THE ARCHAEOBOTANICAL MATERIAL FROM THE SITE OF PYRGOUTHI IN THE BERBATI VALLEY: THE SEEDS

BY

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The Classical, Early Roman and Late Antique site at Pyrgouthi has produced a rich assemblage of plant material, which is important not only *per se* in order to get a glimpse of agriculture from the remains of a farmstead in the Roman Argolid, but also to augment data which are very thin on the ground for the relevant periods, as few excavators collect organic remains of material culture with the same reverence that they gather inorganic cultural data.

The archaeobotanical seed assemblage retrieved from the site of Pyrgouthi comes from three sources. Most of the material was, of course, retrieved through water flotation. Some material (4 samples) was recognized and handpicked during excavation and was noted as BER001 to BER004. The third area of provenance was the seed material found in what was classified as charcoal samples (9 samples) when examined by eye, but when sorted under a stereoscopic microscope were recognized as seeds and were noted as BER005–BER013.

THE MATERIAL

Soil from 44 samples of soil (in all 527 litres) (*Fig. 1*) was subjected to water flotation and these samples produced 3 categories of material: residue (which consists of the heavy fraction caught by a mesh of 1 mm; some heavy organic material is often present), coarse flot (all organic material larger than 1mm) and fine flot (all organic material larger than 250 microns). Because of the rather small samples (some were as small as 0.5 litres and others 35 litres) and the paucity of environmental data, and of particular data from the Early Roman and Late Antique periods in general, it was decided to proceed and sort all of the three categories in their totality. In other circumstances it is, generally, routinely sub-sampled in the laboratory.

The seeds were partly sorted at the Institute of Mediterranean Studies, identified and compared to modern seeds in my private comparative collection, which has been created over the years. As for identification of cereal, mainly wheat, I have used Jacomet,[2] Maier[3] and Hillman[4] but I also had the good fortune to have personal communication with the last named during my stay in London (UCL) in October and November of 1998.[5]

The Tower trenches: 636, 637, 638, 639, and 641

In the Tower trenches, samples were collected from stratum 4 downwards only, as the first three strata were judged sub-modern/topsoil.[6]

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[2] Jacomet 1987, esp. 36-49.

[3] Maier 1996, *passim*.

[4] Hillman 2001, esp. 30f.

[5] Here I would like to thank Gordon Hillman for all his time, always generously given, and for sharing his knowledge of *Triticum carthlicum* with me, as well as Ann Butler for many discussions on legumes.

[6] For a description of the stratigraphy, see Penttinen and Hjohlman, this volume.

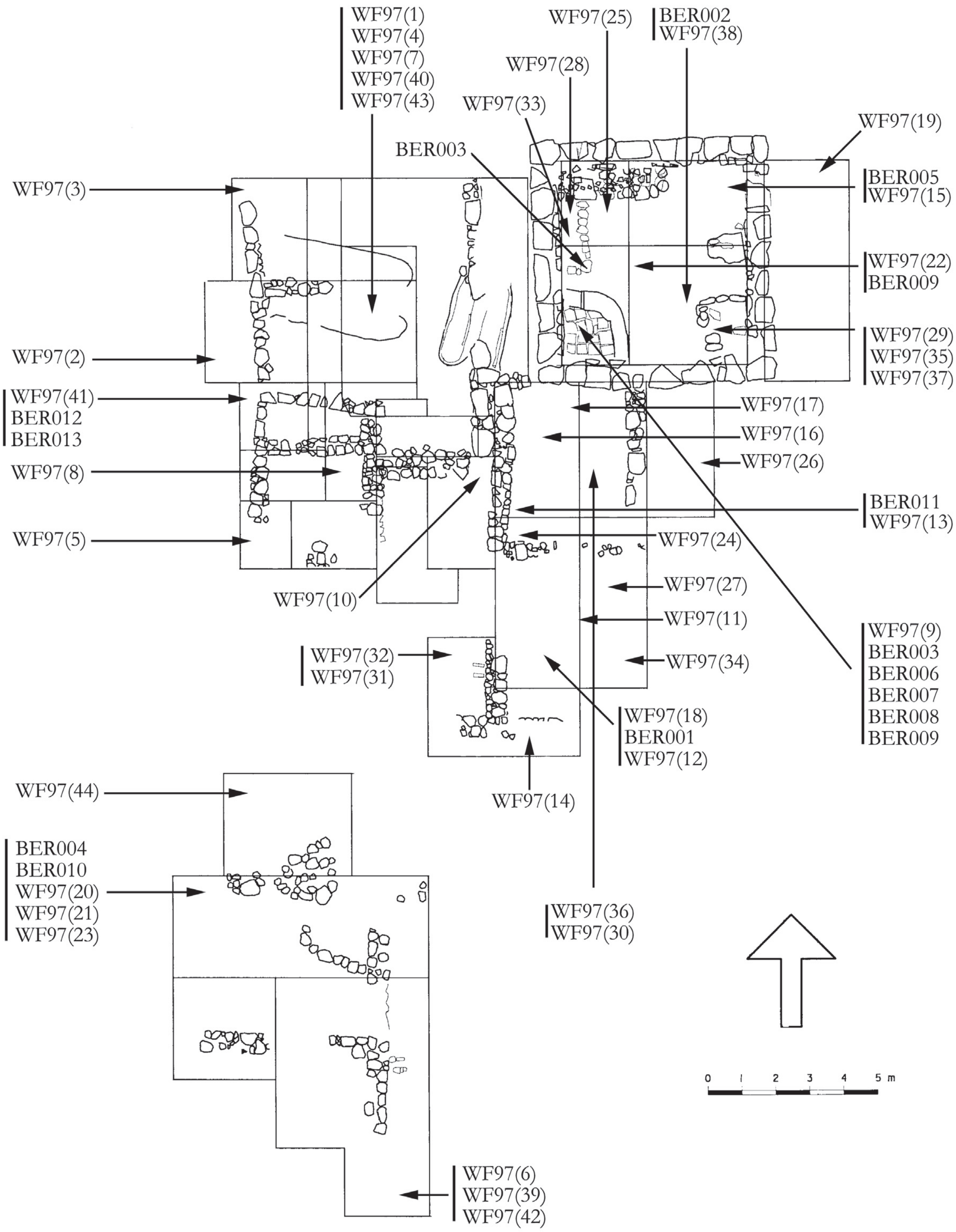

Fig. 1. Distribution of water flotation (WF) samples from the excavations at Pyrgouthi in 1995 and 1997.

Stratum 4 (*Tables 1* and *11*): tile fall – Late Antique

This being the layer that sealed the Late Antique levels, it would be logical to suggest that the six (6) samples BER005 [636], WF97 (15) [636],[7] BER008 [637], WF97 (9) [637], WF97 (22) [637] and WF 97(25) [639] seem to be not only remnants of storage for human use but also material 'splashed' around (displaced) through the fall of the tower's roof (see abundance of roof tiles) and, of course, including other debris. The sample that is noticeably different is WF97 (9) [637]. It was found on top of the permanent 'pressing' installation built at the south-west corner of the tower. Installations of similar type might have had multiple functions such as pressing grapes and also olives, as these two activities are conducted at different times of the year and could be performed on the same structures, if the material is hard enough to allow for the crushing of the olive stones.[8] However, the material of this structure does not seem to have been very hard, as it was built with stones and bricks and dressed with plaster.[9] A terracotta pipe to lead the liquid out through the wall to the exterior side of the structure and ending in a spout on the outside was also discovered.[10] Therefore, of the two possible functions, only grapes could have been crushed, although there is a total lack of grape pips in the tower samples. And yet another oval possible press-bed for grapes was built along the eastern wall of the tower.[11] Milling (see the find of a grinding stone) might also have been another activity as several classes of seeds have been found fragmented such as olive (*Olea europaea*),[12] cerealia, and legume fragments.

The other sample, which was found in the same square, is WF97 (22) [637]. This does not seem to be stored seeds but rather by-products of these in that the cultivated species were many and mixed, such as hulled barley (*Hordeum vulgare*), the free-threshing, durum-type wheat (*Triticum cf. carthlicum*),[13] horsebean (*Vicia faba*), dwarf chickling (*Lathyrus cicera/sativus*), and field pea (*Pisum sativum*), unless this was the store for fodder representing a mixture of by-products of several in-house sievings.[14]

Sample WF97 (25) [639] is from the same west side, which seems to have a hollow bench containing some broken clay vessels and perhaps a sack, as is denoted by the piece of charred cloth that could be the remnants of such a container (see H. Granger-Taylor, this vol.).[15] The sample consists mainly of hulled barley (*Hordeum vulgare* – six-row)[16] but other crops such as emmer (*Triticum cf. dicoccum*), durum wheat (*Triticum durum* s.l.), lentils (*Lens esculenta*), horsebean (*Vicia faba*), dwarf chickling (*Lathyrus cicera*), bitter vetch (*Vicia ervilia*), Spanish vetchling (*Lathyrus clymenum*), grape (*Vitis vinifera*), and olive (*Olea europaea*) imply rather that we have at hand a by-product of crop cleaning (see the weeds), which could have been stored for fodder but definitely not for food for a farmer.[17] The fragments of olive do not seem to have been pressed with a millstone or similar 'eroding' equipment.

Even more than the previous sample, WF97 (15) in square [636] seems to be a by-product of crop-cleaning(s), as it seems to be a mixture of by-products from various crops. Carob fruits too seem to have been stored whole (i.e. not processed) together with these by-products. We believe that carob might have been stored for the feeding of animals, although its use as human food cannot be negated. Some believe that at some periods in history and prehistory, it could have been considered as a stress food.[18] Its importance, just as with grapes, was most probably its use as a sweetening agent as well.[19]

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[7] WF stands for water flotation followed by the year it was floated and the number of the sample – its ID. The number in the brackets refers to grid.

[8] Kopaka & Platon 1993, *passim*; Hamilakis 1996, 18.

[9] Pers. info. B. Wells. Moreover, no crushing stone has been found in the tower, or near it, to further justify such an assumption.

[10] Hjohlman, this volume. There seems to be three drains from the area excavated at Pyrgouthi, one from the Tower (west wall), one in trench 537 and another in trench 322, and all three might have been connected to some wine-making installations.

[11] See Hjohlman, this volume.

[12] They could still have been hand crushed for the preparation of what is called "tsakistes" for consumption as whole olives. This operation does not aim at crushing the stone but only to make the pulp tenderer. Often though, the stone is crushed too.

[13] It is a tetraploid wheat collectively grouped under *Triticum turgidum* L. *(= T. persicum Vav.)* and commonly known as Persian wheat. It is not presently cultivated in Greece, as far as I know (personal information provided by the Institute of Cereal Seedbank, Thessaloniki), and does not seem to have been cultivated, not even in 1929 when Papadakis, published his work on the wheats cultivated then, in Greece.

[14] Had they been a mix of legumes and cereals, which could grow together as a maslin crop, it would have been possible to treat them as a deliberate storage. However, we know that legumes, barley and wheat mature at slightly different periods, so that harvest and threshing would have taken place at different times, and they should, therefore, have been planted in different fields, as this different maturing time would have caused great difficulties during reaping.

[15] This piece of cloth was retrieved in the residue of a water-floated soil sample and to the naked eye looked like a piece of charcoal. It was recognised only when the charcoal was sorted under a stereoscopic microscope in order to detect seeds possibly found in the charcoal samples. This shows very clearly that water flotation is not only appropriate in order to recover fauna and flora data generally, but other delicate categories of material culture are also retrieved. However, Hjohlman, this vol., refers to it as a possible press bag, presumably for olives, used in the second stage in wine production after treading the grapes: the pressing of the wine on the press bed. However, the pressing as we know it in Greece today, unlike Egypt, grapes are pressed by treading, and, therefore, would need no bags. It is true, though, that the method used for extracting wine is assumed and we need to keep our minds open for all sorts of technical applications. Sacks, we hypothesize, might have been used mainly for transport of goods, as the sacks would have been too vulnerable for permanent storage. If this is the case, it might be an indirect piece of evidence for agricultural produce coming and going to other sites and even to the centres of Corinth and/or Argos. The presence of part of a balance, of the type commonly called 'balanza' in Greek, dated to the Late Antique period was found (catalogue no. 194) in the southern trenches, Area D (Hjohlman, this vol.), as well as chains and hooks which could have also belonged to balance weights (e.g. Hjohlman, this vol., catalogue nos. 148–152).

[16] Many of the grains are twisted so six-row is deduced but the presence of *Hordeum distichum* (two-row) cannot be excluded.

[17] As a worse resort as stress food.

[18] Galen remarked that they had a constipating effect, whereas at Babylon, carob was considered food for the poor around 1000 BC. (Theophr., *Cans.pl.* 4.2.2; see also Dioscorides, *Materia Medica* 1.114; Plin., *HN* 15.95; Gal., *Nat.Fac*. 2.33. In the New Testament (Luke 15,16) it is indicated that the carob was considered a low-status food.

[19] From grape, the grape honey, 'petimezi', is made and from carob, the 'charoupomelo', the carob honey. In a period when honey was con-

However, it is not uncommon in farms to store animal feed and human feed together, although human feed would have needed to be subjected to more careful storage, not only to avoid crop loss (insect and other pest infestation) but also to protect them from crop contamination, which would be perilous to human life (see mouse dung in samples).[20] In the Late Antique period, the tower seems to have been used together with the buildings lying to its south and southwest as a storage area. This is indicated by the various archaeological and organic finds, together with the results from the residue analysis,[21] which has shown that wine was stored in a number of pottery vessels.[22] This is interesting when seen together with the find of an amphora stamp found in the Late Hellenistic/Early Roman layer, stratum 2, in the western trenches.[23]

Stratum 5 (*Table 2*): the destruction stratum of the Late Antique period

Trench [637] is represented by only one sample, BER003 (collected by eye) and no collection for water flotation, whereas trench [639] is represented by 2 samples submitted for water flotation, WF97 (28), and WF97 (33), both inside the bench. The pattern is the same as in stratum 4 and represents by-products of crop cleaning for crops, which might have been stored together for use as fodder.

Trench [638] produced the following samples: WF97 (29), WF97 (35), WF97 (38) and BER002. None of them is estimated to be a stored crop but they also seem to be by-products of crops. Sample WF97 (29) for example seems to be from a crop of hulled barley (*Hordeum vulgare* – six-row) and another of wheat WF97 (38) (rather the *T. turgidum/carthlicum* type), i.e. macaroni/Persian wheat. On the other hand, sample WF97 (35) seems to be a crop of oats (*Avena sativa s.l.*) with admixtures of legumes.

Stratum 7 (*Table 2*): Early Roman

Stratum 6 was not sampled for environmental material. Stratum 7 WF97 (37) [638] has produced a sample of by-products, again with evidence of crops such as barley and wheat, mainly macaroni/Persian wheat. What is also interesting is all the diversity of pulse crops (all could be edible by man), such as peas, Spanish vetchling, bitter vetch, dwarf chickling, lentils and others, which at the present are still unidentified.

Western trenches, 621–629, 521–525, 534–535

Stratum 1 WF97 (5) [523], WF 97 (10) [534]: topsoil (*Table 3*)

Although it consisted of topsoil, it was sampled and some charred olives (*Olea europaea*) and almonds (*Prunus amygdalus*) were found as well as some legumes, but most of the other seeds except for the charred fig (*Ficus carica*) must be considered of dubious origin and possibly sub-modern.

Stratum 2 WF97 (40) [622], WF97 (41) [626]: Early Roman occupation (c. 2nd century BC) (*Table 3*)

There is a presence of olive and almond but the layer is mixed with modern material (high presence of modern seeds), which must have intruded through modern ploughing or burrowing by rodents.[24]

Stratum 3 WF97 (1) [622], WF97 (3) [625], WF97 (4) [622], WF97 (7) [622], WF97 (43) [622]: Classical (fill in kiln I) (*Fig. 5*)

Unfortunately, the archaeobotanical material is so poor and disturbed (see modern seeds) that it is impossible to make any suggestion (same as above).

Stratum 4 WF97 (2) [621] and stratum 5 WF97 (8) [524]: Classical (*Table 4*)

These layers are still very disturbed as can be inferred from the modern seeds (intrusions) in them. However, even in this period we notice the cultivation of the olive, the grape, barley and legumes. It seems to be the same combination as in the later periods and only wheat is missing. This, of course, should be considered as an indication of a possible pattern but could also be an accident of preservation and/or sampling.

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sidered a luxury produce, other sugaring agents would have been very much sought after.

[20] It is known that rodents, such as mice and rats, who form the main source of infection, could infect both humans and animals with leptospirosis, which is passed on by the urine of the animal. The bacteria involved are *Leptospira interrogans*. This could be fatal and described commonly as bubonic plague. Yet, it is believed that the common doormouse was bred in the Classical period (Isager & Skydsgaard 1995, 94).

[21] The two methods of Fourier Transform Infrared Spectroscopy and Gas Chromatography with Mass Spectrometry on lipids were applied by Dr Sven Isaksson (this vol.).

[22] It would be important to check whether the iron so-called knife found in area A (Hjohlman, cat. no. 119) is not a knife at all, but a tool used for cleaning pots or even wooden barrels from the lees deposited during wine-making, something like the tool named 'korastari' in present-day Greece. However wine could have circulated in wine skins, too (Immerwahr 1992, 123, n. 8, although drinking from wineskins was unusual. On the Getty psykter − Getty Museum, Malibu, No. 83.AE285 − a group of servants had come to the vineyard to fill their wineskins (p. 127) presumably to transport it).

[23] The fragment of the neck of an amphora (for full details, see Penttinen, this vol., cat. no. 106) has the letters OINO preserved together with an eight-armed star. It is believed that the fabric of the amphora makes a local origin unlikely. Other imported items were found in the same context.

[24] Arto Penttinen has confirmed that there were burrows in this stratum but no mice bones, thus indicating the transport of sub-fossil seeds to deeper storage by the rodents.

Stratum 6 WF97 (14) [534]: Late Antique (*Table 5*)

This layer seems also excessively disturbed. The fall of roof-tiles could have trapped some modern seeds or helped rodents' circulation and as a consequence could have contributed to the intrusions. Otherwise, at this stage of study and if we wish to generalize, we could claim that there seem to have been no major changes in agricultural management from the Classical period to the Late Antique. Unfortunately, though, no soil samples were taken from stratum 7, the occupation floor of the Late Antique period, and the Late Antique fill of stratum 8. However, directly on bedrock was found (stratum 7) the iron sickle (see Hjohlman, this vol. cat. no. 153), which is of interest to people studying agricultural practices.[25]

Southern trenches, 531-533, 536-539

Stratum 1 WF97 (13) [531] and WF97 (27) [538]; stratum 2 WF97 (36) [539]; stratum 3 WF97 (30) [539]; stratum 4 BER011 [533], stratum 5: WF97 (17) [531]: sub-modern–mixed (*Table 6*)

Samples from strata 1 to 5 are composed of very mixed material and although stratum 1 (WF 97 (13)) is described as topsoil, the material appears to be mixed even in layer 5,[26] as detected by the presence of a charred olive fragment, legume fragments and some other smaller seeds.[27] All the other samples seem to confirm the cultivation of olives and grapes.

Stratum 6 WF97 (12) [531], WF97 (16) [531], WF97 (18) [531], WF97 (31) [537], WF97 (32) [537]: Late Antique (*Table 7*)

This layer (together with stratum 7) seems to have been the occupation layer that the roof-tiles had fallen on. A mixing of charred archaeological and sub-modern seeds has been noted. As explained, it could well be the movement of rodents, moles and so forth in the soil, which creates holes through which modern seeds trickle down. The charred plant material, therefore, must have been material dropped on the floor when the building was still standing. The presence of the olive is again almost everywhere, but there is an absence of crop plants,[28] which would be unexpected from a habitation site. It is possible that the structure was used for the storage of fuel,[29] or even fodder.

Stratum 7 BER001 [533], WF97 (11) [531], WF97 (24) [533], WF97 (26) [536], WF97 (34) [538]: Late Antique (*Table 8*)

Although this layer is the occupation level proper, it also seems to be a somewhat disturbed layer as it contains a large number of modern seeds. The only strong presence of cultivated crops seems to be the olive, whereas the fig, the grape, legumes and the hulled barley are modestly represented. The presence of weeds represents, most probably, by-products of stored crops just as in the previous stratum 6 and could well indicate the use of this area as fodder storage.

South-western trenches, 322, 428, 429, 430

Stratum 3 WF97 (44) [420]: Late Antique (*Table 9*)

This stratum is very disturbed, as can be seen from the table and in WF97 (44); only modern seeds were preserved.

Stratum 4 BER 004 [428], WF97 (6) [322], WF97 (20) [428], WF97 (21) [428], WF97 (23) [428],[30] WF97 (39) [322], WF97 (42) [322]: Late Antique (*Table 10*)

Although remains of certain species of plants are represented, they are very sparse and the layers must have been disturbed, as there are very many modern seeds. The only sample which contains a high presence of fragmented olives and other charred seeds of cultivation (weeds) is WF97 (39). Yet, as the olives could have been fragmented during excavation,[31] we could not interpret this material as fodder, feed or fuel, but rather as a cache of olive pits, either discarded or stored for other purposes.

Stratum 4 (WF97 (19) [641] (*Table 9*): is treated separately as it is the trench to the east of the Tower and tower door.

Although this stratum has been described as sub-modern, the archaeobotanical remains indicate a fairly consistent archaeo-

[25] It seems to be the type, which in Greek is called λελέκι, which would reap the crop collecting the stalk, too, whereas δρεπάνι would reap higher up on the stalk and would therefore concentrate on cutting the ears of cereals.

[26] The plough would/could have brought to the surface archaeobotanical material from the Late Antique deeper strata. Perhaps iron nails, hand stones and pottery are just evidence of this mixing of earlier layers.

[27] Reading the notebook and the accompanying finds, one gets the impression that it is a remnant of refuse. Many burnt and unburnt bones, charcoal, and even the mixture of archaeobotanical remains could well indicate a discard context.

[28] It is barley, wheat and other legume plants, which I have in mind, but instead there is the presence of oat, which is considered more of a fodder plant in Greece today. However, the status of that plant in those economies is still not exactly known.

[29] It is believed that olive fragments were used as fuel. At Eleutherna, Crete, olive fragments were noted from a Hellenistic house, House A. (Sarpaki 1994, 211).

[30] There were no seeds found in this sample.

[31] The edges of the fragments are not eroded and the breaks seem fresh; thus, it favours the assumption that fragmentation occurred during excavation and not in antiquity.

logical level with a fair amount of agricultural data. All of the plants expected from the Late Antique period are represented here and it seems very close to what we find in stratum 4, Tower trenches. Could these remains have been dispersed from a top floor or from the Tower itself?

From stratum 5 and 6 there are no archaeobotanical samples.

THE AGRICULTURE: THE MICRO-ENVIRONMENT

The earliest archaeobotanical remains from Pyrgouthi date to the Classical period (5th century) and were sampled from the western trenches. Unfortunately, very few archaeobotanical remains were retrieved (*Table 4*), as exceptionally little survived. After all it was a kiln site, where temperatures reached were so high as to destroy all organic remains.[32] Yet, the main crop plants present were already the olive (*Olea europaea*)[33] and some almond (*Prunus amygdalus*). We can, therefore, claim that the cultivation of the olive had a long and prosperous history in the Berbati Valley and presumably in the Argolid in general.[34] The other crop plant, which is believed to have had a presence, the grape (*Vitis vinifera*), is not visible in the archaeobotanical samples. This reflects either a true absence of grape cultivation at that time and place, or a problem of chance of preservation, as the grape has a low visibility in archaeobotanical remains in general.[35]

Evidence from the Late Hellenistic/Early Roman period (c. 1st century BC) was found in the western area too,[36] but very little can be said about agricultural practices due to a scarcity of environmental samples (*Table 3*). However, the possible emphasis on the olive[37] and the almond cultivation seems to have continued from the Classical period. The find of a neck of an amphora, stamped (ovoid stamp) with the letters OINO (wine) and an eight-armed star suggests wine might have been imported (non-local ware) but grapes could also have been cultivated for "coarser" wine and other grape products (see press-beds for wine (?). Its find near the kiln is indicative of the circulation of wine at that period. According to Arto Penttinen a macroscopic examination of its micaceous fabric indicates a clay source not consistent with Argive clays.[38] It would therefore make it exceedingly interesting to find the source of the clay in order to determine the origin of the ware and the wine[39] In other words was the wine coming in and/or going out of the Argolid area, and/or Corinth?

All of the remaining archaeobotanical material belongs to the Late Antique period (second half of the sixth century and the beginning of the seventh century AD).[40] None of the samples seems to be the product of human storage *per se*, although, of course, we cannot negate the possibility of storage for livestock or remains of stress food.[41] Even samples such as WF 97 (25) and WF 97 (29) (hulled barley), WF 97 (38) (macaroni/Persian wheat), WF 97 (35) (oat), which, due to the high number of one species of seeds, could be thought of as stored product, still seem to have admixtures of other 'environments', such as fuel (?), the olive fragments, or evidence of arboriculture, such as fig (*Ficus carica*), walnut nut (*Junglans regia*) (*Fig. 7c*), pomegranate (*Punica granatum*), carob (*Ceratonia siliqua L.*) (*Fig. 7a* and *b*) and even phrygana niches such as the mint family (*Labiatae*). One would assume that as fragments of olive pits and charcoal are present, surely there must have been olive production in the area not too far from Pyrgouthi, a site which is characterized by a paucity of other woods.[42]

As these samples come from various contexts and are not limited to human storage, it is of no importance to analyze the samples internally so as to determine their spatial distribution, or to detect stages as well as the nature of crop-processing activities within the rooms. It is also stepping on unstable ground to conclude the importance of crops by juggling their numerical presence. After all, we need to remember that only the Tower seems to have been destroyed by conflagration and only within this context did the fire preserve the presence of the plant remains at the time.[43] In all the other contexts, the plant remains were preserved as they had been trapped within firing events and therefore burnt or heated in other ways, such as in hearths or in the fuel from the hearth blowing away from it and into the surroundings, the firing of jars in order to disinfect from vermin, such as fumigation and so forth. It was, therefore, thought of as more important to quantify the number of samples that include the category of material specified (*Fig. 3*).

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32 They would reach a point when they do explode if they contain humidity or else turn to ash/dust.

33 There seems to be at least two varieties of olive, one very tiny such as are the olives for oil, and there is also the larger, possibly edible variety.

34 See (*Table 13* and mainly Corinth) for its high presence in the Sanctuary of Demeter and Kore. Read below the section on pollen, as well as the little evidence from other sites. In the valley, five large trapeta were noted, and 3 mortaria found close together, which might indicate that in the Roman period, large quantities of oil were produced at the same time (Forsell 1996, 341).

35 Sarpaki 1995, *passim*.

36 Penttinen, this vol.

37 The comparatively high presence of olive could also be somewhat fictitious if olive was used as a fuel, and might just represent the fuel used, especially as no sign of a destruction by fire was detected at Pyrgouthi except for the fire destruction in the Tower. On the other hand, it could also indicate the supremacy of olive cultivation (see plant macrofossil material from Corinth in Bookidis *et al*. 1999, esp. 20).

38 Penttinen, this vol.

39 A. Penttinen believes that the fabric is unlikely to have been of local origin. Pottery could have a secondary use as well, in that emptied jars could have been filled with other goods and consequently mislead the research.

40 For a lengthy discussion and bibliographical references on the choice of terms, see Hjohlman, this vol.

41 It is known that in AD 522 severe earthquakes shook Greece and among others that the city of Corinth was levelled (Topping 1972, 64). Between 541 and 543 the pandemic of bubonic plague hit the Levant and Europe, and this pestilence returned at least five times between 555 and 608 AD. Moreover, in the Late Antique period (Hahn 1996, 435) there seems to be a dearth of fine pottery in the valley, so it seems as if the region was isolated and self-sufficient and the farmers were, probably, tenant farmers.

42 It is important to mention that the charcoal analysis conducted by Maria Ntinou (this volume) shows that most of the wood is olive wood and *Juniperus* sp.

43 The reader has to keep in mind that charring the botanical material is the sole way to preserve it in the archaeological context.

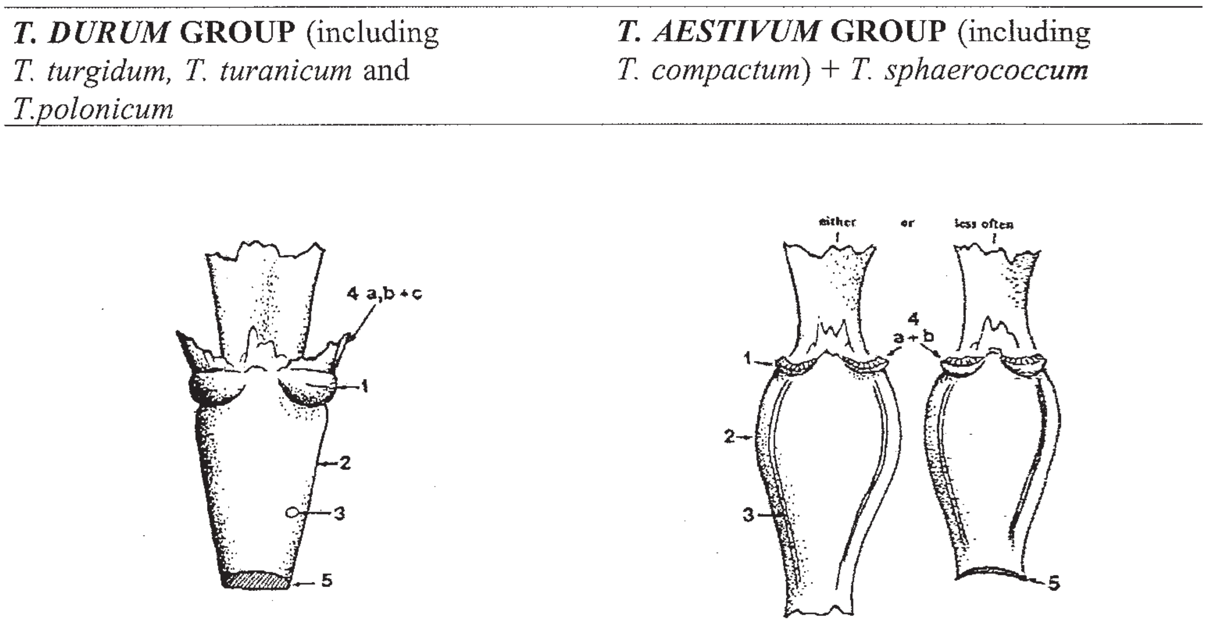

Fig. 2. Drawing of tetraploid (A) and hexaploid (B) rachis fragments showing the discriminant criteria for distinguishing between them (after G. Hillman 2001, 34–36) and compare with *Fig. 4a* and *b*.

From *Fig. 3*, it seems clear that the crop, which is dominant at the site, is the olive. This high presence could of course represent a real estimate of the situation, but due to the nature of these particular samples, it could also be misleading and not, perhaps, represent the true ratio of crops cultivated. This information would have been provided had our samples come from human and/or animal storage samples. Here we are possibly faced with a crop that would have had the highest rate of survival under these circumstances. This might be a pertinent, indirect indication that could justify our hypothesis that crushed olive stones might have been used as fuel.[44] This would have been the main reason – apart from the fact that olive cultivation could have been of paramount importance in the area – accounting for their high survival rate compared with other archaeobotanical remains, as it exposed them to the fire, which charred them.

The next most abundant group of crops seems to be the legume plants, exhibiting a wide diversity, as mentioned above. Some could grow in dry-farming regimes such as *Lathyrus cicera/sativus* (dwarf chickling), *Lathyrus clymenum* (Spanish vetchling), *Vicia ervilia* (bitter vetch), *Trifolium* spp. (the clovers), *Lupinus* sp. (lupins) and *Lens esculenta* (lentils), whereas others need somewhat more humidity such as *Pisum sativum* (the common pea) and *Vicia faba* (horsebean), which is often grown as an irrigated garden plant. There also seem to be some indeterminate legume plants. Their presence and their diversity show their importance in the agricultural practices, such as, possibly, rotation.[45] Probably, these are reflections of food habits in ways that are not, presently, and readily decipherable from the site of Pyrgouthi.

Cereal growing seems to be the third crop group in the possible order of importance.[46] As with the legume crops, there is a

Non-water-floated samples (n = 13)
- Olea (olive) 10
- Vitis (grape) 5
- Cereals (wheat & barley) 6
- Legumes (all varieties) 2

Water-floated samples (n = 44)
- Olea (olive) 28
- Vitis (grape) 5
- Cereals (wheat & barley; oat & brome) 13
- Legumes (all cultivars) 15
- Weeds, segetal and ruderal plants 29

Fig. 3. Number of samples in which the olive, the grape, the cereals, the legumes and the weeds are present.

[44] It is well known that in many parts of Greece, olive stones which come out of an olive mill, after being pressed for olive oil, are used as fuel (‘spitha’ in western Crete). This is known as a very good fuel, especially as it does not smoke. This is a very important factor to consider for houses, which had small openings. Another use would have been as animal feed, especially for pigs, as some of the pulp would have still contained soft tissue and oil. Other uses have been noted (Mattingly 1996, 224) such as its use for lighting (for lamps see Hjohlman, this vol.) where Mattingly has estimated, by experiment, that 1 litre of oil could provide 134 hours of light with a single-nozzled lamp. Its other uses are equally important such as the black liquid that remains after pressing (amurca), which could be used as fertilizer, moth proofer (Mattingly 1996, 225), wood preserver, water proofer, and even insecticide. It is therefore important not to underestimate, undervalue and overlook that oleoculture does provide highly prized products and even its by-products have an economic value.

[45] For the importance of the legumes in the agricultural cycles, see Sarpaki 1992, passim; Garnsey 1999, 15; Flint-Hamilton 1999, 171–175.

[46] Hubbard 1975, 203; Hubbard & Clapham 1992, where on p. 131 he states how aware one should be when quantifying fossil remains and

large variety of species. The following crops seem to have been grown independently or as maslin admixtures: *Triticum dicoccum*[47] (emmer wheat), *Triticum durum*-type (a tetraploid type), *T. turgidum* s.l./*T. cf. carthlicum* (Persian wheat), *T. cf. aestivo-compactum* (bread wheat),[48] (*Hordeum vulgare* (hulled–six-row), *Avena sativa* s.l. (oat),[49] *Bromus* sp. (brome), *Secale* sp. (rye), and cf. *Panicum* sp. (millet). The last three cereals are noted in the order of their relative presence, which is minute, but nevertheless exists.

Of all those cereals, the only ones which have been found in large enough numbers to justify the term 'crop' at Pyrgouthi are hulled six-row barley, Persian wheat, a free-threshing tetraploid wheat other than Persian wheat, a hexaploid wheat[50] and oats. All the others are found as contaminants within other crops but indirectly can be considered as having been crops cultivated in their own right at this particular site or in nearby sites.

Hulled six-row barley is a hardy cereal. It withstands very dry conditions and thus can survive with very little rainfall. It was the cereal cultivated *par excellence* in the driest areas of Greece until recently. It also grows on poor soils and matures earlier than any of the other cereals, so that it is mature in areas of early summers. Due to these qualities it was obviously a principal crop in numerous areas of Greece and the Mediterranean and, therefore, an important element of human and domestic animal diet. Status-wise it was considered the poor relative of wheat, and would have been considered the staple crop for the less well-to-do people.[51]

The most enigmatic presence is the find of the "possible" Persian wheat (*T. cf. carthlicum*).[52] My hesitancy, at this stage, in regard to this identification is multi-faceted. Except for its claimed presence in Neolithic Britain (see below), it has not been identified archaeobotanically, so far, outside its own area, which covers the mountains of the Caucasus, Georgia, Armenia, east Anatolia,[53] and west Iran.[54] In the Turkish-Caucasian region, it is known to be grown as a grain crop up to an elevation of 2100 m. The archaeobotanical references to this wheat comes mainly from the Transcaucasus.[55] *Triticum carthlicum* was identified on the basis of ears of grain from the Eneolithic and Bronze Age,[56] but as no drawings of these finds have been published,[57] archaeobotanists in the west are still not convinced about the archaeobotanical presence of this cultivar.[58] The identifications therefore are much disputed. More recently McLaren has tried to back up morphological classification by implementing infrared spectrometry (IR) and she believes that it is an ideal technique suitable for cereal grain analysis as it 'unambiguously', according to her, identifies a single grain to species or sub-species level.[59] Using the IR technique she confirmed finding *Triticum carthlicum* from the Neolithic site of Balbridie. However, this method is still in an experimental stage and there is no general consensus as to its success. The spectrum illustrated in her article refers to *T. aestivum* grains and not *T. carthlicum*;[60] a specimen of *T. cf. carthlicum* from the site of Pyrgouthi, which was submitted to McLaren for IR has not yet provided results. Another analytical method for identifying wheat cultivars is DNA, but this method has met only limited success so far. Therefore, here the identification of the wheat from Pyrgouthi remains a tentative one (*Figs. 4a* and *b*, *5a* and *b*, and *6a* and *b*). What is important to stress here, at this stage, is that the specimens from Pyrgouthi seem to be quite different from the other turgidum wheats so far identified (*Fig. 2*).[61]

goes on to assert that there are conditions "when numbers (or percentages) degenerate into nonsense".

[47] We cannot exclude the presence of *T. monococcum* (einkorn) as well, but as we have found no chaff of that wheat and grain kernels are not generally identifiable to variety, we have to assume – with reservations – its absence.

[48] The presence of bread wheat *(T. aestivo-compactum* s.l.*)* is inferred not because of the presence of hexaploid rachis remains but because of caryopsis morphology, and, therefore, this hypothesis remains tentative.

[49] Sample WF97 (35) is mainly an oat crop. Samples WF97 (15), WF97 (25) and WF97 (38) have a fair number of examples of Persian wheat or are mixed crops. The presence of *Hordeum distichum* also cannot be excluded. Samples WF97 (25) and WF97 (29) are, mainly, barley crops.

[50] This is based on observation of wheat grains and not rachis, which would have been more correct, as no hexaploid rachis is present, but the grains seems typical – if one is allowed to use this term – of *T. aestivo-compactum*.

[51] Garnsey 1999, 119 for the mention in texts from the Roman period which point to the low status of barley and its continued consumption in the Greek countryside in the late 2nd and early 3rd centuries AD, whereas in Classical Greece, barley was a staple food for most Greeks. This observation is interesting in its own right, in order to observe how the status of some food cannot be treated as diachronically stable, even in the same geographic area.

[52] All the credit for this identification should be given to Gordon Hillman without whose help I would have been unable to identify it so closely. It is identified as an ancient and obsolete tetraploid species (al Hakimi & Monneveux 1998, 277.

[53] Personal communication, where D. Zohary mentioned having seen this wheat in several places in east Turkey.

[54] Personal communication by Krystyna Wasylikowa. Also see Uphof 2001, 528.

[55] Wasylikowa *et al*. 1991, 233–235. However, Hillman *et al*. 1992, 199 refers to the possibility that *T. carthlicum* may have been more widespread in the past.

[56] Wasylikova *et al*. 1991, 233 and 235, where it seems to span the whole Bronze Age from the E.B.A, M.B.A & L.B.A. The archaeobotanical remains described came from Georgia and Armenia and were published by G.N. Lisitsyna & L.V. Prishchepenko, *Paleoetnobotanicheskiye nakhodki Kavkaza i Blizhnego Vostoka*, Moskva, 1977, but I was unable to find this reference.

[57] Only caryopses are drawn in Rushishvili 1988, 22, but, as we know, they are of no definite help in identifying the cultivar.

[58] Rushishvili 1988, 19–28 refers to the find of *T. carthlicum* from the site of Arukhlo (6th–5th centuries BC – finds not very many and not well preserved), but at the site of Sioni (3rd millennium BC), a large number of rachis fragments were found. The measurements convinced the author that they were the Persian wheat. A third site is Digomi (2nd millennium BC) where spikelet remains were also found with the specific morphological characteristics of *T. carthlicum*. Strangely enough even in Rusishvili 1991, 285–294, where she did illustrate (photographs) the morphological characters of the wheat, which she identifies as *T. carthlicum*, and yet it is not clear which characters were identified as belonging to the latter cultivar. See discussion on wheat distribution in Nesbitt 2001, 39.

[59] McLaren 2000, 91–100.

[60] McLaren 2000, 94, fig. 9.1.

[61] Characteristics were provided by Hillman in 2001, 27–36. Personal communication from Gordon Hillman is that *T. carthlicum* has a rachis that is intermediate between the hexaploids such as *T. aestivum* and the tetraploids such as *T. turgidum*. I believe we have to undertake a thorough study of many populations of the various tetraploids

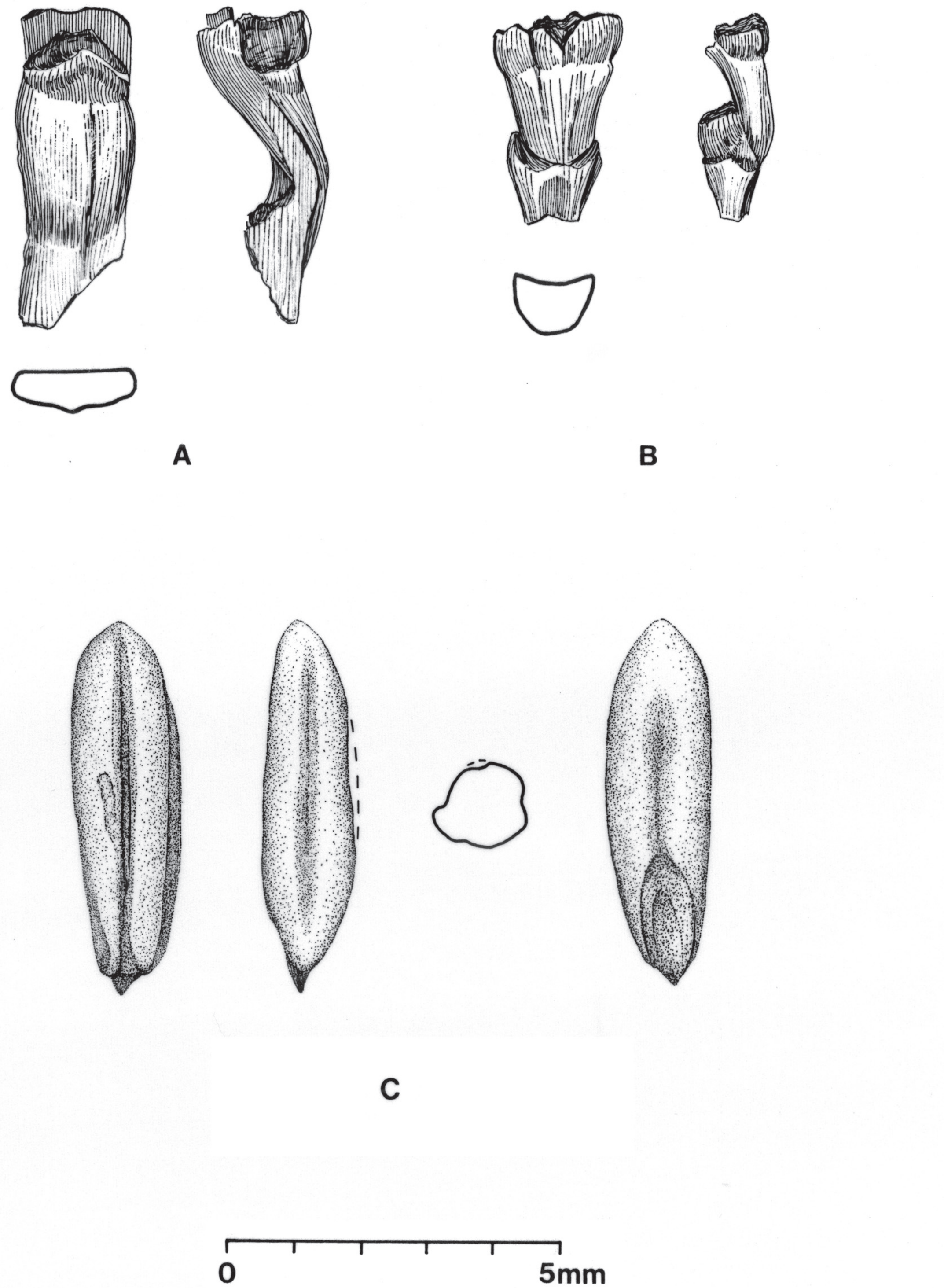

Fig. 4. Drawing of (a) rachis from the so-called *Triticum cf. carthlicum* (durum-type wheat) and compared to (b) the 'typical' tetraploid wheat; (c) *Avena sativa* s.l. (oat).

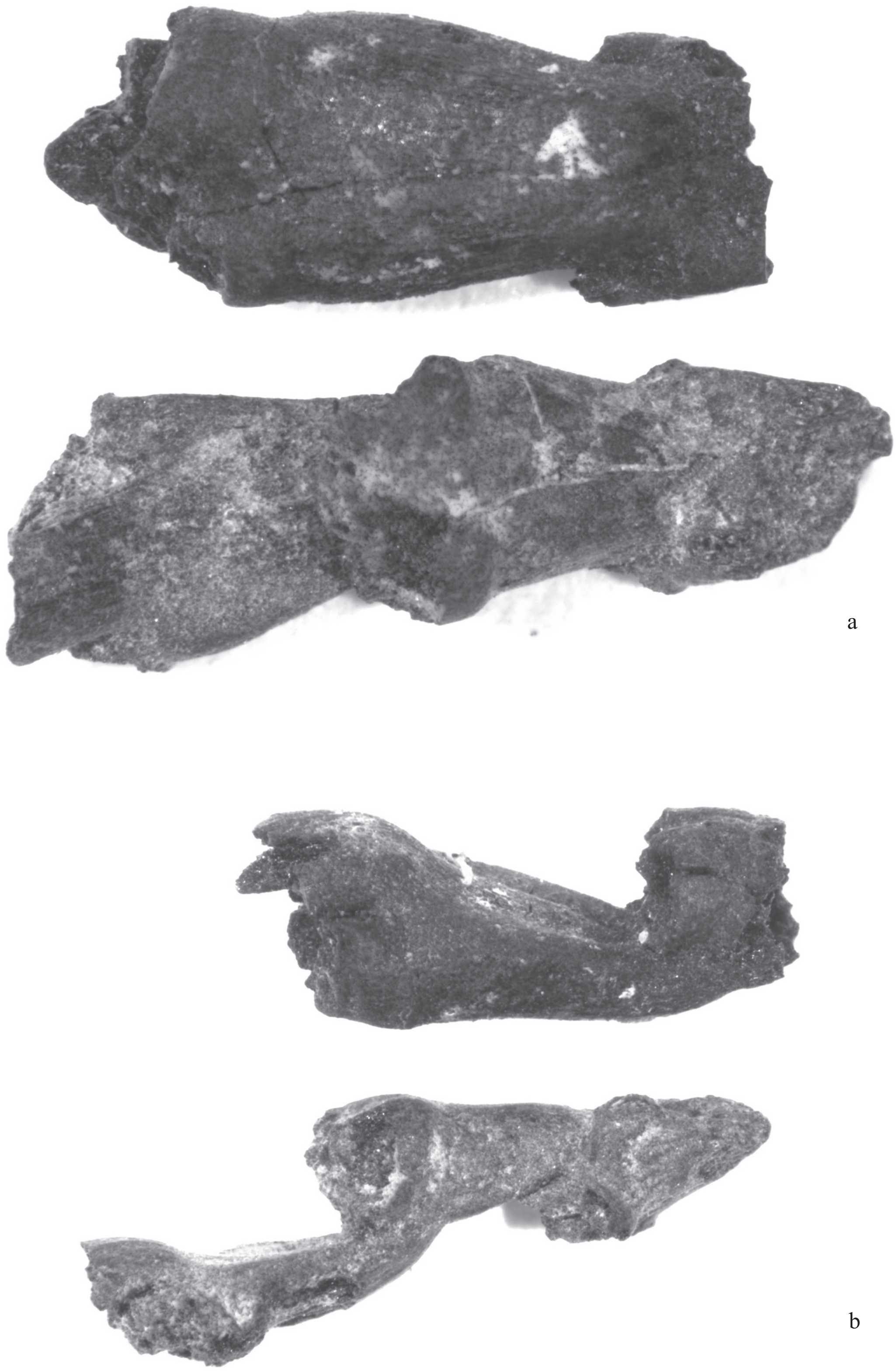

Fig. 5. Photograph of rachises of (a) ‘typical’ tetraploid wheat (sample WF97 (38)), external face view. (b) Photograph of same rachises in lateral view.

Fig. 6. Photograph of *Triticum cf. carthlicum* rachis (WF97 (38)), (a) external face view and transverse section; (b) *Triticum cf. carthlicum*, lateral view of rachis.

The questions, which spring to mind, are many. What does this find mean in terms of cultivation or crop importation, in case it is a product of trade? Was this a trend, which covered a short or a long period of time? All these questions are extremely important with a multitude of socio-economic effects and counter-effects that need to be answered separately for each independent period and for each geographical region.

Persian wheat is an early maturing species, which can grow at high altitudes,[62] can endure water stress due to its low leaf area, and yet has good spike fertility and a high level of protein content.[63] Further, it is important to note that it is also resistant to fungus diseases. It is of interest though to observe its absence from the Greek wheats cultivated in pre-War Greece.[64] Yet, had it been cultivated in the Berbati area, it could well have grown in the mountains surrounding the plain.

Regarding wheat, it is known from written texts that it was imported to the large cities or specially purchased and was much sought after since the prehistoric period. [65] Garnsey believes that in the early Christian era, in the countryside, bread was not eaten often at all. [66] Wheat, according to him, would have been marketed in the city. The traffic of foodstuffs was a huge and viable part of the economy and was in the hands of private traders.[67] We know, for example, that a wide spectrum of goods was acquired from the Black Sea area and that wheat was also imported.[68] In the 5th and 4th centuries, Athens had to import vast quantities of wheat from the Black Sea and exchanged a surplus of olive oil. The same transactions could have taken place in other cities in the periphery such as Argos or Corinth, and in the later periods as well, considering that olive cultivation was thriving at Pyrgouthi (see the omni-presence of olive in the archaeobotanical samples). Is the presence of by-products (rachises) of Persian wheat at Pyrgouthi an indication that Pyrgouthi had cleaned a crop and had traded it to the city?[69] It is believed that the presence of rachises is an indication of the local cultivation of this naked wheat in the neighbourhood of Pyrgouthi rather than the importation of this crop. Naturally, it could also have been imported for seed crop in ears so as to protect the grains from insect attack and moss while being transported. The transportation could have taken weeks. It is known that the Classical farmhouse tower was not only for defence but also served as living quarters and storage. It provided some insurance for the land-owning class against robbery and pillaging.[70] Thus wheat could have been stored there before being traded or used.

Avena sativa s.l. (common oats) (*Figs. 4* and *7*) is a cereal, which was cultivated mostly, one would assume, for fodder, although very little of its consumption by humans in antiquity is known. A Byzantine dietician was to write that this food was not fit for humans but only for cattle,[71] except when extreme famine dictates that bread be baked from common oats, as it was supposed to have an unpleasant flavour. However, so far, one knows archaeologically very little about its place and importance within agriculture in Greece in the Classical period and down to Late Antique times.

Jardé[72] claims that rye (*Secale cereale*) was unknown to the Greeks,[73] but *Panicum* sp. (millet) was one of the minor cereals of antiquity. At Byzantium a millet porridge was made.[74] As very few classical sites have been sampled for archaeobotanical remains, we need to investigate these crops much further before any conclusions can be reached about their relative importance regarding their status within the agriculture of the relevant periods. The fact that they are not mentioned, though, indicates indirectly their relative unimportance and/or low status (see *Table 14* for the presence of these 'minor' crops).

AGRICULTURAL PRACTICIES

It is impossible at this stage to suggest definite agricultural practices but the presence of an equal relative number of cereals and legume crops would indicate some form of rotation. The presence of trees as well (see above) and mainly the olive could well have made viable a form of double-cropping, as seen in the Argolid up to recent times.[75]

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and hexaploids in order to refine even more what Gordon Hillman has already done. The find of "a new glume wheat" (Jones, Valamoti & Charles 2000, 133–146) as well as finds such as *T. cf. carthlicum* could easily be misidentified or their differences not stressed enough and, thus, could be considered lost within publications. In a personal note to me, Professor D. Zohary wrote the following about *T. carthlicum*: "*T. carthlicum* is different from all the other tetraploid AABB free-threshing forms as to the genetic control of the free-threshing trait. While in all other 4X naked AABB cultivars, free threshing is brought about by a multiple gene system, in *T. carthlicum* it is governed principally by a single mutation q. This is the same gene that controls free threshing in the hexaploid bread wheat, *T. aestivum*. This single gene actually transforms a hulled spelta-type wheat into a naked aestivum-type one. No wonder that *T. carthlicum* (which is the only tetraploid which carries q) looks morphologically intermediate between the 4X durum and the turgidum forms and the 6X aestivum cultivars. This also reflects itself when rachis segments of all these free-threshing wheats are compared." In Hillman *et al*. 1992, 204 Hillman refers to morphological criteria, which do exist – and he meant those that are used by him I suppose – in order to identify *T. carthlicum*, but unfortunately to this day, the criteria have not yet been published.

62 Rusishvili 1988, 22.
63 Damania *et al*. 1998, 275.
64 Papadakis 1929.
65 Garnsey 1999, 120. This, of course, does not claim to be exhaustive.
66 Garnsey 1999, 121.
67 Garnsey 1999, 30.
68 Noonam 1973, 241, where he mentioned that no grain export from Olbia to Greece can be proved before the time of Herodotus (c. mid-5th century BC); Lohmann, 1992, 54; Dalby 1996, 129.
69 No clean crop of wheat has been found at Pyrgouthi. Therefore, could we assume that perhaps this lack of wheat in the large cities such as Athens was superseded by importing from areas such as Berbati, rather than from the Black Sea, when political and economical unrest occurred, which justified a more intensive "internal trade" rather than an overseas one?
70 Lohmann 1992, passim.
71 Dalby, 1996, 90.
72 Jardé 1979, 4.
73 Garnsey 1999 does not mention it in any form. The same goes for Isager & Skydsgaard 1995, and Dalby 1996.
74 Dalby 1996, 197; Koukoules 1952. The themes dealt with include foods and drinks, meals and symposia, dance, the agricultural life, bee keeping, animal husbandry, fishing, life connected to the sea and hunting. Koukoules 1952, 130, refers to an alcoholic drink made from millet and brome.
75 van Andel & Runnels 1987, 105.

The ard would surely have been used, as a Late Antique iron ard share (see Hjohlman this volume, catalogue no. 280) has been unearthed, and as we know, the ownership of an ard is by itself an indication of a fairly well-to-do farmer.[76] The shape of this ard, if not dictated by the local typology,[77] would indicate to my knowledge its use in a stony environment, as it is fairly pointed, whereas the ones used in soft soils are fairly broad.[78]

The reaping of the crop – at least for some crops – was done with an iron sickle (see Hjohlman this volume, catalogue no. 153). Some of the crops could have also been uprooted, although we have no archaeobotanical data for such a harvesting method.[79] Moreover, there were no fragments of cereal culms, indicating perhaps that only the ears were cut, leaving behind the stubble for animal, and especially sheep, grazing.[80] Sections of the stubble, the roots, the weeds and animal dung could have fertilized the fields. The high degree of contamination of the crops, either by chaff by-products and/or by weeds, is more of an indication that the site was a crop-producing area rather than a crop-consumption one, and seems typical of what one would expect from a farm.

The crop would have been probably threshed on a threshing floor but none was found in the Berbati survey.[81] Another implement, which could be indirectly detected from the flint flakes, is the threshing sledge and it would be interesting to see what the chipped stone specialist has had to say.[82] Some believe though that the threshing sledge is an invention later than the Classical period.[83] But Foxhall seems to have identified a word, which is thought by her to refer to this implement and perhaps, the existence of very large threshing floors (15–24 m. in diameter) [84] would make it a reasonable guess. Although, of course, harrows[85] ('Svarna' as they are called in some areas in modern Greece) could equally have been used. They could have been made totally of wood and would have left no indication of their presence. Another method for threshing would have been to use several animals attached in a line to a pole in order to tread on the grain, just as is the practice in the southern Cyclades.

THE ARCHAEOBOTANICAL CONTEXT: SEEDS FROM OTHER SITES OF THE SAME PERIOD

Archaeobotanical remains found from nearby (*Table 13*) and more distant (*Table 14*) Classical and later-period sites are, on the whole, poor. It is true that not all of these sites were sampled systematically for environmental remains. The presence of olives might be more than fortuitous, and might reflect a more general trend.

An interesting point is the presence of a crop of rye from Byzantine Agios Mamas, as well as a crop of chickpeas from the same site. The wide spectrum of crops grown seems to follow the trend which existed already in prehistory and which is seen at Pyrgouthi as well: that is, to grow a multitude of crops in order to minimize potential damage or loss when/if climate or other perils harmed the crops.

At Byzantine Sparta turnip (*Brassica rapa*) [86] has been identified from its tuber and it is more probable that it was grown as a vegetable and not so much as an oil plant. This is an exceptional find as tubers are rarely preserved in archaeological contexts. [87]

THE POLLEN: THE MACRO-ENVIRONMENT

The pollen diagrams from the Messenian area,[88] which produced data from both Osmanaga and Kaïafa, show interesting results. For Osmanaga the period (radiocarbon dates) between (I-1951) 60 BC and (I-1950) 1130 AD indicates an increase of *Olea* (olive), grasses, *Pistacia* sp., *Pinus* sp., (pine), and *Erica*-type (heather), whereas *Quercus* sp. (oak) dramatically decreases. This could mean that in agriculture there was an emphasis on olive and cerealia cultivation (no *Vitis* (grape) pollen is mentioned), although the vine could have grown and would still be invisible in the pollen counts.[89] Another possible explanation could be a decrease of animal husbandry, especially of animals[90] that would thrive on maquis plants, such as heather and *Pistacia* sp.,[91] as well as permit the regeneration of forests

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[76] In order to own an ard, which is a composite tool, one would have had to know carpentry or have it made by a carpenter. Moreover, access to a metalworker would have been deemed necessary for nails, the ardshare and the harnesses. Last and not least, the farmer would have needed to own work animals. This is the reason why some ethnographic work done at Santorini in the 1980's by the author has shown that a few farmers only in the village, who offered their services to the others, owned the ard. They were repaid by other services and/or labour or paid in kind.

[77] Hereby I mean the local typology of shares used in ards.

[78] Sweet 1960, 69.

[79] Uprooting can be detected in the archaeobotanical data by the presence of culm bases. The culm bases found at Pyrgouthi are exceptionally few in number.

[80] Although the presence of the sickle-type named λελέκι would indicate reaping the plants low. On the other hand zooarchaeological data justifies rather the larger number of sheep compared to goats.

[81] Threshing floors seem to make their appearance at least from the Late Bronze Age (Sarpaki 2000, 657–680). For later periods, see Isager & Skydsgaard 1995, 55–56; Lohmann, 1992, 58 and several references in Wells (ed.), 1992.

[82] Surely the total absence of chipped stone, typical sledge stones, would be a secure indication of the non-existence of such a tool.

[83] Isager & Skydsgaard 1992, 53

[84] Lohmann 1992, 42.

[85] Lohmann 1992, 42.

[86] Hather, Peña-Chocarro & Sidell 1992.

[87] Many tubers, roots and other organic remains are not even detected in Greece, due to the fact that charcoal is rarely sorted and studied.

[88] Wright 1972.

[89] An observation by S. Bottema (Bottema & Sarpaki 2003, 735) is that grape pollen is very thin on the ground when it comes from cultivated grape, whereas wild grape seems to produce more pollen.

[90] Here the goat especially comes to mind.

[91] *Pistacia* sp. is a species that grows well on degraded soils (by heavy agriculture and over-grazing) and could well repopulate overgrazed areas, which are left to revive their floral populations. Even if animal husbandry on a household level did exist, it might have been conducted on a household scale in that a few animals could have been attached to a peg in a field and, in the worse days of winter, fed in stables. (See Mylona, this vol., for a discussion of this point).

such as pine.[92] The pig population (see Mylona, this vol.) is also fairly high, which might explain the presence of carob pods, whose usage – at least one usage – could have been for stalled animals.

The Kaïafa diagram has two radiocarbon dates close to the period that interests us: (I-2864) 270 AD and (I-2865) 300 AD. The diagram does not show land clearance for the period concerned and olive is present throughout at 10–20 percent.[93] Yet, we have to keep in mind that these studies refer to the Messenia region and we cannot conclude that the economic exploitation of the landscape was comparable in the Argolid. What we can claim is what factors were at play, at the same period, in a nearby area.

In the Argolid, pollen for that period was studied from the Thermisia area,[94] the sites of Limni Saktouri, and Porto Kheli Bay, where Sheehan had detected that after 2,700 b.p. (Archaic and Classical Periods), it seems that olive cultivation became very important and reached a peak around 2000 b.p. (Late Hellenistic–Roman Periods).[95] It is important to note too that the evidence for maquis vegetation (*Pistacia* sp., *Ericaceae*) is scarce in sediments between 2000 and 1200 b.p. (Roman and Late Antique periods), a factor that might justify the hypothesis that animals were not customarily kept in flocks but rather stalled as the need required.

The pollen evidence from Kiladha Bay strongly points to an increase in precipitation for the Argolid during Zone II (after 3500 b.p.).[96] Moreover, van Andel & Sutton claim, that streamflood deposits occurred about 300 BC to 50 BC (as dated by pottery).[97] These deposits can occur when the climate becomes wetter or if existing terracing is neglected: they proposed the latter possibility, as there was no evidence then for an increase in precipitation. Now the added evidence of the pollen for an increase in rainfall, forces Bottema to believe that these streamflood deposits could have been the outcome of joint or single events, such as increased precipitation as well as a neglect of terracing.[98]

Lake Lerna produced a diagram whose dating is still uncertain but, broadly speaking, it is in the period concerned. It shows that *Olea* and *Juglans* both display a continuous curve, and could have possibly been cultivated.[99]

The pollen diagrams indicate that in the Argolid, crops could have grown on the piedmont plain or on valley floors, whereas on the steeper slopes of mountains, forest could have still been present.[100] However, one would have expected the olive groves to have clad the slopes around the Berbati valley and perhaps more dispersed olives could have populated the valley itself as well, interspaced with other trees such as almond,[101] walnut, and pomegranate, as they do now in the Fourni valley.[102] A characteristic motif is also the growing of olive trees and some other fruit trees in the open cereal and/or legume valley fields. As competition between olives and cereals fares well on the valley soils, it is believed by Gavrielides that in the past, vineyards, too, could have shared this competition.[103]

CONCLUSIONS

The site of Pyrgouthi has definitely enriched our knowledge regarding the cultivated plants. We can claim that the possible presence of *Triticum cf. carthlicum* (Persian wheat) indicates a direct or indirect communication with the Black Sea continuing perhaps to the later periods. On the other hand, this crop could equally well have been grown indigenously. It could well be that the ports of Corinth and/or Argos were still importing produce, or it would have eventually come through Athens.[104] However, for the crop found at Pyrgouthi, it is believed that it was locally grown for the reasons explained above, but whatever was happening, that is, whether the agricultural produce itself was imported or only the seed corn, one way or another, it reached the periphery and was not confined to Athens alone. This is enrichment of our knowledge, as most of the preserved Classical written sources were Athenian-based.

Another important contribution is the presence of oat crops (*Avena sativa* s.l.), thus enriching the spectrum of cultivated crops, together with other fruit crops such as walnut (*Junglans regia*) (*Fig. 7c*), pomegranate (*Punica granatum*), carob (*Ceratonia siliqua* L.) (*Fig. 7a* and *b*) and Spanish vetchling (*Lathyrus clymenum*). The spectrum of weed plants has increased, too,[105] and these could eventually inform us on crop processing at the site, and especially a farm site.

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[92] See the study of bones by Mylona, this vol., where among the distinguishable bones of the group named conventionally sheep and goat sheep are twice as common as goats (see also Hjohlman, this vol.). We know that these two animals have different eating habits, whereby the goat would harvest phrygana, maquis and tree vegetation and would endanger the cultivation of trees among which is the olive tree, whilst the sheep would eat the stubble on the fields and would feed happily on weeds and grasses. Perhaps it is no coincidence when in the archaeobotanical material no culms of cereals or legumes were found.

[93] Wright 1972, 198.

[94] Sheehan 1979, 14.

[95] Sheehan 1979, 46–47. In this case it would be no coincidence that the products of the olive such as wood and stones would have been used as a major fuel.

[96] Bottema 1990, 117–138.

[97] van Andel & Sutton 1987.

[98] It is strongly believed that the abandonment of terraces is a particularly important factor enhancing erosional processes leading to features that are frequently blamed on the voracious appetite of the goat (Forbes & Koster 1976, 119).

[99] Jahns 1990, 298, where he states that in the Late Classical and Early Hellenistic period, the farming concentrated on olive production, and he visualizes a mixed regime of farming and small-scale animal husbandry prevailing in the southern Argolid, compared to the one proposed for Classical Attica.

[100] Bottema 1990, 129.

[101] In the Peloponnese, in the Fourni valley, it was noted that where the terrain was more irregular or steeper, more olive trees grew (Gavrielides 1976, 148). It is also possible that vines grew side by side with olives just as they did in Byzantine time. See Bryer 1986, 47 and 78, where he claims that vines were allowed to run in olive groves or propped up rather than trellised.

[102] Gavrielides 1976, 148.

[103] Gavrielides 1976, 148, where many of the place names had connections to vine cultivation.

[104] Unfortunately, no Persian wheat has been found in Athens. All that we know about the importation of wheat is through written sources.

[105] It is important to note that none of the sites studied so far has the variety of weeds that Pyrgouthi provides. Firstly, the sites excavated a long time ago have only grab samples detected visually. Moreover, the sites examined more recently have been water floated with fine meshes of 0.5 mm. and/or down to 250 microns and thus trap most of the weed seeds.

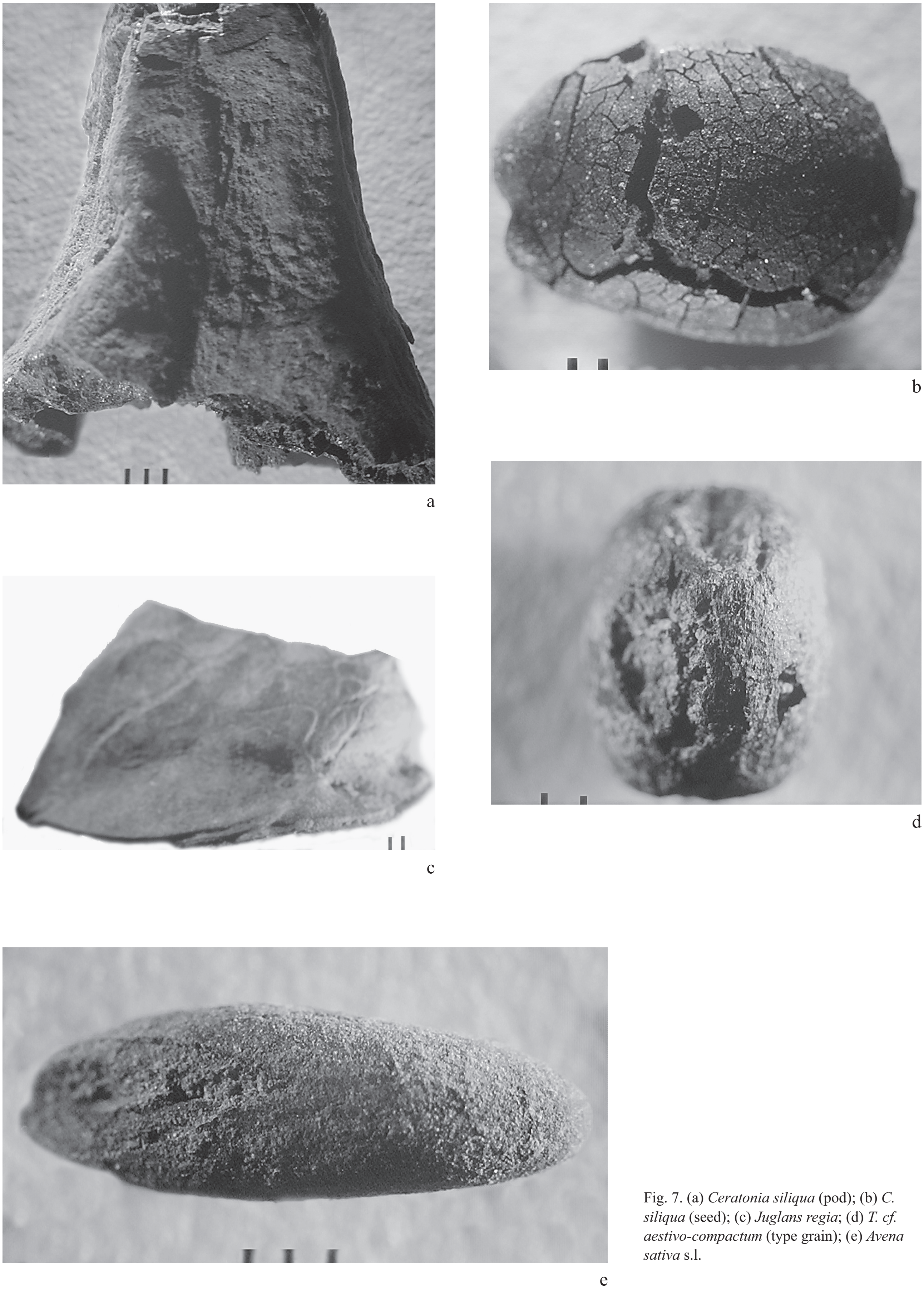

Fig. 7. (a) *Ceratonia siliqua* (pod); (b) *C. siliqua* (seed); (c) *Juglans regia*; (d) *T. cf. aestivo-compactum* (type grain); (e) *Avena sativa* s.l.

The importance of the olive in the Berbati area is stressed once again together with other data, as pollen was the sole provider of information so far. It is interesting to note, too, that olive stones after pressing must have been used as a source of fuel in the countryside. This could have been a supplement to, or substitute for, wild wood resources, and could be accepted as some form of passive conservation.

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BIBLIOGRAPHY

Amouretti, Brun & Eitam (eds.) 1993 — M.-C. Amouretti, J.-P. Brun & D. Eitam (eds.), *La production du vin et de l'huile en Mediterranée* (BCH Suppl., 26), Paris 1993.

van Andel & Runnels 1987 — T.H. van Andel & C. Runnels, *Beyond the Acropolis: a rural Greek past*, Stanford 1987.

van Andel & Sutton 1987 — T.H. van Andel & S.B. Sutton, *Landscape and people of the Franchthi region* (Excavations at Franchthi Cave, Greece, Fasc. 2). Bloomington and Indianapolis 1987.

Behre & Oeggl (eds.) 1996 — K.-E. Behre & K. Oeggl (eds.), *Early farming in the Old World*, Berlin 1996.

Blitzer 1993 — H. Blitzer, 'Olive cultivation and oil production in Minoan Crete', in Amouretti, Brun & Eitam (eds.) 1993, 163–176.

Bookidis *et.al*. 1999 — N. Bookidis, J. Hansen, L. Snyder & P. Goldberg, 'Dining in the sanctuary of Demeter and Kore at Corinth', *Hesperia*, 68, 1999, 1–54.

Bottema 1990 — S. Bottema, 'Holocene environment of the Southern Argolid: a pollen core from Kiladha Bay', in Wilkinson *et al*. (eds.) 1990, 117–138.

Bottema, Entjes-Nieborg & van Zeist (eds.) 1990 — S. Bottema, G. Entjes-Nieborg & W. van Zeist (eds.), *Man's role in the shaping of the Eastern Mediterranean Landscape*, Rotterdam 1990.

Bottema & Sarpaki 2003 — S. Bottema & A. Sarpaki, 'Environmental change on Crete: a 9000 year record of Holocene vegetation history and the effect of the Santorini eruption', *The Holocene* 13(5), 2003, 733–749.

Bryer 1986 — A. Bryer, 'Byzantine agricultural implements: the evidence of medieval illustrations of Hesiod's *Works and Days*', *BSA* 81, 1986, 45–80.

Caligari & Brandham (eds.) 2001 — P.D.S. Caligari & P.E. Brandham (eds.), *Wheat taxonomy: the legacy of John Percival*, London 2001.

Dalby 1996 — A. Dalby, *Siren Feasts: a history of food and gastronomy in Greece*, London 1996.

Damiana *et al*. (eds.) 1998 — A.B. Damiana, J. Valkoun, G. Willcox & C.O. Qualset (eds.), *The origins of agriculture and domestication: the Harlan Symposium* (ICARDA), 1998, 273–279.

Dimen & Friedl (eds.) 1976 — M. Dimen & E. Friedl, *Regional variation in Modern Greece and Cyprus: toward a perspective on the ethnography of Greece*, New York 1976.

Fairbairn (ed.) 2000 — A.S. Fairbairn (ed.), *Plants in Neolithic Britain and Beyond*, Oxford 2000, 91–100.

Flint-Hamilton 1999 — B. Flint-Hamilton, 'Legumes in ancient Greece and Rome. Food, medicine or poison?', *Hesperia* 68, 1999, 371–385.

Forbes & Koster 1976 — H. Forbes & H.A. Koster, 'Fire, axe and plow human influence on local plant communities in the southern Argolid', in Dimen & Friedl (eds.) 1976, 109–126.

Forsell 1996 — R. Forsell, 'The Roman period', in Wells (ed.) 1996, 285–343.

Garnsey 1999 — P. Garnsey, *Food and society in Classical Antiquity*, Cambridge 1999.

Gavrielides 1976 — N. Gavrielides, 'The impact of olive growing on the landscape in the Fourni valley', in Dimen & Friedl (eds.) 1976, 143–157.

Hahn 1996 — M. Hahn, 'The Early Byzantine to modern periods', in Wells (ed.) 1996, 345–451.

al Hakimi & Monneveux 1998 — A. al Hakimi & P. Monneveux, 'Utilization of ancient tetraploid wheat species for drought tolerance in durum wheat (*Triticum durum desf.*)', in Damiana *et al.* (eds.) 1998, 273–279.

Hamilakis 1996 — Y. Hamilakis, 'Wine, oil and the dialectics of power in Bronze Age Crete: a review of the evidence', *OJA* 15, 1996, 1–32.

Hansen, forthcoming — J. Hansen, 'Plant remains from Isthmia', forthcoming in *Isthmia* publication series.

Hather, Peña-Chocarro & Sidell 1992 — J.G. Hather, L. Peña-Chocarro & E.J. Sidell, 'Turnip remains from Byzantine Sparta', *Economic Botany* 46, 1992, 395–400.

Hillman *et al*. 1992 — G. Hillman, S. Mason, D. de Moulin & M. Nesbitt, 'Identification of archaeological remains of wheat: the 1992 London workshop', *Circaea* 12, 1992, 195–209.

Hillman 2001 — G. Hillman, 'Archaeology, Percival and the problems of identifying wheat remains', in Caligari & Brandham (eds.) 2001, 27–36.

Hubbard 1975 — R.N.L.B. Hubbard, 'Assessing the botanical component of human palaeoeconomics', *BICS*, 1975, 197–205.

Hubbard & Clapham 1992 — R.N.L.B. Hubbard & A. Clapham, 'Quantifying macroscopic plant remains', *Review of Palaeobotany and Palynology* 73, 1992, 117–132.

Immerwahr 1992 — H.B. Immerwahr, 'New wine in ancient wineskins: the evidence from Attic vases', *Hesperia* 61, 1992, 121–132.

Isager & Skydsgaard 1995 — S. Isager & J.E. Skydsgaard, *Ancient Greek agriculture: an introduction*, London & New York 1995.

Jacomet 1987 — S. Jacomet, *Prehistoric cereal finds: a guide to the identification of prehistoric barley and wheat finds*, Basel 1987 (translated into English from the German by James Greig).

Jahns 1990 — S. Jahns, 'Preliminary notes on human influence and the history of vegetation in southern Dalmatia and southern Greece', in Bottema, Entjes-Nieborg & van Zeist (eds.) 1990, 333–340.

Jardé 1979 — A. Jardé, *Les cereals dans l'antiquité grecque,* Paris 1979.

Jones, Valamoti & Charles 2000 — G. Jones, S. Valamoti & M. Charles, 'Early crop diversity: a "new" glume wheat from northern Greece', *Veget. Hist. archaeobot*. 9, 2000, 133–146.

Kalpaxis, Furtwängler & Schnapp (eds.) 1994 — Th. Kalpaxis, A. Furtwängler & A. Schnapp (eds.), *Ελεύθερνα*, Τομέας ΙΙ: *Ένα Ελληνιστικό σπίτι ("Σπιτι Α") στη θέση Νησί*, (University of Crete publications), Rethymno 1994.

Kopaka & Platon 1993 — K. Kopaka & L. Platon,'ΛΗΝΟΙ ΜΙΝΩΙΚΟΙ. Installations minoennes de traitement des produits liquids', *BCH* 117, 1993, 35–101.

Koukoules 1952 — F. Koukoules, *Βυζαντινών Βίος και πολιτισμός*, vol. 5, Athens 1952 (second edition, no date for reprint).

Lohmann 1992 — H. Lohmann, 'Agriculture and country life in Classical Attica', in Wells (ed.) 1992, 29–60.

Maier 1996 — U. Maier, 'Morphological studies of free-threshing wheat ears from a Neolithic site in southwest Germany, and the history of the naked wheats', in Behre & Oeggl (eds.) 1996, 39–55.

Mattingly 1996 — D. J. Mattingly, 'First fruit? The olive in the Roman World', in Shipley & Salmon (eds.) 1996, 213–253.

McDonald & Rapp (eds.) 1972 — W.A. McDonald & G. Rapp (eds.), *The Minnesota Messenia Expedition: Reconstructing a Bronze Age environment*, Minneapolis, 1972.

McLaren 2000 — F. McLaren, 'Revising the wheat crops of Neolithic Britain', in Fairbairn (ed.) 2000, 91–100.

Nesbitt 2001 — M. Nesbitt, 'Wheat evolution: integrating archaeological and biological evidence', in Caligari & Brandham (eds.) 2001, 37–59.

Noonam 1973 — T.S. Noonam, 'The grain trade of the northern Black Sea in Antiquity', *AJPh* 94 (3), 1973, 231–242.

Papadakis 1929 — J.S. Papadakis, *Formes grecques de blé* (Ministère de l'agriculture, station d'amélioration des plantes à Salonique, Bulletin Scientifique, 1), Thessaloniki 1929.

Rushishvili 1988 — N. Rushishvili, 'Fossil remains of wheat from Georgia' (in Russian), *Flora, Geobotanical and Palaeoethnobotanical* 1, 1988, 19–28.

Rushishvili 1991 — N. Rusishvili, 'Fossilised species of wheat from the territory of Georgia', in *Palaeoethnobotany and archaeology: International Work-Group for Palaeoethnobotany, 8th Symposium Nitra-Nové Vozokany* (Acta Interdisciplinaria Archaeologica, 7), Nitra 1991, 285–294.

Sarpaki 1992 — A. Sarpaki, 'The palaeoethnobotanical approach. The Mediterranean triad or is it a quartet?', in Wells (ed.) 1992, 61–76.

Sarpaki 1994 — A. Sarpaki, 'A palaeoethnobotanical sample from House A', in Kalpaxis, Furtwängler & Schnapp (eds.) 1994, 210–211.

Sarpaki 1995 — A. Sarpaki, 'The archaeological visibility of the vine in Crete and in Greece in the Prehistoric period' (in Greek with a summary in English), in *Πεπραγμένα του Ζ Διεθνούς Κρητολογικού Συνεδρίου*, Rethymno 1995, 841–861.

Sarpaki 2000 — A. Sarpaki, 'Plants chosen to be depicted on Theran wall-paintings: tentative interpretations', in Sherratt (ed.) 2000, 657–680.

Sheehan 1979 — M.Ch. Sheehan, *The postglacial vegetational history of the Argolid peninsula, Greece*, PhD dissertation, Indiana University 1979.

Sherratt (ed.) 2000 — S. Sherratt (ed.), *Proceedings of the First International Symposium "The Wall Paintings of Thera" (September 1997)*, Athens 2000.

Shipley & Salmon (eds.) 1996 — G. Shipley & J. Salmon (eds.), *Human landscapes in Classical Antiquity*, London 1996.

Sweet 1960 — L.E. Sweet, *Tell Toqaan: a Syrian village*, Ann Arbor 1960.

Topping 1972 — P. Topping, 'The post-classical documents', in McDonald & Rapp (eds.) 1972, 64–80.

Uphof 2001 — J.C.Th. Uphof, *Dictionary of economic plants*, Dehra Dun 2001, 528.

Wasylikowa *et al*. 1991 — K. Wasylikowa, M. Cârciumaru, E. Hajnalová, B.P. Hartyányi, G.A. Pashkevich & Z.V. Yanushevich, 'East-central Europe', in van Zeist, Wasylikowa & Behre (eds.) 1991.

Wells (ed.) 1992 — B. Wells (ed.), *Agriculture in Ancient Greece. Proceedings of the Seventh International Symposium at the Swedish Institute at Athens, 16–17 May, 1990* (ActaAth-4°, vol. 42), Stockholm 1992.

Wells (ed.) 1996 — B. Wells (ed. in collaboration with C. Runnels), *The Berbati-Limnes Archaeological Survey 1988-1990* (ActaAth-4°, 44), Stockholm 1996.

Wilkinson *et al*. 1990 — T.J. Wilkinson, S.T. Duhon, with contributions by J.A. Gifford and S. Bottema, *Franchthi Paralia: The sediments, stratigraphy and offshore investigations* (Excavations at Franchthi Cave, Greece, Fasc. 6), Bloomington & Indianapolis 1990.

Wright 1972 — H.E. Wright, 'Vegetation history', in McDonald & Rapp (eds.) 1972, 188–199.

van Zeist, Wasylikowa & Behre (eds.) 1991 — W. van Zeist, K. Wasylikowa & K.-E. Behre (eds.), *Progress in Old World palaeoethnobotany*, Rotterdam 1991.

Zohary & Hopf 2000 — D. Zohary & M. Hopf, *Domestication of plants in the Old World*. Oxford 2000.

Table 1. Tower trenches 636 to 639, stratum 4: the Late Antique period.

Plant species Trench Quantity of soil floated	WF97 (9) 637 25 lit.	WF97 (15) 636 15 lit.	WF97 (22) 637 1.5 lit.	WF97 (25) 639 38 lit.
Hordeum (hulled)	2	6	16	
Hordeum (6-row)(hulled)				308
Hordeum sp. – rachis base				1
Triticum/Hordeum indet.			1 + (26)	
Triticum sp. (cf. T. durum s.l.)			9	7 (+++)
Cerealia frags.	5	2	(1)	
Panicum sp.		1	1	
cf. Triticum sp. frag.		1		
Triticum sp. free-threshing-rachis				1
T. glume base				1
Avena sp.			1	
cf. Avena sp.				1
Triticum cf. dicoccum		1		26
Tetraploid/hexaploid grains		30		36
T. (tetraploid) rachis		1		
Cerealia (collar of culm)		(1)		(1)
Vicia faba	5	1	1	1
Lathyrus cicera/sativus	14	2		20
Lathyrus clymenum				17
Pisum sativum			1	2
cf. P. sativum			2	
Legume indet. medium				32
Legume fragments	(37)	(+++)		(++)
Legume (large)		4		
Legume (medium)	3	1		12
Legume (small)				3
Legumes indet.				32
Lupinus sp.				1
Vicia ervilia				2
Trifolium sp. (v. small)		1		
Trifolium sp.		2		2
Coronilla sp.		1		2+4 frags.
Lens esculenta				4
cf. Vitis vinifera frags.				5
fruit (drupe) (cf. Vitis sp.)				2
Olea stone		1/2		12+15 halves
Olea europaea frags.	4	(28)	8	> 34
Olea – fruit (fleshy part)	7			
Ceratonia siliqua L. seed		2		
C. siliqua L. flesh frags.		15		1
Junglans regia frags.				2
Ficus carica		1		2
cf. Punica sp.				1

Table 1 (cont.).

Plant species Trench Quantity of soil floated	WF97 (9) 637 25 lit.	WF97 (15) 636 15 lit.	WF97 (22) 637 1.5 lit.	WF97 (25) 639 38 lit.
cf. Lolium sp.	4	13	9	133
cf. Lolium (cf. rigidum)	1			
cf. L. temulentum		6		
Gramineae	2 + (1)	6 + (5)	(2)	(++)
Chaff (stems of Gramineae) frags.	1	2		
Cynodon dactylon	1			3
Gramineae (type A)		1		6
Gramineae (type B)				1
Gramineae (type C)				1
Gramineae (type D)				1
Gramineae – spkt fork				1
cf. Psilurus cf. incurvus				1 1/2
cf. Polygonum sp.		1		
Urticaceae		6		
cf. Rumex sp.	1			1
Chenopodiaceae	2			
Portulaca sp. (subfossil)	1			
Caryophyllaceae	7			2
cf. Spergularia sp.				1
Papaver sp.	18	5	2	32
Cruciferae				2
Cruciferae (cf. Brassica sp.)				1
Cruciferae (cf. Moricandia arvensis)				1
cf. Androsace sp. (subf.?)	1			
Rubus sp.				2
Rubiaceae (cf. Gallium sp.)				1
Euphorbia sp.				1
Euphorbia cf. helioscopia				2
Euphorbia peplis				2
cf. Agrostemma githago				1
Galium sp.	1			
Galium cf. aparine			1	
Boraginacae	1			
Bugglosoides sp.	1			
Labiatae (type A)	1	1		2
Labiatae (type B)	6			
Labiatae (type C)	4			
Plantago lanceolata-type				4
Typhaceae		1		
Ignota – identifiable	9	28		1
Ignota – v. damaged	> 15	7		4
Ignota – featureless			5	30
Ignota – modern	8	29		22
Spores				10

Table 2. Tower trenches 636 to 639, stratum 5 (closed deposit) and 7: the Late Antique period.

Key: (1) = number of fragments; + = presence not quantified but up to 10; ++ = over 10 and under 50; +++ = over 51.

[1] This sample was not-floated.
[2] Sampled in the same way as BER 002.
[3] Seems to be rather short and compressed.
[4] Five cotyledons.
[5] All the stones were charred – In parenthesis are the half stones.
[6] Could not calculate exact fragments.

Plant Species Trench Quantity of soil floated	BER002[1] 638	BER003[2] 637	**WF97(28)** 639 11 lit.	WF97(29) 638 16 lit.	WF97(33) 639 19 lit.	WF97(35) 638 10.5 lit.	WF97(38) 638 15 lit.	WF97(37) 638 11 lit.
Hordeum (hulled)			7	394	1		2	17 + (3)
Hordeum (6-row) (hulled)				1	9	8	43	
cf. Hordeum sp.				2	(19)			
cf. Hordeum sp. immature							7	
Hordeum sp. – rachis base								4
cf. Panicum sp.								1
Cerealia frags.				(+)		+++	(3)	5 + (10)
Cerealia				1			21	
Cerealia - spkt fork						1		
Cerealia (collar of culm)							1	(5)
Cerealia (culm frags.)							9	3
Cerealia – rachis							+++	
Gramineae			(1)	29 + (33)	7 + (3)	9 + (8)	30+ (27)	3
Gramineae rachis							1	1
Chaff (stems of gramineae) frags.					2			
Gramineae (rachis)				1				
Gramineae (type A)				2				
Triticum/Hordeum indet.		1		1	3	5	12	1
Triticicum sp.		1		6	1	1	1	1 + (2)
Triticum s. immature				2				
Triticum/Hordeum rachis				9				
Triticum cf. dicoccum			2	3	2			
Triticum tetraploid/hexalpoid grains				1	1	6	334	
T. durum/turgidum s.l.				1		1	28	7
T. (cf. tetraploid) rachis[3]				4			72	
T. (diploid) basal rachis				2			5	
T. glumes (cf.lemma/palaea)				1				
T. culm collar-free-threshing				2			(18+)	
Cerealia culm nodes							1	

Table 2 (cont.). Tower trenches 636 to 639, stratum 5 (closed deposit) and 7: the Late Antique period.

Plant Species Trench Quantity of soil floated	BER002[1] 638	BER003[2] 637	**WF97(28)** 639 11 lit.	WF97(29) 638 16 lit.	WF97(33) 639 19 lit.	WF97(35) 638 10.5 lit.	WF97(38) 638 15 lit.	WF97(37) 638 11 lit.
Avena sp.				(1)		(2)		
cf. Avena sp.								
Avena sativa s.l.				2		158	2	1
Secale sp.				1		7	5	
Cerealia frags.				1.45 gr. +				
Vicia faba		1				(1)		
Lathyrus sp.						16		
Lathyrus cicera/sativus		1		5		32	9	
Lathyrus clymenum							6	
cf. Lathyrus clymenum					1			
Vicia ervilia				2				
Pisum sativum				1		2		
Legume indet. medium							1	
Legume fragments			(4)	(+++)	(14)	(99)	(36)	(4)
Legume (large)				1+ (5)[4]		4		
Legume (medium)				3+(5)		11		
Legume (small)						1		
Legumes indet.			2					
Trifolium sp. (v. small)						1		
Trifolium sp.				2				2
cf. Trifolium sp.				2		3		
Coronilla sp.				12		1	2+1/2	1
cf. Lens sp.				5		9	1	
Vitis vinifera				1				
cf. Vitis vinifera frags.		(1)	(1)			(1)		(1)
Olea stone	1	6 (12)[5]		9		3 halves+	3	½
Olea europaea frags.	(11)	(25)	(5)	(19)	(35)	(18)	11	5
Ceratonia siliqua (pods)		14 plus[6]						
Ficus carica				1				3
Prunus amugdalus frags.				(2)	(2)			
Lolium sp.			3	169	7	4		9
cf. Lolium sp.					(6)	2	65	
cf. L. temulentum						6	91	
cf. L. remotum sp.						9		5
Cynodon dactylon				2		1		
Phalaris minor							8	

Key: (1) = number of fragments; + = presence not quantified but up to 10; ++ = over 10 and under 50; +++ = over 51.

[1] This sample was not-floated.
[2] Sampled in the same way as BER 002.
[3] Seems to be rather short and compressed.
[4] Five cotyledons.
[5] All the stones were charred – In parenthesis are the half stones.
[6] Could not calculate exact fragments.

Table. 2 (cont.). Tower trenches 636 to 639, stratum 5 (closed deposit) and 7: the Late Antique period.

Plant Species Trench Quantity of soil floated	BER002[1] 638	BER003[2] 637	**WF97(28)** 639 11 lit.	WF97(29) 638 16 lit.	WF97(33) 639 19 lit.	WF97(35) 638 10.5 lit.	WF97(38) 638 15 lit.	WF97(37) 638 11 lit.
cf. Bromus sp.						1	1	(1)
Brize sp.				1				
cf. Phleum sp.				1				
cf. Haynaldia or parapholis rachis							4	
Urtica sp.								5
cf. Urtica sp.			1	1				1
cf. Rumex sp.				1		2		
Chenopodium sp.				1	1	1		2
Portulaca sp. (subfossil?)								
Caryophyllaceae				1			2	5
Silene (cf. S. vulgaris)							1	
cf. Spergularia sp.						1		
cf. Adonis sp.								
Papaveraceae (cf. Glaucium)				2		1		
cf. Glaucium sp.			17		27			
cf. Papaver sp.				7		72	21	7
Papaver sp. (cf. rhoeas)				58			33	
Cruciferae				25				
Cruciferae (cf.Brassica sp.)			1					
Cruciferae (cf. Moricandia arvensis)			1	31				6
Reseda sp.				4	19	10		8
cf. Potentilla sp.						2	1	2
cf. Sarcopoterium sp.							1	
cf. Trigonella sp.				1			1	
Trigonella cf. monspeliaca				9			11	3
Anagalis sp.				2		1	3	
cf. Erodium sp.								
Euphorbia (cf. graeca)								
Euphorbia cf. helioscopia						1		1
Euphorbia peplis								
cf. Thymelaeaceae								

Key: (1) = number of fragments; + = presence not quantified but up to 10; ++ = over 10 and under 50; +++ = over 51.

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[5] All the stones were charred – In parenthesis are the half stones.
[6] Could not calculate exact fragments.

Table 2 (cont.) 2. Tower trenches 636 to 639, stratum 5 (closed deposit) and 7: the Late Antique period.

Key: (1) = number of fragments; + = presence not quantified but up to 10; ++ = over 10 and under 50; +++ = over 51.

[1] This sample was not-floated.
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Plant Species Trench Quantity of soil floated	BER002[1] 638	BER003[2] 637	**WF97(28)** 639 11 lit.	WF97(29) 638 16 lit.	WF97(33) 639 19 lit.	WF97(35) 638 10.5 lit.	WF97(38) 638 15 lit.	WF97(37) 638 11 lit.
Malva sp.				1				1
Bifora sp.						1	3	1
cf. Agrostemma githago				1		1		
cf. Viola sp.						1	1	
Sherardia arvensis							1	
Rubiaceae (cf. Gallium sp.)							1	
cf. Asperula sp.				1				
Galium cf. aparine							1	
G. cf. mollugo							1	
Scrophulariaceae					1	1		
(cf. Verbascum)								
cf. Verbenaceae				1			1	
cf. Labiatae.				4				
Labiatae (type A)			1	6		1	1	
Labiatae (type B)								
Labiatae (type C)								
Plantago lagopus – type				9	1	2	7	1
Compositae (cf. Cent				1				
Typhaceae							4	
Ignota – identifiable			2	50		32	32	
Ignota – v. damaged				43		26	28	8
Ignota – featureless		+			5			
Ignota – modern			4	26	5	39	28	6
Shell frags. indet.			4		1			
Spores			1		2			
Modern seeds			1	5				1
Dung ?- mouse ?								3

Table 3.

Plant species Trench Quantity of soil floated	WF97(5) 523 11 lit.	WF97(10) 534 20 lit.	WF97(40) 622 0.16 lit.	WF 97(41) 626 0.5 lit.
Olea europaea frags. cf. Prunus amygdalus frags. Ficus carica	(7) (1)	 2[1]		(1) (2)
Vicia faba minor Legume (large) Legume (medium)		1 1 1		
cf. Solanum sp.	1			
Caryophyllaceae Papaver sp. Labiatae[2] Silybum marianum	2 4 1	 +++		
Ignota (modern) Ignota (v. damaged)	6	+++	 2	32

Table 3. Western trenches 621–29, 521–525, 534–535, stratum 1 WF97 (5) [523] and WF 97 (10) [534]; stratum 2 WF 97 (40) [622] and WF97 (41) [626]: early Roman occupation.

[1] One is charred and other is mineralised.
[2] Could be modern.

Table 4.

Plant species Trench Quantity of soil floated	WF97(1) 622 6 lit.	WF97(3) 625 9 lit.	WF97(4) 622 19 lit.	WF97(7) 622 11 lit.	WF97(43) 622 0.5 lit.
Olea europaea frags. cf. Prunus amygdalus	(1)	(1) (1)	(3)		
Gramineae				1	
cf. Amaranthus sp.[5] Portulaca sp. Caryophyllaceae[6] Papaver sp. (cf. rhoeas)		 1 2	1 1	1 2	
Ignota – featureless Ignota – modern Ignota – v. damaged Ignota – identifiable			>100	+++ 41	 1 2

Table 4. Western trenches 621–29, 521–525, 534–535, stratum 3 WF97 (1), WF 97 (3), WF 97 (4), WF 97 (7) and WF97 (43): the Classical period – fill in kiln.

[5] Probably humified and therefore modern.
[6] Humified and therefore subfossil (modern).

Table 5.

Plant species Trench Quantity of soil floated	WF97(2) 621 18 lit.	WF97(8) 524 8 lit.	WF97(14) 534 17 lit.
Olea europaea frags. Vitis vinifera	(4)	(3) 1	(3)
Hordeum (hulled) Hordeum (6-row) Cerealia culms (frags.)		1 1 1	
Legume (medium)		1	
Cruciferae Labiatae – modern Silybum – modern		1 4	 6
Ignota – modern Ignota – identifiable Ignota – damaged Ignota – featureless		34 1 1 5	+++ 3

Table 5. Western trenches 621–29, 521–525, 534–535, stratum 4 WF97 (2) and stratum 5 WF97 (8): the Classical period; stratum 6 WF97 (14): the Late Antique period.

Table 6.

Plant species Trench Quantity of soil floated	WF97(13)[7] 531 18 lit.	WF97(27)[8] 538 1 lit.	WF97(36) 539 28 lit.	WF97(30) 539 15 lit.	BER011 531	WF97(17) 531 34 lit.
Olea europaea frags	(1)	(2)	(1)+ 5 h/ves			(5)
Vitis vinifera		1 + (1)	(19)	2		
cf. Punica sp.			(4)			
Legume frags.	2					
Chenopodium sp.		2	6	12		
Portulaca cf. oleracea			1			
cf. Silene sp.			1			
Papaver sp.			2			
cf. Moricandia cf. arvensis				2		
cf. Trifolium sp.	1					
Anagallis sp.			1			
cf. Labiatae sp. – modern	6					
cf. shell frags.	1					
cf. Silybum marianum					+++	
Ignota – v. damaged	7		13			4
Ignota – featureless			9			2
Ignota – modern			4	42		
Ignota	2	3				
cf. spores	2	+	2			6

Table 6. Southern trenches 531, 538–539, stratum 1 WF97 (13) and WF97 (27); stratum 2 WF97 (36); stratum 3 WF97 (30); stratum 4 BER011, stratum 5 WF97 (17): sub-modern strata.

[7] Most seeds are modern.
[8] Most seeds are modern.

Table 7.

Plant species Trench Quantity of soil floated	WF97(12) 531 18 lit.	WF97(16) 531 15 lit.	WF97(18) 531 17 lit.	WF97(31) 537 14 lit.	WF97(32) 537 ?
Olea europaea frags.	(7)	(2)	(5)	(1)	
Ficus carica frags.				(5)	
cf. Ficus carica				4	1
cf. Avena sp. frags.			(1)		
cf. Trifolium sp.	1				
Legume frags	(1)				
cf. Chenopodium sp.				8	
Caryophyllaceae				1	
Malva sp.				1	
Silubum sp. – modern	+++				
Ignota – damaged		1	3		5
Ignota – shell frags.	2				
Ignota – modern	+++	+++	+++	+++	19
Ignota – cf. leaf	1	4			
cf. spore		19			

Table 7. Southern trenches 531–533, 536–539, stratum 6 WF97 (12), WF97 (16), WF97 (18), WF97 (31), WF97 (32): the Late Antique period.

Table 8.

Plant species Trench Quantity of soil floated	BER001[9] 531	WF97(11) 531 15 lit.	WF97(24) 531 0.5 lit.	WF97(26) 536 8.5 lit.	WF97(34) 538 19 lit.
Olea europaea Olea europaea frags. cf. Ficus carica Vitis sp. frags.		 (3) 1 		1 + 3 halves (+++) 	 (6) 1
cf. Hordeum sp. (hulled) Gramineae cf. Bromus sp.				4 2	 1
Legume frags. (pod)				(1)	
cf. Chenopodium sp.[10] Caryophyllaceae Papaver sp. Reseda sp. cf. Euphorbia sp. Malva sp. – modern Silubum marianum[11]	 +++	4 2 	 1 	1 2 4 1	29 1 3
Ignota frags. Ignota – modern Ignota – featureless Ignota Dung (mouse?)		1 +++ 3	 1 	+++[12] 1 3 1 	 69 2 3

Table 8. Southern trenches 531–533, 536–539, stratum 7 BER001, WF97 (11), WF97 (24), WF97 (26), WF97 (34): the Late Antique period.

[9] This sample has not been water-floated. The organic material was collected by eye.
[10] Humified, therefore, most probably subfossil.
[11] They seem subfossil.
[12] Could also be Olea epidermis.

Table 9.

Plant species Trench Quantity of soil floated	WF97(30) 539 15 lit.	WF97(44) 420 1.5 lit.	WF97(19) 641 11 lit.
Vitis vinifera – modern Olea europaea frags. Ficus carica			 (11) 26
Triticum sp. frags. Legume frags. Legume (small)			(1) (6) 1
Urtica sp. Chenopodium sp. – modern Papaver sp. cf. rhoeas Malva sp. cf. Thymelaeaceae cf. Moricandia arvensis	 12 2	 1 	1 2 95 2 1
cf. Bifora sp. (damaged) cf. Scrophulariaceae (cf. Verbascum sp.) cf. Vitex agnus-castus			1 3 1
Ignota Ignota – damaged Ignota – modern cf. spore Dung – mouse?	 42 	 1	5 +++ 4 1

Table 9. South-western trenches, stratum 3 WF97 (44): topsoil and the Late Antique period. Trench 641, stratum 4 WF97 (19): sub-modern strata.

Table 10.

Plant species Trench Quantity of soil floated	BER004[13] 428 # W.F.	WF97(6) 322 6 lit.	WF97(20) 428 8 lit.	WF97(21) 428 1 lit.	WF97(39) 322 1.5 lit.	WF97(42) 322 0.12 lit.
Ficus carica Olea europaea frags			1		 (31)	
Lolium sp.					1	
cf. Amaranthus sp. – modern cf. Ranunculus sp. Caryopllylaceae (cf. Cerastium sp.) Papaver sp. (cf. rhoeas)		1	 1 5		 1 1	
cf. Moricandia sp. cf. Guttiferae					1 1	
Ignota – modern Ignota – damaged Ignota featureless Ignota	 1	1 2	1	20 1	 2 1	1

Table 10. South-western trenches, stratum 4 BER004, WF97 (6), WF97 (20), WF97 (21), WF97 (23), WF97 (39), WF97 (42): The Late Antique period.

[13] This sample has not been water-floated.

Table11.

Plant species Trench	BER005 636	BER006 637	BER007 637	BER008 637	BER009 637
Triticum sp. Hordeum sp.	(1)		2 9		1
Lathyrus cicera/sativus Lathyrus sp. cf. Vicia ervilia Legume (medium)	 (2)			4 1 2 5	
Olea europaea – stone Olea europaea frags. Vitis vinifera[14] Ceratonia siliqua L. (pod frags.) Ceratonia siliqua L. (seeds)	(3)[15] (7) (3)	 (+++) 1	7 (9)+ ½	 13	½ (3)
cf. Silybum marianum				22	
Ignota – identifiable Ignota – identifiable (?)			+ 1	 1	

Table 11. Seeds and plant reproductive parts found among the category of finds classified as charcoal from trenches 636 and 637: the Late Antique period.

[14] Not charred, rather humified except for 1 which seems mineralised. They could, therefore, be submodern.
[15] All half stones.

Table 12.

Plant species Trench	BER010 428	BER011 531	BER012 626	BER013 626
Olea europaea Olea europaea frags.			½ (2)	 (7)
cf. Silybum marianum	+	+++		

Table 12. Seeds and plant reproductive parts found among the category of finds classified as charcoal from Trenches 428, 533 (the Late Antique period) and 624 as well as 626 (possibly Early Roman).

Table 13. Archaeobotanical remains from areas in the Peloponnese or close-by for the relevant periods.

Plant species	Athens[1] Byzantine	Halieis[2] Classical	Isthmia[3] Classical	Corinth[4] (end of 6th to end of 4th BC)	Lerna[5] Classical 4th BC
Triticum cf. aestivum L.	4[6] +++			+	
Hordeum vulgare – 6-row-hulled	12[7]+++[8]		2	+	
cf. Panicum				+	
Legume	1[9]				
Lens sp. (microsperma)				+	
Vicia ervilia				+	
Pisum sativum				+	
Cicer arietinum				+	
Lathyrus sp.				+	
Vicia sp.				+	
Olea europaea L.		+			(2)[10]
Vitis vinifera			2	+	
Punica granatum				+	
Ficus carica				+	
Capparis spinosa				+	
Labiatae				+	
Chenopodium sp.				+	
Fumaria sp.				+	
cf. Scirpus sp.				+	
Pinus sp. /wood				+	
cf. Quercus sp. /wood				+	
cf. Juniperus sp. /wood				+	

[1] M. Hopf, 'Plant remains from the Athenian Agora, Neolithic to Byzantine. Appendix', in S.A. Immerwahr (ed.), *The Athenian Agora* XIII. *The Neolithic and Bronze Ages*, Princeton 1971, 267–269.

[2] M.H. Jameson, 'Excavations at Porto Cheli and vicinity, preliminary report I: Halieis, 1962–1968', *Hesperia*, 1969, 38, 311–342; *Hesperia* 43, 105–131. A whole excavated Classical house was located with olive press.

[3] E. Gebhard & F. Hemans, 'University of Chicago excavations at Isthmia', *Hesperia* 67, 1989 1–77; on p. 2 it is mentioned that soil samples were taken and exported to the USA for Julie Hansen, the archaeobotanist, to study and on p. 75 that on the East Terrace 5 deposit the seeds mentioned here were recovered. Some interesting observations on the possible planting of trees were noted on p. 64 of the same article. The paucity of seeds is rather the result that the study of these has not yet been completed.

[4] The macrofossil plant remains are of special importance as they were retrieved from dining areas of the Sanctuary of Demeter and Kore (N. Bookidis, J. Hansen, L. Snyder & P. Goldberg, 'Dining in the Sanctuary of Demeter and Kore at Corinth', *Hesperia* 68, 1990, 16–32. The plant remains were collected and studied by Julie Hansen. As it is impossible at this stage to differentiate the plant material into periods, I will only note by (+) their presence and for all further details, the reader is referred to the original article. Weeds/grasses are few, we believe, due to the coarse fine flot sieve (0.5 mm mesh).

[5] M. Hopf, 'Pflanzenfunde aus Lerna/Argolis', *Der Zuchter* 31, 1961, 239–248; M. Hopf, 'Nutzpflanzen vom Lernischen Golf', *JRGZM* 9, 1962, 1–19. Plant material goes back to the Early Neolithic period and also some spans from the Late Neolithic to the Middle Helladic periods.

[6] From a Byzantine granary, area T–U 22. As a comparison it is mentioned in W.A. McDonald, W.D.E. Coulson & J. Rosser (eds.), *Excavations at Nichoria in southwest Greece* III. *Dark Ages and Byzantine occupation*, Minneapolis 1983, 424, that no identifiable seeds from Byzantine levels at Nichoria were found. Only some wood was identified, the majority of which was olive and fig.

[7] Area T–U 22.

[8] It is referred to as a large sample without stating precise number but they were found in another area "apotheke or granary, area T 22".

[9] Area T–U 22.

[10] Hopf 1961 (supra n. 5), 243: Two half stones of olive were found with a relatively thin coat.

Table 14. Archaeobotanical remains from other areas in Greece but from the relevant periods.

Plant species	Agios Mamas[1] Byzantine (12–14th)	Demetrias[2] Roman – 2nd BC	Kalapodi[3] Classical 5th BC	Kalapodi[4] Classical 4th BC	Ossa[5] Second half of 2nd BC
Secale cereale	424				
S. cereale rachis	1				
Hordeum vulgare – hulled	9	+	15		+
H.vulgare – nudum	1				
Triticum			4		
dicoccum	12	+			
T. monococcum	2				+
T. aestivum	20	+	3		
T. spelta	4				
Cerealia indeterminata	23		4		
Panicum miliaceum	8				+
Avena sp.		+	2		
Cicer arietinum	308				
Vicia faba	9		2		
Pisum sativum	2	+			
Lens culinaris		+	2		+
Vicia ervilia		+	3		
Lathyrus sativus		+	27		
Leguminosae sativae indeterminata	4				
Vitis vinifera	6	+	7		+
Olea europaea		+	1	3	
Ficus carica	2	+	3		+
Prunus amugdalus		+			
Myrtus communis		+++[6]			
Quercus sp.	2				
Camelina sativa					+
Malva sp.	10				
Boraginaceae	1				
Polygonaceae	1				
Stellaria sp.					+
Silene sp.					+
Thalictrum flavum					+
Medicago sp.					+
Trifolium sp.					+
Hypericum perforatum					+
Galium sp.					+
Lolium temulentum			3		+
Cynodon dactylon					+
Setaria viridis					+

[1] H. Kroll, 'Byzantinischer Roggen von Agios Mamas, Chalkidike', *BZ* 92, 1999, 474–478. On p. 475 he referred that out of 800 samples taken, only 5 samples were of the Byzantine period (see table 1, p. 476). What concerns me is the irretrievability of weeds in those samples, as in footnote 5, p. 475 he mentioned having used the mesh size of (in mm) 5, 2, 1, and 0.5. Some of the weeds and, for example, seeds of figs are smaller than 0.5 mm. The same observation is applied to the material retrieved from Corinth where the finer flot was c. 0.5 mm: Bookidis *et al*., 1999, 18).

[2] H. Kroll, *Kastanas*. *Ausgrabungen in einem Siedlungshügel der Bronze- und Eisenzeit Makedoniens*. *1975–1979. Die Pflanzenfunde* (Prähistorische Archäologie in Südosteuropa, 2), Berlin 1983, 108; Kroll 1991, 177.

[3] H. Kroll, 'Kulturpflanzen von Kalapodi', *AA* 1993, 161–182. It seems that there is a ritual context of these samples, as they were found in a temple and Kroll described these as "sacrificial cereal". As they were found near shattered large pithoi. Kroll puts a few questions as to what these might mean.

[4] Kroll (supra n. 3), 161–182. On page 179, table 3, he mentions having taken 9 samples for the 5th century BC and 3 samples for the 4th century BC.

[5] P. Adam-Veleni *et al*., 'The pottery and the archaeobotanical remains of the settlement', *Archaeologiko Ergo Makedonias Thrakis* 6, 1992 (pr. 1995), 383–393. Four (4) samples were water floated with 1 mm and 300 microns mesh. Only the presence (+) is mentioned.

[6] Kroll 1983 (supra n. 2), 108, where he refers to a possible myrtle cult in the LH period, comparing with finds at Tiryns, but I believe we still do need more evidence for such a claim.