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An Introduction to the Archaic Societies of the Midcontinent

Dale L. McElrath, Andrew C. Fortier, and Thomas E. Emerson

Archaic Themes

In our position as editors, we sometimes felt, as the various authors submitted their chapters, that we were privileged recipients of pieces of an intricate mail-order puzzle. From this vantage point, we were able to see commonalities that would have been far less obvious to the volume's individual contributors. Although the individual authors are of differing opinions and scholarly persuasions concerning major factual and many theoretical issues confronting Archaic studies, they are surprisingly evenhanded in presenting and summarizing the available regional data. Most have gone to extraordinary efforts to integrate gray literature and unpublished site reports and to use available site records to develop a comprehensive, if not always temporally representative, framework. In this introduction, we examine some of the issues that dominate the discussions and explore both the truisms and conundrums that have fettered attempts to reconstruct Archaic lifestyles. We have developed opinions that are sometimes at odds with those of our colleagues. We are especially concerned in this chapter with identifying positions that may have questionable foundations—positions that obscure rather than elucidate patterns that are essential for reconstructing the history of Archaic societies.

Ideally, our call for contributions to this conference and volume would have resulted in regionally balanced summaries of Archaic-period developments based on the natural physiographic regions within which related groups might have been expected to develop. Such an approach would have enabled

construction of an overarching chronological framework for relating Archaic social and technological developments, as has been attempted, for example, for the Woodland and Mississippian periods (e.g., Emerson and Lewis 1991; Emerson et al. 2000; Farnsworth and Emerson 1986). The nature of the available archaeological data and the configuration of researchers' study areas, however, are somewhat at odds with this aim. Although the arbitrary political boundaries of midwestern states were of no relevance for the coming and going of Archaic peoples, they are of paramount relevance for shaping the research scope of institutionally affiliated archaeologists. The quantity and quality of Archaic research, therefore, for multiple historical reasons, have varied considerably from state to state.

As we assembled these many contributions on the Archaic period in the Midcontinent, it became clear to us that three themes dominate, either implicitly or explicitly, all of the chapters and that they are fundamental to interpreting or, we should perhaps say, reinterpreting Archaic societies. First and foremost among these issues is the establishment of basic relative and absolute chronologies; the second is the essential question of the meaning of material culture, often summarized as the "points equal people" debate; and the third is the relationship of culture, climate, and landscape. These are hardly new issues and we are not the first to discuss them, but we highlight them here because of their central importance for Archaic research, interpretation, and theorizing. In the following sections of this introduction, we explore in some detail the implications of these issues for interpreting the past.

Dating the Archaic

There can be no doubt that the development of radiocarbon dating has revolutionized, and continues to revolutionize, understanding of the archaeological record, no more so than in the case of the Archaic. The picture changed dramatically from the late 1940s, when the Archaic was formally recognized and thought to comprise a few thousand years of prehistory, to the late 1950s, when its antiquity was appreciated for the first time. The large number of radiocarbon dates (exceeding 1,000) gathered in this volume testifies to the value placed on this tool by researchers. However, given the extensive time span and expansive area of Archaic manifestations, even this number must be viewed as inadequate to properly document the sequence of cultural developments and events that unfolded. Also, researchers are realizing that radiocarbon dating has limitations that prevent achieving the tight chronological controls that are necessary to answer many of the questions they pose.

Although advances in radiocarbon dating have overcome initial concerns with, for example, dating bone and shell or C_4 plants such as corn, the process is still plagued by contamination of samples, issues of context, and variation between labs and, surprisingly, in results between specific techniques (i.e., conventional vs. AMS dating; see Fortier et al. 2006). In addition, variations in atmospheric carbon have generated problems that were not apparent at first glance. So, archaeologists not only are faced with issues of sampling and instrument limitations in the accuracy of sample measurement but also with the fact that samples of substantially differing ages can each have multiple “intercepts.” Whereas archaeologists once operated under the (mistaken) assumption that dates could be reliably compared with one another within the latitude offered by statistically measurable confidence limits, they must now contend with the reality that dates can be easily “flipped” depending on which intercepts one “accepts.” The dilemma has been compounded by the most recent version of a standard calibration scheme used by researchers in the Midwest (CALIB 5.0). While this version is, no doubt, more realistic and accurate in its results than previous versions, the system generates differing probabilities for assigning a date to specific time frames, thereby precluding convenient presentation in text form and complicating any attempt to summarize information from multiple dates. These difficulties explain the reluctance of contributors to this volume to adopt CALIB 5.0, even though they were offered the opportunity to do so prior to final submission of their chapters. The calibration dilemma has caused some (e.g., Ahler and Koldehoff, this volume; Ray et al., this volume) to prefer the original uncalibrated dates as simpler and offering greater clarity (with relative accuracy), at the expense of obfuscating precision.

Whatever the shortcomings of the radiocarbon dating method, it is clear that this method still provides the main vehicle for establishing and comparing the timing of cultural

developments between and within regions. It is also clear that researchers are only beginning to determine the ages of the various Archaic manifestations that typify the Midcontinent. Using the American Bottom in the Mississippi River valley of western Illinois as a test case, we note that, while the 9,000-year-long Archaic period is estimated to represent approximately 75 percent of the post-Paleoindian archaeological record, less than 20 percent of the radiocarbon date assays are for this time span. While other regions and states may present more balanced results, the number of authors in this volume who indicate that their regions of study lack basic chronological frameworks suggests that the American Bottom region is, in fact, at least marginally ahead of the curve in terms of Archaic radiometric documentation.

We suspect that, in large part, this is due to the scholarly focus on later time periods and ceramic-producing groups. In this case, the cultural-evolutionary paradigm acts as a two-edged sword; not only are the later time periods viewed as the pinnacle of cultural development and complexity but the earlier periods are also conceived of as simpler, more uniform, and therefore easier to characterize. Because the Archaic period is viewed monolithically, that is, in terms of “homogeneous long-term trends,” more attention has been given to dating later periods, characterized in terms of cultural dynamics or emergences and collapses. As long as this perspective prevails, there is little incentive to create detailed histories of Archaic people. Because of this, researchers find it acceptable to extrapolate dates and interpretations from neighboring, or even distant, regions to “fill in” local sequences of cultural expressions; given such practices, one should not be surprised to find broad homogeneity characterizing interpretations of the archaeological record of the Archaic period.

To some degree, such generalizations result from the paucity of Archaic archaeological manifestations. The factors of time and preservation have taken their toll on Archaic remains. Archaic sites often yield substantially fewer features containing diagnostics and datable charcoal than do their later counterparts. This accounts for the large number of Archaic dates that have been generated for features (e.g., Lovis, this volume) and stratigraphic levels (e.g., Ahler and Koldehoff, this volume) without associated diagnostic material. Much of the Archaic chronology is built on the radiocarbon dating of geomorphological rather than cultural units, with all of the uncertainties such contexts engender. This testifies to the need to excavate larger samples from Archaic-period sites to generate sufficient cultural material for dating. In our experience, only one out of 10 or 20 (or in some cases one out of 100 or 200) pit features at open-air Archaic sites yields diagnostics. Furthermore, Archaic pits are usually shallow, small processing features that seldom served as trash repositories, and they contain little charcoal. Given these factors, then, greater effort must be made to collect datable material from the few features that are capable of providing reliable and contextually secure diagnostic material.

Regardless of the reason, there can be little doubt that many Archaic-period material expressions remain poorly dated at the regional level. Examples in Illinois that come to mind involve well-recognized point traditions or horizons (e.g., Kirk, Table Rock, Hardin Barbed, Smith Basal Notched, Fox Valley Barbed, and Merkle side-barbed, among others), for which there are no known dates from single-component sites or stratigraphic levels in which these point types dominate. If culture-historical reconstructions and histories rest on constructing chronologies, establishing spatially delineated social boundaries, and, most importantly, identifying regional population stability and movements, then the vagaries of the dating methods employed thus far have left considerable latitude for interpretation of the archaeological record.

Dividing the Archaic

When it became available in the early 1950s, the radiocarbon dating method provided a major boost to understanding Archaic culture history. It confirmed archaeologists' suspicions that aceramic sites represented groups that existed prior to the ceramic-using Woodland lifestyle. More importantly, no longer were interregional comparisons completely dependent on the vagaries of trait distribution analysis to establish cultural associations and contemporaneity. For the first time, small sites with modest assemblages could be reasonably dated. This resulted in a major reappraisal of the age of and variability present among Archaic cultures. Although Ritchie proposed a comprehensive division of the Archaic period, it was Fowler (1959a, 1959b) who struggled with subdividing materials spanning the entire Archaic period from a single site (Modoc Rock Shelter). In the end, he did so arbitrarily by dividing a 6,000-year period of occupation (i.e., 8000–2000 B.C. uncalibrated) into three subperiods of equal 2,000-year units. This division suited his research focus since he was primarily interested in identifying subsistence trends through time (on the basis of artifacts and faunal and floral data) for the various periods of rockshelter use. Although Fowler (1959a, 1959b) created his divisions arbitrarily for intrasite comparative purposes, his ability to recognize substantive differences between them led him to propose three periods of Archaic use of the Modoc site area: (1) a period of initial occupation, (2) a period of localization, and (3) a period of specialization. Once he had identified these subdivisions, he sought to refine the dating involved, incorporating available Archaic dates from throughout the Midwest. He suggested that the initial occupation dated prior to 8000 B.C. and that the period of specialization began about 3500 B.C.

Because he published extensive comparisons between Modoc and sites in eastern Missouri (Graham Cave and Logan), southern Illinois (Faulkner and Ferry), and Kentucky (Green River sites), these divisions represented, for the Midwest at least, the beginnings of the Early, Middle, and Late tripartite

division of the Archaic (even though Fowler did not use these designations). Researchers have struggled ever since with the chronological boundaries assigned to these divisions and the associated lifestyles. For example, Cook (1976), using the established date of 3500 B.C. for the beginning of the Late Archaic in the lower Illinois River valley, defined and characterized two sequential phases, Helton and Titterington, at the famous Koster site. However, presumably because major differences were observed between these two phases in subsistence and settlement patterning, later researchers used the end of the Helton phase to denote the conclusion of the Middle Archaic and the beginning of the Titterington phase (ca. 2500 B.C.) to signal the beginning of the Late Archaic. The problem researchers encounter outside the valley in using this criterion is that the Titterington phase has a very limited distribution in Illinois (many argue that it represents an intrusion from the west; e.g., see McElrath et al. ch. 11, this volume), and they have struggled to find equivalent-age materials. The issue is further complicated by the appearance of the Matanzas point (the hallmark of the Helton phase) much later in Indiana and its use there well into the Late Archaic period (Stafford and Cantin, this volume).

Subsequent Archaic studies in Illinois provided further impetus to the concept that the Early, Middle, and Late subdivisions represented logical divisions of directional trends, especially after Brown and Vierra (1983) published their Middle Archaic model (themes that Brown [1985, 1986] further explored and that we discuss below). This provided the basis for a seemingly perfect marriage of data and theory by taking the Koster site stratigraphic data and wedding it to a hypothesized switch from residential mobility to logistical mobility. This built on Binford's (1980) influential article on the relationship between resource distribution and hunter-gatherer settlement patterning. An indication of the impact of Brown and Vierra's and Binford's articles on midcontinental Archaic research is that they are both cited by many of the contributors to this volume.

Brown used the schema suggested by Binford of a continuum of hunter-gatherer subsistence-settlement strategies that related consumers to available resources, and he transmogrified this concept into a cultural-evolutionary model. Thus, whereas Fowler (1959a, 1959b) had assumed, at least for purposes of discussion, that the environment between 8000 and 2000 B.C. was essentially stable, Brown (1985; Brown and Vierra 1983), using more recent data developed at Koster (e.g., Butzer 1977, 1978; Hajic 1981) and elsewhere in the Midwest (King 1981), attempted to relate the archaeological record in the lower Illinois Valley to rather dramatic changes in riverine geomorphology combined with vegetational changes purportedly associated with the Hypsithermal climatic episode. In the resultant reconstruction, populations were both forced off the upland prairie regions by deteriorating climatic conditions associated with a drying episode and attracted to enhanced aquatic resources in the floodplain associated with the development of meandering river channels. This "push-

pull” reorientation of populations has assumed the dominant role in explaining population distribution in the Midwest, just as the switch from residential mobility to logistical mobility (à la Binford) has become a dominant explanation for significant changes in the archaeological record throughout the Midcontinent (although the timing of this event is viewed as regionally variable).

One might expect that the broad perspective gained by incorporating data at the midcontinental level in this volume would provide a comprehensive regional basis on which to divide the Archaic into consistent, comparable, yet regionally sensitive diachronic units. In our judgment this is not feasible at this juncture because every region has a historically rooted rationale for its own temporal divisions, and, at least in some cases, rationality has less to do with it than does the force of tradition. It seems reasonable to divide such a lengthy period (which is now seen as extending for at least eight millennia) into manageable subdivisions, and virtually all contributors to this volume make use of a tripartite schema of some sort. This triple division has become the de facto temporal framework and will no doubt continue to be, despite its problems, for the foreseeable future.

It seems reasonable, therefore, to retain the tripartite system as an arbitrary division of the Archaic for purposes of identifying the time frame with which one is dealing; but, at the same time, it seems unwise to link temporal boundaries to perceived technological “progress,” adaptational “advances,” or changing climatic episodes for the simple reason that, to the extent that any of these factors influenced human actions, they were, by definition, regionally experienced and highly variable. Virtually all of the technological innovations that have been enlisted to define the Archaic either by inclusion or exclusion (e.g., the inception of the bow and arrow, agriculture, pottery, sedentism, political complexity, mound building, etc.) have proven to be, if not outright inapplicable, at least equivocal. It is no longer feasible to view the Archaic at any supraregional level as exhibiting broad trends that can be used to characterize temporal subdivisions representing isomorphic units, even if one allows for the time-transgressive expression of effects associated with south-to-north vegetational shifts resulting from glacial retreats, and west-to-east changes triggered by an advancing prairie. Indeed, the Archaic seems to have been far more complex than either its name or the previous attempts at overviews have intimated.

Projectile Point Style, Form, and Function

Archaic-period research begs the question, how do scholars establish local or regional sequences and determine historic trajectories for Archaic-period societies? The answer is, of course, that they use “diagnostics” (usually projectile point types) from surface sites to establish the relative intensity of

local and regional occupations and the settlement systems employed; the presumed dates of the various diagnostics are usually assigned in the Midwest on the basis of relative dates and radiocarbon determinations generated from other areas, particularly the Midsouth and Southeast. This dependence on surface diagnostics raises a host of inevitable and very thorny issues concerning the nature and reliability of projectile point typologies and the validity of types as chronological markers. In fact, the “hafted biface,” as researchers now prefer to call the projectile point, has been viewed with mixed feelings and today has a problematic place in archaeological research.

The use of projectile point types by midwestern cultural resource management (CRM) archaeologists has persisted because types have proven valuable for recognizing chronological and cultural units and because they facilitate communication among researchers. The idea of types may also prove useful in new analytical approaches involving the concepts of communities of practice and the *chaîne opératoire*. While we do not wish to relive or, worse, rekindle the typology debates of the mid-twentieth century, we briefly explore the historical development of the point-type debate and new perspectives that may serve to resolve some of the more contentious issues that were once considered irresolvable.

One philosophical aspect of the typology issue that was hotly debated in the 1950s concerned the nature of types. Some theoreticians argued that types existed in the real world and simply awaited discovery (Spaulding 1953), whereas others argued that they were arbitrarily imposed (Rouse 1960). Perhaps because a new generation of scientists has turned its attention to phenomena, such as certain life-forms and subatomic particles, that defy conventional classification, increasingly, researchers in many fields have accepted that all categories are humanly constructed and, therefore, by definition, are arbitrarily imposed on the unsuspecting “real” world (Tschauner 1994). If one accepts this premise, then the only measure of the validity of a defined type or classification system is how useful the categories prove for advancing understanding of the subject matter. It also means that the essentialism that purportedly undercuts the usefulness of artifact types (Lyman et al. 1997) is of equal concern for all organizing schema used by archaeologists (be they artifact types, political types, settlement types, subsistence types, ethnic types, or selectionist traits).

Whereas previous conceptualizations of artifact typologies analogized them as “mental templates” representing ideals that were shared by social groups and that producers strove to replicate, practice theory recognizes that they are the products of communities of practice, that is, interacting individuals who are involved in their production. Although the two concepts appear superficially similar, the latter is more flexible and less abstract because it explicitly acknowledges the method (human agency) by which the knowledge of tool production was transmitted between generations. In terms of our discussion, it recognizes that a teacher-student (i.e., master-novice) relationship provided the context for

training successive generations of flintknappers in the “correct” way to perform a task (in this case, producing hafted bifaces). Correct performance involved not only the basic mechanical aspects and the chaîne opératoire of tool production but also the religious and symbolic implications that imbued the process with meaning. Many idiosyncratic elements of point production were also transmitted, involving the appropriate blade shape, stem treatment, hafting method, refurbishing sequence, and so on. Obviously, the subject of training was not limited to the production of hafted bifaces but, rather, included a multifaceted catechism of lithic tool manufacture; raw material acquisition; weapon production; techniques of tracking, trapping, killing, and processing game; and the general wisdom and special lore necessary for defending and supplying the individual, family, or corporate group with food.

Much attention has been focused on how hafted bifaces inform archaeologists about activities undertaken (i.e., function) or group interaction (form or style). The neutral term *hafted biface* became popular after Stanley Ahler convincingly argued, on the basis of his examination of a sample of 114 projectile points from a single level (Stratum 2) at Rodgers shelter in Missouri, that the belief that points served as tips for projectiles is not always consistent with evidence from use-wear analysis. He further addressed the issue of whether the morphological variability in the Rodgers assemblage was due to “mental templates” derived from ethnic preferences or, as he surmised, from functional distinctions. Ahler (1970:118–121) arrived at a series of conclusions that have typically been characterized as supporting functional categories as opposed to “formal” or cultural categories, although Ahler himself was more cautious in describing his results. Among other things, he discovered functional categories that crosscut some formal categories and formal categories that fulfilled more than one function, suggesting they contained more than one tool “type.” Ahler was also able to replicate many of the wear patterns evident in the sample assemblage and provide insight into some of the activities undertaken by the tool users. Among other things, he suggested that heavy serration was correlated with sawing or slicing and that, by contrast, beveling was not related to function (i.e., tool use) but, rather, was the result of resharpening. Eastern Woodland specialists have largely accepted these conclusions, while often ignoring other of Ahler’s insights, for example, that “gross morphological” formal categories were better supported by factor analysis than the refined formal categories based on “objective” criteria (Ahler 1970:119).

Weapon Systems

Ahler may have been one of the first of the New Archaeologists to address point typology and function, but he and contemporary lithic researchers were not the first to confront the problem of discerning the uses of stone projectile points; nor

are today’s researchers the first to struggle over the form versus function dilemma. The great artist and anthropologist William Henry Holmes, who documented many of the lithic quarry sites and flintknapping techniques used in North America, observed in a symposium on “Arrows and Arrow-Makers” that “it is not possible, in all cases to distinguish points made for the arrow from those made and employed for projectiles thrown by the hand, or throwing stick, or from those intended to be hafted and used as knives, daggers, drills, and the like. It is not unlikely that many points were alternately used for a number of purposes as necessity demanded” (1891:49). In the same symposium, Thomas Wilson, another important student of the stone projectile point, reinforced this observation with his own. “The arrow-heads, spear-heads, and knives of the prehistoric races have such likeness of form, style, and size that a line of division between the three is practically impossible” (Wilson 1891:58). The problem was expressed even earlier by Haldeman in a consideration of “unsymmetric arrow-heads.” He observed that, “while irregularities would interfere with the function of arrows, all these objects are not to be regarded as arrow-heads, some of the larger kinds being for spears, while others are probably borers, . . . scrapers . . . and knives” (Haldeman 1879:292).

The fundamental question concerning the weapon system represented by projectile points from archaeological contexts persisted into the twentieth century, when systematic excavations began to yield stratigraphic results that could be used to separate and relatively date artifact assemblages. Turn-of-the-century attempts to solve the problem, as they are today, were based on observations made on ethnographic and archaeological collections and on experimentation and replication. Willoughby (1902) scoured the literature and museum collections to identify prehistoric knives that were still hafted onto handles. He discovered several from California, Colorado, Oregon, and Ohio as well as examples from dry caves in northern Mexico (state of Coahuila). He noted that the stone blades were “of the common typical forms (leaf-shaped, triangular, stemmed and notched) usually found in a collection of chipped implements” (Willoughby 1902:3). He further observed that the blades were affixed to wooden handles sometimes using only gum, sometimes only cords (either plant cordage or animal sinew), and sometimes both. He concluded by enumerating the various uses that researchers today ascribe to projectile points and observed that “the greater number of the implements of the common types, of lengths varying from about two inches to seven inches, were probably used as knife blades” (Willoughby 1902:6). Despite these early observations, which continued to be upheld by the recovery of additional specimens from dry cave sites in the Southwest (e.g., Guernsey and Kidder 1921), archaeologists to this day hold out hope that the geometry of the hafting element will eventually be proven to vary according to the specific weapon system in use. To further pour cold water on this idea, we offer the example of late prehistoric arrowpoints (e.g., Justice 1987), which display all of the hafting-element

shapes that are present among earlier hafted bifaces, with the possible exception of fluting.

Aside from the function of projectile points, early researchers speculated on the rationale for such attributes as beveling, serration, and barbs. By the late nineteenth century, the process of stone tool production had been demystified through direct observation of tool production by native flintknappers (Redding 1879; Wilson 1899) and by some researchers' mastery of stone tool production techniques (e.g., Cushing 1895). Researchers began to examine the individual elements of stone tools, in particular, hafted bifaces, to debate the functional merit of individual characteristics. For example, Haldeman (1879) suggested that barbs, especially the single barbs associated with "unsymmetric points" might be related to fish gigging. Fox addressed the issue of serration, noting that, although characteristic of tools from North America, Europe, and Japan, its widespread occurrence was probably not the result of diffusion or migration, and he observed that

the mode of working flint and other materials which flake off with conchoidal fracture, by taking off flakes and leaving facets from the edge alternately on opposite sides, naturally produces a more or less serrated edge, in consequence of the projection of the edges between the facets. A perfectly serrated edge, therefore, appears to me to be a refinement of workmanship produced by deepening the facets, which might or might not have been produced independently in different countries. [1875:319]

Similar arguments were presented for the "spiraling" or beveling that was noted on points. Beveling was popularly thought to impart a spinning or "rifling" motion to the dart or arrow in flight (Fairbank 1864; Hough 1891; Wilson 1899). This notion was disputed by accomplished practitioners to the degree that, by the mid-twentieth century, reference to "rotary points" brought derision from one flintknapper: "The fable that beveled points were made in that manner to spin an arrow in flight is in the same category as that fable about the Mound Builders tempered copper, and the one about chipping arrow heads from red-hot flint with an icicle. Let us forget them or leave them to the writers of filler pieces for the Sunday Supplement" (Smith 1953:270). The assertion that beveling imparts important flight characteristics, however, continues to be asserted by some researchers today (i.e., O'Brien and Wood 1998:96).

Like modern researchers, these early pioneers were also fascinated by the relationship between the spear-thrower and the bow and arrow. Otis Mason (1885) published a study of North American spear-throwers in the collections of the National Museum, and in 1891, Zelia Nuttall published her influential study of the atlatl, based on an analysis of Mexican codices. Interest increased considerably when several ethnographic spear-throwers, collected along the western coast of North America during the Vancouver expedition in the late eighteenth century (1790–1795), came to light when the

expedition collection was donated to the British Museum almost a hundred years later (Read 1892). The discovery of ethnographic specimens was followed quickly by reports of archaeological specimens from Colorado (Mason 1893) and Florida (Cushing 1897). Like their modern counterparts (e.g., Vanderhook 1998), early researchers also experimented with the efficiency and accuracy of the atlatl weapon system.

These discoveries spurred debates over the antiquity and possible multiple inventions of the bow and arrow, which was clearly the weapon of choice in subarctic and temperate North America at the time of European expansion. Sporadic discoveries of archaeological atlatls were made throughout the early twentieth century, leaving little doubt as to the ubiquity (cf. Kellar 1955) and, to some extent, the antiquity of the spear-thrower. By 1940, when Fenenga and Wheat (1940:222) reported on one specimen recovered from the Baylor Rock Shelter in Texas, they were able to list multiple southwestern examples, from Arizona, Oklahoma, New Mexico, Mexico (Chihuahua), and Texas. Once the spear-thrower was shown to have been widespread and important in North America, the discussion eventually shifted to practical considerations involving the identification of archaeological correlates of this weapon system, since few regions outside the Southwest enjoyed favorable preservation conditions.

Fenenga (1953) was the first to formally employ weight to distinguish between atlatl and arrow points. In fact, size had already been recognized as a potential criterion for sorting atlatl points from arrowheads, and archaeologists had been informally using it for years to classify specimens. Baker and Kidder (1937) dated the transition from spear-thrower to bow and arrow in the Southwest to Basket Maker II times and noted the absence, in general, of arrow-sized points from "respectably ancient deposits." This prompted a response from Browne (1938, 1940), an avid archer and hunter, concerning the optimal size of arrow points. Browne had experimented extensively with stone points and had concluded that there was considerable overlap between atlatl and arrow points, in terms of both overall size and haft-element size. He used stone points exceeding 5 cm in length, including archaeological specimens from the Signal Butte I, Sheep Mountain, and Pictograph Cave sites, and was able to shoot arrows tipped with these points to distances of 175–200 yds (Browne 1938). He lamented that he was not able to test a Folsom point from the Lindenmeier site, suggesting that, "if ever there was a point that was made for efficient bow and arrow shooting, it is the Folsom point" (Browne 1938:359).

Elements of this long debate have been resolved to some degree in recent times; Thomas (1978) did what researchers had done almost a century earlier and examined museum specimens in an attempt to distinguish spear from arrow points. He developed a statistical method of separating them that proved accurate 86 percent of the time. His method was based on his examination of over 100 archaeological hafted arrowheads but only 10 dart points attached to foreshafts. Shott (1997) extended the hafted-dart sample size to 39 by

visiting several more North American museums. On the basis of his larger dart population, he was able to demonstrate that simply measuring shoulder width was as effective as the more complex statistical methods employed by Thomas (1978) to distinguish between arrow and dart points. Researchers quickly realized, however, that, while shoulder width might be a reasonably accurate guide for distinguishing between isolated dart and arrow points from surface survey, it would not serve to resolve the issue of the antiquity of the bow and arrow if both systems operated contemporaneously (Corliss 1980; Shott 1997).

In addition to the stone tips of darts, researchers have also attempted to identify “adjuncts” to the spear-thrower that might be considered *cartes de visites* in the absence of preserved specimens of the spear-thrower itself. Occasionally, bone spurs have been recovered that are interpreted as the hooks that were attached to the distal end of the throwing stick and that served as the point of contact with the base of the dart shaft during launch (Goslin 1944). While bone is only slightly more likely to be preserved than wood, the recovery of such hooks in linear association with ground bannerstones and stone points in Late Archaic burials in the Midsouth (Webb 1946; Webb and Haag 1939) led most researchers to conclude that the exotically shaped bannerstones served as spear-thrower weights. Atlatl weights of copper, galena, and stone were soon identified in archaeological context (sometimes associated with burials) throughout North America (e.g., Butler and Osborne 1959; Neuman 1967). Other archaeological atlatl adjuncts that were recognized included shell or stone “spurs” from California (Riddell and McGee in 1969) and U-shaped shell “fingerhooks” from northern Mexico (Ekholm 1962). In the Eastern Woodlands, the bannerstone (e.g., Winters 1961) and, eventually, the “boatstone” and “birdstone” of the Northeast (Griffin 1967) became synonymous with the atlatl. The earliest occurrence of the bannerstone (i.e., Middle Archaic) was thought by some (e.g., Griffin 1967, 1968) to date the invention of the spear-thrower.

These circumstantial associations seemed to generate confidence among Eastern Woodlands scholars that the artifacts involved were functional parts of an atlatl weapon assembly. However attempts to prove the functional advantage of attaching a weight to a spear-thrower were considerably less supportive; for example, Hill (1948) suggested only “some” improvement using a weight with lightweight darts; Peets (1960) was unable to demonstrate any advantage; Mau (1963) suggested improved distance throws; Howard (1974) suggested no improvement; Palter (1976) suggested diminished throwing capacity; and Raymond (1986) suggested no improvement in distance but potentially improved accuracy. Although the jury is still out on the subject, the one thing that is beyond doubt is that weights are not necessary for competent and reliable use of the spear-thrower as a hunting and warring device. Notably, none of the ethnohistoric or ethnographic atlatl examples on record involved use of a weight (Palter 1976); however, small “fetish” stones (often turquoise or hematite)

and related symbolically charged paraphernalia (usually animal teeth) were sometimes attached near the proximal end presumably to confer a spiritual, if not a functional, advantage to the operator (Palter 1976). In any event, the presence or absence of atlatl weights, if, indeed, the artifacts so identified operated as such, cannot be argued as proof of the antiquity of this weapon.

The past couple of decades have seen a renewed emphasis on the study of projectile technology on a worldwide basis (e.g., contributors to Knecht 1997), one aspect of which has been an attempt to identify archaeological correlates of specific weapon systems. Christenson (1986) has provided a comprehensive review of attempts at relating hafted-biface attributes to appropriate weapon systems, noting that several ethnographic, archaeological, and experimental studies support a relationship between stem width and haft diameter that may have implications for distinguishing different weapon systems. In an impressive, commanding grasp of both the physical principles governing projectile flight and the knowledge gained through experimentation with artifacts, he assessed how information about projectile accuracy, killing power, range, and durability can be used to functionally decode archaeological hafted bifaces. He used a surface-collected sample from the Sangamon Valley of Illinois to explore these issues and examined technological developments in the context of a generalized temporal framework. Although Christenson found that hafted bifaces dating to certain periods seem to conform to predicted trends, he encountered problems in recognizing long-term technological trends; in particular, the larger hafted bifaces associated with the Early and Middle Woodland periods counter an expected trend of decreasing point size through time. We would add to this the observation that, in the American Bottom, the average sizes of points from dated context are erratic through time, sometimes oscillating wildly, as exemplified by the hypertrophic Titterington points and the diminutive Riverton point types, the latter only a few hundred years later than the former (contra Shott 1996; cf. McElrath et al. ch. 11, this volume).

We have embarked on this history of the study of Archaic weapon technology and the functional and typological aspects of hafted bifaces to highlight several issues that we consider to be of paramount importance, especially in a volume dedicated to Archaic societies. First, after almost a century and a half of directed research by some of the best minds, past and present, in the discipline, the categorization of hafted bifaces either by form or by function remains problematic. Disciplinary consensus has emerged on occasion. For instance, archaeologists seem to have concluded that projectile points are better viewed as hafted bifaces, because they were often used as knives (e.g., Ahler 1970; Finkelstein 1937; Haldeman 1879; Holmes 1891; Nance 1971; Odell 1994; Willoughby 1902; Wilson 1899). Points of consensus, however, are few.

Archaeologists are unable to convincingly distinguish between the tips of arrows and the tips of atlatl darts or to determine whether the bow and arrow or the spear-thrower

is a technologically or functionally superior weapon system, whether groups used multiple weapon systems contemporaneously, or whether hafted-biface morphological form was generated by ethnic practices or simple functionality or both. Inability to answer these simple real-world questions has a dramatic impact on interpretations of the past.

Take, for example, the inability to identify the morphological characteristics of arrow versus dart points. This precludes archaeologists from determining the individual histories of these two weapon systems in the New World. It leads to a lack of consensus on such topics as the date of the introduction of the bow and arrow in North American prehistory. If, for example, one were to poll current views on when the bow and arrow was introduced or reinvented in North America, one would find the following opinions: Paleoindian (Amick 1994; Patterson 1994), Early Archaic (Byers 1959; Shott 1997), Late Archaic (Bradbury 1997; Nassaney and Pyle 1999), Middle Woodland (Justice 1987), and Late Woodland (Hall 1977, 1980; McElrath et al. 2000). The best that can be said from written historic accounts is that both systems existed at contact in the Western Hemisphere. An equally diverse set of archaeologists could be called on to dispute related topics, such as whether there were single versus multiple inventions of the bow and arrow or whether it was technologically superior to the spear-thrower.

It would appear that well over a century of functional analysis has resolved little about the relationship between stone points and their counterpart weapon systems. In reviewing the current literature, we note that researchers are of two opinions. The optimistic scenario is perhaps best expressed by Christenson, who passionately argues that the pursuit of several lines of research “will ultimately lead to the development of numerous general and specific models of projectile design” (1986:123–124). In seeming contradiction, Shott concludes that, “leaving aside other possible uses of chipped-stone bifaces, we cannot with certainty classify archaeological unknowns as dart or arrow points, and we will never attain such an impossible goal” (1997:99). Although these views may seem an unusual segue into the next topic, which concerns the use of hafted bifaces as spatially and temporally sensitive group-identity markers, we argue that it is the reconciliation of these two seemingly contradictory statements that will provide the foundation for building a more productive and realistic understanding of the place of Archaic people and the social role of technology, in the history of the Eastern Woodlands.

We begin by pointing out that we have presented the two quotes in the previous paragraph out of context. Christenson is referring to interpreting a sequence of points from a specific region (the Sangamon River valley of Illinois), whereas Shott is referring to the overlap in archaeological hafted dart and arrow point metrics that reduces to 85 percent the reliability that unhafted projectile points can be correctly assigned to either class, thereby leaving considerable room for doubt about the assignment of any given specimen. This

is relevant because researchers interested in identifying early (indeed, the earliest) use of the bow and arrow will find this objective difficult to achieve if the bow and arrow was used in tandem with the atlatl system. Still, one can view this state of affairs from the perspective of the glass half full rather than half empty. After all, Shott points out, regarding the 85 percent level of accuracy, “Considering the problematics of archaeological inference, this is not a bad average.” It goes to the core, however, of what questions archaeology and archaeologists may be capable of addressing.

Of course, a large part of the uncertainty in hafted-biface studies comes from applying modern engineering concepts of specialization and optimal efficiency to prehistoric systems of technology that were, in fact, extremely flexible and technologically forgiving, especially when used in combination with a variety of hunting techniques (e.g., communal drives, netting, and perhaps even poisoning). The minimal requirement of a stone point hafted on a shaft is that it allow the shaft to be propelled a “reasonable” distance, with sufficient force, accuracy, and penetrating power to kill or cripple the target, whether a person or an animal. Despite impressions to the contrary presented by modern researchers, this minimum requirement is met by a wide array of shapes and sizes of “points” (witness the multitude of shapes and sizes of stone, bone, wood, teeth, antler, and other materials that bedeck the business end of historic arrow and spear shafts). The “significant” engineering parameters of projectile points may, in fact, be limited to broad principles; for example, beyond a certain threshold, a point may simply be too large or heavy to be propelled by a bow. Clearly almost no point is too small to be placed on the piercing end of an atlatl or spear shaft. This suggests that studies based on the principle of functional optimization may, again, be misdirected when applied to ancient tradition-bound technologies.

Are Points People?

Moving beyond the concept of functional optimization, we consider the demonstrable relevance of projectile point types as group-identity markers and their importance in documenting group interaction across space and through time. The early pioneers involved in relating projectile points with their counterpart weapon systems were also concerned about classifying projectile points into logical categories. To some extent, this was no doubt a reflection of the museum mentality that favors classification as an organizational device, but it is also clear that early researchers entertained the idea that similarities in form indicated historical and social relationships. For example, Fox (1875) argued that stone point styles from sites in Patagonia were more similar to North American forms than Old World types, suggesting historical relationships within the New World. The issue of classificatory types was such a common concern in the nineteenth century that

Wilson complained about the complexity of the classification systems that had been employed by his contemporaries, suggesting that they were “too complex, the divisions have been too close, and the distinctions not sufficiently broad to be popular. A classification of infinitesimal divisions, with slight differences, difficult to distinguish and still more difficult to remember, will never be satisfactory or acceptable” (1891:58). He went on to propose a simplified system that included three shape categories: leaf shaped, triangular, and stemmed, with each shape type including up to three subclasses. He further identified a “peculiar” category made up of beveled, serrated, and bifurcated specimens and examples with “extremely long barbs usually squared at the ends.” Obviously, “lumpers” and “splitters” have a long tradition in archaeological studies.

We credit a fellow American Bottom researcher, Robert McCormick Adams, with popularizing the term *diagnostic* to refer to point types that were spatially or temporally restrictive or both. He noted that “several valuable classifications of flint points have been formulated but few of these have attempted to distinguish between those points having diagnostic value, and the numerous forms which are found rather indiscriminately over a large series of cultures and which may or may not have value as cultural determinants” (Adams 1940:72). Adams may have been the first to explicitly lay out criteria to be considered in developing point types. He suggested that a classification system might “include a description of form, technique of chipping, type of chipping scars, and the nature of flint or chert used in its manufacture” (Adams 1940:72). The examples he chose as diagnostic for the Eastern Woodlands were all Woodland or late prehistoric forms; no Archaic examples were considered illustrative. This highlights a problem that persists today, that is, that many Archaic projectile point types cannot confidently be associated with other “cultural traits” that could be used to establish their diagnostic value. So, many Archaic point “types” were created simply on the basis of morphological similarity rather than on cultural and chronological contextual associations. Is it a surprise, then, that many of these types are suspect as valid cultural indicators or even as morphological units?

By the 1930s, researchers were beginning to promote “taxonomic systems” of classes and types of projectile points (e.g., Finkelstein 1937). As with other artifact categories, many researchers believed that projectile point types existed and awaited discovery (Smith 1954). By the 1960s, the analytical power of computers was seen as the key to sorting out the myriad of metric and nonmetric data necessary to scientifically describe and objectively categorize stone tools (Krieger 1964; Weyer 1964), an unfortunate trend that continues to this day. The classification of projectile point types very quickly became caught up in the debate over artifact types, in general (see Lyman et al. 1997). An even more unfortunate fate was in store for types when they were equated with “norms” (Binford 1965) and were swept up in the normative-substantivist debates (cf. Lyman and O’Brien 2004). Ironically, although Binford equated “type” with “norm” and treated both as

four-letter words not to be used in social discourse, it was the New Archaeologists who undeniably incorporated norms into their methodological approach to model building (cf. Lyman and O’Brien 2004).

One outcome of the processualist approach to artifact analysis was the famous “style or form versus function” or “tale of two caves” debates between Binford and Bordes (Bordes 1972) in the 1970s; in the Old World, the argument centered on the implications of variability among Mousterian lithic assemblages, but in North America it signaled the start of a major reassessment of how archaeology should be conducted. The scholarly free-for-all that resulted directly and indirectly affected midcontinental Archaic studies, partly because Binford learned (and taught) much of his archaeology in the Midwest but also because the debate thrust hunter-gatherers into the limelight. The North American Archaic became the darling of the Americanist New Archaeologists. Efforts to persuade archaeologists that the miscreant type concept was so heavily laden with flaws that it could not be usefully applied largely succeeded. This only served to drive the use of types underground; while researchers in the Midwest openly talked about and used types for purposes of communication, in published reports they tried to objectify their analyses by using arbitrary biface categories (e.g., Class Ia, Ib, II, etc.). This attempt at sidestepping the issue actually made it worse for those attempting to compare reported assemblages, because of the confusing overabundance of artificially labeled categories to be considered. Meanwhile, CRM archaeology was steadily amassing evidence that supported the affiliation of specific point types with specific regions, periods, and even societies. The premature announcement of the death of point types was eerily similar to the conclusion reached by engineering studies that bumblebees, by virtue of their poor body weight-to-wing ratio, were not actually capable of flight. During the 1970s and 1980s, the chronological and cultural validity of projectile point types was being demonstrated as was the value of culture history (e.g., Bareis and Porter 1984).

We might point out that recognizing “communities of practice” as the underlying rationale for the existence of types should clarify one aspect of the archaeological record, but it will do so at the expense of the traditional functionalist approaches cited above. At issue is the central role accorded to the master-novice relationship and the impact this relationship has on shaping material culture. This holds major significance for the debate concerning the antiquity of the bow and arrow. Typically, in ethnographic hunting and gathering societies, the teacher charged with the training of a student in the necessary lore of hunting will gift the student with a “toy” set of weapons (or perhaps several sets throughout his childhood and early adolescence) to allow him to develop the complex motor skills required to skillfully operate weapons as an adult. Archaeologically, this would be reflected in “undersized” stone tools, appropriate to the size of the person being trained. In the case of spears or darts, the small hafted bifaces would easily fall into the size range of arrowpoints. Most midwestern

archaeologists have encountered diminutive examples of all of the commonly recognized Archaic forms and have privately speculated that they served as teaching toys. Such points would only account for a small number of the points used by the average hunter throughout his lifetime, but this scenario certainly highlights the concerns that some researchers have expressed (Corliss 1980; Shott 1997) concerning the reliability of distinguishing between arrow and dart points.

As proof of the validity of types, we offer the success that has been achieved in the recognition of contextually and chronologically based projectile point types or styles. In fact, time and the accumulation of data tend to favor resolution of issues surrounding the viability of point types. Few archaeologists now dispute the priority of fluted points in the Eastern Woodlands sequence and North America, in general. The 14 point types Scully (1951) identified for the central Mississippi Valley are still recognized as valid today, even if researchers have modified their associations on the basis of new information; for example, several types originally identified as Late Archaic or Early Woodland are now recognized as indisputably Early Archaic (i.e., Hardin Barbed, St. Charles, Graham Cave Notched). Points that had been assigned to a broad Late Archaic–Early Woodland time span have recently proven to be restricted, on the basis of good contextual data, to one or the other period, at least in some regions (e.g., Emerson and Fortier 1986). Other examples abound. Dalton points were once chronologically grouped with side-notched varieties because of their co-occurrence in mixed deposits in cave and rockshelter sites, but their unique occurrence on open-air sites in the Southeast led to their recognition as an earlier horizon marker (Goodyear 1982). Kramer points, which were thought to bridge the Terminal Archaic–Early Woodland transition, are now definitively associated exclusively with Early Woodland times (in fact, with one specific Early Woodland culture—Marion), at least in the Midwest. The straight- and expanding-stemmed, barbed varieties (e.g., Dyroff, Springly, Mo-Pac) that were thought to persist from Archaic times into the Early Woodland in Illinois (Linder 1974) are now recognized as restricted to the terminal Late Archaic (McElrath et al. 1984). Contracting-stemmed points have been historically difficult to employ as cultural identifiers because they seem to reappear often in the archaeological record, having been found in the Eastern Woodlands and on the Plains in contexts dating from about 6000 B.C. to A.D. 500. In specific localities, however, they seem to be restricted in their affiliation to narrow periods or specific cultural associations. For example, in the American Bottom Archaic sequence, they are largely restricted to a single Late Archaic phase (i.e., Mule Road). They reappear in Early Woodland contexts, in which they are associated with Black Sand and Florence-phase sites, but not with Marion-phase sites (Emerson and Fortier 1986; Farnsworth 1986), and they are common in Middle Woodland contexts but may be more temporally and regionally sensitive than previously thought (Fortier 2001).

Archaeologists are also beginning to recognize significant boundaries in the distribution of particular point types; for example, the classic Dalton variety is arguably restricted to the central Mississippi Valley (Koldehoff and Walthall, this volume). We are even beginning to recognize contemporary (ethnic?) boundaries or interface zones between point types, as in the case of the McLean point type of the Falling Springs phase of the American Bottom and the side-notched Hemphill and Godar types in the central Illinois Valley (McElrath et al. ch. 11, this volume; Nolan and Fishel, this volume). Stafford and Cantin (this volume) suggest a possible boundary between the Brewerton Eared variety of the Ohio River valley and the Matanzas types of the southern Indiana hill country.

This is not to imply that the pursuit of types has not been without missteps, setbacks, or failures, many of which have involved grouping points by a single apparent morphological trait, usually centering on the haft element. The failure to conduct careful typological examinations and to rely on secure collections from chronologically and contextually secure deposits has led to much confusion. For example, in the Midwest, the common assumption that side-notched points can be reliably assigned to the Middle Archaic period (O'Brien and Warren 1983) has largely been disproved (Nolan and Fishel, this volume). Contracting-stemmed points are a perennial focus of examination in the effort to develop explicit criteria to formularize a method of objectively sorting surface-collected materials into various named Archaic and Woodland types. Such studies seldom yield publishable results; as is the case for side notching, the tendency is to resort to a functional explanation for the contracting base shape (Boszhardt 2002; Musil 1988).

It is important to recognize that projectile point types do not form a classification scheme that can be invalidated or undermined because a given point type proves not to be a useful indicator of age or cultural affiliation. We recognize that each type must stand on its own and that some are more useful and restrictive, either temporally or spatially, than others are. Also, we reject any attempt to mathematically define or recognize point types on the basis of a uniform set of criteria. A single trait, such as a distinctive haft element (e.g., Turkey-tail), shoulder element (e.g., Table Rock), blade shape (e.g., Wadlow), barb shape (e.g., Calf Creek), or unusual composite shape (e.g., Fox River Valley), may be sufficient to define a category; more often, multiple factors, such as frequency of heat treatment, method of resharpening, degree and placement of grinding, and material preference play significant roles in contributing to the recognition of distinct types. Again, the criteria for accepting a type (or variety) as useful rests solely on the degree to which the point can be reliably associated with a group or time period on the basis of excavated, contextually secure materials.

The suggestion that projectile point types are subjective is absolutely correct; all attempts at lithic categorization are subjective. Researchers have recently recognized that debitage types are not easily replicated or necessarily logically bounded

(Shott 1994). Degree of thermal alteration of chert has always been difficult to define, and even assignment of chert to bedrock formations is not without difficulty (McElrath and Emerson 2000). Still, experienced regional practitioners who are accustomed to identifying the projectile point types that occur in their region will achieve and share a consistency rate of identification that matches the success rate that lithic use-wear analysts have demonstrated with blind testing (Odell and Odell-Vereecken 1980).

Whatever misgivings researchers may have had in the past concerning the concept of projectile point types, it is clear that the universality and heuristic value of types as cultural markers outweighs the shortcomings accruing to small pointed stones with few distinguishing comparative traits. Many contributors to this volume have endorsed hafted bifaces as ethnic or cultural markers to varying degrees (e.g., McElrath et al.; Ray et al.; Stafford and Cantin; Nolan and Fishel; cf. Ahler and Koldehoff; Butler; Purtill; and Wiant et al.). In fact, the projectile point has assumed a preeminent role in assigning time and cultural affiliation, to judge by the contributions. For example, in their summary of western Illinois Archaic prehistory, Nolan and Fishel (this volume) list 62 radiocarbon dates from 29 sites, but the database they draw from of sites with chronological parameters exceeds 4,000 locations (Dave Nolan, pers. comm. 2005), indicating that over 99 percent of the sites are given a temporal assignment on the basis of diagnostic projectile point type present.

Most researchers now recognize the falsity of the form-versus-function dichotomy that developed during the twentieth century and accept the two aspects as complementary sides of the same “biface” (Christenson 1986; Odell 1994, 1996; Shott 1997). The cultural-evolutionary paradigm that artificially postulates a trend of continually increasing efficiency precludes the independent study of point styles and forms since those who endorse that paradigm seek answers that are, to a large extent, predetermined by the model. We see the projectile point form as a very forgiving, functionally diverse, and variable tool that was documented in the ethnohistoric record as having served, at a minimum, as a piercing weapon for hunting and war, as a butchering and cutting tool, and as a scraping implement. Functionalist studies that impose modern standards of tool specificity onto the past establish false parameters by which to measure tool selection. Point shape was more likely dictated by hafting needs and cultural preferences than by standards of physics and functionality. We further argue that only by adopting a theoretical stance that allows for the stereoscopic perspective necessary to integrate form and function will archaeologists contribute to a meaningful, three-dimensional reconstruction of the history of Archaic societies. The basic documentation of the growth, spread, and interaction of Archaic social groups in a culture-historical framework (homology) is the fundamental and necessary precondition for any contextually meaningful discussion of the role of environment and technology (analogy) among the apparently diverse trajectories undertaken by those societies.

The incomplete and sometimes contradictory nature of the evidence surrounding formal stone tool uses and associated weapon systems precludes data-based conclusions that lead to a grand narrative theme. The narrative themes that have been employed in the literature were in place prior to the collection of the data that are marshaled to dispute the issues. So, for example, the argument that the bow and arrow system is technologically superior to and, therefore, replaced the atlatl and dart as a preferred weapon system exists in the absence of conclusive data from the prehistoric record; instead, the evidence cited in support of the argument is selected on the basis of its conformity to the paradigm. We believe that most researchers quickly overlook this in the heat of debate. Even more problematic are the subtle, unexpressed biases inherent in the Western outlook. In particular, we argue that the concepts or, more accurately, the assumptions of the inevitability of technological progress and innovation and the accepted importance of “newer, better” devices are so ingrained in the Western world view that they have become the accepted scientific explanation for whatever archaeological phenomenon is thought to require illumination.

Earth, Wind, Fire, and Water and the Archaic Landscape

The study of climate change and culture-climate relationships has been an integral part of Holocene research for at least a century and was especially emphasized in the New Archaeology. Climates change because of natural forcing mechanisms such as variations in solar output, increases in carbon dioxide and methane gases, volcanic aerosols, and rapid deglaciation, which creates changes in oceanic water temperatures (Webb et al. 2004). The relationship between climate change and fluvial response is unpredictable and variable (Knox 1985; Van Nest 1997). Understanding the episodic nature of rainfall, erosion, and flooding, especially in regard to human habitation in river valleys, is, however, an important aspect of Archaic research as is documenting the relationship between landscape evolution and climatic change at the local level during the Holocene. In fact, large-magnitude flooding in river valleys likely had more direct impact on landscape modification and human environments than broader regional changes in climate (e.g., Kidder 2006; Kidder and Sassaman, this volume).

Biotic communities, which form the sources for human subsistence, are directly shaped by the inherent characteristics of prevailing air masses, wind patterns, and resulting weather conditions. Evidence of regional climate change based on reconstructions of vegetation patterns comes largely from pollen cores (King 1981; Webb et al. 2004; Wright 1968). In the Midcontinent, the advance and contraction of the Prairie Peninsula has been a major area of research (Transeau 1935). Early characterizations of this movement (King 1981; Wright 1968) were based primarily on pollen sequences derived

from the northern periphery of the prairie. However, recent research has broadened perspectives through additional sequences from virtually all of the states bordering the Prairie Peninsula (cf. Styles and McMillan, this volume). The scenario recorded by pollen has been corroborated by additional data sets, including macrofossil remains (Baker et al. 1992), and by stable isotope analysis of speleothem calcite from cave sites (Denniston et al. 1999; Dorale et al. 1992). Faunal (Styles and McMillan, this volume) and floral (Simon, this volume) data from cultural contexts have also provided information on species availability useful for local environmental reconstruction. The emerging picture of Holocene climate change in the Midwest is assuming a much sharper focus, and we refer the reader to the excellent summary of this data by Styles and McMillan (this volume).

Despite the considerable strides being made, local environmental conditions usually still must be extrapolated from regional data. For example, the Illinois River valley, which has generated climate and culture-change models, has not been sampled by pollen cores (Van Nest 1997). As a result, there is little direct evidence for vegetation or climate change in this area during the Archaic. Botanical evidence from the Koster site is derived from carbonized wood fragments, and it is through these remains that researchers have argued for minimal direct climatic effect on floral communities in this locality during the Hypsithermal. The general absence of pollen data in the southern portion of the Midwest is striking, leading researchers to rely more heavily on faunal remains to reconstruct ancient environments for specific locales (Klippel 1971; McMillan and Klippel 1981; Styles and McMillan, this volume). Lower Illinois River valley geomorphologists have also often utilized landscape deposition and alluviation rates to model landform changes and, by extension, changes in vegetation and climate (Hajic 1990). The data from which researchers reconstruct climate and vegetation during the Holocene are, at best, indicators of broad regional patterns. Debates continue about the specific effects of climate change on vegetation in many localities because of the uneven nature of the data. Geomorphic data are usually modeled on such an expansive scale that they are of limited use in understanding and interpreting local conditions that would have had significant impacts on human populations. It is apparent that when this very incomplete environmental record is considered in conjunction with the very limited archaeological evidence, researchers need to proceed with some caution when proposing human-climate relationships in the Midwest.

Rather than attempt a comprehensive review of the posited climatic shifts that potentially impacted midcontinental Archaic populations, we highlight several aspects of the climate-landscape connection that not only may have affected the life histories of prehistoric native groups but also may have altered or structured the appearance of the archaeological record. There has been a trend in recent years, largely in response to the perceived trend toward environmental determinism,

to discount the environment as a relevant factor influencing the historical trajectories of human groups. While it is true that some researchers have accorded the environment unwarranted preeminence and treated it as a prime mover in shaping human behavior, there is little doubt it is a relevant factor in human decision making.

A distinction must be drawn, however, between long-term meteorological shifts that operated over millennia (e.g., the Hypsithermal) versus short-term calamitous events (flooding, volcanoes, earthquakes, mudslides, natural dam breaches, tsunamis, regional droughts, etc.). For the most part, longer-term climatic shifts had little perceptible year-to-year impact on the lifestyles of groups who occupied and exploited the environmental niches that were gradually impacted. Life-threatening catastrophic events involving days, months, several years, or decades, however, would have focused the attention of indigenous populations in ways that were direct and immediate, perhaps instilling patterns in the corporate memory that lasted for generations. It is important to note that both of these categories of events affected the ultimate disposition of the archaeological record, but only the latter impacted the real-life histories of native groups at the individual or transgenerational level.

Researchers also need to be cognizant that in many cases human practices in conjunction with specific environmental settings become key factors in long-term landscape modification. Perhaps the most profound impact on the landscape initiated by nonindustrial human practice is through the use of fire. The maintenance of prairie-forest ecotonal zones through the use of fire has been proposed in the past (Abrams 1992; Grimm 1984; Guyette and Cutter 1991; Nelson et al. 2004; Sauer 1950; Van Nest 1997). Palynologists generally view the effect of fire on the landscape as the result of natural causes; from their standpoint, fire was not utilized by Native Americans until after they became slash-and-burn corn agriculturalists (McAndrews 1988). However, the ethnographic record in North America indicates that the use of fire was not restricted to agriculturalists (Barrett and Arno 1982; Sauer 1950; Van Nest 1997:352; Wright 1973), and recent research has largely tipped the scale in favor of human burning practices having characterized the earliest periods of occupation in the Midcontinent (Styles and McMillan, this volume).

There is little doubt that the Hypsithermal episode initiated a drying effect resulting in the expansion of the Prairie Peninsula; at the same time, however, the drying impact favored xeric forest expansion at the expense of mesic forested areas and would have made midwestern woodlands even more susceptible to impact by anthropogenic burning. The prevailing westerly winds and the general lack of relief over much of the Midwest ensured the rapid spread of fires from west to east. Not only did human intervention hasten prairie expansion but it also prolonged the episode of expansion and slowed what would have been the natural reversal of this process when a wetter climatic regime returned. More important,

however, was the net effect on resources of economic value to human groups. As Styles and McMillan (this volume) point out, the expansion of the Prairie Peninsula opened up and expanded the woodland-prairie interface, making it a more suitable habitat for animals (rabbit, squirrel, deer, turkey, etc.) that were of interest to humans. So, not only were the quantity and variety of floodplain resources improved as a result of climatic change associated with the Hypsithermal, but upland resources surrounding the advancing prairie also were enriched. We believe that the growth and economic enhancement of a large area of the prairie-woodland ecotone during mid-Holocene times have been ignored by those suggesting a net deterioration of the resources of the greater Prairie Peninsula. While some areas would, no doubt, have become economically less productive (e.g., tallgrass prairie), other areas would have been substantially enhanced. Importantly, this would have unfolded at such a “glacial” pace that it would not have been perceptible to indigenous populations (Simon, this volume); it would have had little impact on the real-life histories of individual native groups.

Nevertheless, such a time-transgressive phenomenon would have contributed to the ultimate shape of the archaeological record. For example, if Early Archaic groups regularly hunted animals that preferred the open savannas associated with timber-grass ecotones, their collective multigenerational campsites and hunting losses would have accumulated in the archaeological record in such a way as to mimic the movement of the forest edge as it retreated (e.g., Conrad 1981). Moreover, the advance and retreat of the prairie edge would have triggered several landscape-altering events that would, in turn, have reconfigured the archaeological record. The episodic erosion and infilling of stream valleys routinely erases or buries traces of human occupation, and to the extent that such phenomena are temporally restricted at the regional level, the net effect is to erase evidence of specific periods of occupation or specialized components of settlement systems. Geomorphologists in Iowa (Bettis and Hajic 1995) have demonstrated the role that geomorphic and soil processes have played in the Midwest to disguise the nature of the archaeological record.

Archaeologists are just beginning to appreciate the importance of water-level history on the modern disposition of the Archaic portion of the archaeological record. Griffin (1967), in his classic summary of Eastern Woodlands prehistory, recognized that many coastal Middle Archaic sites are now underwater. Kidder and Sassaman (this volume) indicate that mid-Holocene rising sea levels drowned many coastal Early Archaic sites and occluded the entire chapter on subsistence and settlement for this period along the coast. The drowning of Archaic sites is not limited to the seacoast. If anything, because of their association with glacial events, the interior Great Lakes have experienced significant and complex water-level histories. Lovis (this volume) paints a vivid picture of alternating higher and lower lake levels for

the Michigan-Huron and Superior basins (by comparison with today). Such reconstructions are complicated by the distinctive histories of each lake basin, one often experiencing high water levels at the same time that the other underwent low-water episodes. Lovis notes that at the inception of the Early Archaic, the Michigan-Huron basin was at its lowest and that all of the initial Early Archaic settlements that were within several miles of the coast are now submerged. This picture is further complicated by water levels that were, at times, higher than those prevailing today, resulting in “coastal” sites occurring at locations deep in the interior of Michigan, not to mention that the alternately submerged and exposed sites have undergone complex geomorphic histories often resulting in burial by deposition of sediments.

In addition to the drowning of many Early Archaic sites, the fluvial activities associated with river valleys have buried many sites from later periods beneath often-thick layers of sediment. Kidder and Sassaman cite the example of the Nolan site, a Middle Archaic mound complex on the modern floodplain of the Mississippi River that is buried by up to 5 m of alluvium. The only Early and Middle Archaic open-air sites in the American Bottom floodplain that have been investigated were buried by a meter or more of alluvium. In the lower Illinois River valley, Archaic deposits at the Koster site exceed 10 m in depth, and remains of all three subperiods have been buried by a combination of alluvial and colluvial processes (Brown and Vierra 1983). More recently, archaeologists have come to appreciate that many sites in upland settings may have been buried by a combination of wind-borne loess and other soil processes (Abbott 1987; Benn and Thompson, this volume; Bettis and Hajic 1995; Van Nest 1997), and Lurie et al. (this volume) identify a series of factors that have caused the burial of sites in the glaciated topography typifying northeastern Illinois.

It is important to distinguish between those gradual, time-transgressive climatic events that may have resulted in a gradual shift in the location of settlements through time (rising or falling sea levels) or the location where hunting activities took place (expanding prairie-woodland ecotones) from events with a certain urgency, like the unexpected onset of a period of catastrophic floods, that would have immediately affected the locations of villages and fishing stations, if not associated lifestyles. Even the latter events may not have affected the overall lifestyle of native groups unless the resources they depended on were seriously degraded by such catastrophes. An example of the latter involves the episode of increased flooding and overall cooling of the temperatures in eastern North America at the end of the Archaic (see Kidder 2006; Kidder and Sassaman, this volume). The degree to which such events disrupted established social networks and the extent to which they can, in turn, be deciphered from the existing archaeological record vary considerably; but the occurrence of such history-altering episodes cannot be ignored by cultural evolutionists who seek to explain every perceived

social development as a step toward social integration and complexity. It is important to disentangle the *historical trajectories* of specific native groups from the background of *reconfigured archaeological records* that are the inevitable result of landscape evolution. This is the peculiar task of the archaeologist, who, by undertaking it, will shed light on issues of concern to social scientists, such as anthropology, economics, social interaction, technology, and the growth of complex societies.

Concluding Remarks

In this chapter, we have discussed three domains of Archaic research—chronology and taxonomy; projectile technology, function, and style; and climate and landscapes—and the many-layered issues embedded in their interpretation. These topics, in various forms and guises, have dictated the course of Archaic research for generations. The impressive growth of Archaic databases resulting from CRM research has only served to highlight the commanding role that these themes play in attempts to understand the nature of early indigenous societies in North America. The contributors to this volume, each to a differing degree, have been forced to confront these themes in the course of their research. Climate change, landscape evolution, and their subsistence implications, for instance, have been central to much Archaic research. For topical specialists, changes in climate form the organizational frame (Styles and McMillan), or at least the backdrop, for population studies (Milner et al.) or establishing the context of diet choices (Simon). For those examining culture change, as interpreted from deep stratigraphic sequences (Ahler and Koldehoff; Ray et al.; Stafford and Cantin; Wiant et al.), reconstructing environmental conditions is key to understanding not only the geomorphological determinants of site contexts but also the habitats encountered by the human occupants of sites and those occupants' lifeways. For those attempting regional summaries, the environment is of concern for understanding broad-scale populations movements, local and regional adaptations, and habitat preferences of successive populations.

Problems associated with dating artifacts, recognizing contemporary assemblages, and taxonomic organization of material remains have proven more difficult to resolve than one might have imagined, despite the advent of radiocarbon dating. In addition to the limitations of ^{14}C dating (which were magnified with the advent of calibration programs), the problems inherent in determining secure archaeological context and meaningful associations (especially in deep sites such as Modoc [Ahler and Koldehoff, this volume] and Koster [Wiant et al., this volume]) still plague archaeologists. These concerns are increased when one considers that most artifacts are dated only by association. Because of these constraints, archaeologists have made only erratic progress in transforming

diagnostic artifact markers into reliable regional chronologies. These problems are exacerbated by the sad state of artifact typologies, especially hafted-biface categories—which are all too often indiscriminately correlated, dated, identified, and modified to the extent that they become unusable for defining cultural and chronological contexts. The use of artifact typologies to identify technological or cultural traditions is further hampered by researchers' inability to understand the relationship of points and people. As we discussed above at length, archaeology as a discipline has yet to come to terms with issues as seemingly straightforward as hafted-biface function, chronological associations, styles, delivery systems, and so forth. The lack of detailed chronologies and cultural associations is most critically felt by researchers reconstructing social landscape use on the basis of distribution patterns of surface-collected diagnostics (e.g., Nolan and Fishel, this volume).

All of the above factors and more play into the essential taxonomic divisions of the Archaic period promoted by various archaeologists. These divisions, in turn, recursively dominate the interpretation of what the Archaic “means.” It has become increasingly popular to use perceived climatic and landscape changes to demark changes in Archaic cultures. Whether they are intended to or not, these climatic shifts all too often become the primary variables in creating cultural (i.e., material and subsistence) change. In a broad sense, such scenarios provide a reassuring picture of cultural adaptations marching through time in lockstep with climatic shifts. Yet, as is apparent from the evidence we have presented above (as well as from the chapters in this volume by Kidder and Sassaman; Lovis; and Styles and McMillan), while there have been significant, indeed, almost catastrophic landscape changes in some regions, many landscapes remained almost unchanged in terms of their habitability through the Archaic. There is no doubt that environmental conditions do create boundary conditions for human subsistence and habitation, but we contend, and many of the authors in this volume illustrate, these parameters are extremely broad and more often serve as enabling rather than delimiting factors.

The specialists invited to participate in this volume have had to cope with and, to some extent, overcome the problems just enumerated to impart as complete a picture as possible of Archaic developments in their specific regions or topics of interest. Despite the often-unstated misgivings researchers may have about their respective data sets, it seems midwestern archaeologists are collectively on the threshold of a breakthrough in the construction of a new baseline for Archaic research. We believe that the careful reader will discern in the following chapters a somewhat inchoate framework of the early history of native social developments and interaction in the Midcontinent. We also believe that this beginning will serve to encourage future researchers to break out of the neo-evolutionary straightjacket within which Archaic studies have all too often been confined.

References Cited

- Abbott, Larry R.
1987 *Archaeological Investigations at the Kewanee Site (11-HY-126), Henry County, Illinois*. Research Reports 27. Resource Investigation Program, Department of Anthropology, University of Illinois, Urbana.
- Abrams, Marc D.
1992 Fire and Development of Oak Forest. *Bioscience* 42:346–353.
- Adams, Robert McCormick
1940 Diagnostic Flint Points. *American Antiquity* 6:72–75.
- Ahler, Stanley A.
1970 *Projectile Point Form and Function at Rodgers Shelter, Missouri*. Research Series 8. Missouri Archaeological Society Columbia.
- Amick, Daniel S.
1994 Technological Organization and the Structure of Inference in Lithic Analysis: An Examination of Folsom Hunting Behavior in the American Southwest. In *The Organization of North American Chipped Stone Tool Technologies*, edited by Philip J. Carr, pp. 9–34. Archaeological Series 7. International Monographs in Prehistory, Ann Arbor, Michigan.
- Baker, Richard G., Louis J. Maher, Craig A. Chumbley, and Kent L. Van Zant
1992 Patterns of Holocene Environmental Change in Midwestern United States. *Quaternary Research* 37:379–389.
- Baker, W. E., and A. V. Kidder
1937 A Spear Thrower from Oklahoma. *American Antiquity* 3:51–52.
- Bareis, Charles J., and James W. Porter (editors)
1984 *American Bottom Archaeology: A Summary of the FAI-270 Project Contribution to the Culture History of the Mississippi River Valley*. University of Illinois Press, Urbana.
- Barrett, Stephen W., and Stephen F. Arno
1982 Indian Fires as an Ecological Influence in the Northern Rockies. *Journal of Forestry* 80:647–651.
- Bettis, E. Arthur, III, and Edwin Hajic
1995 *Landscape Development and the Location of Evidence of Archaic Cultures in the Upper Midwest*. Special Paper 297. Geological Society of America, Boulder, Colorado.
- Binford, Lewis R.
1965 Archaeological Systematics and the Study of Culture Process. *American Antiquity* 31:203–210.
1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45:4–20.
- Bordes, François
1972 *A Tale of Two Caves*. Harper and Row, New York.
- Boszhardt, Robert F.
2002 Contracting Stemmed: What's the Point? *Midcontinental Journal of Archaeology* 27:35–67.
- Bradbury, Andrew P.
1997 The Bow and Arrow in the Eastern Woodlands: Evidence for an Archaic Origin. *North American Archaeologist* 18:207–233.
- Brown, James A.
1985 Long-Term Trends to Sedentism and the Emergence of Complexity in the American Midwest. In *Prehistoric Hunter-Gatherers: The Emergence of Cultural Complexity*, edited by T. Douglas Price and James A. Brown, pp. 201–231. Academic Press, New York.
1986 Food for Thought: Where Has Subsistence Analysis Gotten Us? In *Foraging, Collecting, and Harvesting: Archaic Period Subsistence and Settlement in the Eastern Woodlands*, edited by Sarah W. Neusius, pp. 315–327. Occasional Papers 6. Center for Archaeological Investigations, Southern Illinois University, Carbondale.
- Brown, James A., and Robert K. Vierra
1983 What Happened in the Middle Archaic? Introduction to an Ecological Approach to Koster Site Archaeology. In *Archaic Hunters and Gatherers in the American Midwest*, edited by James L. Phillips and James A. Brown, pp. 165–196. Academic Press, New York.
- Browne, Jim
1938 Antiquity of the Bow. *American Antiquity* 3:358–359.
1940 Projectile Points. *American Antiquity* 5:209–213.
- Butler, B. Robert, and Douglas Osborne
1959 Archaeological Evidence for the Use of Atlatl Weights in the Northwest. *American Antiquity* 25:215–224.
- Butzer, Karl W.
1977 *Geomorphology of the Lower Illinois Valley as a Spatial-Temporal Context for the Koster Archaic Site*. Reports of Investigations 34. Illinois State Museum, Springfield.
1978 Changing Holocene Environments at the Koster Site: A Geo-Archaeological Perspective. *American Antiquity* 43:408–413.
- Byers, Douglas S.
1959 The Eastern Archaic: Some Problems and Hypotheses. *American Antiquity* 24:233–256.
- Christenson, Andrew L.
1986 Projectile Point Size and Projectile Aerodynamics: An Exploratory Study. *Plains Anthropologist* 31:109–128.
- Conrad, Lawrence A.
1981 *An Introduction to the Archaeology of West Central Illinois: A Preliminary Archaeological Survey of the Canton to Quincy Corridor for the Proposed FAP 407 Highway Project*. Reports of Investigations 2. Archaeological Research Laboratory, Western Illinois University, Macomb.
- Cook, Thomas Genn
1976 *Koster: An Artifact Analysis of Two Archaic Phases in West-central Illinois*. Prehistoric Records 1, Koster Research Reports 3. Northwestern Archaeological Project, Evanston, Illinois.
- Corliss, David W.
1980 Arrowpoint or Dart Point: An Uninteresting Answer to a Tiresome Question. *American Antiquity* 45:351–352.
- Cushing, Frank Hamilton
1895 The Arrow. *American Anthropologist* 8:307–349.
1897 Exploration of Ancient Key-Dweller Remains on the Gulf Coast of Florida. *Proceedings of the American Philosophical Society* 35:329–432.

- Denniston, Rhawn F., Luis A. Gonzalez, Holmes A. Semken Jr., Yemane Asmerom, Richard G. Baker, Heather Recelli-Snyder, Mark K. Reagan, and E. Arthur Bettis III
1999 Integrating Stalagmite, Vertebrate, and Pollen Sequences to Investigate Holocene Vegetation and Climate Change in the Southern Midwestern United States. *Quaternary Research* 52:381–387.
- Dorale, Jeffrey A., Luis A. Gonzalez, Mark K. Reagan, David A. Pickett, Michael T. Murrell, and Richard G. Baker
1992 A High-Resolution Record of Holocene Climate Change in Speleothem Calcite from Cold Water Cave, Northeast Iowa. *Science* 259:1626–1630.
- Eckholm, Gordon F.
1962 U-Shaped “Ornaments” Identified as Finger-Loops from Atlats. *American Antiquity* 28:181–185.
- Emerson, Thomas E., and Andrew C. Fortier
1986 Early Woodland Cultural Variation, Subsistence, and Settlement in the American Bottom. In *Early Woodland Archeology*, edited by Kenneth B. Farnsworth and Thomas E. Emerson, pp. 475–522. Kampsville Seminars in Archeology 2. Center for American Archeology, Kampsville, Illinois.
- Emerson, Thomas E., and R. Barry Lewis (editors)
1991 *Cahokia and the Hinterlands: Middle Mississippian Cultures of the Midwest*. University of Illinois Press, Urbana.
- Emerson, Thomas E., Dale L. McElrath, and Andrew C. Fortier (editors)
2000 *Late Woodland Societies: Tradition and Transformation across the Midcontinent*. University of Nebraska Press, Lincoln.
- Fairbank, Frederick Royston
1864 Some Flint Arrow-Heads from Canada. *Journal of the Anthropological Society of London* 2:lxiv–lxv.
- Farnsworth, Kenneth B.
1986 Black Sand Culture Origin and Distribution. In *Early Woodland Archeology*, edited by Kenneth B. Farnsworth and Thomas E. Emerson. Kampsville Seminars in Archeology 2. Center for American Archeology, Kampsville, Illinois.
- Farnsworth, Kenneth B. and Thomas E. Emerson (editors)
1986 *Early Woodland Archeology*. Kampsville Seminars in Archeology 2. Center for American Archeology, Kampsville, Illinois.
- Fenenga, Franklin
1953 The Weights of Chipped Stone Points: A Clue to Their Functions. *Southwestern Journal of Anthropology* 9:309–323.
- Fenenga, Franklin, and Joe Ben Wheat
1940 An Atlatl from the Baylor Rock Shelter, Culbertson County, Texas. *American Antiquity* 3:221–223.
- Finkelstein, J. Joe
1937 A Suggested Projectile Point Classification. *American Antiquity* 2:197–203.
- Fortier, Andrew C.
2001 A Tradition of Discontinuity: American Bottom Early and Middle Woodland Culture History Reexamined. In *The Archaeology of Traditions: Agency and History Before and After Columbus*, edited by Timothy R. Pauketat, pp. 174–194. University Press of Florida, Gainesville.
- Fortier, Andrew C., Thomas E. Emerson, and Dale L. McElrath
2006 Calibrating and Reassessing American Bottom Culture History. *Southeastern Archaeology*, in press.
- Fowler, Melvin L.
1959a *Summary Report of Modoc Rock Shelter 1952, 1953, 1955, 1956*. Reports of Investigations 8. Illinois State Museum, Springfield.
1959b Modoc Rock Shelter: An Early Archaic Site in Southern Illinois. *American Antiquity* 24:257–270.
- Fox, A. Lane
1875 On a Series of About Two Hundred Flint and Chert Arrowheads, Flakes, Thumbflints, and Borers, from the Rio Negro, Patagonia; with Some Remarks on the Stability of Form Observable in Stone Implements. *The Journal of the Anthropological Institute of Great Britain and Ireland* 4:311–323.
- Goodyear, Albert C.
1982 The Chronological Position of the Dalton Horizon in the Southeastern United States. *American Antiquity* 47:382–395.
- Goslin, Robert
1944 A Bone Atlatl Hook from Ohio. *American Antiquity* 10:204–205.
- Griffin, James B.
1967 Eastern North American Archaeology: A Summary. *Science* 156:175–191.
1968 Observations on Illinois Prehistory in the Late Pleistocene and Early Recent Times. In *The Quaternary of Illinois: A Symposium in Observance of the Centennial of the University of Illinois*, edited by Robert E. Bergstrom, pp. 123–137. Special Publication 14. University of Illinois College of Agriculture, Urbana.
- Grimm, Eric C.
1984 Fire and Other Factors Controlling the Big Woods Vegetation of Minnesota in the Mid-Nineteenth Century. *Ecological Monographs* 54:381–311.
- Guernsey, Samuel James, and Alfred Vincent Kidder
1921 *Basketmaker Caves of Northeastern Arizona*. Papers of the Peabody Museum of American Archaeology and Ethnology 8(1). Harvard University, Cambridge, Massachusetts.
- Guyette, Richard P., and Bruce E. Cutter
1991 Tree-Ring Analysis of Fire History of a Post Oak Savanna in the Missouri Ozarks. *Natural Areas Journal* 11:93–99.
- Hajic, Edwin
1981 Geology and Paleopedology of the Koster Archeological Site, Greene County, Illinois. Master’s thesis, Department of Geology, University of Illinois.
1990 *Koster Site Archeology I: Stratigraphy and Landscape Evolution*. Research Series 8. Center for American Archeology, Kampsville, Illinois.
- Haldeman, S. S.
1879 On Unsymmetric Arrow-Heads and Allied Forms. *The American Naturalist* 13:292–294.
- Hall, Robert L.
1977 An Anthropocentric Perspective for Eastern United States Prehistory. *American Antiquity* 42:499–518.

- 1980 An Interpretation of the Two-Climax Model of Illinois Prehistory. In *Early Native Americans*, edited by David Browman, pp. 401–462. Mouton, The Hague.
- Hill, Malcom W.
1948 The Atlatl or Throwing Stick: A Recent Study of Atlatls in Use with Darts of Varying Sizes. *Tennessee Archaeologist* 4:37–44.
- Holmes, W. H.
1891 Manufacture of Stone Arrow-Points. In *Arrows and Arrow-Makers*, by Otis T. Mason, W. H. Holmes, Thomas Wilson, Walter Hough, Weston Flint, W. J. Hoffman, and John G. Bourke. *American Anthropologist* 4:49–58.
1919 *Handbook of Aboriginal American Antiquities: Part I, Introductory, the Lithic Industries*. Bulletin 60. Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.
- Hough, Walter
1891 Arrow Feathering and Pointing. In *Arrows and Arrow-Makers*, by Otis T. Mason, W. H. Holmes, Thomas Wilson, Walter Hough, Weston Flint, W. J. Hoffman, and John G. Bourke. *American Anthropologist* 4:60–63.
- Howard, Calvin D.
1974 The Atlatl: Function and Performance. *American Antiquity* 39:102–104.
- Justice, Noel D.
1987 *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States*. Indiana University Press, Bloomington.
- Kellar, James H.
1955 *The Atlatl in North America*. Prehistory Research Series 3(3). Indiana Historical Society, Indianapolis.
- Kidder, Tristram R.
2006 Climate Change and the Archaic to Woodland Transition (3000–2500 cal B.P.) in the Mississippi River Basin. *American Antiquity* 71:195–231.
- King, James E.
1981 Late Quaternary Vegetational History of Illinois. *Ecological Monographs* 51:43–62.
- Klippel, Walter E.
1971 Prehistory and Environmental Change along the Southern Border of the Prairie Peninsula during the Archaic Period. Ph.D. dissertation, Department of Anthropology, University of Missouri.
- Knecht, Heidi (editor)
1997 *Projectile Technology*. Plenum Press, New York.
- Knox, James C.
1985 Responses of Floods to Holocene Climatic Change in the Upper Mississippi Valley. *Quaternary Research* 23:287–300.
- Krieger, Alex D.
1964 New World Lithic Typology Project: Part II. *American Antiquity* 29:489–493.
- Linder, Jean
1974 The Jean Rita Site: An Early Woodland Occupation in Monroe County, Illinois. *The Wisconsin Archeologist* 55:99–162.
- Lyman, R. Lee, and Michael J. O'Brien
2004 A History of Normative Theory in Americanist Archaeology. *Journal of Archaeological Method and Theory* 11:369–396.
- Lyman, R. Lee, Michael J. O'Brien, and Robert Dunnell
1997 *The Rise and Fall of Culture History*. Plenum Press, New York.
- Mason, Otis T.
1885 Throwing-Sticks in the National Museum. *Report of the United States National Museum for 1884*, pt. 2, pp. 279–289. Government Printing Office, Washington, D.C.
1893 Throwing Sticks. *Science* 22:152–153.
- Mason, Otis T., W. H. Holmes, Thomas Wilson, Walter Hough, Weston Flint, W. J. Hoffman, and John G. Bourke
1891 Arrows and Arrow-Makers. *American Anthropologist* 4:45–74.
- Mau, Clayton
1963 Experiments with the Spear Thrower. *New York State Archaeological Association Bulletin* 29:1–13.
- McAndrews, J. H.
1988 Human Disturbance of North American Forest and Grasslands: The Fossil Pollen Record. In *Vegetation History*, edited by Brian Huntley and Thompson Webb III, pp. 673–697. Kluwer Academic Publishers, Dordrecht, the Netherlands.
- McElrath, Dale L., and Thomas E. Emerson
2000 Toward an “Intrinsic Characteristics” Approach to Chert Raw Material Classification: An American Bottom Example. *Midcontinental Journal of Archaeology* 25:215–244.
- McElrath, Dale L., Thomas E. Emerson, and Andrew C. Fortier
2000 Social Evolution or Social Response? A Fresh Look at the “Good Grey Cultures” after Four Decades of Research in the Midwest. In *Late Woodland Societies: Tradition and Transformation across the Midcontinent*, edited by Thomas E. Emerson, Dale L. McElrath, and Andrew C. Fortier, pp. 3–36. University of Nebraska Press, Lincoln.
- McElrath, Dale L., Thomas E. Emerson, Andrew C. Fortier, and James L. Phillips
1984 Late Archaic Period. In *American Bottom Archaeology: A Summary of the FAI-270 Project Contributions to the Culture History of the Mississippi River Valley*, edited by Charles J. Bareis and James W. Porter, pp. 34–58. University of Illinois, Urbana.
- McMillan, Bruce R., and Walter E. Klippel
1981 Post-Glacial Environmental Change and Hunting-Gathering Societies of the Southern Prairie Peninsula. *Journal of Archaeological Science* 8:215–245.
- Musil, Robert R.
1988 Functional Efficiency and Technological Change: A Hafting Tradition Model for Prehistoric North America. In *Early Human Occupation in Far Western North America: The Clovis-Archaic Interface*, edited by Judith A. Willig, C. Melvin Aikens, and John L. Fagan, pp. 373–387. Anthropological Papers 21. Nevada State Museum, Carson City.
- Nance, J. D.
1971 Functional Interpretation from Microscopic Analysis. *American Antiquity* 36:361–366.
- Nassaney, Michael S., and Kendra Pyle
1999 The Adoption of the Bow and Arrow in Eastern North America: A View from Central Arkansas. *American Antiquity* 64:243–263.

- Nelson, David, Feng Sheng Hu, and Eric C. Grimm
2004 Dynamics of Middle-Holocene Climate, Vegetation, and Fire on the Northern Prairie Peninsula. *AMQUA 2004: American Quaternary Association Program and Abstracts of the 18th Biennial Meeting*. University of Kansas, Lawrence.
- Neuman, Robert
1967 Atlatl Weights from Certain Sites on the Northern and Central Great Plains. *American Antiquity* 32:36–53.
- Nuttall, Zelia
1891 The Atlatl or Spear-Thrower of the Ancient Mexicans. *Archaeological and Ethnological Papers of the Peabody Museum* 1(3):173–197. Harvard University, Cambridge, Massachusetts.
- O'Brien, Michael J., and Robert E. Warren
1983 An Archaic Projectile Point Sequence from the Southern Prairie Peninsula: The Pigeon Roost Site. In *Archaic Hunters and Gatherers in the American Midwest*, edited by James L. Phillips and James A. Brown, pp. 71–98. Academic Press, New York.
- O'Brien, Michael J., and W. Raymond Wood
1998 *The Prehistory of Missouri*. University of Missouri Press, Columbia.
- Odell, George H.
1994 Prehistoric Hafting and Mobility in the North American Midcontinent: Examples from Illinois. *Journal of Anthropological Archaeology* 13:51–73.
1996 *Stone Tools and Mobility in the Illinois Valley: From Hunter-Gatherer Camps to Agricultural Villages*. Archaeological Series 10. International Monographs in Prehistory, Ann Arbor, Michigan.
- Odell, George H., and Frieda Odell-Vereecken
1980 Verifying the Reliability of Lithic Use-Wear Assessments by "Blind Tests": The Low-Power Approach. *Journal of Field Archaeology* 7:87–120.
- Palter, John L.
1976 A New Approach to the Significance of the "Weighted" Spear Thrower. *American Antiquity* 41:500–510.
- Patterson, Leland W.
1994 Identification of Unifacial Arrow Points. *Journal of the Houston Archaeological Society* 108:19–24.
- Peets, Orville H.
1960 Experiments in the Use of Atlatl Weights. *American Antiquity* 26:108–110.
- Raymond, Anan
1986 Experiments in the Function and Performance of the Weighted Atlatl. *World Anthropology* 18:153–177.
- Read, Charles H.
1892 An Account of a Collection of Ethnographical Specimens Formed during Vancouver's Voyage in the Pacific Ocean, 1790–1895. *The Journal of the Anthropological Institute of Great Britain and Ireland* 21:99–105.
- Redding, B. B.
1879 How Our Ancestors in the Stone Age Made Their Implements. *The American Naturalist* 13:667–674.
- Riddell, Francis A., and Donald F. McGeein
1969 Atlatl Spurs from California. *American Antiquity* 34:474–478.
- Rouse, Irving
1960 The Classification of Artifacts in Archaeology. *American Antiquity* 25:313–323.
- Sauer, Carl O.
1950 Grassland Climax, Fire and Man. *Journal of Range Management* 3:16–21.
- Scully, Edward G.
1951 Some Central Mississippi Valley Projectile Point Types. Unpublished manuscript, Museum of Anthropology, University of Michigan, Ann Arbor.
- Shott, Michael J.
1994 Size and Form in the Analysis of Flake Debris: Review and Recent Approaches. *Journal of Archaeological Method and Theory* 1:69–110.
1996 Innovation in Prehistory: A Case Study from the American Bottom. In *Stone Tools: Theoretical Insights into Human Prehistory*, edited by George H. Odell, pp. 279–309. Plenum Press, New York.
1997 Stones and Shafts Redux: The Metric Discrimination of Chipped-Stone Dart and Arrow Points. *American Antiquity* 62:86–101.
- Smith, Arthur George
1953 Beveled or "Rotary" Points. *American Antiquity* 18:269–270.
- Smith, Marian W.
1954 Attributes and the Discovery of Projectile Point Types: With Data from the Columbia-Fraser Region. *American Antiquity* 20:15–26.
- Spaulding, Albert C.
1953 Statistical Techniques for the Discovery of Artifact Types. *American Antiquity* 18:305–313.
- Thomas, David Hurst
1978 Arrowheads and Atlatl Darts: How the Stone Got the Shaft. *American Antiquity* 43:461–472.
- Transeau, Edgar N.
1935 The Prairie Peninsula. *Ecology* 16:426–437.
- Tschauner, Hartmut
1994 Archaeological Systematics and Cultural Evolution: Retrieving the Honour of Culture History. *Man* 29:77–93.
- Van Nest, Julieanne
1997 Late Quaternary Geology, Archeology and Vegetation in West-Central Illinois: A Study of Geoarcheology. Ph.D. dissertation, Department of Geology, University of Iowa.
- Vanderhook, Richard
1998 The Atlatl and Dart. Master's thesis, Department of Anthropology, University of Illinois.
- Webb, Thompson, III, Bryan Shuman, and John W. Williams
2004 Climatically Forced Vegetation Dynamics in Eastern North America during the Late Quaternary Period. In *The Quaternary Period in the United States*, edited by A. R. Gillespie, S. C. Porter, and B. F. Atwater, pp. 459–478. Elsevier, Amsterdam.
- Webb, William
1946 Indian Knoll. *Reports in Anthropology and Archaeology* 4(3, pt. 1):111–365. Department of Anthropology and Archaeology, University of Kentucky, Lexington.
- Webb, William S., and William G. Haag
1939 The Chiggersville Shell Heap in Ohio County. *Reports in Anthropology and Archaeology* 4:1–62. Department of Anthropology and Archaeology, University of Kentucky, Lexington.

- 1940 Cypress Creek Villages, Sites 11 and 12, McLean County, Kentucky. *Reports in Anthropology and Archaeology* 4:63–110. University of Kentucky, Department of Anthropology and Archaeology, Lexington.
- Weyer, Edward M.
- 1964 New World Lithic Typology Project: Part I. *American Antiquity* 29:487–489.
- Willoughby, Charles C.
- 1902 Prehistoric Hafted Flint Knives. *The American Naturalist* 36:1–6.
- Wilson, Thomas
- 1891 Form of Ancient Arrow-Heads. In *Arrows and Arrow-Makers*, by Otis T. Mason, W. H. Holmes, Thomas Wilson, Walter Hough, Weston Flint, W. J. Hoffman, and John G. Bourke. *American Anthropologist* 4:58–60.
- 1899 Arrowpoints, Spearheads, and Knives of Prehistoric Times. In *Annual Report of the Smithsonian Institution for 1897*, pp. 811–988. Smithsonian Institution, Washington, D.C.
- Winters, Howard D.
- 1961 The Archaic Period. In *Illinois Archaeology*, pp. 9–16. Bulletin 1. Illinois Archaeological Survey, Urbana.
- Wright, Henry E., Jr.
- 1968 History of the Prairie Peninsula. In *The Quaternary of Illinois: A Symposium in Observance of the Centennial of the University of Illinois*, edited by Robert E. Bergstrom, pp. 129–134. Special Publication 14. University of Illinois College of Agriculture, Urbana.
- 1973 *Patterns of Indian Burning in California: Ecology and Ethnohistory*. Ballena Press, Ramona, California.