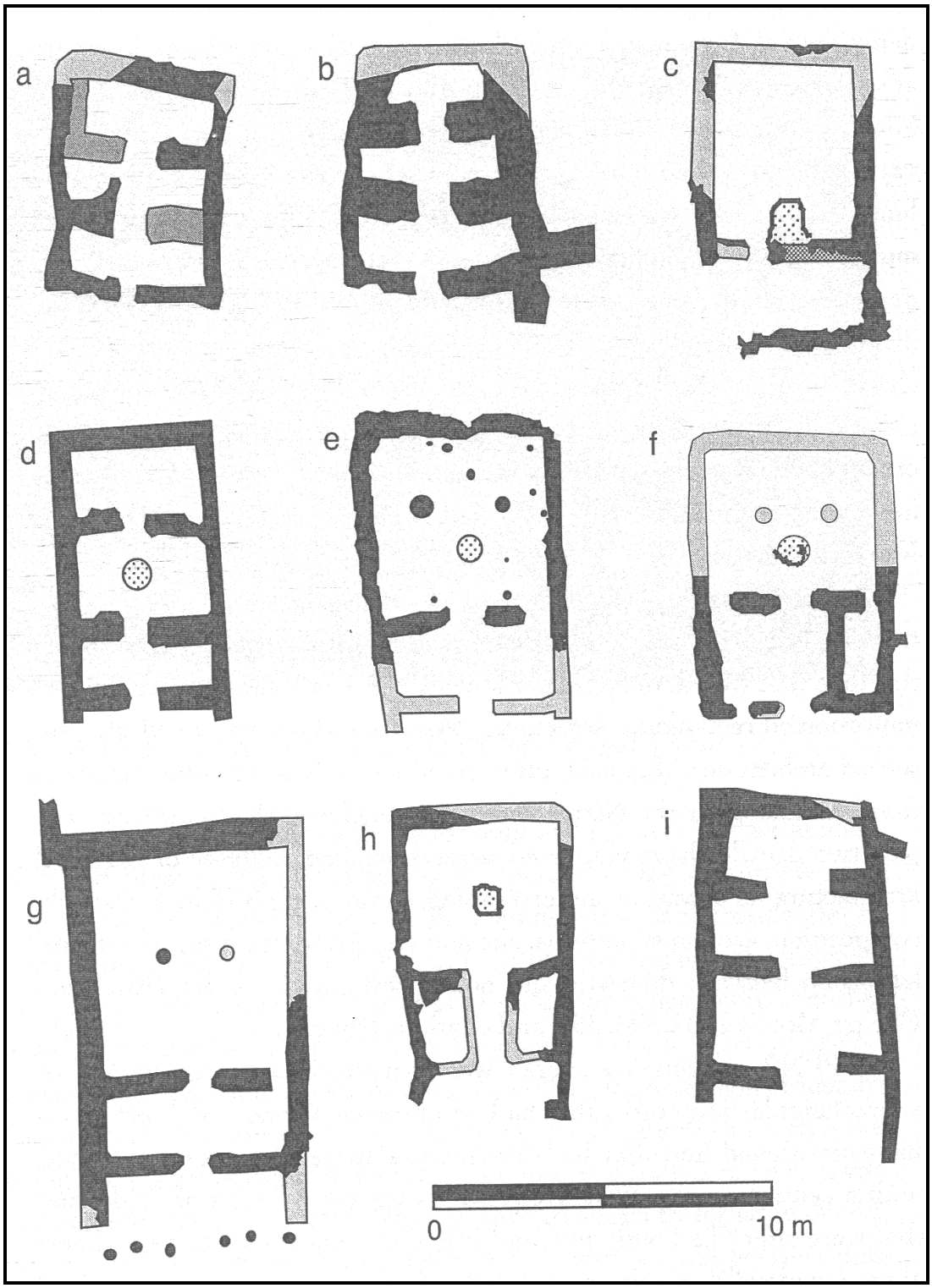

Fig. 3.7: PPNB Structures: (a-b) Beidha.(c) Beisamuon. (d-e) Ain Ghazal. (f-h) Jericho. (i) Yiftahel (Simmons 2007).

3.2.C. *Late PPNB*

Mega Neolithic sites continued to be occupied since the Middle PPNB. Population became concentrated in the mega farming villages. The neolithisation revolution moved from nuclear phase to be more spread to fare regions. This period was present in the Near East from 9,250 BP until 8,700 BP (Kuijt and Goring-Morris 2002; Simmons 2007).

The geographic distributions of the Late PPNB sites were found in different geographic zones like Mujahiya in Golan heights and Nahal Oren and El Wad in the coastal basin of Galiliee. Other sites have been interpreted as hunter gatherer sites in Negev (ex, Abu Salem) and Sinai (ex, Nahal Boqer). While in Syria basin, the Late PPNB has been poorly documented (Kuijt and Goring-Morris 2002; Simmons 2007).

As a natural result of continuous occupation of the Middle PPNB during the late PPNB, many general characteristics became common between these two phases. However, in the Late PPNB they had their own particular changes.

During the Late PPNB, there are many similarities of the Middle PPNB chipped stone technology. One of the particular characteristics of this period is the presence of grinding stones from limestone's and the production of bracelets from sandstones and lime stone. Lithic studies show that the Byblos and Amuq points (projectile points) were the dominant in this period. The number of knives increased during the Late PPNB (Fig. 3.8) (Kuijt and Goring-Morris 2002; Simmons 2007).

Also the Middle PPNB structures were reused during the Late PPNB but they were modified according to their requirements. The number of rooms increased but the size became smaller. Also two story building started to appear in this period; some of these buildings contain internal stairways. During the Late PPNB, the use of spaces change, common parts to be shared by different nuclear families appear, modifying the social behavior among families. Large fire hearths were established in the external spaces of houses, which could related to common cooking activities and storage facilities between groups (Kuijt and Goring-Morris 2002; Kuijt 1994; Rollefson 1998; Simmons 2007; Wright 2000).

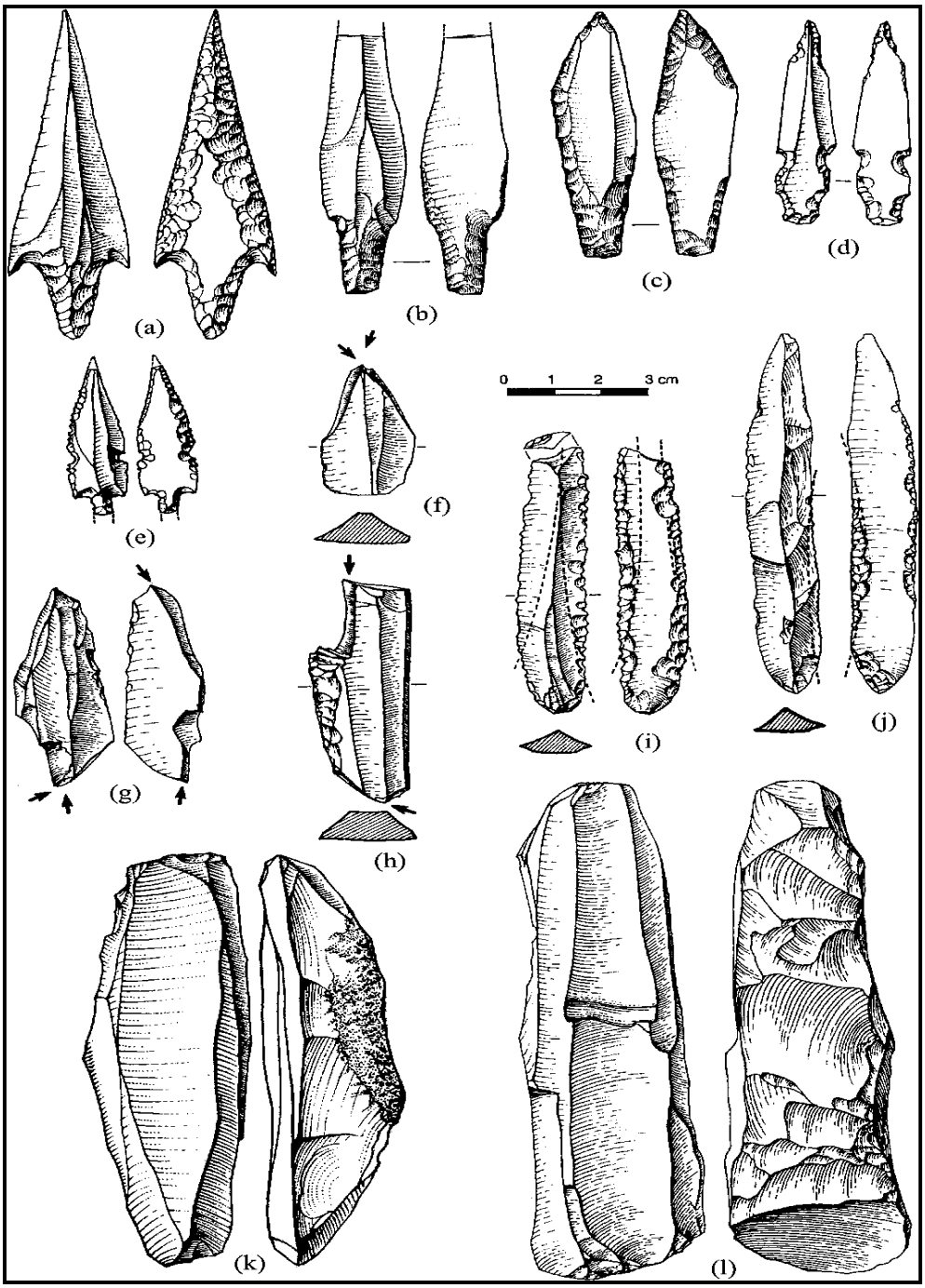

Fig. 3.8: Chipped stone tools from the Early and Middle, Late PPNB periods of the southern Levant: (a) Jericho projectile point. (b) Byblos projectile point. (c) Amuq projectile point. (d) Jericho projectile point. (e) Helwan projectile point. (f–h) Burin. (i-j) Sickle blades. (k-l) Generalized bipolar core (Kuijet, Goring-Morris 2002).

3.3. Pre-Pottery Neolithic C (PPNC) in Near East

This term is used mainly in the Near East to replace the old term of the final PPNB from the period 8,300 BP until 7,900 BP. This period present the last phase of the Pre-Pottery Neolithic period. It is a very important transitional stage from the Pre-Pottery to Pottery Neolithic. In Jordan Ain Ghazal is one of the well-documented sites belonging to this phase (Kuijt and Goring-Morris 2002; Kuijt 1994; Rollefson 1998; Simmons 2007).

It is noted that in this period, animal domestication increased and structures were modified. The PPNC structures from Ain Ghazal shows two typology of houses. The first one is small rectangular structure that could be used for families while the second one could be used for storage. Pavements were made of crushed marl instead of plaster.

Lithic industry was mainly evident in the PPNC with less use of pink flint. Rollefson suggested that the harvesting of reeds rather than cereals could be the reason for using naviform blades as blanks for sickles. Also during the PPNC the projectile points became smaller and lighter than before. On the other hand, their quantity is similar to the previous phases (Rollefson 1990).

3.4. Pottery Neolithic (PN) in Near East

Pottery Neolithic period (PN) is a very important stage of the Neolithic civilization due to the invention of pottery production. Many contemporary cultures during the PN, located in different geographical zones in the Near East, provide evidences of regional specialization. Pottery Neolithic period in the Near East was between 7500 BP until 6900 Bp (Fig. 3.9) (Garfinkel 1999; Kefafi 1987). Researchers have been proposing two different chronological subdivision. The first one has been suggested by Garfinkel. He subdivided the PN into three contemporary phases: the Yarmoukian culture, Jericho IX and the Nizzanim. The second one has been proposed by Kefafi. He subdivided the PN into two phases: Late Neolithic 1 and Late Neolithic 2.

Many archaeological evidences show that the first experimental pottery production during the PPN came from Ain Ghazal. The statuaries of Ain Ghazal, works plasters and clay have been documented in different sites, supporting the theory of regional developments of ceramic industries in southern Levant (Garfinkel 1999; Kefafi 1987).

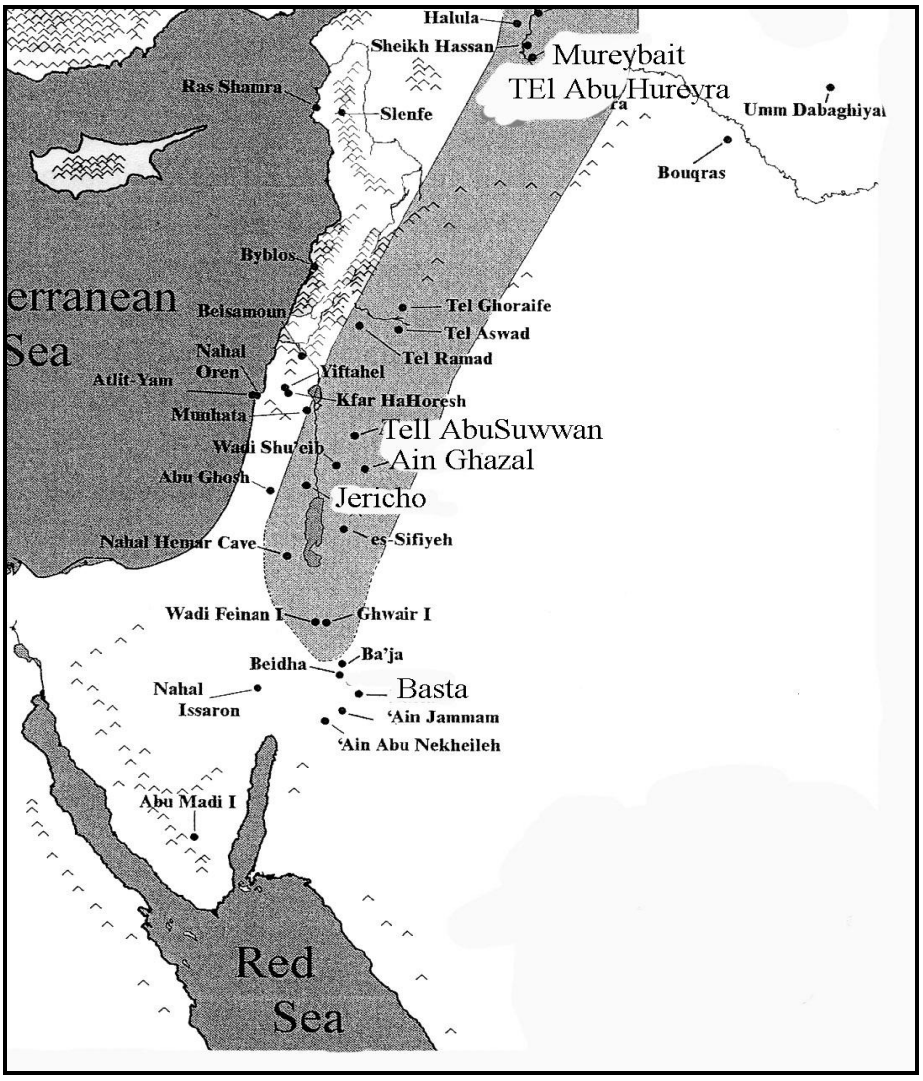

Fig. 3.9: Pottery Neolithic sites in the Near East (Simmons 2007).

Byblos and Yarmoukian ceramics were the earliest pottery industries in southern Levant. The Byblos vessels were handmade and globular with round or concave bases. It was poorly fired and the surface decorations were based on incised lines with cardium-shell impressions. These decorations were rare. There were many examples of this typology like holemouth jar and jar with short necks.

The Yarmoukian ceramics included different size of decorated bowls and jars with flat or pedestal bases. They have many typologies like short pedestaled bowls, chalices and necked jars. There was a particular decoration of the ceramics that was designed by using plain reverse bands incised with herring bone motifs. There was also painted jars without incised decoration (Fig. 3.10) (Kefafi 1987; Simmons 2007).

Jericho IX ceramics have two types. The first form is crude ware. Crude ware is a coarse and porous, straw-tempered raw material made of light creamy ware. Bowles, which contain rounded or strait sides and upright or vertical sides, and holemouth jars, which have inverted rims and sometimes cylindrical knobs, are the main examples of the crude category (Garfinkel 1999; Kefafi 1987; Simmons 2007).

The second type of Jericho IX ceramics is the fine wear. It is fine and light buff without organic additives. The main examples of this typology are the wide open bowls, small jars and cups.

Wadi Rabah ceramics were made of coils with different raw materials. It has new typologies and new decoration. Techniques of decoration changed and were performed before firing the ceramics. Wadi Rabah vessels include many typologies like the bow-rim jars, holemouth jars and carinated bowls.

During the pottery Neolithic lithic industries changed from blade to flakes. Pyramidal cores became common during this period. There was a variety of projectiles, sickles and implements (burins, bifacial knifes and notches). There are distinguished characteristics for different cultures during the pottery Neolithic. During the Yarmoukian phase, researchers noted the use of composite tools of short backed and truncated blade segments. While Wadi Rabah sickle blades have a tiny denticulation and nibbling. Also these sickle blades do not contain retouch in their cutting edges (Garfinkel 1999; Kefafi 1987; Kafafi Zeidan 1993).

During the Pottery Neolithic, many mega villages were created in the Near East. Human used many materials to build different rectangular structures typologies composed of single or multi-rooms. Structures have dimensions around 10 to 30 m^2, while some multi-rooms structures have two storage spaces with living area up to 100 m^2. In some geographic zones, large structures could have been used as storage place a continuous tradition from the PPN period like in central Turkey (Catal Huyuk, Asikli). While in Jarmo in northern Iraq, a traditional Jarmoan rectilinear building was built from mud-brick. The structures were characterized by presence of multi-rooms and pit structures and the use of plasters and terrazzo for floors (Fig. 3.11) (Garfinkel 1999; Kefafi 1987; Simmons 2007).

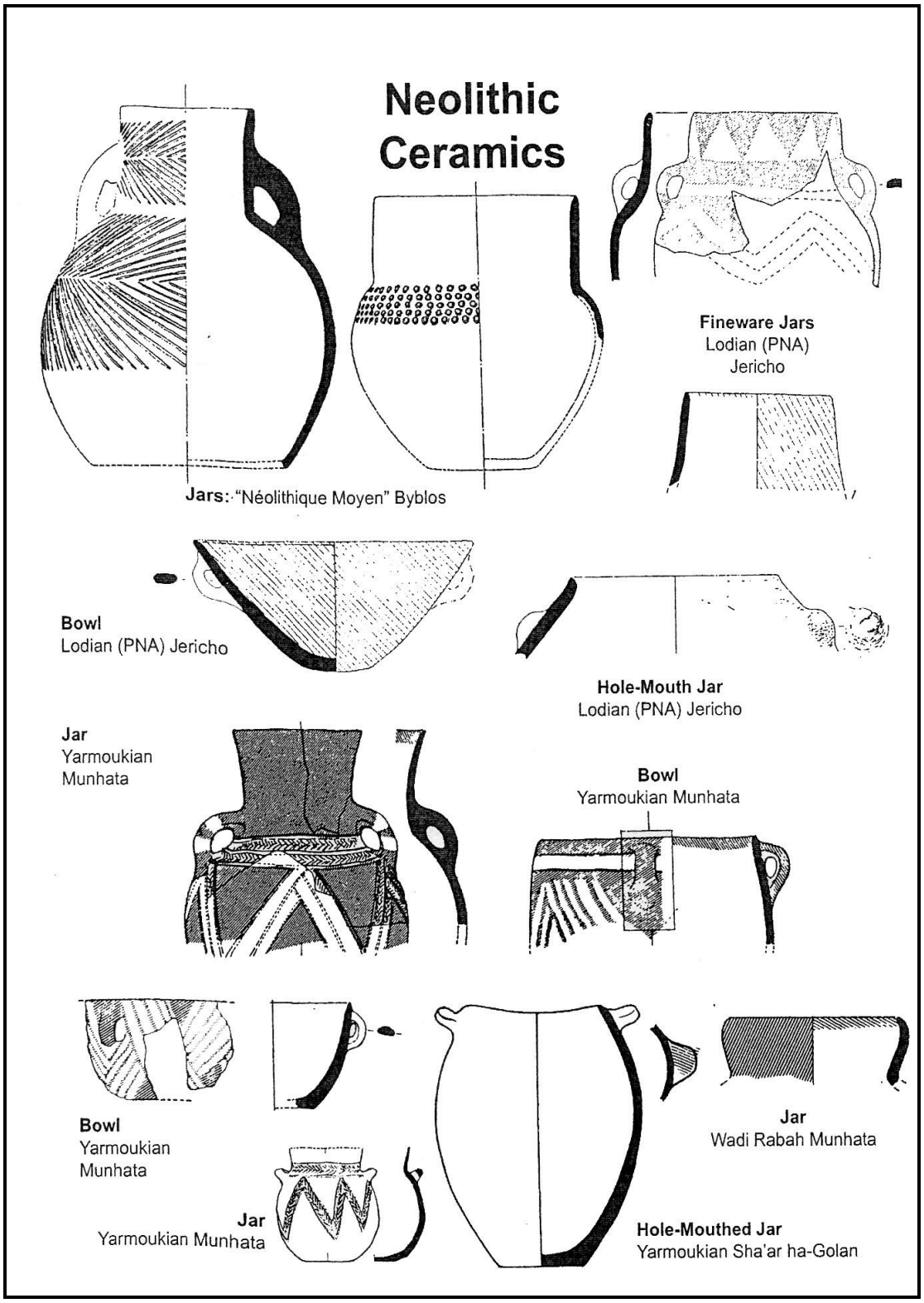

Fig. 3.10: PN; Ceramic typologies (Simmons 2007).

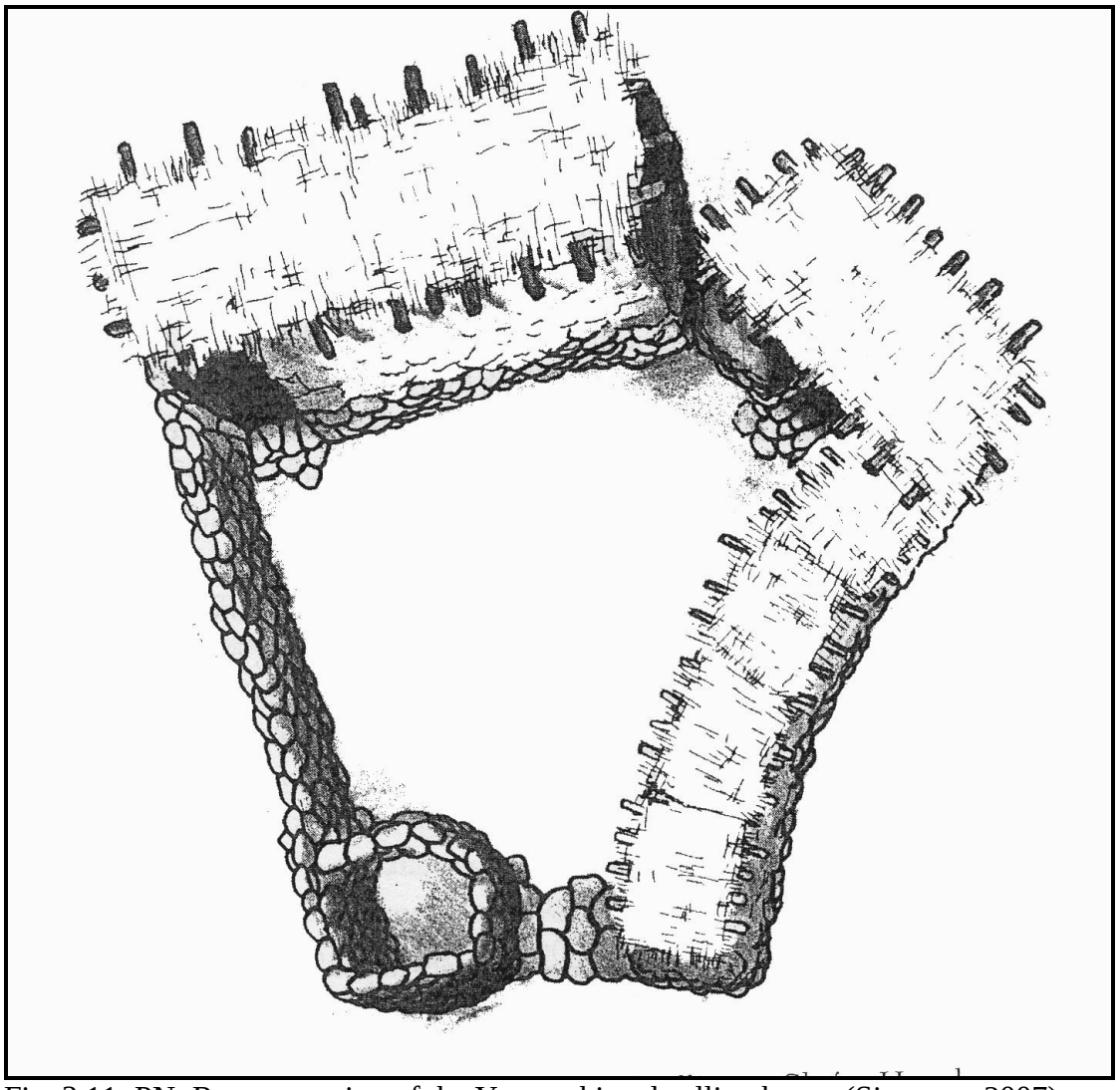

Fig. 3.11: PN; Reconstruction of the Yarmoukian dwelling house (Simmons 2007).

3.5. Origin of animals domestication in the Near East

There was a global environmental transition at the end of the Pleistocene and beginning of the Holocene. The presence of new fertile geographical regions in the Near East is the main factor that contributed to the success of the Neolithic revolution.

There were archaeological evidences of common cultural characteristics in the Near East at the beginning of the Pre-Pottery Neolithic. Also, there are specific evidences that support regional cultural developments. The social organization became more complex and highly organized (Tchernov 1993; Twiss 2007, 2008; Wright 2000).

During the Pre-Pottery Neolithic A, there was a concentration of the Neolithic villages around alluvial zones and water sources. These sites were distributed along the Jordan River, the Damascus basin, and the Euphrates River. There were also high concentrations of Neolithic sites in the Jordan valley (Levantine Corridor) beside the alluvial zones (Tchernov 1993; Twiss 2007; Wright 2000).

Archaeological excavation cover evidences of the first domestication of wheat in different sites in the Middle East. The economy in the PPNA period was based on the cultivation of domestic wheat and wild cereals. There is no evidence of animals' domestication during the PPNA. They used the regional environment for meat sources through hunting of wild animals. Gazelle and wild boar and cattle were the main sources of meat. There was also evidence of hunting small animals like hare and birds.

Location of some PPNA sites in the rout of bird emigration between Europe and Asia give them secondary seasonal sources of birds. Archaeozoological evidences present notable high quantities of bird bones in different sites like Dhra and Wadi Faynan 16 (Tchernov 1993; Wright 2000).

PPNA structural evidences highlight a new social organization and behaviors. These structures have wide spaces for work activities and cooking. Fire places are located within the internal structures. Researches predicted that some spaces and structures were used as storage spaces.

A rise in population size within the sites is reflected by the increase in food requirements and in social organization activities. These conditions supported start of specialized activities within the internal society during the PPNA (Tchernov 1993; Twiss 2007, 2008; Wright 2000).

In particular arid zones, especially in the black desert and Azraq basin in Jordan, PPNA sites are still smaller. Archaeological evidences support the continuous presence of seasonal occupations.

The PPNB changes are clearly evident in the Near East. Global climate became better during this period. Mega farming villages were distributed in different geographical zones in Jordan. Also the distribution of the PPNB sites along with their size increased in the Near East.

Economy of the PPNB became dependent on plant and animal domestication. The increase in production of sickle blades, used for cultivation of cereals, and presence of storage

structures during the Middle PPNB support the above hypothesis. Hunting of animals was less practiced than in previous periods because of the exploitation of the secondary products, like wool and milk, obtained by the domestic animals. People during the PPNB used to hunt animals for their meat and leather. The above facts present a high change of social organization (Tchernov 1993; Twiss 2007; Wright 2000).

During the PPNB structures typologies became rectangular. People created new spaces for daily activities and storage system. There was external area beside the structure (courtyard). Also, plaster was used for flooring. These two points are archaeological evidences that represent new treatment of structures as habitation use and keeping other activities out site (food preparation).

During this period, the Neolithic sites were established near to water courses where plants and animals were easier to exploit, like Ain Ghazal and Jericho. But by the increase of people number during the Neolithic period increased their food demands. There was, therefore, a need for new food supplies.

Neolithic sites in Near East were dependent on small regional environmental sources. The most common animals hunted during this period are auroch and gazelle, wild boar, wild goat (*Capra aegagrus*), wild sheep (*Ovis orientalis*) and small animals like hare (Twiss 2007, 2008).

The beginning of domestication in the Near East is difficult to be clearly understood. Two hypotheses have been suggested to explain animal domestication in the Near East. The first hypothesis supposes the introduction of ovicaprines from Turkey and Anatolia through trading routs during the PPNB. Research has supported the presence of similarity of wild sheep remains from Neolithic sites in Jordan and Turkey (Wasse 1997). On the other hand, the second hypothesis suggests that domestication of wild goat and wild sheep is a regional development in the southern Levant. It does not accept the suggestion of transportation of domestic ovicaprines from Anatolia regions.

Archaeological evidences in southern Taurus and Tell Abu Hureyra and Tell Halula show that the first domestication of wild goat occurred at the end of the Middle PPNB, while in south-eastern Turkey (Nevah Cori) the domestication of wild sheep started in the Late PPNB and PPNC (Peters 1999; Simmons 2007).

It is important to report that during the Middle PPNB there were regional developments of economy with an increase in number of farming mega-villages in the Near East. The

archaeological evidences indicate that trading exchange came from the Red Sea zone. This supports regional developments of domestications in the Near East.

The presence of the domestic ovicaprines in the Jordanian sites during the PPNB and later periods shows an increase in size of these species. This could be related to environmental changes or new adaptation of these animals with the new domestic generations.

During the Pre-Pottery Neolithic C and Pottery Neolithic, there was an increase of domestic sheep in the faunal remains. This indicates new developments in people's use of their resources. This could be supported by that fact the domestic sheep gives more secondary products than domestic goat (Horwiz 1993; Tchernov 1993).

Domestication of auroch begun during the Early PPNB. Small size auroch was found with large size bones of auroch in Basta site in southern Jordan and in Tell Es-Sinn in Syria. These small-size bones represent a new domestication phase of the *Bos primigenius* in Jordan.

Wild boar domestication in the Near East mostly started during the Yarmoukian period (Pottery Neolithic). Archaeological fauna coming from different Pre-Pottery Neolithic sites shows young wild boar remains. Researchers expect this was an outcome of spring season hunting but not due to domestication as ovicaprines (Wasse 1997).

These archaeological evidences indicate that people during the Pre-Pottery Neolithic improved their abilities of domestication and cultivation of domestic plants. At the end of the Pre-Pottery Neolithic, there was a documented start of pottery Neolithic climate deterioration in the Middle east. These climate changes and the increase of population size were the reason for development of new economical strategies. Economy at this stage was more stable and based on domestication, but with some hunting activities of gazelle and small animals.

Ch. 4. NEOLITHIC PERIOD IN JORDAN

Archaeological excavation recovered important archaeological sites related to the Neolithic period in Jordan. The distribution of the Neolithic sites in different geographical zones in Jordan provides a very important evidence for development during the Neolithic period. Also, many of these sites represent the oldest evidences of Neolithic period in the Near East. Researchers have subdivided the Neolithic period of Jordan into Pre-pottery Neolithic and Pottery Neolithic. In this thesis, chronology approach will be used as described by Bar-Yosef and Rollefson (Henry 1998).

Period	BP
Pre-pottery Neolithic A (PPNA)	10.300-9.600
Early Pre-pottery Neolithic (EPPNB)	9.600-9.200
Middle Pre-pottery Neolithic (MPPNB)	9.200-8.500
Late Pre-pottery Neolithic (LPPNB)	8.500-8.000
Pre-pottery Neolithic C (PPNC)	8000-7500
Pottery Neolithic (PN)	7.500-6.500

Table 4.1: Chronological table of the Pre-pottery and Pottery Neolithic periods in Jordan (Henry 1998).

4.1. Pre-Pottery Neolithic A (PPNA) in Jordan

Few sites that represents this phase were found in Jordan such as the rock shelter Iraq ed Dubb in the north and temporary campsites in Sabra and Dhra in the south of the country. Jilat 7, located in the middle of Jordan, represents a continuous occupation from the PPNA to PPNB.

No architecture was found in Sabra while two PPNA buildings were identified one above the other inside the shelter. Radiocarbon dating of the lower building is 9.950 ±100 BP. The lower building contains a mud floor and adjacent mud bricks (Kuijt, Goring-Morris 2002; Rollefson 1998).

The upper building has an oval shape with a mud floor. The buildings could indicate a semi permanent settlement in the site.

Dhra is one of the oldest permanent PPNA farming villages. The site is distributed on an area of at least 50X80 m and contains oval or circular structures made of mud stones. Radiocarbon dating of the site estimated that occupation of this site goes back to 9.960 ±110 BP (Kuijt, Goring-Morris 2002; Rollefson 1998).

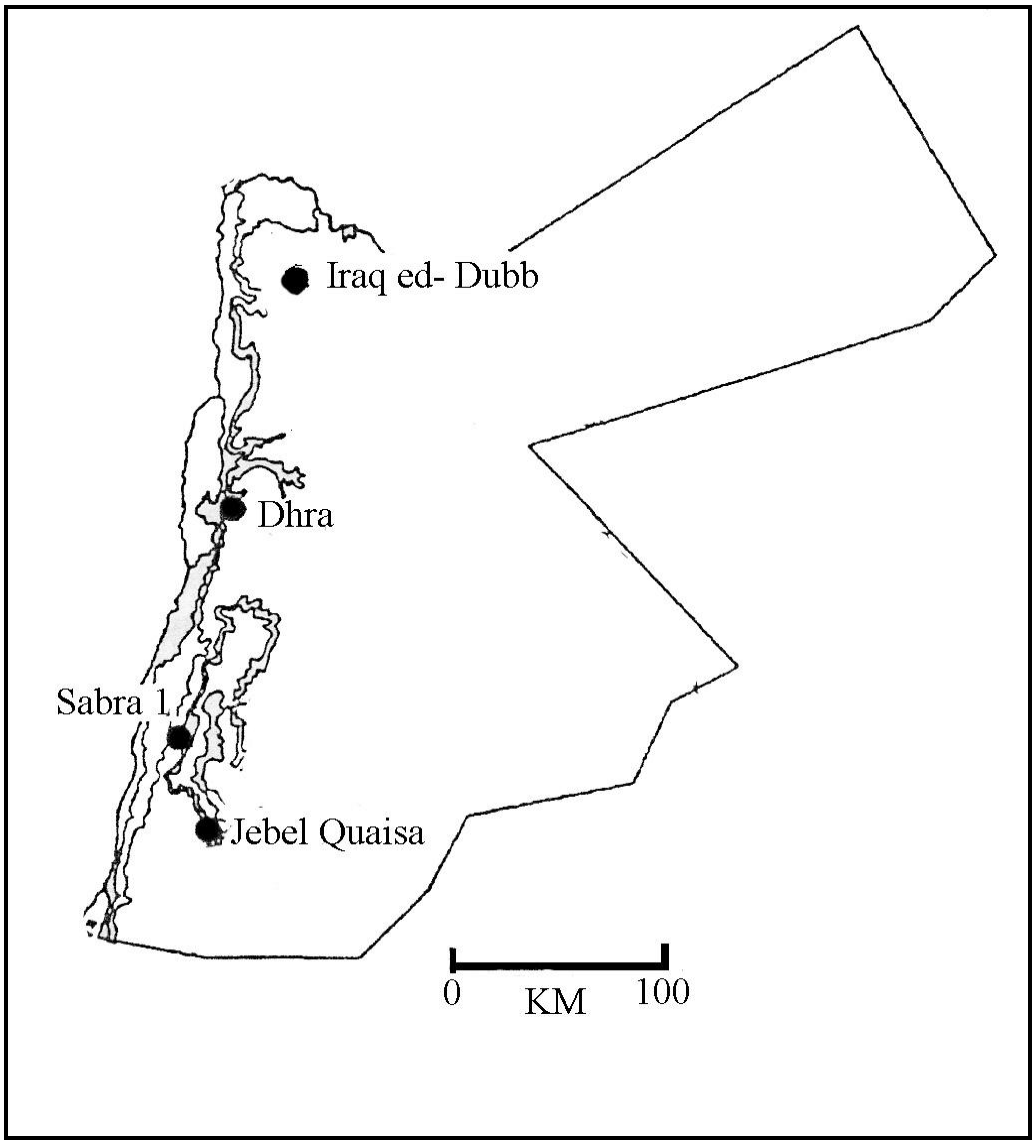

Fig. 4.1: PPNA; sites location in Jordan (Rollefson 1998).

The main lithic assemblage of PPNA are the Khiamian and Salibiya culture. Khiamian points are Hagdud truncations, unidirectional blades and blade cores.

In Sabra 1 and Jebel Queisa, a high percentage of points and piercing were detected. This indicates that these sites are a campus for hunting. While in Iraq ed Dubb archaeological remains show good quantity of sickle blades. This indicates longer habitations of the Iraq

ed Dubb if it compared with other sites. (Bar Yosef 1982; Kuijt, Goring-Morris 2002; Rollefson 1998).

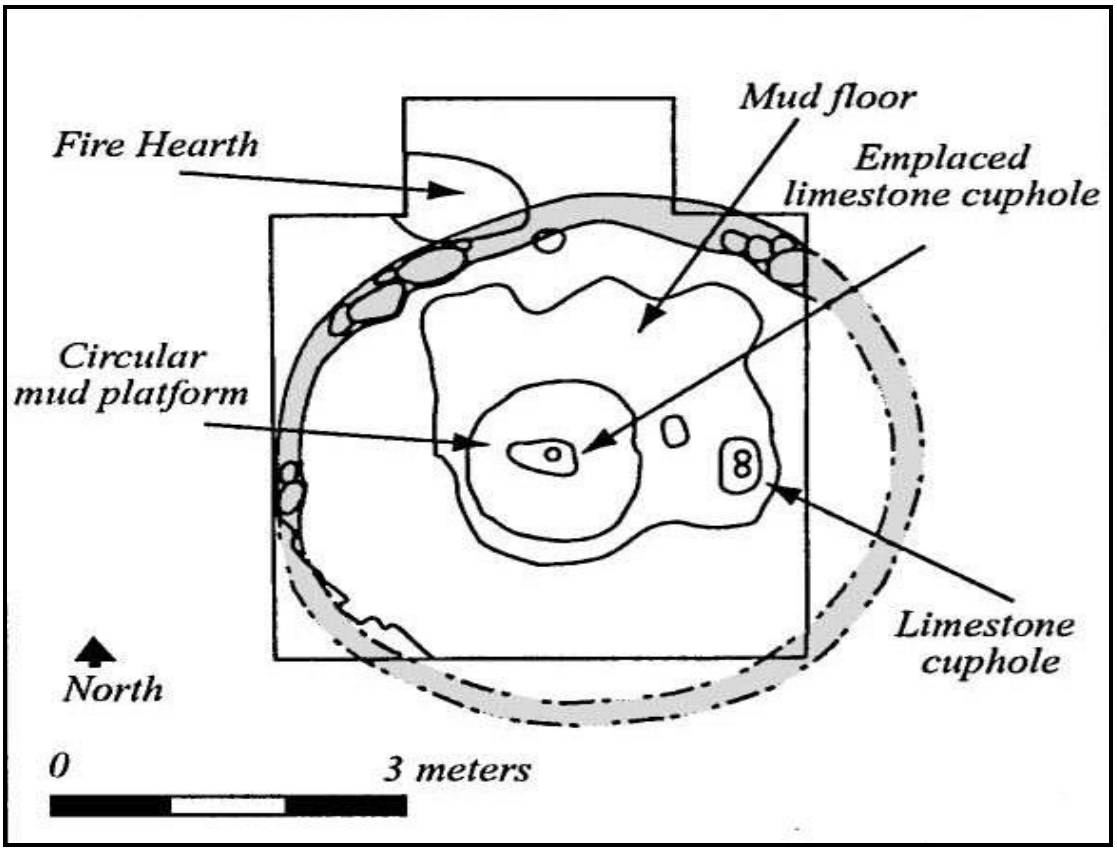

Fig. 4.2: PPNA; Iraq ed-Dubb structure planimetry (Kuijt 2001).

Jilat 7 excavations cover a Khiamian and Helwan projectile points. Dating of the site shows an occupation related to the period between 10.000 BP and 9.500 BP, which contemporary to the other PPNA sites in Jordan. In Jilat 7 site, structures and features in bedrock were related to the early PPNB (Kuijt 1994).

PPNA sites in Jordan have particular characteristics like the distribution in different geographical zones and the typology of the PPNA sites, which are related to seasonal hunting sites and permanent village sites. Researchers have expected the presence of the hierarchy settlements from the presence of different settlement sites during the PPNA in Jordan. Also, there has been a good evidence of connections and close relations between these sites as predicted by the similarity of cultural behaviors and cultural material, the presence of similar burial practices, and the similarities in lithic industries (Bar Yosef 1982; Kuijt, Goring-Morris 2002; Rollefson 1998).

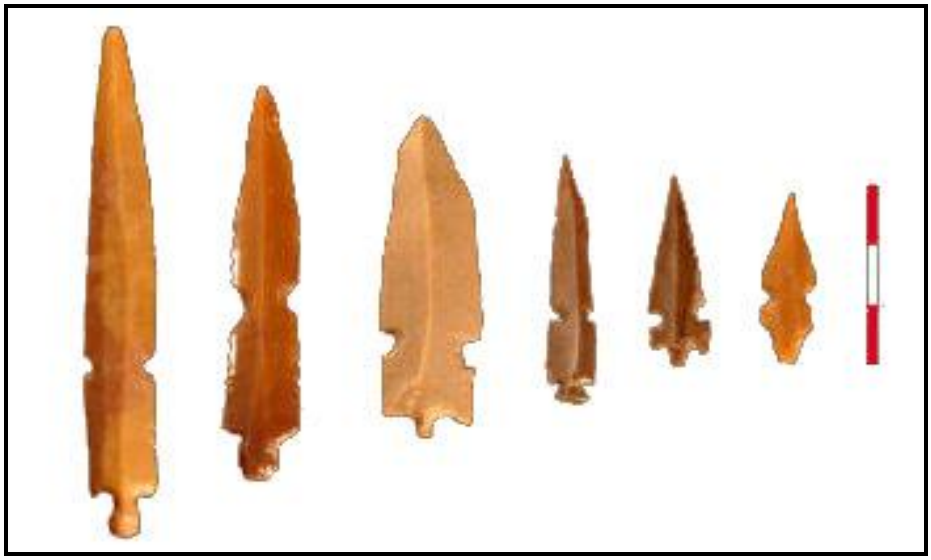

Fig. 4.3: PPNA; Helwan projectile points (Ibáñez 2010).

4.2. Pre-Pottery Neolithic B (PPNB) in Jordan

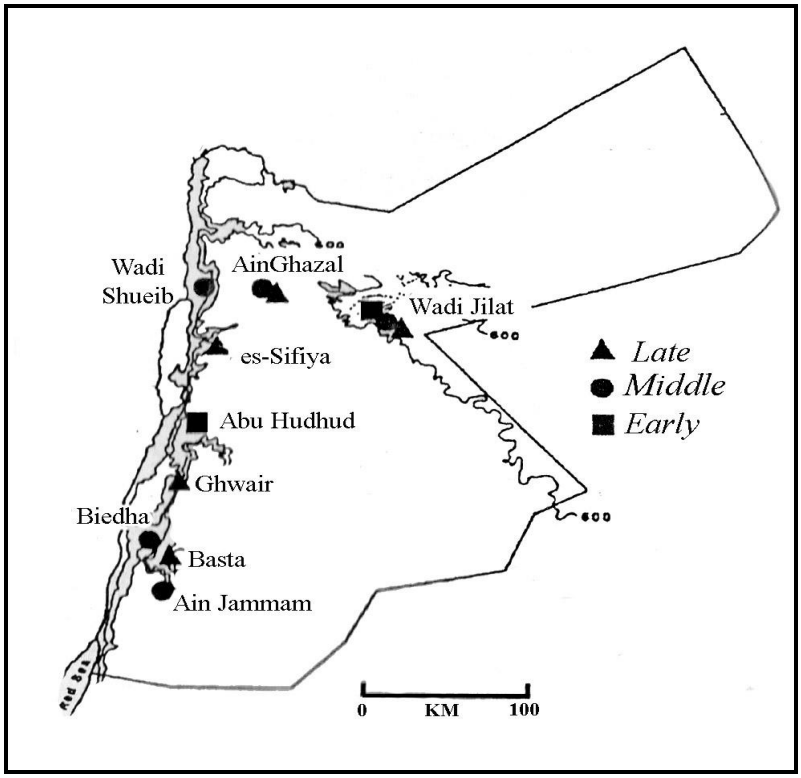

Fig. 4.4: Early, Middle and late PPNB sites in Jordan.

During this period, Jordan started to have new mega farmer villages. Also continuous occupation of different sites was initiated in this period. Example of the mega villages are

Ain Ghazal, Basta, and Tell AbuSuwwan. These sites provide more evidence of cultural development that lead new chronology used in the Pre-pottery B period (Fig 4.4).

4.2. A. *Early Pre-Pottery Neolithic B (EPPNB)*

There are few documented sites in Jordan during this period. As reported earlier, Jilat 7 contains a continuous occupation from the PPNA to the early PPNB. Abu Hudhud presents another example of this period in Jordan.

The main characteristic of the EPPNB is the shift to naviform blade production and the presence of bidirectional blades. This technology came from the Middle Euphrates and northern Levant then spread to the south Levant (Bar Yosef 1982; Rollefson 1998).

Helwan points are the main culture product in this period, but the Khiamian points were still used.

Jilat 7-I excavation covers a lot of different activities like grinding stones (mortars, pestles and stone vessels). This site contains residential rectangular structures with rounded angels (oval structures). Structured walls were built by using the field stones, while they used organic materials for roofing. Four small oval or sub-rectangular structures were recovered at Abu Hudhud excavation (Bar Yosef 1982; Rollefson 1998).

It's important to report that there were no non - residential structures known for this period. (Kuijt, Goring-Morris 2002)

4.2. B. *Middle Pre-Pottery Neolithic B (MPPNB)*

During the Middle PPNB there were great developments of the Neolithic period in Near East and also in Jordan. There was an increase in establishment of many farming mega-villages in different geographical zones in Jordan. These villages represent well organized societies that lead to development of large communities. The middle PPNB was characterized by domestication of plants and animals. Ritual and mortuary practices became more complicated during this period (Bar Yosef 1982; Kuijt, Goring-Morris 2002; Rollefson 1998; Simmons 2007).

Middle PPNB architecture was similar in typologies within the Near East but with some difference in particular characteristics. In Ain Ghazal and Basta, there are rectangular structures built by field stones using parallel lines of stones filled by mud and small stones such as mortars. A red and white plaster was used for pavements. While in Beidha in

southern Jordan, oval structures were broadly used. In the Azraq bazin in the eastern desert of Jordan, seasonal hunting sites were identified. These sites were built of stones but without plaster walls and floors (Bar Yosef 1982; Kuijt, Goring-Morris 2002; Rollefson 1998; Simmons 2007; Twiss 2008).

In the Middle PPNB sites, some spaces or structures were detected integrated to the Neolithic site structures that could be used as ritual activities. This could be supported by presence of large hearth than in the residential structures and by the rare presence of artifacts related to daily life activities. In Beidha, three stone structures were found far from the residential structures. They could also be established for ritual activities (Byrd, 1994).

During the Middle PPNB, there were lithic technological developments through the use of naviform blade cores. This allowed them to gain better control over the blades morphology. Therefore, they were able to produce long straight, parallel sided blades. It was used to produce sickle blades and arrowheads, borers and perforation (see Fig. 4.6) (Bar-Yosef, 1982).

During this period a high quantity of the purple-pink flints were available in Jordan and Palestine. This glossy material was available in outcrops located in the northern heights of Jordan. Different projectile points were found in north and south of Jordan like Byblos, Amuq and Jericho points. The transverse burins were made on naviform blades. While the sickles consisted mainly of long and intact naviform blades (see Fig. 4.6) (Bar Yosef 1982; Kuijt, Goring-Morris 2002; Rollefson 1998).

4.2. C. *Late Pre-Pottery Neolithic B (LPPNB)*

During the Late PPNB there was an expansion of sites' size in Jordan. On the other hand, the Middle PPNB sites were abandoned during this period in west of Jordan valley.

In Jordan, Late PPNB sites were large with an area of more than 10 ha. Examples of these sites are Ain Ghazal, Wadi Shuieb, Ain el-Jammam, Basta and Khirbet Hammam. Some of these sites could be considered as mega farming villages like Ain Ghazal and Basta. (Bar Yosef 1982; Rollefson 1998; Simmons 2007)

Architecture during the Late PPNB period is characterized by increase in room numbers but with smaller size. The Late PPNB sites architecture could be described in general as

rectangular or sub-rectangular. Structures that were built using field stones for walls and plasters for the pavement.

In the desert zones as in Azraq basin, sites consisted of 4 to 6 oval structures. During the Middle PPNB periods, sites in this area were used as seasonal sites. While during the Late PPNB, their size was bigger. This could represent a longer period of occupation. (Bar Yosef 1982; Kuijt, Goring-Morris 2002; Rollefson 1998; Simmons 2007; Twiss 2008)

During the Late PPNB, there are non-residential structures found in different sites in Jordan. In Ain Ghazal and Basta, this was evident in two stored structures. The size of the two stories structures rooms was between 1.5-2.0 m². There is lack of lithic tools within these structures. This could support the hypothesis of using these structures for storage.

At Ain Ghazal excavation, two structures were recovered that contain fireplaces. These fireplaces were built with inset stones forming the rims and several upright monoliths at one end of the room. These structures are expected to be temples or special buildings (Kuijt, Goring-Morris 2002).

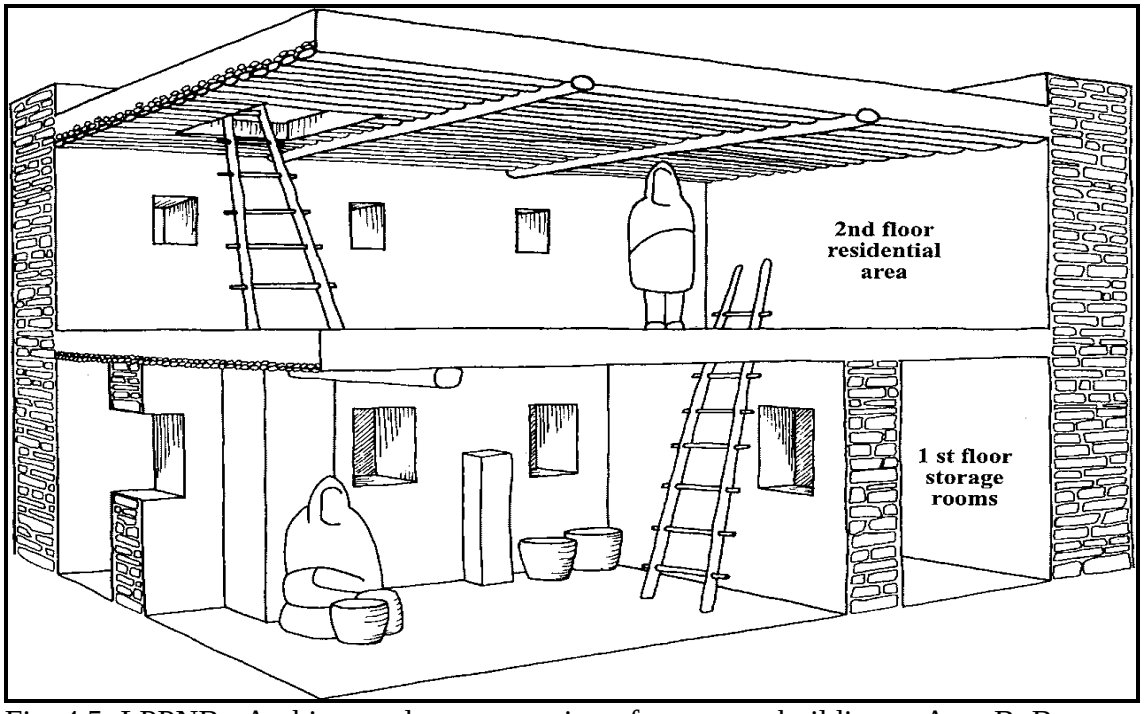

Fig. 4.5: LPPNB; Architectural reconstruction of two-story building at Area B, Basta, Jordan (Kuijt, Goring-Morris 2002).

Lithic technology during the Late PPNB was similar to the technology during the Middle PPNB. Naviform technologies were used, but the shape of the tools was different. During

this period, the Byblos and Amuq points were dominant in Jordan. There was a decrease in the use of glossed sickle blades that was parallel to an increase in knifes production during the Late PPNB (see Fig. 4.6). (Bar Yosef 1982; Rollefson 1998; Simmons 2007; Twiss 2008)

Excavation in different sites in Jordan zones highlights use of sandstone and limestone bracelets and use of direct percussion and grinding of limestone (see Fig. 4.7).

During this period, there was a particular shift to regional development. There was rare long distance exchange. Sea shells from the Red Sea in south of Jordan were detected in different sites in Jordan. (Kuijt, Goring-Morris 2002; Rollefson 1998; Simmons 2007; Twiss 2008)

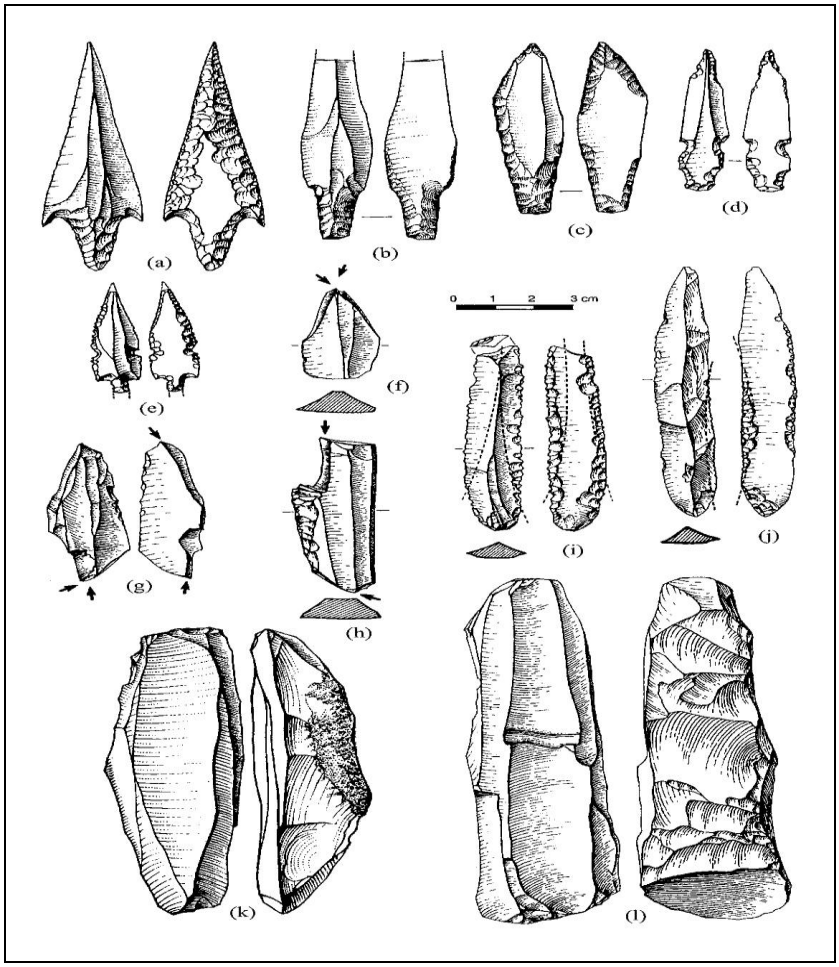

Fig. 4.6: PPNB; Lithic tools in the Near East sites: (a) Jericho projectile point; (b) Byblos projectile point; (c) Amuq projectile point; (d) Jericho projectile point; (e) Helwan projectile point; (f–h) burin; (i-j) sickle blades; (k-l) generalized bipolar core (Kuijt 2001).

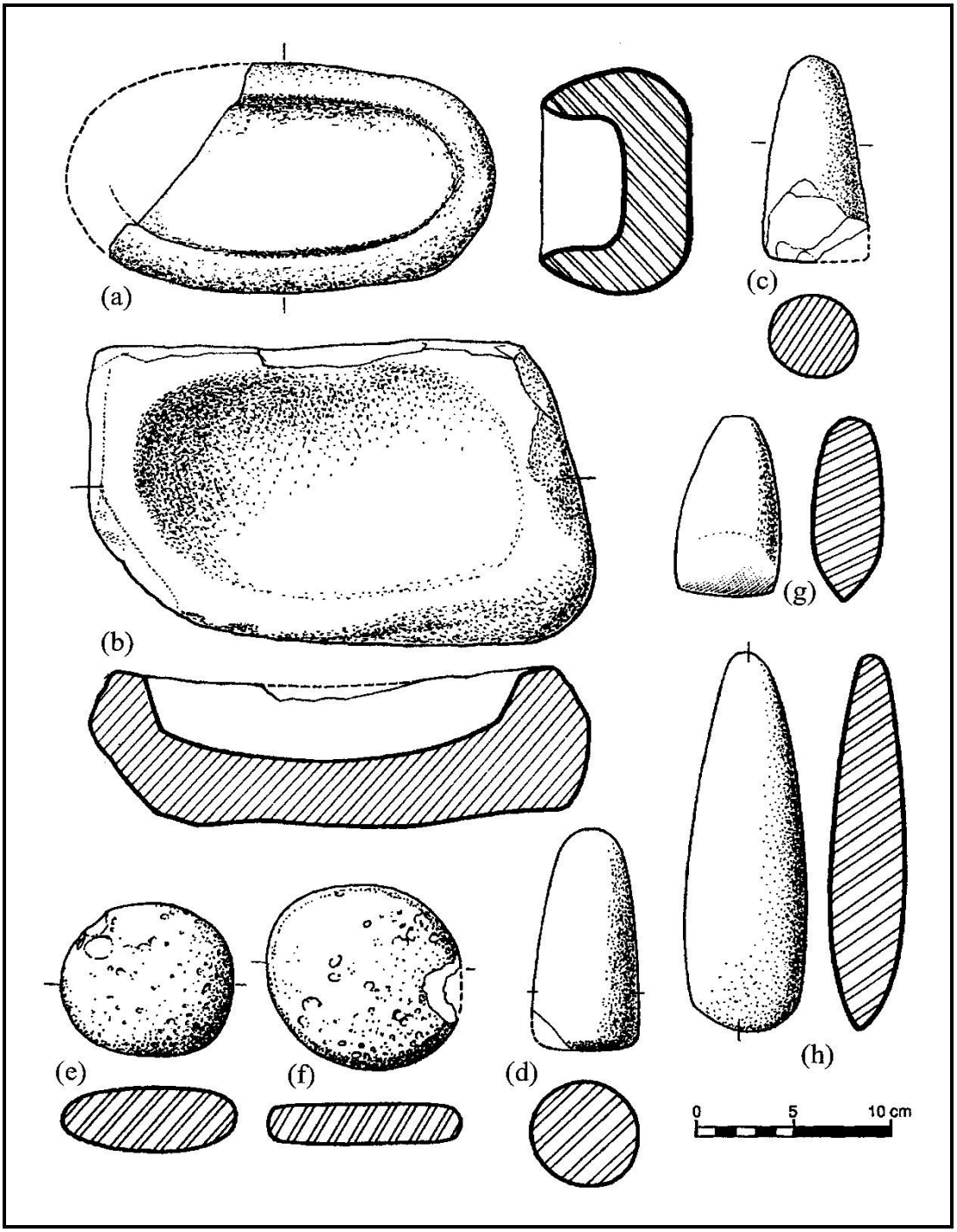

Fig. 4.7: PPNB; Ground and polish stone from the Near East sites: (a-b) grinding stone; (c-d) pestle; (e-f) hand stones; (g-h) ground and polished stone axes (Kuijt 2001).

4.3. Pre-Pottery Neolithic C (PPNC) in Jordan

This period was previously described as the "final Pre-Pottery Neolithic B" or as transitional phase to the Pottery Neolithic. Excavation in Ain Ghazal in Jordan, however, has provided new evidence of particular developments during this period. It has been, therefore, given a new chronological term called "Pre-Pottery Neolithic C" (Kuijt, Goring-Morris 2002; Rollefson 1990).

There are a lot of archaeological sites that represent this period in Jordan. The main source of information came initially from Ain Ghazal site. This was followed by new evidences that came out from other sites like Basta and Wadi Shueid. (Bar Yosef 1982; Rollefson 1990; Simmons 2007; Twiss 2008).

Settlements were based on the re-use and modification of the structures of the previous periods with some changes in characteristics. Structures size became smaller with no further use of two storage structures, which were built in the Middle and Late PPNB.

Structures in this period consist of one simple small size room with less use of plaster for floors. Small course stones were used for pavements. During this period, residential structures have became close to novel dual houses (Kuijt, Goring-Morris 2002).

During the Pre-Pottery Neolithic C, there was a decrease in the size of site and structures. On the other hand, there was a continuous occupation of many sites from the Late PPNB to the PPNC.

Evidences from Beidha highlight have indicated use of some structures as public architectures instead of domestic structures. Examples are the Great wall and wall street.

Lithic technologies also changed during the PPNC (Rollefson 1990).

The Naviform techniques and blade techniques decreased along with abandonment of the use of pink-purple tools. This indicates lack of the flint tools specialization during the PPNC period. Projectile points became smaller than those available during the Middle PPN (Rollefson 1998) .

During this period the main lithic industry is represented by the production of bifacial retouched knifes and tubular knifes. There was also a shift from the side-scraper to transverse scraper. All typologies of retouched lithic tools became shorter, wider and thicker.

Kuijt (2008) compared evidences between the PPNC and the previous period. Results indicate that there was a decrease in site's size along with decrease in number of people within the sites during the PPNC.

It is important to report that there is still a need for further archaeological research to obtain better information and clearer understanding of the characteristic of the Pre-pottery Neolithic C period in Jordan.

4.4. Pottery Neolithic (PN) in Jordan

The name of this culture was firstly adopted by M. Stelelis (1972), who excavated in Shaar Haglolan. The main characteristics of this culture are the decorated ceramic vessels. They were painted or incised by herring bone chevrons or another instruments. Examples are incised pebble figurines, clay figurines with coffee-bean eyes (Kafafi 1993, 1998; Simmons 2007).

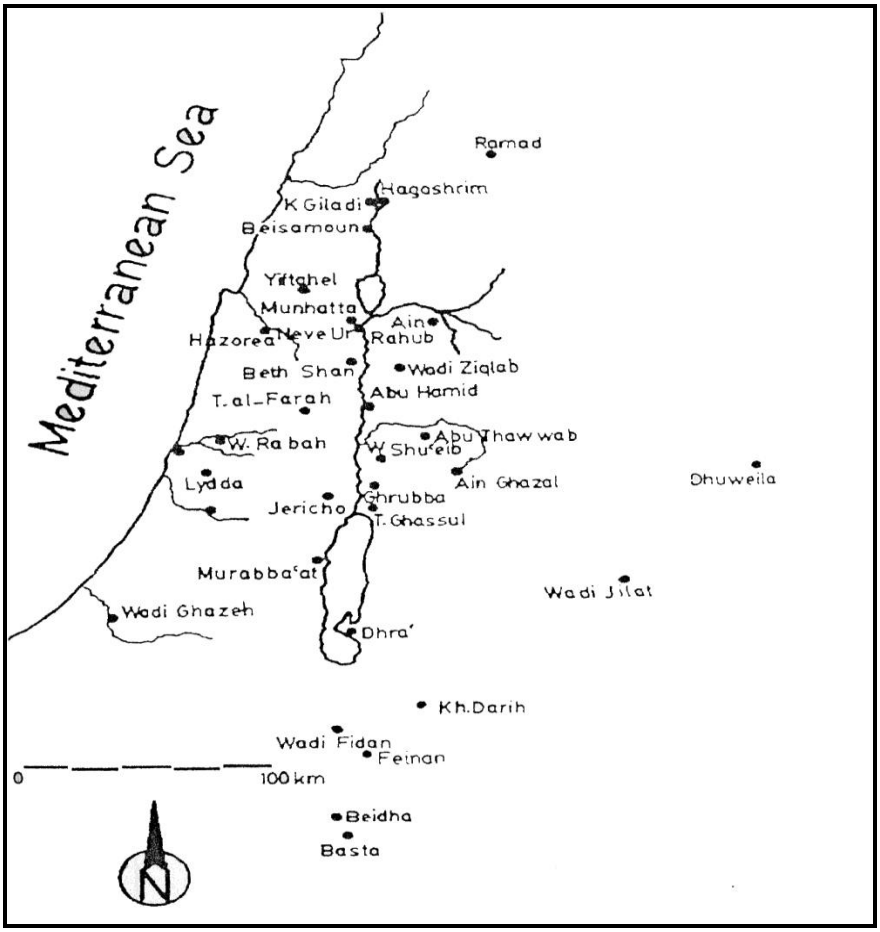

Fig. 4.8: PN; sites distribution in Near East (Kafafi 1998).

Flint industries that consist mainly of deeply dentinculated sickle blades and small squamous retouched arrow head, burins, chisels and pointed tools.

Yarmoukian cultures were identified in several sites like Tell el-Arbain, ed-Debab, Khirbet Falah and Ain Ghazal. In these sites they were presented by incised pottery shards by herring bone chevrons. (Bar Yosef 1982; Kafafi 1998; Rollefson 1990, 1992; Kuijt 2008)

The initial steps of pottery industry were located in the previous cultures made of sun dried or low fired clay.

The Yarmoukian first sub phase is characterized by dark red painted and red slipped pot shards. While in the upper levels, typical Yarmoukian pottery was present.

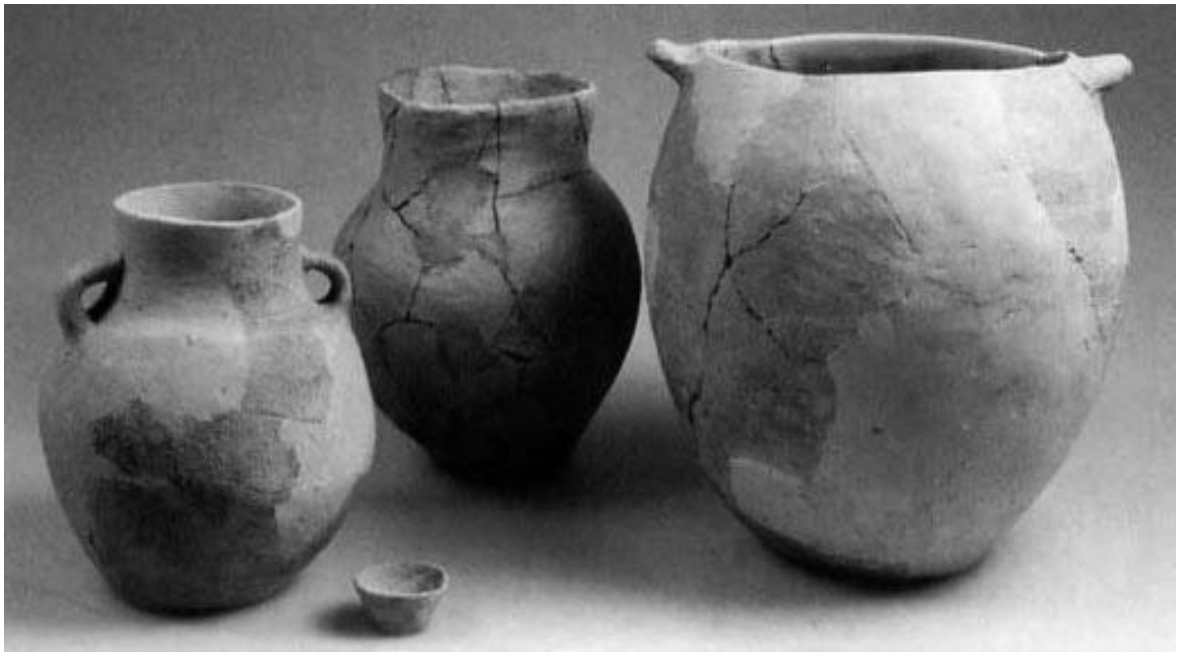

Fig. 4.9: Yarmoukian pottery (Twiss 2007).

The Yarmoukian period contains three sub phases. The first phase is the shift from the PPNC to PN that is characterized by reuse of the earlier architectures. The second phase is the classical Yarmoukian culture. It has decorated pottery (painted or incised) and clay figurines with coffee-bean eyes. The third one is the end of the Yarmoukian culture that is represented by dwelling pits. In this phase, Ain Ghazal seems to be occupied by semi-nomadic pastoralists. (Bar Yosef 1982; Kafafi 1993,1998; Rollefson 1992; Kuijt 2008).

The Yarmoukian architecture is characterized by using of dwell in pits or in huts inside pits in the Jordan valley. While in the mountainous area, houses were built with stone walls.

The main typology of the Yarmoukian structures:

1. Rectangular structures: the main examples came from excavations like Jebel Abu Thawwab and Ain Ghazal. Ain Ghazal rectangular buildings were built on the top of the PPNC levels. House is medium in size (5x 3 m) and contains one to two rooms and a courtyard (Kafafi 1993,1998; Kuijt 2008; Rollefson 1992);
2. Apsidal structures: this typology was excavated in Abu Thawwab and Ain Ghazal. At Ain Ghazal, the best preserved structure is a rectangular building (5-4X 4-3 m). It has a curved wall on its southern side (1.4m) and includes one large monolith. The entrance door is not anymore opened through the walls like the previous periods. Pavements were made from plaster but were not well preserved. New sort of structures was built during this period that is close to towers with a diameter of 2.5-3 m² (Kafafi 1993,1998; Kuijt 2008; Rollefson1992);
3. Curvilinear structures: this typology was detected in Abu Thawwal site. It is one line building (diameter of 2 m) that has a pavement and post hole in the center (Kafafi 1993,1998; Kuijt 2008);
4. Pit-dwellings: this typology represents the final stages of Yarmoukian culture. Evidence on these structures was found in Ain Ghazal and Jebel Abu Thawwab. Large pits were detected, but there were not yet completely excavated. Therefore, they do not provide a clear picture of the dwelling inside the pits (Kafafi 1993,1998; Kuijt 2008)

4.5. Climate in Jordan during the Neolithic period

Vegetation changes associated with changes in the global climatic change took place around the world between 18000 to 6000 PC. In Jordan there were different changes in palaeo-environments during the transitional period from Mesolithic to Neolithic period.

Climatic change was associated by the presence of different geographical zones in Jordan. Palynological study from Abu Hureyra site (Hillman 1996) show the shift from the oak forest before 11000 BP to steppe forest type, pistachio, after 11000 BP in the Younger Dryas (Miller 1997).

In Wadi Hisma there was amelioration of the paleo-climatic condition(Emery-Barbier 1995). During the Mesolithic period the dominate specie was the very small grains of Chenopodiaceane (*Atriplex*) which indicate a cold climate. At the end of the Mesolithic period (Late Natufian) climate change became warmer and more humid corresponding to the Dryas transition (Miller 1997; Tcheronv 1997).

In Azraq basin another palynological evidences support the presence of moister condition during this Late Natufian while in Southern Jordan sites like Beidha climate testify dry episode.

The palynological studies of the lower Jordan valley highlight vegetation changes by the global climate changes. The presence of arboreal pollen was around 10-15% between 18000-14500 BP after that its decrease to 2-4 % during the Natufian period (11000-10750) BP. In the PPNA arboreal pollen show back presence to 10% until it reached 20% in the PPNB.

The study of the Dead Sea (Lisan lake) zone during the 10000 BC became arid and the lake leave a flat muddy area which confirm the presence of wet climate before 11000 BP followed by arid climate after 11000 BP (Almogi-Lubin 1991;Tcheronv 1997).

During the Neolithic period start the presence of river valley vegetations like poplar *(Populus)*, salt cedar *(Tamarix)* and olive (*Fraxinus*) within the period 10500-8900 BP.

Different vegetation was found in Mureybet like borage species *(Boragginaceae*) and other problematic types like wild einkorn and borages (Hillman 1996). Steppe legume has a significant presence within the flora of Mureybet site while the amount of the grasses was low. Arboreal vegetation was expanded for maximum in the eastward in Levant after that it became extended.

During the PPNA the oak was close to warrant harvesting for food but far from firewood collection. The woodland in Levant was more directed to the climate changes in the last glacial age. Within the PPNA and PPNB the start of early agriculture villages in Levant were associated to the area of steppe vegetation like pistachio, almond, hackberry and hawthorn. In Jordan were presented a arid steppe which view raining percentage of 100mm/yr. during the Early PPNB palynological researches highlight the presence of pluvial episode climates in the arid geographical zones in Jordan like Jilat 6 and Azraq 31 and Dhuweila (Garrad 1994). Domestic barley and emmer pollens were found in these sites.(Rollefson 1998).

During the middle and early PPNB there are more abundant of the farming villages and there was an increase of plant domestication. Domesticated Emmer and einkorn, barley and large annual seeds were found. (Henry 1997; Tcheronv 1997).

At the end of the PPNB period there was a high climatic deterioration which presented by increasing the temperature and decreasing the annual raining percentage. Also researched

supposed anthropical causes to increase the deterioration of the surrounded environments. Increasing the size of farming villages and population during the PPNB period which required more wood supply for cooking and warming.

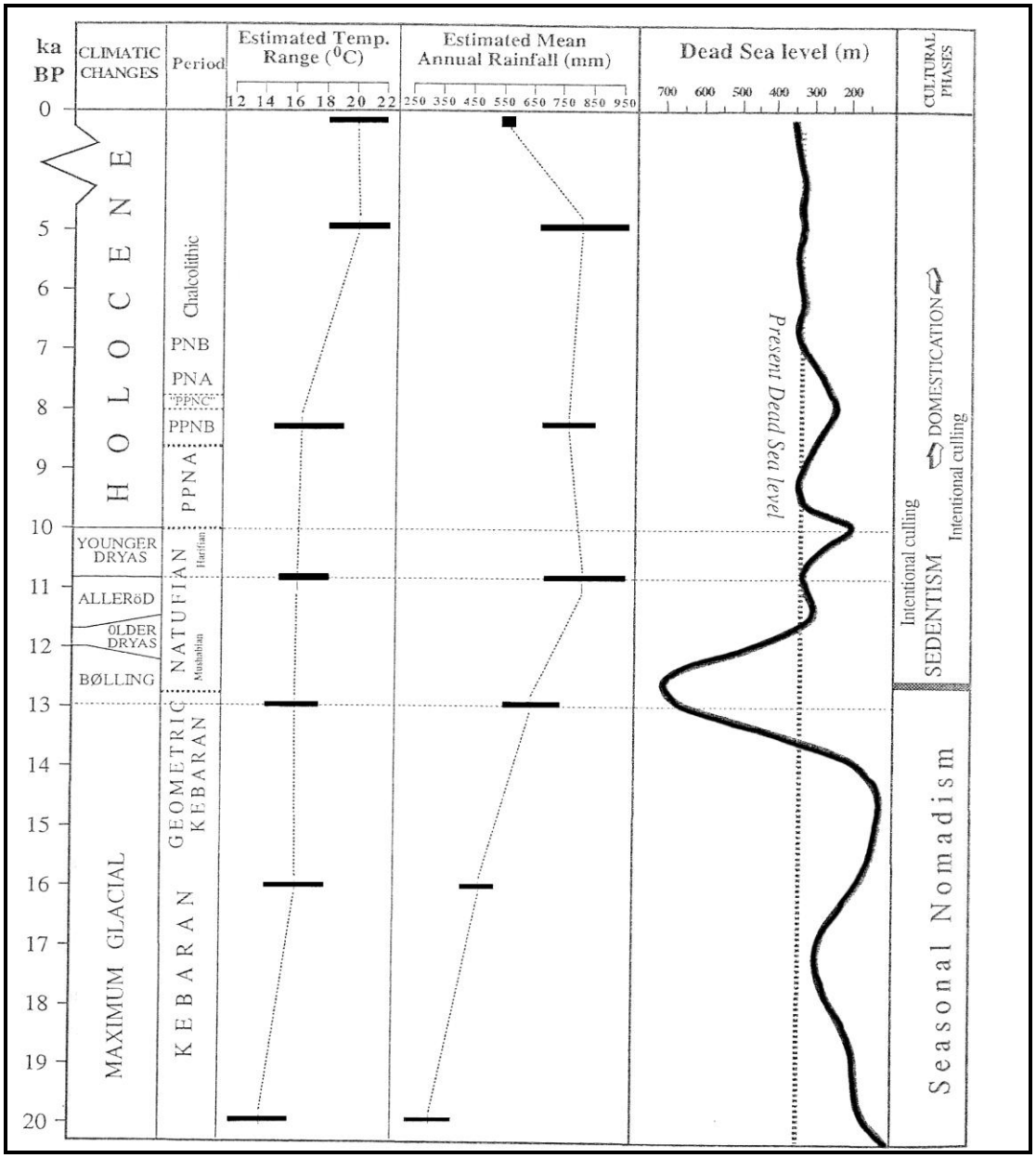

Chart 4.1: Late Pleistocene to early Holocene climate in Jordan (Tchernov 1997).

It is important to note that there still needed more palynological researches to understand the climate change between Pre-Pottery Neolithic and Pottery Neolithic because there are new evidences of continuance occupation of many sites during this period.

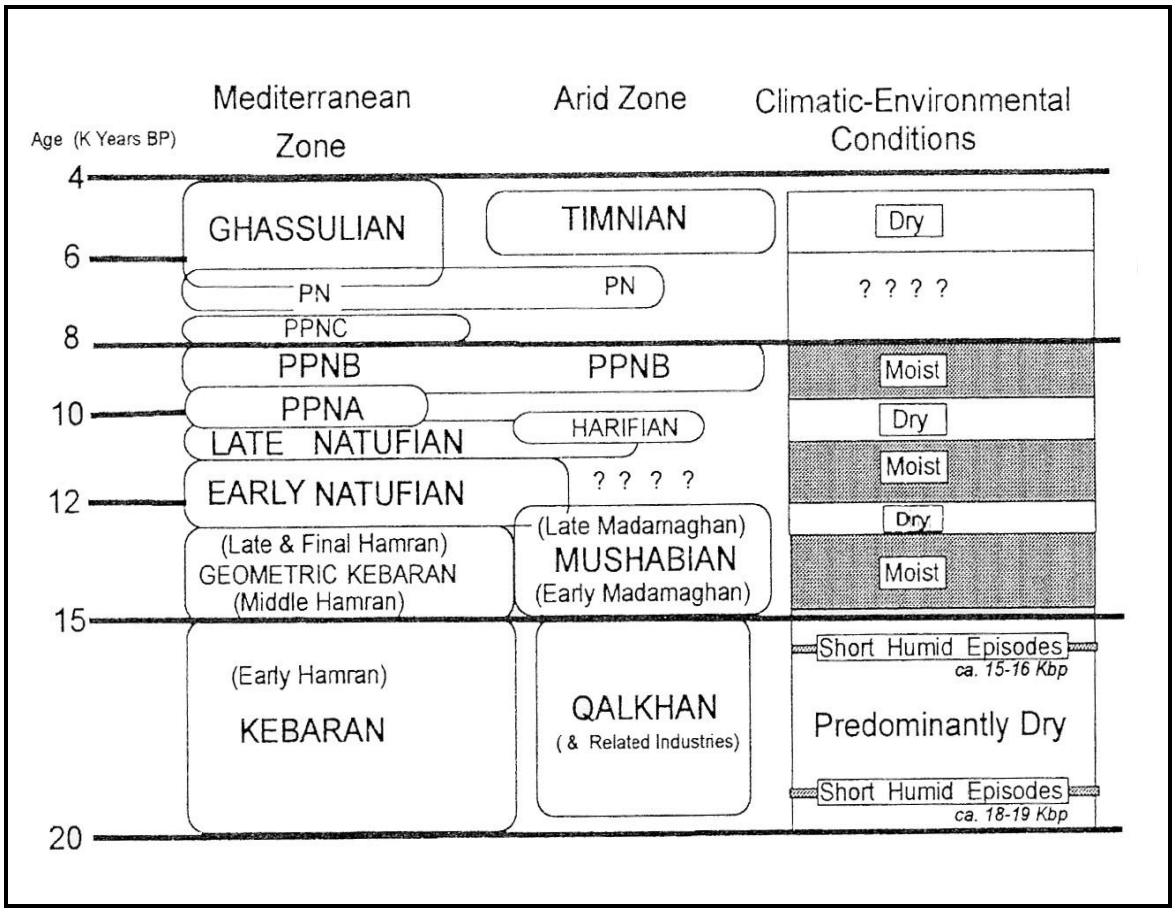

Chart 4.2: Schematic diagram of Cultural chronology and environmental conditions in Southern Levant (Henry 1997).

Ch. 5. NEOLITHIC SITES IN JORDAN AND SURROUNDED

5.1. Tell AbuSuwwan

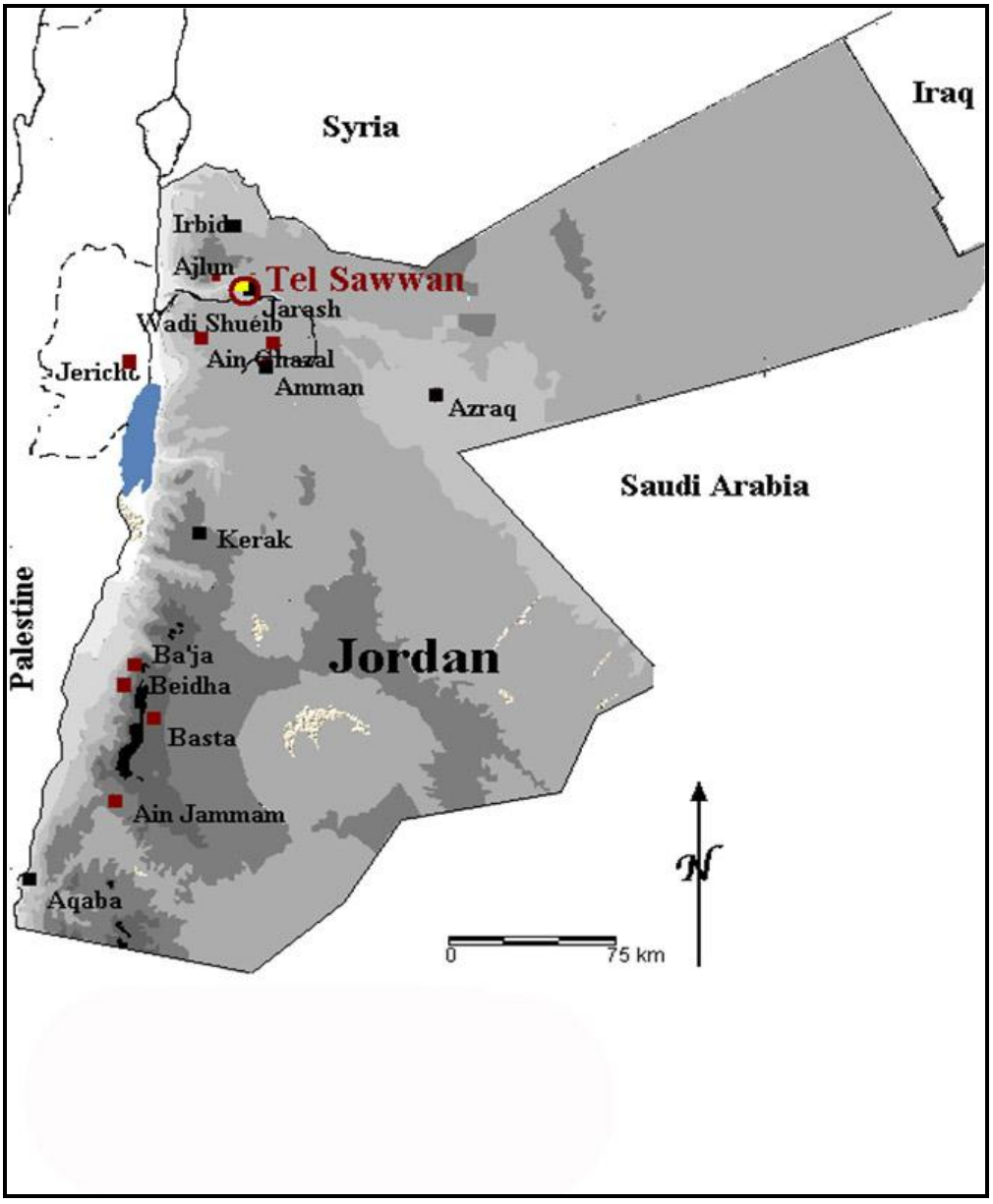

Fig. 5.1: Tell AbuSuwwan: Location in relation to Neolithic mega farming sites in Jordan (photo by Al Nahar).

Tell AbuSuwwan is one of the mega farming villages in Jordan. The site is located in Jarash city in northern Jordan and it is the only excavated Neolithic site in northern Zarqa River (Fig. 5.1).

This site was first presented by Harding in 1948 and followed by an archaeological survey by Kirkbride in 1955. The site has been excavated by the University of Jordan team directed by Maysoon Al Nahar during the summer seasons of 2005 to 2008 (Al Nahar 2005, 2010).

Archaeological excavations have recovered high quantities of lithic industries, animals' bones, other archaeological findings within the site area, which reaches around 12 hectares. Archaeological evidences indicate that occupation of the site spanned from the Pre-pottery Neolithic A until the Pottery Neolithic (Table. 5.1).

Archaeological remains recovered from Tell AbuSuwwan show that it had particular characteristics of life organization and specific architectural buildings. The site contains common lithic industries and habitation characteristics similar to other Neolithic sites in the Near East like Jericho and Basta.

SAMPLE	Cal. BC	Cal. BP	PERIOD
ASW.A.D4.6	7470 - 6900	9420 - 8850	MPPNB
ASW.A.D4.6	6890 - 6830	8840 - 8780	LPPNB
ASW.A.D4.7	6580 - 6420	8530 - 8370	LPPNB
ASW.B.G6/7.7	5360 - 5210	7310 - 7160	YARM
ASW.B.J6.10/11	7020 - 6930	8970 - 8880	MPPNB
ASW.B.J6.10/11	6920 - 6880	8870 - 8830	LPPNB
ASW.B.J6.10/11	6840 - 6620	8800 - 8570	LPPNB
ASW.B.F6.13	7060 - 6580	9010 - 8530	MPPNB

Table. 5.1: Tell AbuSuwwan; Radiocarbon datings (Al Nahar 2010).

5.1.A. *History of excavation*

Site excavations were performed in two areas in the site (Area A, Area B) by using grinding squares (5X5 M) (Fig. 5.2). These squares were initially excavated within an internal area of (4X4M). A bulk area of (4X1) between squares was kept during excavations in order to preserve the stratigraphical sequences. At later stages, some of the bulk areas were excavated to recover any other findings between the main squares. This has been done according to the excavation requirements (Al Nahar 2005, 2010).

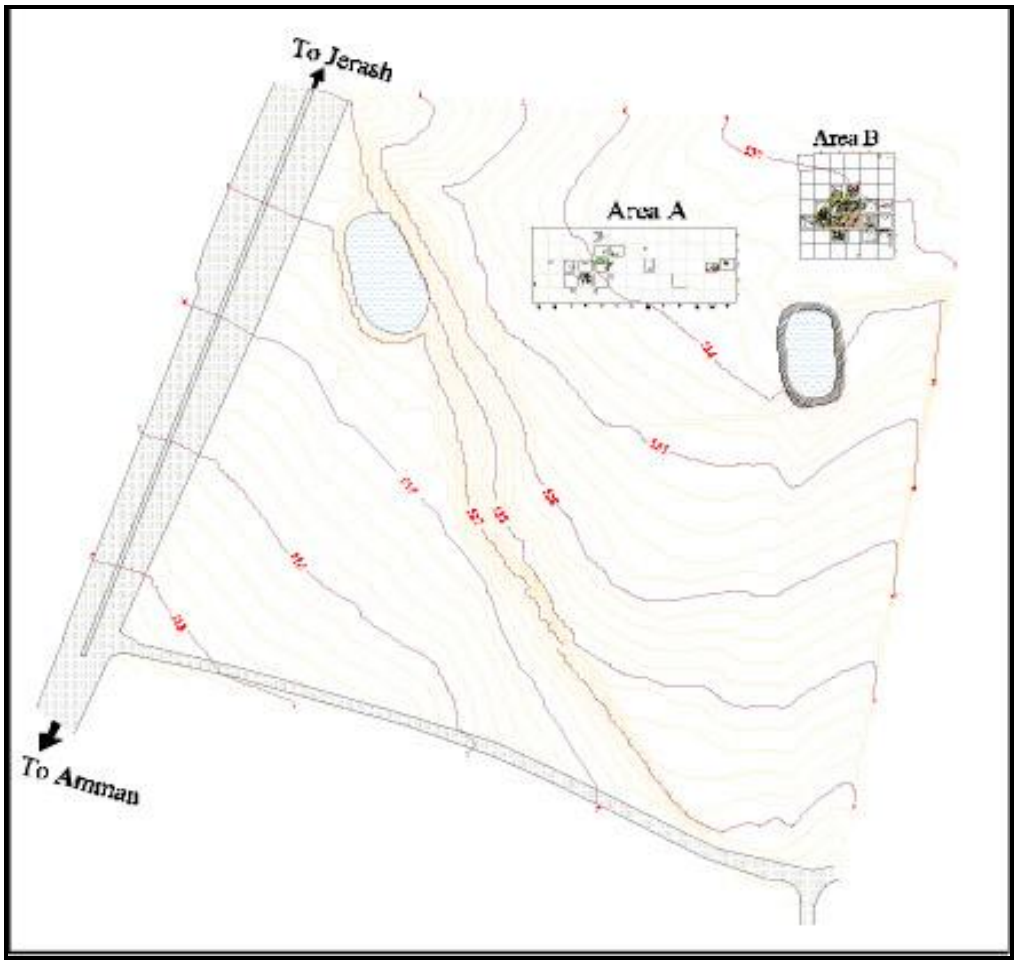

Fig. 5.2: Tell AbuSuwwan; Topographic map of the site (photo by Al Nahar).

5.1.A.1. Area A

This area is located in the south of the site. Archaeological evidences recovered three walls made of medium and small stones in Sq E2. The mortar was composed of small stones with mud, which was used to fill between the wall stones. The walls have a medium length between 1.5-2.0 m and a width of 0.5 m. Floors were made of small stones and white plaster. The walls are connected to each other and presents a small room. Three pits were found near to the eastern wall of this room (Fig. 5.3).

The external zone hearths present a food preparation activities and one of these hearth are big size. Within the heart sub layers; it has been founded different levels of soft clay soil and soft ash remains. The heart was surrounded by calcite stones. Near to it excavation recovers a remains of big size clay ceramic plate above plaster floor possible use for pottery heating and clay preparation (Al Nahar 2005, 2010).


Fig. 5.3: Tell AbuSuwwan; Southeastern structure in Area A (Al Nahar 2010).

In the squares (C3, D2, D3, Bulk C3/D3) archeological excavation recovered a wall with stair steps and mud floor and two large boulders (Fig. 5.4).

In the external zone hearths were used for food preparation activities; one of them was of big size. Within the internal sub-layers different levels of soft clay soil and soft ash remains were detected. The hearth was surrounded by calcite stones. It has been suggested that it was used for pottery heating and clay preparation. Excavations have recovered remains of big size clay ceramic plate above plaster floor near to it.

In the squares (C3, D2, D3, Bulk C3/D3) archaeological excavations have recovered a wall with stair steps, a floor made from mud, and two large boulders (Fig. 5.4).

Area A is characterized by the presence of high quantities of lithic industries like scraper and burins. In square (D4), five hearths were found; three of them are on top of each other.

Within the Area A, two yellow-colored floors were found. They were prepared by clay and small stones. Their presence indicates that they could have been surrounded by wall. These walls unfortunately could have been removed by agricultural activities.

According to dating of samples from area A, Al Nahar suggests that this area represents living structures surrounded by working areas. This area was occupied in the Late PPNB and continued to be reused from the PPNC to the Pottery Neolithic period. Unfortunately, this area is located near to the top soil surface, therefore, it has been destructed by the recent agricultural activities (Al Nahar 2005, 2010).

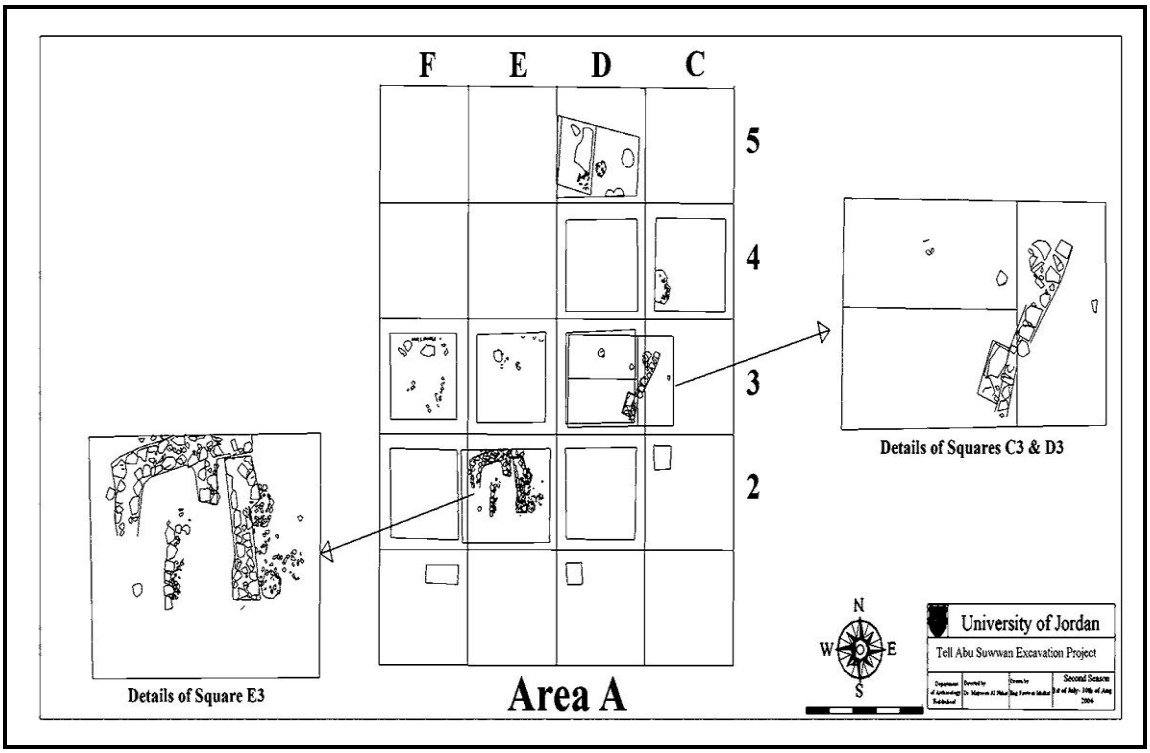

Fig. 5.4: Tell AbuSuwwan; Planimetry map of excavated squares from Area A (Al Nahar 2010).

5.1.A.2. Area B

Area B is composed by two zones. The first zone is a large complex rectangular structure. It is composed of different walls that give a typology of grid system structure called "Grill Building". This structure was excavated within eleven squares (K6, J5, J6, J7, I4, I5, I6, I7, H5, H6 and H7). On the other hand, the second zone is the processing area zone as presented by Al Nahar (Fig. 5.5) (Al Nahar 2005, 2010).

Fig. 5.5: Tell AbuSuwwan; Planimetry map of excavated squares from Area B (photo by Al Nahar).

5.1.A.2.1. Complex Structure

The external walls of the structure have been built by similar techniques (Fig. 5.6). People used big and medium stones for the wall and filled by small stones mixed with mud and plaster as a mortar. These walls have a length between 11 and 13 meters and a thickness between 1.2 and 1.5 meter.

The preserved height of the North-West wall is between 25 and 60 cm, while the south west is between 50 cm and 80 cm. West wall is located at a higher point than the southwest wall, but these walls have the same top height level. The southwest wall height was increased to recover the slope differences.

In the southwestern corner, excavations have recovered a wide bench (Mastaba). It has a width between 3.2 m and 4.5 m and a length of 11.25 m.

Fig. 5.6: Tell AbuSuwwan Site; Aerial view archaeological excavation in Area B (photo by Al Nahar).

The preserved height of the North-West wall is between 25 and 60 cm, while the south west is between 50 cm and 80 cm. West wall is located at a higher point than the southwest wall, but these walls have the same top height level. The southwest wall height was increased to recover the slope differences (Al Nahar 2005,2010).

In the southwestern corner, excavations have recovered a wide bench (Mastaba). It has a width between 3.2 m and 4.5 m and a length of 11.25 m.

The internal walls are different from the external walls. These walls were built from two stream walls using boulder, and limestone and sandstones of medium and big size. Pebble and small stones with plaster were used as mortar to fill gab between the wall stones.

The internal walls are well-built and have better foundation than the external walls. This could be related to the reuse and continuous modification of the internal spaces of the structure.

Excavations within the internal spaces of the structure have recovered different layers and pavements. Three colored plaster floors (white, red, yellow) and stone pavement were also found there (Fig. 5.7).

These layers and pavements represent continuous occupation of the site and modification of floor since the Pre-Pottery Neolithic until the Pottery Neolithic.

Within the structures, excavation recovered different pits and hearths, human bone remains, lithic stones, faunal assemblages, animal hard tissue tools and ritual objects.

Fig. 5.7: Tell AbuSuwwan; Locus 7, 16, 18 and 19 in Sq. H6 in Area B (photo by Al Nahar).

In addition to the dating samples, the sequence of the structure's walls and plaster floors within the site represent a complex occupation within the site structure. The dating samples and surface collections found during the excavation have indicated that the first possible occupation occurred within the area of the structure belongs to the PPNA. The rectangular structure is a well-known typology during the Early PPNB and Middle PPNB. These structures could have been built during the Early PPNB. The structure initially contained two rooms. Excavations have detected presence of orange clay and white floor. The site

was modified by adding two internal walls during the Middle PPNB period. Also, different levels of red plaster and stone pavement floors were recovered.

Structure spaces contain evidences of habitation and human burial remains. The purpose of the structure spaces changed during the different periods of occupation. This will be discussed further in the next sections within the result of the faunal assemblages' analysis.

5.1.A.2.2. Processing area zone

This area is located in front of the entrance of the building in the northeastern to southwestern squares of Area B (G5, G6, G7, F5, F6, F7, F8, and E7) (Fig. 5.8).

The area near to the structure contains yellow floor that continues to the southeastern part of the main structure. Within the Squares E7, F7, G7, there are two walls built by one line of big size fluvial stones. A large orange clay pavement was recovered beside these two walls. Two postholes were found in this area. They could have been used to contain the wood columns in order to carry the roof (Al Nahar 2005, 2010).

In this excavated area different pits, big hearth and one huge bedrock stone with two incised holes have been recovered. These findings could be related to cereal preparation and storage activities. Archeological remains within this area contain high quantities of core stones and lithic stone tools. This could be interpreted as this zone was used as processing area for lithic industries.

High quantities of faunal assemblages have been found too. They will be presented in the archaeozoological results in the next sections.

Carbon dating samples from this area indicate that the utilization of this area has been starting from the Pre-Pottery Neolithic A and continued until the Pottery Neolithic. Different pavements layers were found (yellow plaster and white plaster as well as stone pavements).

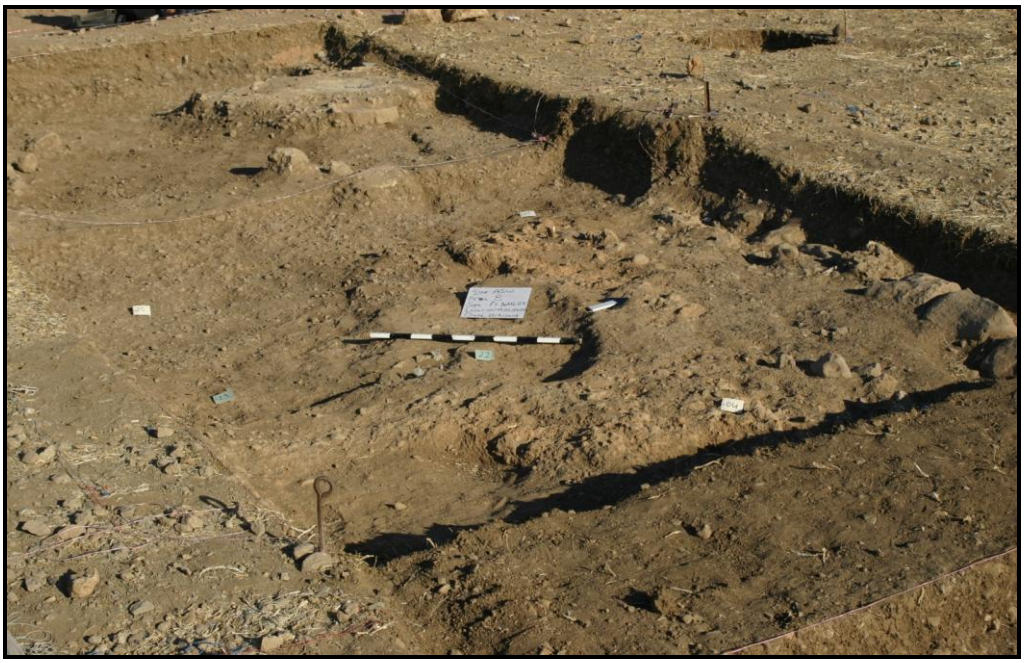

Fig. 5.8: Tell AbuSuwwan site; Sq. F7 located in the proccesing area. Area B (photo by Al Nahar).

5.1.B. *Lithic industries*

Tell AbuSuwwan excavations have recovered high quantities and typologies of lithic industries. The analyses of the lithic industries coming from Tell AbuSuwwan excavations are still in progress by Al Nahar. Preliminary view of the lithic analysis from the excavation presents numerous grinding stones and large number of different cores typologies like naviform blade cores, flakes, blades and other typologies. Lithic tools, found during the excavation, consist of wide range of arrowheads, sickle blades and large number of scrapers of different sizes (Fig. 5.9; Fig. 5.10) (Al Nahar 2005, 2010).

Tell AbuSuwwan has similar lithic industry to other sites in the Near East and Jordan. Excavation within the site recovered new local speciality of scraper tools called "Jarash Scraper", as presented by Nahar and Olszewski (Al Nahar 2010).

Jarash Scraper is made of blade and form isosceles triangle in plan view. It is pointed in the proximal end and abruptly retouched in the distal end to form straight line perpendicular to the axis of the blade. The scrapers have different sizes that range from 3 cm to 6 cm. (Al Nahar 2010)

Lithic tool industries of Tell AbuSuwwan are linked to different Pre-Pottery Neolithic and Pottery Neolithic periods. As reported earlier, lithic industries related to the PPNA were

also found. The variety and richness of the site confirm continuous lithic industries modification throughout this site occupation.

Fig. 5.9: Tell AbuSuwwan; Jericho arrowheads (Al Nahar 2010).

Fig. 5.10: Tell AbuSuwwan; Amuq arrowheads (Al Nahar 2010).

5.2. Ain Ghazal

Ain Ghazal is located in the eastern zone of Amman, capital of Jordan, near to Zarqa River. This site was excavated by Prof. Zeidan Kefafi and Gary Rollefson during the summer season 1982-1989. Ain Ghazal is one of the mega farming Neolithic villages in Jordan. These sites are unique and of great importance because their discovery has helped to reconstruct the Neolithic revolution in the Near East and in Jordan (Kafafi 1993, 1998; Rollefson 1992, 1993; Simmons 1988).

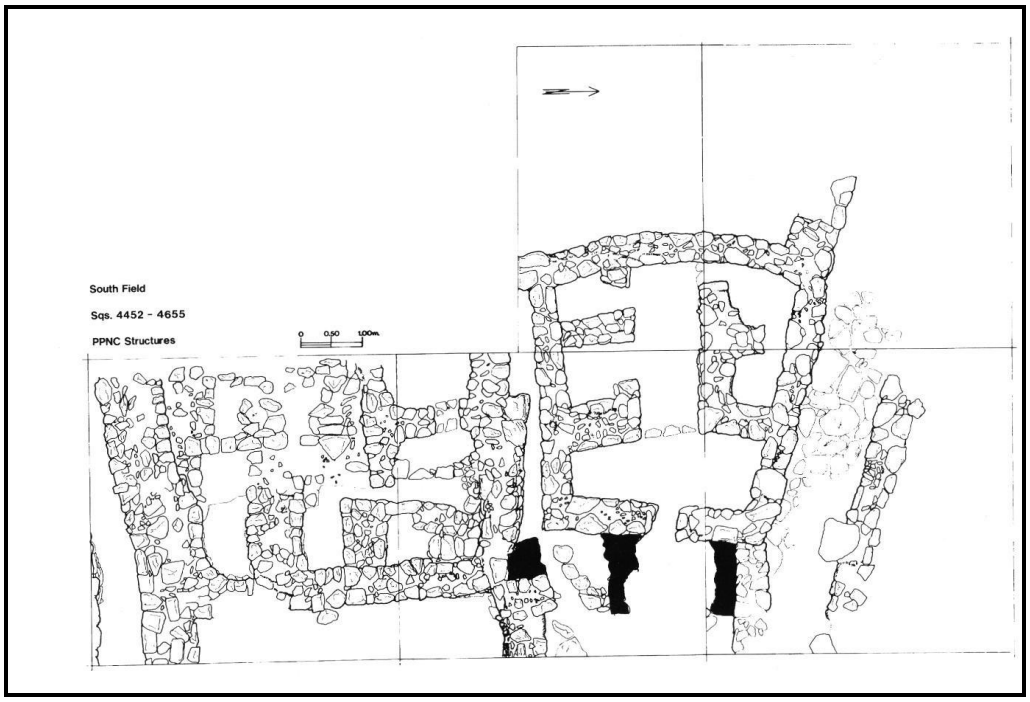

Fig. 5.11: Ain Ghazal; Planimetry of houses from PPNA to PN (Rollefson 1993).

The first reported settlement in this site was during the PPNB around 9,200 BP. Further settlements occurred during the PPNC and the pottery Neolithic. Archaeological excavations in Ain Ghazal have recovered a variety of rectangular structures. These structures were related to habitation, religious and ritual activities (Fig. 5.11). The site is rich of lithic industries and faunal remains of wild and domestic animals (Kafafi 1993, 1998; Rollefson 1992, 1993; Simmons 1988).

Ain Ghazal site contains rectangular structures that were first build during the Middle PPNB. Each structure is composed of one room (5X8m) with lime plaster for floor. The roof was supported by massive posts with height up to 60 cm. Ain Ghazal structures were built close to each other.

Structures during the late stages of this period were modified by dividing the room into two small rooms without changing on the external walls (Kafafi 1993, 1998; Rollefson 1992, 1993; Simmons 1988).

It has been noted that there was an isolation between the single structures and there was no common courtyards between buildings. Economy was based on independent families as producers and consumers during the MPPNB in Ain Ghazal. On the other hand, a general view of the Neolithic villages indicates that there were common cultural and ritual activities between families (Henry 1982; Kafafi 1993, 1998; Kuijt, Goring-Morris 2002; Rollefson 1990, 1992, 1993; Simmons 1988).

The architecture of Ain Ghazal structure changed during the Late PPNB. The room numbers within the building was increased, but the room size was decreased. Also, two story buildings were built during this period.

Excavations in Ain Ghazal have recovered the anthropomorphic statues, which are rare ritual objects. Plaster figurines and limestone masks represent a particular ritual activity during the Middle PPNB in Jordan and the Near East (Rollefson 1992, 1993; Schmandt-Besserat 1997; Simmons 1988).

Approximately two hundred animal figurines were found during excavation in Ain Ghazal. Rollefson suggested that some of these figurines could have been prepared by children, while the rest were more related to magical or ritual activities.

Human figurines were also found during these excavations. Several theories have been suggested to justify their use. One sort of these figurines presented pigmented women, researches suggested that they are fertility figurines. While the rest of human figurines could have been used as a kind of protection from natural and spiritual forces (Fig. 5.12) (Henry 1982; Kafafi 1993, 1998; Rollefson 1990, 1992, 1993; Simmons 1988).

Lithic tools founded in Ain Ghazal have many typologies like spear points, arrowheads, sickle blades, scrapers bifacial tools, knives and other lithic tools. The presence of different tools in each site was due to the variations in the use of these tools during different Neolithic periods. This was due to changes in people's requirements (Henry 1982; Kafafi 1993, 1998; Simmons 1988).

Ain Ghazal is the most important Pre-Pottery Neolithic C site in Jordan. Researchers use archaeological evidences coming from Ain Ghazal have been used to reconstruct the main characteristics of PPNC in Jordan.

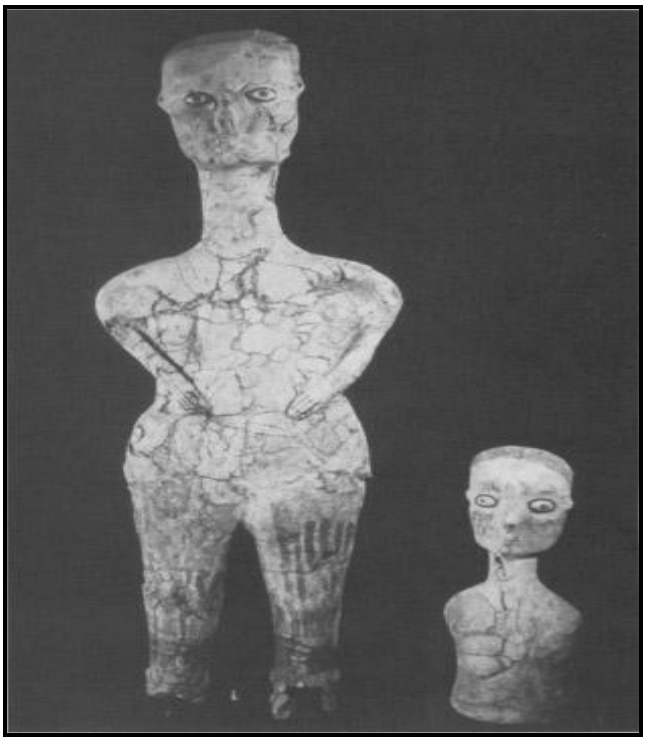

Fig. 5.12: Ain Ghazal; Human figurines (Rollefson 1990).

Ain Ghazal structures were reused during the PPNC, but they were changed to contain one small room. The two-storage structures were not anymore used during this period. Structures were designed for single family occupation for each building.

Lithic typologies were changed. People abandoned the naveform lithic technology. The decrease in pink-purple flints from Wadi Huweijjir led to the loss of the flint specialization. Lithic dominant technology was bifacial retouched knives and the tabular knives. Researcher noted different changes in lithic typology and forms. Lithic production shifted from side scraper to transverse scraper. All types of retouch tools became shorter, wider and thicker (Henry 1982; Kafafi 1993, 1998; Rollefson 1990, 1992, 1993; Simmons 1988).

Pottery Neolithic (Yarmoukian Culture) transition was documented in Ain Ghazal. People reused the PPN structures in the centre of the site field. Apsidal building was found in Ain Ghazal. This building has only lime plaster and a fire ware. Researchers have suggested that it was used for a special purpose that has not be identified (Henry 1982; Kafafi 1993, 1998; Kuijt, Goring-Morris 2002; Rollefson 1990, 1992, 1993).

Ain Ghazal potteries are related to the latter phases of the Yarmoukian culture. The first Yarmoukian potteries remains, detected in this site, were dark red painted and red slipped

pot sherds. In later phases potteries that have been found represent the typical 2nd Yarmoukian subphase (Fig 5.13) (Henry 1982; Kafafi 1993, 1998).

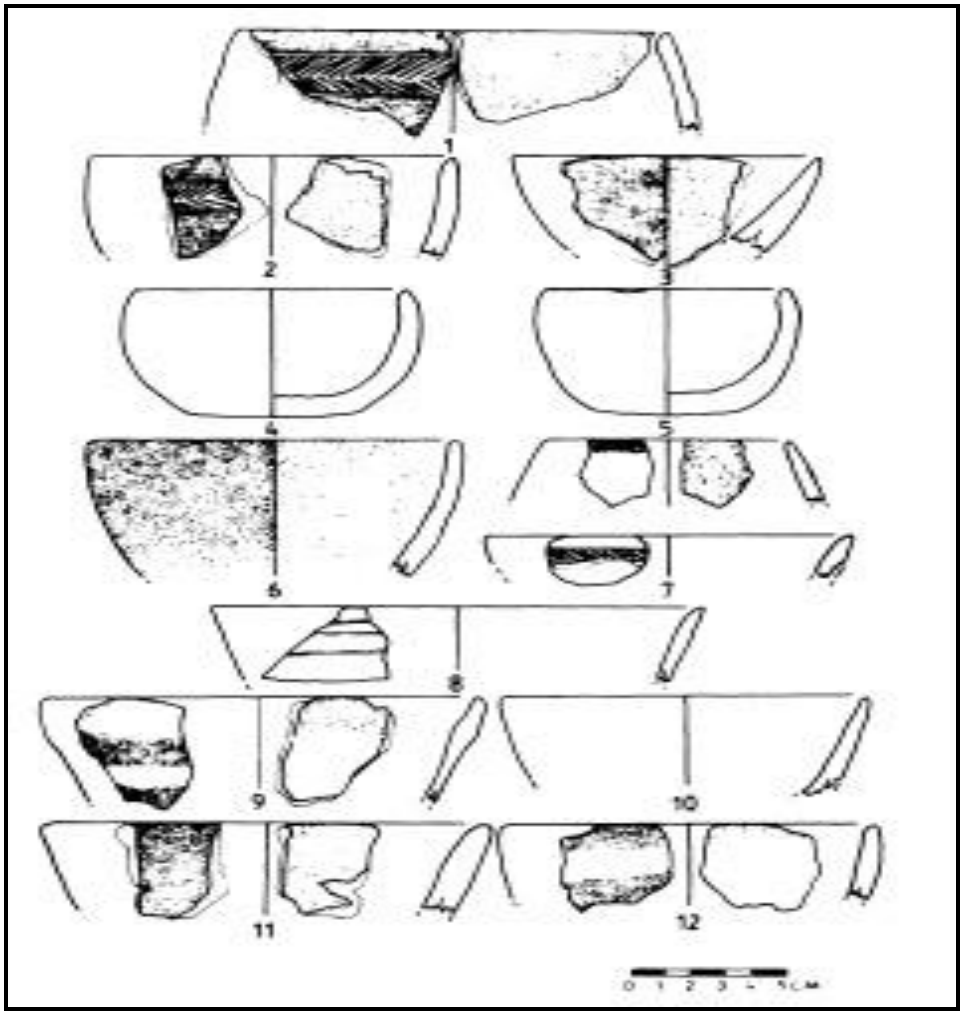

Fig. 5.13: Ain Ghazal; Yarmoukian bowls (Rollefson 1992).

Lithic industries were continuing PPNC typologies. There was a predominance of flake *debitage* and a presence of small projectile points. During PN, there was an increase in the burins percentage. The retouched bifacial became the typical lithic typology (Henry 1982; Kafafi 1993, 1998; Kuijt, Goring-Morris 2002; Rollefson 1990, 1992, 1993).

5.3. Basta

The site of Basta is located in southern Jordan near to Petra. It lies at 1420-1460 m above the sea level. The site was excavated under the direction of Hanz Jorg Nissen and Mujahed Muheisen. Excavations showed the presence of other mega Neolithic villages in Jordan.

This site has a good preserved architectures, walls and plastered floors. Uncalibrated dating for the site proposed a time between 8380 ±100 B.P and 8155 ±50 B.P, which is related to PPNB.

Researchers have suggested that the first occupation in Basta was during the Late PPNB. Depending on the archaeological remains and structures, the site reused until the Pottery Neolithic (Hermansen, Gebel 1996; Henry 1982).

Architecture of Basta is characterized by the presence of connected rooms with common walls and courtyard spaces. The structures composed of medium and small rooms with dimensions around (3X2) m^2 (Fig. 5.14).

Fig. 5.14: Basta; Area B, Wall of Room 2 of Building Unit B VIII (Gebel 2006).

Basta architectures were found in different Neolithic sites within the southern of Jordan like Ain Jammam and es-Safia sites. This provides an evidence of good communication between these sites during the Late PPNB (Hermansen, Gebel 1996; Henry 1982; Kuijt, Goring-Morris 2002).

This site has architectures built in a good way along with organized spaces. This represents a well organized agricultural society.

Lithic industries found in Basta are similar to industries of other Jordanian sites like Ain Ghazal. Byblos and Amuq projectile points were dominant in this period. There was

particular presence of sandstone and limestone bracelets within the archaeological remains from Basta (Henry 1982; Kuijt, Goring-Morris 2002).

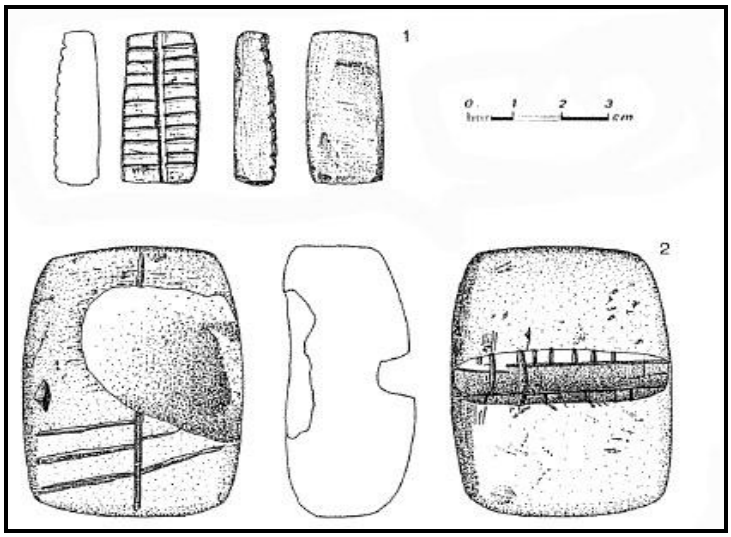

Fig. 5.15: Basta; LPPNB Pillow-shaped pieces. (Hermansen 1996).

Within the Late PPNB stratigraphies few pieces of decorated artifacts called "Pillow shaped pieces" were found (Fig. 5.15). Researchers subdivided them into three typologies depending on the grooving on surface: only grooved, grooves plus a distinctive pattern of geometrical engraving and engraved pattern without the grooves (Hermansen, Gebel 1996; Henry 1982).

5.4. Jericho

Jericho is located in the west of Jordan Valley. Jericho is one of the oldest Pre-Pottery Neolithic sites in the Near East. The site was excavated by Dame Kathleen Kenyon during the summer season of 1952-1958. Jericho was occupied from the Mesolithic to the Byzantine period. In this thesis, only the Neolithic period history and archaeozoological published data in relation to this study will be presented (Clutton –Brock 1979; Henry 1982; Kuijt, Goring-Morris 2002).

Archaeological evidences coming from the excavation of Jericho present a continuous occupation from the Mesolithic period. The Pre-Pottery Neolithic architecture within the site is similar to the architecture of earlier periods. Jericho structures were oval to sub-rectangular structures. A high stony tower of 8 meters height was found in Jericho.

Researchers have suggested that it was used as a storage building (Henry 1982; Kuijt, Goring-Morris 2002; Rollefson 1990, 1992, 1993; Simmons 1988).

During PPNB architecture's typology became rectangular with larger size. Jericho during the Middle PPNB became one of the largest Mega farming Neolithic villages in the Near East. Structural remains indicate an increase in room size that reached almost 8X4 m^2 (Fig.5. 16). The internal spaces have varieties of colored plasters with mainly white, red and pink colours (Henry 1982; Kuijt, Goring-Morris 2002; Simmons 1988; Twiss 2007).

Archaeological evidences have shown that there was a big development in social organization in Jericho. Economy of this site during this period was based on agricultural and animal domestication.

The Neolithic Pottery in Jericho has been subdivided into two phases according to the typologies of the pottery production. The first phase is called "Jericho Neolithic A". The pottery during this period was characterized by simple forms like plan bowls, globular jars, knob and ledge handle. While the second phase is the "Jericho Pottery Neolithic". During this phase, people used a fine and course ware to produce the pottery. Red paintings were used to decorate the surface of the potteries (Kafafi 1993, 1998; Kuijt, Goring-Morris 2002).

Jericho has different relations and communications with other Neolithic sites in the Near East and possibly far away. Excavations recovered within the PPNA stratigraphies the obsidian lithic tools, which came from the central Turkey. While Jericho Points were one of the main characteristics of the lithic industries within Near East sites during the Middle PPNB (Kafafi 1993, 1998; Kuijt, Goring-Morris 2002).

Some of the findings in Jericho are 14 plastered and painted skulls. Ten of them were remodeled plastically with multiple plastering events. These plaster skulls could be related to a complex ritual activities within the site (Fig. 5.16) (Kafafi 1993, 1998; Kuijt, Goring-Morris 2002; Twiss 2007).

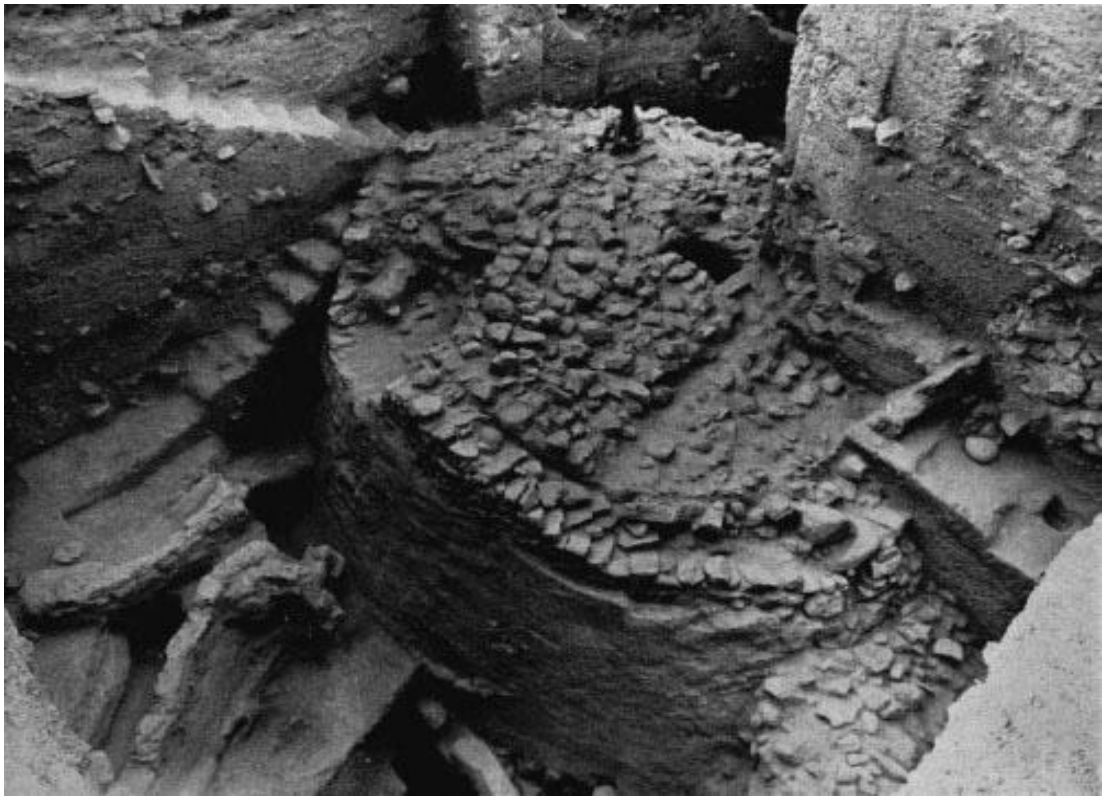

Fig. 5.16: Jericho; stony tower (Twiss 2007).

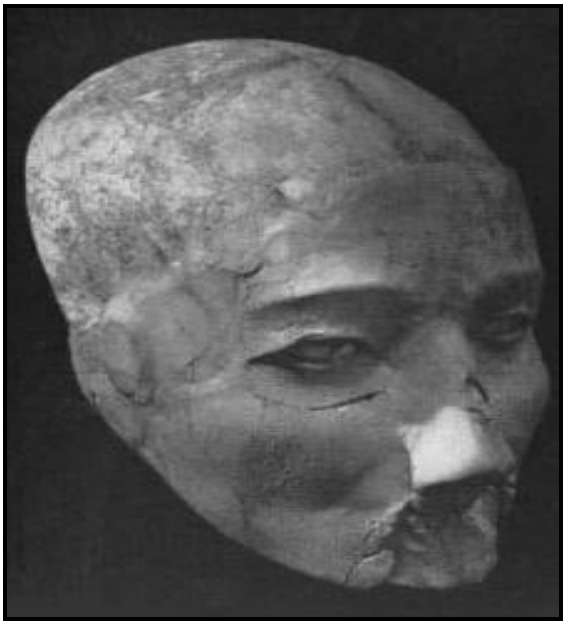

Fig. 5.17: Jericho; Plastered skull (Twiss 2007).

Ch. 6. ARCHAEOZOOLOGY AND TAPHONOMY

This thesis concerns the study of the faunal remain from Neolithic sites Tell AbuSuwwan. During the Neolithic period, human life had become more organized with a complex behavior and culture. Human started to a specialized system of life. Human agriculture of wheat and serials and stable life gave a new direction for their relation to animal resources.

In this part, a short explanation of terms of archaeozoology and taphonomy will be presented in order to make them familiar to the reader.

Archaeozoology is a study of faunal remains to reconstruct the palaeo-environment and economy of the archaeological sites. The study of the faunal remains of the archaeological site includes analyzing animal skeletal portions like bones and teeth, horns/antlers. This help to determinate the species that were hunted or herded by human in the archaeological site (Davis 1987; Rietz and Wing 1999).

Bones from different animals have particular sizes, morphology and textures. These characteristics are used to identify species and elements present in the site. After the species and elements of the assemblages are identified, other kinds of information like animal age are calculated using two methods. The first method includes examining the sequence of replacement of the deciduous teeth with adult teeth and assessment of later wear on adult teeth. These can provide an approximate age of the animal. The second way is the grade of fusion of the bones. The limb bones are useful for determining age because in young animals the ends of the bone (epiphyses) are not attached to the shafts (diaphysis), but as the animal gets older the epiphyses and the diaphysis fuse (Davis 1987; Grant 1982; Grigson 1982; Rietz and Wing 1999; Silver 1969).

Sex could be identified using comparative analysis skeletal dimensions of the animals. The presence of horns or antler is also used to determined the sex of the animal.

Faunal remains provide information on ancient economy, subsistence strategies, seasonality and environmental conditions. It can also shed light on social status. Animal bones give direct and indirect information on human behavior and its relation to surrounded environments. The presence of particular portion of animal skeleton could indicate that initial butchering processes have been done in area of hunting. The age of the animal could help to determine the season of hunting. Some animals are linked with

specific zones and locations far from the funeral site. This gives evidence of long hunted trips or exchange of food with other sites (Davis 1987).

Taphonomy can be defined as study of the transition, in all details, of organics from biosphere into lithosphere or geological record. Taphonomy also studies the natural environmental and anthropological modification on the faunal remains until they discovered by the excavation such as destroying and damaging processes (Davis 1987; Lyman 1994; Rietz and Wing 1999).

The modifications are an important source of information about bone assemblages' history. It is likely that a specimen will bear evidence of several modifications since animals have been killed. Specimens may be fragmented during butchering processes and it may be burned during cooking or tossed into the hot coal of hearth. It might also be fragmented at the time when long buried remains are recovered (Davis 1987; Rietz and Wing 1999).

Cut marks are caused by skinning and portioning animals' carcass. Cut marks from skinning marks are often similar to those made by dismembering the animals' carcass. However, the location of skinning marks is often diagnostic. They are usually found on the skull near the snout and around the mandible, at the base of the antlers and ears, and around the metapodial and phalanges (Lyman 1994; Rietz and Wing 1999).

While disarticulation marks reflect a number of complex behaviors of human in that period such as relation to the place. Some animals were first butchered out but near where it was killed. Others were killed in a zone within the site specific for such activities. This could be usually identified from the skeletal portions founded in the site spaces (Lyman 1994; Rietz and Wing 1999).

Scraping occurs during either step in some cases. Sawing was used to make tool and ornaments during the preparation processes.

Anthropical fractures occur in different butchering and disarticulation processes of the animal carcass. It is also used to recover the marrow of the bone .

Another anthropical modification of the animal bones is the grade of bone burning. The color of the bone reflects the grade of burning that could be related to the cooking process. It could also indicate if it was thrown in the hearth. The main characteristics of the burned bone is that it is 5% smaller in diameter than unburned portion because of shrinking under hottest conditions. Black bones are bones burned under relatively low temperatures so the

organic components are carbonized (Davis 1987; Lyman 1994; Koon 2003; Rietz and Wing 1999; Stiner and Kuhn 1995).

Ch. 7. METHODS

Series of archaeozoological and taphonomical analysis have been used to study the faunal assemblages coming from Tell AbuSuwwan Neolithic site. Different methods and analyses to collect most possible information and data about the paleo-economy and cultural behavior of Tell AbuSuwwan site have been applied. Sequence the analyses that were used:

1. The study of the faunal remains was started in the laboratory of the Department of Archaeology of the University of Jordan. Faunal assemblage was separated at first to the provenience squares from Tell AbuSuwwan. Then faunal assemblage was classified within two main categories: the first category includes the identified specimens at species level. While the second is composed by unidentified specimens. Within these categories osseous tools have been recognised (Davis 1987; Lyman 2001; Reitz, Wing 1999) .
2. Unidentified specimens have been subdivided to nearest skeletal portion and in relation to animal size, when possible. Unidentified assemblages were also measured in length to nearest mm. Then, they were classified into two main groups (<50mm, ≥50mm) and counted (Davis 1987; Reitz, Wing 1999).
3. The degree of burning was recorded for all the remains that were examined during the archaeozoological analysis. It was classified into two categories according to burned and not burned. Burning modification were documented both for the identified and unidentified faunal remains. Degree of burning were taken in consideration during the work (Davis 1987; Lyman 2001; Koon 2003;Rietz and Wing 1999; Stiner and Kuhn 1995).
4. Skeletal elements have been identified to the closest possible taxonomic unit: This includes cranial fragments, vertebrae, long bone epiphysis and shafts that were examined using different osteological atlases and animal bones collections from different zoological and paleontological laboratories: Laboratory of Paleontology (University of Ferrara), Laboratory of Archaeozoology (University of Ferrara), Collection of the Natural Science Museum “La Specola”, section of Zoology,

University of Florence) and Laboratory of Paleoanthropology (University of Florence) (Barone 1980; Boessneck 1963, 1969; Peters 1986; Schmid 1972).

5. Composition of the faunal assemblage: frequencies of the remains (NISP) and evaluation of the minimum number of individuals (MNI), element portions were used also to calculate the minimum number of skeletal elements (MNE). MNI will help to understand the main species that were present in the site and to assess if there were changes in the human economy in relation to species that were hunted or domesticated. While the MNE will help to understand human behaviors particularly in the relation to butchering places. (Davis 1987; Reitz, Wing 1999)
6. Age at death of the faunal remains and the age composition are estimated on the basis of tooth eruption and replacement, use wear degree and epiphysial fusion of the long bones. These data will help to understand the main relation between human hunting and herded animals. Age at death could help to understand if there are particular season of hunting in sequences to agricultural seasons (Silver 1963,1967; Wilson B., Grigson, Payne 1982).
7. Faunal assemblages were highly fragmented. Bone fragmentation has been analyzed by controlling the anthropical and natural modification processes on the bones surfaces (Davis 1987; LaBianca, Von Den Driesch 1995; Lyman 2001; Reitz, Wing 1999).
8. Anthropical and natural modification marks have been examined at the laboratory of archaeozoology (University of Ferrara) using a magnification lens (15x) and a stereomicroscopy (LEICA MZ6) with resolution magnifying lamp (LEICA CLS-150XE). These methods help to confirm the anthropical modification on the surfaces of faunal assemblages.
9. Variety of osseous bone industry assemblages were founded during the archaeozoological analysis. Bone industry assemblages were examined at the laboratory of archaeozoology (University of Ferrara) using a stereomicroscopy (Leica LAS EZ) with Leica EC3 digital color camera. Analyses at Scanning Electron Microscopy (SEM) were carried out in the centre of Electron Microscopy of the University of Ferrara.
10. An experimental work has been done to reconstruct the production technology categories of osseous tools from Tell AbuSuwwan. It have been taken in consideration

different published works of the osseous bone industries in the Near east and other published scientific osseous bone experimental procedures (Choyke, Schibler 2007; Cristiani 2008; Keeley 1980; Newcomer 1974).

11. Tell AbuSuwwan is one of the Neolithic mega farming villages in Jordan. Bibliographical research have been done to reconstruct the possible present animal species within Tell AbuSuwwan faunal assemblage. Several published archaeozoological results from Neolithic sites in Jordan and Near east were collected to understand the variable animal species which could be found within Tell AbuSuwwan faunal assemblage. Bibliographical research was carried in order to understand sequence of evolution of animal domestication during the Neolithic period. Published archaeozoological results were used to compare the Tell AbuSuwwan archaeozoological results with different sites in Jordan and surround sites in the Near east (like Ain Ghazal, Jericho and Basta) (Bar Yosef 1982; Becker 1991; Byrd 1994; Clutton-Brock J., 1979 Henry Donald 1982 Horwitz 1999).

Ch. 8. RESULTS

8.1 Archaeozoological Analysis

Archaeozoological analysis of the faunal remain from Tell AbuSuwwan belonged to continuous occupation of the Neolithic period. Archaeozoological results are mentioned in this chapter following the radiocarbon dating and stratigraphical sequences of site occupation.

The faunal assemblages were classified in four cultural phases: 1. Pre-pottery Neolithic A (PPNA) and Early Pre-pottery Neolithic B (EPPNB); 2. Middle Pre-pottry Neolithic B (MPPNB); 3. Late Pre-pottery Neolithic B (LPPNB) and Pre-pottery Neolithic C (PPNC); 4. Pottery Neolithic (PN).

Tell AbuSuwwan faunal assemblages, that have been studied, are 16194 specimens. Archaeozoological basic analysis were done to determinate the faunal assemblages to taxonomical units. After that unidentified faunal assemblages were classified to nearest anatomical portion.

During the study of the faunal assemblages 64 osseous instruments have been found. It have been taken attention to apply different archaeozoological analysis and scientific experimental work to study the osseous instruments. The osseous analysis are presented in the next chapter.

Faunal assemblages were classified to two categories depending on the taxonomical and anatomical identification level. First one is the identified taxonomical faunal assemblages. 1950 faunal assemblages have been identified. Second category is composed by unidentified faunal remains. This category contains all the rest of the faunal assemblages and includes the identified anatomical element and totally unidentified faunal specimens.

Period	NISP
Pre-Pottery Neolithic A (PPNA/ EPPNB) Early Pre-pottery Neolithic B	38
Middle Pre-Pottery Neolithic B (MPPNB)	683
Late Pre-Pottery Neolithic B (LPPNB/PPNC) Pre-pottery Neolithic C	1023
Pottery Neolithic (PN)	206
Total	1950

Table. 8. 1: identified remains within the chronological sequence of Tell AbuSuwwan site.

8. 1. 1. *Pre-pottery Neolithic A and Early Pre-pottery Neolithic (PPNA/EPPNB)*

Faunal remains coming from this level are 495. Identified faunal remains are 38 specimens (Fig. 8.1). The most represented species are auroch and wild boar followed by the wild cat, gazella and wild goat. Equid and hare are scarce. For which concern the calculation of the MNI wild cat is the most represented number of individuals during this period, followed by equal presence of auroch and wild boar and wild goat (Fig. 8.3; Table. 8.2).

Wild cat faunal remains are 6, related to two adult individuals and one young individual. Wild cat is the only carnivore specie found within Tell AbuSuwwan faunal assemblage during the PPNA/EPPNB (Table. 8.2; Table. 8.3).

Auroch (*Bos primigenius*) anatomical elements are related to two individuals, one sub-adult and adult individuals. Auroch remains are 9 faunal remains presented by different anatomical portions, belonging to skull and stylopodium. Wild boar and wild goat anatomical elements recovered belongs to two individuals. Both animals anatomical elements contains fused and unfused bone remains. Wild boar and wild goat anatomical elements are related to one adult and one young age individuals (Fig. 8.1; Fig. 8.3; Table. 8.2; Table. 8.2).

The rest of the recovered animal during this period are related to adult animal age. Gazella is presented by 6 faunal remains while equid and hare are presented by only one faunal specimens (Fig. 8.1; Table. 8.3).

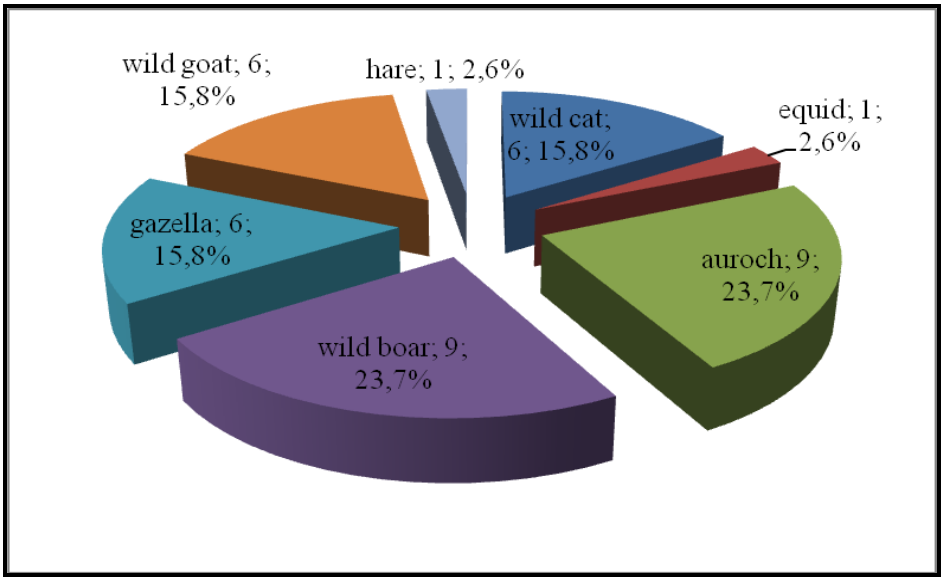

Fig. 8.1: EPPNB/PPNA; percentage and frequence of individual specimens (NISP).

sk./ sp.	wild cat	equid	auroch	wild boar	gazella	wild goat	hare
cranium	-	1	2	-	1	-	-
horn	-	-	2	-	-	-	-
teeth	-	-	-	1	1	-	-
ribs	-	-	-	-	-	-	-
scapula	1	-	1	1	-	-	-
humerus	2	-	1	2	-	-	1
radius-ulna	-	-	-	-	-	1	-
radius	-	-	-	1	2	-	-
ulna	-	-	-	-	-	-	-
metacarpal bone	-	-	-	-	-	1	-
pelvis	-	-	-	1		-	-
femur	3	-	1	-	1	-	-
astragalus	-	-	-	-	1	1	-
calcaneus	-	-	-	1	-		-
metatarsal bone	-	-	-	1	-	1	-
phalanges	-	-	2	1	-	2	-
total	6	1	9	9	6	6	1

Table. 8.2: PPNA /EPPNB; number of identified specimens (NISP).

sp./age	young	sub adult	adult	total
wild cat	1	-	2	3
equid	1	-	-	1
wild boar	1	-	1	2
auroch	-	1	1	2
gazella	-	-	1	1
wild goat	1	-	1	2
hare	-	-	1	1

Table. 8.3: PPNA /EPPNB; minimum number of individuals (MNI) and age classes.

Calculation of the Minimum Number of Individuals (MNI) in relation to the age at death presents 12 wild species individuals of different age. Wild cat is the most represented species (three individuals) followed by two individuals of wild boar, auroch and wild goat and one individual of equid, gazelle and hare (Fig. 8.2; Table. 8.3).

The unidentified faunal sample is composed by 311 fragment remains. 258 specimens have a length less than 5 cm and 53 specimens have more or equal length to 5 cm. 146 faunal remains were identified to anatomical portion. Vertebrae are the most represented elements

(51.4%) followed by ribs (45.2%), and one unit of long bones (humerus, radius and tibia) , cranium and pelvis (0,7%; Fig. 8. 4).

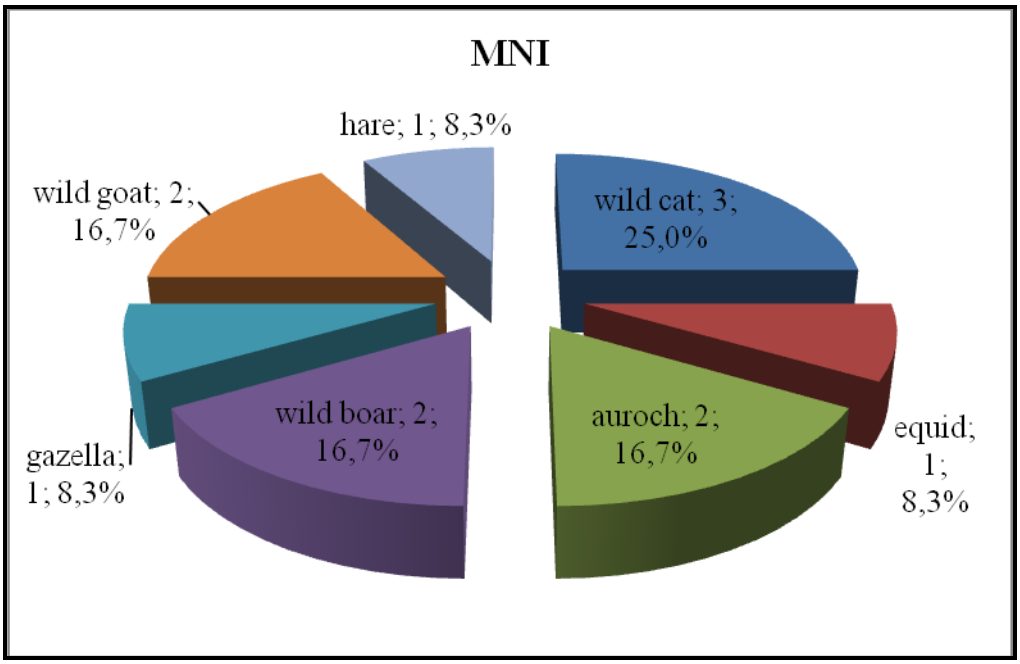

Fig. 8.2: EPPNB/PPNA; frequence and percentage and minimum number of individuals.

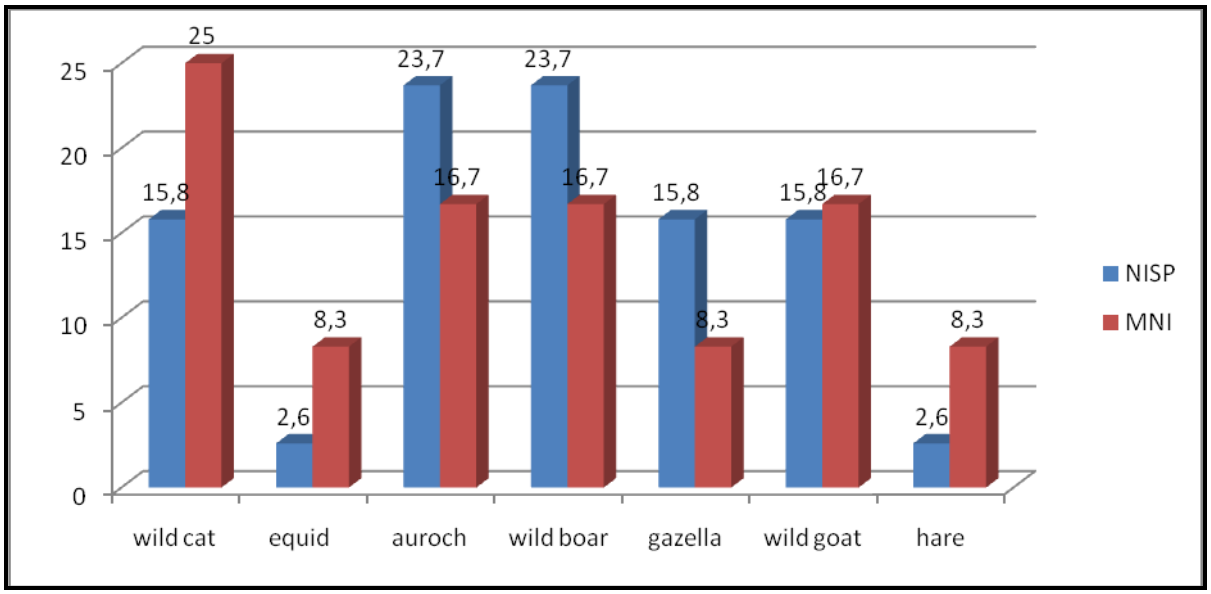

Fig. 8.3: EPPNB/PPNA; MNI and NISP percentage.

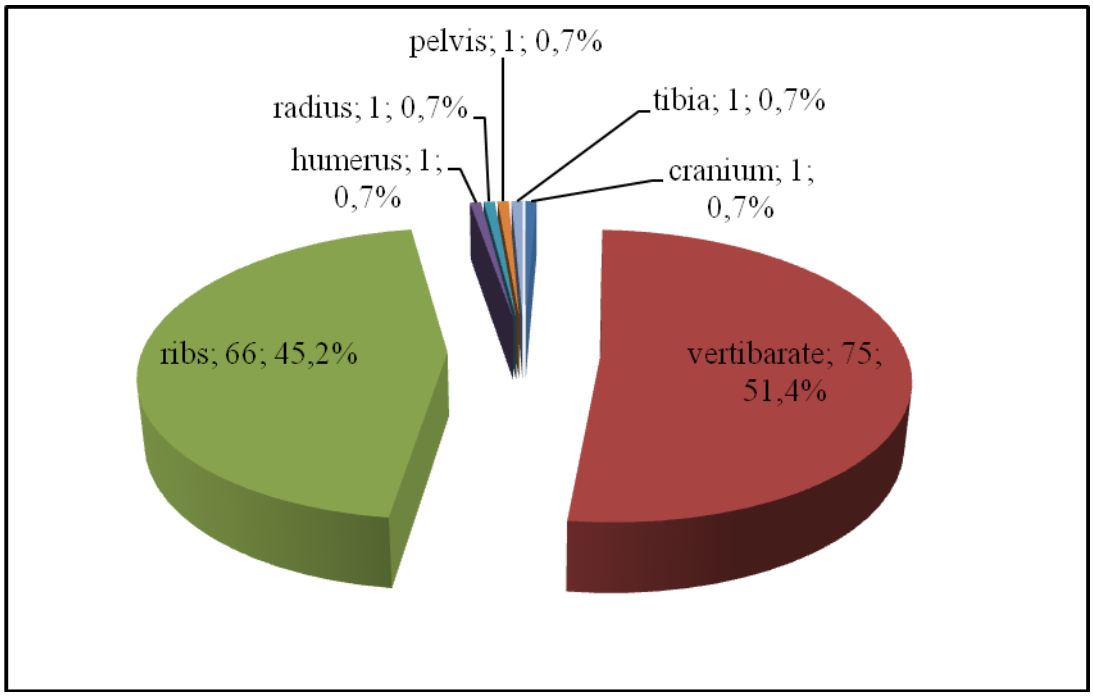

Fig. 8.4: PPNA /EPPNB; frequence and percentage of identified faunal fragments to anatomical portion.

8. 1. 2. *Middle Pre-pottery Neolithic B (MPPNB)*

Faunal specimens coming from the MPPNB occupation from Tell AbuSuwwan are 5678. Identified taxonomical remains are 683. They represent 12.0% of the MPPNB faunal assemblage (FIG. 8. 5).

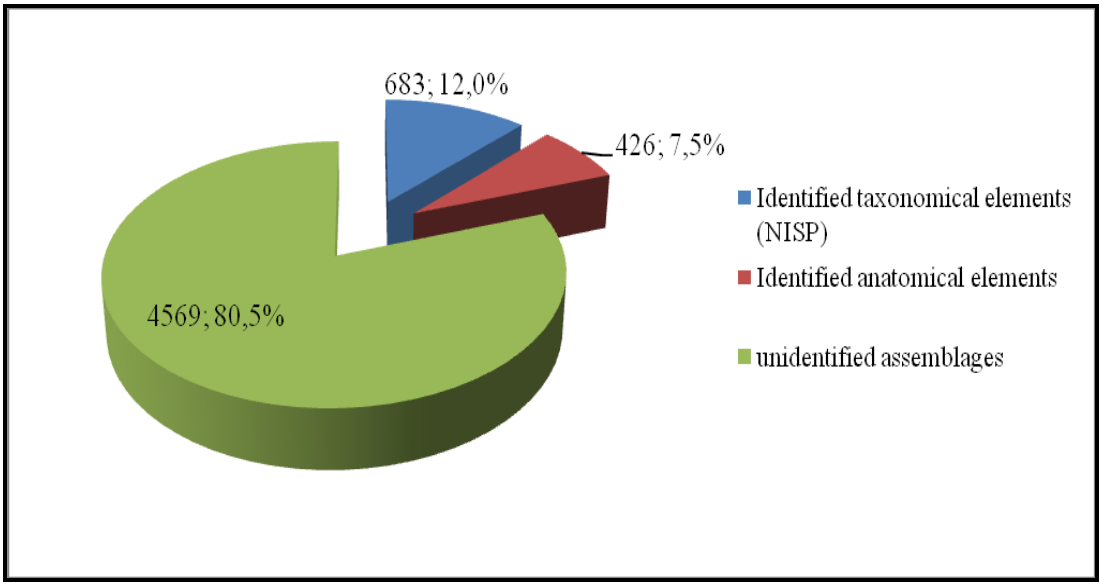

Fig. 8.5: MPPNB; frequence and percentage of faunal assemblages.

Domesticated sheep/goat are confirmed from the osteological measurements. Osteological measurements were confronted with different published results from Neolithic sites in Jordan and surrounded area. Osteological measurements tables are presented at end of the thesis.

NISP results view high anatomical elements related to domestic sheep/goat. Sheep/goat anatomical elements represents the half of the identified anatomical elements (51.8%). The anatomical elements present all the anatomical proportions. Tooth and phalanges are most preserved followed by posterior long bones (Fig. 8.6).

Second represented anatomical portions are wild boar (17.4%). Phalanges present almost the half of the anatomical elements followed by tooth then ulna. Long bone are quite similar in quantities instead of tibia which were not found (Fig. 8.6).

Wild goat is present (9.9%) followed by auroch (9.2%) then gazella (8.6%). Gazella anatomical portion are almost represented by the whole skeletal elements. Phalanges are the higher found followed by cranial portions (horn, mandible and teeth) (Fig. 8.6).

The most represented species is domestic sheep/goat with 11 individuals of different ages, followed by 6 individuals of wild boar, gazella, auroch, wild goat and wild cat. The calculation of the MNI presented in Table. 8.4 and Fig. 8.7 and Fig. 8.8.

Different size carnivores remains were recovered in this period. 7 anatomical elements of wild cat related to one young individual and one adult individual. Wild cat anatomical elements found are related to mandible, humerus, ulna, calcaneus and astragalus. Medium size carnivore were present by few anatomical portions of one individual of jackal and unidentified carnivore skeletal elementes presented as *Canis* sp. because its osteological morphology is related to *Canis* genus.

Hare is the only small mammal species that were found within the faunal assemblages during this period, while one individual of turtle (reptiles) and one unidentified bird species were found.

Mostly of the wild species and domestic sheep/goat are related to adult individuals and followed by young age individuals (Fig. 8.7).

sk/specie	*Canis* sp.	jackal	wild cat	wild boar	auroch	gazella	wild goat	sh/gt	hare	total
cranium	-	-	-	4	4	-	-	4	-	12
horn	-	-	-	-	9	4	1	8	-	22
mandible	-	2	1	2	1	3	-	14	-	23
teeth	-	1	-	17	10	6	5	71	-	110
vertebrae	-	-	-	1	-	1	-	4	-	6
scapula	-	-	-	7	-	2	2	6	-	17
humerus	2	-	2	4	1	4	3	12	-	28
radius-ulna	-	-	-	-	-	1	-	3	-	4
radius	-	2	-	2	2	2	-	21	1	30
ulna	-	-	1	11	2	1	1	4	-	20
metacarpal	-	-	-	5	-	2	8	22	-	37
pelvis	-	-	-	4	2	2	-	16	1	25
femur	-	-	-	6	-	-	-	19	2	27
tibia	-	-	-	-	5	3	2	22	-	32
astragalus	-	-	1	5	1	1	3	12	-	24
calcaneus	-	-	2	3	1	1	3	20	1	31
metatarsal	-	-	-	6	2	3	1	12	-	24
phalanges	-	-	-	35	13	22	30	67	-	167
sesamoid	-	-	-	4	9	-	2	9	-	24
epiphysis	-	-	-	3	1	1	7	9	-	21
total	2	5	7	119	63	59	68	352	5	683

Table. 8.4: MPPNB; number of identified specimens (NISP).

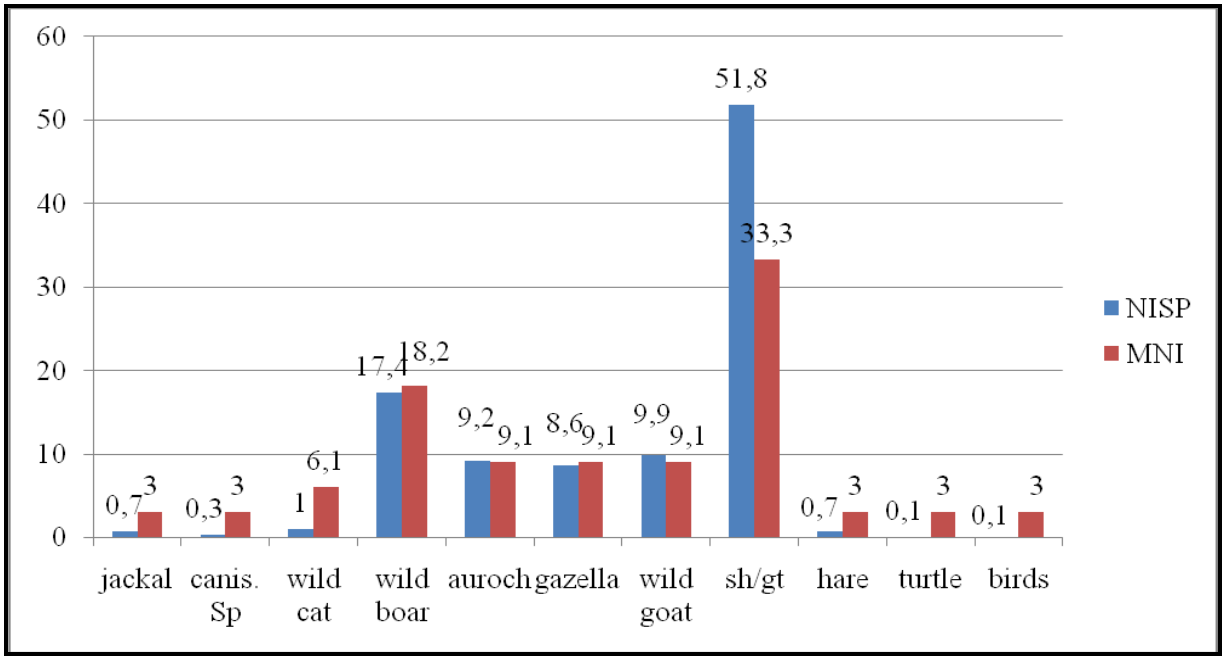

Fig. 8.6: MPPNB; MNI and NISP percentage.

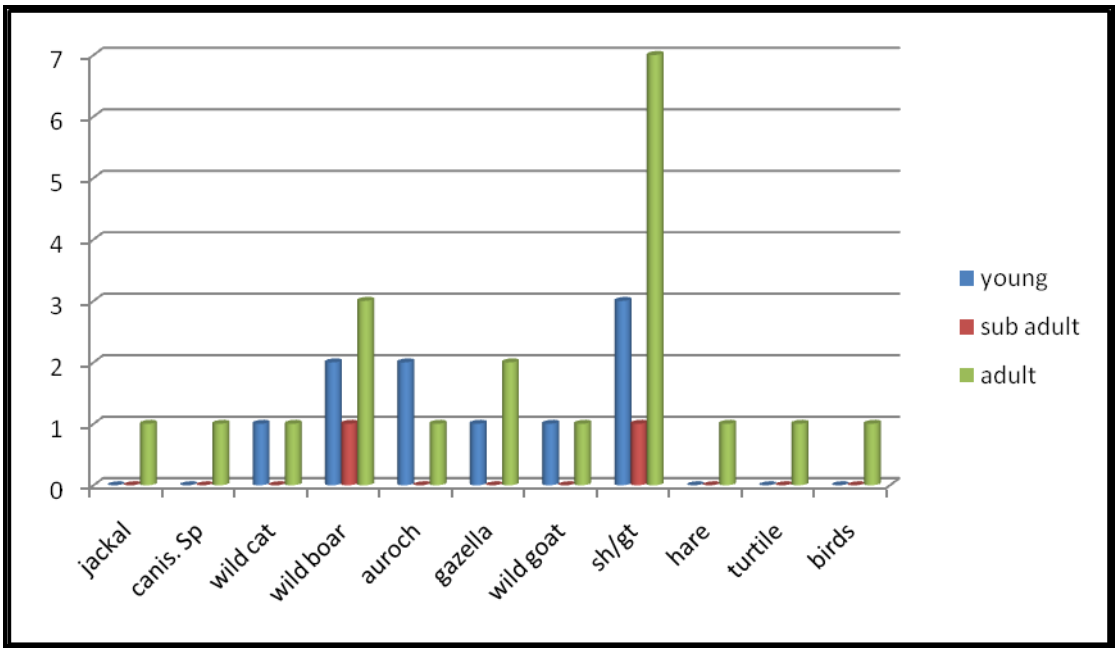

Fig. 8.7: MPPNB; age classes for each species.

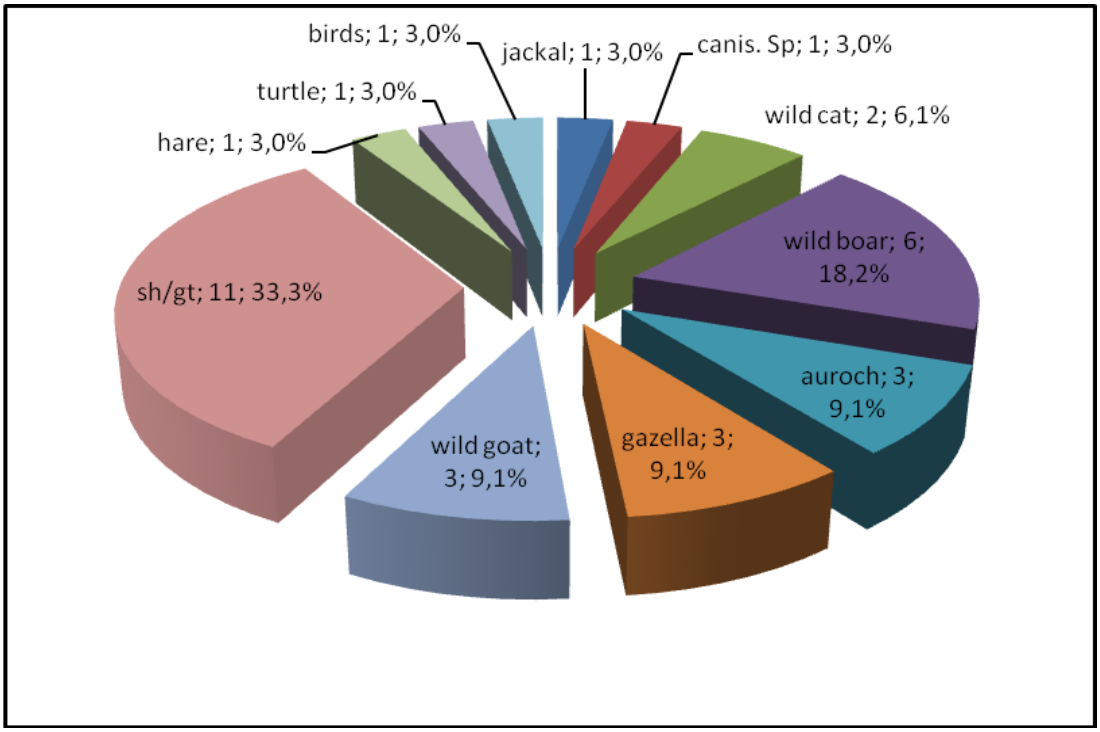

Fig. 8.8: MPPNB; frequence and percentage of MNI.

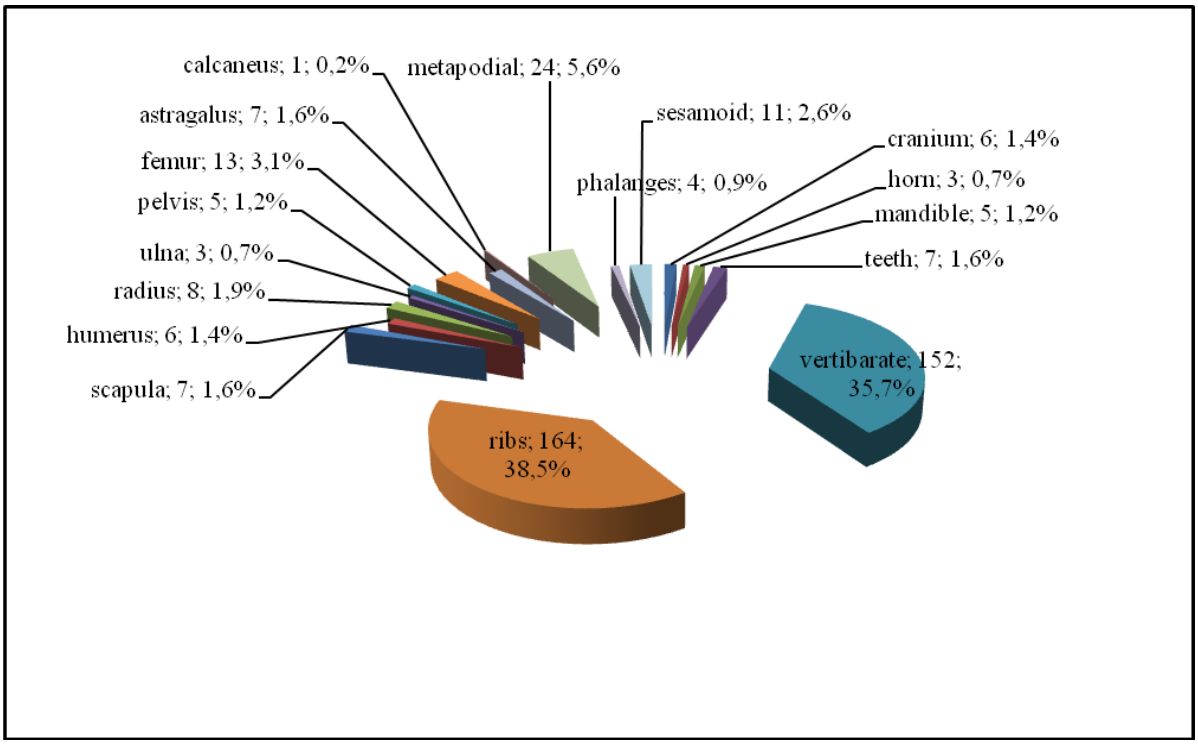

Fig. 8.9: MPPNB; frequence and percentage of identified anatomical elements.

Identified anatomical elements are 426 bone assemblages and they represent 7.5 % of the total faunal assemblages during this period. Faunal assemblages in this categories is composed by fragments anatomical portion which can't be identified at taxonomical level. Ribs and vertebrae anatomical portions fragments are the most represented followed by metapodial and femur specimens (Fig. 8.9).

Unidentified faunal remains are 4569 specimens. 4438 specimens have length less than 5 cm and only 131 specimens have length more than 5 cm. This results will be discussed within the taphonomical analyses results.

8.1. 3. *Late Pre-pottery Neolithic/Pre-pottery Neolithic C (LPPNB/ PPNC)*

Faunal assemblage coming from Tell AbuSuwwan site during this period is composed by 8165 specimens. Identified taxonomical specimens are 1023 and represent 12.5% of the total faunal assemblages during this period. Identified anatomical specimens are 279 and represented only 3.4% of the faunal assemblage during this period (Fig. 8.10).

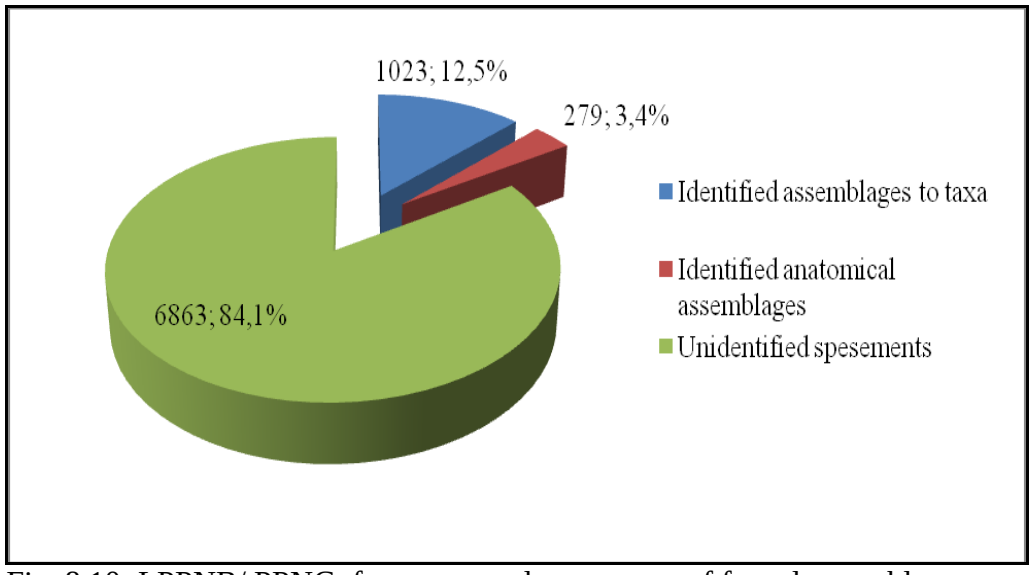

Fig. 8.10: LPPNB/ PPNC; frequence and percentage of faunal assemblages.

NISP calculation present high percentage of sheep/goat anatomical elements. Domestic sheep/goat anatomical elements present 40.4% of the total identified faunal assemblages during this period. All the anatomical elements were present. Tooth and phalanges are higher preserved followed by metapodials bones. The anterior and posterior bones are almost similar in quantities (Fig. 8.11; Table. 8.5).

Also wild boar is well represented within the identified faunal assemblages. Wild boar anatomical elements present 25.5%. Phalanges are the most represented followed by tooth and metapodial bones . Anterior and posterior bones are quite low in quantities (Fig. 8.11; Table. 8.5).

Auroch, wild goat and gazelle anatomical elements are almost all represented. Auroch anatomical elements represent 12.2% followed by wild goat 11.1% and gazella 8.1% (Fig. 8.11; Table. 8.5).

Within carnivores anatomical elements wild cat is the most represented. Wild cat anatomical elements present 1.5%. Two anatomical elements are related to the indeterminate *Canis* sp. Unidentified carnivore similar to dog anatomy was found but kept as *Canis sp*. in the results. Jackal and sand cat are represented only by one anatomical element (Fig. 8.11; Table. 8.5).

Calculation of MNI and NISP view an increase in the faunal remains during this period. Identified taxonomy assemblages is composed by 44 individuals of domesticated sheep/goat and different wild animals (Fig. 8.12; Fig. 8.13; Table. 8.6).

Domesticated sheep/goat remains are related to 10 individuals: one young individual and two sub-adult individuals, four adult and three old individuals (Fig. 8.12; Fig. 8.13; Table. 8.6).

sk/specie	*Canis* sp.	jackal	wild cat	sand cat	wild boar	equid	aurock	wild goat	gazella	sh/gt	hare
cranium	-	-	-	-	10	-	8	1	1	5	-
horn	-	-	-	-	-	-	9	5	2	6	-
mandible	-	1	1	-	15	-	3	-	1	20	-
teeth	-	-	-	-	27	-	22	8	4	80	-
vertibarate	-	-	-	-	1	-	1	1	-	3	-
scapula	-	-	1	-	7	-	1	7	4	22	
humerus	-	-	2	-	8	-	5	6	9	20	-
radius-ulna	-	-	-	-	-	-	2	2	1	4	-
radius	-	-	1	1	12	-	2	5	5	19	-
ulna	1	-	-	-	13	-	3	3	2	7	-
metacarpal bones	-	-	1	-	22	1	9	18	6	41	-
pelvis	-	-	1	-	14	-	3	6	5	32	-
femur	1	-	-	-	12	-	3	3	4	23	-
tibia	-	-	1	-	7	1	6	3	2	21	1
astragalus	-	-	1	-	7	-	2	9	9	17	-
calcaneus	-	-	3	-	12	-	1	3	1	20	-
metatarsal bones	-	-	3	-	20	-	7	5	3	13	-
phalanges	-	-	-	-	67	-	24	26	26	65	-
sesamoid		-	-	-	4	-	8	-	2	9	-
epiphyse	-	-	-	-	4	-	6	3	2	4	-
total	2	1	15	1	262	2	125	114	83	415	1

Table. 8.5: LPPNB/ PPNC: number of identified specimens (NISP).

Wild boar is the highest wild animal represented during this period with different ages at death, followed by 7 wild goat individuals, 4 individuals of gazella and 3 auroch individuals (Fig. 8.13).

Different carnivores were found within the faunal assemblages. Two different *Felis* sp. were identified. Two wild cat individuals and one sand cat. Medium size carnivore were represented by two *Canis* species. Remains of jackal individual and another indeterminate *Canis* sp. (Fig. 8.13).

The rest of the faunal assemblage is composed by one specimen of equid, hare, turtle and bird. (Fig. 8.12; Fig. 8.13; Table. 8.6).

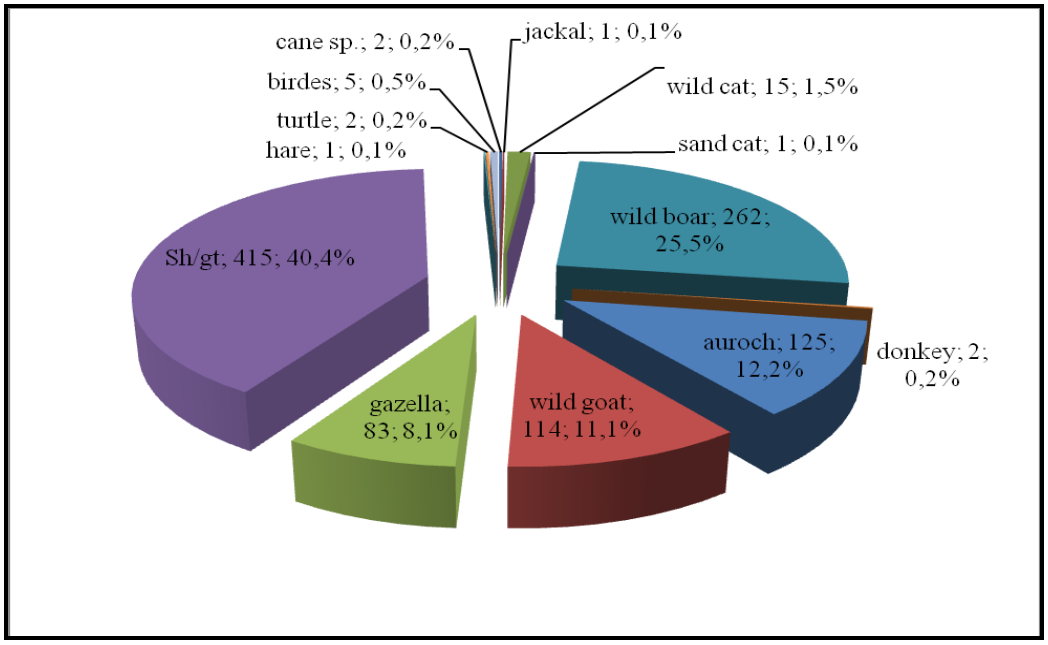

Fig. 8.11: LPPNB/ PPNC; frequence and percentage of identified specimens (NISP).

species/ age	young	sub-adult	adult	old	total
Canis sp.	-	1	-	-	1
jackal	-	-	1	-	1
wild cat	-	-	2	-	2
sand cat	-	-	1	-	1
equid	-	-	1	-	1
wild boar	3	1	5	-	9
auroch	-	1	2	1	4
wild goat	1	1	4	1	7
gazella	1	-	4	-	5
sh/gt	1	2	4	3	10
hare	-	-	1	-	1
turtle	-	-	1	-	1
birds	-	-	1	-	1
total	6	6	27	5	44

Table. 8.6: LPPNB/ PPNC; age classes of identified taxa.

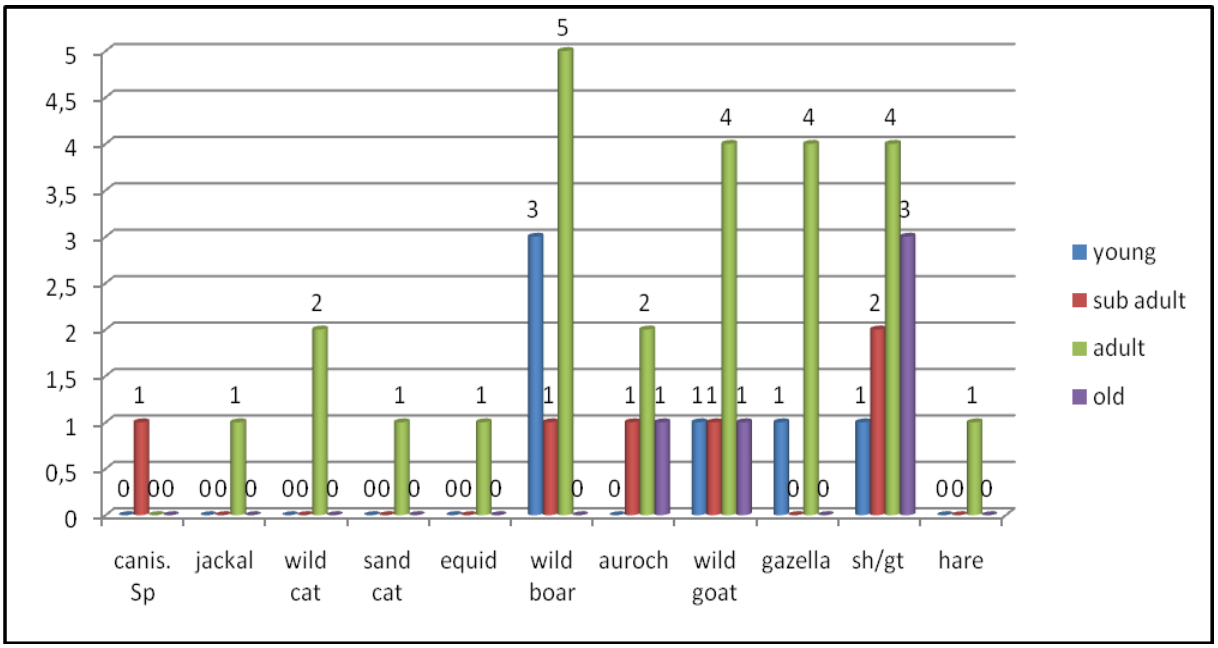

Fig. 8.12: LPPNB/ PPNC; age classes of each identified taxa.

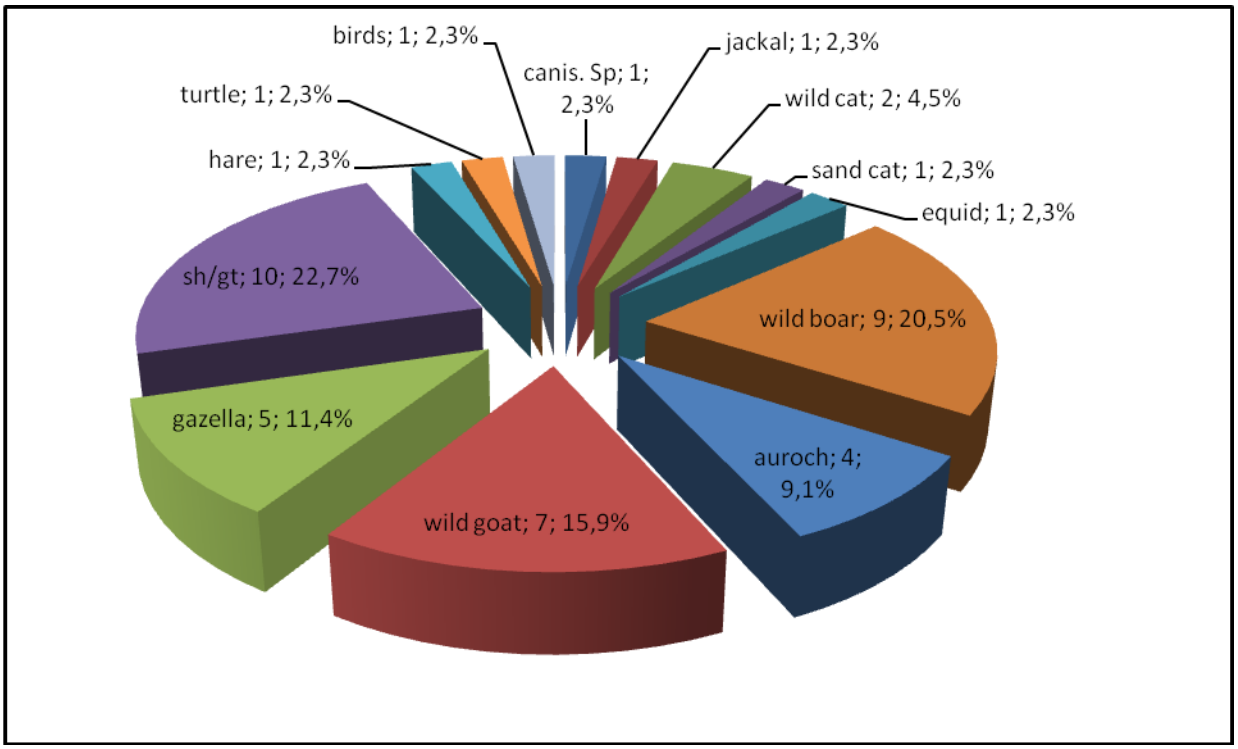

Fig. 8.13: LPPNB/ PPNC; frequence and percentage of identified taxa (MNI).

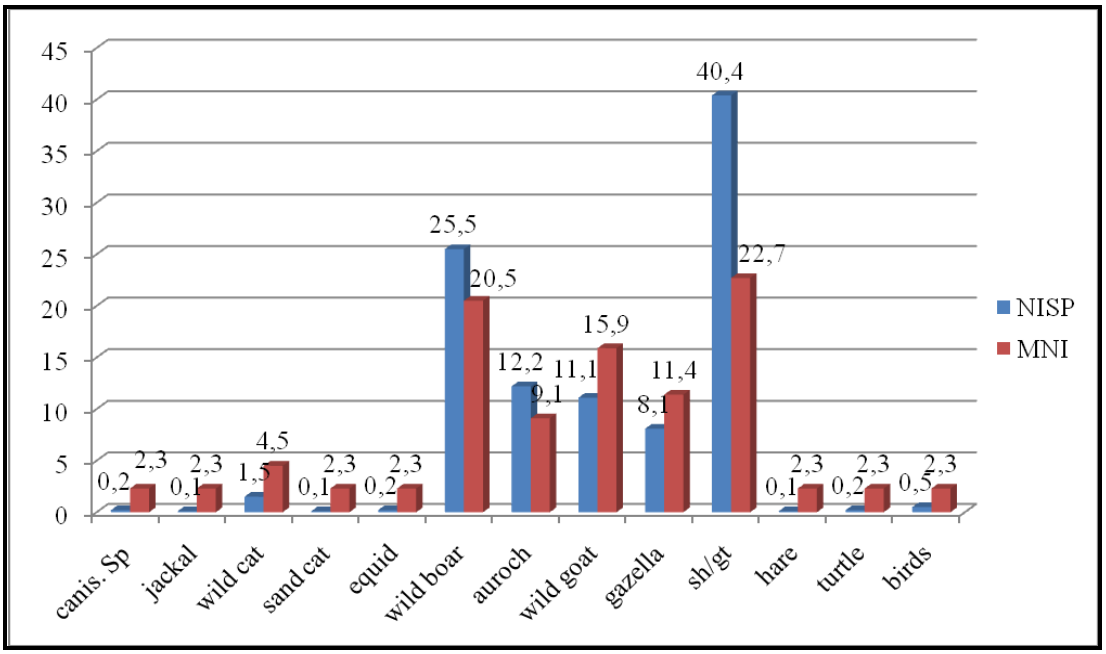

Fig. 8.14: LPPNB/ PPNC; MNI and NISP percentage.

Identified anatomical faunal remains are 279. Vertebrae elements are higher represented (35.1%), followed by ribs (25.1%). Then metapodial specimens (10.4%) and femur (6.5%). The rest of the skeletal elements are represented but with low percentages (Fig. 8.15; Table. 8.7).

anatomical portion	number
horn	4
mandible	3
teeth	7
vertebrae	98
ribs	70
scapula	2
humerus	11
radius	7
ulna	1
pelvis	6
femur	18
tibia	2
calcaneus	2
metapodial	29
phalanges	8
sesamoid	11

Table. 8.7: LPPNB/ PPNC; identified anatomical specimens.

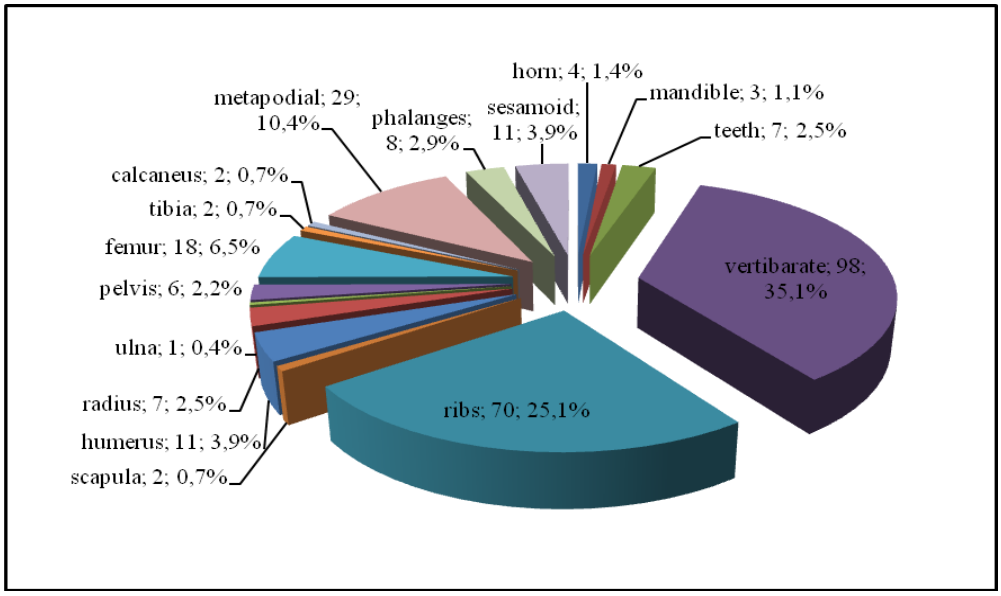

Fig. 8.15: LPPNB/ PPNC; frequence and percentage of identified specimens.

Unidentified faunal specimens are 6863. Indeterminate faunal remains represent 83.8% of the total faunal assemblages during this period. 6668 specimens have length less than 5 cm while 195 are longer than 5 cm. This result will be presented later within the taphonomical analysis results.

8. 1. 4. *Pottery Neolithic (PN)*

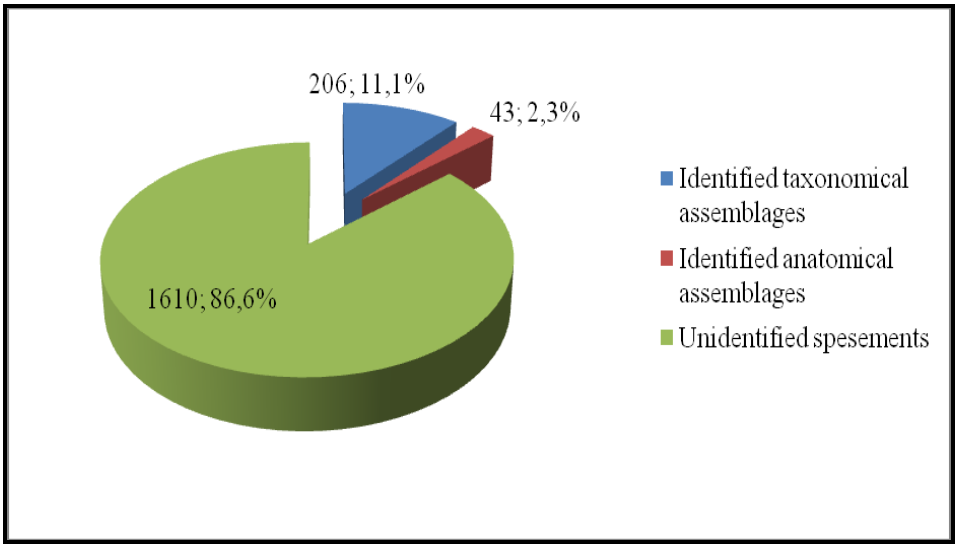

Fig. 8.16: PN; frequence and percentage of faunal assemblages categories.

Faunal assemblages found within the stratigraphical unit of the Pottery Neolithic period are 1859 specimens. Identified specimens are 206. The identified taxonomical assemblages

represent 11.1 % of the total faunal assemblages during this period while identified anatomical elements are 43 specimens which represent only 2.3% (Fig. 8.16)

The major part of the faunal assemblages from the Pottery Neolithic is composed by unidentified specimens (86.6%).

Regarding the results of the NISP, the most represented anatomical elements are related to domestic sheep/goat. Domestic sheep/goat anatomical elements are almost presented by 46.6%. Phalanges are the most represented followed by tooth. Anterior and posterior bones are present but in small quantities (Fig. 8.17; Table .8.8).

Wild boar is the second higher represented species. Most of the anatomical elements were documented but in low quantities. Only wild boar phalanges are higher represented (Fig. 8.17; Table .8.8).

Gazelle followed by wild goat have different anatomical elements but not all. While auroch anatomical elements are only 7 and are related to phalange and horn and one sesamoid bone (Fig. 8.17; Table .8.8).

Wild cat, jackal and hare are only represented by few anatomical elements (Fig. 8.17; Table .8.8).

Domestic sheep/goat is the most represented. 34.8% of the total number of the identified individuals. Calculation the age at death of the identified faunal assemblages related to domestic sheep/goat view different age at death. Four adult individuals and two young individuals, one sub-adult individual and one old individual (Fig. 8.18; Table .8.9).

Wild boar anatomical portions represent 5 individuals. They present 21.7% of the identified individuals, followed by gazella and wild goat. Auroch represent only 4.3%, only one sub-adult individual was found (Fig. 8.18; Table .8.9).

Carnivore were represented by one adult jackal individual and one adult wild cat (Fig. 8.18; Table .8.9).

Only one adult remain of hare has been documented during this period (Fig. 8.18; Table .8.9).

sk/specie	jackal	wild cat	wild boar	auroch	gazella	wild goat	sh/gt	hare
cranium	-	-	2	-	-	-	2	-
horn	-	-	-	1	-	-	2	-
mandible	-	1	2	-	-	-	6	-
teeth	1	-	5	5	5	-	17	-
scapula	-	-	2	-	-	-	2	-
humerus	-	-	-	-	6	1	5	-
radius-Ulna	-	-	1	-	-	1	1	-
radius	-	-	4	-	2	-	6	-
ulna	-	-	3	-	1	-	-	1
metacarpus	-	-	3	-	-	3	4	-
pelvis	-	-	4	-	1	1	1	-
femur	-	1	1	-	1	1	7	-
tibia	-	-	3	-	-	-	3	-
astragalus	-	0	2	-	1	3	6	1
calcaneus	-	-	1	-	1		8	-
metatarsus	-	-	2	-		1	3	-
phalanges	-	-	18	-	6	4	20	-
sesamoid	-	-	-	-	-	1	1	-
epiphyse	-	-	2	1	-	2	3	-
total	1	2	55	7	24	18	97	2

Table .8.8: PN; number of identified individuals specimens (NISP).

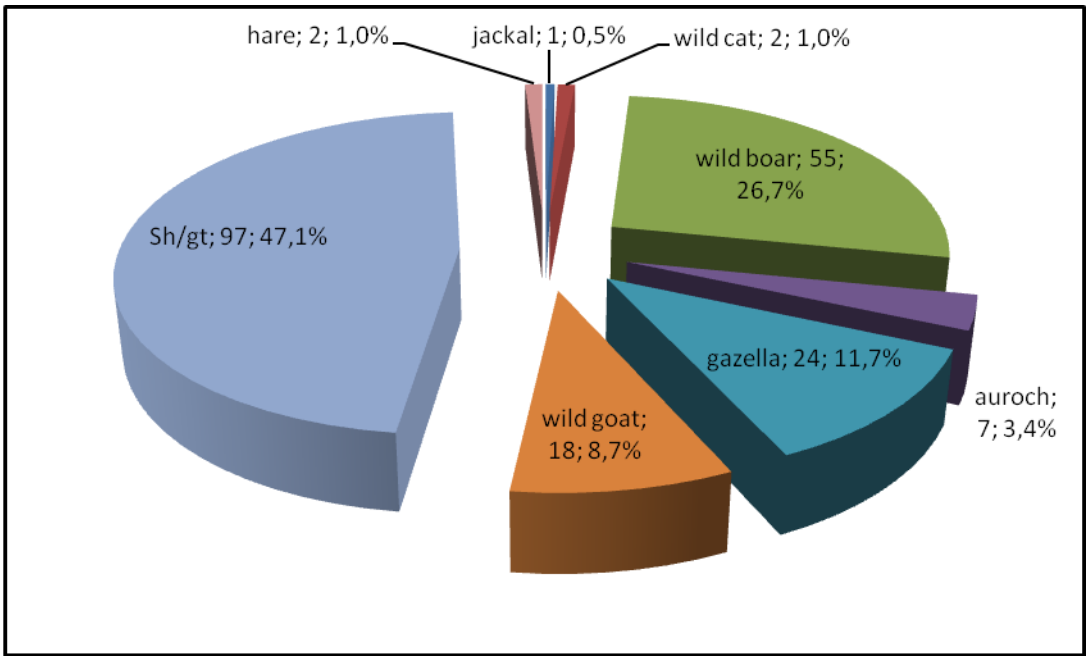

Fig.8. 17:PN; frequence and percentage of identified individuals specimens (NISP).

specie/age	young	sub-adult	adult	old	total
jackal	-	-	1	-	1
wild cat	-	-	1	-	1
wild boar	2	1	2	-	5
auroch	-	1	-	-	1
wild goat	1	-	2	-	3
gazella	1	-	2	-	3
sh/gt	2	1	4	1	8
hare	-	-	1	-	1
total	6	3	13	1	23

Table. 8.9: PN; age classes of identified species.

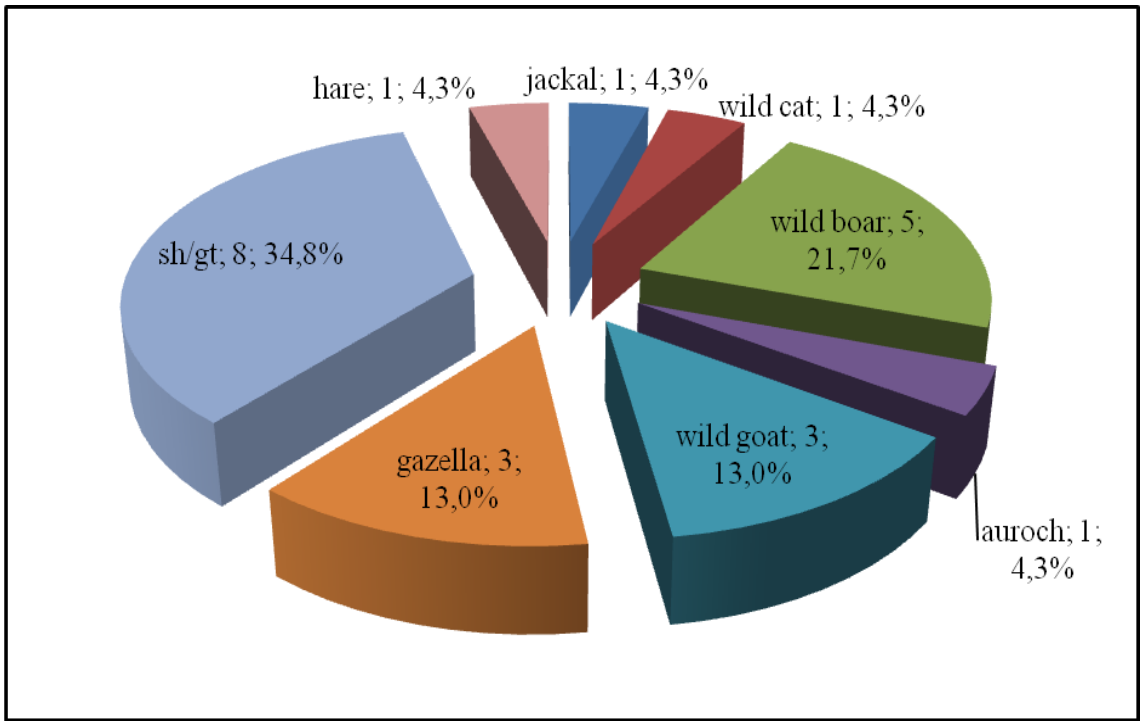

Fig. 8.18: PN; frequence and percentage of identified individuals (MNI).

Comparing between the NISP and MNI percentages, there are similarities between the number of individuals and determinate anatomical elements. The only difference were documented between gazella and wild goat. Gazella has 11.7% of NISP and wild goat has 8.7% of NISP. Both of them have 13% of MNI (Fig. 8.19).

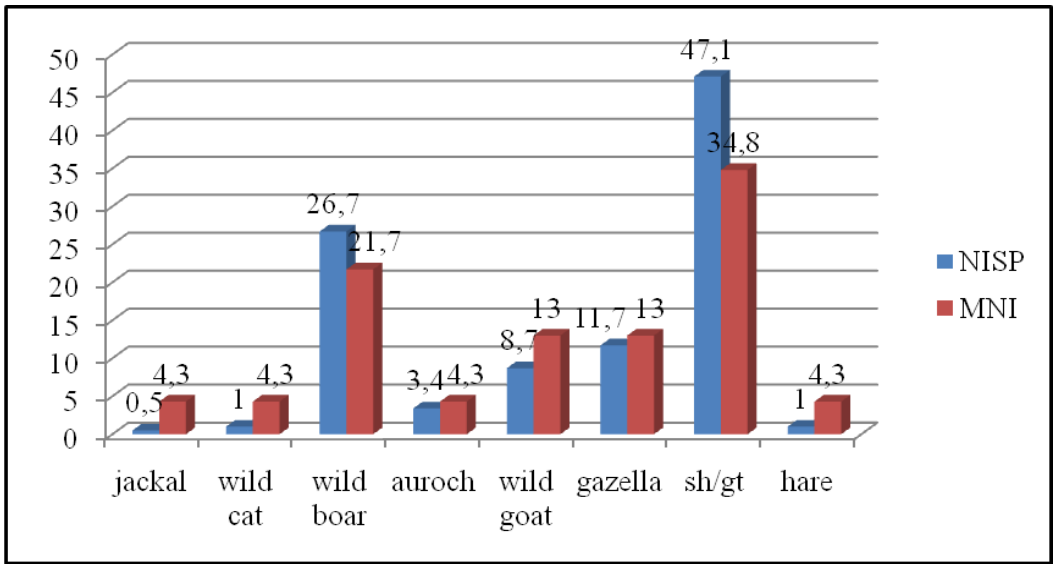

Fig. 8.19:PN; NISP and MNI percentage.

Identified anatomical elements are 43 . They represent only 2.3% of the Pottery Neolithic faunal assemblages. Vertebrae and femur specimens are the most represented in this category followed by metapodial bones (Fig. 8.20).

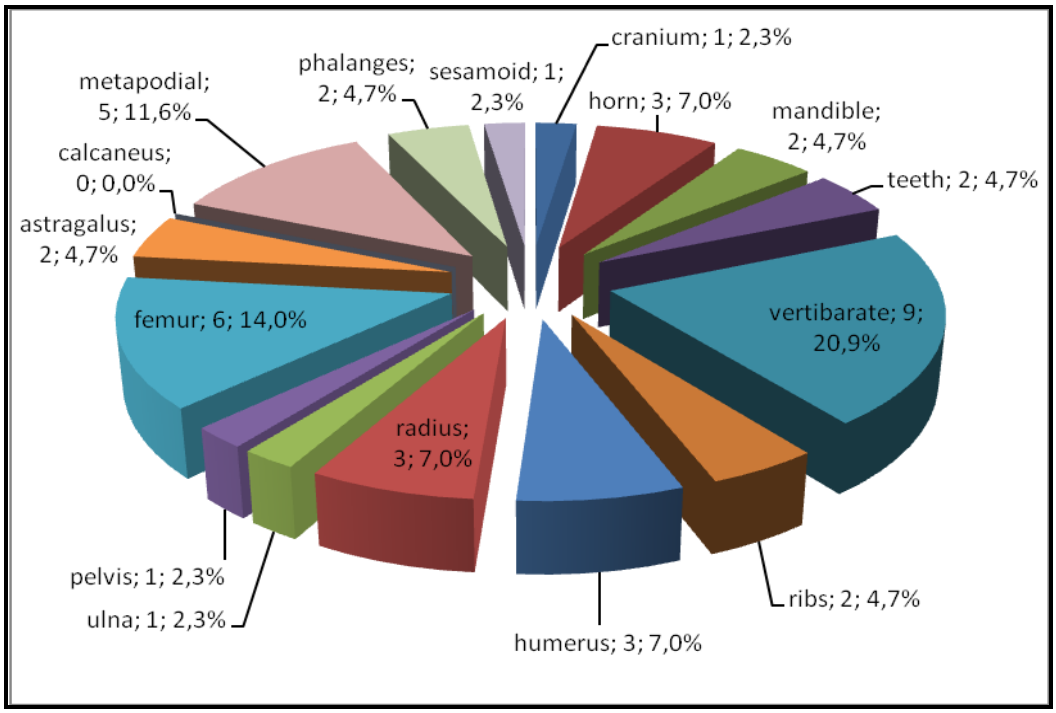

Fig. 8.20: PN; identified anatomical specimens.

Indeterminate faunal specimens 1610. 1571 specimens have length less than 5 cm while 39 specimens have length equal or more than 5 cm. Indeterminate faunal assemblages will be represented in the taphonomical results.

8. 1.5. *Discussion*

Results of the archaeozoological analysis of the faunal assemblages from Tell AbuSuwwan view a development sequences of life economy. Identified taxonomical remains represent 12.0% of total faunal assemblages from Tell AbuSuwwan

Archaeozoological results view a change of the site paleo-economy. The chronology of the faunal assemblages studies were taken in consideration. Fig. 8.21 present the percentage of the faunal assemblage during the Pre-Pottery Neolithic until the Pottery Neolithic period.

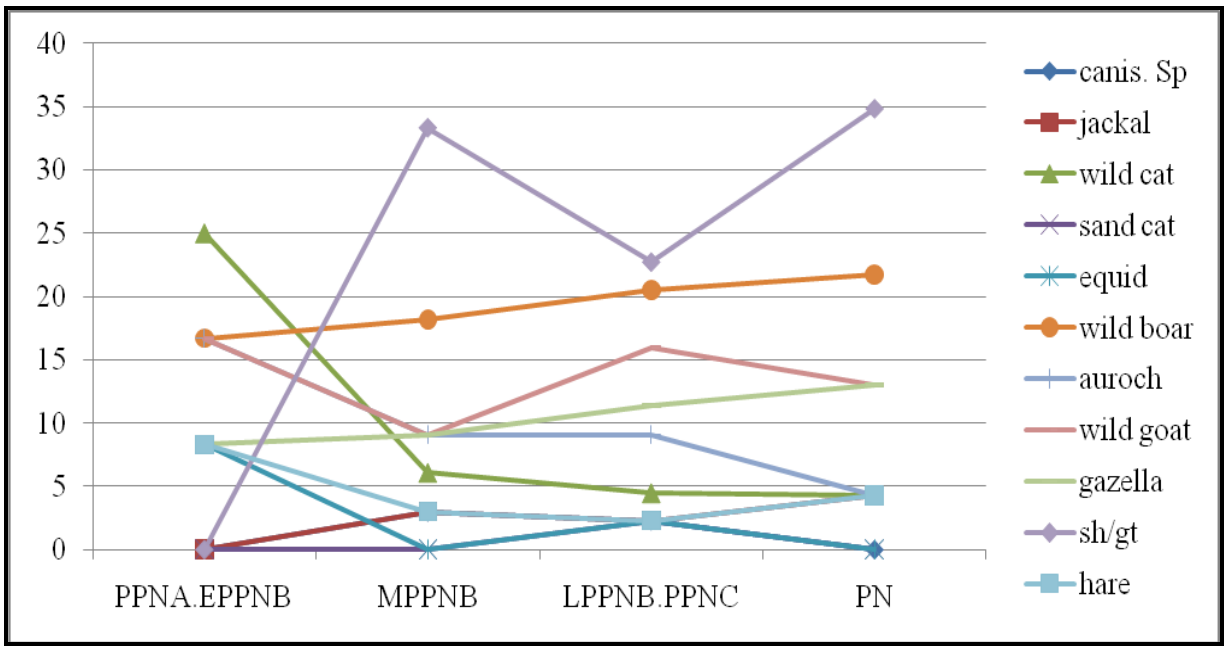

Fig. 8.21: Tell AbuSuwwan; MNI%.

Faunal assemblages coming from the PPNA/ EPPNB occupation have not high quantities. This could be related to the taphonomical preservation conditions. These results attest a variety of wild animal hunted. Seven wild species were documented during this period. Wild boar and auroch were the most hunted followed by gazella and wild goat. And one individual of wild cat, equid species and hare.

During the MPPNB Tell AbuSuwwan faunal assemblages view an high increase of wild species presence and domestic sheep/goat.

Domesticated sheep/goat appeared in this period. The MNI percentage of the sheep/goat is 33.3%. domestic sheep/goat skeletal elements view a variety of age of death. Major kill individual are adult age followed by young age.

People during MPPNB kept hunting different wild species. Wild boar is the second represented after sheep/goat. Wild goat, auroch and gazella were another source of meat during this period.

New carnivore species appear during this period. Unidentified carnivore similar to dog anatomy was found but kept as *Canis* sp. in the results. Jackal was the second new carnivore appear in this period.

Small bird and rest of one turtle individual were documented during MPPNB.

Faunal assemblages increased during LPPNB/PPNC period. Indentified taxonomical remains are 12.7% of the LPPNB faunal assemblages. 44 individuals of wild species and domestic sheep/goat were found.

Domestic sheep/goat individuals decreased during LPPNB/PPNC while wild animals number of individual increased.

LPPNB/PPNC noted the presence of different age classes of wild and domestic animals. This fact could be due to two reasons: the first one is the development of domestic sheep/goat strategies within the site, people increase the hunting of wild animal to become the main source of meat.

The most reresented wild animal is the wild boar followed by wild goat, gazella and auroch.

Different size carnivores were found. Medium size carnivores were presented by Jackal and one individual of *Canis* sp. Small carnivores were represented by wild cat and small *Felis* species. This small *Felis* skeletal elements found is similar to wild cat in anatomy, but they are more smaller so its preferred to presented as sand cat.

During the PN period the faunal composition decreases. Identified taxonomical remains are 206. Wild goat present the higher identified assemblages followed by wild boar.

Percentage of MNI view a continue increasing of wild boar and gazelle hunting and a decrease hunting of wild goat and auroch.

Jackal and wild cat are the only carnivores represented during PN. Other carnivores are absent during this period.

Turtle and unidentified bird animals were found during the MPPNB and LPPNB/PPNC. They were represented by one individual for each period.

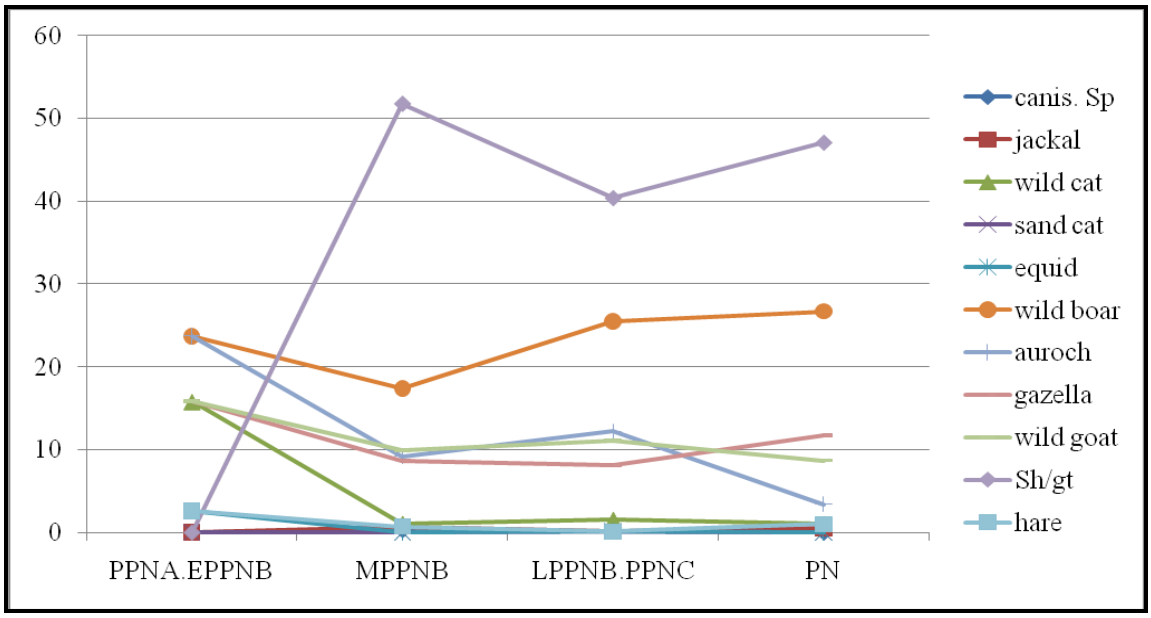

Fig. 8.22: Tell AbuSuwwan NISP%.

8. 1. 6. *Comparative archaeozoological results*

Archaeozoological published results from Ain Ghazal and Jericho are used to compare with Tell AbuSuwwan archaeozoological results. Its necessary to take in consideration that in this case study the percentages of the number of identified specimens (NISP) have been used (Fig. 8.23; Fig. 8.24; Fig. 8.25).

Ain Ghazal faunal results concern three Neolithic periods (MPPNB, LPPNB/PPNC, PN). Archaeozoological results of Ain Ghazal view a high percentages of domesticated sheep/goat during the three periods. Hunted wild species are gazella and wild boar, auroch and equides.

During the earlier periods wild animals percentages decreased while domestic sheep and goat increased. Carnivores were presented but with low percentages (Fig. 8.24)

Jericho faunal assemblages are coming from three Neolithic periods (PPNA, PPNB, PN). Archaeozoological results view a variety of wild animals. Gazella is the main hunted wild animal followed by wild boar and auroch (Fig. 8.25).

Different carnivore species were documented in Jericho during this period. The most represented species are *Vulpes* followed by *Canis* sp. and *Felis* sp.

During the PPNB first domestic sheep/goat are documented. Its percentages were low fronting the wild animals. Wild boar represents the highest hunted wild animal followed by gazella and auroch.

Dama and *Capreolus* identified elements increase but they are still in low percentage (0.6 %).

During the PN period domestication of sheep/ goat increased. And during PN first *Bos domestic*us were found in Jericho. Wild boar and gazella percentages decreased while auroch and other wild animals were not documented in this period. PN economy of Jericho were passed on the domesticated animals and small hunting activities.

Basta faunal assemblage presents a variety of different wild and domestic animals. Unfortunately the published information were represented without MNI or NISP results. Authors presented results in quantified number and weight measurements of the faunal assemblages. Its taken consideration the results of represented species from Basta site during this study.

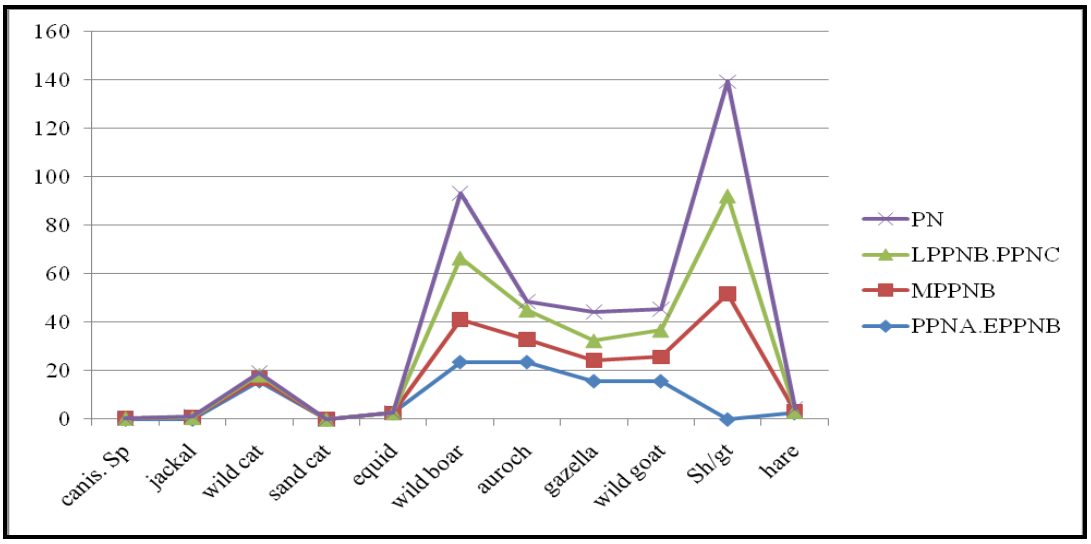

Fig. 8.23: Tell AbuSuwwan; NISP %.

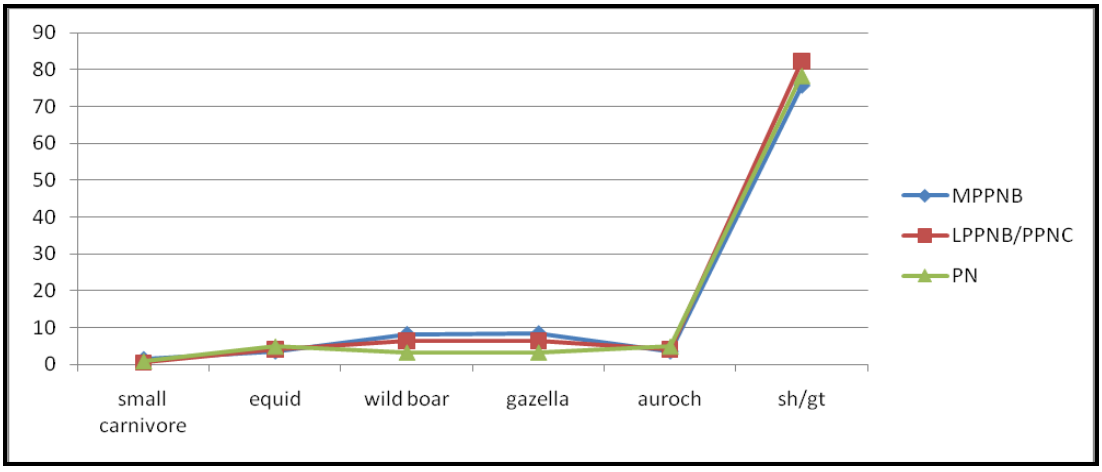

Fig. 8.24: Ain Gazal; NISP% (von den Driesch and Wodthe 1997).

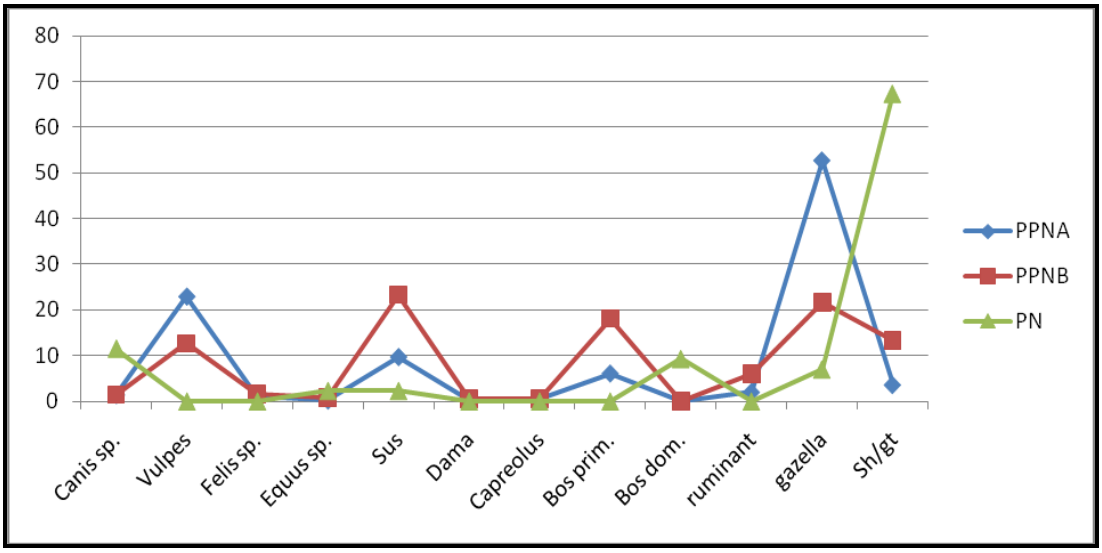

Fig. 8.25: Jericho; NISP% (Clutton-Brock 1979).

8.2. Taphonomical Analysis

Unidentified faunal remains are highly represented within the faunal assemblage coming from Tell AbuSuwwan. Variety of natural and anthropical modifications have been occurred. These modifications caused the decrease of the preservation condition of the faunal assemblage.

8.2. A. *Natural modification*

During the study, different problems related to the conservation degree of the bone assemblages were faced in this Archaeozoological study. The main problem faced in this study is the degree of soil sedimentation on the surface of the bone assemblages. This covers the bone surfaces so the anthropical modification could not be noted on the covered assemblages

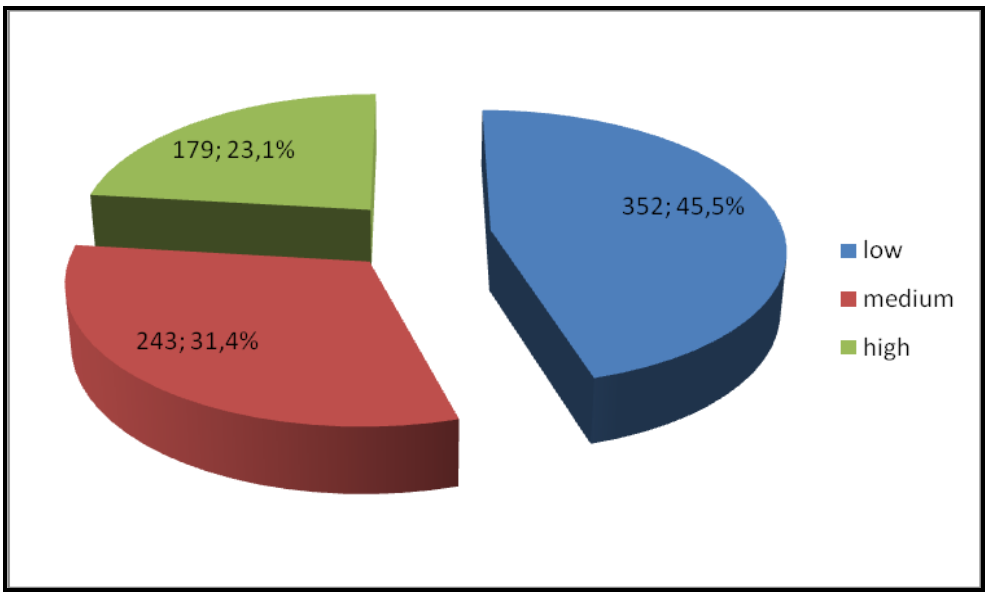

Fig. 8.26: frequence and percentage of concretion level on the surfaces of the identified taxonomical assemblages.

sed.	quantity	percentage
low	352	45.5
medium	243	31.4
high	179	23.1
total	774	-

Table. 8.10: percentage and frequence of concretion degrees on the Identified taxonomical assemblages

In these faunal assemblages the only natural modification that has been documented is the soil sedimentation on the surface of identified taxonomical assemblages.

The degree of concretion level were classified in three degrees; low, medium and high. Number and percentages of concretion presented in table (8.10) and Fig. (8.26).

Soil sedimentation was classified in three degrees depending on the recovered surfaces. This natural fact was noted in all the area studied. 774 specimens were recovered by soil sediments. It represents the 39.7 % of identified taxonomical assemblages.

This modification has been documented on the faunal remains recovered in the whole deposit of Tell AbuSuwwan and it seems to have no relation to the chronological period nor to the analised area.

8.2. B. *Anthropical modification*

Anthropical modifications documented during the study are cut marks related to butchering processes and burning of the bones.

Only 27 specimens bear cut marks on bone surfaces in all the faunal assemblages from Tell AbuSuwwan deposits. This low presence of cut marks is mainly due to burning modification and natural modification. Cut marks were documented on the surfaces of different anatomical portions. These cut marks are related mostly to skinning and disarticulations processes of the hunted and herded animals. Cut marks produced during meat recovering have been documented too. (Fig. 8.27, Fig. 8. 28)

Other anthropical modifications, such as anthropical fractures and percussion cones , have not been documented. This due to burning modification and presence of soil sediments on the faunal assemblage's surfaces.

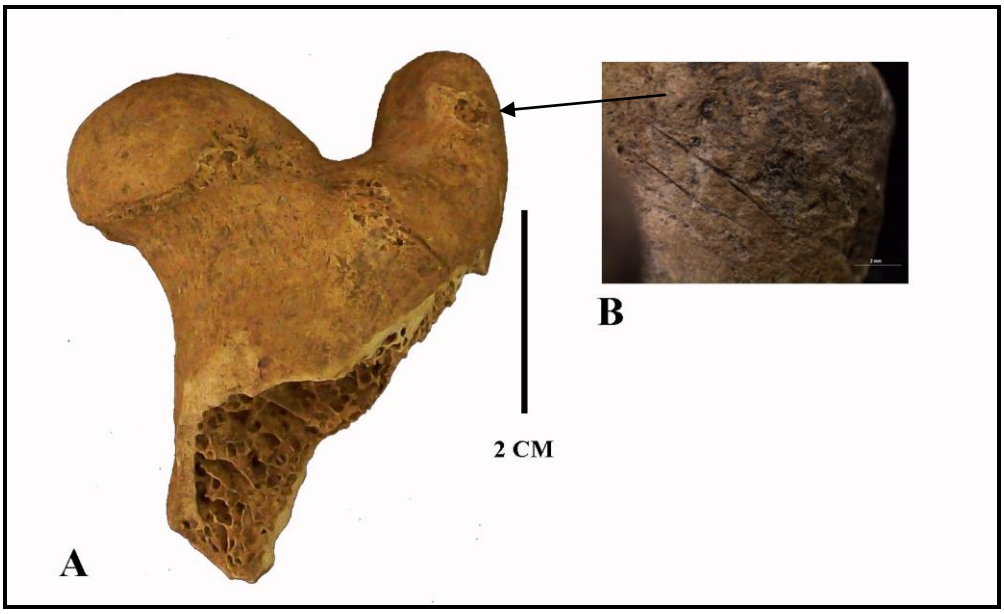

Fig. 8. 27: ASW. 668. A; proximal portion of ovicaprines femur (frontal view, left). B; cut marks related to disarticulation processes, stereomicroscope image.

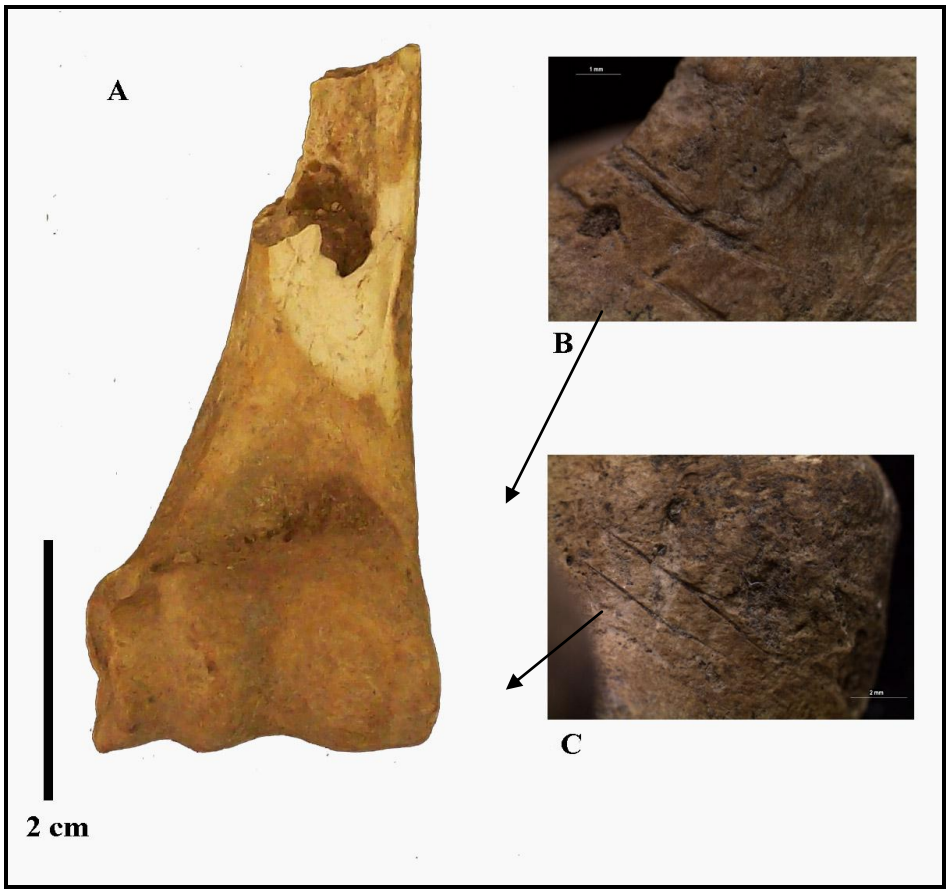

Fig. 8. 28: ASW. 904. A; distal portion of ovicaprines humerus (Distal view, right). B-C; cut marks of disarticulation processes on the lateral view, stereomicroscope images.

Burned bones are highly documented in all the faunal assemblages from Tell AbuSuwwan. It has been taken on consideration the location of the burned identified remains within the analysed area.

Burned identified taxonomical faunal assemblages are 378 and represent the 19.4% of the total identified taxonomical assemblages (NISP). Distribution of the burned taxonomical specimens within the analysed area in Tell AbuSuwwan is presented in Table (8.11) and Fig (8.29).

period/area	not burned	burned
PPNA/LPPNB	16	22
MPPNB	538	145
LPPPNB/PPNC	855	168
PN	163	43
total	1572	378

Table. 8.11: Tell AbuSuwwan; number of burned and not burned identified specimens (NISP).

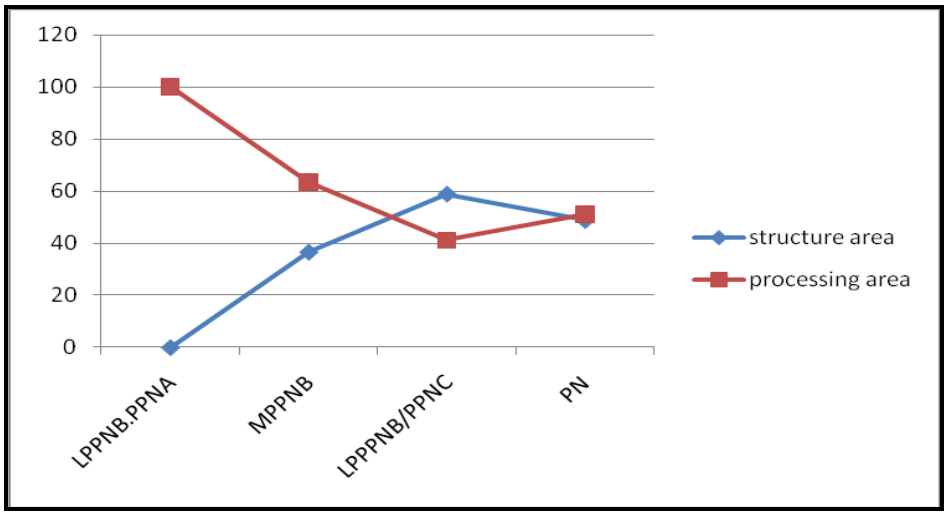

Fig. 8.29: Tell AbuSuwwan; percentage of burned NISP distribution within the analysed area.

Burned identified anatomical assemblages are 116 specimens. While burned unidentified faunal assemblages are 5360 specimens. Burned assemblages present 40.1% of the total unidentified assemblages. (Table. 8. 12)

Comparing the burned unidentified assemblages percentage during the Neolithic period presented in table (8.14), it's noted the increase of the burned assemblage's percentage from PPNA until PN. Percentage of burned assemblages during the MPPNB is almost

equal to LPPNB/PPNC. But there are different in the quantities between the two Neolithic phases. LPPNB/PPNC burned assemblages are 2713 specimens while MPPNB burned assemblages are 1796. (Table. 8.12)

Comparing between unidentified specimens within area B we can see a increasing of the burned assemblages within the internal structure spaces. (Fig. 8.30)

Burned unidentified assemblages were also classified to maximum length in relation to the categories used in the archaeozoological results. This classification present that faunal assemblages have length less than 5 cm are higher burned percentage. This view the high fragmentation caused by the burning processes.(Table. 8.13, Table. 8.14)

catogory/period	PPNA/EPPNB	MPPNB	LPPNB/PPNC	PN	total
burned	8	55	44	9	116
not burned	138	371	235	34	778

Table. 8. 12: number of burned and not burned Identified anatomical specimens.

	not burned		burned		
period	< 5 cm	≥ 5 cm	< 5 cm	≥ 5 cm	total
PPNA/EPPNB	258	0	53	0	311
MPPNB	2674	99	1764	32	4569
LPPNB.PPNC	4023	127	2645	68	6863
PN	790	22	781	17	1610
total	7745	248	5243	117	13353

Table. 8.13: number of burned and not burned unidentified specimens.

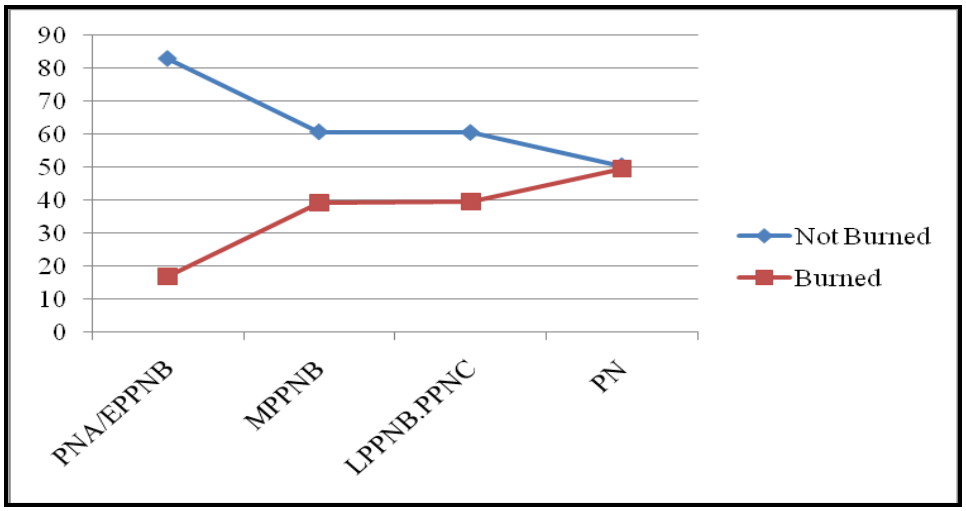

Fig. 8.30: percentage of burned and not burned unidentified specimens.

Period	Not Burned		Burned	
Period	Number	Percent %	Number	Percent %
PNA/EPPNB	258	83	53	17
MPPNB	2773	60,7	1796	39,3
LPPNB.PPNC	4150	60,5	2713	39,5
PN	812	50,4	798	49,6

Table. 8.14: number and percentage of burned and not burned unidentified specimens.

8.3. Animal hard tissues tools

In this chapter different categories of bone artefacts, which were recovered during the archaeozoological analysis of the faunal assemblages from Tell AbuSuwwan, will be analysed. The presence of 64 osseous bone tools from different typologies take the attention to apply a specialized analysis to differentiate their typologies and technology used for manufacturing the bone tools. Then it has been organized an experimental work to reconstruct the producing techniques of the osseous artefacts coming from Tell AbuSuwwan. This work has been carried out in cooperation with group of researchers and students from the University of Ferrara.

8.3.1. Archaeozoological approach and hypotheses

1. Archaeozoological analysis has been carried out to describe the different categories of bone industries. In the assemblage a variety of bone elements, which had been used as raw material to prepare the osseous artefacts, have been found. Comparative animals skeleton collection was used to determinate the species and the skeletal portion of these artefacts.

2. Then osseous artefacts were classifies on the basis of the characteristics related to the shape and size of the osseous tools like point artefacts and spatula.

3. Scientific analysis by using stereomicroscopy (LEICA MZ6) with resolution magnifying lamp (LEICA CLS- 150XE) and a scanning electron microscopic (SEM) to observe the marks on the bone tools surfaces related to butchering processes and the manufacturing and utilization processes.

4. Bibliographical research has been done to understand the main categories of osseous tools that were found in the near east and compare it with Tell AbuSuwwan osseous tools.

5. Finally a scientific experimental work has been carried out to support the results of the archaeozoological analysis of the osseous artefacts. The experimental work will be presented in later part of this chapter.

8.3.2. Osseous categories

The classification of the bone tools, as mentioned before, was based on the archaeozoological analysis of the osseous artefacts coming from Tell AbuSuwwan and by using a different comparative bibliographical resources of the bones tools coming from Neolithic sites in the Near East (Clutton-Brock 1979; Camps-Fabrer 1990; D'Errico, Henshilwood 2007; Garfinkel, Horwitz 1988; Le Dosseur 2008; Newcomer 1974; Waston, Newcomer 1984).

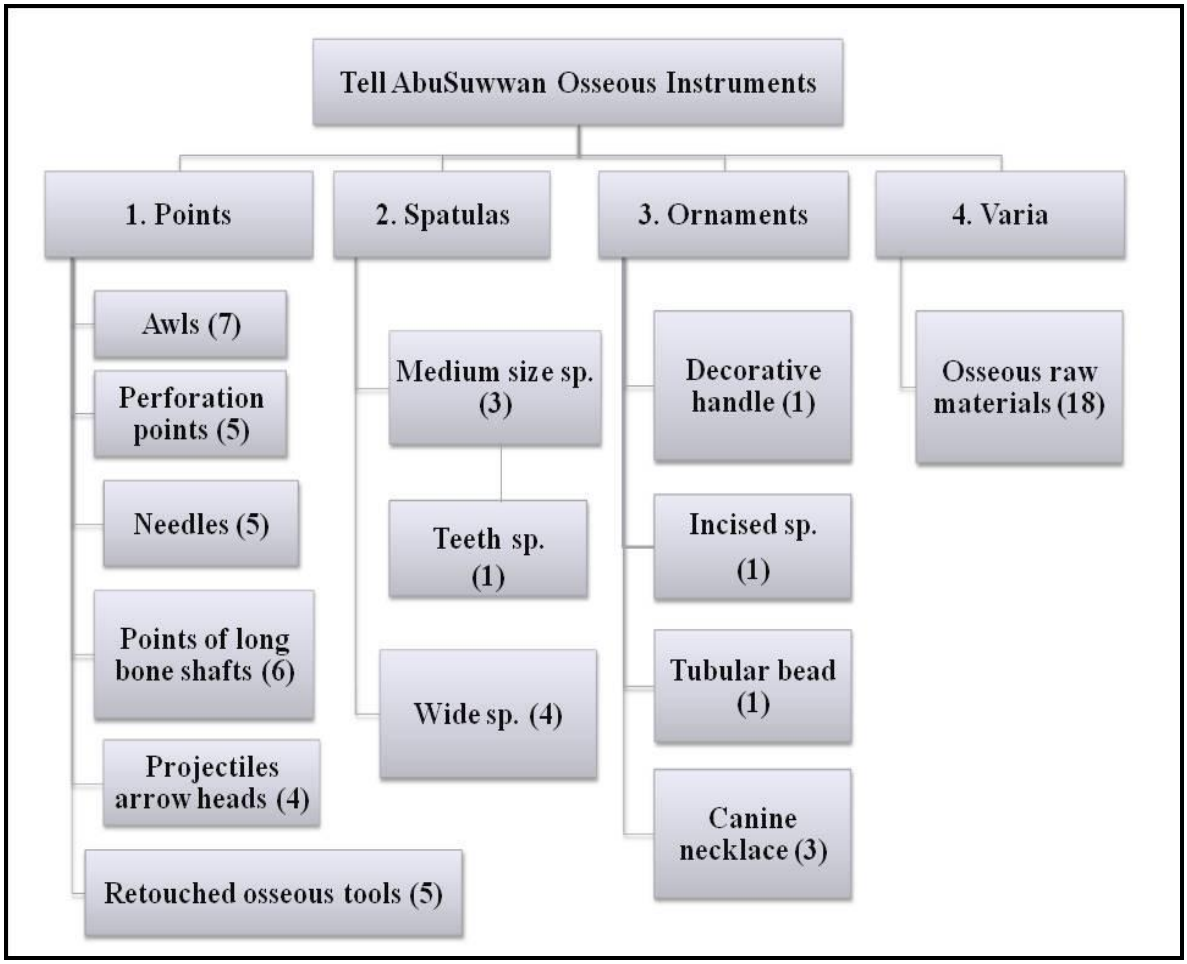

Fig. 8.31: Tell AbuSuwwan; typological scheme of bone tools. (n) represents the number of remains for each category.

The identified categories are pointed tools, spatulas, ornaments, and raw materials. Among these tools there are awls, arrow heads, spatula, and decorated artefacts which have unique type of decoration (Fig. 8. 31 and table. 8.15).

Bone tools categories	Typology		Osseous raw materials	Stone implement: retouched (1) unretouched (2)	Abrading	Utilization traces remarks	Mesurments* (MM) Length/Largnes s/thickness	Preservation of the points
Pointed bone tools	Awls (7)		Femore+Tibia	1+2	Yes	Yes	100.0 /20.0/5.0m	1 Instrument
	Perforation points (5)		Metapodiale Medium size	1+2	Yes	Yes	50.0/11.0/ 2.0	1 Instrument
	Needles (5)		Fragment long bone	2	YES	YES	41.6/ 15.0-2 .0/ 3.0-2 .0	1 Instrument
	Projectiles (4)		Metapodiale Long bone Medium size	1+2	YES	NO	35.3-46.4/ 6.4-2.2/2	1 Instrument
	Points of long bone shafts (6)		Metapodial Medium size	1+2	Yes	Yes	40.0/8.0/5.0	1 Instrument
	Retouched osseous tools	Horn (2)	Goat/Sheep	-	Yes	Yes	92.0/38.0/10.0	1 Instrument
		Long bone (3)	Long bone Medium size	1+2	Yes	Yes	54.0/14.0/5.0	2 Instruments
Spatula	Medium size spatula (4)		Costola Medium size	1+2	No	Yes	61.0/14.0/2.3	2 Instruments
	wide spatula (4)		Costola (Aurochs)	1+2	Yes	Yes	136.0/24.2/8.4	1 Instrument

Table. 8.15: Tell AbuSuwwan; bone tools catogories and documented modification on the bone tools surfaces.

A. Points artefacts:

In this category 6 typologies of tools which present a group of artefacts with common characteristics, have been classified. (D'Errico, Henshilwood 2007; Garfinkel, Horwitz 1988; Le Dosseur 2008; Newcomer 1974; Waston, Newcomer 1984)

A.1. Awl: there are 7 awls. They are not in good preservation conditions. These artefacts were related to different Neolithic periods between the Pre-Pottery Neolithic A until the Pottery Neolithic.

Two artefacts (ASW. 34, ASW.36) have been produced from femur of wild boar. They are generally the longest point artefacts found. There length is between 85mm to 95 mm.

While the rest of the artefacts are related to medium size animal tibia and metapodial bones (Fig. 8.32; Fig. 8.33).

The surface of ASW. 34 is bad preserved. Smoothing of the bone by using abrading technique has been documented on the proximal portion near the point. There are rounded scraping movements that could be related to the use of the awl to work in dray leather (Cristiani 2008).

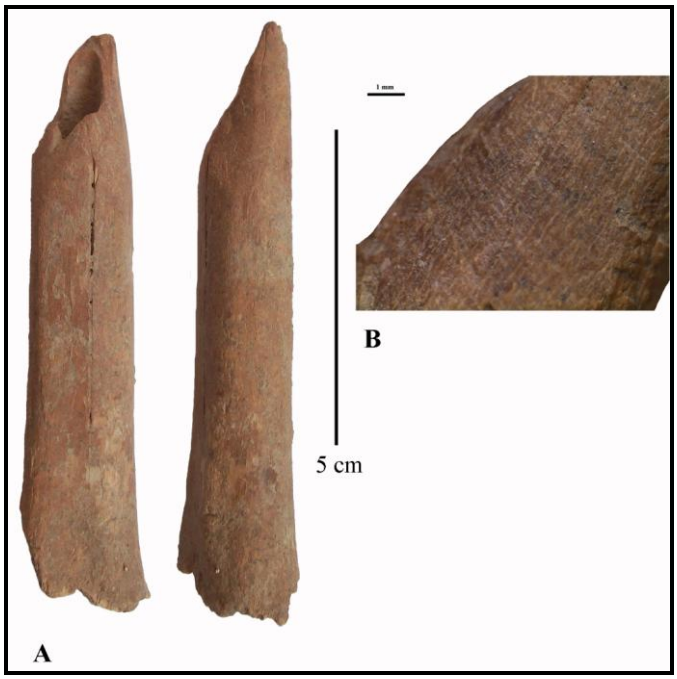

Fig. 8.32: ASW.34; A: ventral and dorsal view. B: Inclined scraping movement, Stereomicroscope image.

While ASW. 36 has a good preserved surface. A variety of cut marks and sawing has been documented. Cut marks are related to butchering processes. A retouched lithic tool has been used to smooth the surface. Longitudinal movements have been applied on the surface of the bone. There also documented the traces of use beside the proximal portion of the awl.

ASW. 35 and ASW. 54 present the middle to proximal portion of the awl. ASW 35 has old fracture in the medium portion and it has been burned to increase its hardness. Preparation of the point is similar to AWS. 36 by the presence of retouched lithic artefacts traces long the bone surface.

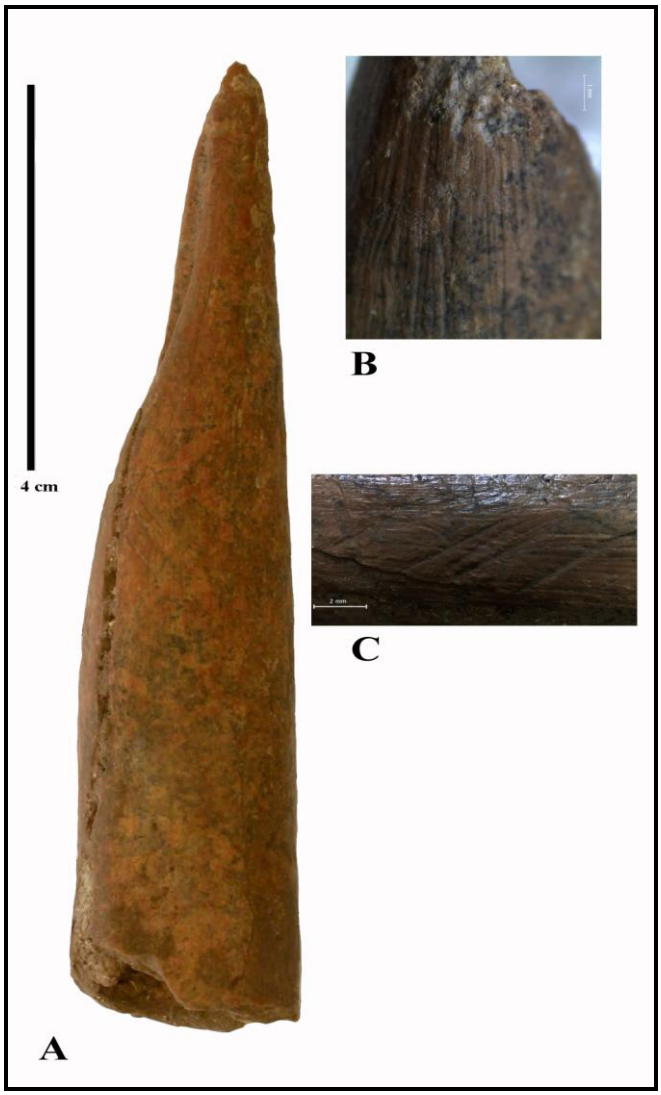

Fig. 8.33: ASW. 36; A: lateral view. B: longitudinal sawing on the proximal portion. C: cut marks on the lateral side happen after the sawing traces, Stereomicroscope image.

ASW. 49 is represented by the middle-distal portion of an awl which has been prepared by an ovicaprines tibia. It has been prepared by using retouch lithic artefact to smooth the surface and using abrading techniques to smooth the proximal proportion. ASW.49 surface present an high degree of burning and high fragmentation of the bone surface. This is related to unintentional fact happened after use and it's not similar to the other artefact which could be heated to increase their hardness.

ASW. 63 only the point of awl which is made of long bone of medium size animal is present. The surface is bad preserved. But it's documented a low degree of burning on the surface of the artefact. In small preserved zone there are also the traces of retouched lithic artefact which used to prepare the surface.

ASW. 62 is a medium portion of awl which was prepared from a tibia of medium size animal. Its preparation of the surface is done by using abrading techniques. The surface is highly smoothed and can be seen the vascular channels of the bone. Also in this case the bone has been burnt.

Its black and white color is similar to ASW. 35 which suggest that this tool has been exposed to fire by the producer for more time than ASW. 63 (Lyman 1994; Rietz and Wing 1999).

A.2. Perforation points

This typology is represented by 5 artefacts which were prepared from metapodial bones of medium size animal like ovicaprines. They particularly made from the middle to distal portion of the metapodial bones (Camps-Fabrer 1990; D'Errico, Henshilwood 2007; Garfinkel, Horwitz 1988; Le Dosseur 2008; Waston, Newcomer 1984) .

The distal portion of the three artefacts is preserved (ASW.4, ASW.8 and ASW. 9). On the surface of the bones cut marks related to butchering processes and also abrading smoothing of the surfaces of the artefacts have been documented (Fig. 8.34).

Two artefacts (ASW. 10, ASW. 11) represented the proximal to medial portion of the perforation points. The shape and size of these two artefacts support that they are related to this typology (Fig. 8.35; Fig. 8.36).

On the Surface of ASW 10 has been documented the scraping by using was prepared by using a retouch lithic artefact to finish the point. Particularly in the point of ASW 10 there are evidences of shaping the point. The movement to sharp the point was unsystematic because the scraping movements were found in different direction.

ASW. 11 was smoothed first by lithic artefact. The scraping remain on the proximal portion of the artefact is canceled and preserved near to the middle portion (Fig. 8.36).

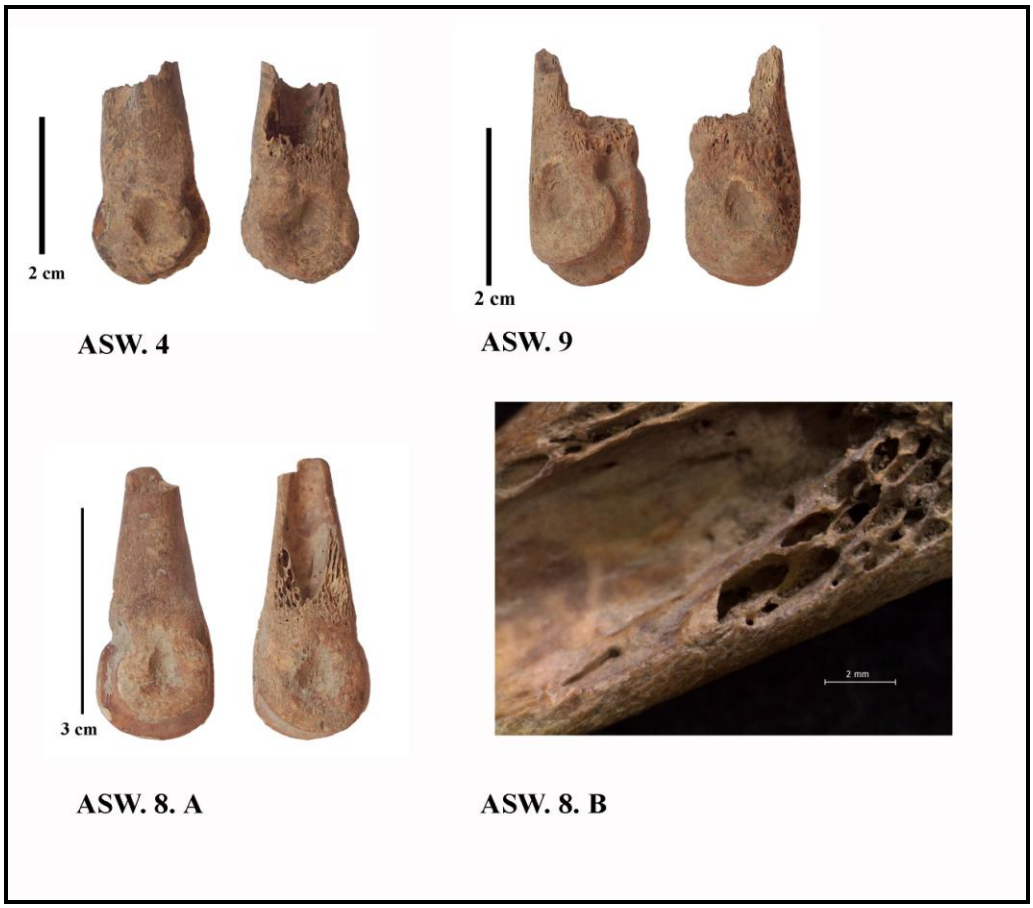

Fig. 8.34: ventral and dorsal view images. ASW. 8 (A, B): ventral dorsal view present smoothing by abrading technique, stereomicroscope image.

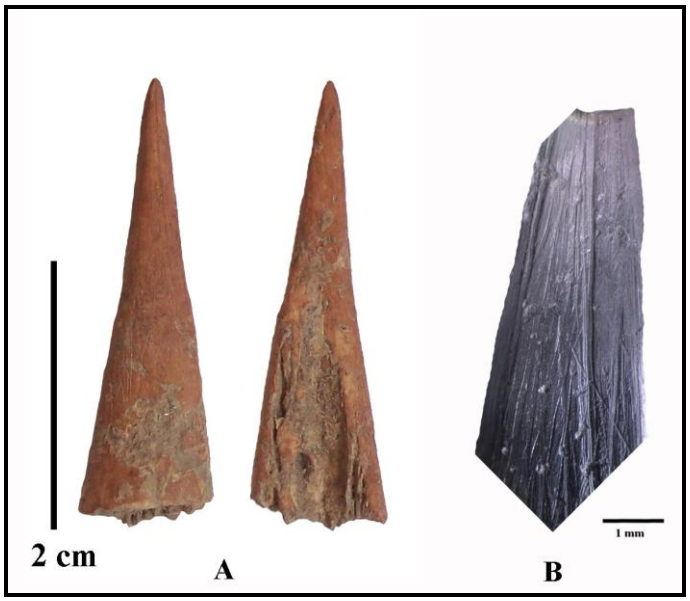

Fig. 8.35: ASW. 10; A: ventral and dorsal view. B: SEM image view longitudinal scraping on the proximal portion.

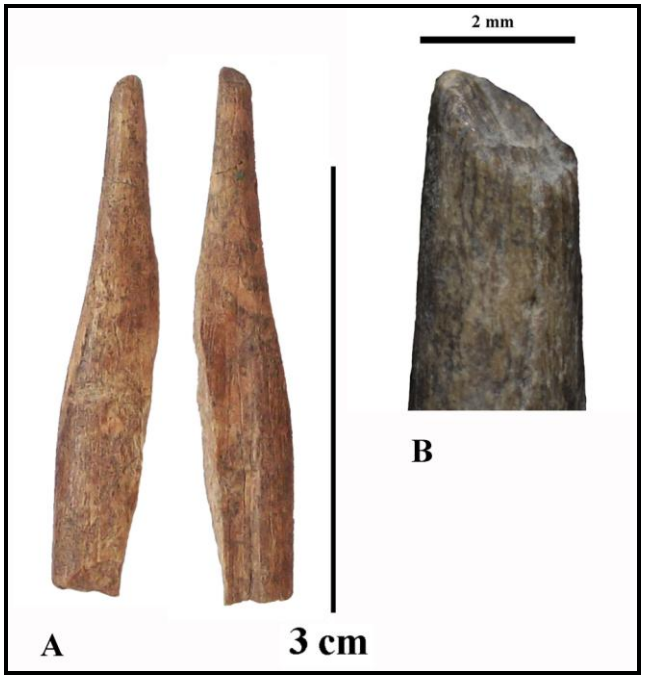

Fig. 8.36: ASW. 11; A: ventral and dorsal view. B: view of the point which has been re-utilized after fracture, Stereomicroscopic image.

A.3 Needles

This typology is represented by 5 small size needles. (ASW5, ASW. 6, ASW. 7, ASW. 57, ASW. 59). (Fig. 8.37; Fig. 8.38; Fig. 8.39) (Clutton-Brock 1979; Camps-Fabrer 1990; D'Errico, Henshilwood 2007; Garfinkel, Horwitz 1988; Le Dosseur 2008; Newcomer 1974; Waston, Newcomer 1984).

ASW.7 is almost preserved artefact. The head point is broken. It has length of 41.6 mm and thickness is around 2 mm. ASW. 5 present the middle-proximal portion of the needle. The shape and technique of preparation are similar to ASW. 7. Both artefacts have on the surface of the longitudinal scraping by using a retouched lithic artefact. The distal portion doesn't have any particular preparation in ASW.7 while in ASW. 5 it's not preserved. The use of the artefacts was for long time because even the scraping traces on the surface appears to be smoothed (Fig. 8.37).

ASW. 6, ASW. 57 and ASW. 59 present the medial-distal portion of needles. In ASW. 6 has been documented an intensive sawing to cut the distal portion. While in ASW. 57 and ASW. 59 were fractured due to use and later taphonomical preservation.

ASW. 6 and ASW. 59 have been prepared by using abrading smoothing of the surface while in ASW. 57 a retouched lithic artefact has been used.

Fig. 8.37: ASW. 7; needle.

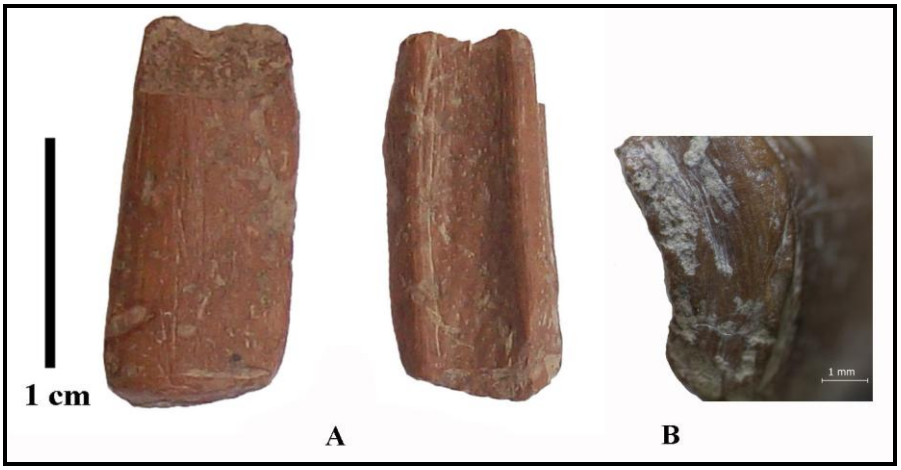

Fig. 8.38: ASW. 6; A: ventral and dorsal view. B: view perpendicular sawing to cut the bone on the of the distal portion, Stereomicroscope image.

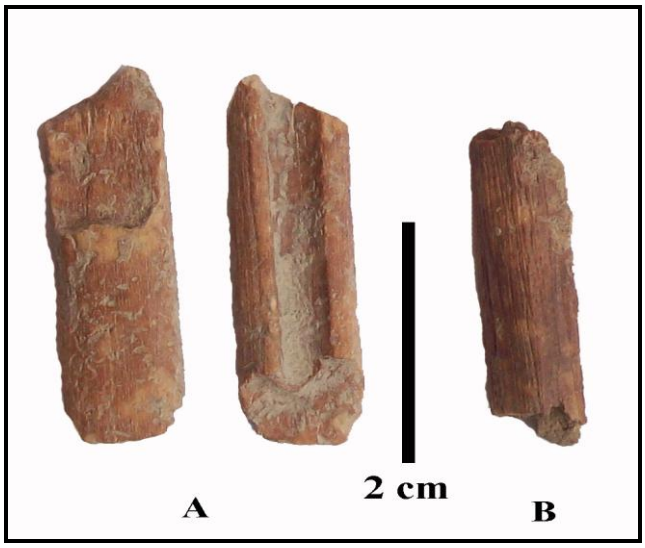

Fig. 8.39: A: ASW. 59; lateral and dorsal view. B: ASW. 57 lateral view.

A. 4. Points in long shafts

This typology is represented by 6 points which are preferred to perforation artefact made on long shaft bones of medium-large size animals. (ASW.20 –ASW. 25). These tools have common characteristics of shape and size. The surfaces of ASW. 20, ASW. 21 and ASW .25 are bad preserved and almost the surfaces of these artefacts are covered by concretion layer (Fig. 8.40) (Clutton-Brock 1979; Garfinkel, Horwitz 1988; Le Dosseur 2008; Newcomer 1974).

ASW. 20 and ASW 25 were smoothed by using lithic artefact. ASW. 21 and ASW. 24 are smoothed by longitudinal scraping of retouched lithic artefact. In the distal portion of ASW 24 an intensive sawing to cut the bone has been documented. This cut indicated that probably the total length of the artefacts is around 40 mm (Fig. 8.41; Fig. 8.42).

ASW. 22, ASW. 23 and ASW. 24 are burned for short time to increase their hardness. Possible using abrading techniques to smooth the surfaces of ASW.21- ASW. 23.

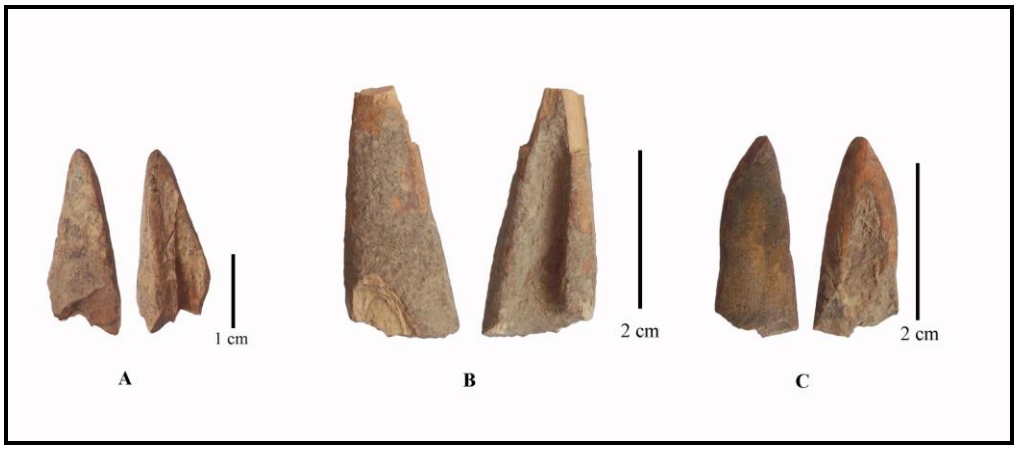

Fig. 8.40: ventral and dorsal views fragments of the points in long shafts. A: ASW. 23. B: ASW. 20. C: ASW. 22.

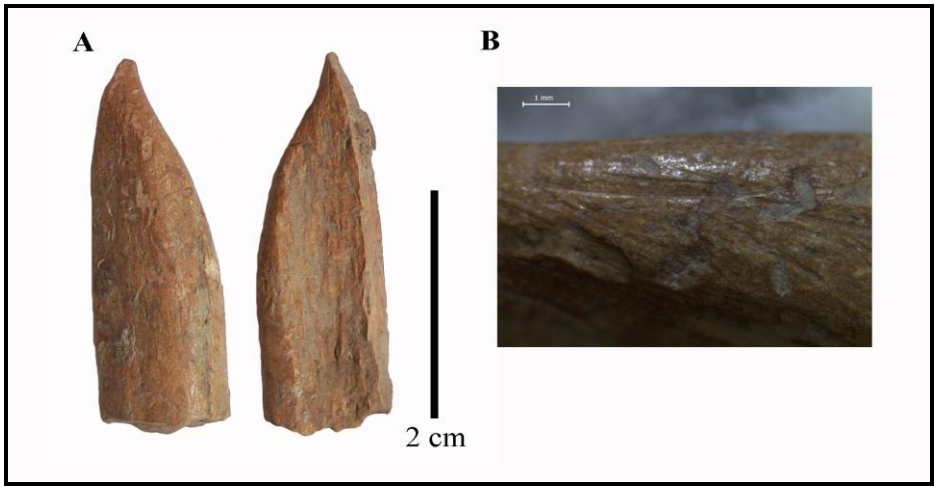

Fig. 8.41: ASW. 21; points in long shafts.; A: ventral and dorsal views. B: scraping traces on the lateral side.

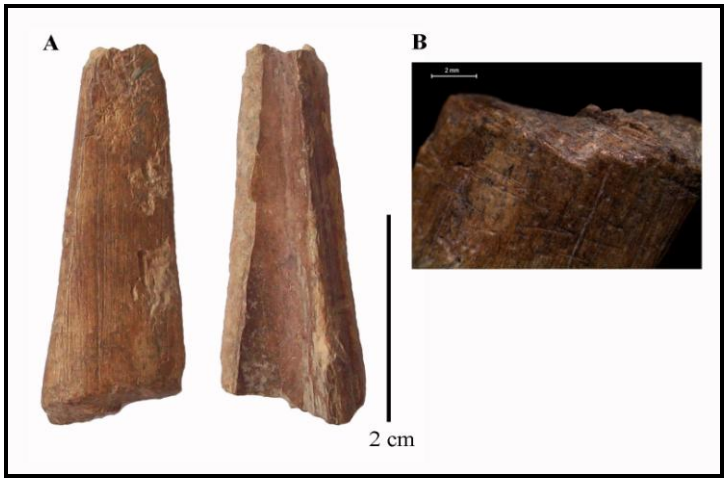

Fig. 8.42: ASW. 24; points in long shafts; A: ventral and dorsal views.B: perpendicular sawing on the distal portion.

A.5. Projectile arrow head points

ASW.1, ASW.2 and ASW.3 represent arrow heads which were found during the archaeozoological analysis of the faunal assemblage. ASW 50, which could be used as handle to carry the arrow head point, has been included in this typology of tool (Fig. 8.43; Fig. 8.44; Fig. 8.45; Fig. 8.46) (Garfinkel, Horwitz 1988).

ASW.1 and ASW. 2 are similar in characteristics. Both artefacts were burnt and they have long oval shaft while ASW. 3 has flat triangle form. It has been documented that both artefacts were smoothed by retouched lithic artefacts and the proximal portion is broken by use and it has been sharped again to reuse it.

ASW. 1 noted a sawing with the distal shaft of the artefact and with same area documented remain of burned organic residue could be used as glue to attached with the arrow shaft.

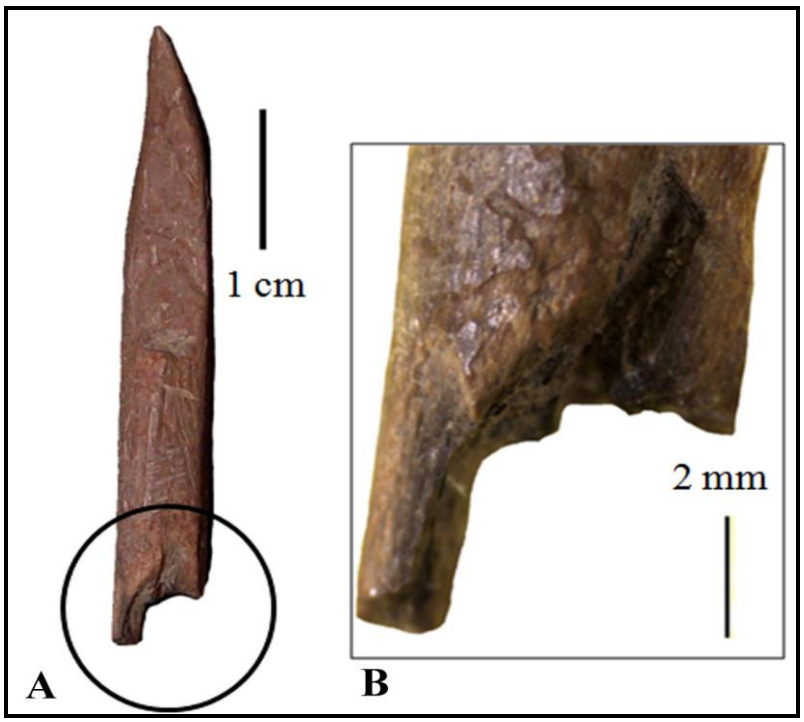

Fig. 8.43: A: ASW. 1; A. arrow head. B: Sawing in the distal portion to connect to the arrow shaft.

Fig. 8.44: ASW. 2: arrow head.

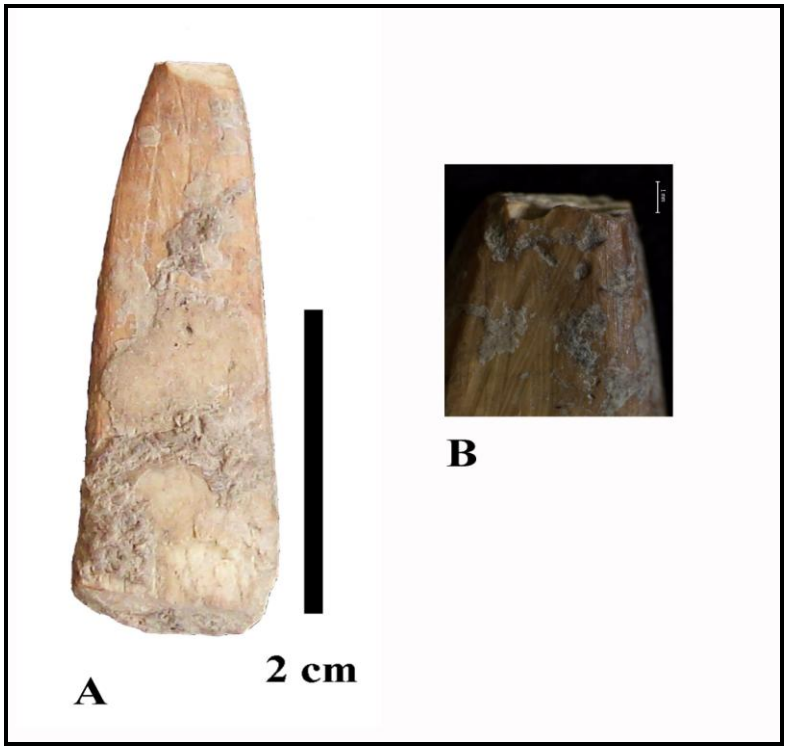

Fig. 8.45: ASW. 3; A: arrow head. B: proximal portion view the scraping traces on the surface, Stereomicroscope image.

Also ASW. 3 and ASW. 50 have been smoothed by using retouched lithic tool. In ASW. 3 distal portion have been documented intensive sawing to cut the bone. While in ASW. 50 was cut from the two sides.

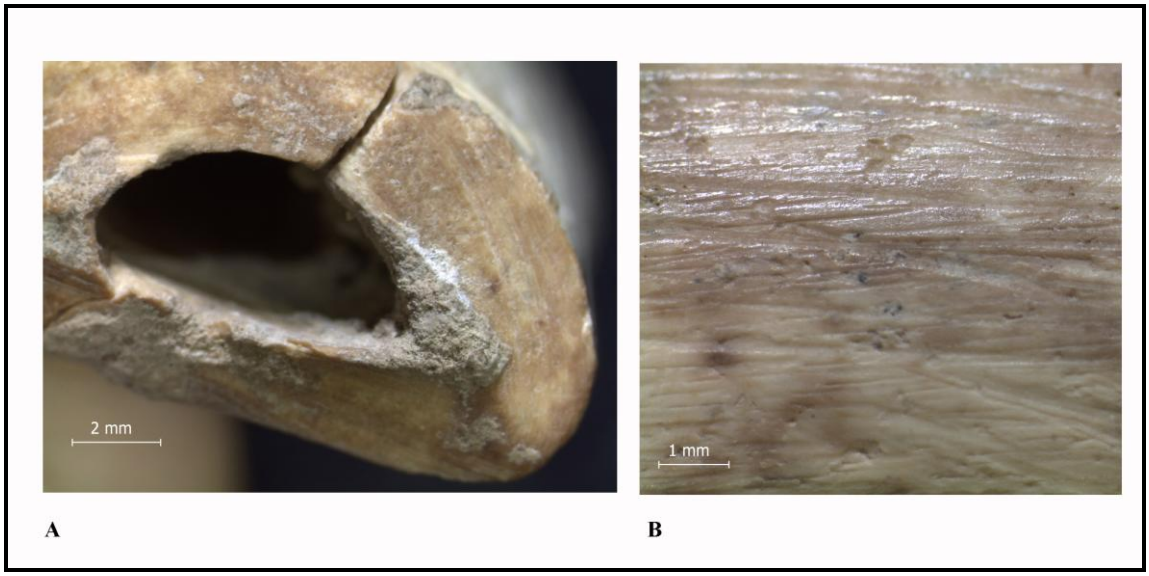

Fig. 8.46: ASW.50; handle to carry the arrow head point; A: distal view present the sawing movements to cut the bone. B: lateral view presents the scraping to smooth the surface.

A.6. Retouched bones

This typology includes three artefacts made on long bone shaft (ASW. 51, ASW. 52 and ASW. 35) and two made on ovicaprines horns (ASW. 31 and ASW. 32) (Garfinkel, Horwitz 1988; Le Dosseur 2008; Newcomer 1974).

ASW. 51 and ASW. 53 are similar in shape and size while ASW. 52 has a triangular shaft bone similar to knife with wide edge/border/margin around 5.1 mm to 10 mm. On the surfaces of the retouched osseous artefacts on bone shaft a variety of cut marks, within the proximal portion that could be related to use, were documented (Fig. 8.48).

ASW. 31 and ASW. 32 are made on a middle-distal part of the horn point. It has been documented an inclined cutting on the proximal and distal portions on the surface of ASW. 31 while ASW. 32 only on the proximal portion and the distal part is bad preserved (Fig. 8.47).

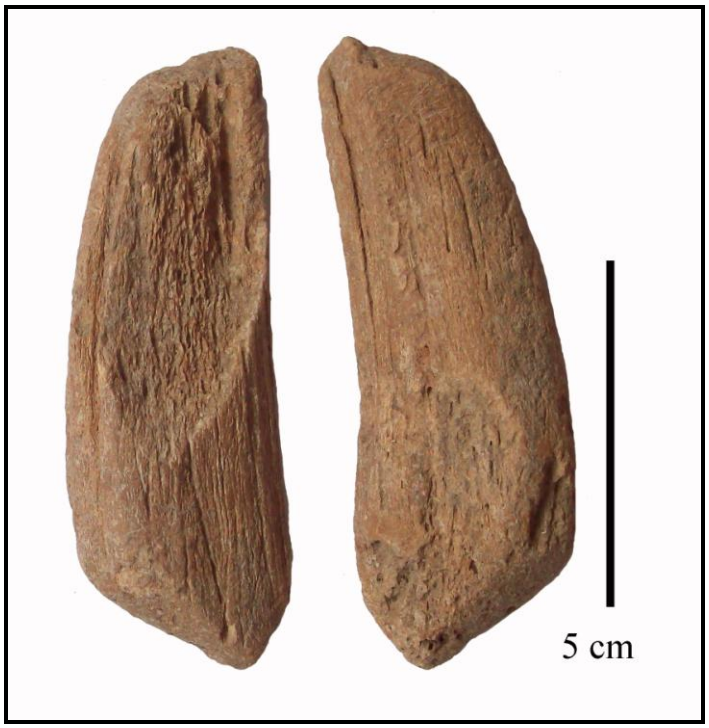

Fig. 8.47: ASW. 31; retouched horn of goat.

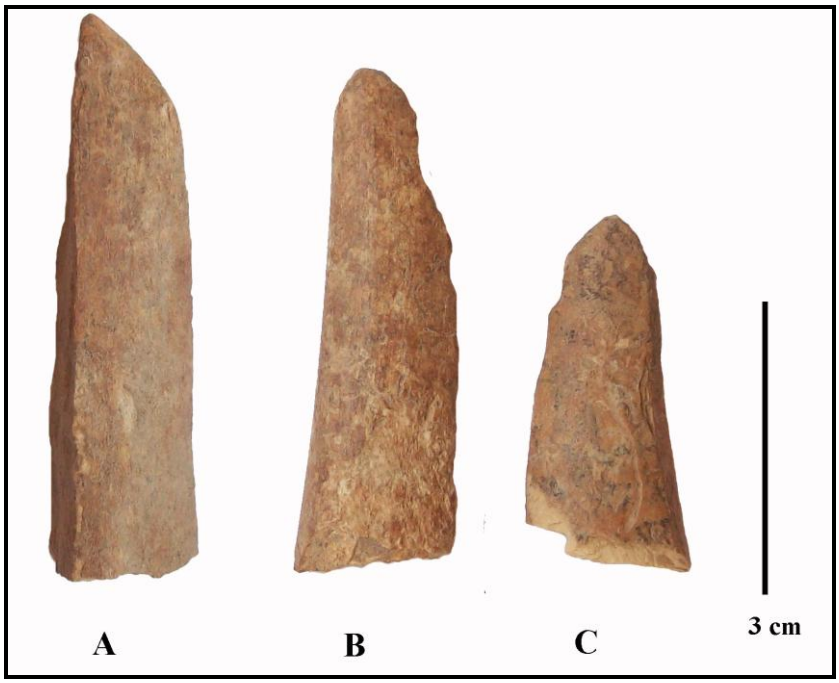

Fig. 8.48: retouched bones fragments; A: ASW. 52. B: ASW. 53. C: ASW.51.

B. Spatula

This category presents a variety of spatulas different in shape and size, that has been classified in two main typologies depending on the size and shapes of the artefacts (Clutton-Brock 1979; Garfinkel, Horwitz 1988).

B. 1. Medium size spatulas

This typology is presented by four spatulas which made of ribs from medium size animals species like ovicaprines. (ASW. 12, ASW. 13, ASW. 14, ASW. 18)

Fig. 8.49: ASW. 12; medium size spatulas. ventral and dorsal views.

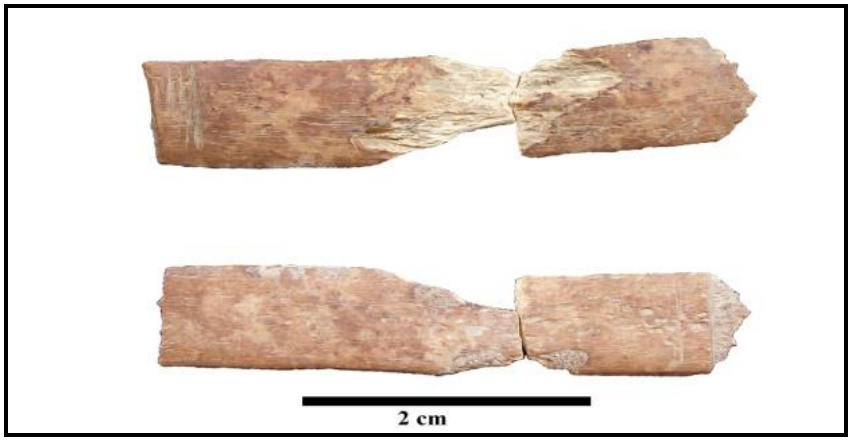

Fig. 8.50: ASW. 14; medium size spatulas. ventral and dorsal views.

ASW. 12, ASW. 14, ASW. 18; these artefacts have flat shaft and only ASW. 12 have preserved half of the proximal portions. On the surfaces of these artefacts several longitudinal scraping documents that these artefacts were smoothed by a retouched lithic artefacts. While in the distal portion there is a perpendicular sawing to cut the artefacts. The proximal portion has been smoothed by using abrading technique (Fig. 8.49; Fig. 8.50; Fig. 8.51).

Fig. 8.51: ASW. 18; medium size spatulas. ventral and dorsal views.

ASW. 13 has been included in this typology but it is a teethed spatula. ASW. 13 presents a proximal portion of spatula with a teethed shape on one side. The proximal portion has been smoothed by abrading technique while the dorsal and ventral surfaces were smoothed by retouched lithic artefacts. It has to be underlined that the teethed form where prepared by using a triangular cutting between each point (Fig. 8.52).

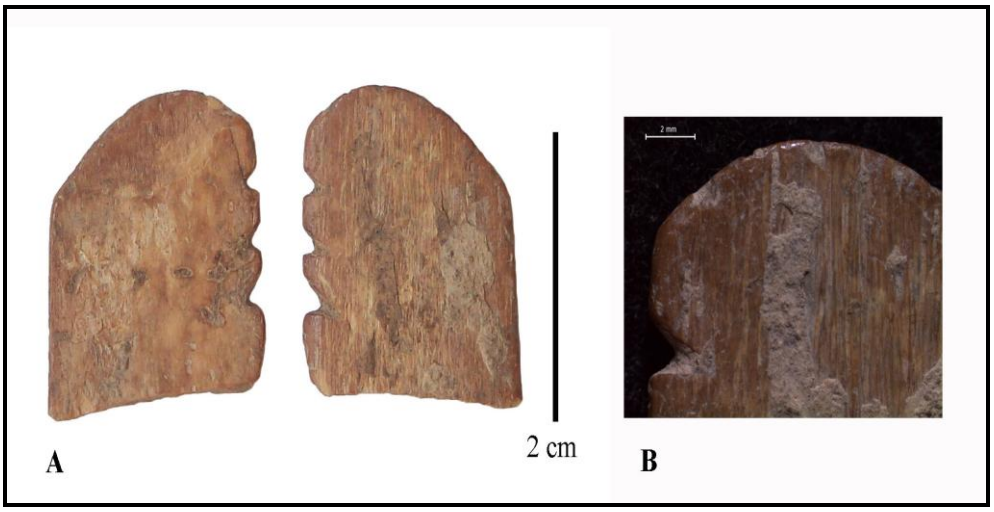

Fig. 8.52: ASW.13; teethed spatula; A: ventral and dorsal views. B: Proximal portion, Stereomicroscope image.

B. 2. Wide spatulas

This category is presented by four spatula made by using ribs of big size animal species like auroch. (ASW. 15, ASW. 16, ASW. 17, ASW. 19).

ASW. 19 is a long spatula but unfortunately was bad preserved because of natural conditions. Both dorsal and ventral surfaces were smoothed by using a retouched lithic artefacts while the proximal portion was smoothed by abrading technique. There are several traces along the lateral side which could indicate its utilization to smooth rough surfaces like pottery (Fig. 8.53).

Fig. 8.53: ASW. 19; wide spatulas.

ASW. 16 is a proximal portion of wide spatula. All surfaces are covered by several traces related to the using to work with rough surfaces whit a perpendicular movement. These traces could be happened because of the movement on rough surface (Fig. 8.54).

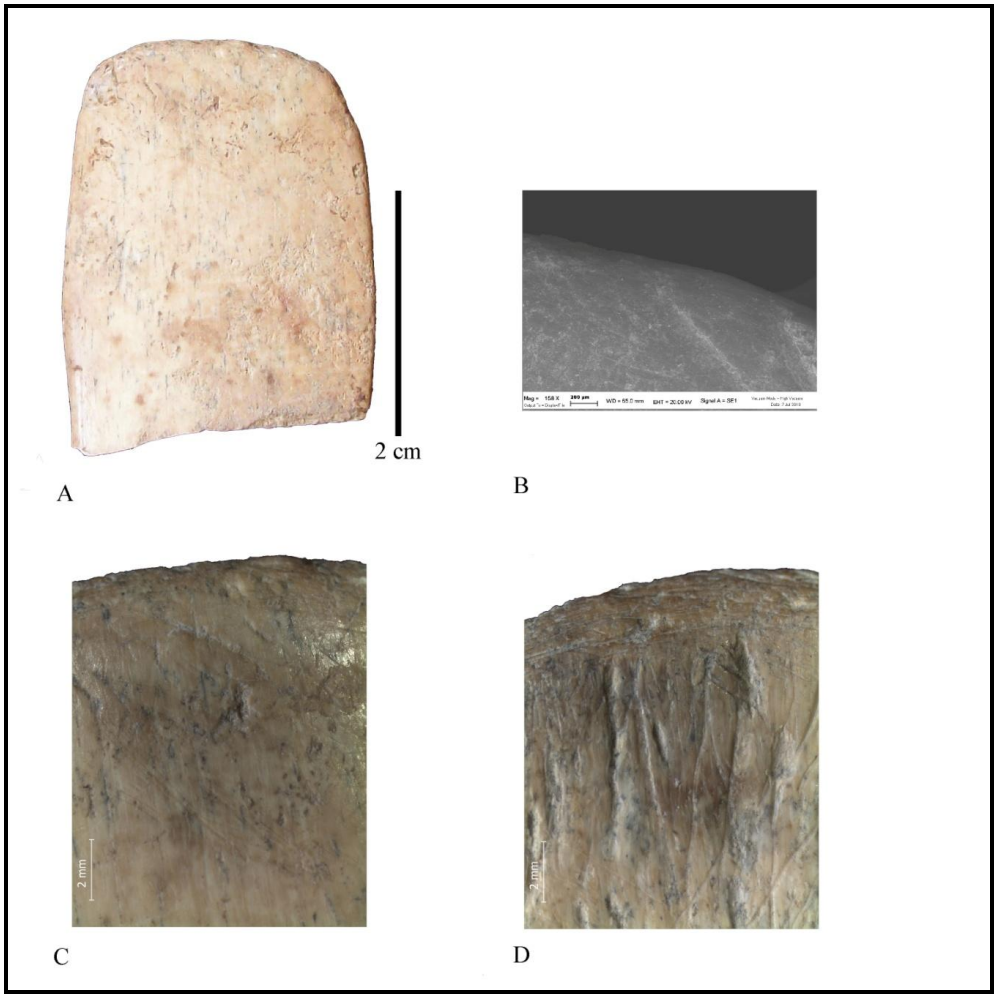

Fig. 8.54: ASW. 16; wide spatulas.
A: Proximal portion of a wide spatula. Ventral view.
B. Use wear traces on the proximal end (SEM Image).
C: Manufacturing marks on the ventral side. (Stereomicroscope image).
D: Manufacturing marks on the lateral side. (Stereomicroscope image).

ASW. 15 and ASW. 17 are fragments of middle-distal portion of spatulas. It's documented on ASW. 17 distal portion which has been transversally cut and then smoothed by abrading technique.

Finally this typology of wide spatula were documented that they were prepared from ventral portion of the ribs.

C. Ornaments

This category contain different ornaments decoration which has been classified in four typologies depending of their raw material and shape (Garfinkel , Horwitz 1988).

C.1 Decorative handle

This artefact present unique form of decorative artefacts in Tell AbuSuwwan and surrounded Neolithic sites. ASW.54 is an incised radius of ovicaprines. The preserved part contains a particular perpendicular parallel sawing long the bone. Inside the grooves a traces of scraping by lithic artefacts has been documented. No preparation traces were found on the outer surface (Fig. 8.55).

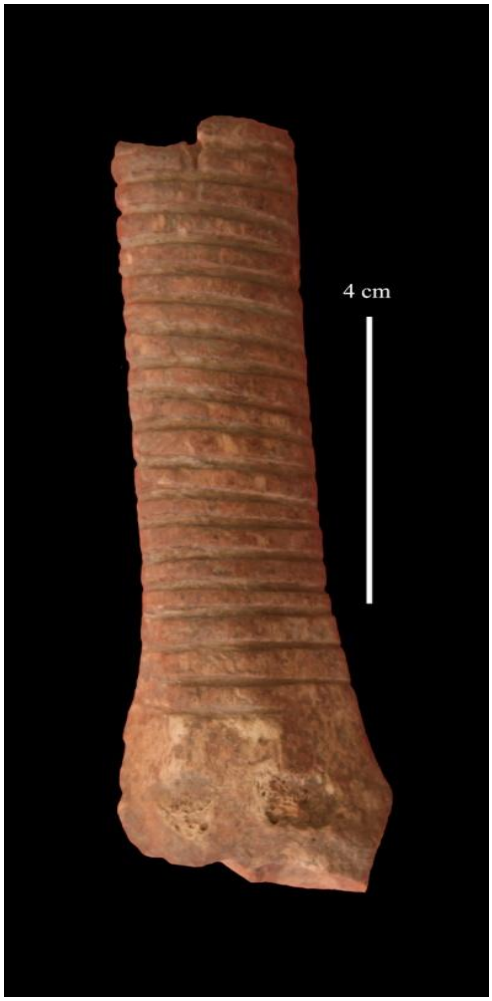

Fig. 8.55: ASW. 54; decorative handle

C.2 Incised spatula

ASW. 27 is a proximal portion of decorated spatula. It contain a parallel transversal sawing on lateral side (Fig. 8.56).

Fig. 8.56: ASW. 27; incised spatula. ventral and lateral view.

C.3. Tubular bead

ASW. 26 is a necklaces bead good preserved and only one recoverd from Tell AbuSuwwan site. The dimension and shape of bone could be related to medial portion of metapodial bone were smoothed by using abrading technique (Fig. 8.57).

Fig. 8.57: ASW. 26; tubular bead.

C.4. Canine necklace

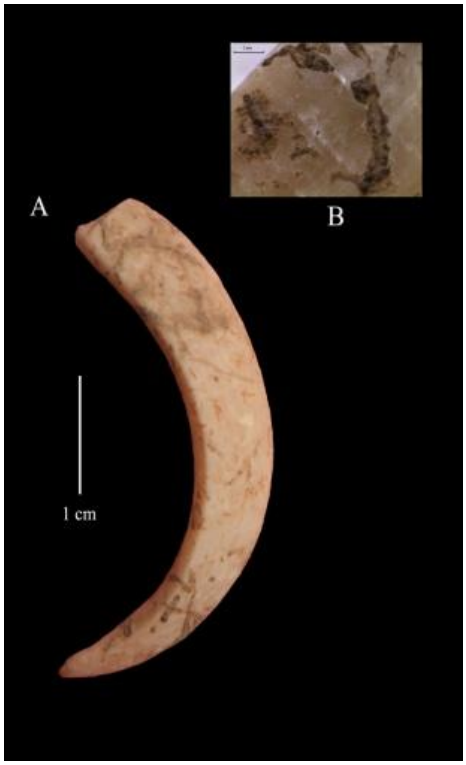

Fig. 5.58: ASW.29; A: canine necklace. B: proximal portion view traces related to cord which carry the canine.

This typology were presented by one full preserved wild boar canine (ASW. 29) and two partial part of wild boar canine necklaces (ASW. 28 and ASW. 30). (Fig. 8.58)

ASW.29 is prepared first by taking of the root of the teeth and the dentine after that the crown of the canine has been smoothed. On the distal portion has been documented a traces related to the cord that carried the canine. ASW 30 is a small portion of the decorated canine similar to ASW. 29.

ASW. 28 presents the enamel and dentine portion of wild boar canine. It was smoothed from the dentine part by using retouched lithic artefact.

D. Varies

In this category 18 osseous assemblages, which present a variety of raw osseous tools found during the archaeozoological analysis, were classified. They give an important evidence of the species and skeletal portion which were used to produce the bones tools.

Also the analysis and documentation of all the modification of their surfaces give evidences of the possible techniques used to prepare the bones artefacts. These results were used to support the scientific experimental work which will be further presented (Fig. 8.59; Fig. 8.60).

These bone raw materials were coming from different species like wild goat and wild boar and ovicaprines. And also they belong to different skeletal portions like tibia and metapodial bones.

Different cutting movements were documented on the surfaces of these bones objects. Particularly they use a perpendicular sawing and different irregular fractures. This could be related to the disarticulation to take off the distal or the proximal portions of the bone. There is a longitudinal sawing on the surfaces of the origin bone which could be used to have two symmetrical portions.

The analysis and result of this category will be presented and discussed with the scientific experimential work.

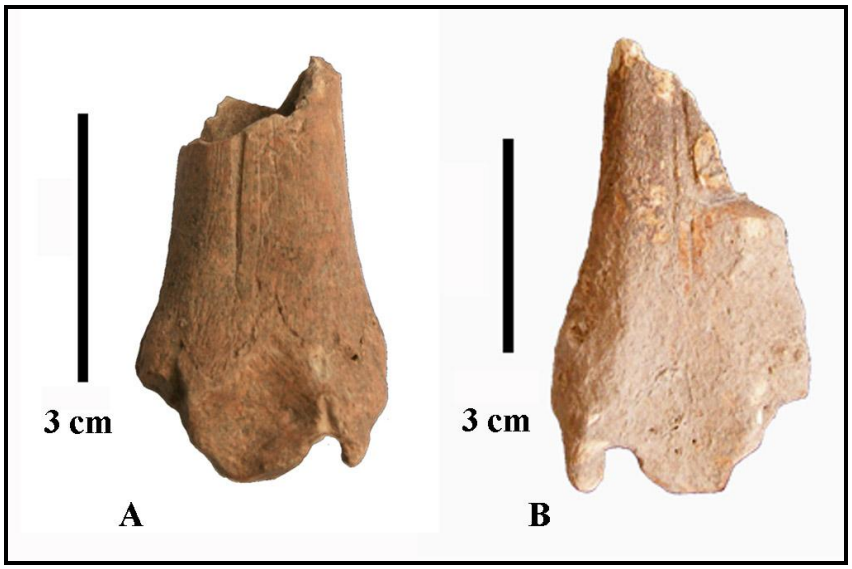

Fig. 8.59: A: ASW. 44; tibia of ovicaprines with a longitudinal sawing. B: ASW. 45; tibia of ovicaprines with longitudinal and perpendicular sawing.

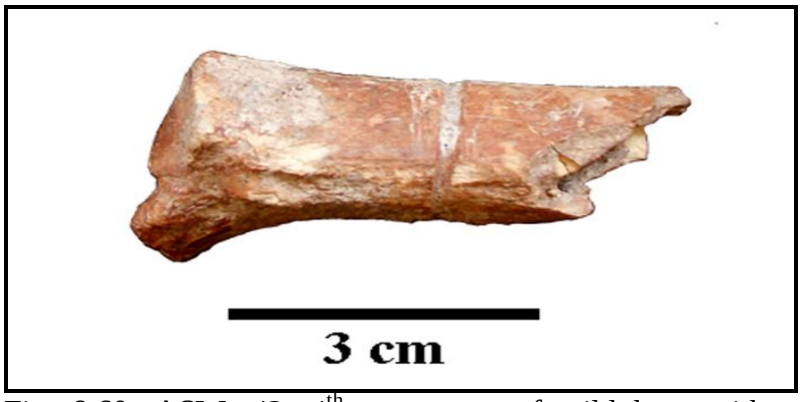

Fig. 8.60: ASW. 42; 4th metatarsus of wild boar with a perpendicular sawing on the surface.

ID	sq.	locus	tax	skeletal anatomy	perpendicular Sawing	longitudinal Cutting	period
37	H6/I6	02	wild goat	tibia R	Yes	No	PN
39	K6	23	wild goat	metatarsus	No	Yes	MPPNB
60	G8	19	wild goat	humerus	No	Yes	MPPNB
47	I7	06	gazelle	metatarsus L	Yes	No	LPPNB-PPNC
38	E7	02	wild boar	metatarsus	Yes	No	PN
42	I4/5	10	wild boar	metatarsal 4 SX	Yes	No	LPPNB
48	G7	10	wild boar	metacarpus 3 R	Yes	No	LPPNB-PPNC
61	G8	19	ovicaprens	tibia L	No	Yes	MPPNB
43	H6	13	ovicaprens	metacarpus	Yes	No	LPPNB
44	J5	02	ovicaprens	tibia R	No	Yes	PN
45	I6	21	ovicaprens	tibia L	Yes	Yes	MPPNB
46	I6	28	ovicaprens	metatarsus L	Yes	No	LPPNB
58	G8	19	ovicaprens	tibia R	No	Yes	MPPNB
56	F7/G7	07	ovicaprins	metacarpus	Yes	No	MPPNB
33	F6	4	sheep	horn	Yes	No	LPPNB-PPNC
40	H7	04	medium size animal	metapodial	Yes	Yes	LPPNB-PPNC
41	J6	13	medium size animal	indetermenated	Yes	No	LPPNB
64	I7	17	large size animal	ribs	Yes	No	MPPNB

Table. 8.16: Tell AbuSuwwan; raw osseous object (sq. square. R: right side, L: left side).

8.3.3. Experimental production of osseous artefacts

Animal hard tissues artefacts from Tell AbuSuwwan presented different tools categories. During the analysis of the artefacts surfaces, different characteristics have been documented as cut marks, scraping and sawing traces. How to distinguish these modifications if they are related to production processes or modified duringg the utilization

of these artefacts?. The need to answer other particular questions about the kind of support used to make these tools and the techniques applied to produce them. If there were particular characteristics of the bone artefacts production techniques during the different period of occupation of Tell AbuSuwwan site.

All of that rise the need to organized a scientific experimental work to produce different the pointed osseous artefacts and wide spatula similar to the animal hard tissues tools from Tell AbuSuwwan. This work was carried out in cooperation with two of my collegues Emanuele Cancellieri and Gabriele L. F. Berruti; students of the University of Ferrara were involved too.

8.3.3.1. Approach and hypotheses for the experimental

The main characteristics of the animal hard tissues used as raw materials for tools production by prehistoric producers has to be taken in consideration (Newcomer 1984). The presence of animals in surrounded environment and also the shape and size of animal bones are the main condition of human selection to choose the raw material and typology and techniques for bone tools fabrication (Choyke and Schibler 2007).

Another bibliographical comparison in the technology of preparation of bones tools were taken in consideration during our case study analysis. Camps-Fabrer H. (1990) studied the manufacturing technologies of the bones tools coming from Chalcolithic and Bronze Age sites in Spain and France, he shows prospective techniques and processes of bone tools manufacturing from metapodials (Camps-Fabrer 1990).

It’s very important to take in consideration the possibilities of the presence of common techniques and shape of bone tools manufacturing in different sites and distinct periods. It is still clear that each culture could have its particular way of producing these artefacts and that the same artefact could be used for different purposes.

Garfinkel Y. and Horwitz L.K. (1988) have been studying the PPNB bone industry from Yiftahel site in Israel, they suggest a typological scheme for the bone tools from Yiftahel site. They use the shape and size to classify the categories but no analyses about the technology of preparation, fabrication and use of these tools were presented. Other published categories from Jericho which indicates the osseous tools in relations to animal’s bones provenience (Clutton-Brock 1979).

Few publication studies were found about the animal hard tissues tools in Jordan and surrounded countries in the Near east. Due to that new specialized studies are required to reconstruct the bone tools typologies and technologies of fabrications coming from Tell AbuSuwwan.

8.3.3.2. Experimental procedure

1. We set a scientific framework scheme to register all the data during the experimental work. The form contains names of object and typology of use and also time estimation for each step has done. We put in relation a scheme for the osseous tools production in relation to lithic tools used and also for the use abrading stone (Fig. 8.61).

	Sperimentazione su manufatti in osso e litici scheggiati per il sito Tell AbuSuwwan-Giordania			
Nome	Number	place	Date	time
Tipology: (Bone/Lithic)		Description		
Strument usated 1. …….. 2. …….. 3. ……..		Intervention:		
Initial time	Final time	Length:	width:	thickness:
Photos				
Disegn:				
Note				

Fig. 8.61: scientific form used during the Experimental.

2. Selected bone artefacts to be produced and lithic tools needed during the fabrication works were established. As we mentioned before, we put a specific categories for the osseous tools found. In our case we try to cover the most represented tools recovered in the site in this experimental work which are the pointed osseous tools and spatulas.

3. Our primary source of bones came from one sheep carcass and cattle ribs. We have been using different elements of the sheep carcass which are the metapodials, the ulna and the

femur to produce different pointed tools categories. Then we have been using cattle ribs to produce a wide size spatula.

4. Scientific analyses by using Stereomicroscope and Scanning Electron Microscope (SEM) to analyse the marks left on the bone tools and stone tools surfaces related to the manufacturing and utilization processes.

5. The functional study of lithic tools was conducted by integrating the approach to low power (Low Power Approach), with the high-magnification (High Power Approach) (Beyries 1987; Christensen 1996; Keeley 1980; Plisson 1985; Semenov 1954).

Microscopic examination at low magnification were carried out with the aid of a stereomicroscope Seben Incognita 3 (10-80x) and a digital microscope Dinolight AM413T (5-230x), while the study was carried out at high magnification with a microscope metallographic AmScope ME300T-M (40-640x) with a camera AmScope MD600.

8.3.3.3. Experimental bone tools and lithic tools products

We would like to present the osseous tools final products of the experimental in relation to stone tools used to confirm our hypothesis of the osseous tools techniques of preparations and fabrication which could be used in Tell AbuSuwwan site.

A. Lithic tools

This work has been done by Emanuele Cancellieri as part of the experimental procedures.

A limited pre-defined set of lithic tools were manufactured and used during the experimental activity. They have been selected on the basis of the main represented ones within the Tell AbuSuwwan assemblage and neighboring coeval sites (AlNahar 2010; Rollefson 1992; Simmons 2001) among those typological classes considered as the best candidates to have been used on bone: end-scrapers, side-scrapers, burins, retouched blades, denticulated blades, truncations and borers. Unretouched blades and flakes have been used as well. It has not been possible to collect the lithic raw material in Jordan to manufacture the experimental tools. While being aware of the bias introduced by performing experimentations using a raw material of different provenance, it has nevertheless tried to limit it, for at least the sake of the functional analyses results, by adopting a series of sampling procedures. The choice of a cretaceous, very fine grained, homogeneous, red flint, wholly collected in proximity of a single outcrop in central Italy,

allowed to keep as a constant, to a certain extent, the variability and the homogeneity of the rock texture.

As regards the means of realization of the blade blanks, whose analysis and reconstruction are far beyond the target of the present work, the guiding principle has been that to achieve the as most as possible regular ones, both in shape and edges morphology. Blade blanks have been generally extracted from cores with one or two opposed striking platforms, by means of direct soft organic hammer percussion. Retouch has been performed by stone direct percussion and bone/antler pressure.

B. Animal hard tissue tools products:

All details were taken in consideration like artefacts used for butchering and artefacts used for preparation of the osseous tools and to finish the proximal points. This will help to understand type of traces that were left on the object surfaces at each step.

Our experimental bone products were one needle and wide size spatula and 7 different points and awl from different skeletal proportion similar to which found in Tell AbuSuwwan bone tools.

Bone tools categories	Typology	Animal hard tissue raw materials	Stone implement: retouched (1) unretouched (2)	Abrading
Pointed bone tools	Awls (1)	Sheep-ulna (left)	1+2	yes
	Perforation points (2)	Meta tarsal	2	yes
	Needles (1)	Meta tarsal	2	
	Projectiles (2)	Meta tarsal	2	yes
	Points of long bone shafts (1)	Sheep-femur (right)	2	No
Spatula	wide spatula(1)	Caw costola Wide size	1+2	yes
Ornament	Decorated handle	Radius	1	No

Table. 8.17: typological scheme of experimental osseous artefacts.

In table (8.17) the main characteristics of the bone tools produced in relation to the artefacts that were used, have been summarized. We noted also the possible presence of other traces on the surfaces produced during the butchering processes of the carcasses.

Stereomicroscope analysis were applied to observe all modifications on the surfaces during the works, then SEM analysis were also carried out to compare the experimental bone tools and the archaeological ones from Tell AbuSuwwan (Fig. 8.62; Fig. 8.63; Fig. 8.64).

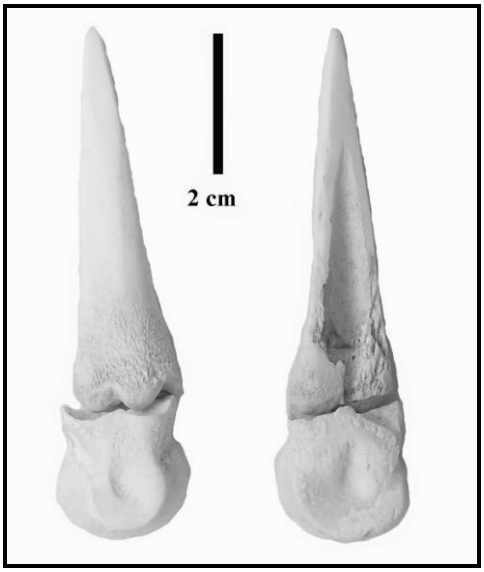

Fig. 8.62: Exp.1.1; perforation point. ventral and lateral view.

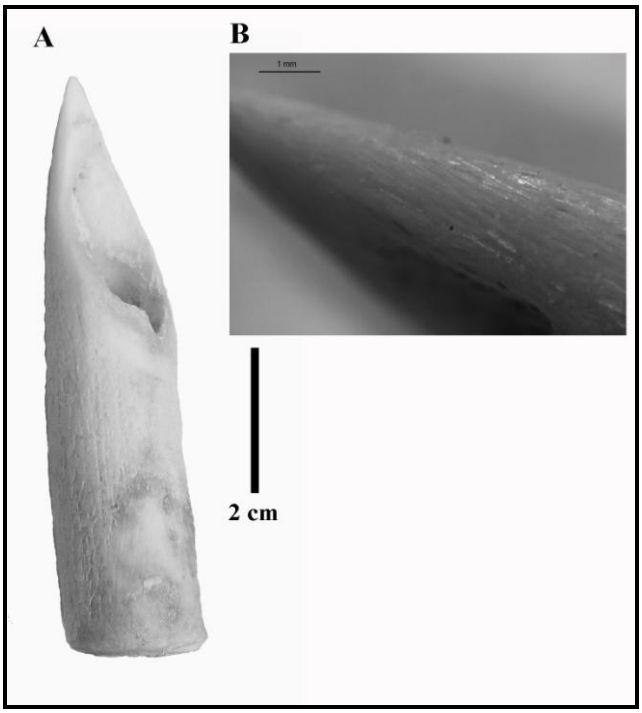

Fig. 8.63: Exp.3.1; points of long bone shafts. A: lateral view. B: trace of retouched lithic artefacts on the frontal surface, proximal portion. Stereomicroscoe image.

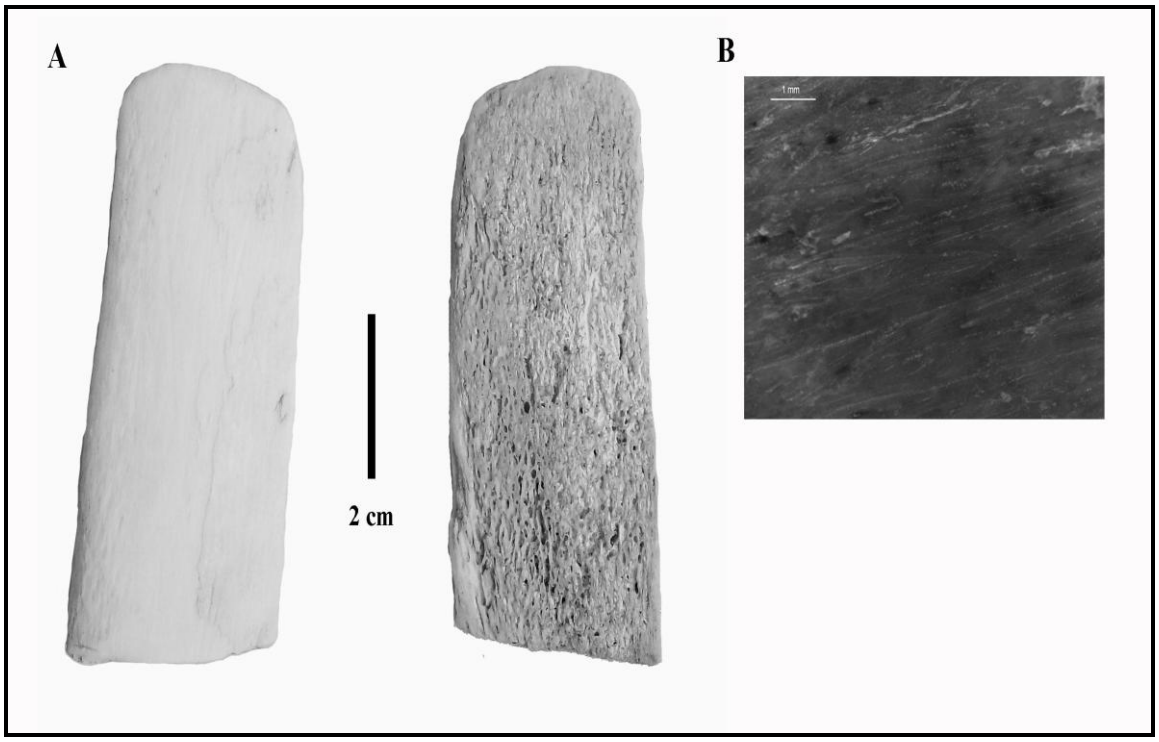

Fig. 8.64: Exp. 15.1. wide spatulas; A: ventral and lateral view. B: traces of retouched artefacts on the ventral surface. Stereomicroscope image.

8.3.3.4. Microscopic analysis of lithic tools

This work has been carried out by Gabriele Berruti as part of the experimental procedures.

The margins of the experimental lithic tools were analyzed at each stage of the operational chain. In this way the degree of wear of fully equipped tools and their effectiveness in carrying out the operations could have been assessed.

Finally, we compared the use wear traces on the margins of the experimentally lithic tools and Tell AbuSuwwan archaeological lithics tool (Beyries 2008; Korobov 2008; Semenov 1954).

In this way we verified experimentally the types of tools that had proved to be more 'effective (retouched blades and sickle blades) within the archaeological collection and produced the same type of traces (Fig. 8.65)

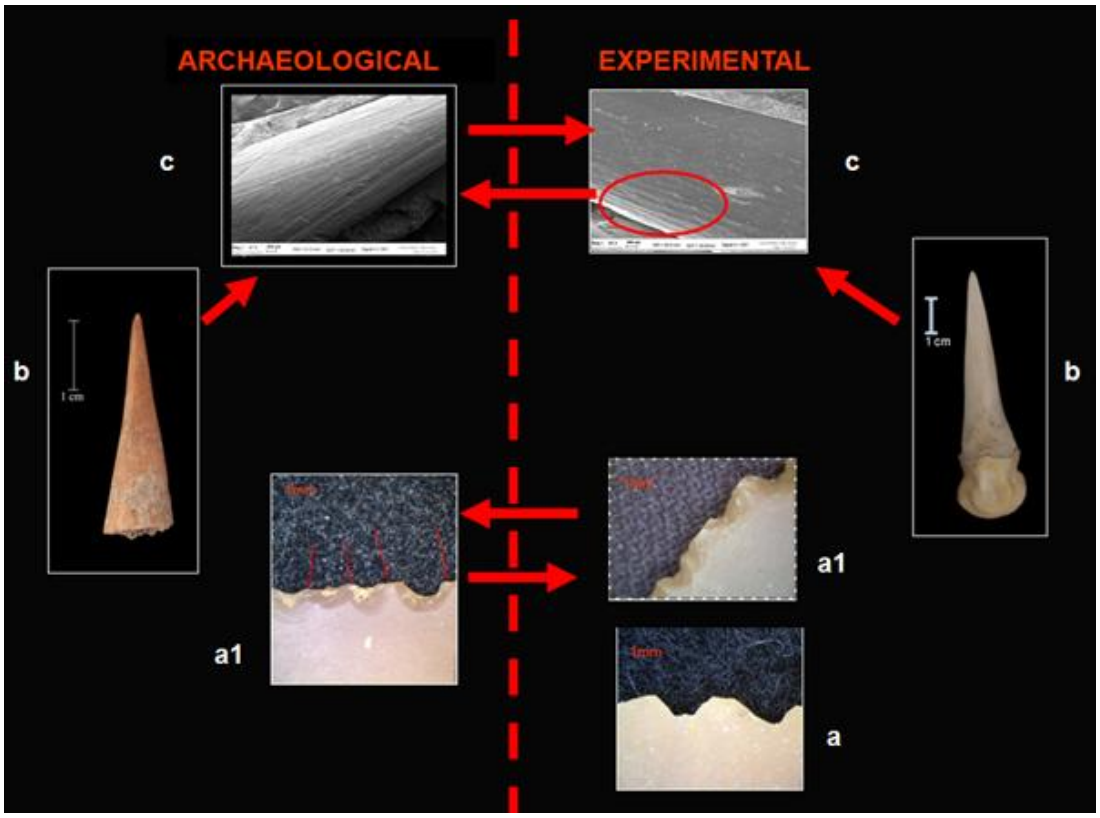

Fig. 8.65: results of the comparative analyses between Tell AbuSuwwan and experimental work:
a: Sickle blade edge before use;
a1: Sickle blade edge showing traces related to bone manufacturing;
b: Bone awl. On the left proximal end of an awl (ASW.10).On the right experimental awl.
c: Processing-related traces left by the use of a sickle blade on the awl surface.

8.3.4. Animal hard tissues fabrication technology

After the laboratory study of the various raw materials and bone artefact, different stages of fabrications have been documented. These stages were confirmed by various modifications on the raw materials and by studying the traces on the animal hard tissues artefacts surfaces.

We proposed two main technological classes of osseous industry:

1. Implements which can be prepared by bone intentional breakage fragments. In this category the suitable fractures of a bone fragment can be modified to prepare needles by abrading or using retouched stone tools. This technique was documented in the needles category from Tell AbuSuwwan like ASW. 7 and ASW. 5.
2. Implements which are planned according to osseous implement manufacturing. In this category the initial phases of the *chaîne opératoire* have been followed for the preparation

of all the osseous tools, while different techniques were utilized to finish the implement. In fact either abrading traces or retouched blade scraping were applied to sharp the pointed tools.

2.1 The first phase is to prepare the bone surface, initially by smoothing the raw materials surface with different lithic tools. This phase could be done before or after the cutting of the bone epiphysial ends in order to prepare the shaft for the further processing. The preparation phase is composed by a longitudinal intensive scraping on the raw osseous surfaces. Then the bone distal portion is separated commonly by cutting in order to produce pointed implements for perforation.

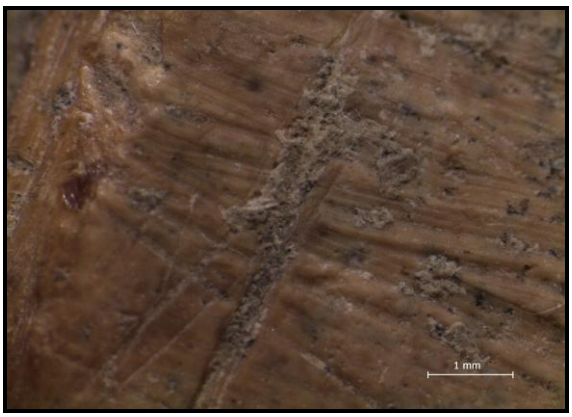

Fig. 8.66. ASW. 41: fragment of raw osseous assemblage, view of scraping by retouched lithic artefact and perpendicular sawing on the surface of the bone.

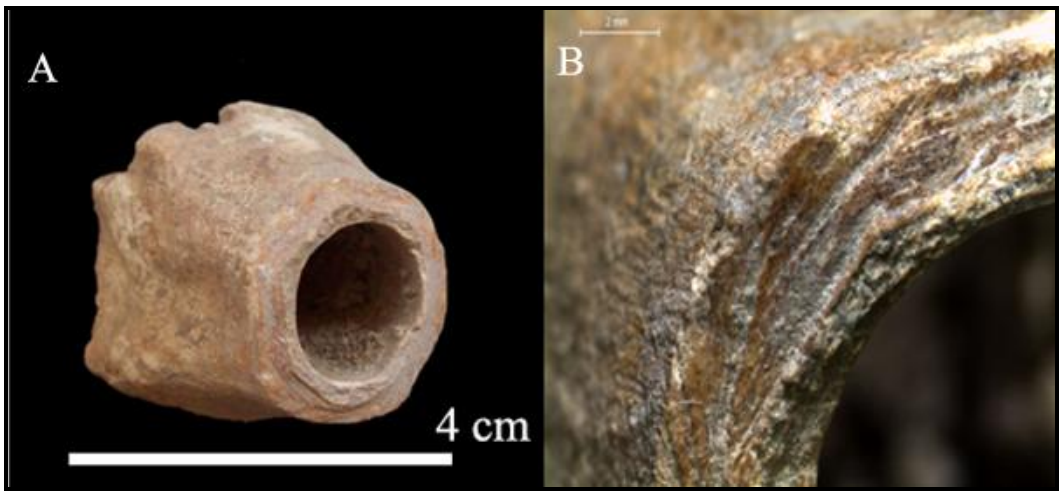

Fig. 8.67. ASW. 37; A: distal fragment of a goat. tibia with sawing marks. B: detail of the sawing that splits the bone. (Stereomicroscope image).

2.2 Second preparation category is to cut the epiphisial portions before the fabrication of the bone artefacts. Several raw materials were found that have been cut transversally to take off the epiphyseal portions. This step of preparation show perpendicular intensive sawing on the surface on the raw osseous surfaces. (Fig. 8.61)

2.3 Another preparation category is characterized by one or more longitudinal sawing. In this way the best exploitation of the raw material was obtained; therefore more than one implement could be produced from the same bone fragment. A spiral cutting on the raw materials shaft has been observed, which could be used to prepare the proximal portion of awls point.

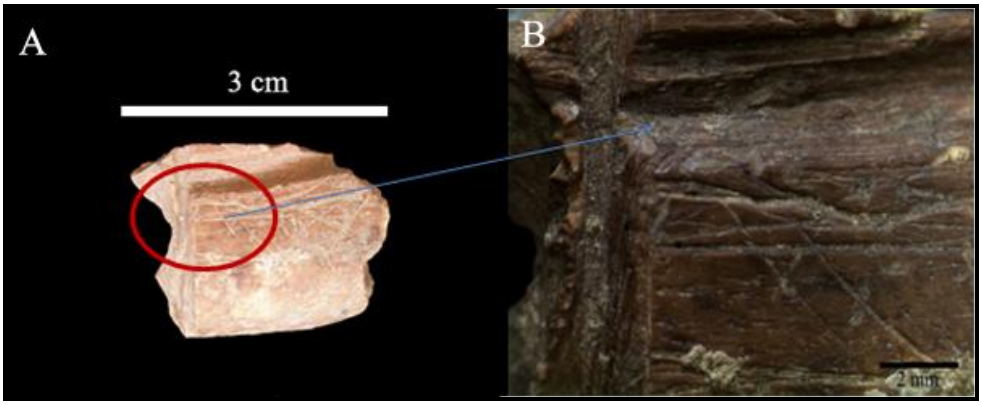

Fig. 8.68. ASW 40; A: raw material fragment on a metapodial. B: longitudinal and transversal sawing marks that cut the bone.

2.4 The last technique is similar to the third one, adding an inclined longitudinal cutting (spiral cutting), that could be used to prepare a long awl point.

Movement of cutting the raw materials is similar; we noted in the cases that the longitudinal cutting is done before the perpendicular cutting. The epiphyseal portions were used as handle to help cutting the longitudinal cutting, this have been also noted during the experimental works which we have done. We note that keeping the epiphyseal portion get more stable the shaft for the sawing movements. After that the longitudinal cutting done by intensive sawing done at least by three cutting angles direction (Fig. 8.67).

Fig. 8.69. ASW. 44: longitudinal sawing on the frontal and lateral surfaces.

The disarticulation of the epiphyseal portions could be done with two methods: the first one, applying a perpendicular hafting with a hammer stone (testified by the presence of irregular fractures on the surfaces); the second one producing a longitudinal fracture by using indirect percussion with a sharp blade.

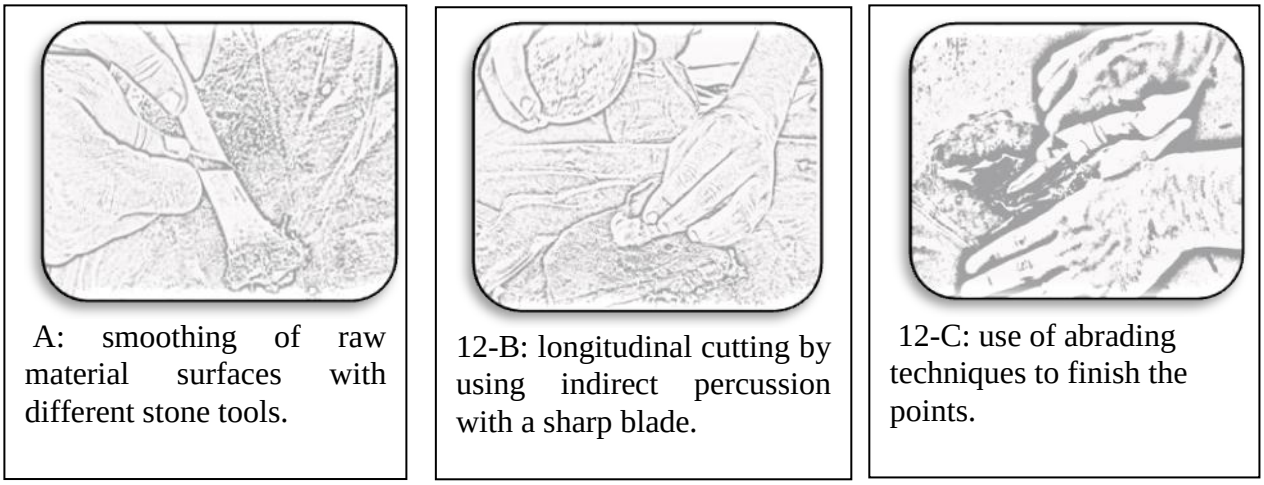

Fig. 8.70: reconstruction designs of osseous artefact fabrication processes.
A: smoothing of raw material surfaces with different stone tools.
B: longitudinal cutting by using indirect percussion with a sharp blade.
C: use of abrading techniques to finish the points.

Analyses of the scraping traces on the internal perpendicular sawing ASW. 55 and by the experimental work revealed that the ASW. 55 tool was prepared by using a lithic artefact. These decorations were done by inclined long sawing on the surface to carve the bone surface. This movement caused to smooth the external portion of the sawing to be looked like it has been smoothed later on. Instead the lateral surfaces of the bone were smoothed by lithic artefacts.

The chronology of the bones tools, as presented in Fig. 8.71, show that pointed bones artefacts were highly found during the middle PPNB until pottery Neolithic while spatulas category were more used during the middle and late Pre-Pottery Neolithic periods.

Ornaments were mostly attested during the PPNA and the Late PPNB. This data will be taken in consideration with the archaeozoological results discussion.

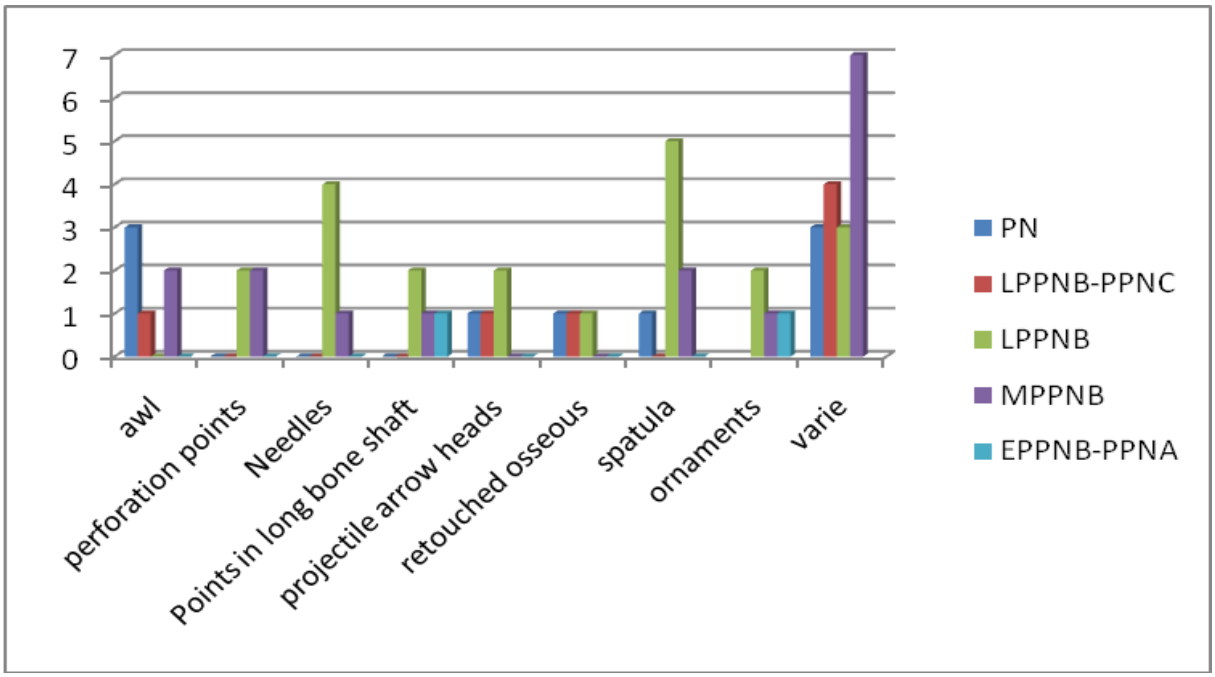

Fig. 8.71: osseous artefact category in relation to their chronology periods.

8.3.5. Conclusion

Through the archaeological evidences and the experimental approach, the use of lower limb bones like tibia and metapodial of wild boar, goat, sheep and gazelle has been noticed to be preferred for the manufacturing of pointed implements and medium and large size animals ribs for spatulas. In general the surface of the osseous tools was prepared with a retouched lithic tool, while abrading techniques were utilized to finish the points.

The chronology of the osseous artefacts during the different phases of Tell AbuSuwwan occupation shows different daily activities of people and there were continues traditional bones artefacts production.

The variety of the implements, recovered in Tell AbuSuwwan assemblages, seems to reflect the specific demand of tools necessary for the various activities. Further analyses will be carried out in order to investigate these preliminary results, in particular use wear analyses will be undertaken in the future.

Ch. 9. CONCLUSION

Tell AbuSuwwan occupation started during the Pre-pottery Neolithic A and continued until the Pottery Neolithic period. Archaeological evidences and radiocarbon datings support the continuous occupation of Tell AbuSuwwan site.

Archaeozoological results view a variety of Neolithic economy during the different Neolithic phases. Faunal assemblages coming from the PPNA/EPPNA are related to wild animals.

Site location near to water sources and mountain of Ajloon in the northern Jordan is an ideal location for hunters during that period. Wild boar and auroch were the most hunted species followed by gazella and wild goat. Wild animal hunted during this period testify a rich palaeo-environment surrounding the site.

All the faunal assemblage founded during this period are coming from the processing area which could represent the oldest occupied area with the site.

Animal hard tissues tools were found during this period. Nicklace canine and point in long bone shaft were found within the faunal assemblage.

Different anatomical proportions of identified species, unidentified remais, burned fragments were documented during this period. This confirms the possibility that butchering and cooking activities were done within the same area.

During the MPPNB Tell AbuSuwwan habitation increased. Complex structure with external courtyard was build during this period. High quantities of archaeological remains were documented within the MPPNB stratigraphies.

Archaeozoological results recover the first domesticated sheep/goat remains. Also hunted animals were still main source of meat. Sheep/goat represents 33.3% of identified faunal assemblage. The rest of the faunal assemblage is related to different wild animals.

Wild boar is the most hunted wild animal followed by auroch, gazelle and wild goat.

Three different carnivores were founded within the faunal assemblages. Medium size carnivores are presented by one jackal individual and *Canis* individual. While small carnivore are represented by two wild cat individuals.

Increase of people number in Tell AbuSuwwan cause also to increase food sources. This fact has been also confirmed by the increase of faunal remains during this period.

The presence of most the anatomical portions within the faunal assemblage view that hunters used to transport the whole carcass into the site. Butchering were done within the structures area and processing area. This fact has also been supported by the distribution of burned faunal assemblages and unidentified fauna within studied area.

Numerous bone tools were documented during this period. This could be due to the increase people requirement of artefacts for their activities.

During the Late PPNB and PPNC faunal assemblages were better preserved. Faunal assemblages were the highest during different Neolithic occupation of the site.

The most represented anatomical elements are related to domestic sheep/goat like mandibules, humerus and astragulus but the number of individual decreased.

Hunting wild animals increased during this period. Wild boar became the main source of meat between the hunted wild animals. It is followed by wild goat and gazelle. 4 individuals of auroch were documented within the faunal assemblage.

These results could be due to change of the economy strategies during LPPNB and PPNC.

People in Tell AbuSuwwan start to keep domestic sheep/goat for secondary products while wild animals were used as meat sources.

Animal hard tissues artefacts are highly represented during this period. Different categories were found within the faunal assemblages. This presence testify the increasing of daily different activities during this period.

The taphonomical results show an increasing of burning faunal assemblage within the structural area. But there are no high differences between burned faunal assemblages within the site areas.

Faunal assemblage mainly come from the structure and surrounded area. This indicated that the butchering activities were done within the structured area or close to the external spaces.

Increase of burning and faunal remains within the structure area could be related to different activities which were done there.

During the PN period faunal assemblages decreased. While the identified domestic sheep/goat increase.

Wild goat and auroch faunal remains decrease during this period and were replaced by wild boar and gazella.

Even if the number of the faunal assemblage decreased during this period and the economy strategies became more based on domestic sheep/ goat, people continued to hunt wild animals from surrounded environments.

Comparing the result of Tell AbuSuwwan with Jericho site and Ain Ghazal we can see different economic strategies used in Tell AbuSuwwan.

In Tell AbuSuwwan faunal assemblage it is evident that people continued to hunt wild animals during the different Neolithic periods even if they start to domesticate sheep/goat while archaeozoological results from other site view a dominant of domesticated sheep/goat at the Pottery Neolithic.

Tell AbuSuwwan view other particular differences of hunted wild animals. Wild boar was the main hunted wild species followed by wild goat and gazella. Instead of gazelle which were well known as hunted wild animal during the Neolithic period.

These facts view that Tell AbuSuwwan economy was based on regional sources for meat. Wild animals were hunted within small rage distances from site between 10 – 20 Km.

Animals presented also a secondary source to produce different daily artefacts and also decoration object.

Animals bone could also present a particular ritual object; location of isolated horn remains were founded during the MPPNB and latter periods, handle object, different decorated objects, these remains support of ritual activities within the site structure.

Finally archaeozoological analyses were done for the faunal assemblages coming from first seasons of excavation. Tell AbuSuwwan need new excavation projects. This will help to understand the site history and relation to other Neolithic sites in Jordan and Near east.

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FIGURES

Fig. 11.1. ASW.505: *Canis* sp., middle-distal portion of a right femur; A: anterior view. B: posterior view.

Fig. 11.2. ASW.2318: jackal, distal portion of a right radius; anterior view.

Fig. 11.3. ASW.652: wild cat, middle-distale portion of a left humerus. A: anterior view. B: posterior view.

Fig. 11.4. ASW.532: wild cat, left calcaneus; dorsal view.

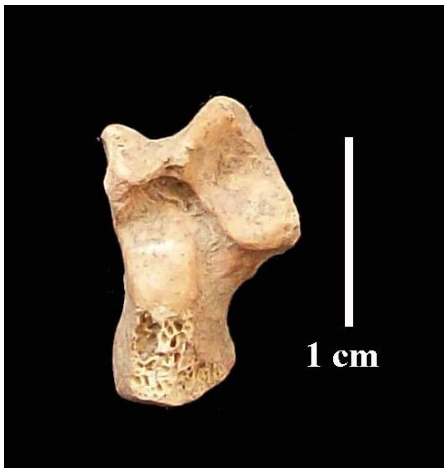

Fig. 11.5. ASW.535: wild cat, right astragalus; plantar view.

Fig. 11.6. ASW.2325: wild cat, second left metacarpal (burned); A: dorsal view. B: plantar view.

Fig. 11.7. ASW.2314: sand cat, left radius middle-proximal portion; A: anterior view. B: posterior view.

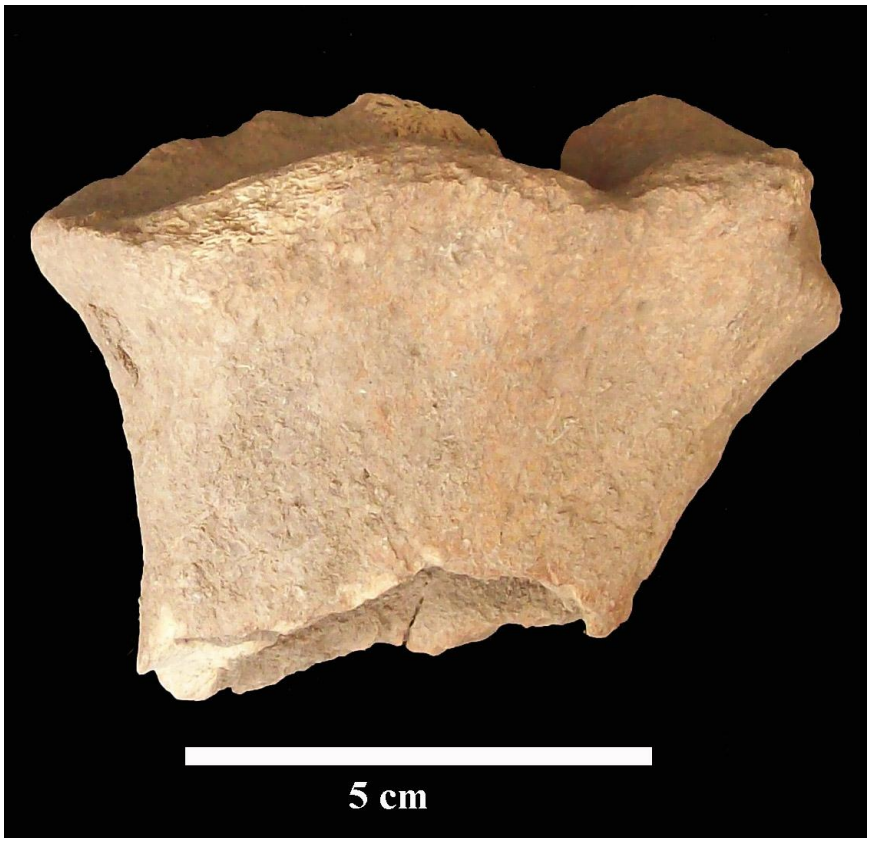

Fig. 11.8. ASW.701: auroch, right radius proximal portion; anterior view.

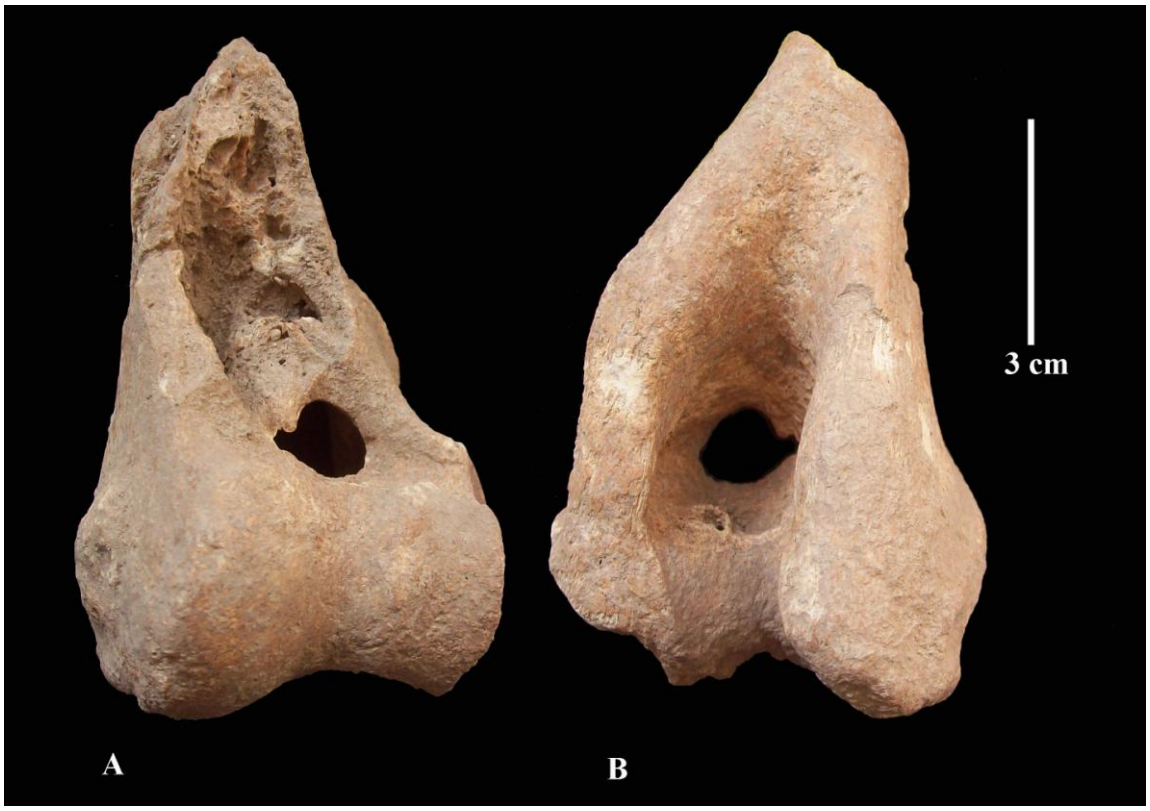

Fig. 11.9. ASW.428: wild Boar, left humerus distal portion; A: anterior view. B: posterior view.

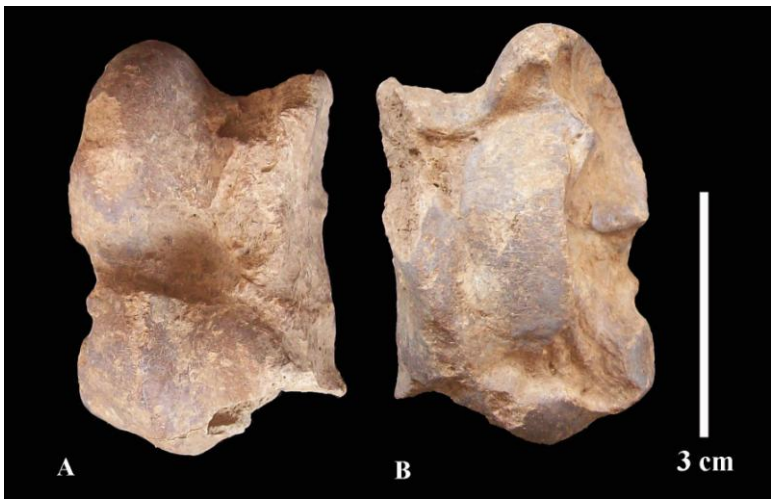

Fig. 11.10. ASW.1804: wild Boar, right astragalus (Burned); A: dorsal view. B: plantar view.

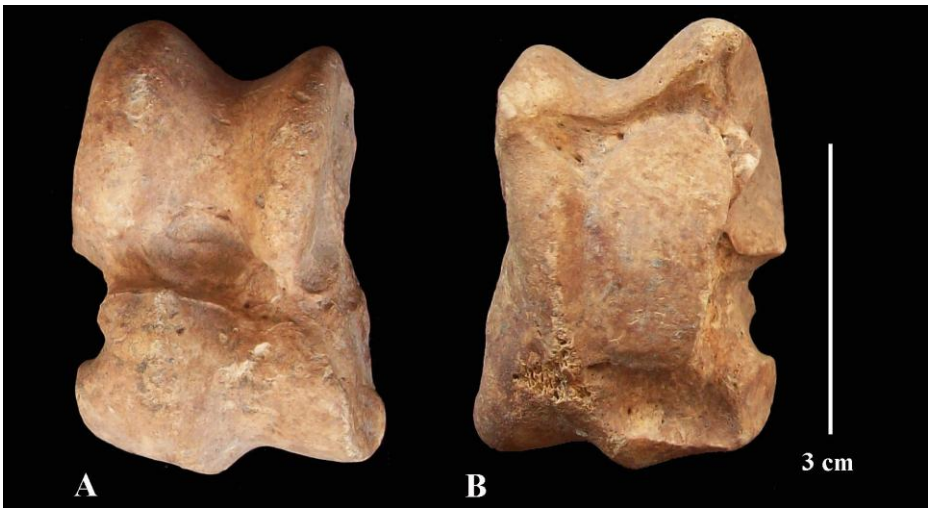

Fig. 11.11. ASW.2356: wild Boar, right astragalus; A: dorsal view. B: plantar view.

Fig. 11.12. ASW.1827: wild goat, left calcaneus; medial view. Present high concretion on the bone surface.

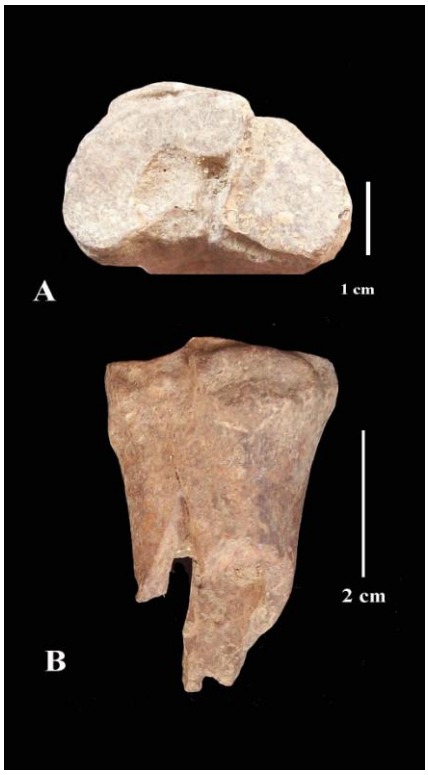

Fig. 11.13. ASW.1208: wild goat, right metacarpal; A: proximal articular surface view. B: dorsal view.

Fig. 11.14. ASW.772: gazella, left humerus; A: anterior view. B: posterior view.

Fig. 11.15. ASW.510: gazella, left astragalus; A: dorsal view. B: plantar view.

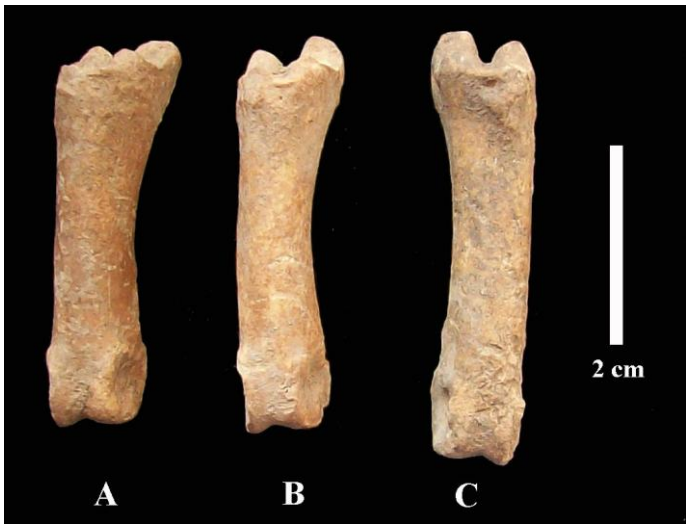

Fig. 11.16. Gazella; phalanges volar view; A: ASW.289. B: ASW.1923. C: ASW.1762.

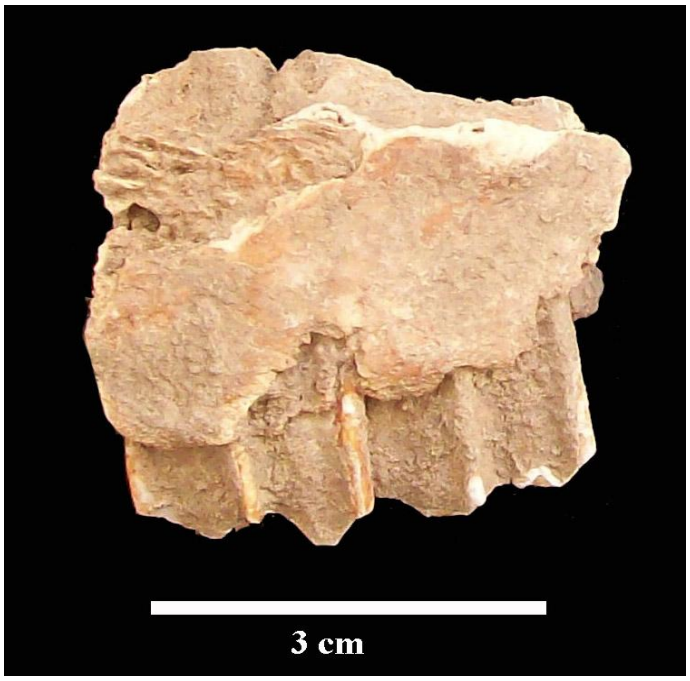

Fig. 11.17. ASW.1305: caprovine, cranium maxilla fragment (right M^1.M^2.). buccal view.

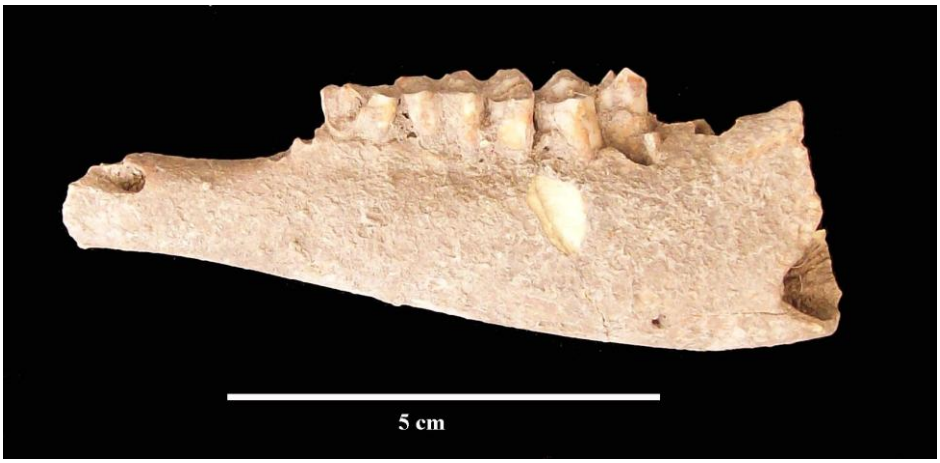

Fig. 11.18. ASW.1335: caprovine, mandidula (left d_3.d_4.M_1.). buccal view.

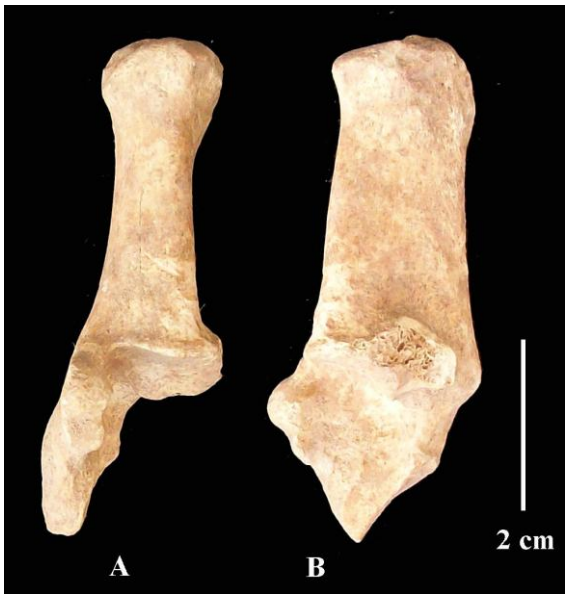

Fig. 11.19: ASW.1913. caprovine, right calcaneus; A: dorsal view. B: medial view.

OSTEOLOGICAL MEASUREMENTS

Table. 12.1: Jackal measurements in mm.*:not absolute measurement.

Table. 12.2: *Canis* sp. measurements in mm.*:not absolute measurement.

Table. 12.3: Wild cat measurements in mm.*:not absolute measurement.

Table. 12.4: Sand cat measurements in mm.*:not absolute measurement.

Table. 12.5: Auroch measurements in mm.*:not absolute measurement.

Table. 12.6: Wild boar measurements in mm.*:not absolute measurement.

Table. 12.7: Gazella measurements in mm.*:not absolute measurement.

Table. 12.8: Wild goat measurements in mm.*:not absolute measurement.

Table. 12.9: Ovicaprines measurements in mm.*:not absolute measurement.

Table. 12.10: Ain Ghazal: Ovicaprines measurements in mm. (Von Dan Driech, Wodtke 1997).

Table. 12.11: Southern Levant; Mountain gazelle (male) range measurements in mm. (Kolska Horwit, Cope and Tchernov 1990).

Canis aureus			
ID	anatomical det.	Bp	Bd
2318	radius	-	13.1
2319	radius	11.2	-

Table. 12.1: Jackal measurements in mm.*:not absolute measurement.

***Canis* sp.**		
ID	anatomical det.	Bd
867	humerus	18.3*
505	femur	17.4*

Table. 12.2: *Canis* sp. measurements in mm.*:not absolute measurement.

Felis silvestris			
ID	anatomical det.	GL	Bp
599	radius	-	7.7
788	tibia	-	19. 2
535	astragalus	11.4	-
2325	II metacarpal	29.1*	-

Table. 12.3: Wild cat measurements in mm.*:not absolute measurement.

Felis margarita		
ID	anatomical det.	Bp
2314	radius	6.3

Table. 12.4: Sand cat measurements in mm.*:not absolute measurement.

Bos primigenius					
ID	anatomical det.	GL	Bp	SD	Bd
602	humerus	-	-	-	10.5
701	radius	-	85.2	-	-
80	tibia	-	5.46*	-	-
206	tibia	-	-	-	66.1
128	calcaneus	96.4	-	-	-
1189	metacarpal	-	83.7*	-	-
203	metatarsal	-	5.17	-	-
1045	metatarsal	-	56.3	-	-
25	I phalanx	-	-	-	18.6
432	I phalanx	61.7	3.53	29.2	32.1
296	I phalanx	71.1	3.51	30.5	36.3
1691	I phalanx	87.4	-	-	-
1606	II phalanx	42.1	35.1	-	27.1
154	III phalanx	74.4	-	-	-

Table. 12.5: Auroch measurements in mm.*:not absolute measurement.

Sus scrofa				
ID	anatomical det.	GL	Bp	Bd
2096	scapula	-	45.2	-
482	humerus	-	-	51.0
911	humerus	-	-	48.1
956	humerus	-	-	45.3
478	radius	-	31.1	-
464	radius	-	35.4	-
665	radius	-	37.4*	-
857	radius	-	35.6	-
899	radius	-	36.6	-
964	radius	-	37.7*	-
184	tibia	-	-	33.7
876	tibia	-	-	34.3
920	tibia	-	-	35.2
661	tibia	-	56.7	-
863	tibia	-	-	33.3
1804	astragalus	48.7*	-	-
1824	astragalus	47.3	-	-
1875	astragalus	46.1	-	-
2356	astragalus	46.1	-	-
1846	astragalus	45.5	-	-
1860	astragalus	44.2	-	-
1826	astragalus	44.1*	-	-
59	astragalus	42.7	-	-
140	calcaneus	84.2*	-	-
1011	metacarpal.4	-	18.2	-
399	metatarsal.3	-	17.5	-
1175	metatarsal.3	-	17.1	-
991	metatarsal.3	-	15.4	-
431	metatarsal.4	-	19.3	-
1019	metatarsal.4	-	17.3	-
1192	metatarsal.4	-	19.8	-
1492	I phalanx	38.3	19.3	15.7
19	I phalanx	-	-	17.2
295	I phalanx	-	-	14.4*
375	I phalanx	42.4	-	-
397	II phalanx	29.4	-	-

Table. 12.6: Wild boar measurements in mm.*:not absolute measurement.

Gazella gazella					
ID	anatomical det.	GL	Bp	SD	Bd
69	humerus	-	-	-	27.1
179	humerus	-	-	-	26.5
612	humerus	-	-	-	30.3
772	humerus	-	-	-	28.3
786	humerus	-	-	-	26.3*
793	humerus	-	-	-	27.6*
794	humerus	-	-	-	26.7
904	humerus	-	-	-	25.1
88	radius	-	32.4*	-	-
577	radius	-	24.4*	-	-
826	radius	-	23.3*	-	-
912	radius	-	33.2	-	-
918	radius	-	-	-	26.2
914	radius-ulna	-	30.5	-	-
938	radius-ulna	-	31.1	-	-
77	femur	-	41.7*	-	-
633	tibia	-	-	-	26.1
819	tibia	-	-	-	22.5*
112	metacarpal	-	21.1*	-	-
47	metacarpal	-	-	-	21.7*
1098	metacarpal	-	-	-	22.0
114	metatarsal	-	20.3	-	-
1899	astragalus	29.4	-	-	-
281	I phalanx	46.1	10.6	8.5	9.1
15	I phalanx	43.3	10.7	7.7	9.3
171	I phalanx	42.7	10.1	7.4	8.5
289	I phalanx	26.1*	12.3*	9.1*	9.2*
17	I phalanx	-	-	8.5	9.1
23	I phalanx	-	-	-	8.3*
282	I phalanx	-	-	-	8.5
283	I phalanx	-	-	8.1	11.0
27	I phalanx	-	-	-	9.7
504	I phalanx	-	-	-	8.3
1488	II phalanx	20.4*	9.1*	-	7.5*
1495	II phalanx	-	12.6	-	-
33	II phalanx	23.3	9.3	6.6	8.3
271	II phalanx	2.31	10.1	8.1	9.1

Table. 12.7: Gazella measurements in mm.*:not absolute measurement.

Capra aegagrus					
ID	anatomical det.	GL	Bp	SD	Bd
2131	scapula	-	40.2	-	-
2129	scapula	-	41.1	-	-
475	humerus	-	-	-	36.2
208	radius	-	38.7	-	-
592	radius	-	37.8	24.4	-
773	radius- ulna	-	41.2*	-	
588	femur	-	52.1	-	-
183	tibia	-	51.6*	-	-
1903	calcaneus	67.2	-	-	-
325	astragalus	33.1	-	-	-
1827	astragalus	67.3	-	-	-
1843	astragalus	34.1	-	-	-
1848	astragalus	34.6	-	-	-
1819	astragalus	35.2	-	-	-
1823	astragalus	31.3	-	-	-
1900	astragalus	35.1	-	-	-
1067	metacarpal	-	-	-	29.3
1099	metacarpal	-	25.3	-	-
1115	metacarpal	-	26.2*	-	-
1950	metacarpal	-	-	-	29.7*
305	metacarpal	-	27.1	-	-
993	metacarpal	-	30.2	-	-
1124	metacarpal	-	-	-	30.9
1185	metacarpal	-	30.7*	-	-
1208	metacarpal	-	28.6*	-	-
303	metacarpal	-	30.1	-	-
304	metacarpal	-	30.7	-	-
1677	I phalanx	-	-	-	-
16	I phalanx	-	-	12.3	15.2
18	I phalanx	38.6	-	12.4	13.9
24	I phalanx	-	17.7	-	-
155	I phalanx	-	-	-	17.4*
160	I phalanx	46.8	15.8	12.4	14.3
166	I phalanx	-	15.3	-	-
293	I phalanx	47.0	15.7	13.4	14.5
294	I phalanx	-	-	-	14.5
285	I phalanx	36.2	18.1	13.1	14.6
13	I phalanx	41.7*	18.2*	13.7*	17.1*
168	II phalanx	30.9	16.7	11.5	-
35	II phalanx	32.3	17.5	-	-
1609	II phalanx	38.1	16.1	-	15.3
118	II phalanx	28.3*	16.7*	12.4*	13.6*
153	II phalanx	32.1	17.7	1.25	14.3

Table. 12.8: Wild goat measurements in mm.*:not absolute measurement.

Ovis*/*Capra					
ID	anatomical det.	GL	Bp	SD	Bd
2130	scapula	-	33.1	-	-
68	humerus	-	-	-	27.6
178	humerus	-	-	-	27.3
651	humerus	-	-	-	31.1
667	humerus	-	-	-	30.2*
733	humerus	-	-	-	36.4
830	humerus	-	-	-	31.2
877	humerus	-	-	-	27.6
895	humerus	-	-	-	33.0*
72	radius	-	-	-	25.7*
689	radius	-	-	-	26.5
768	radius	-	33.2	-	-
800	radius	-	30.7	-	-
840	radius	-	34.1*	-	-
943	radius	-	39.1	-	-
903	radius-ulna	-	31.4	-	-
937	radius-ulna	-	-	-	32.0
760	femur	-	-	-	41.3
936	femur	-	55.1*	-	-
2	tibia	-	-	-	26.5
89	tibia	-	-	-	27.4
580	tibia	-	-	-	23.6
637	tibia	-	-	-	18.7*
856	tibia	-	-	-	28.7
860	tibia	-	-	-	28.7
888	tibia	-	44.3	-	-
590	tibia	31.5	-	-	21.7
145	astragalus	38.7	12.7	-	12.1
223	astragalus	38.0	-	-	12.7
142	astragalus	-	-	-	28.2
1831	astragalus	31.6	-	-	-
1914	astragalus	31.6*	-	-	-
1808	astragalus	31.4*	-	-	-
1816	astragalus	30.8*	-	-	-
407	astragalus	30.3*	-	-	-
1896	astragalus	30.3*	-	-	-
98	calcaneus	39.*	13.6*	11.0*	13.2*
1884	calcaneus	59.5	-	-	-
1913	calcaneus	59.1	-	-	-
49	metacarpal	-	35.1*	-	22.1*
100	metacarpal	-	-	-	31.7
101	metacarpal	-	-	-	25.4
107	metacarpal	-	-	-	25.1
219	metacarpal	-	-	-	30.6*
992	metacarpal	-	-	-	35.1
1016	metacarpal	-	-	-	26.0*

1018	metacarpal	-	-	-	21.5*
1022	metacarpal	-	24.1	-	-
1060	metacarpal	-	21.3*	-	-
1110	metacarpal	-	26.3	-	-
1132	metacarpal	-	-	-	26.4
1138	metacarpal	-	-	-	25.5*
1180	metacarpal	-	21.3	-	-
1956	metacarpal	-	-	-	22.4
1003	metatarsal	-	2-	-	-
1088	metatarsal	-	21.6	-	-
1149	metatarsal	-	22.1	-	-
1166	metatarsal	-	21.4	-	-
1169	metatarsal	-	22.3	-	-
38	I phalanx	-	-	10.1*	13.1*
119	I phalanx	-	-	-	13.3*
159	I phalanx	-	-	-	11.4*
270	I phalanx	-	-	11.5	13.4*
275	I phalanx	-	-	-	11.7
274	I phalanx	40.1	12.2	-	11.5
14	I phalanx	39.4	12.1	-	11.2
4	I phalanx	38.3	14.1	-	14.6
1727	I phalanx	38.3	14.1	-	14.6
288	I phalanx	39.1*	10.3*	6.5*	8.7*
120	I phalanx	40.7	15.3	12.8	14.5
273	I phalanx	40.9	12.7	0.96	12.1
172	I phalanx	40.2*	14.1*	1.16*	13.5*
247	I phalanx	40.2	12.7	10.2	12.2
37	I phalanx	40.1	1.42	11.3	14.1
28	I phalanx	38.1	14.0	11.4	13.4
8	II phalanx	-	-	-	10.1
32	II phalanx	-	-	-	10.7
36	II phalanx	-	-	10.5*	10.9*
298	II phalanx	22.7*	11.7*	-	10.7*
570	II phalanx	30.6	14.6	11.4	12.7
152	II phalanx	30.4	15.7	15.5	12.1
26	II phalanx	30.1*	14.4*	10.2*	12.1*
419	II phalanx	29.8	14.2	9.3	10.4
161	II phalanx	27.6*	13.6*	9.7*	10.2*
29	II phalanx	27.2*	13.3*	8.8*	10.2*
162	II phalanx	27.2*	12.9*	8.6*	10.1*
515	II phalanx	24.2	12.5	9.2	10.9
151	II phalanx	22.9	15.2	-	10.7

Table. 12.9: Ovicaprines measurements in mm.*::not absolute measurement.

period	anatomical det.	GL	Bp	Bd
LMPPNB-LPPNB	humerus	-	-	30.0-40.0
PPNC	humerus	-	-	28.0-38.5
PN	humerus	-	-	27.0-34
LMPPNB-LPPNB	radius	-	31.8-43.0	28.5-29.0
PPNC	radius	-	30.8-38.5	28.5-32.5
PN	radius	-	29.3-34.0	29.0-38.0
LMPPNB-LPPNB	calcaneus	68.5-71.5	-	-
PPNC	calcaneus	64.0-68.5	-	-
PN	calcaneus	54.065.0	-	-

Table. 12.10: Ain Ghazal: Ovicaprines range measurements in mm. (Von Dan Driech, Wodtke 1997).

Gazella gazella			
anatomical det.	GL	Bp	Bd
humerus	135-146	-	24.8-27.9
radius	137-163	24.7-27.3	20.8-25.4
femur	170-187	17.5-19.4	34.2-37.9
metarsal	173-184	18.2-21.1	20.6-22.8
Astagalus	27.2-30.8	-	16.2-18.0
calcaneus	58.1-65.3	-	-

Table. 12.11: Southern Levant; mountain gazelle (male) range measurements in mm. (Kolska Horwit, Cope and Tchernov 1990).

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