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The Challenges of Cause and Explanation in Historical Ecology, Demography, and Movement

ANN F. RAMENOFSKY AND CYNTHIA L. HERHAHN

One goal of the 13th Biennial Southwest Symposium was to explore the current state of regional archaeological knowledge across three significant themes—historical ecology, demography, and movement—recently highlighted by Keith Kintigh and colleagues as grand challenges in the discipline (Kintigh et al. 2014). Movement and ecology have been emphasized in many Southwest symposia (Cameron 1995; Fish and Reid 1996; Hegmon 2000; M. C. Nelson and Strawhacker 2011), but demography has received less attention. In the 1992 symposium (Fish and Reid 1996), demography was linked to organizational complexity, and demographic papers have appeared occasionally in other volumes (Creamer et al. 2002; Doelle 2011; Ramenofsky et al. 2011). Here, however, demography is treated as an independent domain in archaeological investigations. We viewed this focus as essential. Although trivial to say, without people there is no archaeological record.

Another goal of this volume is to consider the broader epistemological issues of cause and explanation in archaeology. The incorporation of these concepts is significant on several fronts. They provide the contextual and theoretical “glue” that binds the three themes together into a coherent whole. Consideration of cause and explanation honors the contributions of Southwest archaeologists to the discipline as a whole (Cordell and Plog 1979; Fritz and Plog 1970; Plog 1974, 1981), adding intellectual depth to all the case studies or discussions and reminding us about the “confines of normative thought.” Of equal importance, using these concepts

facilitates assessing the current and past state of knowledge within each domain. The assessment, in turn, ties back into the structure of the Southwest Symposium. The biennial meeting and subsequent publications of papers create a permanent record of development and change in archaeological knowledge that can be continually revisited. This structure allows us to evaluate older ideas and theories in light of new fieldwork and introduce new methods and techniques to evaluate what we thought we knew only a few years earlier.

Given the importance of cause and explanation to the volume as a whole, we begin by discussing these concepts at the scale of the discipline. To be consistent with this scale, we extend this discussion by examining cause and explanation within each theme at regional scales both outside and within the Southwest. This examination contextualizes how section leaders structured their topics. We end this chapter by introducing the organizational structure of the sections addressing each theme.

CAUSE AND EXPLANATION

During the heyday of Processualism, discussions of cause and explanation in scientific archaeology focused on universal laws, single causes, and the Deductive-Nomological model of explanation (Binford 1968, 1977; Watson et al. 1969, 1984). This structure, however, has not survived. Due in part to the post-processual critique, the purported objectivity associated with cause and explanation has shifted to more contingent and subjective structures for understanding the human past (Fogelin 2007; Hegmon 2003; Kelley and Hanen 1987; Wylie 2002b). These shifts, however, do not make science passé or imply that discussions of cause and explanation are no longer relevant to the discipline. Revisiting these epistemological concerns is appropriate, especially in light of our goal of presenting and assessing current knowledge.

Cause and explanation address both how and why questions (Dunnell 1982, 1989). These questions are the scaffolding that supports cause and explanation, involving different causal mechanisms and different explanatory scales. How questions address process, or those steps, feedbacks, and interactions that result in one or more consequences. Answering why questions, however, requires variables external to the subject of explanation itself. Although process can be part of explanations addressing why, how questions need not include why.

Take, for instance, the depopulation of the Colorado Plateau in the thirteenth century. If we want to know why this abandonment occurred, then investigating climate, precipitation patterns, and intergroup aggression must be considered. By contrast, asking how abandonment occurred involves issues such as abandonment

rate, group sizes, and routes taken—all factors internal to the process. As another example, social networks may be causal in the distribution of certain artifact types during one or another time period. If this is the case, then investigating how social networks work is essential to explaining the distributions. If, however, the goal is to explain why such networks form, rather than their functions, then causes of their formation must be investigated. How social networks function cannot explain why social networks form. We need other mechanisms to avoid circularity.

As the examples make clear, there are no single causes. Instead, there are many causes that vary with the kind of question asked and that are framed in terms of research goal and scale. Research goal establishes what we want to know; functioning like a zoom lens, scale is the scope or inclusiveness of that goal. Accordingly, our investigations can expand or contract along one or more dimensions, including time and space. As a result, stipulating an appropriate cause at one scale becomes inadequate at a different scale.

As our understanding of causal scales has become more sophisticated, so too has our knowledge of adequate explanations. Explanations are inferences. There is a “best” explanation in a particular context, but to select among explanatory options, or “multiple working hypotheses” (T. C. Chamberlain 1890), involves a set of standards against which these competing inferences are judged. Standards include evidence, modesty, generality, simplicity or parsimony, refutability, testing, and conservatism. Even then, no explanation is final. The best explanation is likely to shift as we accumulate new evidence, as our understanding becomes more inclusive, or as explanations require fewer assumptions (Fogelin 2007). Creating these inferences is a process that Alison Wylie (2002a) describes as “archaeological tacking,” or moving intellectually between the theoretical and the concrete.

Relevant here is whether or not this understanding of inference excludes interpretation, defined as relative or subjective understanding of the past. Are explanation and interpretation mutually exclusive? Much archaeological ink has been spilled over this issue (Hegmon 2003; Hodder 1991; Preucel and Hodder 1997; Preucel 1989; Shanks and Hodder 1998; VanPool and VanPool 1999), and we do not provide a final answer to that question. More conservatively, however, because interpretation is also an inference, it can serve the same function as explanation so long as the same criteria of “best” are applied.

Cause and explanatory or interpretative inference, then, are concepts framed in terms of how or why questions that structure and facilitate understanding the archaeological record. Significant here is the integration of the three themes into this conceptual framework. In the following section we explore the ways cause and explanation are treated within each of the three topics.

CAUSE AND EXPLANATION IN HISTORICAL ECOLOGY, DEMOGRAPHY, AND MOVEMENT

Historical Ecology is an interdisciplinary paradigm that subsumes many disciplines, including cultural and human ecology, cultural and historical geography, anthropology, archaeology, environmental history, and landscape ecology (Denevan 2006). Uniting all these disciplines is the strongly held assumption that humans are inextricably tied to the landscapes they inhabit, use, modify, and leave (Balée and Erikson 2006; Denevan 2006; Kintigh et al. 2014; Mann 2011). Although change results from the interaction of humans and landscapes, cause and explanation can be weighted in terms of either variable. The difference between these kinds of cause was recently dramatized by the debate regarding the causes of cultural collapse on Rapa Nui. Whereas Jared Diamond (2006) made humans causal in the ecological suicide of Rapa Nui, Terry Hunt and Carl Lipo argued that the Polynesian rat was the principal source of deforestation and environmental degradation (Hunt and Lipo 2011). Although ancestral Polynesians introduced the rats to Easter Island (making humans part of their own demise), there were unintended consequences. Without competitors or predators, and with abundant trees, the rats rapidly proliferated, destroying their own resource base and ultimately causing soil degradation and cultural collapse.

Human impact studies of subsistence regimes that range from foraging to intensive agriculture often consider both how and why (Broughton et al. 2010; Campbell and Butler 2010; R. M. Dean 2010; Erlandson et al. 2008; Thompson and Waggoner 2013). Asking why, for instance, small fauna increases in late Hohokam villages, Rebecca M. Dean (2010) infers that the process of agricultural intensification, especially canal irrigation, had the unintended consequence of increasing forage for small mammals and birds.

In quite a different study involving foragers, Sarah K. Campbell and Virginia L. Butler found troubling the inconsistent assumptions regarding resource abundance, resource intensification and depression, prey species survival, and social complexity on the Northwest coast (Campbell and Butler 2010). In an earlier study (Butler and Campbell 2004), they had documented the stability of salmonids through time. Using those results as a baseline, they asked why and how these populations were sustained despite increasing subsistence pressure from growing human populations. The how became an investigation of deliberate and sustained habitat management for plants. In the end, optimal prey species were sustained through resource diversification, making the classic North American foragers also cultivators.

As suggested by the above examples, human population sizes, densities, and distributions are significant components in historical ecological explanations. Human demographic questions, however, need not be tied or limited to historical

demography. Demography is a crucial causal variable in all archaeological narratives (Kintigh et al. 2014) or explanations, and in the structure of this volume, it bridges the other two topics. People impact their environment and people are ultimately responsible for the movement of material, whatever the proximate cause.

The discipline of demography is a descriptive science and, at its minimum, addresses the size and structure of a population (the number of males and females in various age categories) (A. Chamberlain 2006; Cook and Borah 1971; Hassan 1981; Weiss 1973). Metrics such as life expectancy, number of live births per female, mean age of death, and health status expand the descriptions. Causal explanations of demographic change are lodged in the theoretical structure of the field and, classically, include three variables acting singly or in combination: increases or decreases in fertility, mortality, and migration. Obviously, these variables are related. When a population is declining over some period of time, emigration of females of child-bearing age could result in fewer births and fewer children. On the other hand, if a population is increasing, the causes could be immigration or capture of those same females, a decrease in the birthing interval, a decrease in childhood mortality, increasing life span, or a combination of all factors. Why a demographic structure changes requires consideration of external causes.

Infectious disease introduction to Pueblo peoples in the Southwest in the early colonial period exemplifies the difference between how and why. There is no question that Pueblo peoples declined in the wake of Spanish contact (Palkovich 1985b; Spicer 1962). As they migrated into the Southwest, Spaniards could have initiated the process of disease introduction that resulted in unexpected consequences, including diffusion of pathogens through native channels. Acute infectious diseases, hitchhikers on Europeans, then became the why of decline, as these unfamiliar pathogens were transferred to immunologically naïve Pueblo peoples. The issue is whether or not such massive disease sweeps occurred in the sixteenth century. Not surprisingly, there continues to be debate on this issue (Barrett 2002a; Dobyns 1983; Ramenofsky 1996; Ramenofsky et al. 2011; Ramenofsky and Kulisheck 2013; Schroeder 1968; Thornton 2000; Upham 1992). The most recent archaeological investigations suggest that, despite the Spanish presence, the infectious agents were not a sixteenth-century introduction. Pueblo peoples were stable demographically until the middle of the seventeenth century.

Addressing cause and explanation in movement studies is the most complex of the three themes in the symposium. First, there are two explanatory scales in movement studies that can be challenging to disentangle. Because people are the primary agent of the accumulation, distribution, and abundance of artifacts, how questions typically address one or more proximate causal mechanisms—for example, migration, exchange, intermarriage, or emulation. Why questions, by contrast, address

the external causes of the social processes, such as risk aversion through intermarriage or outmigration or the formation of networks. Why, for instance, is intermarriage the dominant process at one time while migration on a larger scale dominates at another?

The difference between the fine grain of behavioral causes and the coarse grain of the archaeological record makes equifinality a complicating factor in constructing explanations of movement. Archaeological studies of movement must begin with artifacts and with their geographic or geological source increasingly identified through high-resolution instrumentation. This initial focus on artifacts is, of course, essential because we need to know what before addressing how or why. Once distributions are known, how kinds of questions that address the processes by which the material culture moved become important, including exchange of objects, sharing of ideas, intermarriage, and migration. Due to this focus on material culture, investigation of what constitutes a meaningful pattern, and how that pattern develops, provides rich and humanistically interesting narratives that are inferences. Our difficulty comes in evaluating alternative narratives against the standards of evidence, parsimony, and refutability. This evaluation often leaves the problem of equifinality unaddressed.

Stubborn equifinality issues vex archaeological studies of movement in many geographic areas and are not unique to the Southwest. One long-standing debate from the south central Andes of Bolivia and Peru concerns how hallmark material culture (burial customs, ceramics, and other artifacts) from the Altiplano center of Tiwanaku appeared in the Moquegua Valley 300 kilometers to the southwest. The explanations proposed can be broadly categorized as either top-down or bottom-up social processes. The top-down explanation sees a controlled migration imposed by a ruling elite in the capital of Tiwanaku (Kolata 1993; Ponce Sangines 1972), while the bottom-up explanation sees an agent-based diaspora (Goldstein 1989a, 2000, 2005; Owen 2005) that occurs without the direction of a ruling elite.

In an effort to identify the origin of the Moquegua Valley population, researchers have undertaken a diverse range of studies. Included here are a variety of material culture studies (Goldstein 1989b, 1993; Janusek 2002, 2004); a study of mortuary patterns (Goldstein 1989a); skeletal analyses, including biological distance (Blom 2005; Blom et al. 1998) and skeletal modification isotope analysis (Knudson et al. 2004); and DNA studies (Lewis et al. 2007). The results have shown increased contact and genetic relatedness between the Altiplano and Moquegua populations during the zenith of the Tiwanaku polity. Notwithstanding this rich body of data regarding the identity of these people, the question of the causal social processes at work remains ambiguous. Here, as in many southwestern movement studies that involve multiple levels of analysis on a number of material classes (e.g., Ferguson et

al., this volume; Huntley et al., this volume), researchers search doggedly for independent tests to resolve the how questions but find that resolution elusive. Part of the difficulty in identifying the particular social process behind the movement of material traits is that why questions that address external causal factors have not been as intensively investigated as those internal to it.

In the Southwest, Patricia L. Crown's seminal work on Salado polychromes demonstrates the complexity involved in separating movement of things and ideas from the movement of people (Crown 1994). In this study she documents significant regional variation within the Pinedale Style. Although there are clear regional variations in the local expression of the Pinedale Style horizon (e.g., on Rio Grande Glaze Wares, Zuni Glaze Wares, etc.), she argues convincingly that these different archaeological ceramic types were painted in this style (see Carlson 1970). Its movement is tied to the spread of a difference-masking regional cult during the tumultuous 1200s and 1300s. The explanation is tied to population movements of unspecified scale that would have necessitated and facilitated integration of diverse populations into single communities (for a specific example of such integration, see Huntley et al., this volume). The mechanisms of spread—such as migration, intermarriage, or emulation—are not directly addressed in her study, but subsequent studies have endeavored to tease apart these mechanisms (e.g., chapters in Habicht-Mauche et al. 2006). In addition to the mechanisms of how, we might also ask why the strong stylistic similarities among early Zuni, Acoma, and Rio Grande glaze wares diverge after a relatively short time and emphasize different components of the Pinedale Style. Scott G. Ortman's study of Tewa origins (Ortman 2012c) develops a methodology by which these questions can be addressed, and it integrates external factors such as environmental conditions and demography with social processes.

To this point, we have adopted a broad view of the volume themes. We have shown that knowledge building through causal explanations is richly represented in each theme and that together and separately the explanations have contributed substantially to our global understanding of the human past. When viewed through the lens of cause and explanation, it is clear that all causal factors can become explanatory variables both with and across topics, with unintended consequences beyond the particular case. As populations migrate, for instance, artifact distributions change; new technologies, resources, and styles may be introduced and can result in innovation, emulation, and exchange. Those same populations, however, can become tipping points between subsistence resources and people, triggering still other long-term effects, including deterioration in human health, social conflict, or further migration.

This discussion has also been essential for situating the individual sections in a larger framework. We now introduce these sessions, highlighting how the session

leaders approached their topics. Table 1.1 summarizes the organization of the volume by topic, geographic areas, and time periods represented.

HISTORICAL ECOLOGY

Ronald H. Towner uses Carole L. Crumley's definition of historical ecology (Crumley 1994) as the interaction between humans and their environment. Because southwestern archaeologists have long been invested in explaining this interaction, Towner perceives close connections between the traditional southwestern focus on human-landscape interactions and the more recent development of historical ecology. In the Southwest the investigations of human-landscape interactions extend back to the early twentieth century (Antevs 1955; Douglass 1929), providing a well-developed knowledge base for more current explorations.

Towner examines the environmental-human interface through the lens of extreme events, those occurrences throughout prehistory and history that correspond to Jeffrey S. Dean's "episodic factors" (J. S. Dean 1996, 2006). He carefully differentiates events that are extreme from those that are rare. Rare events are defined by their periodicity. Although extreme events are, by definition, rare, they are defined by their magnitude. These unusual and unpredictable events can be causal factors in Towner's framework. They address the whys of changes in biota (including humans), the physical environment, and cultural traditions.

Despite their significance, extreme events pose challenges for archaeological investigations. Because they are unpredictable and sometimes unique, these events do not necessarily leave a definable archaeological trace. Moreover, and for exactly the same reasons, cultural responses to extreme events are not likely to pattern out uniformly. Consequently, we cannot predict, for example, that extremes in precipitation always result in the same cultural response. Contingent on previous histories, as well as other factors, extreme climatic events could result in migration, system collapse, or coalescence.

These concerns notwithstanding, the three chapters in this section are clear and unambiguous explorations of the interactions between extreme events and cultural traditions. Mary M. Prasciunas, Vance T. Holliday, and Jesse A. M. Ballenger review the Clovis-Folsom continuum in the Southwest in light of the Younger Dryas Climatic Interval. Although this climatic interval has long been considered causal in the change in land use from Clovis to Folsom, the authors cogently elucidate that the connections between the Younger Dryas interval and humans are correlations, not causes. They discuss the assumptions driving the correlations and identify problems in attempts to link the climate record and archaeology. In the end, Prasciunas and colleagues argue that the Younger Dryas interval still has

TABLE 1.1. Organization of this volume

<i>Chapter</i>	<i>Authors</i>	<i>Geographic area</i>	<i>Time period(s)</i>
2	Ronald H. Towner	Overview, Historical Ecology	
3	Mary M. Prasciunas, Vance T. Holliday, and Jesse A. M. Ballenger	Arizona, New Mexico (data by counties)	Paleoindian 13,500–11,700 BP
4	Mark D. Elson, Michael H. Ort, and Kirk C. Anderson	Northwestern Arizona (Arizona Strip, Flagstaff)	AD 1025–1200
5	Emily Lena Jones	Northern New Mexico (San Juan Basin, Picuris), central New Mexico (Salinas)	Colonial New Mexico, contact era (ca. AD 1630–~1790)
6	Jeremy Kulisheck	Overview, Demography	
7	Scott G. Ortman	Southwest Colorado, northwest New Mexico, Northern Rio Grande	AD 800–1700
8	Ann L. W. Stodder	Southwest Colorado, Galisteo Basin	AD 750–900, AD 1300–1680
9	Kathryn A. Kamp	Northern Southwest	Prehispanic Pueblo (AD 700–1600)
10	B. Sunday Eiselt and J. Andrew Darling	Northern New Mexico (Rio Chama)	AD 1700–1900
11	Severin Fowles	Northern Rio Grande (Taos)	AD 1030–1320
12	Deborah L. Huntley	Overview, Movement	
13	Sharon Hull, Frances Joan Mathien, and Mustafa Fayek	San Juan Basin (Chaco Canyon, Aztec, Salmon Ruins)	AD 1000–1280
14	Jeffrey R. Ferguson, Karl W. Laumbach, Toni S. Laumbach, Virginia T. McLemore, and Stephen H. Lekson	Southwestern New Mexico (Cañada Alamosa)	AD 700–1400
15	Erik Simpson	Northern New Mexico, southern Colorado (Upper San Juan)	AD 700–1300
16	Deborah L. Huntley, Jeffery J. Clark, and Mary Ownby	Southeastern Arizona, southwestern New Mexico (Upper Gila and Mimbres)	AD 1300–1600

explanatory power in addressing changes from Clovis to Folsom but that the exact causes remain elusive. In the chapter by Mark D. Elson, Michael H. Ort, and Kirk C. Anderson, the volcanic eruptions of Sunset Crater and Salt Springs are extreme events. Importantly, because the nature of the two eruptions was different, cultural

responses of regional populations were also different. This chapter thus clearly demonstrates the absence of uniform cultural response even to the same kind of extreme event—volcanic eruptions. The last chapter in this section, by Emily Lena Jones, examines Spanish migration and colonization in the Southwest as an extreme event. Her focus is on introduced fauna, especially livestock, and the consequences of those introductions on autochthonous species abundance in relation to Pueblo subsistence regimes. Using concepts of resource depression and rebound from Optimal Foraging Theory, Jones used multiple archaeofauna data sets, demonstrating rebound in higher ranked prey (large artiodactyls) following Spanish migration. Hypotheses to explain the rebound are many, including increased sedentism; local or regional abandonment and/or mortality; new technologies, including the horse; or new economic pursuits, such as Spanish demands for hides.

Demography

Population issues, including estimates of size, organizational structure, relative health, and change, are long-standing concerns to southwestern archaeologists (Bandelier 1890–1892; Crown 1991; Crown and Kohler 1994; Lycett 1989; Plog 1975; Ramenofsky et al. 2009; Schroeder 1992; Spier 1917, 1918, 1919; Upham 1992). These concerns, as Jeremy Kulisheck points out, are a function of several variables unique to the Southwest, including the intensity of regional archaeological research in the region; the relative integrity of the archaeological record due, in part, to the large tracts of land under state and federal control; and the high precision dating of dendrochronology.

Kulisheck provides a broad and insightful introduction to demographic archaeology that supports five equally broad chapters. Crucial to the entire section is the seminal distinction between *population* and *demography*. Although the terms are tightly connected and used interchangeably in publication, population and demography are different concepts—different aspects of the people equation (A. Chamberlain 2006). Population simply refers to the numbers of people at various spatial scales. Beginning with Raoul Naroll's ratio of people to space, southwestern archaeologists have expended considerable effort in exploring, modifying, and changing the equation that links to the two variables (Casselberry 1974; Dohm 1990; Kulisheck 2003, 2005; LeBlanc 1971; Naroll 1962; Nelson, Kohler, and Kintigh 1994; Plog 1975; Ramenofsky et al. 2009). Although demography also begins with numbers of people, it goes deeper, elucidating the composition of a population by age, sex, and, if available, reproductive history. These parameters are estimated through census data, archival documents, and skeletal populations.

With this essential distinction clarified, Kulisheck turns his attention to a consideration of the causes of demographic change. As described earlier, the causal variables

include changes in fertility, mortality, and migration. To this suite, Kulisheck adds identity, both as the process of self-identification among current populations and the important concept that archaeologists use to link material traits and ethnic units. Archaeological inferences about identity are frequently linked with migration through the analysis of artifact technologies and styles that differentiate immigrants from indigenous populations (see section 3 in this volume).

The five chapters in this section highlight different parts of demographic theory. Chapters by Scott G. Ortman and Severin M. Fowles focus on the issue of population numbers. Ortman sees continuing effort to improve the precision and accuracy of actual population numbers as essential for intellectual growth, supporting that position with specific suggestions and examples from the Southwest. Fowles implores us to move beyond the preoccupation with population numbers and argues that models, especially scalar stress models, fall far short. Using the long research history from T'aitōna (Pot Creek Pueblo) as a baseline, Fowles argues that the incorporation of ethnohistory and oral history into archaeological narratives provide a more complete understanding of T'aitōna population trends and abandonment than do scalar stress models. Ann L. W. Stodder's chapter addresses the challenge of quantifying ill health and chronic disease and their impact on prehistoric communities. She presents two contrasting cases (San Cristobal and Ridge Basin), employing disability weight metrics from the World Health Organization's Global Burden of Diseases, Injuries, and Risk Factors (GBD) program. The study shows the value of incorporating paleoepidemiological data in the consideration of population movement and demography. The emergence of *Vecino* identity in late eighteenth- and early nineteenth-century New Mexico is the key concern in the chapter by B. Sunday Eiselt and J. Andrew Darling. Ross H. Frank's (2000) economic model of *Vecino* ethnogenesis is the backdrop of their investigation. Using historical demographic estimates and land grant data, they show the shift in *Vecino* identity from one based on the *Casta* system to one based on the property. Maternal health and child survival are obvious variables to all considerations of demographic change or stability, but in archaeology they are glossed over or embedded in many larger explanatory structures. Kathryn A. Kamp sets out to change this oversight. In her contribution, she analyzes the role of both maternal health and child survival using a costs-benefits, risk-management model. Her discussion makes apparent that agency as family planning was likely practiced in the prehistoric Southwest and is certainly worthy of greater analytic investment by archaeologists.

Movement

Deborah L. Huntley's framework for movement studies is built on a foundation that begins with material culture traits rather than the causes of population movement,

as was the focus of the 2008 Southwest Symposium section on movement (Ortman and Cameron 2011). Giving primacy to material culture traits has unexpected consequences. It expands the possible social processes—how kinds of questions—that are proximate causes in movement. Did people move, and if so, what was the nature of the movement? Did objects move through exchange, trade fairs, or intermarriage? Or are the artifacts the product of shared ideas that resulted in emulation? Huntley explores each potential process and then adds finer discriminations. Included here is the scale of movement, separated into temporal, quantity, and distance; logistics of movement, meaning the organization responsible for movement; and context or value of the transmitted items or knowledge. If population movement is causal in artifact distributions, was the movement short- or long-term, of proximate or great distance, and was the process of movement gradual or rapid? A second consequence of the artifact focus is the tie between causes of movement and Kulisheck's demographic discussion of identity and migration. Migration is a cause of demographic change, and assumptions about material culture styles and technology are employed to identify the migrants.

Much of the introductory essay considers the inferential steps that connect artifact distributions to movement. Of key importance here are identifying geographic source locations and geochemical groups of artifacts, a research arena in which southwestern scholars have always been at the forefront (e.g., Abbott 2000; Crown 1994; Glascock et al. 1999; Glowacki and Neff 2002; Habicht-Mauche et al. 2000; Huntley et al. 2007; Shackley 1988; Shepard 1942; Warren 1979). As Huntley details, a suite of methods exists for addressing the provenance of materials. Provenance studies that employ chemical characterization or mineralogical analyses are direct methods (Harbottle 1982; Wilson and Pollard 2001). Indirect methods that consider shared technological styles are also employed, especially social networks (Habicht-Mauche et al. 2006; Lechtman 1977). As demonstrated in some of these chapters, combining technological style with chemical characterization can suggest when style sharing is emulation, exchange of various sorts, or population movement (cf. Shepard 1956).

The four case studies in this section provide wide spatial coverage, including the Upper Gila/Mimbres (Huntley et al.), the lower Alamosa (Ferguson et al.), the Upper San Juan (Simpson), and Chaco Canyon (Hull et al.). Although there is some duplication in the kinds of artifacts analyzed, explanations accounting for the movement of material are variable.

Erik Simpson's analysis of ceramics and architectural styles from a 600-year period in the Upper San Juan presents compelling evidence that the autochthonous populations were deeply conservative. Situated spatially between Chaco and Mesa Verde, these populations actively resisted being pulled into the vortex of

either system. The chapter by Jeffrey R. Ferguson and colleagues employs ceramics (both style and provenance), architectural elements, and obsidian provenance from Cañada Alamosa in their analysis of approximately 700 years of artifact movement. They demonstrate that explanations of patterns in one material class during one temporal interval are insufficient for addressing the same material at another time, or a different material class, but that different kinds of movement are indicated at different times, including migration, abandonment, down-the-line exchange, and intermarriage. The chapter by Huntley, Jeffery J. Clark, and Mary Ownby explains movement and change of ceramics, architecture, and obsidian following the Kayenta migration into the Upper Gila/Mimbres region using provenance data from decorated ceramics. Despite the uniformity in the origin of immigrants, two types of post-migration communities emerged: coalescent communities and communities in diaspora.

Sharon Hull, Frances Joan Mathien, and Mostafa Fayek consider movement of turquoise within the Chacoan world. Using stable isotopes and secondary ion mass spectrometry (SIMS), they document a great geographic range in source locations, from California to New Mexico. Although limited by the sample size of sourced turquoise artifacts, the diversity of source locations suggests a number of explanatory mechanisms that include direct procurement and a variety of trade structures and networks.

CONCLUSIONS

In the end then, the chapters in this volume consider both how and why questions. The historical ecology chapters focus on why; the demography and movement chapters consider how populations change and how artifacts move. As a result of these concerns, all participants are assessing the status of current and past knowledge. There are, in addition, other contributions, including unexpected theoretical correspondences, discussion of new methods, large-scale spatial investigations, and calls to reinvest our substantial intellectual capital in improving our measurements. Jones and Kamp frame their investigations with behavioral ecology models. Identity and history play significant explanatory roles in the papers by Kulisheck, Eiselt and Darling, and Fowles. Hull and colleagues present a new method for sourcing turquoise that will be invaluable in disentangling the geologically and socially complex question of Chacoan turquoise procurement. Stodder's use of the WHO GBD provides a new pathway for incorporating chronic diseases into archaeological descriptions and explanations of health. Ortman issues a clear road map for archaeologists to develop demographic estimates expressed in real numbers that are particularly significant to questions of migration and historical

ecology. Finally, all the contributions are clear demonstrations that archaeological knowledge in the Southwest continues to expand in directions that could not have been predicted fifty years ago.

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