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**Archaeobotanical macro remains from Late Bronze Age
Kinet Höyük and Tell Atchana (Alalakh) in southern
Turkey: Economical and environmental considerations.**

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Abstract

The geographical locations of Tell Atchana and Kinet Höyük between the Eastern Mediterranean region, North-Syria and South-Anatolia define them as a focal point of cultural and economic relations between these regions.

One of the aims of this archaeobotanical study, which is based on the plant macro-remains from Kinet Höyük and Tell Atchana, is to contribute to the knowledge of the economic position of these settlements during the Late Bronze Age. It is of interest under which conditions the crops were grown, which general agricultural techniques were used, (e.g. soil management, fallowing etc.) as well as how and where crop-processing and storage were conducted within both settlements and how they compare to other relevant sites in the area. The main socio-economic question of this archaeobotanical study is whether crops were primarily brought to Tell Atchana and Kinet Höyük from neighbouring regions with trade relations or grown in their immediate vicinities by the inhabitants themselves or farmers from surrounding villages.

The environment and its development under anthropogenic influence and natural factors is also focus of this investigation, as it defines the possibilities of cultural developments of Tell Atchana and Kinet Höyük during Late Bronze Age.

In order to answer the mentioned questions, 33 samples from Kinet Höyük and 35 samples from Tell Atchana were studied. About 3350 seeds and fruits were identified, counted and grouped into 77 categories, which include plant species or types belonging to 20 families.

Statistical analysis indicates that the organisation of agriculture in the stratified society of Tell Atchana, as far as plant production is concerned, is similar to north-eastern Syrian sites. Tell Atchana probably imported surplus food from surrounding villages and supported large-scale, but also small-scale specialised crop production. In Late Bronze Age Kinet Höyük there is evidence for intensification in large-scale agriculture, with a broad spectrum of crop plants, as a kind of risk-buffering. The spectrum of crops and wild species of Late Bronze Kinet Höyük and Tell Atchana reflects agricultural characteristics of the eastern Mediterranean cultures.

1. Environment and Archaeology of Kinet Höyük and Tell Atchana

This chapter aims to provide the reader with the environmental and cultural background information on Tell Atchana and Kinet Höyük in southern Turkey. The environmental section only briefly outlines aspect of past vegetation in the vicinity of both sites. Detailed considerations for past and modern vegetation based on botanical results and ethno-archaeological studies are given in Chapter 4. The archaeological information on the sites of Kinet Höyük and Tell Atchana is a selection of aspects relevant for the archaeobotanical interpretation of the data.

1.1. Geography, Geology and Geomorphology of Kinet Höyük and Tell Atchana

Environmental and vegetation mapping is realisable in many parts of Turkey only with older geographic maps from the 1970s (Map of Türkiye Cumhuriyeti). There still is a lack of up to date and detailed maps in Turkey (RIEHL, 1999 refers to Güldalı, 1979). ‘Carte de la Végétation Potentielle de la Région Méditerranéenne (feuille N.1, Méditerranéenne Orientale)’ published by P. Quezel and M. Barbero (1985) and Late Quaternary vegetation of the Near East (Van ZEIST, W. and BOTTEMA, S. 1991) were useful for the information on the past vegetation of the southern Turkey in this work.

1.1.1. Geography of Kinet Höyük

Kinet Höyük is a tell site in southern Turkey and lies 30 km north of the province İskenderun- Hatay in the Issos (Erzin) Plain. The Issos Plain is an alluvial formation, probably an early course of the Ceyhan River and a part of the large alluvial coastal plain, formed in the Adana region, north and northwest of the Gulf of İskenderun (Fig. 1: Late Bronze Age sites in northern Syria; AKKERMANS and SCHWARTZ, 2003) (Van ZEIST and BOTTEMA, 1991). The west side of the settlement has a volcanic outcrop and the east side has the serpentine and limestone massif of the Amanus Mountains. The distance of the site from the Mediterranean Sea shore is about 700 m. The mound of the site is striking as an outstanding feature on the flat plain landscape and the largest mound in eastern coastal Cilicia, 26 m high and circa 3, 3 hectares. The settlement has occupation sequences from Bronze Age

until Hellenistic period and strong evidence for Neolithic and Chalcolithic phases. The mound of Kinet Höyük was abandoned first ca. 50 B.C. and reoccupied in the middle Ages. The settlement itself extends beyond the foot of the tell (GATES, 1999). (Fig. 2: Location of Kinet Höyük and Tell Atchana; GATES, unpublished).

The settlement originally sat on a promontory overlooking two harbours, a small natural inlet on the north side, and a river estuary on the south. The chosen location at the seaside and the archaeological remains from the excavation show that links with the maritime trade routes of Eastern Mediterranean cultures played an important role in the settlement of Kinet Höyük (GATES, 1999).

1.1.2 Geology and Geomorphology of Kinet Höyük

Geomorphological studies show that the Deli Çay River which at present flows 2, 5 km south of the mound, changed its riverbed twice in course of time. It is not possible to estimate exactly when the Deli Çay began to flow in the second riverbed, but this change might be connected to the abandonment of the site at the end of the Hellenistic period and the reoccupation in the Medieval Age, during the 10th century A.D. (GATES, 1999; OZANER, 1994). The coastal side of Kinet Höyük and neighbouring modern sites are currently eroding massively due to the intensive use of alluvial sediments and sand for the iron-steel industry and the building activities (both of which can threat Kinet Höyük's mound) (OZANER, 1994). Kinet Höyük pays its prosperity to its close location to the coastal seaside and to the eastern cross of the Amanus Mountains; it indubitably had an important place in trade with inland regions. In fact there is evidence for trade between Issos, the Amuq Plain and inland Syria since the Palaeolithic period.

Geomorphological research of the site was started by T. Beach and his team in 1998 as the first stage of an extended survey to asses the hydrological and coastal history of Kinet Höyük (GATES, 2000). Soil sample cores were collected to evaluate buried soils in a region, where alluvium and erosion have modified the landscape considerably, especially in pre-medieval times. Hydrological surveys and several soundings have been planned for the reconstruction of the changing shoreline of Kinet Höyük (GATES, 2000; 2001).

1.2.3 Geography of Tell Atchana

Tell Atchana, is mentioned in different written sources as 'Alalakh', the capital city of Mukish, which was vassal of the Hittite Kingdom in 14th century B.C. The site lies on the western side of the Amuq Plain Fig. 3: Neighbouring sites to Tell Atchana; WOOLLEY, 1955). , close to the where the plain begins to narrow towards the Antioch pass (YENER et al., 2000). The Amuq Plain, through which the Orontes River flows before breaking through the barrier of the Amanus Mountains to reach the Mediterranean Sea, is scattered with more than two hundred ancient mounds. Tell Atchana itself is a mound with an irregularly oval shape, measuring about 750 m in length by about 300 m in width. Its axis is north-west - south-east orientated. The highest elevation of almost 9 meters is found at the north-west end, while the south-east end sinks almost indiscernibly to the plain (WOOLLEY, 1955). The dimensions of the existing mound are fairly misleading. The Tell undergoes erosion caused by the rain, wind and agricultural activities. The plain itself has risen almost 5 m since antiquity

1.2.2 Geology, Geomorphology and Holocene formations of the Amuq Plain

The Amuq Plain forms a part of a north-northeast south-southwest fault-guided valley; the Amik-Gölbaşı graben is itself a part of the northern extension of Red Sea-East African Rift Valley (YENER et al., 2000; YILMAZ, 1993). The tectonic dynamics of the region is considerably complex and extremely active; recent geological studies show that the west and the east side of the valley are bounded respectively by northeast-southwest and north-south faults, rather than being simple parallel-sided down-faulted trough (YENER et al., 2000; YILMAZ, 1993). The Amanus Mountains to the west are complex ultrabasic, metamorphic rocks and limestones, which formed into a major mountain belt by the differential movements of the Arabian and Eurasian plates. This complex mountain zone includes rocks as ancient as Cambrian to Precambrian. The relevance of these geological formations for the archaeology is that this series include gold, serpentinite, copper sources and probably other metallic minerals. These resources have been used by the inhabitants of the region in Roman times and as well in Islamic Period (YENER et al., 2000).

Braidwood and his team from the Institute of Chicago recorded more than 178 ancient sites found in their Amuq Plain surveys between 1932 and 1938

(WOOLLEY, 1955; YENER et al., 2000). Sir Leonard Woolley excavated Tell Atchana in Amuq Plain between 1936 and 1949

According to WOOLLEY (1955), earthquakes in the sixth century A.D. destroyed Antioch. They threw a barrage of rocks across the narrow valley, through which the Orontes ran to the sea and thereby changed the geomorphological character of the far inland. After this event, the rivers Orontes and Afrin had no exit to the Mediterranean. The entire valley was filled by a huge dam, which turned the Amuq Plain into a lake that buried the Forum of Roman Antioch under more than eight meters of silt and five meters of mud and sand. Woolley believes that the lake formed very rapidly after the earthquake (WOOLLEY, 1955; YENER et al., 2000). Braidwood suggests a more gradual increase of the lake level of Antioch, as a result of the progressive silting in the drainage; he suspects the lake was a late development (WOOLLEY, 1953; BRAIDWOOD, 1937; YENER et al., 2000). In contrary to WOOLLEY's opinion (1955), Braidwood's estimates have been supported by new geoarchaeological research that the lake increased through the second to the first millennium B.C., and as he suggests, the rise in the lake level happened together with aggradation of the Orontes floodplain (Wilkinson in YENER et al., 2000 p.168-179). This thick silt buried many small mounds around Tell Atchana, as well (WOOLLEY, 1955). According to Wilkinson (in YENER, 2000 p. 168-179) the evolution of the Lake of Antioch has to be dated after ca. 3000 BC, as the Amuq G occupation phase, are covered by lake sediments. He suggests that Lake of Antioch was not existed or greatly diminished in the late fourth and third millennia BC and that the lake was risen from the first millennium onwards. The marshland was according to Wilkinson not formed until after the late Roman period.

After the excavations of Woolley and surveys of Braidwood, an international team (Prof. Aslihan Yener, Dr. David Schloen and Amir Fink) of the Oriental Institute from the University of Chicago has restarted the surveys and the excavations in Amuq Plain. Geomorphological research of the Amuq valley Project has been performed by T. J. Wilkinson, who has reinterpreted Woolley's and Braidwood's statements with help of new geoarchaeological methods (Wilkinson in YENER et al., 2000).

The largest river, the Orontes, is not only important to understand the archaeological site developments in Amuq Valley, but also important on account of the significant settlements like Tell Atchana and Tell T'ayinat, which are located at

the sides of this river. The Orontes River is known for its irregularly strong floods, which begin in February or March, and fallow at low flow from August to October. The information about the basic sequence of alluvial sedimentation in the east of the Tell Atchana, ancient 'Alalakh', is supported by the Atchana drain (Wilkinson in YENER et al., 2000) Since the deep sections of Tell Atchana reach down into waterlogged levels lower than plain level, Woolley's estimation about the plain level, which is not risen less than 5 m since the third millennium, is conclusive (YENER et al., 2000; WOOLLEY, 1955). The recovered Late Chalcolithic sherds from Atchana drain, which C 14 determinations date between 4510- 3980 B.P., allow for a more precise estimate on the sediment accumulation (Wilkinson in YENER et al., 2000).

1.3 Climate and vegetation of Kinet Höyük and Tell Atchana

1.3.1 Modern climate of the region

Kinet Höyük and as well Tell Atchana are situated at the eastern end of the Eu-Mediterranean climate belt, which expands to the south Aegean region and the eastern Mediterranean Sea. Today the climate of the coastal lowlands and bordering foothills of west and southwest Turkey, Syria, Lebanon and Israel is characterised by mild, rainy winters and dry, warm to hot summers. Annual precipitation varies between 350 and 1000 mm (ERİNÇ and TUNÇDİLEK, 1952). Because of the closeness to the sea, the humidity is principally high in summer. In the coastal mountains of southwest Turkey, Syria and Lebanon, at altitudes above 1000m, winters are quite cold (up to -20 C°) (Van ZEIST and BOTTEMA, 1991). The annual precipitation of the area of the Amuq Plain is in the range of 500-700 mm and sufficient for rain-fed cultivation. In drier years, irrigation agriculture can increase crop yields significantly (YENER et al., 2000).

1.3.2 Modern vegetation of the region

The arable lands are usually small alluvial plains and restricted between high mountain belts and the sea shore. These alluvial arable soils belong to only 5 % of the Turkey's landmass and are intensively farmed (ERİNÇ and TUNÇDİLEK, 1952) The region has important arable lands for cereal, pulse, cotton, flax, and sesame production. The major cultivar in the region is the citrus fruit (ERİNÇ and TUNÇDİLEK, 1952).

The plain area of the west-Amanus and up to 800 m belongs to Eu-Mediterranean climate zone and without human interference it has a spectrum of evergreen species, which are relatively sensitive to cold conditions. The first zone up to an altitude of 300 m is occupied by the pistachio, olive and heath species of the Ceratonia-Pistacia lentisci communities like *Pistacia lentiscus*, *Olea europaea*, and *Erica verticillata*. This natural plant cover is dominated by brushwood (maquis) without well-developed trees. For Turkey the coastal maquis is considered as remnants of evergreen shady sclerophyllous forests. The light-demanding pine species, *Pinus brutia*, is also integrated in this belt (Van ZEIST and BOTTEMA, 1991) (Fig. 4: Near Eastern vegetation map; Van ZEIST and BOTTEMA, 1991). The vegetation of oak trees 'Quercion calliprini' is found up to the 800 m. *Quercus calliprinos* is dominant, but remarkably in the form of a shrub. *Pinus brutia* is also common. Mixed woodland remnants extend in the Amanus Mountains and are resistant to cold; this area is, dominated by pine oak and juniper species like *Pinus nigra*, *Quercus cerris*, *Quercus pubescens* and *Juniperus excelsior* (Van ZEIST and BOTTEMA, 1991).

1.3.3 Vegetation history and pollen core sites of the region

Reconstruction of the natural vegetation cover is based upon the present vegetation and early Holocene climatic conditions and palynological data. Palynological data are not available from the coastal zone, which makes the reconstruction of natural plant cover difficult (ZOHARY, 1973; Van ZEIST and BOTTEMA, 1991). Kinet Höyük lies in a region which has no direct palynological evidence. Some relevant pollen core sites are mentioned below.

1.3.3.1 Söğüt Lake

Information on the vegetational history of south-western Turkey during the Late Pleistocene and the Holocene is provided by the pollen diagram from a sediment core from the drained Lake Söğüt (Van ZEIST, WOLDRING and STAPERT, 1975; Van ZEIST and BOTTEMA, 1982) (Fig. 5: Pollen core sites; Van ZEIST and BOTTEMA, 1991). From the level of radiocarbon dated 9180, B.P. steppe vegetation was replaced by forest probably as a result of a rise in humidity. The slopes around Lake Söğüt would have been covered predominantly by the pine-forest without the human interference. The high *Pinus*-pollen value in Lake Söğüt

spectrum (radiocarbon date 2885 B.P.) indicate that humidity reached modern levels less than 3000 years ago. The *Pinus*-pollen percentages and low-growing trees like *Pistacia* species and *Quercus calliprinos* (oak) are represented in pine-forest samples. *Olea* (olive) is well represented in the surface sample spectra (Van ZEIST; TIMMERS and BOTTEMA, 1968).

1.3.3.2 Ghab

The main palynological information for northwest Syria has been attained from sediment cores from the Ghab valley, which are the closest to Kinet Höyük and Tell Atchana (Van ZEIST and BOTTEMA, 1991; Van ZEIST and WOLDRING, 1980; Van ZEIST and BOTTEMA, 1982) (see Fig. 4). The three diagram sections, Ghab I, II, III, constitute together a relatively continuous pollen record. After this records in the upper phase of the Late Pleistocene steppe was the predominant vegetation type from 15.000 to 11.000 B.P. Between 11.000 and 10.000 B.P. forest vegetation expanded rapidly in north-western Syria, the above mentioned species (*Quercus calliprinos*, and *Pinus brutia*) became important and the distribution of this forest reached a maximum in the early Holocene, in the period of 10.000 to 8.000 B.P. But the last 1000 to 2000 years are probably missing in the Ghab core (Van ZEIST and BOTTEMA, 1982). The activity of man marked a decline in the oak-pollen curve which points to large scale deforestation 3500 years ago and an increase in *Juglans* (walnut), *Olea* (olive), *Vitis* (vine grape) and *Fraxinus ornus* (ash) (Van ZEIST and BOTTEMA, 1991; Van ZEIST and BOTTEMA, 1982).

1.3.3.3 Köyceğiz and Ova Gölü

The Eu-Mediterranean vegetation belt in Turkey is characterized by pollen cores from Köyceğiz and Ova Gölü, but the cores reach only to the Late Pleistocene and suggest a natural vegetation of mixed scrub pine-oak forest (see Fig. 4). In these cores, there is no significant evidence of climatic change. The pollen core from Akgöl in South central Anatolia do not cover the Kinet Höyük's occupation periods, because of the hiatus in the sediment recovery and gives about 8.000 B.P. *Betula* (birch) maximum and increase in *Quercus*, *Pinus* and *Cedrus* (cedar)-pollen values (Van ZEIST and BOTTEMA, 1991; ERİNÇ, 1978).

1.3.4 Evidence of climatic chances for the region

In the Near East and the Eastern Mediterranean palaeoenvironmental research is still very fragmentary and mostly covers older sequences of the Holocene (Van ZEIST and BOTTEMA, 1991) From the Bronze Age onwards correlation of profiles from different regions is often impossible, due to very distinct local differences in sedimentation rates. Chronological problems, particularly for the mid Holocene onwards, become also obvious for the detailed palynological results of the vegetation development for different regions of the Near East (Van ZEIST and BOTTEMA 1991).

The pollen cores of Amuq and Gölbaşı lakes show only poor evidence of pollen preservation but provide information on sediment evaluations, radiocarbon determination and a program of trace analysis (YENER et al., 2000). Increases in both lake levels between second and first millennium B.C. can stem from climatic changes through the deforestation and grazing of the land for the farming activities by human (YENER et al., 2000).

The changes in lake levels, glaciers and drainage of Turkey show, like pollen cores, similar evidence of Post Glacial climatic optimum with extremely dry conditions between 5.000 and 7.000 B.P. During this stage the former forest shrank in size and changed in composition and the steppes widened its extent (ERİNÇ, 1978). After this phase the glaciers expanded rapidly, and there came relatively cooler, moister period with regenerated glaciers in 4.000-4500 B.P. The situation was interrupted by several stages of recession and re-advance during historical times and glacial advances in the seventeenth century B.C. (EROL, 1978; ERİNÇ, 1978). Later the exploitation of the forests for construction materials, mining and export resulted in considerable changes in the natural vegetation of the country during the pre-Hellenistic, Hellenistic and Roman epochs (ERİNÇ, 1978).

Obviously, the geographically and climatically relevant pollen cores do not show evidence for significant climatic change, and it seems likely that the climatic and environmental conditions were similar to those of today during the occupation of Kinet Höyük and Tell Atchana in Late Bronze Age, with the exception of the changes in the vegetation by human influences.

1.2 Archaeology of Tell Atchana and Kinet Höyük

1.2.1 North Syria and Anatolia in Late Bronze Age

The Hittite Kingdom was the greatest empire in central Anatolia from the beginning of 17th century B.C. until its decline at the end of the 13th century. The capital city of the Hittites was Boğazköy (Hattuşa) in central Anatolia (Fig. 6: Map of Hatti-land; BRYCE, 2002). The Hittite Kingdom could prevail as a strong military power against its neighbours and took the North-Syrian territories and small kingdoms like Mukish under control through their military expansions in the mid-14th century.

1.2.1.1 Hittite and Mitanni supremacy in Late Bronze Age northern Syria

In the Late Bronze Age, c. 1600-1200 B.C., Syria developed into an important area for international connections of powerful states and politically provided a primary area for the confrontation of competing multiregional polities, including the Mitannian, Egyptian, Hittite, and Assyrian empires (see Fig.6). Economically, Syria was an important part of international trade, which is well documented in the Amarna letters (AKKERMANS and SCHWARTZ, 2003, p.327). The Mitanni Kingdom was founded in the Near East at least in the early 15th century and extended its territory from Cilicia in the west to the Zagros Mountains in the east. The capital city of the Mitanni Kingdom, whose name is mentioned in different historical texts, has never been recovered archaeologically. The inhabitants of Mitanni used the Hurrian language for daily conversation and another Semitic Akkadian language for bureaucratic correspondences, which is recorded in the archives of Tell Atchana (Alalakh), Nuzi, Quadna, and Hadidi (AKKERMANS and SCHWARTZ, 2003; YAKAR, 2000) (see Fig. 6). The Mitanni Kingdom came into conflict with the Egyptian Pharaohs of the 18th Dynasty, which caused competing interests in northern Syria and, for the first time in the history, Egypt organised repeated military invasions and tried to take Palestine and Syria under its administrative control (AKKERMANS and SCHWARTZ, 2003). Although Tuthmosis III attacked as far as the Euphrates basin, the Egyptian sphere of influence was largely limited to the southern-most part of the Syrian coast and the region south of Qatna, while the Mitanni Kingdom retained northern inland Syria and northern Mesopotamia (AKKERMANS and SCHWARTZ, 2003; KLENGEL, 1992). At the

end of the Middle Bronze Age (c.1600 BC) the Hittites destroyed Alalakh (Tell Atchana) amongst other cities during their attacks to Yamkhad.

Egypt and Mitanni maintained a balance between the powers in Syria until the advent of Hittite expansion in the mid-14th century. Late Bronze Age Level IV (c.1400 BC) at Alalakh dates to the period of the rule of the Mitanni Empire and was destroyed by the Hittites. Abundant textual and material culture evidence is available at this level.

Under Hittite supremacy, the province Mukish, including the capital city Alalakh, became an important source of grain in times of food shortages as documented by a text from Ugarit. The fact that Mukish played a part in the supply of grain to Hatti demonstrates that its farmers were capable of producing large quantities of surplus wheat and barley (YAKAR, 2000).

The problems with manpower for the Hittite army must have been improved by the incorporation of Kizzuwadna (Cilicia) into the Hittite state in the mid-14th century (MELLAART, 1978; AKKERMANS and SCHWARTZ, 2003) (see Fig. 7) Under the reign Arnuwanda III (1235-1225) there was a serious famine in Hatti-land; Egyptians sent grain ships to the Hittites, as in many times of famine.

1.2.1.2 Some aspects of chronology and trade in the Late Bronze Age North-Syria

Despite the availability of written sources from archaeological context, the archaeological chronology of the Late Bronze Age in northern Syria is incomplete. In spite of the congruence of abundant textual and material culture evidence as at Alalakh IV, doubts about the absolute and relative chronology have yet to be resolved, and this problem is still under heated debate (AKKERMANS and SCHWARTZ, 2003; WOOLLEY, 1955; YENER, et al. 2000). Radiocarbon evidence from Late Bronze Age Syria is scarce and the possibilities of dendrochronological analysis are only beginning to be explored (AKKERMANS and SCHWARTZ, 2003).

One of the problems of the Late Bronze Syrian chronology is the similarities between Late Bronze and Middle Bronze Age ceramic shapes and decorations. The pottery assemblages display only a smooth transition in which many traits of the earlier period persist into later ones. A similarly smooth transition can be observed in the architectural and stratigraphic sequences at major sites like Alalakh, Hama and Hammam et-Turkman in western Syria (see Fig. 1:)While Palestinian-related

distinctions like LB I, IIA, and IIB are sometimes applied to Syrian data, the diagnostic criteria for each sub-period are not made explicit and the international divisions are therefore still ambiguous (AKKERMANS and SCHWARTZ, 2003).

Enclosure of coastal Syria into an eastern Mediterranean maritime trade network is confirmed by the predominance of Cypriot and Mycenaean ceramic imports. As well the ubiquity of imported bowls, many painted and decorated vessels were frequently imported for their own sake and not as containers of trade goods and both Cypriot and Mycenaean pottery were imitated by local producers to manufacture local versions (AKKERMANS and SCHWARTZ, 2003). As usual, imported pottery from Cyprus and Aegean are most abundant in near coastal sites, but their occurrence is reduced or nearly absent in the Syrian interior.

1.2.1.3 Decline of the Hittite Kingdom

The decline in the number of occupied tell sites in the Late Bronze Age has been interpreted by some scholars in terms of an increasingly exploitative urban elite whose oppressive demands forced the peasants to abandon their villages. The fleeing peasants either faced up to live pastoral or joined together as refugees or outlaws like *habiru* in Hittites (AKKERMANS and SCHWARTZ, 2003; YAKAR, 2000). The abandoned sites of peasants could stem from the collapse of agriculture and decay of tribute incomes for states, which supported essential expenditures of military invasions (YAKAR, 2000).

Around 1200 B.C., the eastern Mediterranean world witnessed a period of crisis and collapse of great urban centres and political systems. The great Late Bronze Age centres of Ugarit and Emar were destroyed, never to be reoccupied and the other regional centres like Alalakh, Hammam et-Turkman, and Brak were abandoned by the period's end and the powerful states in northern Syria disappeared from the region; the Hittite state was in decline, Egyptian military power pulled out from the region, and many important sites in Mycenaean and Cyprus suffered destruction (AKKERMANS and SCHWARTZ, 2003). Within this collapse the extensive maritime trade between the eastern Mediterranean broke down. In interpretations, the collapse at the end of Late Bronze Age have been overemphasized, it should be noted that the Syrian Late Bronze was marked by numerous destructions throughout its history. The possible reasons of the "end collapse" are still debated

During the reign of Suppiluliuma II (1225-1195), different archives mention different events; a famine in the Hatti land. He made a stand at the foot of the Amanus range against invading forces of sea people, which marched to the east. The invading armies crossed the Amanus and reached Mukish, as well as Tell Atchana in the Plain of Antioch; they plundered these sites and the coastal region. After this event, darkness fell into the region. According to MELLAART (1978), the “Sea-People” were a big group of warriors and should be interpreted as the own inhabitants of western Anatolia; a group of Lukka people from Pamphylian area, Adaniya and Kizzuwadna (Cilicia), in other words the inhabitants of south coast of Turkey, who realized their great possibility in the famines at the end of 13th century. The origin of Sea-People is mentioned by SINGER (1988) and MAZAR (1988) as western Anatolia and the Aegean islands, which are settled later on the coast of Canaan and identified with the “Philistines” of the Bible. MELLAART (1978) mentions that the Sea-People were unlikely to be the sole destruction of Hittites rather that the final collapse of Hittites came with severe battles on the Anatolian plateau, which can be concluded from the absence of historical records. The threats from western and eastern Anatolia to the Hittite state in the disastrous conditions of famine and the political weakness of Hittites may have been reason for collapse (YAKAR, 2000; AKKERMANS and SCHWARTZ, 2003), even without the hypothetical Phrygian invasion from Europe to southern shores of the Marmara Sea (MELLAART, 1978).

1.2.2 Chronology and recent excavations of Kinet Höyük

Kinet Höyük has long been identified by different scholars as the Port of Issos in Classical times, where Alexander the Great in 333 B.C. began his invasion of the Achaemenid Empire (GATES, 1999). In earlier stages, it could be mentioned as a Phoenician harbour “Sissu” (Iron Age) and Hittite “Zise” in the Kizzuwadna region (Late Bronze Age). The settlement has occupation sequences from Bronze Age until Hellenistic period and strong evidence for Neolithic and Chalcolithic phases. The mound of Kinet Höyük was abandoned first ca. 50 B.C. and reoccupied in the middle Ages (approximately in the mid-9th century). The Medieval settlement was called Hisn at-Tinat and its habitants harboured in the river estuary, a kilometre south of the old site (GATES, 1999).

Periods within each phase represent separate architectural or occupational levels, which are numbered sequentially according to the OP. C master stratigraphic sequence of the settlement (see Chart 1).

Kinet Höyük has been excavated since 1992 by Dr. Marie-Henriette Gates from the Department of Archaeology and History of Art, University of Bilkent, Turkey under the auspices of the Hatay Museum (GATES, 1999, 2000, 2001).

In the Kinet Höyük excavations, the “locus and lot” system has been used to designate trench features and collection units. An operation (OP-) refers to a trench, which measures usually 5 m by 10 m and oriented according to north-south/ east-west grid and is labelled alphabetically. The locus may describe an arbitrary excavation area or a specific archaeological feature: a wall, pit, hearth or a defined surface (e.g. floor in a room). “Lot” designates a deposit, fill, or matrix associated with the locus, and the collection unit for finds in the locus.

Phase	Period	Date
I	1(4)	Medieval (c. 10 th - 13 th A.D.)
II	3 A-2	Hellenistic (c. 330-50 B.C.)
III:1	7-3 B	Late Iron Age (c. 7 th - 4 th c. B.C.)
III:2	11-8	Middle Iron Age (c. 9 th - 8 th B.C.)
III:3	12	Early Iron Age (12 th -10 th c. B.C.)
IV:1	14-13	Late Bronze II (c. 13 th B.C.)
V	–	Middle Bronze Age (2000-1500 B.C.)
VI	–	Early Bronze Age (third millennium B.C.)

Chart 1: Occupation sequences of Kinet Höyük

1.2.2.1 1997 excavation season and Early Iron Age-Late Bronze Age Operation, (J/L) West-Slope

In the 1997 excavation season of Kinet Höyük, the Neolithic and early Chalcolithic phases have been excavated for the first time and the excavation of three architectural periods has been continued: The Neo-Assyrian (Middle Iron Age) and Late Bronze Age building level II on the upper west slope of the mound, the

operations C II and J and the Middle Bronze Age II level on the east terrace of the mound. On the west slope of the mound the first significant Early Iron Age probe of Kinet Höyük, Middle Iron- early Late Iron Age settlements and an important medieval residential area on the east terrace have been recovered. The Iron Age trenches have been examined by the excavators to understand the functional differences between the marine and inland sites (GATES, 1999).

Excavations in OP L began in 1995 and in 1997 the Late Bronze Age II OP J architectural levels, which lie under the Early Iron Age (Period 12) OP L deposits, have been recovered (Fig. 8: Map of Kinet Höyük 1992-1999 excavations; GATES, 2001). A room as a part of a Level 13 building, whose superstructure was burnt and collapsed internally, has been completely excavated. A courtyard bordered this room at the north side.

The lower Late Bronze Age II (Period 14) building consisted of a central court and was enclosed by three rooms that extended to the east into OP L (Fig. 9: Location of botanical samples from the 1997 excavation). In the 1994 season, excavated northern storeroom in OP J contained *in situ* jars and other goods, including barley, wheat, lentil, olive, fruit flesh and walnut recovered from flotation samples (GATES, 1999; HYND, 1997). A few Mycenaean and Levanto-Helladic sherds, found in this room, may give a picture for the reconstruction of the Aegean import wares in Late Bronze Age Kinet Höyük. In the same excavation season the Middle Bronze Age Levels OP K2- K3, the Medieval Levels OP K and some Halaf Period sherds (Late Neolithic-Early Chalcolithic) in medieval pits have been recovered (GATES, 1999).

The palaeobotanical research in Kinet Höyük had been initiated by D. Samuel in 1995. The plant remains from the 1995 excavation season have been analysed by A. Hynd in “A model of local continuity: the 1995 Archaeobotanical Assemblage from Kinet Höyük, Hatay” (HYND, 1997; GATES, 1999). According to GATES (1999), HYND (1997) observed, that in contrast with comparable communities, the Kinet inhabitants preferred glume to free-threshing wheats, probably in reply to the rainy climate conditions of the region; agriculture in Kinet Höyük reflects conservative and specific adaptation to the local environmental conditions.

The zooarchaeological research of Kinet Höyük has been performed by S. Ikram since the 1995 season. Analysis of animal bones and shells indicate changes in keeping of the domestic animals through the time, principally cows and sheep/ goats.

The diet of the inhabitants was supported by hunting and fishing especially during the Iron Age. The Levels of Medieval Age Kinet Höyük give only slight evidence for fish consumption, although fishing had an important place in earlier periods (GATES, 1999).

1.2.2.2. The 1998 Excavation season

Six phases have been supplemented in 1998 season, which have been excavated in previous seasons. The Late Bronze (Phase IV) and Early Iron Age (Phase III: 3) on the west slope of the mound, Middle and earliest Late Iron Age levels (Phases III: 2-1) on the east slope, the burnt Middle Bronze Age building (Phase V) on the east terrace and the Medieval settlement (Phase I) of Kinet Höyük (GATES, 2000) (see Fig. 8).

1.2.2.2.1 Late Bronze/ Phase IV OP J/L, West slope

According to GATES (2000), in the 1998 excavation season architectural levels of the Period 13 and 14 have been exposed for the first time. The final architectural level of Late Bronze Age II, the Period 13, had been defined by a square-room in the northern half of the trench with two outdoor areas excavated in 1997 season, as mentioned above. In the 1998 excavations in these two outdoor areas, twin domed ovens and an open hearth in the south courtyard, and another domed oven beside a cobbled area in the north one have been uncovered (GATES, 2000) (Fig. 10-11: Location of botanical samples from the 1998 excavation). GATES (2000) states, that querns and wheat from these courts confirm their use for the food preparation. The local Late Hittite ceramic containers, which show the same repertoire as in the underlying Period 14, have been found. Two phases involved Period 14 structure was built on two terraces to accommodate the mound slope. In addition three new sectors were exposed; the eastern end of the north store-room (Locus 29), a kitchen (Locus 99/110) with two domed ovens and a stone lined hearth, and a south eastern paved court (Locus 103), which is connected from the west with the paved court (Locus 34) (see Fig. 10-11; GATES, 2000). According to GATES (2000) large and deep postholes against the court and kitchen walls would support the roof, awning or a projecting upper story. The excavated areas include many *in situ* abandoned household goods, which point to an armed attack. 19 plates have been found in storerooms, many of these plates are still stacked. The kitchen has ovens

and many other cooking, serving and storage equipments like two terracotta tripod braziers, a large crater and two storage jars, one of them is of Canaanite type, which still stood as the kitchen was excavated. In one of the domed ovens laid a coarse-ware platter (GATES, 2000).

According to the field reports of D. Samuel and S. Ikram, plant densities were low, as though the owners of the house were careful in keeping these rooms clean. The food remains included barley, wheat, lentil, pomegranate and olive, the butchered bones of large deep sea fish, and a lobster claw. Plant remains were found in and around vessels, and on the floors of the hearth and ovens. Four boar tusks have been recovered above the plates in the southwest corner of the storage room of the Locus 96.

According to GATES (2000), except for a few sherds of standard Cypriot export ware, any trace of contacts are missing in this room with the outside of the political reaches of the Late Hittite Empire.

The architectural structure of Period 14 expanded only the western lower terrace. The space on the north side, where the storeroom (Locus 96) was built, was open, with two floors and a simple fire pit in the middle of the lower floor. Two post holes have been recovered in this space, which suggest an installation of wooden shelter (GATES, 2000). The function of this unit will be mentioned in the context description, in Chapter 3.

The pottery samples from the architectural structures of the Period 15 are fragments of a black burnished vessel, with incised, punctuate and applied decoration in the shape of an animal head, perhaps a lion, which have the similarities with the black impressed Ware from Tarsus and Alalakh V. The animal shape is unattested, although other zoomorphic vessels occur in Alalakh V (GATES, 2000; WOOLLEY, 1955).

The preliminary sorting of the archaeobotanical remains from 1998 season confirmed that the inhabitants of Kinet Höyük did not change the four staple crops (barley, wheat, lentil and grape) through time, which suggests relatively conservative agricultural practices of Kinet Höyük (GATES, 2000).

1.2.2.2 Early-Middle Iron Age / Phase III, OP F

Two early periods of OP F periods 10 and 11 (Middle Iron Age) were represented by poorly preserved stone and brick walling, with hearts and plastered

bins giving them a domestic character. Nonetheless, these scanty remains give a rich ceramic repertoire, in addition to a high concentration of 10th to mid- 9th century B.C. geometric Cypro-Cilician painted wares (bichrome, red-on-black and white slip painted), several Euboean PG skyphos sherds indicate early contacts with Greece. The Early Iron Age/ Period 12 included thick trash deposits, burnt clay, pebble features and large pits, which are similar to those in OP L of 1997 excavation season (GATES, 2001).

1.2.2.3 1999 excavations in Kinet Höyük and OP J/ L

After the excavation of the Period 13 and 14 in 1998 season, the excavation of the earlier architectural stage, Period 15, with a large single structure and three building phases, has begun. According to GATES (2001), the architectural structures of the Period 15 suffered no destruction and reflects the cultural impact of the Hittites in 14th century B.C., when Cilicia (Kizzuwadna) was already integrated into Hittite's territory (GATES, 2001; YAKAR, 2000). At Kinet Höyük this level corresponds to Phase IV: 2.

The earliest architectural structure 15 C has very low foundations and the lacks of doorways are interpreted as basement rooms or sunken foundations (Fig. 12: Location of botanical samples from the 1999 excavation). However, the presence of hearths on various floors can be deduced from filled doorways for the remodelling of building in the next phase (GATES, 2001). In the second building phase, 15 B, a broad buttress was inserted into the long corridor, creating a doorway and dividing this large area into two rooms. In the east unit the room 162 stretches out to the north. The final building phase (15 A) maintained the preceding plan. Doorways were marked out by the divider (Locus 118) between the two rooms of the eastern unit. The space in the north-west edge (Locus 153) of the trench is divided into two sectors: a stone-lined posthole and a 1.6 m stretch of stone uprights, against the corresponding face of wall 147, suggest a built passageway into an area now lost to erosion (see Fig. 12). The function of this building could not yet be proposed, but many metal objects, some stone pounders and tools, and heavy ceramic mortar found in eastern rooms point to manufacturing. These deposits were also rich in faunal remains, the relicts of meals on the premises (GATES, 2001).

The ceramic shapes and fabrics of Period 15 are comparable with the ceramics of Period 14 and 13. They match with central Anatolian ceramic types of

the early New Hittite Empire (GATES, 2001). The changes from Period 15 to Periods 14-13, although both periods belong to Late Bronze Age Hittite Empire, could conclude a social reorganisation, when the monumental structure was replaced by domestic housing (GATES, 2001).

1.2.2.4 Location of the Kinet Höyük's botanical samples

31 samples of Kinet Höyük come from Late Bronze Age operations L and J/L (see Fig. 7) and two samples come from Middle-Early Iron Age Operation F. In Kinet Höyük, archaeobotanical samples derive from different contexts, i.e. kilns, floors, firing places, hearths, jar contents, ovens, postholes and pits (see Fig. 9-11 and Appendices 1-2). The majority of the samples belong to Late Bronze Age occupation levels (13-14) and only 2 samples belong to Early/Middle Iron Age occupation level (12) of Kinet Höyük.

1.2.3 Archaeological research history of Amuq Plain and Tell Atchana

The Amuq Valley has been surveyed by R. J. Braidwood and his team from the University of Chicago in the 1930s. His team recorded 178 archaeological sites in Amuq Valley (BRAIDWOOD, 1937). Braidwood's team showed in their surveys increasing density of occupation on the Amuq Valley from the Chalcolithic period until the Middle Bronze Age and a sudden drop in the number of the settlements during the Late Bronze Age. With the beginning of the Iron Age the number of the settlements in the Amuq Valley increased again (BRAIDWOOD, 1937; YENER et al., 2000; AKKERMANS and SCHWARTZ, 2003). Nevertheless, Tell Atchana was already abandoned at the end of the Late Bronze Age.

Tell Atchana was excavated firstly by Sir Leonard Woolley and his team between 1936 and 1949. He concentrated the excavation mainly on the western part of the tell, where he found palaces with Akkadian cuneiform archives and other objects demonstrating Alalakh's importance for intercultural contacts to all the different polities in the area from the Middle Bronze Age onwards. He noticed that the site would have had no remains earlier than the Bronze Age (WOOLLEY, 1955; YENER et al., 2000).

L. Woolley estimated that the area of the Tell Atchana could have been the port of the capital or a royal city commanding the principal trade routes, including the pass to the sea. He believed that the site could have been controlled due to its

favoured location as well the timber-supplies of the northern mountains, which is the continuation of the Lebanon forests, exploited by the Phoenician cities of the south coast (WOOLLEY, 1955).

The neighboring site of Tell Tayinat may have been in a certain economic and/or socio-political relation to the Atchana settlement, probably in a landscape strongly differing from that today, by another course of the Orontes river (CASANA, 2003). Tell Ta'yinat lies very close to Tell Atchana, and was inhabited both before the foundation of Tell Atchana and after its desertion. Two miles to the west is Tell esh Sheikh, a mile and a half to the east is Tabara al Akrad, towards the eastern end of the plain is Çatal Höyük and Tell al Judaidah (see Fig. 3): According to WOOLLEY (1955), all these excavated sites except Tell Atchana show rich deposits of the Chalcolithic period and, he adds, none of these sites has a significant Neolithic occupation level.

1.2.3.1 Chronology of Tell Atchana and (1936-1949) excavations

Woolley describes the stratigraphical sequence of Tell Atchana, after his excavations between 1937 and 1949 in 17 levels, based mainly on the architectural stratigraphy (WOOLLEY, 1955). In general, the chronology of Alalakh is based on an absolute chronology, extracted from the cuneiform tablets and seals from archives of Alalakh and other important neighbouring states. The differences between the interpretation of the architectural stratigraphy and the absolute chronology obtained from written sources create many difficulties in dating occupation sequences of Tell Atchana. This problem has subsequently been the main reason for the re-excavation of the site today.

According to Woolley's chronology, Level XVII (3400-3300) is the oldest level in Tell Atchana occupation sequence. It is of the regional Early Bronze Age and defined by the characteristic pottery known as "Khirbet Kerak". He took the pottery tradition of the eastern Syria and Mesopotamia as a criterion for the Alalakh's ceramic chronology. At that time, Alalakh was a vassal of Akkad and the pottery sequence is comparable with those of Uruk ware from al' Ubaid (WOOLLEY, 1955).

From Level VII onwards, the occupation sequences have been dated with help of written documents, but the absolute chronology is still discussed, especially in terms of linguistic translation difficulties of the king names and their family relations

with each other, both of which make the a chronological correlation with the neighbouring states problematic.

GATES (1981) revised her chronological reassessment of Alalakh Levels VI and V, which are established by Woolley, on the basis of the Alalakh's architectural sequences and pottery evidence.

Due to the reduced relevance of the chronological discussion for this work, the aspect of Alalakh's absolute chronology has been left out, but architectural evidences have been mentioned to give an overlook for the occupational sequences of the site, especially for the Middle and Late Bronze Age time periods, between the 16th and 13th century (Fig. 13: General plan of Tell Atchana; WOOLLEY, 1955).

'**Level VII**' coincides with the extension of the Egyptian 12th Dynasty over north Syria; although no Egyptian monuments have been found to testify the direct Egyptian control over Ugarit. Nonetheless, a strong influence can be seen in a portrait head in the Yarim-lim temple. The date for Level VII is fixed by the fact that the Yarim-lim was a contemporary of Hammurabi of Babylon, whose date has been estimated to 1728-1686 B.C. and the son of Abba-il, who was the king of Aleppo and the kingdom of Yamkhad. Abba-il had put down a rebellion in Irridi and destroyed the city reigned by his son, and gave him in compensation Alalakh together with surrounding villages as his royal capital city of the Mukish province (WOOLLEY, 1955; YAKAR, 2000). Alalakh became an important city-state, whose territory was enlarged by the purchase of additional villages and land properties for the royal estate (YAKAR, 2000; GAÁL, 1988). Archaeological evidence of Level VII shows that the Yarim-lim palace received additions and strengthening of the walls, but ended as period in disaster; all public buildings being sacked and burned. The evidence of destruction must have been caused by enemies from outside, not by a domestic rebellion. But, interestingly enough, there is no trace of enemy occupation in the pottery tradition or architecture in the following Level VI, moreover the tendency to revive the pottery of Level VIII (WOOLLEY, 1955).

With the following period '**Level VI**', Aleppo has been still dominant in Alalakh's culture, which may have been due to its occupation (c.1595) by the Hittite king Mursili I as well as his influences on Alalakh. There is no trace of a palace from Level VI, but there are traces to point to the existence of a temple. In the course of Level VI the castle was built and rebuilt like in Level V (WOOLLEY, 1955).

In **'Level V'** the traces of a large and well-constructed building, which may have been a palace, have been found on the site later occupied by Niqme-pa palace. The temple of this level is constructed on a plan unlike that of any other temple of the second millennium B.C., which shows coincidence with temples of old Hurrite territory, east of Mitanni and might be a tribute to the Mitanni power (WOOLLEY, 1955). During the Hittite invasion Alalakh does not seem to suffer greatly, although its fortifications were dismantled, the Hittites retired and left the inhabitants in their own devices. The pottery of Level V shows, like White Slip ware from northern Anatolia, new influences and new clients in Alalakh's territory (WOOLLEY, 1955).

'Level IV' began with the building of Niqme-pa palace, but after its burning and destruction, the city and the private houses, which were built with the palace at the same time, remained in use for a long time (see Fig. 13). Many of the Level V buildings continued to be in use with little or no modification (WOOLLEY, 1955). According to GATES (1981), the problem of reuse of the Level V structures in Level IV city caused some false interpretations of its stratigraphy and she has revised Woolley's interpretation.

Stratigraphical studies show remodelling of the castle after the destruction of the palace. The huge fortress of **Level III** was erected in the northwest quarter of the city after the castle's burning on the site of Niqme-pa's palace. The new city walls were built up and they ran across the ruins of the private houses of Level IV. According to WOOLLEY (1955), the end of the Level IV is therefore clearly defined by the architectural sequence. The transition from Level IV to V was more or less peaceful but the building of a royal palace may have introduced a new social as well as a political regime, and pottery shows a marked difference between Levels IV and V. The black-impressed ware is completely absent from the beginnings of Level IV and the White Slip and Base Ring types, which were relatively rare in Level V. In Level IV sixty-four new pottery types occur, which are unknown from earlier levels. The rulers of the Level IV were Niqme-pa and Ilim-ilimma, whose seals bear Egyptian emblems (WOOLLEY, 1955).

Translation of the Idri-mi's statue inscription changed the dating of the Levels VII to III. Evidence of the archaeological stratigraphy has been brought into correlation by Woolley with the accepted chronology of Albright (see Chart 2; WOOLLEY, 1955). As mentioned above, the chronology suggested by Woolley of Alalakh is nowadays questioned.

Level VII	1715/1700-1665/1650 B.C.
Level VI	1665/1650-1550 B.C.
Level V	1550-1435 B.C.
Level IV	1435-1370 B.C.

Chart 2: Albright's chronology for the Late Bronze Age Levels VII-IV of Tell Atchana

The transition from Level IV to Level III is obvious. Due to the increasing Hittite threat the Alalakh's king claimed the protection of Egyptian Pharaoh as their overlord; but no aid was forthcoming. In *c.* 1370 B.C. Suppiluliuma advanced in force and overpowered Aleppo and the land of Mukish; the castle and the late Level IV state rooms in it were burnt, over its ruins and over the site of Niqme-pa's palace a huge fortress-palace was erected, and a new temple was built in the Hittite style. This event marks the beginning of Level III (WOOLLEY, 1955).

Archaeological evidence shows that the temple in Level III seemed to be deliberately burnt and the private houses of Level III contain no evidence of rebuilding or repair and there is no trace for secondary floor levels. But most houses of Level II were built on the foundations of mudbrick houses of Level III (WOOLLEY, 1955). According to WOOLLEY (1955) any attempt to fix the time of the transition from **Level III to Level II** could be taken into consideration as the fact that the temple was burnt but rebuilt again. In Level III, the fortress-palace continued to be used; both facts show that the change was not due to foreign conquest (WOOLLEY, 1955).

The youngest level is **Level I** and corresponds to end of the Late Bronze Age in the Amuq region. At Tell Atchana there are only scarce traces of the Early Iron Age, and after the abandonment of the site at the end of the Late Bronze Age there was no continuity in settlement, in contrary to Tell Ta'yinat.

1.2.3.2 Alalakh archives

The relevance of the Alalakh's archives for this work is restricted to information on the arable lands and the supplying villages around Alalakh. This is not a decisive criterion for the interpretation of the botanical analyses of the site, but

surely useful to mention in this work. The level VII archives identify the site as Alalakh, the capital of the province Mukish and a vassal to the kingdom of Yamkhad (KLENGEL, 1992; YENER et al., 2000). The Kingdom Yamkhad itself was a vassal kingdom of the Hittites. The Alalakh texts refer to interaction between Alalakh itself and the settlements in the countryside (ZEEB, 2001). According to MAGNESS-GARDINER (1994), the villages in the territory of Alalakh can be differentiated in accordance with the conditions under which their inhabitants worked the land. Consequently, more analysis of settlement dates are necessary to make a better sketch of the economic and human landscape of the plain in the context of the Alalakh VII texts (YENER et al., 2000).

The differences existing between the societies of the periods reflected in the archives of the VII and IV Alalakh Levels come into light if the Alalakh texts are examined, for example the role of the king and the influence of state sector or social strata. The reasons for these differences are usually given by increased Hurrian immigration, which increased as due to the change of the political situation in northern Syria, and as due to the rise of the Mitanni, as a reorganiser of the north Syrian political scene (GAÁL, 1988; BRYCE, 2002; Van de MIEROOP, 2004; AKKERMANS and SCHWARTZ, 2003). According to GAÁL (1988), the kings of the level VII were the landlords of the royal/ state sector; they directed personally the state sector. By contrast, the kings of the level IV, with the exception of Idrimi, were only pale figures and mostly passive participant in legal cases. The texts from these archives listed the royal estate units; more than 200 localities, bigger cities and small villages, but it is very difficult to conclude the connections between the royal and the private sectors as due to different lists, which enumerate them and their inhabitants with their class designations, mention the king, the state and royal sector scarcely (GAÁL, 1988; YAKAR, 2000).

Archives of Level IV provide abundant evidence of the names of kings with duplications common throughout the 14th and 16th centuries in Syria and also in Hittites (BRYCE, 2002; YAKAR, 2000; WOOLLEY, 1955), which makes the correlation of Alalakh's kings with contemporary kings of neighbouring states possible. Merely the interpretation of the Idrimi's statue inscription caused doubts for scholars, if Idrimi should be interpreted as the father, or the grandson of Niqme-pa (WOOLLEY, 1955). This problem has influenced the chronology for Levels VII to III, as mentioned above.

1.2.3.3 Amuq Valley project (2000-2004) and recent excavations of Tell Atchana

Archaeological surveys conducted in the 1996 indicate that there little evidence for archaeological surface finds around Tell Atchana, and early sites such as the Late Chalcolithic occupation sequences of Tell Atchana were deeply buried, due to the frequent flooding of the Amuq River (YENER et al., 2000).

At the same time as the Amuq Valley Project 2000-2001, the new excavation of Tell Atchana has begun. The reason for the new research was that only a small part of the whole site was excavated by Woolley and that the chronological sequences derived from those excavations have been questioned consistently. According to YENER (2000), given the importance of a second millennium chronological sequence for the history of the whole region, re-examination of Alalakh the Kingdom of Mukish and its relations with its neighbours is necessary.

In the 2004 excavation season, two squares have been uncovered, which probably belong to the private houses, almost at the southeast side of the “grid system” of Tell Atchana excavations (see Fig. 13).

The “grid system” is based on a 1 km by 1 km grid and oriented north-south. This grid system encompasses the tell, which is an approximately 700 m long and 300 m wide elongated oval mound oriented northwest to southeast. The large 1 km by 1 km zone is divided into a hundred “grid units”, each of which measures 100 m by 100 m, and each of these “grids” is, in return, divided into 100 “squares”, each of which measures 10 m by 10 m. The squares are the main units of excavation; “finegrids” (1 m by 1 m) being opened, when street, occupational debris recovered *in situ*.

The “locus” is a real stratigraphic unit (e.g., a wall, floor and hearth), like in other excavations, which means that the given locus may span more than one excavation square. “Pottery pails” contain all potsherds in a locus. These are sorted for washing, sorting and analysis.

The report of the 2004 excavation is still in preparation, and therefore detailed mapping and contexts interpretation for the botanical samples and the occupational sequences are impossible.

1.2.3.4 Location of Tell Atchana’s archaeobotanical samples

In Tell Atchana, archaeobotanical samples come from the contexts of the occupational debris and other floor deposits, kilns, tabuns, bins and occasionally

from pits. All samples belong to Late Bronze Age Tell Atchana occupation (14th century) levels. Examination of the fine gradation of the levels and absolute chronological dating are currently progressing under the Chicago excavation team (YENER pers.com.). Currently, the occupation levels have been summarised as Late Bronze Age.

2. Archaeobotanical methods

In the first part of this Chapter archaeobotanical methods like on-site sampling, flotation, and identification of botanical remains are described, which have been used for Kinet Höyük and Tell Atchana samples. In the second part, the evaluation of archaeobotanical data is illustrated with help of quantitative methods.

2.1 Sampling methods in archaeobotany

The sampling strategy is one of the most discussed problems in the archaeobotanical methods as due to the risk of emerging accidental patterns, which can influence the results of an archaeobotanical analysis.

M. K. JONES (1991) discussed different sampling strategies and mentioned the ‘purposive or judgmental sampling’ as the most effective sampling method in terms of information content, when there is documentation of the sample context, but this method has the danger of being too presumptuous. RIEHL (1999) mentioned that this method seems to be the most commonly practised sampling strategy in the Near Eastern excavations.

‘Probabilistic or random sampling’ has the danger that information will be lost, as due to haphazard selection of sampling locations. Previous knowledge can be neglected, and the most important contexts in terms of the actual broadness of the species spectrum might not be sampled. Under the condition that excavators know the structuring of the whole site in advance and can clearly define all the contexts, they can sample those contexts with random numbers, and finally, calculate the representativeness of the samples (Van der VEEN, 1983). Not only might patterns be accidental, but, if the sampling rate is low, this method can also lead to misinterpretation (RIEHL, 1999). Random sampling is therefore a more suitable method as an additional method rather than a basic one (JONES, 1984).

According to RIEHL (1999), the only way to exclude accidental patterns is to enlarge the coverage of the sampling. This method is commonly used on excavations

with large-scale archaeobiological investigations. But in many cases, it is not possible to sample the whole sediment from an archaeological site and to improve representativeness by high coverage. However, it is generally accepted that large amounts of samples of large volume from the widest possible range of contexts provide the highest probability for representative investigation (RIEHL, 1999).

2.1.1 Sampling method and flotation at Kinet Höyük

In Kinet Höyük and Tell Atchana the archaeobotanical sampling methods seem to be appropriate for the excavated areas and contexts. The excavators of Kinet Höyük preferred a kind of ‘judgmental sampling’, as due to the small scale of excavation sections and visible changes in the contexts. ‘Random sampling’ is proven to be incompatible with excavation methods at Kinet Höyük.

Archaeobotanical documentation sheets of both sites came along with samples, providing information including the date, the trench, coordinates, a context or description of features, stratigraphical dating, sediment volume, and a rough sketch of the location of the sample within the excavated area. On Kinet Höyük sample sheets there are no descriptions concerning sediment quality, which makes the taphonomic interpretation difficult.

Archaeobotanical remains of Kinet Höyük were collected by the archaeobotanist D. Samuel from the University of Cambridge between 1995 and 2001. HYDN (1997) analysed, in her MSc Dissertation, 23 samples from Middle Bronze Levels, 6 from Late Bronze Age Levels, 10 samples from Neo-Assyrian Period 8-10 (Middle Iron Age), a single sample from Middle/Late Iron Age, 13 samples from Late Iron Age and additionally, 5 samples from Hellenistic Period. The remaining samples of Bronze Age, Iron Age and Medieval Age levels have been sent to the Laboratory for Archaeobotany at the University of Tübingen for further analysis. For the botanical analysis of this work 31 samples have been chosen from Late Bronze Age (Levels 13-14) and 2 from Early/Middle Iron Age (Level 12)

The samples derive from pits, bins and hearts, ovens, vessel contents, floor deposits and general fill and had volumes between 40 and 60 l. They were processed with a flotation machine. In the case of a large context, such as floors, samples were taken at several different locations, in order to determinate whether there was any spatial patterning within these contexts. The result was either that different activity

zones could be recognised, or that no significant differences over the surface could be detected (GATES, 2000).

2.1.2 Sampling method and flotation in Tell Atchana

In case of Tell Atchana a combination of ‘systematic sampling’ and ‘judgmental sampling’ has been chosen. Archaeobotanical remains were collected according to a field manual of the Tell Atchana excavation by the excavators. The samples were taken from each finegrid square in a living surface, which resulted in systematic sampling of all floors, courtyards, and streets. In the case of the thin debris layers, lying below or above living surfaces, the flotation samples have consisted of the entire contents of the locus within the fine square. From features like ovens, pits, and hearts, which seemed to contain botanical remains, it was tried to take 4 buckets of flotation samples.

In the excavation season of 2003, botanical samples have been floated by Dr. Simone Riehl and Katrin Hieke from the University of Tübingen. In the 2004 season, the flotation of botanical samples has been performed by the same team and the author. In the 2004 excavation season, 1019 litres of sediment were floated. The sample sizes were between one and 75 litres with a mean of 32 litres (4 buckets), which is recommended as a standard.

The flotation machine was constructed with 3 tanks of different sizes, a water pump, which allows water circulation from the biggest tank to the smallest. The biggest water tank has a holed pipe, which spreads water up to the mesh. A fine mesh of 2 mm was chosen. The sediment was poured into water through the firm mesh at the boarder of the tank. Fine sediment particles went down to the bottom of the tank, and the organic parts, especially charcoals and carbonised archaeobotanical remains floated onto the fine sieve (Fig. 14: Flotation machine). With help of this machine, archaeobotanists were able to float the sediments rapidly, which is unlikely by hand flotation. After the flotation, the wet samples were dried in small bounded bags, kept away from the direct sunlight. The dried samples have been packed into small hard boxes to avoid a damaging by transport.

From Late Bronze Age Tell Atchana 35 samples have been chosen for the botanical analysis of this work. The flots or ‘light fractions’ of the samples were sorted for identification in the laboratory of the University of Tübingen. Sorting was conducted with an Euromex binocular under 10- to 30-fold magnification using soft

tweezers For efficient sorting (i.e. separation of carbonized from uncarbonized light remains) the samples have to be separated by dry sieving into different fractions (1mm, 0.63mm and 0.18mm). Typical remains of the 1mm fraction are cereal grains, crop pulses and charcoal. Most of the wild plant taxa are recovered from the smaller fractions. Fully sorting large samples or fine fractions (<1 mm) of some samples, mostly in the case of Kinet Höyük and rarely in the case of Tell Atchana, would have been too time consuming. With the advice of Dr. S. Riehl, sub-sampling had to be conducted by a cumulative sampling method with a riffle-type sample splitter, which splits samples in two identical halves. Sub-samples of 1/8 or 1/4 were sorted to obtain an appropriate number of seeds. Larger fractions were sorted, if necessary.. Wood charcoals in the samples have been sorted out for the wood charcoal analysis conducted by Kathleen Deckers from the same university.

2.1.4 Identification and documentation

Identifications were conducted using the comparative collections in the Laboratory of Archaeobotany at the University of Tübingen and relevant archaeobotanical publications (e.g. ANDERBERG, 1994; BERGGREN 1969, 1981; JACOMET, 1987; SCHOCH, PAWLIK and SCHWEINGRUBER, 1988; Van ZEIST and BAKKER-HEERES, 1985). Information about identification and additional data are documented in the catalogue.

As a modern reference, *Flora of Turkey* published by DAVIS (1965-1988) was very useful for this work for flora of the research area. In cases that a genus is very rich in species in modern vegetation, the comparative seed collections do not reach to complete identification. Occasionally, the archaeobotanical object could not be checked for similarities with all of the modern species that are recorded for the area, because their seeds are not available in the botanical collections (RIEHL, 1999). In the case of ‘missing taxa’, the seed, if it matched one of the available species in collection, was described with the extension name ‘type’.

2.1.5 Some remarks on the contamination of archaeological sediments with modern seeds and the presence of mineralised seeds

The most common modern seed contaminant in both sites was *Chenopodium* sp. They occur in large numbers, especially in the samples of Tell Atchana.

Lithospermum seeds were present in one sample of Kinet Höyük (99-0-71) as modern contaminants.

Some species were preserved both in carbonised and mineralised forms. The mineralised seeds are *Carex* sp., *Fumaria* sp. and *Ficus carica* seeds. Some of the mineralised *Carex* sp. seeds are greyish-white, which might have been caused by contact with fire. The differences between mineralised sub-fossils and modern contaminants are easily observable.

Silica skeleton of macroscopic plant remains from ash of a Late Bronze Age site Wiltshire and a 2nd century A.D. site Welton Wold have been studied by M. Robinson and V. Straker (1991).

Silica bodies or silicified cells comprising opal SiO₂ · n H₂O are present in very wide range of plant taxa. The structures, become silicified, can include membranes, cell linings, etc. Purposes of silica deposition in plants are not entirely clear; it is possible that silica bodies serve to make some plant structures more rigid (ROBINSON and STRAKER, 1991). Silicification is greater in hot and arid climates, perhaps due to a greater rate of transpiration. Macroscopic silica remains provide the opportunity of retrieving information on plant material that has been burnt under fully oxidising conditions (ROBINSON and STRAKER, 1991).

In the case of the silicified macro remains of Kinet Höyük, they derive mostly from shell pit contexts. Only some of *Carex* sp. seeds show greyish-white colour as a trace of possible contact with fire, as mentioned above. Most of the seeds have no visible traces of fire contact. Mineralization of these seeds might have been caused by water presence in shell pits.

2.2 The Evaluation of the Archaeobotanical data

2.2.1 Taphonomy of the botanical macro remains from Kinet Höyük and Tell Atchana

The taphonomic conditions of both settlements are different. The main portion of the Tell Atchana macro remains are distorted, fragmented or poorly preserved, one of the reasons of this occurrence could be “mechanical stress” (RIEHL, 1999). That means that aggressive agents like micro fauna and roots can disturb the botanical remains and sediment particles. It was observed during the flotation of soil samples in Tell Atchana that samples often show organic disturbance like roots and other micro faunal traces, which have been recorded in botanical

sample sheets. Another taphonomic problem for the identification of the botanical remains was the high chalk content of the soil, which plastered the seeds and made in some case their cleaning by diluted acid preparation essential. The chalky soil can damage the fragile carbonised remains, because of its potential to harden the sediment (RIEHL, 1999). According to HUBBARD (1976), the metrical characteristics of crops are influenced not only by soil and topographical conditions, but also by disease and weather (with the former being more drastic).

In general, the botanical samples from Kinet Höyük seem to have a better preservation than those in Tell Atchana. Tell Atchana samples derive from Late Bronze occupation sequences, which lie ca. 97 cm above of modern soil surface. This smaller elevation difference between modern soil surface and sampled contexts suggests that taphonomy of the botanical remains must have been negatively influenced by the roots, climatic conditions, micro-fauna and at least by human activities.

Unfortunately, there are no descriptions of either the soil type, elevation or other material classes, which can be important for the taphonomic interpretation of sample sheets of Kinet Höyük. In case of Kinet Höyük samples, it is not easy to say, if the preservation of the seeds was caused mainly by crop processing and food preparation activities or by post-depositional preservation problems, like soil quality, micro fauna and roots without the descriptions of soil quality (probably a combination was responsible for the taphonomy of the botanical samples).

According to G. JONES (1991), it is important to distinguish between ‘preservation’ and ‘distortion’ for the taphonomic conditions of the archaeobotanical seeds. ‘Distortion’ is the result of charring, the effects of which vary according to severity of the charring conditions (e.g. temperature, supply of oxygen etc.) and ripeness, dryness of the grain. ‘Preservation’ is largely related to post-charring conditions both before and after burial – in particular to mechanical damage and the effects of wetting and drying. For example, the pounding to make ‘bulgur’ from durum wheat (HILLMAN 1984b; G. JONES, 1991) or the coarse grinding of pulses to remove the testa and split the seed, (e.g. in the manufacture ‘fava’ or ‘split peas’) (G. JONES, 1991) causes fragmentation and distortion of the crop seeds.

The remains of crop plants in both sites are partly strongly fragmented or distorted, but in comparison, wild plant remains have better preservation than the crop plants. Considering wheat fragments, there is no evidence of bulgur production.

2.2.2 *Quantitative methods*

According to G. JONES (1991), the differentiation between numerical description (counting things) and interpretation (assessing importance) of archaeobotanical data is important but absent from much of archaeobotanical literature. The purpose of numerical description in archaeobotany should be understood as a basis for the inference of past human behaviour. In her opinion, it is desirable to choose for the numerical descriptions a ‘unit of analysis’ or ‘behavioural episode’, which results from a single human activity. However the sampling of one context several times, in hope of isolating separate behavioural episodes, may finally prove to be of common origin. The numerical description of the archaeobotanical data at the level of a site or phase conflates the results of numerous different activities and so loses sight of the description (G. JONES, 1991). In her opinion, it is necessary to apply other statistical methods like multivariate analysis, especially for the statistical evaluation of a large amount of samples from an archaeological site.

According to G. JONES (1991), the presence analysis is as a semi-quantitative method only reliable for samples of equal size and under the precondition that multiple sampling of the same context can be excluded. One deposition event (e.g. an architectural layer) might be sampled several times, or different events within one feature (e.g. layers in one ditch) might be unrecognised. In the case of Kinet Höyük and Tell Atchana, samples which come from the same context have been presented on the plans of the site together with the descriptive graphs. ‘Ubiquity’ or ‘frequency’ is used as statistical method to show how common a species is within the set of samples (RIEHL, 1999). The descriptions and interpretations about the ubiquity of crop species of both sites are mentioned in Chapter 3. More information about the ubiquity of each species is available in the catalogue.

The percentage occurrence of specific plant groups (e.g. crops) in both sites gives an impression of dominance or under-representation of each species in each site. Dominance of a species within the set of analysed samples should not be confused with the ‘importance’, which would be an ‘unjustified assumption’ that numerical values reflect importance (DENNELL, 1976; G. JONES, 1991; RIEHL, 1999).

At least percentage occurrence gives a clear pattern of the increase or decrease of ubiquities of single species in one site from a time period to another time

period, in this work; Kinet Höyük and Tell Atchana have been compared with this method in Chapter 3 to see the differences in the occurrences of crop species and wild plant taxa.

Density partly reflects the rate of deposition and can therefore help to distinguish material discarded all at once from that discarded piecemeal over a period of time and mixed with other refuse (G. JONES, 1991). She mentioned as a case, where dung is the predominant fuel, density of charred seed may also indicate level of fuel use and thus contribute to the identification of seasonal strata in a refuse deposit.

In this work the seed density per sample of both sites have been shown by graphs and interpreted in Chapter 3.

Another measure used in archaeobotany to describe the composition of a plant assemblage is its diversity. According to G. JONES (1991), the ratio of numbers of species to the numbers of seeds is the simplest expression of diversity, but this ratio is influenced by the sample size. The same ratios can be produced depending on the degrees of evenness of abundance (i.e. few species with even abundance can produce the same ratio as many species with uneven abundance). The evenness of species should be considered.

According to PEARSAL (2000), the species diversity can be taken into consideration to give information on the total number of species represented and the abundance of each species at a site.

Low species diversity, especially in crop species, at the level of whole assemblage is not rarely interpreted as an indicator of specialisation in one site. This aspect is discussed in Chapter 5. However, the comparability of the diversity measures between different sites creates difficulties, especially as due to the different preservation conditions of the sites (RIEHL, 1999) (The differences between 'distortion' and 'preservation', in the taphonomic sense, have been mentioned above). The importance of recording preservation and distortion separately for charred remains is appropriately emphasised by G. JONES (1991) on the grounds that two results of different taphonomic processes and mention the numerical scales for recording preservation and distortion of cereal grains, depending on the homogeneity of the sample.

In this work, it was decided not to use the numerical scales (e.g. Shannon-Weaver index) to calculate species diversity, because of the overall different

taphonomic conditions of the both sites. Instead, only the presence of crop species in Late Bronze Age Kinet Höyük and Tell Atchana was compared to give an impression of the broadness of the spectra of cultivated plants. Wild plant taxa have been categorised into ‘eco-groups’ to give an overview about the distribution of wild taxa (Appendix 5). This distribution and the criteria are explained by the graphs in Chapter 3. More detailed information about species of wild plant taxa are provided by the Excel-Tables (Appendices 1-5).

In archaeobotany, canonical discriminant analysis is used to determine crop-processing stages. This multivariate method is pointed out by JONES (1984, 1987, 1991), CHARLES, JONES & HODGSON (1997) and HILLMAN (1984a, 1984b) and worked out in ethnographic study by Jones on Amorgos in south Greece (G. JONES, 1991).

However, in the case of this work, weed occurrence is limited to only a few taxa, and in a small amount of the sample number. Therefore, it was possible to obtain the evidence of crop processing activities without multivariate analysis. In both settlements, the crop processing by-products from early stages are very scarce; they likely occur only as contaminants. The interpretation of the crop processing stages with help of weed occurrences will be mentioned in Chapters 3 and 5.

2.2.3 Recording system and data preparation

Analysed 68 samples from Late Bronze Age Tell Atchana and Late Bronze Age Kinet Höyük have been reconsidered for the statistical evaluation. The Early/Middle Iron Age samples are due to the insignificant number of analysed samples not representative and were taken statistically not into consideration. At the beginning of botanical analysis of both sites, the aim was to analyse Kinet Höyük not only from Late Bronze Age samples, but also about 30 samples from the Early Iron Age levels to make a comparison between the Late Bronze Age and Iron Age ecological as well as economical patterns, especially for the estimations of the transition level from Late Bronze Age to Early Iron Age Kinet Höyük. But only 2 samples were available from the transitional period between Late Bronze/Early Iron Age and 10 samples from Early Iron Age levels.

The small amount of the total number of the samples and the poor evidence of seed density (see Graphs 1-2 and Appendices 1-4) per litre sediment allowed statistical evaluation of data only with simple descriptive methods. The number of

the samples, which have more than 50 seeds and would, therefore, be suitable for multivariate statistical methods are limited to 15 for Kinet Höyük 15 and 5 for Tell Atchana. Due to the poor evidence of the seed density in the samples, and with the advice of Dr. S. Riehl, the more advanced statistical methods like multivariate methods and correspondence analysis are considered inappropriate for this work.

The first steps of the data analysis were done with simple evaluations of sample composition for each sample and for each site in Excel. Because of the small total sample amount, the analysed samples of both sites have been described with their archaeological context together, to give the reader an impression of the possible functions of the contexts. In many cases, the similarities and differences between the samples could be easily recognised.

Samples have been taken into consideration for descriptive methods when they included more than 20 seeds, which applied for 27 samples of Kinet Höyük and 19 samples of Tell Atchana. Total soil volume of the analysed Late Bronze Age samples in Kinet Höyük is 1025 litres, but five of the analysed samples have no description about the soil volume, these are the samples 99-0045 (KT.11943), 99-071 (KT.12794), 99-0056 (KT.12732), 99-0075 (KT.13010) and 99-020 (KT.1140) and left out of consideration in the graphs of the seed density in the Kinet Höyük samples. Total soil volume of the analysed samples for Tell Atchana corresponds to 1014 litres and one of the samples (BP 43) without description of soil volume has not been taken into consideration. Excel, could aid to evaluate ecological and economical questions for both sites.

Ecological aspects of plants include potential habitats and life form. Problems related to the application or adoption of modern plant ecology and phytosociology to the archaeobotanical remains are discussed below. Basic ecological groupings of plants were conducted according to modern plant communities recorded by DAVIS (1965-1988). Number of represented plant families in whole data set is 16, the number of species, types and genera in Kinet Höyük 47 and in Tell Atchana 48.

2.2.4 Ecological evaluation of the data

The ecological classification of species was carried out for pattern searching. According to RIEHL (1999), ecological classification of wild species through the use of schemes for their potential ecological habitat is difficult for living populations and even more so for archaeological remains. Phytosociology and archaeobotany

have totally different quantitative approaches, which is complicated by archaeological questions of taphonomy and uniformity in the origin and the selectivity of remains, due to the different times of seed maturity, resulting in an incomplete species composition (RIEHL, 1999). This problem is widely discussed in archaeobotany (KÜSTER, 1991; HILLMAN 1991; BEHRE and JACOMET 1991, JONES, 1992).

According to KÜSTER (1991), it is not feasible to use the terms of phytosociology for the group of archaeological macro remains. It is not possible to recognise one specific plant community in an archaeological context, but groups of like “formations” such as ‘forest plants’, ‘crop weeds’ and ‘grassland species’. He proposes as a method the listing of the plant species, which are observed in an archaeological context and also indicate, in which plant communities these species most commonly occur in the present day.

Because a plant species might grow within different plant communities, the phytosociological system is fairly inflexible, while autecology allows much more flexibility in considering potential habitats in a prehistoric landscape (RIEHL; 1999 KÜSTER 1991). Furthermore, a chronological change in ecological attributes is known for several species. This includes a change in optimal habitats, so that modern indicator species might be misleading (RIEHL, 1999).

Due to this reasoning, the phytosociological approach was not undertaken in this work. Eco-groups, which occur in Kinet Höyük and Tell Atchana, can be comprehended as a model to summarise species with similar autecological behaviour (Appendix 5).

Defining the formation systems of the weed communities and factors, which influence them, is difficult. There is still no reliable method to group the weeds in archaeological remains under specific categories (RIEHL, 1999).

HANF (1990) divides the factors, which are responsible for the composition of a weed assemblage into two groups; ‘unspecific factors’ and ‘specific factors’. The first group consists of general factors such as climatic and soil conditions, the second considers ‘specific factors’ like soil treatment, crop planting and harvesting method conducted by humans. This second factor can give good information on interrelations between the weed classes and specific types of cultivation. JONES (1992) relates the ‘Chenopodietae’ type of weeds, which require high soil fertility, with garden-type cultivation and the ‘Secalietae’ type of weeds with cereal

cultivation, because both classes are more likely to be stronger dependent on soil treatment than on seed germination times, although winter annual ‘Secalietae’ and summer annual ‘Chenopodietae’ weed communities belong to two different phytosociological classes. Some other botanists support the separation of these two weed communities not according to the dependence of soil treatment, but according to the seed germination times (RIEHL, 1999).

Some research (CHARLES, JONES and HODGSON, 1997) compares functional and ecological attributes of wild plants and correlates them with ecological significance.

Ecological data for this work is based on the *Flora of Turkey* by DAVIS (1965-1988). Ecological information about the species was used for the classification of the “eco-groups” (see also RIEHL, 1999). Regarding to this qualification, weed categories contain only typical weed species in the modern sense, however categories like ‘open vegetation’ contain potential weeds, as well. In Chapter 3, in the sample description the possible weeds will be mentioned.

2.2.5 The economic evaluation of the data

2.2.5.1 Possible plant use in Kinet Höyük and Tell Atchana

Economic importance of plants in the past could be very different from today. In Mediterranean communities, wild plants find different purposes; before categorising them as weeds, it is useful to look for other economic meanings: for consumption, medicinal use, for building purposes, and or fuel (e.g. dung). In Near Eastern regions, where wood resources are meagre, fuel can be obtained from the maquis, garrigue and other alternative fuel resources. The scrubby plants have been brought into the settlements for fuel purposes in the Late Bronze Age with the opening of woodland vegetation and intensive charcoal fabrication for metal production (RIEHL, 1999).

Some species of modern weed plants like *Salsola* and *Valerianella dentata* were used in historical times as enrichments of the human diet and prepared as salad or spices. Even if these weeds are not used in the relevant region today for the human consumption, it does not mean they might not have been used in historical times. This conclusion is also applicable for many wild plants. The possible medicinal use of the plant could be assumed from the archaeobotanical sample composition and contexts. *Galium aparine* helps against dermatologic problems, as well as liver and

bladder sufferers, *Heliotropium europaeum* has effects against poisonous bites, *Artemisia annua* is styptic, has prophylactic effect against malaria and *Fumaria officinalis* have some antispasmodic and antiseptic effects (RIEHL, 1999).

Dung is an important alternative fuel resource in the Mediterranean and the Near East, especially in regions with scarce wood cover. The importance of dung in the formation of archaeobotanical contexts is discussed in different publications (MILLER, 1984). Crop processing residues and ‘maslins’, a kind of crop mixtures would have also been used for animal feeding (JONES and HALSTEAD, 1995). In the case of Tell Atchana and Kinet Höyük, the recovery of archaeological contexts, in which dung use is proven, could be helpful for the interpretations about the plants, which were used as animal fodder and for human consumption. The use of dung as a fuel means, losing it as fertiliser for the soil.

2.2.5.2 Soil treatment and farming activities

Soil treatment, disturbance of the ground and destruction of the roots can influence the appearance of the annual weeds in arable fields. Another agricultural activity, which gives information about the technical development stage, is weed control (RIEHL, 1999; HILLMAN, 1984a). Hillman mentions some harvesting methods, in which the low growing weeds do not appear in harvested crops, because the crops were cut immediately below the ears. This method can influence the presence of low-growing weeds in the samples positively, but the mere presence of the low-growing weeds in the archaeobotanical samples does not mean harvesting close to the ears. The presence or absence of the low-growing weeds may give information about the potential growing heights of cereals or wild plants (RIEHL, 1999).

Estimation of sowing times is also important for the reconstruction of seasonality and the productivity of the site (RIEHL, 1999; HILLMAN, 1981 and 1984a). HILLMAN (1981) refers to a study of M. Jones and P. Reynolds, that the weed flora of crops, which are sown in autumn, differs significantly from that of the same crop sown in spring, and added that the noxious weed cleavers (*Galium aparine*) is restricted to autumn sown crops, which is observed in case of the spelt wheat remains from Iron Age and Romano-British sites. Using the absence of cleavers seeds as indicator for spring sowing is more problematic. When other autumn germinating weeds from the same size range and similar habit like Cleavers

are also absent in the archaeobotanical samples, as due to the above mentioned harvesting methods, they could be an indicator for spring time sowing. Due to traditional sowing times, barley and pulses are sown more in spring (in the case of barley, the vegetative period is shorter than those in autumn sowing, but a grain yield is possible; in the case of pulses, they are mostly cold sensitive and to be sown in autumn) (HILLMAN, 1981).

Differentiation between the “pastoralist” and the “producer” sites is used for interpretations of plant food as an object of trade. By-products in certain stages of crop processing can be interpreted as remains of “producer” sites, missing by-products and the limited presence of weeds, which are not separable from the crops with the crop processing, can be understood as an indicator for “pastoralist” or “consumer” sites (RIEHL, 1999; HILLMANN, 1981). It is also possible, that the deposit of the early stage remains of crop processing in activity zones has still not been recovered. This problem is discussed for Kinet Höyük and Tell Atchana in Chapter 5.

As animal fodder, some potential fodder plants (e.g. *Vicia ervilia*, *Melilotus* sp.) are present in both settlements. Weed plants, which were not associated with the crop plants, can have a use as fodder or dung. The different growing heights of the plants make them available for different animals. Due to the differences between the masticatory apparatus between sheep/ goats and cows, low-growing plants are more suitable for sheep/ goats and the high growing plants for cows. A clear domination of short growing potential fodder plants may indicate that those remains originate with high possibility from sheep rather than from cattle fodder (RIEHL, 1999).

3. Sample descriptions and analytical results

In the first part of this Chapter the analysed botanical samples of both sites are described according to their context relations. In the second part, ‘Analytical results’, the analysed crop plants and wild taxa are illustrated to give an economical and ecological outline for both sites.

3.1 Functional meaning of deposits for archaeobotanical analysis

The descriptions of the contexts, from which the archaeobotanical samples have been derived, are based on their function; which itself is closely related to

architectural structures. The find contexts additionally give information about human activities like storing, cooking, wasting, etc.

In general, the floors inside of the building are not rich in botanical remains, because of cleaning activities. Accidentally burnt floors, which might have been caused by attacks or catastrophic circumstances, can contain more plant remains than unburnt ones. "Fills", as opposed to floor deposits, contain generally more plant remains, but the classification of an activity in such context is difficult. There are more concentrated deposits in ovens, hearths and firing places than on floors, since charred remains can survive better than the remains from the other contexts. But, if remains were very close to fire, they are mostly strongly charred or deformed, making identification of the remains impossible. The contents of jars, bowls or other storage facilities can include (depending on the function of the container), different amounts and spectra of plant remains. After cleaning activities, walls and postholes are suitable places for the accumulation of the different small objects; they are in general richer in remains than the middle of floors. Pits are used as disposal places.

3.2 Description and interpretation of contexts and samples

3.2.1 Late Bronze Age Kinet Höyük samples from the 1997 excavation season

The Kinet Höyük samples are described according to their context relations. The samples come from different contexts, i.e. kilns, floors, firing places, hearths, jar contents, ovens, postholes and pits (see Fig. 9-11 and Appendices 1-2). Crop plants are mentioned with their Latin and English nomenclature. Weed and wild plant names are mentioned only with their Latin nomenclature. English names of all taxa are given in the catalogue.

3.2.1.1 Samples from pit and posthole contexts

Sample **97-70** was taken from OP L (KT. 8573 Locus 62 Lot. 295; total seed amount 373) and comes from a shell pit context (Locus 62) and nearby secondary pit (Locus 54; see Fig. 9). The shell pit belongs to Late Bronze Age Level 13. The botanical sample from this deposit is the richest sample in Kinet Höyük with a density of 11 seeds per litre sediment. Although 42 different cereal remains have been recovered from this pit, only a single emmer chaff has been found. The sample is also rich in pulse seeds like *Lathyrus sativus*/*Vicia ervilia* (grass pea/ bitter vetch,

2 seeds), *Vicia faba* (broad bean, 5 seeds) and fruits like *Vitis vinifera* (vine grape, 4 seeds), *Punica granatum* (pomegranate, 2 seeds) and also in cereal weeds like the *Lolium remotum* Schrank-type and the *Lolium temulentum*-type. 16 mineralised seeds of *Carex* species were also found there. The reason for the mineralised preservation of these seeds could be the presence of water in the pit. Function of this shell pit might be a waste pit. Possible use as a storage facility for human consumption or animal fodder seems to be unlikely, since the high percentage of crop seeds of weeds like 142 *Lolium remotum* seeds, 5 *Lolium temulentum*, 2 *Asperula arvensis/orientalis*, 5 *Galium aparine/spurium*, 9 *Galium* sp., open vegetation plants, possible weeds like *Lolium* sp. (59 seeds), *Phalaris minor* (4 seeds), 9 *Gramineae* seeds, *Medicago* sp. (3 seeds), *Trifolium/Melilotus* (7 seeds), small seeded *Leguminosae* (21 seeds), and 13 *Bupleurum* sp. (163 weed-55 crop seeds) in this pit. As remains of crop processing stages, the weed taxa (*Trifolium/Melilotus*, small seeded *Leguminosae* and *Lolium* sp.) were the fine sieve by-products, because they are already smaller than crop plants like barley and wheat; they could have been passed through the sieve, which were used as ‘chicken fodder’ or thrown into a fire. A single winnowing by-product (chaff remain) could be seen as a contaminant of fine-sieve by-products. According to JONES (1984), the fine sieve as a crop processing stage carried out piecemeal through the year, ethno-archaeologically; it would be impossible to collect sufficient samples of fine sieve by-products during the harvest season alone, because the crops are stored without fine-sieving and sieved shortly before for the food preparation.

Another sample **97-67** (OP L, KT. 8439, Locus 62, Lot 289; total seed amount 135) from the same pit is one of the richer Late Bronze Age samples of Kinet Höyük and dates to the Late Bronze Age Level 13, as well. 12 cereal seeds, 17 pulses and one *Vitis vinifera* pipe have been recorded. 70 *Lolium remotum* and 4 *Lolium perenne* seeds are also well represented, similar to sample 97-70. Other non-identified *Gramineae* (13 seeds), *Trifolium/Melilotus* (6 seeds) small seeded *Leguminosae* (6 seeds) are also common. This sample composition supports the assumptions about the fine sieve crop processing residues in a shell pit context.

Sample **97-73** (OP L, KT. 8638, Locus 68, Lot 305; total seed amount 12) is taken from a posthole in the area 5E of a Late Bronze Age house, between walls 64 and 66 (see Fig. 9); it is relatively poor in archaeobotanical remains. Only 12 botanical objects, as crop plant remains only 2 *T. dicoccum* (emmer wheat) chaff

remains, no cereals, one *Vitis* (grape vine) fragment, as crop weeds 4 *Galium aparine/spurium*, as an open vegetation plant and possible weed, 2 seeds of *Malva* sp. and 2 of *Melilotus* sp. have been found. It could be interpreted in this context, that winnowing by-products, acting as contaminants of fine-sieve by-products, were accumulated as waste in this posthole. The sample is dated to Late Bronze Age Level 13.

Sample **97-71** (OP L, KT. 8576, Locus 67, Lot 296; total seed amount 59), like samples 97-70 and 97-67 from the shell pit (see Fig. 9), comes from the room of Late Bronze Age 5E house floor deposit and dates to the Late Bronze Age Level 14. Botanical remains are limited to 25 seeds of *T. aestivum/ durum* (bread/ durum wheat), 2 seeds of *Hordeum cf. vulgare* (barley) and, as cereal weeds, 9 seeds of *Lolium remotum*, 2 *Lolium* sp. and 19 unidentified seeds of the *Gramineae* family. Although the sample comes from a floor context, it is rich in cereal remains, almost a “monocrop sample”. It is very likely that the room was used for storage of fodder or as a food processing area with two different pits; one of them, pit 62, was very probably used as a waste pit.

Sample **97-62** (OP L, KT. 8363, Locus 58, Lot 276; total seed amount 39) was received from a small pit 58 in room 55. The location of the pit 58 is not visible on the plan of OP J/ L; it lies south of the small posthole in Locus 55 and dates to the Late Bronze Age Level 13. There are no cereals or other crop plant remains in this sample, but as crop weed 3 *Lolium remotum* and 2 *Lolium* sp., as possible weed 4 small seeded *Leguminosae* and 5 *Valerianella* sp. as plant of various habitats 17 mineralised *Carex* seeds have been found. According to the analysed plant remains, the function of this pit is not really known. One possible use is as a waste place or as a storage for animal fodder, due to the scarcity of crop weeds and the absence of the other crop processing by-products. The mineralised *Carex* seeds could be reminding the sample 97-70 (KT.8573) the presence of water in this pit.

Sample **97-60** (OP L, KT. 8385, Locus 59, Lot 278; total seed amount 50) is gained from a large pit (Locus 59) from room 55 (see Fig. 9). The sample is, despite a soil volume of 32 litres, not rich in botanical remains (like the sample 97-62). The remains are concentrated on 14 seeds of *T. aestivum/ durum* (bread/ durum wheat) and 2 *Hordeum cf. vulgare* (barley), 5 unidentified cereal remains, and, as cereal weed, 9 *Lolium remotum*, 2 *Lolium* sp., 16 unidentified *Gramineae* seeds and 2 small seeded *Gramineae*. This pit may be interpreted as a small storage facility for animal

fodder or a waste pit of a working place, due to the higher amount of crop weeds as fine sieve by-products and unidentified *Gramineae* seeds. The pit belongs to the Late Bronze Level 13, as well.

3.2.1.2 Sample from jar

Sample **97-78** (OP L, KT. 8833, Locus 71, Lot 321; total seed amount 20) is a jar content from the Late Bronze Age destruction layer on Level 14 close to locus 71 (see Fig. 9). According to GATES (1999), although reason for the destruction is not mentioned, it is described as “collapsed mud brick super structure into the room cause of burning”. The jar content was very poor in regard to botanical remains; only one *T. aestivum/ durum* seed, one unidentified *Cerealia* seed, crop weeds 2 *Bromus* sp. and 1 *Heliotropium* cf. *europaeum*, as possible weed 2 *Bupleurum* sp., 4 unidentified *Gramineae* seeds, 1 *Medicago* sp. and 6 unidentified small *Leguminosae* seeds and as open vegetation plant 2 unidentified *Compositae* seeds were found. The jar does not seem to be a storage vessel for grains.

3.2.2 The Late Bronze Age Kinet Höyük samples from the 1998 excavation season

3.2.2.1 Samples from pit, posthole and fill contexts

Sample **98-012** (OP J/L, KT. 9530, Locus 94, Lot 384; total seed amount 23) is collected from 2 small pits together. The pits are located at the north-east edge of the OP L (see Fig. 11) and belong to late Level 14. According to the excavator, M. H. Gates, it is estimated that the pits were used for animal burrows. The sample includes as crop plants 3 *T. aestivum/ durum* grains, 1 unidentified cereal, 2 *Lens culinaris*, 1 *Vicia ervilia* (bitter vetch), 1 *Vitis vinifera*, 1 unidentified large pulse, as weed 3 *Lolium remotum* seeds, as open vegetation plants and possible weeds 1 *Lolium* seeds, 5 unidentified *Gramineae* and 5 small seeded *Leguminosae*. The function of the pit is not really comprehensible through the botanical evaluation.

Sample **98-002** (OP J/L, KT. 09304, Locus 91, Lot 376; total seed amount 154) is collected from a wash fill (see Fig. 11), just below the lowest or earliest Level 13. According to the excavator sketch, location of the wash fill (west of pit 62), is not really comprehensible. In this fill-sample crop plants 3 *T. dicoccum* (emmer) and 4 *T. aestivum/ durum* remains, 1 unidentified *Triticum* sp., as weeds 14 *Lolium remotum*, as possible weeds and open vegetation plants 10 *Lolium* sp. seeds and 17 unidentified *Gramineae* seeds, because of the special taphonomic conditions in the wash fill,

more than 80 mineralised preserved seeds of *Carex* sp., and 18 mineralised pips of moisture-indicating plant *Ficus carica* (fig), and as possible weed 2 mineralised *Medicago* sp. were found, as an indicator of arable fields 1 mineralised relative big *Adonis annua* fruitlet, as a probable weed 1 *Fumaria* sp. and one insect (Drawing 44). The presence of water in this fill can be assumed by the mineralised preservation of the seeds and supports the excavator's suspect, that the use of this context as a "wash fill". There are fine-sieve by-products of crops and some crop plant remains, which may have been thrown away into this pit.

Sample **98-004** (OP J/L, KT. 09316, Locus 84, Lot 379; total seed amount 15) is from a possible posthole deposit and is located to the east of wall 73 (see Fig. 10); it belongs to the upper Level 14 and is related to sample 98-013. According to the archaeobotanist, during sieving one grape and one *Lolium* seed have been found. The sample seems to be relatively poor in botanical remains; as crop plant only 1 *Vitis vinifera* pip, as weeds 3 seeds of *Lolium remotum*, as open vegetation plant and possible weeds 2 *Lolium* sp., 6 unidentified *Gramineae* and 2 *Polygonum* sp. seeds, 1 *Phalaris minor*-type seed were found. As expected, some plant remains were accumulated from the floors into the posthole.

Sample **98-013** (OP J/L, KT. 9125, Locus 86, Lot 356; total seed amount 35) is collected from an intermediate fill context above the northern extension of wall 73 (see Fig. 11). This context belongs to early Level 13 or late Level 14. After sieving, one pea and one wheat fragment were found. The sample was, for an intermediate deposit, not poor; the botanical remains were likely accumulated at the edge of wall 70 and wall 73, since the floor cleaned to this direction. In this sample 2 *T. aestivum/durum*, 2 *Hordeum* cf. *vulgare*, 2 *Lens culinaris*, 1 unidentified large pulse, as weeds 3 seeds of different *Lolium* species and as open vegetation plants 1 *Medicago* sp., 15 *Trifolium* sp., 1 small seeded *Leguminosae*, 1 *Carex* sp., 1 unidentified *Compositae*, 1 *Bupleurum* sp. have been recovered.

3.2.2.2 Samples from hearts and ovens

Sample, **98-009** (OP J/L, KT. 9262, Locus 88, Lot 366; total seed amount 20) is taken from the material that stuck on to back of clay pieces, parts of sides and roofing of an 'oven' (Locus 88; see Fig. 10). The oven belongs to the early Level 13 or late Level 14 of the Late Bronze Age. After the flotation comments of archaeobotanists, there were no seeds on the sieve, but a surprising amount of wood

charcoal has been found in only 2 litres of sample volume. The macro remains consisted of crop weed 4 *Lolium remotum*, as possible weed 8 *Lolium* sp., unidentified *Gramineae* and 3 small seeded *Leguminosae* like in the related sample 98-025. It is astonishing that no cereal remains or other crop plant remains have been found from this 'oven context' sample. In general, during cooking and baking accidentally carbonised cereals and pulses are usually uncovered in an oven context, but crop weeds like *Lolium* could be seen as an indicator to the use of fine sieve by-products as fuel in the oven.

Sample **98-034** (OP J/L, KT.9751, Locus 101, Lot 399; total seed amount 28) is taken from an unusual stone lined feature (Locus 101) with traces of burning, possible cooking activities and includes matter stuck on the bark of a large sherd from a cooking pot (see Fig. 11); it belongs to Level 14 of the Late Bronze Age. This sample is related to 98-041 (KT. 9788) and includes: as crop plant a single *Triticum* sp. seed, 1 unidentified large pulse seed, as open vegetation plants and possible weeds 10 unidentified *Gramineae* seeds, 10 *Trifolium/Melilotus* seeds, 1 *Bupleurum* sp. seed and 3 small seeded *Leguminosae*. It is astonishing to find only small amounts of botanical remains in this structure, if it was used for cooking activities. The possibility that the feature was cleaned very properly after each cooking or baking activity is unusual. High temperatures might have caused the total charring of crop remains. One possibility that the feature is used for the heating of the kitchen is a plausible explanation to why the structure includes some possible weed seeds, which came in with fuel.

Sample **98-076** (OP J/L, KT. 10118, Locus 108, Lot 430; total seed amount 66) comes from the bottom section of the fill inside an oven (see Fig. 11). A plate has been found on top of this fill. The context is related to the other samples from the kitchen deposit (Locus 99) and, like other contexts, belongs to Period 14. From this oven context, crop plants 1 *T. aestivum/ durum*, 2 *Hordeum* cf. *vulgare*, 8 *Lens culinaris*, 10 unidentified large pulses, as crop weed 2 *Valerianella dentata*, as possible crop weeds and open vegetation plants 6 *Lolium* sp. 19 unidentified *Gramineae* seeds, 1 *Artemisia annua*, 4 unidentified *Compositae* seeds, 9 small seeded *Leguminosae* inclusive *Trifolium* sp. seeds and 2 *Bupleurum* sp. seeds have been recovered. Apparently, aberrational burnt weeds and other wild species are due to their possible use as fuel, predominate in this sample; it does not mean, however, that the oven was not used for baking or cooking purposes. It is possible that

“negative evidence” occurs and that the cereals may have been used for baking, but charred intentionally.

3.2.2.3 Samples from jars

Sample **98-061** (OP J/L, KT. 10048, Locus 99, Lot 422; total seed amount 31), is taken from above, around and just below fragments of a large storage jar in the kitchen deposit (Locus 99; see Fig. 11). The context is a part of a large floor deposit with several other storage jars. In this sample, the following was found: as a crop plant, 1 *T. aestivum/durum*, 3 *Triticum* sp. seeds, 2 unidentified cereals, 2 *Lens culinaris* seeds, 1 unidentified large *Leguminosae*, as crop weeds 5 *Lolium temulentum*, as open vegetation plants and possible weeds 2 *Lolium* sp., 2 unidentified *Gramineae*, 7 *Trifolium* sp. and 1 small seeded *Leguminosae*, single *Polygonum* and 2 *Bupleurum* sp., 1 unidentified *Compositae* and as marine water plant *Salsola* sp. A possible use as crop storage jar is not out of the question, but due to the rarity of seeds in comparison with the soil volume (62 litres); this explanation does not seem to be plausible. The comments of the archaeobotanist indicates that wheat seeds have been found on the sieve, but they were probably from general fill surrounding the jar, not from the jar contents directly. Such mixed contexts are known from different archaeobotanical investigations (HUBBARD, 1976). This supports the suspicion that the jar was probable not a storage jar for grains.

Sample **98-041** (OP J/L, KT. 9788, Locus 99, Lot 407; total seed amount 5) is the content of a large bowl, 36 cm diameter and 21 cm high; it was found tilted on its side (see Fig. 10) and related to KT.9787 jug contents. According to the archaeobotanist, during flotation a single barley grain has been found, which does not belong to bowl content, but associated with the floor deposit, that seems to have more botanical remains. This observation corresponds with the evaluation of the sample 98-051, which comes from the floor deposit mentioned above. The jar contained only few remains: crop plant 1 *Hordeum* cf. *vulgare*, as crop weeds 1 *Lolium remotum*, 2 *Galium aparine/ spurium* seeds, as open vegetation plant 1 unidentified *Gramineae* have been found. According to the excavator comment, the jar was not broken and only tilted on its side. It seems to be unlikely that the entire content of the jar would pour onto the floor, with almost nothing in its interior. Due to the scarcity of the botanical remains, it is possible to say that the jar was not a storage jar for grains. The sample from the adjacent jug has not been botanically

analysed; this makes an interpretation about the accumulation of the seeds on the floor difficult.

Sample **98-078** (OP J/L, KT. 10111, Locus 99, Lot 429; total seed amount 20) is collected from around, on and under a plate and a broken collapsed jar, which originally stood on the plate (see Fig. 11); it belongs to the kitchen deposit (Locus 99) and is related to the sample 98-051. The sample dated in the Late Bronze Level 14. The jar was probably a storage jar for cereal-pulse and fruit mixture; 6 *Triticum aestivum/durum*, 8 *Hordeum cf. vulgare*, 7 unidentified cereals, 9 *Lens culinaris*, 5 *Vicia faba*, 6 unidentified large pulses, 6 fragments of unidentified large fruits, as crop weeds 7 *Lolium remotum*, 3 *Asperula arvensis*, as open vegetation plant and possible weeds 4 *Lolium* sp. seeds, 1 *Galium* sp., 4 other unidentified *Gramineae* seeds, 1 *Melilotus* sp., 1 *Trifolium/Melilotus*, 10 small seeded *Leguminosae*, as marine water plant 1 *Salsola*, as indicator for dry conditions, coastal sides and waste places or fields 1 *Rumex* sp., 2 *Bupleurum* sp., 1 *Valerianella* sp. have been recorded. A large amount of weeds could be interpreted in that, after the collapsing of the storage jar, its content was mixed up with the floor deposit.

Sample **98-077** (OP J/L, KT. 10104, Locus 99, Lot 429; total seed amount 22) is gained from the content of a Canaanite jar (see Fig. 10) and related to 98-051 and the other samples of kitchen context (Locus 99). As crop remains 2 *T. aestivum/durum*, 2 unidentified *Cerealia*, 3 unidentified large pulses, as weed 1 *Galium aparine/spurium*, as possible weed 1 *Lolium* sp., 4 unidentified *Gramineae*, 1 *Melilotus* sp. and 5 small seeded *Leguminosae* and 1 *Polygonum* sp. have been recorded. Evidence suggesting its use as a storage jar is possible but can not be assumed with great certainty. The possibility that the jar content may have been mixed with floor context cannot be excluded.

3.2.2.4 Samples from floor surfaces and intermediate deposits

Sample **98-025** (OPJ/ L, KT. 9745, Locus 85, Lot 397; total seed amount 54) is from an area with traces of burning, ash and earth deposit; east of wall 74 southeast of OP L. An oven and hearth (88) are on the west side of wall 74 (see Fig. 10). This sample is related to sample 98-009. The area is remarkable, with extensive pyrotechnical activity. The floor belongs to late Level 14 or possibly the earliest Level 13 of Late Bronze Age. In this sample, 3 *T. aestivum/durum* grains 6 unidentified *Cerealia*, 4 large unidentified *Leguminosae*, as fruit remains 2 *Vitis*

vinifera (grape vine), as crop weeds 7 *Lolium remotum*, as possible weed 2 *Lolium* sp. and 11 unidentified *Gramineae* seeds, 13 small seeded *Leguminosae*, 1 unidentified *Compositae* and 2 *Cyperaceae/ Polygonaceae* seeds were found. The sample is for a floor deposit rich in crop remains; it has about 30% crop remains and more than 50% open vegetation plants. The crop plants could be the residues of working place near by oven and hearth (88).

Sample **98-0-135** (OP J/L KT. 11089 Locus 115 Lot. 512; total seed amount 35) is a surface sample from the northeast side of wall 35 (see Fig. 11) and related to sample 98-118. The floor belongs to the earliest period of Level 14 or Level 15. As a floor deposit rich in cereal remains, 2 *T. dicoccum* (emmer) 5 *T. aestivum/ durum* (bread/durum wheat), 1 *Triticum* sp. and 5 unidentified *Cerealia*, 1 unidentified large *Leguminosae*, as crop weed 13 *Lolium remotum* seeds and as possible weed 2 *Lolium* sp., 1 small seeded *Gramineae*, 4 small seeded *Leguminosae* have been recorded. This sample composition includes some crop weeds, which could be the residues of fine-sieving.

Sample **98-0-118** (OP J/L, KT. 10761, Locus 115, Lot 482; total seed amount 52) is collected from the floor deposit 115, northwest of OP J and 40 cm south of the room with jars of Level 14 (see Fig. 11). As cereal 2 *T. aestivum/ durum* and 3 *Hordeum cf. vulgare* seeds, 7 unidentified *Cerealia*, as pulse remains 12 *Lens culinaris* and 5 unidentified large pulses, as open vegetation plants and possible weeds 2 *Lolium* sp., 9 unidentified *Gramineae* seeds, 1 *Silene* sp., and as fruits 1 fragmented *Vitis vinifera* and 1 *Ficus carica*, as open vegetation plants 1 *Valerianella coronata*, 4 unidentified *Compositae* seeds and 1 *Carex* sp. have been found. This sample is, as a floor deposit, rich in crop plant remains, but crop weeds, which could be seen as fine sieve by-products, are rare. They might have been sieved away from cereals, just before of food preparation, and were probably used as fuel. By-products of early crop processing stages are absent. This floor deposit may be interpreted as residues from the “working place” near to hearth 119 together with the sample 98-0135 from the same Locus (see Fig. 10).

Sample **98-0-127** (OP J/L, KT. 10858, Locus 116, Lot 495; total seed amount 89) comes from the south of associated Locus 118 (see Fig. 11), from Level 14 south of the kitchen deposit (Locus 99), and related with the southern lying floor Locus 103. This sample is related to sample 98-051 and belongs to early Level 13 or late Level 14 of the Late Bronze Age. Most *T. dicoccum* chaff remains with 19 segments

have been recovered in this sample. Other crop plant remains are 4 *Triticum* sp. and 8 *Hordeum* cf. *vulgare*, 1 unidentified *Cerealia*, 4 pips of *Vitis vinifera* and crop weeds 11 *Lolium remotum*, as open vegetation plant and possible weed 5 *Lolium* sp., 20 unidentified *Gramineae* seeds and 14 small seeded *Leguminosae*, as marine water plant a single *Salsola* fragment have been found. Since the floor, from which the sample was taken, is situated immediately south of the kitchen deposit (Locus 99), it is probable that the waste of the kitchen may have been accumulated by cleaning at the edges of mudbrick structure 118 (see Fig. 10). The functional information about structure 118 is not given on the sample sheets and in the preliminary reports.

Sample **98-051** (OP J/L, KT. 9933, Locus 99, Lot 415; total seed amount 148) is from the kitchen floor deposit (Locus 99), on which a large bowl stood (see Fig. 11). The content of the large bowl is collected in sample 98-041 (KT. 9788). The context is related to Locus 103 and samples 98-034, 98-095, 98-061 and 98-039 and belongs to the Late Bronze Age transition between Level 13 and 14. The material of this floor deposit is abundant; crop plants 7 *T. aestivum/durum*, 1 *Triticum* sp. and 12 *Hordeum* cf. *vulgare*, 2 unidentified cereals, 18 *Lens culinaris* (lentil) seeds, 3 *Vicia faba* (broad bean), and a single *Cicer arietinum* (chickpea), 14 unidentified large pulses, 10 *Punica granatum* (pomegranate), as crop weed 8 *Lolium remotum* seeds, as open vegetation plant and possible crop weed 1 *L. perenne*, 3 *Lolium* sp., 3 *Phalaris* (canary grass), 11 unidentified *Gramineae* seeds, 16 *Trifolium* sp. and 14 unidentified small seeded *Leguminosae*, 1 *Artemisia annua* were found, and as an indicator for arable fields 9 *Rumex* sp. and 5 *Polygonum/Rumex* seeds as possible weed but also as and indicator for dry conditions *Asperula arvensis* and *Bupleurum* seeds were found. According to the archaeobotanist comment, some barley, pomegranate and a possible pea seed have been recovered on the sieve, which correspond with the botanical evaluation of the sample. A possible interpretation for this floor context is that the botanical residues had been accumulated, after some kitchen activities in Locus 99 and swept away to the edges. Rich fine sieve by-products supported the cleaning of the crops, just before the crops were prepared as food.

Another sample related to 98-051 is sample **98-039** (OP J/L, KT. 09922, Locus 103, Lot 412; total seed amount 228), taken from the surface floor level on and around caliche-conglomerate slabs; it is ashy material with burning traces (see Fig. 10). The context belongs to Level 14 of the Late Bronze Age. According to the

archaeobotanist comment, the sieve included wheat, weed seeds, lentil, olive and barley but was poor in flotation material. As a floor deposit, the sample is one of the richest samples in Kinet Höyük (density 4, 4) and has abundant botanical composition; crop plants 2 *T. aestivum/durum*, 1 *T. dicoccum*, including 2 *T. dicoccum* (emmer) chaff remains, 5 *Hordeum cf. vulgare*, 2 unidentified cereals, 6 *Lens culinaris*, 4 *Lathyrus sativus/ Vicia ervilia* (grass pea/ bitter vetch), 1 *Vicia faba* (broad bean), 1 *Cicer arietinum* (chickpea), 4 other unidentified large pulses, 1 unidentified large fruit, as plant of various habitats almost 100 *Carex* seeds, a big part of it (70) is in mineralised form, as possible crop weed 32 *Lolium remotum*, as open vegetation plants and possible weeds 16 *Lolium* sp. and 34 unidentified *Gramineae* seeds, 14 small seeded *Leguminosae* (inclusive *Medicago*, *Melilotus/ Trifolium*), 1 *Polygonum* sp., 4 *Polygonum/ Rumex* and 1 *Fumaria* sp. were found. The caliche-conglomerate paving probably has a function as a working place of the kitchen, where the crops were processed, but the fine sieve by-products like *Lolium* and small seeded *Leguminosae* are an indicator that the crops were finely sieved just before preparing for cooking or baking. Two founded emmer chaff remains could be interpreted as an accidental mixing of winnowing or coarse sieve by-products into the crop. In this context, crop pulses play a role; they could be seen as a working place more for cooking, rather than for baking activities. The mineralization of *Carex* seeds may have occurred with the presence of water.

Sample **98-064** (OP J/L, KT. 10054, Locus 98, Lot 426; total seed amount 28) is collected from an intermediate (but not a floor deposit) north of wall 97 (see Fig. 10) and the related kitchen unit (Locus 99). The context is related to sample 98-026. According to the archaeobotanist comment, one emmer and one other wheat fragment have been recovered by sieving. Crop plants 1 *Hordeum cf. vulgare*, 4 unidentified *Cerealia*, 2 *Lens culinaris*, as weed 1 *Lolium remotum*, as possible weeds and open vegetation plants 3 *Lolium* sp., 8 unidentified *Gramineae*, 1 *Medicago* sp. 1 *Trifolium/ Melilotus* and 4 unidentified small seeded *Leguminosae* have been found in this sample. The sample is not really poor in botanical remains for an intermediate deposit, probably due to the fact that there is a kitchen context near Locus 98 and that feature 101 has an opening to its north (Locus 98), which can have a functional dependence with this side. GATES (2000) assumed that the room 96 has 2 postholes, which can be a suggestion for wooden sheltering and is probably

connected with a large basalt block, later serving as a threshold into the kitchen, as mentioned in Chapter 2.

Sample **98-026** (OP J/L, KT. 9625, Locus 98, Lot 392; total seed amount 5) is taken from the deposit north of wall 97 (see Fig. 10), in an area whose purpose has still to be identified. The sample, in comparison with the sample 98-064 from the same context, has relatively poor in botanical remains; as crop plants only a single *T. dicoccum*, 2 *Vitis vinifera* (grape vine), 1 unidentified large pulse, as possible weeds and open vegetation plants 1 *Trifolium* sp. and 1 unidentified *Gramineae* have been recorded. After analysis of this poor sample, it is still difficult to make an interpretation about the function of this area.

3.2.3 Middle-Early Iron Age Kinet Höyük samples from the 1998 excavation season

Samples from Middle-Early Iron Age have no location plan and graph; nevertheless, the sample composition Excel-table is useful for consideration (see Appendix 3 and 4). With only two samples from Middle-Early Iron Age Kinet Höyük, it is unlikely to make comprehensive conclusions about the plant use at the site, but they can give some evidence for comparisons. These samples have no statistical meaning.

Sample **98-0-140** (OP F, KT. 11237, Locus 70, Lot 187; total seed amount 101) is taken from the contents of an orange clay or brick feature, probably a hearth and adjacent to Locus 67; it belongs to Period 11 of the Middle Iron Age. The sample is related to sample 98-139 and is not poor in botanical remains; as crop plants 13 *T. aestivum/ durum*, 1 unidentified cereal, 1 *Lens culinaris*, 4 unidentified large pulses, 2 *Vitis vinifera*, as possible crop weeds 23 *Lolium* seeds, 1 *Phalaris* sp., as open vegetation plants 40 unidentified *Gramineae* seeds, 2 *Trifolium*, 6 small seeded *Leguminosae*, 2 *Bupleurum* and 1 *Valerianella* sp. have been recorded. The possible function of the structure as an oven or hearth seems plausible. Crop processing by-products may have been used probably as fuel.

Sample **98-0-139** (OP F, KT. 11010, Locus 67, Lot 179; total seed amount 29) comes from a floor deposit, which belongs to the transitional level between the bottom of Period 11 and the top of Period 12 in north of OP F. Period 11 belongs to Middle Iron Kinet Höyük, but Period 12 to the Early Iron Age. OP F is enclosed by walls 65, 66 and 68 of Period 11. In the botanical sample of Locus 67 as crop plants 2 *T. aestivum/ durum*, 2 other *Triticum* sp., 2 unidentified *Cerealia*, as an important

cultivar of Iron Age 1 *Sesamum indicum* (sesame), as marine water plant 1 *Salsola* sp., as possible crop weeds 1 *Lolium* sp., 1 *Galium aparine/spurium*, as open vegetation plant 12 unidentified *Gramineae*, 4 *Trifolium/ Melilotus*, 1 small seeded *Leguminosae*, 1 *Bupleurum* sp. have been recovered. To find a single sesame seed in the Early Iron Age sample is a pleasant recovery, due to the general taphonomic difficulties of the sesame preservation in the archaeological contexts. There are quite few archaeological sites in the Near East, where evidence of sesame cultivation in the archaeobotanical samples is present, although the cultivar appeared regularly at these sites with the beginning of the Iron Age. The use of sesame is illustrated with more information in the Catalogue.

3.2.4 Late Bronze Age samples Kinet Höyük from the 1999 excavation season

Only few samples were chosen from the 1999 excavation season for the description of different contexts (see Fig. 11). Unfortunately, many of the 1999 season samples have no information concerning soil volume, which makes the evaluation of archaeobotanical data difficult.

3.2.4.1 Samples from pit and hearth contexts

Sample **99-0-071** (OP J/L, KT. 12794, Locus 141, Lot 643; total seed amount 84) is taken from the lower half of pit 141 with ash and soft earth inside at the south baulk of OP J/L (see Fig. 11). The context belongs to Period 15. The sample is relatively rich in botanical remains; crop plants 6 *T. aestivum/ durum*, 3 *Triticum* sp., 1 *Hordeum cf. vulgare.*, 1 *Lathyrus sativus/ Vicia ervilia* (grass pea/ bitter vetch), 2 unidentified large pulses, 1 *Punica granatum* seed, as crop weed 46 seeds of different *Lolium* species, as a possible weed 1 *Phalaris* sp., as open vegetation plants 3 unidentified *Gramineae*, 1 *Medicago* sp., and 1 *Medicago/ Melilotus*, 2 *Polygonum/Rumex* and 1 *Valerianella* sp. and as plant of various habitats 15 *Carex* sp., have been recovered. The possible use of this pit as waste pit seems to be plausible.

Sample **99-0-075** (OP J/L, KT. 13010, Locus 163, Lot 649; total seed amount 170) is taken from a hearth, although it is not formally delimited with a baked clay edge, due to the extensive ashy deposit on an irregularly shaped burnt clay surface, defined as a hearth (see Fig. 11). The context is located on the northwest edge of OP J/L and belongs to Phase 15. The sample is one of the richest samples of Kinet

Höyük; 6 *T. dicoccum* chaff remains, as crop plants 3 *T. aestivum/durum*, 2 *Triticum* sp., 2 *Hordeum* cf. *vulgare.*, 2 unidentified cereals, 3 *Lens culinaris*, 3 *Vicia ervilia*, 3 *Lathyrus sativus/ Vicia ervilia* (grass pea/ bitter vetch), 1 *Vicia faba*, 13 unidentified large *Leguminosae*, as crop weeds 16 *Lolium remotum*, 1 *Asperula arvensis* and 1 *Galium aparine/ spurium* seed, 1 *Heliotropium* cf. *europaeum*, as possible crop weeds and open vegetation plants 14 *Lolium* sp. seeds, 84 unidentified *Gramineae* seeds, 2 unidentified *Compositae* seeds, 4 unidentified small seeded *Leguminosae*, 1 *Fumaria* sp., as weed and ruderal in dry conditions 1 *Rumex* sp. and 1 *Bupleurum* sp. have been recorded. It can be interpreted almost with a great certainty, that the hearth was used for cooking and baking activities, due to the high percentage of the cereal and pulse remains. The early stage crop by-products (like chaff remains) may have been the contaminants of the fine sieve by-products (weeds) and were probably used together as supplementary fuel for the fire.

3.2.4.1 Samples from floor contexts

Sample **99-0-045** (OP J/L, KT. 11943, Locus 152, Lot 579; total seed amount 24) is collected from beside and below a burnt area (see Fig. 12) and belongs to Period 15 or latest phase of Level 14 of the Late Bronze Age. The sample is, as a floor context sample, not poor in botanical remains; crop plants 1 unidentified *Cerealialia*, 1 *Lens culinaris*, 1 unidentified large *Leguminosae*, as crop weed 5 *Lolium remotum* seeds, as open vegetation plant and possible weed 4 *Lolium* sp., 5 unidentified *Gramineae*, 2 *Medicago* sp., and 3 small seeded *Leguminosae*, 1 *Silene* sp., 1 *Polygonum/ Rumex* seed were found. According to the excavation reports, the use of the location (Locus 152) is not really defined, but with a great probability it was used as a kitchen or living room.

Sample **99-0-056** (OP J/L, KT. 12732, Locus 135, Lot 630; total seed amount 42) is collected from a possible surface layer with ashy matter (see Fig. 12) and related to sample 99-0-020. According to the botanical analysis of the context of the room 135, the southeast edge of OP J/L, seems to be not only rich in faunal remains (as in Chapter 1 mentioned), but also in botanical remains: crop plants 6 *T. dicoccum* (emmer) chaff remains, 1 *T. aestivum/durum*, 1 *Triticum* sp., 2 *Lens culinaris*, 1 *Vicia ervilia*, 2 *Lathyrus sativus/ Vicia ervilia*, 4 unidentified large *Leguminosae*, 2 *Vitis vinifera*, 1 *Punica granatum*, as crop weeds 5 *Lolium remotum*, 1 *Heliotropium* cf. *europaeum* seed, as open vegetation plants and possible crop weeds 5 *Lolium* sp.,

1 unidentified *Gramineae*, 1 *Melilotus* sp., 5 small seeded *Leguminosae*, 2 *Polygonum/Rumex* have been found. A possible function of the eastern part of the building could be as a 'working place' for the kitchen activities. This is supported by the evidence of faunal remains, ceramic mortar and other pounding tools.

Sample **99-0-020** (OP J/L, KT.11400, Locus 135, Lot 541; total seed amount 74) is collected from a possible floor deposit of Period 15 (see Fig. 12). The sample includes crop plants 2 *Triticum* sp., 6 *Hordeum* cf. *vulgare*, 2 *Lens culinaris*, 1 *Vicia ervilia*, 2 unidentified large *Leguminosae*, as possible crop weeds 20 *Lolium remotum*, as open vegetation plant and possible weeds 9 *Lolium* sp., 3 *Phalaris* sp., 10 unidentified *Gramineae*, 1 *Medicago* sp., 9 small seeded *Leguminosae*, 1 *Trifolium* sp., 1 *Silene* sp., 1 *Carex* sp., 1 *Polygonum* sp., 1 *Polygonum/Rumex* and 1 *Valerianella* sp. This sample is related to 99-0-056, and is also rich in crop and weed remains. As mentioned above, the possible function of the room as 'working places' could be taken into consideration.

3.2.5. Some considerations for the Kinet Höyük sample contexts

In general, it is observable that the spectrum of crop plants and weed taxa is varied among different archaeological context. Nevertheless, it is impossible to state, which plant remains dominate in which archaeobotanical contexts.

The above listed archaeobotanical contexts and their plant remains could be summarised as following:

- Pit, posthole and fill contexts are in general rich in fine sieve by-products like weeds and open vegetation plants (e.g. see Fig. 9; the Graphs of the samples 97-70, 97-67, 97-73, 97-71, and 97-62), but contain less crop remains. A possible explanation for this 'negative evidence' is that these contexts contain the residues of kitchen activities, which were thrown away into pits, fills and postholes.
- Jar contents, if they were broken or tilted, are mixed mostly with other floor deposits and in general, contain less than 30% crops and 50-60% open vegetation plants and weeds. Only one jar context (98-041) has more than 65% crop plant remains.
- The samples from oven and hearth contexts (e.g. see Fig. 10-11; the Graphs of the samples 98-009, 98-034, 98-0135 and 98-076) contain few crops (about 10-15%) and probably represent a 'negative evidence'. In these

samples mainly fine sieve by-products like open vegetation plants and weeds predominate, which were probably used as fuel.

- In general, the samples from floor surfaces and intermediate deposits (e.g. see Fig. 10-11; the Graphs of 98-0135, 98-0118 and 98-051) contain high amounts of crop species (about 40-60%). In these contexts, the open vegetation plants (35-45%) are also well represented. The high amounts of crops could be explained as residues of cleaning activities of cooking and working places, as mentioned above.

3.2.2 Tell Atchana samples from the 2004 excavation season

In Tell Atchana, archaeobotanical samples come from the contexts of the occupational debris and other floor deposits, kilns, tabuns, bins and occasionally from pits. All samples belong to Late Bronze Age Tell Atchana occupation (14th century) levels. Since preliminary reports of the 2004 excavation are still in preparation, there are difficulties about the evaluation of the functional context descriptions and the dating of the stratigraphical units as has already been mentioned in Chapter 1. Under these conditions, according to context descriptions, some simple sketches have been used to describe the location and to interpret botanical samples (Fig. 15-16 Location of Tell Atchana samples from the 2004 excavation). The Tell Atchana samples are described according to their context relations.

3.2.2.1 Samples from the Square 80

Locus 04-2002 (floor): Sample **BP-13** (Grid 44, Square 80, Finegrid 72, Pottery pail 68; total seed amount 24) is taken from occupational debris, perhaps from a courtyard surface (see Fig. 15). The context is probably in an open-air courtyard with kilns and tabun nearby. At the east side of the Finegrid, there are two small ashy bone pits. Sample BP-13 from Finegrid 72 is related to samples BP-14, 17, 18 and 20 from Finegrids 83, 63, 82, and from tabun L04-2021. The sample has crop plants 1 *T. dicoccum* (emmer), 1 *T. aestivum/durum* (bread/ durum wheat), 1 unidentified *Cerealia*, 3 *Vicia ervilia* (bitter vetch), 3 large unidentified pulses, as open vegetation plant 2 *Silene* sp. and 4 *Phalaris aquatica/ paradoxa*-type, as crop weed *Lolium remotum* Schrank-type, 2 unidentified *Gramineae*, and 1 small seeded *Leguminosae*. The occupational debris has traces of crop plant use and is related to the tabun structure in L04-2021.

Sample **BP-14** (Grid 44, Square 80, Finegrid 83, Locus 04-2002, Pottery pail 69; total seed amount 39) is collected from the same occupational debris like BP-13 upon a probable courtyard surface (see Fig. 15). A part of a tabun is in Finegrid 83. In the sample, crop plants 3 *T. aestivum/ durum* remains, 1 *Triticum* sp., 2 unidentified *Cerealia*, 5 unidentified large *Leguminosae*, 1 *Vitis vinifera* (grape vine), as crop weed 1 *Heliotropium* cf. *europaeum*, 1 *Lolium remotum*, 1 *Galium aparine/ spurium*, 2 *Galium* sp. and 1 *Valerianella dentata*, as open vegetation plants and possible weeds 3 *P. aquatica/ paradoxa*- type, 3 *Phalaris minor*, 4 unidentified *Gramineae*, 1 *Trifolium/ Melilotus*, as fresh water plant *P. arundinacea* as a plant of various habitats 3 *Carex* sp. and 3 unidentified *Cyperaceae* have been recovered. Crop plant and crop weed percentages of the sample could be an indicator of the use of the tabun structure for cooking or baking activities, but a possible use of this structure as heating installation with dung or fine-sieve by-products as fuel, can not be excluded.

Sample **BP-17** (Grid 44, Square 80, Finegrid 63, Locus 04-2002, Pottery pail 79; total seed amount 30) is collected from occupation debris upon a courtyard surface (see Fig. 15). The context possibly belongs to a courtyard with tabun and firing kilns or a workshop area. The sample has crop plants 2 unidentified *Cerealia*, 1 *Vicia ervilia*, 4 unidentified large pulses, as crop weed 2 *Lolium remotum*, 7 *Phalaris minor*, as open vegetation plants and possible weeds 2 *Phalaris aquatica/ paradoxa*- type, 1 unidentified *Gramineae* and 5 small seeded *Gramineae*, 2 small seeded *Leguminosae*, 1 *Polygonum/ Rumex*, 1 *Valerianella* sp. This sample has similarity to samples BP-13 and BP-14 in cereal and pulse remains; crop weeds indicate working and cooking activities near this context.

Sample **BP-18** (Grid 44, Square 80, Finegrid 82, Locus 04-2002, Pottery pail 78; total seed amount 31) is taken from the same occupational debris upon a courtyard surface with tabun and firing kilns (see Fig. 15), like BP-13, 14 and 17. The sample has crop plants 4 *T. aestivum/ durum* remains, 1 *Triticum* sp., 1 *Hordeum* cf. *vulgare*, 3 cf. *Lens culinaris*, 1 *Lathyrus sativus/ Vicia ervilia* (grass pea/ bitter vetch), as crop weeds 7 *Lolium remotum*, as possible crop weed and open vegetation plant 2 *Lolium* sp., 1 *Phalaris aquatica/ paradoxa*-type, 1 small seeded *Gramineae*, 2 *Melilotus* sp., 2 *Melilotus/ Trifolium* and 1 *Polygonum* sp. and as fresh water plant 3 *Phalaris arundinacea*. Like BP-13, 14 and 17, this sample has a spectrum of cereals,

pulses and crop weeds; that is evidence that cooking or food preparation activities had taken place near this context.

Sample **BP 22** (Grid 44, Square 80, Finegrid -, Locus 04-2002, Pottery pail 88; total seed amount 6) is collected from an ashy lens in occupational debris in a courtyard or workshop area with tabun and kilns (see Fig. 15). The sample is relatively poor in botanical remains; 2 *Triticum* sp., 1 *Vitis vinifera*, as open vegetation plants 1 *Phalaris aquatica/ paradoxa*- type and 2 unidentified small seeded *Gramineae* were found. One possible interpretation of this context is that the 'ashy lens' has no direct connection with food preparation activities.

Locus 04-2011 (floor): Sample **BP-15** (Grid 44, Square 80, Finegrid 27, Pottery pail 70; total seed amount 17) is taken from a sandy occupational debris upon a surface (see Fig. 15), it may be an outdoor context and related to walls L04-2003, L04-2012, L03-3003, near kilns L04-2014 and L04-2015. Sample BP-15 is related to sample BP-16, 19, 31 and 37. In this context, crop plants 2 unidentified *Cerealia*, 3 *Lens culinaris* (lentil), 1 *Vicia ervilia* (bitter vetch), and 3 *Vicia faba* (broad bean), 1 unidentified large *Leguminosae*, as fresh water plant 1 *Phalaris arundinacea*- type, as open vegetation plants and possible weeds 1 *Medicago* sp. (medick), 1 *Melilotus/ Medicago*, 1 small seeded *Leguminosae*, 2 *Malva* sp. and 1 *Sherardia arvensis* have been found. It is very probable that there was a place for disposal of kitchen waste near this context.

Sample **BP-16** (Grid 44, Square 80, Finegrid 27, Locus 04-2011, Pottery pail 82; total seed amount 11) is taken from the same occupational debris upon a surface like BP-15 and next to the small wall foundations near firing kilns (see Fig. 15); it is possibly a courtyard. The sample includes crop plants 1 *T. aestivum/ durum* grain, 2 *Vitis vinifera*, 1 *Phalaris minor*- type, as open vegetation plants and possible weeds 1 unidentified *Gramineae* seed, 1 small seeded *Gramineae*, 1 *Trifolium/ Melilotus* and 3 *Polygonum* sp. This sample has, in comparison to BP-15, no crop legumes, and a single bread/ durum wheat grain. The context has a possible relation with waste place. Another possibility which can be taken into consideration is that the wastes of open-air activities have been accumulated after the cleaning of the courtyard outside or in the street.

Sample **BP-19** (Grid 44, Square 80, Finegrid 28, Locus 04-2011, Pottery pail 83; total seed amount 8) is taken from an occupational debris (Finegrid 28; see Fig. 15). This context is next to the foundations of loci L04-2003, L04-2012, L03-3003,

possibly on the courtyard surface and near kilns. The sample is directly related to the sample BP- 38 from the same Finegrid, which was taken late in the excavation; it is also related to the samples from Finegrid 27 (BP-15, 16, 19, 31 and 37) The sample is poor in botanical remains; it has no crop plants and includes open vegetation plants and possible weeds 2 *Phalaris aquatica/ paradoxa*-type, 2 *Trifolium/ Melilotus* and 2 *Valerianella* sp. The poorness of the sample may have been explained through the distance of Finegrid 28 to firing installations.

Locus 04-2014 (bin or kiln): Sample **BP- 32** (Grid 44, Square 80, Finegrid -, Pottery pail 114; total seed amount 12) is taken from a fired mud installation; according to excavator, it is probably a kiln (see Fig. 15). The structure is located in a courtyard or open-air workshop area with kilns and tabun nearby. The sample is related to BP-34 and 45 and is relatively poor in botanical remains; as crops only 1 unidentified *Cerealia* and 1 *Vitis vinifera*, as crop weeds 2 *Heliotropium* cf. *europaeum*, 1 *Valerianella dentata*, as indicator for open vegetation and possible weeds 6 *Silene* sp., 1 *Lolium* sp. and 1 *Melilotus* sp have been recovered. It is astonishing that a possible kiln structure has a few plant remains inside, especially crops or crop weeds. The possibility that the structure was cleaned very properly after each use seems to be unlikely. It could be helpful to examine other possible functions of the structure rather than as a kiln, like the heating installation as in L-04-2015 (BP 27, 30, 35)

Sample **BP- 34** (Grid 44, Square 80, Finegrid-, Locus 04-2014, Pottery pail 116; total seed amount 9) is taken from a fired mud installation; according to excavator, it is probably a kiln (see Fig. 15). The sample is related to samples BP- 32 and 45 and has, as crop plants, only 3 unidentified large *Leguminosae*, as crop weed 1 *Heliotropium* cf. *europaeum*, as indicator for open vegetation 1 small seeded *Gramineae* and 2 small seeded *Leguminosae*, 1 *Sherardia arvensis*. As mentioned in regard to the sample BP- 32, the possible use of this fired mud installation as a kiln for cooking or baking seems to be unlikely.

Sample **BP- 45** (Grid 44, Square 80, Finegrid -, Locus 04-2014, Pottery pail 159; total seed amount 68) is taken from the contents of a with baked mud-brick plastered bin in an open-air workshop area with kilns (see Fig. 15). The sample is related to BP- 32 and 34. In this sample the following was found: as crops 1 *T. dicoccum* (emmer), 1 *T. aestivum/ durum*, 3 *Hordeum* cf. *vulgare*, 4 unidentified *Cerealia*, 7 *Vitis vinifera*, as crop weeds 8 *Heliotropium* cf. *europaeum*, 7 *Lolium*

remotum Schrank-type, 1 *Asperula arvensis/ orientalis*, 1 *Lithospermum* sp., as open vegetation plants and possible weeds 3 *Silene* sp., 1 unidentified *Compositae* seed, 9 *Lolium* sp., 6 unidentified *Gramineae* seed, 5 unidentified small seeded *Gramineae*, 8 unidentified small seeded *Leguminosae*, 2 *Polygonum/ Rumex* and *Phalaris aquatica/ paradoxa*-type. As I have mentioned with samples BP- 32 and 34, the possible use of this fired mud installation as a kiln for cooking or baking seems unconvincing.

Locus 04-2015 (kiln): Sample **BP- 27** (Grid 44, Square 80, Finegrid -, Pottery pail 103; total seed amount 15) is taken from a rectangular mud installation (see Fig. 15); according to excavator, it is possibly a kiln. The structure is located in a possible courtyard or workshop area with other kilns nearby. The sample is related to BP- 30, 35 and includes crop plants 1 *T. aestivum/ durum* grain, 1 unidentified *Cerealia*, 2 cf. *Lens culinaris*, 1 unidentified large *Leguminosae*, as crop weed *Heliotropium* cf. *europaeum*, 3 *Lolium remotum* Schrank-type, 1 *Phalaris minor*-type and 1 *Thymelaea* sp., as open vegetation plant and possible weeds 1 *Trifolium/Melilotus* seed and 3 small seeded *Leguminosae*. Crop plant remains seem to be, for a kiln structure, very scarce. The use of this fired mud installation as a kiln for cooking or baking activities seems to be unlikely. Due to the representation of crop weeds and wild plants, possible use as a heating structure with fuel from later stage crop processing by-products, scrubby plants like *Thymelaea* sp. and dung, could be taken into consideration.

Sample **BP- 30** (Grid 44, Square 80, Finegrid -, Locus 04-2015, Pottery pail 109; total seed amount 22) is collected from the same kiln or other fired mud installation like the sample BP- 27 (see Fig. 15), in a courtyard or workshop area with other kilns nearby. The sample includes crop plants 2 *T. aestivum/ durum*, 1 *Triticum* sp., 1 *Vitis vinifera*, as crop weed 4 *Lolium remotum* Schrank-type, as open vegetation plants and possible crop weeds 1 *Lolium* sp., 1 *Cyperaceae/ Polygonaceae* seed, 4 *Phalaris aquatica/ paradoxa*- type, 1 unidentified *Gramineae*, 4 *Melilotus* sp., 1 small seeded *Leguminosae* and 1 *Thymelaea* sp. The use of this structure as a firing-heating installation seems to be very plausible.

Sample **BP- 35** (Grid 44, Square 80, Finegrid -, Locus 04-2015, Pottery pail 117; total seed amount 10) is taken from a fired mud installation (see Fig. 15). The sample is related to BP- 27 and 30 and includes 1 *Triticum* sp., 2 unidentified large *Leguminosae*, as crop weeds 1 *Heliotropium* cf. *europaeum*, 2 *Lolium remotum*

Schrank-type, as open vegetation plants and possible weeds 1 *Lolium* sp., 1 small seeded *Leguminosae* and 1 *Malva* sp. As in samples BP-27 and 30, there are less crop plant remains in this sample, which could be understood as a possible use of this installation for heating of courtyard.

Locus 04-2020 (kiln): Sample **BP- 33** (Grid 44, Square 80, Finegrid -, Pottery pail 107; total seed amount 12) is taken, according to excavator, from a possible kiln with its interior (see Fig. 15). The structure is situated in a courtyard or a workshop area with kilns and firing installations. The sample is related to BP- 36 but relative poor; there are no crop plant remains; crop weed 4 *Heliotropium* cf. *europaeum*, as open vegetation plant and possible weed 3 *Silene* sp., 1 small seeded *Leguminosae*, 1 *Polygonum* sp., 1 *Sherardia arvensis* and as fresh water plant 1 *Alisma* sp. have been found This structure may have been used as firing installation for open-air activities, perhaps for the heating of the courtyard, like L-04-2015 and L-04-2014. Due to the absence of crop plant remains and scarce weeds, it seems to be unlikely that this structure had a function as a kiln for food preparation.

Sample **BP- 36** (Grid 44, Square 80, Finegrid -, Locus 04-2020, Pottery pail 122; total seed amount 12) is collected from the same fired mud installation with chambers (see Fig. 15), like sample BP- 33. The sample has (like sample BP-33) no crop plant remains; it has as crop weeds 1 *Heliotropium* cf. *europaeum*, 2 *Lolium remotum* Schrank-type, as open vegetation plant and possible weeds 1 *Silene* sp., 5 small seeded *Gramineae*, 1 *Melilotus* sp., 1 small seeded *Leguminosae* and 1 *Valerianella* sp. This structure could have been used as a firing installation for open-air activities, or for the heating of the courtyard.

Locus 04-2021 (tabun): Sample **BP 20** (Grid 44, Square 80, Finegrid -, Pottery pail 85; total seed amount 6) is taken from the tabun (see Fig. 15). This context is located in the courtyard and what is likely an open-air workshop area. The sample is poor and only includes crop plants 1 *Lathyrus sativus*/*Vicia ervilia*, 2 unidentified large *Leguminosae* and 1 *Vitis vinifera*, as fresh water plant 2 *Phalaris arundinacea*. It is astonishing that the cereals and the crop weeds are totally absent in this tabun context and that other crop plant remains like pulses are also so rare. There is no clear evidence for cooking or baking of prepared food in this tabun. The possibility that the tabun was attentively cleaned after each use seems to be unlikely.

Locus 04-2032 (floor): Sample **BP- 26** (Grid 44, Square 80, Finegrid -, Pottery pail 99; total seed amount 14) is collected from the material above a floor

surface in a courtyard or workshop area with kilns and tabun (see Fig. 15) and is related to BP- 44. The sample has as crops 1 unidentified *Cerealia*, 1 unidentified large *Leguminosae*, as crop weed 1 *Galium aparine/ spurium*- type and 1 *Galium* sp., as open vegetation plant and possible weed 1 *Silene* sp., 3 unidentified *Gramineae*, 3 small seeded *Gramineae*, 1 *Medicago* sp., 1 *Thymelaea* sp. This sample may have been interpreted with sample BP-44 together as an accumulation of household disposal.

Sample **BP- 44** (Grid 44, Square 80, Finegrid -, Locus 04-2032, Pottery pail 161; total seed amount 35) is collected from occupational debris on floor L04-2037 (see Fig. 15). The context is located in an open-air workshop area near tabun and kilns. The sample is related to BP-26, as mentioned above. In this sample, the following was found: 4 *Hordeum* cf. *vulgare*, 3 unidentified *Cerealia*, 4 unidentified large *Leguminosae*, as crop weed 3 *Heliotropium* cf. *europaeum*, 1 *Lithospermum* sp., as open vegetation plants and possible weeds 1 *Silene* sp., 1 unidentified *Compositae*, 1 unidentified *Cyperaceae/ Polygonaceae*, 5 *Lolium* sp, 8 *Phalaris aquatica/ paradoxa*- type, 1 unidentified *Gramineae*, 1 *Melilotus/ Medicago*, 1 *Polygonum* sp., 1 *Valerianella coronata*. Together with the sample BP-26, this context could be a result of the accumulation of cleaning and disposal activities.

Locus 04-2035 (floor): Sample **BP- 31** (Grid 44, Square 80, Finegrid 27, Pottery pail 115; total seed amount 12) is collected from a sandy occupation debris above the surface, near the wall foundations L04-2003 and L04-2012 (see Fig. 15). The sample is related to BP-15, 16 and 37, and is from the same Finegrid mentioned above. 1 *T. aestivum/ durum*, 1 *Vicia ervilia*, as crop weed 2 *Heliotropium* cf. *europaeum*, 1 *Lolium remotum* Schrank-type and 1 *Valerianella dentata*, as open vegetation plants and possible weeds 1 *Silene* sp., 1 *Phalaris aquatica/ paradoxa*-type, 1 unidentified small seeded *Gramineae*, as indicator for arable fields around Tell Atchana 1 *Adonis annua* were found. As mentioned above this context has a possible connection with a waste place or an accumulation place of cleaning activities.

Sample **BP- 37** (Grid 44, Square 80, Finegrid 27, Locus 04-2035, Pottery pail 119; total seed amount 5) is taken from a sandy occupation debris above the surface near the wall foundations L04-2003 and L04-2012 (see Fig. 15). The sample is related to BP- 15 and 31 from the same Finegrid, as mentioned above. In this sample the following was found: only 3 *Heliotropium* cf. *europaeum*, 2 small seeded

Gramineae and in contrary to BP- 15 and 31 no crop plant remains. The possible interpretation of this context in connection with other samples from the same Finegrid is as accumulation of waste, as mentioned above.

Sample **BP- 38** (Grid 44, Square 80, Finegrid 28, Locus 04-2035, Pottery pail 123; total seed amount 11) is collected from the same sandy occupational debris on the surface, like Finegrid 27 and abuts wall foundation L04-2003 (see Fig. 15). In this sample, crop 1 *Lens culinaris*, as crop weed 5 *Heliotropium cf. europaeum*, as open vegetation plant and possible weed 4 small seeded *Gramineae* and 1 *Sherardia arvensis* have been recovered. The interpretation of this context could be similar to Finegrid 27, because Finegrids 27 and 28 belong to the same locus.

Locus 04-2036 (pit): Sample **BP- 39** (Grid 44, Square 80, Finegrid -, Pottery pail 129; total seed amount 28) is taken from a pit deposit in a courtyard and a workshop area near kilns and tabun (see Fig. 15). This sample includes no crop plant remains, but the crop weeds 5 *Lolium remotum* Schrank-type, 1 *Asperula arvensis/orientalis*, 1 *Galium* sp., as fresh water plant 1 *Phalaris arundinacea*, 2 *Phalaris minor*-type, as open vegetation plants and possible weeds 1 *Salsola* sp., 1 *Lolium* sp., 1 unidentified *Gramineae*, 3 small seeded *Gramineae*, 3 *Melilotus* sp., 1 *Trifolium* sp., 2 small seeded *Leguminosae*, 2 *Polygonum* sp., 1 *Sherardia arvensis* and 1 *Bupleurum* sp. have been found. It seems difficult to interpret the function of this pit with a single collected sample. Since there were no crop plant remains and scarce weeds came from this pit context, the use of the pit had with a great certainty no connection with kitchen activities. Wild plant seeds could be accumulated by different factors, like the transport of dung, or through wind or rain.

Locus 04-2039 (kiln): Sample **BP- 41** (Grid 44, Square 80, Finegrid -, Pottery pail 137; total seed amount 34) is collected from a possible kiln deposit and is located in open-air workshop area with kilns and other industrial installations (see Fig. 15). The following crop plants were found there: 3 unidentified *Cerealia*, 4 unidentified large *Leguminosae*, 1 *Vitis vinifera* pipe, as crop weeds 1 *Heliotropium cf. europaeum*, 2 *Lolium remotum* Schrank-type, 1 *Galium* sp., as open vegetation plants and possible weeds 1 *Silene* sp., 4 *Lolium* sp., 3 *Phalaris aquatica/paradoxa*-type, 1 *Medicago* sp., 1 *Medicago/Melilotus* sp., 4 *Trifolium* sp., 4 small seeded *Leguminosae* and 1 *Polygonum* sp. Crop plant remains and weeds of this sample are scarce, but the possible use of this structure as a kiln for cooking or baking is not out of question.

3.2.2.2 Samples from the Square 79

Locus 04-2005 (tabun): Sample **BP- 43** (Grid 44, Square 79, Finegrid -, Pottery pail 54; total seed amount 41) is collected from a possible tabun context on a place for outdoor activity (see Fig. 16). In this sample crop plants 3 *T. aestivum/durum*, 1 *Triticum* sp., 4 unidentified large *Leguminosae*, 7 *Vitis vinifera*, as crop weeds 4 *Lolium remotum* Schrank-type, as open vegetation plants 1 unidentified *Boraginaceae*, 1 cf. *Carthamus* sp., 5 *Lolium* sp., 3 *Phalaris minor*- type, 2 unidentified small seeded *Gramineae*, 6 unidentified small seeded *Leguminosae*, 1 *Polygonum* sp., 1 *Sherardia arvensis* and 1 *Bupleurum* sp. have been found. The percentage of crop plants, especially cereals and pulses are low, but the probable use of this tabun context for the cooking or baking activities is not out of question.

Locus 04-2007 (floor or pavement): Sample **BP 21** (Grid 44, Square 79, Finegrid -, Pottery pail 51; total seed amount 153) is taken from an ashy area, which is part of a pavement structure and is made from the same material as L04-2041 at the south end of the Square 79 (see Fig. 16). The square-supervisor described this context as “outdoor”. This is the richest sample of all Tell Atchana samples and includes 1 *T. dicoccum*, 1 *T. aestivum/durum*, 5 unidentified *Cerealia*, 18 *Lens culinaris*, 6 unidentified large *Leguminosae*, 12 *Vitis vinifera*, as crop weeds 7 *Asperula arvensis/orientalis*, 3 *Galium aparine/spurium*, 1 *Galium* sp. and 5 *Valerianella dentata*, as open vegetation plants and possible weeds 2 *Silene* sp., 3 seeds of *Cyperaceae/ Polygonaceae* family, 8 *Bromus* sp., 8 *Lolium* sp., 11 *Phalaris aquatica/paradoxa*- type, 5 unidentified *Gramineae*, 1 *Medicago*, 1 *Trifolium/Melilotus*, 6 small seeded *Leguminosae*, 5 *Rumex* sp., 2 *Sherardia arvensis*, 1 *Valerianella coronata*, as marine water plant 1 *Salsola* sp., as indicator for arable field 2 *Adonis annua*, as crop weed 21 *Lolium remotum*, 6 *Phalaris minor*- type, as fresh water plant 1 *Phalaris arundinacea*. Crop plants *Vitis vinifera* and *Lens culinaris* are predominate, but their dominance does not make the interpretation of this context easier. The occurrence of a high percentage of crop weeds and other open vegetation plants may explain that the crop weeds were brought with harvested crops, or that the open vegetation plants (as well as possible weeds) were brought through animal dung into the settlement. Small seeded weeds as fine sieve by-products and animal dung are presently used as a fuel resource, as well. These plants may have been with a great possibility swept outside after their use as fuel.

Locus 04-2029 (pit): Sample **BP- 25** (Grid 44, Square 79, Finegrid -, Pottery pail 52; total seed amount 48) is collected from an “ash pit” (see Fig. 16). Crop plant 1 *T. aestivum/ durum*, 2 *Triticum* sp., 1 *Hordeum* cf. *vulgare*, 2 unidentified *Cerealia*, 1 *Vicia ervilia*, 3 unidentified large *Leguminosae*, as crop weeds 4 *Lolium remotum* Schrank-type, as open vegetation plants and possible weeds 1 *Artemisia* sp., 2 *Bromus* sp., 3 *Lolium* sp., 6 unidentified *Gramineae*, 7 *Melilotus* sp., 3 unidentified small seeded *Leguminosae*, 1 *Polygonum* sp. and 1 *Galium* sp, 3 *Phalaris minor*-type and 4 small seeded *Gramineae*, have been recovered. Together with the sample BP-24 from the ‘ashy lens’, the context of this sample could be interpreted as an ashy disposal place for kitchen or food preparation waste. It is astonishing that the chaff remains of cereals have been recovered neither in this pit context, nor in another working place in Tell Atchana. It could be an indicator that early stage crop processing activities were performed outside the settlement or that such inside city contexts were still not recovered.

Locus 04-2030 (floor): Sample **BP- 24** (Grid 44, Square 79, Finegrid -, Pottery pail 53; total seed amount 22) is taken from an ashy line, near the “ash pit” context L04-2029 (see Fig. 16). Crop plant 3 *T. aestivum/ durum*, 1 *Triticum* sp., 1 *Hordeum* cf. *vulgare*, 3 unidentified *Cerealia*, as crop weeds 5 *Lolium remotum*, as open vegetation plants and possible weeds 2 *Artemisia* sp., 1 unidentified *Gramineae*, 1 *Melilotus* sp., 1 *Polygonum* sp., 1 *Rumex* sp. and 1 *Bupleurum* sp. have been recovered in this context. The content of this sample is interpreted with BP-25 together.

Locus 04-2040 (kiln): Sample **BP- 42** (Grid 44, Square 79, Finegrid -, Pottery pail 75; total seed amount 16) is taken from inside a kiln (see Fig 16). Crop plant 1 *T. aestivum/ durum*, 1 *Triticum* sp., 4 unidentified large *Leguminosae*, 1 *Vitis vinifera*, as open vegetation plants and possible weeds 3 *Silene* sp, 1 *Lolium* sp., 2 *Melilotus* sp., 1 *Bupleurum* sp. and 1 *Thymelaea* sp. have been recorded. The sample is relatively poor in botanical remains and there are only few crop plants, mostly *Leguminosae* seeds. It is relative difficult to say, if this context had been used as a kiln or not, but this possibility is not out of question.

Locus 04-2041 (pavement): Sample **BP- 46** (Grid 44, Square 79, Finegrid 94, Pottery pail 101; total seed amount 84) is taken from scattered bones and sherd concentrations on the pavement of a street or outdoors (see Fig. 16). The sample is related to sample BP- 47, 48 and 49 and includes as crops 1 *T. aestivum/ durum*, 5

Triticum sp., 1 unidentified *Cerealia*, 1 *Vicia ervilia*, 1 *Lathyrus sativus*/*Vicia ervilia*, 10 unidentified large *Leguminosae*, 1 *Vitis vinifera*, as crop weeds 1 *Heliotropium* cf. *europaeum*, 12 *Lolium remotum* Schrank-type, 1 *Lithospermum* sp., as open vegetation plants and possible weeds 6 *Silene* sp, 14 *Lolium* sp., 6 unidentified *Gramineae*, 4 unidentified small seeded *Gramineae*, 8 *Melilotus* sp., 4 *Trifolium*/*Melilotus* sp., 1 unidentified small seeded *Leguminosae* and 6 *Phalaris minor*- type. This sample has, in comparison with the samples from tabun and kiln contexts, and although it came from an outdoor-pavement, relatively rich crop plant assemblage. If the interpretation of this context as ‘outside pavement’ is to be taken into consideration, it is possible to say that the residues from kitchen activities or from a working place have been swept out to this outdoor context.

Sample **BP- 47** (Grid 44, Square 79, Finegrid 84, Locus 04-2041, Pottery pail 102; total seed amount 124) is collected like BP-46, 48 and 49 from scattered bones and sherd concentrations on the outdoor-pavement (see Fig. 16). The sample has crop plant remains 2 *T. dicoccum*, 8 *T. aestivum*/*durum*, 11 *Hordeum* cf. *vulgare*, 11 unidentified *Cerealia*, 1 *Lens culinaris*, 12 unidentified large *Leguminosae*, 8 *Vitis vinifera*, as crop weeds 1 *Heliotropium* cf. *europaeum*, 21 *Lolium remotum* Schrank-type, as open vegetation plants and possible weeds 5 *Lolium* sp., 3 *Phalaris aquatica*/*paradoxa*- type, 8 unidentified *Gramineae*, 6 unidentified small seeded *Gramineae*, 4 *Melilotus* sp., 7 *Melilotus*/*Trifolium*, 1 *Trifolium* sp., 1 *Polygonum* sp., 2 *Polygonum*/*Rumex*, 1 *Sherardia arvensis*, 3 *Bupleurum* sp. 8 *Phalaris minor*-type. This sample is rich in crop plant remains and weeds, like BP 46. The interpretation of this context is an accumulation of kitchen or working place residues, as mentioned above.

Sample **BP- 48** (Grid 44, Square 79, Finegrid 73, Locus 04-2041, Pottery pail 96; total seed amount 40) is taken from the same scattered bones and sherd concentration on the outdoor-pavement (see Fig. 16). In this sample the following was found: 1 *Lens culinaris*, 3 unidentified large *Leguminosae*, 3 *Vitis vinifera*, as crop weeds 1 *Heliotropium* cf. *europaeum*, 1 *Galium aparine*/*spurium*- type, as open vegetation plants 1 cf. *Carthamus* sp., 1 *Centaurea* sp., 3 *Lolium* sp., 5 unidentified *Gramineae*, 5 small seeded *Gramineae*, 4 *Trifolium* sp., 1 *Trifolium*/*Melilotus*, 1 unidentified small seeded *Leguminosae*, 1 *Rumex* sp. and 8 *Phalaris minor*- type. The crop plant remains of this sample are, in comparison with other samples from the same context, scarce, nevertheless, they should be interpreted with BP 46, 47 and 49 together.

Sample **BP- 49** (Grid 44, Square 79, Finegrid 74, Locus 04-2041, Pottery pail 97; total seed amount 53) is taken from the same context of scattered bones and sherd concentrations (see Fig. 16), as mentioned above. In this sample crop plants 4 *T. aestivum/durum*, 4 *Hordeum cf. vulgare*, 2 *Lens culinaris*, 1 *Vicia ervilia*, 5 unidentified large *Leguminosae*, 1 *Heliotropium cf. europaeum*, 11 *Lolium remotum* Schrank-type, 15 unidentified *Gramineae*, 1 *Phalaris aquatica/ paradoxa*-type, 2 *Medicago/ Melilotus*, 3 *Trifolium/ Melilotus* and 1 *Bupleurum sp.*, as fresh water plant 1 *Phalaris arundinacea*, 2 *Phalaris minor*-type have been found. Together with the above mentioned samples BP-46, 47 and 48, this sample could be interpreted as a rich deposit accumulation outside a still undefined as a working place or kitchen.

Locus 04-2010 (floor): Sample **BP- 28** (Grid 44, Square 79, Locus 04-2041, Finegrid 88, Pottery pail 60; total seed amount 45) is collected from mud-brick detritus of a possible floor deposit (see Fig. 16). In the sample, crop plants 1 *T. dicoccum* (emmer), 3 *Triticum sp* (wheat), 1 *Hordeum cf. vulgare* (barley), 3 *Lens culinaris* (lentil), 1 *Vicia ervilia* (bitter vetch), 1 *Vicia faba* (broad bean), 1 *Vitis vinifera* (vine grape), as crop weed 7 *Heliotropium cf. europaeum*, *Lolium remotum* Schrank-type, as open vegetation plants and possible weeds 1 *Fumaria sp.* and 1 *Valerianella dentata*, 1 unidentified *Compositae*, 7 *Phalaris aquatica/ paradoxa*-type, 2 unidentified small seeded *Gramineae*, 5 *Melilotus sp.*, 2 *Melilotus/ Trifolium*, 1 *Bupleurum sp.* and 2 *Phalaris minor*-type were found. Without a more detailed context description, it is not possible to make a plausible interpretation about this context.

Sample **BP- 29** (Grid 44, Square 79, Finegrid 89, Locus 04-2041, Pottery pail 59; total seed amount 46) is taken from the same Mud-brick detritus of a possible floor deposit like sample BP- 28 (see Fig. 16). In this sample, 5 unidentified *Cerealia*, 1 *Lens culinaris*, 1 *Vicia ervilia*, 3 unidentified large *Leguminosae*, as crop weed 1 *Heliotropium cf. europaeum*, 10 *Lolium remotum* Schrank-type, as open vegetation plant 1 *Silene sp.*, 1 unidentified seed of *Cyperaceae/ Polygonaceae* family, 6 *Lolium sp.*, 6 *Phalaris aquatica/ paradoxa*-type, 1 unidentified small seeded *Gramineae*, 4 *Melilotus sp.*, 2 unidentified small seeded *Leguminosae*, 1 *Malva sp.* and 1 *Thymelaea sp.* have been recovered. As mentioned above, possible interpretation seems to be unlikely, as due to insufficiently context description.

3.2.3 Some considerations for the Tell Atchana sample contexts

Due to the difficulties in evaluating the functional context descriptions, in Tell Atchana samples, it is not clearly observable, whether the spectrum of crop plants and weed taxa is varied among different archaeological contexts or not. There are only some clear evidences, in which crop species are well represented, like tabun and floor (near by tabun) contexts L04-2021, L04-2002, L04-2032 (Square 80). These contexts could have been used for cooking activities or disposal. The predominance of wild and weed species in the contexts of mud installations could be interpreted that these structures had probably heating functions in courtyard or open-workshop area.

In Square 79 is also not clearly observable, why the samples from the pavement structure (L04-2007 and L04-2041) contain 20-40% crop plants (e.g. samples BP-21, BP-46, BP-43, BP-49 and BP-47). They might have been disposals of household activities, and swept onto the pavement. One sample context has a better explanation for its high crop plants (about 45%); a tabun (L04-2005; BP-43).

3.3 Analytical results of the archaeobotanical data

3.3.1 Seed density of the samples

Two samples of Kinet Höyük, 97-70 and 98-009, have a seed density of more than 10 seeds per litre soil. The other two samples 97-67 and 98-076 have more than 4 seeds per litre. The rest of the samples have seed densities between 0,5 and 2,7 (Graphs 1-2). There are no descriptions on the samples sheets of Kinet Höyük about the elevation of the excavated areas.

The Tell Atchana samples, in general, have lower seed densities than those of Kinet Höyük. Only 7 of the Tell Atchana samples have a seed density between 2 and 4 (BP 21, 22, 45, 46, 47, 48 and 49). Low seed densities of the Tell Atchana samples could mainly be caused by lower elevation differences between the modern soil surface and the sampled contexts, which suggest that the taphonomy of the botanical remains must have been negatively influenced by the roots, climatic conditions, micro-fauna and by modern agricultural activities (Graph 2).

3.3.2 *Eco groups and life forms in sample compositions*

Archaeobotanical species and types for the ecological evaluation were classified into groups of species with similar autecological behaviour, as mentioned in Chapter 2. Five principal eco-groups' were formed: crops, weeds, open vegetation, water habitats (including fresh water and marine water habitats) and maquis-type vegetation (see Appendix 5). Many of the species appear in modern vegetation in one or more than one eco-group; the category 'open vegetation' therefore contains many species that might originally have been weeds or were growing in the maquis (RIEHL, 1999). Some moisture-indicating plants might also have been grown and harvested in the past with the crops; they could be seen as possible weeds.

3.3.3 *General patterns of crop species in Kinet Höyük and Tell Atchana*

3.3.3.1 **Cereals of Kinet Höyük and Tell Atchana and their economical information**

In Kinet Höyük the wheat species, like *T. aestivum/durum* (bread/durum wheat) (106 seeds in Kinet Höyük and 36 seeds in Tell Atchana), and unidentified *Triticum* seeds are more abundant than in Tell Atchana (Graphs 5-6). *Hordeum cf. vulgare* (barley) is better represented than in Tell Atchana with higher ratios in the crop spectrum (10% in Kinet Höyük, 8% in Tell Atchana; Graph 3-4).

Also the ubiquity of *T. aestivum/durum* and *Hordeum cf. vulgare* is higher in Kinet Höyük than in the Tell Atchana samples (Graphs 7-8). Despite the absence of *T. dicoccum* chaff remains in Tell Atchana samples, the crop itself is with few seeds represented (the amount of *T. dicoccum* and *T. cf. dicoccum* make together 6 seeds and 5, 7% ubiquity) (Graphs 7-8). In Kinet Höyük *T. dicoccum* has scarce occurrence; the amount of *T. dicoccum* and *T. cf. dicoccum* is only 7 seeds and 3, 2% ubiquity in the entire data set (Graphs 7-8).

The absence of *T. dicoccum* chaff remains in Tell Atchana samples suggests that early stage crop processing activities might have happened not directly in the settlement, but rather outside. Another possible explanation is that contexts of early crop processing activities have still not been recovered at the inside of the city. This aspect will be discussed in Chapter 5. In Kinet Höyük *T. dicoccum* chaff remains are very rare, and they appear in small amounts only as contaminants of fine sieve by-products, as mentioned above. The same result of rare occurrence of *T. dicoccum* chaff remains has been mentioned by HYND (1997). No chaff remains of *T.*

aestivum/durum (bread/ durum wheat) and *Hordeum cf. vulgare* (barley) have been found in both sites. Processing by-products of free-threshing cereals (e.g. bread/durum wheat) are more vulnerable to charring conditions than those of the hulled cereals (BOARDMAN and JONES, 1990; VALAMOTI, 2003). Glume-wheats differ from free-threshing cereals: in order to remove the grain from the husks surrounding them, an extra set of operations is required in addition to threshing, winnowing and sieving. These operations involve pounding of the spikelets and the removal of the husks either by sieving, winnowing, or both (HILLMAN, 1981, 1984a, 1984b; VALAMOTI, 2003). This aspect will be discussed in more detail in Chapter 5.

The number and percentage occurrence of unidentified cereals are, due to preservation and distortion problems, high in both sites (65 seeds in Kinet Höyük and 47 seeds in Tell Atchana).

3.3.3.1.1 Barley (*Hordeum cf. vulgare*)

According to the botanical analysis of *Hordeum cf. vulgare* (barley), it was an important crop in subsistence economy of Kinet Höyük. The barley seeds appear in some contexts together with bread/durum wheat and bitter vetch seeds. At least, the chaff remains of *Hordeum cf. vulgare* are absent in both sites, which could be interpreted that the inhabitants of Kinet Höyük and Tell Atchana might have processed their own barley products outside the settlement or they might have brought them as a result of a coordinated economic system, as RIEHL (1999) mentions in regard to Middle Bronze Age Troy, from the surrounding villages as cleaned barley into the settlement. Barley is known for its salt and drought-tolerance (YAKAR, 2000 refers to Nesbitt, 1995) and cultivated not only as animal fodder; today it is also an important crop for human consumption. Barley cultivation is common in semi-arid regions of Anatolia and the Near East (HILLMAN, 1973a, 1984a, 1984b; YAKAR, 2000). In Tell Atchana, the barley occurrence is not as significant as in Kinet Höyük, and was probably combined with pulses for food preparation, as it is well known from eastern Mediterranean cultures. Cereals contain high amounts of starch and less protein. Due to their high protein contents, pulses can accompany cereals in a well-balanced diet (VALAMOTI, 2003).

3.3.3.1.2 Emmer (*T. dicoccum*)

The cultivation of *T. dicoccum* (emmer) in the vicinity of both settlements seems to be closely related to risk management for bad harvesting times or for crop failure. *T. dicoccum* alone might have had no significant economic importance in the subsistence economy, however due to the resistance of this crop for drought and fungal disease, in comparison to *T. aestivum/ durum*, it surely was important as a risk-buffering component in cereal cultivation, as mentioned in different studies (HILLMAN 1973a, 1984a, 1984b; JONES, 1984; RIEHL, 1999). The occurrence of emmer chaff remains in Kinet Höyük as a later stage crop by-product suggests that the inhabitants of Kinet Höyük might have produced their own emmer demand, but probably as small-scale cultivation as an alternative crop in the case of crop failure. According to emmer finds in Tell Atchana, the cultivation of *T. dicoccum* might have been small-scale at this site as well. Small-scale agriculture means that crops are cultivated in gardens or small fields in contrary to large-scale agriculture with extended fields.

3.3.3.1.3 Free-threshing wheats (*T. aestivum/durum*)

The Late Bronze Age subsistence economy of Kinet Höyük was dominated by free-threshing wheats (*T. aestivum/durum*). In Tell Atchana, bread/durum wheat is the main cereal. In both sites no rachis and chaff remains of free-threshing wheat were found. One possible reason for this could be that the inhabitants of Kinet Höyük might have conducted early processing stages of naked wheat outside the settlement. At Tell Atchana, it seems to be very likely that the inhabitants could have got their bread/durum wheat already cleaned from the surrounding producing farming villages. More information about economy of *T. aestivum/durum* is given in the Catalogue.

3.3.3.2 Pulses of Kinet Höyük and Tell Atchana and their economical information

According to the analysed samples, agricultural activities at Tell Atchana seem to have been dominated by growing crop legumes. The occurrence of pulses as percentage in Tell Atchana is higher than in Kinet Höyük. The lentil (*Lens culinaris*) has almost the same percentage in both sites, but is different as seed number (72 seeds in Kinet and 35 seeds in Tell Atchana). Unidentified large pulses are highly

abundant in Tell Atchana (80 seeds) and Kinet Höyük (91 seeds) (Graphs 3-6). Other pulses like *Vicia ervilia* (bitter vetch), *Vicia faba* (broad bean), *Lathyrus sativus*/*Vicia ervilia* (grass pea/ bitter vetch) appear in small amounts but they have relative high ubiquity for their seed amounts (Graphs 7-8). *Cicer arietinum* (chickpea) appears with only 2 seed and solely in Kinet Höyük samples.

Pulses and cereals as staple crops seem to be represented in different grades in subsistence economy of both settlements. In Kinet Höyük all cereal remains constitute up to 55% of the crop plant assemblage and pulses 34%, however in Tell Atchana the cereals constitute up to 42%. Pulses have a slightly better representation than the cereals in Tell Atchana. They constitute 43% of the crop plant assemblage (Appendices 1-5 and Graphs 3-6).

3.3.3.2.1 Lentil (*Lens culinaris*)

Lentil is known for its high protein content of 25% and is one of the most important protein supplies, after meat, for human consumption. The lentil seeds are well represented in their seed numbers at Kinet Höyük with highest ubiquity (32, 2%, Graph 7) in the pulse assemblage, which suggests, that lentil was the main pulse in crop category and cultivated in large-scale. In the case of Tell Atchana, the lentil is well represented as seed number and percentage occurrence, but its ubiquity is lower than *Vicia ervilia* (Graph 8). The occurrence of lentil in Tell Atchana as ubiquity is comparable with barley and naked wheat occurrences (Graphs 7-8). The occurrence of lentil in Kinet Höyük is somewhat different from Tell Atchana; lentil is in its ubiquity comparable with barley, however the seed amounts of naked wheat are clearly higher. In both sites, lentils might have been used for human consumption; it is, for example, combined for meal with barley, as well as for animal fodder in the form of ‘maslin’, as mentioned in ethno-archaeological studies (JONES and HALSTEAD, 1995). The possible large-scale cultivation of lentil in the surrounding area of Tell Atchana and Kinet Höyük in the Late Bronze Age might be taken into consideration.

3.3.3.2.2 Bitter vetch (*Vicia ervilia*)

Vicia ervilia is represented by 7 seeds in Kinet Höyük and 11 seeds in Tell Atchana. *Lathyrus sativus*/*Vicia ervilia*-type appears in Kinet Höyük with 12 seeds, but in Tell Atchana it is represented only with 3 seeds. The species *Vicia ervilia*

and is generally produced as animal fodder, due to their high toxin contents (hydrocyanic acidic glycoside) and used only in bad harvesting times for human consumption. *Lathyrus sativus* is, despite its toxins, cultivated for human consumption. To remove toxins of both pulses, the seeds must be cooked; prior to consumption, however, toxins can be tolerated by ruminants (STAHL, 1989).

Bitter vetch appears in Tell Atchana more regularly than in Kinet Höyük (ubiquity 25, 7% in Tell Atchana and 16, 1% in Kinet Höyük; Graphs 7-8). The seed size of *Vicia ervilia* in Tell Atchana samples is small, (similar observations have been noted in the studies of KROLL (1984) on Late Bronze Kastanas and RIEHL (1999) on Late Bronze Troy).

The percentage occurrences and the ubiquity of *Vicia ervilia*, *Lathyrus sativus*/*Vicia ervilia*, *Vicia faba* (Graphs 3-8) could be interpreted as a kind of risk-buffering strategy in agriculture; they might have been used not only for human consumption but also as animal fodder.

3.3.3.2.4 Broad bean (*Vicia faba*)

The cultivation of the broad bean in Kinet Höyük and in Tell Atchana was probably small-scale or sown together with other legumes, which also appear in small amounts. Nevertheless, the taphonomic conditions have to be taken into consideration. Ubiquity of the *Vicia faba* seeds in Kinet Höyük samples is higher than in Tell Atchana samples (19, 3% in Kinet Höyük and 5, 7% in Tell Atchana; Graphs 7-8). *Vicia faba* is used at present in the Near East as animal fodder and for human consumption.

According to VALAMOTI (2003) consumption of *Vicia faba* seeds could have good effects against malaria.

3.3.3.3 Fruit and oil plant cultivation in Kinet Höyük and in Tell Atchana – with an emphasis on the grape vine

Horticultural crops are represented in Tell Atchana samples only by *Vitis vinifera* (grape vine). Other fruit species like *Ficus carica* (fig) and *Punica granatum* (pomegranate) are totally absent in analysed Tell Atchana samples (Graphs 3-6).

In Kinet Höyük samples, some unidentified fruit stones have been found. One of the well-preserved fruit stones is illustrated in the Catalogue. Interestingly, olive stones have been recovered in Late Bronze Age samples in the early excavations of

Kinet Höyük (HYND, 1997), but are totally absent in the present sample of Late Bronze Age. Like olive, another oil plant, flax, has been recorded in Late Bronze Age samples of early excavations (HYDN, 1997); they did not appear among present Kinet Höyük samples. As an important oil crop, sesame is represented with a single seed in only one of the Middle/Early Iron Age samples of Kinet Höyük, as mentioned in Chapter 2. More information about ecology and economy of sesame is available in the Catalogue.

Fresh water habitats in Tell Atchana show the presence of water or river estuaries near the settlement. Moisture-indicating crop plants *Vitis vinifera* (18 pips in Kinet Höyük and 48 pips in Tell Atchana) are present in both sites (Graphs 3-6), but *Ficus carica* (19 seeds) is represented only in Kinet Höyük in mineralised form, in two pit contexts with apparent water presence (Appendix 3 and 4); the taphonomic conditions in pits could be the reason of this special form of preservation, as mentioned above. In the case of Kumtepe, mineralised seeds of the fig in pits have been interpreted as deriving from human faeces (RIEHL, 1999). The partial cultivation of *Ficus carica* (fig) in Kinet Höyük is not to be excluded, but due to its scarce occurrence, it is more likely that fig were gathered from wild trees on the surrounding landscape. The distinction between wild and cultivated forms of *Ficus carica* through seed morphology is not possible (RIEHL, 1999).

3.3.3.3.1 Pomegranate (*Punica granatum*)

Pomegranate appears in small amounts (14 seeds, ubiquity 12, 9%) only in Kinet Höyük samples, as mentioned above. The plant might have been consumed as fresh fruit; however it is also possible to produce wine from pomegranate juice. According to ZOHARY and SPIEGEL-ROY (1975) Kinet Höyük does not lie at the natural distribution area of wild forms, which could be interpreted that the seeds of pomegranate come from cultivated trees. Pomegranate finds appear in some Late Bronze Age Cyprus and Greece settlements, they could be local cultivated in Late Bronze Age Kinet Höyük.

3.3.3.3.2 Grape vine (*Vitis vinifera*)

Seeds of grape vine are more abundant in Tell Atchana than in Kinet Höyük. Large scale cultivation of *Vitis vinifera* in the vicinity of Tell Atchana seems likely. The percentage occurrence and seed amount of *Vitis vinifera* in Tell Atchana is

higher than the main cereal of the site; *T. aestivum/durum* (36 seeds of bread/durum wheat and 48 seeds of grape vine; Graphs 5-6), but the ubiquity of bread/durum wheat (*T. aestivum/durum* 45, 7%, *Vitis vinifera* 42, 8%; Graphs 7-8) is slightly greater than that of grape vine. It is remarkable that the occurrence of the grape vine is almost as high as the main cereal of Tell Atchana. A considerable part of the grape harvest might have been used for direct consumption in the form of fresh grapes or as dried grapes (raisins), since the remains of vine production contains very few pips and ended up a kind processing, which causes strong fragmentation of the pips. The analysis of wine vessels or containers could be helpful to consider the importance of this plant for settlement. In the vicinity of Tell Atchana, the vineyards were probably situated on the terraced mountain-slopes of Amanus, where moist-conditions were available for grape vine-growing and not used for the cereal and pulse cultivation. In Mediterranean regions, as well in temperate Europe, mountain-slopes and foothills are still used for grape cultivation.

In Kinet Höyük, the grape could be interpreted as a supplemental crop or enrichment for the human diet. Its occurrence as seed amount is comparable with those of *Vicia faba* (broad bean), but its ubiquity is considerably higher (29% grape vine, 19, 3% broad bean). Preparation of cereal-pulse-fruit mixtures as animal fodder to support milk production of livestock is known from different ethno-archaeological studies (JONES and HALSTEAD, 1995; VALAMOTI, 2003). Evidence of grape for wine production may have taken with the analysis of wine containers together in to consideration.

3.3.4 Some considerations for the crop production of Tell Atchana and Kinet Höyük

In Tell Atchana, it is more difficult to assume, why pulses seem to have been dominant in the subsistence economy. It does not mean that the cereals were less important than pulses for the inhabitants of Late Bronze Age Tell Atchana. The possibility of ‘negative evidence’ in the taphonomy of the cereal remains could be taken into consideration. In general, pulses are well adapted to dry growing conditions and useful for their nitrogen fixing properties as soil-enrichment. They are also very important as animal fodder, due to their high protein content of their straws and pods (CHARLES, 1984a; ZOHARY and HOPF, 1994). Around Tell Atchana, there were sufficient water resources during the Late Bronze Age occupation of the site and as the settlement lies in the climatic belt of rainfall agriculture, which was

certainly essential for efficient cereal cultivation with less drought risk. In such regions, cereals, which require hot conditions, normally dominate crop assemblages and crop legumes tend to have low occurrences in crop spectra. However, the patterning of crop species in Tell Atchana samples is difficult to interpret without conclusive definition of the archaeological contexts.

In Kinet Höyük, the inhabitants do not seem to have been concentrated on few crop species; they have broader species diversity than in Tell Atchana. The inhabitants might have chosen this as a subsistence strategy for better risk management in bad harvesting times or crop failure. According to cereal-pulses rates in the entire data set of Kinet Höyük, it is possible to assume that the crop-rotation (e.g. fallow-wheat-barley) has been applied to have constant crop yield from Kinet Höyük fields.

Considering the crop spectrum of Kinet Höyük, it is possible to assume that the settlement could produce at least its own subsistence requirements. Other aspects like possible export to the local markets could be taken into consideration and will be mentioned in Chapter 5.

3.3.5 Crop weeds and wild plant taxa

The ‘weed category’ as eco-group contains only those species that have been noted in the modern literature (e.g. *Flora of Turkey*, DAVIS, 1965-1988) as typical crop companions.

An increase in Secalietae-type weeds during the occupation of the settlements was interpreted by the archaeobotanist as a development from intensive small-scale agriculture to large-scale cereal cultivation and intensification of the agricultural methods (RIEHL, 1999; JONES; 1992). In contrast, the Chenopodietae species in crop stores could have been interpreted as intensive garden-type cultivation, because the Chenopodietae weed are relatively easy to separate from crops during crop processing (JONES; 1992; RIEHL, 1999).

The Chenopodietae-type crop weed *Heliotropium cf. europaeum* is represented in Tell Atchana with 45 seeds and in Kinet Höyük with 4 seeds. Another crop weed, *Valerianella dentata*, appears in Tell Atchana only (8 seeds) and not in Kinet Höyük.

Galium aparine/spurium-type is represented with 6 seeds in Tell Atchana and with 14 seeds in Kinet Höyük. The amount of *Galium* sp. seeds, which could be

identified on the genus level, is in Tell Atchana 7 and in Kinet Höyük 10. Another weed plant, which belongs to the same family *Rubiaceae*, is *Asperula arvensis/orientalis*-type. This type is represented with 9 seeds in Tell Atchana and with 10 seeds in Kinet Höyük and belongs to the weed category ‘Secalietae’ (Appendices 1-5 and Graphs 9-12).

According to KÜSTER (1990), *Galium aparine* is a moisture-loving ruderal weed, which grows on nitrogen-rich river banks and lake shores. HILLMAN (1990) mentions that today the riverbank plants can survive in arable fields only on damp patches. In early periods, poor drainage of the fields was probably a more widespread problem, and weeds today that are limited to occasional wet patches; they would have pervaded in the past the entire crop often. According to BEHRE and JACOMET (1990), *Galium aparine* belongs to the ‘special flax weed flora’, which is available from Late Bronze Age lake-shore settlements of temperate Europe.

The high percentage of annuals in weed categories (e.g. *Lolium* spp, *Galium* spp. and *Asperula* spp.) and concentration of weed taxa on few species could be interpreted as being well established agricultural practices in both sites (Graphs 9-12). The occurrence of highly competitive crop weeds in relatively big amounts like *Lolium remotum*, which is difficult to separate during crop processing, shows the intensification of field management. The ecological ranges of weedy components in both sites do not seem to be very different; in the case of Kinet Höyük, they derive from open vegetation and a small part from various habitats. In the case of Tell Atchana, most of the weeds come from open vegetation as in Kinet Höyük, but a small amount come from fresh water habitats.

In Tell Atchana samples *H. europaeum* appears relatively abundant (45 seeds) and very regularly (ubiquity 54, 2%; Graphs 9-12). However, the Secalietae members (e.g. *Lolium remotum*, *Lolium temulentum*, *Asperula arvensis/orientalis*, their total seed amount 139) are already dominant in the samples. This occurrence might be interpreted as existence of small-scale garden-type cultivation in the vicinity of Late Bronze Age Tell Atchana. *H. europaeum* is represented in Kinet Höyük with 4 seeds (ubiquity 12, 9%). In Kinet Höyük there is a clear dominance of Secalietae weeds (4 seeds of Chenopodietae, 430 seeds of Secalietae), which suggests that there is no observable evidence for garden-type cultivation in Late Bronze Kinet Höyük. However, this occurrence of weed flora might have been influenced by the different taphanomic conditions of both sites.

3.3.5.1 *Lolium* spp.

The *Lolium* species are the most abundant weeds, especially *Lolium remotum* L.-type appears in both settlements in relatively high amounts (415 seeds in Kinet Höyük and 130 seeds in Tell Atchana). *Lolium temulentum* is rare and represented by only 5 seeds from Kinet Höyük samples. Other *Lolium* sp., which could not be identified to the species level, come to 103 seeds in Kinet Höyük and 20 seeds in Tell Atchana samples (Graphs 9-12). Considering the total cereal amount of both sites (161 seeds in Kinet Höyük and 59 seeds in Tell Atchana) and the total amount of pulse seeds (49 in Kinet Höyük and 69 in Tell Atchana) the rate of *Lolium* species is relatively high (1: 2,5 in Kinet Höyük and 1: 1,4 in Tell Atchana). These different occurrences in *Lolium* rates at both sites suggest that the separation of the *Lolium* species from crops was not easy; it might be especially for the inhabitants of Kinet Höyük, which could have been less specialised for the weed-control than the farmers of Tell Atchana. Due to the capability of the *Lolium* species to adapt their seeds to the seed morphology of the cereals, their separation is more difficult than other members of Secalietae. The relation of Chenopodietae weeds to Secalietae decreases during the progress of crop-processing; they are easier to separate from crops and represented almost exclusively in by-products (JONES, 1992; RIEHL, 1999).

Harvesting *Lolium temulentum* together with cereals can have a poisonous effect, due to the infested caryopses of this weed with pyriditin-alkoloid (temulin), which produces fungus (*Gloeotinia temulenta*). This fungus mainly affects the nervous system of the livestock and humans (RIEHL, 1999). In Late Bronze Age Kastanas *Lolium temulentum* has correlation with einkorn cultivation and population growth (KROLL, 1984). *Lolium* species can appear in association with a diverse set of crops, as in the case of Middle Bronze Age Troy, darnel appears in association with emmer and barley (RIEHL, 1999).

3.3.6 *Open vegetation*

According to RIEHL, (1999) the members of shrubby vegetation that grow today mainly in maquis or phrygana were quite rare, therefore, most of these plants were summarised in the category ‘open vegetation’, but could also grow in ‘maquis vegetation’, as well. Open vegetation includes two categories; the first one is a ‘grassland-type vegetation’, which grows on moist soils and is grazed by animals, the second one is ‘dry-land’ and contains those species typically found on dry soils. In

the eco-group 'open vegetation' the Kinet Höyük samples have another species spectrum than those from Tell Atchana (Appendices 1-5; Graphs 13-16); *Lithospermum* sp. appears in Tell Atchana with 2 seeds and it is absent in Kinet Höyük. *Valerianella* sp. (9 seeds in Kinet Höyük and 4 seeds in Tell Atchana) and *Valerianella coronata* are present in the samples of both settlements (3 seeds in Kinet Höyük and 2 seeds in Tell Atchana). In contrast to Tell Atchana, there are no seeds of *Compositae* family in Kinet Höyük, and the members of *Compositae* are represented with only 7 seeds (e.g. *Carthamus*, *Centaurea*) in Tell Atchana. The open vegetation plant *Phalaris aquatica/paradoxa* is absent at Kinet Höyük, but appears to be relatively abundant and common among Tell Atchana samples (60 seeds, ubiquity 45, 7%). This species is probably grazed by animals and brought into the settlements. At Tell Atchana, *Sherardia arvensis* probably appeared as a ruderal species in the samples, in spite of its small amount (9 seeds), very regularly (ubiquity 22, 9 %). *Bupleurum* sp. is not very abundant in Tell Atchana samples (11 seeds) but appears regularly in the samples (ubiquity 25, 7%). In Kinet Höyük samples they are more abundant and appear regularly (30 seeds, ubiquity 35, 4%). The possibility that *Bupleurum* sp. appears in both sites as a crop weed, seems to be plausible. *Malva* sp. is only recorded by 4 seeds per site and unlikely deriving from animal dung, because they are mostly avoided by the livestock (RIEHL, 1999). *Fumaria* sp. is also very rare (1 seed in Kinet Höyük and 3 seeds in Tell Atchana).

Unidentified small seeded *Leguminosae* are abundant in Kinet Höyük samples (147 seeds) and they are represented in Tell Atchana samples with 46 seeds. *Trifolium* sp. (50 seeds) and *Trifolium/Melilotus*-type (31seeds) are relatively well represented in Kinet Höyük. *Trifolium* sp. is not rare as well in Tell Atchana, 25 seeds have been recovered, but *Trifolium/Melilotus*-type is only recorded with 6 seeds. Only 5 *Melilotus* sp. seeds in Kinet Höyük samples have been found, as in comparison to Tell Atchana samples, where 47 seeds have been recorded. *Medicago* sp. is represented with 12 seeds in Kinet Höyük and with 4 seeds in Tell Atchana. There are also some *Medicago/Melilotus*-type seeds, which make in Kinet Höyük 2 and in Tell Atchana 5 seeds. An argumentation about *Melilotus* sp. and *Medicago* sp. seeds that might have been appeared in Kinet Höyük samples as crop weeds could be taken into consideration. *Melilotus* sp. are not rare in Tell Atchana samples; they derive from contexts of firing places, floor deposits or ash pits, which suggest that they might have been fine sieve by-products, or that they might have been grazed by

animals and finally burnt in animal dung used as fuel. *Trifolium* sp. and *Trifolium/Melilotus*-type seeds are not rare in Kinet Höyük, but *Trifolium* sp. came mostly from floor deposits, and only some *Trifolium/Melilotus* seeds appear in shell pit contexts, which might have to be seen as fine sieve by-products, *Melilotus* sp. are also very rare in samples.

Finally the occurrence of the above mentioned species of small seeded *Leguminosae* were suitable open vegetation plants for animal grazing but they could appear as well as crop weeds. For the further interpretation of these open vegetation plants, the botanical analysis of the *in situ* dung remains could be helpful. However, such contexts have not been recovered from both sites. The use of animal dung has different aspects; dung might have been used as fuel, but also mixed with hay and could be used for the mud-brick production. After the destruction of the buildings, the seeds from destroyed mud-brick structures might have been mixed with other plant remains in the vicinity.

Thymelaea sp. and *Phalaris minor*-type are represented with 52 seeds in Tell Atchana (Appendices 1-5; Graphs 13-16); these plants could appear in maquis vegetation in the vicinity of this site, as well. They were possibly used by inhabitants for feeding their animals or for other purposes, like basketry and hoarding of the houses.

3.3.8 Fresh water habitats

This eco-group contains plant species, which are characteristic of reed-beds or periodically submerged habitats on riversides near ditches or irrigation channels (RIEHL, 1999).

Fresh water plants like *Phalaris arundinacea* (with 11 seed) and *Alisma* sp. (with only one example) appear only in Tell Atchana samples (Appendices 1-5; Graphs 13-16). There are no indicator plants for fresh water habitats in the Kinet Höyük samples, which seems surprising, since according to geomorphological researches the river Deli Çay has changed its riverbed at least after the 1st century A.D., and before this time, the river streamed very close to the settlement. Apparently, the inhabitants of Late Bronze Kinet Höyük might have rarely used the vicinity of the river Deli Çay for the animal grazing.

The Amuq Plain surveys show that the plain is formed by different geomorphological formations like alluvial fans, river levees, intervening flood basins,

which have been developed since the 2nd millennium B.C. (YENER, 1998 refers to Wilkinson, in prep.). Fresh water habitats in Tell Atchana samples suggest that the water logged areas in the vicinity of the settlement might have been used for animal grazing or as fields. *Phalaris arundinacea* as moisture-loving plant might have been grazed by animals or as crop-accompanying plant brought after harvest by human into the settlement. At present, *P. arundinacea* is cultivated in different regions of the Near East as animal fodder (RIEHL, 1999); however, due to its small seed amount, the cultivation of this plant in the vicinity of Late Bronze Age Tell Atchana seems to be unlikely.

3.3.9 Various habitats and marine or salt-water habitats

As plants of various habitats, *Carex* sp. appear in Kinet Höyük samples with 48 seeds as well as in mineralised form are very abundant (185 seeds). There are also 4 unidentified *Cyperaceae/Polygonaceae* seeds in Kinet Höyük samples. *Carex* sp. is represented by only 3 seeds in Tell Atchana samples and the mineralised form of *Carex* sp. does not appear. There are also unidentified *Cyperaceae* (3 seeds) and *Cyperaceae/Polygonaceae* (6 seeds) in Tell Atchana samples.

As a salt-tolerant species, *Salsola* is found primarily near the sea coast or inland waste places, mentioned in the eco-group ‘marine water’ or ‘coastal habitats’. *Salsola* sp. is represented by 3 seeds in Kinet Höyük and 2 seeds in Tell Atchana. *Salsola* sp. might have been brought into Kinet Höyük by animals, which grazed in the salt-marshes of the coastal site of Kinet Höyük. The *Salsola* finds in Tell Atchana might have been derived from inland waste places or from saline soils caused by small-scale irrigation (RIEHL, in prep.).⁴ Ecological consideration for Late Bronze Age Kinet Höyük and Tell Atchana

3.3.2 Some considerations for eco groups and life forms in sample compositions

Considering crop plants of both sites, in Tell Atchana, pulses seem to have been dominant in the subsistence economy. In Kinet Höyük, there is a broader species diversity than in Tell Atchana. The inhabitants of Kinet Höyük might have chosen species diversity as a subsistence strategy for better risk management in bad harvesting times or crop failure. According to cereal-pulses rates in the entire data set of Kinet Höyük, it is possible to assume that the crop-rotation (e.g. fallow-wheat-barley) has been applied to have a constant crop yield from the fields.

The high percentage of annuals in weed categories (e.g. *Lolium* spp, *Galium* spp. and *Asperula* spp.) and concentration of weed taxa on few species could be interpreted as intensive field management in both sites. The ecological ranges of weedy components in both sites do not seem to be very different; in Kinet Höyük, they derive from open vegetation and a small part from various habitats (Graphs 15-16). In Tell Atchana, most of the weeds come from open vegetation as in Kinet Höyük, but a small amount comes from fresh water habitats. In Tell Atchana samples Chenopodietae-type weeds together with the Secalietae members might be interpreted as existence of small-scale garden-type cultivation in the vicinity of the Late Bronze Age tell. In Kinet Höyük there is no significant evidence for Chenopodietae-type weeds, which suggests that there is no observable evidence for garden-type cultivation in the Late Bronze.

Most of the members of shrubby vegetation were summarised in the category 'open vegetation'. Small seeded *Leguminosae* were, as plants of 'grassland-type vegetation', suitable for animal grazing but they appear as well as crop weeds. For the further interpretation of these open vegetation plants, the botanical analysis of the *in situ* dung remains could be helpful. *Thymelaea* sp. and *Phalaris minor*-type could appear in maquis vegetation in the vicinity of Tell Atchana. They were possibly used by the inhabitants to feed their animals or for other purposes, like basketry and hoarding of the houses.

Fresh water plants like *Phalaris arundinacea*, in Tell Atchana samples suggest that the water logged areas in the vicinity of the settlement might have been used for animal grazing or as fields. In Kinet Höyük samples, fresh water plants are not represented (Graphs 15-16).

Plants of various habitats are well represented in Kinet Höyük samples, due to taphonomic condition of the wash fill context, especially in mineralised forms. In Tell Atchana, they appear rarely (Graphs 15-16).

4. Ecological consideration for the LBA Kinet Höyük and Tell Atchana

4.1 The ecological interpretation of the archaeobotanical data

Pollen analysis of different regions show, that plant communities changed their structures over time periods, especially during 'regeneration' processes after a

human occupation (ROBERTS, 1990). Especially in temperate Europe, with the opening of the forest for new arable fields and meadows, the composition of plant species changed, so-called semi-natural plant associations developed, whose existence depended on specific anthropo-zoogenic factors. Even if these landscapes have been left to the 'regeneration' new plant associations appeared (BEHRE and JACOMET, 1991).

The ancient vegetation of Turkey has been far less studied than that of central Europe, so that only little is known about how present day plant associations compare to those of the past (RIEHL, 1999).

In this work, the potential habitats of plant species are described according to typical vegetation units of Mediterranean landscapes; the moisture low plateau pastures, maquis and also salt marshes, which are used for the livestock grazing.

Using the eco-groups of the archaeobotanical species, potential habitats can be located in the past landscape, considering to the openness of the vegetation, coastline or river bank. For the grouping of the species and types into different habitats see Appendix 5.

4.2 Interrelations between ecology and economy

Consideration of the natural and anthropogenically changed habitats of the Late Bronze Age Kinet Höyük and Tell Atchana has been drawn in this Chapter. Plant communities in disturbed landscapes largely reflect agricultural activities of the inhabitants, which are discussed within the scope of this work. The plant species and types are grouped into 'eco-groups' according to autecological data, which means, that some possible weeds were categorised in the group of moisture-indicating plants or in the category of open vegetation, indicating the most probable growing conditions, as mentioned in Chapter 2.

The weed flora apparent from the archaeobotanical samples might indirectly indicate the agricultural practices for each crop. The different occurrences between the perennial and annual weeds can explain intensification of agricultural practices like crop processing and soil treatment (HILLMAN, 1973b, 1991; JONES, 1992; RIEHL, 1999).

4.3 The contribution of geomorphology and soil science for landscape reconstruction

Soil science and geomorphology may help to understand the changes in the vegetation like deforestation, increase of maquis and phrygana vegetation over time. Erosion seems to play an important role for both settlements during the Late Bronze Age and was probably accelerated by deforestation for metal production and for cultivated fields in Amuq Valley for Tell Atchana and Kinet Höyük. Nowadays, the evidence of the pump-irrigated cotton fields changed the agricultural picture in the region and has become a cause of extension of such fields using bulldozers; this, in turn, has confronted many archaeological sites with destruction (YENER; et al., 2000).

In Southern Turkey, soil erosion is active and is accelerated by the steepness of the slopes and the intensity of the rainfall. Terracing of the mountain slopes has been used over centuries to prevent the soil erosion. Despite the high annual precipitation, the local deficiency of water resources, particularly during the hot summer, is problematical (ERİNÇ and TUNÇDİLEK, 1952).

The best evidence to age the onset of accelerated erosion comes from alluvial fills, which have been deposited since prehistoric times in the circum-Mediterranean basin (ROBERTS, 1990). Hill-slope erosion is observed for the rivers Küçük and Büyük Menderes, which drain the mountain belt of southwest Turkey and transport eroded soils from the hill-slope of the partly deforested mountains. This soil is stored temporarily as colluvium before being evacuated downstream by rivers after the land was abandoned (ROBERTS, 1990).

Culturally caused deforestation is often characterised by increases in soil erosion and sediment flux (ROBERTS, 1990). New landscape development after deforestation by human activity would be a kind of new landscape formation rather than a return to the old one. One of the controlling parameters for the forest regeneration is the soil itself, if it has been the subject to erosion and degradation may no longer support natural vegetation cover (ROBERTS, 1990).

Flood intensity of the Orontes River, which transports masses of silt and alluvium to the Mediterranean Sea since the prehistoric times, is with high probability influenced by the deforestation of the Amanus Mountains. The Orontes River is the most significant factor; it influences the entire landscape development in the Amuq Plain, together with Lake Antioch (YENER, 1998). The alluvial

accumulation of Orontes during the time periods has been buried many small mounds and prehistoric settlements on this plain (YENER et al., 2000).

Kinet Höyük is located at the south edge of the Cilician plain (Çukurova), which is formed as part of large alluvial fan of Ceyhan and Seyhan Rivers. The geomorphological research of Kinet Höyük suggests that the alluvium and the erosion have modified the landscape dramatically, especially in pre-medieval periods (GATES, 2000). Palaeosol sedimentary sequences of the river banks of Deli Çay, Tüm Çayı, and Özerli Çay indicate relative periods of climatic instability in the Late Bronze Age and Hellenistic periods (GATES, 2002)

4.4 Aspects of Eastern Mediterranean vegetation

The vegetation history of the relevant region for this work is mainly deduced from pollen analysis of the Ghab boring core. The development of potential composition of the Mediterranean woodland during the Late Holocene and the increase in arboreal pollen percentage as indicator for human activity has been sketched in Chapter 1.

The following defined units of ‘maquis vegetation’ are based on the studies of the Mediterranean maquis and phrygana vegetation by QUÉZEL (1981a and 1981b). DI CASTRI (1981, p. 3) defines ‘Mediterranean-type shrublands’ as follows: “Shrublands are the scrub formations, found primarily within the xerothermic range of Mediterranean climates, characterised by the dominance of woody shrubby plants with evergreen, broad and small, stiff and thick (sclerophyll) sometimes being present with or without an understory of annuals and herbaceous perennials”. ‘Matorral’ is a generic term, used by QUÉZEL (1981a) for maquis and phrygana. These communities constitute the stage preceding the establishment and re-establishment of forest eco-systems or may represent degraded forest (RIEHL, 1999). The Mediterranean shrublands (open matorral, maquis and phrygana) are divided into two phytosociological classes; a western and an eastern class. The eastern Mediterranean class with less developed maquis and phrygana vegetation belongs to the Cisto-Micromerietea class (QUÉZEL, 1981a; RIEHL, 1999).

The maquis and phrygana formations have in eastern Mediterranean relative species poverty (ca. 200 species) (RIEHL, 1999). This poverty contrasts with the considerable richness of grassland in the same region, which generally represent stages of regression in the maquis and garrigue (QUÉZEL, 1981b; RIEHL, 1999).

These grasses may appear as part of the maquis, but also in other ecological (e.g. open vegetation) habitats, which makes not only phytosociological, but also archaeobotanical interpretations difficult.

4.5 Human influences on past and modern vegetation

4.5.1 Grazing, browsing and effects of fire

Mediterranean pastures include five main categories: productive forests, maquis and phrygana, dry grassland, meadows and halophytic steppes. The flora of pastures is generally characterised by three aspects: the presence of evergreen species and shrubs (e.g. *Quercus coccifera*), low shrubs with persistent aromatic foliage (e.g. *Cistus* spp.) and numerous geophytes (RIEHL, 1999). *Quercus coccifera* and *Olea europaea* are mostly browsed by sheep and goat. The typical grazed grasses of Mediterranean pastures *Lolium perenne*, *Phalaris arundinacea* are present taxa in Tell Atchana, and the species like *Medicago* spp., *Trifolium* spp., are represented in both sites as well. Beside the pasture, the meadows in the moister Amuq valley must have been comparatively important for animal grazing.

Different fire forms, which are caused by humans or by natural reasons, effected past vegetation efficiently. The greatest damage in semi-arid and sub-humid zones is caused in coniferous forest (*Pinus halepensis* and maquis vegetation rich in essential oils and resins (*Cistaceae*) (HOUÉROU, 1981; RIEHL, 1999). The effects of fire depend on the type of vegetation and the frequency of fire, within a specific period of time. Grazing of burnt woods can suppress the development of woodland (RIEHL, 1999). Pyrophytes are the plants, whose propagation, multiplication and reproductions is stimulated by fire; they dominate Mediterranean vegetation today and are assumed to be one reason why little is known about the potential climax vegetation less affected by fire (HOUÉROU, 1981; RIEHL, 1999). Seed dispersal and germination of *Pinus halepensis*, *P. brutia* and *Cistus* species is greatly stimulated by fire (BOTTEMA and WOLDRING, 1990). The growth of *Quercus coccifera* can also be supported by fire and some other species like the small-seeded legumes and grasses are mentioned as successors of fire in different studies (see RIEHL, 1999).

Since trees and shrubs of oak produce the same pollen, pollen analysis is not able to distinguish maquis from woodland. With macro-fossil analysis of oak species,

trees and shrubs of oaks can be distinguished. The different occurrences of these two oak types can give good information about grade of openness of the vegetation cover.

The determination of the human influence to the development of maquis vegetation is problematic. In arid and semi-arid regions, woodland elements left to regenerate do not become true forest, and it is obvious that maquis must represent the climax stage of the vegetation (RIEHL, 1999). In contrast in the humid and sub-humid Mediterranean zones, where true forest may theoretically develop, maquis is considered as a secondary landscape of essentially anthropogenic origin (by grazing or fire) (RIEHL, 1999). This aspect is discussed considering of the evidence of the high growing maquis communities, which would render establishment of typical forest species impossible (RIEHL, 1999). Their soil conditions are practically identical to those of the climax forest of the same regions (QUÉZEL, 1981a and 1981b). A solid argument for the degradation is the lack of endemic species in the maquis vegetation, which is through to indicate that the impoverished coastal Mediterranean vegetation is of relatively recent origin (DAVIS, 1965-1988).

Wood charcoal analysis of both sites is proceeding by Kathleen Deckers from the University of Tübingen. With the help of the wood charcoal analysis, it would be possible to make some extensive interpretations about the landscape development of the relevant region.

5. Economical consideration for the LBA Kinet Höyük and Tell Atchana

5.1 Interpretation of crop husbandry practices from the archaeobotanical remains

5.1.1 Crop processing

Ethnographic studies of two archaeobotanists, G. Hillman and G. Jones, in Anatolia and Greece made the main contribution to an understanding of the methods of the prehistoric agricultural practices and the taphonomy of the archaeobotanical samples. The following paragraphs are based mainly on the observations of HILLMAN (1981, 1984a, 1984b) and JONES (1984, 1992).

According to HILLMAN (1984a and 1984b), prehistoric crop-processing methods can be recognised by detailed study of their products and by-products. Differences in crop processing stages between hulled and free-threshing cereals are

observable in ethno-archaeological researches. Similarly, JONES (1984) differentiates crop processing stages by discriminant analysis, which identifies the samples as distinct waste products or products.

The basic sequences of crop processing consist of: harvesting, threshing, winnowing, coarse sieving, fine sieving and storage.

Earlier studies implied that the growing height of the harvested cereals could be determined by the growing heights of the dominant weed species. HILLMAN (1981) pointed out that some primitive cereals like Anatolian emmer have very variable growing heights, which makes a conclusion for crop weeds questionable.

By 'reaping', ears, straw and weeds are harvested together; by 'uprooting' additionally to the first group, the culm bases are harvested, as well. After harvesting, the crops are left to dry, either in the field or in the settlement.

'Threshing' can be made with different implements, like trampling with the hooves of the animals or with a long stick to release the grain from the straw or chaff. Sometimes, a second threshing is conducted after the first winnowing, to break off the awns (hummeling). The by-products of threshing are used in a short time as animal feed and are found rarely near fire places.

'Winnowing' is conducted to separate the light fractions like chaff and straw (in the case of pulses leaf and stem) from the grain; threshed crop is tossed into the wind with a winnowing fork, light chaff and straw are carried aside, heavier remains (e.g. grains, heavy and big weeds) fall straight to the ground. If the crop was threshed a second time, a second winnowing would follow.

At the stage 'coarse sieving,' the crop is sieved with large meshes. The grain passes through the sieve, whereas all the larger parts (not-threshed ears, heads of weeds, heavy culm nodes) stay on the sieve. By-products of this stage are kept for immediate use as animal fodder.

At the stage 'fine sieve,' a narrow meshed sieve is used to remove small weed seeds from the crop grain, the cleaned grain remains on the sieve. This process is piecemeal throughout the year. By-products are used to feed the chickens or directly thrown into the fire. Some of the fine-sieved crops must be cleaned once more by hand.

5.1.2 Fallow

Consideration of the soil treatment in agriculture is inseparable from the life form of wild species. Generally, an increase in annuals is assumed, when soil management becomes more intensive (HILLMAN, 1981; RIEHL, 1999). High presence of annual weed species is evident for both sites, which suggests an intensification of agriculture in Late Bronze Age Kinet Höyük and Tell Atchana.

According to RIEHL (1999), the evidence of fallowing at an archaeological site influences the evaluation of prehistoric yields. Duration of fallow as regeneration time of the soil has an economic meaning. The introduction of fallowing might be deduced from an increase in perennials, because typical weeds are mainly annuals. An increase in perennials would suggest that the new fields were opened for agriculture or cultivated fields left to fallow for several years (BEHRE and JACOMET, 1991). The high percentage of annuals in weed categories (e.g. *Lolium* spp, *Galium* spp. and *Asperula* spp.) and concentration of weed taxa on few species could be interpreted as being well established agricultural practices in both sites, as mentioned in Chapter 3.

In the case of Tell Atchana and Kinet Höyük, considering clear evidence of the annual weeds and under-represented perennials, in addition to the crop-rotation system, fallowing might have been practiced in short-time sequences.

5.2 Transhumance and pastoralism in eastern Mediterranean communities

5.2.1 Agricultural activities and pastoral live in modern times

Today, southern Turkey is not densely populated. Except for local agglomerations, as on the alluvial Çukurova Plain, the population is dispersed on the limestone plateaus of the Taurus Mountains. The upper zone of agriculture in southern Turkey is between 400-1800 m. From this limit upwards, the cultivation of citrus fruits and cotton disappear and wheat and barley predominate in the agricultural production; in the western part of the region, millet is the principal bread grain (ERİNÇ and TUNÇDİLEK, 1952).

Until the beginning of the 19th century the Cilician plain (Çukurova) was badly drained and sparsely populated and inhabited mainly by nomadic tribes, most of them 'Yörük' (YAKAR, 2000). In the Cilician Taurus, raising livestock is of much greater importance than cropping in the rural economy and is still the chief

area of pastoral nomadism in Turkey. Nomads live during the winter in non-cultivated corners of the coastal strip and they leave at the beginning of the warm season and wander through the mountain pastures, perhaps more than 200 km. Sheep can not survive such wide migrations, therefore goats and camels are the principal animals and are suitable for long-distance transportation (ERİNÇ and TUNÇDİLEK, 1952). Before descending in October to winter villages, wheat and barley planted in the summer zone have to be harvested the following summer. This broad spectrum subsistence strategy in Cilicia-region reduces the risks faced by most farmers during crop failures due to aridity and allows the villagers to keep relatively large herds without having to work for animal fodder (YAKAR, 2000).

The Çukurova section is supported with a well developed irrigation system today; it is the best-developed agricultural area of Turkey (ERİNÇ and TUNÇDİLEK, 1952; YAKAR, 2000). Wheat yield is raised in a three-year rotation and the production of early fruits and legumes, but especially the cotton (which constitutes more than two-third's of country's total), play important role in agriculture. Cotton is the most important crop plant today in the Amuq Plain as well. South of the Çukurova plain, in the vicinity of Kinet Höyük and the foothills of the Amanus Mountains citrus cultivation becomes almost a monoculture and makes more than 80 percent of Turkey's citrus output (ERİNÇ and TUNÇDİLEK, 1952).

5.2.2 Agricultural activities and transhumance in the past

The climate of coastal lowlands and bordering foothills of southern Turkey is characterised by mild, rainy winters and dry, warm to hot summers. Annual precipitation is between 350 and 1000 mm, which offers the region suitable conditions for dry-farming.

The most fundamental distinction between traditional Mediterranean and temperate European farming is seasonal transhumance (RIEHL, 1999).

The slopes of the Amanus Mountains and its vegetation is about 25 km away from the west side of Tell Atchana and from the east side of Kinet Höyük. Moist pastures in the river valleys of both sites were available. According to YAKAR (2000), the pastoral nomads and transhumant groups from Cilician and Amuq Plain still visit the fertile pastures of the Amanus Mountains in the summer, as in the past.

Considering the geographical circumstances of Kinet Höyük and Tell Atchana, livestock management played an important role and, in the case of Tell

Atchana, had been practised as a profession, also as migration of shepherds, which is described in Alalakh IV achieves with the name '*haniahhu*' (YAKAR, 2000). They might have used the open habitats of Amanus Mountains as pastures.

5.3 Agricultural aspects of the Hittites and evidence of trade in Late Bronze Age

5.3.1 Agricultural organisation and trade relations of the Hittite Kingdom

Since the Old Kingdom, the Hittites established a well-organised state sector in the rural economy; they retained maximum control over the agrarian and pastoral economies and regulated the status of the cultivated fields, ownership rights and activities related to the expansion of natural sources. In other words, the Hittite central administration did not maintain a free market economy based on supply and demand, as it was the case in the Assyrian Colony period (YAKAR, 2000). Therefore, relatively few existing documents refer to lands and belonging to king and seldom to independent farming communities. Hittite documents about the lands give an impression of aimed productivity and stability of the agrarian sector (YAKAR, 2000). Indeed, the semi-arid conditions of central Anatolia are one of the main problems affecting the rural economy and there were some difficulties in predicting the outcome of annual yields, which were often influenced by long spells of dry or cold winter and spring months (YAKAR, 2000). In the Bronze and Iron Ages, cereal cultivation in the central Anatolian Plateau and in Assyria, where the yields depended mostly on rainfall, was sometimes endangered by cycles of severe droughts. Drought related famines, caused the loss of humans and livestock, are recorded in Hittite archives (YAKAR, 2000).

In addition to drought, the spoils of war, which enriched the royalty and some elite in Hittite society were not enough to sustain the large numbers of dependent Hittite subjects with 'non-productive professions' and large professional armies, whose income derived heavily from rural economy (YAKAR, 2000).

In Hittite documents, more than half of the words used for the food plants are still not completely understood (YAKAR, 2000). The archaeobotanical remains from most second millennium sites confirm that barley and wheat were the principal crops cultivated in Hatti, due to the semi-arid conditions, where the annual precipitation falls occasionally below 300 mm, barley was dominated in crop production.

According to YAKAR (2000), Hittite farmers might have used different fallow systems in order to ensure medium- or long-term success of dry-farming in the semi-arid regions of Anatolia. The fields were sown year after year until they reached a point of sharply decreasing yields. In cycle-system, while the infertile fields are abandoned to regain their fertility for some years, other plots are opened up for the new cultivation, until the cultivator returns to the field cleared first and repeats the cycle. In this system, the area kept uncultivated is larger than the field under cultivation.

It is very likely that the Hittite farmers used a fallow system similar to that still being used in Anatolia, in which the fields are planted alternately with cereals and pulses and after two years is left to fallow for some years or is used as a meadow for livestock, which fertilise the fields naturally. In other words, this system is a kind of crop-rotation (cereal-pulse-fallow) (YAKAR, 2000).

5.3.2 Agricultural organisation and trade in Kizzuwadna

In the first phase of the second millennium B.C., the history of Cilicia was dominated by Kizzuwadna, which occurs in Hittite texts both as an ally and vassal of Hatti (YAKAR, 2000). The territory of Kizzuwadna extended between the rivers Ceyhan (Pyramos) and Seyhan (Saros). According to Hittite texts, Kizzuwadna controlled a large and partly arable territory beyond the Amanus Mountains (YAKAR, 2000). The Hittite and Ugarit texts indicate that the merchants of the Hittite king were well-organised at coastal Cilicia in the shipping, importing and exporting of the goods (YAKAR, 2000; HELTZER, 1988; CLINE, E. H., 1994). The feudal administrative system, established in Hittite times, survived in this region until the Classical period. The towns on the Cilician plain controlled the trade routes and were highly developed in the rural sector economy (YAKAR, 2000).

The incorporation of coastal Syria into an eastern Mediterranean maritime trade network is confirmed by the predominance of Cypriot and Mycenaean ceramic imports, especially in Middle and Late Bronze Age (YENER, 1998; GATES, 2000). The archaeobotanical evidence of the Late Bronze Age ship wreck 'Ulu Burun' indicate the trade of the organic materials like resin of frankincense in Canaanite amphoras, also some other botanical remains, which were used in daily life of seafarers like seeds, barks and twigs. Some of the vessels of the ship include fig seeds, seeds of *Polygonum* sp. and *Punica granatum* (pomegranate) (HALDANE,

1991). Ceramic imports from the Aegean and the Levant also reached Alalakh's territory and as far as eastern and upper Mesopotamia through trade routes (WOOLLEY; 1955, 1959; YENER et al., 2000). Considerably little is known about local trade; many of the items transferred from the countryside to the towns and vice versa were not strictly trade goods (WAGSTAFF, 1985). Some Cilician cities with harbours (e.g. Kinet Höyük) were suitable for the exchange of inland surplus like farm produce, minerals and timber (YAKAR, 2000).

The Hittite texts demonstrate the importance of olive oil and wine production in the Hittite economy. Inland Cilicia is exposed to the mild Mediterranean climate and is suitable for vine (*geštin*) and olive (*serdu*) groves. This is illustrated by a Hittite text mentioning large fields in Kizzuwadna (Cilicia) containing olive trees and vine yards (YAKAR, 2000) and other Hittite sources mention the cultivation of fig (*peš*) and pomegranate (*nurma*), which were planted in regions with Mediterranean-type climate as well as in Cilicia (YAKAR, 2000).

5.3.3 Agricultural organisation and trade in Mukish and Alalakh

The province Mukish was a vassal kingdom of the Hittites in the 14th century B.C.; the capital city Alalakh became an important source of grain in times of food shortage as documented by a text from Ugarit. This text mentions that king Arnuwanda III received 2000 measures of grain shipment from Ugarit (YAKAR, 2000 refers to RS 20. 212, line 20; HOPF, 1992; MELLAART, 1978). In the 13th century B.C. and perhaps before, such grain shipments from Mukish and Egypt might have been sent to Anatolia by sea, when the famine threatened Hatti-land.

According to HELTZER (1988), towards the end of the 13th century, a considerable change took place in the demographic ratio between the population of village communities and that of the 'royal dependents'. Around 60% of the 'royal dependents' were engaged in 'non-productive professions'. According to written sources in this time period, droughts succeeded one another over a period of several years, and the necessity of feeding a large number of royal dependents in the non-productive professions lead to social and economic crisis, which weakened the society (HELTZER, 1988 refers to Owen, 1983). The import of cereals by the Hittite Empire did not solve the problem of famine in long-term.

In Alalakh, but also in Kizzuwadna (Cilicia), the Hittite supremacy controlled the agriculture resources with state administration and local rulers (YAKAR 2000;

GAÁL, 1988). The archives of Alalakh VII and IV reflect different developments in the society and the central administrative system (YAKAR 2000; GAÁL, 1988). As in other states of the Near East at that time, the kings of Alalakh VII were the lords of state-owned land. Nearly half of the ca. 90 villages mentioned in the archives of Alalakh VII belonged to the royal/state sector and one third to the private owner (YAKAR 2000; GAÁL, 1988). According to ZEEB (2001) more than half of the monthly registered crop outputs, which had been handed to the royal dependents and population of the village communities, registered on the 'crop-supplying lists' of Alalakh VII. These lists suggest that barley was the main crop, which was mainly delivered to the palace dependents and other servants. Emmer is mentioned in almost one third of the registered outputs in connection with the king and the elites and used as a kind of 'currency' (ZEEB, 2001). There is no registry of bread wheat-outputs in the Alalakh VII archives. There are also some other plant names, which have already been speculated by the linguists of Late-Old Babylon. The linguists assume, that 'ZI.AŠ' might have been the name of a crop plant, which is used not only as fodder for cows and horses, but also used for 'bread-making'. The description suggests that this plant could be a species of 'vetch'. Nevertheless, the text based differentiation between *Vicia sativa* (common vetch) and *Vicia ervilia* (bitter vetch) was not possible (ZEEB, 2001). The names of different pulses and spices have been mentioned in the Alalakh VII texts; however, translation difficulties make the differentiation of the plants open for the linguistic speculations (ZEEB, 2001).

In second millennium B.C. Mukish, there were two types of land properties. The first category belonged to rural families living in villages, which was certainly an important source of state income. The second category belonged to the palace and palace dependents. Despite the right of free subjects to own land, the palace at Alalakh supervised the private sector economy (YAKAR, 2000).

The royal archive of Alalakh IV partly reflects the Late Bronze Age social structure and rural settlement pattern of the ca. 50,000, who populated the Kingdom of Mukish (YAKAR, 2000; GAÁL, 1988). The number of royal estates with more than 200 towns and villages in the countryside, which are controlled by the royal palace, is difficult to estimate with accuracy (YAKAR, 2000). Few of the in Alalakh IV achieves mentioned villages were very big and contained more than 180 houses and on average villages had 25 houses, inhabited by 120-150 people (YAKAR, 2000). In Mukish, native farmers (*hupšu*) were 80-90% of the core of the group of

Alalakh's population; free subjects (*sabe*) and shepherd/nomads (*haniahhu*) supported the subsistence independently from the farmers (YAKAR, 2000).

The importance of timber resources of Mukish for Mesopotamia is known from the records of Sargon of Akkad (2371-2316 B.C.); he aimed to expand his territory as far as to the Cedar Forests (presumably Lebanon and Amanus Mountains) and the Silver Mountain (Taurus) (WAGSTAFF, 1985). Archaeobotanical and geographical studies refer to the textual evidences from the first half of the 2nd millennium B.C., which mention the transport of cedar wood (probably *Cedrus libani*) from Levantine forest by floating on the Euphrates (Van ZEIST and BAKKER-HEERES, 1985; WAGSTAFF, 1985). The cedar remains of the Bronze Age site Selenkahiye on the North Syrian Euphrates (see Fig. 3) might have originated from the eastern part of the distribution area of *Cedrus libani* from western Syria or South-Central Turkey. Cedar and pine wood at this site might have been used in the construction of more 'prestigious buildings' (Van ZEIST and BAKKER-HEERES, 1985).

5.4 Interpretations on the economical systems of Kinet Höyük and Tell Atchana in regional context

Geographic and climatic differences between different regions are interpreted by the archaeobotanists as causal determinants for a different set of crops. These aspects suggest that barley cultivation is more dominant in arid or semi-arid regions in contrast to wheat cultivation in regions with more precipitation (YAKAR, 2000).

Environmental conditions of Kinet Höyük are similar to those at Tell Atchana; however, Tell Atchana lies more or less at the transition zone of the humid Mediterranean climatic-zone to the semi-arid zone of the northern Syria.

Important North-Syrian Bronze Age sites like Emar, Hamam et-Turkman (see Fig. 4 and 5) lie in semi-arid to arid zones with different climatic conditions and vegetation cover (Dwarf-shrublands, steppe) from Tell Atchana and Kinet Höyük (Figure 2). Bronze Age sites on the North-Syrian Euphrates Selenkahiye, Hadidi (see Fig. 3) show a major crop spectrum of two-rowed barley, free threshing wheat, lentil and grass pea (Van ZEIST and BAKKER-HEERES, 1985; MILLER, 1991). By the end of the Early Bronze Age, emmer becomes reduced in this region; instead of emmer, an increase in hulled barley is evident (MILLER, 1991). In Selenkahiye, bread/durum wheat (*T. aestivum/ durum*) and *T. dicoccum* (emmer) had minor

importance. The wild flora of the site is dominated by *Melilotus* sp. (Van ZEIST and BAKKER-HEERES, 1985).

In the Middle and Late Bronze Age levels of Hadidi, two-rowed barley (*Hordeum distichum*) is the major crop, as wheat only *T. aestivum/ durum* grains have been recorded. The written sources of Hadidi (tablets 18-22) suggest the importance of barley in the Late Bronze Age settlement, which is indicated as well by the archaeobotanical remains. Great numbers of *Lathyrus sativus* and *Lens culinaris* suggest their large-scale cultivation in the Middle-Bronze Age. Bitter vetch appears possibly as weed. Weed flora of Hadidi is similar to those of Selenkahiye, with the occurrence of *Melilotus* in large amounts.

According to MILLER (1991), Late Bronze Age Deir' Alla in Jordan yielded concentrations of bread/durum wheat, as well two-rowed barley, bitter vetch, flax, cumin and fenugreek. Emmer seems to be absent at the site.

The capital city of the Hittites, Boğazköy (Hattuša), is located in central Anatolia (Figure 3). According to HOPF (1992) naked barley remains from a 'pithos' and naked wheat remains from a ceramic jar have been recovered in a mud-brick house in the under-city of Boğazköy. She suggests that these crop plants might not have been cultivated on the high plateau and probably have been cultivated in arable valleys northern of Boğazköy. NEEF (2001) performed botanical researches of a silo-complex behind the 'Poternenmauer' of the city walls in Boğazköy. According to his report, the rooms of the silo-complex were mainly filled with two-rowed barley and einkorn (*T. monococcum*). There were minor amounts of vetches (*Vicia sativa/ Vicia pannonica*) as admixture in barley/ wheat storage facilities, as well. Occurrence of typical winter-crop weeds for calcareous soils (e.g. *Ranunculus arvensis*, *Vaccaria pyramidata* and *Bifora radians*) point out that crops derive from surrounding territories of Boğazköy and according to his analysis, there is no evidence for imported crops from other regions with different climatic conditions. He points out that naked wheat/ barley remains analysed by HOPF (1992) might have been brought into the settlement from different climatic regions as a result of centralised agriculture of the Hittites.

Bronze Age sites of the humid Aegean differ in their crop spectra in comparison to those in the semi-arid North-Syrian sites. Late Bronze Age Troy has the features of an intensive cultivation of crop legumes, dominated barley cultivations and emmer rich crop assemblages, which correspond very well with Late

Bronze Kastanas in Greek Macedonia (RIEHL, 1999). “In Troy VI a tendency towards extensification is suggested, with a specialisation in barley and emmer cultivation to meet the purposes of an emerging elite”. “These tendencies increase during Troy VIIa with emmer and einkorn, intensive soil management and culmination of *Lolium* spp.” (RIEHL, 1999; p. 85).

According to KROLL (1983), Late Bronze Kastanas shows as a cereal spectrum: emmer, einkorn (*T. monococcum*) and hulled barley, as pulses bitter vetch, lentil, chickpea, grass pea, bean and pea, as horticultural crops fig and grape vine. Spelta and bread wheat (*T. aestivum*, *T. spelta*) were in the younger Late Bronze Age more frequent than in the Early Bronze Age, but did not reach the quantities of individual cultivation. Wheat harvest is highly contaminated by *L. temulentum* (darnel), which suggests that the agriculture reached its limits in this time (KROLL, 1983).

These dominant occurrences of emmer and einkorn at Troy and Kastanas make the big difference between the North-Syrian sites and Aegean sites; einkorn is totally absent in Late Bronze sites on the Euphrates, emmer appears either very rarely, if at all. According to VALAMOTI (2003), the existence of einkorn as a major cereal in southern Greece and the dominant emmer cultivation in the north might reflect different ethnic groups with different traditions. Otherwise, it is presumed that there were no climatic differences between these regions at that time, which could be the reason for this special pattern (VALAMOTI, 2003). The climatic conditions of the Aegean, with mild winters and sufficient precipitation, are also suitable for the cultivation of bread/durum wheat, but the occurrence of bread wheat is very rare and interpreted as a ‘newly introduced crop for the elite’ (VALAMOTI, 2003). Although the semi-arid to arid conditions of northern Syrian sites were less suitable for bread/durum wheat cultivation, this wheat is dominant amongst the cultivated wheat species. Cultivation of six-rowed hulled barley is very common in Late Bronze Greece; in northern Syria and in Boğazköy rather the cultivation of two-rowed barley is common.

The cereals of Kinet Höyük and Tell Atchana, due to the rare occurrence of emmer and the absence of einkorn, could not be directly correlated with Kastanas and Troy. The barley occurrences of both sites have no similarities with those of North-Syrian sites and with Boğazköy; however the evidence of bread/durum wheat and pulses (e.g. bitter vetch, lentil and grass pea) of Kinet Höyük and Tell Atchana is

comparable with those of the Selenkahiye and Hadidi. Crop cultivation of Late Bronze Kinet Höyük and Tell Atchana might have some similarities in evidence of bread/durum wheat, two-rowed barley, bitter vetch and flax with the Late Bronze Levantine site Deir' Alla in Jordan. The organisation of agriculture in Tell Atchana by a stratified society is similar to north-eastern Syria sites; at least as far as plant production is concerned. This in mind, one might assume that the crop spectrum of the Late Bronze Kinet Höyük and Tell Atchana reflects agricultural characteristics of the eastern Mediterranean cultures at the coastal regions.

In Kinet Höyük, despite the evidence of risk-buffering agriculture in a broad spectrum of crops, there is no clear archaeobotanical evidence for intensive-small scale garden-type agriculture. The dominance of Secalietae weeds could be interpreted rather as an indicator for the intensification in large-scale agriculture, with a broad spectrum of crop plants.

In Tell Atchana, the Chenopodietae weeds are represented in comparison with Secalietae weeds in small amounts as evidence of small scale garden-type cultivation, although the agriculture at this site was coordinated by elites, which requires specialised large-scale crop cultivation, as Alalakh VII Archives mention. At present, taphanomic problems and small amount of analysed samples of this site do not allow extended interpretations on the agricultural organisation of Tell Atchana.

The evidence of crops in the samples suited to the local agricultural potentials of both sites and no plant remains of potential trade goods are evident from Kinet Höyük and Tell Atchana.

Far reaching trade contacts are suggested by ceramic and other trade objects of both sites, but there is lack of organic precious objects including spices and resins. At the other site, many of the samples are from contexts in which one would not expect spices or aromatic essences (pits and floor deposit, kilns). However, the socio-political patterns of Tell Atchana show that the contacts with Aegean, Egypt, Canaan, and upper-Mesopotamia must have been considerable.

Considering the analysis of the botanical remains, despite Alalakh archives, there is no clear evidence for the argumentation of 'producer' or 'consumer' site for Kinet Höyük and Tell Atchana. All crop processing by-products of both sites are fine sieve by-products; there is no evidence of early crop processing activities from both sites, which could make an interpretation for a producer site possible.

6. Concluding summary: A model of subsistence economy and environment in the LBA Kinet Höyük and Tell Atchana

On present evidence, the primary value of the Kinet Höyük and Tell Atchana samples is a contribution to an understanding of regional patterns of agricultural development in southern Turkey. The analysed samples from the Late Bronze Age periods of Kinet Höyük and Tell Atchana do not cover the complete range of excavated periods and can only give a kind of snap-shots of the full archaeobotanical potential of both sites. Due to taphonomic problems and very low abundances of botanical remains in samples from Tell Atchana, extended interpretation has been withheld for this site.

For a complete reconstruction of the subsistence economy it is necessary not only to focus on plant production and gathering, but also to investigate how these results correlate to animal production and hunting. Questions of interest do not only comprise such as to the different proportions of plant and animal products in the daily diet but also whether domestic animals were fed on crops. In Kinet Höyük, cereals have dominated in subsistence economy as a staple crop. Crop species, together with the zooarchaeological remains (cattle and sheep/goat, as well shell and sea-fish remains) from this site suggest a well-developed subsistence strategy. It can be assumed that seafood and domestic animals as well as fruit and pulses have supplemented a mainly cereal based diet with high protein content. Domestic animals of both sites, Kinet Höyük and Tell Atchana, might have found enough fodder in the open and the grassland-type vegetation in the immediate vicinity of the sites. Apart from this, cattle might have been fed with bitter vetch and barley.

The dominance of Secalietae weeds gives evidence that risk-buffering, intensive large-scale agriculture was very likely conducted at Kinet Höyük during the Late Bronze Age.

In general, species diversity among the archaeobotanical remains from Tell Atchana, in comparison to those of Kinet Höyük, is very low and might indicate a certain degree of specialisation. This would correspond to the archaeological evidence for a stratified society of Tell Atchana, the capital city of Mukish. Social stratification is described in the royal archives of Alalakh VII and IV as well as in other historical records. Therefore it might well have been possible that crop plants from surrounding villages were brought into the city for consumption by the non-

peasant population and palace dependents. Nevertheless, analysed botanical samples show a kind of snap-shot evidence for the centralised agriculture of Tell Atchana; *T. aestivum /durum* is evident in botanical samples of this site, but it is not mentioned in Alalakh VII and IV crop-supplying lists. Barley is registered in the Alalakh archives as a major crop for village communities, but it was not the major crop in botanical samples from the same site.

Intensification in agricultural practices of both sites is observed in their weed assemblages; high percentages of annuals in some weed categories (e.g. *Lolium* spp, *Galium* spp. and *Asperula* spp.) and limitation of weed taxa to only a few species are interpreted as evidence for well established agricultural practices at both sites. The occurrence of highly competitive Secalietae member crop weeds, like *Lolium remotum*, shows the intensification of field management at both sites. Dominance of annual weeds and under-represented perennials suggest that a crop-rotation system and short-time fallowing might have been practiced. Slight evidence of Chenopodietae weeds along with the dominance of Secalietae weeds in the Tell Atchana samples point to large-scale crop cultivation combined with intensive garden-type agriculture at this site.

The rare occurrences of emmer and the absence of einkorn at Kinet Höyük and Tell Atchana do not suggest direct connections with the Late Bronze Age Aegean sites (e.g. Kastanas and Troy). Barley occurrences at both sites are not overriding as in North-Syrian sites and in Boğazköy. Evidence of bread/durum wheat and pulses (e.g. bitter vetch, lentil and grass pea) of Kinet Höyük and Tell Atchana is comparable with those of the North-Syrian sites (e.g. Selenkahiye and Hadidi). The organisation of agriculture in Tell Atchana, as far as plant production is concerned, is similar to north-eastern Syrian sites.

In summary, the crop spectra of the Late Bronze Kinet Höyük and Tell Atchana, with mainly free-threshing wheat and hulled barley, might reflect agricultural characteristics of the eastern Mediterranean cultures at the coastal regions with a certain degree of socio-political dependence of both sites from the Hittite Kingdom at the relevant time period. The spectrum of wild species are consistent with a typical Late Bronze Age Mediterranean archaeobotanical assemblage. Future research needs to establish the regional composition of the woodland vegetation.

ILLUSTRATIONS

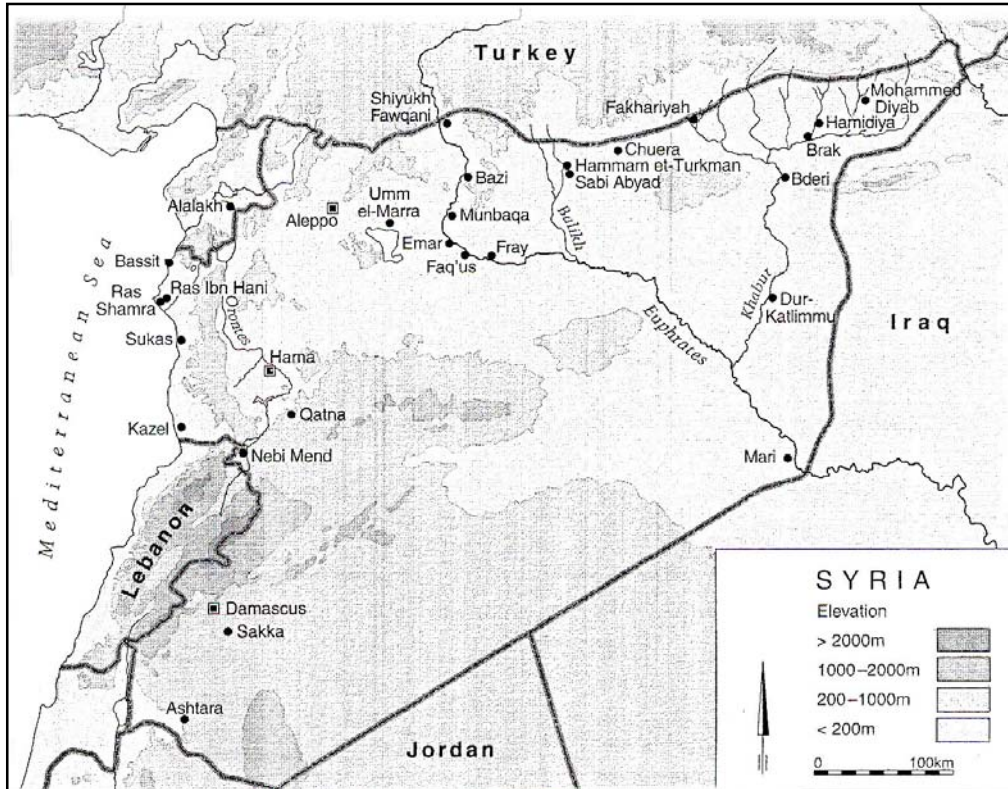


Fig. 1: Late Bronze Age sites in northern Syria (AKKERMANS and SCHWARTZ, 2003)



Fig. 2: Location of Kinet Höyük and Tell Atchana (GATES, unpublished).

Fig. 3:
Neighbouring sites
to Tell Atchana
(WOOLLEY,
1955).

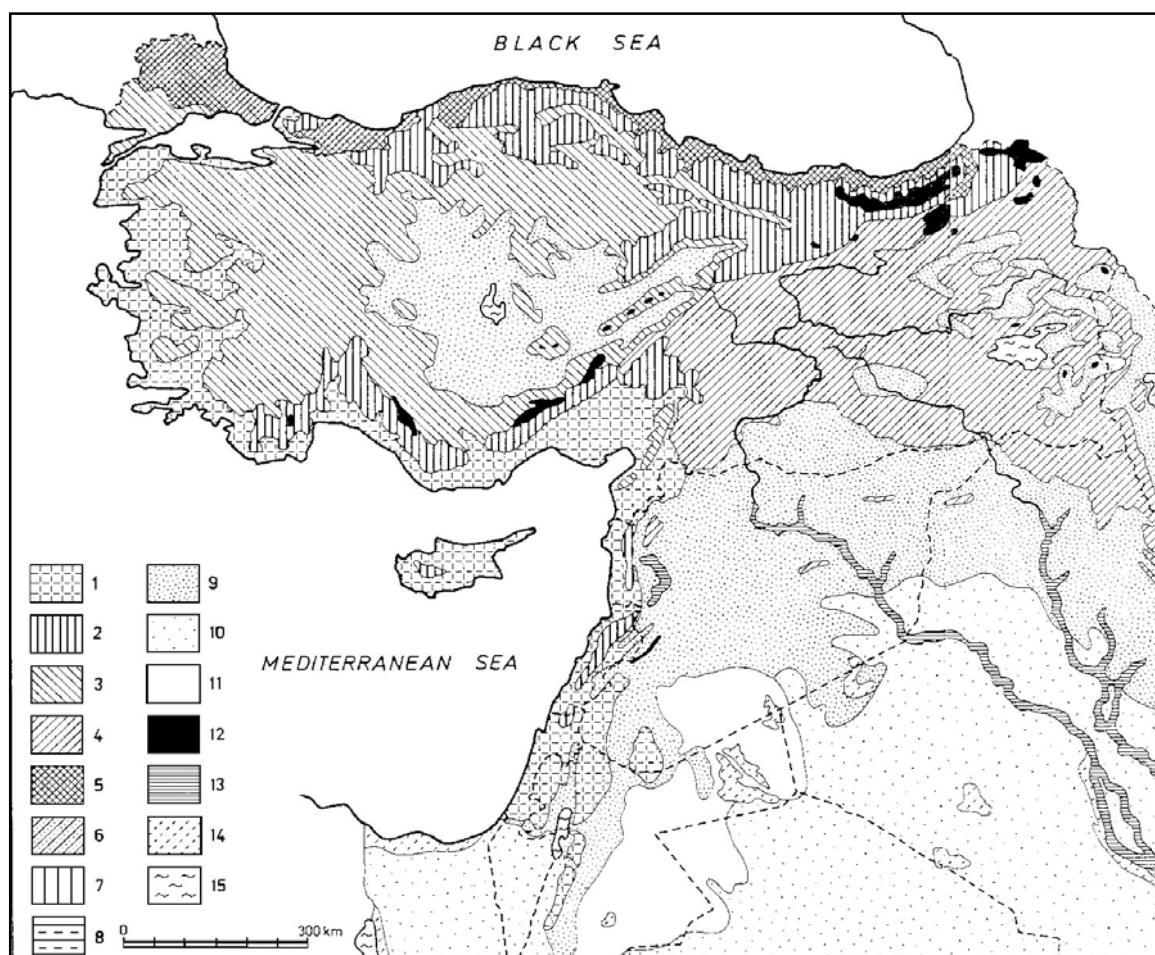
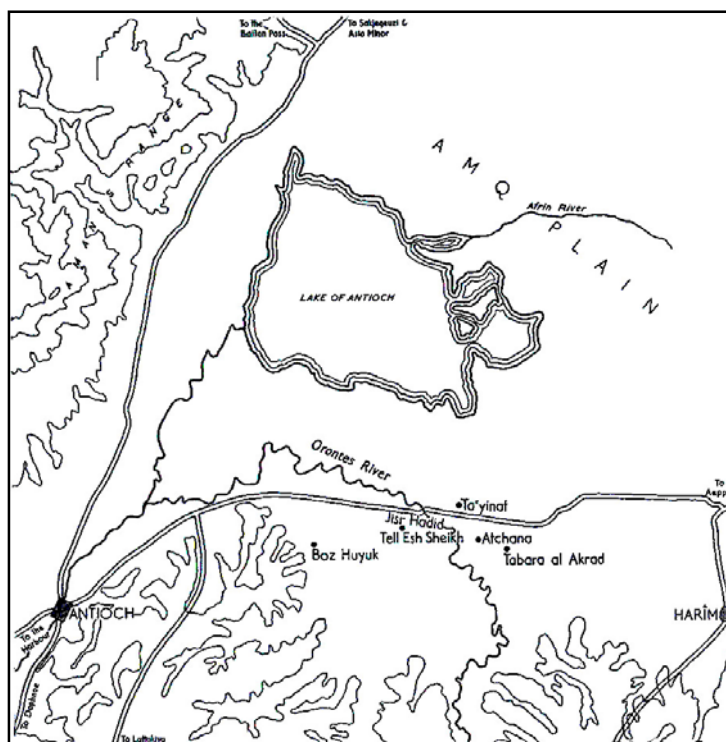


Fig. 4: Near Eastern vegetation map (ZEIST Van and BOTTEMA, 1991).

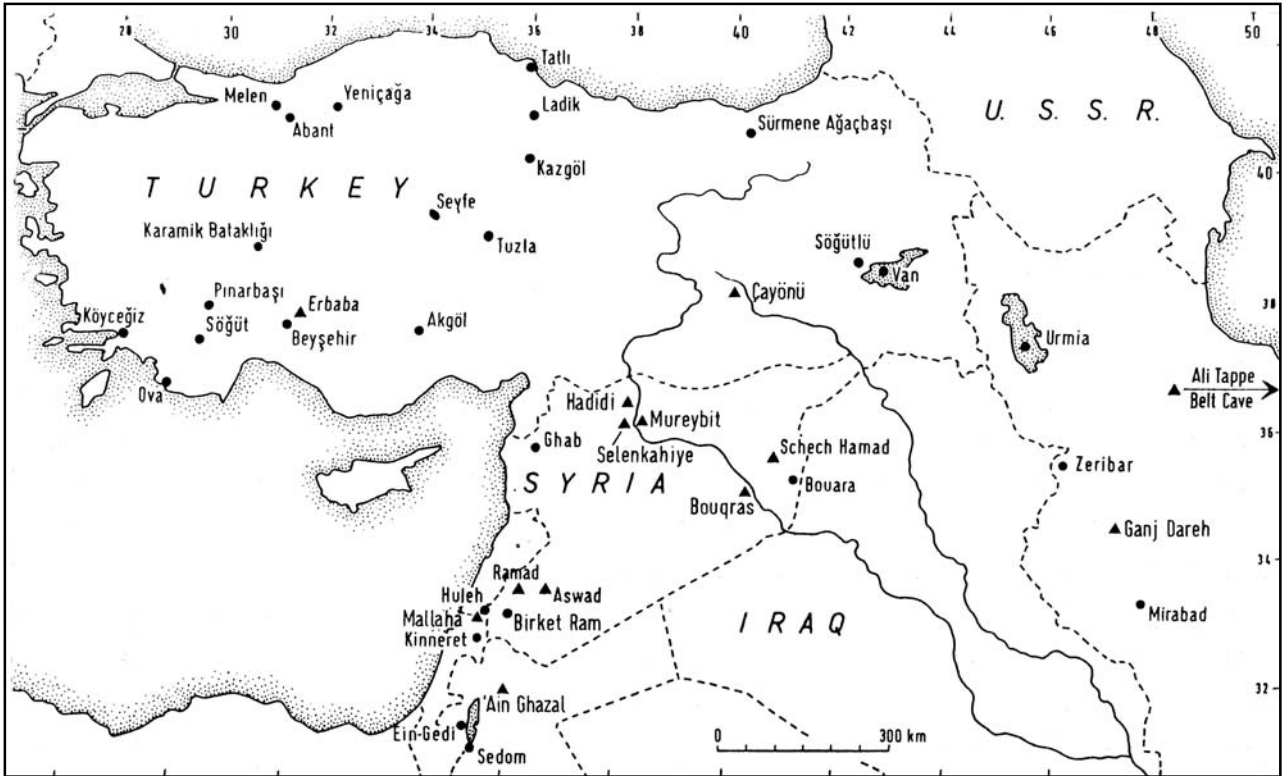


Fig. 5: Pollen core and archaeological sites in the Near East (ZEIST Van and BOTTEMA, 1991).

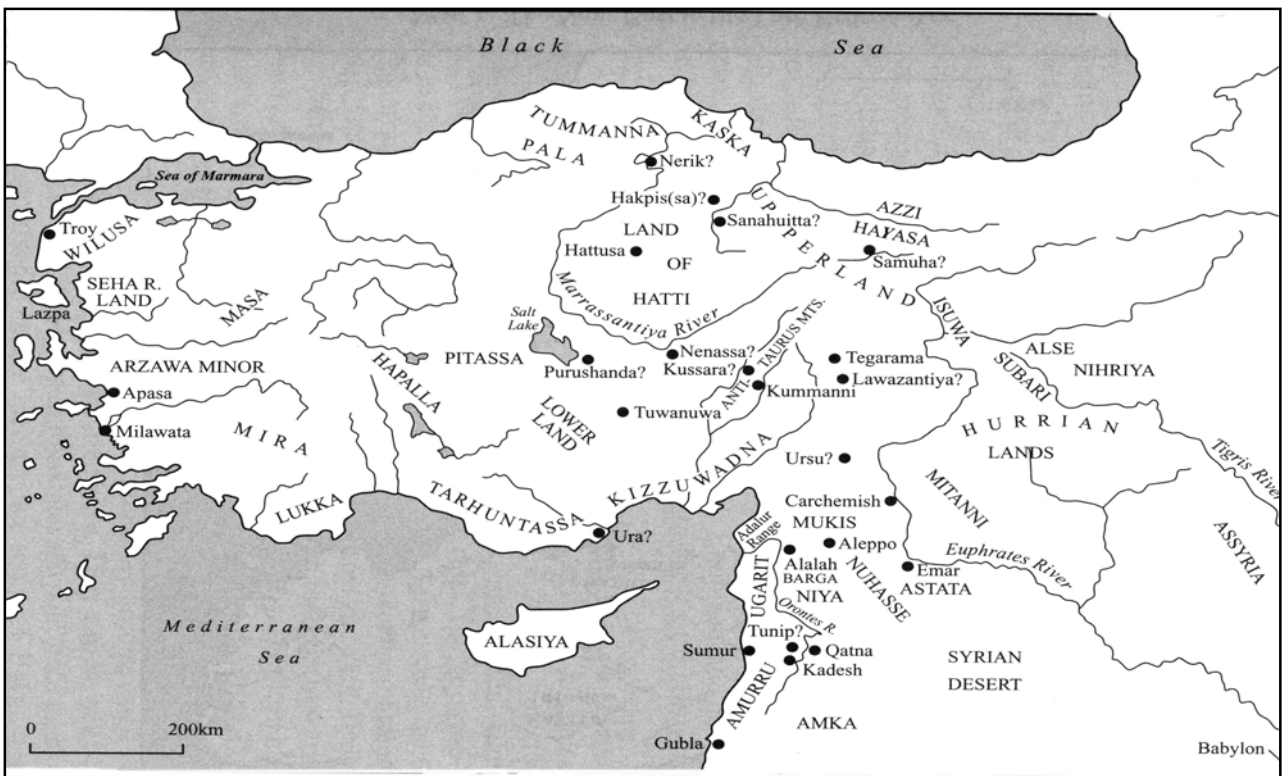


Fig. 6: Map of Hatti-land (BRYCE, 2002).

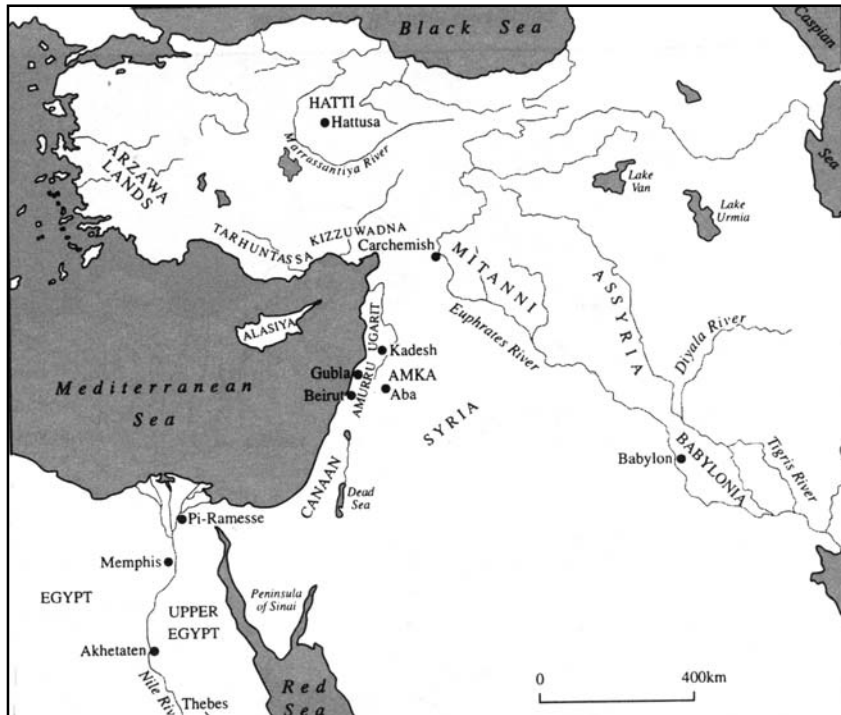


Fig. 7: The Near East in Late Bronze Age (BRYCE, 2002).

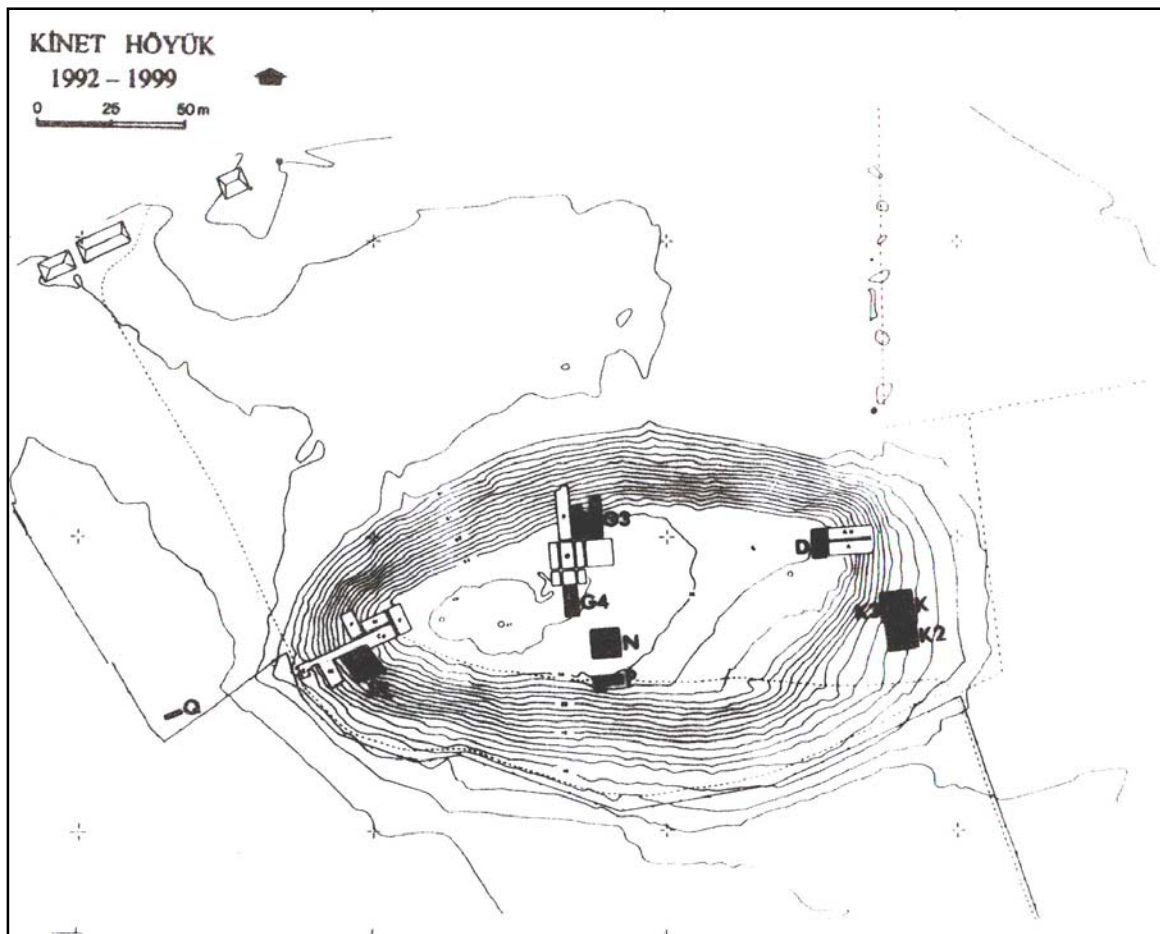


Fig. 8: Map of Kinet Höyük: 1992-1999 excavations (GATES, 2001).

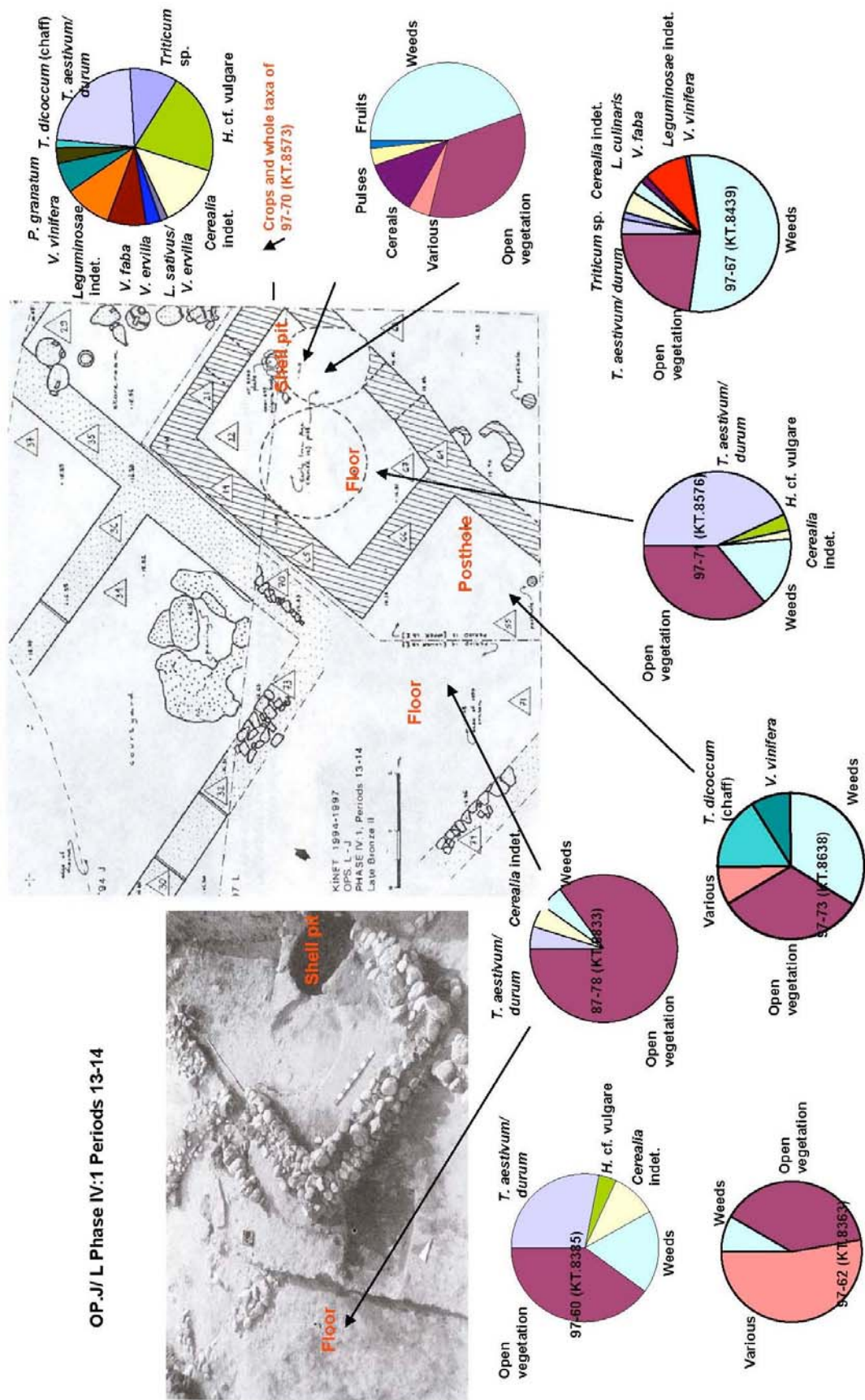


Fig. 9: Location and percentage occurrences of Kinet Höyük samples from the 1997 excavation (total seed amounts per sample are given in sample descriptions and Appendix 2-3).

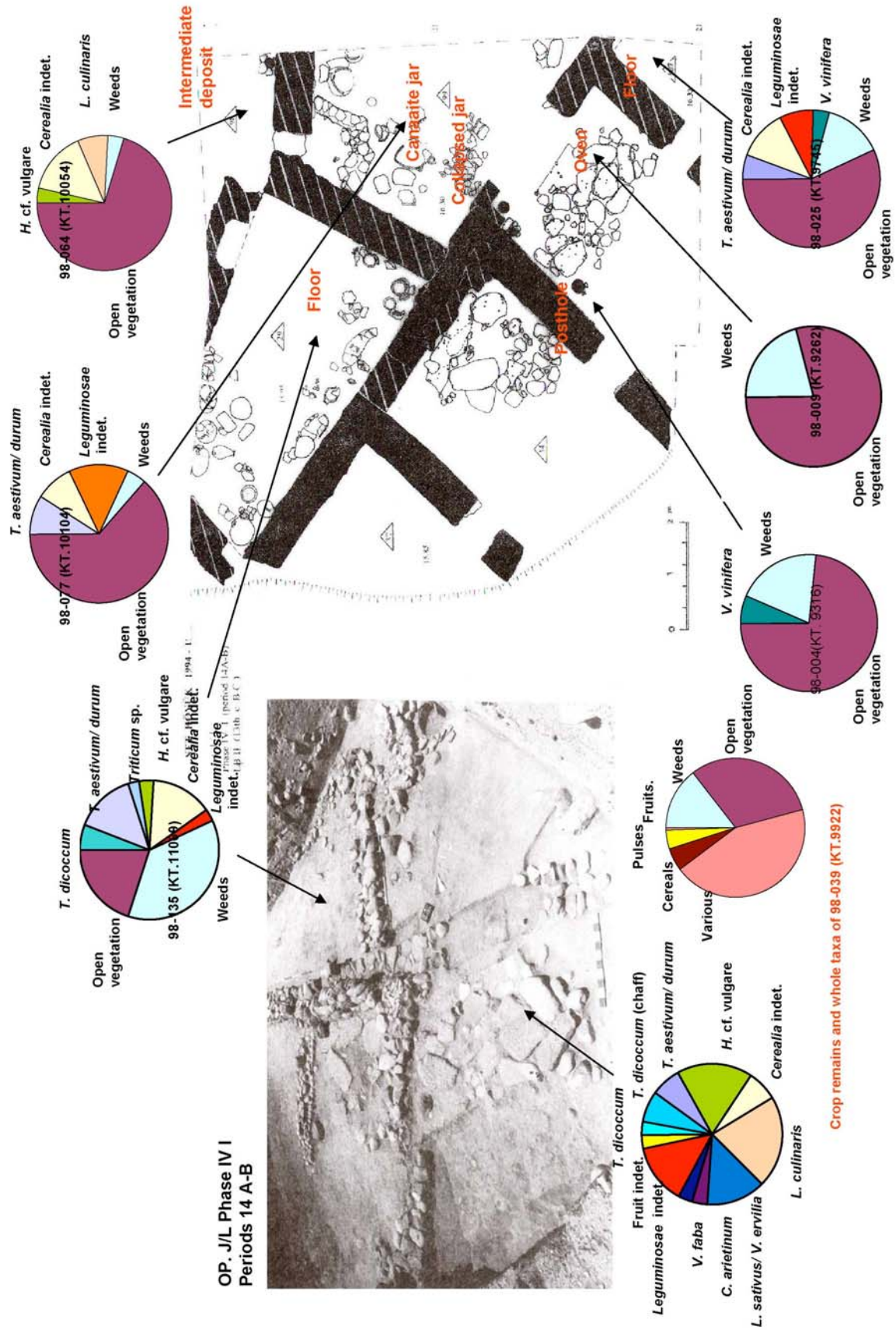


Fig. 10: Location and percentage occurrences of Kinet Höyük samples from the 1998 excavation (total seed amounts per sample are given in sample descriptions and Appendix 2-3).

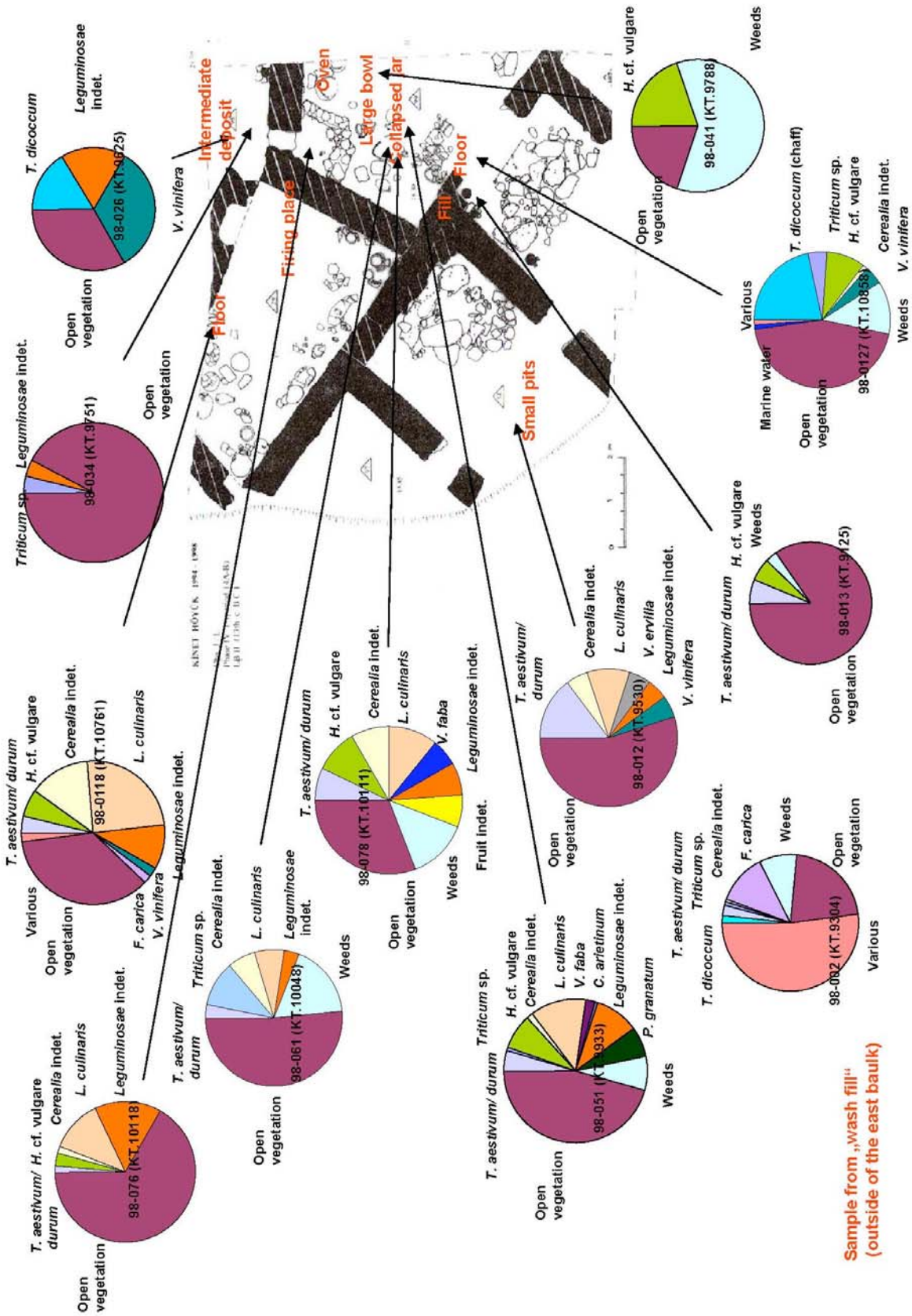


Fig. 11: Location and percentage occurrences of Kinet Höyük samples from the 1998 excavation (total seed amounts per sample are given in sample descriptions and Appendix 2-3).

Crop remains and whole taxa of 99-0075 (KT.13010)

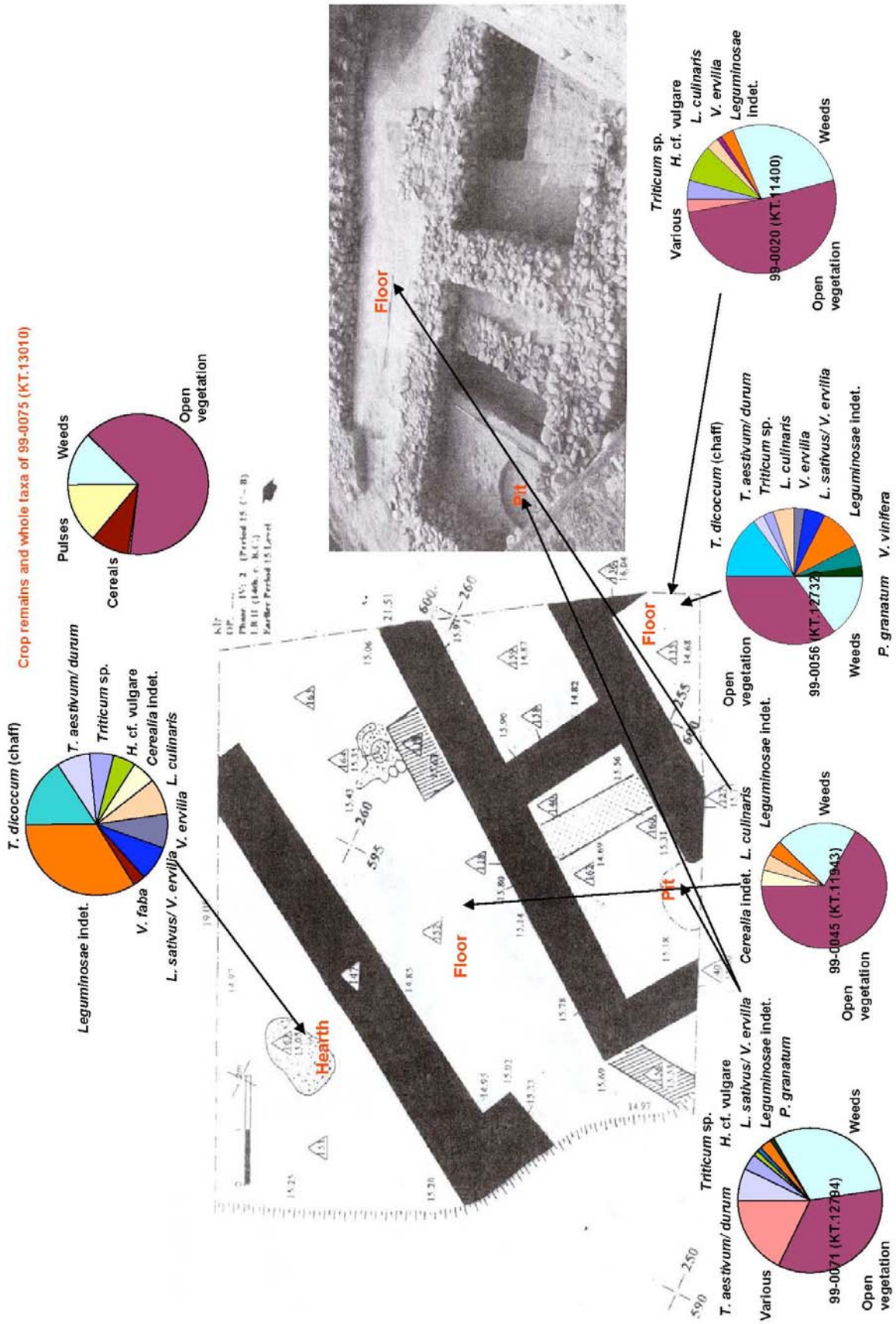


Fig. 12: Location and percentage occurrences of Kinet Höyük samples from the 1999 excavation (total seed amounts per sample are given in sample descriptions and Appendix 2-3).

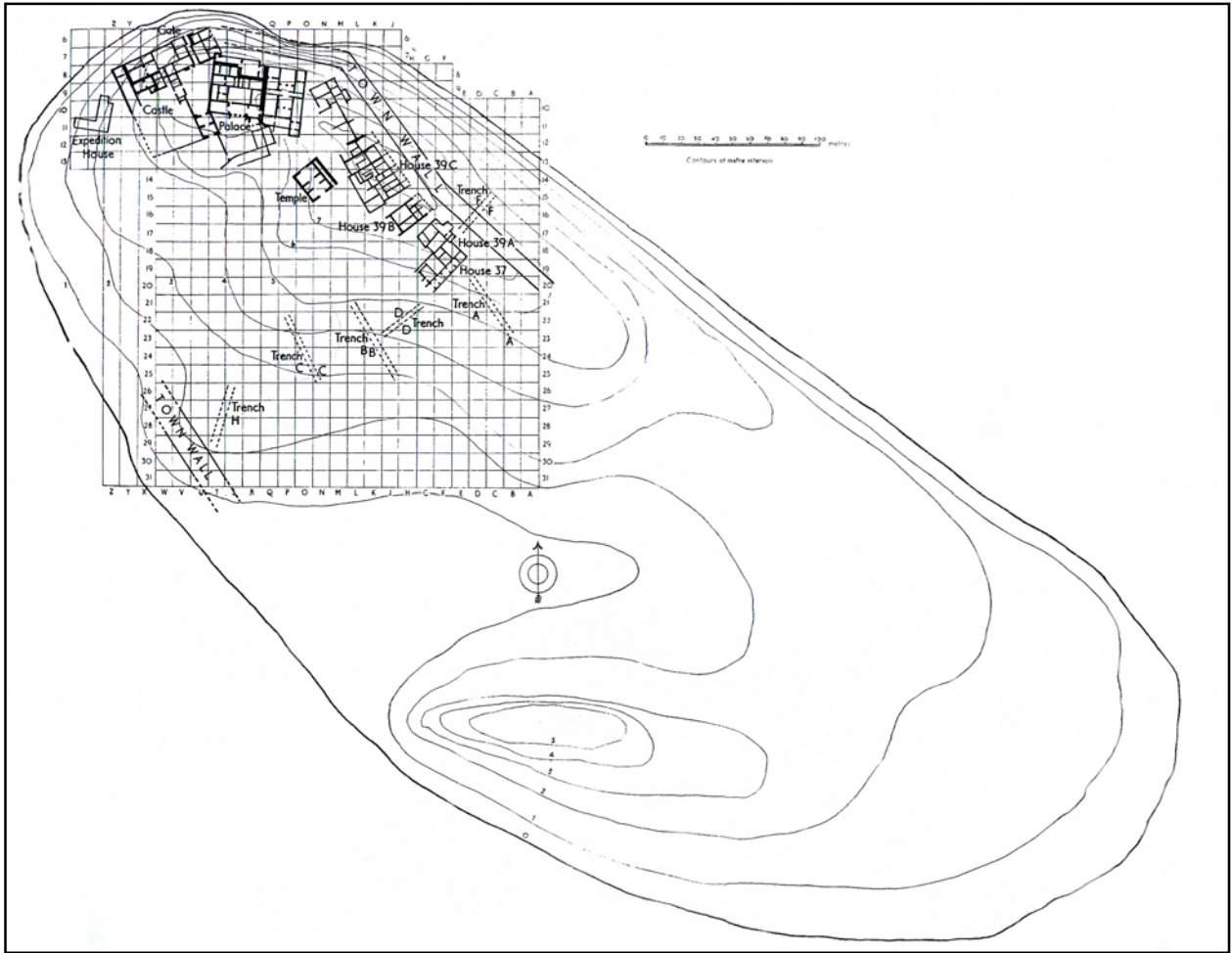


Fig. 13 (below): General plan of Tell Atchana Level IV (WOOLLEY. 1955).



Fig. 14: Flotation machine of Tell Atchana excavation.

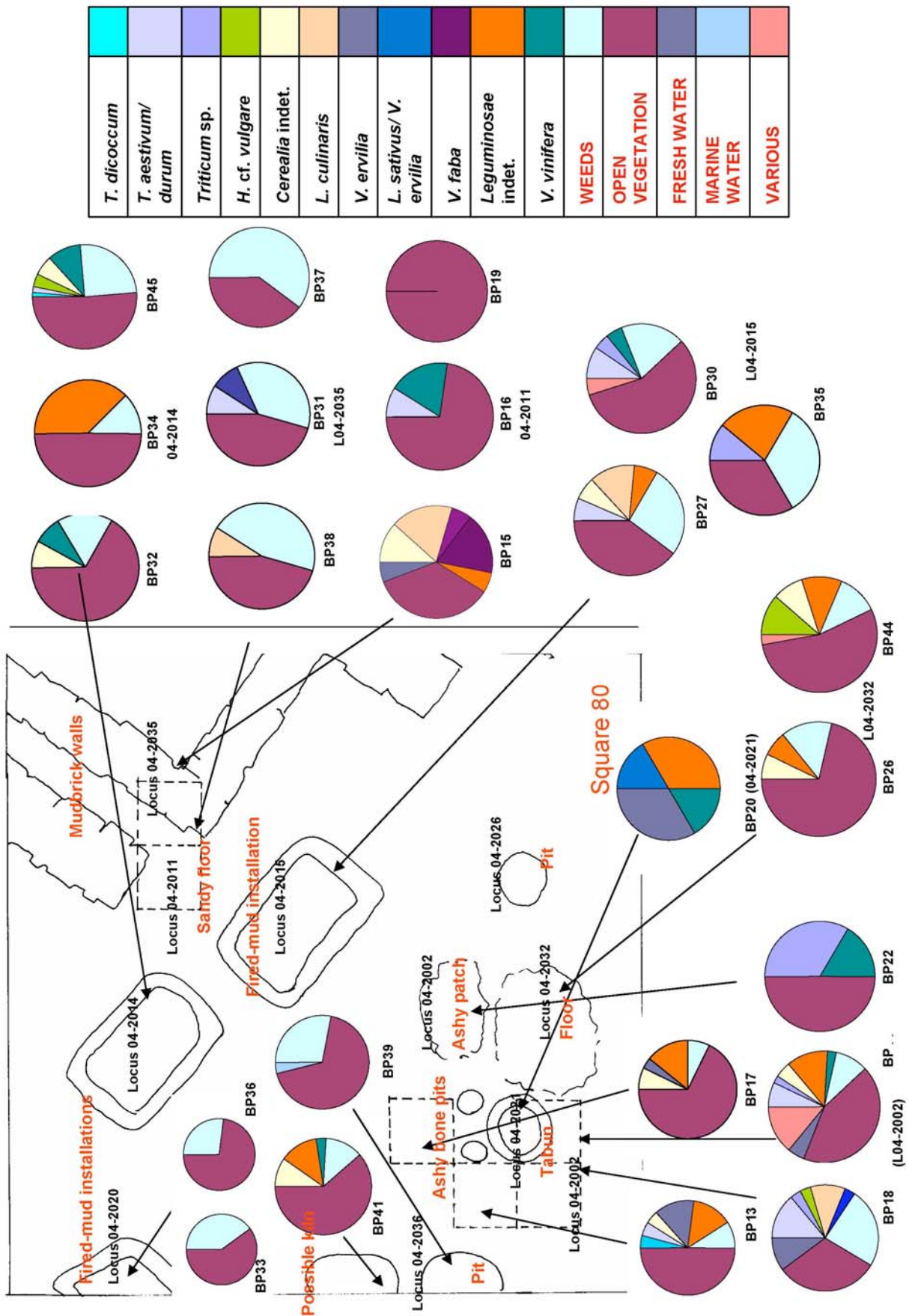


Fig. 15: Location and percentage occurrences of Tell Atchana samples from the 2004 excavation (total seed amounts per sample are given in sample descriptions and Appendix 1-2).

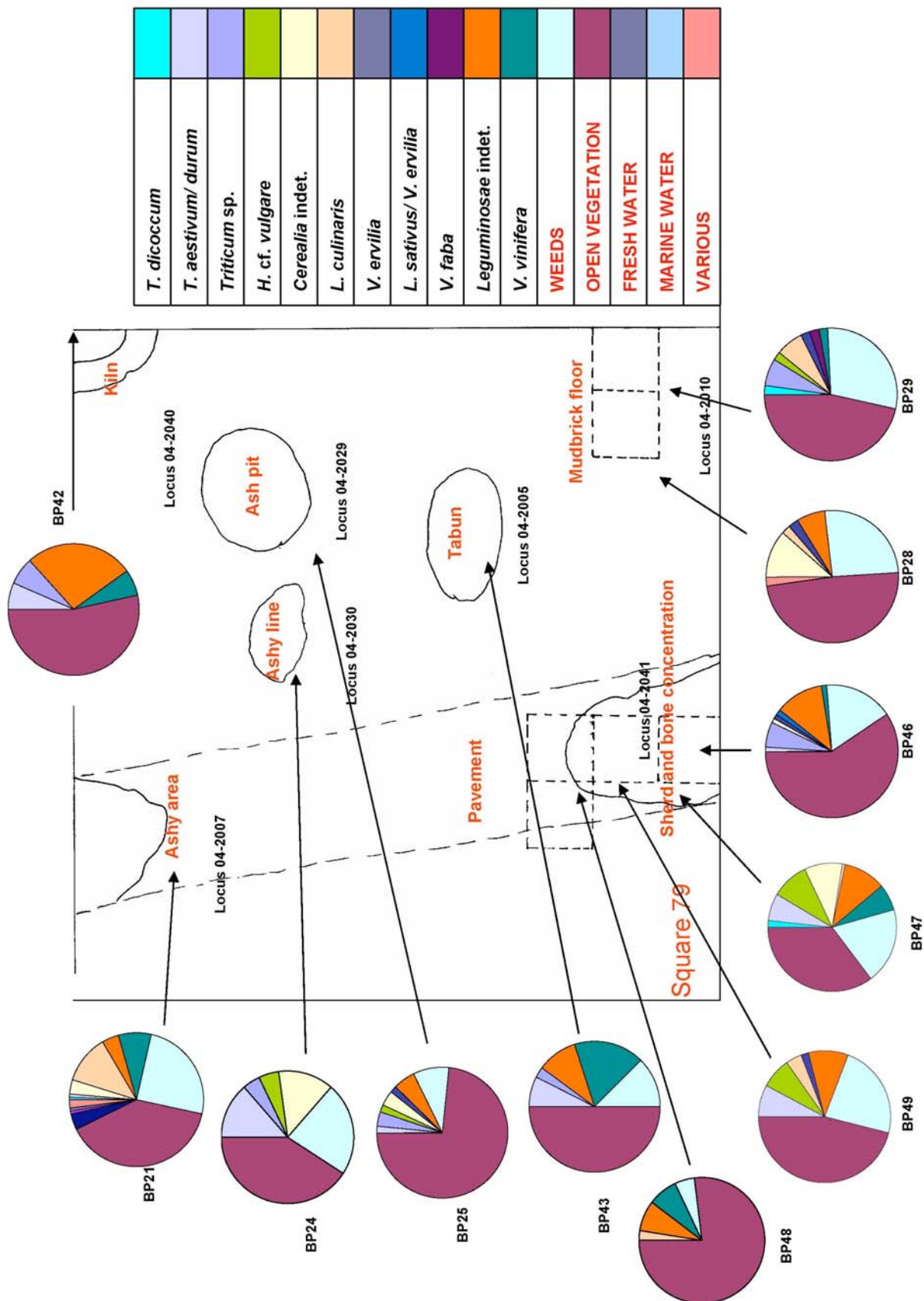
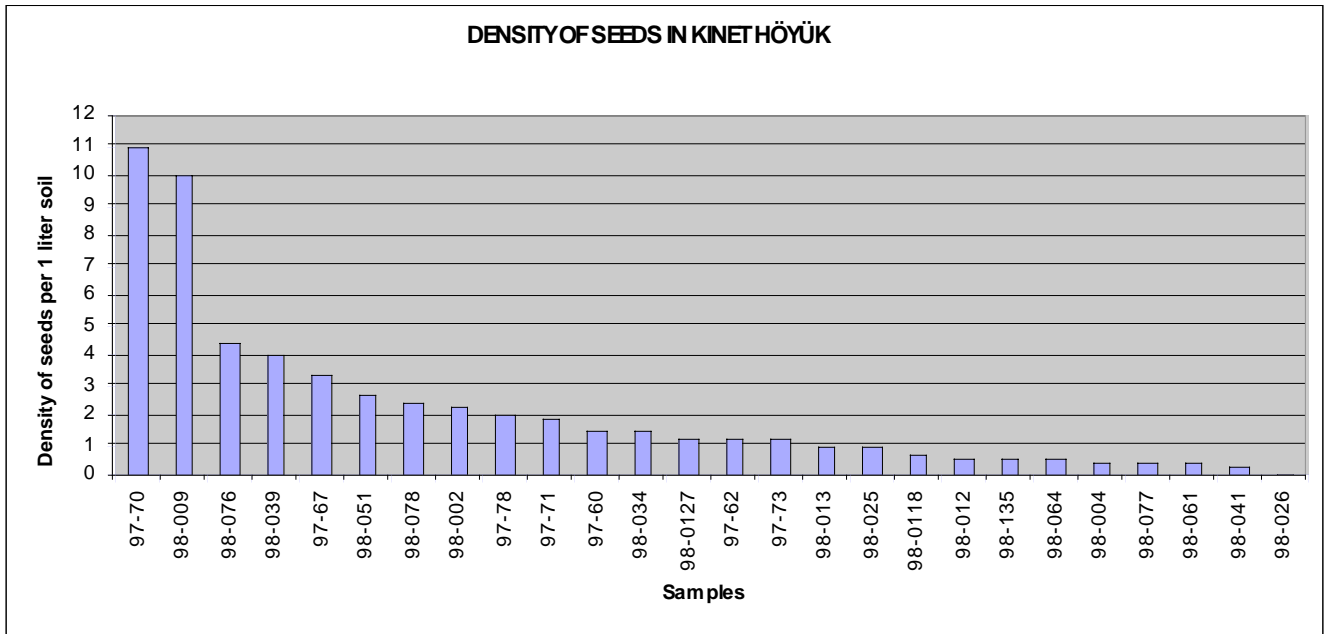
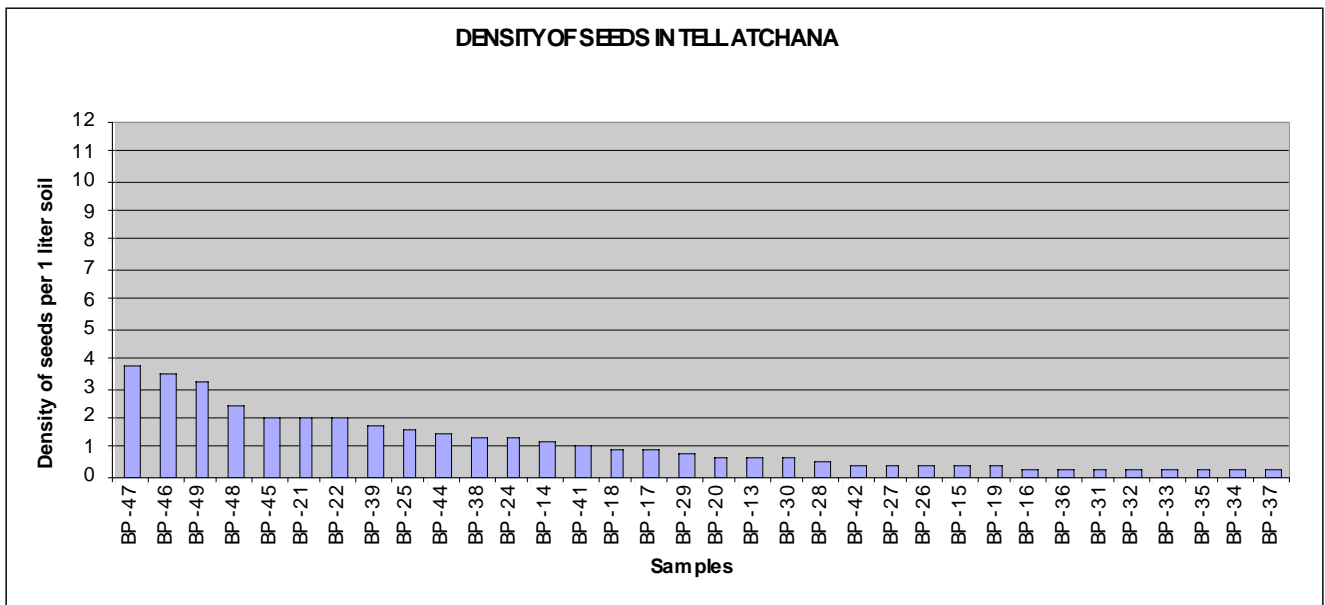


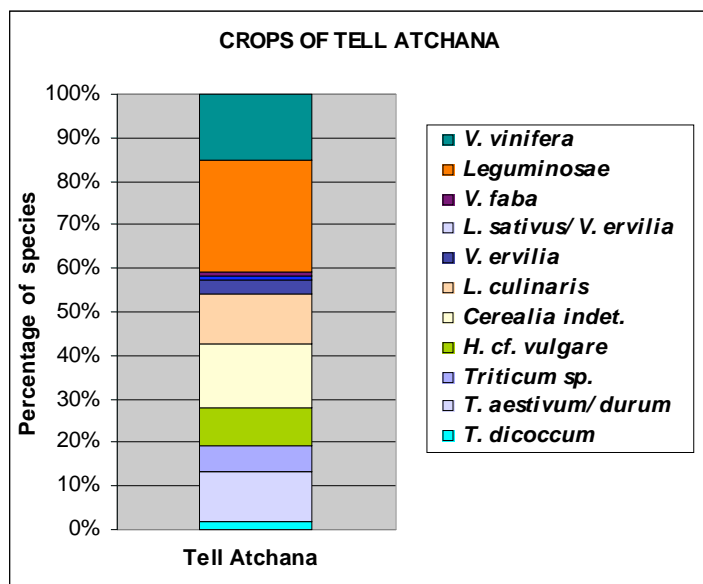
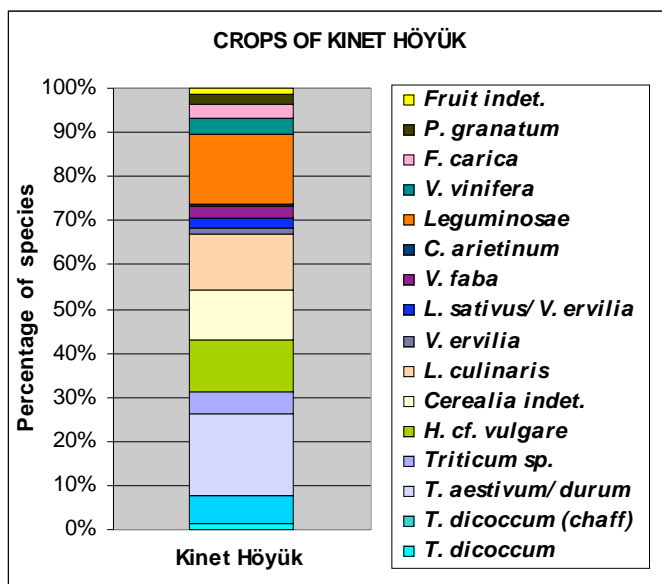
Fig. 16: Location of Tell Atchana samples from the 2004 excavation (total seed amounts per sample are given in sample descriptions and Appendices 1-2).



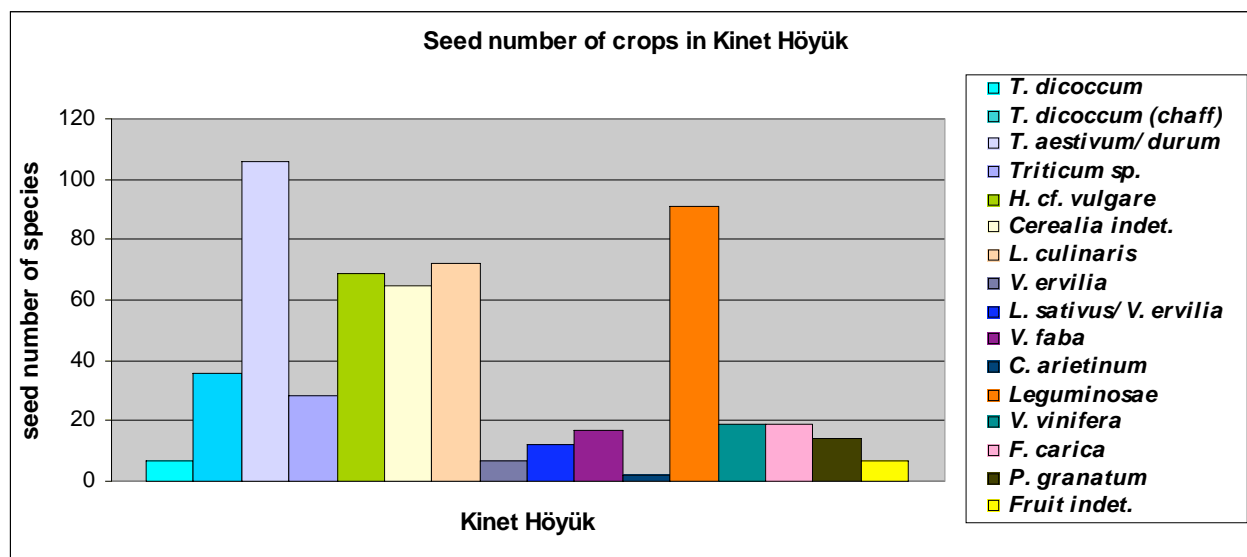
Graph 1: Seed density of the Kinet Höyük samples per 1 litre soil. The samples 99-0045 (KT.11943), 99-071 (KT.12794), 99-0056 (KT.12732), 99-0075 (KT.13010) and 99-020 (KT.1140) left out of consideration.



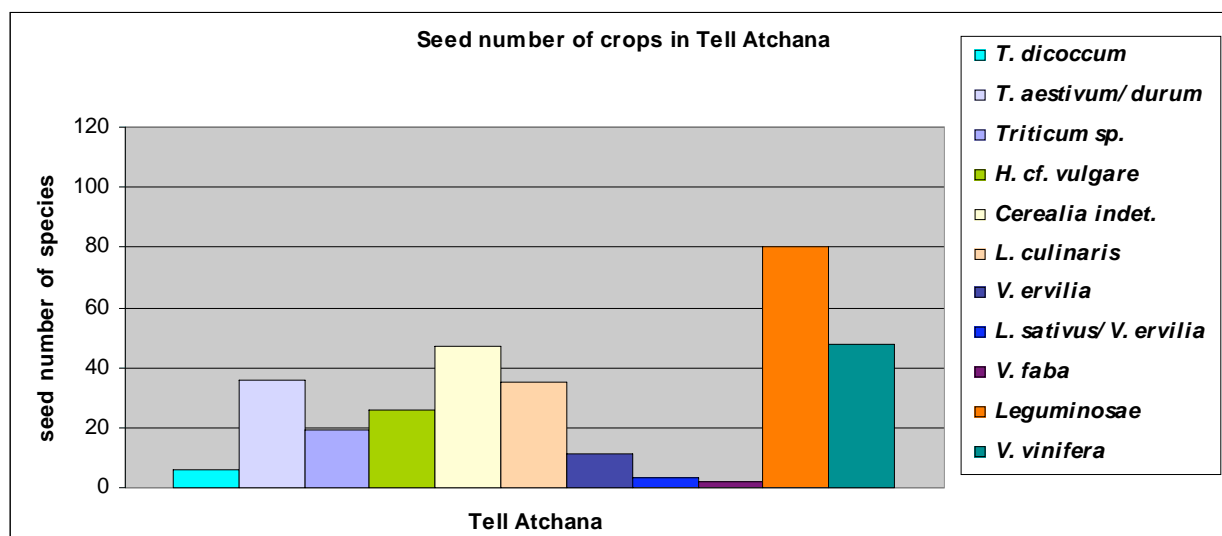
Graph 2: Seed density of the Tell Atchana samples per 1 litre soil. Sample BP-43 is given without description of soil volume.

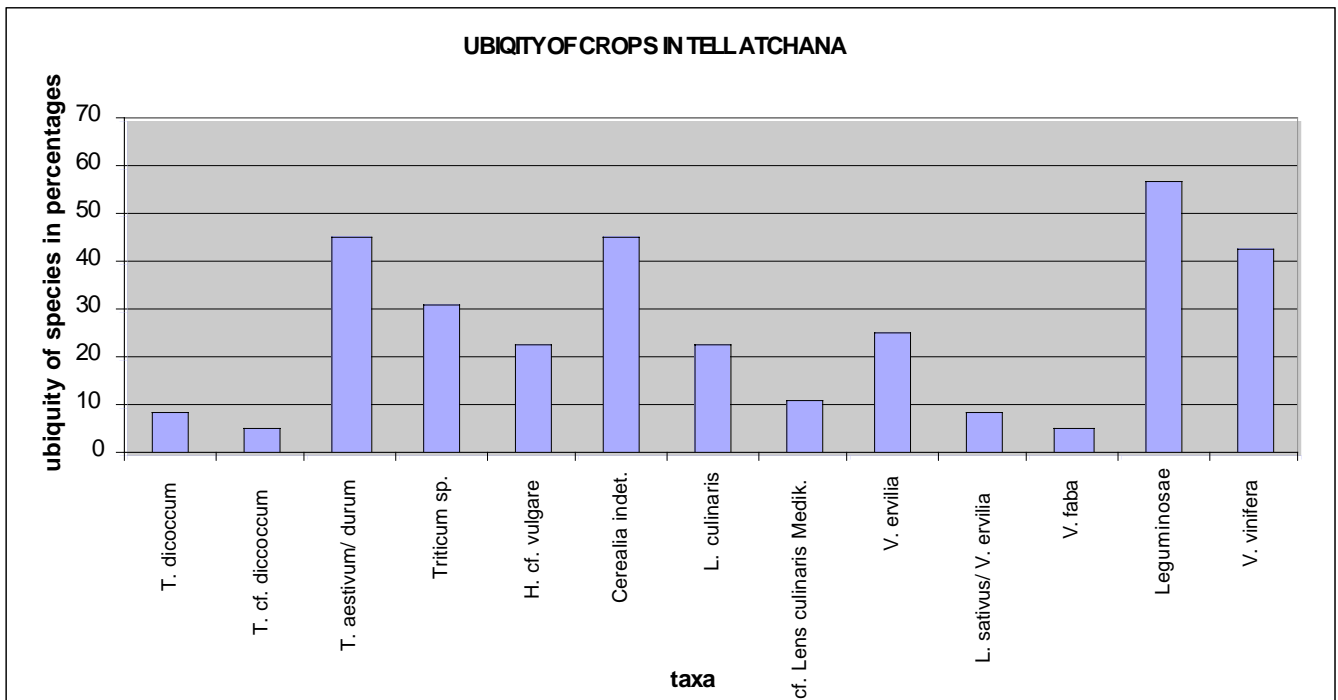


Graph 3 and 4: Percentage occurrences of crop plants in Kinet Höyük and in Tell Atchana samples.

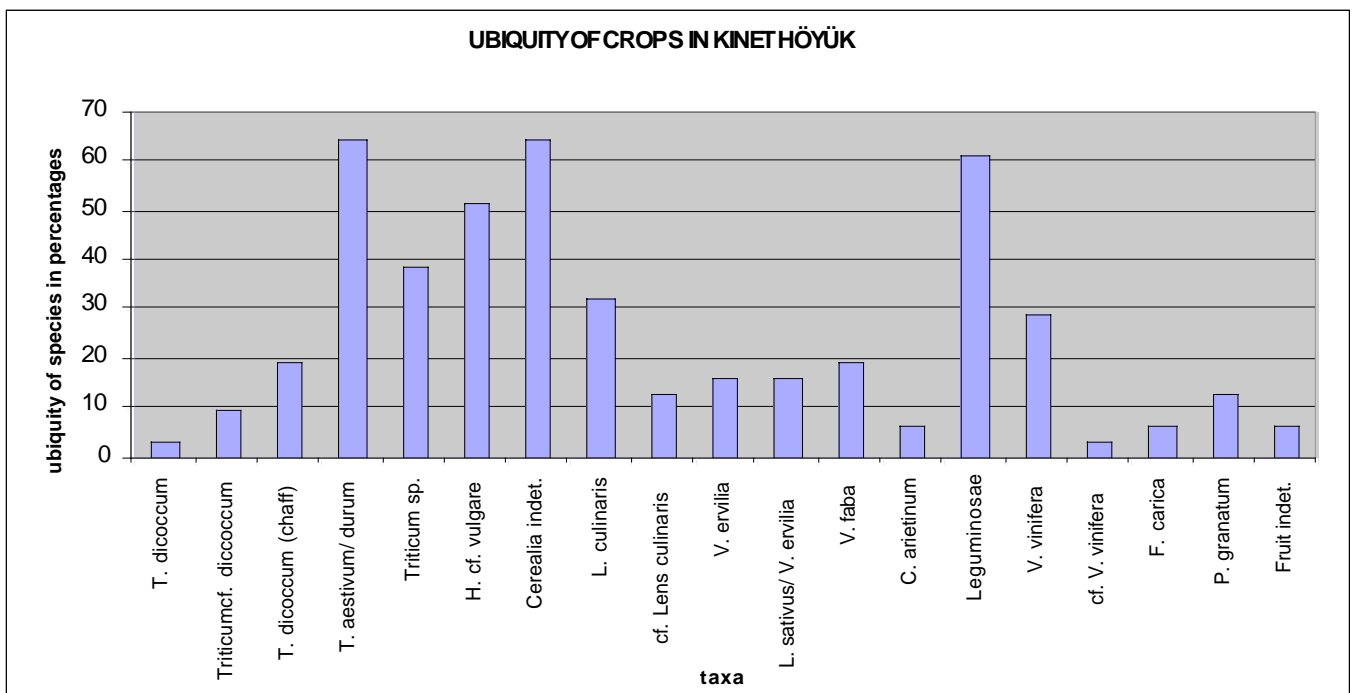


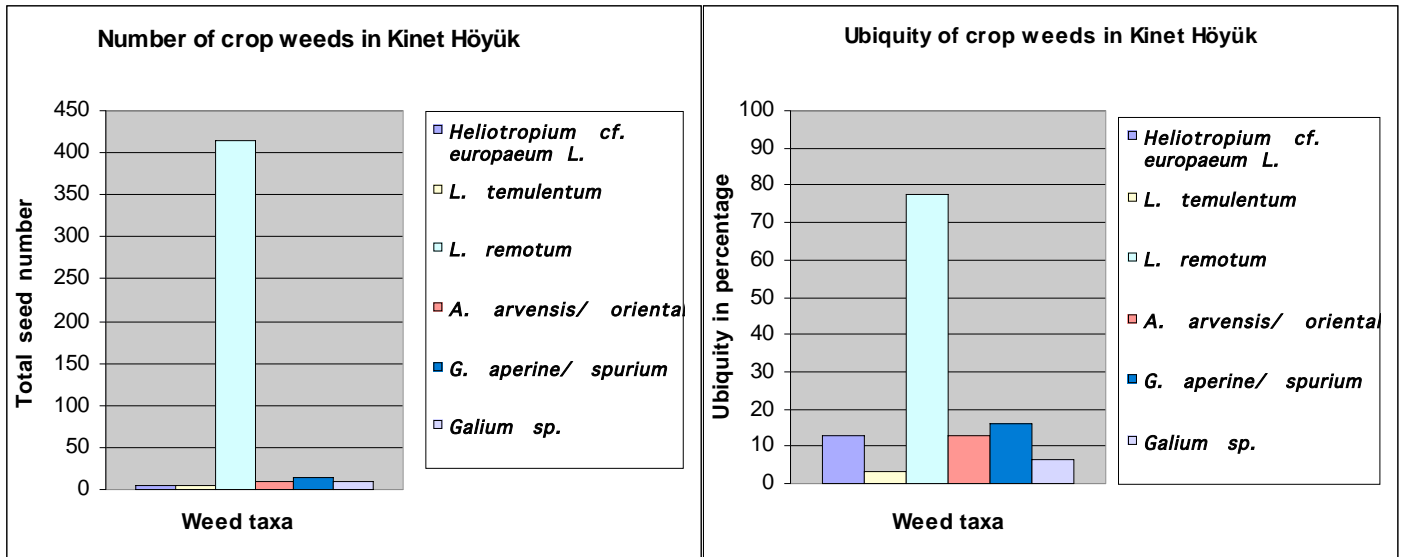
Graphs 5 and 6: Seed number of crop plants in Kinet Höyük and in Tell Atchana samples.



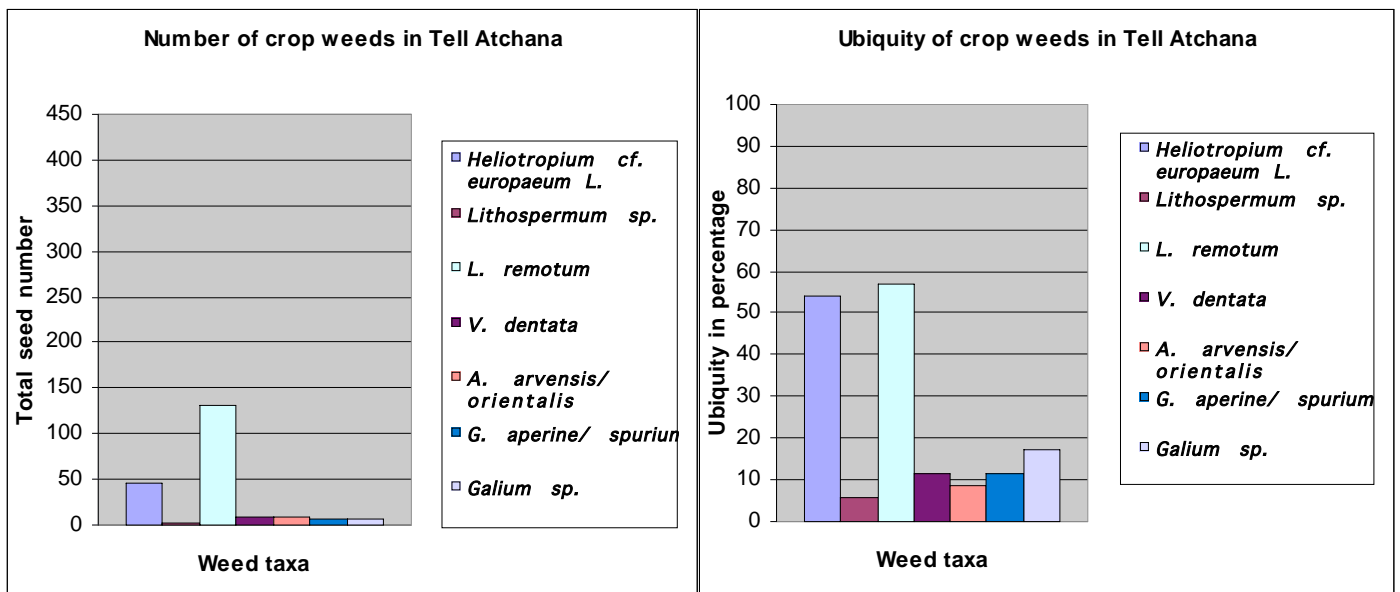


Graphs 7 and 8: Ubiquity of crop plants in Kinet Höyük and in Tell Atchana samples.

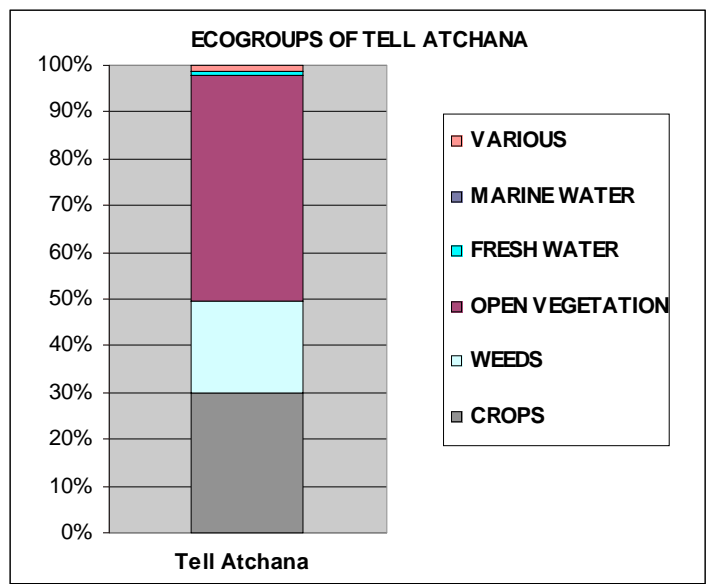
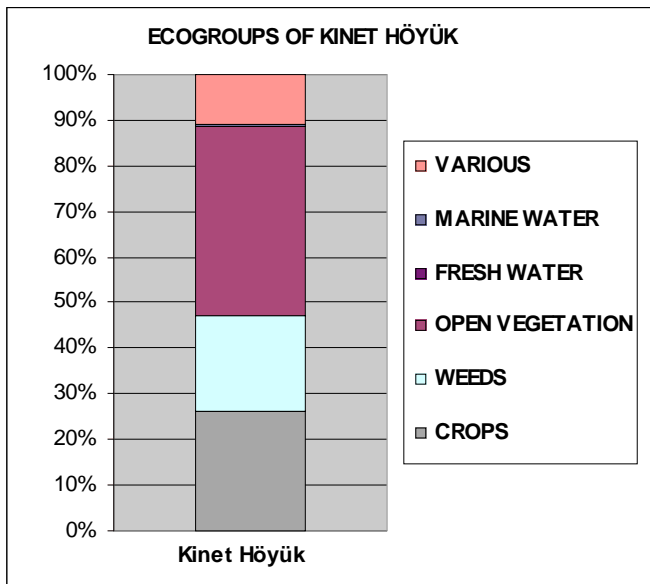




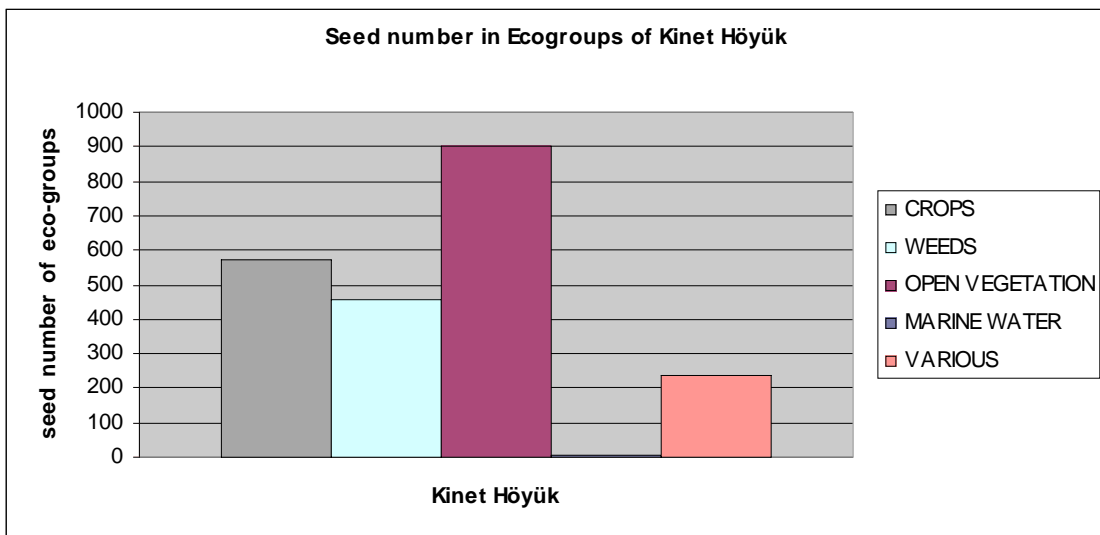
Graphs 9 and 10: Seed number and ubiquity of weeds in Kinet Höyük samples.



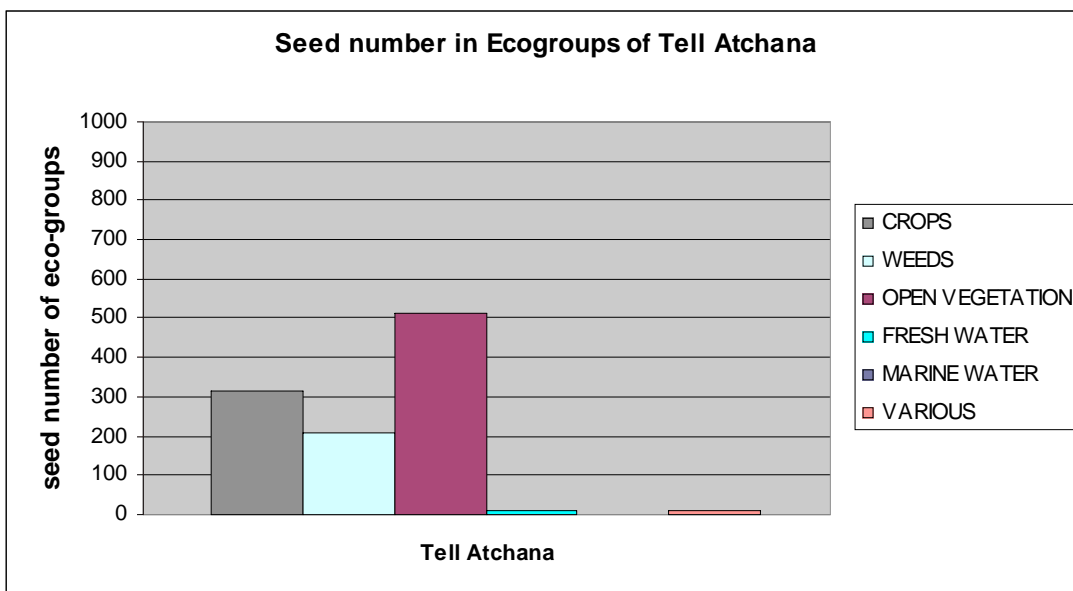
Graphs 11 and 12: Seed number and ubiquity of weeds in Tell Atchana samples.



Graphs 13 and 14: Percentage occurrences of eco-groups in Kinet Höyük and in Tell Atchana samples.



Graphs 15 and 16: Seed number of eco-groups in Kinet Höyük and in Tell Atchana samples.



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