A Contextual Approach to the Emergence of Agriculture in Southwest Asia: Reconstructing Early Neolithic Plant-Food Production

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Reconstructing Early Neolithic Plant-Food Production

by Eleni Asouti and Dorian Q Fuller

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The scale and nature of early cultivation are topics that have received relatively limited attention in research on the origins of agriculture. In Southwest Asia, one the earliest centers of origin worldwide, the transition to food production is commonly portrayed as a macroevolutionary process from hunter-gatherer through to cultivator-forager and farming stages. Climate change, resource intensification, sedentism, rising population densities, and increasing social complexity are widely considered by prehistorians as pivotal to the emergence of protoagricultural village life. In this paper we revisit these narratives that have been influenced by culture-history and social evolution, together forming the dominant theoretical paradigms in the prehistory of Southwest Asia. We propose a complementary contextual approach seeking to reconstruct the historical development of Early Holocene plant-food production and its manifold sociocultural environments by intersecting multiple lines of evidence on the biology of plant domestication, resource management strategies, settlement patterns, cultivation and harvesting technologies, food storage, processing and consumption, ritual practices and symbolic behaviors. Furthermore, we propose that early plant-food production in Southwest Asia should be dissociated from ethnographically derived notions of sedentary village life. Plants emerge as important components of community interactions and ritual performances involving suprahousehold groups that were mediated through communal food consumption.

Research Context

A substantial body of research on agricultural origins in Southwest Asia, one of the earliest and best documented centers of early food production worldwide, focuses on representing this spatially and temporally variable process as the outcome of systemic causalities operating at the macro scale. Climate change (Richerson, Boyd, and Bettinger 2001), demographic growth (Cohen 1977), social competition (Bender 1978; Hayden 1995) and cognitive-symbolic "revolutions" (Cauvin 2000) have all featured as potential prime movers of the "Neolithic Revolution." A common thread linking these diverse perspectives is a pervasive concern with the subsistence economy. Economic change together with culture-history and associated theories of diffusion and acculturation represent the lasting legacy of Gordon Childe's thinking to the prehistory of Southwest Asia and form the dominant theoretical paradigms in the prehistoric archaeology of the region (cf. Asouti 2006; Edwards et al. 2004). Several scholars, accepting Childe's conceptualization of the Neolithic Revolution as a transformation in socioeconomic practices, have awarded primacy of consideration to subsistence production in relation to the development of sedentism and the impact of climate change on the environment (e.g., Bar-Yosef 1998; Bar-Yosef and Belfer-Cohen 1992; Bar-Yosef and Meadow 1995; papers in Harris and Hillman 1989; Henry 1989; Moore and Hillman 1992; Moore, Hillman, and Legge 2000). Others have argued, instead, that changes in subsistence practices followed more fundamental shifts in human cognition that took place during the Pleistocene-Holocene transition (Mithen 2007; Watkins 2002). Other authors, seeking a more holistic perspective on the diverse contributions of environmental, economic, sociocultural, and ideological factors, have tried to reunite them in narratives centered on the theme of domestication in relation to symbolic and ritual practices (Verhoeven 2004). What these theories have in common is a shared premise conceptualizing the Neolithic transformation in the Mid-

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dle East as a single developmental process and a transition: from hunting-gathering to agriculture, from egalitarian to complex societies, from the wild to the domestic, from the realm of nature to that of culture.

Recently published articles and commentaries have pointed out the limited explanatory power of such universal theories of agricultural origins: their key expectations are increasingly constrained by a diverse empirical record, containing multiple and often competing sources of evidence, that does not permit establishing primacy of cause (Zeder 2009*a*, 2009*b*:45–48). Instead, they have advocated adopting a macroevolutionary approach focusing on how climate, ecology, demography, economy, society, culture, and historical contingency interacted in shaping the "developmental trajectory of the transition from foraging to farming" (Zeder and Smith 2009:686). However, other authors have argued that, in its current form, the very concept of the Neolithic transition is a problematic one as it privileges explanatory models projecting onto the prehistoric past contemporary perceptions and ethnographically derived notions about how Neolithic societies functioned and structured their relationships with the landscape and the world (Asouti 2011; Asouti and Fairbairn 2010; Finlayson and Warren 2010). Some authors have also remarked that relations of production among protoagriculturalists, rooted as they are in "cultural understandings of sociality," tend to retain the structures of a hunter-gatherer habitus (Barnard 2007:14). This dimension of early food production is rarely addressed by the culture-historical and social evolutionary perspectives that have dominated prehistoric archaeology in the Middle East. The reason is that they often approach the development of prehistoric socioeconomics retrospectively as a stadial process. In it early food production acquires significance primarily as the enabler of demographic growth, the accumulation of surpluses, and the emergence of social complexity and inequality, rather than as a product of historically constituted and socially mediated economic practices (cf. Asouti 2006; Asouti and Fairbairn 2010; Belfer-Cohen and Goring-Morris 2009).

Our purpose with this article is to complement existing macroevolutionary frameworks through a historical contextual approach to the investigation of early plant-food production. We accept that macroevolutionary approaches (*sensu* Zeder 2009*a*, 2009*b*, 2011) offer appropriate frameworks for analyzing from a comparative, cross-cultural perspective the long-term trajectories of resource management strategies, socioeconomics, and demographic histories to spatially and temporally varied environments. However, we propose that a historical perspective, grounded on a detailed appreciation of the archaeological record, is better placed for interpreting the material remains of Neolithic subsistence activities in their original contexts of occurrence, that is, as elements of prehistoric habitual practices (cf. Barrett 2012; Bradley 2005; Bruno 2009; Denham 2005, 2009, 2011; Denham and Haberle 2008). Such practices include not only the construction and expansion of new anthropogenic niches through the intentional management of landscape resources (cf. Zeder 2009*a*) but also the sociocultural environment of early plant-food production. As "sociocultural environment" we define here the nexus of resource management strategies, settlement patterns, cultivation and harvesting technologies, food storage, processing and consumption, ritual practices, and symbolic behaviors. A consideration of the impacts of the local and regional sociocultural environments on the long-term development of subsistence economies allows for an appreciation of the role of historically constituted human agency in economic change and an archaeologically grounded understanding of the historical contexts in which such changes materialized. Thus, rather than viewing historical and evolutionary perspectives on the origin of food production as mutually exclusive, we argue that the former can inform the latter in significant ways: through a historically situated understanding of the Neolithic political economies it becomes possible to reconstruct both the complex interdependencies of their sociocultural, economic, and ecological components, and also how adjusted or maladjusted they might have been to the goals of survival and reproduction.

In its practical application, the approach proposed in this article can be described as "contextual," in the methodological sense of the term. Its aim is the detailed evaluation of the archaeological attributes of assemblages of plant-food remains preserved in archaeological layers and features, including their context of occurrence and their associations with other categories of archaeological data (especially material culture and the built environment). Monitoring these relationships and how they changed within and between different sites and areas permits a data-informed understanding of the coevolution of plant-based subsistence strategies and their sociocultural environments. This in turn enables archaeobotanical research to move beyond traditional concerns with domestication and the ecology of early cultivars and address from a solid factual basis the role of plant-based subsistence production in Neolithic social life. A key difference of our approach from classic contextual interpretative frameworks (cf. Hodder 1982) is that we do not seek to tease out symbolic or other nonmaterial meanings from contextualized archaeological evidence. What we aim for rather is to develop a methodology approximating within the limitations posed by the partial nature of the archaeological record, the historical method, targeted at reconstructing past practices through their material remains. Furthermore, we do not conceptualize early food production mainly as a subset of human-environment interactions taking the form of specific landscape management practices (cf. Denham 2011; Denham and Haberle 2008). We adopt instead an explicitly materialist methodology emphasizing the site-by-site contextual analysis of archaeobotanical assemblages (i.e., the material residues of plant-related past activities). Our aim is to reconstruct site-specific practices associated with plant production, consumption, storage, and discard and determine how such practices might have related to other domains of social life (Asouti and Fuller 2012:159). However, particularly

Table 1. Summary of Late Epipaleolithic: Early Neolithic chronocultural horizons and subsistence economies in Southwest Asia

Chronocultural horizons	Calibrated years BC	Regional cultural entities and subsistence economies
Late Epipaleolithic	~12,000–10,000	Natufian (Levant, south Anatolian coast), Epipaleolithic of the northeastern Fertile Crescent (Taurus-Zagros arc): hunting-gathering
Pre-Pottery Neolithic A (PPNA)	~9700–8700	Khiamian (northern, southern? Levant), Early PPN of the northeastern Fertile Crescent: hunting-gathering
		Mureybetian (northern Levant), Sultanian (southern Levant): hunting-gathering; predomestication cultivation
		PPNA habitations at Göbekli Tepe, Çayönü (SE Anatolia): hunting-gathering (predomestication cultivation?)
Early PPNB (EPPNB)	~8700–8200	Northern Levant, southeast Anatolia, (persistence of the PPNA in the southern Levant?), Early PPN of the northeastern Fertile Crescent, Early Cypro-PPNB; earliest known Neolithic settlement in central Anatolia: predomestication or mixed cultivation, hunting-gathering, herding, first appearance of domesticated crop "packages"
Middle PPNB (MPPNB)	~8200–7500	MPPNB cultures of the southern Levant, aceramic Neolithic cultures of the northern Levant, southeast and central Anatolia, Cyprus and the Zagros: diverse habitation patterns and subsistence practices observed region-wide
Late PPNB (LPPNB)	~7500–7000	Late aceramic Neolithic cultures, southern Levantine "megasites": establishment and expansion of mixed agropastoral economies based on cereals, pulses and caprine herding region-wide, completion of the plant domestication process, widespread adoption of domesticated crop "packages" in mixed agropastoral economies

Source. Asouti and Fuller 2012 (table 1).

in Southwest Asia, integrated archaeobotanical analyses carry additional benefits for the investigation of plant-related landscape practices, given that off-site paleoenvironmental proxies (i.e., pollen and sediment archives) are scarce and often poorly preserved and consequently lack the spatial and temporal precision required for high-resolution reconstructions of people-vegetation interactions (Asouti, forthcoming).

A key difference of our approach compared with what we term "ethnographically derived" models is that it does not consider traditional anthropological concepts of prestate or "traditional" farming societies as quasi-natural categories, which can be directly or indirectly transferred onto the Neolithic. It thus holds no a priori assumptions about the nature of Neolithic food producing communities, for example, as sedentary communities that practiced normal surplus economies based on kin-, household-, or gender-based divisions of labor and that were characterized variously by quasi-egalitarian, nonhereditary hierarchical or heterarchical social structures (for an overview of anthropological approaches to Neolithic social organization, see Souvatzi 2008; for applied concepts in the Neolithic of Southwest Asia, see Kuijt 2000). Instead, we follow a bottom-up approach that prioritizes the analysis of the contextual associations of archaeobotanical data for reconstructing specific practices associated with plant-food production. These archaeologically derived practices are then used as key referents for evaluating its sociocultural environment in each site/area and how it varied through time and between different sites and areas. Ethnographic parallels are used for highlighting possibilities in the interpretation of the patterns observed in the archaeological record, rather than for guiding interpretation from the start. Our approach is thus perforce historical, as it cannot generate or sustain on its own cross-cultural generalizations about the causes of the transition from foraging to farming worldwide. Its aim is to propose empirically grounded frameworks for reconstructing the historical development of early plant-food production at local or subregional scales, which can then inform current understandings of regionwide macroevolutionary processes. Demonstrating how such a historical understanding can be achieved through the contextual analysis of Southwest Asian archaeobotanical data sets represents perhaps the most valuable contribution of our work to research on agricultural origins worldwide.

Our paper addresses a specific time period in the chronology of the Early Neolithic of Southwest Asia, spanning the tenth and early to mid-ninth millennia cal BC, in culture-historical terms coeval with the Pre-Pottery Neolithic A (PPNA) and the Early PPNB (table 1, fig. 1). This period (henceforth termed the "Early PPN") represents a key stage in the development of food production with the onset of plant cultivation, to be followed slightly later by animal herding, at several localities across the region (Asouti and Fuller 2012; Bar-Yosef 1998; Bar-Yosef and Belfer-Cohen 1989*a*; Colledge and Conolly 2007; Colledge, Conolly, and Shennan 2004; Garrard 1999; Harris 2002). However, it also represents an ambiguous stage that sits somewhat uncomfortably between the Late Epipaleolithic "complex hunter-gatherers" and the Middle to Late PPNB "farming communities" (cf. Bar-Yosef and Meadow 1995; Belfer-Cohen and Bar-Yosef 2000; Byrd 2005; Kuijt 2000; Kuijt and Goring Morris 2002). The reason is that

Figure 1. Map of Early PPN sites in Southwest Asia.

there is very little and highly contested evidence dating to this period for cereal domestication, contrasted with the abundant evidence for hunting-gathering and the cultivation of morphologically wild plants (conventionally termed "predomestication cultivation"), including cereals (Asouti and Fuller 2012). Some prehistorians, considering biological domestication as coeval with agriculture, have resolved this ambiguity by denying the applicability of the term *agriculture* until the LPPNB, while ascribing "true" agricultural status only to post-PPN economies (e.g., Akkermans 2004). Others have opted for a stadial approach, subdividing PPN economies in four developmental stages: (1) hunting-gathering, (2) cultivation of predomesticated crops supplemented by hunting and gathering, (3) cultivation of fully domesticated crops, and (4) integrated agropastoral production with the adoption of domesticated caprine herding (Harris 1989, 2002; see also fig. 2). In this evolutionary trajectory, Early PPN subsistence economies are viewed as corresponding to stage 2 and have thus been categorized by current scholarly consensus as "low-level food production" economies (*sensu* Smith 2001*a*; see also Byrd 2005).

Prehistorians have proposed various models for understanding the contribution of low-level food production to the broader sociocultural developments characterizing the PPN of Southwest Asia. Recent research has emphasized in particular resource intensification, considered as the basis for the "onset of large food-producing villages" (Byrd 2005:262). Accordingly, subsistence economies have been portrayed as increasingly reliant on cereal cultivation supplemented by hunting, especially after the first half of the tenth millennium and the rapid improvement of climate that followed the end of the cold and arid Younger Dryas oscillation (~10,900–9600 cal BC), which enabled the permanent settlement of favorable ecotones on the borders of lakeshores, marshes, and alluvial surfaces that provided suitable habitats for cereal cultivation (Bar-Yosef and Meadow 1995; Byrd 2005; Kuijt and Goring-Morris 2002; Sherratt 1997). Increased reliance on cultivars is also believed to be reflected in ground stone technologies

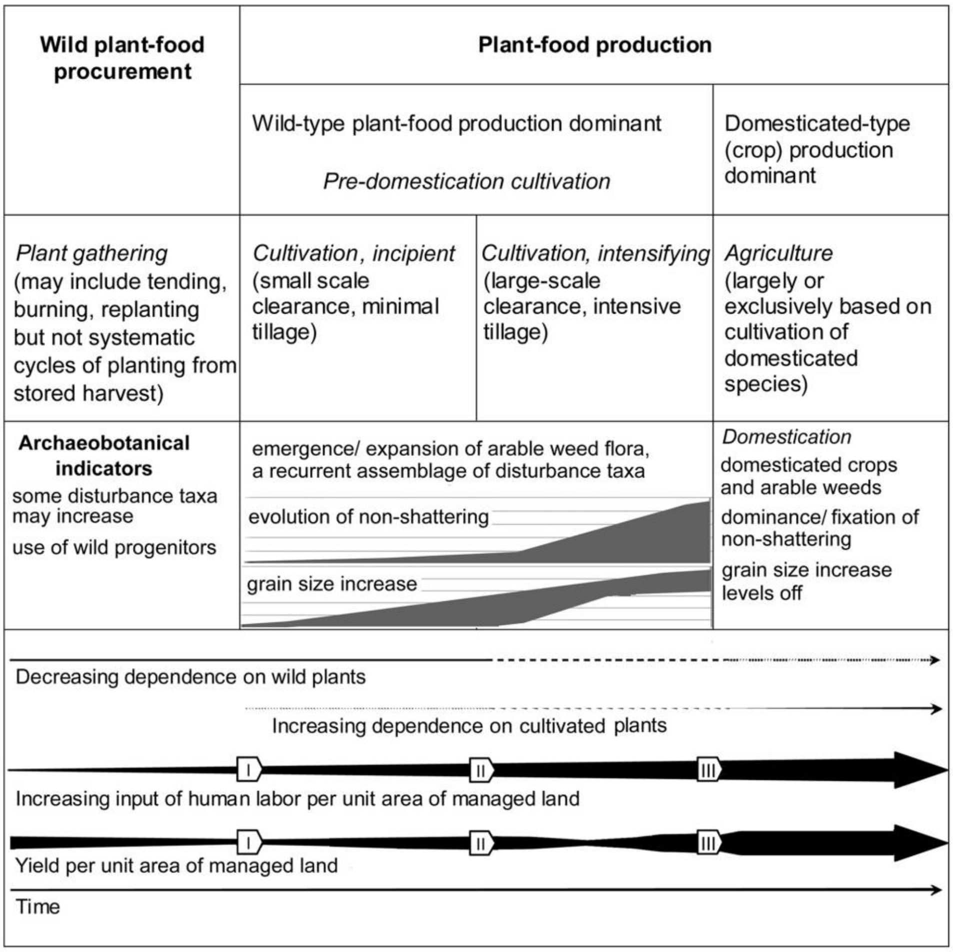

Figure 2. An evolutionary classification of Early Neolithic plant-food procurement and production systems in Southwest Asia. Modified after Harris 1996: table 1.1.

(Wright 1991), communal grain storage (Kuijt and Finlayson 2009; Stordeur and Willcox 2009), and institutions of corporate leadership inferred from the perceived management needs of building projects that required the mobilization of communal labor (e.g., the "public" buildings of Göbekli Tepe, Mureybet, Jerf el Ahmar, Jericho, and Tell Qaramel; cf. Kenyon 1981; Mazurowski and Yartah 2002; Schmidt 2000; Stordeur 2000*b*; Stordeur and Ibáñez 2008). As "public" buildings are defined structures that, according to the excavators' reports, differed from "residential" architecture and might have served various communal functions as loci of ritual activities, including mortuary rites, public gatherings, communal storage, monuments demarcating sites in the wider landscape, or combinations thereof. The increasing archaeological visibility of residential architecture, public structures, and associated ritual practices have also been interpreted as indicative of increasing sedentism and social complexity, which were directly linked to resource intensification (Byrd 2005). Altogether these elements of the archaeological record have been treated as the material correlates of the increasing ability of leaders "to garner greater power and authority by conducting elaborate rituals, maintaining control over ritual knowledge and paraphernalia, and 'ensuring' the success of each step in the agricultural process. . . . Thus leadership roles were legitimized through ideology" (Byrd 2005:266–267).

Archaeobotanical analyses published in the course of the last decade, coupled with recent advances in genetic research, have demonstrated that the biological domestication of the Southwest Asian cereal and pulse founder crop species was a very slow process evolving over an extended period that lasted for approximately three millennia (see reviews by Allaby, Brown, and Fuller 2010; Fuller, Allaby, and Stevens 2010; Fuller, Asouti, and Purugganan 2012). However, their implications for archaeological interpretations positing that sedentary "village life," based on intensive cereal management and cultivation, was a widespread form of human engagement with the landscape in the Early PPN, have not been yet fully appreciated. This has been partly the result of the lack until recently of up to date syntheses of the botanical record and an in-depth assessment of how botanical evidence correlates with other categories of archaeological data. The uncertainty with which many prehistorians approach Early PPN plant management is manifested, for example, in arguments that cultivars formed only a "minor component" of the regional subsistence economies appearing side by side with their categorization as "staple foods" (e.g., Belfer-Cohen and Bar-Yosef 2000; Byrd 2005; Kuijt and Goring Morris 2002; Zeder 2009*b*; Zeder and Smith 2009). A key premise adopted in this paper is that the pace of the development of the domestication syndrome in Early Neolithic cultivars was primarily a function of the nature, intensity, and duration of human interventions in their lifecycles and ecology. Thus, several important questions arise from the revision of the botanical record: How intensive was plant cultivation and what was its contribution to Early PPN socioeconomics? Were cereals staple foods or minor components of the regional subsistence economies? If the notion of intensified plant gathering and cultivation being practiced by sedentary "village communities" is incompatible with the botanical record, what could replace it as an empirically viable model for conceptualizing Early PPN political economies? What was the contribution of the sociocultural environment of early cultivation to the emergence of the domestication syndrome? Is conceptualizing the development of food production as a stadial process, involving the progressive succession of recognizable (by ethnographic and sociological criteria) modes of production, warranted by the available evidence?

The next section of the paper presents a critical overview of the archaeobotanical and genetic evidence pertaining to the rate of plant domestication and the evidence for Early PPN plant management practices. Following that, we present our propositions for intersecting botanical and material culture data sets through a contextual approach that explores their multiple associations at select sites across the region. In it we try to show how resource management strategies, food storage, processing, and consumption practices and activities were embedded in regionally patterned lifeways, which were in turn characterized by diverse and versatile dwelling practices. We also demonstrate that cultivars and gathered plants formed important elements of community interactions (often associated with ritual performances) that linked habitation sites to the wider landscape and were mediated by communal food consumption. The implications of this reconstruction for current thinking on Early PPN socioeconomics and, more generally, the origin and spread of food production in Southwest Asia are discussed in the concluding sections of the article.

Crop Cultivation, Gathering, and the Rate of Plant Domestication in the PPN of Southwest Asia

From Single to Multiple Centers of Origin

While systematically retrieved archaeobotanical assemblages were available from few Epipaleolithic and Neolithic sites and subphases, it remained possible to postulate that most of the "founder crops" (table 2) of Southwest Asia originated from a single center (e.g., Bar-Yosef and Meadow 1995:90, Garrard 1999; Zohary 1999). However, a simple tally of species presence in Early PPN sites demonstrates that different species were gathered or cultivated in each area, while domesticated crop packages emerged gradually and piecemeal (table 3; Asouti and Fuller 2012). For example, two-grained einkorn, rye, and barley were cultivated in the upper Euphrates basin, contrasting with the evidence for emmer and barley in the southern Levant. Furthermore, recent refinements in identification criteria have demonstrated the existence of two separate einkorn taxa characterized by different but partly overlapping distributions (Willcox 2005). Both types were domesticated

Table 2. Neolithic founder crops of Southwest Asia and their wild progenitors

Crop species	Common English name	Wild progenitor
Triticum turgidum subsp. *dicoccum*	Emmer wheat	*Triticum turgidum* subsp. *dicoccoides* (= *T. dicoccoides*)
Triticum monococcum	Einkorn wheat	*Triticum monococcum* subsp. *boeoticum* (= *T. boeoticum*)
Hordeum vulgare	Hulled barley	*Hordeum vulgare* subsp. *spontaneum* (= *H. spontaneum*)
Pisum sativum	Pea	*Pisum sativum* subsp. *humile* (= *P. humile*)
Lens culinaris	Lentil	*Lens culinaris* subsp. *orientalis* (= *L. orientalis*)
Cicer arietinum	Chickpea	*Cicer arietinum* subsp. *reticulatum* (= *C. reticulatum*)
Vicia ervilia	Bitter vetch	Viciae family (wild forms of *V. ervilia*)
Linum usitatissimum	Flax	*Linum usitatissimum* subsp. *bienne* (= *L. bienne*)

Source. Zohary 1996:144 (table 9.1).

and subsequently spread to Europe (Köhler-Schneider 2003; Kreuz and Bohnke 2002). However, two-grained einkorn became extinct from the Euphrates basin during the Chalcolithic (van Zeist 1999). In addition, an early variant of rye, which is indistinguishable from wild two-grained einkorn on the basis of grain morphology but identifiable from chaff remains, was widely gathered and probably cultivated in parts of the upper Euphrates during the PPN (Willcox 1999; Willcox, Fornite, and Herveux 2008). Subsequently, domesticated ryes occurred at some sites in Anatolia and the Euphrates (see table 3). It is very unlikely that this taxon is directly related to the modern European ryes that appear to have evolved separately from a weedy rye form in Early Iron Age Europe (Behre 1992). Archaeobotanical data thus suggest the existence of more pathways to cultivation than those represented by modern domesticated crop lines, including early experiments with cultivation that did not lead to domestication, as well as early domesticates that went extinct in prehistoric times. These observations raise the question of whether other early crop lines may have existed in the past that have become extinct.

A growing body of genetic studies has also failed to pinpoint a geographically focused nuclear zone for the origin of crop species (cf. Allaby, Brown, and Fuller 2010; Allaby, Fuller, and Brown 2008). We now know that barley had a western (Southwest Asia) and an eastern (Central Asia) gene pool (Morell and Clegg 2007; Saisho and Purugganan 2007), while emmer and pea had northern and southern Levantine gene pools (Kosterin and Bogdanova 2008; Luo et al. 2007). Very few crops (flax and probably chickpea) can be identified with single gene pools (Fu and Allaby 2010; Shan et al. 2005). Gene pools represent detectable distinct subsamples of wild populations and thus, by implication, separate divergence events from wild populations. However, such events need not be coincident with the start of cultivation or with the origin or fixation of biological domestication traits, although it can be hypothesized that dispersal from the core regions of early cultivation may leave traces of divergence events. Another outcome of recent genetic modeling has been the realization that geographically separate populations of early cultivars may share genes, including domestication adaptation alleles, due to gene flows effected through the "bridge" of intervening wild populations (Allaby 2010; Allaby, Brown, and Fuller 2010). Cultural interactions may also act as potential "bridges," for example, through the exchange of grain along the same networks and paths of movement used for the circulation of material culture, such as obsidian.

Rate of the Development of the Domestication Syndrome

The pace of biological domestication in cereals can be documented by two traits of the domestication syndrome: nonshattering ears and grain size (Fuller and Allaby 2009; Fuller, Allaby, and Stevens 2010; Fuller, Asouti, and Purugganan 2012). These traits are adaptive to different behaviors exerting selection pressures on the progenitors of crop species. Thus, understanding their timing and context of occurrence can provide insights into the plant management activities that selected for them: tillage and sowing (affecting germination traits, including inhibition loss and large grain size) and harvesting (nonshattering ears prohibiting free seed dispersal upon maturation). In cereals, changes in shattering habit are manifested in the attachment scars on the rachis segments, which form part of the spikelet base (fig. 3). Wild taxa have smooth scars, as spikelets are readily released from the cereal ears upon maturation, while domesticated taxa have rough scars as spikelets remain attached to the ears. Hence a clear distinction between wild and domesticated variants can be achieved through the study of rachis remains. While this has been known since the 1950s (e.g., Helbaek 1959), actual data were limited to a few cereal chaff impressions on mud bricks. Rachis remains were also recovered by flotation, yet large assemblages of wild and domesticated morphotypes did not begin to be published until the mid-1980s with van Zeist's study of barley rachises from E/MPPNB Tell Aswad (van Zeist and Bakker-Heeres 1985*a*). Rachises damaged by crop-processing tasks, such as dehusking by pounding, may further complicate assessments of their morphology (Tanno and Willcox 2006, 2012).

The recent accumulation of prehistoric assemblages of wheat and barley rachises has been charted by Allaby, Brown, and Fuller (2010). This and subsequent analyses have demonstrated a time lag between the onset of predomestication

Table 3. Summary of archaeobotanical evidence for crops and wild progenitors in Southwest Asia

	BC cal.	Einkorn one-grained	Einkorn two-grained	Rye	Emmer	Naked wheat	Barley	Flax	Lentil	Pea	Chick pea	Grass pea	Bitter vetch	Broad bean
Southern Levant:														
Ohalo II	~21,000	0	0	0	X	0	XXX		X		0			
Wadi Hammeh 27	12,200–11,600	0	0	0	0	0	x				0			
Wadi Faynan 16	10,600–8200					0	X				0			
Iraq ed-Dubb	9660–8800	?	?		?	0	XX				0			?
Gilgal I	9550–9100	0	0	0	?	0	XX				0			
Netiv Hagdud	9310–8850	0	0	0	XX	0	XXX		XX		0		X	
ZAD 2	9160–8830			0	?	0	d-XXX		XX	?	0	?	?	
el-Hemmeh	9150–8660				X		XXX		XX		?			
Jericho I (PPNA)	9150–8350	d-X			d-XX		d-XX		X		?			
Tell Aswad I	8700–8300	0	0	0	d-XX	0	d-XX		**D-XX**	X	0		X	
Jericho II (PPNB)	?8200–7500	**D-X**	0	0	**D-XX**	0	**D-XXX**	**D-X**	**D-XX**	**D-XX**	X			d-XX
Beidha	8300–7550	0	d-X	0	d-XX	0	d-XX		**D-XX**		**D-X**		X	
Yiftahel	8200–7650		0	0		0			**D-XX**		0			d-XX
Wadi Jilat 7	8200–7350	d-XX	d-XX	0	d-X	0	d-XXX				?			
‘Ain Ghazal	8300–6600		0	0	**D-XX**	**D-X**	**D-XXX**	X	**D-XX**	**D-XX**	**D-X**			d-X
Nahal Hemar	8000–7050		0	0	d-XX	0	**D-XX**	X				X		
Ghoraife	7800–7050	**D-X**			**D-XXX**	**D-X**	**D-XX**	X	**D-X**	**D-XX**			X	
Basta	7550–7050	**D-X**	0	0	**D-XXX**	**D-X**	**D-XX**		**D-X**	**D-XX**			X	
Azraq 31	7490–7180					**D-X**	**D-X**						?	
Ramad	7300–6650	**D-X**	**D ?**	0	**D-XXX**	**D-X**	**D-X**	X	**D-XX**	**D-XX**	**D-X**			
Wadi Fidan A	7300–6750	**D ?**	**D-XX**	0	**D-XXX**	**D-X**	**D-XX**							
Wadi Jilat 13	7030–6600	**D-XX**	**D-XX**	0	**D-X**	0	d-XXX							
Northern Syria and Middle Euphrates:														
Abu Hureyra 1	11,150–10,450	0	XX	XX	0	0	0	X	XX	0			X	
Tell Qaramel	10,300–8850	XXX	0	0	X	0	X		X	0			X	
Mureybet I-III	9700–8500	0	XX	XX	0	0	XX	X	X	X			X	
Tell ‘Abr 3	9500–9200	0	XX	XX	0	0	X		X					
Jerf el Ahmar	9450–8700	X	d-XX	XX	0	0	d-XXX			?			X	
Dja’de	8700–8270	X	d-XX	XX	X	0	d-XXX			X			X	
Mureybet IV	8750–7950		x	X			x		x	x				
Tell Halula	7820–7320		X	0	**D-XX**	**D-XXX**	**D-XX**		**D-X**	X			X	d-X
Abu Hureyra 2A-C	7800–7000		**D-XX**	**D-X**	**D-X**	**D-X**	**D-XX**	X	**D-X**	?	**D-X**	?	?	d-X
Sabi Abyad II	7650–6750		**D-X**	0	**D-XXX**	**D-XX**	**D-XX**	XX	**D-X**					
Tell Bouqras	7500–6300	**D-X**			**D-XX**	**D-XX**	**D-XXX**	X	**D-X**	**D-X**				
El Kowm II	7100–6350		**D-XXX**	**D-X**	**D-XX**	**D-XX**	**D-X**						X	

Southeast and Central Anatolia:														
Göbekli Tepe	9200–8600	0	XX	?	0	0	XXX							
Çayönü (RP, GP, Ch.H)*	8600–8200	d-X	d-X	0	d-XX	0	XX	X	X	**D-X**	X	X	X	d-X
Nevalı Çori	8600–7950	d-XXX	d-XX	0	XX	0	X		X	**D-X**	?	X	X	d-X
Cafer Höyük XIII-VIII	8300–7450	**D-XXX**	X	**D-X**	**D-XX**	**D-X**	X		**D-X**	X	?	X	XXX	d-X
Hacılar	8200–7550	**D-XX**		0	**D-XXX**	**D-X**	**D-X**		**D-X**					
Aşıklı Höyük**	>7820–7520	**D-XX**		0	**D-XXX**	**D-X**	**D-XX**		XX	**D-X**	?		X	
Can Hasan III	7720–7360	**D-X**		**D-XX**	**D-XX**	**D-XXX**	**D-XX**		**D-X**	**D-X**			X	
Çatalhöyük East***	>7100–6400	**D-X**		0	**D-XXX**	**D-X**	**D-XX**		**D-X**	**D-X**	**D-X**		X	
Eastern Fertile Crescent (eastern Turkey, Iran, Iraq):														
Qermez Dere	10,100–8800	0	0	0	0	0	X		XX				X	
Körtik Tepe	9700–9300	?	?	?			XXX							
Demirköy	9440–9280	0	0	0	X	0	X		X					
Hallan Çemi	>9670–9300	0	0	0	0	0	0			?		?	?	
Nemrik 9	>9900–8200				0	0			X	X				
M'lefaat	9500–8800	?	?		0	0	XX		X				X	
Chogha Golan	8700–7700	?	?											
Chia Sabz	8400–7700	?	?		?		XXX		XX					
Tepe Abdul Hosein	8300–7800				**D-XX**		**D-XX**		**D-X**					
Ganj Dareh	8240–7840					0	**D-XXX**		X	X				
Jarmo	8000–7400	d-X			d-XX		d-XX		**D-X**	**D-X**		X		
Chogha Bonut	7600–6900	**D-XX**			**D-XXX**		**D-XX**		**D-X**					
Ali Kosh (B M ph.)	7650–6800	**D-X**			d-XXX	0	**D-XX**	X						
Tell Maghzaliyeh	7050–6250	**D-XX**			**D-XX**		**D-XX**	**D-X**	**D-X**					
Ali Kosh (A K ph.)	6800–6100	**D-X**			d-XXX	0	**D-XX**	X	**D-X**					
Umm Dabaghiyah	6900–5500				**D-XX**		**D-XX**							
Yarim Tepe I	6800–6000				**D-X**	**D-X**	**D-XX**							
Western Syria and Cyprus:														
Kissonerga-Myl.	8700–8200	**D-XX**	**D** ?	0	**D-X**	0	**D-XX**	X	X					
Tell el-Kerkh	8540–8320	d-X	0	0	d-X	0	d-X		X	0	**D-XX**		X	d-XX
Shillourokambos	8250–7350		X		XX		d-XXX		x			x		
Ras Shamra	7600–6000	**D-X**	**D** ?		**D-XXX**	**D-X**	**D-XX**	X	**D-X**	**D-X**		X		
C. Andreas-Kastros	6800–6100	**D-X**			**D-XXX**	0	**D-XX**	X	**D-X**	**D-X**				?
Khirokitia	>6400–6100	**D-X**			**D-XXX**	**D-X**	**D-XX**		**D-X**	**D-X**		?		?

Sources. Modified after Asouti and Fuller 2012. Summaries of the archaeobotanical evidence from PPN Southwest Asia can be found in Asouti and Fuller (2012), Charles (2007), Colledge and Conolly (2007), Garrard (1999), Nesbitt (2002), Willcox (2007); Willcox, Fornite, and Herveux (2008). (All primary sources alongside short summaries of and commentaries on the data from each site, and a detailed presentation of the associated radiocarbon dates are listed in CA+ supplement A).

Note. x = present, nonquantified, or sample size too small to quantify; ? = possibly present; 0 = absence considered significant for region/period and is genuine rather than being attributable to sampling and identification biases. Semiquantitative ranking for cereals: XXX = very frequent/dominant; XX = frequent; X = present, low frequency; D (bold) = domesticated type; d = partial domestication syndrome (large seed size or presence of a minority of domesticated-type nonshattering rachises). Note that wild two-grained einkorn is indistinguishable from rye based on grain morphology alone; the status of early finds of broad bean (*Vicia faba*) as domesticated type is currently unresolved.

* Çayönü has a long occupation through the PPN. The sum of 23 dates (excluding those with large standard deviations and the Basal level date, which is too early) produces a strong modal peak at ca. 8300 BC, which is taken as the date for the Early PPN finds of einkorn, emmer, and pea at the site.

** at Aşıklı the majority of dates have derived from later Level 2, which was also the focus of the archaeobotanical analyses published to date (van Zeist and de Roller 1995).

*** at Çatalhöyük the summed 1σ probability of 65 dates (excluding those with large standard deviations) provided an extended modal range of 7100–6400 BC. The earliest (aceramic) levels of the mound have produced very few reliable dates by comparison to the ceramic Neolithic phases.

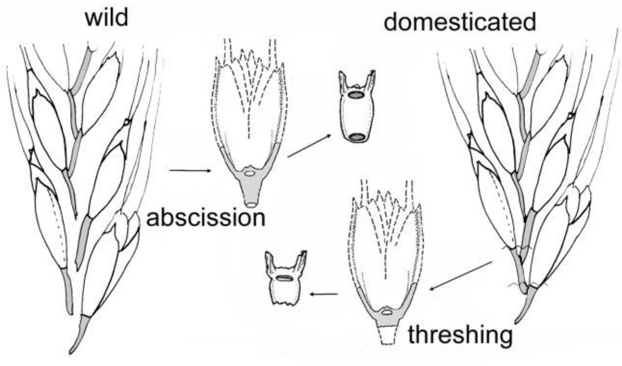

Figure 3. Diagrams comparing the disarticulation of (*A*) a wild-type glume wheat ear and (*B*) of a domesticated type. The part that is usually recovered archaeologically (the spikelet base or spikelet fork) is indicated, showing the difference between wild-type rachis that detaches through clean abscission and domesticated-type rachis that can detach only through human action (threshing). Modified after Fuller and Allaby 2009: fig. 7.1.

cultivation during the PPNA, the initial appearance of nonshattering ears in the EPPNB, and the completion of the biological domestication process with the fixation of nonshattering forms by the LPPNB (fig. 4; Fuller 2007; Fuller and Allaby 2009; Fuller, Willcox, and Allaby 2012; Purugganan and Fuller 2009; Tanno and Willcox 2006). The causes for the slow evolution of nonshattering rachis (∼3000 years from the beginning of cultivation) contrary to its rapid fixation in < 100 years that is theoretically possible (Hillman and Davies 1990; Honne and Heun 2009) are debated. One key factor appears to be the continuous gene flow between contiguous wild and cultivated populations (Allaby 2010). Other factors probably include continued gathering from the wild, especially in the event of periodic crop failures, for replenishing supplies of seed corn (Willcox, Fornite, and Herveux 2008) and variations in harvesting practices, such as harvesting before cereals reached full maturation, by basket/paddle or from the ground, or in multiple passes in which an earlier pass was saved for procuring seed corn (Fuller 2007). The key point to emphasize here is that overall the evidence suggests variation and diversity in harvesting practices (e.g., among different households and communities), while the continuation of gathering alongside cultivation would have exerted varied pressures on local cereal populations for, or against, the nonshattering rachis trait. In addition, the fixation of nonshattering ears would have led to the requirement for further labor investment in threshing and winnowing prior to dehusking, hence adding to crop-processing labor costs (Fuller, Allaby, and Stevens 2010). In turn, additional labor costs might have militated against the intentional selection of nonshattering forms for replanting. It is also possible that in predomestication cultivation contexts, fields with a proportionally higher occurrence of nonshattering types might have been perceived as "infested" by comparison with wild stands, if one allows for early perceptions of cultivars that might have differed from the "agronomic" mind-set characterizing later established agriculturalists (Fuller, Asouti, and Purugganan 2012). However, empirical verification of such phenomena requires examining the processing routines for both gathered and cultivated grain individually for each site, something that is not always feasible in the absence of detailed reporting of botanical data. More generally, analyses of this sort could also provide useful data for assessing how crop-processing routines evolved from Early PPN predomestication cultivation and gathering into the better understood practices that characterized arable production in later periods.

Grain size changes, especially the increase in grain width and thickness, also evolved gradually (fig. 5). Evidence for larger grain size in archaeobotanical assemblages from Zahrat adh-Dhra' 2 (ZAD 2), 'Iraq ed-Dubb and the later phases of Jerf el Ahmar suggests that selection for this trait began much earlier than the selection for nonshattering ears (Fuller 2007; Willcox 2004). However, it is also clear that larger grain size developed in tandem with the persistence of nonshattering ears and that it continued to evolve until the LPPNB (compare figs. 4, 5). Larger grain size is selected for by soil clearance, tillage, and seed planting, and, while requiring labor involved in field preparation, it would have also returned higher yields as grain weight increased (Fuller, Allaby, and Stevens 2010).

The Archaeological Evidence for Harvesting and Tillage Technologies

Sickles made of chipped stone are known to have been used as harvesting tools in Southwest Asia since the Natufian (Anderson and Valla 1996; Bar-Yosef 1998; Edwards 2007; Stordeur 1999*a*). Sickle blades formed parts of composite tools, being hafted in bone or wooden handles, and bear a characteristic gloss on their surfaces. Experimental studies and microscopic analyses have suggested that they were extensively used for harvesting cereals (Unger Hamilton 1989, 1991). Using sickles has the advantage of maximizing yields derived from limited areas compared with the efficiency of other harvesting methods (e.g., by beaters and baskets; cf. Hillman and Davies 1990). However, the identification of blades with sickle sheen primarily as cereal harvesting tools has been questioned by other researchers, who have found that similar types of polish can be produced from the processing of materials such as reeds, stone, clay, and leather (cf. Anderson 1994; Quintero, Wilke, and Waines1997).

The question of the intensity of use of sickles as cereal harvesting tools has direct implications for reconstructing Early PPN plant management practices and the rate of biological domestication. Harvesting mature wild-type cereals with sickles is considered inefficient, because it leads to the free detachment of the spikelets from the ears and thus to seed loss. This is why many researchers have hypothesized that beating and collection in baskets might have been a more efficient method for harvesting grain from the wild (e.g., Hill-

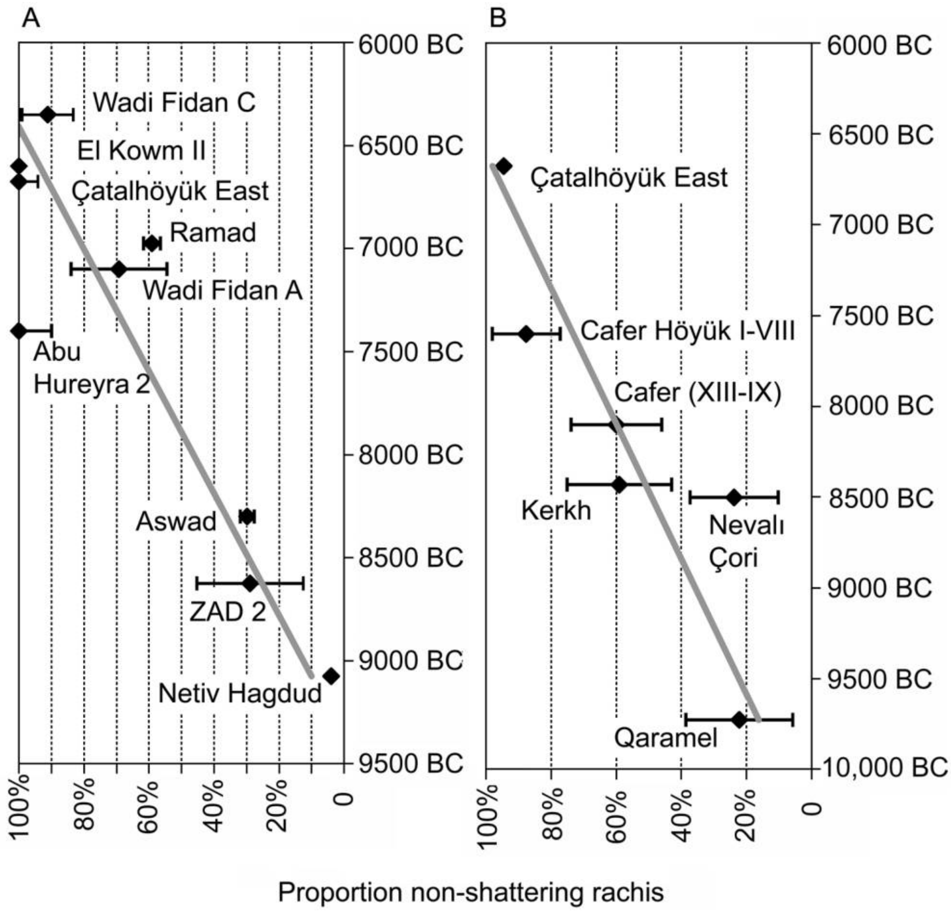

Figure 4. Graphs showing the gradual evolution of the nonshattering ear trait for (*a*) barley and (*b*) einkorn wheat. Based on botanical assemblages from each site, mean and standard deviation estimates of the percentage count values of nonshattering rachises are plotted against a time axis, in which a modal or median age estimate has been defined for each site. The mean value represents the proportion of nonshattering (domesticated) types, calculated only for the sums of items that were positively identified as shattering and nonshattering types. The error bars indicate the estimated standard deviation: maximum and minimum estimates of domesticated types were calculated by including indeterminate rachis remains as either domesticated or wild type (not shown). Standard deviations have been calculated on the basis of this estimated range, plus sample size, on the assumption of a normal distribution. Modified after Fuller, Asouti, and Purugganan 2012: fig. 2; for primary sources of archaeobotanical data sets and radiocarbon dates, see CA+ supplement A (parts 1 and 2).

man and Davies 1990; cf. Willcox 2008). In turn, similar harvesting methods have been proposed as one of the likely causes for the delayed appearance of the nonshattering ear trait (e.g., Fuller 2007; Fuller, Allaby, and Stevens 2010). However, these arguments are contradicted by increasingly accumulating archaeological evidence for the use of sickles in Early PPN contexts coupled with more refined phytolith analyses and in use-wear and experimental studies (e.g., Anderson 2000; Goodale et al. 2010; Ibáñez, González Urquijo, and Rodríguez 2007, 2008; Quintero, Wilke, and Waines 1997). These studies have demonstrated that certain practices of plant procurement, such as the harvesting of cereals in the dough stage (i.e., green), may result in higher incidence of sheen gloss compared with the harvesting of mature plants with dry stalks that may generate flatter and duller surfaces (for examples of the latter, see Goodale et al. 2010). One explanation proposed for the low frequency of chipped stone sickle elements in south Levantine Early PPN sites has to do with the habitual use of technically elaborate, multipurpose, composite tools characterized by long use-lives that extended over multiple seasons (Goodale et al. 2010), continuing traditions of manufacture and use that extend as far back as the Natufian (cf. Stordeur 1999*a*). In the north, in sites such as Mureybet, glossed sickle blades appear to be more ubiquitous (Ibáñez, González Urquijo, and Rodríguez 2008). It is debatable whether the proportionally higher archaeological visibility of sickles in the later phases of the PPN (cf. Ibáñez, González Urquijo, and Rodríguez 2007, 2008) was the result of changes in the technology of their manufacture, with the substitution of straight shafts with curved ones and the more

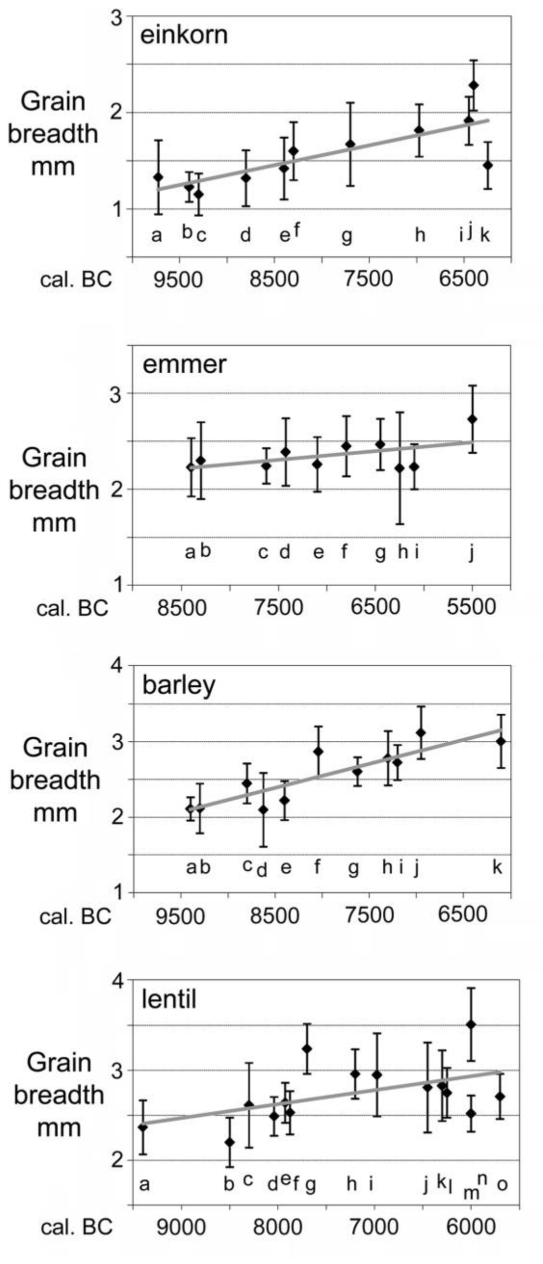

Figure 5. Graphs showing the gradual evolution of the large grain size trait for major Southwest Asian founder crops. Based on measured populations from each site, mean and standard deviation estimates are plotted against a time axis, in which a modal or median age estimate has been defined for each site. Sites are indicated by lowercase letters across the base of each chart. Einkorn wheat (likely including some rye grains): *a.* Tell Qaramel, *b.* Mureybet I-III, *c.* Jerf el Ahmar (early), *d.* Jerf el Ahmar (late), *e.* Dja'de, *f.* Çayönü, *g.* Wadi Jilat 7, *h.* Tell Ramad, *i.* Höyücek, *j.* Erbaba, i. C. Andreas-Kastros. Emmer wheat: *a.* Dja'de, *b.* Çayönü, *c.* Tell Aswad West, *d.* Ghoraife, *e.* Tell Ramad I, *f.* Tell Ramad II, *g.* Erbaba, *h.* Höyücek, *i.* Yarim Tepe, *j.* Kosak Shamali. Barley: *a.* Mureybet, *b.* Jerf el Ahmar (early), *c.* Jerf el Ahmar (late), *d.* ZAD 2, *e.* Dja'de, *f.* Ganj Dareh, *g.* Tell Aswad West, *h.* Tell Ramad 1, *i.* Ras Shamra, *j.* Tell Bouqras, *k.* Yarim Tepe. Lentil: *a.* Mureybet I-III, *b.* Nevalı Çori, *c.* Tell Aswad, *d.* Ganj Dareh, *e.* Beidha, *f.* Yiftahel, *g.* Jericho (PPNB), *h.* Ras Shamra (PPNB), *i.* Tell Ramad 2, *j.* Erbaba, *k.* Ras Shamra (Pottery Neolithic), *l.* Höyücek, *m.* Jericho (PN), *n.* Tepe Sabz, *o.* Çayönü (PN). Modified after Fuller, Asouti, and Purugganan 2012: fig. 2; for primary sources of archaeobotanical data sets and radiocarbon dates, see CA+ supplement A (parts 1 and 2).

secure hafting of sickle segments in them (cf. Ibáñez, González Urquijo, and Rodríguez 2008:401), thus reducing the likelihood of accidental loss of sickle segments during use. Goodale et al. (2010) have remarked that the frequency of occurrence of sickles is, overall, low in M-LPPN contexts as well. Generally, relative frequencies are more likely to relate to the range of activities for which such tools were used, their contexts of manufacture, use, and discard (near or further away from habitation sites), and how intensively they were curated. With regard to cultivation technologies, there is no evidence for tillage tools made from nonperishable materials in Southwest Asia prior to the MPPNB. Currently available data suggest that intensive hand tillage was likely coeval with the initial management of domesticated crops, as indicated by finds of cattle bone hoes at Beidha and Basta (Stordeur 1999*a*) and ground stone hoes at Tell Halula (Ibáñez, González Urquijo, and Rodríguez 2007: fig. 4), Çayönü (Davis 1982) and sites in the Zagros (Hole, Flannery, and Neely 1969:189–192).

Predomestication Cultivation and the Gathering of Wild Plant Foods

Analyses of "weed" floras (assumed to be undesirable species) have suggested that predomestication cultivation can be inferred from Early PPN archaeobotanical assemblages (Colledge 1998, 2001). Weeds might have derived from the same steppe habitats as wild cereals, or they might have invaded field plots from disturbed habitats in their vicinity. Their identification began with the investigation of changes in assemblage composition at Abu Hureyra (Hillman 2000; Hillman et al. 2001; but see Colledge and Conolly 2010) and the comparative multivariate analysis of weed seed assemblages from several sites, which also permitted distinguishing cultivation practices predating crop domestication (Colledge 2001; Willcox 1999; Willcox, Fornite, and Herveux 2008). Regional variation in the composition of weed floras also became apparent: differences were observed between southern and northern Levantine sites with fewer and, in many cases, different weed taxa retrieved from the southern sites, while Anatolian sites also appear to diverge (Colledge, Conolly, and Shennan 2004). These patterns suggest that early arable weed floras developed independently, in a manner analogous to the development of early cultivars, possibly reflecting differences in regional habitats and microecologies.

There is also growing recognition that a large number of seed plants found in Early PPN sites are likely to represent gathered foodstuffs (table 4). Hillman (2000) has provided an extensive consideration of the potential food uses of the >150 noncereal species identified at Abu Hureyra, as has Kislev (1997) for PPNA Netiv Hagdud. The realization that PPNA-contemporary sites in northern Mesopotamia, such as Hallan Çemi, Qermez Dere, M'lefaat and Demirköy, preserved in large quantities noncereal taxa, contrasting with limited representation of cereal finds, also brought to the fore the possibility of their management as mainstay subsistence resources (Savard, Nesbitt, and Jones 2006). In addition, one of the long-term trends characterizing sites in the upper Euphrates basin is the gradual decline in the proportions of noncereal taxa coevally with the increase in the proportion of predomesticated cultivated cereal grain, in a pattern likely representing a slow evolving shift in subsistence choices from noncereal to cereal plants, from the mid-tenth millennium onward (Willcox, Buxo, and Herveux 2009; Willcox, Fornite, and Herveux 2008). Overall, limited as it is, the available archaeobotanical evidence suggests that the management of gathered noncereal plants varied widely between different sites and regions across Southwest Asia.

Contextualizing Early PPN Plant-Based Subsistence

Synthetic accounts of Early Neolithic settlement in Southwest Asia have emphasized the "village," consisting of several coresident households, as the main social unit characterizing fully sedentary food-producing communities of this period (e.g., Byrd 1994, 2000; Kuijt 2000). Buildings found in association with variable densities of features (hearths, storage facilities, burials), tools (querns, mortars, other ground stone implements, chipped stone, etc.), refuse deposits, and bioarchaeological evidence of multiple occupation seasons are viewed by a majority of scholars as indicators of sedentary coresident groups (e.g., Bar-Yosef and Meadow 1995; Belfer-Cohen and Bar-Yosef 2000; Henry 1989; Lieberman 1993; Tchernov 1991; Wright 1994; for contrasting arguments in the Natufian context see Boyd 2006; Edwards 1989). The assumption of permanent, year-round, sedentary habitation is often perceived to be strengthened by the presence of evidence for food storage, and the processing and consumption of cultivars that are considered to reflect full-time preoccupation with agricultural tasks. The higher archaeological visibility of built environments compared with short-lived open-air sites and rock shelters that may preserve little or no evidence of architecture and are seldom intensively investigated, tends to accentuate the conceptual gap between villages, which are perceived as representative of social life and cultural practices, and the "landscape," which is viewed mainly as a source of raw materials and subsistence. Concomitantly, the landscape figures very little in debates about the structuring of PPN social spaces that remain focused on the analysis of the built environment (e.g., Banning and Byrd 1987; Byrd 1994, 2000; Byrd and Banning 1988; Flannery 1972; Steadman 2004).

A starting point for achieving a more balanced understanding of Early PPN political economies beyond conjectural distinctions drawn between habitation sites (= society) and the landscape (= environment) is through a consideration of the regional settlement patterns. There are relatively few Early PPN excavated habitation sites across Southwest Asia (fig. 1), even if this picture is undoubtedly influenced by excavation and reporting biases, plus the uneven coverage of the region

Table 4. Summary of selected gathered plant taxa in Southwest Asia

Location	BC cal.	Other Viciae	Small legumes	*Avena* (oat)	*Hordeum murinum/ marinum* (wall/sea barley)	*Stipa* (feather grass)	Small-seeded grasses	*Scirpus* (sea club-rush)	Other sedges	Polygo-naceae (knot weeds)	*Pistacia* species	*Amygdalus* (almond)	*Quercus* (acorn)	*Ficus* (fig)
Southern Levant:														
Ohalo II	~21000		X	X	XX		XXX		X		X	X	XXX	X
Wadi Hammeh 27	12200–11,600	X					XXX				X			
Wadi Faynan 16	10,600–8200		XXX			X	XX				XX			
Iraq ed-Dubb	9660–8800		XX				XXX				XXX	XX		XXX
Gilgal I	9550–9100	XX											X	XX
Netiv Hagdud	9310–8850	XX	XXX	XX	X	X	XX			X	XX	X	X	XXX
ZAD 2	9160–8830		X			X	XX		X		XXX			XX
el-Hemmeh	9150–8660	XX	XX				XXX				XX	X		XX
Jericho I (PPNA)	9150–8350										XX	XX		
Tell Aswad I	8700–8300	X	XX	X	X?		X	XXX		XX	XXX	X		XX
Beidha	8300–7550	X	X				XX				XXX		X	XX
Jericho II (PPNB)	?8200–7500										XX	XX		
Wadi Jilat 7	8200–7350	XX	XXX	X	X?	X	XXX		X		XX			XX
Nahal Hemar	8000–7050	X	X				XX				X	X	X	
‘Ain Ghazal	8300–6600										X			
Ghoraife	7800–7050		XX	X				XX	X		X		X	X
Basta	7550–7050		X								XX	X	X	X
Azraq 31	7490–7180	X	X				X	XXX			X			
Wadi Fidan	7300–6750		X	X			X							
Tell Ramad	7300–6650		XX	X	X	X	XX	X	X	X	XX	X		
Wadi Jilat 13	7030–6600	X	XXX	X	XX	X	XXX		X		XX			X
Northern Syria and Middle Euphrates:														
Abu Hureyra 1	11,150–10,450	X	XXX	X	XX	XXX	XXX	XXX		XXX	XX			
Tell Qaramel	10,300–8850	XX	XX			XX	X		XX	X	XXX	XXX		X
Mureybet I-III	9700–8500		X				X	XX		XXX	X			X
Tell ‘Abr 3	9500–9200	X									X			
Jerf el Ahmar	9450–8700		XX		XX	X	X	X		X	X	XX		X

Dja'de	8700–8270		XX			XX			X	X	XXX	X		X
Tell Halula	7820–7320	X		X		X	XX			X	X	X		X
Abu Hureyra 2A-C	7800–7000		XXX		XX	X	XX	XX	X	XX	X			
Tell Bouqras	7500–6300	X	XX			X	XX	XXX	X	XX	X			
El Kowm II	7100–6400	X	XX			X	XX		X					
Southeast and Central Anatolia (Turkey):														
Göbekli Tepe	9200–8600		X				X				XXX	XXX		
Çayönü (RP, GP, Ch.H)*	8600–8200	X	X			X	X	XXX		X	XXX	XX	X	X
Nevalı Çori	8600–7950					X	X	X	X	X	XXX	X		
Cafer Höyük XIII–VIII	8300–7450	X					XX			X	XX			
Hacılar	8200–7550	X	X				XX	XXX		X	X	X	X	
Aşıklı Höyük*	>7820–7520					X	X	X	X	XX	XX	X		
Çatalhöyük East*	>7100–6400	X				X	XX	XXX	X	XX	XX	XX	XX	X
Eastern Fertile Crescent (eastern Turkey, Iran, Iraq):														
Qermez Dere	10,100–8800	XXX	XX		X		XXX							
Körtik Tepe	9700–9300	XX	XX				XX	XX		XX				
Hallan Çemi	>9670–9300	XX	X				XX	XXX		XXX	X	XX		
Demirköy	9440–9280	XXX	XX		XX		X	XXX		X	X	X		
M'lefaat	9500–8800		XX				XX							
Chogha Golan	8700–7700		X				X							
Chia Sabz	8400–7700	XX	XXX				XX							
Ganj Dareh	8240–7840	X	X			XX		XX			XXX	XX		
Ali Kosh (B M ph.)	7650–6800	X		X			XX	X			X			
Tell Maghzaliyeh	7050–6250		XXX				XX		X	X	X			

Sources. Primary data sources for the botanical assemblages derived from these sites are listed in CA+ supplement A.

Note. Semiquantitative ranking for wild species: XXX = very frequent/dominant, including occurrences with ubiquity (% of samples in which taxon is present) or frequency (percentage counts of identified items) similar to, or greater than, those of cereals; XX = frequent but less common within the site compared with the very frequent species; X = present, low frequency.

* For commentary on the radiocarbon date ranges listed for these sites, see note of table 3.

by field surveys. Furthermore, there are several sites reported in the literature as transient hunting-foraging camps and activity areas, although their relationship to the more extensively researched and published residential sites remains to be established (cf. Abbès 2008; Akkermans 2004; Bar-Yosef 1991; Kuijt 1994; Kuijt and Goring-Morris 2002; Peasnall 2000; Wright 2005). A degree of residential cum logistical mobility is also implied by evidence for intrasite discontinuities, even at sites with long stratigraphic and radiocarbon records (see figs. 6–8), which suggests episodes of site abandonment and reoccupation, and by settlement size estimates (0.5–1 hectares on average, often less than that) (cf. Akkermans 2004; Akkermans and Schwartz 2003:49–50, Coqueugniot 1998; Kuijt 2008; Molist and Stordeur 1999; Peasnall 2000; Stordeur 1998). Together these observations suggest that Early PPN sites might be more realistically viewed as temporally variable nodes of habitation and coresidence rather than as permanent, year-round, sedentary villages with fixed agricultural and foraging territories.

This tentative picture of the nature of Early PPN habitations, viewed alongside the evidence for the slow rate of plant domestication, brings to the fore the question of the intensity and form of Early PPN plant-food production. At the very least it suggests that in order to achieve a more balanced understanding of its sociocultural environment, one must entertain the possibility that it could have entailed more complex forms of sedentism compared with the somewhat inflexible notion of peasant-like village communities. The assumption of a directional evolutionary continuum from mobility to sedentism overlooks more versatile dwelling practices that could have involved diverse and interchanging degrees of residential and logistical mobility (cf. Eder 1984; see also Flannery 1972; Graham 1994). Similarly, the assumption of clear-cut boundaries between residential and logistical mobility can be problematic, as it inevitably ignores manifestations of mobility occurring at different scales (e.g., of solitary individuals, task groups, single households, groups of households, or entire local groups; Eder 1984:846). Instead of positing polarized distinctions between mutually exclusive notions of mobility and sedentism, a more productive perspective would be to view "sedentariness . . . as a threshold property of social groups, while mobility is best seen as a continuous variable and a variable of individuals . . . in their social organizational context" (Eder 1984:838). The question thus becomes not whether mobility witnessed an overall decline with the onset of cultivation and the increasing permanence and archaeological visibility of built environments but rather how and why mobility strategies changed through time and what the impact of these changes on subsistence economies and associated landscape practices was.

Due to preservation and sampling limitations, archaeological investigations seldom produce the fine-grained data sets that would be required for emulating the detail generated by anthropological research on the diversity and dynamics of cultivator-forager mobility. At the site level, both bioarchaeological indicators of multiseasonal habitation and the occurrence of more permanent structures can be problematic for inferring year-round, sedentary habitation. Sites could have been permanent, in that they witnessed long-term occupation on different seasons of the annual cycle, but this does not necessarily imply that the communities that inhabited them were sedentary (cf. Edwards 1989; Milner 2005). Contextual analyses may provide one way to build alternative models of Early PPN landscape practices in their site- and area-specific contexts, especially for older excavations that cannot benefit from more recent advances in techniques such as stable isotope research (cf. Bentley 2006). In the following sections we provide such a contextual model of Early PPN plant-food production, drawing on the comparative analysis of settlement and subsistence archaeology data sets from select sites and areas (see also summary in table 5). Our aim is not to substitute current interpretations as proposed by the excavators of each site with our own. For many of the sites discussed here, analysis of field results is still in progress and interpretations may thus change with forthcoming publications. The purpose of reviewing these data sets is to explore any latent potential that may exist for expanding current interpretations through the contextual analysis of archaeobotanical data that are often "black-boxed" in ethnographically derived categories of hunter-gatherer, forager, and agricultural economies. In the north, we have concentrated on the thoroughly documented botanical assemblages of Jerf el Ahmar and proceed to discuss them by comparison to relevant data sets available from other sites in Syria (Mureybet, Dja'de, Tell 'Abr 3, Tell Qaramel), the eastern Fertile Crescent (Hallan Çemi, Qermez Dere, M'lefaat, Zawi Chemi Shanidar, Iranian sites), and southeast Anatolia (Çayönü, Nevalı Çori, Göbekli Tepe). In the south, due to the overall low contextual resolution of the published botanical data sets and the variation observed in the size, type, and structure of the excavated sites, we have opted for a comparative analysis of relevant data sets from the better documented south Levantine sites of Jericho, Netiv Hagdud, Gilgal I, 'Iraq-ed-Dubb, Dhra', ZAD 2, and WF16. Detailed information on the botanical data sets of these and other sites for which it has not been possible to link the botanical results to relevant contextual information are provided in CA+ online supplement A.

The Syrian Euphrates Basin

Jerf el Ahmar contains one of the best known PPNA sequences in the northern Levant, documented by its excavator Danielle Stordeur in a series of papers detailing its stratigraphy, architecture, settlement structure, material culture, symbolic imagery, and ritual practices by comparison to other sites (Stordeur 1998, 1999*b*, 2000*b*, 2000*c*, 2003, 2004; Stordeur and Abbès 2002; Stordeur and Willcox 2009; Stordeur et al. 2001). Another advantage offered by Jerf el Ahmar as regards contextual analysis is the meticulous recording of horizontally exposed settlement plans that has been complemented by

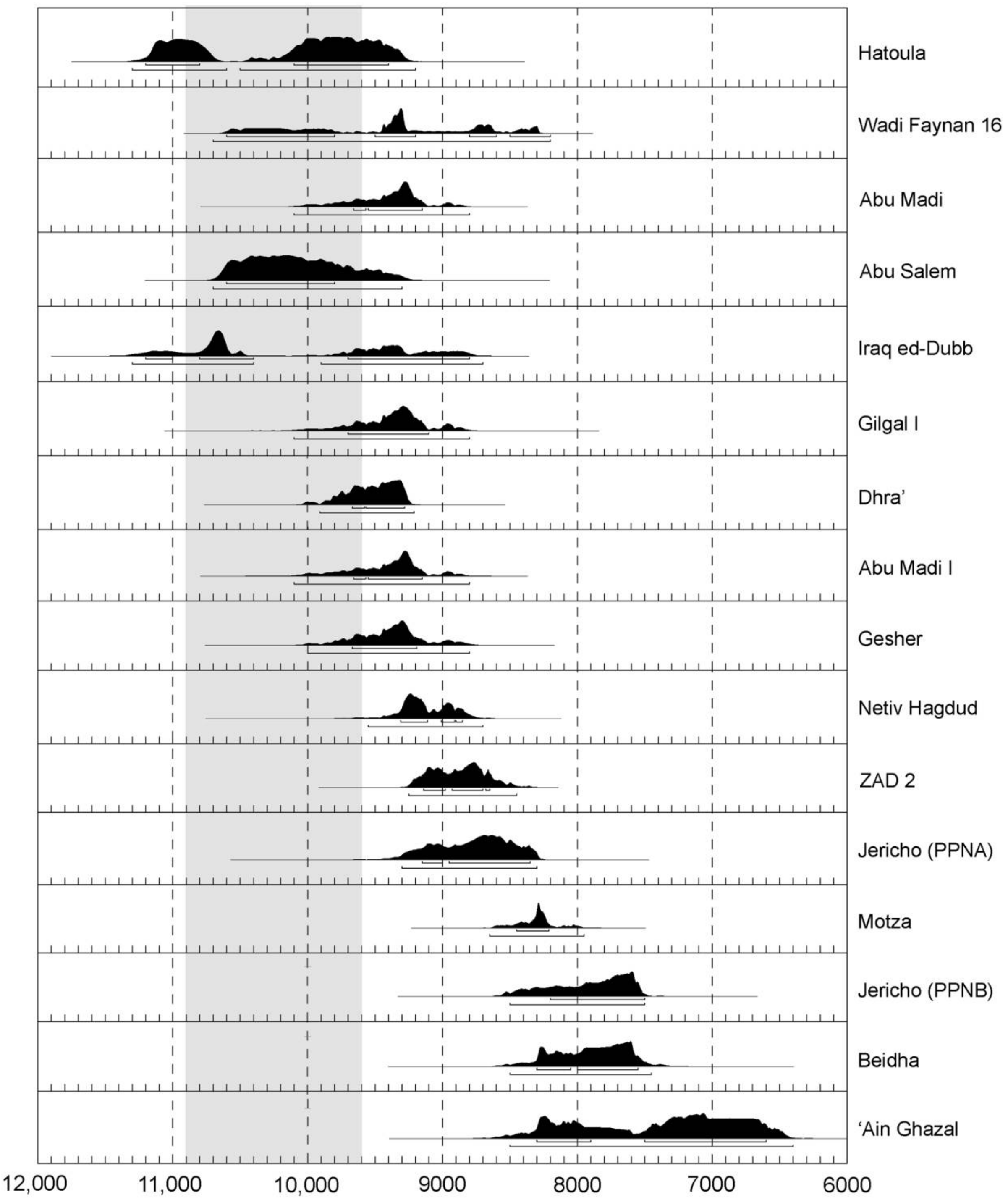

Figure 6. Comparison of calibrated age estimates (cal BC) for select PPN sites in the Southern Levant. Shaded area denotes the timing of the Younger Dryas. Calibrations were performed with OxCal 3.10 (Bronk Ramsey 2005) using the most recently revised IntCal09 calibration curve (Reimer et al. 2009). For lists of raw dates, and individual site plots, see CA+ supplement A (parts 2 and 3).

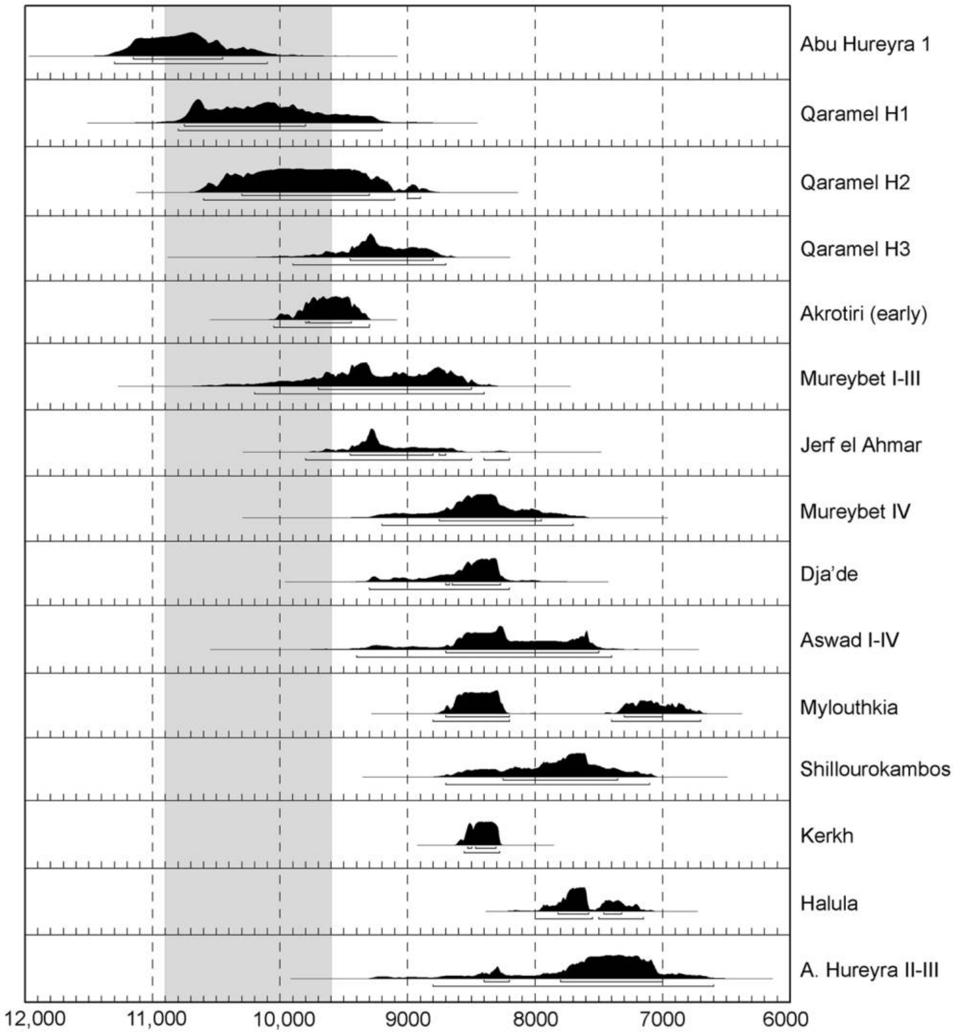

Figure 7. Comparison of calibrated age estimates (cal BC) for select PPN sites in Syria and Cyprus. Shaded area denotes the timing of the Younger Dryas. Calibrations were performed with OxCal 3.10 (Bronk Ramsey 2005) using the most recently updated IntCal09 calibration curve (Reimer et al. 2009). For lists of raw dates and individual site plots, see CA+ supplement A (parts 2 and 3).

extensive botanical sampling of buildings and other features. This sampling strategy together with the systematic recovery of plant remains by flotation have provided a degree of spatial resolution for archaeobotanical remains that remains largely unmatched by other published archaeobotanical assemblages of this period in Southwest Asia.

Jerf el Ahmar is a small (<1 ha) site located on the east bank of the Euphrates, at the foothills of Jebel esh Sheikh Anan, ~60 km south of the Turkish-Syrian border. The site was excavated between 1995 and 1999 prior to its submersion by the rising levels of the Tichrine dam lake. It consists of two colluvial hills (East–West) separated by a wadi channel, which held the architectural remains of successive PPNA habitations. Occupation levels on both hills are regularly interrupted by sterile layers of limestone colluvium, which often give the impression of deliberately burying their entire habitation surfaces (Stordeur 1998:98–99). The eastern hill, including ten occupation levels, was the earlier of the two, while habitation on the western hill containing five levels began at a later time, roughly coeval with the latest habitation phases of the eastern hill (Stordeur and Abbès 2002). Together these observations indicate the possibility of noncontinuous occupation of Jerf el Ahmar by its inhabitants.

Another characteristic of the site, which is shared by other sites of this period, is the distribution of hearths that are reported to be found almost exclusively in open areas. Fire pits were also found in open areas, often in association with dense concentrations of animal bone, and have been interpreted as meat roasting facilities (Molist 2008). Evidence of storage inside buildings has also remained elusive. An exception has been proposed for the early public buildings at Jerf el Ahmar (EA7, EA30, the latter built in the place of an earlier

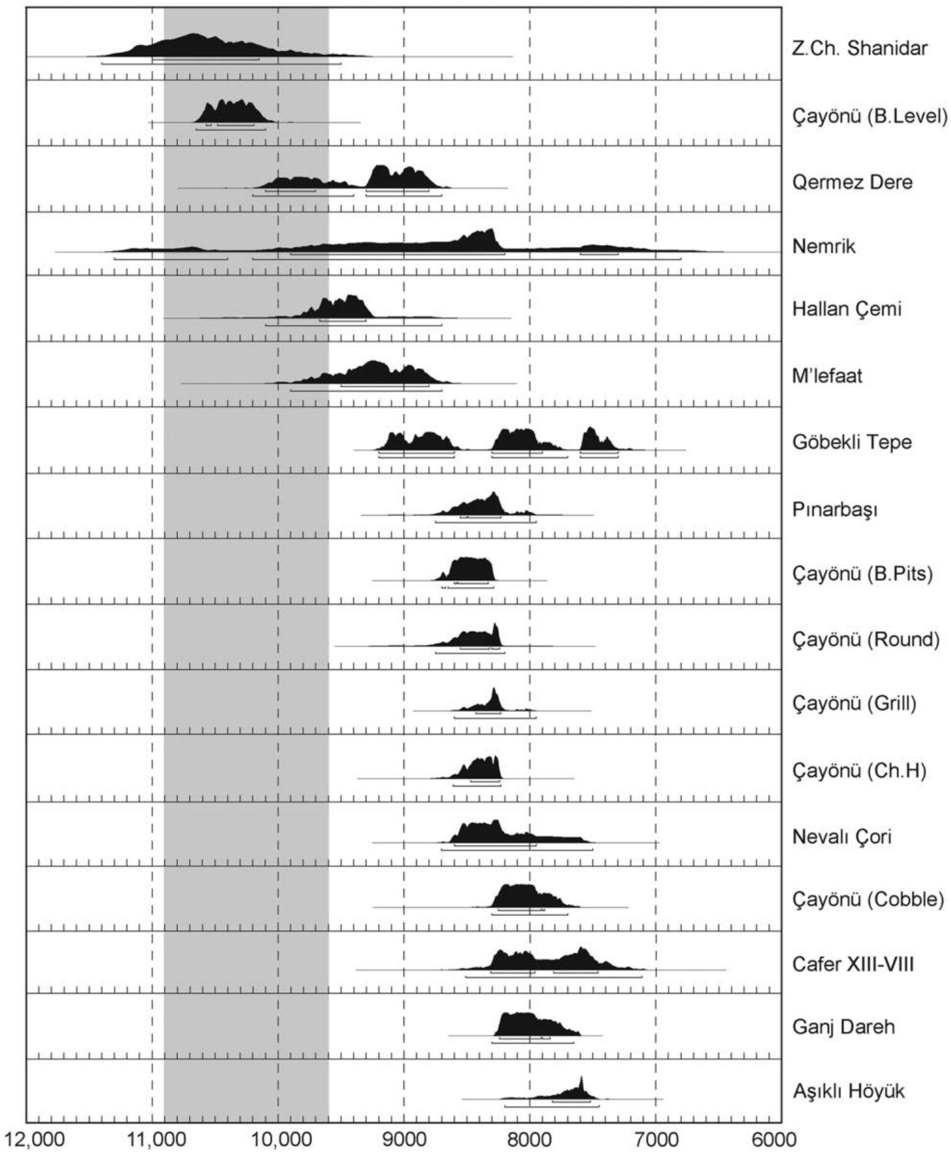

Figure 8. Comparison of calibrated age estimates (cal BC) for select PPN sites in Iran, Iraq, and Turkey. Shaded area denotes the timing of the Younger Dryas. Calibrations were performed with OxCal 3.10 (Bronk Ramsey 2005) using the most recently updated IntCal09 calibration curve (Reimer et al. 2009). For lists of raw dates and individual site calibration plots, see CA+ supplement A (parts 2 and 3).

structure with similar characteristics; for detailed descriptions see Stordeur and Ibáñez 2008; Stordeur et al. 2001) and Mureybet (Buildings 54, 42, 47: Stordeur and Ibáñez 2008; see also fig. 9). The best-known examples from Jerf el Ahmar comprise large curvilinear structures that were sunk deeply into the ground up to a depth of ~2 m. Their shafts had stone built retaining walls that rose by ~50–60 cm above ground level with wooden posts embedded into them. They had flat earthen roofs supported by centrally placed vertical wooden posts and were probably entered from an opening through the roof. The interiors were furnished with benches and cellular compartments subdivided by partition walls backing against the retaining walls, which were arranged around a central empty area. Walls, floors, benches, and cells were mud-plastered. Public buildings were deliberately destroyed by fire at the end of their use life and appear to have been buried afterward in a prescribed manner. At Jerf el Ahmar, the end of the use life of EA30 was marked by a dramatic event: the death of a young woman whose skeleton, lacking its skull and the first four cervical vertebrae, was found on the floor lying on its back, covered by burned roof debris. The excavator has proposed a quick succession of events

Table 5. Generalized model of the potential mobility patterns proposed for Early PPN cultivator-forager communities

Early PPN cultivator-forager mobility spectrum		
Entire group	Household(s) groups	Individuals and groups of individuals
Settlement relocation (residential)	Seasonal/annual moves between (dispersed) cultivated fields and parent settlement (logistical and residential)	Variable duration (few days to several months) moves of individuals, task groups, and kin/age set/gender groups in relation to hunting/foraging trips, participation in exchange/kinship/mating networks, ceremonial rites and other social obligations (logistical and residential)

whereby death was followed immediately afterward by the conflagration of the building and the collapse of the roof over the body that bore upon its excavation the apparent signs of rigor mortis (Stordeur et al. 2001). Following the burial of EA30, a shallow pit was dug near it, marked on the surface by a pile of four stones, which contained a cache of chipped stone (Astruc et al. 2003). It consisted of four opposed platform cores alongside a selection of blades and flakes produced from high-quality flint. Their technological characteristics, quality of production and choice of raw material signify "special" items with few known parallels from elsewhere on the site (Astruc et al. 2003).

The nature of the activities undertaken inside these early, subterranean public buildings is debated in the literature as few in situ materials have been found in them. The presence of cellular compartments has been considered as indicative of grain storage, although this interpretation has been questioned (e.g., Bogaard et al. 2009:650). The cells of the best preserved example at Jerf el Ahmar (EA30, Level II/West; fig. 9) were found for the most part empty. Only cells 2, 3, and 7 had some materials left in situ including aurochsen bones, flint, ground stone, obsidian, and a small quern with ochre in it; the remaining cells preserved only a few barley grains (Stordeur and Willcox 2009; Willcox and Stordeur 2012). Cells 4 and 6 were accessible by steps from the central area, while cell 5 (completely enclosed by two retaining walls that supported the roof) had its front blocked by a thin screen wall, which preserved a very small rectangular porthole located at ~20 cm above ground. The design of cell 5 suggests its possible function as a silo, likely refilled from the rooftop (Stordeur and Willcox 2009). Bone remains of domestic mice and gerbils and mouse droppings were recovered in high concentrations from EA30, thus indicating that rodents were living in it; their presence lends additional support to the suggestion that grain storage was one of the functions of EA30 (Stordeur and Willcox 2009; Willcox and Stordeur 2012).

As Stordeur and Willcox (2009) point out, there is no evidence for the existence of storage facilities in any other structures except public buildings. In fact, the earliest occurrence of public structures at both Mureybet and Jerf el Ahmar links well with the archaeobotanical record, indicating the routine gathering of cereal grain and, from the second half of the tenth millennium, the presence of cultivated (predomesticated) crops (Willcox 2008). More tangible evidence linking grain storage to public buildings has derived from an earlier round structure at Jerf el Ahmar, EA47 (Level III/East). EA47 had also been deliberately burned at the end of its use life alongside the rest of the structures associated with Level III (Stordeur 1999*b*). It contained a clean store of carbonized rye/einkorn seeds (undifferentiated on the basis of grain morphology alone) in association with three aurochsen skulls and a bucranium that originally hung from its walls and the rooftop, some dried clay beads, a hearth surrounded by small pounders, and a basalt axe with a polished cutting edge; it is likely that cereal grain had been stored in a container made of perishable materials (Stordeur 2000*c*; Stordeur and Willcox 2009; Willcox and Stordeur 2012). At the later site of Tell ʿAbr 3, broadly contemporaneous with the west hill habitation of Jerf el Ahmar, public building M1 (again burned and buried at the end of its use life) also contained a clean store of rye/einkorn found in association with a podium-like structure, in which were deposited numerous aurochsen bones and bucrania encased in clay and framed by alignments of pebbles; other contextual attributes included a large circular hearth, five large limestone basins, and two basalt querns, while several animal bone elements comprising gazelle horn cores, bucrania, and scapulae had been incorporated into its walls (Stordeur and Willcox 2009; Yartah 2005). Together these finds suggest that grain storage was practiced and, moreover, that it was integrated to the ritual practices associated with the Early PPN public buildings in the Syrian Euphrates basin. It is possible that in the earliest public structures of Jerf el Ahmar such as EA47 smaller volumes of cleaned cereal grain might have been deposited as part of ritual activities, perhaps dedicated to harvest or planting rituals, in a pattern that may be encountered at other sites as well, such as Tell ʿAbr. By contrast, later and much larger multifunction buildings such as EA30 might have housed communal grain stores nested within spaces associated with a broader range of nondomestic activities. Overall, despite the absence of plants from Early PPN symbolic imagery, the figurative element of which appears to focus exclusively on wild animals, birds, humans, and animalized humans (Stordeur 2003), the contextual attributes of the Syrian Early PPN public buildings suggest that grain stores were deliberately associated with contexts and practices that can be plausibly categorized as nondomestic. The term "nondomestic" is used here in a descriptive manner, to denote practices that are attested in communal contexts according to the interpretations suggested by the excavators of the sites discussed in this paper.

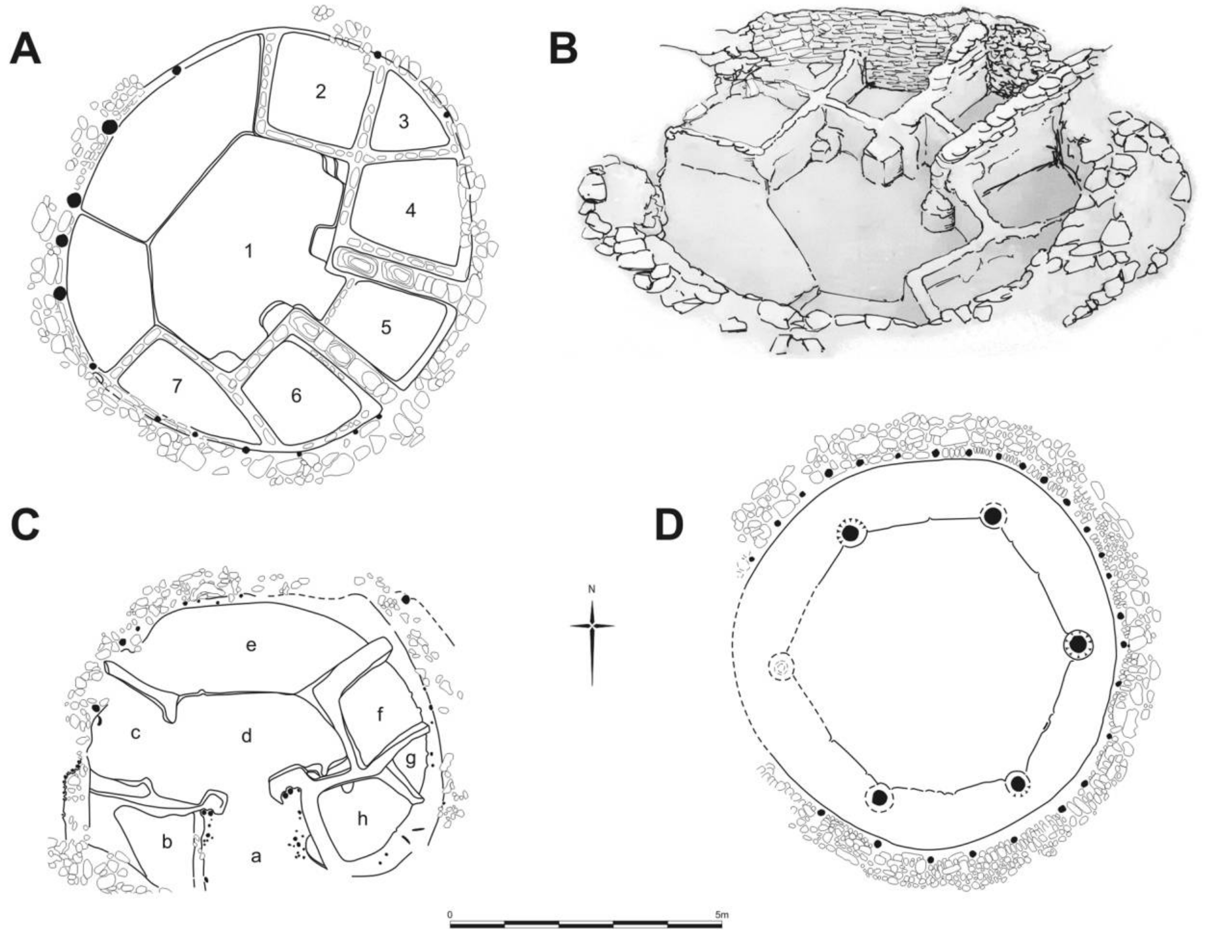

Figure 9. *A*, plan of public building EA30 at Jerf el Ahmar; *B*, 3D representation of EA30; *C*, plan of Building 47 at Mureybet; *D*, plan of EA53 at Jerf el Ahmar. From Stordeur et al. 2001. All plans were redrawn, and the 3D representation of EA30 was produced from a photograph of EA30 with the kind permission of Danielle Stordeur.

Storage apart, establishing the nature and temporality of predomesticated crop production and consumption is somewhat more difficult. The Jerf el Ahmar botanical evidence suggests that rye/einkorn and barley are never found in mixtures, thus indicating that these crops were the products of separate harvests occurring at different localities in the landscape (Stordeur and Willcox 2009). Impressions of crop-processing by-products have been found in abundance in building materials: barley, einkorn, and rye chaff as temper in pisé and straw in burned roof fragments (Stordeur and Willcox 2009; Willcox and Fornite 1999). There seems to be clear patterning in the presence of different types of crop-processing residues: straw is very rarely encountered in pisé that contained almost exclusively chaff (glumes, spikelet bases, awns, lemmas) and grain, without admixtures of wild/weed species, while the presence of whole grains also suggests that winnowing was not particularly effective (Willcox and Fornite 1999). Two observations arise from this evidence: (*a*) primary threshing, to the extent that it was practiced in the absence of nonshattering ears, might have occurred off-site, as straw was possibly procured and stored separately from other residues to be used in a circumscribed building activity (roof construction); (*b*) grain was stored hulled, with fairly limited weed seed admixtures. The latter were also absent from pisé inclusions, thus indicating that winnowing and fine sieving were carried out at a large scale (i.e., collectively) to clean the crop prior to dehusking that generated the chaff used in construction. The abundant finds of crushed cereal grains and fragmented spikelet bases in pisé suggest that dehusking was done locally, either at a large scale or with chaff being stored. Thus it seems likely that earlier and later steps of the crop-processing cycle were separated in time and space, with some taking place off-site or away from the buildings, while crop-processing by-products were used at different times, for mutually exclusive purposes. These observations and the apparent occurrence of clean crop stores in public structures suggest that crop processing was not embedded in routines of practice characteristic of an agricultural "village" community engaging

Figure 10. Plan showing the location of rectangular, internally subdivided, multiroom buildings with food processing installations in relation to public buildings in the published settlement plans from Jerf el Ahmar. *A* and (1), Level I/East, Building EA23; *B* and (2), Level II/West, Building EA; (3), Building EA54, Level I/West (no settlement plan is available for this level). Plans were redrawn from Stordeur and Abbès 2002 and Stordeur and Willcox 2009, with the kind permission of Danielle Stordeur.

in small-scale, household-based arable production. Instead, crop production appears to have been the object of large-scale, communal labor invested in crop processing. Still, these observations cannot preclude the possibility that, irrespective of how crops and processing by-products arrived at the site (e.g., through their importation from dispersed task sites or via exchange) final preparation (dehusking) and consumption were indeed household-centered activities. In order to elucidate this point, it is necessary to address evidence for food preparation and consumption. Were these activities taking place solely or predominantly in domestic, household-centered contexts?

It has been already mentioned that, in common with other sites of this period, no indoor fire installations have been found at Jerf el Ahmar, except for the hearth in public structure EA47. Hearths have also been reported from Mureybet, alongside food preparation equipment (querns/mortars) in public buildings 42 and 47 (the latter including eight figurines; Stordeur and Ibáñez 2008). At Jerf el Ahmar, all evidence of food preparation and processing other than cooking has derived from rectangular or quasi-rectangular structures situated near public buildings (see fig. 10; for detailed descriptions of the processing installations and associated botanical finds, see Stordeur and Willcox 2009; Willcox 2002; Willcox and Stordeur 2012 on which the summary given below is based). EA23 (Level I/East) was the largest of a group of 11 buildings arranged over three terraces, located near public building EA7. Its largest room contained three querns and several pestles, aligned against the partition wall. EA10 (Level II/West) was one of the structures that surrounded in an arc-like pattern public building EA30, being the closest to it. EA10 was laid out in a plan nearly identical to that of EA23, consisting of two rooms and a courtyard, and had been destroyed by fire. Processing facilities were concentrated in its eastern room and were organized in three clearly differentiated task areas that were associated with different crop species. The grinding area contained three in situ querns, plus one upturned quern that might have been used as a seat, one stone vessel and two large, round, and extremely polished grinding slabs that might have been used as work surfaces. Botanical remains included fragments of rye/einkorn grains and wild mustard seed cakes. The second task area comprised a shallow depression containing the remains of burned lentils and fragments of seed cakes mixed with ashes. It is possible that the depression was used as a cooling area for cooked seed cakes, as it bore no traces of in situ burning. The third task area had three stone basins with fragments of dehusked barley seeds but no evidence for in situ grain storage. EA54 (Level I/West) was a four-room structure. Although its spatial association with a public structure remains uncertain, its location near the poorly preserved EA100 (Level I/West) might imply the existence of an earlier public structure in this area. In one of its rooms were found three permanent stone-built bases, aligned on an east-west axis. Two of them supported huge querns. The adjoining room contained an assemblage of pounders and limestone hafts, which probably formed parts of cutting tools, while a cache of six sickle blades was also found in an open, stepped niche inside a wall (Astruc et al. 2003). Finally, a sizable quern was found near the external wall of EA48, a two-room, oval-shaped building from Level III/East, surrounded by scattered remains of barley, lentils, and rye. Perhaps significantly, this is also the earliest level in which a public structure (EA47) has been found.

The above description of the contextual attributes of food processing facilities and associated botanical remains reveals a strong functional relationship between food processing activities and multiroom, internally divided buildings. The latter also appear to have been spatially associated with the public structures. Stordeur's interpretation of settlement organization at Jerf el Ahmar has classified as "domestic" all excavated structures with the exception of the public ones. Furthermore, the transition from curvilinear to rectangular domestic architecture has been viewed as one of the hallmarks of the PPNB culture in its homeland in northern Syria at sites such as Mureybet, Jerf el Ahmar (Cauvin 2000; Stordeur and Abbès 2002; Stordeur and Ibáñez 2008), and Tell Qaramel (Mazurowski et al. 2009). However, Stordeur has noted the persistent variability in architectural forms found in the later levels of the site with round, oval, rectangular, and intermediary forms co-occurring in the same phases and has already proposed that it may reflect differences in building functions (Stordeur 1998, 2000*a*). Stordeur and Abbès (2002) have also observed that the appearance of public buildings appears to be stratigraphically coeval with the onset of the construction of internally divided structures, which culminated with the building of true rectangular architecture in the PPNA/EPPNB transition. In our opinion, these observations cast doubt on the identification of internally divided buildings with continuously occupied, domestic residential structures. Furthermore, the impression rendered from the published architectural sequence (see figs. 10, 11) is that architectural diversity is patterned: large, internally divided rectilinear structures are always found in spatial association with public buildings, whereas smaller, round structures that might have been used primarily as residences are usually found further away from them.

In light of all the evidence discussed so far, it is possible to propose a set of sequentially structured routines of practice linking the use of space to food production and consumption: grain storage took place in public buildings where grain stores were incorporated into a rich nest of symbolic, ritual, and perhaps even magical associations. Food processing, adhering to prescribed routines and culinary choices (grinding, preparation of oily seed cakes), occurred in dedicated spaces within multiroom structures that were situated in direct proximity to public buildings. Finally, meat cooking was conducted in fire pits that were located in open communal areas. Together food storage, processing (grinding and roasting), and consumption emerge as highly structured practices, possibly associated with communal events that took place in spatially and socially prescribed contexts. Occasions for such communal events might have been a new harvest, ancestral commemorations, or other ritual performances of varying frequency. The diversity observed in architectural forms may reflect, just as proposed by the excavator, different building functions, including residences for suprahousehold groups (e.g., lineages, age sets, segments) and spaces dedicated to ritual performances (e.g., initiation rites) and associated food preparation routines. Consequently, a contextually enriched interpretation of settlement structure at Jerf el Ahmar would seem to be that it does not represent a "village community" of permanently settled, coresident cultivator-foragers. Instead, it might be better perceived as a place where larger social groups, including households residing at the site, congregated periodically and engaged in communal food consumption events.

The architectural sequence of Jerf el Ahmar provides further useful insights into the changing nature of Early PPN plant food production and consumption through time. An important discontinuity in the layout and function of public buildings occurred in the course of the later phases of the site, dating to the PPNA/EPPNB transition (Stordeur and Abbès 2002; Yartah 2004, 2005). Public buildings EA53 (Level I/East) and EA100 (Level I/West) were still subterranean but

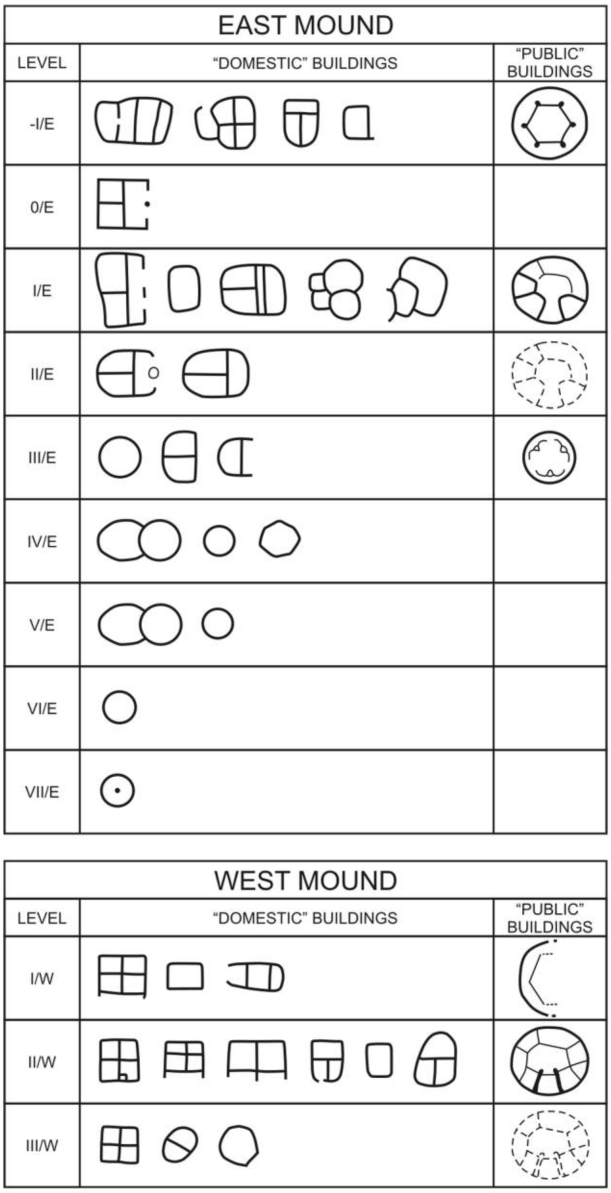

Figure 11. Association of domestic architecture types and public buildings following the excavated stratigraphy of the East and West Mounds at Jerf el Ahmar. Redrawn from Stordeur and Abbès 2002, with the kind permission of Danielle Stordeur.

were no longer subdivided into cellular compartments. Instead they acquired a monumental character, with continuous plastered and painted benches fronted by large, cut, and polished limestone slabs, facing an open hexagonal central space; they also contained elaborately carved, symbolically charged internal fixtures (see fig. 9; Stordeur 2000*b*: figs. 7–9; Stordeur et al. 2001). The mud plaster coating of the retaining wall of EA53 had embedded in it tool blanks and retouched blades (sickles and arrow points); each blank had been inserted into the plaster with its flat surface against the wall, hence indicating its deliberate placement rather than chance inclusion as clay contaminants (Astruc et al. 2003). After the closure of EA53, a cache of 15 standardized sickle blades was deposited in a pit sunk in an open area among a group of rectangular buildings (Astruc et al. 2003). Standardized blades were characteristic of the PPNA/EPPNB transition and were generally rare on the site, being predominantly used for the production of sickles (Stordeur and Abbès 2002). These observations together with the occurrence of tool blanks in caches, suggest the heightened symbolic value of harvesting implements in this transitional period (Stordeur and Abbès 2002). Although the practice of grain storage in public buildings appears to have been discontinued at Jerf el Ahmar toward the end of the PPNA, at the same time the relationship of public structures to food preparation and consumption activities appears to have become more formalized through their continuing spatial association with internally divided, rectangular buildings, and the embodiment of symbolically valued harvesting tools within the structural adobe of the public buildings, thereafter reconfigured and reinvented as monumental, sacred spaces.

During the EPPNB it is possible to observe the continuing transformations of the social spaces that structured community interactions in the upper Euphrates basin, in which predomesticated cultivars appear to have played a prominent role. At Dja'de (Coqueugniot 1998, 1999, 2000) a site with evidence for the predomestication cultivation of einkorn, barley, emmer, and possibly rye, residential structures comprised very small rectilinear buildings without internal partitions. By contrast, open spaces contained evidence for the presence of temporary structures. Their association with communal food preparation and consumption activities is indicated by the finds of postholes, screen walls, and fire pits that might have been used as cooking installations (Coqueugniot 1998, 1999, 2000). A permanent installation consisting of a series of low walls arrayed in grill-plan (Coqueugniot 2000: photos 1–3) could have been used for the drying, storage, or public display of foodstuffs destined for communal consumption. Furthermore, mortuary practices also suggest that communal gatherings were increasingly focused on ancestor commemoration, aimed at enhancing individual and group identities through mortuary rituals. At Mureybet and Jerf el Ahmar, human remains deliberately interred in public buildings were few and apart, consisting mainly of crania placed in them as foundation deposits (Stordeur et al. 2001). By contrast, at Dja'de are found different types of public structures that seem to have functioned as communal burial monuments: the "House of the Dead" was a two-room, rectilinear building that contained several burials of children and young adults, including primary and secondary inhumations, alongside collections of long bones and skulls arrayed in various combinations (Coqueugniot 1998, 2000). The presence of secondary burials suggests that the site might have functioned, inter alia, as a central place for nonresident groups or individuals for the purpose of conducting funerary ceremonies accompanied by communal food consumption events. Thus at Dja'de too, although contextual information, including botanical remains, is awaiting full publication, it is possible to argue for the communal nature of plant food production and consumption activities, possibly involving both resident and nonresident groups at different levels (i.e., individual, household, and suprahousehold).

Eastern Fertile Crescent

Communal food consumption appears to have underwritten Early PPN community interactions in the eastern Fertile Crescent. The Iraqi upland site of Zawi Chemi Shanidar (Solecki 1981) has provided evidence of lightly built round structures associated with external burned areas, fire-cracked stones, burned bones, charcoal lenses, and open-air hearths; some of the bone deposits contained concentrations of wild goat bone and skulls alongside raptor wing bones, which suggest ritualized practices linked to communal food consumption. The earliest levels of the site contained large shallow pits with dark fills that were rich in animal bone. Preliminary investigations at the Iranian sites of Sheikh-e Abad and Jani have indicated that their basal levels consist of deposits of fire-cracked stones and ash lenses rich in plant remains (Matthews et al. 2010). Such finds suggest that these sites might have been periodically frequented by groups in occasions marked by communal food consumption events before and plausibly after the establishment of more fixed habitations at the same localities. The Iraqi site of Qermez Dere also appears to have been sparsely occupied: in total the remains of seven curvilinear structures have been revealed in a sequence that covers the entire tenth-to-ninth-millennia timespan (Watkins 1990; Watkins et al. 1991, 1995). Buildings were associated with an open, clay-paved, central area that contained stone circles, querns, mortars, pestles, and other ground stone implements. Watkins (2004) has interpreted these buildings as permanently occupied domestic residences. All seven structures were subterranean, preserved no traces of ground-level entrances, and appear to have been deliberately destroyed and buried at the end of their use life. Three oval-shaped, superimposed buildings found in the later levels of the site were also furnished with centrally placed plastered clay pillars, upright stone slabs, and hearths; the latest structure in the sequence had six crania of adults and children that had been deposited within its fill upon its destruction and burial (Watkins 1990). However, it is uncertain whether these built structures were permanently occupied. Alternatively, they might have been erected and maintained during intermittent visitations at the site, or they might have functioned as residential bases for larger groups, with periods of coresidence marked by communal food preparation and consumption events. Archaeobotanical research has shown that plant management at Qermez Dere as well as M'lefaat was focused on pulses and small-seeded grasses gathered from the wild (Savard, Nesbitt, and Jones 2006).

At Hallan Çemi in eastern Anatolia (Rosenberg 1994, 1999; Rosenberg and Redding 2000; Rosenberg et al. 1998), three different building phases have been identified consisting of C-shaped structures, plastered low circular platforms, open hearths, postholes, and the remains of wattle and daub, arrayed around a large central depression. The latter contained fire-cracked stones, dark lenses rich in plant remains, dense concentrations of animal bone, including still-articulated skeletal portions of carcasses, and three wild sheep skulls in a linear arrangement, which have been interpreted as evidence of feasting activities (Hayden 1995; Rosenberg 1999: figs. 1–16). Archaeobotanical remains included mainly nuts, sea club-rush, dock/knotweed, mullein, large-seeded legumes, and wild lettuce, with low representation of grasses, all gathered from the wild (Savard, Nesbitt, and Jones 2006). Small-scale nut storage and consumption have been proposed, based on the finds of concentrations of almonds (Rosenberg et al. 1995). Stone bowls and notched batons, believed to represent tallies, and the presence of two semisubterranean public structures that contained long-distance imports (obsidian, copper ore) have been considered as indicators of civic leadership and even social stratification (Redding 2005). These finds, alongside the presence of organic indicators of multiseasonal habitation, have led to the interpretation of Hallan Çemi as a sedentary village community (Rosenberg and Davis 1992; Redding 2005). Furthermore, it has also been proposed that available food resources were intensively used for sponsoring competitive feasting events manipulated by civic leaders (Hayden 1995).

Alternative interpretations of this evidence are possible. Organic indicators of multiseasonal habitation derived from external refuse deposits contain the accumulated debris of activities performed in the course of centuries of site use. It is therefore possible that they represent the conflated signals of temporally distinct episodes of site habitation. Furthermore, animal bone analyses have indicated that hunting activities and prey choice were sustainable in the long term, as there is no evidence for resource stress caused by the overexploitation of high-ranked game species (Starkovich and Stiner 2009). This might suggest that the site was not occupied year-round over prolonged periods of time. In addition, claims for early pig management at Hallan Çemi (Redding 2005) have been questioned (Peters, von den Driesch, and Helmer 2005). The massive deposits of bones recovered from Hallan Çemi might have accumulated in the aftermath of group hunts aimed to provide meat for communal food consumption events. Large-scale plant processing is also suggested by the abundance of mortars, pestles, querns, and mullers (Peasnall 2000). Ornately carved stone bowls could have been deployed in such communal events, while notched batons might have been used to affirm food contributions by different participants/groups. Similarly, the deposition of exotic goods inside public structures might signify gift exchange embedded in cycles of food preparation and consumption, as a means for establishing and reaffirming social ties between local and regional groups. Altogether the Hallan Çemi record permits hypothesizing that subsistence production was focused on provisioning for communal food consumption events that took place at the site, in the context of local and regional community interactions. Although the excavators have proposed that the site record is best interpreted as a reflection of social differentiation among complex sedentary hunter-gatherers, mediated through competitive feasting, alternative readings of the same evidence are possible. It should also be noted that there is no evidence of primary burials at the site, which may be another indication for the absence, or the limited presence, of a permanently settled, coresident group.

Southeast Anatolia

At the multiperiod site of Çayönü (Özdoğan 1995, 1999; Özdoğan and Özdoğan 1989; the following description is based on information provided in these publications), the earliest known PPN phases are represented by the Round Plan phase and the Basal Pits, Grill Plan, and Channeled House subphases (cf. Özdoğan 1999: figs. 6–21), together spanning the late tenth and most of the ninth millennia. The Round Plan phase comprises at least eight curvilinear structures with wattle and daub or reed superstructures and floors sunk into the ground, arrayed around a central circular area containing ground stone implements, fire pits lined with heat cracked stones, and dense concentrations of animal bone. Subfloor burials and inhumations in open spaces are common during this phase. With the beginning of the Grill Plan subphase there appear elongated grill-plan structures, reminiscent of the grill-plan structure of Dja'de. Early grill-plan structures were oval-shaped, stone-built platforms with floors made from brushwood and mud plaster and did not preserve any evidence of a superstructure. It is thus possible that they were not roofed but were used instead as work areas or for the drying and processing of foodstuffs. These structures did not contain burials. Isolated primary and secondary burials were placed in the burned fills of the older Round Plan phase structures. During the closing centuries of the ninth millennium there are indications for increasing investment in built environments. Grill-plan structures were built with wattle-and-daub walls supported by posts set around the perimeter of their platforms and were furnished with plastered floors. Burials were subfloor, placed in the spaces between the grill walls. Upon their closure, buildings were buried with pebble layers. In the transition to the Channeled House subphase, there appear for the first time buildings with platforms that were totally sealed by flat capstones. Public structures like the Flagstone and the Skull buildings were located in a spacious open area that contained 46 fire pits and might have been used for communal cooking and food consumption events. During the early phase of the Skull Building primary and secondary burials were placed in two shallow pits inside it, one of which also contained aurochsen skulls and horns. Isolated skulls and jaw fragments were frequently attested in courtyards and work areas associated with the Channeled House subphase.

At broadly contemporary Nevalı Çori, orthogonal, multi-room longhouses had subfloor burials placed inside their channeled, stone-built platforms and were associated with open spaces containing fire pits and hearths that were likely used for communal cooking (Hauptmann 1999). At the edge of the main settlement area there had been erected a nearly square, semisubterranean public structure with a stone-built retaining wall, onto which backed a continuous bench capped with stone slabs, and a terrazzo floor covering its central area. It was dismantled and buried before a second building with similar characteristics was constructed in its place. Both structures were embellished with vertical T-shaped monolithic pillars embedded in their benches, while a pair of opposed vertical T-shaped pillars stood at their center (Hauptmann 1999: figs. 7–9). Their association with practices potentially involving shamanic performances and ancestral commemoration rituals is suggested by the representations of animal, human and hybrid beings in freestanding sculptures retrieved from their infill (Hauptmann 1999: figs. 10–17) and by the anthropomorphic rendering of the T-shaped pillars with pairs of arms and hands in bas relief on their vertical sides (Hauptmann 1999; Peters and Schmidt 2004).

For the better part of the Early PPN phases at Çayönü and Nevalı Çori, plant food management was focused on wild-type pulses, especially lentils, which were likely cultivated (table 3; fig. 5; cf. Asouti and Fairbairn 2002; Pasternak 1998). The important contribution of pulses to the diet of the Nevalı Çori inhabitants has also been indicated by paleodietary stable isotope analysis (Lösch, Grupe, and Peters 2006). The settlement record indicates that the temporality and forms of habitation at Çayönü were far more complex than the predictions allowed by dichotomous models of mobile versus sedentary habitation. In the earliest Round Plan phase, dwellings with subfloor burials were perceptibly more fixed compared with the later early Grill Plan subphase, the unroofed structures of which would seem to indicate seasonally patterned mobility practices. Unfortunately, the published archaeobotanical materials lack the spatial and contextual resolution required to evaluate more precisely the relationship of these settlement patterns to plant-related subsistence activities. Significant minorities of domesticated-type cereal chaff appear for the first time during the E/MPPNB at both Nevalı Çori (einkorn: Pasternak 1998) and Çayönü (einkorn and emmer: van Zeist and de Roller 1991/2; table 3; fig. 4). These finds, denoting the start of the shift toward morphological domestication in the late ninth millennium, correlate well with the evidence for fixed, elaborately built dwellings at both sites and the formalization of mortuary practices and associated public structures/open spaces linked to communal food consumption. They are also broadly contemporaneous with zooarchaeological indicators for the onset of animal domestication in southeast Anatolia during the ninth millennium (Peters, von den Driesch, and Helmer 2005). They thus demonstrate the contemporaneity of indicators of fixed dwellings, incipient crop domestication—implying greater commitment to farming—

and the formalization of ritual practices that appear to have been associated with communal food consumption.

The site that, to date, has provided some of the most spectacular evidence for Early PPN public structures in southeast Anatolia is Göbekli Tepe (Hauptmann 1999; Schmidt 2000, 2003, 2006, 2008, 2010; Peters and Schmidt 2004). Located atop a limestone hill, Göbekli Tepe is subdivided in three levels. Level III is the earliest known, assigned by the excavator to the Late PPNA/EPPNB. In it, a series of megalithic curvilinear structures (A–D) have been uncovered (fig. 12) consisting of symmetrically placed, upright T-shaped monoliths that were embedded in perimetric stone-built walls and benches. Monoliths were often decorated with sculpted representations of various wild animals, birds, serpents, scorpions, as well as abstract motifs (for a comprehensive list, see Peters and Schmidt 2004). Freestanding, three-dimensional sculptures depicting wild animals have also been found. At the center of each enclosure stood an opposed pair of T-shaped monoliths, which were always decorated, whereas their entrances were marked by U-shaped stone pillars. During the closing centuries of the ninth millennium these structures were deliberately buried with infill deposits containing abundant flint tools, knapping waste, bone, and carbonized plant remains.

Preliminary analyses of the archaeobotanical remains retrieved from the Early PPN levels of Göbekli (Neef 2003) revealed the presence in low densities of wild-type einkorn, barley, lentil, and possibly rye alongside unidentified cereal grains, steppe grasses, almonds, plum fruit stones, and charcoals of *Pistacia*, almond, willow/poplar, Maloideae (including hawthorn and wild pear), and oak. Based on this limited study it has been suggested that charred plant remains are very rare at Göbekli (Peters and Schmidt 2004). However, given the limited sampling coverage and the low volume of soil floated by comparison to the estimated size of the infill (cf. Neef 2003:14, Schmidt 2003:7), it seems unlikely that the currently available botanical data sets are representative of the preservation status, much less the taxonomic diversity of the botanical remains. Therefore, a reliable evaluation of the status of cereals and pulses as gathered foods or predomesticated crops is not feasible at present. An evaluation of the subsistence practices associated with the megalithic structures is, however, possible through the animal bone retrieved from their infill. The results of this analysis, together with the technological characteristics of the flint implements, suggest that the infill originated from PPNA hunting and in situ flintknapping activities; the comparison of the species composition of animal bone to the corpus of animal representations has also indicated that prey choice and hunting activities were not linked to the themes represented in the decoration of the megaliths (Peters and Schmidt 2004). Furthermore, the presence of cup holes sunk in the bedrock on the western plateau, found in association with a round structure with polished floor, a pair of centrally placed pillar bases, and two oval-shaped cisterns to the north of it (Hauptmann 1999:79 and fig. 32) is a tentative indication of links between food processing (grinding) activities and the public structures.

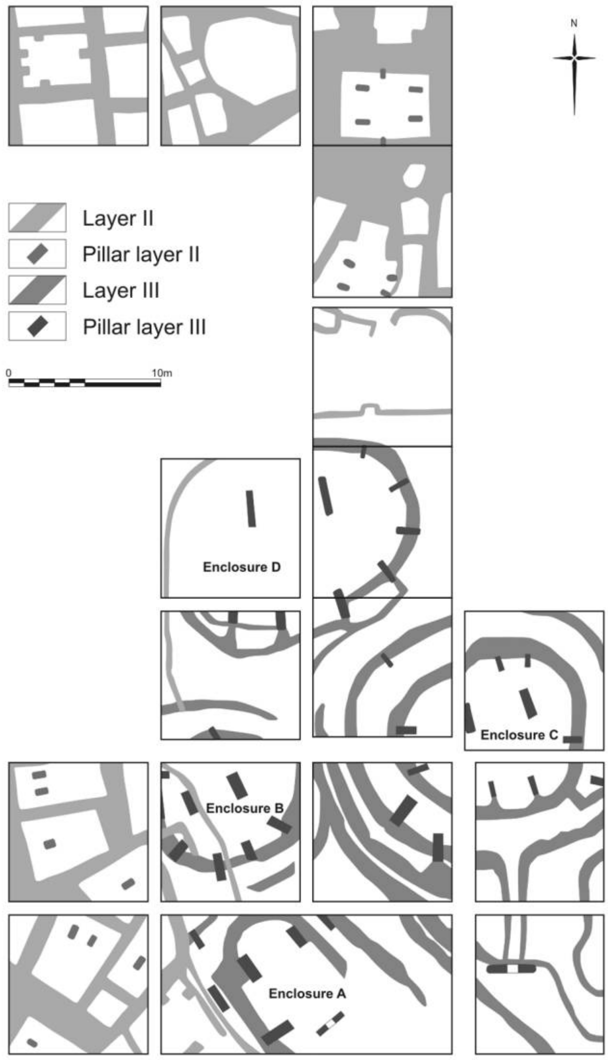

Figure 12. Plan of the main excavated area at Göbekli Tepe. Redrawn from Peters and Schmidt 2004, with the kind permission of Klaus Schmidt.

One possible interpretation of these patterns is that Göbekli represents a "ritual center," a place where regional communities congregated on a regular basis for cultic and social purposes, bringing to the site foodstuffs and other materials from elsewhere, as proposed by the excavator of the site (Schmidt 2005, 2010; cf. Banning 2011). Peters and Schmidt (2004:215) have suggested that the workforce and technical know-how required for the construction of the megalithic structures necessitated hierarchically controlled division of labor by sedentary communities willing to invest on this project over extended periods of time, possibly spanning several generations. This interpretation rests on the assumption that the construction of these structures represented a preplanned "project," coordinated by a single or at most a few decision-making centers. In reality, however, we know very little about the sequence, rate, and duration of the building of each structure, or their duration of use. They could have been used sequentially or simultaneously, and each alternative is directly relevant to modeling habitual practices at Göbekli and their sociocultural environments. On the other hand, the recent discovery of an assemblage of much smaller, round buildings (not shown on the plan of fig. 12; cf. Schmidt 2010) just to the northeast of the excavated area may indicate that the megalithic buildings were associated with habitation structures. It is possible therefore that the Göbekli public buildings formed the focus for activities involving larger social groups, including resident and nonresident participants, that were marked by communal food consumption events. Their infill might also represent accumulated food debris that was generated by communal food preparation and consumption and was either formed in situ or was redeployed from nearby dumping areas in order to mark the end of the use life of each structure. In a recently published article, Dietrich et al. (2012) have proposed, based on circumstantial evidence, the brewing of alcoholic beverages at Göbekli Tepe during its PPNA and PPNB phases, while they have also raised the possibility that such activities were taking place at Jerf el Ahmar and Tell 'Abr 3 as well. Further research will shed more light on Early PPN practices at Göbekli, especially the association of its megalithic structures with communal food and drink preparation and consumption events.

Southern Levant

South Levantine Early PPN habitation and settlement patterns are more difficult to disentangle by comparison to the north. Some authors have noted the apparent restriction of sites to the better-watered Mediterranean woodland zone and the Jordan valley, coevally with their absence from the Eastern Desert that had witnessed widespread Epipaleolithic occupation (cf. Bar-Yosef 1991; Bar-Yosef and Belfer-Cohen 1989*a*; Byrd 1994; Garrard et al. 1994; Kuijt 1994). This pattern has been interpreted as indicating the growing importance of plant cultivation in relation to the establishment of sedentary villages (Bar-Yosef and Belfer-Cohen 1989*a*, 1991; Byrd 2005; Kuijt and Goring Morris 2002). Sites with deep stratigraphies and public architecture such as Jericho have been considered as indicative of emergent settlement hierarchies consisting of sedentary large villages (e.g., Jericho, Netiv Hagdud, Gilgal I, ZAD 2, Dhra') and hamlets or logistical localities (e.g., Hatoula, Nahal Oren, 'Iraq ed-Dubb, 'Ain Darat; Kuijt 1994; Kuijt and Goring Morris 2002). In this context it has been proposed that communities of cultivators-hunters-gatherers residing at particular sites for a substantial part of the annual cycle coexisted in the landscape with more mobile hunter-forager groups (Edwards and Higham 2001; for a critique of similar arguments regarding the construction of Levantine Natufian site hierarchies see Olszwewski 1991).

There is a considerable body of literature regarding the development of sedentism in the southern Levant during the PPN (cf. Bar-Yosef and Belfer-Cohen 1989*a*, 1989*b*, 1991, 1992; Belfer-Cohen and Bar-Yosef 2000). What is, however, absent from it is a data-informed evaluation of the role that predomestication cultivation played in this process (Asouti and Fuller 2012). To date, Early PPN sites with relatively well-preserved and published archaeobotanical assemblages are few in the southern Levant (for a review of the preceding Natufian evidence, see Asouti and Fuller 2012). These include Netiv Hagdud (Kislev 1997), Gilgal I (Weiss, Kislev, and Hartmann 2006), ZAD 2 (Edwards et al. 2004), and 'Iraq ed-Dubb (Colledge 2001). Other sites have furnished very little archaeobotanical evidence. Jericho (Hopf 1983) is the most glaring example in which quantitative and contextual analysis is impossible, due to its excavation in the 1950s when flotation sampling for the systematic retrieval of carbonized plant remains was not practiced. The archaeobotany of Dhra', where large horizontal exposures were systematically sampled in recent years, is pending completion of analysis and publication (Colledge et al. 2008). Previous excavations at WF16 produced very poorly preserved plant remains (Kennedy 2007). However, fieldwork has been recently resumed at WF16 and substantial horizontal exposures of built spaces and external areas were systematically sampled for the retrieval of organic remains (Finlayson et al. 2009). It is hoped that this extensive sampling will address the preservation issues that hampered earlier work. Another issue that has hampered contextual analyses in the southern Levant is that most archaeobotanical studies have focused on determining the domestication status of potential crop species and investigating cultivation practices, with relatively little effort expended on documenting context-related variation in botanical assemblages.

At present, none of these sites has provided incontestable evidence for the cultivation of domesticated-type cereals (Nesbitt 2002). By contrast there is abundant evidence for the cultivation of predomesticated types of barley and, less conclusively, emmer and pulses (table 3; Edwards et al. 2004; Kislev 1997; Weiss, Kislev, and Hartmann 2006). There is also the inference of a few "dead-end" early cultivars such as oats at Gilgal I (Weiss, Kislev, and Hartmann 2006) and rambling vetch at Netiv Hagdud (Melamed, Plitzmann, and Kislev 2008). Several sites such as Netiv Hagdud, Gilgal I, Dhra' and Jericho have provided evidence for the presence of storage facilities (Kuijt and Finlayson 2009). Yet, at the same time, it is not possible to establish a straightforward correlation between the existence of storage facilities, cereal cultivation and sedentism. ZAD 2, with evidence for the cultivation of wild-type barley, represents a relatively short-lived habitation and has provided no evidence for built storage installations (Edwards et al. 2004). 'Iraq ed-Dubb, comprising two curvilinear structures erected inside an upland rock shelter (Kuijt 2002; Kuijt, Mabry, and Palumbo 1991) is another example of a small site with some evidence for cereal cultivation (Colledge 2001). Although an external pit has been interpreted as a possible storage feature, this attribution remains tentative (Kuijt 2002), and the site may just as well have been occupied only intermittently. These sites have also provided evidence for gathering activities, including small-seeded grasses and *Pistacia* nuts (table 4). More substantial sites, such as Dhra', have preserved evidence for carefully built and continuously renovated communal storage installations with suspended floors, probably used as barley grain stores (Kuijt and Finlayson 2009: figs. 4, 5). It remains to be demonstrated whether they were used for the storage of cultivated as opposed to gathered grain. WF16 is another substantial site that has provided architectural as well as biological indications for long-lived occupation (Mithen and Finlayson 2007). To date, it has produced no evidence for cultivation; published botanical analyses have indicated that plant-based subsistence relied on gathered resources, with very limited contributions from cereals (Jenkins and Rosen 2007; Kennedy 2007).

Sites such as Netiv Hagdud have demonstrated that the storage of cultivated barley did occur at sites that were occupied year-round (cf. Bar-Yosef and Gopher 1997; Kislev 1997; Tchernov 1994). However, recent analyses of its architecture have also shown that there is little evidence for the modification of individual structures and building continuity between the different phases of the site (Hemsley 2008:167–168), thus casting doubt as to whether it represents a sedentary settlement that was characterized by long-term, interannual habitation. Gilgal I is another site with compelling evidence for the storage of cultivated barley and oats (Weiss, Kislev, and Hartmann 2006), although it was a short-lived site (Noy 1989). Jericho, on the other hand, has produced definitive evidence for its long-term occupation, with building modifications and the rebuilding of structures across different phases (Kenyon 1981). All the same, the assumption that these buildings were inhabited year-round by permanently settled, coresident households is problematic due to the absence of hearths from the interiors of most of the excavated PPNA buildings. Direct archaeobotanical evidence for plant management activities at Jericho is, as noted already, poor. Cereals were used, as indicated by their charred remains that were hand-picked from the excavated deposits alongside plant impressions (Hopf 1983), although their status as locally cultivated or gathered foodstuffs remains equivocal. Chaff impressions found in mud bricks (Hopf 1983) suggest that crop-processing by-products (dehusking waste) were used onsite, much as in Jerf el Ahmar, generated either by locally grown crops or through the importation of grain from elsewhere.

What this brief overview of the contextual associations of the south Levantine archaeobotanical assemblages demonstrates is that, in most cases, conjectural linkages between plant management strategies, settlement organization, and sedentism (i.e., year-round, permanent habitation) are not warranted by the available evidence. One could argue, with some justification, that this is partly the artifact of insufficient sampling, limited horizontal excavation or, more pertinently perhaps, the different objectives of botanical and archaeological research. However, the evidence does reflect a degree of diversity in plant-based subsistence practices that is unaccounted for by classic resource intensification models envisioning fully sedentary village communities engaged in the cultivation of grain staples. From the subsistence viewpoint, reconstructing regional settlement hierarchies consisting of "large" residential centers, located near arable land, and "small" logistical sites (*sensu* Kuijt 1994) does not seem to be feasible. Instead, the evidence points to a much more fluid and variable distribution of cultivation and gathering activities in the landscape, which do not appear to link in predictable ways to settlement size and structure. This is not surprising, as evidence from lithic analyses has also revealed technological diversity that cannot be considered as the outcome of functional variation in tool kits used by cognate communities inhabiting different site types; instead, diversity appears to reflect locally distinct technological traditions and group identities (Mithen and Finlayson 2007). Furthermore, recent synthetic studies of Early PPN settlement architecture have indicated that, although there is significant inter- and intrasite variability in the organization of built spaces, each site was collectively characterized by standardized community-wide attitudes to the perception and structuring of the built environment (Hemsley 2008). The combined archaeobotanical and settlement records suggest that the temporality of Early PPN plant management strategies and how they related to dwelling practices varied considerably even between neighboring communities. Hence, rather than envisioning a directional, developmental trajectory from mobility to sedentism underwritten by predomestication cultivation, we may be more justified to argue for the existence of idiosyncratic and locally diverse perceptions of, and practical engagements with, all kinds of plant-derived subsistence resources including predomesticated cultivars.

Given the limitations of the published archaeobotanical data sets it is practically impossible to unpack and define more precisely the nature of these relationships, in order to reconstruct from a sound empirical basis the contribution of cultivated and gathered plant foods to the social life of south Levantine Early PPN communities. For example it is possible, empirical demonstration pending, that plant foods harvested from the wild were stored and consumed locally, as it seems to be the case at WF16 and, less conclusively in the absence of a final macrobotanical report, at Dhra'. By contrast, cultivated grain might have been consumed, inter alia, in ritual or ceremonial communal contexts, in a pattern that is at least conceptually analogous to the situation observed in the north. The structural parallels observed between sites such as Jericho and Jerf el Ahmar are difficult to bypass. Both sites, as well as Netiv Hagdud, had communal facilities (fire pits) used for meat cooking (Molist 2008). All three preserved communal structures that were related, albeit in different ways, to grain storage. The association of the Jericho tower with "enclosures" possibly representing silos (Kenyon 1981: Plate 204) is at least suggestive of the potential use of the latter for the storage of cultivated grain destined for communal food consumption. Furthermore, Jericho was delimited from the wider landscape by its monumental wall and ditch (Kenyon 1981), while its tower and at least some of the enclosures contained burials (see also Kuijt and Goring-Morris 2002: fig. 4). At Netiv Hagdud, variation in building size and presumably in function too might also reflect the use of the more sizable oval structures by suprahousehold groups. The finds in Locus 8 of cuphole slabs and abundant pestles, mortars, and bowls, alongside a rectangular feature bearing a cache of three skulls (Bar-Yosef and Belfer-Cohen 1991; Bar-Yosef and Gopher 1997:55–57 and fig. 3.20), suggest the association of plant processing activities with spaces that appear to have fulfilled symbolically charged functions. At Gilgal I, a quasi-rectangular structure (House 11; Noy 1989: fig. 3) preserved evidence for the storage of large quantities of grain/seeds, including barley and oats, alongside the remains of basketry, bone tools, a collection of highly distinctive chipped and polished stone artifacts, and four figurines (Noy 1989; Weiss, Kislev, and Hartmann 2006). It is worth noting here that at these sites and others for which there are no published botanical remains hearths, cuphole slabs, heavy mortars, and (unbroken) pounding and milling tools occur both within and without built spaces, thus suggesting a fluidity of boundaries between built spaces and open areas with regard to food preparation and consumption (cf. Wright 2000:101). In addition, plant food storage appears to have involved clean crop stores (Weiss, Kislev, and Hartmann 2006) free of weed seeds and other crop-processing residues. This indicates a degree of investment in crop-processing usually associated with consumption contexts and large-scale processing prior to storage (Fuller and Stevens 2009). Given the limitations of the available evidence, it would be too simplistic to claim that cultivars held predominantly "ritual" as opposed to "mundane" roles in Early PPN social life. The point is rather to draw attention to the possibility that predomesticated cultivars were used in multiple ways and were involved in complex and locally varied routines of practice, which the archaeobotanical record as it stands at present is ill-equipped to address in a more substantive manner.

Discussion

One issue that emerges prominently from the review of the available evidence on the rate and geographical distribution of plant domestication, and on Early PPN plant management practices, is the disjunction observed between theoretical models positing the intensive management of plant food resources by fully sedentary village communities, which are ubiquitous in the literature, and the (contextualized) data. The unambiguously slow rates of biological domestication cannot be accounted for by technical factors alone—for example, the choice of harvesting technologies: harvesting with sickles was probably practiced for millennia before the initial appearance of higher proportions of nonshattering rachises in botanical assemblages. Its practitioners would have certainly noticed its effect on the selection of nonshattering individuals long before they deliberately selected them for propagation. A more plausible explanation for the delay is that this trait was not actively selected for during the Early PPN, possibly due to the labor traps of increased crop-processing costs. Nonselection might have been achieved by harvesting crops at various stages before full maturation, while straw might have been harvested selectively for specific types of raw materials (e.g., roof bedding) as evidenced at Jerf el Ahmar. Some authors, attempting to reconcile the evidence for the longevity of predomestication cultivation with the prevalent perception of habitation sites as permanently settled, intensively farming villages with fixed territories and access to arable land, have opted for biological imperatives sensu stricto, that is, that seed corn was obtained primarily from stands growing in the wild or, in the case of sites located outside the geographical range of the wild progenitors, through long-distance exchange (cf. Willcox 2005). Neither proposition actually explains why, if cereals were intensively exploited by fully sedentary groups aiming to secure year-round provisions of staple foods with the technologies available to them, the pace of biological domestication was so slow. Biological domestication is to a significant extent a function of the nature and intensity of human interventions with the reproductive cycles of cultivars. Its slow rate during the PPN suggests therefore that human interventions were such that precluded or, at the very least, did not facilitate a faster pace of genetic and related morphological modifications for Early PPN cultivars.

One plausible explanation for slow rate of the development of the domestication syndrome in the PPN of Southwest Asia is that predomestication cultivation was opportunistic, flexible in its practice, and, moreover, spatially dispersed. It probably involved various forms of management, including the harvesting and replanting of cereal stands at sites located within the natural distribution zones of the wild progenitors (e.g., Tell el-Kerkh, Tell Qaramel), and outside these zones the opportunistic sowing of select cereal species at dispersed localities in the landscape (e.g., Mureybet, Jerf el Ahmar, Tell 'Abr 3, Dja'de) both complemented by gathering and hunting. Such a pattern may explain the presence at these sites of distinct weed floras, indicative of disturbed habitats and predomestication cultivation, while also accounting for the slow pace of biological domestication. At other sites (e.g., Çayönü-early phases, Hallan Çemi, Qermez Dere, M'lefaat), gathered and cultivated pulses, plus grasses and wetland plants collected from the wild, dominated plant-derived subsistence. A critical element to this argument is that these diverse strategies are not treated as separate evolutionary stages but rather as different options that were taken up by Early PPN communities depending on local microecologies, group- and area-specific mobility strategies, and cultural traditions and preferences. Ethnographic research (e.g., Tucker 2006) has demonstrated that mobile or semisedentary cultivator-foragers may engage in opportunistic plant cultivation in the form of low-labor, extensive horticulture. Cultivated fields can be established in dispersed locales in the landscape that may be minimally tilled, planted, and then left untended until harvest time. Harvest losses due to predation and crop spoilage are offset by the absence of year-round labor investment in field tending (intensive tillage, weeding, and protection from predators), which permits concentrating instead on the procurement of game and gathered plants. The transition from such routine practices to intensive, year-round cultivation is not determined by fixed parameters such as the availability of crop species or their caloric value. Instead, it results from complex decision making involving projected crop yields (dependent on, inter alia, environmental contingencies and favorable microecologies), decreases in the perceived risks of intensified crop production, the degree to which immediate food needs can be met by storage or exchange (thus freeing labor for delayed-return arable production), and the cultural importance of cultivation and foraging as identity-bound practices. In Southwest Asia, the capacity of cultivation to produce viable surpluses buffering the risks of crop failure was not achieved until the Late PPN with the appearance of large, nucleated communities and the coeval establishment of intensive, fixed-field, mixed-cropping regimes that were fully integrated with caprine herding (Asouti and Fuller 2012; Harris 2002).

With regard to the sociocultural environment of Early PPN plant management practices, our contextual analysis indicates that plant foods held a prominent position in regionally patterned communal food consumption practices. Although the quality of the available evidence is very uneven, the better documented sites such as Jerf el Ahmar have provided strong indications for the association of predomesticated grain production, processing, storage, and consumption with ritually and symbolically charged contexts and for the changing nature of these relationships through time. Contrary to previous interpretations describing cultivars as "mundane" subsistence resources, we have argued that their transformation to crop stores, food, and raw materials was subject to ritualized practices and performances involving suprahousehold entities. Predomestication cultivars probably served as one of the means that such entities and social groups had at their disposal for identifying with, and tying themselves to, particular places and sites, through ritual practices likely involving communal food consumption events. Associated mobility strategies differed substantially from region to region. In the upper Euphrates and, to different degrees, in southeast Anatolia, full-time, year-round coresidence does not appear to have been the sole dwelling pattern, while mobility appears to have been overall more pronounced in the Zagros. In the northern Levant and southeast Anatolia, the multifaceted residential and logistical mobility strategies of the local cultivator-forager communities were probably instrumental in the transmission of architectural traditions, ritual and symbolic behaviors, and related sociocultural practices that were shared, albeit in locally varied forms, within and between these areas. Community interactions involving both resident and nonresident groups appear to have been almost universally underwritten by communal food consumption. Although in this paper we have concentrated on plant-based subsistence, it is pertinent to note here that, at least in the upper Euphrates basin, the PPNA is the period when a shift occurred from broad spectrum hunting toward a focus on larger animals, involving mass kills of entire herds (Gourichon and Helmer 2008). Given the evidence for sparse settlement and the small size of the excavated habitation sites, it seems unlikely that this shift was driven by net demographic growth or sedentary farmers protecting their crops from herbivore predation. Instead, it might reflect the increasing social importance of communal food consumption involving suprahousehold groups, in regional community interactions. Over time, the increasing fixation of particular places with ancestral collective memories, marked by burials deposited in public structures and open spaces dedicated to communal cooking and food consumption, led in some cases (e.g., Çayönü, Nevalı Çori) to the transformation of these sites into sacred places coevally with the formation of more permanent habitations. The evidence available from the southern Levant on the coevolution of mobility/subsistence strategies and community interactions is less yielding. Although, as noted already, sites like Jericho, Netiv Hagdud, and Gilgal I have provided strong indications for the close association of predomesticated crops with communal or symbolically and ritually charged contexts, what the southern Levantine record demonstrates best is the enormously diverse range of its Early PPN built environments, habitation types, and associated landscape practices. Plant resource management does not appear to form an exception to this pattern, thus casting doubt on the customary identification of predomestication cultivation with resource intensification and permanent, year-round habitation.

Evidence for the occurrence of fire pits, processing equipment, and, in many cases, storage facilities in communal areas within habitation sites has been previously interpreted as reflecting the nature of Early PPN households (e.g., cooking or processing facilities shared between nuclear households; cf. Banning 1996; Byrd 2000). To date, little research has focused on the potential role of communal food consumption as a theater for community interactions involving suprahousehold groups. The reasons may be sought in the negative disposition of several prehistorians to arguments suggesting a central role for feasting in domestication and agricultural origins (e.g., Smith 2001*b*; Zeder 2009*b*; Zeder and Smith 2009; see also overview by Twiss 2008). Brian Hayden has been the main proponent of the theory that feasting operated as a vehicle for social competition, involving rare and symbolically important "prestige" foods that were manipulated by aggrandizing individuals and households in alliance-building and risk-buffering strategies (Hayden 1995, 2003, 2009). According to this theory, increasing investment in the production of food surpluses destined for redistribution via feasting led to biological domestication and the eventual transformation of plant and animal domesticates from prestige food items to widely available commodities. However, other scholars (e.g., Kuijt 1996, 2000; Zeder 2009*b*; Zeder and Smith 2009) argue that the regional archaeological record suggests the integrative rather than competitive function of ritual performances, especially mortuary rituals, during the PPN. At the same time, there is no reason to speculate that cereals were rare or especially difficult to procure. They have thus concluded that the archaeological record provides no evidence confirming the prominence of competitive behaviors as suggested Hayden in Early Neolithic social life or that such behaviors were played out through feasting.

Our analysis suggests that a more nuanced approach to the topic of communal food consumption is required. Instead of accepting polarized definitions of predomesticated crops as mundane or prestige items, we view plant foods more broadly as resources embedded in performances associated with communal food consumption. The latter probably formed an essential component of community interactions that mediated the negotiation, production, and reproduction of social identities. This perspective stands in diametric opposition to Hayden's competitive feasting theory as it disassociates communal food consumption from the restrictive and, in Hayden's model, integrally linked notions of resource intensification and social competition. Other sources of ethnographic research (cf. Wiessner 2001) have suggested that in nonsecular, collective contexts (e.g., ancestor commemorations, dedications to the spirit world, initiation rites, and mortuary ceremonies), the provisioning of food destined for group consumption may not entail rare or prestige plant species and is unlikely to be the outcome of intensive production of food resources. This happens because such occasions are not perceived as appropriate vehicles for sociopolitical manipulation by entrepreneurial individuals and groups, at least not in overt and socially sanctioned ways. In addition, they may involve the participation of suprahousehold groups originating from dispersed communities within a particular geographical area, whose members may converge periodically at specific localities. Such places can be delineated in the landscape through constructed boundaries, such as fences or walls, and may include distinct architectural forms and open spaces dedicated to various functions (e.g., the housing of ritual experts, residences for different visiting groups, cultic ceremonies, gendered initiation rites, ancestor skull deposition, and food preparation and consumption). Several Early PPN sites (e.g., Jerf el Ahmar, Göbekli Tepe, Jericho) have provided variable types of evidence for potentially comparable structural characteristics and could thus be approached through perspectives departing from currently established concepts of sedentary farming villages. In addition there is enough evidence, at least from northern Syria, indicating the complex association of the harvesting-processing-storage-consumption activity cycle with symbolically and ritually charged contexts. This is perhaps best exemplified in the public buildings of Jerf el Ahmar and Tell ʿAbr 3, where the ritualization evidenced in the structuring of these practices and their integration to public buildings reveals dimensions of the latter that extend beyond their functionalist interpretation as signifiers of civic leadership exercised by emergent "elites" and "entrepreneurial" households (contra Byrd 2005).

Conclusion

In this paper, we have argued for the utility of a historical-contextual approach to the investigation of early plant-food production. We have suggested that investigating the historical interface of Early PPN sociocultural environments, mobility strategies, and plant-based subsistence activities is necessary in order to achieve a more complete understanding of how the transition from foraging to farming unfolded across different parts of Southwest Asia. Macroevolutionary approaches to the Neolithic transformation posit directional trajectories of resource intensification, agricultural expansion, demographic growth, and increasing social complexity. These must be complemented by contextual-historical approaches. Our own contextual approach to Early PPN plant-food production was based on the comparative analysis of archaeobotanical, settlement pattern, architectural, and material culture data sets. Its aim was to reconstruct specific practices associated with Early PPN plant-food production and consumption and their sociocultural environments at local and subregional scales. In line with more recent approaches to PPN sociocultural phenomena in Southwest Asia (cf. Asouti 2006, 2012; Bolger 2008; Croucher 2006, 2008; Finlayson and Warren 2010), we have proposed that Early PPN plant-based subsistence formed a key component of community interactions concerned with the negotiation and reproduction of social identities, which were mediated through communal food consumption. Recent research (Goring-Morris and Horwitz 2007; Russell and Martin 2005; Twiss 2008) has suggested that feasting played a central role in community interactions during the later phases of the PPN of Southwest Asia. In this context, Bogaard et al. (2009) have proposed that during the Late PPN, meat consumption was a key focus for public events and conspicuous display, while access to cultivated crops and crop stores was restricted to, and controlled by, individual households. We maintain that similar perspectives, centered on the more neutral and archaeologically verified concept of "communal food consumption" are applicable to the Early PPN. The key difference is that during the Early PPN both plants and animals are likely to have played important roles in communal activities and practices that had little, if anything, to do with competitive feasting as envisioned by Brian Hayden.

The establishment during the second half of the ninth millennium of sedentary communities at sites such as Çayönü, Nevalı Çori, and Jericho that probably formed regional nodes of ritual activity (including mortuary rites) likely acted as a catalyst for significant, albeit at present poorly documented, shifts in landscape perceptions and plant management practices. Such changes were manifested, for example, in the appearance of the earliest known indicators of the domestication syndrome in cultivated plants on the Southwest Asian mainland (see review in Asouti and Fuller 2012, which also includes a discussion of the Cypriot evidence for Early PPN domesticated-type cultivars). We have found no convincing evidence indicating that any of these developments could have been the result of resource intensification brought about by environmental stress, or population growth beyond local carrying capacities, or the manipulation of food production by emergent "leaders." At the same time, however, this does not imply that ritual/symbolic and other nonsecular incentives should henceforth be elevated to the status of a new theory or monocausal explanation of agricultural origins. Complex symbolic behaviors were attested in Southwest Asia long before the onset of the Holocene and the Neolithic transformation, evidenced in mortuary rites dating from at least the Middle Epipaleolithic (Maher et al. 2011), while strong cultural continuities between the PPNA and the Epipaleolithic have also been observed in built environments and lithic traditions (Finlayson, Mithen, and Smith 2011). A more productive way to conceptualize the coevolution of subsistence and cultural behaviors is by considering the latter to provide a historical baseline and a context for the former, each linked to the other by variable and changing social practices set against larger-scale processes, such as the rapidly improving climate and the resource-rich environments of Early Holocene Southwest Asia.

It is from such a perspective that we have sought to deconstruct the artificial distinction between mundane/subsistence and ritual/symbolic behaviors, itself a pervasive feature of the Neolithic archaeology of Southwest Asia. Our aim has not been to establish a new theory for the transition to food production. Instead, we have concentrated on tracing the historical development of plant-based subsistence by taking into account the diverse sociocultural environments and developmental trajectories that characterized the Early PPN of Southwest Asia. More generally, contextual approaches of this sort alongside microevolutionary studies of economic decision making in specific ecological and cultural contexts (cf. Winterhalder and Kennet 2009) are well positioned to provide a much needed historical dimension to macroevolutionary accounts of socioeconomic change. Contextual, micro-, and macroevolutionary perspectives address processes that operate at different spatial and temporal scales. Therefore, a balanced understanding of the transition from foraging to farming requires inclusive, integrated narratives that allow for such multiscalar perspectives. At the same time a focus on local, historical trajectories provides a useful check on the scope and applicability of cross-cultural comparisons for the study of human evolution. The future development of a contextual research agenda in archaeobotanical research of agricultural origins in Southwest Asia rests on the collection of larger and better documented botanical evidence. Obtaining such data sets is crucial for reconstructing local and regional resource management strategies and their histories, while their systematic collection will add much needed empirical detail to broader current and emergent understandings of the Neolithic transformation. We hope to have demonstrated that, despite current data limitations, a contextual approach to the investigation of Early PPN plant-food production is feasible. Its effectiveness largely depends on the availability of sufficiently collected and documented archaeobotanical data sets and on their integration with other relevant sources of evidence in order to evaluate resulting models and interpretations.

Acknowledgments

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Comments

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The paper is an innovative and extremely refreshing addition to the "emergence of agriculture" debate, with ramifications far beyond its geographical focus on Southwest Asia. As the authors argue in their opening discussion, although archaeologists have long favored external mechanisms of causation for the emergence of agriculture such as climatic or demographic forcing, or, more recently, internal mechanisms such as social competition, the unifying characteristic of most archaeological thinking on the topic has been the assumption of systematic causalities operating at the global scale, and a one-way journey of successive stages of human progress that Gordon Childe (e.g., Childe 1936, 1942) and even Victorian writers such as Hodder Westropp (1872) would still recognize. The second underpinning but unwarranted assumption, as they point out, has been the premise that ethnographic or ethnohistoric examples of "traditional" foraging and farming societies are likely guides to how prehistoric societies may have functioned in the past. Yet, as I argued in a global synthesis of the material a few years ago (Barker 2006), we can discern a deep antiquity to some domesticatory relationships beginning in the Late Pleistocene; evidence in many regions for predomestication cultivation systems; multiple pathways of domestication processes both within and beyond the traditionally assumed "hearths of domestication" that included "failed experiments" and "reverse" movements along the foraging/farming spectrum (well illustrated in this paper in the case of Southwest Asia); and examples of long-lived combinations of foraging and farming that have no parallels in the ethnohistoric or ethnographic records. Asouti and Fuller add further spice to the mix, demonstrating through their careful contextual analysis of key Early Holocene archaeological sites in Southwest Asia that the food quest for these societies was not "just" a subsistence activity but was enmeshed in complex social and often clearly ritual behaviors related especially to communal food consumption practices underpinning the production and reproduction of social identities. They also show that sedentism cannot be treated simplistically as a key signature of "settling down and growing food," as PPNA major sites functioned as important locales where (we assume) otherwise mobile forager-cultivators came together on a seasonal basis for communal ritualized activities related to food consumption rather than the "settlements" of the kind normally envisaged when archaeologists use that term. Presumably these PPNA communities would have been completely baffled by an archaeologist working on the emergence of agriculture giving them a questionnaire with headings such as "are you a hunter-gatherer or a farmer? [delete as appropriate]," "are you mobile or settled? [ditto]," and "please list your subsistence activities" as a section in the questionnaire separate from "please list your religious practices"! The same questionnaire would have brought out similar head scratching in the prehistoric societies I have been studying in the tropical rainforests of Island Southeast Asia (Barker and Richards 2012; Barker et al. 2011). In Borneo, for example, rice appears to have been known about for millennia before it eventually became a food staple, yet from the period of its initial use it likely possessed considerable symbolic, indeed magical, powers. The Kelabit people of interior Borneo describe rice as the one plant of the dozens that they grow that "needs people to grow it" and regard its cultivation as separating them in a spiritual as well as practical sense from the forest that they rely on for much of their food (Janowski 2003; Janowski and Langub 2011). It is heartening that the authors deliberately resist proposing a new theory for the transition to food production, advocating instead the likely value in other parts of the world of similarly detailed contextual studies to try to elucidate decision making in specific ecological and cultural contexts. At the same time, the paper is an important reminder for scholars working on the emergence of agriculture in other parts of the world that incorporating new foods into prehistoric lives, or new ways of dealing with known foods, likely involved engaging with new mysteries and magic as much as with issues of dietary stress, risk buffering, social competition, and the rest of the panoply of processes involved in the eventual development of the agricultural systems that feed most of the world's populations today.

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9 I 13

This paper makes an important contribution to emerging new ways of understanding the transition from foraging to food-producing societies in Southwest Asia. Asouti and Fuller provide confirmation of an increasing awareness that while the process of transformation took place over a wide region, it by no means followed a single or uniform history. Their discussion of a range of cultivation and harvesting practices including the management of weed flora reinforces the idea of diversity. They note that with the rapid increase in the quantity of data available to us, universal synthetic accounts become harder to accept, as these fail to take account of the emerging detail. It has therefore become not only possible to employ a historical approach such as they recommend but essential.

Asouti and Fuller's reference to Barnard's (2007) argument raises a second issue based on contemporary ethnography, namely, that hunter-gatherers who take up farming maintain a hunter-gatherer mind-set. This is an important concept that has changed the way we see the transition from foraging to food production, providing a more sophisticated understanding of how such transitions have worked in the ethnographic present. However, it is not clear how applicable this argument is to deep prehistory, especially the initial transition from a world of foragers. Some scholars working in the Southwest Asian transition may unconsciously be echoing Barnard and arguing for a continued hunter-gatherer social framework in ethnographically derived models (e.g., Kuijt's egalitarian Early Neolithic, maintaining existing social patterns despite economic and demographic changes [Kuijt 2000]). Beyond the question of how appropriate the use of modern ethnographic examples may be to autochthonous developments 10,000 ago, critically, as Asouti and Fuller observe, at heart this relies on opposing foragers to farmers. The length of time the transition took and the increasingly visible and widespread patterns of diversity within it both add weight to the argument that such stadial models are of little value here.

As Asouti and Fuller discuss, applying the term "agriculture" to the Early Neolithic is a matter of definition, and the alternatives also impose a stadial scheme onto the data. Surely, however agriculture is defined, it is not appropriate for the Early Neolithic, and its use as a chronological marker is part of a dualist tradition that opposes the Neolithic to hunter-gather societies, strengthening the idea of a sharp economic divide.

A final issue is the question of "public" as opposed to "residential" architecture. While such an opposition makes no logical sense, it is also clear that increasing discoveries of public architecture do not actually equate to a simultaneous discovery of residential architecture (cf. Finlayson, Mithen, Najjar, et al. 2011).

This issue extends into the question whether it is useful, or possible, to separate public from "domestic," or whether this is another meaningless opposition, with "nondomestic" being used to describe activities conducted in public buildings. Reports from Jerf el Ahmar refer to buildings as *communautaires* (e.g., Stordeur et al. 2000), and this seems a more accurate term than "public" (which for some of the closed spaces referred to seems entirely inappropriate). Our work at PPNA Dhra' and WF16 in the southern Levant suggests that buildings generally have specific purposes, and the one that is hardest to identify is the residential structure (Finlayson, Mithen, Najjar, et al. 2011) or the highly specific "house" (Finlayson, Kuijt, et al. 2011). The presence of storage buildings at WF16 (Finlayson, Mithen, Najjar, et al. 2011) shows that such structures could be part of small settlements as well as the larger sites identified previously by Kuijt and Finlayson (2009). A storage building is both public and domestic in nature, as are structures apparently designed principally for crop processing, which may have been an important communal activity. Communal buildings are not only the larger structures but also buildings that serve the community rather than an assumed household. In this context, separating public from domestic, ritual from residential, and all such oppositions may be illusory (and see the recent paper and comments by Banning 2011). Community may be a key concept in understanding these settlements, and as Asouti and Fuller observe, it was probably community interactions that helped create social identities.

Asouti and Fuller agree with developing ideas of architectural diversity (cf. Stordeur et al. 2000 and Finlayson, Mithen, Najjar, et al. 2011), diversity that does not fit well with the idea of a Neolithic village (Finlayson, Kuijt, et al. 2011). Such terminological building blocks, what Asouti and Fuller describes as "prevalent perceptions" of an agricultural Neolithic, circumscribe our understanding. Asouti and Fuller also question the idea of "sedentism," and I agree that this terminology is not based on evidence; we simply do not know how full-time these settlements were occupied and must develop a more sophisticated understanding of variable scales of mobility. The problem is that these terms are not used in a casual manner but as central interpretative planks.

The approach proposed by Asouti and Fuller, for a bottom-up methodology that is based on archaeologically derived information, is one we should all be following to escape from universal theories. This paper helps show the way and indicates that we need to start with smaller building blocks, a historical contextual analysis of every site.

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The authors have produced a valuable collation of data from Early Neolithic sites of Southwest Asia, which will be of lasting value to researchers in this field, and they have generated interesting insights into the charred macrobotanical remains from the site of Jerf el Ahmar above all. There are, however, several issues regarding the theoretical orientation adopted in the article. First, the authors need to define some key terms that recur throughout the article, including "protoagriculturalists" and "predomestication" (both rather teleological phrases), as well as "political economy" and "household." These are highly charged terms that might be interpreted in multiple ways—in which ways are the authors using them?

Second, the authors attempt to set their arguments against a posited background of scholarship rooted in "culture-history and social evolution," which is claimed to assume "a directional evolutionary continuum from mobility to sedentism" involving "dichotomous models of mobile versus sedentary habitation" and a "directional, developmental trajectory." Research on the Early Neolithic of Southwest Asia has not been formulated in these terms for at least 30 years, and it is notable that the authors fail to cite a single published source for these claimed attitudes at the many points in the article where this straw man pops up. Recent reviews of the emergence of agriculture in Southwest Asia and elsewhere (Barker 2006; Bellwood 2005; Mithen 2003; Willcox 2005; Zeder and Smith 2009), including its adoption through Europe (Hadjikoumis et al. 2011; Whittle 2003), share an emphasis on considerable regional variety and flexibility, along with lack of directionality and linearity, in locale-specific transitions from hunter-forager to farmer-herder. It might be more profitable for the authors to situate their arguments within the rich context of current research into global and local patterns of Neolithization rather than to attempt to contrast them against a derelict paradigm.

Third, and more significantly, the authors' claim to be taking a contextual approach to the emergence of agriculture is too grand when their definition of "contextual" comprises charred macrobotanical remains and occasional architectural and other material evidence. What is missing from this approach is the potential for charred macrobotanical remains to be interpreted within a matrix of material evidence that includes input from multiple strands. These strands must include zooarchaeology. Animals are barely mentioned in this article and yet human-animal interactions are inextricably intertwined with trajectories of human-plant engagement throughout the Neolithic, from foddering (of tamed, morphologically wild animals in the Early Neolithic), dung collection and use, to consumption of plants as flavorings for meat, to mention only a few possible avenues. No consideration is made of the potential for noncharred plant remains, such as phytoliths, to contribute to the discussion, and a more rewarding approach would consider issues such as seasonality, changing climate, and the role of gender in Neolithic transitions. Richer considerations of the emergence of agriculture in Southwest Asia have been effectively set out in recent studies such as Bolger's (2010) gendered approach and Hodder's (2012) notion of entanglement, which sees plants as one inseparable component among many in the development of cultivation and agriculture. We appreciate that multistranded, integrative approaches to major issues such as the emergence of agriculture can be conducted only where the necessary multiple forms of evidence have been appropriately recovered, recorded, and published from archaeological excavations and environmental studies, and that this requirement drastically reduces the scope for application of such an approach at present. In that case, the article might more productively have focused in greater detail on those few sites, such as Jerf el Ahmar and Çatalhöyük, where such rich, integrative contextualization is feasible.

Fourth, the authors claim that their approach does "not seek to tease out symbolic or other nonmaterial meanings from contextualized archaeological evidence," yet at several points they propose that "ritual practices," "ancestral commemorations," and "symbolically charged functions" may have been critical in structuring communal food consumption practices. We are unclear as to why the authors feel that this does not constitute "teasing out symbolic or nonmaterial meanings" nor indeed why they should claim to be hesitant to do so given the rich evidence for the role of symbols at Early Neolithic sites, much of it referred to in this article.

Where this study works best is in its detailed consideration of the charred macrobotanical remains within their architectural contexts at Jerf el Ahmar, where innovative and valuable insights are made, largely thanks to the fulsome publication program pursued by the site's excavators. Beyond that, the often too broad interpretations offered here are at the mercy of the inadequate data recovery and publication strategies pursued by excavators of many Neolithic sites in Southwest Asia.

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It is refreshing to see new thinking on the Near Eastern Neolithic, and this paper is wonderful in its rigorous review of available data, highlighting the impressive work at Jerf al Ahmar (and the regrettable poverty of documentation from other sites).

Asouti and Fuller rightly eschew an assumption that ethnographically derived social types correspond to communities in the PPN; thus architectural units (houses) may not reflect sedentary social units (households), and it also may be true that the PPN landscape was rich in off-site, low-intensity places mostly undetected today. But their "contextual approach" stumbles on one of the most stubbornly persistent of archaeological interpretations—the taphonomic premise that (charred plant or other) remains are distributed where processing and consumption took place rather than in secondary garbage dumps away from living and activity areas. Impoverished remains within houses may mean that (sedentary) communities dumped rake-out and garbage in communal, outside areas rather than discard them on clean interiors. Horizontal contexts are problematic, because they reliably preserve the spatial arrangements of human activity in cases of sudden destruction and short-term occupation. As the authors argue for short-term aggregations at Early PPN sites, their arguments about the distribution of plant remains become contradictory–these were short-lived occupations even though the pattern of discard more closely resembles ethnoarchaeologically known sedentary villages. The distributions discussed here may represent episodes of dumping rather than communal feasting, especially since the charred remains in question are mostly not in hearths, where charring occurred. External middens and the caching of objects like querns, tucked aside or inverted for intended reclamation, are typical of sedentary households (Joyce and Johannessen 1993). It is not clear to me why outdoor cooking installations would necessarily be communal.

Taphonomic issues of charred plant distributions aside, the collectivity involved in early plant processing and the separate uses of crop-processing by-products is intriguing. To that argument I would also add that flax incurs a collective task in retting (rotting) and in bracking (threshing) to produce fiber. Flax was an early domesticate both for its oil content and for its fibers, used in the earliest textiles, which appear under unique preservation conditions among ritual paraphernalia in the latter PPN. It is difficult to imagine households of low-level food producers tending, defending, and processing the volume of flax needed for habitual use of linen textiles, especially in a landscape of mobile, multiresource, multiseasonal food collection. Domesticated flax also suggests collective work groups and socially binding ideological practices in which collectively processed plants weave the identity of a community into portable and durable mnemonics of place. It is important that flax also required the best land in terms of moisture and nutrients and would have required human cultivation (seeding and weed removal) to grow sufficient stands for fiber production.

The bigger and compelling issue in this paper is the constituted nature of Early PPN societies and the social cohesion afforded in periodic gatherings and feasting. The emergence of households as the metastructural framework for social constitution is indubitably evident in the archaeological record of the Near Eastern Neolithic, but it is intriguing that this may occur later in the PPN. Were earlier constitutive practices more akin to the pilgrimages (i.e., gatherings, sacrifices, and feasts) implicated in the social constitution of pastoral networks throughout Arabia from (at least) the Neolithic onward (McCorriston 2011)? For all its ideational and symbolic connotations, pilgrimage may be rooted in human behavioral ecology (McCorriston et al. 2012). Social boundary defense among foragers and low-level food producers who cooperate in pay-to-play resource sharing offers an alternative to the territorial defense mechanisms (Rosenberg 1990) inherent in the "settling down and breaking ground" (Harris 1989) macroevolutionary framework of plant domestication. A gathering and feast on large food packages (e.g., aurochsen) accompanied by the fruits of collective labor (gathered grain) would not only affirm common identity among otherwise physically fragmented communities but would also offer opportunities for the exchange of information, marriage partners, and other goods, while affirming common resource access and mechanisms to deny intruders. If such a social boundary defense indeed constituted Early Neolithic society, then Asouti and Fuller's microevolutionary, historical approach has brought us back to big questions in the Neolithic. How and why did the transition occur to sedentary villages populated by households whose socially constitutive practices relied on daily encounters and the food resources that could sustain them? Evolutionary approaches, macro and micro, address the how. Ultimately we still want to understand the why, why then, and why there. As this paper demonstrates, these are fundamentally historical questions whose particular circumstances will contribute to research on agricultural origins worldwide.

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Ten years after the critical review on the state of the evidence on early domesticated plants by Mark Nesbitt (2002), Asouti and Fuller present a long-due update, this time including also contextual archaeological information as part of the sociocultural environment of early plant-food production, which so far seems to have been neglected in considerations on the macroevolutionary scale.

Asouti and Fuller also pinpoint two very important methodological issues in the discussion of the emergence of early agriculture in the Near East, one of which is the problem arising from applying the principle of uniformitarianism in explanatory models in archaeology, the other the general tenor of assuming unidirectional developments.

Reconstructing specific practices associated with plant-food production is often based on ethnographic observations, but these are usually conducted by observers with a cultural background different from the observed, thus applying the eighteenth-century principle of uniformitarianism to human perception. The imposing question is, therefore, if we can indeed be free from transferring our perceptions to the past in considering the "contextual" evidence for local and regional sociocultural environments, and if our interpretation of the role of historically constituted human agency in economic change is not biased by our own sociocultural and historical tradition. Therefore the model of "communal food consumption" indicated by "formalization of mortuary practices and associated public structures/open spaces" may be difficult to prove, particularly considering the uneven state of the evidence. The authors correctly note (here in restriction to the southern Levantine evidence but in my opinion equally applying to the Zagros region) that "one could argue, that this [permanent habitation] is partly the artifact of insufficient sampling, limited horizontal excavation or, more pertinently perhaps, the different objectives of botanical and archaeological research."

The assumption of the unidirectional nature of the neolithization process, what the authors characterize as the "shared premise conceptualizing the Neolithic transformation . . . as a single developmental process," reflects Western philosophical traditions. Such assumptions cannot be generalized, particularly not when applied to an archaeological site with a stratigraphic sequence of high chronological resolution. The most important argument raised by Asouti and Fuller, and based on hard evidence, is that of site-internal occupational discontinuity.

Archaeobotanical data suggest the existence of several pathways to cultivation augmenting those represented by modern domesticated crop lines, including crop species and varieties that may have existed and became extinct in the past. The cultural dimension of such aspects is particularly important in comparisons of "developmental stages" of ancient sites, often based on consideration of the so-called founder crops. How can we characterize sites where long-term cultivation of wild progenitors of the founder crops was practiced without leading to domestication or where no modern analogues are known for species cultivated in the past, such as the so-called *Triticoid* type according to van Zeist (e.g., van Zeist and Bakker-Heeres 1985*b*)?

With these aspects in mind one can implicitly join Asouti and Fuller in that "we may be more justified to argue for the existence of idiosyncratic and locally diverse perceptions of, and practical engagements with, all kinds of plant-derived subsistence resources including predomesticated cultivars."

One aspect I would like to stress here concerns the state of paleoenvironmental knowledge. The authors correctly note that application of earlier macroevolutionary models revealed various methodological problems in interpreting the paleoclimate record concerning its role as impact factor on the development of agriculture. Reasons for this may lie not only in the lack of local environmental records or chronological resolution but also in the fact that regionally diverging patterns, which are more than likely (e.g., Riehl 2012 for Bronze Age settlements), disturb our expectations of unidirectional development. On the current basis of paleoenvironmental information for the whole area of the Fertile Crescent, the authors consequently conclude that they "found no convincing evidence indicating that any of these developments could have been the result of resource intensification brought about by environmental stress." This should, however, not mean that our paleoenvironmental knowledge is already brought to perfection. In contrast, it appears very likely that the slow development of fully domesticated species was hampered by environmental change, for example, forcing ancient people to shift their priorities in subsistence strategies. Forthcoming investigations of long-term occupational sequences and their environs will shed more light on local environmental developments and their relation to archaeobiological remains and archaeological contexts.

In all, this review makes clear that, without contextual analyses, archaeobotanical studies are substantially less efficient, as they may determine the domestication status of potential crop species but cannot explain context-related variation in botanical assemblages.

In consideration of existing prehistoric chronological studies, it may be allowed to ask whether Bayesian sequence modeling could help to achieve a more precise chronological framework for individual sites and prehistoric processes in order to provide more detail about the chronological relationships between the different archaeological sites (Benz et al. 2012). Future work in this direction may leave the path of the currently mainly documentary character of studies on the Neolithization process by applying statistical methods to the individual archaeological, archaeobiological, and chronological parameters.

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Asouti and Fuller have taken a very welcome and more nuanced view of the role and consequences of PPN predomestication cultivation than normally is found in the existing literature. Their paper is an important step toward examining the social and economic complexities of the transitions from foraging to cultivation and finally to an agricultural economy in the PPNB. It points out the value of blurring the lines between agriculture and foraging, and among other things it highlights the major importance of wild foods and the likelihood that nondomesticated plant-food cultivation was more opportunistic at first, rather than a major new economic investment. Importantly they give examples of how placing early food production in its social and ritual contexts not only enhances our view of the increasing reliance on cultivation throughout the PPN but also provides insights into social developments and changing settlement patterns. Much of this has been said before, such as the importance of low-level cultivation of predomesticated plants (Smith 2001*a*), the trade-offs between more or less foraging versus cultivation with changing social, economic, and environmental demands (e.g., Rosen and Rivera-Collazo 2012), and the importance of communal displays of consumption for social cohesion (e.g., Twiss 2008); however, Asouti and Fuller bring together a more complete picture of Early Holocene societies through a broad perspective of the Near East, highlighting differences between northern and southern ends of the Fertile Crescent in a way that facilitates new insights.

The importance of display sharing of "everyday" plant foods for feasting and social cohesion is an interesting concept developed by the authors for the Near Eastern Neolithic. They make a compelling case against the idea that feasting necessarily involved precious and rare specialty plant foods and drink and also against the notion that feasting played a competitive role rather than one of social binding. This plays out nicely when examining the evidence for enhanced ritual activities among the growing populations in the PPN, especially in the northern parts of the Fertile Crescent, since rituals also function to strengthen group identity and cohesion.

The emphasis of this paper is on the social rather than environmental elements of the shift from low-level cultivation to more complete investment in a farming economy. This works well for the Early Holocene PPN, since environmental stress was decreased due to ever-increasing rainfall. However, the role of environmental change (e.g., frost cycles and rainfall patterns) cannot be completely removed from the equation since even opportunistic cultivators are very aware of environmental risks and benefits.

Although Asouti and Fuller restrict their discussion to the PPN societies of the Near East from the Early Holocene onward, it is widely recognized that these populations are the direct descendants of Epipaleolithic peoples, and hence there is some continuity in the traditions of provisioning. Just as we can now blur the lines between forager and cultivator, it is possible to blur the line between Late Pleistocene and Early Holocene economic adaptations, especially if we view the post–Late Glacial Maximum warming of the Bölling/Alleröd as roughly equivalent to the Early Holocene. In the southern Levant, from the LGM (ca. 23,000 BP) onward, the macrobotanical (Ohalo 2; Weiss et al. 2004) and microbotanical records (Eynan, el Wad, Hilazon Tachtit, Raqefet; Rosen 2010) all suggest an adaptive fluidity in shifts between possible low-level cultivation and foraging of large and small-seeded grasses. This may have been a general part of Near Eastern adaptations stretching back in time into the Late Pleistocene. It was present thousands of years before the PPNA as a regular part of the adaptive strategies of the Epipaleolithic peoples from the LGM onward. Seen in this light we have to wonder why the social institutions for group cohesion such as ritual and feasting lurched into overdrive only in the later PPN rather than at an earlier time such as the post-LGM Bölling/Alleröd.

In their concluding sentence Asouti and Fuller emphasize that a contextual approach such as the one outlined in their paper can only be effective when archaeobotanical (and by extension other "archaeo-environmental" data sets) are integrated with more traditional sources of archaeological evidence. For too long there has been a kind of hierarchy of privilege in archaeological data sets with material cultural remains such as ceramics, lithics, and architecture taking precedence over less prioritized environmental data sets. This paper highlights the importance of weaving environmental data into the total picture of human cultural and social adaptions.

Reply

In their commentaries our colleagues have raised a number of key points and issues that help bring together a revised agenda for future research on the origin of food production. While systemic theories and teleological explanations will undoubtedly continue appealing to the imagination of scholars and the wider public alike, in recent years their certainties have been increasingly undermined by new evidence accumulated from ongoing field- and laboratory-based empirical work. However, in most cases, this proliferation of research has not resulted in the explicit revision of long-standing theoretical approaches. This has been the case partly due to the inductive nature of much of the research undertaken in different parts of the world, the majority of which has been problem oriented. Consequently, little attention has been paid to the (often unstated) biases underpinning many of the key propositions put forward by its practitioners. A close examination of these assumptions is therefore critical if we wish to broaden our intellectual horizons and achieve something more than incremental progress in this field.

We wholeheartedly agree with Barker, Finlayson, and Riehl that the use of ethnographically derived socioeconomic and cultural taxonomies and ethnoarchaeologically derived middle range theory as analogues for studying Early Holocene forager-cultivator societies is not only limiting but may also be positively misleading. A similar theoretical position has been already espoused by other scholars in this field who have identified foragers-cultivators as inherently resistant to categorization by traditional anthropological tools. It is typified, for example, in Melinda Zeder's characterization of Southwest Asian Early PPN resource management strategies as the "broad middle ground between wild and domestic, foraging and farming, hunting and herding" and her suggestion that "instead of continuing to try to pigeonhole these concepts into tidy definitional categories, a more productive approach would be to embrace the ambiguity of this middle ground and continue to develop tools that allow us to watch unfolding developments within this neither-nor territory" (Zeder 2011: S231). Worldwide Early Holocene forager-cultivator societies lived in environments and engaged in sociocultural and landscape practices that bore little to no relation at all to what is known from the ethnographic (and ethnoarchaeological) present. What is then the alternative source of models for archaeologists attempting to study such nonanalogue situations in the prehistoric past? The solution lies in the study and comparative analysis of the fragmentary material remains of these unique lifeways and people-environment relationships preserved in the archaeological and paleoenvironmental records. It is these archives that preserve important clues about the solutions adopted by our Early Holocene ancestors when faced with the perennial problems of survival and biological and sociocultural reproduction in rapidly changing environments.

In the context of the Neolithic archaeology of Southwest Asia, there have been a number of topics on which empirical research has focused during the last decades. One such key issue is sedentism. We have proposed that sedentism is best conceptualized as a continuum of mobility strategies and associated dwelling practices that varied enormously across different cultural, socioeconomic, and ecological contexts. That this should be the case during the Neolithic is hardly surprising, given that mobility is a property characterizing individuals and communities from prehistoric times to present-day urban communities. Thus, a data-informed understanding of prehistoric mobility strategies cannot be predicated mainly on the perceived permanence of the built environment alongside indicators of multiseasonal habitation. Instead, a bottom-up, multistranded understanding of the empirical record is required including site formation processes (stratigraphy and deposition), individuals (skeletal and isotopic evidence), communities (ritual practices, built environments, resource management strategies), and the negotiation of social identities within this interface (for a recent exploration of these issues in the context of the American Southwest prehistory, see Wills et al. 2012). Particularly as regards the negotiation of Southwest Asian Neolithic social identities, we are in complete agreement with Finlayson that such arenas should be described as "communal" rather than "public." This is due to the distinct connotations of the term "public," at least as used in the English language, belying a level of spatial separation between the "private" and "communal" domains that is not reflected in the archaeological record of this period.

A second major area of research deals with symbolic and ritual behaviors. These developed within and reflected concrete social contexts, including socioeconomic relationships and landscape practices that linked knowledgeable agents. From this perspective it is not only pertinent but also necessary to study the function, structuring, spatial arrangement, and contextual attributes of the built environment (e.g., the "communal" structures) without our interpretations being unduly concerned with the specific meanings of the stories narrated through them or the worldviews that such stories might reflect. The cases of the symbolic representations encountered at Göbekli Tepe and Jerf el Ahmar form telling examples of this principle: the interpretations proposed in our paper do not seek to explain their meanings. Instead what we have offered are plausible accounts of the ritual (routine) uses, social functions, and temporality of these built environments. The ritual should not be equated with the symbolic, which also addresses the point raised by Matthews and Fazeli Nashli concerning the scope and remit of our engagement with this particular subject.

The third major area relates to Early PPN plant management practices. A prevalent bias in the literature is that an agronomic mind-set was present from the very beginning of predomestication cultivation aimed at risk buffering and maximizing arable returns. However, clear-cut distinctions between "weed" and "crop" taxa as well as defining the desirable attributes of the latter that foragers-cultivators allegedly sought to improve cannot be established retrospectively (i.e., by drawing parallels with later mixed agropastoral practices). Forager-cultivator plant-management strategies form the historical product of distinct sets of landscape practices and associated food-processing and preparation traditions, which are amenable to empirical investigation. For example, it is possible that tough rachises were intentionally not selected, as this would require significant investments in crop-processing time and labor; this might have been the case in the southern Levant. On the other hand, in northern Syria the longevity of predomestication cultivation alongside the reported high incidence of sickle gloss indicate that harvesting unripe cereals might have been predominant. Contrary to what is the case with animals where early management controlled and altered behavior rather than biology (Zeder 2012), early plant cultivation might have been purposefully reproducing forms encountered in the wild. This could have been the case because rare variants were undesirable or unobservable or because the process of mutation itself was too slow to be perceived and acted upon. An example of the latter is the increase in seed size through time, which could be attributed, inter alia, to intentional planting (when this particular practice actually became widespread). Finally it should also be emphasized that cultivation in temperate environments could not be relied upon to produce viable normal surpluses before its integration with caprine herding and the establishment of integrated agropastoral economies. Again the increasing sophistication of the archaeozoological record (see Zeder 2011, 2012) indicates that this was neither a straightforward nor a directional process.

With regard to research practices and methodologies, we agree with Matthews and Fazeli Nashli that the study of plant micro-fossils such as phytoliths (and starch) should be fully integrated to reports of plant macrofossil work, including regional contextual syntheses, once sufficiently large, detailed, and published microfossil assemblages become available from a representative range of Southwest Asian Early PPN sites. While this paper was being written this was still not the case, although the picture is rapidly changing with several new projects currently under way. In a recently published paper (Asouti and Fuller 2012) reviewing the current state of archaeobotanical research in the southern Levant, we have made extensive use of phytolith evidence especially for the Natufian periods (see also overview by Rosen 2010). Phytoliths provide a useful complementary source of evidence of plant-related activities and management practices, particularly at sites and areas for which macrobotanical data are not available.

In her commentary McCorriston suggests that our advocating of the systematic sampling of horizontal exposures, including open and inside buildings areas is flawed, because it does not account for a generic principle of archaeobotanical taphonomy: that carbonized plant food remains are very rarely preserved where processing and consumption activities originally took place but are instead found discarded in secondary, spatially distinct refuse deposits. However, this principle (derived from ethnoarchaeological observations of discard practices) is not a universally applicable law. Rather the taphonomic evaluation of all deposits sampled for archaeobotanical remains needs to be undertaken on a case-by-case basis using quantitative and qualitative descriptions of the preservation and densities of different taxa and plant parts, alongside an appreciation of their context-related variation (Colledge 2001). Moreover, Epipalaeolithic and Early PPN sites are likely to preserve much dirtier and messier activity areas, both within and without built spaces, compared with Late PPN and ceramic Neolithic sites where the discard of refuse in spatially distinct middens is routinely observed (Hardy-Smith and Edwards 2004). Finally, McCorriston's statement that "The distributions discussed here may represent episodes of dumping rather than communal feasting, especially since the charred remains in question are mostly not in hearths, where charring occurred" is counterintuitive: plant remains (with the partial exception of firewood) are rarely if ever preserved in hearths, for obvious reasons. On the other hand, disregarding the stratigraphy, spatial arrangement, preserved features, material culture associations, and manner of animal bone deposition in contexts that may hold the debris of communal food consumption in favor of their generic interpretation as domestic refuse deposits is actually unwarranted by the available evidence. Methodology aside, as we have argued already, a clear-cut distinction between notions of the "communal" as opposed to the "domestic" is unlikely to apply to the Early PPN of Southwest Asia.

For heuristic as well as substantive reasons the Early Neolithic of Southwest Asia is (correctly) perceived by a majority of scholars as a distinct entity that was both temporally and spatially delimited (Asouti 2006). However, unity should not be mistaken for uniformity. Some of the respondents seem to have fallen foul of this misconception. McCorriston questions our proposed reconstruction of Early PPN mobility practices. As justification she brings up the case of flax cultivation for linen production. However, as she herself admits, the earliest evidence for linen use dates from the end of the eighth millennium cal BC (i.e., the end of the Late PPN), which is significantly later than the period discussed in our paper. She also postulates that "middens" and "caches" should be interpreted as signifiers of permanent, year-round settlement. Yet her wording belies a somewhat rigid perception of what "middens" and "caches" are, which seems to be influenced by both regional ethnographies and archaeological correlates found in later Neolithic communities. Matthews and Fazeli Nashli exemplify the same attitude when suggesting that we should have included in our discussion the case of Çatalhöyük, despite the fact that this site dates ~7300–6000 cal BC, that is, well outside the chronological scope of the paper. They also opine that our analysis is not sufficiently "contextual" because we did not consider foddering and dung use, both representing important interfaces of Neolithic (*sensu lato*) plant and animal management practices. However, commenting on such practices is relevant to the Middle and Later PPN, falling once more outside the remit of our paper. A closer reading of our text also refutes the perplexing allegation that we have disregarded (alongside the relevant body of literature) evidence for regional diversity and the lack of directionality and "linearity" in patterns of change; quite the opposite is the case. In addition, terms such as "contextual," "predomestication," and "political economy" are all sufficiently discussed in the text and thus need not be rehearsed here.

More to the point, Matthews and Fazeli Nashli note that in our discussion of the evidence we have not addressed interpretative categories and relevant bodies of theory relating to "gender," "seasonality," "entanglement," and the "changing climate." However, the core thesis developed in this paper is that such concepts must be set within specific historical contexts for any such treatises to be meaningful. With regard to climate change in particular, both Riehl and Rosen offer more nuanced viewpoints emphasizing the critical contribution of high-resolution paleoenvironmental archives to understanding small-scale changes in local microecologies, which can then be integrated in informative ways to archaeobiological and material culture sequences. Putting theory to practice, one of us (Asouti) has recently initiated, funded by the Leverhulme Trust, such an interdisciplinary research project aimed at reconstructing people-environment interactions and changing forager-cultivator landscape practices in south-central Anatolia during the tenth and ninth millennia cal BC.

McCorriston has superbly pinned down the question that is, in our opinion, central to contemporary agricultural origins research: "How and why did the transition occur to sedentary villages populated by households whose socially constitutive practices relied on daily encounters and the food resources that could sustain them?" In the case of Southwest Asia, answering this question in a plausible manner depends on our understanding of the sociocultural and ecological contexts of changing prehistoric landscape practices both at the micro level and also in their *longue durée*, extending as far back as the Late Pleistocene (Asouti and Fuller 2012). Resource availability and technological change sensu stricto (i.e., plant and animal resource management and domestication) cannot provide the full answer, much like coal or the invention of the steam engine could not possibly do so for the causes of the nineteenth-century Industrial Revolution. What is required for understanding these far-reaching social transformations is a historical knowledge of how the diverse contexts and circumstances in which economic resources and innovations were deployed changed through time and how, in this process, resource ecologies, properties, and management strategies were also transformed.

—Eleni Asouti and Dorian Q Fuller

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