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Introduction

Most archaeologists would agree that craft specialization is an integral component of increasing socioeconomic complexity. The occurrence of specialized craft production has served as a perennial favorite for discussions involving social stratification, economic exchange, and ultimately state-level organization (e.g. Brumfiel and Earle 1987; Childe 1950; Wright 1986:323–324). In fact, craft specialization could be characterized as the workhorse of archaeological investigations into complex society. Specialized production, as exemplified in an almost bewildering variety of material manifestations, has been used to monitor administrative influence over production (Feinman, Kowalewski, and Blanton 1984; Spence 1986), the development of inter- and intra-regional trading networks (Rathje 1975; Wright and Johnson 1975), and various characteristics of the producer/consumer relationship, including the degree of producer competition (Feinman et al. 1981) and the existence of elite consumers (Rice 1981:223).

Given its central role in interpreting social complexity, it is not unreasonable to also consider how craft specialization is viewed archaeologically. What methods have been advocated to identify craft production? What interpretive models have been advanced to meld these archaeological data into an understanding of the past?

The present work employs ceramic production data to address these questions. Ceramics were chosen for several reasons: (a) their positive correlation with sedentism and complex society (e.g. Rice 1987:190; Skibo et al. 1989:126); (b) their almost exasperating quantity as archaeological data (e.g. Willey 1961:230; Sullivan 1988: 23); and (c) their potential as vehicles for interpreting past production organization (e.g. Arnold 1985; Kramer 1985; Rice 1987). These characteristics make pottery and pottery production extremely relevant to research into socioeconomic complexity.

This study presents ethnoarchaeological information on the ceramic production and consumption behaviors of nonspecialized traditional potters in Veracruz, Mexico. It responds to the recently identified need for middle-range theory devoted to ceramic production (Rice 1987:171–172). Such a theory would aid in the identification of production loci as well as contributing to more general socioeconomic interpretations of production organization. Middle-range research (Binford 1977:7, 1981:26) is the necessary first step in developing theory of this type. Middle-range research is actualistic and attempts to link the dynamic properties of extant behavioral systems with the material patterns encountered by archaeologists. As an example of middle-range research, the present work seeks to establish "signature patterns" (Binford 1981:26) of pottery manufacture.

Like many ethnoarchaeological studies devoted to pottery making (e.g. Kramer 1985) this research discusses production materials and techniques and supplies data on household ceramic assemblages and vessel use-lives. These comparative data are instrumental in facilitating the generalizations that form the basis for generating laws and building theory (e.g. Hempel 1977:244, cited in Binford 1982a:130; Kaplan 1964:84; Nagel 1961:179–181). Unlike most other studies, however, this research also investigates the spatial organization of production, as reflected in the arrangement of activities and facilities within production areas. Concurring with recent statements by Stark (1985:172) and Rice (1987:171), the present study argues that all too often research emphasis is placed on tools and production output rather than focusing on production organization. A concern with the organizational properties of production moves research beyond documenting *what* occurred and toward more theoretically satisfying issues of *how* and *why* a specified pattern was generated.

Evaluating ceramic production

Although characterizations of production scale and organization abound in the archaeological literature, there is a growing climate of critical self awareness directed at these inferences (e.g. Brumfiel and Earle 1987; Muller 1984; Rice 1987:170–172). Some archaeologists have become concerned that our methodological reach is beginning to exceed our interpretive grasp. Traditionally, archaeologists have cited ethnographic studies to substantiate their interpretations, but as Rice (1981:219) observed a decade ago: "Archaeological definitions of craft specialization are poorly developed and virtually impossible to correlate with these [ethnographic] criteria . . . It is clear that some operational definition of craft specialization needs to be developed for and by archaeologists."

Nowhere is this difficulty more apparent than in the area of ceramic production studies. Despite a wealth of data describing all phases of pottery making (e.g. Arnold 1985; Kramer 1985; Rice and Saffer 1982), there are few consistently reliable methods that link these contemporary observations to the material record. The limitations of our knowledge are clearly seen in reference to pesky "cautionary tales," statements demonstrating that material patterns documented in one example contradict the patterning observed in a purportedly similar context. Archaeologists studying the manufacture and use of pottery are particularly fond of demonstrating just how variable production systems can be (e.g. Adams 1979; Hodder 1982; Stanislawski 1978).

Unfortunately, cautionary tales do little to rectify the problem. The fact that a contrary argument can effectively negate an interpretation merely underscores our ignorance of how the variables are causally related. Cautionary tales simply beg the question of why the observed variability exists. Still lacking is an understanding of the variables selecting for a particular production decision; that is, a theory of ceramic production.

Basic to this theory is our knowledge of the articulation between the activity of pottery making and its material consequences. The importance of this articulation is

manifest at several different levels. First we must have confidence that our identification of production evidence is justified. Like other archaeological phenomena, production "evidence" does not speak for itself. To identify an object as a polishing stone or mold, for example, is to generate an inference about how that item functioned in the past. How we justify that inference is dependent upon our methological and theoretical approach to ceramic production and artifact analysis.

But let us assume, for now, that a valid identification has been established. The next step would be to place that evidence into some interpretive framework. How do we move from a site containing certain categories of inferred production phenomena to a statement about how production was conducted in the past? How do we use production evidence to interpret production activities?

Certainly the most common procedure is to reference a hierarchical classification of production scale. In these models production comprises a number of distinct "states" or "modes" representing the ethnographically established range of production activities (e.g. Peacock 1981:8–11, 1982; van der Leeuw 1976:392–404). Differences in pottery making follow a general progression from part-time household production to full-time industrialized manufacture (Rice 1987:183–191). Each discrete type is associated with certain production characteristics, often with an emphasis on technological differences. These models should not be construed as representing a unilineal evolution of ceramic production, however. They are simply typological schemes attempting to categorize a continuum of behavior.

As typologies, however, these models are subject to the same regulating conditions noted for other classifications (e.g. Brew 1946; Dunnell 1971; Rouse 1960). One condition is the need to stipulate those characteristics necessary for class membership (Dunnell 1971:15–17). Attention, therefore, focuses on shared, definitional characteristics while variations in nondiagnostic attributes may be ignored. Consequently, these models can obscure considerable intraclass variability that may be extremely relevant to the dynamic properties of the production system. While such typologies have considerable utility as heuristic devices, they should not bear the full weight of synchronic interpretations of ceramic production.

Nor does this approach lend itself to analyses of diachronic variability. The ability to perceive change through time is one of the great strengths of archaeology. Yet a perspective that presents variation as a static concept is of little use in this regard: "Clearly, such juxtapositions cannot in any way be construed as representative of actual changes in the organisation of pottery-making. They remain an *a posteriori* construct of the researcher, and they say little about the real nature of changes which are or were taking place" (van der Leeuw 1984:720). As a consequence, it can be extremely difficult to determine at what point variability has reached critical mass, requiring a restructuring from one production state to another. Under such typologies, attention is diverted away from the boundaries between types in favor of the types themselves. This problem has been likened to the "drunkard's search" (Kaplan 1964:11), in which research efforts are concentrated in a certain area, not because it is potentially informative, but rather because it is easier to manage (Rice 1984a:233).

Ceramic ecology, middle-range research, and spatial organization

The limitations discussed above justify attempts to establish a theory of ceramic production. Since *theory* has worn a haberdashery of definitional hats, its use deserves some explication. In the present context theory refers to a "device for interpreting, criticizing, and unifying established laws" (Kaplan 1964:295). The construction of theory goes beyond collecting generalizations, although as noted above these empirical data can be extremely informative. But theory is not built from empirical observations. Rather, theory is invented to account for those observations. A theory, therefore, is more than the sum of its generalizations; theory enables the researcher to anticipate potentially undocumented variability. Theory building is learning *from* experience as much as learning *by* experience (Kaplan 1964:295).

This study uses ethnoarchaeological experience to learn from ceramic producers. Ethnoarchaeology "systematically defines[s] relationships between behavior and material culture not often explored by ethnologists" (Kramer 1979:1) in the hopes of applying these relationships archaeologically. The ethnoarchaeological experience discussed here derives from a study of traditional potters inhabiting the low sierra along the southern Gulf Coast of Veracruz, Mexico. A total of fifty potters, residing in four communities, provides the data base. Production data were generated through interviews, observation, household inventories, mapping, and houselot excavation. Potters in and around this area have been the subject of previous attention (Foster 1955:22; Krotser 1974, 1980; Stark 1984); this present work builds upon that research while supplying new information on the character of production in this area.

CERAMIC ECOLOGY

The present work employs a two-pronged approach in furthering the cause for a ceramic production theory. First, this study uses the tenets of ceramic ecology to focus on the interaction between potters and their natural and social environment (e.g., Kolb 1989:335). A call for research that placed ceramic studies squarely in an environmental context was initially made by Frederick Matson (1965). Dubbing this approach "ceramic ecology," Matson suggested that it be viewed as a "facet of cultural ecology, that which attempts to relate the raw materials and technologies that the local potter has available to the functions in his [her] culture of the products he [she] fashions" (1965:203). Matson's goal was to advance archaeological perceptions of pottery; releasing ceramics from the tyranny of culture history and relating ceramic studies to the broader anthropological issues of the day.

Since then ceramic ecology has provided a strong paradigm for contextualizing pottery production systems (e.g. Kolb 1976, 1989). Through an explicit concern with the environment, ceramic ecology supplies a method for cross-cultural comparisons that may also be used to investigate past production activities (e.g. Arnold 1985:14).

At the core of ceramic ecology is an emphasis on the natural environment, including the natural resources available to the potter and the climatic forces acting on production (e.g. Arnold 1975; Rice 1987:314). The most relevant natural resources for the potter include clays, temper, and fuel. A ceramic ecological perspective thus requires information on the geology of the region, as well as data on hydrology and land-use practices (Rice 1987:314).

In addition to raw materials, a region's climate may also provide mechanisms for regulating ceramic production. Some of these variables have been recently discussed by Arnold (1985:61–98). Precipitation and temperature are obvious concerns; other factors include humidity, prevailing winds, and cloud coverage. Climate may affect the schedule of production, the intensity of manufacture, and the production technology (Arnold 1985:98).

The social and economic environments of the potter are also of interest; the so-called "human aspects" of ceramic production (Matson 1965:216; also Arnold 1985). Ceramic ecology calls for data on production tools and techniques, the social organization of potters and rates of pottery production and consumption (e.g. Rice 1987:316). Ceramic ecology seeks information on all factors relevant to the study of pottery making. By adopting a perspective in keeping with the goals of ceramic ecology, this study establishes archaeologically relevant relationships between ceramic production, ceramic consumption, and both the natural and social environments of the potter.

MIDDLE-RANGE RESEARCH AND SPATIAL ORGANIZATION

This present study is also an exercise in middle-range research (Binford 1977:7, 1981:25). As noted above, research of this type is designed to link the dynamic properties of contemporary systems with archaeological patterns. Since the cultural activities that contributed to a given archaeological deposit are unobservable, we must look to the present for insights into the behavior generating the material patterns:

> What we are seeking through middle-range research are accurate means of identification and good instruments of measuring specified properties of past cultural systems . . . We are looking for "Rosetta Stones" that permit the accurate conversion from observations on statics to statements about dynamics.
> (Binford 1982a:129)

Such a research program, in turn, is designed to contribute to middle-range theory. This theory serves to link the observations made in the present with the potential archaeological record; it is concerned with the formation processes responsible for patterning in material remains (e.g. Schiffer 1987, 1988; cf. Raab and Goodyear 1984).

Middle-range theory enables the researcher to anticipate archaeological variability, based on an understanding of causality established through middle-range research. Anticipation as used here is not interchangeable with prediction. Prediction can occur without understanding why two variables are causally related; "statistical" or "probabilistic" explanations (e.g. Nagel 1961:24; Salmon 1982) for example, are essentially a series of generalizations that require no underpinnings of theory. Since probability implies more than one possible outcome, these explanations also provide a breeding ground for "spoiler" arguments (e.g. Yellen 1977:133). Middle-range research generates empirical data but also seeks to establish causality.

An additional step is required when making justified statements about the past. Archaeologists, explicitly or implicitly, employ certain uniformitarian assumptions.

These assumptions hold properties of the natural and/or cultural systems constant; they serve as moorings for inferential arguments. Any study that proposes to use contemporary data to evaluate the archaeological record must also justify the uniformitarian assumptions that are in use.

For this reason the present study also focuses on the spatial organization of production activities. To what degree can spatial organization serve as a viable uniformitarian assumption? A concern with spatial organization is characterized by an emphasis on those variables affecting the management and scheduling of activities across space (Kent 1987a, 1987b). Most research dealing with activity organization has been conducted by archaeologists interested in mobile cultural systems. Ironically, complex systems, with their penchant for sedentism and wealth of architectural data, have traditionally received far less attention in this regard. One wonders if there is not a degree of empathetic interpretation involved; our personal experience is certainly more attuned to the use of space in a sedentary system. Are we less inclined to challenge our conceptions of complex societies than our models of mobile cultural systems?

An evaluation of this possibility is outside the scope of the present study. Regardless of the answer, the utilization of space is a crucial variable for production studies. Ethnographic research suggests that full-time producers display a very different spatial organization than potters adhering to a more irregular production schedule (e.g. contra Peacock 1982:25–31; Reina and Hill 1978:50–64). The number of producers, the quantity of output and the need for task simultaneity will similarly affect the spatial organization of production (e.g. Wilk and Netting 1984:7). The important point to remember is that space presents certain limitations on production organization – the greater the scale of production, the greater the demands on space. A desire for greater production efficiency will usually be reflected in a reallocation of space and/or a reorganization of the activities utilizing that space. Tasks performed simultaneously cannot be conducted within the exact same location. As part of a middle-range research program, this study investigates spatial organization as a potential uniformitarian assumption for studies of ceramic production.

Organizational requirements of pottery making also affect decisions concerning production tools and techniques. Rather than viewing technological change as a simple concomitant of increased consumer demands or the need for more efficient production, this research argues that technology is also regulated by the spatial resources of the producer. And since evidence for this same technology frequently anchors archaeological interpretation of specialization (see discussion in Stark 1985), this study calls for a re-evaluation of the models used to characterize craft production in the past.

These research interests serve as the basis for the organization of the present work. Part 1 presents three main sets of data relevant to ceramic ecological studies. The production environment, including both natural and social characteristics, is discussed in Chapter 2. This presentation makes the case for relative homogeneity throughout the producer environment. Climatic variability is minimal and potters generally have access to the same suite of raw materials. Moreover, the socioeconomic circumstances of the potters is comparable.

This ecological similarity makes the discussion of production activities in Chapter 3

all the more interesting. In contrast to their environment, the potters of Los Tuxtlas display some important distinctions in production techniques. One such distinction is the use of kilns by a small number of producers while the remaining potters prefer open firing. Another difference is exhibited in vessel forming. Chapter 4 considers variability in household assemblage attributes and identifies important relationships between the size of assemblages and the life span of pottery.

Part 2 focuses on how production differences might be evaluated archaeologically. Chapter 5 presents a critique of conventional procedures for identifying and interpreting ceramic manufacture. This discussion makes the point that current methods for giving meaning to the archaeological record are ambiguous and difficult to reconcile with questions of culture process. This problem is addressed in Chapter 6, which argues for an emphasis on activity organization when addressing pottery production. This approach focuses on the organizational structure of production; how tasks are spatially and temporally scheduled and what factors condition those decisions. Chapter 6 also uses this perspective to re-examine the firing variability noted above. This analysis suggests that spatial constraints can have crucial implications for the kinds of tools and techniques adopted by the potter.

If spatial constraints are genuinely influencing activity organization, other domestic activities should be similarly affected. This possibility is investigated in Chapter 7 with an analysis of refuse disposal within producers' houselots. Through a comparison of surface and subsurface material patterning, this chapter reaffirms that spatial constraints can significantly alter activity patterns and in an archaeologically visible manner. Spatial organization is thus a legitimate variable in investigating ceramic production archaeologically.

In Part 3, Chapter 8 places these findings in the broader context of production studies by applying them to the archaeological site of Matacapan. An understanding of spatial organization permits a view of both diachronic and synchronic variability across the site. Chapter 9 discusses the role of middle-range research in production studies and offers a justification for emphasizing spatial organization as a relevant link between the present and the past.

PART 1

Ceramic production and consumption in Los Tuxtlas

2

The ceramic production environment

Although central to the study of ceramic ecology (e.g. Matson 1965), the role of the environment in ceramic production has only recently been addressed in a systematic fashion (Arnold 1985). Arnold's ethnographic synthesis demonstrates how both the natural and social environment are intimately related to the character and tempo of pottery manufacture. For example, the availability and quality of clay, temper, and fuel can help determine the location and scale of production efforts (Arnold 1985:20–60; Nicklin 1979). Climate can regulate drying time, firing opportunities, and the length of the production season (Arnold 1985:61–98). Population pressure and market demand may also contribute to the development and trajectory of a production industry (Arnold 1985:171–201; Rice 1984a:249–250, 255–257).

This chapter describes the Tuxtlas production environment from the perspective of ceramic ecology. It places the potters and production communities in a natural and social environmental context and explores some of the factors regulating pottery manufacture. These factors include weather patterns, the quality and accessibility of raw material, and the demographic and labor organization of the Tuxtlas potters.

This ecological discussion underscores the relative homogeneity in the Tuxtlas production environment. Potters have access to similar suites of raw material and there are minimal climatic differences between the production communities. The potters' social environment is characterized by comparable household demographics and subsistence activities. Given this overall similarity, one might also expect consistency in the potters' tools and production techniques. The fact that significant distinctions do occur, both in the production and consumption of ceramics, is addressed in the following chapters.

Study region

The Sierra de Los Tuxtlas is a low range of volcanic mountains rising abruptly out of the Gulf Coast Plain of southern Veracruz, Mexico (Figure 1). The Tuxtlas region is located along the Gulf of Mexico, about 80 km southeast of the city of Veracruz and almost 60 km west-northwest of Coatzlcoalcos. In its entirety, the sierra occupies an area between 4500 and 5000 sq km (Andrle 1964:6; Tamayo 1949). To the north and east the Tuxtlas abut the Gulf of Mexico; to the south and west the sierra slopes gradually downward to meet the salt marshes and sand dunes of the Gulf Coast Plain. At the center of the region are numerous cinder cones, craters, and volcanoes providing mute testimony to a violent geological history (e.g. Pool 1990; Rios Macbeth 1952).

The cinder cones that punctuate the sierra's skyline lie along an axis running from the northwest to the southeast. The more prominent volcanoes include San Martin Tuxtla (1660 m) and Cerro Vigia (*c.* 700 m) in the western Tuxtlas, and Santa Marta (1600 m) and San Martin Pajapan (1270 m) in the eastern part of the region (Andrle 1964:11). Near the center of this axis is Lake Catemaco, the third largest natural lake in Mexico. Heavy precipitation and natural springs maintain the level of this fresh water lake (Rios Macbeth 1952:330).

Lake Catemaco provides a convenient means to divide the Tuxtlas into separate sections: (a) the northwestern San Martin massif, and (b) the southeastern Santa Marta massif (Andrle 1964; Killion 1987). Although this division may not reflect distinct geological differences between the respective areas (e.g. Williams and Hiezer 1965), it might indicate slightly different rates of geological development (Arnold 1987:65; Pool 1990:159). This possibility is consistent with the continued activity of the San Martin

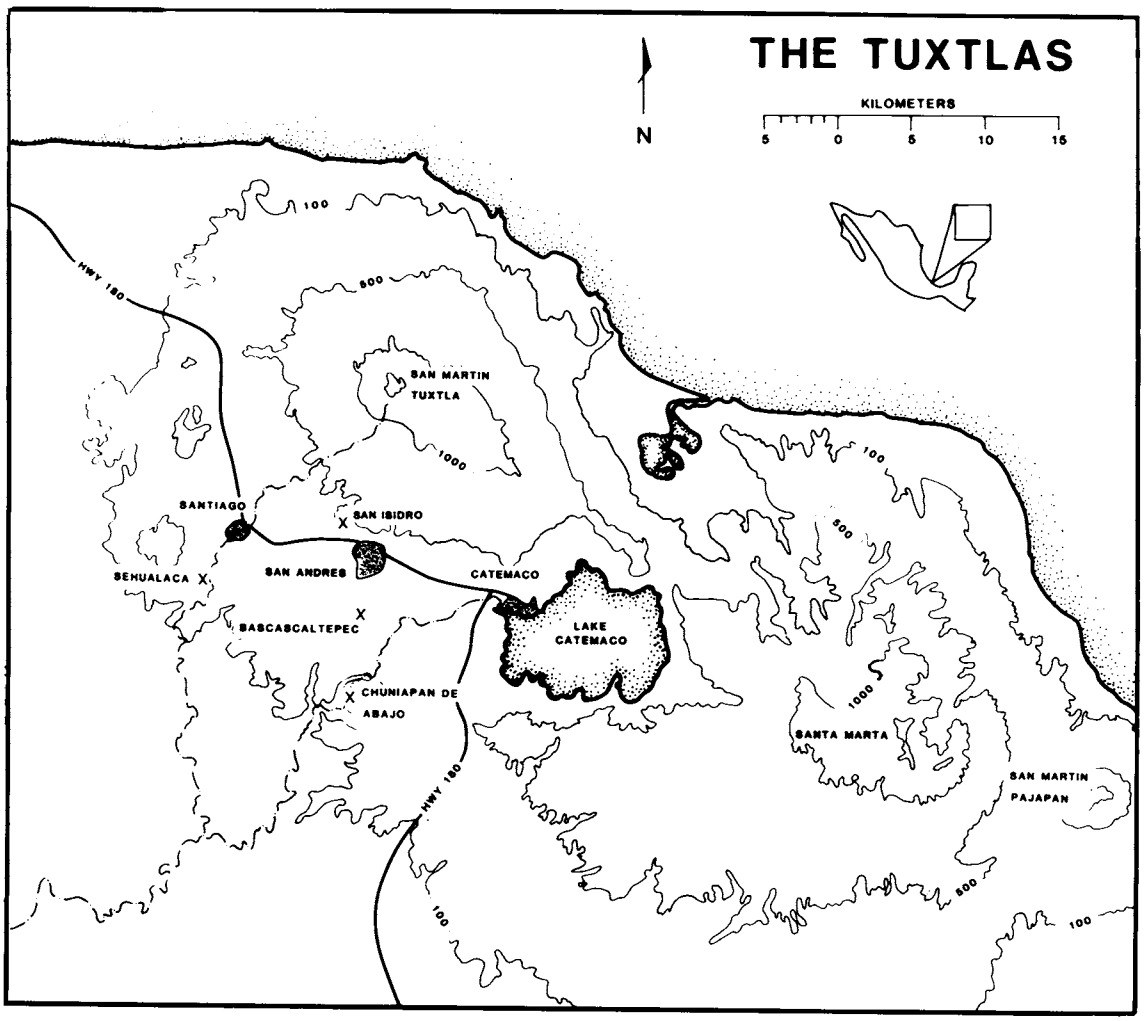

Figure 1 Sierra de los Tuxtlas study region.