Neolithic Dispersals from the Levantine Corridor: a Mediterranean Perspective

Article *in* Levant · January 2001

DOI: 10.1179/007589101790217300 · Source: OAI

6 authors, including:

Edgar Peltenburg
The University of Edinburgh

Sue Colledge
University College London

Paul Croft
University of Cyprus

Carole J. Mccartney
University of Cyprus

LEVANT 33 2001 Pp. 35–64

Neolithic Dispersals from the Levantine Corridor: a Mediterranean Perspective

Edgar Peltenburg[1], Sue Colledge[2], Paul Croft[3], Adam Jackson[1], Carole McCartney[3] and Mary Anne Murray[2]

[1] *Department of Archaeology, University of Edinburgh, Old High School, Edinburgh EH1 1LT, Scotland U.K. E.Peltenburg@ed.ac.uk. Ajackson@hsy1.ssc.ed.ac.uk*
[2] *Institute of Archaeology, University College London, 31-34 Gordon Square, London WC1H 0PY, England U.K. S.Colledge@ucl.ac.uk. Mamurray@compuserve.com.*
[3] *Lemba Archaeological Research Centre, 8260 Lemba, Paphos District, Cyprus. Paulcroft@cytanet.com.cy. Carole@spidernet.com.cy*

The earliest agro-pastoralists of the Near East are generally held to have emerged in a narrow Levantine Corridor. Agricultural life initially spread from this discrete core zone in the Early Pre-Pottery Neolithic B to adjacent inland regions, only reaching the Mediterranean coast of Syria by the Late Pre-Pottery Neolithic B. Recent discoveries on Cyprus, far to the west of the core zone, prompt re-configuration of several elements of this model. They also provide evidence for characteristics of a regional variant of the PPNB and, in a broader context, fresh data for an understanding of the triggers and mechanics of precocious neolithic dispersals.

In a flurry of recent reviews of evidence for the transition from foraging to agricultural societies in the Near East, emphasis is placed on the Levantine Corridor as the geographical focus of this seminal process (e.g. Bar-Yosef 1993; 1998a; 1988c; Bar-Yosef and Belfer-Cohen 1989; Bar-Yosef and Meadows 1995; Byrd 1992; Cauvin 1989, 1997; Cauvin *et al.* 1998; Garrard 1999; Harris 1996a). The corridor is a narrow belt of land stretching from the Dead Sea to the Balikh River and the great bend of the Euphrates in north Syria and south-east Anatolia (see Fig. 1 which only shows the northern part of the corridor for the sake of convenience). There is a growing consensus that the cultivation of cereals and other crops began here in the eleventh-tenth millennia BP and that animal husbandry appeared as much as a millennium later, at different times in the Early-Middle Pre-Pottery Neolithic B (Bar-Yosef and Meadows 1995; Harris 1998). It was especially after the establishment of agro-pastoral communities that demographic expansion took place and that farming spread beyond the Levantine Corridor. [All dates in this paper are in uncalibrated radiocarbon years BP; E, M and L PPNB = Early, Middle and Late Pre-Pottery Neolithic B].

Cauvin (1989; 1997) has suggested a stadial model for this dispersal. According to his model, expansion took place from north Syria in the EPPNB towards the north, into south-east Anatolia, still within the corridor, followed by migration to the south Levant in the MPPNB and the Mediterranean coasts and the arid zone in the LPPNB (cf. also Cauvin *et al.* 1998, 62, 64). Özdoğan (1997) has added a fourth episode at the end of the PPNB which saw movement westwards through Anatolia towards Europe (cf. Van Andel and Runnels 1995). Leaving aside questions about types of diffusion, the appearance of domestic-type grains in the PPNA, and ephemeral settlement with domestic-type einkorn and barley at Jilat 7 in arid zone Jordan, already in the EPPNB, demonstrate how tenuous these models are in our present state of knowledge (Garrard *et al.* 1996). It may be more prudent to follow Bar-Yosef and Meadows (1995, 41) who prefer an uneven series of movements into areas bordering the Levantine Corridor, rather than particular waves. Whatever the sequence and mechanics, all recognise the patchiness of the archaeological record in areas adjacent to the Levantine Corridor, hence the important issue of initial neolithic dispersals

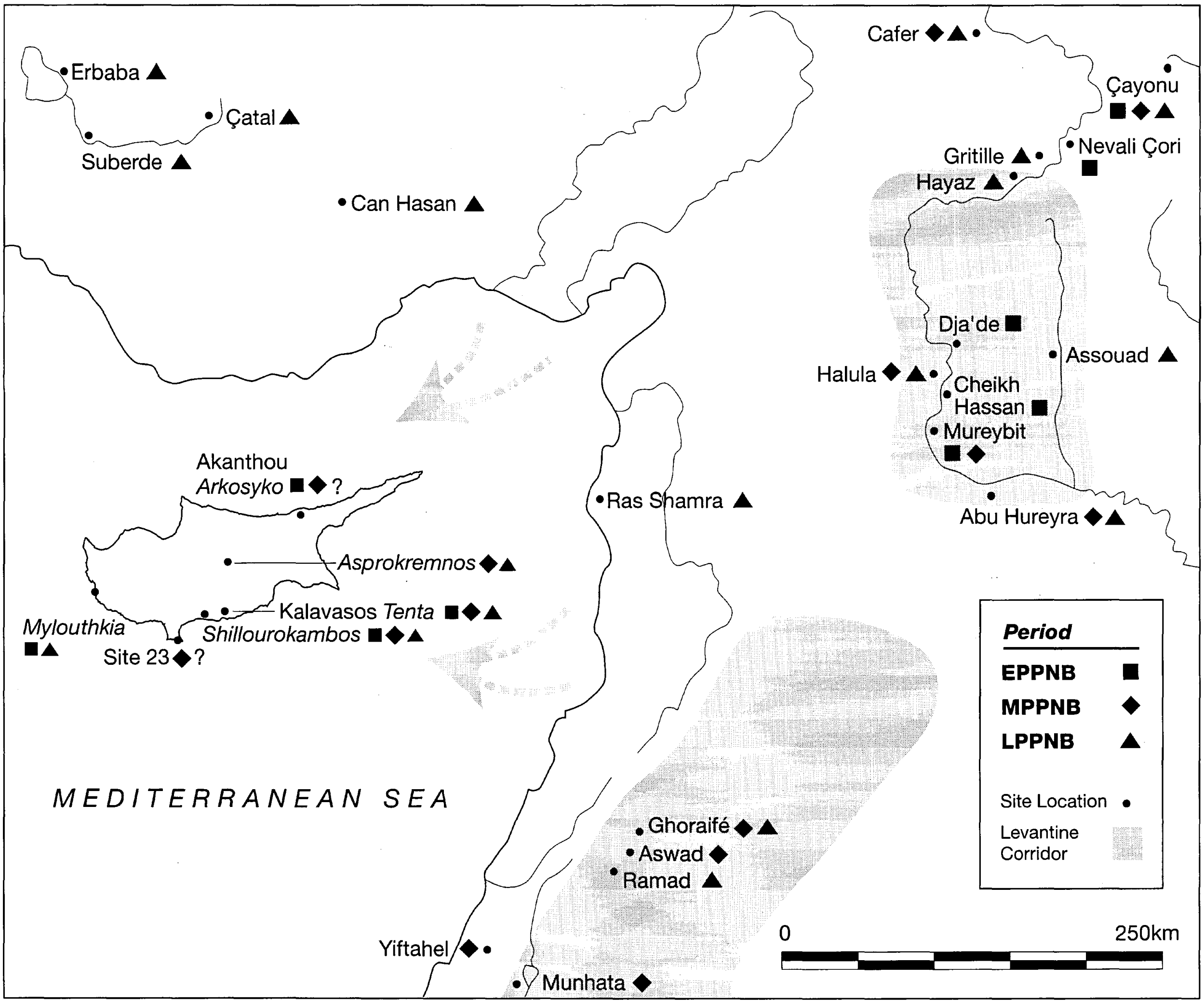

Figure 1. *Map of the northern mainland Levant and Cyprus during the Pre-Pottery Neolithic B period, c. 9500–8000* BP. *For other sites that may have been occupied during one or more phases of this period see p. 56. Area of Levantine Corridor (shaded) after Bar-Yosef 1998a.*

from pristine centres can only be addressed in a general manner. Indeed, if the archaeological record around the corridor is so poorly known, then the integrity of the corridor itself must be in some doubt. The discovery and excavation of key sites in that zone is more the result of rescue excavation in dam areas along the Euphrates than systematic survey. In short, the exclusiveness of the corridor concept during the PPNA-EPPNB may be more a reflection of the current concentration of fieldwork than past reality.

In what is a widely debated issue, many contend that the impetus for this movement was demographic expansion following the advent of increased sedentism, cultivation and agriculture. According to this view, we are dealing with migration rather than stimulus diffusion, although empirical evidence for migration and its causes, such as stress due to density of large sites or insufficient size of sustaining territories, is lacking. In spite of much valuable research in the south Levant and Syro-Anatolia, it is evident that we are still poorly informed about the distribution of PPNA-EPPNB sites that will supply contextual evidence for initial neolithic dispersals. Thus, "there is no clear picture of the spread of [cereal] species from the Levantine Corridor" (Bar-Yosef 1998c, 60) and "the mechanisms by which agriculture spread throughout the fertile Levant during the PPNB are as yet undemonstrated" (Byrd 1992, 53).

The Cypriot background

As sometimes happens in research, new light on old problems comes from unexpected quarters, in this case the island of Cyprus. Until now, Cyprus has had little to offer to debates concerning the transition from hunter-gatherer to agricultural societies or to neolithic dispersals. Maps conveying the formative transition stages exclude the island or leave it as a blank canvas because there were no Aceramic Neolithic sites that could certainly be ascribed to the period prior to the fully-fledged Khirokitian of the eighth-seventh millennium BP (e.g. LeBrun 1989). This lacuna helped to reinforce the argument most clearly put forward by Cauvin (1989) that neolithic dispersal beyond the corridor to the west was a belated episode, occurring only in the LPPNB in coastal Syria and after that to Cyprus. The earlier arrival of farmers much further west at Franchthi cave in Greece *c.* 8000 BP highlights the anomalous nature of the Cypriot, and to some extent also, the west Syrian archaeological record (Hansen 1992).

Claims for earlier occupation of Cyprus based on poor flint assemblages remain highly equivocal (Cherry 1990). More certain evidence emerged in the mid-1980s when Ian Todd published a series of radiocarbon dates from Aceramic Neolithic deposits at Kalavasos-Tenta (hereafter, Tenta) that included one as early as the tenth millennium BP (Todd 1987, 173–8). On the basis of the dates shown in Fig. 3, two phases of the site could be dated to before Khirokitia. However, he treated the first with caution and rejected dates for the second. The first, his Period 5, comprised exiguous traces of post structures. The second, Todd's Period 2, consisted of a discrete arrangement of circular, stone-based buildings in an area known as 'top of site', stratigraphically unconnected with other structures in the lower area. According to the prevailing orthodoxy of the 80s, aceramic sites with circular stone architecture could not be earlier than Khirokitia. For this underlying reason, and because of his site phasing, a phasing that was discordant with three 'top of site' ^{14}C dates, Todd attributed these structures to the Khirokitian. He was at pains to point out, however, that the 'top of site' settlement was not stratigraphically linked to the lower area and that an earlier date remained a possibility. Nonetheless, most scholars have followed his attribution, leaving only elusive hints of pre-Khirokitian sedentary occupation on Cyprus. To be sure, humans had reached the island much earlier, perhaps in the eleventh millennium BP at the rock shelter of Akrotiri-Aetokremnos (hereafter, Aetokremnos) but, in his final publication of the site, Simmons concludes that these precocious foragers only stayed for a short time and abandoned the island when the indigenous megafauna on which they depended became extinct (Simmons *et al.* 1999, 319–23). In sum, standard prehistories of Cyprus claim that hunter-gatherers did not survive on the island which to all intents and purposes remained uninhabited until the Khirokitian.

Our understanding of this hiatus was radically altered in the 1990s as a result of excavations and renewed study of chipped stone assemblages. To anticipate, some six sites are now recognised to belong to the tenth-ninth millennia BP, one possesses domestic cereals in the later tenth millennium BP, and combined evidence from two sites establishes the presence of morphologically wild cattle, sheep and goat, and domestic pig, also in the later tenth millennium BP. The existence of such an array of cultigens and subsistence animals on a Mediterranean island in the EPPNB, far outside the Levantine Corridor, provides new insights into the timing and direction of early neolithic dispersals and the motives and abilities of the earliest farmers to migrate. It would seem that agro-pastoralism was established more widely and much earlier than even recent evidence has allowed us to think (e.g. Harris 1998, 9).

That such diffusion was the result of the migration of Near Eastern groups is evident from the PPN character of the earliest Cypriot neolithic material culture, the apparent lack of indigenous foragers who may have adopted agriculture and the absence of this faunal array from Cypriot Pleistocene deposits and the Aetokremnos rock shelter. Further, the wild progenitors of einkorn and emmer have not been identified archaeologically in early deposits, and to date there appears to be no recorded evidence that these were native taxa (e.g. Zohary and Hopf 1993). This does not preclude the possibility of their presence in antiquity, but it would seem more likely that domestic grains were imported into the island. As Bar-Yosef and Meadows (1995, 81) assume, "when farmers move into a new territory they will carry with them seed stocks, domesticated animals, basic building preferences and lithic technologies". In the case of Cyprus, the close parallels in subsistence, technology, settlement organisation, ideological indicators and participation in the PPNB interaction sphere (Fig. 2) support the argument that PPN mainlanders emigrated to the island. They probably found it to be depopulated since there are no signs that the diacritical markers of Figure 2 were adjusted to indigenous cultural realities.

So close are the cultural and economic affinities between mainland and island that we view this extension as the Cypro-PPNB *facies* of the PPNB

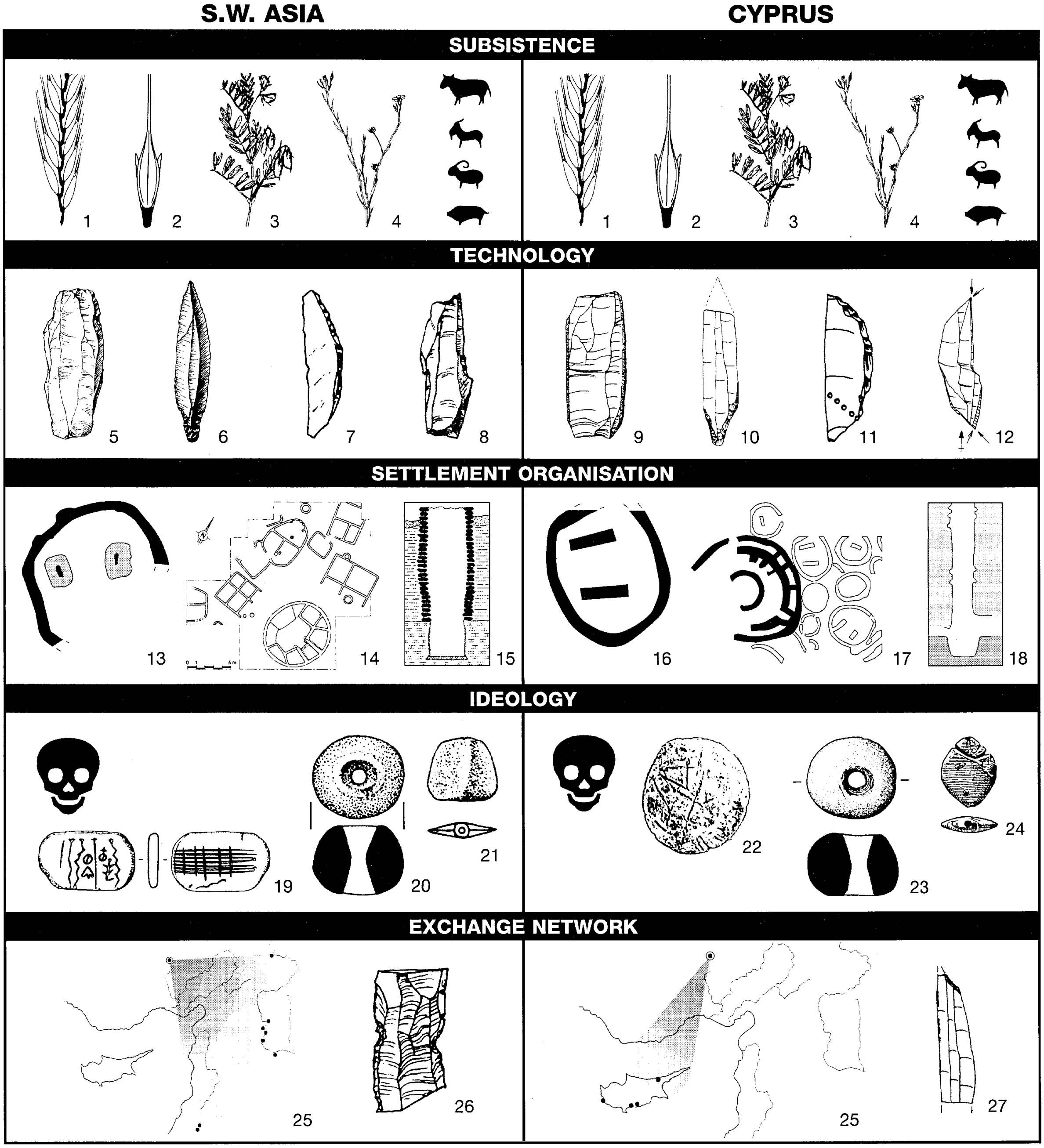

Figure 2. *Selected parallels and interactions between the PPN of south-west Asia and the Cypro-PPNB. Nos1-4. (1. Ear of wheat; 2. Two-rowed barley; 3. Wild lentil; 4. Wild flax). Van Zeist 1988, 66, figs 2, 3; Zohary and Hopf 1993. No. 5. Crowfoot-Payne 1983, 668, fig. 293. No. 6. Cauvin 1974, 434, fig. 3:7. No. 7. Crowfoot-Payne 1983, 663, fig. 291:4. No. 8. Crowfoot-Payne 1983, 652, fig. 278.10. Nos 9-12. From Fig. 9. No. 13. Göbekli: Beile-Bohn* et al. *1998, 48, fig. 20. No. 14. Jerf el Ahmar: Stordeur 1999, 142, fig. 8b. No. 15. Atlit-Yam: Galili* et al. *1993, 141, fig. 10. Nos 16, 17. Tenta: Todd 1987, fig. 20. No. 18. Kissonerga-Mylouthkia (Lemba Archaeological Project archive). No. 19. Jerf el Ahmar: Jamous and Stordeur 1999, 64, fig. 6. 5. No. 20. Nemrik: Mazurowski 1997, pl. 26. 3. No. 21. Tell Abu Hureyra: Moore* et al. *1975, 65, fig. 9. 10–17. No. 22. Parekklisha-Shillourokambos (Guilaine* et al. *1998a, 37). No. 23. Kissonerga-Mylouthkia (Lemba Archaeological Project archive). No. 24. Khirokitia: Dikaios 1953, 306, fig. 107. No. 25. after M.-C. Cauvin* et al. *1998, fig. 7a, 334, with additions. No. 26. Crowfoot-Payne 1983, 700, fig. 330.4. No. 27. From Fig. 9.*

(see also Peltenburg *et al.* forthcoming a). Although similar to Cauvin's concept of a Taurus *facies*, it differs in the important respect that there was little and probably no mixture with native foragers and that hence homeland traditions were modified only insofar as founder principles of colonising communities and adaptations to a different environment are seen to operate (cf. M.-C. and J. Cauvin 1993). In contrast to Guilaine *et al.* (2000) who maintain that the Cypriot Aceramic Neolithic was derived from PPNB cultures in the Upper/Middle Euphrates valley, we argue that the Cypro-PPNB evolved from as yet undetected west Syria populations (see below) and that the similarities with inland regions are due to the widespread distribution of the PPNB and our better knowledge of sites in the Euphrates valley.

Before turning to some inferences from this unfolding testimony, we outline salient features of the new sequence. In doing so, we concentrate on distinctive social practices and on the archaeobotanical and zooarchaeological evidence, since they particularly enhance our understanding of the nature of migration and the spread of early farming. But first, a brief introduction to the sites and their chronology is warranted.

The Cypro-PPNB sites

Kissonerga-Mylouthkia

As a result of a watching brief since 1989, the University of Edinburgh's Lemba Archaeological Project is investigating negative features revealed by quarrying and development at the coastal site of Kissonerga-Mylouthkia (hereafter, Mylouthkia) in the south-west of the island (Fig. 1). They consist of some nine discrete entities belonging to the Aceramic Neolithic: five water wells (three excavated), a semi-subterranean curvilinear structure and three pits. The features occur in a *c.* 200 m. long strip between the 21–25 m. contours located about 100 m. from the present coastline on gentle slopes with denuded old ground surface. Prolific fills of two of the *c.* 8 m. deep wells yielded datable material (Fig. 3). Period 1A well 116 has barley and other short-lived cereal grains AMS dated to the later tenth millennium BP. These data appeared too late for Cauvin to include in his recent treatment of the early Neolithic of Cyprus (Cauvin 1997, 220–26). The grains come from as deep as 3.7 m. below the surviving top of the shaft in rubble and clayey silt fills. *Pistacia* sp. nutlets and *Lolium* sp. seeds provide AMS dates of the late ninth millennium BP from nearby Period 1B well 133. These seeds were recovered almost 2 m. below the extant lip of the well. Since there is no intrusive material in these wells and their essentially undisturbed fills included intact delicate material like a human skull, the wells were most probably deliberately packed at abandonment. They are thus amongst the earliest known wells in the world. Contemporary features which are probably wells exist at Parekklisha-Shillourokambos (below; hereafter Shillourokambos) and a later PPN example occurs at Atlit-Yam (Galili *et al.* 1993), also on the Mediterranean coast. The dates and the samples also suggest that Mylouthkia was occupied continuously or intermittently for at least a millennium by farmers who possessed a tradition of well-digging. Details of Mylouthkia are reported in Peltenburg *et al.* forthcoming a and forthcoming b.

Parekklisha-Shillourokambos

In the late 80s and early 90s a French survey team claimed neolithic dates for flint scatter sites some 5 km. from the south coast near modern Limassol (Fig. 1). Since 1992, Jean Guilaine's excavations at one of these, Shillourokambos, has revealed an extensive array of distinctive features (Guilaine *et al.* 1995, 1998a, 1998b, 2000; Vigne *et al.* forthcoming). The tenth – ninth millennium BP chronology of the site is based on some 13 charcoal-derived radiocarbon dates which point to permanent occupation (Fig. 3 and Vigne *et al.* in press). Settlement phases occur side by side, not vertically superimposed as on continental PPNB tells, and it is possible to discern settlement drift north-west to south-east in an area of *c.* 2 ha. along an interfluve. The excavators have divided the aceramic remains into four periods: Early Phase A, Early Phase B, Middle Phase and Late Phase. Early Phase A comprises probable wells, pits, post-hole alignments, and palisade trenches that form an enclosure with entrances. The multi-entry trapezoidal 76 $m.^2$ enclosure, perhaps set inside a curving palisade, may have functioned as a stockade for animals that were recently brought to the island. Penning of animals, some of which were still morphologically wild, provides an insight, however poorly understood, into the mechanics of tenth millennium BP animal control lacking on the continent. Early Phase B includes a well with plaster(?) figurine, pits and stone wall fragments together with abundant faunal and lithic remains. Upstanding curvilinear stone architecture appears at least by the Late Phase, to be dated to the end of the ninth millennium BP. Thus, there is a general trend from timber to stone-based features, although we should be careful of using building mediums as specific chronological markers since timber is likely

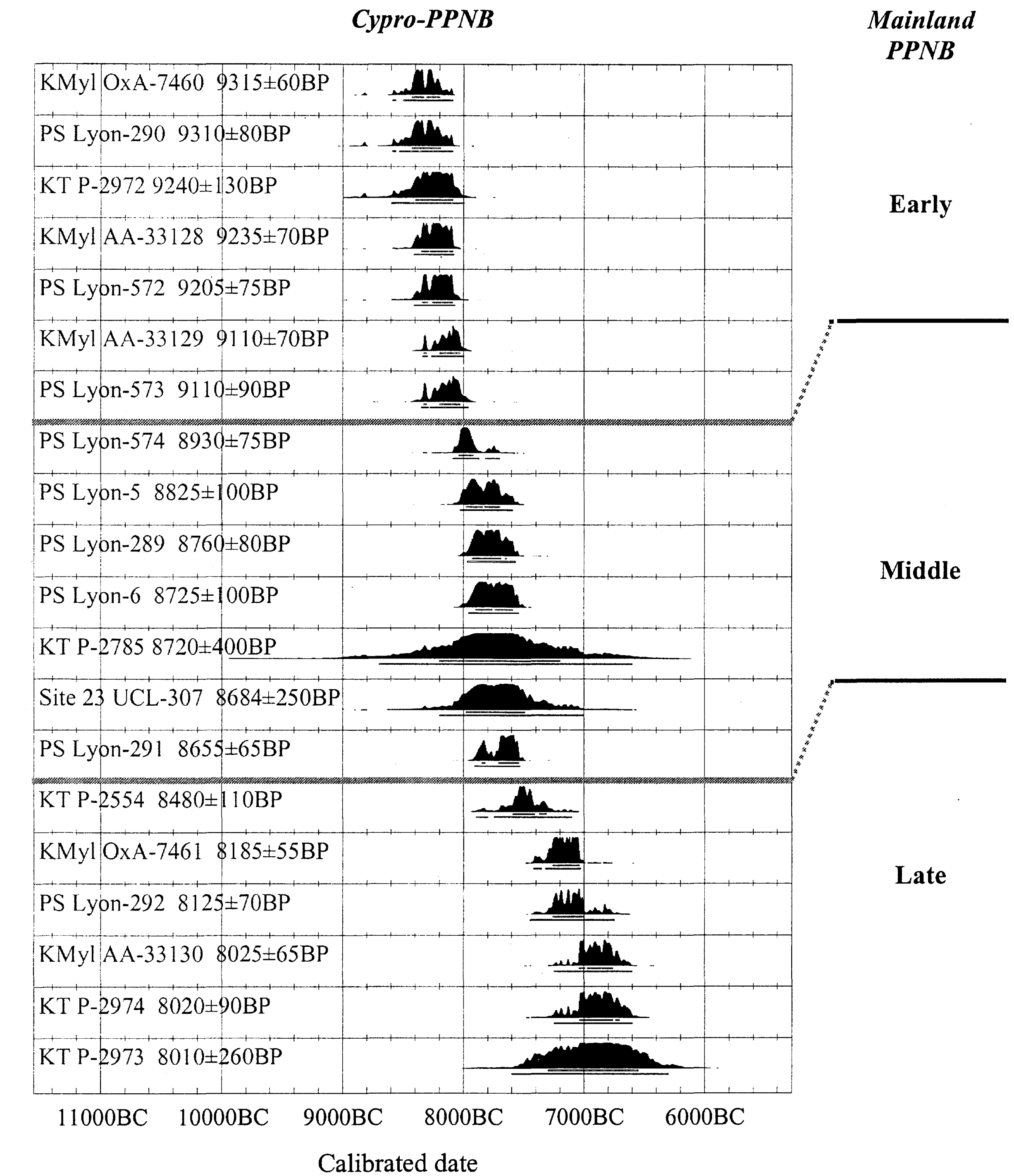

Figure 3. *Calibrated calendar probability age ranges for ^{14}C determinations from the Cypro-PPNB period on Cyprus (calibrations: OxCal version 3.4). KT (Kalavasos-Tenta), KMyl (Kissonerga-Mylouthkia), PS (Parekklisha-Shillourokambos), Site 23 (Akrotiri-Vounarouthkia ton Lamion East). UCL-307 is corrected from Reservoir Effect from 8350±250* BP.

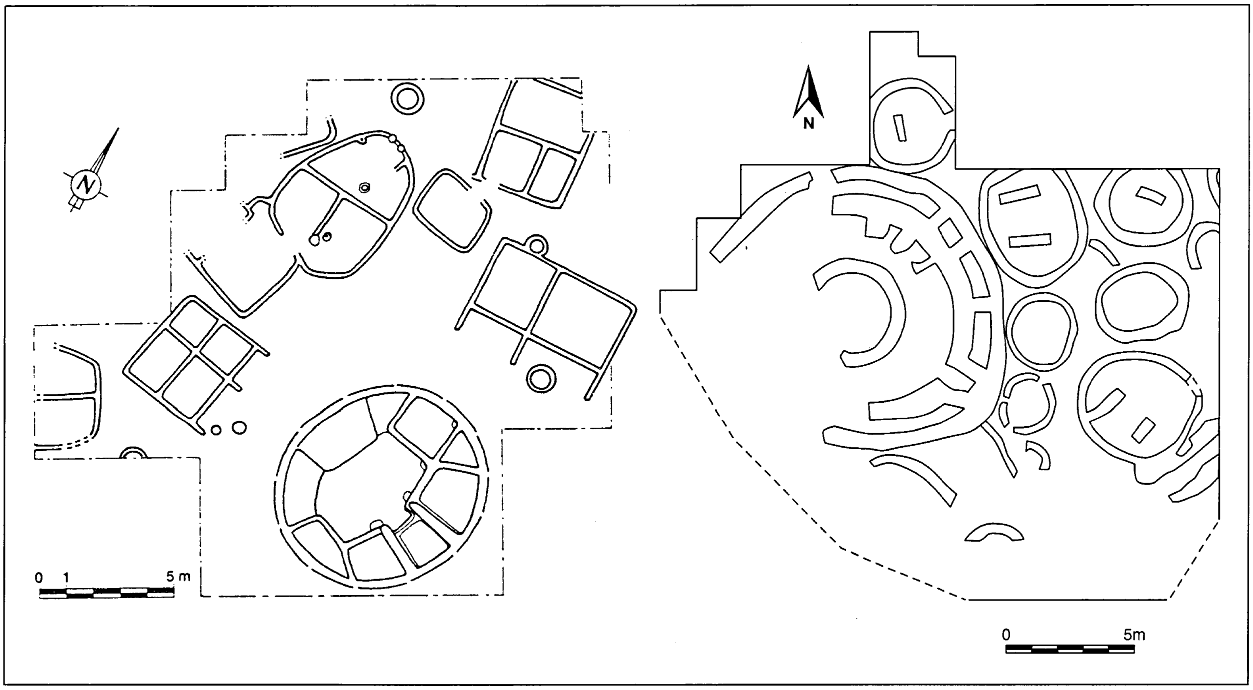

Figure 4. *Comparative plans of PPNA Jerf el Ahmar (left) and Cypro-PPNB Kalavasos-Tenta (right). After Stordeur 1999, 142, fig. 8b and Todd 1987, fig. 20.*

to have been used at any newly founded settlement in a wooded environment.

Kalavasos-Tenta

We have already noted that Tenta 'top of site' (=Period 2) has charcoal derived pre-8000 BP dates, ones that place its distinctive settlement plan in the Cypro-LPPNB, with possible extension into the early Khirokitian. Acceptance of these dates has significant ramifications, so it is necessary to amplify arguments for the re-dating of Period 2. As shown in Figure 4 right, it consists of an imposing, *c.* 12 m. diameter circular structure with three concentric walls and radial cells flanked by rows of relatively thin-walled, small curvilinear buildings with single rooms, some containing pillars. This edifice crowned the top of the small hill on which the site was founded, so it dominated contiguous structures by virtue of topography, size and complexity. That this was an enduring hierarchy is evident from traces of two equally large precursors, each of which had exceptional red plastered floors. The ninth millennium BP dates were from samples located in the latest of the dominant structures and contemporary adjacent units (Fig. 3: P–2554, 2973–4). There are no other dates from this 'top of site' settlement. With the exception of dates from the timber Period 5 (Fig. 3: P-2785, 2972), all other secure dates from the site are later. These 11 dates come from the 'Lower South Slope' which is stratigraphically unconnected with the 'top of site'. Although Todd proposed that the 'top of site' was in fact later than the 'Lower South Slope', the radiocarbon dates are consistent and they allow another interpretation, one in which Tenta 'top of site' is regarded as contemporary with Mylouthkia 1B and Shillourokambos Middle Phase. While we await full publication of finds from the relevant Tenta contexts, preliminary assessments of chipped stone do not contradict the suggested Cypro-LPPNB chronology for the 'top of site' settlement derived from radiocarbon dates (Todd forthcoming).

Three implications of the re-dating of Tenta are pertinent here. First, it endorses the general trend from timber to stone-based architecture within the Cypro-PPNB. Second, it demonstrates that the characteristic circular building plan of the Khirokitian existed in the Cypro-PPNB in a more articulated form than is evident at Shillourokambos. Third, the ninth millennium BP date for Todd's Period 2 settlements renders more plausible a meaningful link between the remarkable 'top of site' plan and the strikingly similar hierarchical layout of Jerf el Ahmar in the Levantine Corridor (Fig. 4 left). At that Tishreen Dam PPNA site, we also have a distinctive core structure which is circular, disproportionately large with radial cells and is flanked by a variety of smaller buildings. Danielle Stordeur, the excavator, argues that the enormous size of the central structure demanded collective labour and asks if, with its small radial cells, it may have served in part as a communal granary (Stordeur 1999, 145). Risk reducing measures or delayed return mechanisms are attested at many sites, but here and at Tenta the elaborate architectural settings for storage surpass functional requirements and suggest controlling authorities.

Similarities extend beyond the general spatial organisation of settlement. Jerf el Ahmar was part of the wider Syro-Anatolian interaction sphere in which pillars occurred inside buildings. Such rectilinear pillars are found at Göbekli and Nemrik (Fig. 2.13 and Kozłowski 1992, 29, fig 16), for example. The significance of this distinctive architectural feature in terms of the re-dating of Tenta is that they provide less distant precursors for identical pillars that occur as singles or pairs in four of the seven more completely excavated 'top of site' structures. In fact, these disproportionate elements have become structurally redundant on Cyprus where wide walls support roofs. In one of the earliest mainland prototypes, at Nemrik, the pillars are tentpole skeumorphs since they, and not the walls, support roofs. Redundancy in the Cypriot examples implies that other reasons account for their retention over millennia in the island colonies. One possibility was the association of pillars with highly charged symbolism. So much is evident from the remarkable representations of people and animals on their shafts and capitals at Göbekli and Nevali Çori (Hauptmann 1999, figs 13A-B, 16, 23, 29) and the recurrence of human representations on a pillar at Tenta (Todd 1987, fig. 39). More pillar decoration on Cyprus has not survived probably because they were executed in paint rather than in relief as in north Mesopotamia. Thus, intramural pillars, circular building plans and settlement organisation are vectors of island archaism that point to an ultimate ancestry for the Cypriot Aceramic Neolithic in north Syria and south-east Anatolia. Of course, to infer an origin from similarity in form has been the undoing of many prehistorians, but when taken together with other connections to be discussed, the claim gains force.

Other sites

Much less is known about the other three Cypriot sites that belong to this period. McCartney's study of a chipped stone grab sample from the recently surveyed inland site of Ayia Varvara-Asprokremnos (hereafter, Asprokremnos) allowed her to date it to the pre-Khirokitian (McCartney 1998). Site 23 on the Akrotiri peninsula is in all probability a deflated multi-period entity whose claim to belong to this period rests primarily on the identification of certain flints, including a Byblos point, and a radiocarbon date (Fig. 3 and Simmons *et al.* 1999, 254-8). More promising is a third site on the northern coast of Cyprus. Long known to archaeologists as an Aceramic Neolithic locality, Akanthou-Arkosyko (or Tatlisu-Ciftlikduzu) has recently yielded cattle bone, miniature picrolite cups with hatched decoration and prodigious quantities of obsidian from survey and trial trenches (Şevketoğlu 2000, 72–9, 117). Picrolite must have been obtained from relatively distant localities on the island, hence the picrolite objects may be exchange items in return for imported obsidian. These features are essentially pre-Khirokitian traits that point to a Cypro-E/MPPNB occupation on the site. For example, it has been shown that high proportions of obsidian may be chronological markers of the Cypro-E/MPPNB (Briois *et al.* 1997; Peltenburg *et al.* forthcoming b; see below). This hallmark suggests that other aceramic sites with high obsidian incidence, like Troulli I, may belong to an earlier period than hitherto suspected (cf. Peltenburg 1979).

The introduced domesticated plants

Background

There has been a long history of research into the origins and evolution of domestic crops in south-west Asia (Harris 1996b). Archaeological and archaeobotanical research has focussed on sites and material from sites in the Levant and south-east Turkey, and particularly on those with occupations spanning the time during which it is thought that cultivation of wild species (e.g. grasses/cereals) began and domestic strains first evolved. The developmental changes took place throughout the Epipalaeolithic, PPNA and PPNB periods, from *c.* 12,500 to *c.* 8000 BP. Genetic studies of present day populations of species in the same areas have concentrated on mapping the distributions of the wild progenitors of the 'founder crops', einkorn wheat (*Triticum monococcum*), emmer wheat (*Triticum dicoccum*), hulled barley (*Hordeum sativum*), lentil (*Lens culinaris*), bitter vetch (*Vicia ervilia*), pea (*Pisum sativum*), chick pea (*Cicer arietinum*) and flax (*Linum usitatissimum*) (Zohary 1996, 143–4). These have resulted in suggested locations where the earliest 'domestication events' may have taken place (Harris 1996b, 5-7; Heun *et al.* 1997; Valkoun *et al.* 1998; Zohary 1996). Much scientific debate has surrounded the issue of 'how many times' the 'founder crops' had undergone domestication. This question is crucial to the understanding of the dynamics of these fundamental episodes that led to the development and spread of agriculture and agricultural communities in south-west Asia. In a recent paper, Zohary concluded,

> "..., the available data – fragmentary as they are – appear to support the hypothesis that the development of grain agriculture in Southwest Asia was triggered (in each crop) by a single domestication event or at most by very few such events." (Zohary 1996, 156)

This issue is contentious and is considered by several scholars to be unresolvable on the basis of present knowledge (Harris 1996c, 555–6). In support of his hypothesis for single, or at most few, 'domestication events', Zohary states,

> "Yet once the technology of crop cultivation was invented, and the domesticated forms of wheats, barley, pulses and flax first appeared, they probably spread over the Near Eastern arc in a manner similar to the way in which they later spread into Europe: not by additional domestications in each species but by diffusion of the already existing domesticates. In other words, soon after the first non-shattering and easily germinating cereals, pulses and flax appeared, their superior performance under cultivation became decisive, and there was no need for repeated domestication of the wild progenitors." (Zohary 1996, 156)

Charting the evolution and spread of the earliest cultivars based on archaeobotanical evidence has involved the examination and accurate identification of charred grains/seeds found in samples recovered from securely dated occupation levels. The reported presence (or absence) of taxa with correctly assigned domestic status at different localities and at different times has formed the basis of our knowledge about the distribution of the earliest crops and also of their subsequent dispersion throughout the Levant, and beyond. Current debates, however, have highlighted problems underlying the accurate identification of ancient plant remains, in particular the grains and chaff of cereals (Harris 1998, 6; Hammer and Specht 1998, 270; Nesbitt and Samuel 1996, 55–59). Misidentification of these taxa or inappropriate allocation of wild or domestic status would have significant implications for interpretations of early subsistence systems. For example, in the case of the two 'founder crop' glume wheats (i.e. *Triticum monococcum* – einkorn and *Triticum dicoccum* – emmer), whose overall gross morphologies (grain shape and size) are very similar, distinction between the ancient grains can be difficult. Likewise, the wild ancestral species of these two cereals, as well as that of the third 'founder crop' cereal (*Hordeum sativum* – hulled barley), closely resemble their domestic forms and differentiation between these can be equally problematic.

The growing consensus is that domestication first occurred in the south-central Levant (i.e. upper Jordan Valley/Damascus Basin) and possibly south-east Turkey, by the early tenth millennium BP, in the PPNA period (Garrard 1999, 82; Harris 1998, 8). It is agreed, however, that the archaeobotanical records are patchy and it is likely as more comprehensive archaeological surveys and excavations are completed and more samples are recovered and examined that the overall sequence of events will become clearer. More sophisticated dating techniques and more refined assessment of the morphological traits required to enable recognition of the domestic species will also enhance our knowledge.

The Mylouthkia samples

In total, 900 litres of deposit from 13 samples were processed and this volume produced 2,642 identifiable plant items and 67.7 ml. of wood charcoal. Of the 12 samples that yielded plant remains, five were from well 116, four from well 133, two from pit fills (338) and one from a possible building fill (340). Samples from both the tenth and ninth millennia BP contained grains and chaff of glume wheats (*Triticum* spp.) and hulled barley (*Hordeum* spp.), lentils (*Lens* sp.), large seeded legumes (*Lathyrus/Vicia* spp.), linseed/flax (*Linum* sp.), pistachio (*Pistacia* sp.), nuts, roots/tubers, wild/weed taxa (particularly wild grasses) and wood charcoal.

Glume wheats

In the following section the suffix 'type' has been added to the names of the cereals. The identifications are inevitably based on knowledge of the morphologies of present day taxa and, as such, there is bound to be a degree of uncertainty about any classifications assigned to the species level. The 'type' suffix is an acknowledgement of the tentative nature of the identifications that have been made.

Of significance to this present study is that the samples contained whole and fragmentary grains of glume wheats. Determination of the wild or domestic status of these taxa was, therefore, an obvious priority. As many as possible of the criteria which previously have been used to distinguish between glume wheat grains were examined and measured in order to justify any identifications that were made (G. Hillman pers. comm.; Nesbitt and Samuel

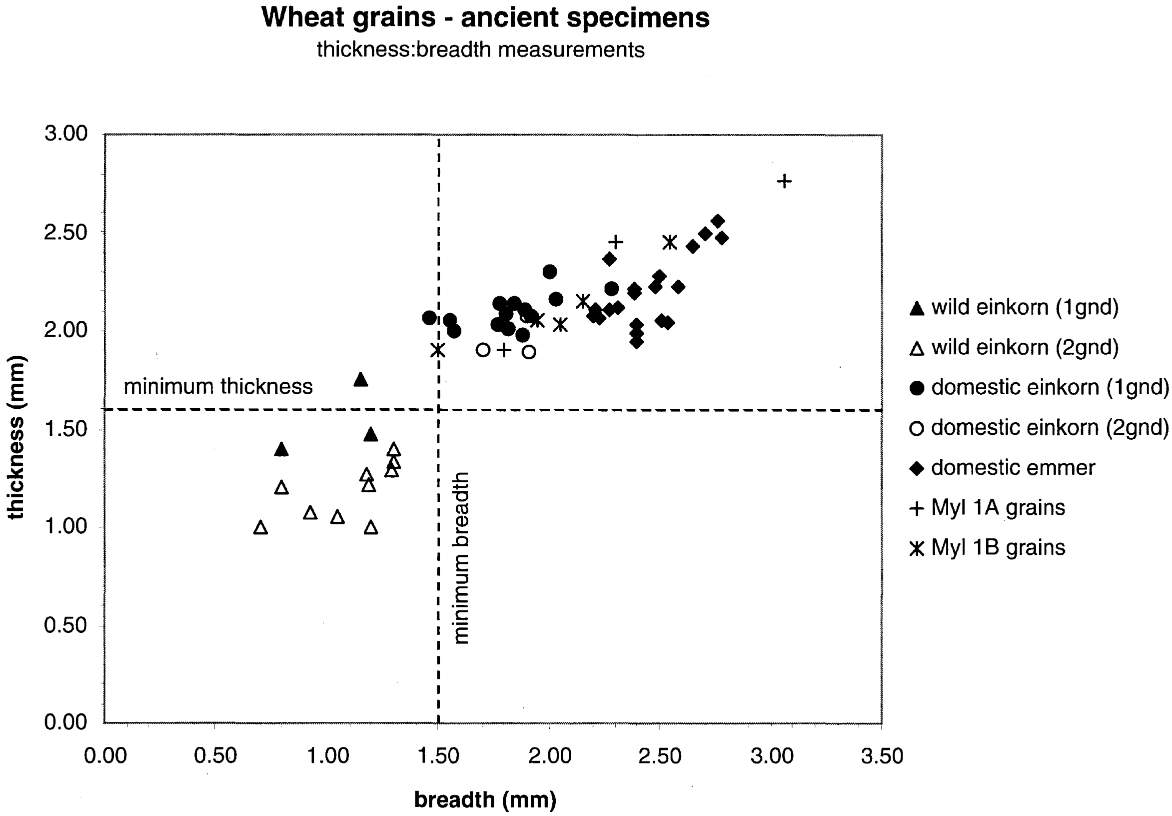

Figure 5. *Glume wheat measurements from the sites of: Erbaba (van Zeist and Buitenhuis 1983); Çayönü (van Zeist and de Roller 1991–92); Wadi Jilat 7, Wadi Jilat 13, Iraq ed-Dubb, Dhuweila, Beidha, Wadi Fidan A/C (Colledge 1994); Tell Ramad, Tell Aswad, Tell Ghoraifé (van Zeist and Bakker-Heeres 1982); Tell Mureybit (van Zeist and Bakker-Heeres 1984b); Tell Ras Shamra (van Zeist and Bakker-Heeres 1984a); Cape Andreas-Kastros (van Zeist 1981). The total is 1507 but level 426J at Erbaba has no record of the numbers of grains measured and so this figure is an underestimation. In most cases, the records of dimensions of grains from the other sites are given as mean values. The authors found no published records of dimensions for grains identified as wild emmer (*Triticum dicoccoides*).

1996, 58; van Zeist and Bakker-Heeres 1982, 185–191). Differentiation between wild *versus* domestic and diploid (e.g. *Triticum monococcum*) *versus* tetraploid (e.g. *Triticum dicoccum*) wheat species is based partly on the degree of attenuation and lateral compression of the grains. For example, einkorn grains tend to be 'thinner' with highly attenuated apical and embryo ends. The shape of the dorsal ridges (i.e. their symmetry or asymmetry), presence of apical 'notches', degree of convexity of ventral and dorsal surfaces are also useful distinguishing characteristics. On the basis of these morphological features alone it is suggested that both domestic einkorn and emmer types are present in the Mylouthkia samples.[1]

Many authors have combined metrical analyses with more subjective morphological descriptions in an attempt to substantiate identifications of cereal grains. In particular, relative measurements of length, breadth and thickness have been used to aid identification (van Zeist and de Roller 1991–92 with references). In this study all 22 whole grains/fragments were measured. Figure 5 presents a scattergram diagram of thickness *versus* breadth for the glume wheat grains (length *versus* breadth comparisons were not appropriate for all specimens because of their fragmentary nature). The measurements of the Mylouthkia grains (i.e. mean values calculated per level and assigned to Periods 1A and 1B) are plotted against those of *c.* 1500 identified specimens from 14 Neolithic sites in the Levant (see Fig. 5 for references). Dashed lines have been drawn on the plots to represent the minimum recorded breadth and thickness of the Mylouthkia grains. Of note in this diagram is that the wild einkorn-type grains form a distinct cluster and are separated from the grains of both domestic species. These grains are apparently much narrower and thinner than the domestic forms. There is also a distinction between those grains recorded as domestic einkorn-type and domestic emmer-type. On the basis of these comparisons of very limited data, it appears that those grains which were identified as emmer-types have consistently broader grains than the einkorn-types. Grains from Mylouthkia Periods IA and IB fall within the size limits 'defined' here for both domestic einkorn and domestic emmer-types. None is within the range of sizes occupied by the wild-einkorn types. The metrical analyses thus concur with the results of the morphological assessments of the grains and it is suggested, therefore, that domestic einkorn and emmer (types) were present on Cyprus in the Cypro-EPPNB and LPPNB.

Hulled barley

The Mylouthkia samples contained 19 whole grains/fragments of hulled barley. Modern populations of wild barley (*Hordeum spontaneum*) produce smaller, slimmer grains than those of modern populations of the domestic species (*Hordeum sativum*). These differences in size, however, can be eliminated during charring (which causes distortion/puffing) and so ancient grains can be extremely difficult to identify. The Mylouthkia grains were relatively large but it was not possible to assign either domestic or wild status on the basis of subjective morphological assessment alone. Again, all the specimens were measured and compared with 346 wild and domestic barley grains recorded from 10 Neolithic sites in the Levant (see Fig. 6 for references). Figure 6 presents a scattergram diagram of the thickness *versus* breadth measurements of these ancient specimens. For the Mylouthkia grains, the mean dimensions per level have been plotted (and assigned per Period) and dashed lines represent the minimum breadth and thickness recorded. The wild-type barley grains are distinct from those identified as domestic-type and there is minimal 'overlap' either on the basis of breadth or thickness between the two. The Mylouthkia grains from Periods 1A and 1B clearly fall within the size range 'defined' here as domestic

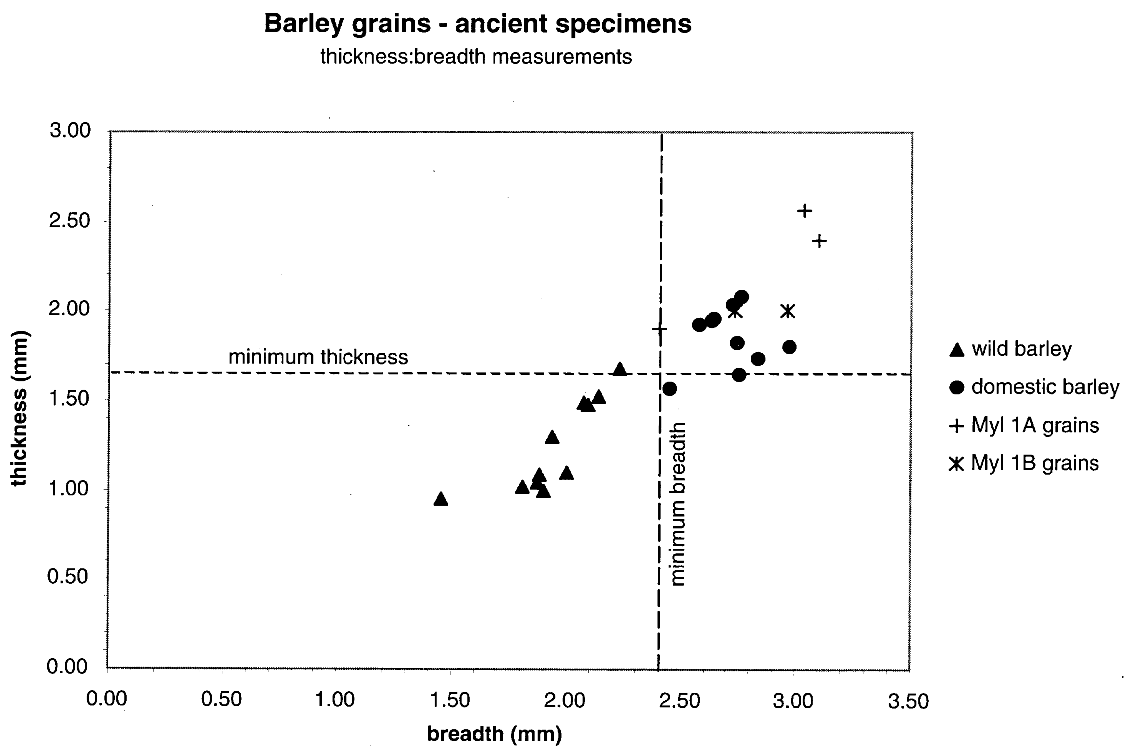

Figure 6. *Hulled barley measurements from the sites of: Çayönü (van Zeist and de Roller 1991–92); Wadi Jilat 7, Wadi Jilat 13, Iraq ed-Dubb, Dhuweila, Wadi Fidan A/C, Azraq 31 (Colledge 1994); Tell Ramad, Tell Aswad, (van Zeist and Bakker-Heeres 1982); Tell Mureybit (van Zeist and Bakker-Heeres 1984b).*

barley (type).[2] Thus, we suggest that domestic barley (type) was also present in the Cypro-E and LPPNB and that consequently the 'founder crop' cereals were present on Cyprus at least from the later tenth millennium BP.

Several observations can be made with regard to the Mylouthkia archaeobotanical assemblages which support the conclusions reached with respect to the domestic nature of the cereals. The samples display the characteristics of cereal processing waste, particularly from the final sieving stage, i.e. high ratios of glume wheat chaff to grains, high ratios of wild/weed seeds to cereal grains and low numbers of grains per litre (Jones 1986, 58). This is consistent with the preparation of domestic crops for consumption. Furthermore, while some of the wild species identified in the Mylouthkia samples may have been deliberately collected for food and other purposes, most of the taxa appear to represent a fairly typical Eastern Mediterranean assemblage of crop weeds. The transmission of this new economy across the sea to Cyprus, moreover, was part of a neolithic package that already incorporated animal husbandry.

Animal transfers to Cyprus

Since none of the animals which are regularly present in the Khirokitian village settlements of Cyprus had naturally occurring ancestors on the island, it has long seemed evident that the fallow deer (*Dama mesopotamica*), pig, caprines and small carnivores were all deliberately imported (e.g. Croft 1988; 1991, 63–64; Davis 1984, 147; Jarman 1982, 66; Watson and Stanley Price 1977, 247). Only recently, however, have discoveries at Mylouthkia and Shillourokambos revealed that the importation of these animals occurred over a millennium prior to the Khirokitian and that cattle (present at Shillourokambos but not at Mylouthkia) must now be added to the list of very early animal introductions (Peltenburg *et al.* forthcoming a and forthcoming b).

Leaving aside the undated (Cypro-PPNB?) cattle bone from Akanthou, cattle are also known at a later stage of the Aceramic Neolithic (probably early on in the Khirokitian) from Kritou Marottou-Ais Yiorkis, in the uplands of the Paphos District of west Cyprus (Croft 1998; Simmons 1998a and 1998b). Three radiocarbon dates on animal bone, including one on cattle bone, are consistent in suggesting an eighth millennium BP date for this assemblage (Simmons 1998a, Table 9). The indications are, then, that cattle-keeping persisted elsewhere on Cyprus for some centuries, possibly up to a millennium, after cattle disappeared from the faunal record at Shillourokambos. It was in the west, apparently, that the earliest cowboys on Cyprus clung most tenaciously to the tradition of bovine husbandry, although the absence of cattle from Kholetria-Ortos, a lowland Khirokitian settlement in west Cyprus (Simmons 1994) dating to the second half of the eighth millennium BP (Simmons pers. comm.) suggests that cattle-keeping may have died out even in the west of Cyprus by this time. The patchy distribution of cattle and the eventual demise of cattle-keeping, as well as the importance of (presumably hunted) fallow deer in the Cypro-PPNB, provide points of contrast with PPNB animal economies on the contemporary mainland.

Presently available evidence for animal domestication in mainland south-west Asia suggests that pig and goat were probably domesticated before the end of the tenth millennium BP, and cattle and sheep around the turn of the tenth/ninth millennium BP (Vigne *et al.* forthcoming, and references). The importation of these animals to Cyprus in the later tenth millennium BP, at about the same time as they are seen to be domesticated on the mainland (pig and goat), or slightly earlier (cattle and sheep), argues for their domestic status at the time of their arrival on the island. Naturally, the distinct possibility exists of escapees or deliberately liberated animals establishing free-living populations of any or all of these taxa, even from the outset, a situation which could operate to confound the accurate interpretation of zooarchaeological data (Croft 1991, 67). Vigne *et al.* (forthcoming) consider that morphological evidence, mortality data and element frequency distributions favour the domestic status of the pig, cattle and caprines at Shillourokambos, and in their discussion of the implications of the importation to Cyprus of these animals during EPPNB times conclude that even earlier evidence for domestication probably remains to be located on the mainland.

A regional tradition: well-digging

A remarkable context for information about these early Mediterranean farmers is the water well. Apparently a distinctive feature of the PPNB in the west, wells are attested at Mylouthkia and probably at Shillourokambos on Cyprus and at Atlit-Yam off the south Levant coast (Galili *et al.* 1993). They have not been found in the Levantine Corridor. The Cypriot instances suggest that this specialised water resource exploitation was already developed in the EPPNB to deal with specific hydrological conditions in the Mediterranean littoral zone. Unlike the situation in the corridor, rapid surface run-off is a problem on Mediterranean islands and many coastal regions. With few residual supplies, variable precipitation has immediate detrimental effects and can often lead to drought. Springs and underground water resources go a long way to restore the balance of land and water in these conditions. As argued below, wells probably supplied water for craft activities as well as for human and animal consumption.

The development of wells in PPN coastal Mediterranean environments, therefore, may be seen as a particular adaptive strategy for sustainable sedentism. Its success is evident from the persistence of the Mylouthkia well types into the Bronze Age and beyond (e.g. Åström 1998). According to Galili and Sharvit (1998), it was the need of large permanent settlements for continuous water supplies that triggered well-building. However, there is no evidence for such large settlements in the Cypro-EPPNB and it may be profitable to consider other reasons. One of the many organisational changes that differentiate sedentary from mobile groups is the investment of considerable labour in the creation of a built environment. A second characteristic to consider here is agriculturalists' propensity to install risk buffering measures for delayed returns. While it is not known when this tradition began, it seems likely that well-digging expanded with the growth of sedentism and not just the emergence of large settlements. Wells, as one instance of increasing control over vital resources, are a specialised aspect of the domestication of the environment in particular situations. Apart from the investment of labour, their execution sometimes required special skills such as water-divining to locate deep underground sources. Their apparent absence in the core areas of the PPN suggests that the use of wells may have been a western hydrological development.

Most is known about the Cypriot wells from two examples at Mylouthkia. Two of these consist of deep, vertical, cylindrical shafts 0.90 – 1.20 m. in diameter which widen out towards the base, and small cavities cut into unlined walls of the shafts for climbing in and out (Fig. 7). Well-diggers removed a minimum of *c.* 5.4 m^3 of soil per well to give access to dependable, clean water resources. We have lost the wellheads in erosion, hence well 116 (8.5 m. deep) and well 133 (7.0 m.) were originally deeper. Well 116 has more than two dozen hand/footholds disposed in no apparent pattern around the circumference of the shaft whereas in well 133 the 43 preserved examples are systematically distributed in fairly vertically aligned, approximately opposed ranges. In several of these climbing holes clear traces of pick marks were noted, antlers of fallow

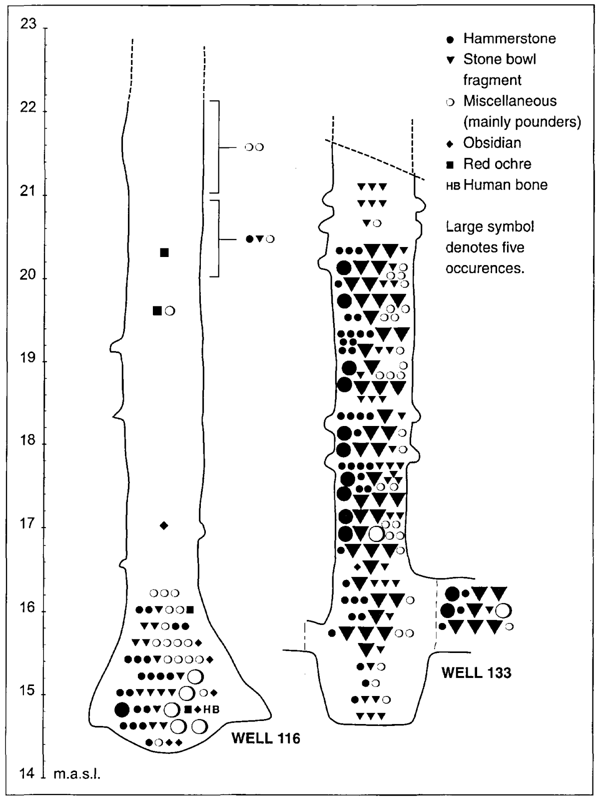

Figure 7. *Schematic profiles of Kissonerga-Mylouthkia wells 116 and 133 showing predominance of stone bowl fragments and hammerstones in fills. HB pertains to well 116 only.*

deer most probably having served as picks. Both wells are cut down into the soft, homogeneous *havara* (a calcareous sediment) bedrock to tap the flow of small underground watercourses (now dry) which flowed in pipe-like channels some 20–40 cm. in width. The bottom of each well consisted of a basin cut down into an impermeable stratum of dense limestone which constitutes the base level of the stream, to permit the accumulation of a sufficient depth of water to facilitate its being drawn out, presumably by means of a container on the end of a rope.

The basin at the base of each well was filled with sticky silts which contained quantities of microfaunal remains. These deposits presumably accumulated whilst the wells were still in use as water sources, and small animals must frequently have fallen in. Successive varied deposits, basically comprising a variety of silts, and containing greater or lesser quantities of clay, *havara*, grit, stones, cobbles, ash and empty air pockets, constitute the fills of the wells which accumulated after they had ceased to be used as water sources.

Shillourokambos also has deep features that are interpreted by the excavators as water wells (e.g. Vigne *et al.* forthcoming). Comparisons are instructive. Whilst the Mylouthkia wells exploited specific small watercourses located deep underground, those at Shillourokambos are somewhat shallower and are cut into unconsolidated sands and gravels, so these wells (if such they are) would appear to have exploited an extensive body of groundwater. Water wells dug anywhere at Shillourokambos would very likely have filled by seepage from surrounding deposits, but at Mylouthkia it is apparent that the well-diggers had to locate their shafts with great precision above small, underground streams. It is hardly conceivable that the exact location of such streams, perhaps only a few centimetres across and flowing some 8 m. or more below the ground surface, would have been betrayed by surface signs such as vegetative indicators. Since it would seem highly unlikely that Neolithic people at Mylouthkia randomly dug shafts to such great depths on the offchance of encountering a small subterranean stream, then the suggestion that some sort of water-divining, or dowsing, was conducted as a preliminary to well-digging here during the Cypro-PPNB must seriously be considered. If it is impossible to determine which of these two Cypro-EPPNB sites possesses the earliest water well presently known anywhere in the world, Mylouthkia alone arguably provides the earliest evidence for water divining.

Upon abandonment, the Mylouthkia wells were deliberately filled and these prolific deposits yielded a variety of economic and cultural data. Dated seeds from founder crops and bones from husbanded and other animals, of utmost significance for an appreciation of neolithic dispersals, have already been mentioned (see also below). More enigmatic are the quantities and types of worked stone.

Stone vessel manufacture?

It is obvious that the Mylouthkia well fills which yielded the dietary evidence just discussed were originally intended to supply a regular supply of water. Well water is naturally regarded as primarily for human and animal consumption, or for small-scale irrigation. The nature of the plentiful worked stone in the fills of two wells, however, introduces a possible secondary use that reinforces evidence for the existence of a sedentary community nearby.

Mylouthkia wells may have played a role in craft activities. Well 133 yielded a remarkable concentration of stone vessel fragments and hammerstones that constitute 63% and 25.4% of the 449 ground stone artefacts recovered from the feature (Fig. 7). The specialised nature of the assemblage is made clear by the total absence of querns, rubbers, mortars and pestles, items that are commonly found at other Cypriot and mainland aceramic sites (Peltenburg *et al.* forthcoming b; cf. Wright 1993; Roodenberg 1986). The abundance of vessel fragments affords an opportunity to consider the ramifications of this apparently deliberate deposition of a specific category of artefact. All fragments are of calcareous rocks. This equates with the rock preference at Shillourokambos, so the more common occurrence of igneous rocks in the later Khirokitian implies an evolution towards preference for harder rocks. A number of scenarios may be entertained for the concentration in well 133, and to a lesser extent in well 116, including the proximity of stone vessel manufacturing activity, the proximity of a dump of defunct stone vessels or the deliberate breakage of intact stone vessels for infilling the well in conjunction with the deposition of human remains (see below). Through observation of the condition of the stone vessel fragments it is clear that of these scenarios the first two are the most credible.

Evidence for an earlier dump of stone vessel fragments near the well-head is found in the abundance, condition and composition of the assemblage. Despite systematic analysis, few vessel joins could be made. A minimum vessel count of diagnostic fragments indicates the presence of over 70 vessels. It must be stressed that this estimate is based on strict criteria and is consequently conservative. The actual figure is significantly greater since the minimum vessel count rose to over 120 when the total assemblage including non-decorated body fragments was considered.

The more robust basal and body fragments of more than 1.5 cm. thickness survived in good condition. Fine rims and thin walled body fragments of less than 1.5 cm. thickness were rare, despite the relatively common occurrence of bases that were obviously from thinner walled vessels. The under-representation of finer material supports the argument that the well material was derived from a surface dump, presumably near the wellhead. Trample in that area would have fragmented thin-walled pieces and the resulting small chips are likely to have been left behind during well in-filling.

The high degree of fragmentation also supports this scenario. Fragments of vessels tend to be small, often less than 10×10 cm. This is demonstrated by the scatterplot of Fig. 8 showing length against width measurements of 250 fragments (out of a total of 283). Only a small number of fragments came from large and thick-walled basins. In addition, breaks appear to be old and worn in the majority of cases and 44 fragments (15.5% of total) had been burnt and/or used as hammerstones after breakage but prior to deposition in the well. Therefore, some time is likely to have elapsed between their initial discard as wasters or as artefacts that were no longer of use in their original intended function and their final discard within the well.

On the basis of this evidence, we can discount *in situ* breakage of complete stone vessels. It is more probable that the occurrence of the weathered stone vessel fragments within the well is a reflection of the proximity of a dump near the well-head of either broken vessels or of debris from stone vessel manufacturing that included artefacts in the later stages of manufacture. The proximity of such a dump would explain the concentration, condition and variety of vessel fragments deposited in the fill of the well.

There is some indication that the assemblage is the product of manufacturing activity. Many fragments show clear evidence of working such as pecking, carving and rough grinding suggesting the possibility that they were unfinished prior to fragmentation. However, the weathered state of fragments probably accounts for the absence of clear evidence of diagnostic traits of wasters or unfinished products. Significantly, re-used chipped stone tools displaying wear consistent with vessel manufacture occurred together with this material in the well (Peltenburg *et al.* forthcoming b). Astruc (1994 and forthcoming) and Roodenberg (1986, 143) provide Cypriot and Near Eastern examples of the relationship of chipped stone with this activity. Lastly, the coincidence of many crude chalk hammerstones (n=114) with the vessel fragments may also indicate manufacturing activity. It is possible that the hammerstones were both utilised in, and a by-product of, stone vessel manufacturing activity.

There is a similar, though less pronounced, concentration of chalk vessel fragments, hammerstones and related chipped stone implements in earlier well 116. The recurrence of these associations with an interval of 1000 years suggests a functional relationship with wells, perhaps because clean water was needed for fine grinding and finishing of stone vessels rather than readily available salt water, the use of which would lead to problems of salt efflorescence on finished calcareous products. In any case, the existence of so many stone vessels over such a long period, many of them too bulky to carry long distances, together with the remains of a semi-subterranean building, support the argument for a sedentary community nearby. The absence of stone tools such as querns in these fills may be understood in terms of expediency. Querns were readily produced

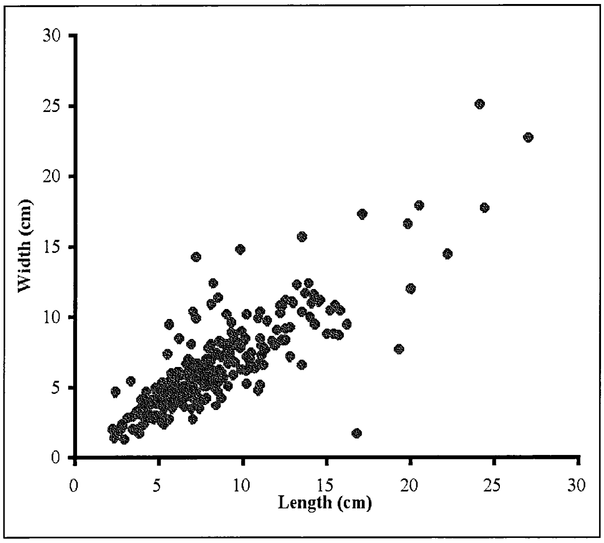

Figure 8. *Scatterplot of width against length of stone vessel fragments.*

whereas manufacture of smoothly finished stone bowls required a more elaborate technology.

As noted above, some of the associated chipped stone was probably re-used in vessel production. Evaluation of the whole chipped stone assemblage in relation to others on the island and south-west Asia helps us to identify more closely the sources, chronology and adaptations of these settlers.

Diffusions and adaptations in tool-making traditions

Certain features of the chipped stone industry, first identified at Mureybet, have long been recognised as highly diagnostic of the PPNB culture in the Levant. Elements which characterise the beginning of the PPNB at Mureybet, as elsewhere, include naviform cores, the production of blades for the manufacture of large tanged projectiles, sickles, burins and other retouched blades (M.-C. and J. Cauvin 1993, 24; M.-C. Cauvin 1994, 288; Kozłowski 1999, 9). Parallels in the lithic industry clearly link Cyprus to the broad uniformity of the PPNB 'interaction sphere' or the more recently suggested BAI (Big Arrowhead Industries) technocomplex (Bar-Yosef and Belfer-Cohen 1989, 64; Kozłowski 1999). By about 9200 BP, this lithic package had appeared in south-east Anatolia, the south Levant, and now Cyprus (M.-C. and J. Cauvin 1993, 24; Gopher 1996, 152–153; Kozłowski 1999, 8–9; McCartney and Peltenburg 2000). In considering a variety of

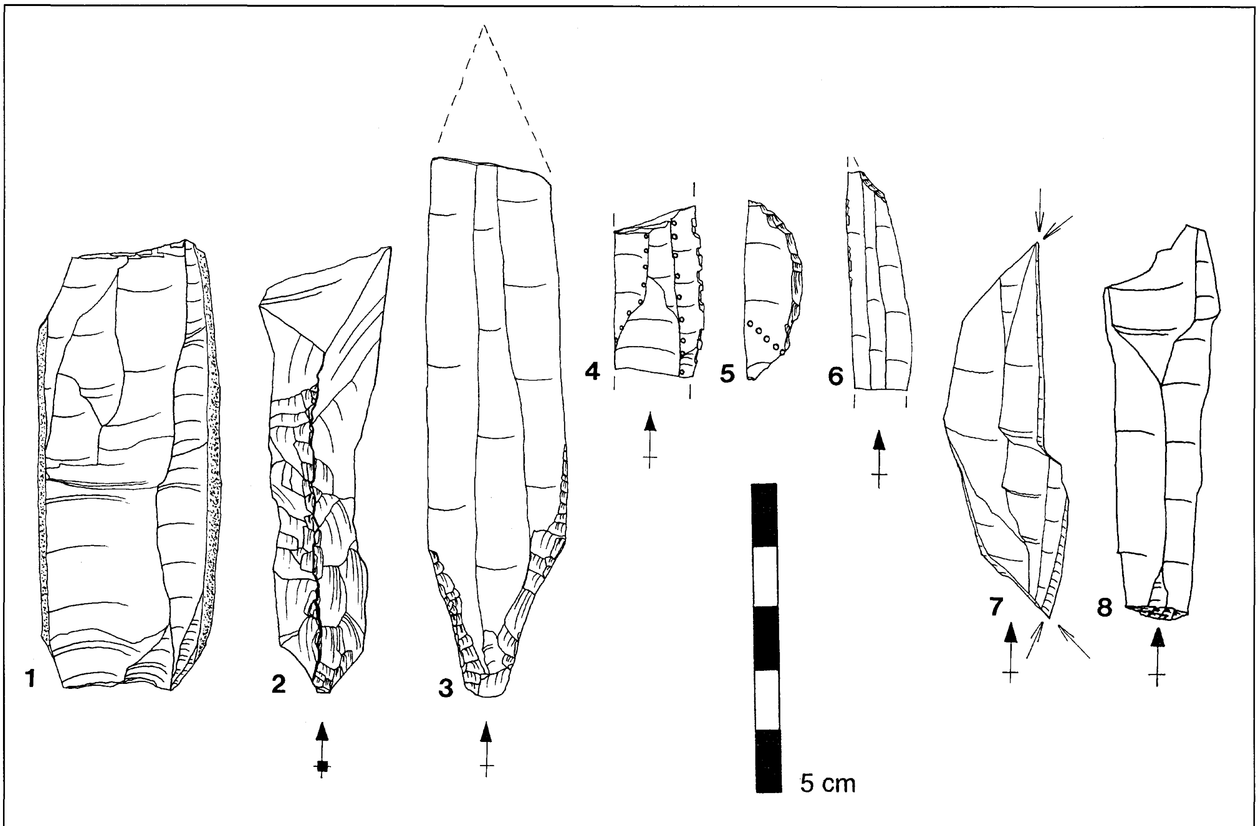

Figure 9. *Diagnostic Cypro-PPNB chipped stone types. 1. Tabular opposed platform core; 2. crested blade; 3. Byblos point tang; 4. finely denticulated glossed blade; 5. glossed crescent segment; 6. retouched obsidian blade; 7. dihedral burin; 8. truncated upsilon blade. (1, 5, 8 from Kalavasos-Tenta; 2, 7 from Ayia Varvara-Asprokremnos; 3, 4, 6 from Kissonerga-Mylouthkia).*

lithic assemblages from the island, it is possible to demonstrate how the Cypriot industry originated in the early diffusion of PPN traits from diverse points in the north Levant. This diffusion process involved the spread of specific 'know-how' that subsequently evolved in line with developments on the mainland and according to insular constraints.

It is not the intention here to list a full sequence of types, but to examine particular type fossils and changes in the *chaîne opératoire* that demonstrate the early diffusion of the industry as well as correspondences in development between Cyprus and the Levantine PPNB (Figs 2: 5–12 and 9; cf. Gopher 1994a, 387–90; Bar-Yosef 1994, 7–8; 1996, 208). In this context, it is important to recognise the presence of 'PPNB' type elements along with the final appearance of curvilinear structures and the appearance of polished axes during the Mureybetian and Aswadian of the north Levant, the PPNA of the south Levant and early Neolithic sites in south-east Anatolia *c.* 10000 – 9600 BP (M.-C. Cauvin 1994, 279, 281–2; Kozłowski 1994, 148–9; Gopher 1996, 153). Naviform and other bi-directional cores, tanged arrowheads made with abrupt retouch, finely denticulated glossed blades, sometimes truncated, flake scrapers and Cappadocian obsidian are recognisable chipped stone features of these pre-PPNB periods. The use of microliths, particularly lunates or crescents, in the Natufian declined in PPNA assemblages in the Levant, but continued later in Anatolia. These features are important points for consideration in the following discussion of the Cypro-PPNB lithic industry (Balkan-Atli 1994, 215; Kozłowski 1994, 148–9; Gopher 1996, 153). Interestingly, the increased dominance of bidirectional core technology in the PPNB appears to define a shift in the direction of diffusion from south to north in the PPNA to the north to south direction of the PPNB (Bar-Yosef 1996, 210). Thus, while elements in the north Levant exhibit a more gradual development initiated prior to the EPPNB, the spread of PPNB culture to the south Levant has been described as a 'package' of characteristics (Cauvin 1977, 30–8; Gopher 1989a; 1989b; 1996, 153–5; M.-C. Cauvin 1994, 281–8). The 'retardation' factor suggested for the later start of the PPNB in the south Levant seems applicable to Cyprus, but it is also probable that the Cypro-PPNB represents a mixture of influences that account for both delayed and transitional elements at any given stage in the sequence (see below).

Early diffusion

Lithic evidence for the Cypro-EPPNB relies on assemblages from Mylouthkia Period 1A, Shillourokambos Early Phase A and Tenta Period 5. Arrowheads are typically viewed as the most diagnostic tools of the PPNB and on Cyprus arrowheads provide significant evidence of early emigration from the mainland (Bar-Yosef and Belfer-Cohen 1989, 64). At Mylouthkia three point tangs were made with flat rather than pressure retouch restricted to the tang, broadly resembling EPPNB arrowheads from Mureybet IVA and Dja'de (M.-C. Cauvin 1994, 288–9, Coqueugnoit 1994, 321–2, figs 3–5). One example exhibits an asymmetric pair of notches just above the tang. This point, rejected before completion, represents, however loosely, the tradition of notched arrowheads that ended relatively early in the PPNB (Gopher 1989a, 1989b). At Shillourokambos, ovular points exhibiting abrupt/semi-abrupt retouch and a denticulated example appear to be similarly early, resembling arrowheads from Mureybet IIIB and Dja'de (M.-C. Cauvin 1994, fig. 6. 3; Coqueugnoit 1994, figs 2, 3, 5; Guilaine *et al.* 1998a, 40; 2000, fig. 3. 7). Arrowheads with longer tangs, including one square-based example from Shillourokambos may show parallels with EPPNB Dja'de examples, but would also be at home with MPPNB types known at Mureybet IVB or Cafer Höyük (Cauvin and Balkan 1985, fig. 2; M.-C. Cauvin 1994, fig. 7. 4; Coqueugnoit 1994, fig. 4; Guilaine *et al.* 2000, fig. 3: 4). Two diminutive, abruptly retouched points belonging to Tenta Period 5 demonstrate additional early point variety showing EPPNB parallels across the Levant, and early Neolithic sites like Demirköy Höyük in eastern Anatolia (Coqueugnoit 1994, fig. 2. 1–8; Gopher and Goring-Morris 1998, fig. 8: 12; Rosenburg and Peasnall 1998, fig. 5: 5–8; McCartney forthcoming, fig. 4). The two other points from Mylouthkia can be attributed to the Byblos type (Fig. 9. 3; Gopher 1994b, 36–9). These examples do not appear to belong to the Mureybet tradition of proto-Byblos points. They are true Byblos forms which occur at Mureybet IVB and Aswad II (M.-C. Cauvin 1994, 288–9, fig. 7. 5; Gopher 1994b, 96, fig. 4. 7, 17–18).

Early arrowhead types on Cyprus, therefore, are diverse. They exhibit different characteristics in the Mylouthkia, Shillourokambos and Tenta assemblages. Such differences in the Cypriot arrowheads have parallels throughout the north Levant and they show early and potentially transitional characteristics, spanning the PPNA through the MPPNB. Cypro-EPPNB dates straddle the 9200 BP boundary that defines developments of earlier PPNB history in the north Levant. Material from this period, therefore, illustrates that both transitional and retardation effects need to be taken into consideration (Gopher 1989a; 1989b; M.-C. Cauvin 1994, 288–9; Cauvin *et al.* 1998, 59–63).

Aside from arrowheads, the Cypro-EPPNB industry is clearly blade-based and produced from mainly bi-directional cores using a high quality translucent native chert (Fig. 9.1). The utilisation of a specific high quality raw material is listed as a prerequsite for naviform core reduction. It is indicative of a certain 'pre-conditioned knowledge' that demonstrates a close association with the workings of the naviform method of the PPNB Levant (Bar-Yosef 1996, 212; Quintero 1996, 235). One classic naviform core example from Shillourokambos, and a variety of evidence including dorsal scar patterns and core trimming elements from Mylouthkia, Shillourokambos and Tenta, show the transfer of the complete package of 'know-how' of this classic PPNB core technology (Fig. 9: 2; Quintero and Wilke 1995; McCartney 1999; forthcoming b; Guilaine *et al.* 2000, 79, fig. 3: 8; Peltenburg *et al.* forthcoming b). It is important to recognise that the evidence representing this PPNB core technology is clearly distinct from the Late Natufian/PPNA characteristics that distinguish the Aetokremnos assemblage (Simmons *et al.* 1999, 143, 276–81; *contra* Simmons 2000, 11–12).

Obsidian from the Gollü Dag area belongs overwhelmingly to the Period 1A sample at Mylouthkia (Peltenburg *et al.* forthcoming b). Though representing a small number of individual artifacts, it accounts for 12% of the Period 1A sample (e.g. Fig. 9: 6). Obsidian is also present in the Shillourokambos Early Phase A sample (Briois *et al.* 1997, 77–8, Table 1; Peltenburg *et al.* forthcoming b). The utilization of obsidian, therefore, appears to be typical of the Cypro-EPPNB.

Expanded contacts?

The Cypro-MPPNB industry shows considerable continuity with the preceding stage in terms of core reduction technology and tool types. Thus, the presence of naviform cores and the use of high quality raw materials define both the Cypro-E and MPPNB industries. These features arrive in the Cypro-

EPPNB, reach a peak in the Cypro-MPPNB and decline from the Cypro-LPPNB onwards, as on the mainland (Quintero and Wilke 1995; Gebel 1996; Gopher 1996, 153–155; Peltenburg *et al.* forthcoming b; see below). Two important differences, however, mark the Cypro-MPPNB stage on the island. At Shillourokambos the quantities of imported obsidian (representing 2% of the assemblage) increased dramatically and obliquely glossed crescents appeared during Early Phase B (Briois *et al.* 1997, 97–8, Table 1; Guilaine *et al.* 2000, 79). The presence of obliquely glossed crescents and other micolithic tools from Tenta, and large numbers of obsidian artifacts at (potentially Cypro-E/MPPNB) Akanthou imply that the developments at Shillourokambos may have been island wide (Fig. 9: 5; McCartney and Peltenburg 2000; Şevketoğlu 2000, 117; McCartney forthcoming).

The use of glossed crescents could well provide evidence of a revived archaic trait, since composite harvesting tools using crescent (or lunates) segments and curvilinear hafts were commonly used during the Natufian and PPNA. The substantial increase in the numbers of obsidian artifacts along with the presence of microliths, however, may alternatively imply the development of closer Anatolian ties during the Cypro-MPPNB. Both crescents and other microliths persisted in early neolithic Anatolian contexts where they were derived from local mesolithic industries. They disappeared following the PPNA in the rest of the Levant (e.g. Cauvin and Aurenche 1982, 126–7; Gopher 1996, 153; Kozłowski 1999, 9). At Tenta, obliquely glossed crescents are present alongside diminutive unretouched glossed bladelets and larger, typically PPNB finely denticulated glossed blades like those seen in Mylouthkia Period 1A (Fig. 9: 4). The Tenta assemblage, therefore, seems to exhibit most clearly the mixture of archaic and PPNB glossed tool traditions seen separately elsewhere. This mixture of traits in the Cypriot industry occurred when east Anatolian obsidian sources became more prevalent in MPPNB Euphrates sites, following the spread of PPNB culture to the Taurus region and expanding PPNB influences in Anatolian sites such as Aşikli Hüyük (Cauvin 1991, 171–2). Since Cypriot obsidian continued to be dominated by Cappadocian sources, it is more likely that such archaic influences, if Anatolian in origin, arrived with the additional central Anatolian obsidian imports.

At Shillourokambos and Tenta, unidirectional core reduction methods using the edges of flakes or single platform cores for the production of small blades and bladelets were employed to make the glossed crescents. Both unidirectional and bidirectional blade core technologies resemble the variety of methods illustrated at MPPNB sites like Cafer Höyük (Cauvin and Aurenche 1982, 125, fig. 7; Guilaine *et al.* 2000, 79–81). Well prepared single platform cores from the undated (probably M/LPPNB) assemblage from Asprokremnos similarly reflect those from Cafer Höyük. They may provide additional evidence of a strengthened Anatolian link during the Cypro-MPPNB adding to the mix of archaic and PPNB features that define the Cypro-PPNB (McCartney 1998, Peltenburg *et al.* forthcoming b). Both the naviform-blade and unidirectional-small blade/bladelet core technologies, which appear respectively at Mylouthkia and Shillourokambos for the manufacture of glossed tools, are united in the Tenta assemblage, again illustrating the variable effects of different influences and practices in the still patchy Cypro-PPNB lithic record.

Adaptation and regionalization

It was fully a thousand years after the island's colonization that the early Cypriot farmers significantly adapted their lithic industry to their new environment. During the Cypro-LPPNB fundamental changes in the dominant bidirectional core technology occurred in terms of raw material utilisation, platform preparation and blade character (Guilaine *et al.* 2000, 79–80; McCartney and Peltenburg 2000; Peltenburg *et al.* 2000). The manufacture of long flat blades and the use of opposed platform cores following the Cypro-MPPNB, however, demonstrate considerable continuity with the preceding naviform tradition. The blades produced from the Cypro-LPPNB onwards were extensively deployed for the manufacture of glossed tools, a variety of retouched blades and burins in line with later mainland PPNB assemblages. At the same time, they reveal responses to local tool requirements (McCartney and Peltenburg 2000; Peltenburg *et al.* 2000 and forthcoming a). The use of obsidian and the exploitation of translucent chert substantially decreased in the Cypro-LPPNB. The latter was replaced by the use of cherts of more moderate quality (Briois *et al.* 1997, 110–111; Guilaine *et al.* 2000, 81–2; Peltenburg *et al.* forthcoming a). These changes dated to *c.* 8000 BP at Mylouthkia 1B were initiated within the Middle Phase at Shillourokambos and were established by the Late Phase *c.* 8000 BP. Cypro-LPPNB shifts in core technology correlate with mainland developments. Thus, a decreasing occurrence of bi-directional cores, the use of more moderate quality raw materials and greater numbers of flake tools are well documented features in later PPNB industries of the mainland Levant beginning *c.* 8000 BP (de Contenson 1992, 53; Rollefson *et al.* 1992, 516–7; Molist and Ferrer 1996, 433–7; McCartney 1999; Peltenburg *et al.* forthcoming a).

Guilaine *et al.* (2000, 80–82) view the decrease of arrowheads and disappearance of cattle by the Cypro-LPPNB at Shillourokambos as evidence of the island's isolation. However, these may be no more than local phenomena since cattle are still evident at Kritou Marottou-Ais Yiorkis (see above) and arrowheads of LPPNB and Final PPNB character still exist in later assemblages at Khirokitia and Kissonerga (Christou 1994, 664; Peltenburg *et al.* forthcoming a; Simmons 1998a, 6). The continued use of opposed platform cores, augmented by a gradually increasing number of single platform cores in later Cypro-PPNB and Khirokitian assemblages illustrate the continued desire for long flat blade products, replaced only gradually from the Khirokitian by greater numbers of flake tools. The differences in the Cypro-LPPNB industry thus correspond with changes in the later stages of the PPNB in the Levant and they relate to the increasing regionalization of the PPNB interaction sphere.

The Cypro-LPPNB chipped stone industry is explained less by reference to cultural isolation, than to the social and economic realities of the island. Sites remained small on Cyprus, and the type of specialization described for large LPPNB sites in the south Levant appears not to have occurred on the island (Gebel 1996; Quintero and Wilke 1995). This 'incipient specialization' is associated with considerable technical investment in the naviform core technology, rather than in the tools formed. It is a technology expensive in terms of the raw material employed (Quintero and Wilke 1995, 24; Baird 1997, 373). This kind of technical investment broadly characterizes Cypro-E/MPPNB assemblages such as Mylouthkia 1A, but the additional necessary ingredient of a large sedentary population base capable of supporting true specialization was missing from the Cypro-PPNB. Blade production focused, instead, on the blade tools required for small-scale farming communities (McCartney and Peltenburg 2000; Peltenburg *et al.* forthcoming a). Without the intensive demand for standardized blades that increased with the development of large villages on the continent, such technological investment was reduced on the island of Cyprus somewhat earlier than on the mainland. Instead, we see the elaboration of other crafts like stone bowl and figurine production at sites like Khirokitia.

Tools belonging to Mylouthkia 1B show the replacement of Period 1A types by those that characterize the subsequent, 'classic' Khirokitian assemblages (Peltenburg *et al.* forthcoming a and forthcoming b). Steeply backed blades figure prominently as do marginally retouched flakes and blades, unretouched but utilized pieces, *pièces esquillées*, denticulates and notches. The numerous truncations, backed blades, 'tanged' blades, pointed blades, burins (including dihedral and truncation examples) and infrequent Byblos tangs from Tenta further define the later Cypro-PPNB (Fig. 9: 7, 8; McCartney forthcoming). Similar tools exist in Shillourokambos Late Phase (Guilaine *et al.* 1995, figs. 4–5). Backed and truncated glossed elements are recognised features of the Levantine LPPNB onwards. This shift in 'sickle' technology is exemplified by the assemblages from sites such as Assouad, Aswad II, Ramad I, Beisamoun, and Ras Shamra (M.-C. Cauvin 1973; 1974, 431–5; 1983, 68–70; Lechevallier 1978, 211–212; de Contenson 1992, 55; 1993, 29). Such 'agricultural' implements are rare in the restricted functional context of Mylouthkia, but are prevalent in later Cypro-PPNB and Khirokitian assemblages like Tenta, Khirokitia, and Cape Andreas. As in the case of the rare Byblos and Amuq arrowheads, these implements disclose links with trends in later PPNB assemblages on the mainland (Le Brun 1981 *et al.*, 33–5; M.-C. Cauvin 1984, 85).

Though much of the detail defining the Cypro-PPNB lithic sequence remains to be documented, it clearly exhibits the 'low levels of similarity' required for membership in the PPNB 'culture group or system' (Gopher 1994a, 389; McCartney and Peltenburg 2000; Peltenburg *et al.* forthcoming a). Devoid of connections with the earlier Aetokremnos chipped stone, bar the persistence of a few microliths, the Cypro-PPNB industry in its earliest phase represents intrusive mainland PPNB traditions that have specific affinities with those of the north Levantine Corridor. It also reflects the broad changes evident in the mainland PPNB sequence from the early through the final PPNB. These parallels and local features indicate two fundamental aspects of the Cypro-PPNB: continuity of membership in the PPNB interaction sphere and practical responses to local demands and pressures within the small-scale agricultural communities of the island.

Secondary burial

Skull caching and to a lesser extent redeposition of the dead are diagnostic behaviours of the PPN in the Levant and south-east Anatolia which were also transferred to Cyprus (Bienert 1991; Goring-Morris *et al.* 1998; and possibly Galili and Nir 1993, 267–9). In line with mainland developments, skull removal ceased on the island by the eighth millennium BP. The context of insular evidence for these specific mortuary practices is unusual in that it comes from well fills. In other words, secondary burials were associated with abandonment behaviour. Wells can be abandoned for a number of reasons, but if simply deserted and allowed to fall into disrepair, then fills will come largely from erosion products. This was not the case at Mylouthkia where much anthropogenic material was inserted or carefully placed. For example, we may infer intentionality from the condition of a skull and the recovery of a group of crania in the fills at different levels in well 133, from the association of a unique macehead of polished pink conglomerate with the crania and the co-occurrence of whole caprines (see below). The many stone vessel fragments, on the other hand, were more randomly distributed.

A single skull of an adult male, with its mandible and possibly its atlas vertebra a little lower in the well fill, was placed 0.8 m. below the surviving well rim. It may have survived a long drop intact, and hence been the result of natural erosion, but that is considered less likely than deliberate insertion. Moreover, the association of the mandible suggests that the human remains may not have been completely disarticulated at the time of their introduction to the well shaft. Its cranial deformation consists of flattening of the occipital, probably by a cradle-board, in the well known later Khirokitian manner (cf. Angel 1953). Three and a half metres lower down was a concentration of a mandible and several skull fragments, two crania and a considerable quantity of other, more fragmentary post-cranial bones. Thus, the deposition of some of the human remains in an only partly disarticulated condition, with soft tissue remaining to hold at least some of the bones together seems, perhaps, to be the best sense which can be made of the situation. These human remains must have been removed from another place where the decomposition of bodies occurred, perhaps graves or some other location where bodies were exposed. They were transported and deliberately introduced to the disused, partially infilled well shaft.

On the PPNA-B mainland, skulls were detached from adult bodies and put in special places. Presumably this was not done exclusively at the time of the abandonment of those places, although at Jerf el Ahmar the skull may have been removed from a splayed body found in the court of the central building mentioned above, presumably upon the abandonment of that building (Stordeur 1999). It may be that well abandonment on Cyprus provided an opportunity for re-burial. This custom contrasts with the Khirokitian where only primary burials are known, but then again, we have no wells of that period. Re-deposition at Mylouthkia applied to all ages since an infant was represented in well 116 and 2 adult males, an adult of indeterminate sex, an adolescent, and a child in well 133. The practice was not confined to Mylouthkia. In a pit (or well?) at Shillourokambos was a mandible and, nearby, a flexed inhumation (Guilaine *et al.* 1998b).

The human remains in Mylouthkia well 133 were accompanied by a concentration of at least 8 immature and one mature sheep, 12 immature (including 2 rather uncertain attributions) and 2 mature goats, seemingly deposited as complete, unbutchered carcases. They were only found in the area of the human remains, from 20.70 m. a.s.l and throughout the succeeding 4.25 m. of the fill of the shaft. The congruence is not perfect since a few human bones were found lower, but the generally coincident distribution distinctly invites speculation that we are not dealing simply with rubbish disposal, but rather some sort of ritual behaviour. If so, then the occurrence of the heads of two pigs in one well and a concentration of substantial goat horncores in another may also prove meaningful (cf. Rosenberg 1999, fig. 16).

In sum, Cypro-PPNB mortuary behaviour has some links with practices in the Levant, but it is difficult to evaluate these further because of the unusual contexts of the Cypriot deposits. We may be in a better position to assess these links when more is known of the Shillourokambos human remains and of the association of fragments of human bone along with animal bones, some of which were articulated, in the well at Atlit-Yam (Galili and Nir 1993, 267–9).

Discussion

The dispersal of the founder crops einkorn, emmer, barley, and domestic pig, morphologically wild sheep, goat and cattle, and the game animal deer in the late tenth millennium BP to Cyprus, far beyond the Levantine Corridor, raises many issues regarding the initial stages of farming. Here we are only concerned with questions of dispersal, since, being an apparently unoccupied island, Cyprus affords a more clear-cut case of neolithic dispersal than is available on the adjacent continental landmass.

A question of chronology

We first need to deal with the assumption that the later tenth millennium BP sites on Cyprus belong to some, if not the earliest Asiatic sedentary communities on the island. This assumption may be erroneous because of the strong presence of PPNA traits in Cypro-PPNB sites. While Davis (1991) already suggested PPNA colonisation for demographic reasons, the question here is whether these traits reflect the existence of undiscovered insular PPNA sites that are different from (earlier?) Aetokremnos, or are a characteristic of western archaising PPNB communities that retained earlier features well after other developments took place in the Levantine Corridor. Such archaising may also have been accentuated amongst island colonists.

We have seen that Tenta faithfully repeats a Syrian PPNA hierarchical settlement pattern. This organisation gave way to other patterns during the tenth millennium on the mainland, and rectangular buildings replaced the circular format (cf. Stordeur 1999; de Contenson 1992). Settlement plan, therefore, as well as circular buildings and disproportionately large intramural pillars, refer back to PPNA traditions. That this was not an entirely uniform mainland evolution, however, is evident from the retention of the circular format with radial cells at PPNB Munhatta (Perrot 1964, 326, fig. 2).

Varied classes of artefacts in the Cypro-PPNB may also point to strong links with earlier traditions. On the basis of current evidence, the presence of glossed crescents and other microliths is as likely to indicate an Epipaleolithic or PPNA 'inheritance' as a reflection of the continued use of such tool types in south-east Anatolia into the PPNB. Importantly, the lack of Epipaleolithic or PPNA diagnostic types like Khiamian points imply that we are not dealing with the direct transfer of Epipaleolithic or PPNA traditions. The Cypro-PPNB entity shows both archaic and classic PPNB traits. Guilaine *et al.* (2000) note the similarity of a Cypro-EPPNB feline head, the earliest sculptural work from Cyprus, with that from PPNA Jerf el Ahmar (*cf.* Jamous and Stordeur 1999, 64, fig. 6.3). Incised pebbles (fig. 2. 19, 22), decorated grooved stones and incised 'baton' (Guilaine *et al.* 2000; cf. Cauvin 1997, 72, fig. 20) are other PPNA-type objects that occur in Cypro-PPNB contexts, although it should be noted that some types also persist on the mainland into the PPNB. It is not just external analogies which may point to earlier occupation. For example, the occurrence of picrolite in what could be Cypro-EPPNB contexts far from sources demands prior knowledge of those sources and hence earlier exploration and perhaps settlement phases. This kind of evidence suggests that the settlements we have now do not represent initial colonising phases or landfalls, or that their inhabitants stemmed from mainland sedentary groups who retained PPNA features into the later tenth millennium BP.

We have also raised the possibility, certainly not novel for Cyprus, that the immigrant communities were deliberately archaising. In analogous cases, Cauvin seeks to explain chronologically distant recollections by postulating that, after assuming a pastoral nomadic life for several generations, groups reverted to their previous, sedentary farming existence and cultural modes (Cauvin 1997, 216). This is not impossible, but in our case the varied domestic plant and animal spectrum is unlikely to refer back to the PPNA and hence we need to distinguish between cultural recollections and more recently acquired subsistence strategies. Although what follows assumes migration of farmers in the EPPNB, earlier departures from the continent to Cyprus by sedentary groups that colonised rather than utilised the island, cannot be ruled out.

Some models of migration

The Cypriot evidence fits uncomfortably with the widely held view that during the EPPNB the new crops together with the techniques required to cultivate them successfully only spread to the north and east from the areas where the original 'domestication events' occurred. How does the recent evidence from Cyprus alter this picture?

As early as the PPNA there is evidence of a network linking social groups over large distances and thus enabling reciprocal trade. Gopher (1989a, 91) proposed that during this period the Levant (here the author refers to an area from the middle Euphrates to southern Sinai) could be viewed as a single cultural system in which the exchange and movement of materials, along with ideas, occurred over wide geographic distances. Similarly, Bar-Yosef comments:

> Khiam points and aerodynamic arrowheads were documented from southern Sinai (Abu Madi I) to Jebel Sinjar (Qermez Dereh) in northern Iraq. These points mark the PPNA interaction sphere, and reflect the communication and exchange between hunters across the landscape. Similarly, imported obsidian pieces that reach the southern Levant from central Anatolia travelled a distance of more than 1000 km. (Bar-Yosef 1995, 198)

The network apparently intensified during the PPNB. Rollefson (1987, 29) argues for the possibility of three regional centres at this time, in Syria, in Palestine and the Jordan Valley, and in highland Jordan. He states that communication across the regional boundaries would have permitted exchange of assets in many directions. Cyprus, and to some extent Western Syria, therefore, have not yet been considered in this interaction sphere.

There has been much debate about whether the diffusion process was 'demic'/'primary' or 'cultural'/'secondary' (involving the adoption of ideas by indigenous hunter-gatherer groups; Harris 1996b, 7). It has been suggested that the initial 'movement' was via contact and exchange and particularly in the marginal areas, at the boundaries between the woodland (moist) and steppe (arid) regions (Byrd 1992, 50; cf. Garrard *et al.* 1996). Bar-Yosef (1989, 58) proposed that the interaction between the early 'farming' communities and contemporary hunter-gatherer groups in these areas would have continued for several millennia. During the PPNB there is evidence for expansion into the arid regions of the Levant (Byrd 1992, 55). While these studies indicate some of the parameters for continental interaction and movement of cultivators, the Cypriot evidence differs insofar as it involves overseas migration without interaction between farmers and mobile hunter-gatherers.

Evidence from sites in the Azraq basin, and now Cyprus, indicate that the spread of early farming was more complex and perhaps earlier than envisaged in many reconstructions. Recognition that a Mediterranean island was affected by these developments as early as the EPPNB implies that initial expansion was far more widespread than we have hitherto assumed.

The many cited parallels between PPN sites in the north Levantine Corridor and Cyprus indicate strong connections between these two zones (see also below). In considering expansion from the former, Bar-Yosef and Meadows (1995), for example, speculate that agro-pastoralist groups budded off from larger communities there. They may have done so well before the late EPPNB and established communities immediately to the west where they could have linked with western trading partners for prestige or other reasons (cf. Anthony 1997). These farmers, together with local seafarers who had a knowledge of Cyprus, proceeded to the island. Leaving aside the absence of large parent sites in the northern corridor and the possibility of pastoral nomadic interludes, there is an obvious lack of intervening sedentary founder communities in coastal areas of the mainland to sustain this reconstruction. With the exception of Qaramel and perhaps Tell Hailane in the Qoueiq river catchment near Aleppo (Copeland 1981), the area between the Euphrates and the Mediterranean coast in the PPNA-EPPNB lacks evidence for sedentary occupations (e.g. Cauvin 1989, 35, fig. 3; 1997, 111, fig. 23; Cauvin *et al.* 1998, 58, fig. 3; Bar-Yosef 1998a, 150, fig. 5). Further south, in the Beqāʿ, as many as eight sites may belong to the PPNB, but they are not yet assigned to a particular phase within that long period (Marfoe 1998, 90). Like Ras Shamra VC, Tell el-Kerch I and Slenfe, they may belong to the LPPNB when there is a general intensification in the expansion of farming sites and hence too late for our purposes (Cauvin 1997, 192, 197, fig. 45).

Anthony's leapfrogging model of prehistoric migration or Van Andel and Runnels' jump dispersal model might provide useful ways to account for this hiatus between putative homeland and destination of early farmers (Anthony 1997; Van Andel and Runnels 1995). In these models, migrants crossed great distances and bypassed large areas to attain their desired new settlement location. For Anthony, pre-existing knowledge of that goal, a clear requisite, was supplied by advance scouts who collected information on social conditions and resource potentials, and who relayed this back to possible migrants. The difficulty with his model in this instance is the lack of evidence for such an information flow. The earlier Aetokremnos foragers on Cyprus could conceivably be classed as 'scouts', but their impoverished remains suggest that these mobile opportunists were there for a limited period to exploit natural resources, some of which became extinct prior to the arrival of cultivator colonists. In the absence of Asiatic imports at the Aetokremnos shelter and distinctively Cypriot materials like picrolite on continental sites, there is no evidence to support arguments that groups initially sought exotics on the island to trade in their homeland (*cf.* Hansen 1992, 245). Mediterranean dentalia, *Nassarius gibbosulus* and *Conus mediterraneus* shells reported from earlier and contemporary Anatolian sites (Rosenberg 1999; Watkins 1996) occur in Cypriot prehistoric contexts (Janet Ridout-Sharpe, pers. comm.), but they cannot be used as evidence for mainland-island contacts since they were available on the mainland seashore. It is also difficult to see what attracted agro-pastoralists to an island that lacked the plants and animals, wild or domestic, which they could use to replenish stocks should their introductions fail, when more suitable territory existed closer to home. The island certainly does not have preferred lands for expanded production, the floodplains of rivers and lakes, which Van Andel and Runnels (1995) claim were the incentive for early farmers to travel considerable distances. If there is no obvious economic motive, there is also the question concerning means. To traverse successfully the minimum 69 km. from the nearest coast to Cyprus was not simply the prolongation of the mainland migratory phenomenon, even if, as Cauvin argues, PPNB movement was impelled by an expansionary ideology (Cauvin 1997, 180–1, 225). Voyagers needed cognitive maps that entailed accurate knowledge of the overseas target, established marine technology expertise and navigational skills beyond what we could realistically expect from distant Euphrates River valley farmers. Consequently, preconditions for successful colonisation require us to infer the existence of coastal sites with farmers or middlemen precisely where they are lacking in our distribution maps.

The problems in understanding the spread of farming to Cyprus, problems created by the absence of intervening sites between the Levantine Corridor and the island and objections to jump dispersal in the context of overseas travel, might be overcome by appreciation of two situations. The first concerns palaeogeography, to which we return below. The second has to do with our rigid divisions between mobile and static patterns of existence. There was usually much more fluidity between these lifestyles in the Levant. Of paramount concern to all non-urban groups was the need to avoid risks and secure their subsistence. The establishment of the cultivation of domestic crops, and, as the Cypriot evidence now demonstrates, cattle, sheep, goat and swine husbandry as well as deer management by the later tenth millennium BP, provided populations with choices for diverse subsistence strategies. If in later times, when these economic modes were ensconced, agricultural life remained precarious, how much more so was this likely in the early stages of agro-pastoralism. The response was an enduring socio-economic pattern comprised of shifting roles, of disequilibrium, of the same people opting as necessary for one of our different, but compatible, socio-economic categories, "of periodic shifts along a spectrum of available economic strategies" (Marfoe 1979, 8). This appreciation of a more fluid society engaged in resource diversification suggests that the quest for intervening sedentary sites of the type found in the Levantine Corridor may be misplaced and that the zone was occupied by less archaeologically visible mobile groups acquainted with the varied subsistence potentials of agriculture and pastoralism. Following Cauvin, this reconstruction rejects demographic pressure and privileges the role of a mobile *facies* of PPNB society in the transmission of the neolithic lifestyle (Cauvin 1997, 224–5, 260–1). Consequently, when, for whatever reason, mainlanders decided to migrate to Cyprus, they were in a position to choose an economic package designed for colonisation and, once they had carved out an insular niche, adopt a sedentary way of life.

Subsistence implications

The Mylouthkia archaeobotanical evidence (albeit slight) demonstrates that domestic crops together with the knowledge of techniques and technologies to grow, harvest and process them were imported to the island. Successful harvests would have ensured yields so that surplus grain could have been set aside to be used as seed stock for subsequent seasons and, as such, would have guaranteed the continued production of adequate supplies for the settlement. Presumably in years when environmental/climatic conditions resulted in the failure of harvests it would have been possible to import seed stocks from the mainland and thus to maintain the crop fields. We may infer continued contacts with the island by the persistence of obsidian exports, the appearance of novelties like carnelian in the Khirokitian (Dikaios 1953, 303–4), long-term artefactual similarities in the chipped stone industries and the absence of very rapid zoological change on the island as a result of founder effects (cf. Davis 1984). But such contacts, which would have been seasonal because of sea transport constraints, are unlikely to have been direct because of the remoteness of the island from the Levantine Corridor. In other words, they imply the existence of intermediate agro-pastoral PPNA/PPNB communities.

The Cypriot evidence also documents how intensively some morphologically wild animals were managed by colonising-herdsmen in the EPPNB. They would have had to have selected enough animals of each species to successfully establish breeding stocks and to control them sufficiently for a long-distance sea-crossing. This transport and breeding programme, which perforce on Cyprus involved automatic genetic isolation from wild populations, may be added to the penning and tending evidence that Bar-Yosef has called for in order to assess the degree of animal control in the early phases of domestication (Bar-Yosef 1998c, 58). While man's manipulation of morphologically wild animal populations prior to domestication is well known (cf. Harris 1996c, 553; Croft 1991, 66–7), Vigne *et al.* (forthcoming) are surely correct in arguing that the Cypriot evidence requires greater attention to be paid to other indexes of animal control than morphological change if we are to understand the processes that led to domestication. For our purposes, the presence of these animals in the Cypro-EPPNB reinforces arguments for intensification of domestication amongst colonists. Migration to a region where there were no large native wild animals resulted in the establishment of communities more exclusively committed to animal husbandry, and hence the integration of domestic plants and animals within the subsistence economy, than their parent communities. Mainland groups continued to hunt a greater variety of animals and it may be argued from the significant number of arrowheads and non-domesticates in faunal assemblages that hunting a range of animals played a more important role there in terms of food supply and social organisation. On Cyprus, the hunting of fallow deer and feral animals, while probable, is a focus of continuing research.

In a similar case of overseas migration of early farmers, Broodbank and Strasser (1991) posit a single sea crossing to Crete by a small flotilla. There are several indications that a single Noah's ark transfer probably over-simplifies dispersal mechanics from the continent to Cyprus in the EPPNB. As pointed out above when discussing the varied traditions in the chipped stone, the Cypro-PPNB is not a homogenous Near Eastern package. At least two zones seem to be involved, although it is not easy to differentiate between influences and population transfers.

Diverse continental participation?

The high proportions of Cappadocian obsidian point to connections with south Anatolia, at *c.* 69 km. from Cyprus a shorter crossing than that from *c.* 101 km. distant Syria (Held 1992, 109–110). Though the proportion of obsidian is relatively high at Cypro-EPPNB Mylouthkia 1A, obsidian artifacts are numerically more prevalent in Cypro-MPPNB Shilourokambos. Pending absolute dating of Akanthou, the involvement of obsidian trade during the initial colonization of Cyprus must be generalized to the Cypro-E/MPPNB. Also, the effects of changes in obsidian sources elsewhere in the north Levant, or the possible export of obsidian from workshops like Kaletepe and Kömürcü to Cyprus must remain speculative (M.-C. Cauvin 1991; Esin 1999). Other potential Anatolian links are evident in the glossed crescents of Shillourokambos as well as these and other microliths in the Tenta assemblage, since such tool types persisted in Anatolia after the spread of PPNB traits to these areas. The difficulty with postulating a population source from Anatolia, however, is chronological and cultural. Mersin was only founded at a time contemporary with the end of the Cypro-PPNB and since earlier aceramic sites have not been documented in Cilicia, one must argue *e silentio* for founder groups there (Caneva 1999; but see below). Earlier occupation is attested inland on the central plain. It has links with the north Levant and the Mediterranean, but it lacks traits paralleled on Cyprus and seems to have an indigenous ancestry that reaches back to the tenth millennium BP (cf. Watkins 1996). Thus, there are few grounds at the moment for inferring significant migration from the north, although there were probably exchange links which may have intensified during the Cypro-MPPNB with the expansion of obsidian trade elsewhere on the mainland.

There are also the unequivocal connections between the north Levantine Corridor and this distant island. In addition to the economic and settlement aspects mentioned previously, there are technological and typological parallels in chipped stone (Fig. 2: 5–12), symbolic elements such as polished maceheads with hourglass perforations (Fig. 2: 20, 23, continuing into the PPNB), a residual(?) butterfly bead from Khirokitia (Fig. 2. 21, 24; cf. also de Contenson 1992, fig. 131.11) and a figurine, reportedly of plaster, a medium widely used in the PPNB of the Levant for figurative works (Guilaine *et al.* 2000, 79; cf. Griffin *et al.* 1998). Although some of these occur in the south as well as the north of the Levant, many are specific to the north. The natural distribution of Persian fallow deer also favours an eastern rather than Anatolian source for the emigrés (Zeuner 1958).

If we cannot identify departure locations, economic data and material remains at least allow us to infer that source populations belonged to the PPN interaction sphere (Bar-Yosef and Belfer-Cohen 1989) and that some groups probably came from the Syrian coastal platform. In this reconstruction, agropastoralists should have existed in western Syria beyond Bar-Yosef and Meadows' early farming and herding zone in the Near East between 9500/9300 and 8500 BP (Bar-Yosef and Meadows 1995, 74, fig. 3.5). This contention of a primarily west Syrian population base most likely accounts for the cooccurrence on Cyprus of classic north Syrian PPNB traits and 'archaisms' like that seen in the Taurus *facies* or retained elsewhere in Anatolian early Neolithic industries.

Ecological stress?

If this argument is accepted, the critical lack of parent sites on or near the west Syrian/ south Anatolian coastal regions must be addressed. Above, we considered jump dispersal, leapfrogging migration and temporary nomads hypotheses. All these suggestions fail to meet the precondition for successful transmaritime colonisation: knowledgeable seafarers. This brings us to the second appreciation mentioned above, palaeogeography.

It is generally agreed that the configuration of the coastal strip of this zone has altered considerably since the last deglaciation. So, as Cherry notes, "it is vital to consider island colonization not in the context of present-day maps, but of the palaeogeography appropriate to the time it occurred" (Cherry 1990, 194). Although there are many variables to consider, including tectonic fluctuations, in general terms the shoreline on the mainland and on Cyprus was –120 m. around 17000 BP during the glacial maximum, –25 m. at *c.* 8000 BP and –7 m. at *c.* 5000 BP (Cherry 1990; Gomez and Pease 1992). Thus, the mainland was marginally closer to the island, but there was no landbridge or island stepping stones between the two. Significantly, both masses lost appreciable amounts of coastlands with their wetland resources to marine transgression during the Early Holocene, especially on the Adana Plain (Held 1992). The significant point here, therefore, is that we are probably missing critical coastal stations, ones that may have been instrumental in transmitting Mediterranean shells to inland sites, for example. The presently submerged site of PPNC Atlit-Yam is a striking instance of a settlement that had to be abandoned in all probability because of rising sea levels during the general period being considered here (Galili *et al.* 1993; Galili and Nir 1993; Galili and Sharvit 1998).

Local migration must have been a long-standing risk management strategy for communities faced with sea encroachments. In this corner of the Mediterranean, the most obvious options were to relocate inland or to the island of Cyprus. Ras Shamra VC may be one example of such a re-location (de Contenson 1992). Founded in the LPPNB some 1 km. inland from the present shoreline, its situation and history may provide a clue to the paucity of recorded early Aceramic Neolithic sites in this zone. So successful were the first inhabitants that the site became the locus of virtually uninterrupted occupation for several millennia. As a consequence, the earliest settlement is buried deeply at the bottom of the tell. Our understanding of the distribution of early Aceramic Neolithic sites in this zone, therefore, is biased since excavations have frequently concentrated on the Bronze and Iron Age strata of tells.

A second and more general reason for lack of archaeological visibility may be gleaned from the character of the remains at Mylouthkia 1, Shillourokambos Early Phase A and Tenta Period 5. These sites are comprised of timber structures and other sub-surface features that leave very few above-ground traces. Unlike the *pisé* and mudbrick settlements that formed tells in the Levantine Corridor, PPN settlements in the western part of the Mediterranean woodlands and forest zone on the mainland may have been more like their Cypriot counterparts and so would have resulted in less obvious archaeological signals. On Cyprus, they were only discovered belatedly as a result of archaeological monitoring of recent quarrying and terracing, systematic survey of eroded landscapes and excavation in relatively shallow anthropogenic deposits. The Cypriot case suggests that watching briefs and intensive surveys in relevant parts of Syro-Anatolia will be required to help disclose what we now see are often exiguous traces of prehistoric activities. Until these are found, our argument for the existence of tenth millennium BP agro-pastoral sedentary communities in the Mediterranean woodland zone between Aleppo and the Syrian coast rests on circumstantial evidence alone.

Conclusions

We have shown that one of the earliest successful overseas migration of farmers in the world took place in the tenth millennium BP from west Syria or, less likely, south Anatolia, to the island of Cyprus, a sea-crossing of some 70–100 km. This new perspective on neolithic dispersals necessitates a refinement to models that have agriculturalists reaching Mediterranean Syro-Anatolia by as much as 1000 years later as part of a larger 'exodus' from the Levantine Corridor.

Migration took place soon after the evolution of the first founder crops and before most reared livestock show morphological signs of domestication. The co-existence of this flora and fauna on the island now indicates that animal husbandry was well integrated into some agricultural regimes of the tenth millennium BP. The assumption that husbandry succeeded the cultivation of cereals by about a millennium needs re-investigation since it is based primarily on morphological change rather than degree of control.

The strong presence of PPNA traits in the Cypro-PPNB is open to a number of interpretations. While we cannot rule out the possibility of successful emigration during that period, the discordant Aetokremnos evidence suggests that it took place after the shelter was abandoned.

Since we conjecture that ecological stress amongst coastal agro-pastoralists due to rising sea levels played a significant role in the migration of farmers to Cyprus, our evidence sheds only limited light on the much broader issue of the general dynamics for the diffusion of the neolithic. It neither supports nor undermines Cauvin's PPNB conquest hypothesis as an underlying trigger that impelled farmers to migrate (Cauvin 1997, 180–1). Independent invention of agro-pastoralism or acculturation by Cypriot indigenes is ruled out because the island seems to have been uninhabited prior to the arrival of farmers. Thus, long-distance dispersal of integrated farming systems took place much earlier than previously postulated or separate paths to farming existed in northerly regions outside the Levantine Corridor that were more closely in touch with the coastal Mediterranean. In order to test some of these suggestions, systematic survey for non-tell sites needs to be undertaken in west Syria. Failure to locate such sites may support arguments for the existence of a mobile *facies* of the EPPNB in the large tract of land between the northern corridor and the coast. There is in any case little evidence to support jump dispersal or wave of advance models from the Levantine Corridor to the island.

Because of its insular context, this new dispersal evidence provides an unprecedented amount of detail regarding the characteristics that underpinned the success of early neolithic migration. If anything, we have underestimated the capabilities of the earliest farmers to undertake long-distance, concerted colonisation of new territory not long after domestication 'events'. Migration, as we have seen, did not simply entail the transfer of population with basic subsistence resources. It encompassed a whole cultural system with unexpected aspects such as game deer for hunting/managing, fox for furs, and cats and dogs. This Mediterranean evidence, therefore, provides firmer evidence than was previously available from the mainland alone that migration played a significant role in the earliest spread of farming. It constitutes a new perspective on "the entire set of activities of human groups [by which we will] reach a better understanding of the Neolithic Revolution" (Bar-Yosef 1998c, 59).

Notes

[1] To date, only cursory examination of the glume wheat chaff (glume bases and spikelet forks) has been possible and it is the intention that more time will be spent attempting to identify these items. However, initial findings seem to indicate that both domestic species (/types) are also represented in these remains.

[2] As with the glume wheats, the hulled barley chaff has been examined only briefly and it has not been possible to suggest whether the rachis internodes derived from wild or domestic species. The final report on the Mylouthkia archaeobotanical assemblages will contain full descriptions of the cereal chaff, including references to any species identifications.

Acknowledgements

University of Edinburgh Lemba Archaeological Project excavations at Kissonerga-Mylouthkia which have provided so much of the information used here are conducted with permission of the Department of Antiquities, Cyprus, and generously supported in part by the British Academy, the Council for British Research in the Levant, the National Museums of Scotland and the University of Edinburgh (Munro Fund). Paul Croft carried out excavation of the Mylouthkia wells under trying circumstances. We have benefited enormously from discussions with many colleagues, especially Jean Guilaine and members of his Shillourokambos team. We are grateful to Sherry C. Fox for comments on the human remains and to anonymous reviewers for their valuable comments. Naturally, we alone are responsible for the opinions expressed in this paper. Warm thanks to the directors of excavations, Ehud Galili, Jean Guilaine, Klaus Schmidt, Danielle Stordeur and Ian Todd for permission to include material for Figure 2. Drawings: Lindy Crewe.

Bibliography

Angel, J.L. (1953) Appendix II: The human remains from Khirokitia. Pp. 416–430 in Dikaios 1953.

Anthony, D. (1997) Prehistoric Migration as Social Process. Pp. 21–32 in J. Chapman and H. Hamerow (eds), *Migrations and Invasions in Archaeological Explanation*. BAR 664. Archaeopress: Oxford.

Åström, P. (1998) *Hala Sultan Tekke 10. The Wells*. Studies in Mediterranean Archaeology 45:10. Åström: Jonsered.

Astruc, L. (1994) L'outillage en pierre non-taillée et les petits objets. Pp. 215–289 in A. Le Brun (ed.) *Fouilles récentes à Khirokitia (Chypre) 1988–1991*. Éditions Recherche sur les Civilisations: Paris.

—— (forthcoming) Lithic tools involved in the manufacture of stone ornaments and utilitarian products, in I. Caneva (ed.) *Beyond Tools. Reconsidering Definitions, Counting and Interpretation of Lithic Assemblages, Workshop on PPN Chipped Lithic Industries*. Venice, Nov. 1998.

Aurenche, O. and J. Cauvin eds (1989) *Néolithisations*. BAR-Int Ser 516: Oxford.

Baird, D. (1997) Goals in Jordanian Neolithic Research. Pp. 371–81 in H. Gebel, Z. Kafafi and G. Rollefson (eds) *The Prehistory of Jordan*. II. *Perspectives from 1997*. Studies in Early Near Eastern Production, Subsistence, and Environment 4. Ex oriente: Berlin.

Balkan-Atli, Nur (1994) The Typological Characteristics of the Aşikli Höyük Chipped Stone Industry. Pp. 209–221 in Gebel and Kozłowski 1994.

Bar-Yosef, O. (1989) The PPNA in the Levant – An overview. *Paléorient* 15, 57–63.

—— (1994) Form, Function and Numbers in Neolithic Lithic Studies. Pp. 5–14 in Gebel and Kozłowski 1994.

—— (1995) Earliest food producers – Pre Pottery Neolithic (8000–5500). Pp. 190–201 in T. Levy (ed.) *The Archaeology of Society in the Holy Land.* Leicester University Press: London.
—— (1996) Late Pleistocene Lithic Traditions in the Near East and their Expression in Early Neolithic Assemblages. Pp. 207–216 in Kozlowski and Gebel 1996.
—— (1998a) On the Nature of Transitions: The Middle to Upper Palaeolithic and the Neolithic Revolution. *Cambridge Archaeological Journal* 8, 141–63.
—— (1998b) The Natufian Culture in the Levant, Threshold to the Origins of Agriculture. *Evolutionary Anthropology* 6, 159–77.
—— (1998c) Agricultural Origins: Caught Between Hypotheses and a Lack of Hard Evidence. *The Review of Archaeology* 19, 58–64.
Bar-Yosef, O. and A. Belfer-Cohen (1989) The Levantine 'PPNB' Interaction Sphere. Pp. 59–72 in I. Hershkovitz (ed.) *People and Culture in Change, Proceedings of the Second Symposium on Upper Paleolithic, Mesolithic and Neolithic Populations of Europe and the Mediterranean Basin.* BAR 508. British Archaeological Reports: Oxford.
Bar-Yosef, O. and Meadows, R. (1995) The origins of Agriculture in the Near East. Pp. 39–94 in T. Douglas Price and A. Gebauer (eds) *Last Hunters, First Farmers: New Perspectives on the Prehistoric Transition to Agriculture.* School of American Research Press: Sante Fe.
Beile-Bohn, M., C. Gerber, M. Morsch and K. Schmidt (1998) Neolithische Forschungen in Obermesopotamien. Gürcütepe und Göbekli Tepe. *Istanbuler Mitteilugen* 48, 5–78.
Bienert, H.-D. (1991) Skull Cult in the Prehistoric Near East. *Journal of Prehistoric Religion* 5, 9–23.
Briois, F. B. Gratuze, J. Guilaine (1997) Obsidiennes du site Néolithique Précéramique de Shillourokambos (Chypre). *Paléorient* 23, 95–112.
Broodbank, C. and T. Strasser (1991) Migrant farmers and the Neolithic colonization of Crete. *Antiquity* 65, 233–45.
Byrd, B. (1992) The Dispersal of Food Production Across the Levant. Pp. 49–61 in A. Gebauer and T. Douglas Price (eds) *Transitions to agriculture in prehistory.* Monographs in World Archaeology, 4. Prehistory Press: Madison, Wisconsin.
Caneva, I. (1999) Early Farmers on the Cilician Coast: Yumuktepe in the Seventh Millennium BC. Pp. 105–111 in Özdoğan 1999.
Cauvin, J. (1977) Les fouilles de Mureybet 1971–1974 et leur signification pour les origines de la sedentarisation au Proche-Orient. *AASOR* 44, 19–48.
—— (1989) La néolithisation au Levant et sa première diffusion. Pp. 3–36 in Aurenche and Cauvin 1989.
—— (1997) *Naissance de divinités. Naissance d'agriculture.* 2nd ed. CNRS Éditions: Paris.
Cauvin, J. and O. Aurenche (1982) Le Néolithique de Cafer Höyük (Malatya, Turquie). Fouilles 1979–1980. Pp. 123–138 in J. Cauvin (ed.) *Cahiers de L'Euphrate* 3. Éditions Recherche sur les civilisations: Paris.
Cauvin, J., M.-C. Cauvin, D. Helmer, and G. Willcox (1998) L'Homme et son environnement au Levant Nord entre 30,000 et 7,500 BP. *Paléorient* 23, 51–69.
Cauvin, M.-C. (1973) Problémes d'emmanchement des faucilles du Proche-Orient: les documents de Tell Assouad (Djezireh, Syrie). *Paléorient* 1, 101–106.
—— (1974) Outillage lithique et chronologie à Tell Aswad (Damascène-Syrie). *Paléorient* 2, 429–36.
—— (1983) Les faucilles préhistoriques du Proche-Orient. Données morphologiques et fonctionnelles. *Paléorient* 9, 63–79.
—— (1984) L'outillage lithique de Khirokitia Chypre et le Levant. Pp. 85–87 in A. Le Brun *et al. Fouilles récentes à Khirokitia (Chypre) 1977–1981.* Éditions Recherche sur les Civilisations 41. ADPF: Paris.
—— (1991) L'obsidienne au Levant préhistorique: provenance et fonction. *Cahiers de l'Euphrate* 5–6, 163–190.
—— (1994) Synthèse sur les industries lithiques Néolithique Préceramique en Syrie (Synthesis Contribution). Pp. 279–297 in Gebel and Kozłowski 1994.
Cauvin, M.-C. and J. Cauvin (1993) La Séquence Néolithique PPNB au Levant Nord. *Paléorient* 19, 23–8.
Cauvin, M.-C and N. Balkan (1985) Cafer Höyük: Analyse de l'outillage lithique (campagnes 1982–1983). Problèmes typologiques et chronologiques. Pp. 53–83 in J. Cauvin (ed.) *Cahiers de L'Euphrate* 4. Éditions Recherche sur les civilisations: Paris.
Cauvin, M.-C. *et al.* eds (1998) *L'obsidienne au Proche et Moyen Orient.* BAR Int-Ser 738. Archaeopress: Oxford.
Cherry, J. (1990) The First Colonisation of the Mediterranean Islands: A Review of Recent Research. *JMA* 3, 145–221.
Christou, D. (1994) Chroniques des fouilles et découvertes archéologiques à Chypre en 1993. *Bulletin de Correspondance Hellènique* 118, 647–93.
Colledge, S.M. (1994) *Plant exploitation on Epipalaeolithic and early Neolithic sites in the Levant.* Unpublished PhD Thesis, University of Sheffield.
—— (1998) Identifying pre-domestication cultivation using multivariate analysis. Pp. 121–31 in Damania *et al.* 1998.
Copeland, L. (1981) The flint industries of the Nahr Queiq Valley. Pp. 81–129 in J. Matthers (ed.) *The River Qoueiq, Northern Syria, and its Catchment.* BAR-IntSer 98. BAR: Oxford.
Coqueugniot, E. (1994) L'industrie lithique de Dja'de el Mughara et le début du P.P.N.B. sur l'Euphrate Syrien (Sondages 1991 et 1992). Pp. 313–30 in Gebel and Kozłowski 1994.
Croft, P. (1988) *A Study of some Faunal Remains from Neolithic and Chalcolithic Cyprus.* Unpublished PhD thesis, University of Cambridge.
—— (1991) Man and Beast in Chalcolithic Cyprus. *BASOR* 282/283, 63–79.
—— (1998) Faunal Materials from Ais Yiorkis. Pp. 5–6 in Simmons 1998a.

Crowfoot-Payne, J. (1983) Appendix C: The Flint Industries of Jericho. Pp. 622–758 in K.M. Kenyon and T.A. Holland (eds) *Excavations at Jericho*. 5. British School of Archaeology in Jerusalem: London

Damania, A.B., J. Valkoun, G. Willcox, and C.O. Qualset eds (1998) *The Origins of Agriculture and Crop Domestication.* ICARDA: Aleppo.

Davis, S. (1984) Khirokitia and its mammal remains a Neolithic Noah's Ark. Pp. 147–162 in A. Le Brun *et al. Fouilles récentes à Khirokitia (Chypre) 1977–1981*. Éditions Recherche sur les Civilisations 41. ADPF: Paris.

—— (1991) When and Why did Prehistoric People Domesticate Animals? Some Evidence from Israel and Cyprus. Pp. 391–8 in O. Bar-Yosef and F. Valla (eds) *The Natufian Culture in the Levant*. International Monographs in Prehistory. Archaeological Series 1: Ann Arbor (MI).

de Contenson, H. (1992) *Ras Shamra-Ougarit*. VIII. *Préhistoire de Ras Shamra.* Éditions Recherche sur les Civilisations: Paris.

—— (1993) Ramad dans le Neolithique du Levant. *Paléorient* 19, 29–31.

Dikaios, P. (1953) *Khirokitia*. Oxford University Press: London.

Esin, U. (1999) Introduction. The Neolithic in Turkey: A General review. Pp. 13–23 in Özdoğan 1999.

Galili, E. and Y. Nir (1993) The submerged Pre-pottery Neolithic water well of Atlit-Yam, northern Israel, and its palaeoenvironmental implications. *The Holocene* 3, 265–70.

Galili, E. and J. Sharvit (1998) Submerged Neolithic Water-Wells from the Carmel Coast of Israel. Pp. 31–44 in H. Koschik (ed.) *Brunnen der Jungsteinzeit, International Symposium in Erkelenz 27. bis 29. Oktober 1997.* Rheinland Verlag: Köln.

Galili, E., M. Weinstein-Evron, I. Hershkovitz, A. Gopher, M. Kislev, O. and H. Lernau and L. Kolska-Horwitz (1993) Atlit-Yam: A Prehistoric Site on the Sea Floor off the Israeli Coast. *Journal of Field Archaeology* 20, 133–57.

Garrard, A. (1999) Charting the Emergence of Cereal and Pulse Domestication in South-west Asia. *Environmental Archaeology* 4, 67–86.

Garrard, A., S. Colledge and L. Martin (1996) The emergence of crop cultivation and caprine herding in the "Marginal Zone" of the southern Levant. Pp. 204–26 in Harris 1996a.

Gebel, H. (1996) Chipped Lithics in the Basta Craft System. Pp. 261–70 in Kozłowski and H. Gebel 1996.

Gebel, H. G. and S. K. Kozłowski eds (1994) *Neolithic Chipped Stone Industries of the Fertile Crescent*. Studies in Early Near Eastern Production, Subsistence, and Environment 1. Ex oriente: Berlin.

Gomez, B. and P. Pease (1992) Early Holocene Cypriot Coastal Palaeogeography. *RDAC*, 1–8.

Gopher, A. (1989a) Diffusion process in the Pre-Pottery Neolithic Levant: The case of the Helwan Point. Pp. 91–105 in I. Hershkovitz (ed.) *People and culture in change.* BAR-IntSer 508 (i): Oxford.

—— (1989b) Neolithic Arrowheads of the Levant: Results and Implications of a Seriation Analysis. *Paléorient* 15, 43–56.

—— (1994a) Southern-Central Levant PPN Cultural Sequences: Time-Space Systematics Through Typological and Stylistic Approaches. (Synthesis Contribution). Pp. 387–92 in Gebel and Kozłowski 1994.

—— (1994b) Pottery Neolithic 6th/5th Millennia B.C. Industries of the Southern Levant Seen through PPN Glasses. Pp. 563–6 in Gebel and Kozłowski 1994.

—— (1996) What happened to the Early PPNB? Pp. 151–8 in Kozłowski and Gebel 1996.

Gopher, A. and A. Goring-Morris (1998) A Pre-Pottery Neolithic B Camp in the Central Highlands, Israel. *BASOR* 312, 1–20.

Goring-Morris N., R. Burns, A. Davidzon, V. Eshed, Y. Goren, I. Hershkivitz, S. Kangas and J. Kelecevic (1998) The 1997 Season of Excavations at the Mortuary Site of Kfar Hahoresh, Galilee, Israel. *Neolithics* 3, 1–4.

Griffen, P., C. Grissom and G. Rollefson (1998) Three Late Eighth Millennium Plastered Faces from ʿAin Ghazal, Jordan. *Paléorient* 24, 59–70.

Gratuze, B. (forthcoming) Provenance study of eight obsidian artefacts excavated from the Aceramic Neolithic levels of the site of Kissonerga-Mylouthkia Cyprus, in Peltenburg *et al.* forthcoming c.

Guilaine, J., F. Briois, J. Coularou and I. Carrère (1995) L'Etablissement néolithique de *Shillourokambos* (Parekklisha, Chypre). Premiers résultats. *RDAC* 11–32.

Guilaine, J., F. Briois, J. Coularou, J-D. Vigne and I. Carrère (1998a) Les débuts du Néolithique à Chypre. *L'Archéologue* 33, 35–40.

Guilaine, J., F. Briois, J. Coularou, P. Devèze, S. Philibert, J-D. Vigne and I. Carrère (1998b) La site néolithique précéramique de Shillourokambos (Parekklisha, Chypre). *Bulletin de Correspondance Hellénique* 122, 603–610.

Guilaine, J., F. Briois, J-D. Vigne, and I. Carrère (2000) Découverte d'un Néolithique précéramique ancien chypriote (fin 9e, début 8e millénaires cal. BC), apparenté au PPNB ancien/moyen du Levant nord. *Earth and Planetary Sciences* 300,75–82.

Hammer, K. and Specht, C.-E. (1998) The Variation of Grain Characters in Diploid and Tetraploid Hulled Wheats and its Relevance for the Archaeological Record. Pp. 2l. 69–272 in Damania *et al.* 1998.

Hansen, J. (1992) Franchthi cave and the beginnings of agriculture in Greece and the Aegean. Pp. 231–47 in P. Anderson (ed.) *Préhistorie d'agriculture: nouvelles approches expérimentales et ethnographiques*. Monographie du CRA 6. Éditions CNRS: Paris.

Harris, D. ed. (1996a) *The Origins and Spread of Agriculture and Pastoralism in Eurasia.* UCL Press: London.

—— (1996b) Introduction: themes and concepts in the study of early agriculture. Pp. 1–9 in Harris 1996a.

—— (1996c) The origins and spread of agriculture and pastoralism: an overview. Pp. 552–573 in Harris 1996a.

—— (1998) The Origins of Agriculture in Southwest Asia. *The Review of Archaeology* 9, 5–11.

Hauptmann, H. (1999) The Urfa Region. Pp. 65–86 in Özdoğan 1999.

Held, S. (1992) Colonization and Extinction on Early Prehistoric Cyprus. Pp. 104–64 in P. Åström (ed.) *Acta Cyprus: Acts of an International Congress on Cypriote Archaeology Held in Göteborg on 22–24 August 1991.* Studies in Mediterranean Archaeology Pocket-book 114.2. Åström: Jonsered.

Heun, M., Schäfer-Pregl, R., Klawan, D., Castagna, R., Accerbi, M., Borghi, B. and Salamini, F. (1997) Site of Einkorn Wheat Domestication Identified by DNA Fingerprinting. *Science* 278, 1312–3.

Jamous, B. and D. Stordeur (1999) Tell Jerf el-Aḥmar un site meureybetien du moyen Euphrate syrien. Horizon PPNA-Xe millenaire a. J.C. Pp. 57–69 in G. del Olmo Lete and J.-L. Montero Fenollós (eds) *Archaeology of the Upper Syrian Euphrates, The Tishrin Dam Area.* Aula Orientalis-Supplementa 15. Editorial Ausa: Barcelona.

Jones, G. (1986) The carbonised plant remains from Meare West 1979:2. *Somerset Levels Papers* 12, 57–9.

Jarman, M.R. (1982) Palaeoeconomic perspectives. Pp. 49–71 in M. Jarman, G.N. Bailey and H. Jarman, *Early European agriculture: its foundations and development.* University Press: Cambridge.

Kozłowski S. (1992) *Nemrik* 9. Vol 2: *House No. 1/1A/1B.* Wydawnictwa Uniwersytitu: Warsawa.

—— (1994) Chipped Neolithic Industries as the Eastern Wing of the Fertile Crescent. (Synthesis Contribution). Pp. 143–71 in Gebel and Kozłowski 1994.

—— (1999) The Big Arrowhead Industries BAI in the Near East. *Neo-lithics* 2, 8–10.

Kozłowski S.K. and H.G. Gebel eds (1996) *Neolithic Chipped Stone Industries of the Fertile Crescent, and Their Contemporaries in Adjacent Regions.* Studies in Early Near Eastern Production, Subsistence, and Environment 3. Ex oriente: Berlin.

Le Brun, A. (1989) La néolithisation de Chypre. Pp. 95–107 in Aurenche and Cauvin 1989.

Le Brun, A. *et al.* (1981) *Un site néolithique précéramique en Chypre: Cap Andreas-Kastros*, Recherche sur les grandes civilisations 5. Editions ADPF: Paris.

Lechevallier, M. (1978) *Abou Gosh et Beisamou. Deux gisements du VII millénaire avant l'ère chrétienne en Israël.* Memoire et Travaux du Centre de Recherches Préhistoriques Français de Jerusalem 2. Association Paléorient: Paris.

McCartney, C. (1998) Preliminary Report on the Chipped Stone Assemblage from the Aceramic Neolithic Site of Ayia Varvara Asprokremnos. *Levant* 30, 85–90.

—— (1999) Opposed Platform Core Technology and the Cypriot Aceramic Neolithic. *Neo-Lithics* 1, 7–10.

—— (forthcoming) The Chipped Stone Assemblage from Tenta (Cyprus), Cultural and Chronological Implications, in I. Caneva (ed.) *Beyond Tools. Reconsidering Definitions, Counting and Interpretation of Lithic Assemblages, Workshop on PPN Chipped Lithic Industries.* Venice, Nov. 1998.

McCartney, C. and E. Peltenburg (2000) The Colonization of Cyprus: Questions of Origins and Isolation, *Neo-lithics* 1/00, 8–11.

Marfoe, L. (1979) The integrative transformation: patterns of sociopolitical organization in southern Syria. *BASOR* 234, 1–42.

—— (1998) Kāmid el-Lōz 14. *Settlement History of the Biqā^c up to the Iron Age.* Saarbrücker Beitrage zur Altertumskunde 53. Rudolf Habelt: Bonn.

Mazurowski, R. (1997) *Nemrik* 9. Volume 3: *Ground and Pecked Stone Industry in the Pre-Pottery Neolithic of Northern Iraq.* Zaklad Poligrapficzny: Warsawa.

Molist, M. and A. Ferrer (1996) Industries Lithiques pendant la périod 8000–7500 B.P. à Tell Halula dans le cadre d'Euphrate moyen Syrien. Pp. 431–42 in S. Kozłowski and H. Gebel 1996.

Moore, A., G. Hillman and A. Legge (1975) The excavation of Tell Abu Hureyra in Syria: a preliminary report. *PPS* 41, 50–77.

Nesbitt, M. and Samuel, D. (1995) From staple crop to extinction? The archaeology and history of the hulled wheats. Pp. 41–100 in S. Padulosi, K. Hammer and J. Heller (eds) *Hulled wheats. Promoting the conservation and use of underutilized and neglected crops.* 4. Proceedings of the First International Workshop on Hulled Wheats, 21–22 July 1995, Castelvecchio Pascoli Tuscany, Italy. IPGRI: Rome.

Özdoğan, M. (1997) The beginning of Neolithic economies in southeastern Europe: an Anatolian perspective. *Journal of European Archaeology* 5, 1–33.

Özdoğan, M. ed. (1999) *Neolithic in Turkey.* Arkeoloji ve Sanat Yayıları: Istanbul.

Peltenburg, E. (1979) Troulli reconsidered, in V. Karageorghis (ed.) *Studies presented in memory of Porphyrios Dikaios*, 21–45. Department of Antiquities: Nicosia.

Peltenburg, E., S. Colledge, P. Croft, A. Jackson, C. McCartney and Mary Anne Murray (2000) Agro-pastoralist colonisation of Cyprus in the 10^{th} millennium BP: initial assessments. *Antiquity* 74, 344–353.

Peltenburg, E., P. Croft, A. Jackson, C. McCartney and M. Murray (forthcoming a) Well established colonists: Mylouthkia 1 and the Cypro-Pre-Pottery Neolithic B, in S. Swiny (ed.) *The Earliest Prehistory of Cyprus: from Colonization to Exploitation.* ASOR.

Peltenburg, E. *et al.* (forthcoming b) *Lemba Archaeological Project.* III.1. *Excavations at Kissonerga-Mylouthkia 1977–1996.* SIMA 70:4. Åström: Jonsered.

Perrot, J. (1964) Les deux premières campagnes de fouilles à Munḥatta (1962–1963). *Syria* 41, 323–45.

Quintero, L. (1996) Flint Mining in the Pre-Pottery Neolithic: Preliminary Report on the Exploration of Flint at Neolithic 'Ain Ghazal in Highland Jordan. Pp. 233–42 in Kozłowski and Gebel 1994.

Quintero, L. and P. Wilke (1995) Evolution and Economic Significance of Naviform Core-And-Blade Technology in the Southern Levant. *Paléorient* 21, 17–33.

Rollefson, G. (1987) Local and external relations in the Levantine PPN period: 'Ain Ghazal (Jordan) as a regional centre. Pp. 29–32 in A. Hadidi (ed.) *SHAJ* III: 29–32. Department of Antiquities of Jordan: Amman.

Rollefson, G., A. Simmons and Z. Kafafi (1992) Neolithic Cultures at 'Ain Ghazal, Jordan. *Journal of Field Archaeology* 19, 443–70.

Roodenberg, J. (1986) *Le mobilier en pierre de Bouqras. Utilisation de la pierre dans un site néolithique sur le Moyen Euprate (Syrie)*. Nederlands Historisch-Archaeologisch Institut te Istanbul: Istanbul.

Rosenberg, M. (1999) Hallan Çemi, pp. 25–34 in Özdoğan 1999.

Rosenberg M. and B. Peasnall (1998) A Report on Soundings as Demirkoy Höyük: an Aceramic Neolithic Site in Eastern Anatolia. *Anatolica* 24, 195–207.

Şevketoğlu, M. (2000) *Archaeological Field Survey of the Neolithic and Chalcolithic Settlement Sites in Kyrenia District, North Cyprus: Systematic Surface Collection and the Interpretation of Artefact Scatters*. BAR-IntSer 834. Archaeopress: Oxford.

Simmons, A. (1994) Early Neolithic settlement in western Cyprus, Preliminary report on the 1992–1993 test excavations at Kholetria-Ortos. *BASOR* 295, 1–14.

—— (1998a) Test Excavations at two Aceramic Neolithic Sites in the Uplands of Western Cyprus. *RDAC*, 1–16.

—— (1998b) Of tiny hippos, large cows and early colonists in Cyprus. *JMA* 11, 232– 41.

—— (2000) A Brief Summary of the Chipped Stone Assemblage from Akrotiri *Aetokremnos*, Cyprus, *Neolithics* 1/00, 11–13.

Simmons, A. and Associates (1999) *Faunal Extinction in an Island Society: Pygmy Hippopotamus Hunters of Cyprus*. Plenum: New York.

Stordeur, D. (1999) Organisation de l'espace construit et organisation sociale dans le Néolithique de Jerf el Ahmar (Syrie, Xe-IXe millénaire av. J.C.). Pp. 131–49 in F. Braemer, S. Cleuziou and A. Coudart (eds) *Habitat et société*. Éditions APDCA: Antibes.

Todd, I.A. (1987) *Vasilikos Valley Project* 6. *Excavations at Kalavassos-Tenta* 1. SIMA 71:6. Åström: Göteberg.

—— (forthcoming) Kalavasos-*Tenta* Revisited, in S. Swiny (ed.) *The Earliest Prehistory of Cyprus: from Colonization to Exploitation*. ASOR.

Valkoun, J., J. Waines and J. Konopka. (1998) Current Geographical Distribution and Habitat of Wild Wheats and Barley. Pp. 293–299 in Damania *et al.* 1998.

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

Vigne, J-D., I. Carrère, J-F. Saliége, A. Person, H. Bocherens, J. Guilaine and F. Briois (forthcoming) Predomestic cattle, sheep, goat and pig during the late 9th and the 8th millennium cal. BC on Cyprus: Preliminary results of Shillourokambos (Parekklisha, Limassol). In H. Buitenhaus, M. Mashkour and F. Poplin (eds) *Archaeozoology of the Near East IV, Proc. 4th Int. Symp. Archaeology of Southwestern Asia and adjacent areas*. Archaeological Research and Consultancy: Groningen.

Watkins, T. (1996) Excavations at Pınarbası: the Early Stages. Pp. 47–57 in I. Hodder (ed.) *On the surface: Çatalhöyük 1993–95*. British Institute of Archaeology at Ankara Monograph 22. Oxbow: Oxford.

Watson, J. and N. Stanley Price (1977) The vertebrate fauna from the 1972 sounding at Khirokitia. *RDAC*, 232–60.

Wright, K. (1993) Early Holocene stone assemblages in the Levant. *Levant* 25, 93–111.

Zeist, W. van (1981) Plant remains from Cape Andreas-Kastros (Cyprus). Appendix VI. Pp. 95–99 in A. LeBrun (ed.) *Un site néolithique précéramique en Chypre: Cap Andreas Kastros. Recherche sur les grandes civilisations*. Memoirs 5. Editions ADPF: Paris.

—— (1988) Some aspects of early neolithic plant husbandry in the Near East. *Anatolica* 15, 49–67.

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

Zeist, W. van and J. Bakker-Heeres (1982) Archaeobotanical Studies in the Levant 1. Neolithic sites in the Damascus Basin: Aswad, Ghoraifé and Ramad. *Palaeohistoria* 24, 165–256.

—— (1984a) Archaeobotanical Studies in the Levant 2. Neolithic and Halaf levels and Ras Shamra. *Palaeohistoria* 26, 151–170.

—— (1984b) Archaeobotanical Studies in the Levant 2. Late-Palaeolithic Mureybit. *Palaeohistoria* 26, 171–199.

Zeist, W. van and G. de Roller (1991–92) The plant husbandry of Aceramic Çayönü, SE Turkey. *Palaeohistoria* 33/34, 65–96.

Zeuner, F. (1958) Animal Remains from a Late Bronze Age Sanctuary on Cyprus, and the Problem of the Domestication of Fallow Deer. *Journal of the Palaeontological Society, India* 3, 131–5.

Zohary, D. (1996) The mode of domestication of the founder crops of Southwest Asian agriculture. Pp. 142–158 in Harris 1996a.

Zohary, D. and M. Hopf (1993) *Domestication of Plants in the Old World.* (2nd edition). Clarendon Press: Oxford.