

## Compositional Patterning in Ceramics from Pacific Coastal and Highland Guatemala

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**ABSTRACT** This article provides an overview of the ceramic sequence of the Pacific slope of Guatemala from the perspective of compositional data generated by instrumental neutron activation analysis (INAA) of 1166 ceramic specimens from the Pacific coastal plain and Valley of Guatemala. Excluding ethnographic ceramics and raw material samples, the analyzed specimens pertain to four chronological divisions, the Early Formative, Middle through Terminal Formative, Classic, and Early Postclassic periods. Differences in subgroups among the four chronological subdivisions of the sample reflect shifting ceramic resource procurement, production, and exchange.

### INTRODUCTION

Compositional characterization of ceramics by neutron activation analysis has been used to investigate pottery from the Maya area for over 30 years (e.g., Bishop 1976, 1980; Bishop, Rands, and Harbottle 1982; Hammond, Harbottle, and Gazzard 1976; Rands and Bishop 1980; Rice 1977, 1978; Sabloff, ed. 1982; Sayre, Murrenhoff, and Weick 1958; Sayre, Chan, and Sabloff 1971). During the past decade, production of analytical data has accelerated dramatically, due in part to a long-term research effort begun in 1978 as the Maya Jade and Ceramics Project (e.g., Bishop 1984; Bishop and Demarest 1986; Bishop et al. 1983; Bishop et al. 1986; Neff 1984, 1989a, b; Neff and Bishop 1988). As director of the project, Bishop oversaw the neutron activation analysis of more than 12,000 ceramic specimens from the Maya area, including 1166 from the Pacific coastal plain and Valley of Guatemala. The material discussed here comes from three subregions in southern and western Guatemala (shaded areas in Fig. 1). Analytical data on the specimens, and provenience and stylistic/typological information are housed in the Smithsonian Archaeometric Research Collections and Records database (SARCAR; cf. Bishop, Olin, and Blackman 1984).

Recent additions to the analytical data-

base are ceramic raw material samples from the Escuintla coastal plain. Of particular interest are three raw clay samples from the coastal plain along the Nahualate River and five raw clays from the coastal plain along the Coyolate River. We plan to expand the database of analyzed raw materials, to enhance the specificity of and confidence in our source zone attributions.

Here we give a compositional overview of the entire ceramic sequence of the Pacific slope. There are, of course, gaps in the chronological coverage, and these limitations should be kept in mind. Figure 2 shows how specimens in our analyzed sample from the Pacific coast and Valley of Guatemala are distributed in time. Although Late and Terminal Formative (500 B.C.–A.D. 250) and Late Classic (A.D. 700–A.D. 950) periods are clearly best represented, we have sufficient data from the coast to make tentative inferences regarding developmental trends during the Early and Middle Formative (1400 B.C.–500 B.C.) and the interval between the end of the Formative and the beginning of the Late Classic (A.D. 250–A.D. 700). Synthesis of the existing information has not been completed, and more analyses are planned to fill gaps in the existing database. Nonetheless, we are beginning to identify subregional groups and regional developmental trends.

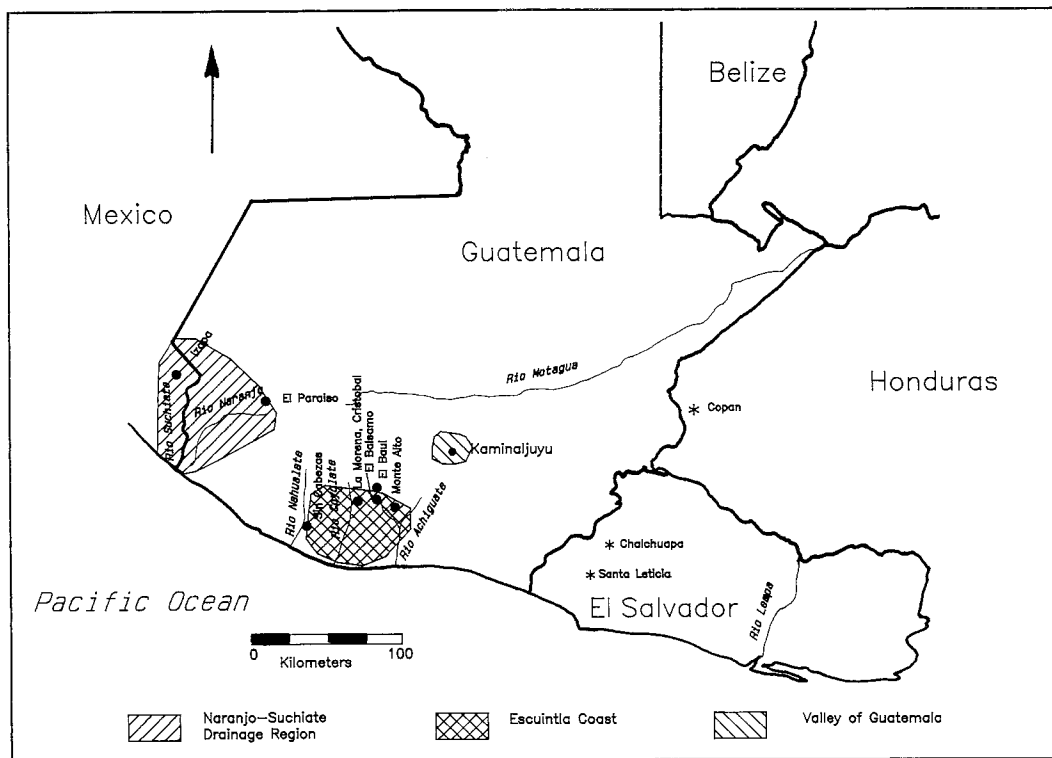


Fig. 1. The Pacific slope of Guatemala. Shaded regions are represented in the sample of ceramics analyzed by instrumental neutron activation analysis (INAA).

#### METHODS

The compositional data were produced by instrumental neutron activation analysis (INAA) using standard procedures developed at Brookhaven National Laboratory (Bishop, Harbottle, and Sayre 1982), with the exception that only single irradiations and counts for the long-lived isotopes were carried out. The elements Sc, Cr, Fe, Rb, Cs, Ba, La, Ce, Sm, Eu, Yb, Lu, Hf, and Th were determined for nearly all specimens in the analyzed sample, and thus were chosen as the bases for group formation. In the analysis of compositional data, we generally try to deal simultaneously with a series of levels hierarchically arranged according to geographical inclusiveness. The most specific compositional divisions we hope to identify are those containing the products of a small group of potters who utilized a very restricted range of raw material sources over some restricted, contin-

uous span of prehistoric time. Pottery produced by several such localized, related production centers is expected to form a more inclusive group which subsumes all the more specific groups. On a more inclusive level, we expect that all pottery made throughout prehistory in some geographical zone should be compositionally distinguishable from pottery made in other zones. Successively more inclusive categories subsume lower level groups, making it possible to attribute lower level groups to geographic zones even if an exact source cannot be located.

Reference groups or "paste compositional reference units" (PCRUs; cf. Bishop, Rands, and Holley 1982) representing varying degrees of geographical inclusiveness are formed by a variety of means, including inspection of raw analytical data for various geographic and stylistic categories, ordination by principal components analysis, and cluster analysis. The provisional groups

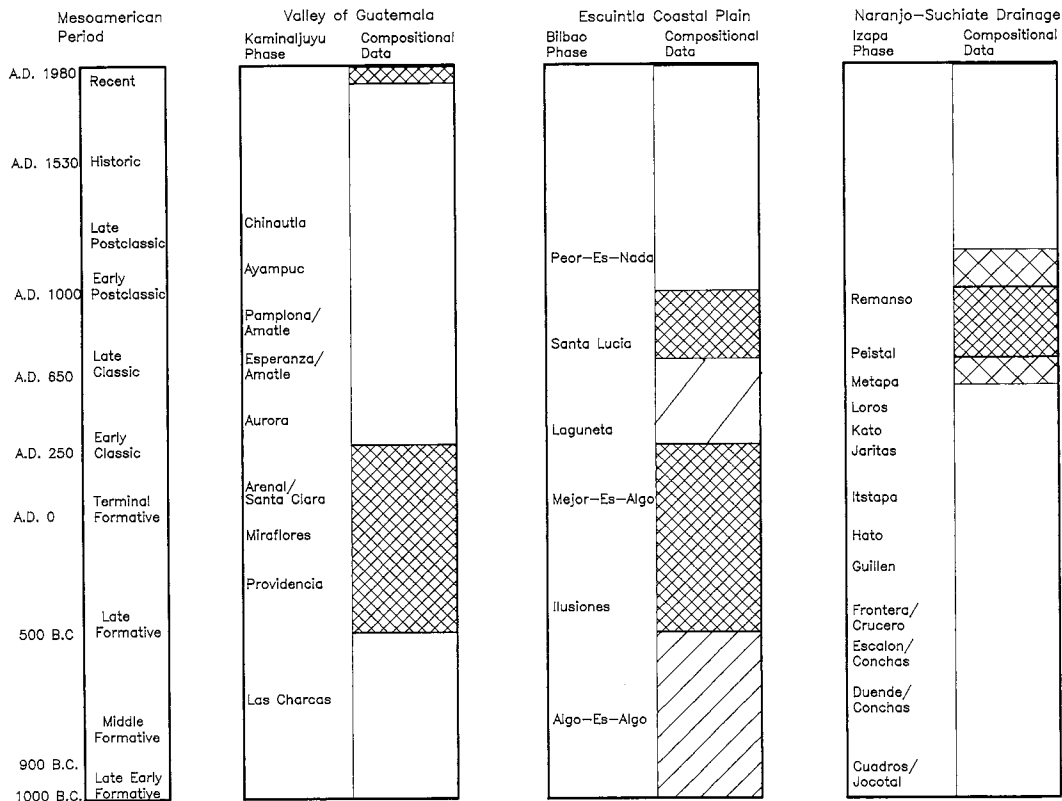


Fig. 2. Chronological chart showing periods and phases represented in the sample of ceramics analyzed by INAA. The three different sequences correspond with the geographical subdivisions indicated in Figure 1. Density of hatching on the vertical bars indicates relative representation in the sample analyzed by INAA. Kaminaljuyu sequence after Borhegyi (1965) and Wetherington (1978). Bilbao sequence after Parsons (1967). Izapa area sequence after Lowe, Lee, and Espinosa (1982), Coe (1961), and Coe and Flannery (1967).

are refined by single group and multiple group evaluative techniques based on dispersion-corrected distances from the group centroids and associated multivariate probability calculations (Bishop and Neff 1989; Bishop, Harbottle, and Sayre 1982). Each stage of group refinement is associated with a series of working hypotheses about the chronological extent, geographical origin, and geographical inclusiveness of the provisional groups. Formulating and evaluating these working hypotheses entail consideration of non-compositional data (stylistic/typological, textural, color, provenience, etc.) for the member specimens. Canonical discriminant analysis may be used both in the group refinement and to present the final results of group refinement graphically, as we do here. The pos-

sibility of further subdivision of groups and reapportionment of member specimens as new data become available is always recognized, and may, in the future, alter some of the conclusions we present below.

One special kind of reference group we refer to below is the "generalized regional group." These generalized groups provide the grounds for attributing lower level PCRUs or individual unassigned specimens to source regions. They are formed from analyzed specimens which have a high prior probability of being found in their own source region (these may be either abundant ceramic classes or, preferably, local raw materials). In practice, we usually form the generalized groups on the basis of the most abundant ceramic classes of the region. (Specimens to be projected against

the general group are, of course, excluded from initial membership in the group.) The profile of such a generalized group is, we hope, distinct from the compositional profile of other zones and broad enough to subsume the various compositional profiles of distinct raw material sources present within the zone. More inclusive zonal profiles can be found by combining the generalized groups from contiguous zones.

A caveat is necessary here. Although a hierarchical description of compositional variation such as we assume has a certain intuitive appeal, its appropriateness for any area of the world is an empirical matter, not a theoretical one. Nested geographic ranges may not coincide neatly with nested compositional variation if, for example, a single clay bed outcrops discontinuously over a wide geographical area or if a certain desirable clay is exchanged widely. In general, the model would seem most applicable to sedimentary environments where raw material sources represent mixtures of several primary sources. On the Guatemalan Pacific coastal plain, where streams running generally north-south drain different, but partially overlapping parts of the volcanic cordillera, progressive compositional differentiation should be observed in raw materials as one moves east or west from any particular point. On a higher level of geographical inclusiveness, the Pacific coastal plain as a whole and the Valley of Guatemala form two distinct geological provinces which we expect to have divergent chemical signatures.

## RESULTS

In the subsections that follow, we discuss the compositional evidence for each of the chronological divisions represented in our analyzed sample (Fig. 2).

### *Early Formative*

Our sample from the Escuintla region includes 37 specimens of Coastal Undifferentiated ware, assigned by Shook and Hatch (1978) to the Late Early Formative period (Cuadros-Jocotal equivalent). As might be expected for early pottery in any region, utilitarian wares dominate and local pro-

duction appears to have been the rule. Locations as little as 10 km. apart are easily differentiated. For example, coastal undifferentiated specimens from the Monte Alto, El Balsamo, and the Cristobal/La Morena area are clearly distinct in canonical discriminant space (Fig. 3). Other group evaluative techniques easily confirm the separation shown in the plot. In terms of the hierarchical model of resource variability introduced previously, the three compositional subdivisions of coastal undifferentiated ware represent an intermediate geographical level; that is, they represent the ceramic environment in the vicinity of each of the Early Formative centers as those environments were perceived and exploited by the Early Formative makers of coastal undifferentiated ware.

Judging from the compositional evidence, pottery-making in the Escuintla region during the Late Early Formative period was carried out exclusively to meet local needs. This evidence is consistent with a model of redundant, self-sufficient domestic units, an absence of local specialization, and an absence of intra-regional or inter-regional ceramic exchange.

### *Middle through Terminal Formative*

The pattern of local production of domestic wares continued on the coast during the Middle and Late Formative, with coastal undifferentiated ware developing into El Balsamo brown and, later, Monte Alto brown ware. Like coastal undifferentiated ware, Monte Alto and El Balsamo brown specimens from closely spaced locations on the Escuintla piedmont are compositionally distinct (Fig. 4).

New ceramic types associated with the Providencia and Miraflores interaction spheres (cf. Demarest 1986) are added to the existing local ceramic inventory during the Late and Terminal Formative periods. One of these new categories includes types equivalent to polished black-brown pottery from Kaminaljuyu and Chalchuapa, El Salvador. As a group, the analyzed black-brown specimens are compositionally heterogeneous, so they certainly do not represent a single production center. In fact, we can distinguish at least three distinct zones of

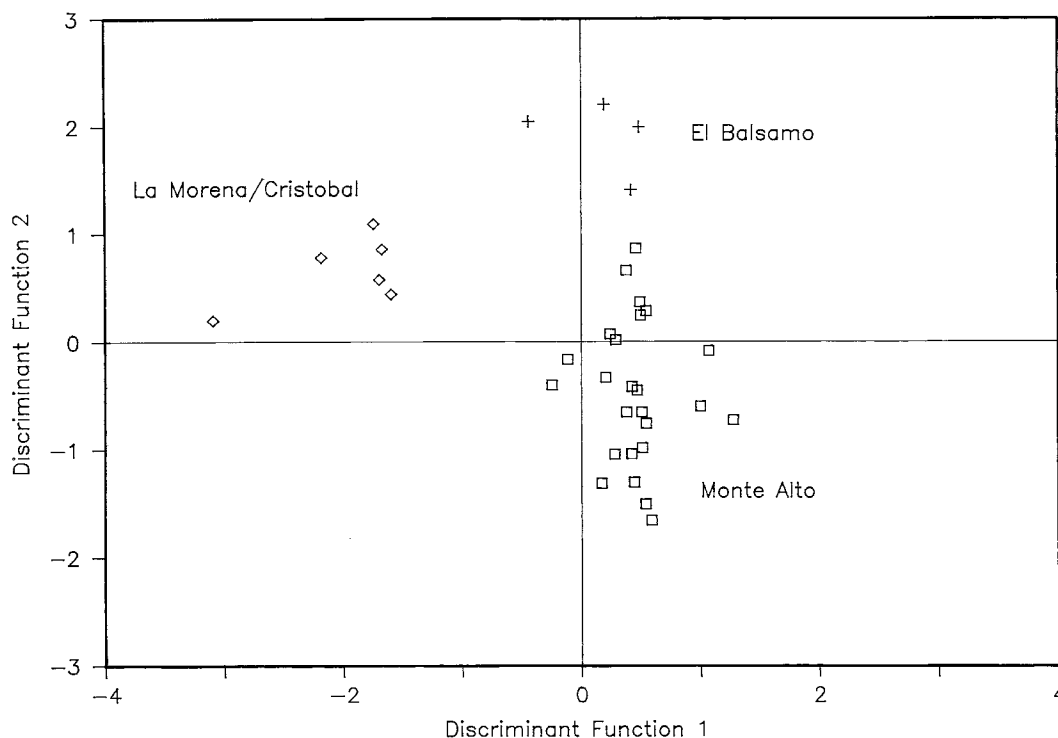


Fig. 3. Discriminant analysis plot of Late Early Formative Coastal Undifferentiated ware from three closely spaced sites on the Escuintla piedmont

black-brown ware production (see Fig. 5, a plot based on discriminant analysis of black-brown ceramics from the Valley of Guatemala and two coastal drainages). Analyzed raw clay samples from the Coyolate and Nahualate drainages were projected into the discriminant space derived from the data for black-brown ceramics. Two of three clays from the Nahualate drainage plot with the Nahualate black-brown specimens, while four of five raw clays from the Coyolate drainage plot with the black-brown specimens from that drainage. The deviant Coyolate raw clay is a visibly ferruginous specimen that is distinguished compositionally by an iron concentration about double that normally found in coastal ceramics and clays. The Nahualate raw clay that falls with the Coyolate specimens is from a location about 20 km. inland from the zone where most of the ceramics and the other Nahualate clays were derived. The locations of the other clays analyzed in the discriminant space help confirm the hypoth-

esis of localized production and distribution of the black-brown specimens on the coastal plain.

Black-brown specimens from the piedmont centers of Monte Alto and El Balsamo do not appear to be locally made judging from their lack of resemblance to generalized local groups. At the same time, they are compositionally heterogeneous and therefore not likely to have been produced in a single restricted zone. Some are compositionally similar to the Coyolate or Nahualate drainage profiles, but it would be unwise to infer exchange relations on the basis of the small numbers of specimens involved and without a more comprehensive set of analyzed raw materials. Our provisional interpretation is that potters in several zones on the coast and piedmont produced the black-brown pottery found at the piedmont centers. This interpretation implies that localized exchange of ceramics emerged on the coastal plain during the Middle to Late Formative.

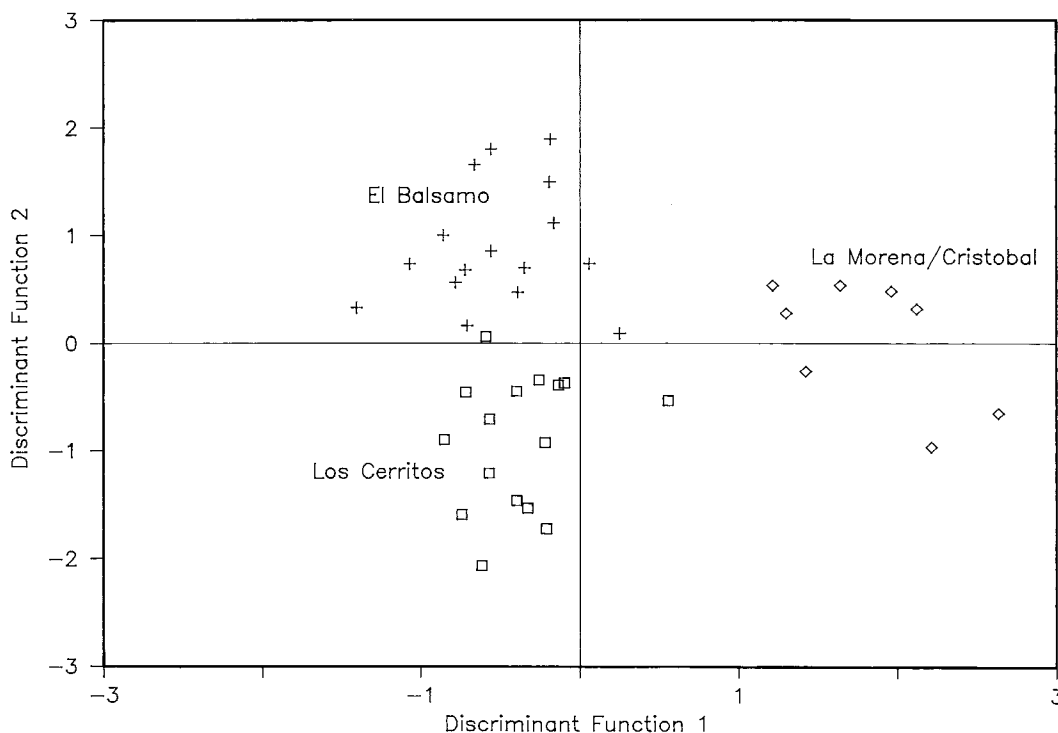


Fig. 4. Discriminant analysis plot of Middle through Late Formative El Balsamo Brown ware, Monte Alto Brown ware, and unspecified brown ware from three closely spaced sites on the Escuintla piedmont

While black-brown types were produced and distributed within circumscribed local areas, several other categories of Late Formative pottery apparently were exchanged more widely. This is most easily demonstrable for several compositional groups represented abundantly in our sample from the Valley of Guatemala, which we assume were produced somewhere in the highlands. Previously, Bishop and Demarest (1986; Bishop, Demarest, and Sharer 1989) reported compositional homogeneity in the Valley of Guatemala sample when contrasted with an analyzed sample of parallel types from sites in El Salvador. This finding demonstrated that the typological parallels between the two regions result from sharing information rather than material exchange. Although this basic point cannot be questioned, the Valley of Guatemala material no longer appears to be chemically homogeneous. Instead, at least three distinct subgroups can be recognized (Fig. 6).

Chemical homogeneity is matched by stylistic and typological homogeneity, leading us to name the chemical groups after the dominant types present, that is, fine red, fine white, and polished black. The polished black group is the same group contrasted with coastal plain black-brown pottery in Figure 5. The overall congruence of style and composition leads us to infer that each group represents the production of one or a few villages located close to the requisite raw material sources (cf. Neff, Bishop, and Arnold 1988, 1989).

The distributions of the three highland Late Formative compositional groups overlap in the Valley of Guatemala at Kaminaljuyu. As mentioned previously, the polished black group occurs only at Kaminaljuyu. Outside the Valley of Guatemala, the fine white group is distributed very widely, occurring at numerous sites on the coastal plain and even far to the north at the Peten site of El Mirador (not shown).

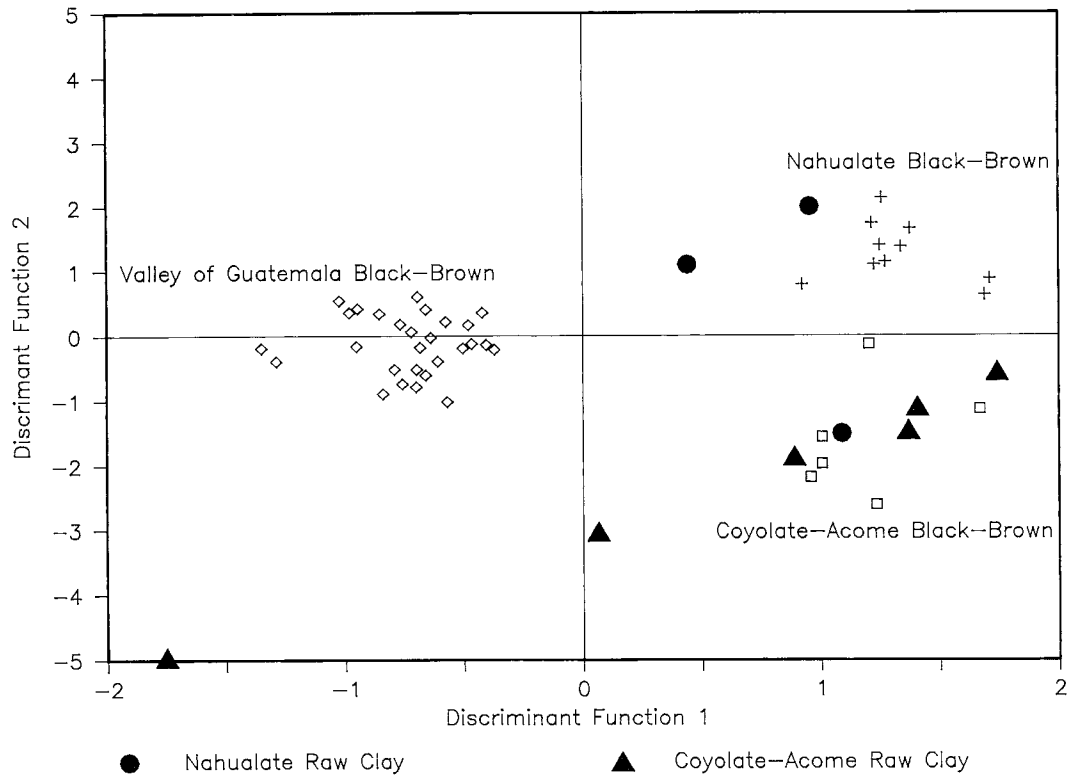


Fig. 5. Discriminant analysis plot of Late through Terminal Formative polished black-brown specimens from the Valley of Guatemala and two coastal drainages. Solid circles represent Nahualate drainage raw clays projected into the discriminant space defined by the ceramic data. Solid triangles represent projected Coyolate drainage raw clays.

Fine red occurs on the coastal plain, but finds from farther afield have not yet been identified by compositional analysis.

Comparison of the three highland Late Formative groups to a general compositional profile for the Valley of Guatemala suggests that all three were produced in or around the valley. We should also note, however, that the current data refute an earlier suggestion that Formative white-ware was derived from the same clays used by modern potters in the northern Valley of Guatemala (Rice 1977, 1978): neither the fine white core group members nor any of the non-core whiteware samples fall within the range of variation of a generalized group formed from contemporary northern Valley of Guatemala ceramics and raw materials (Neff, Bishop, and Arnold 1989). Survey reports indicate peak whiteware frequencies in the western Valley of Gua-

temala and adjacent Sacatepéquez highlands (Rice 1978: table 15; Shook, Hatch, and Donaldson 1979; Stark et al. 1985). Assuming that these data indicate the white-ware source zone, we speculate that the inter-regional distribution of Late Formative fine white paste ware may have paralleled distribution of obsidian from the source at San Martín Jilotepeque, also located in the Sacatepéquez area. We discuss the compositional affiliations of Formative white-ware in much greater detail elsewhere (Neff, Bishop, and Arnold 1989).

In addition to the fine red and fine white core groups, other Late Formative ceramic categories found on the coast which have not yet been subsumed within well-defined PCRUs appear to originate in the highlands. For example, analyzed graphite painted pottery and Usulután decorated pottery from most coastal sites resemble a

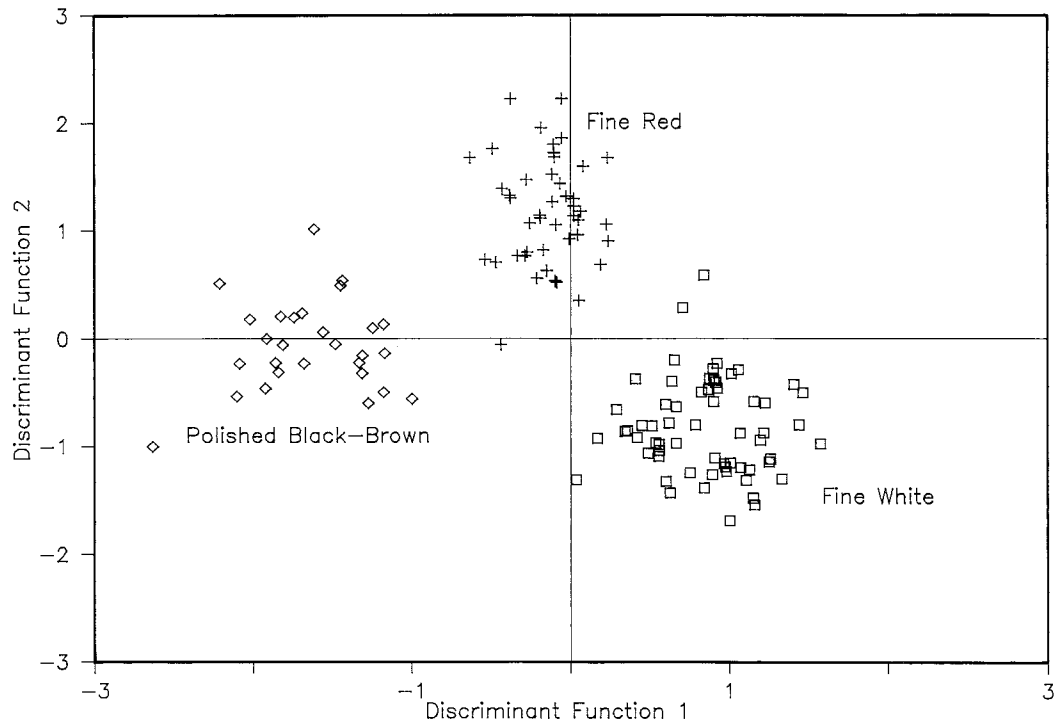


Fig. 6. Discriminant analysis plot of specimens in three PCRUs representing localized ceramic traditions of the Late through Terminal Formative Valley of Guatemala

general Valley of Guatemala compositional profile. One Usulután sherd from a site on the Coyolate River about 5 km. from the coast is a member of the fine white core group, presumably from the Sacatepéquez highlands. The piedmont centers of El Balsamo, Monte Alto, and Los Cerritos apparently had alternative, non-Valley of Guatemala sources for Usulután and graphite painted pottery, as none of the analyzed specimens from these sites matches a general Valley of Guatemala profile. Clarification of the patterns of Usulután production and exchange awaits a more comprehensive survey of ceramic raw materials and more analyzed Usulután ceramics from key coastal plain sites.

An astonishing finding of our study is that Arenal Coarse Buff, a type which first appeared during the Terminal Formative (after 250 B.C.), was apparently imported to sites in the Coyolate and Nahualate zones of the Coastal plain from the Valley of Guatemala. We call this finding astonishing be-

cause the type is characterized by thick walled, heavy vessels that would be difficult to transport. Because the Arenal Coarse Buff specimens have not yet been subsumed within any well-defined core groups, there is greater uncertainty attached to a highland attribution than is the case, for example, with the fine red core group specimens. Still, no matter how we look at the data, the same pattern of highland affiliation for the coastal Arenal coarse buff emerges, and this provides strong initial support for the hypothesis of importation to the coast. The appearance of these large vessels as far west as the Nahualate drainage, over 100 km. away from the Valley of Guatemala, is a remarkable, if tentative, indicator of large scale investment in long distance exchange relations among the Terminal Formative populations of the Pacific slope. Clearly, this topic deserves further investigation.

To summarize the Middle through Terminal Formative evidence, there apparent-



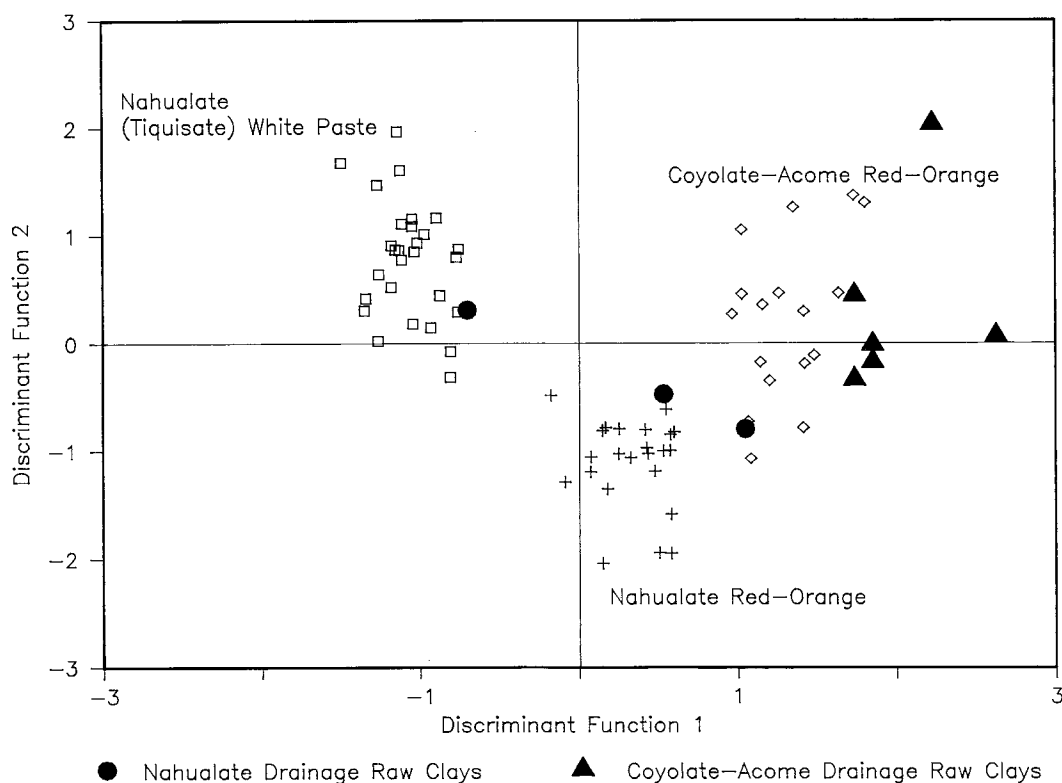


Fig. 7. Discriminant analysis plot of specimens in three PCRUs representing localized ceramic traditions of the Classic period on the Escuintla coastal plain. Solid circles represent Nahualate drainage raw clays projected into the discriminant space defined by the ceramic data. Solid triangles represent projected Coyolate drainage raw clays.

ly were two major shifts from the Early Formative pattern. First, there was a tendency toward differentiation of local traditions, especially in the highlands, with distinct pottery-making groups tending both to use specific sets of raw materials and to emphasize particular decorative modes. This is why compositionally and stylistically homogeneous subgroups such as fine red, fine white, and polished black are recognizable among the highland specimens. Second, ceramic exchange, which implies production beyond immediate consumption needs, emerged as a viable economic alternative among some groups. The dominant, if not exclusive, direction of ceramic movement was from highlands to coast. We must assume that this flow of ceramics was balanced by a flow of coastal goods in the opposite direction. Considering the longer growing season and fertile soil on the coast, one possibility is that coastal populations

produced agricultural surpluses which were exported to the highlands.

#### *Classic Period*

Classic period specimens in our sample come mainly from the Escuintla coastal plain and from the coastal plain farther west, in the vicinity of the Mexico-Guatemala border. In both regions, fine to medium paste traditions seem to have been developing from Early or Middle Classic times on, culminating in distinctive, vigorous ceramic industries of the Late Classic period.

Among the analyzed Classic period specimens from the Escuintla region, we can recognize three chemically homogeneous groups (Fig. 7). Most of the specimens in the Nahualate red-orange and Tiquisate white paste compositional groups come from sites along the Nahualate River. The Nahualate red-orange group is further linked

to the Nahualate drainage by five group members that were collected from a probable production locus at a site just east of the Nahualate River. All specimens in the Coyolate-Acomé red-orange group come from sites lying farther east on the coastal plain, between the Coyolate and Acomé rivers. In confirmation of the source attributions inferred from distributional data, when we project the raw clay analyses from the Coyolate and Nahualate drainages onto the two discriminant axes (Fig. 7), we find that Nahualate clays plot with the Nahualate centered groups, while Coyolate clays plot with the Coyolate centered group. In sum, several lines of contextual and compositional evidence confirm our inference that the three compositional groups represent two production zones, namely the Coyolate and Nahualate drainages of the coastal plain.

The two red-orange compositional groups are both dominated by bowls and cylindrical vessels with specular hematite red slip. These vessel categories fall into what Parsons (1967: 134-140) has designated Patulul Orange Brown ware. Besides these Middle to Late Classic categories, the Nahualate centered red-orange group also includes Early Classic Larrave Red on Cinamon and Terminal Formative Bonifacio Red on Orange. Larrave Red on Cinamon appears to be a stylistic precursor of the later specular hematite painted type. The combined evidence of continuity in style and resource use builds a strong case favoring continuous local development of a red-orange tradition within the Nahualate drainage from the end of the Formative through Late Classic times.

In contrast, our hypothesis concerning the genesis of the Coyolate-Acomé red-orange group is that it represents a Middle to Late Classic spread of the red-orange tradition out from a core zone along the Nahualate River. The reason we are invoking spread from a core area is that there are no precursors of Middle to Late Classic specular red bowls and cylinders in the Coyolate-Acomé compositional group, whereas the Nahualate group, as mentioned, includes Terminal Formative and Early Classic specimens, particularly Larrave Red on

Cinamon. We recognize, of course, that this conclusion may represent a bias in our sampling of ceramics from the two zones.

The Tiquisate fine white paste group consists almost exclusively of white paste variants of the well-known Classic period type designated Tiquisate ware (e.g., Parsons 1967). We believe that its development from Terminal Formative roots paralleled the development of the Nahualate red-orange tradition just discussed. Although the evidence is scant, the fact that our Tiquisate white paste compositional group includes a single specimen of Terminal Formative Bonifacio Red on Orange provides some support for this developmental interpretation. Essentially, we see a generalized Terminal Formative red-orange tradition differentiating during the Early Classic period into two separate lines, then emerging as the distinctive Tiquisate white paste ware and specular red painted ware of the Late Classic period.

Fifteen analyzed specimens typologically related to Tiquisate ware do not fit with any of the three compositional groups just discussed. Most of them are from the coastal plain zone where the Coyolate-Acomé red-orange group originates. We feel that these unassigned specimens provide tentative evidence of Tiquisate white paste ware production outside the original source zone, and may represent a Middle to Late Classic spread of the Tiquisate white paste tradition parallel to that we have inferred for the red-orange tradition.

Besides the fine paste wares from the Escuintla region, the other major component of our Classic period sample is Plumbate ware from the Naranjo drainage region, in the vicinity of the present Mexico-Guatemala border. As reported in detail elsewhere (Neff 1984, 1989a, b; Neff and Bishop 1988), three distinct Plumbate compositional subgroups are conceived as chronologically successive, but overlapping, manifestations of a single, continuous stylistic/technological tradition pertaining to the Naranjo-Suchiate drainage region of the coastal plain. Of particular interest here is the fact that Plumbate development appears to parallel the development of the Tiquisate white paste and Nahualate red-

orange tradition. In all three cases, an initially localized tradition appears to capitalize on increasing opportunities, resulting in expansion from the original source zones. Similarities in form and paste texture among the three traditions may reflect a common evolutionary origin.

Finally, the compositional data document widespread ceramic exchange of Late Classic period Pacific slope ceramics. San Juan Plumbate from the Naranjo drainage region was apparently traded most widely, with occurrences documented far to the east and west on the Pacific coast and in the Valley of Guatemala. Members of the Tiquisate white paste compositional group occur at El Baúl, approximately 50 km. from the inferred source region, and at El Paraiso, on the upper reaches of the Naranjo River approximately 100 km. from the source region. Nahualate red-orange composition specimens occur at El Baúl, and one possible group member comes from a coastal site in the Naranjo drainage. Parsons (1967) indicates that both specular hematite painted vessels (his Patulul Orange Brown ware) and Tiquisate ware vessels are distributed over a much wider area than we have documented, with examples occurring in numerous highland locations and in the upper Motagua Valley. So far, we have not identified any exports of specular hematite painted vessels from the Coyolate drainage, but we must reiterate that our sample is limited, and we have certainly failed to provide a complete picture of exchange involving potters in the Escuintla area.

#### *Early Postclassic*

The fine paste traditions of the Escuintla region and the Naranjo-Suchiate drainage region apparently suffered similar fates at the end of the Classic period. In Escuintla, available data suggest that production of Tiquisate related wares ceased abruptly. In the Naranjo-Suchiate drainage region, Plumbate production continued, but only among a small group of potters who introduced a radically different decorative style referred to as fancy Tohil Plumbate. The question of whether the developmental discontinuities in the two regions are really synchronous, and perhaps related, deserves further evaluation.

#### CONCLUSION

Compositional evidence affords a unique perspective on ceramic development, but the potential of compositional analysis has not often been exploited for insight into historical developmental processes. Most often, the perspective has been synchronic, and the focus has been on the limited goal of demonstrating the presence of foreign pottery at some site or in some region. The observations we have just presented on the Pacific slope sequence have been designed, for one thing, to exemplify a broader approach in which compositional data are used to address historical processes of change in ceramic traditions.

#### *Acknowledgments*

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