1988

Materials Issues in Art and Archaeology

CERAMIC TECHNOLOGY AND PROBLEMS OF SOCIAL EVOLUTION IN SOUTHWESTERN IRAN

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INTRODUCTION

The use of the technology of manufacture of a class of artifacts as data to address questions of culture process (social evolution) is fraught with pitfalls. This is especially true with ceramic technology. The study of this type of artifact begins with a basic circularity for most prehistoric periods in most areas of the world. Many prehistoric chronologies are based on the most abundant and durable artifact, ceramics. Periods or phases are, to a large extent, defined by similarities in form, style, and production methods of these ceramics. Therefore using more refined assessments of the technology of production to assess changes occurring between periods or phases and to infer cultural change is merely reaffirming the consequences, and reinforcing an image of abrupt step wise progression. This image is of little help in understanding the inner causes and dynamics of social or technological evolution. The use of more refined ceramic technological data to test the validity of a chronology based on ceramic data must be used with great caution.

When ancient ceramic technology is studied there is a tendency to disembed the ceramics from their cultural context and view them as individual objects. These objects are studied, grouped based on technological similarity, technological trait lists drawn up, the groups are compared, and conclusions presented based on this comparison. The critical step, that of reattaching the cultural context information is sometimes forgotten in the process.

As objects, ceramics can only answer the question of how they were made, not the culturally more important question of why they were made that way. As objects, ceramics tell us little about the level of technological sophistication of the potters that produced them. The ceramics provide enabling information, i.e. base line technological data on what was necessary to produce the pots, but not sufficient information to understand the production as a cultural process. Ceramics that display relatively unsophisticated levels of technological knowledge can not, a priori be assumed to have served unsophisticated functions in the culture that produced them.

To be sure, prehistoric potters were circumscribed by their technological knowledge and the available raw materials. They were, however even more circumscribed by the culture in which they lived. Prehistoric potters should not be viewed as systematic technological innovators struggling to push back the frontiers of ceramic science. The potters were rather the keepers of pools of accumulated knowledge of their products and raw materials. For a technological innovation to be accepted not only must potters know of it, but it must result in a product acceptable to the society as a whole. In addition to serving as containers, ceramics have been postulated to have served many other functions in prehistoric societies, including the expression and maintenance of various kinds of social boundaries, such as badges of kinship or cultural identity. Such functions are quite beyond the ability or the desire of the potters to change. Changes in these functions result from internal or external stresses place upon the society as a whole, adaptation to these stresses are then reflected by the ceramics. Therefore the knowledge of how to produce a technologically different product may exist with the potters for generations

before cultural changes allow its acceptance.

The prehistoric potters were functioning members of culturally conservative societies, producing a culturally well defined range of goods that were acceptable to those societies. Models for technological innovation in these societies, based implicitly or explicitly on feudal guild systems or post-industrial revolution market economics are inappropriate. To understand technological changes in ceramic production, it must be viewed within the context of the culture in which it was embedded. This can only be achieved when the full range of available archaeological data is considered.

DISCUSSION

The Kur River Basin in the highlands of SW Iran provides an example of the interpretive problems that may be encountered when the technology of production alone is studied. Ceramic production is first documented beginning about 6000 B.C. with the introduction of a painted buff ware tradition into the basin during the Mushki Phase. This tradition continued for nearly 2200 years, with slow evolution of forms, style, and paste preparation through the Jari and Bakun Phases. At ca. 3800 B.C. an apparent abrupt change occurred in the ceramics of the basin with the appearance of the coarse and fine unpainted red wares of the Lapui Phase. These ceramics appear to be technologically very different from the preceding tradition and were themselves replaced at about 3400 B.C. by the chaff tempered and grit tempered varieties of Banesh ceramics. At about 2400 B.C. the painted buff ware of the Kafteri Phase appears and continues through 1800 B.C. This admittedly brief recapitulation of the ceramic chronology is sufficient to document three major breaks in the sequence: the Bakun/Lapui; the Lapui/Banesh; and the Banesh/Kafteri. These breaks are used to establish the local cultural historical chronology.

Bakun, Lapui, and Banesh ceramics have been examined by a number of analytical techniques to determine differences in technological and compositional parameters. Instrumental neutron activation analysis was used to identify chemical composition; X-ray diffraction and thin section petrography for mineral phase composition; and SEM for paint, temper, and slip composition, and degree of vitrification. In all about 300 sherds (100 Bakun, 50 Lapui, and 150 Banesh) were examined in this study. The results are presented in summary form in Tables 1 and 2.

Bakun/Lapui transition

The change in ceramics between the Bakun and Lapui Phases has been used to argue for immigration of a new population into the Kur River Basin bringing with them a new ceramic style and technology [1]. This argument is based not only on the changes in the ceramics, but also on the apparent decreased population of the basin during the Lapui (as reflected by the number and size of settlements) [2,3]. Examination of the comparison presented in Table 1 shows that the major technological differences between the ceramics of these two Phases involved the selection of raw materials. The intentional shift from high calcium alluvial clays used in the Bakun ceramics to the medium to low calcium clays used in the Lapui produced most of the technological changes observed in the ceramics. It should be noted that the Bakun buff ware-producing potters knew how to produce red paste wares and sometimes did. When this happened, however, they invariably slipped the vessel with a buff (brown) firing slip to maintain the culturally desirable buff color. The reverse was true in the Lapui Phase where, particularly for the coarse ware, the potters went to some lengths to slip buff firing paste with red firing slip. Introduction of a new,

previously unknown technology (either through diffusion, innovation, or migration) does not provide a compelling explanation for the observed changes. The evidence presented by the ceramics points to culturally based reasons for the changes noted.

Table 1. Summary of Bakun and Lapui ceramic technology.

	BAKUN CERAMICS	LAPUI CERAMICS	
		COARSE	FINE
Forms:	Primarily open bowls	Primarily open bowls	Primarily open bowls
Paste:	Buff (rare orange-red)	Red to Buff	Red
Slip:	Buff (rare brown) (always with red paste)	Red (always with buff paste)	Red
Paint:	Black, red, brown (very common)	Unpainted	Extremely rare black (<<1%)
Temper:	None	None	None
Forming Technique:	Handmade	Handmade	Handmade?/ slow wheel?
Clay:	High calcium - illitic	Med.-low Ca	Low Ca
Mineral.:	Qtz:diopside:gehlenite: plagioclase	variable with Ca	Qtz:hematite plagioclase
Vitrif.:	Incipient	Incipient	Moderate
Firing Temp.:	850 - 1000°C	850 - 1000°C	+ 1000°C
Paint:	Iron oxide	None	Rare Mn-Fe
Kiln Atmos.:	Red/ox	Ox.	Ox. (rare red/ox

To this point we have been dealing with the basic circularity discussed in the introduction, i.e. using typological and technological data from two types of ceramics to examine the causes for differences between phases that are themselves defined by the differences between the ceramics. The phenomena that caused the changes in the ceramics to occur happened before the changes occurred. The roots of the phenomena do not lie at the interface between the two Phases, but rather in the later part of the Bakun Phase. It is during this time that the pressures that lead to cultural change as reflected in the ceramics came to bear. Sumner [3] has presented data to support his hypothesis that over salinization due to poor irrigation practices led to abandonment of the central basin beginning in the late Bakun Phase. Prior to this time and for the preceding 2000 years the settlement history of the basin was one of a gradually accelerating process of in filling of the arable portions of the basin. Sumner [3] has postulated that the stresses caused by the forced abandonment forced a portion of the population to adopt a new subsistence strategy - pastoral nomadism. The social disruption and increased contacts with other cultures that would have resulted from such a change in subsistence strategy would have lead to fundamental changes in many aspects of the Bakun culture. The changes in stylistics of the ceramics may be better explained as a reflection of these cultural changes rather than wholesale repopulation of the basin by a new people.

Table 2. Summary of Banesh ceramic technology.

	BANESH CERAMICS	
	CHAFF WARE	GRIT WARE
Forms:	Tray, bevel rim bowl/ goblet	Bowls, large storage jars
Paste:	Buff, common black core	Orange, frequent grey core
Slip:	None	None
Paint:	None	White bands/ maroon-brown bands over white bands
Temper:	Coarse chaff	Coarse grit (up to 2 mm)
Forming Tech:	Crude mold/handmade	Handmade/slow wheel finished?
Clay :	High Ca illitic	med - low Ca illitic
Mineral.:	Qtz:primary calcite and/or dolomite:illite	Qtz:plagioclase:diopside: Hematite
Vitrif.:	Baked clay	Incipient
Firing Temp.:	Below 700°C	850 - 1050°C
Paint Type:	None	White/?, maroon-red/iron oxide
Kiln	No kiln	Red/ox
Atmos.:	Red/ox in open fire	

Lapui/Banesh transition

Space does not permit a full discussion of the technological and stylistic changes in the ceramics between the Lapui and the subsequent Banesh Phases. A quick comparison of the Banesh grit ware (Table 2) and the Lapui ceramics (Table 1) shows many differences of both a stylistic and technological nature. Common painted decoration reappears as monochrome and bichrome bands. New forms are introduced, the occurrence of one of these, large storage jars, appears to signal a fundamental alteration in storage and shipping requirements. Technologically, the introduction of intentionally added grit temper, and new forming and firing requirements all signal a major break in the ceramic sequence. As no precursors for the grit ware exist outside the Kur basin, this ware appears to be an indigenous response by local potters to a changing socio-economic need. This response was to develop a technology for producing the large jars with coarse grit temper added to decrease shrinkage during drying and increase green strength. Again the emphasis is on changing social needs with the ceramics being but one reflection of these changes. The developments that led to the changes in form, function, and technology of the Banesh grit ware have their roots in the Lapui Phase and can only be fully understood by study of all aspects of this Phase including stratified samples of ceramics.

Specialist vs. household production

Examination of the two Banesh ceramic types (Table 2) shows great disparity in technological sophistication raising the possibility of specialist produced grit wares vs. household produced chaff wares. The question of craft specialization vs. household production is one frequently addressed by technical examination of the ceramics. Using stylistic, technological, and chemical characterization, the uniformity or homogeneity of the product is taken as an indicator of the degree to which specialists are involved in the production. The greater the uniformity, the greater the likelihood of specialist involvement. This formulation assumes that certain culturally controlled norms exist that govern form and decoration of a given ceramic and that these norms are adhered to by both the specialist and the household potter. With household production, the number of individual producers will be high, while the skill of the individual producer (on an average) will be low. The variability in the product, therefore, should be high from potter to potter and in fact from pot to pot. With specialist production, the number of individuals should be much lower than in household production and the individual skill level higher. The variability in the product should reflect the higher skill levels of the fewer potters and should decrease with increasing specialization. The same argument holds for selection and preparation of raw materials. While in principle this formulation is logical and has produced much thought-provoking research, it ignores the function of the product being produced and the minimum skill level necessary to produce it. Distinctly low tech, low skill products can also be the result of specialized production.

The Banesh grit ware gives every indication of being a full or part-time specialist production. Both Alden [1,4] and Blackman [5] reached the same conclusion based on independent lines of evidence. Alden's research was based on distributional survey data, excavation at an early Banesh village production site, and form and stylistic analysis of the grit wares. He concluded that grit ware production took place in a single specialized village and that the geographic location of this grit ware-producing village was moved from time to time. The relocation being necessitated by fuel availability. Blackman, based on chemical and petrographic analysis of grit ware sherds from stratigraphicly controlled levels at the middle Banesh urban center of Tal-e Malyan, demonstrated that two distinct and contemporaneous compositional groups could be identified. He concluded that, at least by the middle Banesh, two production sites were in existence. The absence of a source of the medium to low calcium clays use to make the grit ware in the vicinity of Tal-e Malyan, and lack of production debris at Tal-e Malyan seemed to rule out the urban center as one of the production sites. Taken together, these two investigations indicate that production of the grit tempered ware, by at least part-time specialists, occurred in one or two small specialized villages, with some controlled system of distribution to the other villages and the emerging urban center of Tal-e Malyan.

The technologically unsophisticated chaff tempered ware, on the other hand, seems to fit well the non-specialist household production model. These ceramics were made of unlevigated local alluvial soil and sometimes contain pebbles up to 5 mm in diameter. Tempering was with coarsely chopped chaff, a process last used in the basin about 1500 years earlier. Forming technology was primitive. The bevel rim bowls were formed by pressing lumps of clay into a small pit excavated in the soil (crude mold), and the trays by the same process on a flattened earth surface. Both the bowls and trays retain impressions on one surface from contact with the earth "mold." The goblets appear to have been hand formed without the use of molds. Firing was most probably in open fires with no "formal" kiln structure, and temperatures were not controlled (several samples disintegrated when placed in an ultrasonic cleaner). There is no decoration, and there appears to be no effort to insure more than general uniformity of size or volume.

Contextual data, however, paints an entirely different picture of the production, function, and distribution of this ware. Sumner [2] and Alden [1] conducted extensive surveys in the Kur River Basin and found a rather constant ratio among chaff tempered ware forms on most Banesh sites. The exceptions were two sites where one form outnumbered the other two forms by at least an order of magnitude. Alden [4] estimates that one of these sites could have supplied the entire population of the basin with one of the forms. These data strongly indicate that certain villages were specializing in the production of one of the three forms of chaff tempered ware and that

some organized system of distribution existed. The function of these ceramics in the Banesh society, particularly at the center of Tal-e Malyan, also seems to have been, at least in part, specialized. Nicholas [6] postulates a tax collecting function for the bevel rim bowls, while Zeder [7] and Blackman and Zeder [8] postulate an institutional food serving function for all three forms. Such specialized production, distribution, and functions are invisible to the observer of the ceramics alone. It is only when the complete contextual data is considered that it emerges.

CONCLUSIONS

This paper has been a brief overview, excerpted form a much longer manuscript in preparation. In the space allowed, I have attempted to demonstrate with examples from SW Iran, the need to incorporate all the available data, both technical and contextual, in the interpretations drawn from ceramic analysis and to demonstrate the pitfalls encountered when one or the other is ignored in drawing conclusions. If technological studies are to serve the more productive goal of aiding the understanding culture process and social evolution in ancient societies, rather than merely providing trait lists and "the earliest example of ...", then the material scientist and the archaeologist must work in close collaboration on well defined problems. More importantly, both must understand the nature and the weaknesses of the data sets with which they work.

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