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Stone Tools, Style, and Social Identity: an Evolutionary Perspective on the Archaeological Record

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ABSTRACT

Because of their prevalence in the archaeological record, chipped stone assemblages have long been used for the identification of social entities and the tracing of cultural relationships through space and time. To do this, archaeologists have focused primarily on variations in lithic morphology. Although the forms of stone artifacts are determined by a combination their utilitarian function, 'style', and the physical constraints of knapping different cryptocrystalline rocks, there is widespread belief that style provides the best information about social group membership. Style, however, is not a unified concept, including both passive variability resulting from stochastic processes and actively encoded social information, constrained by selection and manipulated by the makers and users of artifacts.

A neo-Darwinian framework is used to evaluate differing concepts of style and their applicability to the lithic archaeological record. Identifying prehistoric social entities and tracing cultural relationships is loosely analogous, methodologically and theoretically, to identifying taxa and tracing ancestor/descendant relationships in biology. Lithic technology is also examined from the point of view of neo-Darwinian evolutionary theory to identity sources of morphological variability most likely to mark group social identity, and suggest methodologies best able to identify and differentiate prehistoric social groups.

INTRODUCTION

Since the discovery of the first recognized human ancestor in the Neander Valley of Germany nearly 150 years ago, archaeologists have been concerned with the identity of prehistoric individuals and the social groups in which they lived. For the preagricultural economies that represent most of the human past, stone artifacts-primarily spatial and temporal variation in the macroscopic form of these artifacts-comprise the predominant form of behavioral residue used to reconstruct prehistoric social identity.

In recent decades, the ability of morphological variability in stone artifacts to permit reliable inference of social identity has been increasingly questioned, leading to a series of debates in the archaeological literature. The best known of these debates was between Lewis Binford and François Bordes (Binford 1973, Binford & Binford 1966, Bordes 1973, Bordes & de Sonneville Bordes 1970; see also Dibble 1995) over the meaning of variability in Middle Paleolithic assemblages. Similar debates have focused on North American projectile point forms (Bettinger, O'Connell, & Thomas 1991; Thomas 1986, Flenniken & Wilke 1989, Flenniken & Raymond 1986, Wilke & Flenniken 1991, Rondeau 1996, Hoffman 1985) and Eurasian microliths (Neeley & Barton 1994, Barton & Neeley 1996, Kaufman 1995, Goring-Morris 1996, Henry 1996, Clark 1996). In general these discussions have focused on the causes and interpretation of variability in stone artifact forms. Also crucial to these debates, however, is the notion of group-level social identity (sometimes referred to as 'ethnicity'), and to what extent it can be recognized in the archaeological record.

Neo-Darwinian evolutionary theory provides a means to explore the inference of social identity with reference to stone technology in particular and material culture in general. While the focus here is on the hunter/gatherer societies that comprise most of the human past and the lithic assemblages that are their most common behavioral residues, this discussion is pertinent at a more general level to more complex societies and other forms of material culture.

SOCIAL IDENTITY AND STYLE

The primary objective of this chapter is to assess the potential for chipped stone artifacts to provide archaeologists with information about extra-individual social identity and social organization from an evolutionary perspective. However, studies of prehistoric social identity are generally closely interwoven with concepts of style in archaeology (Conkey 1990, Hegmon 1992, Shennan 1989). Hence, it is useful first to examine style, as it relates to social identity and stone tools, in an evolutionary context. This is not intended to be an exhaustive treatment (see Carr & Neitzel 1996, Conkey & Hastorf 1990, Hegmon 1992 for more wide ranging discussions), but to briefly review current concepts of style in an evolutionary framework.

Types of Style

Archaeologists generally agree that style can serve to demarcate boundaries between social units but disagree as to what constitutes and causes style, and the nature of the social units defined (see Conkey 1990, Hegmon 1992, Shennan 1989). To oversimplify somewhat for the sake of brevity, archaeological approaches to style fall into two groups. The approach with the longest history sees style as shared forms created by common social learning within social groups. Often called the 'social interaction' school of style, the degree of similarity between stylistic forms here reflects the social distance between the makers of artifacts in question (e.g., Plog 1990, Neiman 1995). Generally implicit in this view is that variability in stylistically relevant characteristics is not directly affected by variations in artifact manufacturing processes or artifact use (see Jelinek 1976, Sackett 1990, Neiman 1995 for explicit discussions of this criterion). In Sackett's words, style comprises culturally prescribed choices among the "spectrum of equivalent alternatives, of equally viable options, for attaining any given end in manufacturing and/or using material items." (1990: 33). This approach has been characterized as viewing style as 'passive' and reflecting a normative perspective on human cultural systems (e.g., Clark 1989, Conkey 1990, Sackett 1990).

Using neo-Darwinian concepts, Dunnell (1978a, 1978b) suggested that style is best considered as stochastic variability in material culture. That is, style is represented by those artifact characteristics that are under so little selective pressure that their variability in time and space can be described by transmission effects (i.e., social learning patterns) and chance (see also Neiman 1995). Such traits are effectively neutral with respect to selection. Dunnell contrasts these stylistic characteristics of material culture with functional ones that are affected by selection (see also Jones, Leonard, & Abbott 1995; Teltser 1995; O'Brien & Holland 1990, 1995). This is similar in effect to the social interaction approach to style, especially as described by Sackett (1990). Neiman (1995) has used simulation modeling to show quantitatively how stochastic processes can produce the type of stylistic variability proposed by Dunnell and social interaction theorists. Such stochastic variation is still 'passive', in the sense that it *results from* social interaction rather than *mediates* social interaction, but it not tied to a normative view of culture.

An alternative approach to style, popularized by Wobst (1977), views style as those characteristics of material culture that convey information (overtly or covertly) about the social roles of the individuals who make and use it (Conkey 1990; Wiessner 1983, 1985). In this 'information exchange' approach, style is considered an important aspect of artifact function–one that communicates social information. While style may vary according to the social distance between its creators, it is primarily maintained at the group level by selection related to the maintenance (or minimization) of social boundaries and the nature of social networks (see also Barton, Clark, & Cohen 1994).

With respect to the nature of the social units reflected by style, archaeologists have generally remained rather vague (Conkey 1990, Shennan 1989). It is not that archaeologists are naive about the complexities of social identity or are uninterested in the topic (e.g., Wiessner 1983, Shennan 1989). But the nature of the archaeological record–especially its coarse temporal resolution (usually incapable of distinguishing a human generation) and the tendency for artifact assemblages that are archaeologically visible as 'sites' to be palimpsests of repeated use of a given piece of the landscape–often makes it difficult to relate archaeological social units, such as 'cultures', to social units noted in living societies (Shennan 1989). An added difficulty especially relevant to the discussion here is that ethnographic and ethnoarchaeological studies that have investigated relationships between style and social identity have generally focused on behavioral residues other than stone artifacts (Nelson 1991; Wiessner 1983, 1985; but see Sinopoli [1991] for a study that does include stone artifacts).

Style and Evolution

In many ways, inferring social identity at the group level parallels the identification of descent groups in biology (Jones, Leonard, & Abbott 1995; Teltser 1995). Archaeologists seek to define artifact assemblages whose similarities derive from the common social descent of their makers rather than similar (especially techno/economic) uses. In evolutionary terms, archaeologists interested in group social identity are seeking shared, derived characteristics (i.e., synapomorphies) in the archaeological record.

Similarity of form alone is not sufficient to demonstrate common descent, of course. Similarity can also result from convergent evolution (i.e., homoplasy). That is, common selective pressures can produce similar forms. Projectile tips throughout the world tend to be pointed, not because their makers shared a common social descent, but because pointed tips make more effective weapons than non-pointed ones and are, hence, more likely to be replicated in contexts where successful hunting contributes positively to fitness. Focusing on artifact forms whose variability is largely a result of stochastic processes (i.e., drift and transmission effects), rather than selection, helps avoid confusing similarities due to common descent with those resulting from convergence (Neiman 1995).

This does not mean, of course, that artifact properties useful for reconstructing social group identity are non-functional, simply that relevant variation among these assemblages is due primarily to social descent (including social distance) rather than common selective pressures. Nor does it mean that variability due to selection is useless for differentiating social groups. Those employing an information exchange approach to style can argue that selection for the maintenance of social group boundaries is one of the causes of stylistic variation (e.g., Barton, Clark, & Cohen 1994; Clark, Barton, & Cohen 1996; Hegmon 1992, Wobst 1977, Wiessner 1983). This is somewhat analogous to divergent selection associated with niche differentiation. Under such circumstances, stylistic variation in material culture can mark distinct social groups (e.g., Conkey 1980). Not all such 'active' style (*sensu* Clark 1989, Conkey 1990) is equally useful for identifying social groups, however. Those forms, primarily those termed 'emblemic style' by Wiessner (1983) and 'iconic style' by Sackett (1985, 1990), that have other social groups as their targets can best serve to reliably mark group boundaries. As proposed by Wobst and subsequently elaborated by others, those forms that are most effective in boundary definition should be easily visible and recognizable by members of other social groups, have a relatively long use-life, employ a sufficiently complex design and/or manufacture to encode unambiguous social information, and be used in contexts where they are likely to be encountered by members of other social groups (see also Gero 1989; Wiessner 1983; Clark 1989; Clark, Barton, and Cohen 1996).

In sum, from an evolutionary perspective, those forms in the archaeological record that should serve most reliably as markers of social descent, social group identity, and social distance should be:

- those whose heritable variation is primarily due to stochastic processes, and
- those whose variation is due to selection for group boundary maintenance.

As a shorthand to these concepts I will use the terms *passive style* and *active style* respectively. Stochastic and selective style might be more accurate, but I shrink from further muddying terminological waters already filled with labels like 'assertive', 'iconological', 'emblemic', and 'isochrestic'. These different forms are not mutually exclusive. Variation originally due to stochastic processes may later come under the control of selection with changes in the social landscape (Sackett 1985, Shennan 1989). Given these observations, the potential of chipped stone artifact assemblages to provide reliable information about group-level social identity can be evaluated in a neo-Darwinian evolutionary framework.

LITHICS, ACTIVE STYLE, AND SOCIAL IDENTITY

Lithics and Active Style

As mentioned above, Wobst and others have proposed a number of artifact properties that would allow these artifacts to effectively carry information about group boundaries and membership. This makes it a relatively straightforward task to evaluate the ability of chipped stone artifacts to carry such messages. Wobst (1977) suggests that forms most likely to convey information about social group affiliation are those that are most visible, most often play a role in social interactions, and are encountered by the most individuals.

Lithics, generally, are small objects made, used, and discarded by individuals in the performance of economic tasks. This means that an individual must be physically so close to a lithic artifact–and its user–in order to be able to note morphological features that might convey social information, that any such messaging would be of minimal value (Wobst 1977). Furthermore, most lithic artifacts have such short use-lives as to be relatively poor carriers of social group information from the point of view of active style (Clark 1989, Gero 1989).

There are exceptions, of course. Cores and some retouched artifacts–especially hafted ones–probably enjoyed longer use-lives. Given the regular presence of raw materials from sources quite distant from a site, cores may have traveled long distances and/or may have been traded among different social groups. Such exchange can obviate the need to be in close proximity to the artifact maker. Hafting can improve the effectiveness of lithic artifacts and extend their uselife by allowing them to be resharpened to a smaller size than would be possible if they were simply hand-held. This makes it more likely that they would be seen by more individuals. Wiessner (1983), for example, documents the exchange of arrows among San groups. Other hafted artifacts also could have been exchanged, increasing their potential visibility and distribution, and giving them a greater potential for transmitting information about social identity from one group to another. Whether or not this information can inform about group-level social identity is another matter, however.

Information about group membership must be encoded in lithic artifacts in such a way that it can be decoded by prehistoric recipients *and* by archaeologists. Cores, for example, achieve the form in which archaeologists recover them via the process of flake or blade removal. Making the reasonable assumption that exhausted cores would not be exchanged among groups, this means that the morphology of exchanged cores in archaeological contexts would be primarily determined by the flake/blade producing activities of the recipients, not the producers. Any information about group affiliation encoded in core morphology by the producers would be obliterated by the recipients during core reduction. The forms of very many retouched tools–even hafted ones–would also tend to follow the same pattern. The morphology of endscrapers, sidescrapers, burins, and many other retouched artifacts reflects a history of use, resharpening, and changes in function before they eventually become useless and are discarded (Barton 1991, Barton, Olszewski, & Coinman 1996, Dibble 1987, 1995, Frison 1968, Jelinek 1976). Even bifaces, including projectile points, do not seem immune from such morphological dynamism (Frison 1968, Flenniken & Wilke 1989, Hoffman 1985, Kelly 1988). While some artifacts may break and be discarded before such processes alter their form dramatically, others may not. Again, the morphology of the artifact recovered by archaeologists more likely reflects the activities of the recipient than the social identity of the manufacturer. An archaeological assemblage could contain, therefore, examples of forms manufactured by the users and forms manufactured by others, in various states of alteration from their manufactured forms.

It should also be remembered that even *hafted* lithic artifacts are typically the shortest lived and most easily replaced components of compound tools. If there is a selective advantage to signaling social identity in these forms of material culture, it would likely favor encoding in the larger (hence, more easily visible) and longer-lived haft than the lithic portion, providing a better chance of unambiguous decipherment both by prehistoric recipients and archaeologists. In a study of Great Basin arrows, Sinopoli (1991) found significant associations between aspects of shaft form and social group membership, but no such relationship with the morphology of the stone projectile tips.

There are, however, a few lithic forms that have a better chance of embodying information about social identity. Good examples are the intricately flaked 'eccentrics' from Mesoamerica (Shele & Miller 1986, Berrin & Pasztory 1993) and western North America (Hayden & Schulting 1997). Sometimes flaked into the profile of humanoid figures (possibly deities) they show no evidence of use in the types of economic activities in which most lithic artifacts are employed. Furthermore, they show no evidence of maintenance by resharpening and, hence, retain their original forms throughout their possibly extended use-lives. They display a form that was clearly the intent of the manufacturer, and a potentially high visibility that makes them potential carriers of active style. Large, thin bifaces like those found in some North American Early Woodland (e.g., Adena), and European Upper Paleolithic (e.g., Solutrean) contexts *may* also be candidates for markers of social identity. However, care should be taken about automatically assuming that large bifaces reveal social identity. They also serve as efficient cores, especially under conditions of high mobility (Parry & Kelly 1987, Kelly 1988). In this latter case, forms would be more strongly controlled by selection related to economic concerns rather than social group boundary maintenance.

Lithics and Passive Style

While selection to differentiate social groups may affect only a very restricted class of lithic artifacts, stochastic variability has the *potential* to affect a much wider range of lithic variability. Sackett (e.g., 1990) is very clear on the potential for any form of artifact to exhibit passive style (i.e., isochrestic variability). This potential is the underlying basis for most claims for the identification of social groups from the analysis of chipped stone artifact assemblages (e.g., Bordes 1973, Close 1989, Kaufman 1995, Henry 1996, Rick 1996, Sackett 1990). However, beyond addressing the potential for passive style in any kind of artifact, there has been little in the way of concrete predictions about the form it might take or the contexts in which it might appear. This makes it considerably more difficult to evaluate the capacity for lithics to convey information about social identity in this form.

The technological decisions and motor habits responsible for the production and use of lithic artifacts are generally learned in a social context and, hence, potentially transmittable. In order to address the potential for lithics to passively carry information about social identity via stochastically produced variation, it is necessary to first examine the effects of selection on lithic assemblages. Chipped stone technology has been a significant aspect of the human phenotype for at least two and a half million years. Its presence among all known examples of the genus *Homo* and its world-wide persistence until the last three millennia argue strongly for its maintenance by selection.

Throughout this enormous time span, the extremely conservative nature of lithic technology is notable. The basic technique of removing flakes from an amorphous core may predate the appearance of our genus and was still practiced during the Bronze and Iron Ages (e.g., Rosen 1996)-and until this century in some areas. Bifacial technology appeared somewhere around a million years ago and also continued until the recent extinction of lithic technology in the last century. Blade technology initially appeared at least 400,000 years ago and also continued through the early metal ages in the Old World and until historic times in the New World. The overall effect of these few major changes in lithic technology was to increase the efficiency of stone use. That is, they allowed humans to obtain an increasing amount of cutting edge per unit of stone (Hayden 1987, Parry & Kelly 1989). Again, this argues for rather tight and persistent selective control over the forms produced over the lifespan of lithic technology.

This is unremarkable for a number of reasons. First and foremost, chipped stone technology has functioned primarily to acquire and modify a wide variety of resources needed for human survival. In this sense, failure of the lithic technological system could have meant the failure of human society. However, increasing lithic efficiency involves increasing energy investment in lithic technology (Parry & Kelly 1989)-in the acquisition of better quality stone, increased time spent in core preparation, and more investment in knapping tools and training. On the other hand, lithics themselves are not *directly* necessary for human survival, and increasing investment in lithic technology means less can be invested in other pursuits that are more immediately relevant for survival.

Furthermore, the mechanics of knapping impose rather strict constraints on the ways in which lithic artifacts can be produced, including various aspects of core morphology, the angle and force of removal blows, and the resilience of the hammer (Cotterell & Kaminga 1987, Dibble & Whittaker 1981). Although the works of Michelangelo, Easter Island figures, and the temple of Abu Simbel make it clear that there *can* be a wide variety of ways to shape stone, there are a very limited number of methods available for knapping a usable edge. The fundamental principles of knapping were worked out by Pliocene hominids and have been elaborated only a modicum since. In the words of Geof Clark , "there are only a few ways to back a bladelet, all of them immediately apparent to even an exceptionally stupid rock-knocker." (1996: 139) The same is true of lithic technology in general. Schiffer (1996) has compared the commonalties of lithic use-life trajectories that appear widely throughout space and time to ontological development. While not an entirely an apt analogy, given the greater potential for variation in the length and path of such lithic trajectories, it must be remembered that ontology, too, is governed by selection.

The overall result of these constraints on lithic technology has been the evolution-at least as early as the appearance of *H. erectus*-of a flexible system that responded to processing and extraction needs on one hand, and the effective availability of stone on the other. Increased stone availability and/or decreased need for stone in resource acquisition and processing permitted reduced investment in flake production efficiency (e.g., a shift from bifacial to amorphous cores). Decreased stone availability (due to increased residential mobility or the spatial disjunction of stone and other resources such as food and water, as well as limited stone sources) and/or increased need for stone (due to increases in extraction and processing needs or increased population) was balanced by a shift to more efficient core technologies (bifaces or blades) and use-life extension strategies such as retouch and hafting. In neo-Darwinian terms, there is an underlying body of heritable information (analogous to genotype) responsible for technological behavior that can be variably expressed, depending on the environmental context, in phenotypic form as different kinds of lithic assemblages.

There are also selection driven shifts in the technological information that is transmitted. As has been pointed out by design theorists, the design and manufacture of stone tools responds to spatial and temporal variation in resource distribution and levels of uncertainty in these distributions (Bleed 1986, Torrence 1989, Nelson 1991). Myer (1989), for example, suggests that changes in compound projectiles employing microliths were tied to changing hunting techniques and prey selection in Mesolithic Britain. Similarly, Shott (1996) links temporal change in projectile point forms from the American Bottoms to hafting techniques and projectile shaft dimensions. These, in turn, are constrained by projectile delivery systems, prey selection, and hunting methods. Neeley and Barton (1994) focus on the relationships between compound tool manufacture and maintenance, mobility, and microlith forms. Nelson (1991) presents yet other analogous examples. The point here (pun intended) is that lithic morphology has little freedom to vary independently of the larger techno-economic system in which it plays a fundamental role.

Even if there were more permissible morphological variation in chipped stone artifacts, other factors would limit its potential for expression. There is sufficient uncertainty in the knapping process that complex morphologies, such as the eccentrics mentioned above, can be produced through knapping only with a considerable investment in time, skill, and high quality raw material. A usable edge can be produced in seconds, however. Related to this, a skilled knapper can produce a very serviceable biface in less than an hour, but it could easily take considerably more time to create an *exact* duplicate of the first. Furthermore, morphological embellishment has the potential to reduce the effectiveness of lithic tool. Given the extremely short use-life of many lithic artifacts, it is likely that there are selective constraints *against* the potential for a wide range stochastic variability.

Identifying Passive Style in Archaeological Assemblages

It is clear that while lithic morphology may vary, most expressed variability is the product of selective constraints. This means that there are rather stringent limitations on the expression of passive style in lithic assemblages. The extent to which variation due to stochastic processes, operating within these limits and indicating group social identity, can be recognized in archaeological assemblages is a further consideration. Especially relevant here is the fact that the lithics encountered by archaeologists are generally discard assemblages. That is, archaeological assemblages are comprised of artifacts that are no longer in usable condition and, in fact, may differ to a considerable extent from their original morphology (Barton 1991, Frison 1968, Jelinek 1976). Morphological features arising from stochastic processes during manufacture are likely to be altered or obliterated during the use-life of many lithic artifacts. This is the case not only for simple flake tools, but also for more complex forms such as bifacial projectile points (Flenniken & Wilke 1989, Hoffman 1985). Hence, the final artifact forms encountered by lithic analysts are the result of use-life alterations overlaid on the original design.

Many attribute analyses and typologies currently in use conflate features that most likely vary according to intended use or in the course of maintenance during use (Barton 1991, Barton & Neeley 1996; Barton, Olszewski & Coinman 1996, Dibble 1987, 1995, Flenniken & Wilke 1989, 1995, Thomas 1981). However, Whittaker (1987) examines individual-level variations in biface morphology, using projectile points from mortuary contexts, that might give rise to group-wide patterns through stochastic processes. Additional studies of such detailed attributes (e.g., flake-scar orientation angles) may be of value for distinguishing social groups (see also Sackett [1989] for examples with non-bifacial artifacts). Whittaker's work also raises questions as to whether variation at the individual level (either isochrestic or assertive [*sensu* Wiessner 1983] in nature) might be great enough to obscure stochastic variation at the group level.

Following the lead of methodologies successfully employed with ceramics, many archaeologists have used assemblage-level frequency seriations of chipped stone artifacts to infer the boundaries of social groups. That is, variation among assemblages in the relative frequencies of artifact types is interpreted to represent differences in social descent among the makers of the assemblages. Perhaps the best known example of such an approach is the interpretation of assemblages-level variability in the Middle Paleolithic by François Bordes (1973, Bordes & de Sonneville-Bordes 1970, see also Jelinek 1988). The underlying implication is that such variation is stochastic in nature (e.g., Bordes 1973, Close 1989). When frequency seriation produces an accurate chronological ordering, the case for stochastic processes and common social descent is felt to be even stronger (e.g., Teltser 1995). For several reasons, however, frequency seriation applied to lithic assemblages is unlikely to provide information about social group membership in the context of the small scale societies that characterize mobile foragers and even simple agricultural communities.

Primary among these is the relationship between stochastic variability and population size. In brief, the amount of stochastically maintained variability present in a population at any one time is inversely proportional to the size of the population. In stochastically controlled variability, one (isochrestic) variant of a form will eventually become fixed in a population and others will disappear due to chance and transmission processes. The rate at which this process occurs is inversely proportional to population size. This has long been known to be true for biological populations and has recently been modeled for behaviors transmitted via social learning (Neiman 1995). In large populations the rate at which a variant becomes fixed is slower and the rate at which new variations are introduced (a function of population size) is higher. Hence, a number of selectively neutral variants will be present at any given time. In small populations, however, variants go to fixity much more rapidly and new variation is introduced more slowly than in large populations, meaning that fewer neutral variants will be present at any one time. For hunter-gatherer groups of

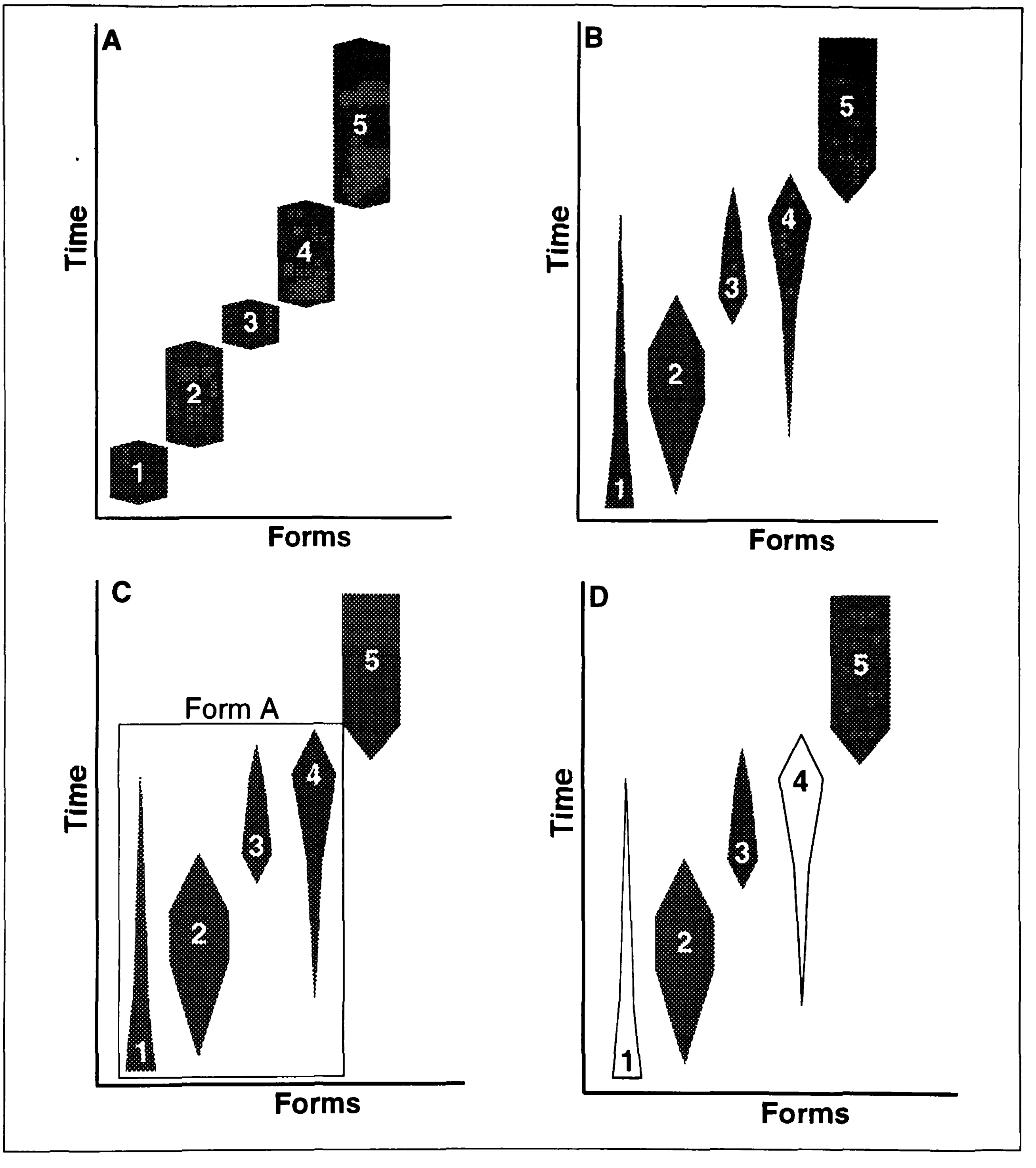

Figure 8.1 Stochastic processes and artifact form. Graphs A through D represent hypothetical frequency distributions over time of a particular artifact class, such as projectile points, within the assemblages from a stratified archaeological site. Each frequency polygon (i.e., battleship curve) represents the change in frequency of a particular morphological form (a.k.a. 'style') over time. Graph A shows the expected distribution over time of forms controled by stochastic processes in small social groups. Note that only one form is represented at any given time, except during rapid transitions between forms. The distribution of forms shown in graph B can either result from selection maintaining multiple (i.e., functionally distinct) forms or stochastic processes in large social groups. Graphs C and D show alternative explanations for the distribution in graph B, especially relevant for small groups. In graph C, forms 1-4 are simply arbitrary divisions of continuous variability in discard morpholgy in a single form ('form A'). Form 5 is morphologically distinct (either functionally or stylistically) and replaces form A. In graph D, forms 2, 3, and 5 represent stochastic change in artifact morphology within a single social group. Forms 1 and 4 derive from different social group; their presence at the site could represent exchange or territorial group boundary fluctuations.

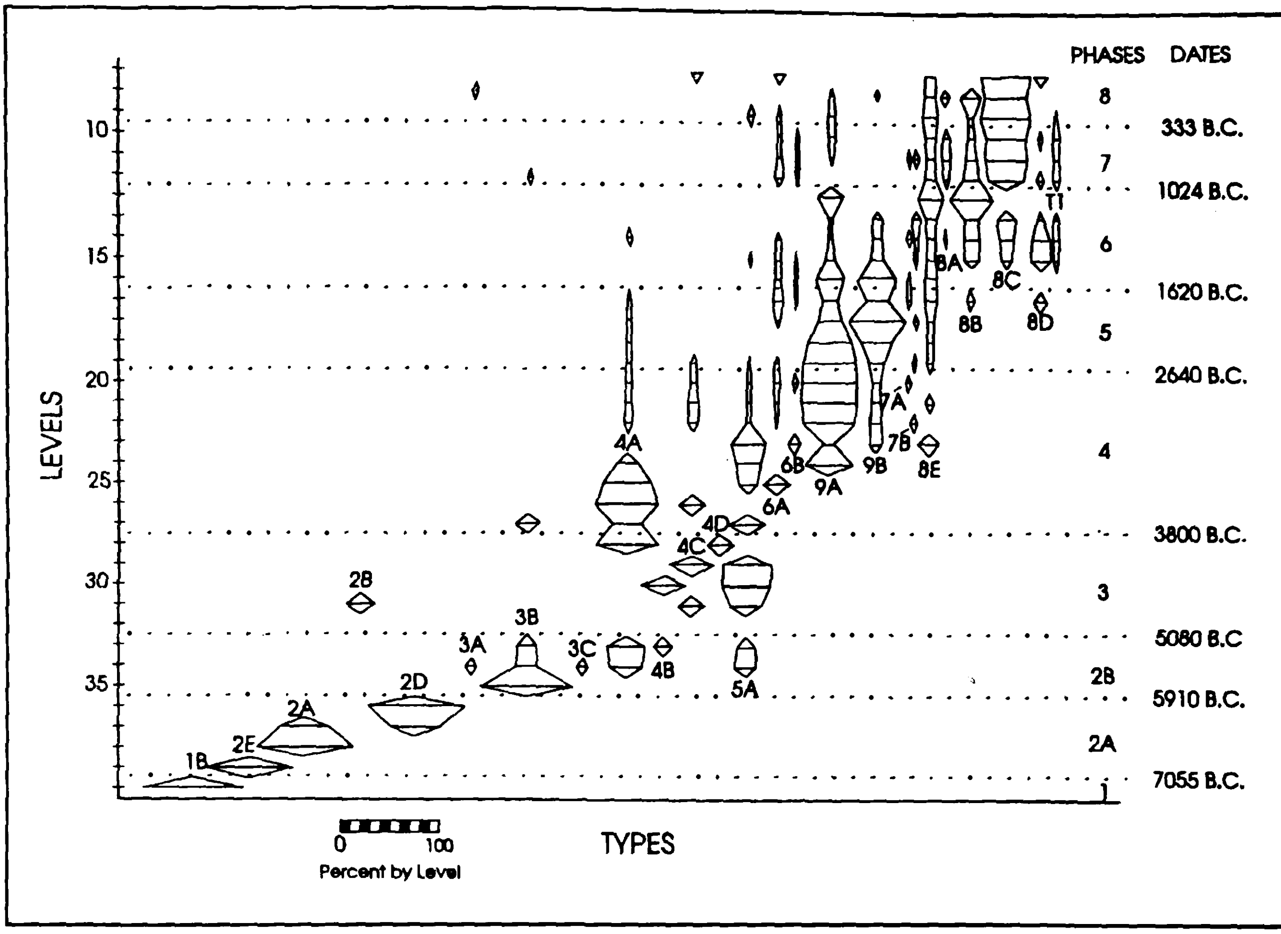

Figure 8.2 Projectile point relative frequencies from Panaulauca Cave, Peru (from Rick 1996: Figure 2).

ca. 25 individuals, only a few of whom would be actively making stone tools, this means that it is highly likely that *only one* stochastically controlled variant of an artifact form would be present at any given time. Any new variant introduced would either rapidly disappear or completely replace the pre-existing variant. Hence, stochastic variability in chipped stone artifact assemblages produced by a given social group should be manifest at archaeological resolutions as a succession of single forms through time rather than changing frequencies of a set of forms (Figure 8.1a).

To cast this situation in terms more familiar to many anthropologists, the stone tools discarded by a band of foragers were made by some subset of the total band. These few individuals were likely closely related, shared in the same socialization processes, and usually worked together. Each individual probably made stone artifacts in a slightly different way (Whittaker 1987, Wiessner 1983). However, at a group level, it is very difficult to imagine a realistic situation in which this small group of knappers made several different styles (in the isochrestic sense) of, say, projectile points and highly unlikely that these styles were maintained as distinct, unchanging forms over many generations of their descendants.

For situations where several apparent variations of a single artifact class are maintained through time, it is highly unlikely that the different forms are simply different 'styles' (in the sense of passive style) of a particular type. A particularly clear case in point is Rick's (1996) study of the Archaic Period lithic assemblages from Peru. In some of the assemblages from Panaulauca rockshelter, as many as ten different 'styles' are thought to have been produced in a single occupation (Figure 8.2). Some of these styles (e.g., type 9A) are thought to have been continuously produced for over 2,000 years. Rick maintains that the different point forms are stylistic alternatives within a single functional class (i.e., isochrestic style [1996: 251]).

In the light of the preceding discussion, this is extremely unlikely. This is not to say that Rick has inaccurately described the projectile point morphology and its variability. However, given that Panaulauca was occupied by bands of Archaic foragers, the number of contemporaneous styles proposed by Rick probably often exceeded the number of active knappers in residence there at a given time. Several other alternatives are more likely (Figure 8.1b-c). One is that this sort of formal variation is maintained by selection, analogous to the common genetic case of balanced polymorphisms (Figure 8.1b). That is, selection, not stochastic processes, probably maintains morphological diversity in point forms in this and many similar contexts. An alternative explanation (Figure 8.1c) is that the apparent discrete artifact types are arbitrary divisions of a range of continuous morphological variability due to variation in the life histories of artifacts with respect to wear, breakage, and maintenance (e.g., Barton 1990, 1991; Dibble 1995, Flenniken & Wilke 1989, Wilke & Flenniken 1991). As discussed above, both the range of such variability and the uselife trajectories that particular artifact forms may take are ultimately under selective control. On the basis of his illustrations (1996: Figure 4), this may account for many of Rick's types. A third alternative explanation (Figure 8.1c) is the movement (i.e., diffusion) of forms among different social groups due to exchange of artifacts or people (as is the case with San arrows documented by Wiessner [1983]). This latter explanation is equivalent to gene flow in biology and will be addressed in more detail below.

These considerations do not necessarily mean that such seriations are useless for constructing chronologies, a point that Thomas emphasizes (1981, 1986). In fact, given that stochastic variants are likely to go to fixity very rapidly and differ among widely spaced, mobile forager bands, stochastic processes may not produce the same kind of temporally patterned variation that they do with larger, more sedentary social groups. Changes in lithic assemblages due to directional selection, cutting across social group boundaries and encompassing larger geographic regions, may be more useful for the construction of chronological frameworks (e.g., Shott 1996).

LITHICS AND GROUP IDENTITY

It is clear that variability in most features of lithic macromorphology-including overall size, shape, and retouch configuration-that form the basis for widely used typologies are likely to be under selective control. Hence, similarity in artifact form and assemblages composition are more likely to be a result of selection favoring one form over others or evolutionary convergence in similar contexts, than indicators of common social descent. Examples include the widespread use of backed microblades in compound tools from the late Pleistocene through the mid-Holocene over much of temperate Eurasia and the spread of small projectile points over much of North America about 2,000 years ago. The development of specialized blade industries in the complex societies of southwest Asia (Rosen 1983), the Indus valley of India (Biagi & Cremaschi 1991), and Mesoamerica (J. Clark 1987) seems best explained by convergence, as do the presence of chopping tools in the Spanish Mesolithic (Clark 1983) and the Oldowan and the appearance of sidescrapers in European Mousterian and Arizona Hohokam assemblages.

In comparing the effects of stochastic processes and selection on lithic form, it should be clear that the recognition of passive style in lithic artifacts is difficult at best. Nevertheless, this is not an impossible task. In fact, the identification of lithic residues of social groups is relatively easy at one level. Given the sparse nature of the *known* archaeological record compared to the amount of material culture originally created and used by prehistoric people, we can say without fear of contradiction that each lithic assemblage from a single occupation (to the extent this can be ascertained given the variable temporal resolution of the archaeological record) minimally represents the residue of a single identity conscious social group. Of course, many (perhaps most) such assemblages probably represent the combined residues of more than one group that left their artifacts at a particular location, of course; only very rarely do we find more than one assemblage deposited by what was demonstrably the *same* group of people. However, this is not what most archaeologists want to know about social identity.

As Teltser (1995) notes, we want to construct 'true phylogenies' (see also Jones, Leonard, & Abbott 1995). In diachronic studies, we need to identify social descent lines in which change takes place. Across space, we want to map the social distance between groups that left contemporaneous residues. In more general terms, archaeologists often need to trace networks of information transmission (including the direction and intensity of 'social interaction' or 'exchange'), and changes in such networks through time (e.g., Barton, Clark, & Cohen 1994, Clark, Barton, & Cohen 1996). Although determining social distance and group membership are not essential to the research questions posed in many studies, there are many more where such information is critical.

My own research on the eastern Spanish Mesolithic and Neolithic is a case in point. Within the region of Valencia there are apparently contemporaneous sites in which only the remains of wild plants and animals are found and sites from which remains of domestic cereals and ovicaprids have been recovered. Did the same group of people (or groups of people) leave the assemblages in both types of sites or are they the residues of two different groups employing different subsistence behaviors? The answer to this question structures the explanations proposed for the evolution of food production in the region.

Given the preceding discussion, several suggestions can be offered for guiding a research program to identify group-level social identity in the archaeological lithic record of prehistoric foragers. An important principal to both structure such research and empirically evaluate its results is the relationship between self-conscious social groups and geography. That is, for foragers–and quite possibly most small-scale societies prior to the evolution of social complexity–social groups are coterminous with a piece of the landscape (Shennan 1989) and there is at least some evidence that such geographical relationships can be stable well into the range of temporal resolution for archaeological data (Hayden, Bakewell, & Gargett 1996). This should come as no surprise, as it is characteristic of the vast majority of mammalian species.

Selection and Social Identity

Evidence for group-level social identity can potentially be found in artifacts whose forms are the result of selection for social boundary maintenance. Logically, such selective pressures are likely to be more clearly discernible in contexts of sedentism, land ownership, and social complexity than among mobile foragers for whom the potential for flexibility in group membership can reduce risk (see Shennan 1989, Wiessner 1983). Where it does occur, in most cases selection will probably favor nonlithic artifacts as more effective media for communicating group membership (Barton, Clark, & Cohen 1994, Clark, Barton, & Cohen 1996, Clark 1989, Conkey 1980, Gero 1989). However, a few lithic forms, such as the previously mentioned eccentrics, may also serve this function. To operate in this role, lithic artifacts should show no evidence of usewear or maintenance, indicating that their morphologies were stable over the course of their uselives. They should have long uselives, though this may be difficult to demonstrate. They should have rather complex morphologies that vary minimally within the context of a single social group in order to unambiguously communicate information. Because communication comprises an important (perhaps primary) function, their discard patterns should be distinct from lithics used in more pedestrian direct economic activities like resource extraction and processing. At a regional level, they should be found within a contiguous geographic region and their distribution should be dichotomous or steeply clinal. This latter criterion, along with discard patterns, should help to distinguish lithic forms that communicate information about group membership from those that are linked to individual roles (Gero 1989, Wiessner 1983).

Geography and Social Identity

The relationship between social groups and geography can provide important clues to social identity. Most useful are resources with fixed, identifiable provenances, that are preserved and can be identified in the archaeological record. Sourcing studies have become increasingly valuable in ceramic studies for identifying social groups and their interrelationships (e.g., Neff 1992, 1993; Abbott 1994; Abbott & Walsh-Anduze 1995). Although there are complications, compared to ceramic sourcing, in identifying the source localities of many of the rocks used in lithic technology (Bush & Sieveking 1987), many of these problems are potentially solvable at least at a local scale (Hayden, Bakewell, & Gargett 1996; Hoffman, Todd, & Collins 1991). Sourcing studies for European Middle Paleolithic (Féblot-Augustins 1993), North American Paleoindian (Seeman 1994), and North American Archaic (Shackley 1986) assemblages exemplify the value of this approach for demarcating social groupings and group-level interaction at a regional scale. In a provocative recent study, Hayden and colleagues (Hayden, Bakewell, & Gargett 1996) present evidence suggesting long-term (i.e., more than a millennium) control over specific lithic resources by local-scale social groups and their descent lines. If such work can be replicated elsewhere, it could provide archaeologists with information about social identity at a resolution much finer than has previously been considered possible for prehistoric foragers.

Stochastic Variation and Social Identity

Finally, expectations about patterning for stochastic variability can be used to evaluate the potential for specific artifact forms to provide information about group-level social identity. Within a given social learning context, stochastic processes should result in a single neutral variant rapidly becoming fixed–that is, only a single variant should be produced–in small forager groups. Thus, individual social groups should be characterized by particular variants of a lithic artifact class, reminiscent of the artifact index types (*fossiles directeurs*) commonly used by archaeologists in the first half of this century. Because of the potential for fluidity in group boundaries (both geographic and social), for exchange, and for individual knappers to occasionally change group membership (see, e.g., Wiessner 1983, 1985) the artifact forms specific to one social group might be discarded with the material residues from other groups in varying frequencies. The frequency at which this is likely to occur should be proportional to the combined social and geographic distances between groups.

In a landscape populated by several forager social groups, the spatial distribution of contemporaneous stochastically controlled variants should appear as a series of overlapping dichotomous to clinal distributions (depending on the social distance between the groups). The central part of each distribution, representing more or less the home range of each group, should have variant frequencies approaching unity. Variant frequencies should

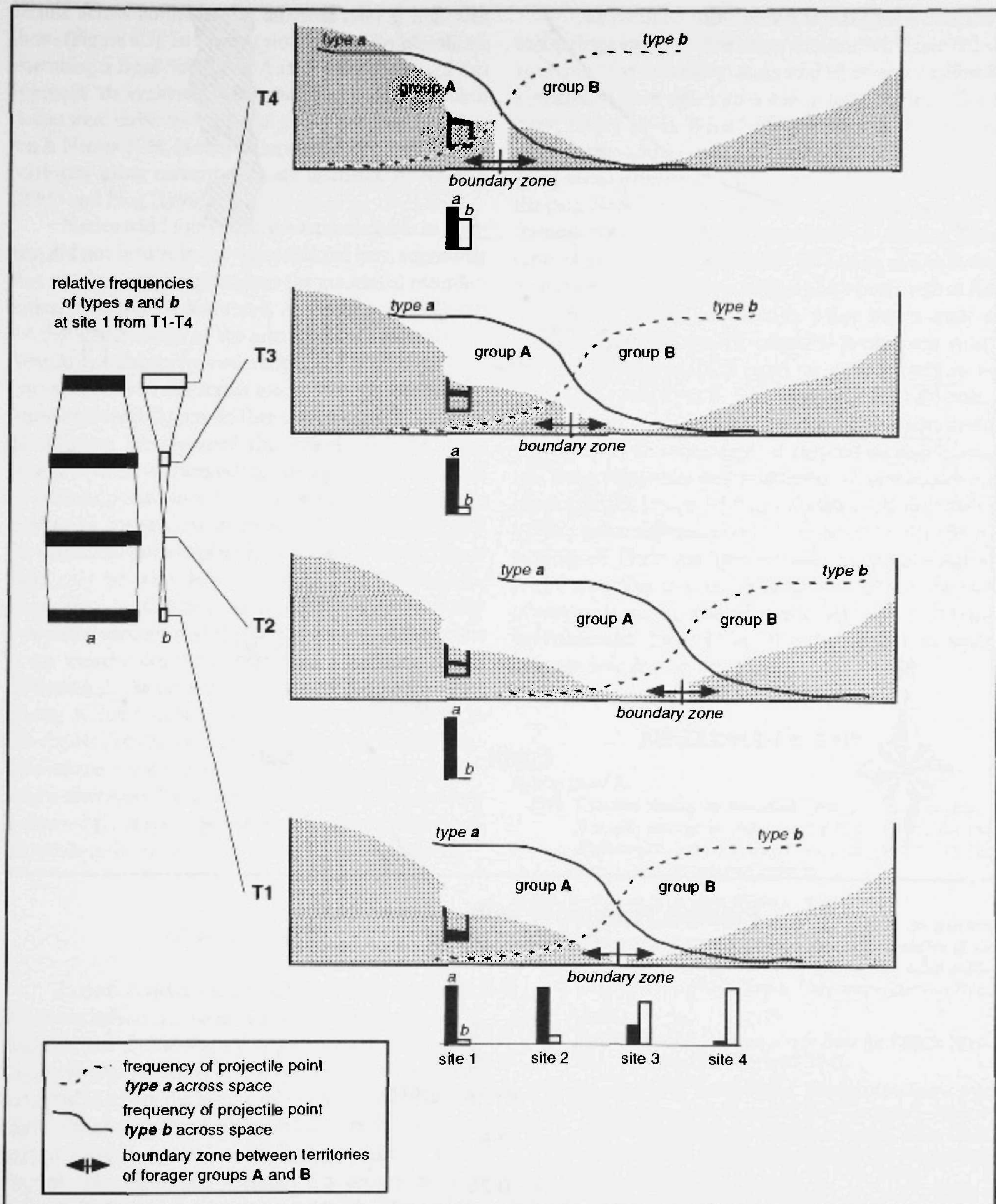

Figure 8.3 Spatial and temporal frequency distributions predicted for two projectile point (or other artifact) types (types *a* and *b*) whose forms are the result of stochastic processes within two groups of mobile forager (A and B). Patterning in the relative frequencies of the two types across space is shown for four time periods (T1-T4). These frequencies display clinal distributions across space, as seen in the relative frequencies of the point types at 4 settlements (site 1-site 4) occupied during time period T1. Note the shift in the spatial (i.e., horizontal) position of the boundary between groups A and B from time periods T1 through T4. The changing relative frequencies of types *a* and *b* at site 1 through time reflect the concommitent changes through time in the distance of site from the boundary zone between the forager groups. These diachronic frequency changes are re-expressed as the "battleship" curves shown at the left side of the figure.

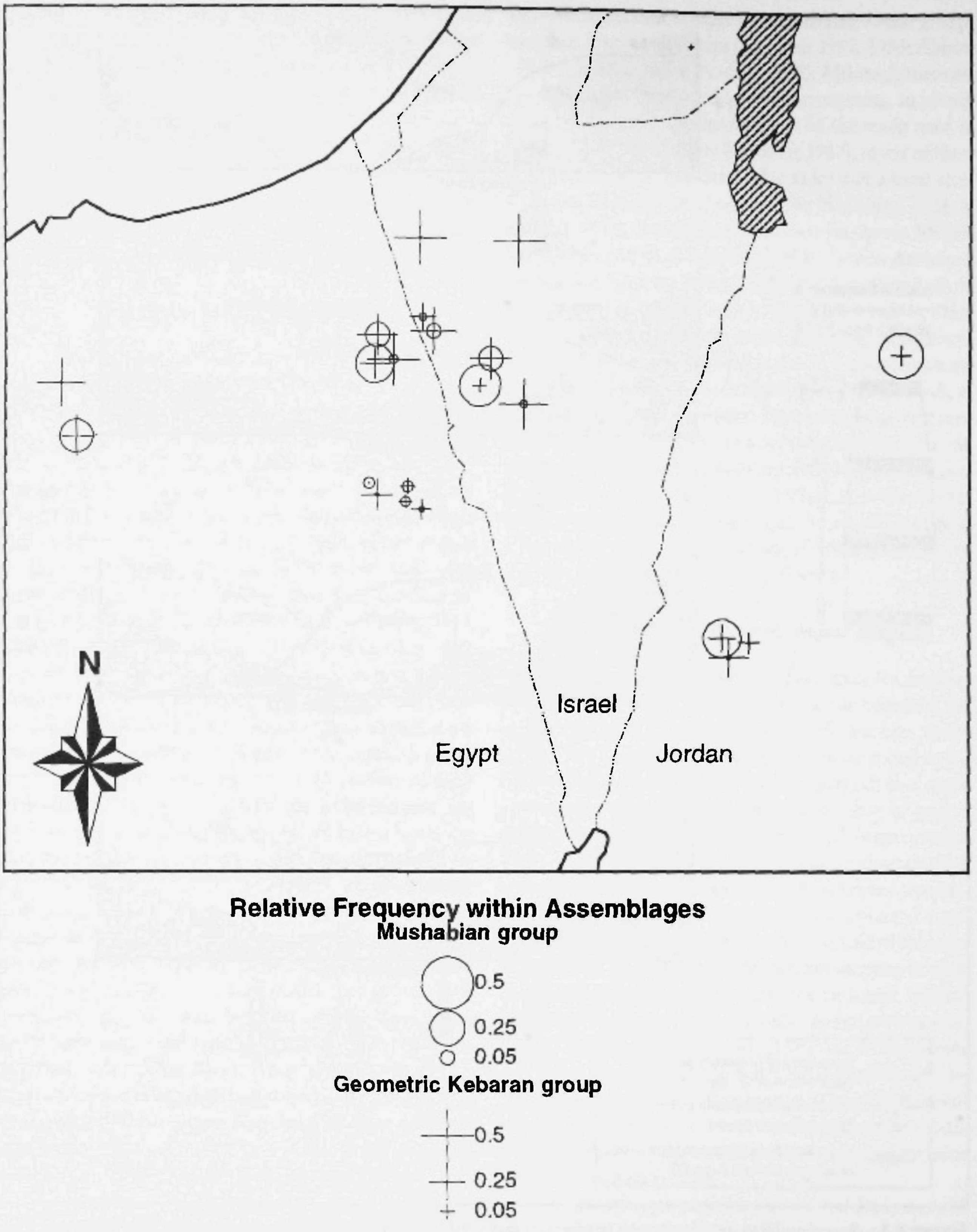

Figure 8.4 Geographic distribution of different microlith forms in the Levantine Epipaleolithic. The map shows relative frequencies of microlith forms widely considered diagnostic of the 'Geometric Kebaran' social entity (straight backed bladelets and trapeze/rectangles), and microlith forms considered diagnostic of the Mushabian' social entity (arched backed and scalene bladelets, and La Mouillah points) in assemblages from sites in the southern Levant. Symbol size is proportional to relative frequency within assemblages (after Barton and Neeley 1996: Figure 1).

decline across boundaries at different rates as indicated above (Figure 8.3). In a recent study of late Epipaleolithic assemblages from Southwest Asia, Neeley and I used this approach to evaluate claims that particular microlith classes were indicative of social group membership (Barton & Neeley 1996, Neeley & Barton 1994). Similar methodologies using ceramic data are discussed in Neiman (1995) and Plog (1990).

Neeley and I found that the artifact classes in question did not behave in the way predicted here, suggesting that an alternative explanation for associated morphological variability is warranted. As can be seen in Figure 8.4 the distributions of the artifact classes in question-Geometric Kebaran type microliths, and Mushabian type microliths-are erratic across space. They are neither differentiated spatially nor do they show a clinal geographic distribution. We suggested alternatively that the distribution of these artifacts was the result of differential discard of compound tool manufacturing and maintenance residues by foragers for whom we cannot yet distinguish distinct social groupings within the region. Nevertheless, there may be other lithic forms in these same assemblages that do distribute as expected for stochastically controlled variants and that might serve to differentiate group membership and boundaries. Analyzing spatial patterning in the discard frequencies of different artifact classes, as described here, would be more informative in this respect than the common practice of classifying lithic assemblages according to the relative frequencies of standard artifact types. Future research in this direction is clearly warranted given the importance of Southwest Asia to understanding the evolution of domestication economies.

CONCLUSIONS

In both non-Darwinian and Darwinian approaches to human behavior, strong cases have been made for partitioning the archaeological record according to social descent groups. As Teltser (1995) and Dunnell (1995) point out, this is where the effects of selection play out. For most of the human past, lithic artifacts are the only phenotypic residues available for inferring prehistoric social identity. The theoretical literature has become increasingly sophisticated during the past two decades at linking artifactual variability with social identity via concepts of style (e.g., Hegmon 1992, Conkey & Hastorf 1990). However, this work has primarily focused on non-lithic residues of human behavior. Furthermore, profound differences as to what constitutes style and its expression have made it even more difficult to apply the theoretical concepts to real archaeological assemblages.

One result for lithic studies is that style is relegated to a garbage category after other explanations have failed to account for variability, and social identity is a fallback explanation when others do not seem to suffice (e.g., Close 1989, Henry 1996). What I advocate here is that archaeologists take a much more proactive approach to identifying social identity that has generally been the case in the past. Neo-Darwinian evolutionary theory provides a framework to reconcile the apparently conflicting concepts of style that are currently debated in the archaeological literature and their relationships both with social identity and artifact assemblages. More importantly it permits us to make specific empirical predictions about the nature of the archaeological record as it pertains to group-level social identity. This, in turn, permits the evaluation of claims of prehistoric social organization based on variability in assemblages of chipped stone artifacts, and the development and refinement of new models of social organization. As several evolutionary theorists have recently pointed (Jones, Leonard, & Abbott 1995; O'Brien & Holland 1995) out partitioning the archaeological record according to social descent is an important part of proposing robust, scientific explanations in a Darwinian framework. I would hope that the suggestions made here can help further this goal.

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