VERSITA

Acta Palaeobotanica 53(2): 263–293, 2013
DOI: 10.2478/acpa-2013-0010

The role of plants in the economy of Tell Arbid, north-east Syria, in the Post-Akkadian Period and Middle Bronze Age

KRYSTYNA WASYLIKOWA[1] and RAFAŁ KOLIŃSKI[2]

[1]W. Szafer Institute of Botany, Polish Academy of Sciences, Lubicz 46, 31-512 Kraków, Poland;
e-mail: k.wasylikowa@botany.pl

[2]Institute of Prehistory, Adam Mickiewicz University, Święty Marcin 78, 61-809 Poznań, Poland;
e-mail: kolinski@amu.edu.pl

Received 20 May 2013; accepted for publication 15 September 2013

ABSTRACT. Archaeological fieldwork carried out at the Tell Arbid site in north-eastern Syria exposed settlement remains dating from the early 3rd millennium BC to the mid 2nd millennium BC. Recent excavations in Sector P, on the eastern slope of the site, revealed the existence of a significant occupation of the Post-Akkadian/Early Jazirah V period and of levels dated to the Early and Classic Khabur Ware/Old Jazirah/Middle Bronze Age I-II periods. Cereal remains were dominated by grains and ear fragments of hulled two-rowed barley *Hordeum distichon*. Less numerous were wheats represented by emmer *Triticum dicoccon*, einkorn *T. monococcum*, and macaroni wheat *T. durum*. The presence of bread wheat *T. aestivum* and six-rowed barley *Hordeum vulgare* could not be excluded. The two periods contained similar sets of cereals, but in the Post-Akkadian Period the percentage of hulled wheat remains was higher, while in the Middle Bronze Age (particularly in its younger phase) naked wheat slightly exceeded hulled wheats. Legumes were represented by only very few seeds of lentil *Lens culinaris* and bitter vetch *Vicia ervilia*. Diaspores of wild plants were very abundant, particularly those from the families of grasses and legumes. The considerable number of ear and culm fragments probably belonging to cereals as well as numerous seeds/fruits of wild plants suggests that the plant remains originated from fodder or animal dung or belonged to threshing waste. The presence of grass stems with nodes indicated that cereals were reaped low on the straw; occasional use of uprooting was suggested by the occurrence of basal culm fragments with traces of rootlets.

KEYWORDS: charred seeds and fruits, cereals, wild plants, harvest methods, Post-Akkadian Period, Middle Bronze Age, Tell Arbid, Syria

INTRODUCTION

The archaeological site of Tell Arbid is located in north-eastern Syria (36°52′20″N, 41°01′17″E), in the area described often as the Khabur Triangle, a fertile rolling plain delimited by the Tur Abdin mountain range on the north, the Khabur river on the south-west, and its tributary Jaghjagh on the south and east (Fig. 1). A reconstruction of ancient biotic zones places the site in an area of park woodland steppe (Hillman 2000), with mean rainfall of ca 380 mm per year (Weiss 2012, fig. 5). The site was briefly excavated by Sir Max Mallowan in 1936 (Koliński 2007a); since 1996, regular excavations have been carried out by the Polish-Syrian Archaeological Mission, led by Professor Piotr Bieliński of Warsaw University (for interim reports on the work of his team see Polish Archaeology in the Mediterranean, Reports, vols. VII–XXII).

The team of the Institute of Prehistory of Adam Mickiewicz University (AMU) in Poznań, directed by the second author, worked within the framework of the Polish-Syrian mission in 2008–2010. The aim of the AMU team's research was to excavate remnants of the so-called Post-Akkadian period (ca 2150–2000 BC conventional

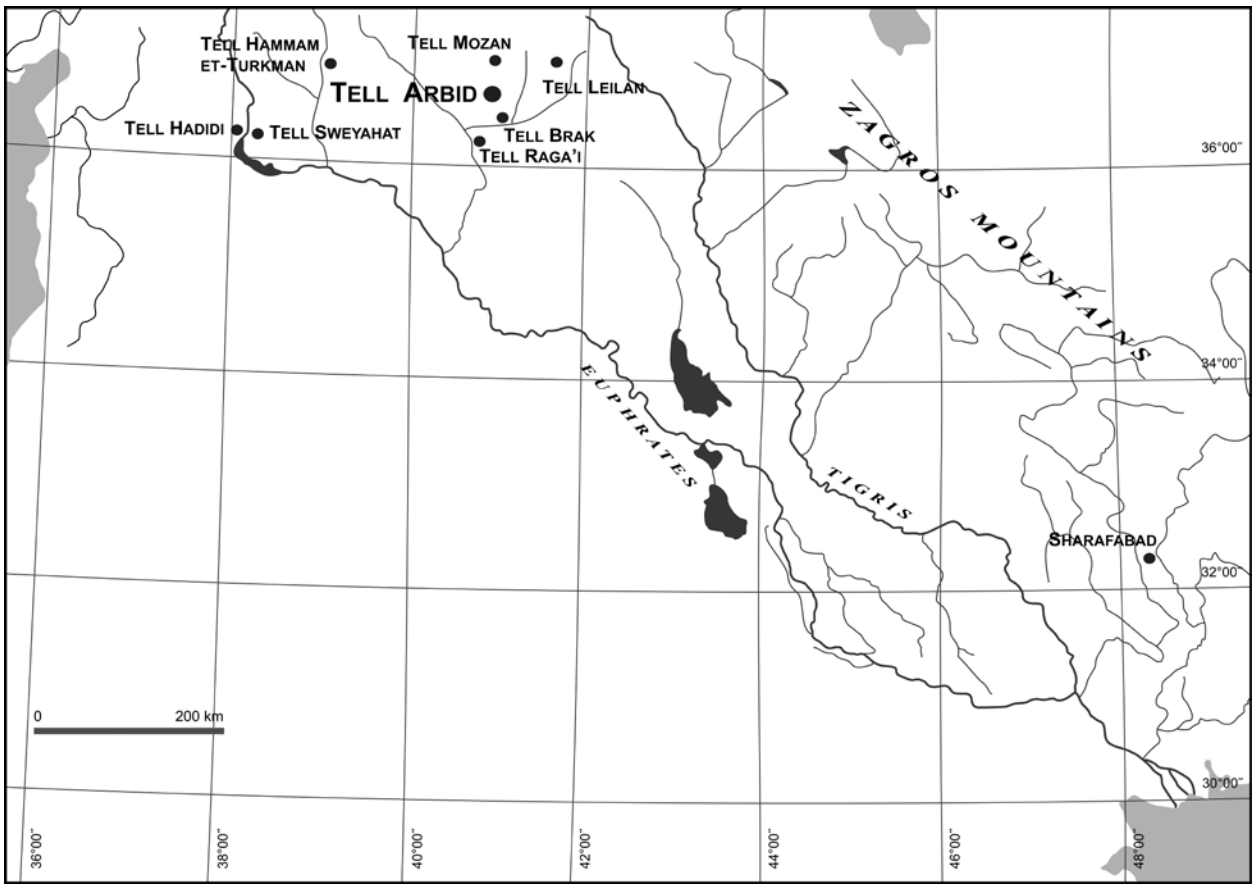


Fig. 1. Map of northern Syria showing the location of Tell Arbid and other archaeological sites mentioned in the text (Ksenia Kolińska)

Middle Chronology) in order to determine their stratigraphy and the role played by settlement, and to gather information on the subsistence of the population of the site. For this last task, a significant assemblage of animal bones was collected (presently being studied by Dr. Joanna Piątkowska-Małecka of Warsaw University), as well as the palaeobotanical samples discussed below. In the wider perspective, the research on Post-Akkadian Tell Arbid was motivated by current discussions of the settlement history and ecology of North Mesopotamia in the terminal part of the 3rd millennium BC. A paper by Weiss et al. (1993) offered a catastrophic perspective on the area. According to this view the whole of North Mesopotamia was abandoned by the end of the Akkadian period and its population migrated towards regions with more stable agrarian conditions). This position, further elaborated by Weiss in his subsequent publications (e.g. Weiss 2000a, b), recently has been contested by most of the scholars working in the area, including one of the present authors – Rafał Koliński (Kuzucuoğlu & Marro 2007, Koliński 2007b, see numerous contributions in Weiss (ed., 2012).

ARCHAEOLOGICAL SETTING

During the three seasons of fieldwork in Sector P at Tell Arbid, archaeological remains dating from the early 3rd millennium BC to the mid 2nd millennium BC were exposed. As expected, however, the most significant discoveries refer to the occupation of the Post-Akkadian/Early Jazirah V period (hereinafter designated PA). Another well-represented period comprised remnants dating to the Early and Classic Khabur Ware/Old Jazirah/Middle Bronze Age I–II periods, hereinafter designated MB (Tab. 1). For a stratigraphic summary of this sequence see Koliński (2012). The Post-Akkadian period (2150–2000 BC) is represented by three architectural strata. The oldest one (Level VI) was excavated to a very limited extent and revealed remains of modest structures of domestic character. Levels Vb–Va featured a substantial building (the so-called Main Building) interpreted as a caravanserai, and other structures forming a service area related to the use of this structure. The building was abandoned before the end of the Post-Akkadian period, and when the ruin filled with

Table 1. Stratigraphy and chronology of Sector P at Tell Arbid. Laboratory of the University of Arizona numbers of ^{14}C samples: 1 – AA98357, 2 – AA 98356, 3 – AA 98355

Level	Period	Conventional dates BC, Middle Chronology	^{14}C dates (2σ cal)	Character of remains	Samples
VIII	Ninevite V	2900–2500	–	houses, grave	–
VII	Akkadian	2330–2150	–	houses	–
–	–	–	–	abandonment	–
VI	PA	2150–2050	–	houses ?	9
Vb	PA		(1) 2460–2204 BC	Main Building, phase 1	1, 5, 12, 40
Va	PA		(2) 2334–2037 BC (3) 2291–1981 BC	Main Building, phase 2	6, 8, 10, 19 23
–	Late PA	2050–2000	–	abandonment	–
IV	Late PA ?		–	Pit horizon 1	25
–	–	–	–	abandonment	–
III	MB/Old Jazirah I	1900–1700	–	pottery kilns, pits, structures	2, 3, 7, 11, 13, 20, 22, 24, 39
II c	MB/Old Jazirah I/II		–	House 3, earliest graves	4, 21, 26,
IIa-b	MB/Old Jazirah II		–	Houses 1–5, graves	14, 18, 27, 28, 29, 42
I	MB/Old Jazirah III	1700–1500	–	traces of settlement	–

earth the area was used for digging pits, some of which accommodated burials (Level IV). Then the area was abandoned for some time and only towards the end of the Old Jazirah/Middle Bronze I period ("Early Khabur Ware" period, 1900–1800 BC) did traces of settlement reappear (Level III). They consist of remains of pottery ovens, and a few large rectangular pits filled with ashy deposit, probably related to the use of the ovens (Koliński, forthcoming). In the subsequent level encompassing a long period (Level II) a group of houses related to the Old Jazirah/Middle Bronze II/"Classical Khabur Ware period" (1800–1700 BC) was built over the earlier remains and numerous graves were dug into earlier deposits in areas around the houses. Finally, Level I included only badly eroded remains of another set of houses dated to the terminal Old Jazirah/Middle Bronze III period (1700–1500 BC). Three samples analysed for ^{14}C isotope content in the laboratory of the University of Arizona (Koliński 2012: 123, tab. 2) yielded dates comparable to those from other sites (Tab. 1) in the Khabur Triangle area (Ristvet 2011, Weiss et al. 2012: 175–185).

Palaeobotanical samples were collected through all the seasons, though the sample collection methods varied. During the 2008 and 2009 seasons, plant remains were collected occasionally, only when charred remains were observed in the explored deposit. Occasionally, small lumps of clay containing visible charred material were collected; some of them contained wood charcoal and those will be analysed separately by Prof. Maria Lityńska-Zając. In 2010, when a flotation machine was available at the site, the method was changed. Samples of soil were collected whenever sediment with considerable content of ash or charred remains was encountered.

The samples analysed in the present contribution represent the three main historical periods excavated in Sector P (Tab. 1). The distribution of samples over the site permits basic comparisons between the Post-Akkadian and Middle Bronze Age periods. Samples dating to the Post-Akkadian period were retrieved from various locations inside and outside of the structures (Fig. 2). Most likely the oldest one is sample 9. It was retrieved from a pit filled with soft brown earth, corresponding to badly preserved remains of structures belonging to the earliest Post-Akkadian level (Level VI) exposed in square 37/62. For another supposedly early sample (40) the precise date is disputable; it was retrieved from a low wall of beaten earth enclosing a large storage pit (Locus 17) in square 38/61. The pit was in use in the earlier phase of the Main Building (Level Vb) but the plant remains that were in the clay of the enclosure wall could have been added to it during construction, or could be from earlier contamination of the clay. In fact the radiocarbon date of grain from this sample (AA 98357) is significantly older than two other dates related to the use of the Main Building (see Tab. 1).

Three samples from the older phase of the Main Building (Level Vb, samples 1, 5, 12) were

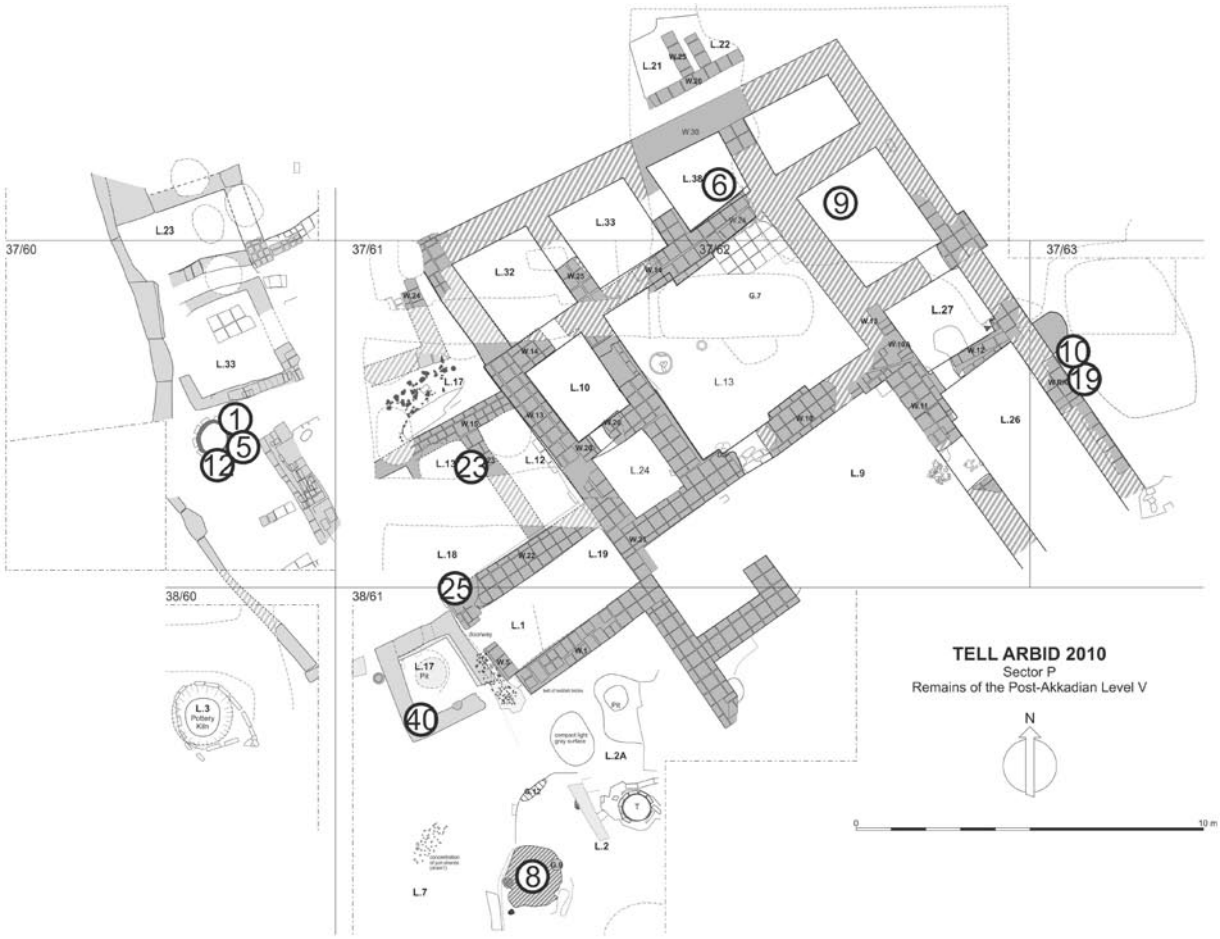


Fig. 2. Tell Arbid 2010 Sector P, plan of Post-Akkadian Level V showing the position of archaeobotanical samples (Marta Momot, Marek Puszkarki, Rafał Koliński)

taken from the same object, a shallow pit filled with ashes and potsherds surrounding an oven discovered in Locus 39 of square 37/60. It is thus tempting to interpret the ashes containing plant remains as resulting from combustion in the oven. The oven in question is of a particular type represented by two other better-preserved structures of this type discovered in squares 38/61 and 37/60, the second structure belonging to a later phase of the Main Building. The oven is oval in shape, measuring 0.65 by 0.8 m. The walls, made of well-prepared clay, deeply burned, some 2–3 cm thick, were originally ca 0.6 m high, as evidenced by the oven in Locus 6 of square 37/60. A particular element of all these structures is brickwork supporting the oven walls from outside. It is made of rectangular bricks standing on a header and adhering to the oven wall. The bricks are set some centimetres apart. Then a higher level of brickwork was laid in a similar manner, with bricks spanning the intervals between the bricks of the lower course. The brick structure formed in this way is the same height as the oven wall but is much lighter than a wall of solid bricks. It seems plausible that the oven in Locus 39 served a foundry discovered in neighbouring Locus 33 of the same square (Koliński 2012: 115).

Two other samples (6, 23) are related to the later phase of use of the Main Building (Level Va). Sample 6 was retrieved from a deposit on the floor of Locus 33, one of the small storerooms on the northern side of the caravanserai. Sample 23 from Locus 18, square 37/61 belonging to the "Extension 1" building, contemporary to the Main Building, was in a similar stratigraphic situation. Both of these samples are related to the latest use of Level Va. Two more samples probably belong to the same period; they were collected from objects whose attribution to the phases of the main building is unclear, but again it is very likely that their presence marks the latest use of the entire complex. The context of sample 8 is extremely interesting. It comes from an object unearthed in an open area used for household activities, located south of the "Extension 1" structure (Fig. 1). The object consists of a series of very

hard floors made of thin gravel and clay, is oval in outline and measures 1.8 by 1.6 m. Very thin ashy deposits were discovered between the floors. The more substantial sediment from which the sample was taken was identified in a shallow depression enclosing the hard floor from the west and north. It seems likely that the hard surface was used for a very specific activity; the composition of plant remains identified in the sample (see below) suggests that it was used as a winnowing floor. The last sample (in fact two samples, 10 and 19, retrieved from the same archaeological level by flotation and by sieving respectively) comes from the hard surface located outside the Main Building by its eastern wall. It may have been formed of chaff and other plant remains blown by wind and deposited under the wall, in a way often observed in modern Near Eastern villages.

The last Post-Akkadian sample (25) comes from the fill of a pit in which Grave 10/38/61 was exposed. A single pottery cup discovered beside the skeleton dates the grave to the Post-Akkadian level, but its stratigraphic position shows that it is later than the Main Building and needs to be dated to Level IV. It is not clear, however, how plant remains found their way into the fill of the grave pit.

The samples dating to the "Early Khabur Ware" period (Level III) form a much more uniform collection (Fig. 3). In fact, nearly all of the samples originate from the same object: Pit 14 in square 37/62. This large (ca 4.5 by 2 m) roughly rectangular object was 0.8–0.9 m deep. Its fill consisted of thin horizontal layers with varying ash content (from very high to moderate). Samples 20, 22, 24 and 39 were dry-sieved or retrieved by hand when plant remains were observed. Two more samples (2, 3) were collected during the 2010 season and retrieved by flotation. This extensive but rather flat pit seems to have been dug to obtain clay for some purpose. Pits of similar shape and depth are found in present-day villages; they are dug to obtain clay for preparing clay-plaster for walls and roofs of mud-brick structures. The regular and horizontal deposition of fine ash layers in the fill suggest that it was intentionally filled,

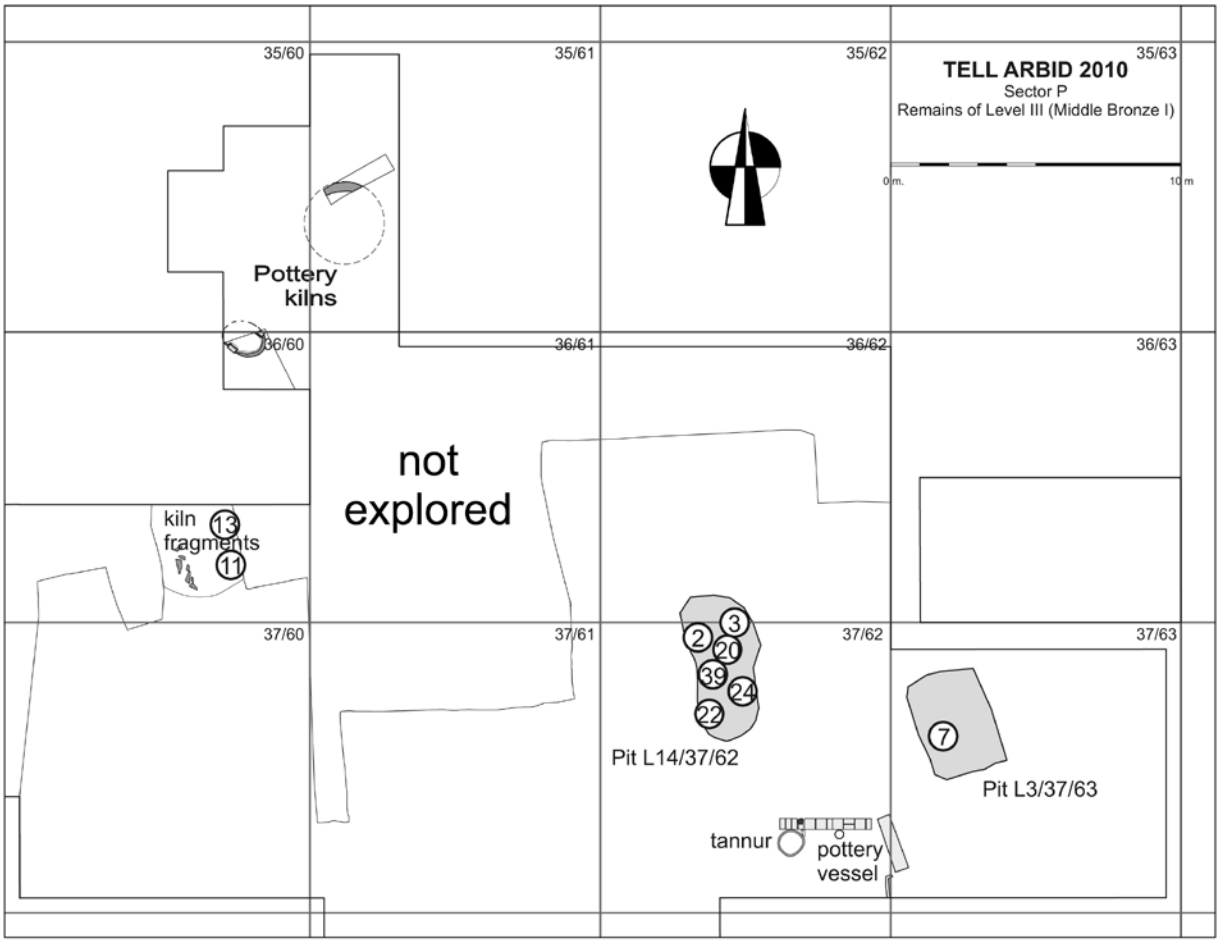


Fig. 3. Tell Arbid 2010 Sector P, plan of Level III, Middle Bronze I, showing the position of archaeobotanical samples (Rafał Koliński)

possibly with ashes from pottery kilns discovered ca 15 meters to the west on the slope of the tell summit. Another similar pit (Locus 3/37/63, measuring 3.75 by 2.5 m) yielded a very similar sequence of deposits; sample 7 comes from its fill.

Two more samples (11, 13) belonging to the described period were collected on subsequent days from the same context: a lens of ash containing earth identified in the northern part of square 36/60. The soil bearing plant remains contained lumps of burned clay and partially fired brick fragments most likely coming from a damaged pottery kiln. The ashes containing plant remains are therefore presumably related to the use of the same object.

Samples 4 and 21 were retrieved from occasional ashy deposits excavated in squares 35/60-1 in the north-west part of the area. The chronological position of these layers is determined by the date of pottery kilns (Level III) whose remnants were under this deposit, and by graves dug into this deposit which date to Level II ("Classic Khabur Ware" period). The origin of plant remains is difficult to determine; as the excavated layers are located below the summit of the tell, it is quite likely that they were formed from material washed down from the top of the High Mound, where a substantial deposit of ashes was identified during the work of the University of Warsaw mission. In such a situation, the plant remains may date to Levels IIc or III, but definitely not earlier.

The samples from the Middle Bronze II period are less precisely dated (Fig. 4). There is a group of samples retrieved either from the grave pits of burials belonging to "Classic Khabur Ware" period settlement (sample 14, from the pit of Grave G4/35/60) or from the fill of the chamber (sample 27 from G7/37/62; sample 28 from G1/37/63; sample 42 from a vessel found in G1/35/61) (Fig. 3). In all those cases the plant remains were discovered in soft fill which probably got into the chamber when the roof was broken by grave robbers (G1/35/61) or collapsed due to other causes. Consequently, they have to be considered later than the graves, probably very late Level IIa or even Level I. Two other samples (18, 29) were identified in bricks belonging either to structures (18) or to graves (29). In both these cases the plant remains had been added to the clay to make the bricks, a practice described extensively in the archaeoethnographic literature. Sample 26 was collected on the floor of Room 31 in square 37/61, in the vicinity of a bread oven. In this case it is tempting to interpret this deposit as containing ashes resulting from heating the oven.

Judging from the contexts of the discovery, none of the samples retrieved in Sector P at Tell Arbid relate to storage of grain or other plant

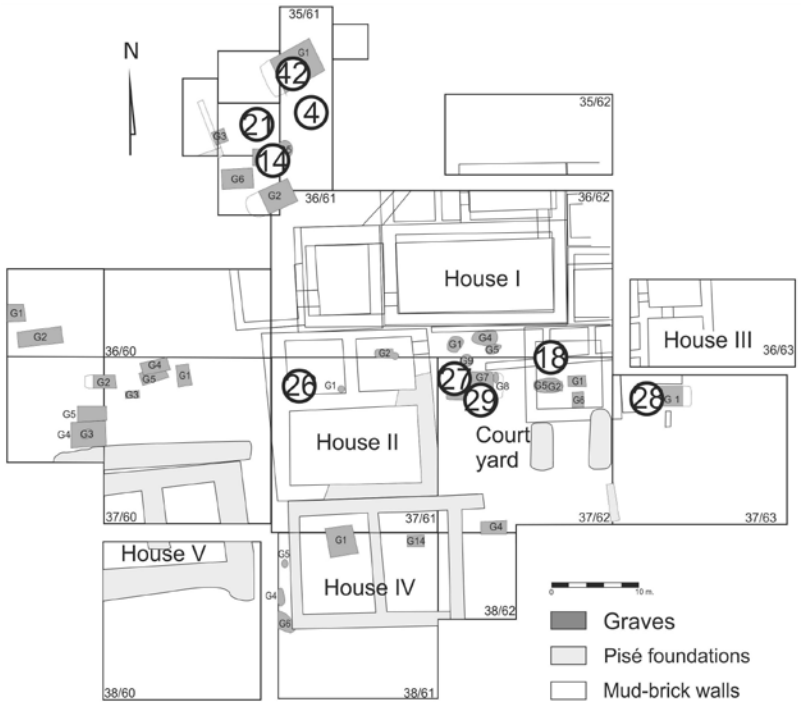


Fig. 4. Tell Arbid 2010 Sector P, plan of Level IIb-IIa, Middle Bronze II, showing the position of archaeobotanical samples (Rafał Koliński)

products. The most numerous group is composed of samples containing burned remains taken from ovens of various types (for pottery, smelting, or baking bread; samples 1–3, 5, 7, 11–13, 20, 22, 24, 26, 39). In this case the plant remains were used as fuel, but it is difficult to tell whether animal dung or actual plants were burned. Another much smaller group comprises remains that were added to clay used for various structures, either as dried bricks (samples 18 and 29) or pisé (sample 40). Very interesting is sample 8, which, if our interpretation is correct, is composed of chaff and plant remains removed from harvested grain by winnowing. The remaining samples come from not very well-defined contexts; in many cases the plant remains found there must have been displaced from their original site of deposition (samples 4, 10, 14, 21, 25, 27–28, 42).

MATERIAL AND METHODS

Sampling of plant material was done under the supervision of the second author (Tab. 1). Soil samples were processed in the field with the use of flotation or dry sieving, and a few were picked by hand from the excavation and later processed in the laboratory. The volume of earth used for flotation varied from 3 to 10 litres. The exact volume of dry-sieved samples was not recorded (ca 10 litres). In total slightly over 220 litres of sediment were used for these studies. The flotation residues were sun-dried and wrapped in soft paper. In addition to charred plant remains they contained mineral particles and uncharred leaves, thin stems, fruits, seeds, insects and a few snails. For dry sieving a sieve of ca 1.5 mm mesh size was used. The samples thus obtained were composed mainly of cereal grains. Samples collected by hand included lumps of earth with charred plant remains recovered in the laboratory by flotation or by picking from dry samples. Sample 39 contained a few larger lumps with indistinct impressions of straw and chaff on the surface. In the laboratory all charred specimens were picked under a low-power stereomicroscope. The uncharred items were discarded because they evidently represented modern material. Laboratory preparation and plant identification were done in the W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków, with the use of its reference collection of modern seeds and fruits, as well as seed atlases. The reference collection was adequate for identification of cereals and other cultivated plants, but the representation of the wild flora of Syria was insufficient for detailed determinations. The illustrations and descriptions published in papers presenting the results of archaeobotanical studies of other sites in this region, especially those of van Zeist & Bakker-Heeres (1982, 1984a, b, 1985) were very helpful, as were lists of taxa found at sites of similar age (Charles & Bogaart 2001, Colledge 2003, Wetterstrom 2003, van Zeist 2003). All taxa identified from Tell Arbid are listed in Tables 2 and 7. For large-grained cereals and wild grasses, complete caryopses and their halves (recorded as fragments in tables) were counted, the basal and apical ends not being distinguished. Complete and broken seeds of *Coronilla* cf. *scorpioides* were counted in the same way.

Nomenclature of cereals follows the traditional names of morphological species (Lityńska-Zając & Wasylikowa 2005, Zohary & Hopf 2000). In some cases a taxon name is provided with a qualification indicating identification accuracy: the abbreviation "cf." means a fairly close determination, while the qualification "type" indicates only a morphological resemblance to the indicated taxon, with the caveat that some other taxa not seen may have similar diaspores.

RESULTS

COMMENTS ON PLANT IDENTIFICATION

Cultivated plants

Four cereal species are positively identified: two-rowed barley, einkorn wheat, emmer wheat, and macaroni wheat. The presence of six-rowed barley and bread wheat is unlikely but not excluded.

The occurrence of hulled two-rowed barley *Hordeum distichon* L. is confirmed by numerous kernels and ear rachis fragments. The caryopses have the typical spindle-like shape and furrow with edges diverging towards the grain apex. Most grains are strongly deformed by charring, but all better-preserved specimens are symmetrical, without the twisting characteristic of the lateral spikelets of six-rowed barley *Hordeum vulgare*. Several grains show longitudinal traces of palea and lemma typical for hulled barley (Pl. 1, fig. 2). Most of the ear rachis fragments are represented by single internodes. A few are composed of two internodes. In the upper part of each segment a small fragment of the next (broken) internode is preserved, which differentiates domesticated barley from wild. At the top of the internode a central scar left by the detached fertile spikelet can be seen, on both sides of which are fragments of stalks of the sterile lateral spikelets (Pl. 1, fig. 6). Many of the internodes are so poorly preserved that it is not possible to decide whether they belong to two- or six-rowed barley. They are recorded as *Hordeum distichon/vulgare* in the tables but they probably represent the two-rowed barley.

Hulled wheat species einkorn *Triticum monococcum* L. and emmer *T. dicoccon* Schrank. are represented by a few typical grains, glume bases and spikelet forks, but most of the hulled wheat remains are not determined to species level.

The distinction between the tetraploid and hexaploid species (see e.g. van Zeist 2003) has been much discussed. Macaroni wheat *Triticum durum* is the possible tetraploid (if the presumed *T. parvicoccum* Kislev is ignored, Kislev 1979/1980) and bread wheat *T. aestivum* the hexaploid. In PA and MB samples from Tell Arbid the naked wheats are represented by grains and ear rachis fragments. In most cases the grains can be easily distinguished from hulled wheat grains by the smoothly rounded dorsal side, rounded furrow edges, and greater angle between the embryo and the ventral plane, but separation of tetraploid from hexaploid naked wheat grains is not possible. For this reason all grains of naked wheat are described here as *Triticum durum/aestivum* (Pl. 1, fig. 3). It was possible to differentiate these two species on the basis of ear rachis internodes. In Tell Arbid, several rachis fragments composed of two internodes were found in addition to the many fragments of upper internode ends and the few complete single internodes (Pl. 1, fig. 4). Most of the internodes are flat (narrow-oval in cross section), which means that they come from the central portion of ears. A few are thick, almost round in cross section, probably internodes from the basal ear parts. The remnants of hairs are preserved in several specimens. Almost all internodes show features considered typical for *T. durum* (Jacomet & Collaborators 2006): very characteristic swellings are present in the upper part of the internode, just below the glumes; the internodes are broadest in the upper part; and a few preserved glume bases attached to the internodes are keeled and have a smooth appearance, without the folds occurring in *T. aestivum*. On the basis of these criteria it seems most likely that the naked wheat from Tell Arbid belongs to *T. durum* Desf., but this identification may not be fully reliable because there were specimens having intermediate characters. This question was discussed in greater detail by van Zeist and co-authors in connection with their studies of the Syrian sites Tell Al-Raqa'i (van Zeist 1999/2000, 2003) and Tell Hammam et-Turkman (van Zeist et al. 2003). The first author of the present paper encountered similar difficulties with modern material. The presence of naked wheat in Tell Arbid is thus quite certain, but the specific identification less so. On ecological grounds the occurrence of macaroni wheat *T. durum* is much more likely. For a few specimens it is not possible to rule out their affiliation to *T. aestivum*; they are recorded in the tables as *Triticum durum/aestivum*.

Some complete and broken grains and ear rachis fragments could be classified only as *Triticum* sp., hulled or naked, or as undetermined cereals Cerealia indet., which could include wheat and barley. Numerous culm fragments of grasses present in PA and MB probably belong to cereals (Cerealia/Poaceae in Tabs 2 and 7). Those with nodes come from higher culm sections; others with fragments of rootlets attached represent basal culm parts. The diameter of culm pieces is of the size of cereals, but the occurrence of other large grasses cannot be excluded.

Edible plants from the Fabaceae family are represented by a few seeds of lentil *Lens culinaris* Medik. and bitter vetch *Vicia ervilia* (L.) Willd. Lentil seeds are preserved without the seed coat. The diameter of four specimens is 4.2 mm, 4.3 mm, 3.4 mm, and 3.6 mm, indicating that they belong to the small-seeded variety (*microsperma* group). Seeds of bitter vetch are pyramid-shaped and the testa is not preserved; the more or less complete specimens measure 4.2 × 3.8 mm, 3.2 × 2.8 mm, 3.0 × 3.2 mm, 3.0 × 2.7 mm, 3.3 × 3.0 mm, and 3.3 × 3.3 mm.

Wild plants

Grasses and legumes are the two most abundant groups of wild plants recovered from Tell Arbid. Among the grasses, six species and two genera are determined to different degrees of accuracy. *Aegilops* cf. *crassa* Boiss. is identified on the basis of 3 complete spikelets, 41 spikelet bases, 16 glume fragments, 7 fragments of ear rachis, and 82 complete and 19 fragmentary caryopses. The spikelets have a barrel-like shape, are broader in the lower part and narrowed toward the top, are almost circular in cross section (Pl. 2, fig. 4), and are three-grained. Spikelet shape, particularly the arrangement of glumes and rachis internodes and the shape of the spikelet detachment scar, are the same as in modern *Ae. crassa*. Somewhat similar spikelets are seen in *Ae. ovata*,

Ae. variabilis and *Ae. triuncinalis*, while those of *Ae. speltoides* are distinctly different. The caryopses are large and dorso-ventrally flattened, exactly like the grains of extant *Ae. crassa*. The identification is considered not quite certain because only 6 of the 17 *Aegilops* species occurring in Syria and Lebanon were available for comparison. *Ae. crassa* grows in fertile dry zones (Mouterde 1966). Five caryopses slightly narrower than those of *Ae. crassa* were described as *Ae. ovata* type, and a still narrower five as *Ae. speltoides* type.

Six grain fragments are identified as brome grass *Bromus* type. They are very thin, the ventral side is concave, and the dorsal one slightly convex, with a delicate edge in the centre and two lines at its two sides (Nesbitt 2006). The tips of the grains are rounded. In some features they resemble *B. tectorum* grains, but the broader tips are more like *B. danthoniae* (comparison based on drawings in Nesbitt 2006: fig. 78: 7; van Zeist & Bakker-Heeres 1985: figs. 6: 4,5). The best-preserved specimen is 5.1 mm long, which suggests that it belongs to the grass group with smaller caryopses (below 9.5 mm on average) according to Nesbitt (2006). The dorsal edge distinguishes these grains from the similar grains of *Brachypodium*. *Echinaria capitata* (L.) Desf. is represented by one caryopsis of a very characteristic shape: short and broad, almost circular in cross section. At present this is the only species of *Echinaria* that grows in Syria and Lebanon, on pastures and other dry lands (Mouterde 1966). A few grains and rather numerous fragments of ear rachis internodes are described as wild barley *Hordeum* cf. *spontaneum* C. Koch. The grains are very flat and distinctly smaller than those of cultivated barley (Pl. 1, fig. 1) and the internodes have a smooth scar after the detachment of the neighbouring internode (Pl. 1, fig. 5). *Lolium temulentum* L. is represented by two grains of typical shape and size (4.8 and 4.1 mm long) found in one sample. This species grows today in cultivation and on ruderal sites (Mouterde 1966). One complete and 4 caryopsis fragments, narrow and almost circular in cross section, are described as *Stipa* type.

A great number of grass grains (902 complete and 80 broken specimens classified as Poaceae indet.) could not be identified even to genus level. The predominant group is formed of small grains (<3 mm long) but the variation of their shape and size indicates that they belong to several species (Pl. 1, figs 7, 8). Most of the grains were recovered from one sample from PA (sample 8, 595 specimens). They all are small, narrow, and cylindrical, many of them resembling grains found by Wetterstrom (2003, fig. 1) at the Tell Leilan site, NE Syria, from the Niniva 5 period. In addition to grains, a few fragments of relatively narrow culms, probably from wild grasses, were found in one sample from MB (sample 14).

The highest number of seeds typical for the family Fabaceae belongs to small-seeded species that are difficult to identify and require good reference material (Butler 1996) which was not available. In this group only one species, *Coronilla* cf. *scorpioides* (L.) Koch., could be determined, though with some degree of uncertainty (Pl. 2, fig. 1). Other seeds were only classified as types: *Scorpiurus*, *Astragalus*, *Trigonella*, *Astragalus/Trigonella* (Pl. 2, fig. 2), *Medicago/Onobrychis*, and *Trigonella astroites*. The group described as Trifolieae tribe may include species from the genera *Medicago*, *Melilotus*, *Trifolium*, and *Trigonella*. Among the Fabaceae having larger seeds, *Prosopis farcta* (Banks & Sol.) Macbride is positively identified (Pl. 2, fig. 5, 6). Its large flattened seeds, obovate in outline, with a characteristic horseshoe-like pattern on the flat faces, were found in two samples from MB. The dimensions of three almost complete seeds are 4.8 × 3.6 mm, >5.1 × 4.1 mm, and >6.0 × 4.5 mm. This is the only species of this genus that grows in Syria nowadays.

Five fruitlets from the family Boraginaceae were identified as *Arnebia* cf. *decumbens* (Vent.) Coss. & Kralik. They have the attachment scar surrounded by a collar-like thickening and very much resemble specimens of *Arnebia decumbens* illustrated by van Zeist and Bakker-Heeres (1982: fig. 22: 1,2). Three specimens are blackish, while two are yellowish. Fruitlets of this family recovered from archaeological sites often show this type of preservation, because due to the high content of silica their fruit coat turns whitish or grey-yellowish under the action of high temperature (van Zeist & Waterbolk-van Rooijen 1985, Wasylikowa 1997). Relatively numerous were seeds of *Silene* type (Pl. 2, fig. 3).

All samples contained a certain number of seeds or fruits that were not determined. There also were fragments of charred wood, most often from small twigs, fragments of the other

Table 2. List of plants from the Post-Akkadian period. Number of specimens is given, frs fragments. For chronology see Tab. 1

Plant taxa	Level	VI	Vb				Va					IV	Total
	Archaeological context	houses ? pit	pisé walls	Main Building, phase 1 ashes in a pit around oven			Main Building, phase 2 fill of room	ash on floor	compact clay of usage level		grey ashes	pit brown earth	
	Sample number	9	40	1	5	12	6	8	10	19	23	25	
	Retrieved by	flot	hand	flot	flot	flot	flot	flot	flot	sieve	sieve	sieve	
	Volume litre	6	–	8	3	10	7	8	6	–	–	–	
CEREALS													
Hordeum distichon	grains	7	35	6	5	13	36	93	3	11	5	1	215
	grain frs	9	53	3	6	13	119	179	8	2	1	1	394
	ear rachis frs	2	–	–	–	17	13	21	–	–	–	–	53
Hordeum distichon / vulgare	ear rachis frs	4	2	3	3	43	8	60	2	–	–	–	125
H. distichon / vulgare / spontaneum	ear rachis frs	–	–	2	–	–	4	–	–	–	–	–	6
Triticum dicoccon	grains	–	–	–	1	3	–	2	–	–	–	–	6
	grain frs	–	–	–	–	–	–	–	–	2	–	–	2
	spikelet forks	–	–	–	–	1	–	–	–	–	–	–	1
Triticum dicoccon ?	grains	–	–	1	–	–	–	–	3	–	–	–	4
Triticum dicoccon / monococcum	grains	–	–	1	–	–	–	5	–	–	–	–	6
	glume bases	4	–	9	–	22	4	41	9	–	–	–	89
	spikelet forks	–	–	–	3	3	–	6	–	–	–	–	12
Triticum durum	ear rachis frs	–	–	–	–	5	1	–	–	–	–	–	6
Triticum durum / aestivum	grains	–	–	–	4	3	–	9	–	–	1	1	18
	grain frs	–	–	–	–	–	2	–	–	–	–	–	2
	ear rachis frs	–	–	–	2	–	–	1	–	–	–	–	3
Triticum monococcum	grains	–	–	–	–	–	–	4	–	–	–	–	4
	grain frs	–	–	–	–	–	–	1	–	–	–	–	1
	glume bases	–	–	6	2	–	–	–	–	–	–	–	8
	spikelet forks	–	–	2	–	–	–	–	–	–	–	–	2
Triticum sp.	grains	2	–	–	–	–	–	6	–	–	–	–	8
	grain frs	1	1	–	–	–	–	22	–	2	–	–	26
	spikelet bases	–	2	–	–	–	–	–	–	–	–	–	2
Cerealia	grains	–	–	1	–	13	–	–	–	–	–	–	14
	grain frs	24	52	11	31	100	100	50	50	13	7	1	439
	ear rachis frs	–	–	–	–	9	2	10	–	–	–	–	21
	culm frs	14	8	9	4	10	18	18	–	–	–	–	81
	culm bases	4	2	–	1	–	1	3	–	–	–	–	11
LEGUMES													
Lens culinaris	seeds	–	–	–	–	–	–	1	–	–	–	–	1
Vicia ervilia	seeds	–	–	–	–	–	–	2	–	–	–	–	2
WILD PLANTS													
Aegilops cf. *crassa*	grains	1	43	–	1	12	1	6	–	–	–	–	64
	grain frs	–	18	–	–	1	–	–	–	–	–	–	19
	ear rachis frs	–	7	–	–	–	–	–	–	–	–	–	7
	glume bases	–	29	1	–	4	2	1	–	2	–	–	39
	spikelet bases	3	19	2	–	4	1	4	–	1	–	–	34
	spikelets	–	3	–	–	–	–	–	–	–	–	–	3
Aegilops speltoides type	grain frs	–	–	–	–	–	–	1	–	–	–	–	1
Apiaceae	fruits	–	–	–	–	2	–	–	–	–	–	–	2
Arnebia cf. *decumbens*	fruits	–	–	–	–	–	3	–	1	–	–	–	4

Table 2. Continued

Plant taxa	Level	VI	Vb				Va					IV	Total
	Archaeological context	houses ? pit	pisé walls	Main Building, phase 1			Main Building, phase 2					pit brown earth	
				ashes in a pit around oven			fill of room	ash on floor	compact clay of usage level		grey ashes		
	Sample number	9	40	1	5	12	6	8	10	19	23	25	
	Retrieved by	flot	hand	flot	flot	flot	flot	flot	flot	sieve	sieve	sieve	
	Volume litre	6	–	8	3	10	7	8	6	–	–	–	
Asteraceae	fruits	1	–	–	–	1	–	8	–	–	–	–	10
Astragalus type	seeds	–	–	–	–	–	–	13	–	–	–	–	13
Astragalus/ *Trigonella* type	seeds	9	–	3	–	15	–	445	36	–	–	–	508
Boerhavia sp.	seeds	–	–	–	–	–	–	1	–	–	–	–	1
Bromus type	grain frs	–	–	–	–	1	–	1	–	–	–	–	2
Capparis sp.	seeds	–	–	–	–	–	–	1	–	–	–	–	1
Coronilla cf. *scorpioides*	seeds	6	–	6	9	9	12	191	33	–	–	–	266
	seed frs	4	–	10	3	16	18	450	88	–	–	–	589
Cyperaceae	fruits	–	–	–	–	–	1	–	–	–	–	–	1
Fabaceae	seeds	–	–	–	–	–	–	2	–	–	–	–	2
Galium sp.	fruits	–	–	–	–	1	–	6	–	–	–	–	7
Gypsophila type	seeds	–	–	–	–	–	1	2	–	–	–	–	3
Heliotropium type	fruits	–	–	–	–	–	–	1	–	–	–	–	1
Hordeum cf. *spontaneum*	grains	–	1	–	–	1	–	5	–	–	–	–	7
	grain frs	–	2	–	–	2	–	–	–	–	–	–	4
	ear rachis frs	–	–	1	–	6	10	5	–	–	–	–	22
Lolium temulentum	grains	–	–	–	–	–	–	2	–	–	–	–	2
Malvaceae	fruits	–	–	1	–	–	–	–	–	–	–	–	1
Medicago/ *Onobrychis* type	seeds	3	–	–	–	2	–	5	–	–	–	–	10
Papaver sp.	seeds		–	–	–	1	–	2	–	–	–	–	3
Poaceae wild	grains	16	8	4	3	75	20	648	46	–	–	–	820
	grain frs	–	–	–	–	25	4	16	2	–	–	–	47
Rubiaceae	fruits	–	–	–	–	–	–	1	–	–	–	–	1
Rumex sp.	fruits	–	–	–	–	–	–	1	–	–	–	–	1
Silene type	seeds	–	–	2	–	–	1	7	1	–	–	–	11
Stipa type	grains	–	–	–	–	–	–	1	–	–	–	–	1
	grain frs	–	–	–	–	–	–	4	–	–	–	–	4
Torilis nodosa type	fruits	–	–	1		–	–	1	–	–	–	–	2
Trifolieae	seeds	–	–	–	1	–	–	–	–	–	–	–	1
Trigonella astroites type	seeds	–	–	–	–	–	–	5	–	–	–	–	5
Trigonella type	seeds	–	–	–	3	–	9	–	–	–	–	–	12
Verbascum sp.	seeds	–	–	–	–	1	–	–	–	–	–	–	1
TOTAL SPECIMENS		114	285	85	82	434	391	2370	282	33	14	4	4094
Indeterminate	fruits/seeds	+	–	+	+	+	+	+	–	–	–	–	–
	wood charcoal	+++	–	+	+++	+	+	+	–	+	+	–	–
	charred tissue frs	+	+	+	+	+	+	+	–	–	–	–	–
	food/dung lumps	–	–	–	–	–	–	+	–	–	–	–	–

plant tissues with cell structure recognisable, and clusters of charred material composed of small lumps of undefined shape stuck together. They may represent remnants of food or dung. Sheep or goat droppings were preserved in two samples from MB.

GENERAL CHARACTERISTICS OF PLANT ASSEMBLAGES FROM THE POST-AKKADIAN AND MIDDLE BRONZE AGE OCCUPATION PERIODS

The Post-Akkadian Period (Levels VIII to IV)

The cultivated and wild plants found in the PA features are listed in Table 2. Cereals are represented by four species: two-rowed barley *Hordeum distichon*, emmer wheat *Triticum dicoccon*, einkorn wheat *T. monococcum*, and macaroni wheat *T. durum*. The presence of *H. vulgare* and *T. aestivum* cannot be excluded. In order to compare the set of cereals in different samples, for each species the number of complete grains, their fragments divided by 2, and all ear fragments are added up (Tab. 3). For barley the sum includes the remains identified as *Hordeum distichon*, *H. distichon / vulgare*, and *H. distichon / vulgare / spontaneum*. The sum of naked wheats includes the remains of *Triticum durum*, *T. durum*?, and *T. durum / aestivum*. Remains described as *Triticum dicoccon*, *T. dicoccon*?, *T. monococcum*, and *T. dicoccon / monococcum* are included in hulled wheats. Percentages are calculated from the number of all cereal remains in individual samples and from the total sum in all samples. Samples 23 and 25, containing a very small number of cereal remains, are not considered.

All PA samples treated together show the predominance of barley (58% of all cereal remains) over wheats but the proportions differ between samples (Tab. 3). Samples 6, 19, and 40, taken from different levels and archaeological contexts, show the most distinct domination of barley over wheats. Hulled wheats exceed barley in samples 1 and 10, and are relatively abundant in samples 8, 12, 5, and 9. Naked wheats are absent from four samples (1, 10, 19, 40), infrequent in four others (9, 12, 6, 8), and most abundant in sample 5; hulled and naked wheats together outnumber barley remains only in sample 5. Apparently there are no correlations between the set of cereal species and the type of archaeological features or their chronology, which might suggest that no substantial change in the structure of cereal cultivation occurred during the time of PA settlement. More samples should be examined to verify this suggestion. The evidence of other cultivated plants is very poor and includes only one seed of lentil *Lens culinaris* and 2 seeds of bitter vetch *Vicia ervilia*, both found in sample 8.

Wild plants are represented by over 2245 diaspores belonging to at least 30 taxa, among which legumes (Fabaceae) and grasses (Poaceae) are the most numerous. The seeds of the Fabaceae family (1102 specimens) were recovered only in samples processed by flotation. They belong to at least eight species (Tab. 4). Seeds of *Coronilla* cf. *scorpioides* and *Astragalus / Trigonella* type appear in the greatest abundance and frequency, particularly in sample 8. Other types of legumes are less common. Among the grasses (1093 caryopses from at least seven species), three species and two genera were identified: *Aegilops* cf. *crassa*, *Hordeum* cf. *spontaneum*, *Lolium temulentum*, *Bromus* type, and *Stipa* type. The most numerous small grass caryopses are specified only as small-grained Poaceae (Tab. 5). Grasses occur almost exclusively in the samples processed by flotation and in sample 40 collected by hand. In addition to legumes and grasses, 50 diaspores of other plants were found, including fruits of *Arnebia* cf. *decumbens* and *Torilis nodosa* type

Table 3. The occurrence of cereals in samples from the Post-Akkadian period, as percentages of the total of cereal remains in each sample

Level	VI	Vb	Vb			Va	Va	Va		Total
Sample number	9	40	1	5	12	6	8	10	19	
Two-rowed barley	46.2	65.2	33.3	28.2	42.0	67.6	71.3	19.6	60	57.9
Naked wheats	2.6	–	–	15.4	4.3	1.1	2.8	–	–	2.7
Hulled wheats	10.3	2.2	48.7	15.4	15.4	2.2	16.3	26.1	5	13.6
Wheat indet.	10.3	3.4	–	–	–	–	–	–	–	0.7
Cereals indet.	30.8	29.2	17.9	41.0	38.3	29.1	9.6	54.3	35	25.1
Total specimens	39	89	39	39	188	179	363	46	20	1002

Table 4. The occurrence of wild legumes in the Post-Akkadian period. Number of specimens is given

Level	VI	Vb			Va	Va	Va	Total
Sample number	9	1	5	12	6	8	10	
Astragalus type	–	–	–	–	–	13	–	13
Astragalus/*Trigonella* type	9	3	–	15	–	445	36	508
Coronilla cf. *scorpioides*	8	11	11	17	11	416	77	551
Fabaceae	–	–	–	–	–	2	–	2
Medicago/*Onobrychis* type	3	–	–	2	–	5	–	10
Trifolieae	–	–	1	–	–	–	–	1
Trigonella astroites type	–	–	–	–	–	5	–	5
Trigonella type	–	–	3	–	9	–	–	12
Total specimens	20	14	15	34	20	886	113	1102
Minimum number of taxa	4	2	3	3	2	6	2	8

and seeds or fruits from the genera *Galium*, *Papaver*, *Rumex*, and *Verbascum*, as well as those resembling *Gypsophila*, *Heliotropium*, and *Silene* (Tab. 6).

The Middle Bronze Age (Levels III to I)

All plants found in samples from the MB levels are listed in Table 7. Cereals are represented by the same species as in PA: two-rowed barley *Hordeum distichon*, two species of hulled wheats, emmer *Triticum dicoccon* and einkorn *T. monococcum*, and free-threshing macaroni wheat *T. durum*. The occurrence of *Hordeum vulgare* and *Triticum aestivum* is uncertain. The proportions between cereal species differ from those in the PA samples (Tab. 8; percentages calculated as for PA, samples 18, 22, 28, and 42 omitted). As in PA, barley dominates the MB material taken together (57% of all cereal remains), but unlike PA the second position is taken by naked wheat (17%) and there are fewer hulled wheats (6%). Individual samples differ in the proportion between barley and wheat but there is no correlation between those proportions and the chronology of samples. On the other hand, there seems to be a temporal trend in the proportion of hulled and naked wheats. In eight samples from Level III the percentages of hulled wheats vary from 8.7 to 31.4% and in five samples from Levels IIc and IIa-b from 0.8 to 6%; the corresponding percentages for naked wheat are 2.2 to 14.3% and 2.5 to 39.1%. Thus it seems that while barley was the main crop throughout the MB period, the role of naked wheat (probably *Triticum durum*) increased with time while that of hulled wheats decreased somewhat. As in PA, other cultivated plants are

Table 5. The occurrence of wild grasses in the Post-Akkadian period. Explanations as in Tab. 4

Level	Kind of remains	VI	Vb	Vb			Va	Va	Va		Total
Sample number		9	40	1	5	12	6	8	10	19	
Aegilops cf. *crassa*	grains	1	43	–	1	12	1	6	–	–	64
	grain frs	–	18	–	–	1	–	–	–	–	19
	spike rachis frs	–	7	–	–	–	–	–	–	–	7
	glume bases	–	29	1	–	4	2	1	–	2	39
	spikelet bases	3	19	2	–	4	1	4	–	1	34
	spikelets	–	3	–	–	–	–	–	–	–	3
	grain frs	–	–	–	–	–	–	1	–	–	1
Bromus type	grain frs	–	–	–	–	1	–	1	–	–	2
Hordeum cf. *spontaneum*	grains	–	1	–	–	1	–	5	–	–	7
	grain frs	–	2	–	–	2	–	–	–	–	4
	spike rachis frs	–	–	1	–	6	10	5	–	–	22
Lolium temulentum	grains	–	–	–	–	–	–	2	–	–	2
Poaceae small-grained	grains	18	8	4	3	75	20	648	46	–	822
	grain frs	–	–	–	–	25	4	16	2	–	47
Stipa type	grains	–	–	–	–	–	–	1	–	–	1
	grain frs	–	–	–	–	–	–	4	–	–	4
Total specimens		22	130	8	4	131	38	694	48	3	1078
Minimum number of taxa		2	3	3	2	4	3	7	1	1	6

Table 6. The occurrence of wild plants other than grasses and legumes in the Post-Akkadian period. Explanations as in Tab. 4

Level	VI			Va	Va	Va	Total
Sample number	9	1	12	6	8	10	
Apiaceae	–	–	2	–	–	–	2
Arnebia cf. *decumbens*	–	–	–	3	–	1	4
Asteraceae	1	–	1	–	8	–	10
Caryophyllaceae	1	–	–	–	–	–	1
Galium sp.	–	–	1	–	6	–	7
Gypsophila type	–	–	–	1	2	–	3
Heliotropium type	–	–	–	–	1	–	1
Malvaceae	–	1	–	–	–	–	1
Ornithogalum type	2	–	–	–	–	–	2
Papaver sp.	–	–	1	–	2	–	3
Rubiaceae	–	–	–	–	1	–	1
Rumex sp.	–	–	–	–	1	–	1
Silene type	–	2	–	1	7	1	11
Torilis nodosa type	–	1	–	–	1	–	2
Verbascum sp.	–	–	1	–	–	–	1
Total specimens	4	4	6	5	29	2	50
Minimum number of taxa	3	3	5	3	9	2	15

represented by only a few seeds of lentil *Lens culinaris* and bitter vetch *Vicia ervilia*.

The wild plants found in samples from MB belong to 36 taxa represented by 488 diaspores. Grass grains are the most numerous group (294 specimens) but they occur abundantly in only one sample from Level IIa-b (sample 14, Tab. 9). Five species and one genus were identified to various degrees of accuracy: *Aegilops* cf. *crassa*, *Echinaria* cf. *capitata*, *Hordeum* cf. *spontaneum*, *Aegilops ovata* type, *Ae. speltoides* type, and *Bromus* type. A large number of small grass grains remained undetermined. A few spike rachis fragments and culm pieces of small diameter, some preserved with rootlets, probably also belong to wild grasses (Poaceae indet.). Seeds of the Fabaceae family are less abundant than in PA; numbering 84 in total, they are scattered in different samples. Two species were identified (*Prosopis farcta*, *Coronilla* cf. *scorpioides*), one species and four genera were indicated only as types (*Trigonella astroites* type, *Scorpiurus* type, *Astragalus/Trigonella* type, *Medicago/Onobrychis* type), and a few were determined to higher taxonomic units – Fabaceae, Trifolieae (Tab. 10). The other plants, represented by 109 diaspores (Tab. 11), include two species (*Arnebia* cf. *decumbens*, *Vaccaria pyramidata* type) and five genera (*Capparis* sp., *Galium* sp., *Hyoscyamus* sp., *Scrophularia* sp., *Verbascum* sp.). Six taxa are described only as morphological types: *Ajuga* type, *Ajuga/Teucrium* type, *Heliotropium* type, *Hypericum* type, *Silene* type, and *Teucrium* type. Three taxa were determined to the families Apiaceae, Asteraceae, and Brassicaceae.

DENSITY OF PLANT REMAINS

Archaeobotanical studies use various ratios to compare samples of unequal size. One of these is density (or concentration) of remains, expressed as the number, volume or weight of items per constant sediment volume or weight. The significance of density is not quite clear. In the case of charred remains when there are no indications of destructive fires, density is usually considered a measure of the character and intensity of activities involving the use of plants in combination with the use of fire. For example, lower or higher densities in samples from different hearths may indicate that some of the hearths were often cleaned while the others were not. If dung was used as fuel, density variations may reflect seasonal differences in the composition of animal food. Miller (1988) quotes an example of higher density recorded in "winter" and lower in "summer" samples. In Tell Arbid, density expressed as the number of items per litre was calculated for 7 samples from PA and 5 from MB (Fig. 5) for which the initial deposit volume was recorded. Density varies from 10.6 to 296.3 specimens/litre (mean 78.3) in samples from PA, and from 11.4 to 49.6 specimens/litre (mean 25.9) in samples from MB. If sample 8 showing unusually high

Table 7. List of plants from the Middle Bronze Age. Explanations as in Tab. 2

Plant taxa	Level	III									II c			II a-b						Total
	Archaeological context	ashy fill in pit 14						pit ash	pottery kiln lens of ash		ash	ash	ash	grave pit	struc. bricks	grave fill	grave fill	grave bricks	grave vessel	
	Sample number	2	3	20	22	24	39	7	11	13	4	21	26	14	18	27	28	29	42	
	Retrieved by	flot	flot	sieve	sieve	sieve	hand	flot	flot	flot	flot	sieve	sieve	flot	sieve	sieve	sieve	sieve	hand	
	Volume litre	8	7	–	–	–	–	6	–	5	7	–	–	–	–	–	–	–	–	
CEREALS																				
Hordeum distichon	grains	5	10	11	5	13	4	3	5	1	57	20	20	384	5	67	1	43	–	594
	grain frs	5	18	9	–	8	5	3	6	–	16	6	6	388	6	3	–	78	–	557
	ear rachis frs	11	28	–	–	–	1	–	–	6	10	–	–	95	–	–	–	–	1	152
Hordeum distichon/ vulgare	ear rachis frs	1	–	–	–	–	6	3	2	6	–	–	–	–	–	–	–	–	–	18
Triticum dicoccon	grains	–	–	1	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	4
	grain frs	–	–	2	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	3
Triticum dicoccon ?	grains	–	–	–	–	–	–	–	–	–	–	–	–	15	–	1	–	–	1	17
	grain frs	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
	glume bases	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	3
	spikelet forks	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2
Triticum dicoccon/ monococcum	grains	–	2	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	4
	glume bases	6	26	–	–	–	–	–	–	4	5	–	–	6	–	–	–	–	–	47
	spikelet forks	–	–	–	–	–	–	–	3	–	1	–	–	3	–	–	–	–	–	7
Triticum durum	ear rachis frs	–	6	–	–	–	3	–	–	–	–	–	–	130	–	–	–	–	–	139
Triticum durum/ aestivum	grains	1	7	1	1	–	–	–	3	3	9	12	21	87	3	9	1	3	–	161
	grain frs	–	5	–	–	–	–	–	–	–	–	–	1	15	–	–	–	–	–	21
	ear rachis frs	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1
Triticum monococcum	grains	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1
	glume bases	3	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6
	spikelet forks	1	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8
Triticum sp.	grains	–	–	–	–	–	–	–	–	–	–	–	–	13	–	–	–	–	–	13
	grain frs	–	–	–	–	–	–	–	3	–	–	–	–	4	–	–	–	–	–	7
	ear rachis frs	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1
Cerealia	grains	–	–	–	–	–	–	–	–	–	–	–	35	–	–	–	–	–	–	35
	grain frs	30	43	9	8	8	5	38	23	50	165	29	–	100	4	10	4	67	–	593
	ear rachis frs	–	–	–	–	–	–	–	–	–	–	–	–	5	–	–	–	–	–	5
Cerealia/Poaceae	culm frs	7	16	2	–	–	7	1	–	–	19	–	–	370	–	–	–	–	14	436
	culm bases	1	4	–	–	–	–	–	–	–	7	2	–	78	–	–	–	–	1	93
	straw imprints	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	

Table 7. Continued

Plant taxa	Level	III									II c			II a-b						Total
	Archaeological context	ashy fill in pit 14						pit ash	pottery kiln lens of ash		ash	ash	ash	grave pit	struc. bricks	grave fill	grave fill	grave bricks	grave vessel	
	Sample number	2	3	20	22	24	39	7	11	13	4	21	26	14	18	27	28	29	42	
	Retrieved by	flot	flot	sieve	sieve	sieve	hand	flot	flot	flot	flot	sieve	sieve	flot	sieve	sieve	sieve	sieve	hand	
	Volume litre	8	7	–	–	–	–	6	–	5	7	–	–	–	–	–	–	–	–	
LEGUMES																				
Lens culinaris	seeds	–	2	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	3
	seed frs	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	2
Vicia ervilia	seeds	–	–	–	–	–	–	–	–	–	1	–	–	4	–	–	–	–	–	5
	seed frs	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	2
Vicia ervilia ?	seed frs	–	–	–	–	–	–	–	–	–	–	–	–	4	–	–	–	–	–	4
WILD PLANTS																				
Aegilops cf. *crassa*	grains	3	–	5	–	–	–	–	1	3	2	–	1	3	–	–	–	–	–	18
	glume bases	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1
	glume frs	–	–	–	–	–	–	–	–	–	–	–	–	16	–	–	–	–	–	16
	spikelet bases	–	–	–	–	–	–	–	1	–	–	–	–	6	–	–	–	–	–	7
Aegilops ovata type	grains	–	–	–	–	–	–	–	–	–	–	–	–	5	–	–	–	–	–	5
Aegilops speltoides type	grains	–	–	–	–	–	–	–	–	–	–	–	–	4	–	–	–	–	–	4
Ajuga type	fruits	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Ajuga/Teucrium type	fruits	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
Apiaceae	fruits	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Arnebia cf. *decumbens*	fruits	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1
Asteraceae	fruits	–	–	–	–	–	–	–	–	1	–	–	–	3	–	–	–	–	–	4
Astragalus type	seeds	3	2	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	6
Astragalus/Trigonella type	seeds	–	–	–	–	–	–	–	–	5	–	–	–	–	–	–	–	–	–	5
Avena sp.	grains	–	–	–	–	–	–	–	–	–	–		–	7	–	–	–	–	–	7
Avena sp. ?	grains	–	–	1	–	–	–	–	–	–	–	2	2	–	–	1	–	–	–	6
	grain frs	–	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
Brassicaceae	fruits	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
Bromus type	grain frs	–	1	–	–	–	–	–	2	–	–	–	–	1	–	–	–	–	–	4
Capparis sp.	seeds	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
Coronilla cf. *scorpioides*	seeds	2	4	–	–	–	–	3	1	7	5	–	–	1	–	–	–	–	–	23
	seed frs	2	3	–	–	–	–	11	–	22	7	–	–	–	–	–	–	–	–	45
Echinaria cf. *capitata*	grains	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1
Fabaceae	seeds	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	3
	seed frs	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1

Galium sp.	fruits	–	1	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	2
Heliotropium type	fruits	–	–	–	–	–	–	–	–	–	3	–	–	1	–	–	–	–	–	4
Hordeum cf. *spontaneum*	grains	1	–	–	–	–	–	–	–	–	5	–	–	17	–	–	–	–	–	23
	grain frs	–	–	–	–	–	–	–	–	–	1	–	–	11	–	–	–	–	–	12
	ear rachis frs	–	2	–	–	–	–	–	–	1	1	–	–	36	–	–	–	–	–	40
Hyoscyamus sp.	seeds	–	–	–	–	–	–	–	–	–	–	–	–	4	–	–	–	–	–	4
Hypericum type	seeds	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	2
Poaceae wild	grains	–	12	–	–	–	–	–	1	25	3	–	–	41	–	–	–	–	–	82
	grain frs	–	–	–	–	–	1	–	–	3	6	–	–	23	–	–	–	–	–	33
	ear rachis frs	4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
	culm frs	–	–	–	–	–	–	–	–	–	–	–	–	20	–	–	–	–	–	20
	culm bases	–	–	–	–	–	–	–	–	–	–	–	–	8	–	–	–	–	–	8
Prosopis farcta	seeds	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	3
	testa frs	–	–	–	–	–	–	–	–	–	–	–	–	3	–	2	–	–	–	5
Scrophularia sp.	fruits	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
Scorpiurus type	seeds	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	2
Silene type	seeds	1	2	–	–	–	1	–	–	–	12	–	–	66	–	–	–	–	–	82
Teucrium type	fruits	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	2
Trifolieae	seeds	1	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	2
Trigonella astroites type	seeds	2	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	3
Trigonella type	seeds	–	–	–	–	–	–	1	1	–	3	–	–	–	–	–	–	–	–	5
Vaccaria pyramidata type	seeds	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1
Verbascum sp.	seeds	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1
TOTAL SPECIMENS		91	205	40	14	29	34	75	52	138	347	69	89	1986	18	32	6	192	17	3434
Indeterminate	fruits/seeds	4	3	–	+	–	–	+	+	+	+	+	–	+	–	+	–	–	–	
	wood charcoal	+	+	–	+	+	+	+	+	+	–	–	+	++	–	+	+	+	–	
	charred tissue frs	+	+	–	–	+	+	+	+	–	+	–		+	–	+	+	–	+	
	food/dung lumps	+	+	–	–	+	–	+	–	–	–	–	–	+	–	+	–	–	+	
Goat/sheep coprolites	droppings	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–	–	–	–	2
	dropping frs	–	–	–	–	–	–	–	–	–	–	–	–	44	–	–	–	–	–	44

Table 8. The occurrence of cereals in samples from the Middle Bronze Age. Explanations as in Tab. 3

Level	III					III	III		II c	II c	II c	II a-b	II a-b	II a-b	Total
Sample number	2	3	20	24	39	7	11	13	4	21	26	14	27	29	
Two-rowed barley	43.5	37.2	65.2	80.9	66.7	24.2	33.3	28.9	42.9	43.8	25.3	67.6	34.8	68.3	57.2
Naked wheat	2.2	13.2	4.3	–	14.3	3.0	10.0	6.7	5.1	25.0	26.5	22.9	39.1	2.5	17.4
Hulled wheats	21.7	31.4	8.7	–	–	15.2	10.0	8.9	4.6	–	6.0	2.4	4.3	0.8	5.7
Wheat indet.	–	–	–	–	4.8	–	6.7	–	–	–	–	1.5	–	–	1.0
Cereals indet.	32.6	18.2	21.7	19.1	14.3	57.6	40.0	55.6	47.4	31.3	42.2	5.6	21.7	28.3	18.7
Total specimens	46	121	23	21	21	33	30	45	175	48	83	984	23	120	1773

Table 9. The occurrence of wild grasses in the Middle Bronze Age. Explanations as in Tab. 4

Chronology	Kind of remains	III				III	III		II c	II c	II a-b	II a-b	Total
Sample number		2	3	20	39	7	11	13	4	26	14	27	
Aegilops cf. *crassa*	grains	3	–	5	–	–	1	3	2	1	3	–	18
	glume bases	–	–	–	–	1	–	–	–	–	–	–	1
	glume frs	–	–	–	–	–	–	–	–	–	16	–	16
	spikelet bases	–	–	–	–	–	1	–	–	–	6	–	7
Aegilops ovata type	grains	–	–	–	–	–	–	–	–	–	5	–	5
Aegilops speltoides type	grains	–	–	–	–	–	–	–	–	–	4	–	4
Bromus type	grain frs	–	1	–	–	–	2	–	–	–	1	–	4
Echinaria cf. *capitata*	grains	–	–	–	–	1	–	–	–	–	–	–	1
Hordeum cf. *spontaneum*	grains	1	–	–	–	–	–	–	5	–	17	–	23
	grain frs	–	–	–	–	–	–	–	1	–	11	–	12
	spike rachis frs	–	2	–	–	–	–	1	1	–	36	–	40
Poaceae indet. small-grained	grains	–	12	–	–	–	1	25	3	–	41	–	82
	grain frs	–	–	–	1	–	–	3	6	–	23	–	33
	spike rachis frs	4	–	–	–	–	–	–	–	–	–	–	4
	culm frs	–	–	–	–	–	–	–	–	–	20	–	20
	culm bases	–	–	–	–	–	–	–	–	–	8	–	8
Total specimens		8	15	5	1	2	5	32	18	1	191	1	278
Minimum number of species		3	3	1	1	2	3	3	3	1	6	1	8

Table 10. The occurrence of wild legumes in the Middle Bronze Age. Explanations as in Tab. 4

Level	III		III	III		II c	II a-b	II a-b	Total
Sample number	2	3	7	11	13	4	14	27	
Astragalus type	3	2	–	–	–	1	–	–	6
Astragalus/*Trigonella* type	–	–	–	–	5	–	–	–	5
Coronilla cf. *scorpioides*	3	6	14	1	18	9	1	–	52
Fabaceae	–	1	–	–	–	–	3	–	4
Medicago/*Onobrychis* type	–	–	–	–	–	–	–	–	0
Prosopis farcta	–	–	–	–	–	–	5	1	6
Scorpiurus type	–	–	2	–	–	–	–	–	2
Trifolieae	1	–	1	–	–	–	–	–	2
Trigonella astroites type	2	–	–	–	–	–	1	–	3
Trigonella type	–	–	1	1	–	3	–	–	5
Total of specimens	9	9	18	2	23	13	10	1	85
Minimum number of taxa	4	3	4	2	2	3	4	1	10

density is excluded from the density calculation for PA, the density variation ranges of the two chronological units are similar, suggesting that there was no substantial difference in the intensity of the use of vegetal material between the two periods. Under this assumption, in both periods the differences between individual samples might be accidental or might reflect various human activities involving the use of plants.

Table 11. The occurrence of wild plants other than grasses and legumes in the Middle Bronze Age. Explanations as in Tab. 4

Level	III			III	III	II c	II a-b	Total
Sample number	2	3	39	7	13	4	14	
Ajuga type	–	–	–	–	–	–	1	1
Ajuga/*Teucrium* type	–	–	–	–	–	1	–	1
Apiaceae	1	–	–	–	–	–	–	1
Arnebia cf. *decumbens*	–	–	–	1	–	–	–	1
Asteraceae	–	–	–	–	1	–	3	4
Brassicaceae	–	–	–	–	–	1	–	1
Capparis sp.	–	–	–	–	–	1	–	1
Galium sp.	–	1	–	–	1	–	–	2
Heliotropium type	–	–	–	–	–	3	1	4
Hyoscyamus sp.	–	–	–	–	–	–	4	4
Hypericum type	–	–	–	–	–	–	2	2
Scrophularia sp.	–	–	–	–	–	1	–	1
Silene type	1	2	1	–	–	12	66	82
Teucrium type	–	–	–	–	–	–	2	2
Vaccaria pyramidata type	–	–	–	–	–	–	1	1
Verbascum sp.	–	–	–	–	–	1	–	1
Total specimens	2	3	1	1	2	20	80	109
Minimum number of taxa	2	2	1	1	2	7	8	18

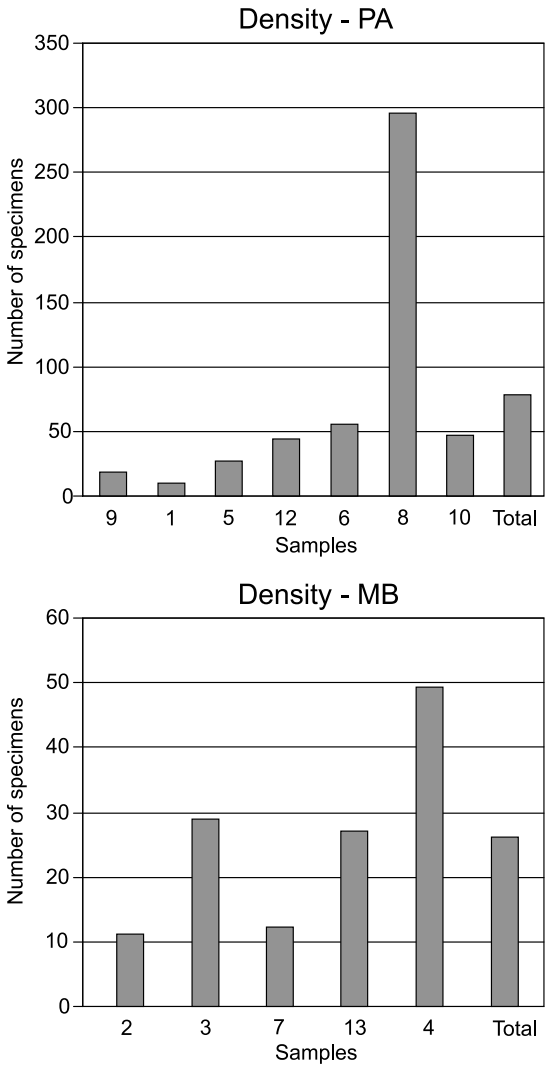


Fig. 5. Density of plant remains in individual samples and in whole material from the Post-Akkadian and Middle Bronze periods (only samples of known volume included)

The density of plant remains in Tell Arbid is more or less at the same level as in some other sites from the Near East. For example, in Tell Brak it varied from 10 to 35 specimens/litre (Colledge 2003), and in Sharafabad (Iran) from 28.72 to 30.55 specimens/litre in "winter" and 6.35 to 9.00 specimens/litre in "summer" strata (Miller 1988).

CROP CONTAMINATION

Most of the samples from Tell Arbid contain cereal grains contaminated by chaff (ear and culm fragments) and diaspores of wild plants. The degree of contamination is expressed in two ways: number of all contaminants as a percentage of the sum of grains plus contaminants, and grain-to-chaff ratio (Tabs 12, 13). Both calculations clearly show that the number of contaminants in our material depends on the sample recovery method and not on the kind of archaeological feature from which samples were recovered. Large quantities of chaff and diaspores of wild plants were found only in samples processed by flotation or collected by hand. In this category of samples, those with lower contaminant content (below 50%: PA samples 5, 6; MB samples 7, 11, 4) may represent either highly infested cereal grain stores before winnowing or fodder with intentionally added cereal grain, while those with the higher number of weeds and chaff may represent refuse from threshing and/or animal dung. The very high number of contaminants

Table 12. The degree of cereal contamination in samples from the PA levels. Percentages are calculated from the total of specimens

Level	Sample number	Recovery	Total specimens	% of contaminants	Grain to chaff ratio
VI	9	flotation	114	62.3	0.6
Vb	1	flotation	85	72.9	0.4
Vb	12	flotation	434	66.8	0.5
Vb	5	flotation	82	42.7	1.3
Vb	40	hand	285	53.7	0.9
Va	8	flotation	2367	84.5	0.2
Va	6	flotation	391	34.3	1.9
Va	10	flotation	282	77.3	0.3
Va	19	sieve	33	9.1	10
Va	23	sieve	14	–	–
IV	25	sieve	4	–	–

Table 13. The degree of cereal contamination in samples from the MB levels. Explanations as in Tab. 12

Level	Sample number	Recovery	Total specimens	% of contaminants	Grain to chaff ratio
III	2	flotation	91	54.9	0.8
III	3	flotation	203	60.1	0.7
III	20	sieve	40	20.0	4
III	24	sieve	29	–	–
III	39	hand	34	58.8	0.7
III	7	flotation	75	41.3	1.4
III	11	flotation	52	23.1	3.3
III	13	flotation	138	60.9	0.6
III	22	sieve	14	–	–
II c	21	sieve	69	5.8	16.3
II c	4	flotation	345	27.8	2.6
II c	26	sieve	89	3.4	28.7
II a-b	18	sieve	18	–	–
II a-b	14	flotation	1974	49.4	1
II a-b	27	sieve	32	9.4	9.7
II a-b	29	sieve	192	–	–
II a-b	28	sieve	6	–	–
II a-b	42	hand	17	94.1	0.1

in all samples, including the least contaminated ones, suggests that none of the samples represents a pure crop store, supporting our typology of the features examined.

THE EFFECT OF SAMPLING TECHNIQUE ON SAMPLE CONTENT

The Tell Arbid samples furnish a good illustration of the significant influence of sampling technique on sample content. Flotation recovered the greatest number of remains and the greatest number of taxa. Of the total 7530 specimens and 66 taxa, 88.3% of the specimens and 81.8% of the taxa were found in 14 samples obtained by flotation; 7.2% of the specimens and 10.6% of the taxa were recovered in 12 dry-sieved samples, and 4.5% of the specimens and 12.1% of the taxa in 3 hand-picked samples. The proportions remain the same after correcting for the unequal volume of sediment processed in different ways and calculating the number of items and taxa per sample (Fig. 6). Recovery was best by flotation and worst by dry sieving (on a coarse-mesh sieve). Hand-picking gave better results than dry sieving because the lumps of soil collected by hand in the field were later processed by flotation in the laboratory.

PLANT CONTENT OF INDIVIDUAL SAMPLES

Here we discuss the plant assemblages found in individual samples, with a view to establishing the origin of the plant material and possibly shedding more light on the functions of the archaeological features. These features are more extensively described in the "Archaeological setting" section, and the sample locations are given in Figures 2–4.

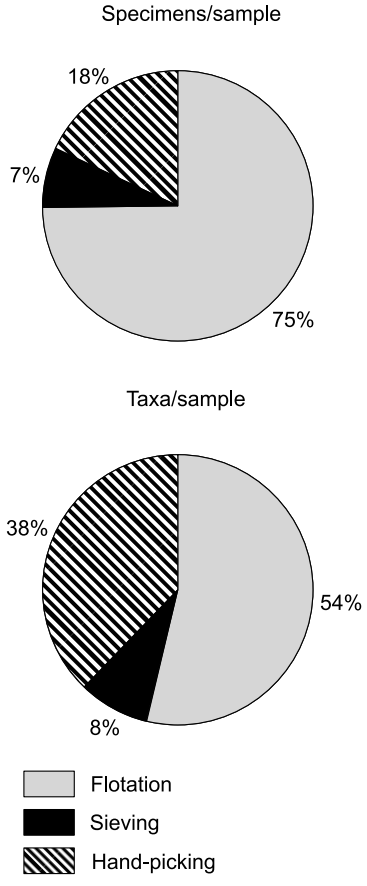


Fig. 6. Effect of sampling method on number of specimens and taxa recovered at Tell Arbid. Percentages based on totals from all samples from the Post-Akkadian and Middle Bronze periods

The Post-Akkadian Period

The earliest PA level (Level VI) is represented only by sample 9 collected from a pit which was filled with brown soil mixed with ash. The fill probably was of secondary character, though intentional filling of the pit is a possible scenario. The concentration of plant remains is low (Fig. 5). The sample contains a 2:1 mixture of barley and wheats (Tab. 3) with a high proportion of chaff and weeds (62% of all specimens). Chaff fragments outnumber grains (Tab. 12), suggesting that this is waste material.

Sample 40, collected from a pisé wall dated to the early Level Vb, is unique for its large number of grains and ear fragments of *Aegilops* cf. *crassa*, not found in any other sample (Tab. 5). The origin of charred plant remains in this sample is not clear. They could have entered the material during clay mixing, or may have been already present in the clay retrieved from an undetermined place on the archaeological site. The latter possibility is hinted at by the ^{14}C date of the grain from this sample, which is significantly earlier than other dates (see Tab. 1).

Samples 1, 5, and 12 come from pit 39, connected with an oven and situated outside a room (probably a foundry) from the older phase of the Main Building (Level Vb). Sample 12 contains more plant remains than the other two (Tab. 2). These three samples differ in cereals composition. Samples 1 and 5 are the only PA samples with wheats slightly predominating over barley (Tab. 3), sample 1 contains the highest number of hulled wheats, and sample 5 contains hulled and naked wheats in equal number. Sample 12 has more barley grains than wheats. The taxonomic composition of wild plants does not differ significantly between samples 1 and 5, where legumes prevail over grasses; the proportion is reversed in sample 12 (Tabs 4, 5). This difference suggests that despite the proximity of the sampling sites (Fig. 2) these three samples contain plant material of different origin. Samples 1 and 12, with a large number of contaminants (Tab. 12), may represent threshing refuse, while sample 5 with its higher number of cereal grains may come from a store of infested grain (e.g. before winnowing). Assuming that the plant remnants recovered from these samples originate from fuel used in the oven, we may speculate that the fuel (dung?) was collected in different places or different seasons.

Sample 6 was collected from the lowermost layer of the fill of a room, and is connected with the later phase of the Main Building (Level Va). In field observations this deposit differed from all the others in that it contained little ash and its numerous charred plant remnants could be seen with the naked eye. This difference is confirmed by plant content analysis: among all the floated samples it contains the fewest contaminants, and twice more cereal grains than chaff (Tab. 12). Barley is the dominant grain, with a very small admixture of wheats (Tab. 3), and grass kernels are the most abundant wild plant remains (Tabs 4, 5, 6). The density of plant remains is high (Fig. 5). Plant content suggests that this sample represents a store of barley grain infested by weeds (poorly cleaned or before cleaning). Dry-sieved sample 23 comes from the same context.

The cultivated and wild plant material is richest in sample 8 dated to Level Va. It was collected from a feature situated outside a complex of buildings and identified as an oval mud floor, which probably was used as a working surface and was renewed several times. The sample contains the highest number of plant specimens and taxa and also the highest density of remains (Fig. 5) and highest degree of contamination (Tab. 12). Barley is the main cereal species (71.3%), with some hulled wheats (16.3%) and a negligible percentage (2.8%) of naked wheat (Tab. 3). Wild plants are represented mainly by grasses and leguminous taxa (*Coronilla* cf. *scorpioides* and *Astragalus/Trigonella* type, Tabs 4, 5, 6). The function of this feature is unknown but the large accumulation of vegetal debris suggests that crop processing (threshing or winnowing) possibly was done in this place; it is not clear where the plant remnants became charred.

Samples 10 and 19 come from compact clay of a usage level (trampled surface) situated in open space east of the outer wall of the Main Building dated to Level Va. In sample 10 the density of plant remains is relatively high (Fig. 5). Hulled wheat grains are slightly more abundant than barley grains (Tab. 3), contaminating chaff and weed diaspores are very abundant (77% of all items) and the grain-to-chaff ratio is very low (Tab. 12). Seeds of leguminous plants (*Coronilla* cf. *scorpioides* and *Astragalus/Trigonella* type) are more abundant than grains of wild grasses (Tabs 4, 5). This sample probably represents an accumulation

of waste material. Sample 19 contains almost pure barley grain, but as it was processed by dry sieving the contaminants may have been artificially eliminated.

Sample 25, from brown earth filling the pit of grave 10, very poor in plant remains (Tab. 2), is the only sample dated to the latest period of PA activities at the site, Level IV.

The Middle Bronze Age

Samples 2 and 3 recovered by flotation, dry-sieved samples 20, 22, and 24, and hand-collected sample 39 all come from a shallow pit filled with soil mixed with a large amount of ash, dated to Level III. The ashes could be from pottery kilns. Each sample has a different set of cereal grains and wild plants (Tabs 8, 9, 10, 11). Density, measured only for samples 2 and 3, is rather low (Fig. 5). Samples 2, 3, and 39 contain a large number of contaminants, and chaff fragments outnumber grains (Tab. 13), suggesting that these samples represent refuse from cereal processing.

Sample 7 comes from a very similar pit (Level III) discovered 8 m east of the pit described above. It was also an ashy fill apparently from a pottery kiln. The density of plant material is rather low (Fig. 5). The cereals are a mixture of barley and hulled wheats with a small number of naked wheat grains (Tab. 8). Unlike samples 2 and 3, in sample 7 more than half of the specimens are cereal grains and the grain-to-chaff ratio is 1.4 (Tab. 13). This indicates that sample 7 represents highly infested cereal grain but probably not waste material.

Samples 11 and 13, dated to Level III, come from an ashy layer probably also connected with a pottery kiln. Several pieces of baked clay present in this layer probably are remnants of a destroyed kiln. The set of cereals is similar in the two samples: barley predominates, and naked and hulled wheats occur in smaller and almost equal numbers (Tab. 8). Some difference is seen in the representation of wild plants. Sample 13 contains more wild grass grains and *Coronilla* cf. *scorpioides* seeds (Tabs 9, 10), the percentage of contaminants is higher and the grain-to-chaff ratio is lower (Tab. 13). Most probably the sample represents waste material. Sample 11, on the other hand, contains only a few wild plant diaspores (Tabs 9, 10, 11), the percentage of contaminants is low and the grain-to-chaff ratio is high (Tab. 13), suggesting that this sample represents uncleaned cereal grain.

Sample 4 from Level IIc was collected from a clay layer having a large admixture of ash and situated in an open space. The main cereal is barley (Tab. 8), and wild plants are well represented (Tabs 9, 10, 11). The degree of contamination is low and the grain-to-chaff ratio high (Tab. 13), as in an assemblage of uncleaned grain. Dry-sieved sample 21 was taken from brick rubbish with some ash, and its context was similar to that of sample 4. Sample 14 (Level Va-b) comes from the same square as sample 4 but from a pit in which grave G4 was located. The deposit was soil with ashes, which could originate from layers truncated by the pit (in this case the plant material would be older than the grave) or else from the fill of the grave; the first suggestion is more likely. It is a very interesting sample because of the great number of plant remains (Tab. 7). Barley dominates the cereals, there is a high percentage of naked wheats, and the share of hulled wheats is very low (Tab. 8). The large number of ear rachis fragments enabled certain identification of macaroni wheat (*Triticum durum*). This sample contains several species of grasses and other wild plants absent or very rare in the other samples (Tabs 9, 10, 11). This is also the only sample with many goat/sheep droppings. The equal quantities of grain and chaff (Tab. 13) make it difficult to interpret the content of this sample. In this connection we note that in describing the Selenkahiye site van Zeist and Bakker-Heeres (1985) mentioned the possibility that barley grain was added to fodder. Along these lines we suggest that sample 14 contains remnants of fodder or dung which included not only waste plant material but also purposely added barley grain.

No interpretation can be suggested concerning the character of samples retrieved by dry sieving from Levels III (sample 22), IIc (samples 21, 26) and IIa-b (samples 18, 27, 28, 29), and sample 42 collected by hand from Level IIa-b. They contain almost exclusively cereal grains (Tab. 7).

CONCLUSIONS

VEGETABLE FOOD

A striking feature of the Tell Arbid samples is the almost total absence of legumes, which occur more abundantly at some other Near Eastern sites (e.g. Leilan – Wetterstrom

2003, Smith 2012; Tell Brak – Colledge 2003, Charles & Bogaard 2001; Selenkahiye, Hadidi – van Zeist & Bakker-Heeres 1985). Only a few seeds of lentil *Lens culinaris* and bitter vetch *Vicia ervilia* were found in both periods from Tell Arbid, which confirms that these species were available but allows no suggestion concerning their significance in the diet. Various authors have emphasised that the small number of remains of pulses may result from the fact that they are less likely to become charred than cereals are, due to the way they are prepared for consumption. However, several sites yielding large numbers of charred legume seeds have been described. The set of cereals is similar to sets known from the other sites. The hulled form of two-rowed barley *Hordeum distichon* predominates over wheats in PA and MB (Fig. 7). *Triticum dicoccon*, *T. monococcum*, and *T. durum* are present, and the occurrence of *H. vulgare* and *T. aestivum* cannot be excluded. The proportion of barley to wheats indicates that in both periods barley was the most important crop cultivated by the inhabitants of Tell Arbid. This does not necessarily mean that it was used only as human food, because no stores of pure barley or other cereal grain were discovered and the content of several samples suggests that they represent fodder. If so, the presence of well-developed mature barley kernels indicates that they were added to animal food (van Zeist & Bakker-Heeres 1985) and not grazed by sheep and goat, as happens nowadays in dry zones of Syria (Wilkinson 2000). The over-representation of grains as compared to legumes may be attributable to the use of cereals for fodder.

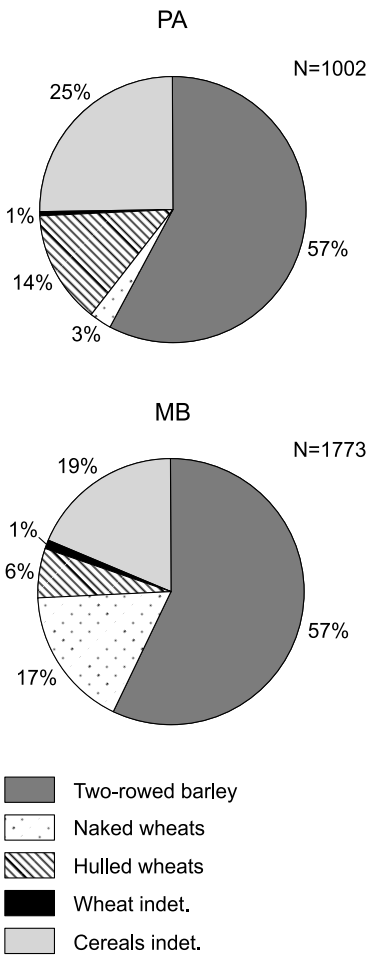


Fig. 7. Proportions of different cereals in the Post-Akkadian and Middle Bronze periods. Percentages calculated from total number of cereal specimens in each period

In PA, hulled wheats (ca 14% of cereals) were more abundant than naked wheats (3%). In MB the proportion was the reverse, with naked wheats comprising 17% and hulled wheats 6%. The switch of wheat proportions may reflect the tendency for free-threshing macaroni wheat (*Triticum durum*) to eliminate hulled wheats in the course of the Middle Bronze Age, but it might also reflect the origin of samples from fields on drier (hulled wheats) or wetter (macaroni wheat) soils. The disappearance of emmer after the Early Bronze Age from some sites in northern Syria was suggested by van Zeist and Bakker Heeres (1985). At Tell Mozan, on the other hand, Riehl (2010) observed variable (but not time-progressive) relations between barley and free-threshing wheat in different phases of the Early and Middle Bronze Age. For Tell Arbid we need more evidence to draw reliable conclusions about changes in the predominance of one or the other cereal species.

PALAEOECOLOGY

The ecology of wild plants can give information on plant communities and soils in areas penetrated by people and, indirectly, on the location of cultivated fields. In the case of Tell Arbid, unfortunately very little can be said about the ecological requirements of wild plants because most of them are identified to above-species taxonomic units, for which the information on habitat is only very general. Some of the plants were probably growing in cereal fields because *Coronilla scorpioides*, *Hordeum spontaneum*, *Trigonella astroites*, and *Vaccaria pyramidata* are known as arable land weeds today (Charles & Bogaard 2001). The genera *Astragalus*, *Aegilops*, *Bromus*,

and *Melilotus* also include several weed species. They produce seeds at the same time as cereals and can be harvested together with the crops. Some other species from the same genera are steppe plants, however, and could have been brought to the settlement on animal hoofs or fur, or in animal dung collected for fuel (van Zeist & Bakker-Heeres 1985, van Zeist 2003). Probably dung was the source of *Prosopis farcta* seeds found in sample 14 from MB together with the large number of goat/sheep droppings. This shrub, which grows mainly on disturbed ground, fallow fields, and sandy plains (Boulos 1999), may also appear in fields, but it produces fruits after harvest time, which makes their transport to the site together with cereals unlikely. Pods of this species have spongy mesocarps which are eaten by sheep, goats, and cattle (Charles & Bogaard 2001, Colledge 2003). Another possible explanation of the presence of its seeds at the site is that whole *Prosopis* shrubs are collected for fuel (van Zeist et al. 2003).

The wild plants recovered from PA and MB are of similar taxonomic composition, with slight quantitative differences (Fig. 8). In the total PA material, seeds of leguminous plants (mainly *Coronilla* cf. *scorpiodes* and *Astragalus/Trigonella* type) and grasses (mainly small-grained) occur with the same abundance and predominate over other species. In the material from MB, legumes are less abundant than grasses and other wild plants are more numerous than in PA. A striking difference between the two periods is found in the ratios of wild to cultivated plants, calculated for the total specimens from each chronological unit (Fig. 9). Wild plant diaspores constitute 69% of all items in PA but only 22% in MB. The distinct predominance of wild over cultivated plants in PA may be due partly to the greater volume of soil used for flotation (48 litres in PA, 33 litres in MB) but the percentage difference seems too large for it to be the only reason. Perhaps cereal fields were less infested with weeds in the Middle Bronze Age than in the Post-Akkadian period, or the harvest was cleaned better. Since the studied samples represent fodder, waste or dung, another possible explanation is that at Tell Arbid animal food contained more cereals in the Middle Bronze Age than in the Post-Akkadian period. The small number of samples prevents a firm explanation of this difference. Feeding grain to domestic animals is evidenced by written texts. Two situations are described. One example is the feeding of working animals, for instance oxen, during the field work season when there was not enough time for grazing (for the Old Babylonian period, 20th–16th cent. BC: Stol 1995: 195–196). Rations issued to such animals are often mentioned in Middle Assyrian texts (ca 13th–12th cent. BC) and typically were issued during six months of the year (Röllig 2008: 27). Another case concerns animals, mainly sheep, fattened for consumption, first of all as sacrificial offerings (Third Dynasty of Ur period, corresponding to the post-Akkadian period at Tell Arbid: Maekawa 1983; Neo-Babylonian period: Tarasewicz 2008: 223–238). Other animals were fattened as well; for example, 21 oxen are qualified this way on tablet SH 867 concerning a herd of 138 cattle belonging to Kuwari, ruler of Shusharra, dated to the 18th cent. BC (Eidem 1992: 85). A similar practice is shown for the Southern Mesopotamia during the Third Dynasty of the

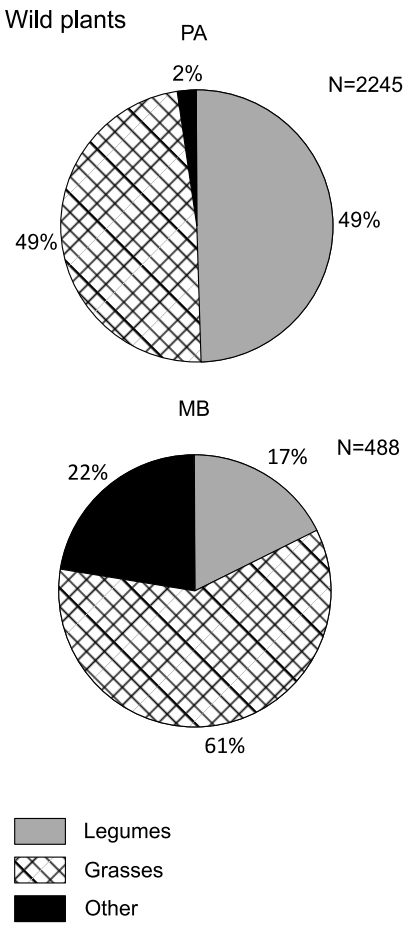


Fig. 8. Proportions of three groups of wild plants in the Post-Akkadian and Middle Bronze periods. Percentages calculated from total number of specimens of wild plants in each period

Ur period (Gomi 1997). The archaeological work carried out in sector P at Tell Arbid provided no evidence that any of these practices were pursued by the inhabitants of the settlement, however.

At the present stage of investigations we can offer no convincing explanation for the general difference between the PA and MB material, nor for the variations in the qualitative and quantitative composition of individual samples. The samples may reflect different activities of people and/or may contain plants from cereal fields or grazing places that had different flora. Similar differences observed by van Zeist and Bakker-Heeres (1985) in a much larger assemblage from Selenkahiye were interpreted as indicating the origin of crops from different fields or different seasons of the year. The predominance of drought-resistant barley over more sensitive wheat in the PA and MB samples may indicate that Tell Arbid was situated in the zone of a barley-based system as suggested by Jones 1993 (cit. after Wilkinson 2000). This zone is characterised by rainfall of 300–200 mm, barley is the main cereal, wheat and legume cultivation is of low significance, and fodder crops play an important role.

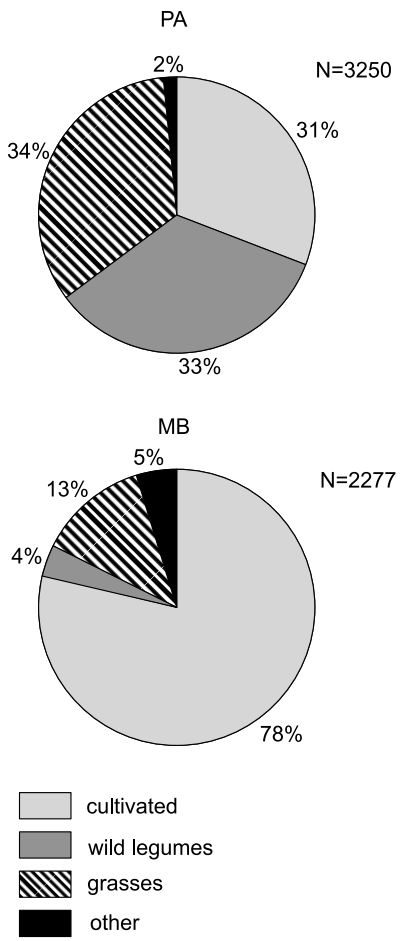


Fig. 9. Proportions of cultivated and wild plants in all samples from the Post-Akkadian and Middle Bronze periods. Percentages calculated from total number of specimens of cultivated and wild plants in each period

HARVEST

The presence of bronze sickles at Tell Arbid and some other sites of similar age from Syria indicates that crops were harvested with sickles. The numerous pieces of the upper portions of grass stems with nodes found in Tell Arbid (Tabs 2, 7) suggest that cereals were probably cut low on the straw. At the same time, the presence of many basal culm fragments may mean that occasionally harvesting was done by uprooting. They are particularly abundant in sample 14 from Level IIa-b. Out of the 450 culm pieces found in this sample, 17% have remnants of rootlets attached. Such subterranean culm ends are also found in a few other samples from both periods, but in small numbers. The occurrence of culm bases is sometimes interpreted as an indication of uprooting of cereals (Buurman 1998/1999) but van Zeist (2003) noted that reaping with a sickle, particularly a blunt one, can also uproot individual cereal plants. In material from Tell Hamman et-Turkman, a Late Bronze Age site in Syria, he considered a 16% admixture of basal culm fragments to be an indication of systematic uprooting, while an 8% admixture would not, in his opinion, be decisive with respect to the harvesting method (van Zeist 2003). Both harvesting methods would collect weeds together with cereals.

SUMMARY

The charred plant remains recovered from the Tell Arbid archaeological site in Syria and dated to the Post-Akkadian Period (2150–2000 BC) and the Middle Bronze Age (1900–1700 BC) represent cultivated and wild-growing species. The four species of cereals include hulled two-rowed barley *Hordeum distichon*, emmer wheat *Triticum dicoccon*, einkorn wheat *T. monococcum*, and macaroni wheat *T. durum*. Barley predominates in both chronological units, hulled wheats are more numerous in PA, and in MB the number of naked wheats is slightly increased. Other cultivated plants are represented by very few

seeds of lentil *Lens culinaris* and bitter vetch *Vicia ervilia*. Seeds and fruits of wild plants are much more abundant in PA than in MB. Most of them are field weeds and steppe plants. There are no significant differences in the taxonomic composition of plant remains between the two periods, but samples differ in the quantitative proportions of taxa. These differences may be accidental but may also reflect specific activities carried out in various places within the settlement.

The relatively large amount of chaff and wild plant diaspores versus cereal grains, and the presence of steppe or desert-steppe plants, suggest that the examined material represents mainly charred animal food and/or charred waste from threshing. In the first case the plant remains may come from fodder stored for future use or from dried dung cakes. A few samples may represent stores of uncleaned grain. Cereals probably were harvested by cutting low on the straw with a sickle, and occasionally by uprooting. The differences in composition between samples processed by flotation and by dry sieving shows that the latter method provided information only about the presence of cereal grains, the smaller diaspores and chaff fragments having been lost.

ACKNOWLEDGEMENTS

The excavations at Tell Arbid, Sector P would not have been possible without the endorsement of Professor Piotr Bieliński, Director of the Polish-Syrian Archaeological Mission to Tell Arbid, and the Syrian authorities: Dr Basam Jammous, Director of DGAM, Dr Michel el-Maqdissi, Director of Excavations Department of DGAM in Damascus, and Dr Abdel-Messih Baghdo, Director of the DGAM office in Hasake and Co-director of the Mission in 2010. To them we owe our heartfelt thanks for their cooperation and constant support. The fieldwork was co-sponsored by Adam Mickiewicz University in Poznań, the Adam Mickiewicz University Foundation, the Kazimierz Michałowski Foundation, Polkomtel S.A., ça ira Ltd. and Akmemedian Ltd. The second author thanks Dr Inna Mateicuciová of Masaryk University in Brno, who allowed us to use her flotation equipment and shared the necessary knowhow, and to Professor Harvey Weiss of Harvard University, who included three ^{14}C samples from Tell Arbid Sector P in his research program and had them analysed in the laboratory of the University of Arizona. The first author thanks Professor Rafał Koliński for providing the material for study and for making accessible all information about the Tell Arbid archaeological site. The help of Ms Katarzyna Cywa, M.Sc., who photographed the plant remains, is gratefully acknowledged. The authors are much obliged to two anonymous referees for their valuable comments. The research was financed by a grant from the Committee for Scientific Research, Republic of Poland, no. N109 3938 33: "Collapse, decline or development? Settlement and cultural changes in Syrian Jazireh at the turn of the Early Bronze Age".

REFERENCES

BOULOS L. 1999. Flora of Egypt. vol. 1. Al Hadara Publishing, Cairo.

BUTLER A. 1996. Trifolieae and related seeds from archaeological contexts: problems in identification. Veget. Hist. Archaeobot., 5: 157–167.

BUURMAN J. 1998/1999. Archaeobotanical investigations of a Middle and Late Bronze Age settlement site at Westwoud (West-Friesland). Ber. Rijksd. Oudheidk. Bodenmon., 43: 99–139.

CHARLES M. & BOGAARD A. 2001. Third millennium BC charred plant remains from Tell Brak: 301–326. In: Oates D., Oates J. & McDonald H. (eds), Excavations at Tell Brak, 2. McDonald Institute for Archaeological Research/British School of Archaeology in Iraq, Cambridge.

COLLEDGE S. 2003. Plants and people. Chapter 11: 389–416. In: Matthews R. (ed.), Excavations at Tell Brak, 4. Exploring an Upper Mesopotamian regional centre, 1994–1996. McDonald Institute for Archaeological Research/British School of Archaeology in Iraq, Cambridge.

EIDEM J. 1992. The Shemshâra archives 2. The administrative texts. Historisk-Filosofiske Skrifter, Kongelige Danske videnskabernes selskab, Copenhagen.

GOMI T. 1997. A note on some kinds of fodder for cattle in the Ur III Period. Altorient. Forsch., 24: 35–38.

HILLMAN G.C. 2000. The Setting: 43–91. In: Moore A.M.T., Hillman G.C & Legge A. (eds.), Village on Euphrates: from foraging to farming at Abu Hureyra, Oxford University Press, New York.

JACOMET S. & COLLABORATORS 2008. Identification of cereal remains from archaeological sites. 3rd edition. IPAS, Basel University. http://pages.unibas.ch/arch/archbot/index.htm

KISLEV M.E. 1979/1980. *Triticum parvicoccum* sp.nov., the oldest naked wheat. Israel J. Bot., 28: 95–107.

KOLIŃSKI R. 2007a. Sir Max Mallown's Excavations at Tell Arbid, 1936. Iraq 69: 73–115.

KOLIŃSKI, R. 2007b. The Upper Khabur Region in the Second Part of the Third Millennium BC. Altorient. Forsch., 34: 342–69.

KOLIŃSKI R. 2011. Badania Instytutu Prahistorii UAM w Poznaniu na Tell Arbid (północnowschodnia Syria) w latach 2008–2009. Folia Praehist. Posnan., 16: 219–54.

KOLIŃSKI R. 2012. Generations Count at Tell Arbid, Sector P: 109–128. In: Weiss H. (ed.),

Seven Generations Since the Fall of Akad. Studia Chaburensia, 3.

KOLIŃSKI R. forthcoming, XXth century BC in the Khabur Triangle region and the advent of the Old Assyrian Trade with Anatolia: 11–34. In: D. Bonatz (ed.), The Archaeology of the Upper Mesopotamian Piedmont in the Second Millennium BC. De Gruyter, Berlin.

KUZUCUOĞLU C. & MARRO C. (eds.) 2007. Sociétés humaines et changement climatique à la fin du troisième millénaire: une crise a-t-elle eu lieu en haute Mésopotamie? Actes du Colloque de Lyon, 5–8 décembre 2005, De Boccard, Paris.

LITYŃSKA-ZAJĄC M. & WASYLIKOWA K. 2005. Przewodnik do badań archeobotanicznych. Sorus, Poznań.

MAEKAWA K. 1983. The management of fatted sheep (udu-niga) in Ur III Girsu/Lagash, Acta Sumerologica 5: 81–111.

MILLER N. 1988. Ratios in paleoethnobotanical analysis: 72–85. In: Hastorf Ch. A. & Poper V. S. (eds), Current paleoethnobotany. The University of Chicago Press, Chicago.

MOUTERDE P. 1966. Nouvelle flore du Liban at de la Syrie, vol. 1. Édition de l'Imprimerie Catholique, Beyrouth.

NESBITT M. 2006. Identification guide for Near Eastern grass seeds. Institute of Archaeology, University College London, London.

RIEHL S. 2010. Plant production in a changing environment: the archaeobotanical remains from Tell Mozan: 13–158. In: Deckers K., Doll M., Pfälzner P. & Riehl S. Development of the environment, subsistence and settlement of the city of Urkeš and its region. Stud. Urban. Nordmesopot., Ser. A, 3.

RISTVET L. 2011. Radiocarbon. In: Lebeau M. (ed.), ARCANE. Associated Regional Chronologies for the Ancient Near East. Vol. 1. Jezirah, Brepols Publishers, Turhout.

RÖLLIG W. 2008. Land- und Viehwirtschaft am unteren Habūr in mittelassyrischer Zeit. Berichte der Ausgrabung Tell Šēh Hamad/Dur-Katlimmu, 9: 301–326.

SMITH A. 2012. Akkadian and post-Akkadian plant use at Tell Leilan: 225–240. In: Weiss H. (ed.), Seven generations since the fall of Akkad. Studia Chaburensia 3.

STOL M. 1995. Old Babylonian cattle. Bull. Sumer. Agricult., 8: 173–213.

TARASEWICZ R. 2008 unpbl. Gospodarka hodowlana świątyni Ebabbar w Sippar w okresie nowobabilońskim i wczesnoperskim 626–482 p.n.e. (Animal Economy of the Ebabbar Temple in Sippar in the Neo-Babylonian and the Early Persian Period 626–482 BC). PhD thesis, Adam Mickiewicz University, Poznań.

WASYLIKOWA K. 1997. Flora of the 8000 years old archaeological site E-75-6 at Nabta Playa, Western Desert, southern Egypt. Acta Palaeobot., 37(2): 99–205.

WEISS H. 2000a. Beyond the Younger Dryas: 75–98. In: Bawden G. & Reycraft R.M. (eds.), Environmental disaster and the archaeology of human response. Maxwell Mus. Anthropol. Occ. Papers 7.

WEISS H. 2000b. Casuality and Chance. Late Third Millennium Collapse in Southwest Asia: 207–17. In: Rouault O. & Wäfler M. (eds), La Djéziré et l'Euphrate syriens de la protohistoire à la fin du second millénaire av. J.-C. Tendances dans l'interpretation historique des donnés nouvelles, Subartu, 7.

WEISS H. 2012. Quantifying Collapse: The late third millennium Khabur Plains: 1–24. In: Weiss H. (ed.), Seven generations since the fall of Akkad. Studia Chaburensia, 3.

WEISS H., COURTY M.-A., WETTERSTROM W., GUICHARD F., SENIOR L., MEADOW R. & CURNOW A. 1993. The genesis and collapse of third millennium North Mesopotamian Civilization. Science 261(5124): 995–1004.

WEISS H., MANNING S.W, RISTVET L., MORI L., BESONEN M., McCARTHY A., QUENET Ph., SMITH A. & BAHRANII Z. 2012**.** Tell Leilan Akkadian Imperialization, Collapse and Short-Lived Reoccupation Defined by High-Resolution Radiocarbon Dating: 163–192. In: Weiss H. (ed.), Seven generations since the fall of Akkad. Studia Chaburensia, 3.

WETTERSTROM W. 2003. Ninevite 5 period agriculture at Tell Leilan: preliminary results: 387–400. In: Weiss H. & Rove E. (eds), The origins of North Mesopotamian civilisation. Ninevite 5 chronology, economy, society. Subartu, 9.

WILKINSON T.J. 2000. Settlement and land use in the zone of uncertainty in Upper Mesopotamia: 26–35. In: Jas R. (ed.), Rainfall and Agriculture in Northern Mesopotamia. Proceedings of the 3rd MOS Symposium, Leiden, May 21–22, 1999, PIHANS 88.

van ZEIST W. 1999/2000. Third to first millennium BC cultivation on the Khabur, north-eastern Syria. Palaeohistoria, 41/42: 111–125.

van ZEIST W. 2003. The plant husbandry of Tell Al-Raqa'i: 7–31. In: van Zeist W. (ed.), Reports on archaeobotanical studies in the Old World. Groningen.

van ZEIST W. & BAKKER-HEERES J.A.H. 1982. Archaeobotanical studies in the Levant. 1. Neolithic sites in the Damascus Basin: Aswad, Ghoraifé, Ramad. Palaeohistoria, 24: 165–256.

van ZEIST W. & BAKKER-HEERES J.A.H. 1984a. Archaeobotanical studies in the Levant. 2. Neolithic and Halaf levels at Ras Shamra. Palaeohistoria, 26: 151–70.

van ZEIST W. & BAKKER-HEERES J.A.H. 1984b. Archaeobotanical studies in the Levant. 3. Late Palaeolithic Myreybit. Palaeohistoria, 26: 171–199.

van ZEIST W. & BAKKER-HEERES J.A.H. 1985. Archaeobotanical studies in the Levant. 4. Bronze Age sites on the north Syrian Euphrates. Palaeohistoria, 27: 247–316.

van ZEIST W. & WATERBOLK-VAN ROOIJEN W. 1985. The palaeobotany of the Tell Bouqras, Eastern Syria. Paléorient, 11/2: 131–147.

van ZEIST W., WATERBOLK-van ROOIJEN W., PALFENIER-VEGTER R.M. & de ROLLER G.J. 2003. Plant cultivation at Tell Hammam et-Turkman: 61–114. In: van Zeist W. (ed.), Reports on archaeobotanical studies in the Old World. Groningen.

ZOHARY D. & HOPF M. 2000. Domestication of plants in the Old World. Oxford University Press, Oxford.

PLATES

Plate 1

Charred remains of cereals and wild grasses from Tell Arbid

1. *Hordeum* cf. *spontaneum*, grains
2. *Hordeum distichon*, grains
3. *Triticum durum*/*aestivum*, grains
4. *Triticum durum*, ear fragments
5. *Hordeum* cf. *spontaneum*, ear fragments
6. *Hordeum distichon*, ear fragments
7. grains of various wild Poaceae species
8. grains of various wild small-grained Poaceae species

Photo K. Cywa

Scale bar – 1 mm


1


2


3


4


5


6


7


8

Plate 2

Charred plant remains from Tell Arbid

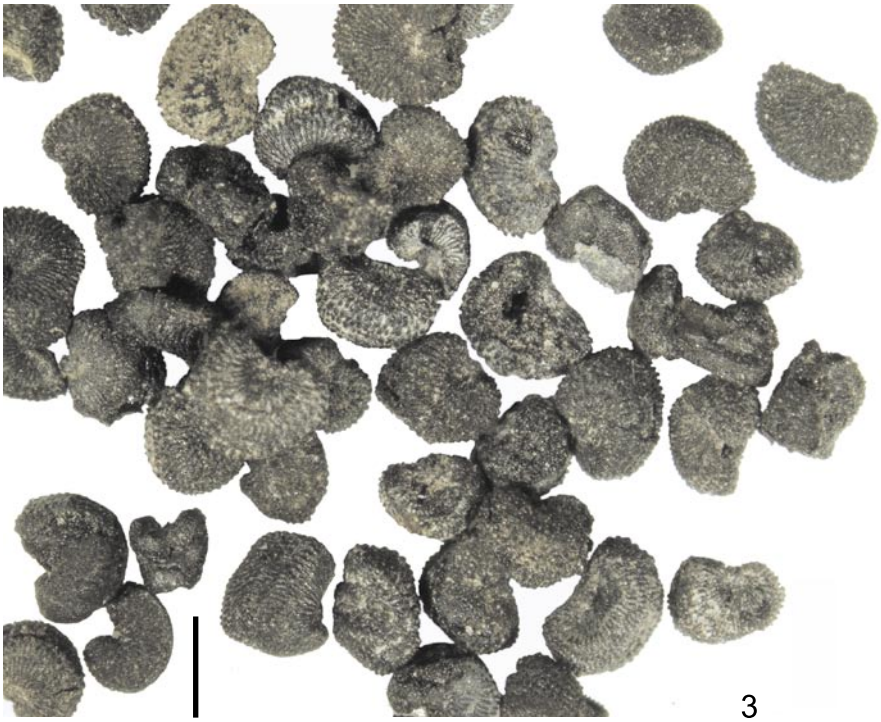
1. *Coronilla* cf. *scorpiodes*, seeds
2. *Astragalus*/*Trigonella* type, seeds
3. *Silene* type, seeds
4. *Aegilops* cf. *crassa*, spikelets
5, 6. *Prosopis farcta*, seeds

Photo K. Cywa

Scale bar – 1 mm


1


2


3


4


5


6