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The Neolithic Macro-(R)evolution: Macroevolutionary Theory and the Study of Culture Change

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Abstract The macroevolutionary approach in archaeology represents the most recent example in a long tradition of applying principles of biological evolution to the study of culture change. Archaeologists working within this paradigm see macroevolutionary theory as an effective response to the shortcomings of neo-Darwinian biological evolution for studying cultural evolution. Rather than operating at the level of individual traits, macroevolutionary archaeologists emphasize the role of hierarchical processes in culture change. While neo-Darwinian archaeologists disavow any element of human intent in culture change, to macroevolutionary archaeologists human agency is a key component of cultural evolution that allows cultures to respond to pressures more quickly and with greater degree of flexibility and directedness than found in biological evolution. Major culture change, when it happens, is likely to be rapid, even revolutionary, with periods of rapid change separated by periods of relative stasis of actively maintained stability. The emergence of Neolithic cultures has long been recognized as one of two periods of major revolutionary culture change in human prehistory. Here I examine the record for the Near East, tracing the empirical record for the origin of agriculture in this region, as well as other demographic, social, and ideological components of Neolithic emergence. While the empirical record from the Near East subscribes in a general way to basic principles of macroevolutionary theory, cultural evolution cannot be understood through appeal to principles of biological evolution alone, whether based in macroevolutionary theory or neo-Darwinianism. Instead, the key role of human agency in culture change distinguishes cultural evolution from biological evolution and requires a more pluralistic and less doctrinaire appeal to multiple models of change based in both the biological and social sciences.

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Introduction

The application of macroevolutionary theory to the study of culture change follows a time-honored tradition in archaeological theory building of borrowing from evolutionary biology. Macroevolutionary principles of hierarchy, directed variation, stasis, and punctuational change have found special resonance with processual archaeologists seeking to isolate the driving forces behind major periods of cultural transformation in the human past. Two such transitions in particular stand out and therefore constitute prime opportunities for the application of macroevolution theory to the study of cultural evolution: (1) the emergence of food production and (2) the development of centralized political systems. The first of these two periods of cultural "revolution," which includes the domestication of plants and animals and the origin of the first agricultural societies, holds special appeal for the evaluation of the efficacy of macroevolutionary principles in the study of culture change. Not only is this "Neolithic Revolution" generally seen as a period of sudden and profound cultural change that occurred independently in multiple places across the globe, it is also one that is coming into increasingly better focus, thanks to significant advances in methods for documenting plant and animal domestication and charting the social and environmental context of domestication. This article looks to the region with the best documentation for the emergence of food production, the Near East, as providing an ideal case study for assessing the effectiveness of macroevolutionary perspectives in the study of the process and pattern of cultural evolution.

Evolutionary models in archaeology

There is nothing new about archaeologists co-opting models of biological evolution. Even before Darwin, archaeologists built taxonomic classifications of artifacts that drew directly from Linnaean principles for ranking and classifying biological organisms (see Taylor 1948). Early social evolutionists like Spencer (1863), Morgan (1871), and Tylor (1871) adopted Darwinian principles of natural selection and change over time to build models that attributed greater directionality and uniformity to cultural evolution than Darwin probably ever intended (Richards 1988; Ruse 1988). The impact of these early social theorists is seen in the work of mid-20th century anthropologists and archaeologists (Childe 1951; Fried 1967; Sahlins and Service 1960; Steward 1955; White 1959), whose evolutionary taxonomies and theories of culture process in turn played a major role in shaping the subsequent "new" or processual archaeology of the late 1960s and 1970s (e.g., Binford 1968; Flannery 1972a; Wright 1977). Processualists themselves drew heavily on biological ecology (Odum 1959), as well as general systems theory (von Bertalanffy 1968), in their efforts to isolate processes responsible for the evolution of one cultural form into the next. The application of macroevolutionary principles to the study of culture change by second-generation processualists like Spencer, Rosenberg, Chatters, and Prentiss (Chatters and Prentiss 2005; Prentiss and Chatters 2003; Rosenberg 1994a, 1998; Spencer 1990, 1993, 1997; Spencer and Redmond 2001) is only the most recent example of this practice.

Macroevolutionary theory in biology

Before examining the application of macroevolutionary biology to the study of cultural evolution, it is helpful to briefly summarize underlying principles of macroevolutionary theory as conceived within its original biological paradigm. Simply put macroevolution is evolution responsible for large-scale morphological changes at or above the species level (Homberger 2002, p. 456). The principle architects of macroevolutionary theory (i.e., Eldredge 1989a; Eldredge and Gould 1972; Gould 1989, 2002; Vrba and Eldredge 1984) framed their ideas as a response to then dominant "neo-Darwinian" (or "modern synthesis") evolutionary models that themselves grew out of a fusion of Darwinian concepts of natural selection with principles of population genetics (Dawkins 1986; Huxley 1942; Mayr 1942, 1963; Simpson 1944). Proponents of macroevolution reject neo-Darwinian perspectives that portray evolution as confined to changes in allele frequencies within individual organisms shaped by gene flow, genetic drift, and, especially, natural selection operating on phenotypic expressions of random genetic variation. Such views, they contend, serve to reduce organisms into discrete parts, or traits, each with its own "adaptive story" that explains its form and function (Gould and Lewontin 1979, p. 581). The alternative macroevolutionary perspective argues that organisms must be analyzed as integrated wholes or constellations of traits that follow basic structural plans, or *baupläne* (singular *bauplan*), which serve as blueprints for organisms at various taxonomic levels (Eldredge 1989a, p. 44; Gould and Lewontin 1979; Hall 1996, p. 226). Instead of concentrating on the adaptive value of individual traits within organisms, macroevolutionary models focus on constraints to evolutionary change, both architectural and phyletic (or historical), which are argued to play at least as much of a role as selection in shaping baupläne and transitions between them(Gould and Lewontin 1979, p. 594; Seilacher 1972).

While acknowledging that changing allelic frequencies within competing organisms are important components of evolution, macroevolutionary biologists maintain that such "microevolutionary" processes are more likely to constrain change than to create new forms and are insufficient, in and of themselves, to account for large-scale evolutionary change (Gould and Eldredge 1993, pp. 223–224). Instead, they adopt a more hierarchical approach that acknowledges that evolution operates simultaneously at the levels of genes, organisms, populations, and entire taxa (Gould 2002, p. 726; Gould and Eldredge 1993, p. 224; Vrba and Eldredge 1984). These higher-order evolutionary processes are responsible for major cladistic change in which organisms following one bauplan are replaced with organisms subscribing to a new one. The primary mechanism of such change is thought to be a process of allopatric speciation that occurs when smaller subpopulations become differentiated from parent populations under conditions of geographic separation (Eldredge and Gould 1972; Mayr 1963).

Although Gould and colleagues explicitly reject progressivist, unilineal frameworks of evolutionary development (Gould 1988), they also do not subscribe to a neo-Darwinian perspective that portrays evolutionary change as the undirected response to selection acting on random genetic variation. Instead, evolutionary change may be highly directional in nature, following pathways shaped both by historical and structural constraints and by the hierarchical nature of evolutionary process. Another factor that lends directionality to evolutionary change is the process of "exaptation," which happens when a feature takes on a new adaptive function different from its original function—a factor that may contribute to evolutionary trends resulting in greater organismal complexity (Gould 1988, 2002, pp. 49, 726–730).

Macroevolutionists also differ with neo-Darwinianists over the tempo and mode of evolutionary change. Although neo-Darwinian evolutionary biologists acknowledge that the pace of change may be variable, they generally envision evolution as following a model of "phyletic gradualism" in which change is ongoing and continual as new species arise through the gradual transformation of whole populations. In contrast, macroevolutionists argue that the kinds of major cladogenic change responsible for the creation of new species are more likely to happen very rapidly in small populations on the peripheries of ancestral population (Eldredge and Gould 1972, p. 96). Thus, rather than occurring as a gradual unfolding process of continual, though perhaps variably paced, change, major evolutionary change is more likely to proceed through a process of punctuated equilibria in which very rapid periods of change are followed by much longer periods of relative stasis (homeostatic equilibria) of actively maintained stability (Eldredge and Gould 1972, p. 84; Gould and Eldredge 1993, pp. 223–224). Proponents of gradualist models of evolutionary change attribute the lack of evidence for gradual change and transitional forms in the fossil record to gaps or imperfections in the record. Adherents of macroevolution (mostly based in paleontology) counter that the paleontological pattern of geologically instantaneous origin of new species and subsequent stability is, in fact, a generally accurate reflection of a process of rapid change in which new species arise from small isolated populations separated by longer periods of homeostatic stability (Eldredge and Gould 1972; Gould and Eldredge 1993, p. 223).

Neo-Darwinian archaeology

Archaeological applications of macroevolutionary principles to cultural evolution also are often framed within the context of critiques of neo-Darwinian evolution and its relevance to the study of culture change. Understanding the basic tenets of macroevolutionary archaeology thus requires some familiarity with the underlying logic of what has been termed the "selectionist" school of neo-Darwinian evolutionary archaeology. The embrace of neo-Darwinian biological evolution by archaeologists like Dunnell, Leonard, Jones, O'Brien, and Lyman is not done in a metaphorical way (i.e., arguing that concepts of phyletic gradualism, undirected evolutionary change, and trait-level adapatationist scenarios serve as analogs for processes of culture change), but is, instead, grounded in a very literal, almost evangelical, application of basic principles of neo-Darwinian biology to cultural evolution (Dunnell 1978, 1980; Leonard and Jones 1987; Lyman and O'Brien 1998; O'Brien and Lyman 2000). Archaeologists practicing this form of evolutionary archaeology acknowledge that human cultures differ from biological systems in two important ways: (1) in the units of variability on which selection acts, which in cultural systems are human behaviors, not genes, and (2) in the mode of transmission of variability, which is not via gene transmission in the course of sexual reproduction, but, following Boyd and Richerson (1985), through cross-generational behavioral emulation and instruction, or social learning (Lyman and O'Brien 1998, p. 619). Yet despite these differences in the units of variability and in the mode of their transmission, selectionist archaeologists hold that homologous principles govern the generation of variability and its differential persistence in both biological and cultural systems (Leonard and Jones 1987, p. 212).

Just as collections of genes within an individual organism constitute a biological genotype, selectionists argue that collections of human behaviors practiced by spatially and temporally bounded groups of people constitute cultural genotypes. The expression of these behaviors through cultural acts represents the cultural equivalent of a phenotype. Material culture is seen as a direct "expression of human behavioral variability," providing the "hard parts" of the human cultural phenotype that archaeologists use to construct cultural lineages (Leonard and Jones 1987, p. 213). The evolutionary trajectories of cultural lineages are shaped by forces of selection and drift operating directly on the constituent traits that make up specific components of material culture: artifacts (Dunnell 1980; O'Brien and Lyman 2000). Traits that directly affect the fitness of its bearer (the artifact) are deemed "functional," while traits with no apparent selective value are held to be "stylistic" or neutral. The Darwinian or "replicative" fitness of a trait is judged by its differential persistence through time. Temporal trait frequencies of "functional" traits are shaped by selection, while the frequencies of "stylistic traits" are governed by stochastic processes like drift (Dunnell 1978; Leonard and Jones 1987, p. 214).

Archaeologists operating within this framework are advised to concentrate on "how selection operates on *variation* [original italics] to produce change" (Dunnell 1987, p. 191), tracking change through time in the "*frequencies* [original italics] of empirical variables (material variables in archaeology) scaled at the appropriate levels of inclusiveness" (Leonard and Jones 1987, p. 210). And while selectionist archaeologists have been somewhat coy about defining just where this appropriate level of inclusiveness rests, they adamantly reject the modal groupings of cultures followed by most processualist archaeologists (i.e., the classification of cultures as bands, tribes, chiefdoms, and states following Service [1962] and Fried [1967]) (Dunnell 1980; Leonard and Jones 1987, p. 200). Such higher-order groupings of human behavioral variability, they argue, tend to blur variability, masking the selective forces that shape this variability and distorting the true picture of cultural evolution. "Carving a continuum of variation into chunks and summarizing each chunk in terms of its central tendencies" (Lyman and O'Brien 1998, p. 627) is also, they argue, likely to create an erroneous impression of discontinuities between static states. Confusing these artificial cultural taxonomies with evolutionary stages further results in directional, progressivist models of culture change that essentially require universal, prime-mover forces to account for the transformation of cultures subscribing to one typological category into the next (Dunnell 1978, 1980, 1988; Leonard and Jones 1987).

Another cause for concern, according to adherents to this form of evolutionary archaeology, is that such typological approaches are more likely to invoke explanations based in human rationality or intention in directing culture change (Dunnell 1987, p. 191). Selectionist models explicitly deny human intentionality any role in culture change, especially as a factor responsible for directed variation in cultural evolution (Dunnell 1998, p. 667; Lyman and O'Brien 1998, p. 618). Conscious human decisions to adopt one behavior over another, or to invent novel behaviors altogether, may introduce new variation into the repertoire of human behaviors (O'Brien and Holland 1992, p. 45; Rindos 1989a), but so do unintentional transcription errors and recombinations of behaviors in their transmission from one generation to the next (Lyman and O'Brien 1998, p. 619). Moreover, since the motivations behind intentional behaviors are unknowable, behaviors that arise from conscious human decisions cannot, at least in the archaeological record, be distinguished from those that are generated unintentionally (Lyman and O'Brien 1998, p. 617). Isolating the degree of human intent in generating new behaviors is, in any event, essentially irrelevant when trying to identify the causes of culture change. Instead, the proper focus of such efforts should be on isolating factors of selection and drift operating on variations in behavior, however they arose, since these factors are the ultimate drivers of cultural evolution (Lyman and O'Brien 1998, p. 644; Rindos 1985). Any apparent directional trends in cultural evolution cannot be attributed to human agency but result instead from either selection operating on "functional traits" or transmission, or drift, operating on "stylistic" traits (Dunnell 1978; Lyman and O'Brien 1998, p. 621). An archaeological explanation of culture change is thus necessarily grounded in particular genealogically linked culture histories and can be attempted only once trait frequency distributions have been discovered and plotted through time so that the specific selective mechanisms responsible for shaping these frequencies can be isolated (Leonard and Jones 1987, p. 213; Lipo et al. 2006; Lyman and O'Brien 1998, p. 615, 2000).

Selectionist archaeologists acknowledge that the tempo of change may be variable, perhaps even more so than in biological systems, given the differences in the units of inheritance (human behaviors) and their mode of transmission (social learning) (Lyman and O'Brien 2001). Nonetheless, they endorse the neo-Darwinian model of phyletic gradualism as the dominant mode of culture change, which is characterized as continuous, proceeding at a generally gradual and incremental pace (Rindos 1985). Apparent instances of punctuational culture change, although theoretically possible, are more likely to be artifacts of an incomplete archaeological record or the result of faulty analytical methods operating at an inappropriate scale of change (Lyman and O'Brien 1998, p. 627).

Macroevolutionary archaeology

Never straying too far from the canonical works of Dunnell (especially 1978, 1980), selectionists are generally uniform in their application of the tenets of neo-Darwinian evolution to the study of cultural evolution, viewing both biological and cultural systems as structured by essentially homologous principles. Archaeologists attracted to macroevolutionary theories of biological evolution, on the other hand, are generally less doctrinaire and less uniform in their co-option of macroevolutionary theories from evolutionary biology, seeing principles of biological evolution as analogs for the forces that drive cultural evolution. As a result, they tend to be much more pluralistic in the application of macroevolutionary theory to the study of culture change (Spencer 1997, p. 247).

Macroevolutionary archaeologists reject the neo-Darwinian view of cultures as collections of discrete, independently varying traits, whose persistence overtime is primarily determined by their adaptive fitness. Instead, they view cultures as constellations of interacting traits, whose form is shaped as much by historical contingencies and constraints to change as by the specific adaptive attributes of individual cultural behaviors. Many have co-opted the term "baupläne" to stand for the basic designs that organize linked constellations of cultural traits into coherent and enduring forms (Chatters and Prentiss 2005, p. 47; Rosenberg 1994a, p. 308; Spencer 1997, p. 234). While there is some variability in the application of the concept of baupläne in biology, most biologists use this term to signify suites of homologous characters, nested in a series of ever more general baupläne that characterize increasing higher taxonomic groupings of organisms (Hall 1996, pp. 223–227). Archaeologists, in contrast, have tended to be less uniform in their characterization of the traits that constitute cultural baupläne and in their notions about the hierarchical arrangement of cultural baupläne.

Chatters and Prentiss (2005, pp. 48–49; Prentiss and Chatters 2003), for example, define cultural baupläne in terms of socioeconomic variables as "the characteristic structure of one or more *related or unrelated* [original emphasis] human communities' resource management strategies (RMS)," with RMS defined as "constellation[s] of shared ideas directed toward the acquisition, distribution, and consumption of energy and resources." Socioeconomic baupläne exist at a hierarchy of levels, at the highest scale of which are constellations of traits that separate between such broadly defined categories as hunter-gatherers and food producers. Within these more encompassing baupläne reside increasingly finer socioeconomic baupläne distinguishable from one another by differences in subsistence scheduling, processing, distribution, and consumption (Chatters and Prentiss 2005, pp. 49–50; Prentiss and Chatters 2003, p. 35).

Spencer focuses more on sociopolitical factors in applying of this term to cultural evolution. While acknowledging deficiencies in the Service–Fried cultural typologies of the 1960s (Spencer 1990, pp. 3–4, 1997, p. 232), he argues that these frameworks still have salience for defining the basic structural features of cultural baupläne. To Spencer cultural groupings like band, tribe, chiefdom, and states provide the most general structural designs for cultural systems and are divisible into more specific baupläne on the basis of different leadership formats. Various egalitarian structures, where leadership is based on achievement and only intermittently exercised, may serve as baupläne within band- and tribal-level societies. Nonegalitarian structures with different degrees and potencies of institutionalized leadership provide basic structural plans within chiefdom- and state-level societies (Spencer 1990, 1993).

Rosenberg (1994a) defines cultural baupläne quite differently, restricting the term to the ideational structure or *ethos* of a culture that provides the highest-order, most conservative organizational framework for a culture. Ideational baupläne sit at the "superstructural" level in a cultural system, which subsumes a lower-order "structural" level that consists of the system's "workings" or its political or economic systems. The system's structural level, in turn, subsumes its "infrastructural" level that consists of its "productive capacity" as dictated by its subsistence economy (Rosenberg 1994a, p. 327). These lower levels, however, are not seen as part of a nested hierarchy of baupläne but rather as increasingly more specific and more localized workings of the system that is ordered in its most general sense by its ideational bauplan.

Just as their biological counterparts discount changes in allelic frequencies at the level of competing individuals as major drivers of cladistic change (Gould and Eldredge 1993, p. 224), macroevolutionary archaeologists uniformly find the selectionist trait-based view of culture focus insufficient to account for major cultural change (Spencer 1997, pp. 225–226). While acknowledging that selective pressures operating at a localized interindividual/intergroup level may help cultures respond to changes in their physical and social environments, they contend that such microevolutionary forces are more likely to maintain cultural norms and cannot account for major shifts in scale and complexity in cultural evolution (Chatters and Prentiss 2005, p. 48; Rosenberg 1994a, p. 333; Spencer, 1997, p. 226). Cultural evolution, they argue, operates within and across a number of levels—from individuals, to families, to local communities, to regional polities (Rosenberg 1994a, pp. 320–321; Spencer and Redmond 2001, p. 201). It is the combined force of evolutionary processes operating across these levels (especially those that affect higher-order levels above that of competing individuals) that drive major cultural changes in which one cultural bauplan is replaced with another.

Given the different ways in which they define cultural baupläne, it is not surprising that archaeologists working within this paradigm differ in how they characterize the conditions under which new baupläne arise and replace old ones. Chatters and Prentiss (2005, p. 51; Prentiss and Chatters 2003, p. 34), for example, who define baupläne in terms of socioeconomic strategies, maintain that diversification of these strategies and the creation of new socioeconomic baupläne are more likely under conditions of economic opportunity than during periods of stress and heightened intergroup competition. Diversification is especially likely when, in a process analogous to allopatric speciation, there is either geographic or effective isolation from competing populations, conditions that reduce the risk of experimenting with new strategies that deviate from dominant cultural behaviors. Periods of cultural diversification are likely to be relatively short-lived and are usually followed by a period of "culture sorting" (often during periods of environmental downturn) in which new baupläne come into increasing competition with each other and with parent groups, resulting in the decimation (or abandonment) of less fit strategies and the proliferation and co-option of those that are better suited to their natural and social environment (Prentiss and Chatters 2003).

Rosenberg (1994a, 1998), on the other hand, sees cultures as more conservative and resistant to change, with stress (usually demographic) as the major precipitating factor behind culture change. Stress-driven innovations in behaviors that conform to societal norms at any of its three structural levels may well be accepted, especially if these behaviors help the society maintain its structural integrity under stress conditions. New behaviors that violate these norms are more likely to be resisted, even if they may be effective in coping with the proximate source of stress. The degree of resistance to "deviant" behaviors becomes stronger at each higher structural level. Deviant behavioral innovations that help individuals meet localized stresses affecting their day-to-day survival (stresses on its productive capacity or infrastructure) may be adopted if they are perceived to be effective in dealing with the proximate source of stress. This is especially true if these behaviors can be accommodated within both the "structural level" norms that govern its more generalized political or economic workings and the "superstructural level" norms that define its basic conceptual underpinnings or belief systems that, to Rosenberg, constitute the society's bauplan. Adopting such behaviors will not threaten the society's overall form but instead allow it to retain its basic outline despite conditions of persistent stress. On the other hand, behavioral innovations that deviate from the conceptual underpinnings defining the society's superstructure will be adopted only under the most extreme conditions. Adoption of innovative behaviors at this superstructural level usually results in the abandonment of the society's bauplan and the creation or co-option of a new one.

Spencer (1997, p. 239), in contrast, allows that both opportunity and stress are capable of propelling scalar shifts in organization and control within societies, which he believes drive the emergence of new sociopolitical baupläne. Such shifts often arise under circumstances that select for group acceptance of the authority of an individual or group of individuals with proven leadership abilities (e.g., circumscribed contexts [following Carneiro 1970, 1981] prone to frequent and unpredictable warfare [Redmond 1994], or regions with unpredictable rainfall where water management activities that require pooled, coordinated labor may vastly enhance agricultural productivity) (Spencer 1993, p. 48). Leadership shifts of sufficient magnitude to bring about the creation of new sociopolitical baupläne are most likely to arise through a scalar process—"extrapolation"—that comes about when "one unit in a given level begins to assert authority over the others, creating a more inclusive political entity" (Spencer and Redmond 2001, p. 199). Examples of such bauplänal shifts include the transformation of confederated autonomous villages into chiefdoms that arise when previously shared authority over intervillage affairs becomes concentrated within a single village (Spencer 1993, 1997, pp. 238–239). Another happens with the internal differentiation of central authority, a key distinguishing factor that separates state-level baupläne from chiefdom-level ones (Spencer 1990, p. 8; Wright 1977).

All of these researchers subscribe to the basic macroevolutionary principle that evolutionary change from one bauplan to another proceeds as a punctuational process in which periods of rapid transition are followed by long periods of relative stasis (Chatters and Prentiss 2005, p. 50; Rosenberg 1994a, p. 318; Spencer 1990, 1997, p. 237). As in the fossil record, abrupt discontinuities in the archaeological record and the lack of transitional forms between ancestral and descendent cultural baupläne are not, as selectionists hold, artifacts of gaps in the record or the result of inadequate methodologies that emphasize constellations of similar attributes rather than variability among discrete cultural traits (Lyman and O'Brien 1998, p. 627). Instead, the long periods of apparent stasis that separate broadly different cultural forms are real and represent actual times of relative stability as cultures actively preserve basic structural continuity by making small microevolutionary adjustments in response to external and internal pressures (Rosenberg 1994a, p. 333). Periods of major culture change in which new baupläne arise and replace old ones involve dramatic, even revolutionary, restructuring of cultural norms (whether they govern resource management strategies, administrative organization, or belief systems). They are rare and are rarely successful. When they do happen they are likely to occur so rapidly that they may not be evident in the archaeological record.

Another area of general agreement among practitioners of macroevolutionary archaeology is the importance of directed variation in cultural evolution. While cultural selectionists admit that culture change may seem directional, they deny that directionality plays any real formative role in cultural evolution—it "explains nothing" about either the causes or course of culture change (Dunnell 1980; Lyman and O'Brien 1998, p. 621). Macroevolutionary archaeologists disagree, arguing that directionality is a critical element in the evolution of both biological and cultural systems and is especially important to cultural evolution. Directionality in culture change can arise from several sources. First, as in natural systems, the hierarchical nature of culture process that operates simultaneously within and across a number of levels lends an important element of directionality to culture change (Spencer 1997, pp. 231–232). Such hierarchical interactions "reinforce the selection processes operating on each level, adding strength and momentum to directional biases and resulting, eventually, in evolutionary trends that are more driven than passive in character" (Spencer and Redmond 2001, p. 201). Directionality in culture change is also provided by historical contingency (or path dependency) when nonconflicting, but not explicitly adaptive, cultural attributes are carried over from the ancestral form into the descendent form (Rosenberg 1994a, p. 329), a parallel to the structural constraints that shape biological baupläne and lend directionality to the transitions between them. Analogous processes to "exaptation" in which cultural behaviors that had served specific functions in ancestral forms take on new adaptive functions in descendent forms also provide directionality (Spencer 1997, p. 232).

The potential for directed change in cultural systems is greatly, perhaps even exponentially, enhanced over that found in biological systems by the human ability to evaluate outcomes of behavior and to abandon, adjust, or perpetuate behaviors based on this evaluation. This human capacity for conscious decision-making generates new behaviors that are transmitted to others, either through processes of "guided variation," in which consciously created cultural variants are directly passed on through social learning or through various forms of "biased transmission" that determine the range and the faithfulness with which others either accept, reject, or modify new behaviors (Boyd and Richerson 1985; Eerkens et al. 2006; Richerson and Boyd 2005, p. 69; Spencer 1993, pp. 46–47, 1997, p. 239). Macroevolutionary archaeologists maintain that this element of directed human behavior, which allows "human actors to fashion variant forms of cultural behavior—creatively, spontaneously" (Spencer 1998, p. 643), introduces a Lamarkian dimension to cultural evolution that greatly increases the potential for rapid, and radical, directional cultural change (Rosenberg 1990, pp. 399–400, 1994a, p. 313; Spencer 1997, p. 230). These distinctive human modes for the creation and transmission of new behaviors impart entirely new and unique characteristics and capacities to cultural evolution that clearly and definitively distinguish cultural from biological evolution (Boyd and Richerson 1985; Spencer 1993, p. 46). Acknowledgment of the central role of human agency in shaping the course of cultural evolution is a critical component of macroevolutionary approaches to culture change and a primary reason why archaeologists of this school of evolutionary archaeology are more likely to borrow more loosely from evolutionary biology as a source of possible analogous rather than homologous processes of change, supplementing biological principles of evolution with those more grounded in the study of human behavior (Spencer 1997, p. 247).

Explanation of culture change following a macroevolutionary model involves isolating the processes, operating on multiple levels of a cultural system, that are responsible for the abandonment of old cultural behaviors and the adoption of new ones. Acknowledgment of the role of historical and contextual variables that shape the course of change between genealogically linked ancestral and descendent cultural forms is clearly important to an archaeological explanation within this paradigm (Chatters and Prentiss 2005, p. 52). Macroevolutionary archaeologists also are likely to stress the importance of a comparative approach that examines independently evolved but similar cultures. It is only through the comparison of different trajectories of long-term culture change that one is able to distinguish processes that cut across convergent cultural forms (perhaps even leading to the discovery of universal processes in the origin of these forms) from processes that are unique to individual expressions of these forms (Spencer 1990, p. 6, 1997, pp. 233–234).

Macroevolution and the Neolithic Revolution

More than 70 years ago Childe recognized two pivotal periods of revolutionary change in human prehistory—the Neolithic and the Urban Revolutions. These two periods of major transformational culture change have preoccupied archaeologists of all paradigmatic persuasions ever since. The Neolithic Revolution, in particular, has been used to make the case for both macroevolutionary (Bar-Yosef and Belfer-Cohen 1992; Rosenberg 1990, 1994a, 1998) and selectionist (O'Brien 1987; Rindos 1984) approaches to cultural evolution. The past 10–15 years have seen remarkable advances in scientific methods for studying the origins of plant and animal domestication and charting the pace and direction of the development of food-producing economies based on domesticates (see Zeder et al. 2006a, b, 2008). As a result, the empirical record in some areas of the world that witnessed this transition (i.e., the Near East and eastern North America) is well enough known to put to rest two common criticisms often levied against punctuational models: (1) that the apparent moment of punctuational change is an artifact of gaps in the archaeological record, and (2) that it is the result of a faulty cultural typology based on an inadequate understanding of the degree of cultural variability. If the Neolithic Revolution is indeed an instance of rapid, revolutionary change governed by hierarchically directed macroevolutionary forces, the empirical record of this transition in these regions is sufficiently well known to be able to capture and characterize the actual archaeological "moment" of punctuational change that transformed hunter-foragers into agriculturists. The Near East, in particular, as one of the oldest centers of pristine emergence of food production and the heartland for the largest number of plant and animal domesticates in the world, is an ideal case study for bringing together a well-documented empirical record of major cultural change with overarching models of how cultural evolution works.

In outlining the basic components of the Neolithic Revolution, the constellation of constituent components that make up the Neolithic bauplan, it is hard to improve on Childe's initial formulation in *Man Makes Himself* (Childe 1951). While the empirical details that Childe provides have not stood the test of time, his discussion of the basic nature of the Neolithic and its key distinguishing features remains the most thoughtful and complete consideration of this pivotal turning point in human history, encompassing the full range of economic, social, and ideological transformations found in more recent treatments of Neolithic emergence in the Near East (Bar-Yosef and Meadow 1995; Byrd 2005; Cauvin 2000b; Hayden 1995; Kuijt 2000b).

Principal among these features are the *cultivation of plants* and *the herding of animals*. While Childe allowed for independence in the process and timing of both plant and animal domestication (as well as for the persistence of previous foraging and hunting strategies), he held that the presence of a mixed economy based on both farming and herding, arguing from an Old World perspective, is "characteristic of the Neolithic stage wherever it exists" (Childe 1951, p. 66).

The revolutionary impact of food production is responsible, in turn, for an exponential *uptick in population* as children became an important resource in both farming and herding activities (Childe 1951, p. 61). Food production also makes it possible to accumulate surplus, which requires both the creation of receptacles for *surplus storage* and the forethought and planning needed to reserve surplus plant and animal resources and conserve seed stock and breeding pools for future use (Childe 1951, p. 71). While Childe recognized that the adoption of a sedentary way of life is possible without food production (and that food producers may follow quite mobile strategies), he nonetheless held that the *establishment of sedentary communities* was a nearly universal, although perhaps not mandatory or exclusive, characteristic of Neolithic life (Childe 1951, p. 64).

Childe (1951, p. 74) envisioned Neolithic communities as essentially self-sufficient, although he predicted that trade among food-producing communities, especially in nonessential or luxury items, established *communication channels* among Neolithic communities that served a key role in the diffusion of Neolithic lifestyles. He also emphasized the importance of *collective, cooperative efforts* in activities such as clearing and tilling land, nurturing and defending flocks, and manufacturing implements and ornaments (pp. 83–85). These cooperative activities would have found outward expression in social and political institutions, which he predicted were organized around "totemic clans" with no real evidence of chieftainship or substantial wealth differences within groups. The social and political institutions that helped coordinate cooperative activities in Neolithic communities were reinforced by *magico-religious sanctions* (ritual and belief systems) that likely emphasized fertility and magical rites to "assist or compel" forces of reproduction.

On a less abstract level, Childe (1951, pp. 75–80) maintained that certain material correlates were part and parcel of Neolithic society. Chief among these were *ground stone implements*, especially hoes and axes needed to clear forests and till soil. Another universal feature of Neolithic society was *pottery* used in the preparation and storage of cereal foods. To Childe pottery represents the first human foray into changing the chemical properties of physical materials, foundational to the subsequent development of craft activities. The manufacture of textiles was another key component of Neolithic society, which should be signaled by the appearance of *spindle whorls* and other implements used in weaving.

There are, then, ten key features of Neolithic life according to Childe's original and still largely viable vision of the Neolithic bauplan: (1) an agricultural economy based on domesticated plants and animals, (2) exponential population growth, (3) storage of surplus and a system of delayed returns of productive resources, (4) sedentism, (5) trade networks focusing on nonessential items, (6) decentralized social mechanisms for the coordination of collective activities, (7) associated and enabling magico-religious traditions that focus on promotion of fertility, (8) ground stone implements, (9) pottery, and (10) weaving implements like spindle whorls.

This vision encompasses the various recent applications of the term "bauplan" to cultural phenomenon, including elements of Rosenberg's ideational baupläne, Chatters and Prentiss's socioeconomic take on this term, and Spencer's sociopolitical configurations. Childe's original vision, then, serves as a kind of "master" bauplan, a basic blueprint of Neolithic society that contains all of the various components of major culture change featured in recent macroevolutionary models of cultural evolution. It also includes a number of material cultural components that figure so prominently in selectionist evolutionary frameworks. Tracing the timing and context of the appearance of these essential components of the Childean Neolithic bauplan in the Near East, where the record of this transition is most complete, promises some insight into the broader evolutionary context of the emergence of food production as a possible instance of macroevolutionary change in human cultural evolution.

Tracking the emergence of the Neolithic bauplan in the Fertile Crescent

Early work on agricultural origins in the Near East focused on the "hilly flanks" and highland valleys of the Zagros Mountains in the eastern Fertile Crescent (Braidwood and Howe 1960; Braidwood et al. 1983; Hole and Flannery 1967;

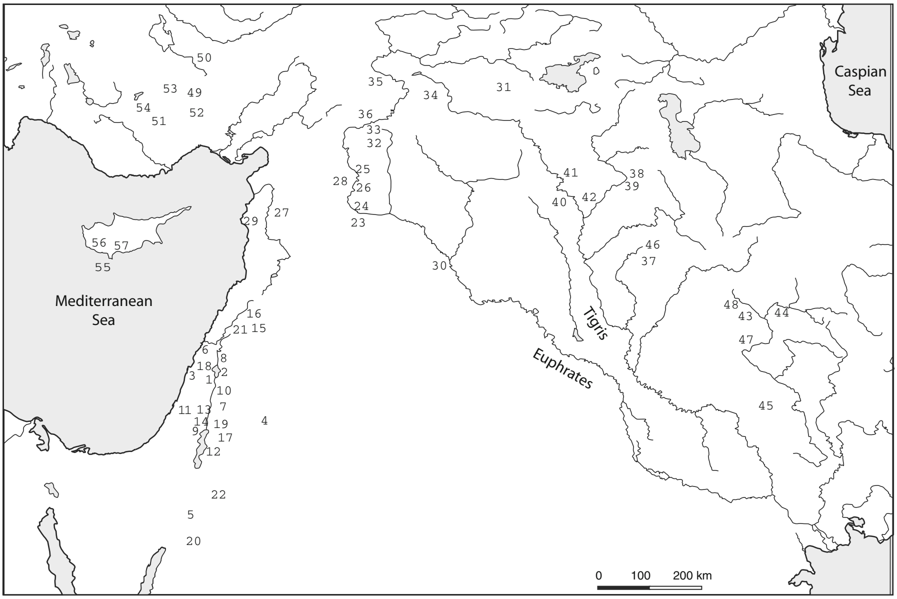

Fig. 1 Map of the Near East showing location of major sites. See Table 1 for names of sites

Hole et al. 1969; Mortensen 1974, 1975; Smith 1972; R. I. Solecki 1981; R. S. Solecki 1965) (Figs. 1 and 2, Table 1). With political events in Iran and Iraq in the 1960s and 1970s, the focus of Neolithic research in the region shifted to the western arm of the Fertile Crescent, especially the Mediterranean coastal belt, the Jordan Valley, and adjacent arid areas in the southern Levant (Bar-Yosef 1982, 1990; Bar-Yosef et al. 1991; Goring-Morris 1987; Perrot 1983). Another areal focus was the northern Levantine steppe region that rolls out from the foothills of the Lebanon, Anti-Lebanon, and Taurus Mountains to the upper Euphrates Valley (Aurenche et al. 1988, 1989; Cauvin 1978; Moore 1991). More recent investigations in the Near East have expanded into the foothills and highlands of the eastern Taurus Mountains of southeastern Anatolia (Hauptmann 1993, 1999; Hours and Copeland 1983; Kozlowski 1999; Rosenberg 1994b; Rosenberg and Davis 1992), central Anatolia (Esin and Harmankya 1999; Özbaşaran 2000; Watkins 1996), and even the island of Cyprus, 60 km from the Levantine coast (Guilaine and Briois 2001; Peltenburg 2003). Comprehensive synthetic treatments of this period provide a remarkably fine-grained view of the trajectory, context, and tempo of the emergence of all of the various components of the Neolithic bauplan across this broad region (e.g., Aurenche and Kozlowski 1999; Bar-Yosef and Meadow 1995; Byrd 2005; Kozlowski and Aurenche 2005; Kuijt and Goring-Morris 2002; Simmons 2007; Swiny 2001). While the emergence of the core features highlighted in Childe's original conception can be traced in the region, one is struck in a review of this vast literature by both the long time span of their emergence and high degree of intra- and interregional diversity in the ways in which they are manifest.

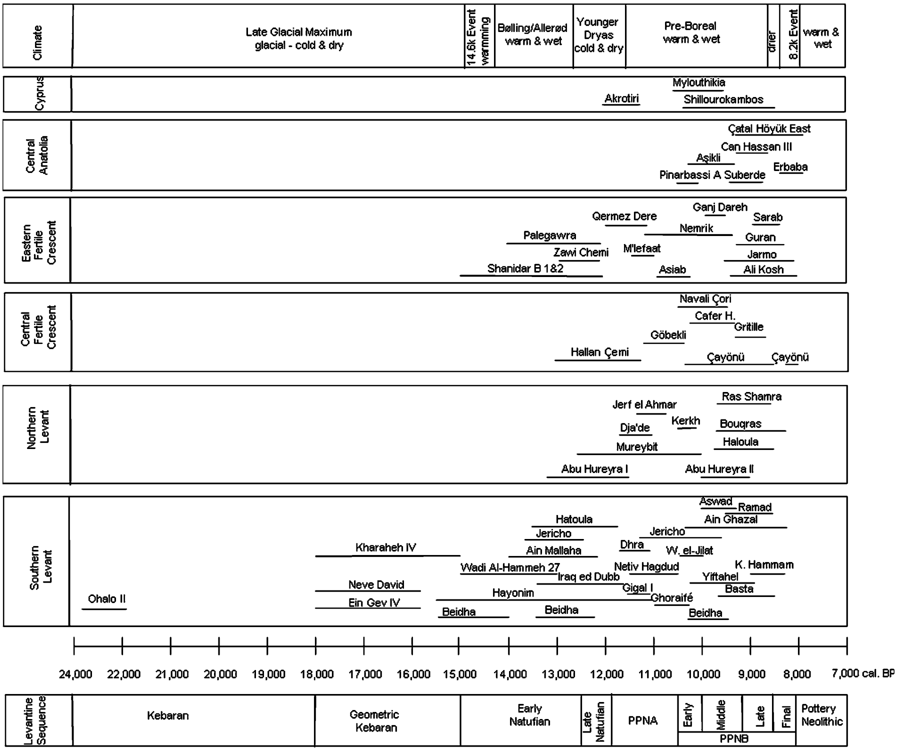

Fig. 2 Timeline of Near Eastern Sites, Levantine chronology, and climatic conditions. Compiled using information from Aurenche et al. (2001), Bar-Yosef and Meadow (1995), Byrd (2005), Kuijt and Goring-Morris (2002), and Nesbitt (2002)

Material constituents

Of Childe's three material culture components, markers of weaving and textile manufacture appeared very late in the emergence of Neolithic societies in the Near East. Spindle whorls appeared in the region only after about 9,500 cal. B.P. and became common in the central and especially the eastern arm of the Fertile Crescent after around 9,000 cal. B.P. (Kozlowski and Aurenche 2005, pp. 31, 258). This is not surprising as the spinning of animal fiber, especially wool, requires considerable genetically driven changes in the coat composition of caprines, changes likely to have emerged as a later part of the domestication process of these animals (Clutton-Brock 1999, p. 75; Ryder 1983). An animal figurine of a sheep with what has been interpreted as a woolly coat (Bökönyi 1977, p. 25), recovered at the highland Zagros site of Sarab (c. 9,000–8,500 cal. B.P.), may be the earliest archaeological evidence for the development of such morphological modification.

Pottery, in contrast, preceded weaving technology by 3,000 years or more. While stone vessels of regionally diverse styles are first seen in the northern Levant and southeastern Anatolia after about 12,000 cal. B.P. (Kozlowski and Aurenche 2005, pp. 25, 167–181), "white ware" vessels made of chalk or gypsum, thought to be the

Table 1 Major Near Eastern sites (from Aurenche et al. 2001; Bar-Yosef and Meadow 1995; Byrd 2005; Nesbitt 2002)

Ref. No.	Site	Region	Modern country	Dates kya cal. B.P.
1	Oahalo II	Southern Levant	Israel	24.0–22.0
2	Ein Gev IV	Southern Levant	Israel	18.0–16.0
3	Neve David	Southern Levant	Israel	18.0–16.0
4	Kharaheh IV	Southern Levant	Jordan	18.0–15.0
5	Beidha Early Natufian	Southern Levant	Israel	15.5–14.0
6	Hayonim Cave & Terrace	Southern Levant	Israel	15.5–11.0
7	Wadi al-Hammeh 27	Southern Levant	Jordan	15.0–13.0
8	Ain Mallaha	Southern Levant	Israel	14.0–12.0
5	Beidha Late Natufian	Southern Levant	Israel	13.4–12.3
9	Jericho Natufian	Southern Levant	Israel	13.7–12.3
10	Iraq ed Dubb	Southern Levant	Jordan	13.2–11.5
11	Hatoula	Southern Levant	Israel	13.7–12.9
12	Dhra	Southern Levant	Jordan	11.6–11.2
13	Netiv Hagdud	Southern Levant	Israel	11.5–10.8
14	Gigal I	Southern Levant	Israel	11.4–11.2
9	Jericho PPNA&B	Southern Levant	Palestine	11.2–9.5
15	Aswad	Southern Levant	Syria	10.5–9.3
16	Ghoraife	Southern Levant	Syria	10.8–10.3
17	Wadi el-Jilat 7	Southern Levant	Jordan	10.5–10.0
18	Yiftahel	Southern Levant	Israel	10.8–8.8
19	Ain Ghazal	Southern Levant	Jordan	10.4–8.2
5	Beidha PPNB	Southern Levant	Jordan	10.2–9.5
20	Basta	Southern Levant	Jordan	9.5–8.7
21	Ramad II	Southern Levant	Syria	9.4–8.6
22	Khirbet Hammam	Southern Levant	Jordan	9.0–8.5
23	Abu Hureyra I	Northern Levant	Syria	13.3–11.5
24	Mureybit Ia-IV	Northern Levant	Syria	12.6–10.0
25	Dja’de	Northern Levant	Syria	11.6–11.0
26	Jerf el Ahmar	Northern Levant	Syria	11.3–10.9
27	Tel Kerkh	Northern Levant	Syria	10.5–10.2
23	Abu Hureyra II	Northern Levant	Syria	10.0–9.0
28	Haloula	Northern Levant	Syria	9.7–8.5
29	Ras Shamra	Northern Levant	Syria	9.5–8.6
30	Bouqras	Northern Levant	Syria	9.5–8.2
31	Hallan Çemi	Central Fertile Crescent	Turkey	13.0–11.3
32	Göbekli Tepe	Central Fertile Crescent	Turkey	11.2–10.5
33	Navali Çori	Central Fertile Crescent	Turkey	10.7–9.7
34	Cayönü Aceramic	Central Fertile Crescent	Turkey	10.5–8.5
35	Cafer Höyük	Central Fertile Crescent	Turkey	10.2–9.5
36	Grittle	Central Fertile Crescent	Turkey	9.5–8.8
34	Cayönü Ceramic	Central Fertile Crescent	Turkey	8.4–8.3

Table 1 continued

Ref. No.	Site	Region	Modern country	Dates kya cal. B.P.
37	Palegawra	Eastern Fertile Crescent	Iraq	16.0–12.0
38	Shanidar B1&2	Eastern Fertile Crescent	Iraq	15.0–12.3
39	Zawi Chemi Shanidar	Eastern Fertile Crescent	Iraq	13.0–12.3
40	Qermez Dere	Eastern Fertile Crescent	Iraq	12.0–11.2
41	Nemrik	Eastern Fertile Crescent	Iraq	11.5–9.2
42	M'lefaat	Eastern Fertile Crescent	Iraq	11.5–11.0
43	Asiab	Eastern Fertile Crescent	Iran	11.0–10.5
44	Ganj Dareh	Eastern Fertile Crescent	Iran	10.0–9.7
45	Ali Kosh	Eastern Fertile Crescent	Iran	9.5–8.0
46	Jarmo	Eastern Fertile Crescent	Iraq	9.5–8.0
47	Guran	Eastern Fertile Crescent	Iran	9.3–8.5
48	Sarab	Eastern Fertile Crescent	Iran	9.0–8.5
49	Pinarbassi A	Central Anatolia	Turkey	10.5–10.2
50	Aşikli Höyük	Central Anatolia	Turkey	10.4–9.4
51	Suberde	Central Anatolia	Turkey	9.6–8.8
52	Can Hasan III	Central Anatolia	Turkey	9.4–8.7
53	Çatal Höyük East	Central Anatolia	Turkey	9.4–8.2
54	Erbaba	Central Anatolia	Turkey	8.6–8.4
55	Aetokremnos	Cyprus	Cyprus	12.0–11.7
56	Mylouthikia	Cyprus	Cyprus	10.3–9.5
57	Shillourokambos	Cyprus	Cyprus	10.2–8.5

precursors of ceramics, did not appear until about 2,000 years later in the region that stretches from the Damascus Basin to the Zagros (Bar-Yosef and Meadow 1995, p. 79; Kozlowski and Aurenche 2005, pp. 26, 182–184). True ceramics crafted from clay are first documented at the site of Ganj Dareh in highland Iran (c. 10,000 cal. B.P.) (Bar-Yosef and Meadow 1995, p. 79; Smith 1976). Undecorated ceramics were quickly joined by painted wares and are found throughout the eastern and central Fertile Crescent, the northern Levant, and the central Anatolian Plateau by about 9,000 cal. B.P., with each broad region displaying highly distinctive stylistic variants (Kozlowski and Aurenche 2005, pp. 32–34, 270–273). Pottery was not used in the southern Levant until sometime later, at about 8,400 cal. B.P. (Aurenche et al. 2001, p. 1198).

Childe's third material component, ground stone tools, are the earliest of the constituent traits to appear in the Near East. Both bedrock and portable ground stone mortars associated with cereal processing were present in the southern Levant as early as 24,000 years ago (Bar-Yosef and Meadow 1995, p. 54; Henry 1989, p. 37; Kozlowski and Aurenche 2005, p. 23). They are ubiquitous in the region, along with various kinds of pestles, querns, stone bowls, small "cup-holes," and hand stones by about 14,000 cal. B.P. (Bar-Yosef 1990; Bar-Yosef and Meadow 1995, p. 57). A full complement of ground stone tools was widespread across the entire arc of the

Fertile Crescent by about 13,000 cal. B.P. (Kozlowski and Aurenche 2005, pp. 23, 145–150). Polished axes and celts were common ground stone tools from the southern Levant to highland Zagros at about 12,000 cal. B.P. (Howe 1983; Kozlowski and Aurenche 2005, pp. 25, 165–166; Solecki, 1981, p. 62).

Far from bursting onto the scene as integrated components of a single Neolithic package, the appearance of the three material culture constituents of Childe's Neolithic bauplan bracket a very long period in the Near East, spanning more than 10 millennia (from roughly 24,000 to 8,400 cal. BP). Childe's other eight components appeared in different ways at different times and places within these widely spaced temporal brackets.

Settlement patterns and human demography

Evidence for three of Childe's primary components—sedentism, surplus storage, and population growth—is present in the relatively abundant data on regional settlement patterns and community plans in the Near East, especially in the southern Levant, where more than 30 years of regional survey and excavation has resulted in the most detailed understanding of settlement patterns and human demography in the entire Fertile Crescent region. While not as extensive, emerging data for other parts of the region echo the general outlines of settlement and population growth in the southern Levant, although with a number of noteworthy variations.

Sedentism and storage

The ground stone mortars that open the long temporal span of Neolithic emergence were used by foraging populations of the Early Epipaleolithic or Kebaran period (24,000–18,000 cal. B.P.), who followed an annual cycle of utilization of plant and animal resources, mostly along the Mediterranean coastal regions of the southern Levant (Bar-Yosef 1990; Bar-Yosef and Belfer-Cohen 1989; Byrd 2005, pp. 253–254). Even during the height of the Late Glacial Maximum (c. 23,000 cal. B.P.), however, small groups of people may have lived year-round in favored locations. Ohalo II, on the shores of the Sea of Galilee in the Jordan Valley, for example, consisted of two or three frequently remodeled and reused small circular brush huts. Archaeobiological remains from the site provide evidence for the utilization of a huge variety of small- and large-seeded wild cereals, legumes, nuts, and fruits, as well as a broad spectrum of animal resources (Nadel 2004; Piperno et al. 2004; Weiss et al. 2004).

With post-Pleistocene climatic amelioration after the Late Glacial Maximum, Geometric Kebaran (c. 18,000–14,600 cal. B.P.) sites proliferated in desertic areas. Middle Epipaleolithic sites in the southern Levant ranged in size from about 1000 m^2 in coastal areas to about 100 m^2 in more arid regions (Bar-Yosef and Meadow 1995, p. 54). During this period people are thought to have followed an annual transhumant cycle, with small, highly mobile groups of probably no more than 10–20 people dispersing into upland areas in the spring and summer and coalescing into larger social units in the autumn and winter. Two favored lowland base camps, Neve David and Ein Gev IV, yielded artifacts associated with plant processing, which implies an emphasis on storable foods (Bar-Yosef 1998; Byrd 2005, p. 254; Henry 1989, pp. 169–170). There is no hard evidence for storage (i.e., storage pits, silos, or bins) at Middle Epipaleolithic sites, although this may be attributable to lack of excavation of broader horizontal exposures or to the use of perishable baskets for storage (Bar-Yosef 1990).

Sedentary communities are clearly evident in the following Early Natufian (c. 14,600–12,500 cal. B.P.) that ushered in the Late Epipaleolithic in the southern Levant. Large (c. 1200 m^2) Early Natufian base camps housing as many as 60 people were generally situated in strategic locations straddling different resource zones (Byrd 2005, p. 255). They usually contain numerous round or oval semisubterranean structures with superstructures of wood and brush, burials, and heavy ground stone implements (Bar-Yosef 1982, 2001a; Bar-Yosef and Meadow 1995, pp. 55–56; Belfer-Cohen and Bar-Yosef 2000; Henry 1989, p. 219). Solid evidence for storage facilities is limited to large base camps, often in the form of circular, paved, binlike constructions (Bar-Yosef 1982, p. 15). At Ain Mallaha, a large base camp near Lake Hulen in the Upper Jordan Valley, plastered pits outside likely house structures are thought to have been used to store perishable plant resources (Bar Yosef 1982, p. 15). Ample evidence for more permanent, if not year-round, occupation of these base camps is provided by the range of seasons represented in subsistence resources and by the presence of commensal animals that exploit the niche created by long-term human habitation (e.g., house mouse, spiny rats, house sparrows, domestic dogs) (Tchernov 1991). Continued mobility and seasonal exploitation of different environmental zones is evidenced by smaller more ephemeral sites radiating from base camps (Henry 1989, p. 219).

The climatic downturn of the Younger Dryas (c. 12,900–11,600 cal. B.P.) that coincides with the Late Natufian in the Levantine sequence saw a return to more mobile strategies, with abandoned Early Natufian base camps often serving as cemetery sites (Bar-Yosef and Meadow 1995, p. 57; Belfer-Cohen and Bar-Yosef 2000, p. 27; Byrd and Monahan 1995, p. 252). Sedentary life was reestablished during the Pre-Pottery Neolithic A (PPNA) period that overlaps with the end of the Younger Dryas and the ensuing amelioration of climatic conditions in the Early Holocene (c. 12,000–10,500 cal. B.P.). PPNA settlements generally were located in well-watered areas in the Jordan Valley (Belfer-Cohen and Bar-Yosef 2000, p. 30) and ranged in size from 2000 to 3000-m^2 "hamlets" to 2.5–3.0-ha "villages," although there also is evidence for special temporary campsites likely used for the extraction of specific resources (Bar-Yosef and Meadow 1995, p. 62). PPNA permanent settlements comprised circular or oval semisubterranean houses similar to earlier Natufian houses, but these houses were more solid, permanent constructions, with at least some superstructures made of mud bricks (Bar-Yosef 1992, p. 34; Bar-Yosef and Meadow 1995, p. 62). Many pits, silos, and bins were located both inside and outside houses at large PPNA sites (Bar-Yosef and Meadow 1995, p. 62). At sites like Netiv Hagdud, located adjacent of a marsh and spring area in the lower Jordan Valley, the presence of seasonally available plant and animal resources, representing at least nine months of the year and an abundance of commensal companions, indicates more or less year-round occupation (Tchernov 1994).

The following Early PPNB period (10,500–10,000 cal. B.P.) marks the beginning of a shift from oval to small-scale subrectangular architecture (Kuijt and Goring-Morris 2002, p. 385). Freestanding, multiroom, rectangular structures, some with two stories and lower floors dedicated to storage and small workspaces, are the norm in Middle PPNB (c. 10,000–9,200 cal. B.P.) villages situated in better-watered parts of the region. These villages average about 3 ha (Byrd 1994, p. 659; Kuijt 2000a, p. 85). Smaller, more ephemeral settlements with small rounded buildings are still found in more arid zones (Kuijt and Goring-Morris 2002, pp. 388–389). During the Late PPNB (9,200–8,700 cal. B.P.) there was a shift in settlement eastward out of the Mediterranean zone, with a number of new sites like Ramad, Basta, and Khirbet Hammam (some as large as 10–14 ha) established in the Mediterranean/desert ecotone of the eastern Jordan Valley. Late PPNB sites also are distinguished by a much greater density of more closely packed, rectangular, often two-story structures that are internally more highly compartmentalized than Middle PPNB structures, with lower stories containing more living space in addition to storage facilities (Kuijt 2000a, p. 81). These villages were largely abandoned in the Final PPNB (or PPNC, c. 8,600–8,200) when more diffuse and less nucleated settlement patterns were adopted in the southern Levant (Kuijt and Goring-Morris 2002, p. 413). The Final PPNB coincided with a period of reduced precipitation from about 8,700 to 8,300 cal. B.P., culminating in another abrupt global pulse of markedly cold and dry conditions at about 8,200 cal. B.P. (Bar-Yosef and Meadow 1995, p. 45; Leuenberger et al. 1999).

While not documented with the same level of detail, settlement patterns outside the southern Levant indicate a similar transition from more mobile hunter-gatherer adaptations to increasingly more sedentary ones. The timing and the context of this transition, however, were quite different. There is little evidence for Epipaleolithic and Early Natufian settlements outside the southern Levant. The few sites that have been documented seem to have belonged to small, mobile, foraging peoples. There is certainly nothing similar to the flourishing Early Natufian sedentary communities of the southern Levant. Moreover, while the Younger Dryas climatic downturn was met by a resumption of more mobile strategies in the southern Levant, in the northern Levant this period was marked by the establishment of the first fully sedentary villages. Village communities like Mureybit and Abu Hureyra 1 in the middle Euphrates Valley are characterized by relatively densely packed round and oval semisubterranean and aboveground brush or reed houses, numerous heavy ground stone tools, and some evidence of storage. Abundant and well-studied plant and animal remains from these sites document a complete seasonal round of resource exploitation and a continued commitment to sedentism (Hillman 2000; Legge and Rowley-Conwy 2000; Moore 1991; Moore et al. 2000; Wilcox 2005). Sedentism is also seen at the upland community of Hallan Çemi in southeastern Anatolia (Rosenberg and Redding 2000), as well as at the roughly contemporary site of Zawi Chemi Shanidar in the highland northwestern and central Zagros (Solecki 1981, p. 66).

Round houses outside the southern Levant also gradually transitioned to rectangular multiroom structures, although there are regional differences in the architectural details of these structures (Kozlowski and Aurenche 2005, p. 32). Storage facilities were incorporated within rectangular houses at a number of sites such as Çayönü in southeastern Anatolia, where it is possible to trace a regular procession of architectural styles from round houses to rectangular houses with different storage configurations (Özdoğan and Özdoğan 1989). The Middle PPNB highland Iranian village site of Ganj Dareh contains four different levels of two-story rectangular houses whose lower stories are thought to have served storage functions (Smith 1990). The timing of the transition from round to rectangular houses also seems to have varied across the region, with perhaps a slightly earlier transition between these architectural styles in the northern Levant and southeastern Anatolia (c. 10,900 cal. B.P.) than in the southern Levant (Kozlowski and Aurenche 2005, p. 32), and an even later transition from round to rectangular houses in the Zagros and on the Anatolian Plateau (around 10,000 cal. B.P.) (Bar-Yosef and Meadow 1995, p. 61). Colonizing populations from the coastal Levant that began to settle on Cyprus at about 10,500 cal. BP, however, never made the transition at all and retained round houses throughout the Neolithic (Peltenburg 2004).

While survey coverage over this large region is poor, there also appear to be significant differences in site density and commitment to sedentism across the region. People in the Zagros, for example, are thought to have persisted in a vertical transhumant seasonal round following ripening stands of cereals and migrating herds of wild sheep and goats in this rugged terrain, even after the establishment of more permanent settlements (Hole 1987, 1996).

Population growth

Estimating the rate and amplitude of population growth from archaeological data is never easy, although once again the more complete record from the southern Levant gives us greater insight into population trends than is possible for other parts of the Near East. In one of the more systematic demographic studies of this region, Henry (1989, 2002) combined four different sets of data—site density, site size, artifact density, and thickness of cultural deposits—to monitor Epipaleolithic population trends in the southern Levant. Contrary to some models that interpret the reduction of site density from the Geometric Kebaran into the Early Natufian as a sign of population decrease just prior to the adoption of more sedentary lifestyles (Bar-Yosef and Belfer-Cohen 1989; McCorriston and Hole 1991), Henry (1989, 2002, p. 23) argues that the marked increase in site size, artifact density, and thickness of cultural deposits of Early Natufian settlements suggests instead that there was a steady, if not significant, increase in population during that time, followed by some decline in population with the onset of the Younger Dryas during Late Natufian times.

Kuijt (2000a; Kuijt and Goring-Morris 2002, p. 424) has used settlement size and the density of occupation in the southern Levant to track population trends in the region from the Late Natufian through the terminal PPNB. Against the backdrop of a gradual but steady increase in the number of settlements over this period, he found a similarly gradual increase in settlement size and density of occupation from the Late Natufian through the Middle PPNB, with an exponential jump in both measures in the Late and Terminal PPNB that crashed in the ensuing PNA (Pottery Neolithic A) at about 8,300 cal. B.P.

Estimating population trends is more difficult outside the southern Levant, especially during the early parts of the developmental sequence before the establishment of sedentary communities. The dearth of information for these regions in large measure is the result of the sporadic application of systematic settlement survey and to the loss of sites in alluvial areas due to sedimentation. The data that are available across this broad territory indicate a similar steady, although slow growth of human population, with a steeper increase in population levels toward the latter part of the sequence from about 9,500 to 9,000 years ago (Hole 1990a, b; Hole and Flannery 1967; Mortensen 1974, 1975; Özbaşaran and Buitenhuis 2002; Özdoğan 2002). Overall population levels were almost certainly lower in areas outside the Levantine Corridor, with possibly relatively "empty" areas separating settlement zones in the southern and northern Levant, southeastern Anatolia, central Anatolia, and the Zagros (Kozlowski and Aurenche 2005, p. 85).

Social aspects of the Neolithic

Archaeological signatures of social aspects of the Neolithic are harder to decipher than settlement patterns and population dynamics. Recent years, however, have seen a proliferation of studies that use the rich archaeological record from the Near East to explore these dimensions of emergent Neolithic society (e.g., Bar-Yosef and Belfer-Cohen 1989; Byrd 1994, 2005; Cauvin 2000a, b; Hodder 2001; Kozlowski and Aurenche 2005; Kuijt 2000b; Kuijt and Goring-Morris 2002). This work gives special insight into the emergence of three additional elements of the Childean Neolithic bauplan that focus on social organization, religion, and the diffusion of Neolithic culture through interregional contact. The wealth of information on household form and community plans available for the region, in particular, have direct bearing on the evolution of corporate communal leadership. The emergence of a reinforcing religious ideology is attested in the rich record of ritual activity, especially that connected with burial ritual, and in the abundant magico-religious symbolism expressed in the varied portable and architectural art found throughout the region. The development of interregional communication networks that linked Neolithic communities and spread the Neolithic way of life outside its original heartland region can be traced through an evaluation of cross-regional similarities and differences in material culture and in the distribution of exotic trade goods across the region.

Household and community level organization

In one of the earliest attempts to examine change in social organization during the Neolithic transition in the Near East, Flannery (1972a, see also 1993, 2002) argued that the transition from round to rectangular residential architecture signaled a major shift in household organization and kinship relations. Drawing from ethnographic analogy with modern African pastoralists (Naroll 1962; more recently in Flannery [2002, p. 420] with African hunter-gatherer groups), Flannery posited that the early compounds of circular buildings represented patrilineal, polygynous extended families, with each building occupied by one or two people (i.e., a man and one of his wives). The later rectangular architecture was consistent with the housing of monogamous nuclear families of three of four people, with the even later combination of rectangular structures into multiroom units seen as compounds housing extended families. The most important change in household-level social organization, according to Flannery, was the shift in the placement of storage structures from exterior to interior locations that seems to accompany the change in household architecture. The placement of food storage facilities in interior contexts, he argued, marked a fundamental change in social organization from one in which risk is assumed at the level of the group and resources are communally pooled and shared to one in which risk is assumed at the level of the individual or the nuclear family and storage is privatized within households (Flannery 1993, pp. 110–111, 2002, p. 421).

Bryd's (1994, 2005) subsequent interpretation of this architectural transition led him to conclude that both earlier round and later rectangular structures were inhabited by nuclear family households and that single-family households persisted up through the PPNB in the southern Levant. He attributes the shift to larger, rectangular houses in the Early PPNB not to a change in household composition or size or to a change in kinship organization, but rather to an increase in the formalization of internal space used for domestic activities, storage, and production. But like Flannery he emphasizes the importance of developing notions of ownership over productive resources and resultant increases in individual household autonomy as primary factors driving changes in household form and organization (Byrd 2000). Kuijt (2000a) sees the Late PPNB increase in housing density, internal compartmentalization, and use of vertical space as indicative of an intensification of this inward focus of households striving to maintain a sense of privacy and control over resources. He also characterizes the compression of Late PPNB communities at that time as an indicator of mounting "social crowding" and social stress.

Evidence of community-level organization, on the other hand, suggests that there was a concurrent effort to promote community cohesion, perhaps as a way of counterbalancing the centrifugal tendencies of the progressive increase in household autonomy and privatization of control over vital resources seen across the region. Architectural evidence of suprahousehold community organization can be traced as far back as Early Natufian Ain Mallaha, where a large structure with a plastered and painted red bench is thought to have served a nondomestic function in promoting community cohesion (Byrd 1994, p. 659). Elements of community-level organization are more clearly seen at the Late Natufian site of Hallan Çemi (c. 12,500 cal. B.P.) in southeastern Anatolia in the existence of two (perhaps three) large semisubterranean structures, at least three times the size of other structures at the site, with specially prepared floors, benches, a lack of evidence for domestic activities, and intact curated animal crania that may have hung on the walls. The placement of several neatly aligned sheep skulls in an outdoor central area of the site is interpreted as some kind of "public act," as is the possible evidence of communal feasting at the site (Rosenberg and Redding 2000). Feasting also may be evidenced at contemporary Zawi Chemi Shanidar in a large mass of animal bones located outside a round structure containing the skulls of at least 15–20 sheep and goats and the wing bones of a number of large raptors, which may have been used as ritual paraphernalia (Solecki 1981, pp. 53–54; Solecki and McGovern 1980).

The best-known example of early communal activity in the Near East is the construction of a large stone wall and tower by inhabitants of PPNA Jericho (c. 11,000 cal. B.P.). While early interpretations awarded these large stone structures a defensive function (Kenyon 1957), the absence of other such "fortifications" in other PPNA sites has lead Bar-Yosef to conclude that the walls were built to divert seasonal flash floods. He also suggests that the tower, which at one point served as a repository for collective burials, functioned as a community shrine (Bar-Yosef 1986), providing a ritual focal point to the community that invested so much labor in its construction (Bar-Yosef 1986; Bar-Yosef and Meadow 1995, p. 63; Kuijt and Goring-Morris 2002, pp. 373–376). Additional architectural evidence of communal activity is found in the Euphrates Valley sites of Göbekli Tepe and Navali Çori, occupied over the course of the PPNA to the Middle PPNB (c. 11,000–9,500 cal. B.P.), in the large, symmetrically arranged, T-shaped stone monoliths decorated with bas-relief images of animals (snakes, foxes, aurochs, gazelle, boars, caprines, large felids, various bird species) that clearly served as a site of communal/ritual activities (Schmidt 1995, 2000).

Special-purpose constructions, of varying form and elaboration, are found throughout the region in the PPNB, often in separate spaces that appear to have been dedicated to "cultic activities." Cultic community-building functions, for example, have been ascribed to the clearly nondomestic buildings found in each subphase of the occupation of Çayönü (Özdoğan and Özdoğan 1989) in southeastern Anatolia, as well as to the Middle PPNB public buildings at Beidha (Byrd 1994) and the Late PPNB "shrines" at Ain Ghazal (Rollefson 2000) in the southern Levant. The possible "cult buildings" at Early to Middle PPNB Aşikli Höyük in central Anatolia (Esin 1998) are posited to have served a similar function in promoting community cohesion. On the other hand, new excavations at Late PPNB Çatal Höyük have failed to find clear evidence of extra-household "cultic buildings." Instead, evidence of household rites and rituals is found within most domestic households, suggesting a much more diffusely organized community structure (Asouti 2006). Despite variations in mechanics of community cohesion throughout the region, the regularity in house size and the generally widespread evidence of community-level social and ritual activity at essentially all sites, large and small, lead Hole (2000) to conclude that PPNB settlements were essentially self-contained independent communities in which highly autonomous households were bound together by community-level social events and ritual.

Ritual and iconography

Ritual activity, most clearly indicated in burial practices, reinforces the impression that emergent Neolithic societies of the Fertile Crescent were working to find ways to promote community cohesion in the face of growing household autonomy. For the most part, the highly mobile Middle Epipaleolithic (Kebaran age) people left little in the way of evidence of explicitly social acts or burial ritual (Nadel 1995). The more permanent settlement of Ohalo II, however, yielded a single adult male burial in an apparently prepared and partially stone-marked grave. Excavators also found an enigmatic alignment of stones under the floor of one hut that seems to mimic the form of the human burial, which is interpreted as a symbolic, socially oriented ritual act (Nadel 2006). Another possible Kebaran-age burial comes from the site of Kharaneh IV in the east Jordan desert (Muheisen 1988), where two individuals were found buried under a living floor with stones placed over the head and legs of one individual.

Permanent Early Natufian settlements yield a wealth of data on ritual behavior in the hundreds of burials, often collective, dug into deserted dwellings and areas outside of houses (Bar-Yosef and Meadow 1995, p. 56). Decoration of bodies with dentalia shell and bone bead ornaments is common in Early Natufian burials, although there is no apparent social or gender differentiation in burial treatment (Belfer-Cohen 1995; cf. Wright 1978). In a comprehensive review of Natufian burial practices, Byrd and Monahan (1995) conclude that the distribution of grave goods, body placement, and burial architecture in Early Natufian sites suggests horizontal, not vertical, differentiation of individuals. Instead of ascribed status differentials between different kin groups, these burial practices reinforce affiliations between different age grade and sex distinctions that cut across kinship distinctions and promote community cohesion (Byrd 2005, p. 257; Byrd and Monahan 1995, p. 283).

Decorated burials disappeared in the Late Natufian when more highly mobile people returned to former Early Natufian base camp locations to bury their dead, often in individual graves as secondary burials, sometimes with skull removal (Bar-Yosef and Meadow 1995, pp. 56–57; Belfer-Cohen 1995, p. 15). To Byrd and Monahan (1995, p. 283) the lack of grave goods in Late Natufian burials serves to emphasize similarities between individuals, while, at the same time, the individual burials and especially the practice of skull removal signal emergent notions of individual leadership.

The primary burial of unornamented bodies, with no accompanying grave goods, and the secondary removal of the skulls of selected adults continued into the subsequent PPNA, often with the reburial of skulls in extra-household, more public locations (Kuijt and Goring-Morris 2002, pp. 376–377). This practice intensified over the course of the PPNB, which saw a dramatic increase in secondary mortuary practices and large-scale caching of the skulls, sometimes decorated with plaster, paint, and shells to reconstruct faces. These burial practices are echoed in other likely PPNB ritual acts like the creation of large plastered and painted human figures at Ain Ghazal (Rollefson 2000), the carving of limestone masks, the decapitation or mutilation of anthropomorphic figurines, all carefully buried, often in public contexts (Kuijt 2000c, p. 151). While the selective removal and decoration of skulls of certain adults may be indicative of some sort of differentiation based on role or status, Kuijt (2000a, c; Kuijt and Goring-Morris 2002) argues that the lack of differentiation of individual burials and the apparently public nature of caching of skulls and other human representational art suggest a social system that seeks to minimize the differences between households, while emphasizing a collective community ethos built around lineage lines and shared leadership among households.

Many of these themes are apparent in ritual practice outside the southern Levant, although there are important variations in the context, style, and, most likely, in the nature of ritual practice across this broad region. The “skull building” at PPNB

Çayönü, for example, is a necropolis containing remains of some 300–400 individuals and up to 90 disarticulated skulls, with some indication of animal and perhaps human sacrifices (or postmortem dismemberment) (Hole 2000; Özdoğan 1997). While these practices are quite different in detail from those in the southern Levant, they were still likely directed at providing special community focus on the veneration of collective ancestors. Another reinterpretation of common ritual themes comes from Late PPNB Çatal Höyük where a plastered and painted skull was placed in the arms of a female buried in the foundation of a building (the only such skull found in central Anatolia). This skull is interpreted as having belonged to a revered household ancestor, or lineage leader (Andrews et al. 2005). The nonpublic placement of the burial of this skull also is seen as reinforcing the household-level ritual focus at the site that apparently lacks evidence of corporate ritual or civic leadership (Asouti 2006).

Iconography in both portable and stationary art provides a window into the ideological systems and views of the cosmos of people coping with a changing world. Small portable clay or stone figurines that may have been vehicles of magic or charms (Ucko 1968; Voigt 2000) are particularly instructive in this regard. Of special significance are female figurines or clay objects emphasizing fecundity and reproduction, often with realistically rendered breasts and sexual organs, that appear in number in the PPNA (c. 12,000–10,500 cal. B.P.). These ubiquitous figurines mark a radical departure from earlier Natufian figurative art (and by extension ritual symbolism) that was dominated by representations of animals or genderless humans (Bar-Yosef and Meadow 1995, p. 64; Kuijt and Goring-Morris 2002, p. 377). While female figurines were present across the Fertile Crescent at that time (and later), there is a great deal of regional variation in posture, ornamentation, and style of female representation (Kozlowski and Aurenche 2005, pp. 28–29, 208–217). Moreover, although much has been made of the ascendancy of the "mother-goddess" symbols during the PPNA and the later rise of bull symbols in the PPNB (Cauvin 2000a, b), there also is ample representation of male and genderless imagery in portable art, as well as continued representation of a wide variety of animal species (caprines, dogs, pigs, birds, etc.) (Kuijt and Goring-Morris 2002, p. 377; Wright 2001).

While certain symbolic elements recur in both portable and nonportable art across the Fertile Crescent over the course of the PPNA to PPNB (female figurines, bull representations and bull crania set into architecture, snakes and birds of prey in glyptic art and wall murals), there are considerable regional differences in the ways in which these symbols were used that likely underscore regional variation in ideological systems. Sites in the central Fertile Crescent, in particular, with their distinctive megaliths and figurative art, are argued to have shared a common symbolic system, and possibly a common language, distinct from that of people in the southern Levant, eastern Zagros, and central Anatolia (Kozlowski and Aurenche 2005; Stordeur 2004).

Interregional communication

Regional differences and similarities in artifact types, house forms, ritual practice, and iconography can, in turn, be used to trace the outlines of interregional communication over this long transitional period. The general pattern across the Fertile Crescent is one of increasingly more finely drawn territories, crosscut by increasingly more active and far-reaching long-distance trade. Lithic industries reaching back into the Late Pleistocene define three very broad interaction spheres among mobile hunter-gatherers in the Fertile Crescent: one in its western arm (a Levantine interaction sphere), another in its eastern arm (an Iraqo-Iranian sphere), and another across its far northern valleys (the southernmost extension of a Caucaso-Caspian sphere) (Kozlowski and Aurenche 2005, p. 65). There are signs of increasing territoriality in the Levantine sphere during the Middle Epiplaeolithic as reflected by the style of chipped stone tools and in the distribution of trade goods like marine shell beads. Byrd (2005, p. 254) has linked this process of regionalization to both growth of population and more restricted movement of hunter-gatherers focused on more localized productive resources.

Over the course of the Natufian and through the PPNA, one can see a continuing process of increasing localization in many elements of material culture across the Fertile Crescent. At the same time there is evidence of interregional linkage in the exchange of traceable trade items like marine shells, exotic stones, and Anatolian obsidian (Bar-Yosef and Meadow 1995; Bar-Yosef Mayer 2000; Kozlowski and Aurenche 2005; Kuijt and Goring-Morris 2002). The PPNB witnessed a considerable expansion and elaboration of trade and interregional connection into what has been characterized as a vast social and economic interaction sphere spanning the entire Fertile Crescent (Bar-Yosef and Belfer-Cohen 1989).

Childe saw the creation of such communication networks as the primary mechanism responsible for the diffusion of components of the Neolithic into ever-widening territories outside the area of its origin. This diffusionist view is very much alive in current interpretations of the Near Eastern Neolithic. Belfer-Cohen and Bar-Yosef's PPNB interaction sphere (Bar-Yosef 2001b; Bar-Yosef and Belfer-Cohen 1989), for example, is sometimes, though not entirely accurately, characterized as a southern Levant-centric diffusionist vision that holds the region responsible for the origin and spread of the Neolithic way of life to the rest of the Fertile Crescent (Gebel 2002, 2004; Watkins 2003). A decidedly more hegemonic diffusionist model was proposed by Cauvin (2000a, b) who maintained that two transformative psychocultural pulses emanating out of the northern Levant were responsible for spreading the Neolithic Revolution throughout the Near East and beyond. The first took place during the PPNA, spearheaded by "mother-goddess"-inspired evangelists who carried notions of human dominance over nature, rectangular houses, plant cultivation, and other northern Levantine customs into both the western and eastern arms of the Fertile Crescent. This was followed in the PPNB by an even more aggressively expansionist pulse of farmers and herders who, inspired by a newer bull deity and associated symbols of virility and male dominance, carried their culture not only throughout the Fertile Crescent but onto the central Anatolian Plateau and beyond.

A similar regional dominance, expansionist model centers on the region situated between the upper Euphrates and Tigris River valleys (Kozlowski and Aurenche 2005). Kozlowski and Aurenche (2005) use the distribution of a wide array of artifact types and architectural styles to define a number of highly localized interaction zones that developed across the Fertile Crescent from the Late Paleolithic to the Final PPNB. These local traditions were eventually replaced, or at least overlain, by the widespread diffusion of "culturally superior" socioeconomic traditions arising in the late PPNA/Early PPNB out of a proposed "Golden Triangle" region situated between the upper Euphrates and Tigris River valleys at the apex of the Fertile Crescent.

There has been considerable critique of these expansionist models, with a number of researchers recently endorsing a more polycentric view of a PPNB world made up of fragmented distinct local cultures that both evolved and remained relatively independent of one another (i.e., Gebel 2002, 2004; Rollefson 2004; Rollefson and Gebel 2004). Clearly, any perceived "Levantine primacy" aspect of Bar-Yosef and Belfer-Cohen's original concept of a PPNB interaction sphere is no longer supported with the wealth of new data from outside the southern Levant. Yet the explosion of trade goods across the region at that time, the spread of tool types and other elements of domestic technology (including plant and animal domesticates), and the repeated reiteration of various elements of social and religious behavior seen across the Fertile Crescent in the PPNB still support the existence of some kind of panregional social, economic, and ideological interaction sphere into which local communities subscribed, selectively adopting foreign elements that they tailored to meet localized needs (Asouti 2006).

Domestication of plants and animals and the establishment of agricultural economies

The final and central component of the Neolithic bauplan, the domestication of plants and animals and the development of agricultural economies in the Near East, has received the most attention over the years. Beginning with Braidwood's interdisciplinary archaeological investigations more than 50 years ago, documenting the domestication of plants and animals and tracing the emergence of agricultural economies based on domesticates have been subjects of widespread interest and intense scholarly activity. In particular, the last decade or so has seen remarkable advances in our understanding of this process in the Near East, thanks in large measure to the development of breakthrough analytical methods for detecting and dating the process of plant and animal domestication (discussed in Zeder et al. 2006a, b). A critical step in the process of the study of plant and animal domestication is identifying clearcut markers that can be explicitly and unequivocally tied to the selective pressures placed on plants and animals undergoing domestication (Zeder 2006a; Zeder et al. 2006c). Recent efforts have focused in particular on reevaluating the efficacy of traditional markers of domestication and in the development of new more powerful markers. This work is not only rapidly transforming our understanding of the process of plant and animal domestication in this region, it has also caused a reconsideration of the very concept of domestication and the relationship between domestication and agricultural emergence.

Domestication of plants

In plants, selective pressures set in motion by the process of domestication tend to operate directly on morphological characteristics (Smith 2006). Deliberate sowing of harvested and stored seeds of annual plants, for example, results in a number of coevolutionary responses in plant germination timing and speed and in dispersal mechanisms—a process that has been called the "adaptive syndrome of domestication" (Smith 2006, p. 18). These adaptations to the new selective pressures introduced by human intervention find morphological expression in features like seed size, seed coat thickness, and seed-head architecture (Heiser 1988; Smith 2001a, 2006) that can be used as markers of ongoing plant domestication. The transition from a brittle grain head that shatters on contact to one that stays intact upon harvesting (a feature selected for once people began to replant harvested cereals) is one of these "automatic" adaptations that represent the unintended consequence of deliberate human harvesting and planting. Readily observable in grain chaff fragments recovered from archaeological sites, the transition from brittle to tough rachis has long been an industry standard in marking cereal domestication in the Near East (Helbaek 1959, 1969; van Zeist 1976). This was the standard used when the discovery of tough domestic-type rachis fragments within a large bin of mostly wild barley at the PPNA site of Netiv Hagdud in the lower Jordan Valley was originally interpreted as the earliest evidence of cereal domestication in the Near East (Bar-Yosef and Kislev 1989). Subsequent research, however, has shown that the low percentage of tough rachis chaff fragments in this sample (around 4%) is consistent with modern wild stands of barley in which this "domestic" feature is found in low frequencies (Kislev 1989, 1997). It is unclear, then, whether the few domestic morphotype grains among the thousands of wild barley grains recovered from Netiv Hagdud represent an early stage in the cultivation of domestic cereals (Zohary 1992) or the intensive collection of wild cereals (Kislev 1997). Another claim for PPNA cereal domestication was based on more securely identified domestic barley and emmer wheat chaff recovered from what were thought to be PPNA levels at the site of Aswad in the Damascus Basin (van Zeist and Bakker-Heeres 1982). Recent redating of these levels, however, pushes forward their date to the Early PPNB (after 10,500 cal B.P.) (Stordeur 2003, 2004; Wilcox 2005, p. 535).

A number of grain and chaff fragments of domesticated cereals (including various varieties of wheat, barley, and rye) were recovered from the Abu Hureyra I, raising the possibility of Late Natufian cereal domestication in the northern Levant (Hillman 2000). Most of these fragments, when directly dated, were found to be intrusive from higher levels dating to about 9,500–9,000 cal. B.P. However, four grains of rye (identified as domestic by Hillman) were directly dated to between 13,000–12,000 cal. B.P., and so may represent the earliest morphologically altered domesticated cereals in the Near East. Hillman admits that as with nonshattering domestic-type rachises, larger grains consistent in size with domestic grains also may be found in low numbers in the wild (Hillman 2000, p. 382). Still, he defends the domestic status of the rye at Epipaleolithic Abu Hureyra based on the low probability of the recovery of these infrequent mutant forms in archaeological contexts (Hillman 2000, p. 382). If rye was domesticated at Abu Hureyra at this early date, it did not have a lasting impact. Domestic rye does not appear again in the archaeological record in the Near East for another 2000 years (at the site of Can Hasan III in southeastern Anatolia [Hillman 1978]) and never seems to have become a major component in cereal grain agriculture in the Near East (Weiss et al. 2006). Unlike founder crops such as wheat, barley, and lentils that arose in the Near East, modern domestic rye traces its heritage to wild European rye (Zohary and Hopf 2000).

In a reconsideration of the evidence for Near Eastern cereal domestication, Nesbitt (2002) takes a critical look at the criteria that have been used to identify and date domestic cereals from sites across the Fertile Crescent. He rejects essentially all evidence for cereal domestication prior to the end of the PPNA at 10,500 cal. B.P. as either too poorly documented or too poorly dated. There is, he believes, well-dated and securely identified evidence of cereal domestication in subsequent Early PPNB sites in southeastern Anatolia such as Navali Çori, Cafer Höyük, and possibly Çayönü, which yielded abundant chaff and grain samples of domestic emmer and einkorn wheat. Nesbitt's cautious reading of the archaebotanical record also leads him to conclude that there is no firm evidence of barley domestication until the Middle PPNB (c. 10,000 cal. B.P.) when clearly domestic two-row barley is found throughout the Fertile Crescent and on the Anatolian Plateau. The Middle and Late PPNB also saw the development of various forms of free threshing of wheat and barley (Nesbitt 2002). Tanno and Wilcox (2006b) have shown that the increase in the proportion of tough rachis grains in cereal occurred very gradually. Tough rachis grains constitute only about 10% of the einkorn at Navali Çori (c. 10,200 cal. B.P.), at Aswad (c. 10,000–9,500 cal. B.P.) they make up 35% of the einkorn recovered, and comprise more than 50% of the einkorn recovered at Ramad (c. 9,500–8,500 cal. B.P.). Interestingly, domestic emmer, einkorn, and barley have been reported from Early PPNB levels (c. 10,300 cal. B.P.) at Mylouthikia in western Cyprus, where neither einkorn nor emmer is endemic (Colledge 2004; Murray 2003a; Wilcox 2003a), although it is not clear whether these cereals have been directly dated.

Drawing from both archaeobotanical data and recent genetic studies of founder crops and their progenitors, Wilcox (2002, 2005) concludes that different cereal crops were likely domesticated in different parts of the Fertile Crescent, some of them multiple times. Until recently it was thought that both archaeobotanical and genetic evidence pointed to a single domestication of einkorn in southeastern Anatolia. The earliest well-documented, domestic, single-grained einkorn comes from Navali Çori (Pasternak 1998), located about 150 km for the "ground-zero" region for einkorn domestication as initially predicted by genetic data (Heun et al. 1997). The discovery of domesticated two-grained einkorn at later sites in northern Syria (van Zeist and Waterbolk 1996; Wilcox 2003b) and a recent reevaluation of genetic evidence (Kilian et al. 2007), however, suggest multiple einkorn domestication events within the north-central Fertile Crescent natural habitat for wild einkorn. Genetic analysis puts barley domestication in the southern Levant (Badr et al. 2000), which corresponds well to the long history of wild barley exploitation in the region stretching back into the Epipaleolithic. Archaeobotanical evidence also suggests that the Zagros served as an independent center for the domestication of a variety of barley (Wilcox 2002, p. 137)—a conclusion supported by a recent genetic study indicating the existence of a second, eastern center of barley domestication (Morrell and Clegg 2007). The archaeological record points to the Northern Levant as the site of initial emmer domestication, with perhaps an independent domestication in the southern Levant (Wilcox 2002, 2005). Genetic data indicate a geographic origin for emmer domestication in southeastern Anatolia (Ozkan et al. 2002; Salamini et al. 2002).

Evidence for the domestication of noncereal crop plants like pulses is less clear. Although the lentils recovered from PPNA deposits at Netiv Hagdud and Jerf el Ahmar show no obvious morphological change expected with domestication, Weiss et al. (2006) argue that these plants had already undergone the first of two critical stages in lentil domestication—the loss of seed dormancy. Specifically, they maintain that the exceptionally high rate of seed dormancy in wild lentils and their low yield make it unlikely that inhabitants of these sites could have collected the large numbers of lentils recovered by archaeologists (267 at Jerf el Ahmar and 205 at Netiv Hagdud) unless lentils were already under cultivation. Genetic evidence points to the initial domestication of lentils somewhere in southeastern Turkey or northern Syria (Ladizinsky 1989), suggesting to Weiss et al. that this first step toward lentil domestication occurred somewhere near Jerf el Ahmar, with cultivated lentils quickly spreading down the Jordan Valley to the area of Netiv Hagdud. Weiss et al. (2006) further argue that the huge 1.4 million seed cache of lentils recovered from the Late PPNB site of Yiftah'el in northern Israel suggests that by 8,800 cal. B.P. lentils had achieved the second stage in their domestication—the loss of pod indehiscence that ensures that pods will not shatter on contact.

Tanno and Wilcox (2006a) argue that the 138 charred chickpeas recovered at Tel Kerkh (c. 10,200 cal. B.P.) in northwestern Syria represent an early stage in the domestication of that Near Eastern staple. While these seeds do not exhibit a clearcut domestic morphology, their high degree of morphological variability and the rarity and sparseness of wild chickpea stands (more than 260 km distant today) suggest that these plants were imported to the site and were undergoing cultivation. Again, the archaeological evidence receives support from genetic evidence. DNA evidence indicates that the variety of wild chickpea most closely related to modern domesticated chickpeas is located at the far western end of the plant's current distribution (Sudupak et al. 2004), the closest wild variety to Tel Kerkh. The 437 faba beans recovered from this site might also represent early attempts at domesticating that crop (Tanno and Wilcox 2006a). However, since the wild progenitor of the faba bean is unknown, it is difficult to say whether the small nondomestic morphotype found at Tel Kerkh represents a transitional form between wild and domestic faba beans or whether it is in fact the ancestral wild variety that was, at the time, growing naturally around the site. The discovery of 2750 faba beans of similar morphology from a Late PPNB context at Yiftah'el (Garfinkle et al. 1988) and the fact that faba beans consistent with large-seeded modern domestic varieties are not recovered until about 1000 A.D. suggest that these early beans were likely cultivated crop plants (Tanno and Wilcox 2006a, p. 203).

The recent discovery of parthenocarpic figs at Gigal I in the lower Jordan Valley, dated to between 11,400 and 11,200 cal. B.P., is argued by Kislev et al. (2006a) as evidence that the earliest domesticated plant was not a cereal grain or a pulse but a fruit tree. Parthenocarpic figs are a mutant variety of wild figs in which the fruit is no longer insect pollinated and, as a result, is retained on the tree longer than fertilized fruit. Longer retention allows the fruit to become soft and sweet and therefore more desirable for consumption. Since these fruit are unfertilized and do not produce seeds, they cannot reproduce independently, but are instead reliant on humans for their propagation by vegetative cloning. The processes of cloning these trees is not as difficult as it is in later tree domesticates like olives or dates, which require grafting. Instead, this shrubby pioneer plant can be easily grown simply by replanting cut branches, a type of vegetative cloning that Kislev et al. (2006a, b) contend is a form of domestication. Lev-Yadun et al. (2006a) have subsequently argued, however, that since parthenocarpy is also found in wild female fig trees, which produce both seeded and unseeded figs, the seedless figs found at Gigal may well represent selective harvesting of these sweeter fruits from wild trees (see also Denham 2007). Kislev et al. (2006b) discount this possibility, pointing out that all nine carbonized figs from Gigal and 313 single drupelets (small parts of aggregate fruit) represent parthenocarpic figs. No seeded figs were recovered from the site as would be expected if people were collecting figs from wild plants with only a preference for parthenocarpic varieties. The fact that both parthenocarpic and seeded figs are found at nearby contemporary Netiv Hagdud, however, suggests to these researchers that wild figs were indeed being utilized as well during these initial stages of fig domestication. If truly the results of vegetative cloning, these figs underscore the degree to which humans were knowledgably and deliberately manipulating their biotic environment to encourage plant resources of interest. It also suggests their willingness to invest in the nurturing of resources, like slowly maturing trees, with highly delayed rewards (Kislev et al. 2006b).

Colledge and Hillman have developed a technique for detecting early human efforts at manipulating environments by examining the composition of whole plant assemblages (Colledge 1998, 2002). Based on a comprehensive analysis of plant communities in a variety of modern-day habitats in northern Syria, they have identified distinctive signatures of weedy plants that are found only in fields under human cultivation. They have subsequently discovered these signatures in a number of archaeobotanical assemblages from the Euphrates Valley and the Damascus Basin (Colledge 1998, 2002), both with clear evidence of domestic cereals (Aswad, Ghoraifé, Ramad, and Ras Shamra), as well as in assemblages dominated by wild cereals and pulses (i.e., Mureybit and Abu Hureyra). These results, in turn, strongly suggest that humans were tilling and tending wild stands of cereals and pulses long before they began to deliberately sow harvested seed and set into motion the "adaptive syndrome of domestication" with its resultant morphological outcomes.

This work further suggests that the appearance of detectable morphological change in plants undergoing domestication may be preceded by an extended period of time during which humans employed a variety of landscape modification strategies aimed at nurturing and otherwise encouraging targeted wild plant resources (Smith 2001b, 2007a, b). In fact, Weiss et al. (2006) have recently proposed that the initial cultivation of non-morphologically altered plants may be separated from the farming of morphological domesticates by several millennia.

Rather than a straight line of development, they envision the process of plant domestication as a nonlinear process of trial and error. The large quantities of wild cereals and pulses found at sites like Netiv Hagdud, Jafr el-Ahmar, Mureybit, and Abu Hureyra may well be products of this early stage of cultivation. A granary at Gigal I, containing more than 200,000 wild barley grains and 100,000 grains of wild oat, is likely another early example of cultivation-enhanced harvest (Weiss et al. 2006). Some species that may have been intensively cultivated for many years (such as rye in the northern Levant and oats in the lower Jordan Valley) seem to have been subsequently abandoned in the Near East and were only fully domesticated much later and entirely independently outside the region. Others species, like barley in the southern Levant and lentils in the north, may have been grown under cultivation for hundreds if not thousands of years before undergoing morphological domestication.

Wilcox et al. (2008) also take the position that active cultivation of crop plants may have stretched back 1000 years or more before the manifestation of morphological markers traditionally used to identify domestic status. Examining plant remains from four sites in the middle Euphrates Valley of northern Syria dating from about 11,500–10,500 cal B.P., they point to five different indicators that suggest an extended period of cultivation of both cereals (emmer, einkorn, barley, rye) and pulses (lentils, chickpeas, faba beans) prior to the display of morphological signs of domestication. These indicators include the transport of both cereals and pulses outside likely habitats (i.e., the presence of wheat species in areas with suboptimal chalky soils), the progressive decrease in other gathered plants such as small-seeded grasses, distinctive weed signatures of cultivation, and an increase in the breadth (but not length) of barley seeds seen as a plastic response to cultivation. None of the cereals from these sites shows the characteristic tough rachis traditionally used to mark cereal domestication. The delayed expression of domestication-induced changes in seed dispersal mechanisms in these cereals is variously attributed to the harvesting of underripe plants before their heads begin to shatter, to the frequent importation of new wild plants when cultivated crops fail (Tanno and Wilcox 2006b), or to the practice of gleaning of shattered seeds from the ground (Lev-Yadin et al. 2006b).

The leading edge of this long temporal process of domestication may stretch back more than 9,000 years before the first appearance of clearly domesticated cereals. The recovery of a large quantity of small-seeded grasses and wild wheat and barley macrobotanical remains from Oahlo II, as well as the discovery of wild cereal starch residue on tools from the site, clearly demonstrates that wild cereals were a key resource reaching as early as 23,000 cal. B.P. (Piperno et al. 2004; Weiss et al. 2004). Just when over this extended period of time people began to actively nurture wild stands of cereals and pulses (and other plants) and at what point this intervention crossed over into domestication remain open questions.

Domestication of animals

Documenting domestication of animals is even more difficult. Unlike plants where archaeologically detectable morphological change can be directly linked to domestication, selective pressures on animals undergoing domestication focus more on behavioral attributes that may only be indirectly linked to observable morphological change (Zeder 2006a, b). Perhaps the most important of these behavioral characteristics is a reduction of wariness and aggression that is thought to be linked to a number of characteristic physiological and morphological traits found in domestic animals. These traits include the early onset of sexual maturity, smaller brain size, changes in neurological organization, and juvenilization of the skull resulting in a shortened snout, tooth crowding, and reduced tooth size (Clutton-Brock 1999; Hemmer 1988; Kruska 1990). These later features are clearly evident in the Early Natufian dogs buried with humans at Ain Mallaha (c. 13,000 cal. B.P.) (Davis and Valla 1978; Tchernov and Valla 1997). Another canid jaw showing tooth crowding and reduced tooth size characteristic of domestic dogs was recovered from roughly contemporary levels at the Palegawra Cave in the northwestern Zagros Mountains (Turnbull and Reed 1974).

Reduction in tooth size also is a recognized marker of domestication of pigs, first documented in pig remains from the Zagros site of Jarmo, at about 9,000 cal. B.P. (Flannery 1983). The beginning of the process of domestication of pigs has been argued to stretch as far back as the Late Natufian, based, in part, on evidence of tooth size reduction among the pigs recovered from Late Natufian Hallan Çemi (Rosenberg et al. 1998). Progressive diminution in rear molar length is clearly apparent over the course of the long occupation at Çayönü, beginning as early as the Early PPNB (c. 10,300 cal. B.P.) and continuing until the final Pottery Neolithic occupation of the site at about 8,500 cal. B.P. when the teeth from the site fall comfortably within the expected size range of domestic pigs (Ervynck et al. 2001; Hongo and Meadow 1998, 2000; Hongo et al. 2002). Pigs, like dogs, are thought to have entered the domestic partnership with humans through a more commensal route as scavengers on human debris associated with long-term settlements. Many of the same selective pressures that operate in animal domestication also are in play in the process of commensalism (i.e., selection of less wary individuals willing to risk closer association with humans). In fact, commensals display a number of the same behavioral and morphological features as domesticates (Hemmer 1988). It is hard to know, using tooth size reduction alone, when over the course of this long period of progressive tooth size reduction (from 12,000 to 8,500 cal. B.P.) the relationship between pigs and humans in southeastern Anatolia shifted from commensal coattailing to domestication.

Another clear morphological marker of animal domestication is a change in the size and shape of horns in ungulates (sheep, goats, and cattle), which can be directly linked to the removal of selective pressures for large horns used in mate competition once humans assumed control over breeding (Shaffer and Reed 1972). In goats, domestication results in both a profound reduction in horn size, particularly in males, and a progressive medial flattening and later twisting in horn morphology. Change in horn morphology was originally used by Zeuner (1955) to identify domestic goats in PPNB levels at Jericho. Reed (1961) also used this marker to suggest goat domestication at roughly contemporary levels at Jarmo (c. 9,500 cal. B.P.). Among other markers of animal domestication, Flannery (Hole et al. 1969) also used a progressive change in horn form as evidence of the ongoing process of goat domestication over the course of the occupation of Ali Kosh, a village site in lowland Iran that recent dating shows was occupied from about 9,500 to 8,000 cal. B.P. (Zeder 2005, 2006c). The discovery of the skull of a hornless female sheep at Ali Kosh was interpreted as evidence for sheep domestication, since hornlessness in females is another morphological artifact of domestication. Despite the clear and unequivocal link between horn form changes and domestication, however, this marker has proven to be of relatively little utility in tracking the leading edge of animal domestication in the Near East. The fragmentary nature of most horn remains makes it hard to estimate horn size or to evaluate whether subtle changes in horn form have been achieved. Moreover, the manifestation of this trait seems to come about relatively slowly. Features like hornlessness are (like tough rachises and plump grains in cereals and parthenocarpy in figs) also known to occur in the wild (Zeder 2006b, in press).

For nearly 30 years the industry standard for documenting initial animal domestication has been a reduction in body size, once thought to be a universal, quick onset marker of animal domestication (Meadow 1989; Uerpmann 1978, 1979). This marker has been extensively used to pinpoint the location and timing of initial domestication of the primary livestock domesticates in the Near East, including pigs, cattle, and, most of all, sheep and goats (e.g., Bar-Yosef and Meadow 1995; Grigson 1969, 1978; Helmer 1992; Hongo and Meadow 2000; Legge 1996; Peters et al. 1999, 2005). Recent research, however, has raised serious questions about the utility of body size reduction as a marker of animal domestication. A study of modern wild and domestic sheep and goat skeletons from the Zagros (Zeder 2001) has shown that sex plays the greatest role in determining body size in caprines. Clearcut differences between the size of males and females seen in essentially all long-bone dimensions of animals older than one year. Environment plays the second most important role in determining body size in sheep and goats, with a strong positive correlation between smaller body size and increasing aridity. Domestic status, on the other hand, has no impact on body size in females and only a limited impact on males that is difficult to detect in archaeological samples (Zeder 2001, 2005, 2006c, in press).

A companion study of curated archaeozoological assemblages from the Zagros, dating between 70,000 B.P. and 8,500 cal. B.P., has also demonstrated that what archaeozoologists once interpreted as domestication-induced body size in aceramic Zagros assemblages (c. 10,000 cal. B.P.) is instead attributable to a shift in the demographic composition of the assemblages. Assemblages of culled animals from managed herds are dominated by smaller females, while those resulting from hunting wild herds are dominated by larger males. This shift in the demography of prey animals has been erroneously interpreted as evidence of domestication-induced body size reduction (Bar-Yosef and Meadow 1995; Helmer 1992; Legge 1996; Uerpmann 1978, 1979). There is indisputable evidence of body size reduction in both sheep and goats in the Zagros at about 9,000 cal. B.P., but the reasons for body size reduction at that time are unclear since both modern wild sheep and goats in the region also show considerable body size reduction when compared to their archaeological counterparts (even undeniably domestic specimens). Moreover, this shift toward smaller body size in Zagros sheep and goats corresponds to a period of significant climatic deterioration and increased aridity that, as noted above, was felt throughout the Fertile Crescent and may well have had an impact on ungulate body size (Zeder, in press). Modern Zagros gazelles also are considerably smaller than ancient gazelles, although the timing of size reduction in gazelle is different than it is in sheep and goats (Zeder 2005, 2006c).

It is possible, however, to use the marked sexual dimorphism in male and female sheep and goats to compute sex-specific harvest profiles in larger archaeological assemblages (Zeder 2001). These harvest profiles are, in turn, capable of detecting the distinctive culling practices employed by herders interested in herd propagation (i.e., young male slaughter and prolonged survivorship of female breeding stock) from the various possible prey profiles that emanate from a hunter's interest in maximizing the return of the hunt (e.g., prime adult male focus, random encounter hunting, seasonal hunting of demographically segregated wild herds). Application of this method to Zagros assemblages has produced unmistakable evidence of the management of morphologically unaltered goats at the highland Zagros site of Ganj Dareh at about 10,000 cal. B.P. This work demonstrates that goats were brought under domestication within the natural habitat of wild goats, growing out of a long hunting tradition that extends back at least to the Middle Paleolithic (Zeder 1999, 2005, 2006c, in press; Zeder and Hesse 2000). Herd management moved outside the highland natural habitat of wild goats some 500 years later with the establishment of lowland village settlements like Ali Kosh, where the development of changes in horn morphology characteristic of domestic goats can be traced over the 1,500 or so years of the site's occupation. This work has further shown that sheep were not initially domesticated in that part of the Zagros as had been suggested by earlier researchers (Hole et al. 1969; Perkins 1964); instead they arrived there fully domesticated fairly late in the sequence at around 9,000 cal. B.P. (Zeder, in press).

Although these new demographic profiling techniques have not yet been applied to assemblages outside the Zagros, lower resolution demographic methods are detecting similar patterns. In particular, Peters and collaborators (1999, 2005) have detected changes in the age (and size) of harvested caprines at Navali Çori (c. 10,500–9,000 cal. B.P.) that are consistent with the kind of demographic shifts associated with early herd management. While goats were the first managed animal in the Central Zagros, at Navali Çori it seems that sheep were the initial early focus of the transition from hunting to herding, with managed goats arriving on the scene from outside the area at about 10,200 cal. B.P. (Peters et al. 2005, p. 111). Similarly, Buitenhuis (1997; Vigne et al. 1999) has detected demographic evidence for the management of morphologically unaltered caprines (mostly sheep) over the course of the occupation of Aşikli Höyük in central Anatolia (c. 10,400–9,400 cal. B.P.). Horwitz (1993, 2003) interprets demographic patterns observed in morphologically wild goats from Middle PPNB (10,000–9,200 cal. B.P.) sites in the Jordan Valley as indication of an ongoing process of independent domestication. Other researchers believe that these managed animals were introduced from outside the region (Bar-Yosef 2000). Evidence from Shillourokambos in Cyprus also points to the management of morphologically wild sheep and goats, as well as pigs and cattle, that are thought to have been imported to the island by colonizing populations beginning about 10,500 cal. B.P., along with fallow deer, foxes, wild cats, and domestic cereals (Colledge 2004; Murray 2003; Vigne et al. 1999, 2000; Wilcox 2001, 2003a).

Genetic evidence has identified several domestic lineages in both sheep and goat pointing to multiple domestication events (Bruford and Townsend 2006, Luikart et al. 2006). At least two of six lineages of domestic goats appear to have originated relatively early in the Near East (Naderi et al. 2007) and were part of a package of Near Eastern domesticates that was carried across the Mediterranean Basin, reaching the coast of southern France by 7,000 cal. B.P. (Fernández et al. 2006; Zeder 2008). While the exact temporal and geographic parameters of the origins of all of these different domestic lineages is not certain, the combined genetic and archaeological evidence is making it increasingly clear that both sheep and goats were brought under domestication (perhaps independently of one another and possibly multiple times) between about 11,000 and 10,500 cal. B.P. within the broad area that stretches from the northern Zagros to central Anatolia (Zeder 2008). Managed goats spread relatively rapidly through the region, reaching the southernmost tips of both the eastern and western arms of the Fertile Crescent by about 9,500 cal. B.P.; domestic sheep are found in these regions about only 500–1000 years later (Horwitz and Ducos 1998; Zeder, in press).

It is unclear how many of the at least seven different domestic lineages of pigs (Larson et al. 2005, 2007) orginated in the Near East. Archaeological evidence, however, suggests that pigs were first domesticated somewhere in southeastern Anatolia between 10,500 and 9,500 years ago, and, like sheep, their dispersal throughout the region was relatively slow. Morphologically domesticated pigs are not found in the southern Levant and lowland Iran until about 8,500–8,000 cal. B.P. (Hole et al. 1969, pp. 172–173; Horwitz et al. 1999). Demographic evidence suggests that at least one of the four domestic lineages of taurine cattle (Bradley 2006) originated in the Euphrates Valley between about 11,000 and 10,000 cal. B.P. (Helmer et al. 2005). Like sheep and pigs, cattle also seem to have been adopted relatively late in more distant parts of the Fertile Crescent. Neither domestic pigs nor cattle are found in central Anatolia until well after 8,000 cal. B.P. (Martin et al. 2002).

The long delay between unequivocal signs of animal management and the display of clear morphological manifestations of animal domestication (a period of about 2000 years in sheep and goats) echoes the similar delay between the first signs of plant cultivation and the appearance of morphologically altered domesticated plants. As with plants, it now seems that animal domestication was the product of a long, and often nonlinear, evolving relationship between humans and eventual animal domesticates. There is, in fact, every reason to believe that the delay in the expression of clear-cut morphological markers in animals was considerably longer than in plants, especially when compared to annual plants where selective pressures introduced by the process of domestication seem to have had a relatively marked and rapid effect on morphology. New analytical techniques for reconstructing harvest profiles of archaeological animal bones promise to provide a window into the evolving relationship between humans and prey populations that lies at the heart of the transition from hunting to herding. Demographic data from sheep assemblages at both Zawi Chemi Shanidar and at Hallan Çemi during the Younger Dryas (c. 12,000 cal. B.P.), for example, show an unusually heavy emphasis on males between 2 and 3 years of age, a pattern that is inconsistent with herd management, as well as with most hunting strategies (Redding 2005; Zeder, in press). This pattern has been interpreted as a prime male hunting strategy practiced under conditions of intense pressure on local wild herds (Redding 2005). Eradication of local males by sedentary hunters is argued to have created a vacuum that drew in younger males with less established home territories from outside regions, creating a continuous new supply of preferred prey animals while preserving a local population of females and young. Whether humans intentionally acted to create or exploit this "male-sink" that replenished the supply of available male prey, this strategy clearly set a kind of precedent for the slaughter of young males and the preservation of female breeding stock characteristic of managed herds. Late Natufian gazelle harvest profiles in the southern and northern Levant also show some evidence of attempts to promote returns under condition of increasing pressure (Cope 1991; Davis 1983; Legge and Rowley-Conwy 1987; Munro 2004), although gazelles, with their high flight reflex, were never domesticated (Clutton-Brock 1999). It seems that in certain cases and with certain species, efforts at enhancing returns from wild herds eventually led to full-scale domestication (i.e., sheep, goats, pigs, and cattle), while in others (i.e., gazelles) they did not.

Together, these new studies of Near Eastern plant and animal domesticates are causing a reconsideration of what is meant by domestication and how we study it. Specifically, the traditional emphasis on identifying a particular moment in time when a wild morphotype is replaced by a domestic one can no longer be supported. Trying to pinpoint such a moment is not really very helpful if we seek to truly understand the origins of plant and animal domestication. Instead of trying to isolate some artificially defined threshold separating foraging from farming or hunting from herding, researchers are increasingly trying to document the long unfolding process of interaction between humans and possible target domesticates that lies at the heart of the process of domestication (Zeder 2006a).

Agricultural economies

The remarkable advances in methods for tracking the course of plant and animal domestication have led to a reevaluation of the concept of agriculture and its relationship to domestication. We have known for some time that agricultural economies do not always include domesticated animals. In fact, more agricultural economies are based either solely, or at least predominantly, on domesticated plants (Smith 1998). Thus, the presence of both plant and animal domesticates is no longer a required benchmark of agricultural economy, as Childe thought in the 1930s. Nor can it be assumed that agriculture was an automatic and immediate outcome of the domestication. We now know that in many world areas (i.e., Mesoamerica, eastern North America, and likely Japan) the appearance of morphological domesticates preceded the establishment of agricultural economies based on domesticates by thousands of years (Smith 2001b, c). As a result, markers of the emergence of agriculture used by researchers today tend to focus not on the mere presence of domesticates but on more qualitative markers—either the degree of investment in agricultural activities (Harris 1996) or the degree of dependence on domesticates in a subsistence economy (e.g., greater than 40% of resources, following Smith [2001b]).

Although the temporal gap between plant and animal domestication and the establishment of agricultural economies in the Near East is not as great as in other areas of the world, the gap is larger than has previously been thought. As we have seen, a number of lines of evidence point to human manipulation, if not full-fledged domestication, of a number of plant and animal species as early as the PPNA, and perhaps earlier in the case of rye at Abu Hureyra. The utilization of wild plant and animal resources remains high if not predominate during the PPNA/Early PPNB, making these low-level food-producing economies (after Smith 2001b), not true agricultural economies. Not until the Middle PPNB (c. 10,000–9,200 cal. B.P.) did the balance swing toward domesticates as the leading components of subsistence economies in the region (Helmer et al. 1998; Nesbitt 2002). Even long after agricultural economies based on herding and farming were well established, we still see a great deal of variability in the mix of wild and domestic resources at different sites in different social and environmental contexts (Zeder 1994, 2006d, p. 140). There is, then, a gap of about 2,000 years, perhaps more, that separates the domestication of plants and animals and the establishment of fully developed agricultural economies dependent on domesticates in the Fertile Crescent. The earliest of these full-fledged agricultural economies are likely to have evolved in the central Fertile Crescent at about 10,000 cal. B.P. (Helmer et al 1998; Nesbitt 2002), with the full package of domestic plants and, especially, animals not reaching the farthest extremities of its eastern and western arms until about 1,500–2,000 years later.

Factors driving the emergence of the Neolithic bauplan in the Fertile Crescent

This review of the emergence of Neolithic society in the Near East underscores the prescient vision Childe formulated nearly 70 years ago. Essentially every core component of his Neolithic bauplan is present in ways that quite closely resemble his original blueprint. Childe clearly did not conceive of the constituent components of the Neolithic bursting forth fully formed as a complete package. Instead, Childe saw these different components as mutually reinforcing parts of an unfolding process. It is highly unlikely, however, that he could have imagined that this revolutionary process in the Near East took more than 10,000 years to progress from the first inklings to the final full flowering of his Neolithic Revolution. Yet this is what, in fact, seems to have happened when we chart the timeline of the appearance of the ten central components of Childe's Neolithic bauplan in the Fertile Crescent (Fig. 3). What is particularly striking about this admittedly oversimplified schematic rendering of the rich Near Eastern record is the very late appearance of the central defining components of Neolithic society—morphological domesticates and the agricultural economies based upon them. Although people began to heavily utilize

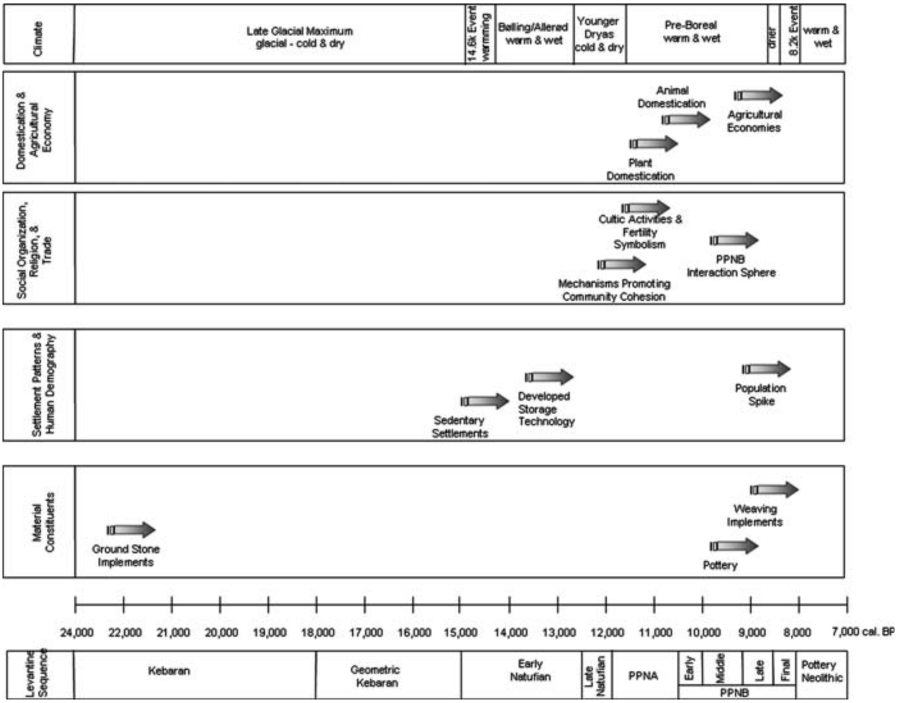

Fig. 3 Timeline of the appearance of major components of Childe's Neolithic bauplan in the Near East

the progenitors of domestic plants about 20,000 years ago, morphologically altered domestic crops did not arrive on the scene until about 10,000 years later, with the appearance of morphologically altered domestic livestock taking another 1,000 years or so, and the full integration of domestic plants and animals into mixed farming economies not fully realized until about 9,000 years ago. Most of the other components of Childe's Neolithic bauplan (e.g., sedentism, storage, community-level mechanisms for supporting social cohesion and collective action, and associated reinforcing of ideological beliefs) were all well in place well before either morphological domesticates or agricultural economies can be documented in the Near East. If the Neolithic Revolution is *prima facie* evidence of a macroevolutionary moment of punctuated change in human cultural evolution, as it is often taken to be, then it seems to take quite a while to get to a final punctuation point.

Efforts at explaining the Neolithic Revolution in this and other regions have tended to focus on major, macroevolutionary forces that are held to universally account for the emergence of agricultural economies wherever they occur. When using the Near East as a case study, researchers have tended to parse the long era leading up to plant and animal domestication and the emergence of agricultural economies in ways that make a favored factor (e.g., climate change, demographic pressure, ideological shifts, social inequality) responsible for all the developments that came after its appearance (e.g., sedentism, resource intensification, domestication, agriculture). Most attempts at promoting one-size-fits-all quick-fix solutions to the puzzle of agricultural origins, however, cannot be easily reconciled with the increasingly richly detailed empirical record of this process in the Near East (Zeder 2006a).

Climate change

Childe's own prime suspect, climatic deterioration at the end of the last Ice Age, has recently been resurrected as a primary factor in Near Eastern agricultural origins, thanks to an increasingly better understanding of both the dates and the magnitude of climatic change from the end of the Pleistocene into the Early Holocene. The Younger Dryas is often cited as a significant if not a deciding factor in the domestication of plants and animals and the origins of agriculture in the Near East (Bar-Yosef and Belfer-Cohen 2002; Harris 2002, 2003; Moore and Hillman 1992). Other models credit the amelioration of climate and the rise in ambient CO_2 that followed the Younger Dryas as primary factors (McCorriston and Hole 1991) that made the origins of agriculture "compulsory" (Richerson et al. 2001). Yet when we look across the Fertile Crescent we see very different reactions to the climatic swings that followed the end of the last Ice Age. People in the southern Levant did not make the transition to the active management of crops and livestock during the height of the Younger Dryas but instead adopted more mobile strategies while following a roughly similar subsistence economy focused on intensive exploitation of morphologically wild plants and animals (Munro 2003, 2004). While people in the northern Levant intensified efforts to encourage the productivity of wild resources, they also did not cross the rubicon of full-fledged plant and animal domestication and the adoption of agriculture. Even if one accepts the patchy evidence for plant domestication during the following PPNA, farming and herding did not really take hold in the region until nearly 1,000 years later in the Early to Middle PPNB, effectively eliminating either climatic downturn or amelioration as viable proximate causes of agricultural origins (Nesbitt 2002; see also Wilcox 2005).

Demographic stress

Population-induced resource pressure does not fare much better when put up against the Near Eastern empirical record. Cohen's (1977) doomsday model of unbridled population growth leading to a global food crisis finds no support in either the record of population growth or even in the grimmest assessments of human impacts on pristine natural environments in the region preceding the origins of agriculture. Binford's original edge-zone hypothesis (Binford 1968) has lost credibility with the clear indications that both plant and animal domestication took place within the natural habitats of their wild progenitor species and not, as he predicted, in marginal environments exploited by emigrants expelled from overcrowded primary zones. His more recent prediction that sedentism and subsequent intensification of resource production leading to domestication are more or less mandatory once a population threshold of 9.098 people per 100 km^2 is reached (Binford 2001) also cannot find much support, not even in the southern Levant where demographic data are relatively good. Rosenberg (1990, 1998) has presented a more nuanced population pressure model that attributes the adoption of sedentism and subsequent resource intensification to increasing demarcation of territorial boundaries in the face of "latent" population pressure—a model that finds some support in the apparently greater degree of territoriality in material culture attributes and trade networks as one moves from the Geometric Kebaran into the Early Natufian (Byrd 2005). Even Rosenberg (1998, p. 675) was hard pressed to produce solid empirical evidence for population-induced pressure on resources, admitting that the evidence for demographically driven hostilities over territorial boundaries was thin at best. Ultimately he slips into a common tautology often found in such models by holding that the reduction of mobility itself is a proxy for population pressure (Rosenberg 1998, p. 663). The subsequent discovery of more-or-less sedentary base camps in favored localities, such as Ohalo II, at the very beginning of the sequence when population levels had yet to begin their long slow climb, implies that people were more drawn to sedentism when conditions permitted, rather than compelled to settle down when options for mobility were eliminated by population packing and resource pressure.

Ideological factors

Other unicausal scenarios that reject externally induced resource pressure look instead at more internal social explanatory mechanisms. These too tend to come up short. Cauvin (2000a, b), for example, spurns the possibility of environmental or economic motivations for the origins of agriculture; instead, he attributes the origin of agriculture to a conceptual shift in mankind's mental template from one that envisions humans as part of the natural world to one in which they assume a position of mastery over nature. He envisions the Neolithic as a "revolution of symbols" manifested by the promotion and eventual deification of the mother-goddess and the bull symbols that he believes propelled humans into enslaving plant and animal species in domesticatory bondage. The mysterious origin of this mental shift remains entirely unexplained, an omission that has, in fact, occasioned criticism even from both more processually oriented scholars (Rollefson 2001) and those grounded in a more postmodern approach to culture change (Hodder 2001). His model has an equally hard time squaring itself with the empirical record. The multiplicity of subject matter and styles of symbolic art undercuts this vision of dual deities overtaking the ideological, social, and economic life of peoples across the region (Rollefson 2001; Wright 2001). The Younger Dryas climatic downturn makes his Eden-like scenario for the birth of this mental shift harder to accept, while the early evidence for the colonization of Cyprus does not fit with the timeline of this expansionist model (Watkins 2001).

Social inequality

Hayden's (1992, 1995, 2003) competitive feasting model sees the origin of agriculture in the Near East as an early example of social promotion in which greedy accumulators were able to take advantage of the times of relative plenty that followed the end of the last Ice Age to advance their own personal agendas (for a more nuanced, socially oriented model see Byrd 2005). His conception of initial domesticates as limited-access "delicacies" cannot be reconciled with the ubiquity and importance of cereals and pulses in the Near East or their long history of exploitation. Even the fig does not fit this description since it is both easily grown and slow to yield realizable profits. While there is some evidence for communal feasting involving consumption of large quantities of meat, the archaeological record from the region clearly does not support Hayden's (2003) blanket declaration that meat was eaten *only* within controlled ritual contexts. Perhaps even more significantly, all of the various signs of social aggrandizement Hayden reads into the record from the Near East (i.e., exotic trade goods, plastered skulls, etc.) have since been more convincingly portrayed by Kuijt (2000b) and other knowledgeable Near Eastern scholars as evidence for maintaining an egalitarian status quo in the face of mounting social tensions that come about when larger groups of people stay together for longer periods of time.

Kuijt (2000a, c, 2001, 2002) goes to great lengths to demonstrate the lack of connection of these developments with the appearance of morphologically altered plant and animal domesticates, arguing that domestication is more of a parenthetical aside in the evolution of social complexity in the Near East. He notes that the initial development and early elaboration of mechanisms promoting social cohesion and egalitarian values in the southern Levant originated shortly after sedentary communities were established in the Early Natufian, at least 1,000 years before the appearance of morphologically altered crop plants. Moreover, the ultimate collapse of these mechanisms, under the combined weight of climatic downturn and social pressures promoting inequality, occurred about 1,000 years after the arrival of animal domesticates in the southern Levant. This impressive corpus of work appropriately brings the social dimensions of Neolithic emergence out from the shadows of the economic and environmental aspects of this process. And yet, by conflating morphological change with domestication, Kuijt, like the proponents of prime-mover models discussed above, uses the appearance of morphologically altered domesticates to make an argument of temporal precedence for the social forces driving his model.

As we have seen, it now appears that there was a long period of time between the initiation of human attempts to encourage the availability of desired plant and animal resources and the actual manifestation of clear-cut morphological markers of domestication. Domestication-induced morphological change is an often latent, unintended, and often quite delayed by-product of a much longer process. Once morphological change is removed as a threshold boundary marker in the domestication of plants and animals, the focus turns instead to the long, evolving relationship between humans and target plant and animal populations that more properly lies at the heart of the domestication process (Smith 2001b; Zeder 2006a).

A multivariable alternative

When we remove the false punctuation mark of morphological change from the developmental trajectory, a much more complex but ultimately more satisfying picture of the mutually reinforcing social, economic, and environmental factors that shaped the Neolithic emergence in the Near East results. Under such a scenario, the climatic amelioration that followed the Last Glacial Maximum allowed the spread of plant and animal resources out of restricted refugia that, in turn, created a sufficiently secure and predictable resource base for the establishment of longer-term, nucleated, sedentary communities. An interest in maintaining the social ties that created and bound these communities together provided the incentive for intensification of resource exploitation under conditions of both localized pressure on resources resulting from increased sedentism and the more global squeeze on resources resulting from climatic downturn during the Younger Dryas. Even when people in the southern Levant were forced to revert to more mobile adaptations during the Late Natufian, their fidelity to a subsistence economy based on cereals and pulses and the clear sense of community and commitment to place brought them back to Early Natufian base camps to bury their dead. The return to these abandoned camps for the burial of group members over the course of this 1,000-year period is a testimony to the combined pull of resource security and social communion that jointly propelled this Neolithic Revolution in the Near East. The increasingly active manipulation of resources leading to their eventual domestication helped provide the secure resource base needed to support these communities. At the same time, this process resulted in the creation of resources amenable to ownership and restricted access that ultimately contributed to the overthrow of the egalitarian ethos that originally bound these communities together. In so doing, domestication and the creation of societies centered on agricultural economies can be seen as setting the stage for the next revolution in prehistory—the development of politically centralized, socially stratified societies.

Rather than a single prime-mover mechanism, it is more likely that the Neolithic Revolution in the Near East was guided by a number of broad-scale, higher-order forces working together—global climate change, economic goals oriented toward promoting predictability and security in resource provisioning, social opportunities and constraints—all operating at the same time to shape this unfolding process. There also were a number of very important more localized factors at work: the differential density and diversity of subsistence resources and raw materials across the region, the demographic history of human colonization and population growth in different parts of the Fertile Crescent, and the agency of individuals trying to cope with their environment, their fellows, and their universe. The larger, more macroevolutionary forces involved in the process actually do not, by themselves, really explain very much about the course of the Neolithic in the Near East. Instead, other more micro, highly contingent, and localized factors seem to have played the greatest role in shaping the individual trajectories of cultural evolution that we see across the Fertile Crescent over this 10,000-year period. These same macrolevel forces also were surely involved in the emergence of agriculture wherever it arose in the world, as we now know that it did independently at least eight different times (Smith 1998, 2001c). Once again, it is the highly contingent on-the-ground factors that are responsible for the very different courses the revolution took wherever it occurred (Zeder 2006a).

Revolution or evolution?

On the face of it, the Neolithic Revolution in the Near East does not seem to follow the basic principles of macroevolution. It took more than 10,000 years, from beginning to end, to be fully realized. Its central components roll out in different ways and different times across the region—sometimes with major reversals, as with the return to mobility during the Younger Dryas in the southern Levant and the abandonment of rye as a domesticate in the northern Levant. Forces operating on a macrolevel serve only to nudge the process along, while it is more microprocesses, including the actions of individual actors, that determined just how the process played out.

Yet when we step back and look at the Neolithic Revolution in the Near East, in a broader, less literal perspective, the correspondence between Neolithic emergence and macroevolutionary theory is quite compelling. First, while 10,000 years seems a long time, if we take a more geological point of view, the emergence of Neolithic lifeways in the Near East seems a better fit with models of punctuated change rather than phyletic gradualism. The transition from foraging to farming in this region occurred after more than a million years during which people were hunting and gathering subsistence resources whose availability they could influence but never truly control. Then in the course of those 10,000 years, with the pace really picking up in the 5,000 years that followed the Younger Dryas, humans began to more actively manipulate basic resources in ways that ultimately led to a radical restructuring of essentially all aspects of their lives—their movements, their homes, their social intercourse with each other and with more distant neighbors, their relationship to the cosmos. All this sounds pretty revolutionary and indeed a very marked, even punctuated departure from what came before, and after.

Perhaps more importantly, while contingent, on-the ground, more microforces play a proximate role in shaping the course of these changes, what becomes very clear from this review is the mutually reinforcing, hierarchical action of a wide variety of factors operating at different levels that came together to move the process along. The operation of evolution over multiple levels is clearly evident in the PPNB when the heightened interaction of individuals, communities, and confederations of communities carried elements of economy, social action, and ideology across the entire Fertile Crescent to be incorporated and adapted in highly localized ways by the people who came into contact with them. Throughout this unfolding transitional period, there was a continual interplay between the constituent components of the Neolithic bauplan—economic, social, and ideological. The synergistic nature of the culture process is particularly apparent during the Early Natufian in the southern Levant, when under particularly favorable climatic circumstances people began to settle down, experiment with new forms of resource management, and renegotiate the social contracts that bind communities together and shape their views of the cosmos (Byrd 2005). It also is clear in the ensuing Late Natufian, when these same social bonds helped shape the way in which people restructured their economy, their mobility patterns, their social interactions, and their ritual practices during a period of climatic downturn. What is particularly impressive when one steps back from prime-mover explanations that artificially spotlight single factors in the unfolding of these developments is how truly interconnected all of the different aspects of these processes are in the emergence of the Neolithic bauplan in the Near East. These aspects encompass the elements of subsistence scheduling, processing, and distribution involved in the emergence of new resource management strategies that Prentiss and Chatters use to track the cultural baupläne; they include the tensions in leadership that propel bauplänal shifts in Spencer's models of culture change, and they involve the radical restructuring of societal ethos that Rosenberg credits with major revolutionary overturns of culture forms. The emergence of Neolithic society in the Near East seems to conform very well indeed to a macroevolutionary way of looking at change.

This degree of interconnectedness also lends this process a marked element of directedness, another fundamental feature of macroevolutionary models of change. Neolithic emergence in the region did not happen in a progressive way with an eye on the prize at the end of the process. But the interconnected forces of environment, security, opportunity, constraint, and individual agency did, nonetheless, keep the process going, step by step, in a highly directed way. The importance of very localized, contingent factors in shaping these developments also provided direction to the process. The specific range of resources available in different regions, the localized effects of climatic changes, the density and distribution of human populations across local landscapes, the ways in which local groups of people came together to structure their interactions with each other and with their cosmos, all these factors helped shape the emergence of Neolithic society in distinctive and directed ways within and across the broad arc of the Fertile Crescent. The continual retooling of technology, subsistence strategies, and ritual practice to better accommodate the new circumstances that arose over the course of this 10,000 year period also lent a strong degree of directedness to the process.

None of this fits a gradualist model of selection and drift acting on randomly generated variation at the level of individual artifact traits. It would take several generations of selectivist archaeologists to piece together cladogenetic trees tracking the evolution of material culture lineages over 10,000 years. And even if this daunting task were eventually completed, this kind of focus on the smallest level of culture change (more of a nano- or even picoevolutionary focus) could never begin to capture the complex hierarchy of interacting forces that are really responsible for driving this process. Just as in biology, an alpha-taxonomy approach to culture change, while effective in tracing patterns of change, does not in itself isolate the processes that drive these changes.

Perhaps the most important reason why a selectivist approach is hopeless in trying to understand the Neolithic emergence is its explicit and absolute rejection of the role of human intent in the process. This element of intent, of human agency, is clearly central to this process, and the Neolithic cannot be understood without acknowledging its importance. Nowhere is the role of intent and directed human decision-making more important than in the domestication of plants and animals, the central focal characteristic of Neolithic society. Domestication occurred in the context of human manipulation of the environment to encourage the growth of resources of interest. It is a classic, even definitional example of niche construction, a practice found throughout nature (Odling-Smee et al. 2003; Smith 2007a, b). The coevolutionary relationship between humans and target plant and animal populations that lies at the heart of the domestication process is itself an excellent example of mutualism, another well-known biological phenomenon (Zeder 2006a). Yet what makes human niche construction and the human/plant and animal mutualistic relationships involved in the process of domestication different from these classic biological processes is the element of human intent. Unlike the relationship between farmer ants and their fungal crops that evolved over tens of thousands of years through mutation-induced behavioral and morphological change driven by natural selection, humans are able to modify their behavior by observing, imitating, and adjusting what they do next based on an evaluation of the effects of their previous actions (Schultz et al. 2005). It is almost certainly true that humans did not understand the ecological principles behind the impact they were having on local environments as they tended and watered wild stands of barley or transplanted branches from trees that produced tastier figs. Until Mendel came along, people were wholly ignorant of the exact genetic responses plants and animals were making to their increasing interference in their life cycles. But what people 10,000 years ago could and did grasp was that these actions had various immediate and desirable results, and they could and did decide to either continue or modify these behaviors and to pass on the ones that worked to their children. This element of intent, of being able to evaluate results and adjust behaviors accordingly and to pass these behaviors directly to others, is what distinguishes the human farmer from the ant farmer and what makes domestication a truly unique phenomenon different from the mutualisms found in nature. By denying human intent any role in the process of cultural evolution, selectionists doom themselves to never being able to understand the origins of domestication, or any other aspect of human cultural evolution.

This element of intent, of deliberate human action in developing new behaviors to address recognized needs, is the principal factor responsible for the directed nature of culture change predicted in macroevolutionary models. It also is this same element of intent and the fact that human behavioral change no longer relies primarily on mutation-induced variation shaped by selection that makes human cultural evolution fundamentally different from biological evolution. Recognition of this difference has made both biologists and archaeologists skeptical of the direct application of principles of biological evolution to human cultural evolution (Angier (on Mayr) 1997; Boyd and Richerson 1985; Eldredge 1989b; Gould 2002, p. 953; Huxley 1956; Simpson 1949, pp. 344–345; Spencer 1993, p. 46). The same rules just do not apply in a literal way to both biological and cultural evolution. This is why, ultimately, a fundamentalist application of neo-Darwinain evolution, macroevolution, or any other school of biological evolution, to human cultural evolution has no real future. As we have seen there is a great deal about macroevolutionary thinking that has value when one considers the course of human cultural evolution. Macroevolution as a theory of biological evolution, however, is not going to solve archaeologists' problems in explaining human cultural change. Instead, it is better to adopt the less doctrinaire, more flexible approach endorsed by Spencer (1997) in which he advocates drawing more broadly, and less literally, from both micro- and macroevolutionary theory, as well as utilizing "complexity theory, action/practice theory, and hierarchy theory" and incorporating concepts of human agency, historical contingency, and directed variation in the study of human cultural evolution (Spencer 1998, p. 247). This brand of revitalized processualism offers a way for archaeologists to construct viable accounts of the histories of culture change that have a lot more to say about cultural evolution than the myopic historical trait lists of cultural selectionists. This approach also has a lot more to offer than the fully "contextualized," but usually woefully "under-empiricized," accounts of culture history advocated by postmodernists. Instead, this approach offers us a chance to explore more robust culture histories, to unravel complex regional puzzles, like the origins of agriculture in the Near East, and to compare these histories to other similarly constructed histories in other parts of the world. In so doing, we can search for commonalities and divergences and identify the factors that shape these different cultural trajectories and begin, perhaps, to explain culture change.

In the case of the Neolithic Revolution, the archaeological sciences (especially the archaeobiological sciences) are providing a remarkably fine-grained empirical understanding of how this process rolled out on the ground. We already have many of the tools needed to track to track the complex mix of macro- and microevolutionary forces that shaped this pivotal event in our history, wherever it occurred. Biologists working with modern biological systems can look at evolutionary change only in the shortest of time scales. Paleobiologists usually have to content themselves with identifying moments of punctuational change in the geological record by studying the much longer periods of stasis that bracket them. Archaeologists, on the other hand, especially in the case of origins of agriculture research, have an opportunity to closely examine the "moment" of punctuational change itself. In this ability, we may, for once, have something to say on the subject of evolution that even biologists might agree is new and novel.

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References cited

Angier, N. (1997). Ernst Mayr at 93. *Natural History* **106**: 8–11.

Andrews, P., Molleson, T., and Boz, B. (2005). The human burials at Çatalhöyük. In Hodder, I. (ed.), *Inhabiting Çatalhöyük: Reports from the 1995–99 Seasons,* British Institute of Archaeology at Ankara, London, and McDonald Institute for Archaeological Research, Cambridge, pp. 261–278.

Aurenche, O., and Kozlowski, S. K. (1999). *La naissance du Neolithique au Proche Orient*, Errance, Paris.

Aurenche, O., Cauvin, J., and Sanlaville, P. (eds.) (1988). *Préhistoire du Levant II* (*1re Partie*), *Paléorient* **14**(2): 5–345.

Aurenche, O., Cauvin, J., and Sanlaville, P. (eds.) (1989). *Préhistoire du Levant II* (*2e Partie*), *Paléorient* **15**(1): 1–179.

Aurenche, O., Galet, P., Régagnon-Caroline, E., and Évin, J. (2001). Proto-neolithic and Neolithic cultures in the Middle East: The birth of agriculture, livestock raising and ceramics 12,500–5,500 cal. B.C. *Radiocarbon* **43**: 1191–1202.

Asouti, E. (2006). Group identity and the politics of dwelling at Neolithic Çatalhöyük. In Hodder, I. (ed.), *Çatalhöyük Perspectives: Themes from the 1995–99 Seasons*, British Institute of Archaeology at Ankara, London, and McDonald Institute for Archaeological Research, Cambridge, pp. 75–91.

Badr, A., Müller, K., Schäfer-Pregl, R., El Rabey, H., Effgen, S., Ibrahim, H. H., Pozzi, C., Rohde, W., and Salamini, F. (2000). On the origin and domestication history of barley (*Hordeum vulgare*). *Molecular Biology and Evolution* **17**: 499–510.

Bar-Yosef, O. (1982). The Natufian of the southern Levant. In Young, T. C., Smith, P. E., and Mortensen, P. (eds.), *The Hilly Flanks. Essays on the Prehistory of Southwest Asia*, University of Chicago Press, Chicago, pp. 11–42.

Bar-Yosef, O. (1986). The walls of Jericho: An alternative interpretation. *Current Anthropology* **27**: 157–162.

Bar-Yosef, O. (1990). The Last Glacial Maximum in the Mediterranean Levant. In Gamble, C., and Soffer, O. (eds.), *The World at 18,000 BP, vol. 2: Low Latitudes*, Unwin Hyman, London, pp. 58–72.

Bar-Yosef, O. (1992). From foraging to farming in the Mediterranean Levant. In Gebauer, A. B., and Price, T. D. (eds.), *Transitions to Agriculture in Prehistory*, Prehistory Press, Madison, WI, pp. 21–48.

Bar-Yosef, O. (1998). On the nature of transitions: The Middle to Upper Paleolithic and the Neolithic revolution. *Cambridge Archaeological Journal* **8**: 141–163.

Bar-Yosef, O. (2000). The context of animal domestication in southwestern Asia. In Mashkour, M., Choyke, A. M., Buitenhuis, H., and Poplin, F. (eds.), *Archaeozoology of the Near East, IV*, ARC Publications No. 32, Groningen, The Netherlands, pp. 185–195.

Bar-Yosef, O. (2001a). From sedentary foragers to village hierarchies: The emergence of social institutions. In Runciman, W. G. (ed.), *The Origin of Human Social Institutions*, Oxford University Press, Oxford, pp. 1–38.

Bar-Yosef, O. (2001b). PPNB interaction sphere. *Cambridge Archaeological Journal* **11**: 114–120.

Bar-Yosef, O., and Belfer-Cohen, A. (1989). The Levantine "PPNB" interaction sphere. In Hershkovitz, I. (ed.), *People and Culture in Change: Proceedings of the Second Symposium on Upper Paleolithic, Mesolithic and Neolithic Populations of Europe and the Mediterranean Basin*, BAR International Series No. 508, Archaeopress, Oxford, pp. 59–72.

Bar-Yosef, O., and Belfer-Cohen, A. (1992). From foraging to farming in the Mediterranean Levant. In Gebauer, A. B., and Price, T. D. (eds.), *Transition to Agriculture in Prehistory*, Prehistory Press, Madison, WI, pp. 21–48.

Bar-Yosef, O., and Belfer-Cohen, A. (2002). Facing environmental crisis. Societal and cultural changes at the transition from the Younger Dryas to the Holocene in the Levant. In Cappers, R. T., and Bottema, S. (eds.), *The Dawn of Farming in the Near East*, Ex Oriente, Berlin, pp. 55–66.

Bar-Yosef, O., and Kislev, M. (1989). Early farming communities in the Jordan valley. In Harris, D., and Hillman, G. (eds.), *Foraging and Farming: The Evolution of Plant Exploitation*, Unwin Hyman, London, pp. 632–642.

Bar-Yosef, O., and Meadow, R. H. (1995). The origins of agriculture in the Near East. In Price, T. D., and Gebauer, A. B. (eds.), *Last Hunters, First Farmers: New Perspectives on the Transition to Agriculture*, School of American Research Press, Santa Fe, NM, pp. 39–94.

Bar-Yosef, O., Gopher, A., Tchernov, E., and Kislev, M. (1991). Netiv Hagdud: An early Neolithic village site in the Jordan valley. *Journal of Field Archaeology* **18**: 405–424.

Bar-Yosef Mayer, D. E. (2000). The economic importance of mollusks in the Levant. In Mashkour, M., Choyke, A. M., Buitenhuis, H., and Poplin, F. (eds.), *Archaeozoology of the Near East IV*, ARC Publications No. 32, Groningen, The Netherlands, pp. 218–227.

Belfer-Cohen, A. (1995). Rethinking social stratification in the Natufian culture: The evidence from burials. In Campbell, S., and Green, A. (eds.), *The Archaeology of Death in the Ancient Near East*, Oxbow Books, Oxford, pp. 9–16.

Belfer-Cohen, A. and Bar-Yosef, O. (2000). Early sedentism in the Near East: A bumpy ride to village life. In Kuijt, I. (ed.), *Life in Neolithic Farming Communities: Social Organization, Identity and Differentiation*, Kluwer Academic, London, pp. 19–38.

Bertalanffy, L. von (1968). *General System Theory: Foundations, Development, Applications*, rev. ed., George Braziller, New York.

Binford, L. R. (1968). Post-Pleistocene adaptations. In Binford, S., and Binford L. R., (eds.), *New Perspectives in Archeology*, Aldine, Chicago, pp. 313–341.

Binford, L. R. (2001). *Constructing Frames of Reference: An Analytical Method for Archaeological Theory Building Using Ethnographic and Environmental Data Sets*, University of California Press, Berkeley.

Bökönyi, S. (1977). *Animal remains from the Kermanshah Valley, Iran*, BAR Supplementary Series No. 34, Archaeopress, Oxford.

Boyd, R., and Richerson, P. J. (1985). *Culture and Evolutionary Process*, University of Chicago Press, Chicago.

Bradley, D. G. (2006). Genetics and the origins of domestic cattle. In Zeder, M. A., Emshwiller, E., Smith, B. D., and Bradley, D. G. (eds.), *Documenting Domestication: New Genetic and Archaeological Paradigms*, University of California Press, Berkeley, pp. 317–328.

Braidwood, R. J., and Howe, B. (1960). *Prehistoric Investigations in Iraqi Kurdistan*, University of Chicago Press, Chicago.

Braidwood, L. R., Braidwood, B., Howe, B., Reed, C. A., and Watson, P. J. (1983). *Prehistoric Archaeology Along the Zagros Flanks*, University of Chicago Press, Chicago.

Bruford, M., and Townsend, S. J. (2006). Mitochondrial DNA diversity in modern sheep: Implications for domestication. In Zeder, M. A., Emshwiller, E., Smith, B. D., and Bradley, D. G. (eds.), *Documenting Domestication: New Genetic and Archaeological Paradigms*, University of California Press, Berkeley, pp. 306–316.

Buitenhuis, H. (1997). Aşikli Höyük: A "protodomestication" site. *Anthropozoologica* **25–26**: 655–662.

Byrd, B. F. (1994). Public and private, domestic and corporate: The emergence of the Southwest Asian village. *American Antiquity* **56**: 639–666.

Byrd, B. F. (2000). Households in transition: Neolithic social organization within Southwest Asia. In Kuijt, I. (ed.), *Life in Neolithic Farming Communities: Social Organization, Identity, and Differentiation*, Kluwer Academic, New York, pp. 63–98.

Byrd, B. (2005). Reassessing the emergence of village life in the Near East. *Journal of Archaeological Research* **13**: 231–290.

Byrd, B., and Monahan, C. (1995). Death, mortuary ritual, and natufian social structure. *Journal of Anthropological Archaeology* **14**: 251–287.

Carneiro, R. L. (1970). A theory of the origin of the state. *Science* **169**: 733–738.

Carneiro, R. L. (1981). The chiefdom: Precursor to the state. In Jones, G., and Kurtz, R. (eds.), *The Transition to Statehood in the New World*, Cambridge University Press, Cambridge, pp. 37–79.

Cauvin, J. (1978). *Les premiers villages de Syrie-Palestine du IX^{eme} au VI^{eme} millenaires avant J.C.*, Editions du CNRS, Paris.

Cauvin, J. (2000a). The symbolic foundations of the Neolithic Revolution in the Near East. In Kuijt, I. (ed.), *Life in Neolithic Farming Communities*: *Social Organization, Identity and Differentiation*, Kluwer Academic, London, pp. 235–254.

Cauvin, J. (2000b). *The Birth of the Gods and the Origins of Agriculture*, Cambridge University Press, Cambridge.

Chatters, J. C., and Prentiss, W. C. (2005). A Darwinian macro-evolutionary perspective on the development of hunter-gatherer systems in northwestern North America. *World Archaeology* **37**: 46–65.

Childe, V. G. (1951). *Man Makes Himself*, New American Library of World Literature, New York.

Clutton-Brock, J. (1999). *Domesticated Animals,* 2nd ed., British Museum of Natural History, London.

Cohen, M. (1977). *The Food Crisis in Prehistory: Overpopulation and the Origins of Agriculture*, Yale University Press, New Haven, CT.

Colledge, S. (1998). Identifying pre-domestication cultivation using multivariate analysis. In Damania, A., Valkoun, J., Willcox, G., and Quallset, C. (eds.), *The Origins of Agriculture and Plant Domestication*, ICARDA, Aleppo, Syria, pp. 121–131.

Colledge, S. (2002). Identifying pre-domestication cultivation using multivariate analysis: Presenting the case for quantification. In Cappers, R. T., and Bottema, S. (eds.), *The Dawn of Farming in the Near East*, Ex Oriente, Berlin, pp. 141–152.

Colledge, S. (2004). Reappraisal of the archaeobotanical evidence for the emergence and dispersal of the "founder crops." In Peltenburg, E., and Wasse, A. (eds.), *Neolithic Revolution: New Perspectives on Southwest Asia in Light of Recent Discoveries in Cyprus*, Oxbow Books, Oxford, pp. 49–60.

Cope (1991). Gazelle-hunting strategies in the southern Levant. In Bar-Yosef, O., and Valla, F. R. (eds.), *The Natufian Culture in the Levant*, International Monographs in Prehistory, Ann Arbor, MI, pp. 341–358.

Davis, S. J. (1983). The age profiles of gazelles predated by ancient man in Israel: Possible evidence for a shift from seasonality to sedentism in the Natufian. *Paléorient* **9**(1): 55–62.

Davis, S. J., and Valla, F. (1978). Evidence for domestication of the dog 12,000 years ago in the Natufian of Israel. *Nature* **276**: 608–610.

Dawkins, R. (1986). *The Blind Watchmaker*, Harlow, Longman.

Denham, T. (2007). Debate: Early fig-domestication, or gathering of wild parthenocarpic figs? *Antiquity* **81**: 457–461.

Dunnell, R. (1978). Style and function: A fundamental dichotomy. *American Antiquity* **43**: 192–202.

Dunnell, R. (1980). Evolutionary theory and archaeology. *Advances in Method and Theory* **3**: 35–99.

Dunnell, R. (1987). Comment on "Sedentism, population growth, and resource selection in the Woodland Midwest: A review of coevolutionary developments. *Current Anthropology* **28**: 191-192

Dunnell, R. (1988). The concept of progress in cultural evolution. In Nitecki, M. H. (ed.), *Evolutionary Progress*, University of Chicago Press, Chicago, pp. 169–194.

Dunnell, R. (1998). Comment on Rosenberg, Cheating at musical chairs: Territoriality and sedentism in an evolutionary context. *Current Anthropology* **39**: 667–668.

Eerkens, J. W., Bettinger, R. L., and McElreath, R. (2006). Cultural transmission, phylogenetics, and the archaeological record. In Lipo, C. P., O'Brien, M. J., Collard, M., and Shennan, S. J. (eds.), *Mapping Our Ancestors: Phylogenetic Approaches in Anthropology and Prehistory*, Aldine Transaction, New Brunswick, NJ, pp. 169–183.

Eldredge, N. (1989a). *Macro-evolutionary Dynamics: Species, Niches, and Adaptive Picks*, McGraw-Hill, New York.

Eldredge, N. (1989b). Punctuated equilibria, rates of change, and large-scale entities in evolutionary systems. *Journal of Social and Biological Structures* **12**: 173–184.

Eldredge, N., and Gould, S. J. (1972). Punctuated equilibria: An alternative to phyletic gradualism. In Schopf, T. J. (ed.), *Models in Paleobiology*, Freeman, Cooper, San Francisco, pp. 82–115.

Ervynck, A., Dobney, K., Hongo, H., and Meadow, R. H. (2001). Born free! New evidence for the status of pigs from Çayönü Tepesi, Eastern Anatolia. *Paléorient* **27**(2): 47–73.

Esin, U. (1998). The aceramic site of Aşikli Höyük and its ecological conditions based on its floral and faunal remains. *Tüba-Ar* **1**: 95–104.

Esin, U., and Harmankya, S. (1999). Aşikli. In Özdoğan, M., and Başgelen, N. (eds.), *Neolithic Turkey, the Cradle of Civilization: New Discoveries*, Arkeoloji ve Sanat Yauinlari, Istanbul, pp. 226–132.

Fernández, H., Hughes, S., Vigne, J. D., Helmer, D., Hodgins, G., Miquel, C., Hanni, C., Luikart, G., and Taberlet, P. (2006). Divergent mtDNA of goats in an Early Neolithic site, far from the initial domestication areas. *Proceedings of the National Academy of Sciences* **103**: 15375–15379.

Flannery, K. V. (1972a). The cultural evolution of civilizations. *Annual Review of Ecology and Systematics* **3**: 399–426.

Flannery, K. V. (1972b). The origin of the village as a settlement type in Mesoamerica and the Near East: A comparative study. In Ucko, P., Tringham, R., and Dimbleby, G. (eds.), *Man, Settlement, and Urbanism*, Duckworth, London, pp. 23–53.

Flannery, K. V. (1983). Early pig domestication in the Fertile Crescent: A retrospective look. In Young, T. C., Smith, P. E., and Mortensen, P. (eds.), *The Hilly Flanks. Essays on the Prehistory of Southwest Asia*, University of Chicago Press, Chicago, pp. 163–188.

Flannery, K. V. (1993). Will the real model please stand up: Comments on Saidel's round house or square? *Journal of Mediterranean Archaeology* **6**: 109–117.

Flannery, K. V. (2002). The origins of the village revisited: From nuclear to extended households. *American Antiquity* **67**: 417–433.

Fried, M. (1967). *The Evolution of Political Society*, Random House, New York.

Garfinkle, Y., Kislev, M. E., and Zohary, D. (1988). Lentil in the Pre-Pottery Neolithic B Yifth'el: Additional evidence of its early domestication. *Israel Journal of Botany* **37**: 49–51.

Gebel, H. G. (2002). The Neolithic of the Near East: An essay on a "polycentric evolution" and other current research problems. In Hausleiter, A., Kerner, S., and Müller-Neuhof, B. (eds.), *Material Culture and Mental Spheres: Rezeption archäologischer Denkrichtungen in der Vorderasiatischen Altertumskunde*, Ugarit-Verlag, Münster, pp. 214–324.

Gebel, H. G. (2004). There was no centre: The polycentric evolution of the Near Eastern Neolithic. *Neo-Lithics* **1**: 28–32.

Goring-Morris, A. N.(1987). *At the Edge: Terminal Pleistocene Hunter-Gatherers in the Negev and Sinai*, BAR International Series No. 361, Archaeopress, Oxford.

Gould, S. J. (1988). On replacing the idea of progress with an operational notion of directionality. In Nitecki, H. (ed.), *Evolutionary Progress*, University of Chicago Press, Chicago, pp. 319–338.

Gould, S. J. (1989). Punctuated equilibrium in fact and theory. *Journal of Biological and Social Structures* **12**: 117–136.

Gould, S. J. (2002). *The Structure of Evolutionary Theory*, Belknap, Cambridge, MA.

Gould, S. J., and Eldredge, N. (1993). Punctuated equilibrium comes of age. *Nature* **366**: 223–227.

Gould, S. J., and Lewontin, R. C. (1979). The spandrels of San Marco and the Panglossian paradigm: A critique of the adaptationalist programme. *Proceedings of the Royal Society London Series B* **205**: 581–598.
Grigson, C. (1969). The uses and limitations of differences in absolute size in the distinction between the bones of aurochs (*Bos primigenius*) and domestic cattle (*Bos Taurus*). In Ucko, P. J., and Dimbleby, G. W. (eds.), *The Domestication and Exploitation of Plants and Animals I,* Aldine-Atherton, Chicago, pp. 277–294.
Grigson, C. (1978). The craniology and relationships of four species of *Bos*. *Journal of Archaeological Science* **5**: 123–152.
Guilaine, J., and Briois, F., (2001). Parekkilisha Shillourokambos: An early Neolithic site in Cyprus. In Swiny, E. (ed.), *The Earliest Prehistory of Cyprus: From Colonization to Exploitation*, American Schools of Oriental Research, Boston, pp. 37–53.
Hall, B. K. (1996). *Baupläne*, phylotypic stages, and constraint: Why there are so few types of animals. *Evolutionary Biology* **29**: 215–261.
Harris, D. (1996). Introduction: Themes and concepts in the study of early agriculture. In Harris, D. (ed.), *The Origins and Spread of Agriculture and Pastoralism in Eurasia*, Smithsonian Institution Press, Washington, DC, pp. 1–9.
Harris, D. (2002). Development of the agropastoral economy in the Fertile Crescent during the Pre-Pottery Neolithic period. In Cappers, R. T., and Bottema, S. (eds.), *The Dawn of Farming in the Near East*, Ex Oriente, Berlin, pp. 67–83.
Harris, D. R. (2003). Climatic change and the beginnings of agriculture: The case of the Younger Dryas. In Rothschild, L., and Lister, A. (eds.), *Evolution on Planet Earth: The Impact of the Physical Environment*, Elsevier, London, pp. 379–394.
Hauptmann, H. (1993). Ein Kultegebäube in Nevali Çori. In Frangipane, M., Hauptmann, H., Liverani, M., Matthiae, P., and Mellink, M. (eds.), *Between the Rivers and over the Mountains,* Archaeologica Anatolica et Mesopotamica Alba Palmieri Dedicata, Università di Roma "La Sapienza," pp. 37–69.
Hauptmann, H. (1999). The Urfa region. In Özdağan, M., and Basgelen, N. (eds.), *Neolithic in Turkey*, vol. 1, Arkeoloji ve Sanat Yay, Istanbul, pp. 65–86.
Hayden, B. (1992). Models of domestication. In Gebauer, A. B., and Price, T. D. (eds.), *Transition to Agriculture in Prehistory*, Prehistory Press, Madison, WI, pp. 11–19.
Hayden, B. (1995). A new overview of domestication. Price, T. D., and Gebauer, A. B. (eds.), *Last Hunters, First Farmers: New Perspectives on the Transition to Agriculture*, School of American Research Press, Santa Fe, NM, pp. 273–300.
Hayden, B. (2003). Were luxury foods the first domesticates? Ethnoarchaeological perspectives from Southeast Asia. *Journal of World Prehistory* **34**: 458–469.
Heiser, C. (1988). Aspects of unconscious selection and the evolution of domesticated plants. *Euphytica* **37**: 77–85.
Helbaek, H. (1959). Domestication of food plants in the old world. *Science* **130**: 365–372.
Helbaek, H. (1969). Plant collecting, dry-farming, and irrigation agriculture in prehistoric Deh-Luran. In Hole, F., Flannery, K. V., and Neely, J. A. (eds.), *Prehistory and Human Ecology on the Deh Luran Plain*, Memoir No. 1, Museum of Anthropology, University of Michigan, Ann Arbor, pp. 383–426.
Helmer, D. (1992). *La domestication des animaux par les hommes préhistoriques*, Masson, Paris.
Helmer, D., Roitel, V. Sana, M., and Wilcox, G. (1998). Interprétations environnementales des données archaéozoologiques et archéobotanique en Syrie du Nord de 16,000 B.P. à 7000 B.P., et les débuts de la domestication de plantes et des animaux. In Fortin, M., and Aurenche, O. (eds.), *Natural Space: Inhabited Space in Northern Syria (10th-2nd mill. BC),* Maison de l'Orient, Lyon, and Canadian Society for Mesopotamian Studies, Toronto, pp. 9–33.
Helmer, D., Gourichon, L., Monchot, H., Peters, J., and Saña Segui, M. (2005). Identifying early domestic cattle from Pre-Pottery Neolithic sites on the middle Euphrates using sexual dimorphism. In Vigne, J. D., Peters, J., and Helmer, D. (eds.), *The First Steps of Animal Domestication*, Oxbow Books, Oxford, pp. 86–95.
Hemmer, H. (1988). *Domestication: The Decline of Environmental Appreciation*, Cambridge University Press, Cambridge.
Henry, D. O. (1989). *From Foraging to Agriculture: The Levant at the End of the Ice Age*, University of Pennsylvania Press, Philadelphia.
Henry, D. O. (2002). Models of agricultural origins and proxy measures of prehistoric demographics. In Cappers, R. T., and Bottema, S. (eds.), *The Dawn of Farming in the Near East*, Ex Oriente, Berlin, pp. 15–26.

Heun, M., Schafer-Pregl, R., Klawan, D., Castagna, R., Accerbi, M., Borghi, B., and Salamini, F. (1997). Site of einkorn wheat domestication identified by DNA fingerprinting. *Science* **278**: 1312–1314.
Hillman, G. C. (1978). On the origins of domestic rye - *Secale cereale*: The finds from Aceramic Can Hasan III in Turkey. *Anatolian Studies* **28**: 157–174.
Hillman, G. C. (2000). Abu Hureyra I: The Epipaleolithic. In Moore, A. T., Hillman, G. C., and Legge, A. J. (eds.), *Village on the Euphrates: From Foraging to Farming at Abu Hureyra*, Oxford University Press, Oxford, pp. 327–398.
Hodder, I. (2001). Symbolism and the origins of agriculture in the Near East. *Cambridge Archaeological Journal* **11**: 107–112.
Hole, F. (1987). Chronologies in the Iranian Neolithic. In Aurenche, O., Evin, J., and Hours, F. (eds.), *Chronologies in the Near East*, BAR International Series No. 379, Archaeopress, Oxford, pp. 353–379.
Hole, F. (1990a). Archaeology of the village period. In Hole, F. (ed.), *The Archaeology of Western Iran: Settlement and Society from Prehistory to the Islamic Conquest*, Smithsonian Institution Press, Washington, DC, pp. 29–78.
Hole, F. (1990b). Settlement and society in the village period. In Hole, F. (ed.), *The Archaeology of Western Iran: Settlement and Society from Prehistory to the Islamic Conquest*, Smithsonian Institution Press, Washington, DC, pp. 78–106.
Hole, F. (1996). The context of caprine domestication in the Zagros region. In Harris, D. R. (ed.), *The Origins and Spread of Agriculture and Pastoralism in Eurasia*, Smithsonian Institution Press, Washington, DC, pp. 263–281.
Hole, F. (2000). Is size important? Function and hierarchy in Neolithic settlements. In Kuijt, I. (ed.), *Life in Neolithic Farming Communities: Social Organization, Identity and Differentiation*, Kluwer Academic, London, pp. 192–209.
Hole, F., and Flannery, K. V. (1967). The prehistory of southwestern Iran: A preliminary report. *Proceedings of the Prehistoric Society* **33**: 147–206.
Hole, F., Flannery, K. V., and Neely, J. A. (1969). *Prehistory and Human Ecology on the Deh Luran Plain*, Memoirs No. 1, Museum of Anthropology, University of Michigan, Ann Arbor.
Homberger, D. G. (2002). Steven J. Gould - An appreciation. *Journal of Biosciences* **27**: 455–459.
Hongo, H., and Meadow, R. H. (1998). Pig exploitation at Neolithic Çayönü Tepesi (southeastern Anatolia). In Nelson, S. (ed.), *Ancestors for the Pigs: Pigs in Prehistory*, MASCA Research Papers in Science and Archaeology No. 15, University of Pennsylvania, Philadelphia, pp. 77–98.
Hongo, H., and Meadow, R. H. (2000). Faunal remains from pre-pottery levels at Çayönü, southeastern Turkey: A preliminary report focusing on pigs (*Sus* sp.). In Mashkour, M., Choyke, A. M., Buitenhuis, H., and Poplin, F. (eds.), *Archaeozoology of the Near East 4A*, ARC Publications No. 32, Groningen, The Netherlands, pp. 121–139.
Hongo, H., Meadow, R. H., Öksuz, B., and Ilgesdi, G. (2002). The process of ungulate domestication in Prepottery Neolithic Çayönü, southeastern Turkey. In Buitenhuis, H., Choyke, A. M., Mashkour, M., and Al-Shiyab, A. H. (eds.), *Archaeozoology in the Near East* 4A, ARC Publications No. 62, Groningen, The Netherlands, pp. 153–165.
Horwitz, L. K. (1993). The development of ovicaprine domestication during the PPNB of the southern Levant. In Buitenhuis, H., and Clason, A. T. (eds.), *Archaeozoology of the Near East I*, Universal Book Service, Leiden, pp. 27–36.
Horwitz, L. K. (2003). Temporal and spatial variation in Neolithic caprine exploitation strategies: A case study of fauna from the site of Yiftah'el (Israel). *Paléorient* **29**(1): 19–58.
Horwitz, L. K., and Ducos, P. (1998). An investigation into the origins of domestic sheep in the southern Levant. In Buitenhuis, H., Bartosiewicz, L., and Choyke, A. M. (eds.), *Archaeozoology of the Near East, III*, ARC Publications No. 18, Groningen, The Netherlands, pp. 80–95.
Horwitz, L. K., Tchernov, E., Ducos, P., Becker, C., von den Driesch, A., Martin, L., and Gararrd, A. (1999). Animal domestication in the southern Levant. *Paléorient* **25**(2): 63–80.
Hours, F., and Copeland, L. (1983). Les rapports entre l'Anatoli et la Syrie du Nord à l'eépoque des premières communautés villageoise de bergers et de paysans, 7600-5000 B.C.. In Young, T. C., Jr., Smith, P., and Mortensen, P. (eds.), *The Hilly Flanks. Essays on the Prehistory of Southwest Asia*, University of Chicago Press, Chicago, pp. 75–90.
Howe, B. (1983). Karim Shahir. In Braidwood, L. R., Braidwood, B., Howe, B., Reed, C. A., and Watson, P. J. (eds.), *Prehistoric Archaeology Along the Zagros Flanks*, University of Chicago Press, Chicago, pp. 23–157.
Huxley, J. S. (1942). *Evolution: The Modern Synthesis*, Allen and Unwin, London.

Huxley, J. S. (1956). Evolution, cultural and biological. In Thomas, W. L., Jr. (ed.), *Current Anthropology*, University of Chicago Press, Chicago, pp. 3–25.

Kenyon, K. (1957). *Digging Up Jericho*, Benn, London.

Kilian, B., Özkan, H., Walther, A., Kohl, J., Dagan, T., Salamini, F., and Martin, W. (2007). Molecular diversity at 18 loci in 321 wild and 92 domesticate lines reveal no reduction of nucleotide diversity during *Triticum monococcum* (einkorn) domestication: Implications for the origin of agriculture. *Molecular Biology and Evolution* **24**: 2657–2688.

Kislev, M. E. (1989). Pre-domesticated cereals in the Pre-Pottery Neolithic A period. In Hershkovitz, I. (ed.), *People and Culture in Change*, BAR International Series No. 508, Archaeopress, Oxford, pp. 147–152.

Kislev, M. E. (1997). Early agriculture and paleoecology of Netiv Hagdud. In Bar-Yosef, O., and Gopher, A. (eds.), *An Early Neolithic Village in the Jordan Valley*, Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge, MA, pp. 209–236.

Kislev, M. E., Hartmann, A., and Bar-Yosef, O. (2006a). Early domesticated fig in the Jordan Valley, *Science* **312**: 1375–1374.

Kislev, M. E., Hartmann, A., and Bar-Yosef, O. (2006b). Response to comment on "Early domesticated fig in the Jordan Valley." *Science* **314**: 1683b.

Kozlowski, S. K. (1999). *The Eastern Wing of the Fertile Crescent*, BAR International Series No. 760, Archaeopress, Oxford.

Kozlowski, S. K., and Aurenche, O. (2005). *Territories, Boundaries and Cultures in the Neolithic Near East*, Maison de l'Orient et de la Méditerranée Jean Pouilloux, Lyon.

Kruska, D. (1990). Mammalian domestication and its effect on brain structure and behavior. In Jerison, H. J., and Jerison, I. (eds.), *Intelligence and Evolutionary Biology*, Springer-Verlag, New York, pp. 211–250.

Kuijt, I. (2000a). People and space in early agricultural villages: Exploring daily lives, community size, and architecture in the late Pre-Pottery Neolithic. *Journal of Anthropological Archaeology* **19**: 75–102.

Kuijt, I. (ed.) (2000b). *Life in Neolithic Farming Communities: Social Organization, Identity, and Differentiation*, Kluwer Academic, New York.

Kuijt, I. (2000c). Keeping the peace: Ritual, skull caching, and community integration in the Levantine Neolithic. In Kuijt, I. (ed.), *Life in Neolithic Farming Communities: Social Organization, Identity, and Differentiation*, Kluwer Academic, New York, pp. 137–162.

Kuijt, I. (2001). Place, death, and the transmission of social memory in early agricultural communities of the Near Eastern Pre-Pottery Neolithic. In Chesson, M. S. (ed.), *Social Memory, Identity, and Death: Anthropological Perspectives on Mortuary Rituals*, Archeological Papers No. 10, American Anthropological Association, Arlington, VA, pp. 80–99.

Kuijt, I. (2002). Reflections on ritual and the transmission of authority in the Pre-Pottery Neolithic of the southern Levant. In Gebel, H. G., Hermansen, B. D., and Jensen, C. H. (eds.), *Magic Practices and Ritual in the Near Eastern Neolithic*, Ex Oriente, Berlin, pp. 81–90.

Kuijt, I., and Goring-Morris, A. N. (2002). Foraging, farming, and social complexity in the Pre-Pottery Neolithic of the southern Levant: A review and synthesis. *Journal of World Prehistory* **16**: 361–440.

Ladizinsky, G. (1989). Origin and domestication of the Southwest Asian grain legumes. In Harris, D. R., and Hillman, G. C. (eds.), *Foraging and Farming: The Evolution of Plant Exploitation*, Unwin Hyman, London, pp. 374–389.

Larson, G., Dobney, K., Albarella, U., Fang, M., Matisoo-Smith, E., Robins, J., Lowden, S., Finlayson, H., Brand, T., Willerslev, E., Rowley-Conwy, P., Andersson, L., and Cooper, A. (2005). Worldwide pylogeography of wild boar reveals multiple centers of pig domestication. *Science* **307**: 1618–1621.

Larson, G., Albarella, U., Dobney, K., Rowly-Conwy, P., Schibler, J., Tresset, A., Vigne, J. D., Edwards, C., Schlumbaum, A., Dinu, A., Balasescu, A., Dolman, G., Tagliacozzo, A., Manaseryan, N., Miravle, P., Van Wijngaarden-Bakker, L., Masseti, M., Bradley, D. G., and Cooper, A. (2007). Ancient DNA, pig domestication, and the spread of the Neolithic into Europe. *Proceedings of the National Academy of Sciences* **104**: 15276–15281.

Legge, A. J. (1996). The beginning of caprine domestication in Southwest Asia. In Harris, D. R. (ed.), *The Origins and Spread of Agriculture and Pastoralism in Eurasia*, Smithsonian Institution Press, Washington, DC, pp. 238–263.

Legge, A. J., and Rowley-Conwy, P. A. (1987). Gazelle killing in Stone Age Syria. *Scientific American* **275**: 76–83.

Legge, A. J., and Rowley-Conwy, P. A. (2000). The exploitation of animals. In Moore, A. M., Hillman, G. C., and Legge, A. J. (eds.), *Village on the Euphrates: From Foraging to Farming at Abu Hureyra*, Oxford University Press, Oxford, pp. 423–474.

Leonard, R. D., and Jones, G. T. (1987). Elements of an inclusive evolutionary model of archaeology. *Journal of Anthropological Archaeology* **6**: 199–219.

Leuenberger, M., Lang, C., and Schwander, J. (1999). Delta15 N measurements as a calibration tool for the paleothermometer and gas-ice age difference: A case study of the 8,200 B.P. event on GRIP ice. *Journal of Geophysical Research* **104**: 22163–22170.

Lev-Yadin, S., Ne'eman, G., Abbo, S., and Flaishman, M. A. (2006a). Comment on "Early domesticated fig in the Jordan Valley." *Science* **314**: 1683a.

Lev-Yadin, S., Gopher, A., and Abbo, S. (2006b). How and when was wild wheat domesticated? *Science* **313**: 296.

Lipo, C. P., O'Brien, M. J., Collard, M., and Shennan, S. J. (2006). *Mapping Our Ancestors: Phylogenetic Approaches in Anthropology and Prehistory*, Aldine Transaction, New Brunswick, NJ.

Luikart, G., Fernández, H., Mashkour, M., England, P. R., and Taberlet, P. (2006). Origins and diffusion of domestic goats inferred from DNA markers: Example analyses of mtDNA, Y-chromosome and microsatellites. In Zeder, M. A., Emshwiller, E., Smith, B. D., and Bradley, D. G. (eds.), *Documenting Domestication: New Genetic and Archaeological Paradigms*, University of California Press, Berkeley, pp. 294–305.

Lyman, R. L., and O'Brien, M. J. (1998). The goals of evolutionary archaeology: History and explanation. *Current Anthropology* **39**: 615–652.

Lyman, R. L., and O'Brien, M. J. (2000). Measuring and explaining change in artifact variation with clade-diversity diagrams. *Journal of Anthropological Archaeology* **19**: 39–74.

Lyman, R. L., and O'Brien, M. J. (2001). On misconceptions of evolutionary archaeology: Confusing macroevolution and microevolution. *Current Anthropology* **42**: 408–409.

Martin, L., Russell, N., and Carruthers, D. (2002). Animal remains from the central Anatolian Neolithic. In Gérard, F., and Thissen, L. (eds.), *The Neolithic of Central Anatolia: Internal Developments and External Relations during the 9th - 6th Millennia cal. B.C.*, Ege Yayınları, İstanbul, pp. 193–206.

Mayr, E. (1942). *Systematics and the Origin of Species*, Columbia University Press, New York.

Mayr, E. (1963). *Animal Species and Evolution*, Harvard University Press, Cambridge, MA.

Meadow, R. H. (1989). Osteological evidence for the process of animal domestication. In Clutton-Brock, J. (ed.), *The Walking Larder: Patterns of Domestication, Pastoralism, and Predation*, Unwin Hyman, London, pp. 80–90.

McCorriston, J., and Hole, F. (1991). The ecology of seasonal stress and the origins of agriculture in the Near East. *American Anthropologist* **93**: 46–69.

Morrell, P. L., and Clegg, M. T. (2007). Genetic evidence for a second domestication of barley (*Hordeum vulgare*) east of the Fertile Crescent. *Proceedings of the National Academy of Sciences* **104**: 3289–3294.

Moore, A.T. (1991). Abu Hureyra I and the antecedents of agriculture on the middle Euphrates. In Bar-Yosef, O., and Valla, F .R. (eds.), *The Natufian Culture in the Levant*, International Monographs in Prehistory, Ann Arbor, MI, pp. 277–294.

Moore, A. T., and Hillman, G. (1992). The Pleistocene to Holocene transition and human economy in Southwest Asia: The impact of the Younger Dryas. *American Antiquity* **57**: 482–494.

Moore, A. T., Hillman, G. C., and Legge, A. J. (2000). *Village on the Euphrates: from Foraging to Farming at Abu Hureyra*, Oxford University Press, Oxford.

Morgan, L. H. (1871). *Ancient Society*, Charles Kerr, Chicago.

Mortensen, P. (1974). A survey of Prehistoric settlements in northern Luristan. *Acta Archaeologica* **45**: 1–47.

Mortensen, P. (1975). Survey and soundings in the Holailan Valley 1974. In *Proceedings of the Third Annual Symposium on Archaeological Research in Iran*, Iranian Centre for Archaeological Research, Tehran, pp. 1–2.

Muheisen, N. (1988). The Epipaleolithic phases of Kharanewh IV. In Garrard, A. N., and Gebel, H. G. (eds.), *The Prehistory of Jordan*, BAR International Series No. 396, Archaeopress, Oxford, pp. 353–367.

Munro, N. (2003). Small game, the Younger Dryas, and the transition to agriculture in the southern Levant. *Mitteilungen der Gesellschaft für Urgeschichte* **12**: 47–71.

Munro, N. (2004). Zooarchaeological measures of hunting pressure and occupation intensity in the Natufian implications for agricultural origins. *Current Anthropology* **45**: S6–S33.

Murray, M. A. (2003). The plant remains. In Peltenburg, E. (ed.), *The Colonization and Settlement of Cyprus: Investigations at Kissonerga-Mylouthkia, 1976-1996*, Åströms Förlag, Sweden, pp. 59–71.
Nadel, D. (1995). The visibility of prehistoric burials in the southern Levant: How rare are the Upper Paleolithic/Early Epipaleolithic graves? In Campbell, S., and Green, A. (eds.), *The Archaeology of Death in the Ancient Near East*, Oxbow Books 51, Oxford, pp. 1–5.
Nadel, D. (2004). Wild barley harvesting, fishing, and year-round occupation at Ohalo II (19.5 KY, Jordan Valley, Israel). In Le Secrétariat du Congrés (ed.), *Section 6: The Upper Paleolithic (General Sessions and Posters), Acts of the XIVth UISSP Congress*, BAR International Series No. 1240, Archaeopress, Oxford, pp. 135–143.
Nadel, D. (2006). Residence ownership and continuity: From the Early Epipalaeolithic unto the Neolithic. In Banning, E. B., and Chazan, M. (eds.), *Domesticating Space: Construction, Community, and Cosmology in the Late Prehistoric Near East*, Ex Oriente, Berlin, pp. 25–34.
Naderi, S. (2007). *Histoire évolutive de l'Aegagre (/Capra aegagrus/) et de la chèvre (/C. hircus/) basée sur l'analyse du polymorphisme de l'ADN mitochondrial et nbucléaire: Implications pour la conservation et pour l'origine de la domestication*, thèse Doc., Laboratoire d'Ecologie Alpine, Université Joseph Fourier, Grenoble.
Naderi, S., Rezaei, H. R., Taberlet, P., Zundel, S., Rafat, S. A, Nagash, H. R., El-Barody, M. A., Ertugrul, O., and Pompanon, F. (2007). Large-scale mitochondrial DNA analysis of the domestic goat reveals six haplogroups with high diversity. *PLoS ONE* **10**: 1–23 (www.plosone.org).
Naroll, R. (1962). Floor area and settlement population. *American Antiquity* **27**: 587–588.
Nesbitt, M. (2002). When and where did domesticated cereals first occur in Southwest Asia? In Cappers, R. T., and Bottema, S. (eds.), *The Dawn of Farming in the Near East*, Ex Oriente, Berlin, pp. 113–132.
O'Brien, M. J. (1987). Sedentism, population growth, and resource selection in the Woodland Midwest: A review of coevolutionary developments. *Current Anthropology* **28**: 177–197.
O'Brien, M. J., and Holland, T. D. (1992). The role of adaptation in archaeological explanation. *Archaeological Method and Theory* **2**: 31–79.
O'Brien, M. J., and Lyman, R. L. (2000). *Applying Evolutionary Archaeology*, Kluwer Academic, New York.
Odling-Smee, F. J., Laland, K. N., and Feldman, W. (2003). *Niche Construction*, Monographs in Population Biology No. 37, Princeton University Press, Princeton, NJ.
Odum, E. P. (1959). *Fundamentals of Ecology*, Saunders, Philadelphia.
Özbaşaran, M. (2000). The Neolithic site of Musular: Central Anatolia. *Anatolica* **26**: 129–151.
Özbaşaran, M., and Buitenhuis, H. (2002). Proposal for a regional terminology for central Anatolia. In Gérard, F., and Thissen, L. (eds.), *The Neolithic of Central Anatolia: Internal Developments and External Relations during the 9th-6th Millennia cal B.C.*, Ege Yayınları, İstanbul, pp. 67–78.
Özdoğan, M. (1997). Çayönü. *The Oxford Encyclopedia of Archaeology in the Near East* **1**: 444–446.
Özdoğan, M. (2002). Redefining the Neolithic in Anatolia: A critical overview. In Cappers, R. T., and Bottema, S. (eds.), *The Dawn of Farming in the Near East*, Ex Oriente, Berlin, pp. 153–158.
Özdoğan, M., and Özdoğan, A. (1989). Çayönü, a conspectus of recent work. *Paléorient* **15**(1): 65–74.
Ozkan, H., Brandolini, A., Schafer-Pregl, R., and Salamini, F. (2002). AFLP analysis of a collection of tetraploid wheats indicates the origin of emmer and hard wheat domestication in southeast Turkey. *Molecular Biology and Evolution* **19**: 1797–1801.
Pasternak, R. (1998). Investigations of botanical remains from Navali Çori, PPNB, Turkey. In Damania, A., Valkoun, J., Wolcox, G., and Qualset, C. (eds.), *The Origins of Agriculture and Crop Domestication*, ICARDA, Aleppo, pp. 170–177.
Perrot, J. (1983). Terminologie et cadre de la préhistoire récents de Palestine. In Young, T. C., Smith, P. E., and Mortensen, P. (eds.), *The Hilly Flanks. Essays on the Prehistory of Southwest Asia*, University of Chicago Press, Chicago, pp. 113–122.
Peltenburg, E. (ed.) (2003). *The Colonization and Settlement of Cyprus: Investigations at Kissonerga-Mylouthkia, 1976–1996*, Åströms Förlag, Sweden.
Peltenburg, E. (2004). Social space in early sedentary communities of Southwest Asia and Cyprus. In Peltenburg, E., and Wasse, A. (eds.), *Neolithic Revolution: New Perspectives on Southwest Asia in Light of Recent Discoveries in Cyprus*, Oxbow Books, Oxford, pp. 71–90.
Perkins, D. (1964). Prehistoric fauna from Shanidar, Iraq. *Science* **144**: 1565–1566.
Peters, J., Helmer, D., von den Driesch, A., and Segui, S. (1999). Animal husbandry in the northern Levant. *Paléorient* **25**(2): 27–48.

Peters, J., Von Den Driesch, A., and Helmer, D. (2005). The upper Euphrates-Tigris Basin, cradle of agro-pastoralism? In Vigne, J. D., Peters, J., and Helmer, D. (eds.), *The First Steps of Animal Domestication*, Oxbow Books, Oxford, pp. 96–124.

Piperno, D. R., Weiss, E., Holst, I., and Nadel, D. (2004). Processing of wild cereal grains in the Upper Paleolithic revealed by starch grain analysis. *Nature* **407**: 894–897.

Prentiss, W. C., and Chatters, J. C. (2003). Cultural diversification and decimation in the prehistoric record. *Current Anthropology* **44**: 33–58.

Reed, C. (1961). Osteological evidences for prehistoric domestication in southwestern Asia. *Zeitschrift für Tierzüchtung und Züchtungsbiologie* **76**: 31–38.

Redding, R. W. (2005). Breaking the mold: A consideration of variation in the evolution of animal domestication. In Vigne, J. D., Peters, J., and Helmer, D. (eds.), *The First Steps of Animal Domestication*, Oxbow Books, Oxford, pp. 41–48.

Redmond, E. (1994). External warfare and the internal politics of northern South American tribes and chiefdoms. In Brumfiel, E. M., and Fox, J. W. (eds.), *Factional Competition and Political Development in the New World*, Cambridge University Press, Cambridge, pp. 44–54.

Richards, R. J. (1988). The moral foundations of the idea of evolutionary progress: Darwin, Spencer, and neo-Darwinians. In Nitecki, H. (ed.), *Evolutionary Progress*, University of Chicago Press, Chicago, pp. 129–148.

Richerson, P. J., and Boyd, R. (2005). *Not by Genes Alone: How Culture Transformed Human Evolution*, University of Chicago Press, Chicago.

Richerson, P. J., Boyd, R., and Bettinger, R. L. (2001). Was agriculture impossible during the Pleistocene but mandatory during the Holocene? A climate change hypothesis. *American Antiquity* **66**: 387–412.

Rindos, D. (1984). *The Origins of Agriculture: An Evolutionary Perspective*, Academic Press, Orlando, FL.

Rindos, D. (1985). Darwinian selection, symbolic variation, and the evolution of culture. *Current Anthropology* **26**: 65–77.

Rindos, D. (1989a). Diversity, variation, and selection. In Leonard, R. D., and Jones, G. T. (eds.), *Quantifying Diversity in Archaeology*, Cambridge University Press, Cambridge, pp. 13–23.

Rindos, D. (1989b). Undirected variation and the Darwinian explanation of culture change. *Archaeological Method and Theory* **1**: 1–45.

Rollefson, G. (2000). Ritual and social structure at Neolithic ‘Ain Ghazal. In Kuijt, I. (ed.), *Life in Neolithic Farming Communities. Social Organization, Identity and Differentiation*, Kluwer Academic, London, pp. 165–190.

Rollefson, G. O. (2001). 2001: An archaeological odyssey. *Cambridge Archaeological Journal* **11**: 114–117.

Rollefson, G. O. (2004). A reconsideration of the PPN koine: Cultural diversity and centralities. *Neo-Lithics* **1**: 46–48

Rollefson, G. O., and Gebel, H. G. (2004). Towards new frameworks: Supra-regional concepts in Near Eastern neolithization. *Neo-Lithics* **1**: 21–22.

Rosenberg, M. (1990). The mother of invention: Evolutionary theory, territoriality, and the origins of agriculture. *American Anthropologist* **92**: 399–415.

Rosenberg, M. (1994a). Pattern, process, and hierarchy in the evolution of culture. *Journal of Anthropological Archaeology* **13**: 307–340.

Rosenberg, M. (1994b). Hallan Çemi Tepesi: Some further observations concerning stratigraphy and material culture. *Anatolica* **20**: 121–140.

Rosenberg, M. (1998). Cheating at musical chairs: Territoriality and sedentism in an evolutionary context. *Current Anthropology* **39**: 653–684.

Rosenberg, M., and Davis, M. (1992). Hallan Çemi Tepesi, an early Aceramic Neolithic site in eastern Anatolia: Some preliminary observations concerning material culture. *Anatolica* **18**: 1–18.

Rosenberg, M., and Redding, R. (2000). Hallan Çemi and early village organization in eastern Anatolia. In Kuijt, I. (ed.). *Life in Neolithic Farming Communities: Social Organization, Identity, and Differentiation*, Kluwer Academic, New York, pp. 39–62.

Rosenberg, M., Nesbitt, M., Redding, R. W., and Peasnall, B. L. (1998). Hallan Çemi: Pig husbandry, and post-Pleistocene adaptations along the Taurus-Zagros arc (Turkey). *Paléorient* **24**(1): 25–41.

Ruse, M. (1988). Molecules to mew: Evolutionary biology and through of progress. In Nitecki, H. (ed.), *Evolutionary Progress*, University of Chicago Press, Chicago, pp. 97–126.

Ryder, M. L. (1983). *Sheep and Man*, Duckworth, London.

Sahlins M. D., Service E. R. (eds.) (1960). *The Evolution of Culture*, University of Michigan Press, Ann Arbor.
Salamini, F., Öakan, H., Brandolini, A., Schäfer-Pregl, R., and Martin, W. (2002). Genetics and geography of wild cereal domestication in the Near East. *Nature Reviews/Genetics* **3**: 429–441.
Schmidt, K. (1995). Investigations in the upper Mesopotamian Early Neolithic: Göbekli Tepe and Gürcütepe. *Neo-Lithics* **2**: 9–10.
Schmidt, K. (2000). Göbekli Tepe, southeastern Turkey: A preliminary report on the 1995-1999 excavations. *Paléorient* **26**(1): 45–54.
Schultz, T., Mueller, U. G., Currie, C. R., and Rehner, S. (2005). Reciprocal illumination: A comparison of agriculture in humans and in fungus-growing ants. In Vega F., and Blackwell, M. (eds.), *Ecological and Evolutionary Advances in Insect-Fungal Associations*, Oxford University Press, New York, pp. 149–190.
Seilacher, A. (1972). Fabricational noise in adaptive morphology. *Systematic Zoology* **22**: 451–465.
Service, E. R. (1962). *Primitive Social Organization: An Evolutionary Perspective*, Random House, New York.
Simmons, A. H. (2007). *The Neolithic Revolution in the Near East*. University of Arizona Press, Tuscon.
Simpson, G. G. (1944). *Tempo and Mode in Evolution*, Columbia University Press, New York.
Simpson, G. G. (1949). *The Meaning of Evolution*, Columbia University Press, New York.
Shaffer, V. M., and Reed, C. (1972). *The Co-Evolution of Social Behavior and Cranial Morphology in Sheep and Goats (Bovidae, Caprini),* Fieldiana: Zoology 61, Field Museum of Natural History, Chicago.
Smith, B. D. (1998). *The Emergence of Agriculture*, W. H. Freeman, New York.
Smith, B. D. (2001a). Documenting domestication: The consilience of biological and archaeological approaches, *Proceedings of the National Academy of Sciences* **98**: 1324–1326.
Smith, B. D. (2001b). Low-level food production. *Journal of Archaeological Research* **9**: 1–43.
Smith, B. D. (2001c). The transition to food production. In Price, T. D., and Feinman, G. M. (eds.), *Archaeology at the Millennium: A Sourcebook*, Kluwer Academic, New York, pp. 199–229.
Smith, B. D. (2006). Documenting plant domestication in the archaeological record. In Zeder, M. A., Emshwiller, E., Smith, B. D., and Bradley, D. G. (eds.), *Documenting Domestication: New Genetic and Archaeological Paradigms*, University of California Press, Berkeley, pp. 15–24.
Smith, B. D. (2007a). The ultimate ecosystem engineers. *Science* **315**: 1797–1798.
Smith, B. D. (2007b). Niche construction and the behavioral context of plant and animal domestication. *Evolutionary Anthropology* **16**: 189–199.
Smith, P. E. (1972). Ganjdareh Tepe. *Iran* **10**: 165–168.
Smith, P. E. (1976). Reflections on four seasons of excavations at Tapeh Ganj Dareh. In Bagherzadeh, F. (ed.), *Proceedings of the Fourth Annual Symposium on Archaeological Research in Iran*, Iranian Centre for Archaeological Research, Tehran, pp. 11–22.
Smith, P. E. (1990). Architectural innovation and experimentation at Ganj Dareh, Iran. *World Archaeology* **21**: 323–335.
Solecki, R. L. (1981). *An Early Village Site at Zawi Chemi Shanidar*, Undena Publications, Malibu, CA.
Solecki, R. L., and McGovern, T. (1980). Predatory birds and prehistoric man. In Diamond, S. (ed.), *Theory and Practice. Essays Presented to Gene Weltfish*, Mouton, The Hague.
Solecki, R. S. (1965). Prehistory in Shanidar Valley, Northern Iraq. *Science* **139**: 179–193.
Spencer, C. S. (1990). On the tempo and mode of state formation: Neoevolutionism reconsidered. *Journal of Anthropological Archaeology* **9**: 1–30.
Spencer, C. S. (1993). Human agency, biased transmission, and the cultural evolution of chiefly authority. *Journal of Anthropological Archaeology* **12**: 41–74.
Spencer, C. S. (1997). Evolutionary approaches in archaeology. *Journal of Archaeological Research* **5**: 209–264.
Spencer, C. S. (1998). Comment on Lyman and O'Brien, "The goals of evolutionary archaeology, history and explanation." *Current Anthropology* **39**: 641–642.
Spencer, C. S., and Redmond, E. (2001). Multilevel selection and political evolution in the Valley of Oaxaca, 500-100 B.C. *Journal of Anthropological Archaeology* **20**: 195–229.
Spencer, H. (1863). *First Principles*, Williams and Norgate, London.
Steward, J. (1955). *Theory of Culture Change*, University of Illinois Press, Urbana.
Stordeur, D. (2003). Tell Aswad 2001 et 2002. *Neo-Lithics* **1**: 7–15.
Stordeur, D. (2004). New insights and concepts: Two themes of the Neolithic in Syria and south-east Anatolia. *Neo-Lithics* **1**: 49–51.

Sudupak, M. A., Akkaya, M. S., and Kence, A. (2004). Genetic relationships among perennial and annual *Cicer* species growing in Turkey assessed by AFLP fingerprinting. *Theoretical and Applied Genetics* **108**: 937–944.

Swiny S. (ed.) (2001). *The Earliest Prehistory of Cyprus: From Colonization to Exploitation*, American Schools of Oriental Research, Boston.

Tanno, K., and Wilcox, G. (2006a). The origins of cultivation of *Cicer arietinum* L. and *Vicia faba* L.: Early finds from tell el-Kerkh, north-west Syria, late 10th millennium B.P. *Vegetation History and Archaeobotany* **15**: 197–204.

Tanno, K., and Wilcox, G. (2006b). How fast was wild wheat domesticated? *Science* **311**: 1886.

Taylor, W. (1948). *A Study of Archaeology*, Memoirs No. 69, American Anthropological Association, Washington, DC.

Tchernov, E. (1991). Biological evidence for human sedentism in Southwest Asia during the Natufian. In Bar-Yosef, O., and Valla, F. R. (eds.), *The Natufian Culture in the Levant*, International Monographs in Prehistory, Ann Arbor, MI, pp. 315–340.

Tchernov, E. (1994). *An Early Neolithic Village in the Jordan Valley, Part II: The Fauna of Netiv Hagdud*, Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge, MA.

Tchernov, E., and Valla, F. R. (1997). Two new dogs, and other Natufian dogs, from the southern Levant. *Journal of Archaeological Science* **24**: 65–95.

Turnbull, P. F., and Reed, C. A. (1974). *The Fauna from the Terminal Pleistocene of Palegawra Cave: a Zarzian occupation site in the northeastern Iraq*, Fieldiana: Anthropology, No. 63(3), Field Museum of Natural History, Chicago.

Tylor, E. B. (1871). *Primitive Culture*, Murray, London.

Ucko, P. (1968). *Anthropomorphic Figurines of Predynastic Egypt and Neolithic Crete with Comparative Material from the Prehistoric Near East and Mainland Greece*, Andrew Szmidla, London.

Uerpmann, H. P. (1978). Metrical analysis of faunal remains from the Middle East. In Meadow, R. H., and Zeder, M. A. (eds.), *Approaches to Faunal Analysis in the Middle East*, Bulletin No 2, Peabody Museum, Cambridge, MA, pp. 41–45.

Uerpmann, H. P. (1979). *Probleme der Neolithisierung des Mittelmeeraumes*, Dr. Ludwig Reichert, Wiesbaden.

Vigne, J. D., Buitenhuis, H., and Davis, S. (1999). Les premiers pas de la domestication animal à l'Oest de l'Euphrate: Chyupre et L'Anatolie centrale. *Paléorient* **25**(2): 49–62.

Vigne, J. D., Carrére, I., Saliége, J. F., Person, A., Bocherens, H., Guilaine, J., and Briois, F. (2000). Predomestic cattle, sheep, goat, and pig during the late 9th and the 8th millennium cal. B.C. on Cyprus: Preliminary results of Shillourokambos (Parekklisha, Limassol). In Mashkour, M., Choyke, A. M., Buitenhuis, H., and Poplin, F. (eds.), *Archaeozoology of the Near East, IV*, ARC Publications No. 32, Groningen, The Netherlands, pp. 83–106.

Voigt, M. M. (2000). Çatal Höyük in context: Ritual at early Neolithic sites in central and eastern Turkey. In Kuijt, I. (ed.), *Life in Neolithic Farming Communities: Social Organization, Identity and Differentiation*, Kluwer Academic, London, pp. 253–294.

Vrba, E., and Eldredge, N. (1984). Individuals, hierarchies, and processes: Towards a more complete evolutionary theory. *Paleobiology* **10**: 146–171.

Watkins, T. (1996). Excavations at Pinarbaşi: The early stages. In Hodder, I. (ed.), *On the Surface: Çatalhöyük 1993-1995*, MacDonald Archaeological Institute, Cambridge, and the British Institute at Ankara, London, pp. 47–57.

Watkins, T. (2001). Review feature: The birth of the gods and the origin of Agriculture (by J. Cauvin), Response. *Cambridge Archaeological Journal* **11**: 105–121.

Watkins, T. (2003). Developing socio-cultural networks. *Neo-Lithics* **2**: 36–37.

Weiss, E., Wetterstrom, W., Nadel, D., and Bar-Yosef, O. (2004). The broad spectrum revolution revisited: Evidence from plant remains. *Proceedings of the National Academy of Sciences* **101**: 9551–9555.

Weiss, E., Kislev, M. E., and Hartmann, A. (2006). Autonomous cultivation before domestication. *Science* **312**: 1608–1610.

White, L. A. (1959). *The Evolution of Culture*, McGraw-Hill, New York.

Wilcox, G. (2001). Présence des céréales dans le Néolithique précéramique de Shillourokambos à Chypre: Résultats de la campagne 1999. *Paleorient* **26**(2): 129–135.

Wilcox, G. (2002). Geographical variation in major cereal components and evidence for independent domestication events in western Asia. In Cappers, R. T., and Bottema, S. (eds.), *The Dawn of Farming in the Near East*, Ex Oriente, Berlin, pp. 133–140.

Wilcox, G. (2003a). The origins of Cypriot farming. In Guilaine, J., and Le Brun, A. (eds.), *Le Néolithique de Chypre*, Bulletin de Correspondance Hellénique Supplément 43, Ecole Française d'Athenes, Athens, pp. 231–238.

Wilcox, G. (2003b). Chacolithic carbonised cereals from Ubaid burnt storage structures at Kosak Shamali. In Nishiaki, Y., and Matsutani, T. (eds.), *Tell Kosak Shamali*, vol. 2, University Museum, University of Tokyo, Tokyo, pp. 267–270.

Wilcox, G. (2005). The distribution, natural habitats, and availability of wild cereals in relation to their domestication in the Near East: Multiple events, multiple centres. *Vegetative History and Archaeobotany* **14**: 534–541.

Wilcox, G., and Tanno, K. (2006). Response. *Science* **313**: 296–297.

Wilcox, G., Fornite, S., and Herveux, L. (2008). Early Holocene cultivation before domestication in northern Syria. *Vegetation History and Archaeobotany* **17**: 313–325.

Wright, G. A. (1978). Social differentiation in the early Natufian. In Redman, C., Berman, M. J., Curtin, E. V., Langhorne Jr., W. T., Versaggi, N. M., and Wanser, J. C. (eds.), *Social Archaeology*, Academic Press, New York, pp. 201–233.

Wright, H. T. (1977). Recent research on the origin of the state. *Annual Review of Anthropology* **6**: 379–397.

Wright, K. (2001). Interpreting the Neolithic of western Asia. *Antiquity* **75**: 619–621.

Zeder, M. A. (1994). After the revolution: Post-Neolithic subsistence strategies in Northern Mesopotamia. *American Anthropologist* **96**: 97–126.

Zeder, M. A. (1999). Animal domestication in the Zagros: A review of past and current research. *Paléorient* **25**(2): 11–25.

Zeder, M. A. (2001). A metrical analysis of a collection of modern goats (*Capra hircus aegargus* and *Capra hircus hircus*) from Iran and Iraq: Implications for the study of caprine domestication. *Journal of Archaeological Science* **28**: 61–79.

Zeder, M.A. (2005). New perspectives on livestock domestication in the Fertile Crescent as viewed from the Zagros Mountains. In Vigne, J. D., Peters, J., and Helmer, D. (eds.), *The First Steps of Animal Domestication*, Oxbow Books, Oxford, pp. 125–147.

Zeder, M. A. (2006a). Central questions in the domestication of plants and animals. *Evolutionary Anthropology* **15**: 105–117.

Zeder, M. A. (2006b). Archaeological approaches to documenting animal domestication. In Zeder, M. A., Emshwiller, E., Smith, B. D., and Bradley, D. G. (eds.), *Documenting Domestication: New Genetic and Archaeological Paradigms*, University of California Press, Berkeley, pp. 171–180.

Zeder, M. A. (2006c). A critical examination of markers of initial domestication in goats (*Capra hircus*). In Zeder, M. A., Emshwiller, E., Smith, B. D., and Bradley, D. G. (eds.), *Documenting Domestication: New Genetic and Archaeological Paradigms*, University of California Press, Berkeley, pp. 181–208.

Zeder, M. A. (2006d). Archaeozoology in Southwest Asia: A status report based on the eighth meeting of the Archaeozoology of Southwest Asia and Adjacent Areas Working Group. *Paléorient* **32**(1): 137–147.

Zeder, M. A. (2008). Domestication and early agriculture in the Meditrranean Basin: Origins, diffusion, and impact. *Proceedings of the National Academy of Sciences* **105**: 11597–11604.

Zeder, M. A. (in press). Animal domestication in the Zagros: An update and directions for future research. In Vila, E., and Goucherin, L. (eds.), *Archaeozoology of the Near East VIII*, Travaux de la Maison de l'Orient et de la Méditerranée (TMO), Lyon.

Zeder, M. A., and Hesse, B. (2000). The initial domestication of goats (*Capra hircus*) in the Zagros Mountains 10,000 years ago. *Science* **287**: 2254–2257.

Zeder, M. A., Emshwiller E., Smith B. D., Bradley D. G. (eds.) (2006a). *Documenting Domestication: New Genetic and Archaeological Paradigms*, University of California Press, Berkeley.

Zeder, M. A., Emshwiller, E., Smith, B. D., and Bradley, D. G. (2006b). Documenting domestication, the intersection of genetics and archaeology. *Trends in Genetics* **22**: 139–155.

Zeder, M. A., Bradley, D. G., Emshwiller, E., and Smith, B. D. (2006c). Documenting domestication, bringing together plants, animals, archaeology, and genetics. In Zeder, M. A., Emshwiller, E., Smith, B. D., and Bradley, D. G. (eds.), *Documenting Domestication: New Genetic and Archaeological Paradigms*, University of California Press, Berkeley, pp. 1–13.

Zeist, W. van. (1976). On macroscopic traces of food plants in southwestern Asia (with some reference to pollen data). *Philosophical Transactions of the Royal Society of London Series B* **275**: 27–41.

Zeist, W. van, and Bakker-Heeres, J. A. (1982). Archaeobotanical studies in the Levant 1. Neolithic sites in the Damascus basin: Aswad, Ghoraifé, Ramad. *Palaeohistoria* **24**: 165–256.
Zeist, W. van, and Waterbolk-van, R. (1996). Cultivated and wild plants. In Akkermans, P. (ed.), *Tell Sabi Abyad: The Later Neolithic Settlement*, Historisch-Archaeologisch Instituut, Istanbul, pp. 521–550.
Zeuner, F. (1955). The goats of early Jericho. *Palestine Exploration Quarterly* **April**: 70–86.
Zohary, D. (1992). Domestication of the Neolithic Near Eastern crop assemblage. In Anderson, P. C. (ed.), *Préhistoire de l'Agriculture*, Editions du CNRS, Paris, pp. 81–86.
Zohary, D., and Hopf, M. (2000). *Domestication of Plants in the Old World*, 3rd ed., Oxford Science, Oxford.

Bibliography of recent literature

Aurenche, O., Sanlaville, P., and Le Mière, M. (eds.) (2004). *From the River to the Sea: The Paleolithic and the Neolithic on the Euphrates and in the Northern Levant*, BAR International Series No. 1263, Archaeopress, Oxford.
Barton, C. M., and Clark, G. A. (eds.) (1997). *Rediscovering Darwin: Evolutionary Theory and Archaeological Explanation*, Archeological Papers No. 7, American Anthropological Association, Arlington, VA.
Bar-Yosef, O. (1997). Symbolic expressions in later prehistory of the Levant: Why are they so few? In Conkey, M. W., Soffer, O., Stratmann, D., and Jablonski, N. G. (eds.), *Beyond Art: Pleistocene Image and Symbol*, California Academy of Sciences, San Francisco, pp. 161–187.
Bar-Oz, G., Dayan, T., and Kaufman, D. (1999). The Epipaleolithic faunal sequence in Israel: A view from Neve David. *Journal of Archaeological Science* **26**: 67–82.
Bar-Yosef, O. (1998a). Agricultural origins: Caught between hypotheses and lack of hard evidence. *The Review of Archaeology* **19**: 58–64.
Bar-Yosef, O. (1998b). The Natufian culture in the Levant: Threshold to the origins of agriculture. *Evolutionary Anthropology* **6**: 159–177.
Bar-Yosef, O. (1998c). On the nature of transitions: The Middle to Upper Paleolithic and the Neolithic revolution. *Cambridge Archaeological Journal* **8**: 141–163.
Bar-Yosef O., Gopher A. (eds.) (1994). *An Early Neolithic Village in the Jordan Valley, Part I; The Archaeology of Netiv Hagdud*, Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge, MA.
Boone, J. L., and Smith, E. A. (1998). Is it evolution yet? A critique of evolutionary archaeology. *Current Anthropology* **39**: S141–S173.
Byrd, B. F. (1998). Spanning the gap from the Upper Paleolithic to the Natufian: The Early and Middle Epipaleolithic. In Henry, D. O. (ed.), *The Prehistoric Archaeology of Jordan*, BAR International Series No. 705, Archaeopress, Oxford, pp. 64–82.
Cappers R. T., Bottema S. (eds.) (2002). *The Dawn of Farming in the Near East*, Ex Oriente, Berlin.
Cauvin, J. (2001). Ideology before economy. *Cambridge Archaeology Journal* **11**: 106–107.
Cauvin, J., Cauvin, M. C., Helmer, D., and Wilcox, G. (1997). L'homme et son environment au Levant nord entre 30,000 et 7,500 B.P. *Paléorient* **23**(2): 51–69.
Colledge, S. (2001). *Plant exploitation on Epipaleolithic and Early Neolithic Sites in the Levant*, BAR International Series No. 986, Archaeopress, Oxford.
Damania A. B., Valkoun J., Wilcox G., Quallset C. O. (eds.) (1998). *The Origins of Agriculture and Crop Domestication*, International Center for Agricultural Research in Dry Areas, Aleppo, Syria.
Davis, M. (1998). Social differentiation at the early village of Çayönü, Turkey. In Arsebük, G., Mellink, M. J., and Schirmer, W. (eds.), *Light on the Top of the Black Hill: Studies Presented to Halet Çambel*, Ege Yayinlari, Istanbul, pp. 255–266.
Eldredge, N. (1999). *The Pattern of Evolution*, W. H. Freeman, New York.
Garrard, A. (1999). Charting the emergence of cereal and pulse domestication in south-west Asia. *Environmental Archaeology* **4**: 67–86.
Gebel, H. G., Hermansen, B. D., and Hoffmann Kensen, C. (2002). *Magic Practices and Ritual in the Near Eastern Neolithic*, Ex Oriente, Berlin.
Gebel H. G., Kafafi Z., Rollefson G. O. (eds.) (1997). *The Prehistory of Jordan II: Perspectives from 1997*, Ex Oriente, Berlin.

Goring-Morris, A. N. (2000). The quick and the dead: The social context of aceramic Neolithic mortuary practices as seen from Kfar HaHoresh. In Kuijt, I. (ed.), *Life in Neolithic Farming Communities: Social Organization, Identity and Differentiation*, Kluwer Academic, London, pp. 103–136.

Grosman, L., and Belfer-Cohen, A. (2002). Zooming onto the "Younger Dryas." In Cappers, R. T., and Bottema, S. (eds.), *The Dawn of Farming in the Near East*, Ex Oriente, Berlin, pp. 49–54.

Harris, D. R. (1998). The origins of agriculture in Southwest Asia. *The Review of Archaeology* **12**: 2–11.

Henry, D. O. (1997). Prehistoric human ecology in the southern Levant east of the rift from 20,000-6,000 B.P. *Paleorient* **23**(2): 107–119.

Henry, D. O. (1998). *The Prehistoric Archaeology of Jordan,* BAR International Series No. 705, Archaeopress, Oxford.

Hillman, G. C., Hedges, R., Moore, A., Colledge, S., and Pettitt, P. (2001). New evidence for Late Glacial cereal cultivation at Abu Hureyra on the Euphrates. *Holocene* **11**: 383–393.

Hodder, I., and Cessford, C. (2004). Daily practice and social memory at Çatalhöyük. *American Antiquity* **69**: 17–40.

Horwitz, L., and Goring-Morris, N. (2004). Animals and ritual during the Levantine PPNB: A case study from the site of Kfar Hahoresh, Israel. *Anthropozoologica* **39**(1): 165–178.

Kuijt, I. (2008). The regeneration of life: Neolithic structures of symbolic remembering and forgetting. *Current Anthropology* **49**: 171–197.

Kuijt, I. (in press). Population, socio-political simplification and cultural evolution of Levantine Neolithic village. In Shennan, S. (ed.), *Pattern and Process in Cultural Evolution*, University of California Press, Berkeley.

Lyman, R. L., O'Brien, M., and Dunnell, R. C. (1997). *The Rise and Fall of Culture History*, Plenum, New York.

Lyman, R. L., Wolverton, S., and O'Brien, M. (1998). Seriation, superposition, and interdigitation: A history of Americanist graphic depictions of culture change. *American Antiquity* **63**: 239–261.

Miller, N. F. (2001). Down the garden path: How plant and animal husbandry came together in the ancient Near East. *Near Eastern Archaeology* **64**: 4–7.

Miller, N. F. (2002). Tracing the development of the agropastoral economy in southeastern Anatolia and northern Syria. In Cappers, R. T., and Bottema, S. (eds.), *The Dawn of Farming in the Near East*, Ex Oriente, Berlin, pp. 85–94.

Mithen, S., Finlayson, B., Pirie, A., Carruthers, D., and Kennedy, A. (2000). New evidence for economic and technological diversity in the Pre-Pottery Neolithic A: Wadi Faynan 16. *Current Anthropology* **41**: 655–663.

Nesbitt, M. (2001). Wheat evolution: Integrating archaeological and biological evidence. In Caligari, P. D., and Brandham, P. E. (eds.), *Wheat Taxonomy: The Legacy of John Percival*, Linnean Special Issue 3, Linnean Society, London, pp. 37–59.

O'Brien, M. J. (ed.) (1996). *Evolutionary Archaeology: Theory and Application*, University of Utah Press, Salt Lake City.

O'Brien, M. J., Lyman, R. L., and Leonard, R. D. (1998). Basic incompatibilities between evolutionary and behavioral archaeology. *American Antiquity* **63**: 485–498.

Özdoğan, M. (1997). Anatolia from the Last Glacial Maximum to the Holocene climatic optimum: Cultural formations and the impact of the environmental setting. *Paléorient* **23**(1): 25–38.

Özdoğan, M., and Basgelen, N. (eds.) (1999). *Neolithic in Turkey: Cradle of Civilization, New Discoveries I*, Arkeoloji ve Sanat Yayinlai, Istanbul.

Özdoğan, M., and Özdoğan, A. (1998). Buildings of cult and the cult of buildings. In Arsebük, G., Mellink, M. J., and Schirmer, W. (eds.), *Light on the Top of the Black Hill: Studies Presented to Halet Çambel*, Ege Yayinlari, Istanbul, pp. 581–601.

Peltenburg, E., Colledge, S., Croft, P., Jackson, A., McCartney, C. and Murray, M. A. (2001). Neolithic dispersals from the Levantine corridor: A Mediterranean perspective. *Levant* **33**: 35–64.

Peters, J., and Schmidt, K. (2004). Animals in the symbolic world of Pre-Pottery Neolithic Göbekli Tepe, south-eastern Turkey: A preliminary assessment. *Anthropozoologica* **39**(1): 1–32.

Tchernov, E. (1997). Are Late Pleistocene environmental factors, faunal changes, and cultural transformations causally connected? The case of the southern Levant. *Paléorient* **23**(2): 209–228.

Teltser, P. A. (ed.) (1995). *Evolutionary archaeology: Methodological Issues*, University of Arizona Press, Tucson.

Valla, F. R. (1998). Natufian seasonality: A guess. In Rocek, T. R., and Bar-Yosef, O. (eds.), *Seasonality and Sedentism: Archaeological Perspectives from Old and New World Sites*, Peabody Museum Bulletin 6, Harvard University, Cambridge, MA, pp. 93–108.

Verhoeven, M. (2002). Ritual and ideology in the Pre-Pottery Neolithic B of the Levant and southeast Anatolia. *Cambridge Archaeological Journal* **12**: 233–258.
Verhoeven, M. (2002). Transformations of society: The changing role of ritual and symbolism in the PPNB and the PN in the Levant, Syria, and southeast Anatolia. *Paléorient* **28**(1): 5–14.
Wilcox, G. (1999). Agrarian change and the beginnings of cultivation in the Near East: Evidence from wild progenitors, experimental cultivation and archaeobotanical data. In Hather, J., and Gosden, C. (eds.), *The Prehistory of Food*, Routledge, London, pp. 479–500.
Wilcox, G. (2000). Nouvelles données sur l'origine de la domestication des plantes au Proche Orient. In Guilaine, J. (ed.), *Premiers paysans du monde*, Editions Errance, Paris, pp. 129–135.
Wright, K. I., and Garrard, A. N. (2003). Social identities and the expansion of stone bead making in Neolithic western Asia: New evidence from Jordan. *Antiquity* **77**: 267–284.
Zeder, M. A. (2003). Hiding in plain sight: The value of museum collections in the study of the origins of animal domestication. In Grupe, G., and Peters, J. (eds.), *Deciphering Ancient Bones: The Research Potential of Bioarchaeological Collections*, Verlag M. Leidorf, Rahden/Westf., pp. 125–138.