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CERAMIC ETHNOARCHAEOLOGY

Carol Kramer

Department of Anthropology, Lehman College, City University of New York, Bronx, New York 10468

INTRODUCTION

The enormous literature on potters and pottery reflects the diverse orientations and concerns of travelers, colonial administrators, ceramists, art historians, classical archaeologists, sociologists, anthropologists, and many others. There is a vast amount of information available, but much of it, reliable as it may be, fails to answer questions often posed by archaeologists. A number of ethnographic accounts of pottery-producing groups aim to aid archaeologists, often emphasizing continuities or "survivals" in the regions they describe. Many of these studies focus particularly on manufacturing techniques, and sometimes describe vessel functions as well. Some of them touch briefly on other matters of potential interest to archaeologists, such as learning routines, aspects of division of labor and social organization of production, scalar and spatial aspects of production and/or distribution (e.g. numbers of vessels manufactured, distances to resources and markets, workshop locations, sizes, and layouts), scheduling problems, secondary uses of pottery, potters' expenditures and income, vessel prices, and the like. Publications in this large corpus are not discussed at length here.[1] Rather, this survey focuses on studies which explicitly consider contemporary pots and potters in terms of particular problems with which archaeologists frequently struggle. Much of this work has been carried out by archaeologists and informed by questions raised in the study of ancient ceramics. Like other ethnoarchaeological research (that is, archaeologically oriented ethnographic research) its ultimate objective is an improved understanding of relationships between patterned human behavior and elements of material culture that may be preserved in the archaeological

[1]See 11, 14, 18, 22, 34, 38, 39, 41, 46, 49, 50, 54–56, 70, 74, 82, 84–86, 92–94, 98, 101, 103, 104, 110, 111, 116–121, 123–125, 136, 137, 142. The interested reader is also referred to a recent annotated bibliography (112).

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record (33, 51, 75, 76, 133). The ceramic component of this record is inherently interesting to archaeologists because pottery is abundant, diverse, and nearly imperishable, it occurs in many geographic areas over long time spans, and it plays a critical role in many economic, social, and ritual contexts.

Archaeologists have traditionally used pottery to build chronologies, identify style zones and boundaries, and illuminate interaction on both regional and interregional levels. Some have also used ceramics to reconstruct household size (138), elucidate economic differentiation (97), and study the development of craft specialization (36), elements of social organization (31, 60, 87, 145), relationships between craft specialists and centralized administrations (37, 71), and other aspects of life in the past.

Ethnoarchaeological research with potters has sometimes been constrained by geopolitics (which can limit the movements of observers) and by the geographic distribution of contemporary traditional potters. Nonetheless, it too has covered a broad topical range, dealing with matters relating to technology, taxonomy, vessel function, longevity, recycling and disposal, division of labor, learning, style, ethnicity, distribution, and technological and stylistic change. Much of this work has been inspired by, or built directly on, a few seminal publications. These include Bunzel's (16) study of contemporary potters in the archaeologically well-known American Southwest, Shepard's (122) treatise on ceramic technology and analytic techniques useful to archaeologists, Thompson's (135) typological experiment with an ethnographic ceramic collection, and Matson's technological analyses of ancient and modern pottery (92, 93). The following pages review a sampling of recent ethnoarchaeological studies of potters and suggest additional avenues of investigation.

CERAMIC PRODUCTION

In the two decades following publication of the proceedings of a seminar organized by Matson (91), one of whose themes was the need for a "ceramic ecology," there has been a shift away from descriptive accounts of pottery production per se toward more focused studies of particular aspects of pottery manufacture and use in their larger social and economic contexts and their implications for archaeology. Although some of the findings of this body of research now seem banal, they have shattered some stereotypes and assumptions long cherished by archaeologists. For example, it is now clear that a single potter can use different clays and nonplastic additives ("temper"), with variation resulting from such factors as changes in availability of raw materials, seasonal shifts in potters' residences, and potters' standards concerning clay bodies for different kinds of vessels. Clay bodies can also vary within individual settlements even where potters' raw materials are accessible to all (2, 5,

24, 28, 29, 92, 105, 143). However, potters' "emic" classifications, based on the physical properties of their raw materials, have been shown in at least one instance (1) to be paralleled in distinctions revealed by "etic" X-ray diffraction analysis of clay minerals, and such patterning may be demonstrable in other settings. Raw materials are sometimes quarried by, or purchased from, middlemen, but they often come from a source within ten kilometers of the potter's place of work (7, 100). However, potters with access to mechanized transport or to boats may not only sell their wares but obtain their materials in locations at substantially greater distances (3, 12, 17, 28, 29, 35, 54, 81). In some systems, seasonally itinerant potters move to clay sources near anticipated buyers (32, 140). In some areas, clays are accessible only in dry seasons; threat of cave-ins at clay beds may be greater during the rainy season, or clays may only become available to potters when agricultural activities in clay-rich deposits have ceased, if only temporarily (5). Seasonality of access may impinge on production timetables or affect potters' strategies for securing or storing raw materials.

There are many ways to form a vessel, as well as to decorate and fire it; these need not be reviewed here (113). In some areas, such as highland Guatemala, variation in building technique appears to be associated with language group affiliation (6, 7). Here and elsewhere, size variation within form classes is often related to differential function, and such differences are often paralleled by potters' terminological distinctions (5, 13, 14, 29, 72, 79, 88, 141, 143). However, even where such distinctions exist, vessels of comparable form are sometimes differently named, and differences of vessel size or even form are sometimes not marked terminologically (13, 83).

Today, with the exception of potters in some industrialized nations, wheel-made wares are produced by men, whereas both male and female potters hand-build and use molds to form vessels. The reasons for the consistent association of the pivoted or "fast" wheel with male potters are not entirely clear, but the proposition that women are anatomically ill equipped to work with such devices seems implausible (44, 134). A more satisfactory if more complex explanation would probably involve such factors as increased demand for ceramics, artisans' household size, composition, and organization, their access to land, livestock, and alternate forms of employment, and the nature and seasonality of other demands on potters' time, energy, and capital. Where pots are consistently formed by members of one sex, children and adults of the opposite sex often participate in the productive process (obtaining raw materials, preparing clay, decorating vessels, assisting in firing) and in the distribution of finished products. There may be patterned relationships between division of labor in ceramic production and potters' commitments to other activities, such as child care and food production. There may also be religious or ideological reasons for gender specialization. In some Muslim areas, ceramic production is concentrated largely or exclusively in the male domain (18, 85,

114), perhaps partly because it is an activity involving considerable mobility and visibility, whereas women are meant to remain in the private sphere. This association is not invariable, however, and there are female potters in some Islamicized societies (10, 24, 83, 92, 103, 142).

Some comparatively specialized potters (generating high volumes for widespread trade, sometimes year-round) are reported in areas with limited or precarious food supplies, and some receive food in return for their vessels (22, 54, 81, 106, 115, 118, 126). Potters in many societies are described as working on a seasonal basis (often the dry season) producing vessels—sometimes in large quantities—when their agricultural work is at a standstill. This can occur even in cases where their wares are slated for a large and far-flung market (5, 12, 53, 54, 83). Some part-time potters are widows or women otherwise economically disadvantaged (24, 70, 78), and many full-time potters evidently do not have access to sufficient land or to other income-generating employment. Alienation from basic means of production may be one cause of potters' increasing specialization and, in some circumstances, of their urbanization (4, 21, 120, 135).

Comparatively little has been written on the subject of spatial and formal attributes of potters' workshops, but descriptions and maps in a number of publications indicate that most traditional potters work where they live, and suggest that sherd quantities and types in their household refuse are distinctive (18, 49, 85, 106, 110, 114, 132, 142). Ceramic workshops often contain settling vats and other structures used for clay storage and preparation, immovable containers for water and clay slops, firing areas or kilns, rotary devices or wheels, wheel pits, and platforms, benches, niches, and storage rooms for drying vessels. Stark (132) describes one contemporary workshop in Veracruz (Mexico) in some detail, specifying her expectations as to the ultimate archaeological visibility of various features and suggesting that a number of tools made of organic materials would perish, but also noting that while leather-hard vessels and stockpiled clay will probably melt, they might still be archaeologically recognizable. Deal (25), discussing residences of Tzeltal Maya potters and nonpotters, concludes that archaeological recognition of potter households would be feasible. For several reasons, it should be possible to distinguish craftsmen's industrial areas from those used primarily for other purposes and potters' workshops and houses from those of nonpotters.

Some differences among potters might relate to scale and context of production. Potters working on a large scale must either have sufficient space to store vessels or a mechanism for removing them to middlemen or buyers soon after they are fired. Urban potters must adapt to spatial constraints imposed by confined quarters and crowded neighborhoods, heavy street traffic, and neighbors' complaints about noxious smoke. As in parts of India, they may create and store vessels on their roofs, they sometimes work in streets and alleys

(where passing vehicles or large animals occasionally break their wares), and they may have scheduling problems if such open but scarce areas as public squares are used for firing by many potters. The location of potters' workshops and quarters in settlements of varying size and function should be of interest to archaeologists working on craft specialization, and it would be useful to know whether—in situations where there is a prevailing wind—potters are often located downwind, and whether they are often near such other potentially esthetically displeasing areas as abattoirs, tanneries, cremation grounds, and middens (94, 106).

Many contemporary traditional potters use bonfires rather than kilns to fire their wares. Setting size and frequency are enormously varied, but, in general, temperatures are lower than those attainable in a kiln, and potters often have less control over the firing process. Where kilns coexist with simpler pits or bonfire areas, they may reflect some potters' more secure financial status (as reflected in building materials), their full-time commitment to the craft, their relatively greater technological expertise, or their willingness to experiment with a new technology. Kilns, as built structures, may be incorporated in archaeological deposits, and their firing chambers, which may vary in size, can be used to estimate a range of numbers of vessels fired at one time. Bonfire areas, in contrast, are often hardened and discolored earth, ash concentrations, or ash-filled pits of varying depth and area (5, 29, 132). They are frequently associated with scatters and piles of sherds, used in some productive systems as vessel props and to cover settings, and often reused over long periods. Such firing areas may be located at some distance from the potter's workshop (and, perhaps, the archaeologist's trench) to avoid competitors' observation of trade secrets, limit vessels' exposure to damage by witchcraft or sorcery, take advantage of prevailing winds to fan the flames or of shelter from unpredictable and potentially harmful winds, or minimize the annoyance caused by smoke (5, 70, 137, 141). Some potters do not fire their own wares. In Mexico, specialist firing crews are hired in Puebla (72), some Yucatecan Maya (135) and Mazahua potters (near Mexico City) sell unfired vessels to middlemen at a price lower than their fired wares would fetch (104), and Oaxacan potters habitually sell unfired pots when short of cash (134). Such division of labor may not occur often in nonurban, noncapitalist contexts, and hence might not be an important consideration in many archaeological reconstructions.

Bonfires and kilns alike can be fueled with a wide array of materials (animal dung, sawdust, wood, bamboo, coconut fronds, shrubs, leaves, grass, coal, cloth, kerosene, rubber tires, etc), and firing duration can range from a few minutes to more than a day. Overall coloration, and degree of color diversity on vessel surfaces, vary with firing techniques and fuels. The cores of vessel walls, in conjunction with mineralogical analysis and refiring experiments, can be used to reconstruct firing conditions such as temperature and duration (82,

92, 93, 102, 122). Intrasettlement variations in firing technology sometimes relate to potters' differing abilities to sustain fuel costs or their potential access to fuels (77, 78), and such variability might be detectable archaeologically.

Decoration is most often done prior to firing, but in some areas vessels are also treated after firing—sometimes to diminish their porosity, as by the addition of resins or other coatings (14, 29, 35, 53, 54, 121, 142). Glazed vessels, too, are not necessarily finished and distinguishable as to type immediately after firing. Glazed vessels are usually fired twice; the first (bisque) firing produces undecorated vessels, the second vitrifies the glaze coverant. "Wasters" broken in a bisque setting may not always be readily identifiable. My excavations in a Guatemalan potter's compound, used by his forebears for five or six generations, produced an array of fired but undecorated sherds which he was unable to name with certainty because he distinguished some types by their glazes and decorative motifs rather than by form or rim profile. He threw most of the vessels produced in his workshop, and, with various members of his household and a hired Guatemalan Indian assistant born and raised in another city, decorated them. Some vessels were thus the work of several individuals. Sharing of decorative work has also been described for the American Southwest (129, 130), Mexico (48), and Peru (29), and is seen in India and elsewhere (C. Kramer, unpublished information). Some potters use identification marks, but even in the absence of such marks, potters can usually identify their own products and often those made by other potters in their community as well (32, 49, 54, 57, 82, 83, 88, 92, 127, 131, 141). However, some potters use identifying marks only when firing jointly with another potter, and vessels are sometimes labeled with the name of the customer rather than the artisan.

Once decorated and fired, pottery is distributed. Ceramic distribution systems have rarely been the subject of systematic ethnoarchaeological research; while volume, spatial scale, and mechanisms of ceramic distribution vary widely (10, 70, 115, 118), a few salient and provocative points have already emerged. For example, several authors indicate that where production is carried out on a small scale and primarily for local use, vessels do not move far from their place of manufacture (24, 29). In contrast, particularly where boat or truck transport is available, some wares travel distances of several hundred kilometers, whether in the context of a complex marketing system or a ritually elaborated noncapitalist exchange network like the Melanesian *kula* or *hiri* (10, 17, 54; F. Hassan, personal communication; C. Kramer, unpublished information). While one might expect larger vessels to move comparatively shorter distances—as is reportedly the case in Nepal (13) and Tanzania (141), for example—under some conditions larger pots may have a wider spatial distribution than smaller vessels (104). Distance from manufacturer and transport cost can affect vessel prices in some areas (115) but are evidently insignificant factors in others (66). Some potters specialize in particular wares or forms to

avoid competition and to monopolize a market (2, 4, 106); one aspect of such specialization can be the occurrence in both buyers' households and centers' markets of a relatively diverse ceramic assemblage whose component types—possibly regardless of vessel size—are derived from a number of sources at differing distances (C. Kramer, unpublished information). Several of the ceramic systems studied by ethnoarchaeologists are embedded in market economies, and some potters distribute their wares using trains, wheeled vehicles, and even planes; one may question the analogical value of such cases for a variety of archaeological contexts. Equally, one may question the long-held assumption that pottery was made in all prehistoric communities. Archaeological research has demonstrated that local, regional, and interregional exchange of ceramics has a long history, and that it can occur in the context of cottage industry (107), and ethnoarchaeological work has shown that complex nonmarket distribution strategies can coexist with formalized marketing systems (95).

PRODUCTION, SOCIAL ORGANIZATION, AND STYLE

Some of the recent interest in the organization of ceramic production was greatly stimulated by a small group of archaeological studies in the New World (31, 60, 87). These and other studies were predicated on a set of assumptions about interaction, learning, and stylistic variability (53, 108, 145). It was suggested that where residence is uxorilocal and women make pottery primarily for household use, processes of learning and production, in combination with limited mobility of women and their wares, will result in stylistic homogeneity within settlements and facilitate the identification of social units. The literature on ceramic production indicates that much contemporary pottery making in the Western hemisphere, Africa, Southeast Asia, and the Pacific falls in the female domain, that men control the craft in the Mediterranean and Aegean, the Middle East, South Asia, and Japan, and that in parts of Africa, Latin America, and the Middle East both men and women form vessels. This suggests that relationships among learning, residential patterns, content and spatial scales of different forms of interaction, and division of labor by sex are worthy of further investigation. Some ethnoarchaeological research has focused on aspects of this nexus of problems.

Predictably, this work reveals a diversity of adaptations. Residential patterns often deviate from normative preferences; in uxorilocal societies, not all female potters remain in their natal communities on marrying, and in virilocal societies, out-marrying female potters do not necessarily move very far from their families of orientation (24, 83, 88, 143). Potters learn their craft—very often by observation and imitation, without explicit verbal or manual instruction—from a variety of people and at diverse ages (24, 120, 125, 131, 141,

143). Potters sometimes work in groups whose composition is occasionally limited to household members but can also include residentially proximate non-kin (48, 53, 54, 131). As was noted above, even in the context of a single industrial household a given vessel may be formed or decorated by more than one person, and vessels are occasionally decorated by passersby, neighbors, visitors, specialists hired for the task, or purchasing vendors (19, 48, 72; C. Kramer, unpublished information). Where women make pottery, men may be knowledgeable about parts of the process, and in societies where men make vessels and women are prohibited from touching the wheel although they participate in other phases of the productive process, an absent potter is sometimes replaced by his wife, who issues a stream of verbal instructions and judgments to a young son experimenting with throwing vessels (142; C. Kramer, unpublished information).

Potters' skills and repertoires may vary with age. There is some evidence suggesting that skill in producing larger pots increases with age (22, 54, 125, 141–143), that particular vessel types are made by older potters whose work is not always as well executed as it was in their youth (135), and that decorative repertoires vary with potters' ages (53, 80, 83). The question of whether one potter's output over a lifetime of production retains distinctive and recognizable consistency—of whatever form—requires further investigation. Stanislawski (130) maintains that it does not, whereas Hill's (61) experimental work with handwriting suggests that it may. Among other things, this issue bears on the possibility of identifying the work of individual prehistoric potters, an endeavor that might be productive in a number of circumstances (62).

Female potters among Hopi-Tewa of Arizona reportedly often work in groups. Using data on learning obtained from 44 potters, Stanislawski argues that residential propinquity plays at least as important a role in the acquisition of artisans' knowledge as does kinship (129–131). In the learning relationships he outlines, a larger number of dyadic pairs of students and teachers involve matri-kin than non-kin. However, learning cross-cuts clan lines, and at least one style in the Hopi-Tewa assemblage is said to be made in seven settlements by women of two linguistic groups distributed over twelve clans. Hopi sharing of design elements (and, presumably, of motifs or configurations) is said to be common and, as elsewhere, designs evidently are not considered the property of individuals, families, clans, or work groups (48, 82, 125, 142, 143). Since Hopi clans today are not localized within settlements, Stanislawski argues that the spatial clustering of ceramic design units or types—such as might be identified archaeologically, were sherds deposited where they were made and used (which they often are not; see below)—would probably reflect such social units as neighborhood work groups involving learning across kin lines, rather than result from training and production within strictly localized kin groups.

Stanislawski has not illustrated the styles he discusses. He has not yet fully described the public for which Hopi-Tewa vessels are created; such information might clarify the role played by consumers in potters' selection of designs. He does not indicate which designs are used by individual potters in different locations and work groups, and with what frequency. His Hopi-Tewa studies argue against simplifying assumptions about the nature of learning and the role of kinship and residence in ceramic production, but do not constitute a conclusive refutation of the archaeological analyses which provided the catalyst for his research.

In his attempt to "test" Longacre's earlier conclusions about prehistoric ceramics from Arizona against an ethnographic case, Stanislawski returned to the same region and worked with modern potters. During the 1970s, Longacre himself went on to work in the Philippines, where the Kalinga potters he studied produce a less elaborately decorated assemblage than the Southwestern ceramics he had analyzed earlier. Despite a stated preference for uxorilocal residence, only approximately 60 percent of Kalinga postmarital residence conforms to the ideal. Nonetheless, grandmothers and mothers usually teach younger women (53, 88). As among Hopi, Kalinga potters' work groups comprise non-kin as well as kin, but most vessels are produced by a single potter, and potters are often able to identify their own work, even after some time. In addition to identifiable individual idiosyncrasies, there are reportedly distinctive Kalinga village styles (52, 53). Graves' work indicates that Kalinga designs vary with potters' birth cohort regardless of kin- or work group membership and that as women age, becoming more experienced potters, they employ a greater variety of designs. Where the number of designs used by individual potters increases with age, continuity between age cohorts appears to result in gradual rather than rapid design change. Rapid change might, in contrast, be expected in situations of large-scale population or birth cohort turnover (53), or following catastrophic events.

In Africa, as in the American Southwest and the Pacific, many potters are female. Among the patrilineal but not strictly virilocal Kisi of Tanzania, mothers and daughters are viewed as the primary pottery-producing units. However, learning continues into middle age and occurs in a variety of contexts, sometimes involving such tutors as elder sisters, co-wives, in-laws, and age-mates (141). As a potter ages, she learns to make more vessel types as well as larger vessels; it is not clear whether her decorative repertoire also expands. No one Kisi potter makes all vessel types; like Hopi (130), Tarascan (48), Huichol (143), Guatemalan (5), North African (10), and Indian potters, their houses contain ceramics made by a number of artisans. Because Kisi compounds have vessels made by more than one potter and because, depending on their functions and numbers in this polygynous society, vessels are located

both within and outside of residential structures. Waane, like Stanislawski, concludes that social groups and basic elements of social organization could not be readily reconstructed from the spatial distribution of ceramics within houses.

Several of the studies cited above consider matters relating to ceramic style without describing in detail the style reviewed. The work of Hardin (48, 57–59) in Mexico and Arnold (8, 9) in Peru is unusual in attempting to specify the components of a single ceramic style. Using one of several wares produced in a Michoacan village, Hardin focuses on the spatial organization of vessel ornamentation and on the configurations (combinations of individual design elements) placed on vessels. She also describes some of the diagnostic features of individuals' painting of design elements. Hardin notes that potters borrow entire configurations fairly readily, and concludes that these could not be used to reconstruct the nature or frequency of interaction among potters. Rather, she suggests, it may be possible to monitor individuals by using, for example, distinctive features of brushwork, although she does not present an operational proposal for using such identifications to specify relationships among individuals. Arnold describes the decorative system used by Quinua potters and suggests that organization of surface treatment reflects potters' perceptions of the organization and use of their natural and social environment. Both Arnold and Hardin provide clear descriptions of selected wares in larger assemblages, although, in focusing on the distinctive components of these wares, neither specifies how they differ from similar wares and styles produced in neighboring communities.

As one part of a wide-ranging review of ceramic production and use in a Cameroon village, David & Hennig (24) discuss the products of female potters of three ethnic groups and illustrate differences in vessel form and surface treatment. They provide some information on ceramic distribution on a regional scale, but their primary focus is a single multiethnic community. Hodder, in contrast, has adopted an explicitly regional perspective in recent studies of pluralistic societies in Africa (63–69). Reviewing a Zambian sample, he notes that sharp ethnic distinctions are not evident in ceramic distributions among Lozi and most neighboring tribes. Until fairly recently these groups had been economically integrated under the traditional kingdom. Following the alteration of this administrative apparatus, first by colonial rulers and then by the postcolonial state, strains between some ethnic groups have developed. These strains, reflected in comparatively weak differential distributions of ceramic and other artifact types in Lozi and neighboring groups on the one hand, and recently settled Mbunda on the other, are construed as related to economic conflicts centering on resources increasing in the absence of the integrative kingdom, and to the recent use by some tribal groups of strategies designed to

assert their distinctive identities for political ends (67). Hodder discerns clearer boundaries between three tribes in Kenya's Baringo district, which he attributes to various forms of long-standing competition among them and to internal tribal pressures for social and ethnic conformity (64). Interaction among tribal groups occurs in both the Zambian and Kenyan cases, but sharpness of boundaries in artifact distributions evidently differs. Hodder's attempts to define tribal and ethnic boundaries will interest many archaeologists, but some will be disappointed by his failure to specify criteria used in defining ceramic styles, the scanty documentation of ages, numbers, and locations of particular vessels and types in his samples, and the fact that the scale of the areas he discusses is considerable. While the issues he addresses are of fundamental importance, particular classes of material culture, including pottery, are—paradoxically, partly because of this laudable regional approach and thus the very scale of observation—used to paint a complex picture with very—sometimes overly—broad strokes.

To summarize: the ethnoarchaeological literature on production and style suggests that some archaeological assumptions are too simplistic. For example, in a range of ethnographic settings, a single vessel can be the work of more than one individual, who has not necessarily learned the craft from near kin. Both learning and production can occur in the context of potting "bees" whose participants are linked by residential bonds that for some purposes supersede those based on kinship. Where learning takes place along kin lines, it need not involve the mother-daughter (or, more rarely, father-son) dyad used in archaeological analogies. Members of some ethnolinguistic groups obtain, from considerable distances, pottery conforming to their own model of ethnic identity (69), while other consumers buy pots available locally, even if these are made by members of other ethnic groups and have alien diagnostic attributes. Some potters make a variety of wares for different ethnolinguistic markets (21, 35, 69, 127, 141). Potters also engage in other forms of style-switching: this can be related to scheduling constraints (57), market demand (24), or artisans' inclinations to experiment (79, 80). Finally, micromotor skills, range of forms, components and diversity of the decorative repertoire of individual artisans, and numbers of vessels produced, may change over time. If archaeological hypotheses involving kinship, ethnicity, interaction, and boundaries are to be better formulated and evaluated, it will be necessary to review our strategies for sampling within and among settlements and to develop appropriate measures for identifying the work of individuals and demonstrating the existence of localized groups. Strategies for identifying kin groups as opposed to other corporate groups and residentially proximate but unrelated potters require refinement, and it may be undesirable to base them on ceramics alone.

Style distributions have sometimes been viewed as reflecting interaction, such as occurs in individuals' learning, in the context of production units, and in exchange. Stylistic homogeneity—whose measurement remains a subject of ongoing discussion, and which has perhaps too often been associated with decorative attributes—is, in contrast to heterogeneity, sometimes taken to reflect interaction. Ceramic standardization, which can entail diminished heterogeneity, is often viewed by archaeologists as a corollary of increasing craft specialization; it is sometimes seen as reflecting greater control over production by centralized institutions, perhaps regardless of potters' social identities or interactions. Use of a recognized style may be one means of transmitting information regarding group affiliation and of marking boundaries (146), but some of Hodder's work suggests that stylistic boundaries can exist in the presence of social and economic interaction. If many ceramic vessels do not usually leave the household context and, when they do, do not travel far, one may ask to whom pots are signaling, what the information content of the message is, and why some household vessels are more elaborately decorated than others (10, 30). Wares and degree of diversity in ceramics produced primarily for a local market may differ substantially from those designed to appeal to a larger and possibly more diverse audience (13, 54). Degree of stylistic diversity within settlements may vary with their functional size, adding to the archaeologist's burden of selecting appropriate units for comparison. More detailed information concerning differences in diversity or standardization in differently organized production settings, and on relationships between decorative style and vessels' forms and functions, between potters' repertoires and styles desired by consumers, and between various forms of interaction and the character of boundaries, might further clarify these matters.

Some ceramic wares and assemblages are more complex than others, comprising more forms, a wider array of productive steps or techniques, or a greater variety of decorative motifs and configurations. For the archaeologist, this fact, and its attendant problems of devising appropriate measures of stylistic variability and complexity, underscore the difficulty of comparing styles with one another. It seems unlikely that less complex vessels convey less information to artisans and users than those that are more complicated technologically or elaborate decoratively; rather, the information load of ceramics and other classes of material culture probably varies across space and time. In some contexts, ceramic vessels may reinforce principles of social structure, including gender and power relationships, or reify other aspects of world view (15, 68, 73, 144). A few authors suggest that ceramics, in their symbolic capacity, can be manipulated to renegotiate and transform cultural behavior (69, 96). But the role of ceramics as "symbols in action" (69) must vary cross-culturally, and may not be demonstrable in many archaeological settings. More mundane uses of prehistoric pottery may be comparatively more accessible.

CERAMIC USE AND DISPOSAL

Many authors provide useful if scattered information about the use of ceramic vessels, but few have dealt systematically with vessel life expectancy, recycling, spatial distribution, and disposal. Such issues are not trivial, since archaeologists have often assumed that sherds found in a single context were used contemporaneously and in related activities. But vessels are often recycled, and sherds may be reused as scoops, drums, hearths, animal troughs or pens, construction and ornamental elements, and the like (25, 29, 128, 143). Potters' workshops often have more sherds and ceramic debris than residences of nonpotters, since they frequently retain ill-fired or damaged vessels for reuse in their work. Various authors suggest that ethnoarchaeological studies of vessel longevity, recycling, and discard might be useful to archaeologists in developing estimates of site population size and duration; analysis of disposal patterns should also be valuable in the development of archaeological sampling strategies aimed at locating and ultimately interpreting activity areas and discard contexts.

In an early account, Foster (45) described vessels in four Tzintzuntzan (Michoacan) households. He concluded that their life expectancy varied with ware, size, use frequency and location, and the presence of children or domestic animals likely to topple pots and cause breakage. Foster notes that life expectancy increases with vessel size and decreases with mobility and use frequency. He suggests that the life expectancy of about 1 year, and the population of 50 to 75 vessels per Tzintzuntzan household, are somewhat higher than might be expected in many archaeological situations, particularly in contexts where pottery was not readily accessible or was fired at lower temperatures and was thus more fragile.

Somewhat greater life expectancies and fewer household pots are reported for the Fulani. David (23, 24) notes that median vessel lifespans in one Cameroon village range from 2.5 to 12.5 years, that the average number of pots in a woman's quarters is 20.9, and that each woman in his sample replaced, on average, 3 pots in a year. Broken vessels are discarded both in pits and on village surfaces; contemporaneity of objects in rapidly filled pits is likely to be greater than it is on surfaces.

Like Foster, DeBoer (26–29) has found that use life is positively correlated with vessel size (partly because larger vessels are used less frequently and partly because their production cost is higher). The lifespan of Shipibo-Conibo vessels appears to be somewhat shorter than it is among Fulani, with a median use life of approximately 1 year (and a range of .25 to 2.25 years). DeBoer has also discussed the issue of vessel disposal. Since specific types are preferred for recycling as sherd temper, some vessels never enter the archaeological record, and some types are represented at lower frequencies than they are known to

exist in their original contexts of manufacture and use. Larger discarded sherds tend to be found at the margins of heavily used areas, while frequently traveled paths are strewn with smaller sherds subject to ongoing comminution. Finally, sweeping of houses and plazas leaves many sherds in locations where cultural behavior relating to pottery is minimal.

Kalinga vessels can be recycled even before they break; when resined surfaces wear out, pots are consigned to some secondary use (88). Longacre's sample of Kalinga pots had use lives ranging from about 4 to 14 years; the average number of household vessels is fewer than 10 (90). Among the Kalinga, too, larger vessels seem to have comparatively greater life expectancies, and although children and dogs cause breakage as they do elsewhere, vessel replacement is evidently higher than among Fulani, at one vessel every month or two. Sherds are discarded in middens at the perimeters of habitation areas, and dense sherd deposits are also found on trails to water sources and at springs; as among the Shipibo, ceramic debris is likely to be found at some distance from original use contexts. Breakage rates vary with location and season, and breakage often occurs on slippery paths and during wet weather. Inventorying Kalinga households over a 4-year period, Longacre found a loss approaching 50 percent. During the interval between his censuses, the "missing" vessels had either been broken or given away as gifts, usually to relatives. However, missing vessels were not always replaced by containers of the same materials or in the same frequencies, so that even after a few years the profile of the censused ceramic population differed from that of the earlier one. Longacre found an increase in large rice cooking pots and a decline in water vessels. He attributes the former change to a greater availability of cash, used in part for feasting, which requires large rice pots: the latter shift evidently resulted from the introduction and greater availability of plastic water jars. This change was comparatively rapid, involved changing frequencies of forms rather than marked change in technology or decoration, and related to the increasing economic integration of one rural community in the larger Philippine world.

In the case just described, older vessels continued in use side by side with younger ones. Given the variation in use lives reported in the ethnoarchaeological literature, it is clear that in any ethnographic setting some pots will be older than others. Excavated assemblages will also include seemingly contemporaneous pots of differing age, and in surface collections, vessels and types presumed to have been contemporaneous need not have been so. David (23) has suggested that these factors might distort archaeological interpretations, particularly those based on seriation. Since smaller vessels in ethnographic contexts have higher turnover rates, archaeologists might focus on smaller vessels in seriating surface collections (90), but given the comparatively short use life of most vessels, archaeological analyses—based on comparatively longer phases—need not be seriously jeopardized by assumptions of vessel contem-

poraneity. Comparing two archaeological assemblages with an ethnographic one, DeBoer (26) points to specific discrepancies (for example, one of the archaeological sites was devoted primarily to mortuary activities), and observes that while the relative frequencies of types do not correspond exactly to relative frequencies of vessels in ethnographic use at any one time, a statistically generated archaeological assemblage suggests that after a period of approximately five years, types' relative frequencies would probably not differ markedly from the ethnographic assemblage from which they had derived.

Descriptions of ceramic longevity, recycling, and disposal raise questions not only about the practice and utility of seriation but about the value of conjoinability studies. Sherds of broken vessels are reused in a variety of ways and may also lie about unused, both within and outside household structures, for long periods. Sherds of a single vessel can have differing use lives and, when finally discarded forever, may come to rest in different locations and at different depths (130, 143). Vessel bases may have longer use lives than rim sherds, which may thus be discarded earlier and be found in deeper stratigraphic contexts. It would seem both desirable to attempt to join sherds even when they are not stratigraphically coeval and reasonable to assume that where pieces of the same vessel are found at different depths, those that are older more accurately reflect the vessel's age. Analysis of ceramics associated with joinable sherds from different stratigraphic contexts might then be designed to establish finer chronological distinctions among sherds and types of differing age. Although current thermoluminescence instrumentation for measuring ceramics' ages produces relatively wide standard deviations, it is conceivable that in the future such analytic techniques might be used in conjunction with attempts to join sherds to estimate site and phase duration through reconstructions of vessel age and reuse. The fact that vessels and types of differing age can enter a single archaeological sample need not be too vexing; if it can be demonstrated from stratified sequences that one type appeared at an earlier date than others, inappropriate groupings can be rectified. In the case of excavated sites it should probably be assumed that some vessels were older than others; however, it should not be forgotten that despite their differing ages they were all used together at some point in time. One of the excavator's problems is to distinguish between contexts of primary use and such secondary deposits as trash, roof collapse, "fill," and so forth, and to specify artifact distributions and type associations in different contexts.

Form and number of vessels may vary with function and use context, and perhaps also with household size, composition and wealth. Comparatively little work has been done on this subject, and it may be difficult to devise archaeologically relevant measures in ethnographic settings where vessels of other materials are being rapidly introduced and increasingly widely used (24, 90). DeBoer & Lathrap (29) found no correlation between number of vessels and

Shipibo household size or composition, and among Kalinga, the number of household pots reportedly has little to do with household size and is more closely related to status and wealth (89). Analyzing relationships between vessels' volumes and several attributes of households in a modern Mayan sample, Nelson (99) notes that total volume of cooking jars may vary with household size, but he also suggests that such variation among households relates to differences in status and wealth. A similar association is implied for at least one area in highland Peru (137), and socially prominent Tarahumara men in Chihuahua (Mexico) are said to have more cooking vessels for hosting fiestas (105).

In sum, several ethnoarchaeological studies have demonstrated that the number and kinds of vessels in a community's houses can vary substantially, that vessel breakage, replacement, and recycling occur at different rates and in a range of circumstances, and that replacement need not result in replication of the composition of immediately antecedent assemblages. They also reveal that much broken pottery is located in places that archaeologists do not necessarily investigate and that when it is found it is not always in original use contexts. Finally, this work suggests that additional empirical documentation of relationships among vessel numbers and types, and household size, composition, age, and wealth, is in order. Exotic imports such as Chinese porcelains or Wedgwood may be one reflection of differences in households' wealth, but archaeologists should also devise independent measures using locally made vessels to identify differences among households, if only because exotics are likely to be comparatively rare. Like local wares, their forms, frequencies, styles, and distribution change over time.

CERAMIC CHANGE

Because of the compressed nature of the archaeological record and the diachronic emphasis of much archaeological work, archaeologists' perceptions and descriptions of ceramic change are often comparatively coarse-grained. Nonetheless, such change is observable and is the meat of innumerable archaeological analyses and the very heart of most chronology building. Ethnographic studies tend to be carried out on a relatively small scale over short periods of time, and comparatively little ethnoarchaeological work systematically addresses the question or describes circumstances in which ceramic change occurs. Moreover, ceramic production is often characterized as a high-risk occupation involving little profit, much debt, and substantial loss in firing and transport. Given potters' desires to appeal to particular markets, one might endorse a stereotype of potters as psychologically and technologically conservative, unwilling to take risks and engage in innovative experiments, with conforming personalities and a low sense of self-esteem. This view,

questioned by others (77, 104, 120, 121), is favored by Foster (47; see also 134). It would appear to be supported by Reina's account (109) of an inventive potter in the Guatemalan village of Chinautla. This young woman was virtually ostracized for her experiments. Her engagement to an agrarian innovator thwarted, she married only after her ceramic output once again conformed to the expected norm. Yet it is possible to imagine a variety of circumstances in which artisanal innovation would be rewarded rather than punished.

In a series of articles reviewing rotating devices utilized by potters, Foster (40, 43, 44, 47) suggests that the transition from slow-turning devices like the Guatemalan *kabal* to the pivoted wheel requires a fundamental shift in potters' motor activities, one unlikely to be deemed desirable unless substantial market demand is perceived or anticipated (see also 119, 135). Discussing potters in North Africa's Maghreb, Balfet (10) similarly observes that technological innovation is unlikely in the absence of consumer demand.

Potters' reluctance to change techniques and reorganize motor habits (such as are involved in a change from hand-building to wheel-throwing, for example) may be offset by their anticipation of an increased market or of greater economies in time and energy expenditures (2, 118, 121). Changes in technology and style, quantity of output, organization of production, and experimentation with new raw materials may occur in response to circumstances that impinge on potters but over which they have no direct control, as in the introduction of piped water or refrigerators that reduce the demand for water carrying or storage vessels, or the depletion of traditional fuels or exhaustion of familiar clay sources (12, 20, 93). In the Amphlett Islands, the use of new but sandier clays to replace clays no longer available resulted in vessels of poorer craftsmanship (82). In Rajasthan (India), the government has recently responded to increasing deforestation by limiting potters' access to traditionally foraged vegetable fuels; some potters now use rubber tires as fuel, and others who express concern about this policy claim that their output has diminished markedly as a result (C. Kramer, unpublished information).

If clays are associated with arable lands that cannot be quarried when potters most need them, those anxious to satisfy a highly seasonal buyer demand may experiment with new clays, and they may also reorganize their relationships with farmers owning clay deposits, middlemen who transport clays, and other potters from whom they can borrow clays. They may also modify their repertoire. For example, Indian potters who would normally expect to produce large, decorated, and comparatively costly water jars for Divali (a nationally important annual festival) can instead turn out many small, undecorated, inexpensive vessels, made with inferior clays but used on a large scale year-round, in the same unit of production time as fewer water jars. Where landowners limit access to clays, or lobby government agencies to limit potters' troublesome demands, traditional government grants and understandings with

landowners allowing potters the freedom to quarry clays may be discontinued. Potters in some economic systems can form cooperatives, and these can affect technology (as when members of a Rajasthani cooperative recently used a low-interest government loan to acquire electric wheels). Division of labor, scale and standardization of production, and distribution of finished wares might also be affected by reorganization of relations among potters and between potters and their sources of materials and capital. Changed transport modes can affect the scale and distance of ceramic distribution, as well as frequencies of types marketed. Greater availability of trucks and tractors can alter frequency of shipments, sometimes destined for increasingly far-flung markets. It may result in shifts in types of vessels marketed, such as wider distribution of comparatively smaller, more easily stacked vessels. Certain forms of specialization may also develop, with one or two types in a potter's larger repertoire slated for particular distant markets where those same types are not locally manufactured.

Ceramic change can result from many other factors. Miller (96) describes a strategy by which low-ranking Hindus replicate vessel types associated with higher castes in an attempt to improve their status in the hierarchical Indian caste system; some higher-caste consumers respond by reorganizing their purchasing or using strategies to reestablish boundaries between groups of differing rank. With the introduction of Islam to West Africa, part of the ceramic assemblage related to production, storage, and consumption of beer dropped out of the household repertoire of a newly abstemious segment of the population; certain forms (and possibly also associated decorative techniques) disappeared and others, associated with Muslim activities, appeared (24, 83). In an ethnically mixed but predominantly Fulani village in Cameroon, the one Lame potter at first tried to conform to a perceived market of Fulani buyers. On realizing that Fulani would purchase non-"Fulani" vessels and that there was a Lame market among new immigrants to the region, the potter reverted to the production of "Lame"-style pots (24).

In Mexico in the 1970s when—for reasons having partly to do with the nature of personal relationships among particular potters, middlemen, and creditors—the organization of credit relationships changed, some Mazahua potters modified their productive strategies (building larger, roofed kilns and increasing production of the *piñata*, a disposable form used at *fiestas*, and much in demand in Mexico's urban centers) as well as the mechanisms by which their wares were distributed [increasing their reliance on trucks (104)]. Changes related to altered market demands are also reported for the Shipibo. Here, as elsewhere, potters have responded to growing tourist demand for ceramics by producing traditional vessel forms in different frequencies and sizes and by modifying and simplifying surface decoration (27, 79; see also 106, 111). In highland Peru, native potters created new forms for post-Conquest overlords and altered some

aspects of their technology and decorative repertoires as well (137). In Japan, World War II government demand for particular ceramic vessels stimulated a production boom among potters and, as in parts of Mexico, a postwar demand for "folk" ceramics has been met by an increase in the number of active potters making different vessel types than they had previously (19, 46, 74, 98, 134). The conservatism of Chinautla potters referred to above was, in a few decades, overridden by a willingness to experiment with new forms for a cosmopolitan urban market [extending to New York City (110)].

Limited though the documentation is, ethnoarchaeological research suggests that ceramic change can result from a variety of causes, including change in forms and vessel frequencies as vessels of other materials become available, use of different body clays and cooking vessel forms as fuels or hearths are modified, alterations in quantities and seasonality of production as availability of raw materials changes, sometimes as a result of governmental meddling, and changes in productive and distribution strategies with tightened or eased access to loans and credit. Ceramic change is not simply a function of altered postmarital residence patterns or of the immigration of new peoples. It does not only affect design elements, and it occurs at different rates, with different effects. We must consider what kinds of change are most feasibly and usefully monitored in ethnographic settings, and at what scales, and decide which ethnoarchaeological observations are most relevant to the interpretation of the various kinds of change observable in archaeological ceramics.

CONCLUSION

Ceramic production, distribution, use, discard, and change are diverse and very complex processes. The foregoing review of recent ethnoarchaeological research outlines some of the directions already taken in studying them, but more work is needed, in the same and other geographic areas, and some of the issues addressed in earlier work should be explored further. Because archaeologists bring particular kinds of questions about behavior to the ceramics they unearth and study, they are singularly equipped to pursue some of the answers they seek by observing contemporary potters.

Much archaeological analysis involves classification. More work might be done on such aspects of indigenous systems of classification as the role of rims and decoration in potters' taxonomies and relationships between vessel name, form, and function. Much archaeological interpretation is concerned with vessel functions; further empirical documentation of vessels' locations, primary and secondary functions, use lives, and disposal would be illuminating. Relationships between vessel types and numbers, on the one hand, and household demographics, wealth, and cooking, serving, and storage practices, on the other, remain to be documented in many contemporary settings. Ceramic

distribution, too, is a crucial but inadequately explored problem area; quantity, distance, differential directionality of distribution, and specialization in production for particular markets are matters of considerable interest to archaeologists. Assumptions concerning distance decay and scale of fall-off in artifact distributions are probably not uniformly applicable to all vessel types or sizes, nor to all economic systems; costs, scales, and modes of distribution under a variety of conditions remain to be specified and their implications for archaeological analysis more clearly delineated. Measures of other forms of interaction and of stylistic similarity or difference warrant further investigation, as do the nature of boundaries under various circumstances.

Some of the shortcomings of previous studies can be remedied in future work. For example, a number of ethnoarchaeological studies of potters do not reveal the sample size on which description and conclusions were based. Others describe the work of only one potter, often considered one of the most skilled in the community, and sometimes said to have made and fired vessels in demonstrations of "typical" events solicited by the visiting observer. The utility of descriptions that fail to specify sample sizes, the period of ethnographic observation, seasonal variation in potters' production schedules and output, content of potters' repertoires, and the possible role of consumers is limited. It has been suggested that observable variability grows with increased sample size; this may be the case not only with archaeological samples, but with ethnographic observations of potters and vessels as well. And when only one potter is studied for a brief period, it may be difficult to evaluate the extent to which she or he is representative of the community or how willing to experiment with novel materials, techniques, and designs. We require additional information on the content and scale of ceramic change, the variables involved, and their relationships and sequence.

The ethnographic and ethnoarchaeological literature reveals an enormous variety of productive strategies. Some "part-time" potters make only a few vessels in a year, while others produce hundreds albeit on a highly seasonal basis. The terms "part-time," "full-time," and "specialist" are used with some abandon by archaeologists, but ethnographic descriptions suggest that this craft involves diverse forms of specialization. The systematic development of such measures of specialization as potters' energy expenditures, seasonal differences in productivity, time devoted to other activities, number of vessels produced in a unit of time, composition, size, and distance of markets, repertoire content and diversity, as well as specification of the tangible and potentially archaeologically retrievable correlates of such variations, should enhance our ability to compare potters in a single community, potters in different areas, and productive systems across time. Further information on spatial and formal attributes of potters' workshops, on their locations within and among settlements, and on the differences between potters' household

ceramics and those of nonpotters should also help us to locate prehistoric specialists and to refine evolutionary models concerning the content and development of craft specialization.

Ethnoarchaeological studies can shed light on division of labor and its relationship to modes of ceramic production in relation to other activities in which potters engage, but it seems unlikely that studies of contemporary technology and sex roles alone will resolve such evolutionary issues as the causes of transformations in productive systems, particularly where such changes occurred in the distant past and in the absence of written documentation. The coexistence of differing modes of production in some cultural contexts today would seem to militate against any universal or unilineal evolutionary model, but it is possible that at various times and in various places the organization of this craft has been affected by other aspects of economic and sociopolitical organization (6, 7, 10, 42, 121, 139). Factors that might figure significantly in organizational transformations include alterations in subsistence economy, changes in household size and organization, the development of suprafamilial kinship or other corporate groups, increased availability of wage labor, and changes in the structure of credit relationships, quantity and seasonality of demand, transport technology, and marketing mechanisms. An improved understanding of the development of ceramic specialization will entail the integration of ethnographic, historic, and archaeological data.

Ethnoarchaeological research in pottery-making societies has produced a number of cautionary tales. In clarifying many aspects of the productive process, as well as a range of circumstances in which vessels are acquired, used and abused, and discarded, it has also quashed some simplifying notions, illuminated a range of behavioral diversity, and begun to outline modal patterns of considerable potential value to archaeologists. Before the world's remaining traditional potters abandon their craft in favor of more lucrative work, and before their wares are replaced by vessels of metal, plastic, rubber, and glass, archaeologists must take to the field so that cross-cultural generalizations about this crucial specialization can be formulated, refined, and operationalized.

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