



Archaeology as a social science

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Because of advances in methods and theory, archaeology now addresses issues central to debates in the social sciences in a far more sophisticated manner than ever before. Coupled with methodological innovations, multiscale archaeological studies around the world have produced a wealth of new data that provide a unique perspective on long-term changes in human societies, as they document variation in human behavior and institutions before the modern era. We illustrate these points with three examples: changes in human settlements, the roles of markets and states in deep history, and changes in standards of living. Alternative pathways toward complexity suggest how common processes may operate under contrasting ecologies, populations, and economic integration.

anthropology | cultural evolution | economics | sociology | political science

Scholars and the public typically think of archaeology as an endeavor to find earliest examples of such things as the domesticated horse or writing or cities. All too often, articles with archaeological themes in the popular media focus solely on our recovery of things associated with the particularities of history. This emphasis misrepresents archaeology, a scientific discipline that has advanced greatly in recent decades. We argue that archaeology can now make significant contributions to the broader social sciences. This advance results from two major trends: the accumulation of considerable new fieldwork data from around the world and the development of new methods and concepts that transform our evidence into reliable reconstructions of past social dynamics. In recent decades, scientifically minded archaeologists from both the anthropological and the classics traditions have found common ground in the rigorous analysis of past human societies and their changes through time.

At first glance the raw data of archaeology—things like broken pieces of pots, stone tools, and fragmentary architectural remains—might not seem ideal for analyzing past social systems, economic processes, or political dynamics. However, analytical advances, including increasingly sophisticated applications of methods from chemistry and physics, now permit many past economic phenomena to be reconstructed with considerable detail. Archaeologists can pinpoint the places of origin of many raw materials and objects and reconstruct ancient technology and manufacturing. Scientific and archaeological techniques now permit increasingly precise dating of sites and artifacts. And new computer power allows archaeologists to find and compare patterns in the extraordinary richness of small finds from archaeological sites. Conceptual advances then allow the new data to be used to reconstruct many phenomena of basic interest in the social sciences,

from inequality and stratification systems to market economies and political institutions.

Archaeological data have several advantages for studying past societies. First, they are the only source of information about the human past before the invention of writing and the development of historiographic traditions. Thus, archaeology gives scholars access to the full range of the human experience, including social forms unlike any that have existed in modern or historical times. Second, archaeology can inform about all segments of society, including commoners, peasants, the underclass, and slaves, groups often left out of early historical accounts. Third, archaeological findings provide a long-term perspective on change, documenting the origins of agriculture, the Urban Revolution, and other transformational social changes. Indeed, archaeology is crucial to a renewed interest in what is now called “Deep History” (1). Fourth, the standard use of random (or quasi-random) sampling methods and quantitative analysis in modern archaeology allows rigorous conclusions about past conditions and changes. Fifth, we now have archaeological data from many regions, allowing systematic comparative analysis of these changes and social patterns. Sixth, most of the societies reconstructed by archaeologists are independent of the western cultural tradition that has been the focus of analysis by most of the social sciences.

Many findings from our own fieldwork projects—and those of our colleagues—relate to major themes in the social sciences. In the past the dissemination of archaeological data was oriented primarily toward the disciplines of anthropology and classics. Wider access to our data was (and remains) limited due to publication practices, including the assembly of lengthy technical reports and publication in specialized journals. As active fieldworkers in both the anthropological and the classical traditions, we, the authors of

this report recognize the applicability of some of our results beyond these narrow disciplinary contexts and we present three topics as illustrations. We begin with the earliest sedentary villages and later urban settlements, omitting the lengthy earlier record of Paleolithic hunter-gatherers because these societies are of less relevance to the social sciences outside of anthropology. Our next two examples focus on ancient state-level societies: market economies and standards of living. We then discuss current trends in multidisciplinary research in which archaeology is positioned at the intersection of the social and natural sciences. The above examples are only a small selection from the many archaeological studies relevant to the social sciences today, but they provide an idea of the new relevance of archaeological data to the social sciences, particularly when viewed from a multidisciplinary or transdisciplinary perspective.

Villages and Cities

The concept of the village has become reified and romanticized in both popular and scholarly discourse. Phrases such as “it takes a village” (2) and “urban village” (3) idealize village life as a stable and normal pattern of social interaction stretching back to Neolithic origins. Archaeological fieldwork around the world has now accumulated considerable data on human settlements—from villages to cities—and their dynamics of change through time. Empirical data now show that some things widely considered to be ancient and timeless (e.g., forms of community life and social interaction in urban

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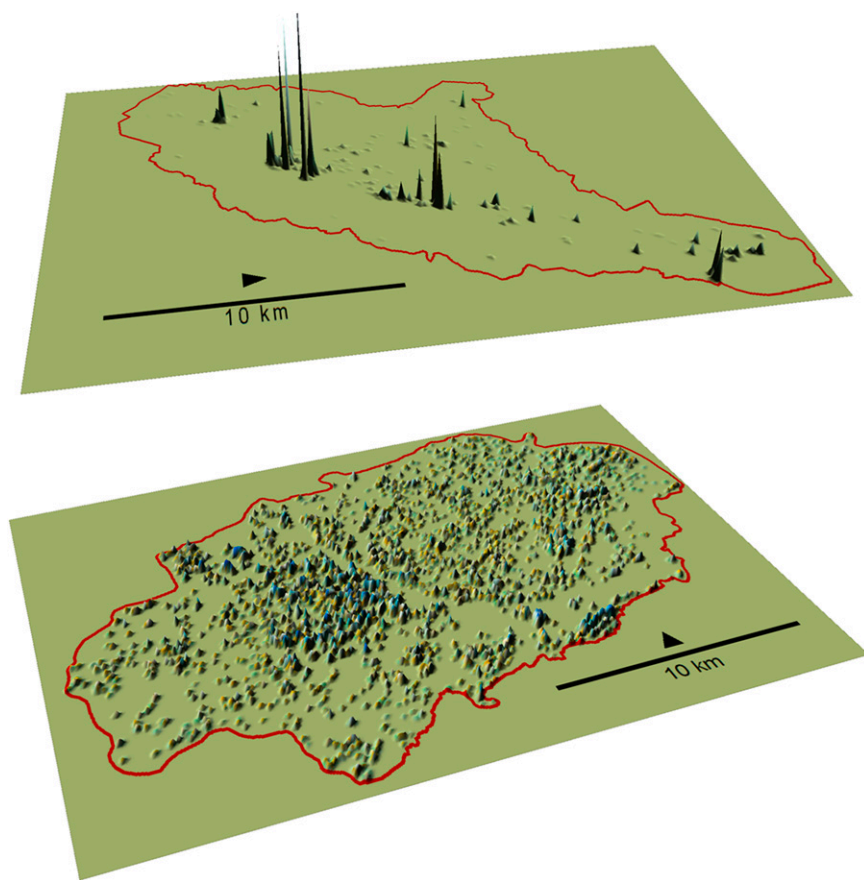


Fig. 1. Regional-scale archaeological evidence for small clusters of compact villages during the fourth millennium BCE in the Daling River valley of northeastern China (*Upper*), contrasted with dispersed farmsteads during the first millennium CE in the Alto Magdalena of Colombia (*Lower*) (graphic is by R.D.D.).

villages) are in fact modern adaptations, whereas other settlement traits considered to be modern innovations (e.g., the shantytowns that surround many cities in the developing world) turn out to have a time depth of millennia.

During the past two or three decades, archaeological information about early settled human communities from the Neolithic era ~5,000–12,000 y ago has become much more abundant. These early communities show far more varied organizational patterns than previously suspected (Fig. 1). Some were the size of modern villages (a few hundred people), but a surprising number were quite small, consisting of 10 or 12 nuclear families at most. Other early sedentary occupations were not even recognizably villages at all, consisting of dispersed single-family farmsteads even less conducive to intensified social interaction than the mobile residence patterns of hunting and gathering groups or migratory herders, which provided for periodic gatherings of many families in one place. Once established, either the dense webs of social interaction of large compact villages or the necessarily more diffuse interaction patterns among dispersed farmsteads can become persis-

tent features of a region's organization, lasting for thousands of years. Under some circumstances, however, this trajectory can also change. Dispersed residence patterns apparently represented economically self-sufficient families and high labor investment in individual family farm plots, among other things. Compact village dwelling, on the other hand, may produce and be produced by greater economic specialization, forms of organizing agricultural labor that involve frequent cooperation, and/or high levels of conflict.

Much larger regional-scale social formations, quite often with pervasively hierarchical social relations, can emerge readily from either compact village communities or dispersed living. Such a transformative increase in the scale of social integration is observable in some regions within two or three centuries after the establishment of sedentary life. Elsewhere large compact villages had remarkable social stability, with little indication of organizational change for a millennium or more. The conflict often thought to result from larger numbers of people living in closer proximity in compact settlements may have been managed by emergent leaders with increasing social or coercive

power or averted by a strong communal ethos. A surprising frequency of traumatic injuries seen in the burials of some Neolithic villages shows that interpersonal violence does not necessarily destroy the bonds of local communities. Now that we have archaeological evidence of early human communities, the origins and outcomes of village life seem more complicated than the generalizations of social philosophy (4). The contemporary urban villages discussed by planners (3, 5) owe little to ancient village organization and are better seen as rather typical urban neighborhoods as found throughout history (6).

Unlike the supposedly ancient nature of village organization, the informal settlements surrounding many cities in the developing world (also called squatter settlements or shantytowns) are assumed by most scholars to be a modern phenomenon. Although the notion that “squatter settlements occur only under capitalism” (ref. 7, p. 382) is widespread, in fact their history is considerably older, and archaeologists have mapped and excavated the remains of informal settlements in numerous premodern cities.

For many people, Classical Greek cities—with their modern-looking orthogonal plans—are the archetypal model for ancient urban centers (Fig. 2, *Left*). Comparative data indicate that such orthogonal urban plans are found in cities whose political authorities (in both democratic and autocratic regimes) have a strong interest in regulating the lives of their urban subjects (8). Research by archaeologists and historians, however, shows that orthogonal planning of residential neighborhoods is quite rare among early urban traditions. Far more common is a design in which the civic architecture is concentrated in a well-planned central district, which is surrounded by residential neighborhoods exhibiting little formal spatial planning (Fig. 2, *Right*) (9).

Archaeologists are developing methods and concepts for the spatial analysis of ancient urban neighborhoods, including energetic measures, models of planning diversity, and space syntax methods (9, 10). The planning and construction of neighborhoods was a dynamic process. In some cases, the imposition of strong imperial political control was accompanied by the spatial regularization of formerly irregular or informal urban settlements. This process of imperial reorganization occurred in both capital cities such as Teotihuacan, Mexico (11), and provincial centers such as the towns conquered by the Inca Empire in the Mantaro Valley of Peru (10). In other cases, including Roman provincial cities from Britain to Syria, the withdrawal of an imperial power led to spatial dispersal as planned neighborhoods were gradually

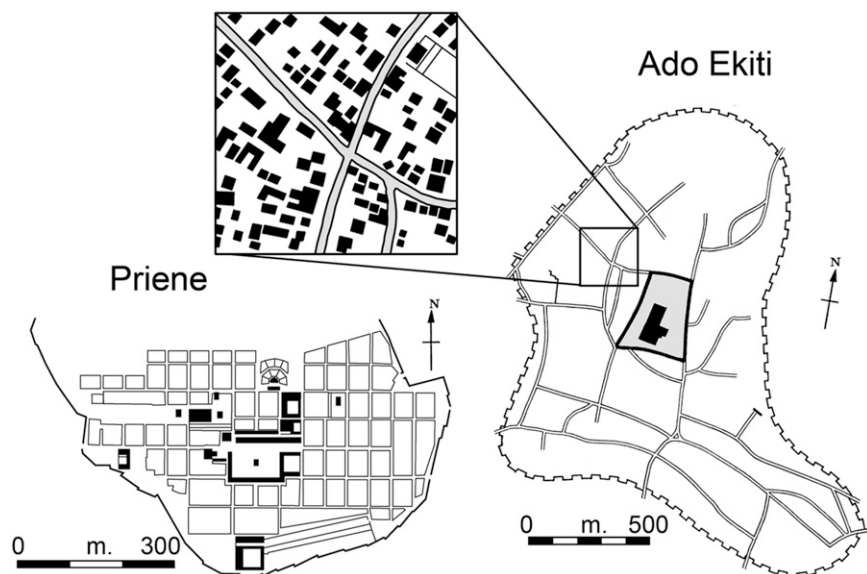


Fig. 2. Classical Greek city (Priene) with orthogonal planned neighborhoods, compared with a Yoruba city (Ado-Ekiti) with informal (unplanned) urban neighborhoods. Cities with layouts like Ado-Ekiti were much more common in the past than those resembling Priene. Graphic is by M.E.S., based on refs. 44 and 45.

transformed into informal settlements (12). This archaeological research greatly expands the sample of urban informal settlements available for study and provides considerable historical time depth on the trajectories of their formation and dissolution. We now know that informal neighborhoods were the norm for ancient cities, where the predominant planning policy was one of neglect by the authorities.

States and Markets in Deep History

Since the mid-20th century, models of human economies have been stuck between two main visions (13). One perspective ignores history and relies on generalized notions that all humans have fundamental instincts to think rationally and economize. From this bottom-up or methodologically individualized vantage, culture and context, like history, are rarely seen as fundamental to economic behavior or systems, and the natural path of economic change is said to conform rather closely to that found in the recent history of the contemporary West (14).

The alternative framework, championed by Karl Polanyi (15), holds that although the above perspective may well have relevance for the contemporary West, such a model is not applicable to ancient or nonwestern societies. Although valuing context and history, this model generally has viewed non-Western economies as “command economies” dominated in top-down fashion by governing authorities and institutions, allowing little room for commercialized exchange, markets, or economizing behavior by individual economic actors.

Archaeological fieldwork has now provided sufficient data on ancient economies to show that neither of these polarized views accurately fits economic dynamics across the global past. There is far more variability in the nature of ancient economies than was suspected previously, and supposedly universal features of modern capitalist economies were absent from many areas. Here we review just two of the significant findings in this area: the existence of dynamic nonmarket state economies in some regions and the distinctive character of early market economies in others. This work was made possible by methodological advances in tracing the exchange of goods and conceptual advances in establishing the material correlates of commercial and noncommercial economic institutions (16–18).

Archaeologists have now identified several regions where dynamic state societies developed without a strong reliance on markets, including Hawaii and the Andes. In the latter area, where states emerged no later than 600 CE (Common Era), 16th century documents clearly state that before Spanish conquest, markets and commercial exchange existed in only a few peripheral regions away from the major states and empires (19). In the Mantaro Valley of Peru, archaeological fieldwork shows that 95% of the pottery and 85% of the stone were obtained locally (<15 km), and almost no goods were obtained from >50 km. With Inca imperial expansion, non-imperial pottery and stone objects did not increase in regional trade, demonstrating that the imposition of peace did not result in the expansion of markets (20). In the Hawaiian Islands, where state-like polities

emerged to integrate each large island and neighboring smaller islands (21), no integrating markets existed. Most household goods were made from local woods, fiber, and gourds; nonlocal materials (basalt and basaltic glass) were surprisingly rare among household goods. Another surprising result of recent fieldwork is the late emergence of markets in Europe (22).

Fieldwork in Mesoamerica, however, tells a very different story about ancient economies. Although 16th century documents describe the presence of marketplaces, merchants, and money in Aztec Mexico (23), these sources are silent on many aspects of the economy. Excavation of Aztec houses has revealed the domestic side of the economy for the first time. In contrast to Inca provincial households, their Aztec counterparts imported nearly 100% of their stone cutting tools and >15% of their pottery from remote sources, often >50 km distant (23, 24).

Archaeological fieldwork at earlier sites has identified markets and commercial exchange practices going back more than a millennium before the Aztec period (18). One surprising result of this work is the finding that many households produced specific goods for exchange (25, 26). For this region of the world, there is almost no evidence for full-time specialized producers or industrial-scale workshops, and yet household inventories indicate that very few domestic units were self-sufficient. At the scale of the household, economic practice likely was flexible, reflecting the capability and necessity to respond to economic opportunities and constraints.

Such dispersed production was impossible to control politically given the limited transport and administrative technologies available in Mesoamerica. Furthermore, specialized economic manufacture for exchange appears to have much deeper historical roots in the region than urbanized states, centralized storehouses, or even large-scale irrigation systems, forcing scholars to question long-held models that see surplus, storage, and the state as providing a unique historical trajectory for economic specialization. Archaeological research thus shows that economic models linking market systems as a “natural” or “efficient” outgrowth of state development (27) are incorrect or at least incomplete. The course to modern, urban life had numerous trajectories that cannot be subsumed under traditional economic models of development.

Ancient Standards of Living

In *Essay on the Principle of Population* (28), Thomas Malthus recognized that changes in climate, technology, or organization could increase well-being, but argued that people always convert surpluses

into population growth, which outruns food supplies, pushing humanity back to bare subsistence. Economic historians have extended Malthus's view into an overarching vision of preindustrial history. According to Gregory Clark, preindustrial living standards fluctuated just above subsistence, and "the average person in the world of 1800 [CE] was no better off than the average person of 100,000 BC" (ref. 29, p. 1).

Archaeology shows that this extension of Malthus is mistaken. Malthus himself distinguished sharply between food and nonfood calories: "It should be remembered always," he wrote, "that there is an essential difference between food and those wrought commodities, the raw materials of which are in great plenty" (ref. 28, pp. 99–100). Forty years ago, the geoscientist Earl Cook (30) noted that whereas food calories have been tightly constrained throughout history, total energy capture per capita (food plus non-food) has increased greatly, from ~4,000 kcal·cap⁻¹·d⁻¹ in simple farming societies to 230,000 kcal·cap⁻¹·d⁻¹ in 1970s America.

Archaeology has now produced a more detailed picture (31). Some preindustrial societies experienced sustained increases in standards of living. In Greece and Rome energy capture rose from ~20,000 kcal·cap⁻¹·d⁻¹ in 1,000 BCE (before Common Era) to ~30,000 kcal·cap⁻¹·d⁻¹ in 1 BCE (32, 33). Others—like the Mediterranean between 200 and 600 CE and China between 100 and 400 CE—endured long declines in living standards (34, 35). In the Andes, Inca imperial expansion resulted in the establishment of peace and an unexpectedly dramatic improvement in living standards, but unlike in

China or the Classical world, this increase occurred in a nonmarket economy (36).

The general trend in standards of living since the end of the last ice age has been upward—slowly until 5,000 BCE, faster until 1,800 CE, and meteoric since then. Although this trend—as documented by archaeology—raises a series of new questions (31), it also helps put our knowledge of contemporary standards of living into a broader empirical context.

Multidisciplinary Research at the Interface of the Social and Biological Sciences

In addition to archaeology's relevance to long-standing issues in the social sciences—as illustrated by the three previous sections—the discipline has recently placed itself "at the center of socio-natural studies" (37). We refer to recent multidisciplinary research involving both natural and social scientists in which archaeologists and archaeological data play central roles. The new development goes far beyond the long-standing use of multidisciplinary teams (primarily biological and earth scientists) for most archaeological fieldwork projects. We single out two relevant domains:

i) Studies of human ecodynamics link archaeological settlement data with paleo-environmental data to examine long-term changes in coupled human and natural systems. This research uses resilience and other concepts from the sustainability literature to address topics such as mobility, collapse, intensification, and a broad range of changes in human societies and landscapes over time (38–40).

ii) Modeling of complex adaptive systems is a second body of research in which archaeology plays a crucial role in integrating the social and natural sciences. Archaeologists (and their colleagues) are increasingly using methods such as agent-based modeling and network analysis to analyze ancient settlement systems, from early hunter-gatherers to urbanized states (41–43). These two approaches frequently overlap within individual research projects.

Looking Forward

We have reviewed several topics that illustrate how archaeology, with its grounded perspectives on different pasts, provides an empirical basis for reconstructing a variety of deep historical processes, thereby reframing and illuminating major debates addressed across the social sciences. Our objective in marshalling these cases is to demonstrate that archaeological data now permit systematic analysis of variation in economic, social, and political changes. For those interested in modeling long-term change in socioeconomic phenomena or understanding the deep background of modern practices, the days of fanciful speculation about the past on merely commonsense grounds or of uncritical extrapolation from the present are over. The dirt-derived findings of archaeology are now providing an empirically sound account of what people actually did, and how they organized their affairs, in the distant past.

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- Shryock A, Smail D, eds (2011) *Deep History: The Architecture of Past and Present* (Univ of California Press, Berkeley).
- Clinton HR (1996) *It Takes a Village and Other Lessons Children Teach Us* (Simon & Schuster, New York).
- Neal P, ed (2003) *Urban Villages and the Making of Communities* (Spon, London).
- Drennan RD, Peterson CE (2006) Patterned variation in prehistoric chiefdoms. *Proc Natl Acad Sci USA* 103: 3960–3967.
- Hao P, Sliuzas R, Geertman S (2011) The development and redevelopment of urban villages in Shenzhen. *Habitat Int* 35:214–224.
- York A, et al. (2011) Ethnic and class-based clustering through the ages: A transdisciplinary approach to urban social patterns. *Urban Stud* 48:2399–2415.
- Portes A, Johns M (1986) Class structure and spatial polarization: An assessment of recent urban trends in Latin America. *Tijdschr Econ Soc Geogr* 77:378–388.
- Grant J (2001) The dark side of the grid: Power and urban design. *Plann Perspect* 16:219–241.
- Smith ME (2007) Form and meaning in the earliest cities: A new approach to ancient urban planning. *J Plann Hist* 6:3–47.
- DeMarrais E (2001) The architecture and organization of Xaua settlements. *Empire and Domestic Economy*, eds D'Altroy TN, Hastorf CA (Plenum, New York), pp 115–153.
- Cowgill GL (2008) An update on Teotihuacan. *Antiquity* 82:962–975.
- Kennedy H (2006) From Shahrstan to Medina. *Stud Islam* 102/103:5–34.
- McCloskey DN (1997) Other things equal: Polanyi was right and wrong. *East Econ J* 23:483–487.
- Buchanan JM (1989) The state of economic science. *The State of Economic Science*, ed Sichel W (WE Upjohn Institute for Employment Research, Kalamazoo, MI), pp 79–95.
- Polanyi K (1944) *The Great Transformation* (Farrar & Rinehart, New York).
- Earle T (2002) *Bronze Age Economics: The Beginnings of Political Economies* (Westview, Boulder, CO).
- Feinman GM, Garraty CP (2010) Preindustrial markets and marketing: Archaeological perspectives. *Annu Rev Anthropol* 39:167–191.
- Garraty CP, Stark BL, eds (2010) *Archaeological Approaches to Market Exchange in Ancient Societies* (Univ Press of Colorado, Boulder, CO).
- LaLone DE (1982) The Inca as a nonmarket economy: Supply on command versus supply and demand. *Contexts for Prehistoric Exchange*, eds Ericson JE, Earle T (Academic, New York), pp 292–316.
- Earle T (2001) Exchange and social stratification in the Andes: The Xaua case. *Empire and Domestic Economy*, eds D'Altroy TN, Hastorf CA (Plenum, New York), pp 297–314.
- Kirch PV (2010) *How Chiefs Became Kings: Divine Kingship and the Rise of Archaic States in Ancient Hawai'i* (Univ of California Press, Berkeley).
- Earle T, Kreiter A, Klehm C, Ferguson J, Vicze M (2011) Bronze Age ceramic economy. *Eur J Archaeol* 14: 419–440.
- Smith ME (2012) *The Aztecs* (Blackwell, Oxford), 3rd Ed.
- Earle T, Smith ME (2012) Households, economies, and power in the Aztec and Inka imperial provinces. *The Comparative Archaeology of Complex Societies*, ed Smith ME (Cambridge Univ Press, New York), pp 238–284.
- Feinman GM (1999) Rethinking our assumptions: Economic specialization at the household scale in ancient Ejutla, Oaxaca, Mexico. *Pottery and People: A Dynamic Interaction*, eds Skibo JM, Feinman GM (Univ of Utah Press, Salt Lake City), pp 81–98.
- Hirth KG, ed (2009) *Housework: Craft Production and Domestic Economy in Ancient Mesoamerica* (American Anthropological Association, Washington, DC), Vol 19.
- North DC (1990) *Institutions, Institutional Change and Economic Performance* (Cambridge Univ Press, New York).
- Malthus TR (1798) *An Essay on the Principle of Population*; reprinted (1970) (Pelican, Harmondsworth, UK), 1st Ed.

29. Clark G (2007) *A Farewell to Alms: A Brief Economic History of the World* (Princeton Univ Press, Princeton).
30. Cook EL (1971) The flow of energy in an industrial society. *Sci Am* 225:135–142, passim.
31. Morris I (2010) *Why the West Rules—for Now: The Patterns of History, and What They Reveal About the Future* (Farrar, Strauss & Giroux, New York).
32. Ober J (2010) Wealthy Hellas. *Trans Am Philol Assoc* 140:241–286.
33. Scheidel W (2010) Real wages in early economies: Evidence for living standards from 1800 BCE to 1300 CE. *J Econ Soc Hist Orient* 53:425–462.
34. Ward-Perkins B (2006) *The Fall of Rome and the End of Civilization* (Oxford Univ Press, New York).
35. Dien AE (2007) *Six Dynasties Civilization* (Yale Univ Press, New Haven, CT).
36. D'Altroy TN, Hastorf CA, eds (2001) *Empire and Domestic Economy* (Plenum, New York).
37. van der Leeuw SE, Redman CL (2002) Placing archaeology at the center of socio-natural studies. *Am Antiq* 67: 597–606.
38. Nelson MC, Kintigh K, Abbott DR, Anderies JM (2010) The cross-scale interplay between social and biophysical context and the vulnerability of irrigation-dependent societies: Archaeology's long-term perspective. *Ecol Soc* 15(3):Article 31.
39. Kirch PV (2005) Archaeology and global change: The Holocene record. *Annu Rev Environ Resour* 30: 409–440.
40. Fisher CT, Hill JB, Feinman GM, eds (2009) *The Archaeology of Environmental Change: Socionatural Legacies of Degradation and Resilience* (Univ of Arizona Press, Tucson, AZ).
41. Wilkinson TJ, Christiansen JH, Ur J, Widell M, Altaweel M (2007) Urbanization within a dynamic environment: Modeling bronze age communities in Upper Mesopotamia. *Am Anthropol* 109:52–69.
42. Kohler TA, van der Leeuw SE, eds (2007) *Model-Based Archaeology of Socionatural Systems* (SAR, Santa Fe, NM).
43. Barton CM, Riel-Salvatore J, Anderies JM, Popescu G (2011) Modeling human ecodynamics and biocultural interactions in the Late Pleistocene of Western Eurasia. *Hum Ecol* 39:705–725.
44. Wycherly RE (1962) *How the Greeks Built Cities* (Norton, New York), 2nd Ed.
45. Ojo GJA (1966) *Yoruba Palaces: A Study of Afins of Yorubaland* (Univ of London Press, London).