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Contents

Knossos, Crete: Invaders, “sea goers”, or previously “invisible”, the Neolithic plant economy appears fully-fledged in 9,000 B.P.

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Introduction

Knossos is the earliest excavated archaeological site in Crete and has an uninterrupted history from the Aceramic Neolithic period. Due to the importance of its Bronze Age palace and town site, very little of the Neolithic settlement has ever been excavated. J. Evans (1964, 1971) undertook six seasons of excavation at the initiation of Sinclair Hood, from 1957 to 1960 and 1969 to 1970. The Neolithic settlement covered a fairly large area under the Minoan Palace, but the Aceramic phase only covered approximately 0.25 ha. By the end of the Early Neolithic I (EN1, Table 23.1*)* the site grew to 2 ha (Evans 1994, 10) and reached 3 ha (Evans 1994, 14) in the Early Neolithic II (ENII). By the Late Neolithic (LN) it extended over approximately 5 ha (Evans 1994, 19). Archaeobotanical samples were collected during Evan’s excavations, but were only subject to a preliminary unpublished study by Hans Helbaek. A more comprehensive collection, including samples from all Neolithic occupation phases, including the

Level	*Flotation sample No.*	*Phase*	*J.Evans levels & dates*	*C14 dates (uncal. BC)*
# 2	E 97(1)	L.N.	Level II	----
# 3	E 97(2a) & E 97(2b)	L.N.		----
# 4	E 97(4) & E 97(5a)	L.N.		----
# 7	E 97(6a)	L.N.		----
# 8	E 97(5b)	L.N.		----
# 9	E 97(6b) & E 97(7)	L.N.		----
# 10	E 97(8)	L.N.		----
# 10b	E 97(9)	L.N.		----
# 12	E 97(10) & E 97(11)	M.N.	Level III	4917-4789 DEM-640
# 14	E 97(12); E 97(13a); E 97(13b)	M.N./ E.N.II	Level IV	4907-4799 DEM-642
# 17	E 97(14)	E.N.II		----
# 20	E 97(15)	E.N.II		----
# 23	E 97(16)	E.N.II		----
# 24	E 97(17)	E.N.II		5061-4945 DEM-658
# 28	E 97(18)	E.N.II		4940-4800 DEM-659 / 4961-4852 OxA-9221
# 29	E 97(19) & E 97(20)	E.N.II		4930-4800 OxA-9218
# 31	E 97(21)	E.N. I	Levels V	5260-5070 DEM-661
# 32	E 97(22)	E.N.I		5207-5037 DEM-663/ 5210-5000 OxA-9220
# 33	E 97(23) & E 97(24)	E.N.I		5210-4990 OxA-9217
# 34	E 97(25) & E 97(26a)	E.N.I		----
# 35	E 97(26b) & E 97(27)	E.N.I		5365-5305 OxA-9219
# 37	E 97(28)	E.N.I.	Levels VI	5210-5060 OxA-9216
	No sample	Early E.N.I	Levels VII-VIII	
# 39	E 97(30)	Aceramic	Level IX 7740±130 BP (BM-436)	7040-6770 OxA-9215
			Levels X – no seeds dated	

Table 23.1. List of levels of the 1997 Knossos excavation with the equivalent water floated sample numbers and C14 dates (after Efstratiou et al. 2004, Table 23.1:1 with additions).

Aceramic period, was made during the 1997 rescue excavation east of the Central Court of the Palace of Knossos. A study of the 1997 material is mainly presented here but draws upon some unpublished research by Helbaek. The aim is to provide a further insight into the nature of the "Neolithisation" of Crete and its possible origins, but also to consider its development as portrayed in agricultural practices and food procurement systems.

The Neolithic of Crete

Several models explain the appearance of Neolithic people on Crete. The invasion-immigration model interprets Crete's Aceramic Neolithic inhabitants as immigrants who brought with them a Neolithic package of economic plants and animals, such as cattle, sheep, goats, pigs, dogs, cereals and, probably, legumes. Evans (1994, 5) hypothesised that they came from southwestern Asia Minor, using islands as stepping stones. Possible routes could have been through Rhodes, Karpathos, Kasos, or the islands of the Dodecanese, such as Kos, then the Cyclades, such as Melos, before reaching Crete. A second could have taken immigrants through the Peloponnese, Kythera, and Antikythera (Broodbank 1999, 34, fig. 1.9; Broodbank 2000, 135, fig. 38) but this is the least likely, especially with the latest results from a multivariate analysis of the archaeobotanical material from the Eastern Mediterranean (Colledge *et al.* 2004). The recent consensus is that the core area of emigration centred around the Syro-Levantine area.

Alternatively, Crete may have been inhabited prior to Knossos by permanent or visiting hunter-gatherers/foragers. If they ever existed, and there are indications that they existed on the islet south-west of Crete named Gavdos (Kopaka and Matzanas 2006) these people remain, largely, archaeologically invisible, although there are indirect signs of their presence, such as the extinction of late Pleistocene Cretan fauna on Crete prior to the Aceramic Neolithic of Knossos, that cannot be attributed to climatic or environmental factors alone (Lax and Strasser 1992; Cherry 1990, 163; Broodbank and Strasser 1991; Hamilakis 1996, 236). However, people who arrived at the site displayed a sound knowledge of what they were undertaking and, perhaps former knowledge of the island, by founding Knossos, at the edge of very good farmland (Broodbank and Strasser 1991, 235–36). The evidence for contact within the Aegean also seems to be indirectly pinpointed by archaeology (obsidian from Melos and Giali, marble from the Cyclades) as early as the Mesolithic, *c.* 11.000 BC.

There is as yet no data for discussing the stages in the "domestication" of Crete, because evidence from the earliest strata of Knossos indicates that the first settlers were fully-fledged mixed farmers when they made their presence felt. Furthermore, no crops were found at the transitional stage between "wild" and "domesticated". It is important though to try to understand why these settlers abandoned their homes and what were the pressures that encouraged them to migrate from their cultural, social and natural environment to another area. Only regional interdisciplinary research can provide answers to such problems. Leaving aside explanations of overpopulation and/or displacement by migrants from elsewhere, most discussion has focused lately on the environmental changes which marked the end of the Pleistocene and start of the Holocene. The striking climatic changes and the extreme seasonality of the Pleistocene/Holocene transition must have had very severe repercussions on subsistence models, thus forcing the radical change to cultivation (Blumler and Byrne 1991, 35; Blumler 1996). From *c.*15000 BP, global temperature gradually increased. However, cerealia pollen data (Bottema 1992, 104) suggest that precipitation did not keep pace with temperature rise, resulting in greater regional dryness. The same is believed for the end of the Pre-Pottery Neolithic A and the beginning of the Pre-Pottery Neolithic B (PPNB) in northern Syria (Helmer *et al*. 1998, 30) and the Levant (Peltenburg *et al.* 2000). Drier conditions may have led to an exodus (Sherratt 1996, 136) from drier parts of the Near East to areas more suited to mixed agriculture. Cyprus received a first wave of settlers (early PPNB period) some 500–1000 years after this climatic change (Peltenburg *et al.* 2000) whereas Crete seems to have been settled even later, although this is, lately, under close scrutiny (Kopaka and Matzanas 2006).

The archaeobotany of Knossos

Archaeobotanical samples from Knossos came from three different and complementary sources. One sample was a cache of seeds found by J. Evans in Level IX in the Aceramic level. It was studied by Helbaek, but never properly published (Table 23.2). Some other material was retrieved by

Class	*Species/type*	*Sorted in Copenhagen*	*Sorted in England*
Wheat grains	Bread wheat	2900	2500
	Emmer	10	
	Einkorn	10	
Barley grains	hulled, straight	9	4
	hulled, twisted	2	2
	naked, straight	12	1
	naked, twisted	2	
Wheat spikelet	Bread wheat	3	
frag. (rachis)	Emmer	191 [1]	
	Einkorn		1
Barley spike	hulled, two-row	9	
frag. (rachis)	hulled, six- row	3	
	naked, six-row	none	
Lentil	seeds	210	140
Weeds	Wild oats (awn)	1	
	Ryegrass (grain)	1	
	Mallow (nutlets)	52	
	Plantain (seed)	1	

Table 23.2. List of plants from Knossos provided to Dr John Evans by Hans Helbaek, stratum IX (here presented unchanged).

M. and H. Jarman (1982) but the archaeobotanical study was also never fully published. The third category was retrieved from the 1997 rescue excavation directed by A. Karetsou, N. Efstratiou and E.Banou (Efstratiuou *et al*. 2004). From the latter excavation, 33 samples of soil were water-floated from an 8.5m deep excavation trench of 3m × 2m in diameter, reducing to 1.5m × 1.5m below 4.5m depth, and 597 litres of soil sampled from most of the excavated strata was water floated for bioarchaeological remains. Helbaek's material was believed, by the excavator, to be a crop-threshing product with its contaminants and weeds. The context of the water-floated material is not yet fully understood as the archaeological study is not yet complete, but nevertheless provides a diachronic sequence.

The Aceramic (Table 23.3)

Material from the Aceramic level was examined by both H. Helbaek (stratum IX) and the author (layer 39). It is interesting to note that not only cultivation but domestication was already attested in this level. All of the field crops were fully domesticated, while the almond and the fig could be wild and/or systematically foraged/cultivated.

The most striking archaeobotanical find of the Aceramic is the free-threshing wheat, which was identified by Helbaek as *Triticum aestivum* (Helbaek 1968, 5) but here regarded as *T. turgidum* L./*T. aestivum* L. (Figure 23.1 and Table 23.4) as no rachis segments were preserved in the flotation samples. Helbaek found rachis and observed that the spikes were dense but not compact, reporting measurements of length 2.20mm and breadth 1.48mm. No drawing or photograph is available of the specimens. It is important to elucidate whether the Knossos specimens were from tetraploid (4× *e.g. T .turgidum*) or hexaploid (6×, *T. aestivum*) species, as it adds to existing knowledge about the spread of wheat species in the eastern Mediterranean (Colledge *et al.* 2004). Hexaploid wheat evolved under cultivation from the hybridisation between a cultivated tetraploid wheat and a diploid wild grass, *Aegilops squarrosa* (Helbaek 1970, 211; Maier 1996, 47; Zohary and Hopf 2000, 51). However, *A. squarrosa* is not present in the Mediterranean Near East and, therefore, hybridisation could not have occurred naturally there. A more likely location is continental or temperate central Asia where *A. squarrosa* is found, including north Iran, Transcaucasia and Afghanistan. Hybridisation could only have been established after the domestication and spread of a tetraploid wheat to north Iran and adjacent Transcaucasia. This expansion is still believed to have occurred some time between 6000 and 5000 BC (Maier 1996; Zohary and Hopf 2000, 54), which post-dates the presence of free-threshing wheat in Crete by 1000 years. The presence of free-threshing hexaploid wheat at Aceramic Knossos would, therefore, raise questions about this theory.

Only grains have been available for study so far as no chaff was retrieved by flotation. The grains were short and blunt, but, unfortunately, no definite separation of hexaploid and tetraploid wheat species can be made using grains alone. Their dorsal profile was rather rounded and thus similar to hexaploid grains rather than tetraploid grains which are truncate and acute (Kislev 1984, 143). The cheeks' outline

Plant species	***Common name***	***E 97(30)-Aceramic 16 litres***
Amygdalus communis	Almond	(1)
Rosaceae (cf. *Malus* sp.)	Rose family	
Ficus cf. *carica* fragments	Fig	(4)
Ficus carica mineralised		
Legume frags. (cf. *Pisum* spp.)	Pulses	
Lens culinaris	Lentils	2
cf. *Lens* sp.		(4)
Legume frags.		(6)
Leguminosae (medium)		1
cf. *Trifolium* sp./cf. *Astragalus* sp.		1
Triticum sp.	Wheat	5 + (3)
Triticum sp. *durum/aestivum*		1
Triticum sp, (cf. *dicoccum*)		
Triticum sp. glume base		1
Hordeum sp. hulled	Barley	(3)
Cerealia sp. (T./H.)		(2)
cf. Cerealia fr.		(26)
cf. *Avena* sp. fr.		
Gramineae		
cf. *Lolium* (medium)		
Caryophyllaceae	Pink family	
cf. Rubiaceae	Bedstraw family	
Ignota - featureless		
	TOTAL	10 + (49)

Table 23.3. Archaeobotanical evidence from Neolithic layers E 97(30) (Aceramic) and E 97(28) (early ENI) from Knossos.

(ventral view) was also rather rounded and not angular, as tends to be the case with tetraploids. However, due to charring deformation, the grains can never be accepted as a foolproof source for identification. Grain measurements fall within the range gathered from specimens of *T. aestivum* sampled and *T. aestivo-compactum* as well as archaeological specimens from several sites (Jacomet 1987, 58: Erbaba (van Zeist and Buitenhuis 1983), Ramad (van Zeist 2000) and Bouqras (van Zeist and Waterbolk-van Rooijen 1985). Until chaff is found and positively identified, this identification cannot be confirmed.

As well as free-threshing wheat, the aceramic flotation

Sample No.	*Phase*	*Length*	*Breadth*	*Thickness*	*L:B*	*B/LX100*	*L:T*
E 97(12)	E.N.II / M.N.	5.0	3.7	3.3	1.35	74	1.5
E 97(13b)	E.N.II / M.N.	4.2	2.9	3.1	1.45	69	1.4
E 97(13b)	E.N.II /M.N.	3.9	2.8	2.5	1.39	72	1.6
E 97(17)	E.N.II	4.6	3.4	2.9	1.35	74	1.6
E 97(17)	E.N.II	4.0	3.4	3.3	1.18	85	1.2
E 97(19)	E.N.II	3.3	2.2	2.3	1.50	67	1.4
E 97(19)	E.N.II	4.0	3.2	2.4	1.25	80	1.7
E 97(19)	E.N.II	3.7	2.9	2.7	1.28	78	1.4
E 97(21)	E.N.I	3.9	3.2	3.0	1.22	82	1.3
E 97(21)	E.N.I	4.0	2.7	2.7	1.48	68	1.5
E 97(21)	E.N.I	3.3	2.5	2.0	1.32	76	1.7
E 97(21)	E.N.I	3.9	2.9	2.6	1.37	73	1.5
E 97(21)	E.N.I	3.7	3.1	2.7	1.19	84	1.4
E 97(21)	E.N.I	4.5	3.0	2.5	1.50	67	1.8
E 97(22)	E.N.I	3.0	2.2	2.2	1.36	73	1.4
E 97(22)	E.N.I	4.2	3.1	2.3	1.35	74	1.8
E 97(22)	E.N.I	4.9	3.1	2.8	1.58	63	1.8
E 97(22)	E.N.I	5.0	3.1	3.1	1.61	62	1.6
E 97(22)	E.N.I	4.5	3.2	2.5	1.41	71	1.8
E 97(22)	E.N.I	5.7	3.2	3.1	1.78	56	1.8
E 97(23)	E.N.I	4.7	3.3	3.4	1.42	70	1.4
E 97(23)	E.N.I	3.6	2.7	2.4	1.33	75	1.5
E 97(24)	E.N.I	4.0	2.9	2.6	1.36	73	1.5
E 97(24)	E.N.I	4.2	2.6	2.5	1.62	62	1.7
E 97(25)	E.N.I	4.3	3.8	3.3	1.13	88	1.3
E 97(25)	E.N.I	3.7	2.9	2.4	1.28	78	1.5
E 97(25)	E.N.I	4.5	3.2	2.9	1.41	71	1.6
E 97(25)	E.N.I	4.7	3.1	2.7	1.52	66	1.8
E 97(26a)	E.N.I	4.6	3.3	3.1	1.39	72	1.5
E 97(26a)	E.N.I	4.7	3.0	2.6	1.57	64	1.8
E 97(26b)	E.N.I	4.0	3.2	2.7	1.25	80	1.5
E 97(26b)	E.N.I	4.5	3.4	3.2	1.32	76	1.4
E 97(26b)	E.N.I	2.9	1.8	1.8	1.61	62	1.6
E 97(27)	E.N.I	4.7	2.8	3.0	1.66	60	1.6
E 97(27)	E.N.I	5.0	3.6	3.4	1.39	72	1.5
E 97(28)	E.N.I	4.5	3.4	3.0	1.32	76	1.5
E 97(28)	E.N.I	5.0	3.2	2.6	1.56	64	1.9
Unit 30	Aceramic	4.9	3.0	2.5	1.63	61	2.0
E 97(30)	Aceramic	5.0	3.2	2.6	1.56	64	1.9
E 97(30)	Aceramic	4.1	2.9	2.7	1.44	70	1.5
E 97(30)	Aceramic	4.7	2.6	2.5	1.81	55	1.9
E 97(30)	Aceramic	4.7	3.0	2.4	1.57	64	2.0

Table 23.4. Measurements of the free-threshing wheat from Knossos.

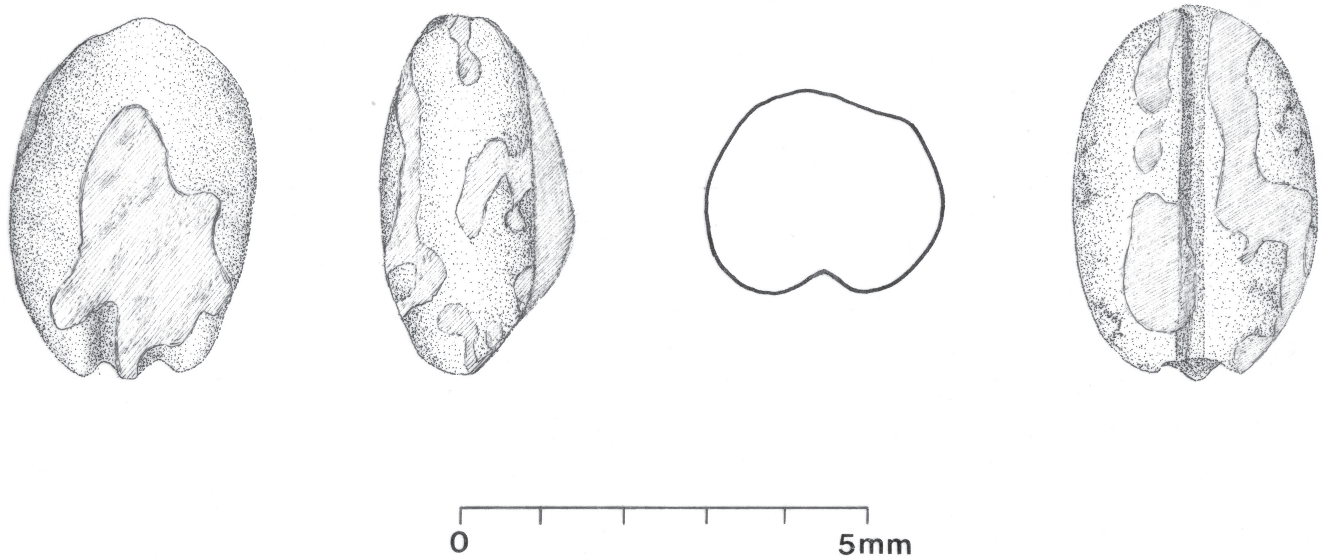

Figure 23.1. Triticum turgidum L./T. aestivum L. s.l. from Knossos.

sample (E97(30)) and Helbaek's list, (Table 23.2) provide evidence for the presence of other crops including einkorn wheat (T.monococcum), emmer wheat (T. dicoccum), hulled two-row barley (Hordeum distichum), hulled six-row barley (H. vulgare) and naked barley (H. vulgare var. nudum). Pulses were of equal numerical importance, but the only confirmed cultivar is lentil (Lens sp.). Almond (Prunus amygdalus) and fig (Ficus carica) fruits were also used.

Although the Aceramic material is rather poor, a wide spectrum of taxa was present, especially of the cultivated cereals. The Knossos einkorn is domesticated and we have not found any presence of wild einkorn (*T. monococcum* subsp. *boeoticum* = *T. boeoticum*) although its distribution (Zohary and Hopf 2000, 37, map 1) extends to mainland Greece. The wild ancestor of cultivated barley, *H. vulgare* L. subsp. *spontaneum* (C.Koch), has a wide distribution in the eastern Mediterranean including Crete, but no evidence has been found of its presence at Knossos.

Early Neolithic I (ENI) (Table 23.5)

This period is represented by 9 samples (123.5 litres of soil) which showed the same crop plants as the Aceramic period. Although the cereals were more abundant than legumes, it was difficult to calculate the exact proportions as cereal grains and legume seeds were differentially preserved. In addition to lentil, the legume list possibly included pea (*Pisum* sp.) and horsebean (*Vicia faba*). The main cereal crop was free-threshing wheat (*T. turgidum*/*aestivum*) but einkorn and emmer were also present, together with barley.

Fruits increased in abundance and several other seed plants were present. Seeds of wild radish (*Raphanus raphanistrum*) were common, and while it is a common weed of cultivation, its higher than usual presence leads us to believe that it may have been deliberately used. It is believed that wild radish is the ancestor of *Raphanus sativus* L., the cultivated radish (Körber-Grohne 1987, 200–202). Radish is rarely found in archaeobotanical assemblages, and whilst identifiable, the roots have not yet been found archaeologically during this period. The seeds also have little chance of being preserved as:

(i) Seeds are unlikely to be stored except for small quantities of seed corn;
(ii) The seeds have a very high oil content which may lead to greater damage by charring, as in other oil crops such as flax, cruciferous crops and sesame;
(iii) If the crop was used for making oil it is unlikely to have been stored for any length of time and would have been pressed soon after reaping, probably reducing the chance of finding the seeds;
(iv) The plant's greens could also have been collected and consumed but the archaeobotanical visibility of leaves is negligible.

So far it is impossible to know with any certainty if the plant was being deliberately used, but the higher than expected number of seeds in some samples suggests deliberate collection. All parts of the plant are edible, even the thin, hard root, which could be used as a condiment. It is possible that the presence of the radish shows the collection of a native wild Cretan plant, perhaps indicating the adaptation of the subsistence system to local conditions.

During ENI, small-seeded legumes were common including the clovers/medicks (*Trifolium* spp./*Medicago* sp.). It is possible that the seeds are the remnants of fodder, perhaps from the stalling of animals, and/or the use of dung for fuel (*e.g.* Miller 1984).

Unit	*E 97(28)*	*E 97(27)*	*E 97(26b)*	*E 97(26a)*	*E 97(25)*	*E 97(24)*	*E 97(23)*	*E 97(22)*	*E 97(21)*	
1997 Unit / J.Evans stratum	37 / VI	35 / VI	35 / VI	34 / VI	34 / VI	33 / VI	33 / VI	32 / VI	31 / VI	
Litres	14	10	14	14	16,5	15	10	15	15	123.5
Fruits										**Total**
Amygdalus communis fr.		1		2	10	2	2	7		24
Ficus cf. *carica* fr.(charred)	4 **	2	*		*				*	6
Ficus carica fr. (mineralised)	1									1
Ficus carica mineralised		8	2	1	4	3				18
Ficus carica charred	1		6	8	3	8			10	36
Total	**6**	**11**	**8**	**11**	**17**	**13**	**2**	**7**	**10**	**85**
Legumes										Total
Legume fr.	5			1	5	3	3			17
cf. *Lens* sp.(cotyledon)	2				3					5
cf. *Pisum* sp.			1							1
cf. *Vicia faba* fr.				1						1
Trifolium sp.									1	1
Trifolium sp. (small)			1	1		3				5
Trifolium sp. (medium)					1				2	3
cf. *Medicago* sp.					1					1
Leguminosae fr.		2								2
Total	**7**	**2**	**2**	**3**	**10**	**6**	**3**	**0**	**3**	**36**

Key. * = 1 - 10 fragments of seed; ** = 11 - 50 fragments of seed; *** = > 50 fragments of seed

Unit	*E 97(28)*	*E 97(27)*	*E 97(26b)*	*E 97(26a)*	*E 97(25)*	*E 97(24)*	*E 97(23)*	*E 97(22)*	*E 97(21)*	
1997 Unit / J.Evans stratum	37 / VI	35 / VI	35 / VI	34 / VI	34 / VI	33 / VI	33 / VI	32 / VI	31 / VI	
Cereals										**Total**
Triticum sp.	5	4	2	6	7		2			26
Triticum cf. *monococcum* (cf. one-seeded)					1				1	2
Triticum sp. (cf. *dicoccum*)	1							3	1	5
Triticum sp. cf. *aestivo-compactum*	1	3	2	4	7	6	3	5	7	38
Triticum sp. –glume base					1					1
cf. *Triticum* sp. awns			1							1
Hordeum sp. (hulled)	1	1		3	1	3				9
cf. *Hordeum* sp.			1							1
Hordeum sp. (hulled) fr.	2				8		3			13
Cerealia sp.(*Triticum/ Hordeu*m sp.)	1	2	2	11					8	24
Cerealia fr.	4 **	18 **	1 **	11 ***	12	12	1	11		70
cf. Cerealia frs.	2				2	***				4
cf. *Avena* sp. fr.	1						1			2
Total	**18**	**28**	**9**	**35**	**39**	**21**	**10**	**19**	**17**	**196**
Condiment-aromaticindustrial (?)										**Total**
Raphanus raphanistrum pod fr.					3				50	53
Raphanus raphanistrum pod segment									2	2
Linum cf. *usitatissimum*									3	3
cf. *Linum* sp.		1				1			2	4
Satureja thymbra L.			1	1					8	10
cf. *Thymus* sp.						1				1
Labiatae (type B)									1	1
Total	**0**	**1**	**1**	**1**	**3**	**2**	**0**	**0**	**66**	**74**

Key. * = 1 - 10 fragments of seed; ** = 11 - 50 fragments of seed; *** = > 50 fragments of seed

Table 23.5. The ENI archaeobotanical material.

Raphanus raphanistrum,							
Sample No.	Phase	Length	Breadth	Thickness	L:B	L:T	B:T
E 97(13b)	E.N.II	5.6	3.1	3	1.81	1.87	1.03
Linum cf. *usitatissimum*							
Sample No.	Phase	Length	Breadth	Thickness	L:B	L:T	B:T
E 97(21)	E.N.I	3.5	1.95	1.1	1.79	3.18	1.77
E 97(21)	E.N.I	3.7	2.1	1	1.76	3.70	2.10
Trifolium/Medicago sp.							
Sample No.	Phase	Length	Breadth	Thickness	L:B	L:T	B:T
E 97(6b)	L.N./F.N.	0.75	0.5		1.50		
E 97(6b)	L.N./F.N.	0.8	0.55		1.45		
E 97(9)	L.N./M.N.	0.8	0.5		1.60		
E 97(13b)	E.N.II	0.7	0.6	0.4	1.17	1.75	1.50
E 97(13b)	E.N.II	1.1	0.7	0.6	1.57	1.83	1.17
E 97(14)	E.N.II	0.9	0.6	0.5	1.50	1.80	1.20
E 97(14)	E.N.II	1.1	0.9	0.7	1.22	1.57	1.29
E 97(19)	E.N.II	2	1.5		1.33		
E 97(19)	E.N.II	0.9	0.6	0.55	1.50	1.64	1.09
E 97(20)	E.N.II	0.8	0.5	0.3	1.60	2.67	1.67
E 97(24)	E.N.I	0.75	0.5	0.4	1.50	1.88	1.25
E 97(25)	E.N.I	1.2	0.8	0.7	1.50	1.71	1.14
E 97(26b)	E.N.I	0.9	0.6	0.5	1.50	1.80	1.20
Leguminosae							
Sample No.	Phase	Length	Breadth	Thickness	L:B	L:T	B:T
E 97(10)	M.N.	1	0.8		1.25		
E 97(12)	E.N.II	0.9	0.6		1.50		
E 97(27)	E.N.I	0.7	0.5	0.5	1.40	1.40	1.00

Table 23.6. Measurements of Linum *cf.* usitatissimum*,* Trifolium *sp., /*Medicago *sp. seeds and R.* raphanistrum *pod segments from Neolithic Knossos.*

The other important introduction in the ENI is flax (*Linum usitatissimum,* Table 23.6). Two seeds measured above 3.5mm in length, proving that specimens were from the cultivated flax and not the wild species (*L. usitatissimum* subsp. *bienne*). Flax is one of the plants which could have been indigenously cultivated and/or domesticated as the distribution of wild flax includes Crete and Greece (Zohary and Hopf 2000, 129). The presence of cultivated flax at Sabi Abyad II (PPNB) and its possible specialisation as a flax-growing site, demonstrates that the species was taken into cultivation early (van Zeist, de Roller and Bottema 2000, 141) and could have been part of the suite of introduced plants brought to the site. It is impossible to tell whether the seeds were used for oil or the stems for fibre.

Early Neolithic II (ENII) (Table 23.7)

There seems to be a continuation in the cultivation of cereals and legumes with an increasing emphasis on the latter. It is possible that increasing legumes may indicate intensification, climatic preferences and/or change in agricultural practice due to some internal/external pressures. There was also a much stronger emphasis on arboriculture with a high presence of almond (*Amygdalus communis*) and figs (*Ficus carica*). All almonds at Knossos were fragmented, perhaps indicating that the remains were a product of consumption or processing. It is impossible at present to know whether almonds were domesticated, but they may have been cultivated. The almond was present in Greece and Crete in the wild (Browicz and Zohary 1996, 232) so may have been cultivated locally.

The fig tree *(Ficus carica*) also existed since very early times on Crete though the earliest archaeological sites showing evidence for use of the plant come from the Near East and pre-date the Knossos samples (Zohary and Hopf 2000, 163; Kislev 2006). There seems to be an increase in the presence of figs in the ENII compared to the previous period.

The grape (*Vitis* sp.) made its appearance in the ENII. In order to recognise wild from cultivated grape, measurements and formulae were used (Mangafa and Kotsakis 1996). Both wild and domestic type specimens seem to have been present. These formulae also categorised as grape pips from the LMIB site of Mochlos as wild (Sarpaki and Bending 2004, 130)

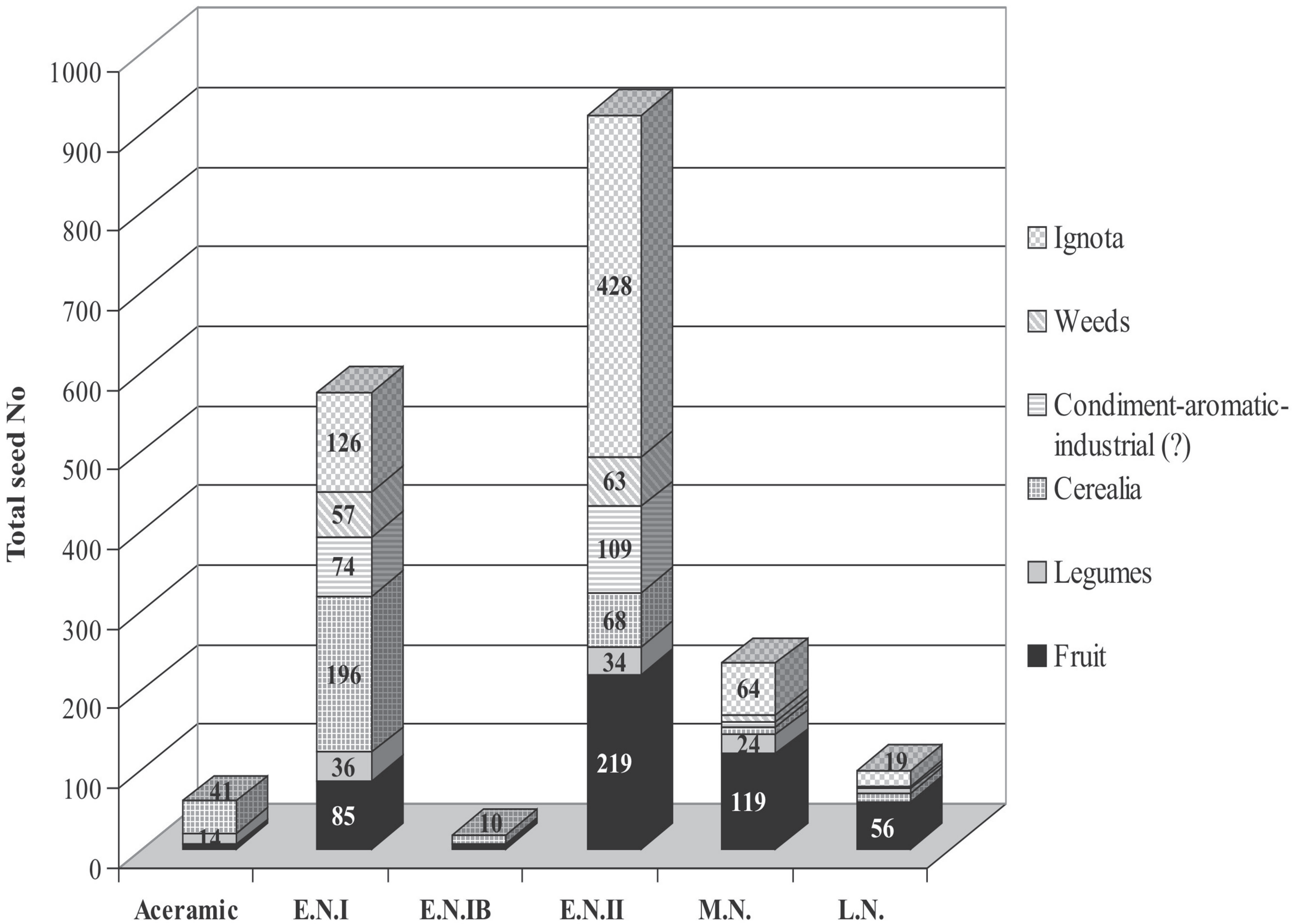

Figure 23.2. Summary of archaeobotanical abundance data from Neolithic Knossos.

which was unexpected, not because of the presence of wild grape on Crete (see Zohary and Hopf 2000, 154 and Bottema and Sarpaki 2003) but rather for its existence in houses. It was therefore of interest to see the results of Jacquat and Martinoli (1999) when studying the pips from Petra in Jordan (150 BC to 400 AD) in order to distinguish between wild and cultivated types. They used three methods to separate them. The first was Stummer's index, which did not help in segregating them. According to Mangafa and Kotsaki's (1996) method, they were identified as wild grapes, but according to the long stalk they were identified morphologically as cultivated. It is unlikely that a Roman private dwelling at Petra contained wild grapes. Therefore, although the method used (Mangafa and Kotsakis 1996) seems to have a great deal of potential, it requires refinement with more measurements and, perhaps, the use of different ratios.

The trend in all the other archaeobotanical material at Knossos shows that there was a continuation in intensive collecting/cultivation (wild radish, flax, and the collection of several aromatic plants – Labiatae) and no major break between the ENI and ENII. One would say that the trends, which make their appearance in the ENI, are reinforced in the ENII.

Middle and late Neolithic (MN, LN, Tables 23.8 and 23.9 respectively)

Eight samples from the MN lacked grape, naked wheat and barley, but followed a similar pattern to the ENII. Crop change may have been linked to changing agricultural priorities, or may simply reflect a change in the function of a particular area within the settlement. Whatever the reason, the density and quantity of archaeobotanical material waned visibly from the ENII. The five LN samples of soil contained fewer remains still than the MN, even taking into account the smaller quantity of floated soil. Bread wheat, barley and grape did not reappear during this phase.

Discussion and conclusion (Figure 23.2)

The rescue excavation of 1997 at Knossos has paved the ground for the reconsideration of the beginning of the Neo-

1997 Unit / J.Evans stratum	Unit E 97(20)	E 97(19)	E 97(18)	E 97(17)	E 97(16)	E 97(15)	E 97(14)	E 97(13)	E 97(12)	
	29 / IV	29 / IV	28 / IV	24 / IV	23 / IV	20 / IV	17 / IV	14 / IV	14 / IV	
Litres	21,5	19	17	29	19,5	18	16	48,5	20,5	209
Fruit										**Total**
Amygdalus communis fr.	12	15	2	4	4			3	2	42
Ficus cf. *carica* fr.(charred)	***	***			*			***	**	0
Ficus carica fr. (min.)				*						0
Ficus carica min.		1								1
Ficus carica charred	63	18		6	1			62	17	167
Vitis vinifera (cf. *sylvestris*)		1								1
V.vinifera ssp. *vinifera*		1								1
cf.*Vitis* sp. fr.	2									2
Vitis sp. fr.	3	2								5
Total	**80**	**38**	**2**	**10**	**5**	**0**	**0**	**65**	**19**	**219**
Legumes										
Legume sp. (medium)					1			1	1	3
Legume fr.	2	2								4
Lens culinaris	1	1							1	3
Trifolium sp. (small)		1	1	1	2		2	2	1	10
Trifolium sp. (medium)	1	1						1		3
cf. *Trifolium* sp.	2									2
cf. *Trigonella* sp.								1	1	2
Leguminosae (pod)	1									1
Leguminosae (small)								2		2
Leguminosae (medium)								3		3
cf. *Onobrychis* sp.		1								1
Total	**7**	**6**	**1**	**1**	**3**	**0**	**2**	**10**	**4**	**34**
Cerealia										**Total**
Triticum sp.	12	9		1						22
Triticum sp. (cf. *dicoccum*)	1									1
Triticum sp. cf. *aestivo-compactum*	6	4		4	1			3	1	19
Triticum sp. –glume base	1									1
cf. *Triticum* sp. awns	4							1		5
Hordeum sp. (hulled)		1								1
cf. *Hordeum* sp.		2	1							3
Hordeum sp. (hulled) fr.		1		1						2
Hordeum sp. (cf. naked)			1							1
Hordeum sp. rachis (damaged)	1									1
cf. *Hordeum* sp. awn	1									1
Cerealia sp.(*Triticum*/ *Hordeum* sp.)		7		1						8
Cerealia fr.								*		0
cf. Cerealia frs.								1		1
Cerealia – rachis									1	1
cf. *Avena* sp. fr.		1								1
Total	**26**	**25**	**2**	**7**	**1**	**0**	**0**	**5**	**2**	**68**

Unit	E 97(20)	E 97(19)	E 97(18)	E 97(17)	E 97(16)	E 97(15)	E 97(14)	E 97(13)	E 97(12)	
1997 Unit / J.Evans stratum	29 / IV	29 / IV	28 / IV	24 / IV	23 / IV	20 / IV	17 / IV	14 / IV	14 / IV	
Litres	21.5	19	17	29	19.5	18	16	48.5	20.5	209
Weeds										**Total**
Gramineae fr.				1	1					2
Gramineae (v.small)(cf. *Arundo* sp.)	2					1			2	5
Gramineae (cf. *Poa*)								1		1
Gramineae (medium)			2							2
Gramineae (type 1)(cf. *Cynodon*)		1	1		1			2		5
Gramineae (type 2) (medium)		3								3
Gramineae (type 3) (small)		1								1
Gramineae – rachis	1								1	2
Phalaris sp.								1		1
cf. *Bromus* sp.								1		1
cf. *Lolium* sp. (small)	1									1
cf. *Lolium* sp. (medium)	1									1
Rumex sp.	1									1
Rumex sp. (*R. sanguineus*-type)		22								22
Rumex sp. fr.		2								2
Cruciferae (cf. *Moricandia arvensis*)								1		1
cf. Cruciferae								1		1
Silene sp.									1	1
Malva sp.		1								1
Sherardia arvensis		1								1
Galium rivale				2						2
Buglossoides arvensis								5		5
Valerianella sp. (cf. *microcarpa*)				1						1
Total	**6**	**31**	**3**	**4**	**2**	**1**	**0**	**12**	**4**	**63**
Condiment-aromatic-industrial (?)										**Total**
cf. *Raphanus raphanistrum* seeds	1	1								2
Raphanus raphanistrum pod fr.	72	5	1	9			1	1		89
Raphanus raphanistrum pod segment	4							2		6
Thymelaea (cf. *hirsuta*) (lvs)										0
Thymelaea hirsuta seed	1			2	1			2		6
cf. *Linum* sp.		2								2
Satureja thymbra L.		1							1	2
Satureja thymbra L.sp.		1								1
cf. *Thymus* sp.										0
Labiatae (type B)		1								1
Total	**78**	**11**	**1**	**11**	**1**	**0**	**1**	**5**	**1**	**109**
Ignota (indeterminate)										**Total**
Total	**58**	**13**	**11**	**36**	**50**	**4**	**37**	**186**	**80**	**428**

Table 23.7. Archaeobotanical remains, ENII.

	UnitE 97(11)	E 97(10)	E 97(9)	E 97(8)	E 97(7)	E 97(6b)	E 97(5b)	E 97(6a)	
1997 Unit / J.Evans stratum	12 / III	12 / III	10 / ?	10 / ?	9 / ?	9 / ?	8 / ?	7 / ?	
Litres	21	24	29	17	18	22.5	27	22	180.5
Fruit									**Total**
Amygdalus communis fr.		14	4	9	6	23	11	12	79
cf. *Amygdalus* sp.						1			1
Ficus cf. *carica* fr.(charred)	*	11							11
Ficus carica min.	4	1		1	4			3	13
Ficus carica charred	3	1	1	2 **	1	1	4	2	15
Total	**7**	**27**	**5**	**12**	**11**	**25**	**15**	**17**	**119**
Legumes									
Legume fr.	2	4		1	1	3			11
Lens culinaris		1							1
cf. *Lens* sp.(cotyl.)				1	1	1			3
cf. *Pisum* sp.				1					1
Trifolium sp. (small)	2		1			2			5
Trifolium sp. (cf. *arvense*)						2			2
cf. Trigonella sp.		1							1
Total	**4**	**6**	**1**	**3**	**2**	**8**	**0**	**0**	**24**
Cerealia									
Triticum sp.				1				1	2
Cerealia fr.		2	6						8
Total	**0**	**2**	**6**	**1**	**0**	**0**	**0**	**1**	**10**

Key. * = 1 - 10 fragments of seed; ** = 11 - 50 fragments of seed; *** = > 50 fragments of seed

Table 23.8. Archaeobotanical remains, MN.

Unit	E 97(5a)	E 97(4)	E 97(2a)	E 97(2b)	E 97(1)	
1997 Unit / J.Evans stratum	4 / ?	4 / ?	3 / ?	3 / ?	2 / ?	
Litres	22	27	5	6	17	77
Fruit						**Total**
Amygdalus communis fr.	16		1	1	3	21
Ficus cf. *carica* fr.(charred)	2	8	3			13
Ficus carica min.	12	2				14
Ficus carica charred	2	6				8
Total	**32**	**16**	**4**	**1**	**3**	**56**
Legumes						**Total**
Legume fr.	1			1		2
Lens culinaris	1					1
Total	**2**	**0**	**0**	**1**	**0**	**3**
Cerealia						**Total**
Cerealia sp.(*Triticum/ Hordeum* sp.)		1				1
Cerealia fr.	6	3	1			10
Total	**6**	**4**	**1**	**0**	**0**	**11**
Condiment-aromatic-industrial (?)						**Total**
cf. *Capparis* sp.min. (fr.)	1					1
Raphanus raphanistrum pod fr.	2		1			3
Satureja thymbra L.	1					1
Total	**4**	**0**	**1**	**0**	**0**	**5**
Weeds						**Total**
Gramineae fr.	1		1			2
Gramineae (small)(v.damaged)		1				1
Fumaria sp.			1			1
Total	**1**	**1**	**2**	**0**	**0**	**4**
Ignota (unidentifiable)						**Total**
Total	**6**	**1**	**5**	**6**	**0**	**19**

Table 23.9. Archaeobotanical remains LN.

lithic in Crete, and the archaeobotanical material provides a tool that allows us to investigate directly agriculture on the island. Many questions remain unanswered about the Neolithicisation process, but archaeobotanical analysis provides some useful insight, regarding the process.

It is now beyond doubt that the first settlement at Knossos was founded by people who were fully-fledged farmers and acquainted with agriculture. The wide range of crops such as almond, fig, lentils, peas, horse beans, possibly clovers/medicks, einkorn, emmer, naked wheat, hulled 2-row and 6-row barley, naked barley, flax and possibly wild radish suggest a mix of field agriculture for cereals and some pulses, with horticulture and arboriculture. Further archaeobotanical study on the Helbaek material will provide more information concerning these issues.

Free-threshing wheat (*T. turgidum L./T.aestivumL.)*, was present from the earliest Aceramic habitation of Knossos and continued in use throughout the EN phases, though it disappeared in the MN and LN. It is difficult to know whether this is a trend within this particular area of the site or it is representative of the cultivated crops at the site as a whole. However, the important point with this cultivar is that it was an import from the east (Anatolia, Levant) and all the early sites where this wheat is found post-date Knossos by around 1000 years (Perles 2003, 2005). Due to the low presence of naked wheat in the north of Greece, one would assume that the immigrants did not come from the North West, *i.e.* Greece, but from the east, using the islands of the Dodecanese, Karpathos, Kasos and perhaps even the Cyclades as stepping stones. It remains uncertain whether almond, fig and wild radish, amongst others, were cultivated from local stock as these people, surely, were masters of the technological knowledge to allow such developments.

This emphasis on cereals and especially the naked wheat from the Aceramic and into the ENI is followed by a shift towards legume cultivation by the ENII. Production of cereals and legumes seems to stabilise, which might indicate agricultural intensification and/or a shortage of land (Sarpaki 1992). As we believe that plants, just as much as other material culture, define a culture and can be used to investigate cultural change, it is possible that changing crop species indicate another demic infiltration from Greece and/or economic change. This trend continues up to the LN. The importation of free-threshing wheat was probably a conscious choice as it is much easier to thresh than hulled wheats (einkorn and emmer) and needs less human labour.

Some form of arboriculture was already present at Knossos in the Aceramic Neolithic, with the presence of almonds and figs, though it is possible that both were part of the natural vegetation of the early Holocene in Greece and not particularly tended. There also seems to be an increase in fruits from the ENI to the ENII. As expected, the earliest utilised trees were those that did not need grafting but rather fruits that could propagate vegetatively or by seed. The presence of *Vitis* sp. in the ENII is problematic for, according to the formulae (Mangafa and Kotsakis 1996), they are grouped as wild, whereas the morphology of one seems rather to be cultivated. The secure presence of domesticated grape would have implied the knowledge of cuttings and/or grafting.

Flax and wild radish appeared in the ENI, perhaps indicating a new wave of immigration, although the latter plant could have been a local innovation, but its deliberate cultivation is not yet proven. Olive, on the other hand, is totally missing from the site.

The people who settled at Knossos seem to have been established farmers and not mere beginners (*cf*. Colledge *et al.* 2004) and, yet, they seem not to have had much affinity with the farmers of Greece. The two basic routes of the movement of crops from the Near East (Colledge *et al.* 2004) does fare well with the Knossos archaeobotany. They cultivated fields, had gardens and also tended fruit trees. The presence of quantitatively more trees in the ENII, together with a higher presence of radish (*Raphanus* sp.) could imply, so to speak, a stronger emphasis on horticulture. Yet, if the botanical material is representative of the site, and if figs were part of the environment, then it could mean that arboriculture proper could have started only in the ENI. We are therefore already detecting as early as the ENI at Knossos, a threefold emphasis on agriculture, arboriculture as well as horticulture.

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References

Blumler, M. 1996. Ecology, evolutionary theory and agricultural origins. In Harris, D.R. (ed.) *The Origins* and *Spread of Agriculture* and *Pastoralism in Eurasia*. London: UCL Press. 25–50.

Blumler, M. and Byrne, R. (1991) The ecological genetics of domestication and the origins of agriculture. *Current Anthropology* 32(1), 23–54.

Bottema, S. (1992) Cereal-type pollen in the Near East as indicators of wild or domestic crops. In P. C. Anderson (ed.) *Préhistoire de* *l'agriculture: Nouvelles approaches expérimentales et ethnographiques.* Monographie du CRA 6, 95–106. Paris, CNRS.

Bottema, S. and Sarpaki, A. (2003) Environmental change in Crete: A 9000-year record of Holocene vegetation history and the effect of the Santorini eruption. *Holocene* 13(5), 733–749.

Broodbank, C. (1999) Colonisation and configuration in the insular Neolithic of the Aegean. In Halstead, P. (ed.) *Neolithic society in Greece.* Sheffield Studies in Aegean Archaeology 2, 15–41. Sheffield.

Broodbank, C. (2000) *An Island archaeology of the early Cyclades*. Cambridge, Cambridge University Press.

Broodbank, C. and Strasser, T.F. (1991) Migrant farmers and the Neolithic colonisation of Crete. *Antiquity* 65, 233–245.

Browicz, K. and Zohary, D. (1996) The genus *Amygdalus* L. (Rosaceae): Species relationships, distribution and evolution under domestication. *Genetic Resources* and *Crop Evolution* 43, 229–247.

Cadogan, G., Hadzaki, E. and Vasilakis, A. (eds) (2004) *Knossos: Palace, city, State.* Proceedings of the Conference in Herakleion organized by the BSA at Athens and the 23rd Ephoreia of Prehistoric and Classical Antiquities of Herakelion, in November 2000, for the Centenary of Sir A. Evans's Excavations at Knossos. BSA, supplement 12.

Cann, J. R. and Dixon, J. E. (1968) Appendix IV: The sources of the Saliagos obsidian. In J. D. Evans and C. Renfrew *Excavations at Saliagos near Antiparos,* 105–107. London, Thames and Hudson.

Cherry, J. F. (1985) Islands out of the stream: Isolation and interaction in early east Mediterranean insular prehistory. In A. B. Knapp and T. Stech (eds) *Prehistoric production* and *exchange: The Aegean* and *Eastern Mediterranean*. UCLA, Institute of Archaeology, Monograph 25, 12–29. Los Angeles.

Cherry, J. F. (1990) The first colonisation of the Mediterranean islands: A review of recent research. *Journal of Mediterranean Archaeology* 3, 145–221.

Colledge, S., Connolly, J. and Shennan, S. (2004) Archaeobotanical evidence for the spread of farming in the Eastern Mediterranean. *Current Anthropology* 45, 535–547.

de Moulins, D. (1996) Sieving experiment: The controlled recovery of charred remains from modern and archaeological samples. In K-E. Behre and K. Oeggl (eds) *Early farming in the Old World*. A special volume of Vegetation History and Archaeobotany, 153–156. Heidelberg.

Efstratiou, N. (2005) Tracing the story of the first farmers in Greece – A long and winding road. In C. Lichter (ed.) *How did farming reach Europe? Byzas 2,* 143–153. Istanbul, Deutsches archäologisches Institut.

Efstratiou, N., Karetsou, A., Banou, E. and Margomenou, D. (2004) The Neolithic settlement of Knossos: New light on an old picture. In G. Cadogan, E. Hadzaki and A. Vasilakis (eds) *Knossos: Palace, city, state.* Proceedings of the Conference in Herakleion organized by the BSA at Athens and the 23rd Ephoreia of Prehistoric and Classical Antiquities of Herakelion, in November 2000, for the Centenary of Sir A. Evans's Excavations at Knossos. BSA, supplement 12, 39–49.

Evans, J. D. (1964) Excavations in the Neolithic settlement of Knossos, 1957–1960, part I. *Annual of the British School at Athens* 59, 132–240.

Evans, J. D. (1971) Neolithic Knossos: The growth of a settlement. *Proceedings of the Prehistoric Society* 37(2), 95–117.

Evans, J. D. (1994) The early millennia: Continuity and change in a farming settlement. In D. Evely, H. Hughes-Brock and N. Momigliano (eds) *Knossos: A labyrinth of history: Papers in honour of S. Hood, 1–20.* Oxford: British School at Athens.

Green, F. J. (1975) *Large seeded legumes of the Old World.* BA thesis, Department of Archaeology and Prehistory, University of Sheffield.

Halstead, P. (1989) Like rising damp? An ecological approach to the spread of farming in southeast and central Europe. In A. Milles, D. Williams, N. Gardner (eds) *The beginnings of agriculture*. BAR, International Series 496, 23–53.

Halstead, P. (1996a). Pastoralism or household herding? Problems of scale and specialisation in early Greek animal husbandry. *World Archaeology* 28(1), 20–42.

Halstead, P. (1996b) The development of agriculture and pastoralism in Greece: When, how, who and what? In D. R. Harris (ed.) *The origins* and *spread of agriculture* and *pastoralism in Eurasia,* 296–309. London, UCL Press.

Hamilakis, Y. (1996) Cretan Pleistocene fauna and archaeological remains: The evidence from Sentoni Cave (Zoniana, Rethymnon). In D. S. Reese (ed.) *Pleistocene* and *Holocene fauna of Crete* and *its first settlers*. Monographs in World Archaeology No. 28, 231–239. Wisconsin, Prehistory Press.

Hansen, J. (1992) Franchthi cave and the beginnings of agriculture in Greece and the Aegean. In P. C. Anderson (ed.) *Préhistoire de l'agriculture: nouvelles approaches expérimentales et ethnographiques*. Monographie du CRA 6, 231–247. Paris, CNRS.

Harris, D. R. (1989) An evolutionary continuum of people-plant interaction. In D. Harris and G. Hillman (eds) *Foraging* and *farming: The evolution of plant exploitation*, 11–26. London, Unwin Hyman.

Harris, D. R. (1996) The origins and spread of agriculture and pastoralism in Eurasia: An overview. In D. R. Harris (ed.) *The origins* and *spread of agriculture* and *pastoralism in Eurasia*, 552–573. London, UCL Press.

Helbaek, H. (1959) Notes on the evolution of Linum. *KUML,* 103–120.

Helbaek, H. (1964) First impressions of the Çatal Hüyük plant husbandry. *Anatolian Studies XIV*, 121–123.

Helbaek, H. (1968) Knossos wheat. (Unpublished manuscript).

Helbaek, H. (1970) The plant husbandry of Haçilar. In J. Mellaart (ed.) *Excavations at Haçilar,* Volume I, 189–244. Edinburgh, Edinburgh University Press.

Helmer, D., Roitel, V., Sanã, M., Wilcox, G. (1998) Interprétations environnementales des données archéozoologiques et archéobotaniques en Syrie du nord de 16 000 BP à 7000 BP, et les débuts de la domestication des plantes et des animaux. In M. Fortin, O. Aurenche (eds) *Espace Naturel, Espace Habité: En Syrie du Nord (10e – 2e millénaires av. J-C.* Lyon: Maison de l'Orient Méditerranéen, travaux de la Maison de l'Orient 28, 9–33.

Hopf, M. (1955) Formveränderunggen von getreidekörnern beim verkohlen. *Berichte der Deutschen Botanischen Gesellschaft* 68, 191–193.

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

Jacquat, C. and Martinoli, D. (1999) *Vitis vinifera* L.: Wild or cultivated? Study of the grape pips found at Petra (Jordan, 150 BC–400 AD. *Vegetation History* and *Archaeobotany* 8, 25–30.

Jarman, M. R., Bailey, G. N. and Jarman, H. (eds) (1982) *Early European agriculture: Its foundations* and *development*. Cambridge: CUP.

Jones, G. (1992) Weed phytosociology and crop husbandry: Identifying a contrast between ancient and modern practice. *Review of Palaeobotany* and *Palynology* 73, 133–143.

Kislev, M. (1979/80) *Triticum parvicoccum* sp. Nov., the oldest naked wheat. *Israel Journal of Botany* 28, 95–107.

Kislev, M. (1984) Botanical evidence for ancient naked wheats in the Near East. In W. van Zeist and W. A. Casparie (eds) *Plants* and *ancient man: Studies in palaeoethnobotany,* 141–152. Rotterdam, A. A. Balkema.

Kislev, M. (1989) Origins of the cultivation of *Lathyrus sativus* and *L. cicera* (Fabaceae). *Economic Botany* 43(2), 262–270.

Kislev, M., Hartmann, A. and Bar-Yosef, O. (2006) Early domesticated fig in the Jordan Valley. *Science* 312, 1372–1374.

Kopaka K. and Matzanas, Ch. (in press) Early sea voyages in the Aegean and Crete: Reflections on the stone tools found on the island of Gavdos. Paper delivered at the Cretological Conference at Chania, Crete, 1–8th October 2006.

Kőrber-Grohne, U. (1987) *Nutzpflanzen in Deutschland.* Germany, Theiss.

Κώστας Κωτσάκης (2000) Η αρχή της Νεολιθικής στην Ελλάδα. In Ν. Κυπαρίσση-Αποστολίκα (ed.) *Σπήλαιο Θεόπετρας – Δώδεκα χρόνια ανασκαφών και έρευνας 1987–98,* 173–177. Athens.

Kroll, H. (1981). Thessalische Kulturpflanzen. *Zeitschrift für Archäologie* 15, 97–103.

Kroll, H. (1983) *Kastanas: Die Pflanzenfunde*. Prähistorische Archäologie in Sűdosteuropa, Band 2. Berlin.

Kroll, H. (1991) Sűdosteuropa. In W. van Zeist, K. Wasylikowa, K-E. Behre and G. Entjes-Nieborg (eds) *Progress in Old World palaeoethnobotany*, 161–177. Rotterdam, A. A. Balkema.

Ladizinsky, G. (1989) Origin and domestication of the Southwest Asian grain legumes. In D. R. Harris and G. C. Hillman (eds) *Foraging and farming: The evolution of plant exploitation,* 374–389. London, Unwin Hyman.

Lambeck, C. (1996) Sea-level change and shore-line evolution in Aegean Greece since Upper Palaeolithic time. *Antiquity* 70, 588–611.

Lax, E. and Strasser, N. (1992) Early Holocene extinctions on Crete: The search for the cause. *Journal of Mediterranean Archaeology* 5, 203–224.

Maier, U. (1996) Morphological studies of free-threshing wheat ears from the Neolithic site in southwest Germany, and the history of the naked wheats. In K-E. Behre and K. Oeggl (eds) *Early farming in the Old World.* A special volume of Vegetation History and Archaeobotany, 39–55. Heidelberg.

Mangafa, M. and Kotsakis, K. (1996) A new method for the identification of wild and cultivated charred grape seeds. *Journal of Archaeological Science* 23, 400–418.

Miller, N. (1984) Intentional burning of dung as fuel: A mechanism for the incorporation of charred seeds into the archaeological record. *Journal of Ethnobiology* 4, 15–77.

Moody, J. (1987) *The environmental* and *cultural prehistory of the Khania region of West Crete: Neolithic through late Minoan III.* PhD Thesis, University of Minnesota.

Peltenburg, E., Colledge, S., Croft, P., Jackson, A., McCartney, C. and Murray, M.A. (2000) Agro-pastoralist colonisation of Cyprus in the 10th millennium PB: Initial assessments. *Antiquity* 74(286), 844–53.

Perlès, C. (1979) Des navigateurs mediterranéens il y a 10,000 ans. *La Recherche* 96, 82–83.

Perlès, C. (2001) *The Early Neolithic in Greece: The first farming communities in Europe.* Cambridge, Cambridge World Archaeology.

Perlès, C. (2003) An alternative (and old fashioned) view of the Neolithisation in Greece. *Documenta Praehistorica* XXX, 99–113.

Perlès, C. (2005) From the Near East to Greece: Let's reverse the focus cultural elements that did not transfer. In D. Lichter, (ed) *How did farming reach europe? Byzas* 2, 275–290. Istanbul, Deutsches archäologisches Institut.

Rackham, O. and Moody, J. (1996) *The making of the Cretan Landscape*. Manchester: Manchester University Press.

Renfrew, J. (1979) The first farmers in South East Europe. In U. Körber-Grohne (ed.) *Festschrift Maria Hopf. Archaeophysika* 8, 243–265. Köln.

Ridley, C., Wardle, K.A. and Mould, C. (eds) (2000) *Servia I, Anglo-Hellenic rescue excavations 1971–73*. British School at Athens, supplement 32.

Roberts, N. (1979) The location and environment of Knossos. British School at Athens 74, 231–241.

Sakellarakis, Y. (1973) Νεολιθική Κρήτη. In Δ. Θεοχάρη *Νεολιθική Ελλάς,* 131–146. Athens: National Bank of Greece.

Sarpaki, A. (1992) The palaeoethnobotanical approach. The Mediterranean triad or is it a quartet? In B. Wells (ed.) *Agriculture in Ancient Greece,* 61–76. Stockholm.

Sarpaki, A. and Bending, J. (2004) Archaeobotanical assemblages. In J. Soles and C. Davaras (eds) *Mochlos IC: Period III. Neopalatial settlement on the coast: The artisans' quarter and the farmhouse at Chalinimouri. The small finds,* 126–131, 135–137, Tables 34–38. Philadelphia, Pennsylvania, INSTAP Academic Press.

Sherratt, A. (1996) Plate tectonics and imaginary prehistories: Structure and contingency in agricultural origins. In D. R. Harris (ed.) *The origins* and *spread of agriculture and pastoralism in Eurasia*, 130–140. London, UCL Press.

Sherratt, D. (1980) Water, soil and seasonality in early cereal cultivation. *World Archaeology* 11, 313–330.

Stavropoulos, N., Zamanis, A., Efthimiadis, P., Samaras, S. and Matthaiou, A. (forthcoming) Phenotypic differences in Greek populations of wild wheat *Triticum monococcum* L. subsp. *boeoticum* (Boiss) and the cultivated diploid wheat *T.monococcum* subsp. *monococcum*. (Greek).

Strasser, T. (1996) Soils and settlements on Neolithic Crete. In D. S. Reese (ed.) *Pleistocene* and *Holocene fauna of Crete* and *its first settlers*. Monographs in World Archaeology 28, 317–336. Wisconsin: Prehistory Press.

Tzedakis, Y. and Marlew, H. (eds) (1999) *Minoans* and *Mycenaeans: Flavours of their time*. Athens, Greek Ministry of Culture and National Archaeological Museum.

van Andel, T. H. and Runnels, C. N. (1995) The earliest farmers in Europe. *Antiquity* 69, 481–500.

van Zeist, W. (1972) Prehistoric and early historic food plants in the Netherlands. *Palaeohistoria* 14, 41–173.

van Zeist, W. (2000) Cultivated and wild food plants at Tell Ramad. In H. de Contenson (ed.) *Ramad. Site Nėolithique en Damascène (Syrie) aux VIIIe et VIIe millénaires avant l'ėre Chrétienne,* 257–273. Beirut.

van Zeist, W. and Bakker-Heeres, J. A. H. (1975) Evidence for linseed cultivation before 6000 BC. *Journal of Archaeological Science* 2, 215–219.

van Zeist, W. and Buitenhuis, H. (1983) A palaeobotanical study of Neolithic Erbaba, Turkey. *Anatolica* 10, 47–89.

van Zeist, W. and de Roller, G. J. (1991–2) The plant husbandry of aceramic Çayönü, SE Turkey. *Palaeohistoria* 33/34, 65–96.

van Zeist, W., de Roller, G. J. and Bottema, S. (2000) The plant remains. In M. Verhoeven and P. M. M. G. Akkermans (eds) *Tell Sabi Abyad II: The Prepottery Neolithic B settlement,* 137–147. Istanbul, Nederlands Historisch-Archaeologisch Instituut.

van Zeist, W. and Waterbolk-van Rooijen, W. (1985) The palaeobotany of Tell Bouqras, eastern Syria. *Paléorient* 11(2), 131–147.

Warren, P., Jarman, M. R., Jarman, H. N., Shackleton, N. J. and Evans, J. D. (1968) *Knossos Neolithic, Part II.* British School at Athens 63, 239–276.

Wilson, D. G. (1984) The carbonization of weed seeds and their representation in macrofossil assemblages. In W. van Zeist and W. A. Casparie (eds) *Plants* and *ancient man: Studies in palaeoethnobotany,* 201–206. Rotterdam, A. A.Balkema.

Zohary, D. and Hopf, M. (2000) *Domestication of plants in the Old World*. Oxford, O.U.P.

Zois, A. (1973) *Κρήτη – Εποχή του Λίθου.* Athens, Athens Centre of Ekistics.