CERAMIC DIVERSITY IN CHAVÍN DE HUANTAR, PERU

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Ceramic diversity in the ceremonial center of Chavín de Huantar in the Peruvian highlands is assessed by neutron activation analysis, petrography, and stylistic analysis. These analyses lead to a new interpretation of ceramic production in Chavín between ca. 850 and 200 B.C. Several compositional groups with very different mineralogical paste types are identified. More than 30 percent of the ceramics are nonlocal. Most of these are bottles and fine wares, probably brought to the site as gifts or offerings. At the local level, ceramic production changed over time. A dramatic shift in resource procurement occurred at the end of the first occupation phase, and production became more diversified and intense as the site and its population grew larger.

Estudios de activación neutrónica y petrografía, y análisis estilística muestran la diversidad cerámica que existe en el centro ceremonial de Chavín de Huantar, en los Andes de Perú. Se proponen nuevas interpretaciones sobre la producción cerámica en Chavín entre 850 y 200 a.C. Varios grupos de composición son identificados, con pastas mineralógicas muy distintas. La mayoría de las vasijas exogenas son botellas y cuencos finos, probablemente llevados al centro ceremonial como ofrendas o productos de intercambio. La activación neutrónica revela que, al nivel local, la producción cerámica cambia en el curso de existencia del sitio. Se nota el uso de pasta volcánica durante las dos primeras fases de ocupación (Urabarriu y Chakinani) y la producción de vasijas principalmente utilitarias con poca variación de forma. En cambio, durante la tercera fase de ocupación (Janabarriu) se usa un material intrusivo como la granodiorita procedente de la Cordillera Blanca. La producción es más diversificada e intensa cuando el sitio conoce su desarrollo máximo. El estudio de activación neutrónica muestra tambien que las cerámicas con un alto contenido del elemento cesium no son locales. La mayoría de estas cerámicas son de estilo atípico. Las cerámicas no locales tienen composiciones químicas diversas lo que sugiere múltiples origines.

The ceremonial center of Chavín de Huantar is known for its fine architecture, extensive stone art, and beautiful ceramics. The Chavín occupation spans nearly 700 years, between 850 and 200 B.C. The site is located at the crossroads of *selva* (tropical forest)-coast and north-south highland routes (Figure 1), at 3,200 m elevation in the upper Mosna Valley. The U-shaped center has two main temples (the old temple, believed to be the first one built, and the new temple, an extension or addition to the old structure), a small sunken circular plaza, and a large rectangular plaza flanked by lateral constructions. The site relates to the pan-Andean stylistic horizon of Chavín and is associated with the spread of Chavín ideology. Fringed creatures, supernatural beings with feline, raptorial bird, and snake-like attributes are carved on stone slabs, columns, and monoliths. The Lanzon, a 5-m-high sculpture, is found within one of the many galleries of the old temple. The ceremonial center is surrounded by a settlement that reaches proto-urban size by 250 B.C. Due to its location, religious importance, and the ceramic offerings found in Chavín, this site has been interpreted as a pilgrimage center (Keatinge 1981; Lumbreras 1974). Its economic importance is reflected by the presence of nonlocal commodities like obsidian, ceramics of foreign style, and products from the tropical forest and Pacific coast. *Spondylus* shells from the warm waters of coastal Ecuador are another example of long-distance trade.

Chavín influence has been felt in many regions of Peru, in both the highlands and along the coast. Many sites bear stylistic traits that link them to Chavín ideology. Ceramics, textiles, bones, carved stones, and clay friezes testify to this cultural affiliation. The spread of Chavín ideology and style, however, is not clearly understood. Chavín de

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Huantar is seen as representing a synthesis of earlier traditions and a center from which ideas, if not objects, radiated. Indeed, Chavín-style ceramics are common at many Peruvian sites. It was, however, not certain if their presence was the result of imitation (diffusion of ideas or styles) or trade (diffusion of objects). This question prompted the present INAA (instrumental neutron activation analysis) study, which completes earlier provenance studies with petrography and XRF (x-ray fluorescence) analyses of Chavín ceramics (Druc 1998a). A few compositional studies had been previously undertaken but not at a regional level and with provenance in mind. These earlier analyses are first reviewed to place the present study in perspective. Methodology and results follow.

A Review of Chavín Ceramic Analyses

Although stylistic analysis offers insight into the provenance of ceramics, compositional analysis of the paste helps to differentiate local products from imports, thus providing a means to investigate interregional interactions. The initial compositional studies of ceramics from Chavín de Huantar were undertaken in the early 1980s. The first study, a petrographic analysis of nine ceramic thin sections by Robert Tracy, was published in Richard Burger's (1984) excavation report. The samples came from ceramics found outside the ceremonial center, in the surrounding Chavín settlement. Tracy identified several mineralogical compositions (with quartz, plagioclase, biotite, hornblende, metamorphic, fine-grained volcanic, and plutonic igneous rock fragments). His observations correspond to my analyses.

The second study, using Mössbauer spectroscopy (MS), instrumental neutron activation analysis (INAA), and X-ray diffraction (XRD), was conducted by a German team (Salazar et al. 1986) on 61 Chavín sherds from an interior corridor of the old temple of Chavín, 50 surface finds (Chavín), two ancient soil samples, and one modern clay sample. The aim of the study was to classify the samples and learn about firing procedure. The hierarchical clustering of the INAA results produced five groups with chemically distinct pastes. The largest group included 57 Chavín and post-Chavín ceramics, and the recent clay sample. It was therefore assumed that the wares had been locally produced. The MS analysis indicated that the ceramics were fired in a reducing atmosphere followed by an oxidation phase. X-ray diffraction (XRD) identified some of the minerals within the ceramics: black talc and feldspar for the main group, and amphibole crystals for some of the other samples.

These two studies showed that ceramics at Chavín de Huantar had varied compositions and some were of nonlocal origin. Stylistic analysis had produced a similar conclusion (Burger 1984; Lumbreras 1977, 1993). Based on style, northern and coastal origins were proposed for the nonlocal wares.

Another compositional study (MS, INAA, thin section microscopy) was conducted by the same German team (Lumbreras et al. 2003) on 70 sherds from the Ofrendas Gallery of Chavín de Huantar. This gallery is famous for more than 500 fine bowls and bottles, believed to be offerings left in the gallery on multiple occasions (Lumbreras 1977, 1993). The Ofrendas material is, however, stylistically different from the other ceramics from the ceremonial center or the surrounding settlement. The hierarchical clustering of the INAA results conformed to stylistic groups within the Ofrendas material. Gebhard et al. (1996) suggest a nonlocal provenance, but no comparative material from other sites was analyzed to allow identification of origins. Stylistic affinities point to the central and north coast, and to the northern highlands (Burger 1984; Lumbreras 1993).

Until 1994, no comprehensive study of a regional scale had been attempted to understand how pottery was produced in the Chavín area. Was it made at different workshops? Were Chavín-style ceramics centrally produced and then distributed? No ceramic workshops or kilns have been found in Chavín de Huantar or in the nearby region.

A study of ceramic production and distribution in the Chavín sphere of influence (Figure 1) was conducted in 1993–1997 (Druc 1998a, 1998b), using petrography and energy dispersive X-ray fluorescence analysis (EDXRF). The study included 284 ceramics and 69 modern soil and modern clay samples from six sites located in five different highland and coastal regions (Chavín de Huantar, Huaricoto, Pallka, Ancón, and two small sites in Nepeña). The analysis results showed that most of the Chavín-style ceramics in the Chavín sphere were

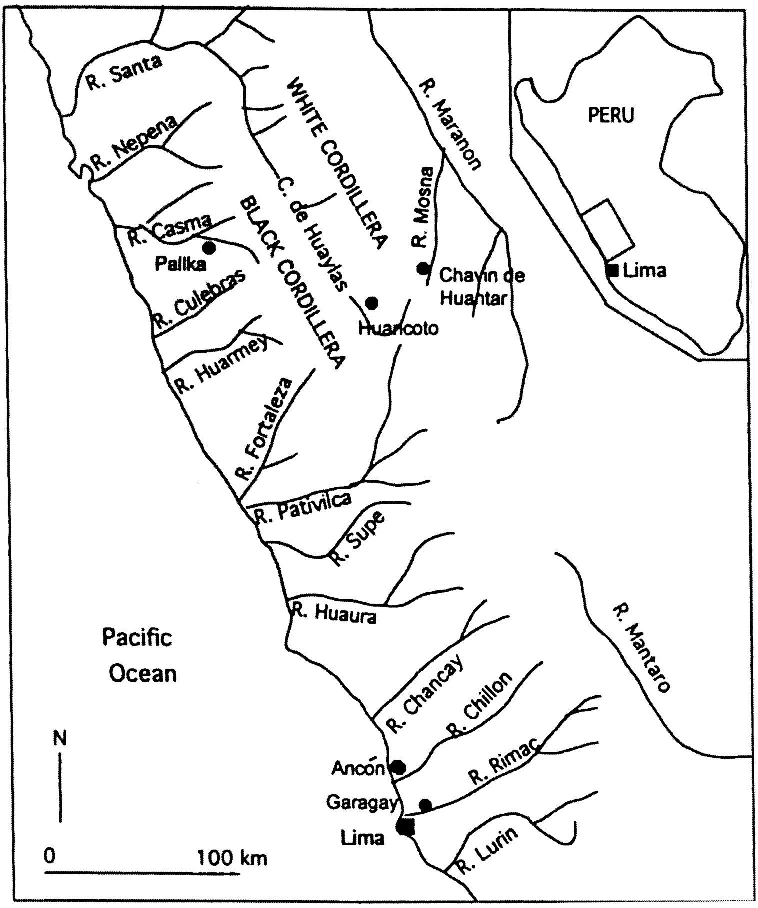


Figure 1. Study region and sites (after Druc 1998a, Figure 4).

locally made imitations. Furthermore, it proved a small-scale exchange of bottles and fine bowls into the ceremonial center of Chavín de Huantar, (and not outward from Chavín). This conforms to the idea of Chavín de Huantar as a pilgrimage center. The study also yielded new insights into ceramic production. Petrographic analysis showed that the wares were produced in several workshops or production areas at each site, and that bottles were very often produced with a fine paste.

The pattern of production at the ceremonial center of Chavín de Huantar, however, proved more complex than at any other site studied. The ceramics analyzed in the 1993–1997 study come from the ceremonial center (n = 86) and the associated settlement (n = 23). As seen in prior studies, the ceramics show high compositional heterogeneity. Six different compositional groups and subgroups were petrographically identified, along with unattributed specimens of atypical composition. Two main groups are identified as local. One is characterized by a volcanic-derived paste (pyroclastic sand with quartz, plagioclase, biotite, hornblende, welded rhyolitic tuff fragments), and the other by an intrusive-derived paste (quartz, plagioclase, biotite, augite, granodiorite fragments). A third group of mixed intrusive-sedimentary composition was also found to be local, on the basis of geological and abundance criteria. Subgroups are granulometric or modal variants. Ceramics with exotic pastes display metamorphic composition (quartz-muscovite-schist) or rare compositions (felsic, granitic) not corresponding to local geology (for details see Druc 1997, 1998a). The EDXRF analysis suggested that at least 30 percent of the ceramics found in Chavín de Huantar were of nonlocal production. This figure conforms to the finding of the INAA study by Salazar and colleagues (1986), where 25 percent of the wares were found to be nonlocal (20 out of 76 wares).

Table 1. Analyzed Sample of Chavín Ceramics by Types and Vessel Forms.

	Urabarriu	Chakinani	Janabarriu	Chavín-Style	Atypical
Bowls	4	6	15	1	4
Ollas	8	3	5	1	2
Jars	1	4	3	0	3
Bottles	1	8	5	3	3
Total	14	21	28	5	12

Although x-ray fluorescence worked well at the intersite level, it failed to distinguish individual groups at the intrasite level and would not partition the corpus as accurately as petrographic classification. For this reason, and to get a clearer picture of ceramic production at Chavín de Huantar, it was decided to submit the Chavín corpus to another round of analysis, this time using neutron activation. In addition, the chemical results could be triangulated with different sets of data: petrographic, geological, stylistic, archaeological, and ethnographic. The results of this last study are presented here.

The methodology will be described first. The results are then discussed in light of the chemical, mineral, and stylistic data. Finally, the discussion is enlarged to reach a higher interpretative level with regard to ceramic production through time in relation to the development of Chavín de Huantar and interregional interactions.

Methodology

Several questions defined the objectives of the INAA study. Its goal was identifying and interpreting intrasite chemical groups and investigating compositional differences in relation to time and space. How many different chemical groups are there in Chavín de Huantar ceramics? What do they reflect? Is there a change in ceramic composition through time? Is there a centralization of production? The sample is comprised of 81 specimens from Chavín de Huantar (56 sherds, and 25 that had already been used for EDXRF), and 20 pressed powder pellets from sherds from the sites of Pallka, Huaricoto, Ancón and Garagay (Figure 1) for comparative purposes. No binding agent was used for preparing the pellets, which were kept in a desiccator after use. The samples have known mineral composition from the previous analyses.

The Chavín sample comes from the three occupational phases and related styles identified by Richard Burger (1984, 1988) at Chavín de Huantar: Urabarriu (850 to 460 B.C), Chakinani (460 to 390 B.C.), and Janabarriu (390 to 200 B.C.). The different ware forms in the sample are representative of those found on the site: bowls, neckless ollas, jars, and bottles (Table 1). The ceramics from the ceremonial area (n = 70) come from excavations by Wendell Bennett (1938, 1944), and bear identification numbers 3700 and above (Table 2). The ceramics from the ancient settlement of Chavín de Huantar outside the ceremonial center (n = 11, ID# B1 and above) come from excavations by Richard Burger (1984). Table 1 shows the number of samples analyzed by type and vessel form. The Urabarriu, Chakinani, and Janabarriu types are specific to the respective time periods of the site occupation. The Chavín category groups ceramics of Chavín style, which could not be identified as Urabarriu, Chakinani, or Janabarriu type ware. Most of the analyzed ceramics from Chavín de Huantar are represented in Figure 2. They are grouped according to the chemical and mineralogical groups in Table 3. Vessel forms per group are listed in Table 2.

The neutron activation analysis was conducted at the Smithsonian Center for Material Research and Education (SCMRE) and at the nuclear reactor facility of the National Institute of Standards and Technology (NIST). Neutron activation analysis in general, and the procedure followed at NIST, have been amply described elsewhere (Bishop and Crown 1994; Bishop et al. 1982; Glascock 1992; Perlman and Asaro 1969). James Blackman and Ronald Bishop conducted the elemental analysis. The samples were prepared from 200 to 400 mg of paste drilled from the sherd cross-sections and from the pressed powder pellets. Standards were run at the same time with the powder samples enclosed in plastic vials. Of the 31 elements commonly measured with INAA, the following 18 elements were used for the statistical analysis: Na, K, Sc, Cr, Fe, Rb, Cs, Ba, La, Ce, Sm, Eu, Tb, Yb, Lu, Hf, Ta, Th.

Table 2. Vessel Forms per Compositional Group (See Table 3 for Group Characteristics).

Group 1		Group 3		Group 6	
3742a	Urabarriu bowl	3780a	Urabarriu olla	3784f	Atypical bottle
3742b	Urabarriu olla	3783a	Janabarriu jar	B15	Chakinani bottle
3764e	Urabarriu olla	3786c	Urabarriu bowl	3790B	Atypical bowl
3786e	Urabarriu olla	P23	Pallka bottle	3787d	Urabarriu bowl
3786h	Urabarriu bowl			3787B	Atypical bowl
3686i	Urabarriu jar			3787a	Atypical bottle
3745c	Chakinani jar	Group 4		3754B	Chakinani bottle
3748c	Chakinani jar	3748b	Urabarriu jar		
3748d	Chakinani olla	3764f	Urabarriu bottle	Group 7	
3780b	Janabarriu olla	3774	Chavín bowl	3764b	Janabarriu jar
3781c	Janabarriu bowl	3783d	Janabarriu bowl		
B19	Chakinani bowl	B21	Janabarriu bowl		
3781D	Atypical olla	3743a	Chavín bottle	Group 8	
B17	Chakinani bowl	3748e	Chavín bottle (spout fragment)	3775a	Janabarriu bowl
3757B	Chakinani bowl	B14	Chakinani bottle (spout fragment)	3786f	Urabarriu jar
3787A	Urabarriu olla	3755a	Atypical bowl	3785	Urabarriu molcajete
3787b	Janabarriu bowl				

Group 2		Group 5	
B4	Janabarriu bowl	3762	Atypical bottle
3781h	Janabarriu olla	3764a	Atypical jar
3781i	Janabarriu olla	3786g	Atypical jar
3781d	Janabarriu bowl	3755b	Chakinani bottle
3780H	Janabarriu bowl	3745a	Chakinani jar
3783b	Janabarriu olla	B20	Chakinani bowl
B13	Chakinani olla	3765a	Chakinani bottle
3786b	Urabarriu olla	3784I	Janabarriu bottle
3784c	Janabarriu bowl	B8	Janabarriu bottle
3780c	Janabarriu bowl	3783c	Janabarriu bowl
3781j	Janabarriu jar	3780e	Janabarriu bowl
3781k	Janabarriu jar	B21	Janabarriu bowl
3787c	Janabarriu bowl	P3	Pallka olla
3781e	Janabarriu bottle	P4	Pallka olla
3783H	Janabarriu bottle	P14	Pallka bottle
3700	Atypical bowl	P24	Pallka bottle

The elements were chosen according to smallest analytical error, expected values in ceramics, and inspection of the raw data. The alkali Cs and Ba were important discriminators for this specific set of samples and were thus included in the statistical analysis. Raw data were log transformed and data were explored via multivariate analyses.

Different clustering methods as well as principal component analysis (PCA), using both covariance-variance and correlation matrices, were explored. Cluster analysis was conducted using log-transformed data, mean Euclidean distances, and hierarchical agglomerative complete and average link methods. Both linkage methods proved conclusive in grouping the samples, yielding strong group overlap, which suggests genuine patterning. The results of the two clustering methods will be discussed as they provide complementary information on ceramic production in Chavín de Huantar. The average linkage allowed for more homogeneous clusters in terms of the mineral composition of the samples. Cluster analysis, however, imposes different patterning depending on the method used and therefore requires external validation of the results (Aldenderfer 1982; Baxter 1994; Shennan 1988). Consequently, working with the raw listings was important in evaluating the clusters, along with information on style and mineralogy. In principal component analysis, the variance-covariance matrix was preferred over the use of a correlation matrix. The latter centers the distribution, an approach not recommended for very

Table 3. Classification of the Ceramic Samples Based on Hierarchical Clustering by the Average-Link Method.

Groups	N 101[a](81)	Description[b]	Mineralogy[c]	Chemistry	Source Area
Group 1	18; 17.8%; (22.2%)	red slip ollas/bowls, combed ollas/bowl; 1 circle-dot bowl, 2 jars, 1 atypical olla; U, C, 3J	volcanic tuff, pyroclastic material	low Cr, Yb, high Rb, Ce, Hf	local highlands
Group 1a	3; 3%; (3.7%)	1 circle-dot bowl, 2 jars; J, C, atypical	volcanics, pyroclastic material	high Cs	non-local/regional?
Group 2	19; 18.8%; (23.4%)	5 ollas, 2 undec, 3 dec & 2 circle-dot bowls, 4 bottles, 2 jars, 1 atyp bowl; J, 3C, 2U	basic-interm. intrusive +2 sed/intr		local highlands
Group 3	4; 3.9%; (3.7%)	dec. olla & jar, bowl, +Pallka bottle; 2U, 2J	2 volcanic, 2 granitic		regional? Non local
Group 4	12; 11.9% (14.8%)	6 bottles, 3 bowls, 2 circle-dot bowls, 1 atyp. Jar; U, C, J	fine paste + sedimentary		valley bottom, partly local
Group 5	16; 15.8% (11.9%)	4 Pallka +12 Chavín sherds, ollas, bottles, jars, circle-dot olla + bowl, atypical bottle + jar; C, J	intrusive, sedimentary, 1 volcanic		multiple origins Pallka + non local
Group 6	7; 6.9%; (8.6%)	bottles, atyp. & dec. bowls and bottles; U, C, atypicals	sedimentary fine paste	low Cs	non local
Group 7	12; 11.9%; (3.7%)	3 Chavín, 3 Garagay, 3 Huaricoto, 3 Ancón; ollas, bowls, bottles, jars; U, C, J	mixed	high Cs	non local, Huaricoto, Garagay, Ancón
Group 8	3; 3%; (3.7%)	olla, jar, circle-dot bowl; 2 U, J	qz-muscovite schist	very high As, Rb, La, Ce, Nd, Sm Eu Tb, Yb, Lu, Th	non local origins
Group 9 + Outliers		7; 6.9%; (1.2%)	Chak bowl 3708A, 2 Huaricoto, 2 Ancón, 2 Garagay	pellitic, metam. + coastal sand	non local

[a]Percentages are based on 101 samples (all sites included), and 81 samples for Chavín de Huantar only (in parentheses)
[b]U = Urabarriu, C = Chakinani, J = Janabarriu, dec = decorated, atyp = atypical.
[c]sed = sedimentery, intr = intrusive, metam = metamorphic, interm = intermediate, qz = quartz.

heterogeneous samples, as is the case with the ceramic compositions from Chavín de Huantar.

Results and Discussion

Eight compositional groups of archaeological significance were identified in the hierarchical classification of the 56 samples from Chavín de Huantar and 20 comparative samples from four other sites. These chemical groups are presented in Table 3, along with information on mineralogy, form, style, chemistry, and possible source areas; the sherd samples for each group are illustrated in Figure 2.

The PCA scatter plot for ceramics from Chavín de Huantar shows five groups (Figure 3). The main chemical variables responsible for this classification are (by order of importance): Cs, Th, La, Ce, Rb, and K, for PC1, and CR, LU, YB, SC for PC2. The first principal component (PC1) explains 42.34 percent of the variance and the second (PC2) 23.25 percent.

The chemical groups show internal heterogeneity. Compositional variability within clusters is above 17 to 20 percent for most of the elements, suggesting multiple origins for the samples in the same cluster or the existence of several workshops using clay from different localized sources in the same production area. Consequently, representation in multivariate space, such as a PCA scatter plot, is not easily interpreted visually. The groups are spread out and give the impression of being intermixed because of the reduction in the number of dimensions to two or three, particularly so when the samples from the comparative sites are included. Nevertheless, the chemical groups point to production areas with internally similar geochemical environment. Due to the degree of compositional diversity in Chavín de Huantar ceramics, the sample classification by cluster analysis on log-transformed data is more informative than the PCA and provides the basis for the discussion.

Sample Classification

The hierarchical classification reflects the main petrographic groups observed in mineral analysis: acidic volcanic, intermediate to basic intrusive, fine/sedimentary, and mica tempers. The clustering constructed with the complete link method follows an acidic to basic trend, with the acidic volcanic samples on one end of the dendrogram and the basic intrusive samples on the other. Elemental variations occur accordingly, allowing the characterization of the mineral trends in terms of chemical tendencies. Table 4 gives the concentration ranges for each compositional group derived by this method. Values outside the range are in parentheses, while values for outliers are not given. The group numbers in parentheses refer to the groups formed by average linkage listed in Table 3. Differences between the acidic and basic poles are mostly seen among trace elements. The acidic pole is characterized by low Sc, and high Rb, Cs, La, Ce, and Th (the reverse is true for the basic pole). Iron content shows differences according to the mineralogy or provenance within the clusters, with a low range in the volcanic group and a higher one in the basic-intermediate intrusive group. Exceptions in chemical trends are observed for ceramics from the coast (Ancón and Garagay), Huaricoto, a few Chavín samples, and the three mica-tempered ceramics. Samples from the comparative sites are found in compositional groups 3, 5, 7 and 9 and as outliers.

In the complete-link dendrogram, some groups encompass samples with different temper composition, although similarities in mineral content are observed. Chemical variations that exist in the clay may not be observed in petrography due to the resolution of the microscope. The clay matrix, which often represents more than 50 percent of the paste of the Chavín ceramics (Druc 1997), is largely uncharacterized. Consequently, finer distinctions are reached with INAA than with petrography when dealing with fine or low-tempered fragments. Samples with similar temper may thus display chemical variations related to the use of a different clay paste. This is the case for the two Garagay ollas, G4 and G6, which were both tempered with crushed granodiorite but had differences in Cs, Ba, Tb, Ta, Th, and Rb content. Their mineralogical composition is very different from the rest of the Ancón and Garagay ceramics (see Druc et al. 2001), hence their separate clustering.

The dendrogram built using the average-link method does not follow the same acidic to basic trend in the ordering of the clusters. Nevertheless, the constitution of the groups is similar. The average-link method yields a more homogeneous clustering of the samples relative to their mineralogy.

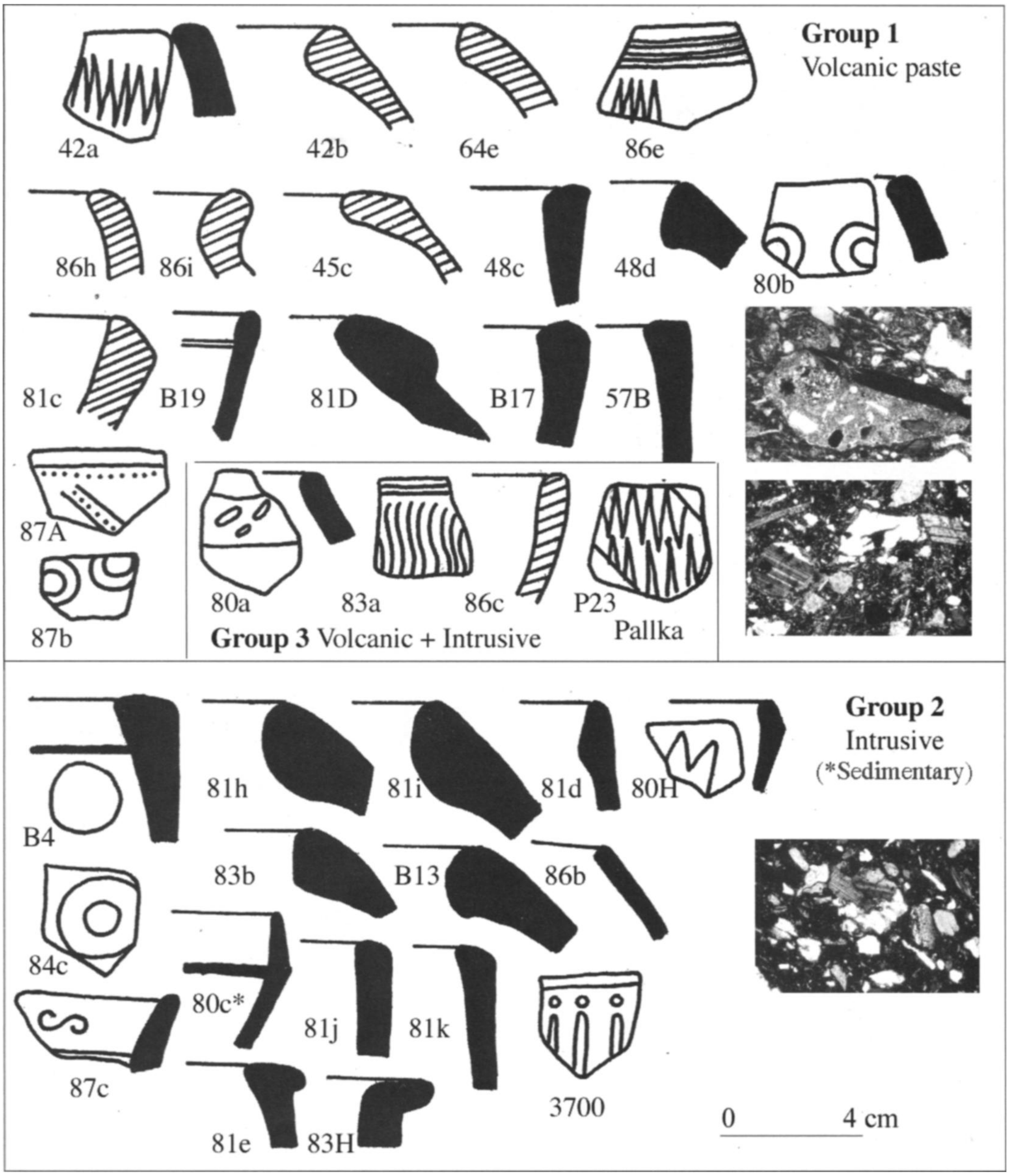
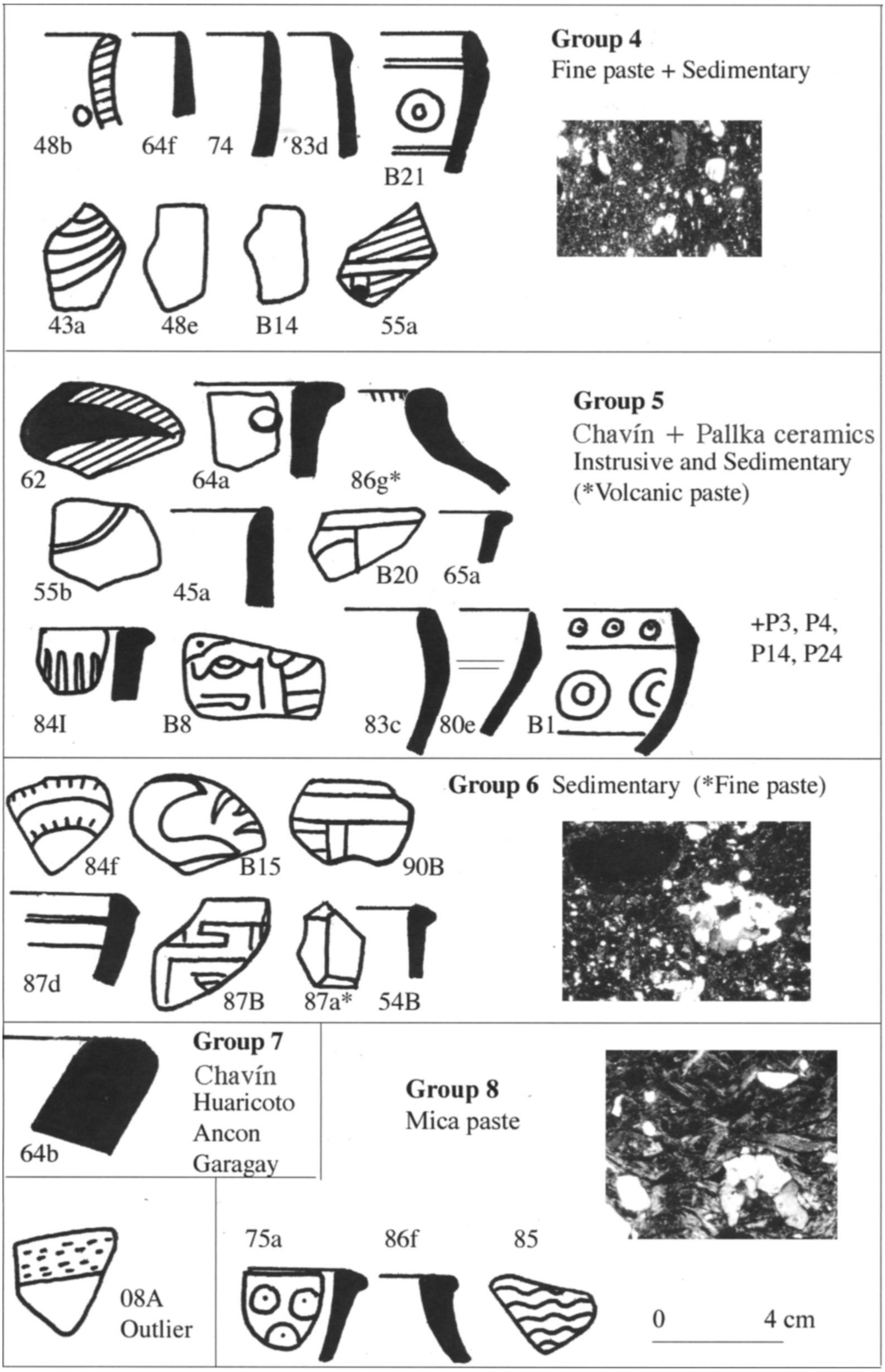


Figure 2. The ceramic sample from Chavín de Huantar grouped according to chemistry and mineralogy. Identifying numbers for samples collected by Bennett (1938, 1944) in this figure correspond to sample numbers listed in Tables 2 and 5, but lack the initial "37"; e.g., 42a corresponds to 3742a in Tables 2 and 5.



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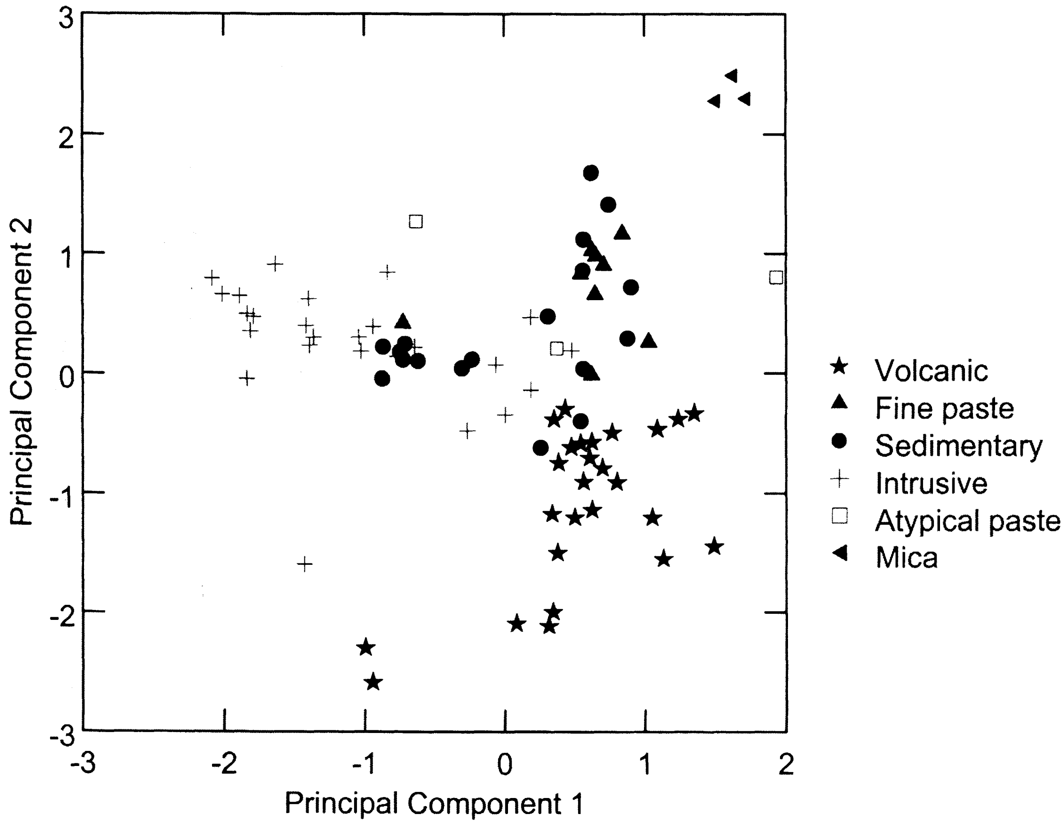

Figure 3. PCA scatterplot of ceramics from Chavín de Huantar on the first two principal components. Covariance matrix, log transformed data.

Cs as Site Discriminant

In order to allow a closer examination of the data and to see which elements characterize each group, the chemical raw data were listed following the order of the hierarchical clustering. One element in particular, cesium (Cs), proved to be important in the classification of the samples. Cesium appears to be a site discriminator, with high Cs content (above 11 ppm) suggesting a nonlocal provenance for the Chavín sherds. However, this criterion is not the sole indicator of foreign provenance and it must be applied in conjunction with other information like the style, mineralogy, and archaeological provenance of the sherds.

Cesium is likely to be found in late-stage-formation crystals in acidic rocks, in leucite, feldspar, and similar minerals (Bruce Velde, personal communication 2001). It is also found as traces in black mica (biotite) (Foucault and Raoult 1995), in white mica (muscovite) in pegmatite, but not in metamorphic rocks (Bruce Velde, personal communication 2001). This point is important to understand the relatively low Cs content in the ceramics tempered with quartz-muscovite schist (mica temper, Table 3). These wares are nonlocal, as no metamorphic rocks are known in the region of Chavín. High cesium content may also point to the use of a micaceous clay to produce the ceramics, due to the preferential absorption of Cs associated with micaceous clays over geological time (Ron Bishop, personal communication 1998).

As a corollary, ceramics found in Chavín with Cs content below 11 ppm are probably local. This is observed for all the ceramics in the basic to intermediate intrusive group and the sedimentary-intrusive group, and for most ceramics in the volcanic group. Their mineralogy also corresponds to local resources around Chavín de Huantar.

Table 4. Concentration Ranges Within Complete-Link Clusters.

Characteristics	Sc (ppm)	Fe (pct)	Rb (ppm)	Cs (ppm)	La (ppm)	Ce (ppm)	Th (ppm)
Volcanic n = 18 (Gr1)	6.5–11	3.2–4.7	67–112 (54)	5–8 (17, 23)	26–62 (90)	70–169 (47)	7–15
Chavín + Pallka n = 16 (Gr5)	10–22	3.4–5.4	75–104 (86)	4–12	20–40	46–87	9–18
Coast + Huar + 2 Chavín n = 14 (Gr7)	14–18 (4–9)	1.7–5.3	101–149	11–39	22–35	42–71	8–15
Mica temper n = 3 (Gr8)	18.3–18.6	5.2–5.3	130–155 (57, 78)	6–11	113–114 (78)	120–132	28–30
Fine paste +sedimentary n = 18 (Gr4)	10–24	3.3–6.4	91–117	7–12 (15, 17, 22, 36)	29–44 (55)	61–96 (120)	10–14 (19)
Sedimentary + intrusive n = 16 (Gr6 + Gr2)	20–25 (17, 33)	5.4–7.4	50–77	3–6	14–27	34–51 (57, 64)	4–11
Basic–interm intrusive n = 12 (Gr2)	24–32	6.2–8.2	28–55	1.5–4	14.5–20	31–47	2.8–3.7

Element values in parentheses fall outside the identified range.
Group numbers in the first column refer to groups derived by the average-link method (See Table 3).

The chemical tendency shown in Table 3 and the associated mineralogy suggest that Cs is a component of acidic volcanic rocks, while it is of low abundance in ceramics with intermediate to basic intrusive paste. Its presence is linked to the geological environment of the source area for ceramic production. The high Cs content of the coastal ceramics from Ancón and Garagay, and Huaricoto in the Callejón de Huaylas, is probably related to the volcanics of those regions. On the contrary, the Mosna-Chavín region is characterized by intrusive-granodioritic and sedimentary geology, which explains the lower Cs content in local Chavín ceramics.

Non-Local Ceramics at Chavín de Huantar

Based on cesium content, mineralogy, local geology, and style, several ceramics found in Chavín de Huantar were identified as nonlocal. In the cluster analysis of the INAA results, they stand out as outliers or they group separately from the main Chavín ceramics (Groups 1 and 2). Most of the stylistically atypical ceramics are found in Groups 7, 6, and 5.

High Cs content is found in about half of the stylistically atypical wares from Chavín (7/12), thereby strengthening their nonlocal interpretation. These include four jars (3742c, 3748b, 3764a, 3786g) and three bowls (3708A, Mosna bowl 3755a, oversized bowl 3764b). Chakinani bowl 3708A has very high Cs (56.90 ppm) and low Na and Fe values. Its paste is not tempered and extremely fine, unlike any other paste found in Chavín. An earlier microprobe analysis of the clay matrix of bowl 3708A showed Si/Al ratios of 4.20 to 4.91, well above local Chavín ceramics with ratios from 1.98 to 2.00 in the illite-montmorillonite range (Druc 1997; Newman 1987).

The high Cs content of several additional sherds suggests they are not local, although they are of Chavín style. This is the case for two jars (3744, 3745a), four circle-and-dot bowls (B21, 3775a, 3787b, 3784d), three plain bowls (B1, 3783c, 3783d), olla 3741d, and bottle 3755c. Sherd 3774, with high Cs content, comes from a concave undecorated bowl found in a cell in the ceremonial area (Bennett 1938) and is probably late Chavín in date. It has a granitic/metamorphic mineral composition with very coarse, altered rock fragments, dissimilar to the usual basic to intermediate intrusive composition of the local Group 2. Its context suggests that it is an offering (Bennett 1938).

The other atypical bowls and bottles (3762, 3787B, 3790, 3784f, 3787a) have normal Cs content but they cluster separately from the local ceramics. They have sedimentary or intrusive pastes. Their style, which is clearly not Chavín, and chemistry suggest nonlocal production.

Atypical olla 3781D clusters with outliers 3787A and B19 within the volcanic local group. Although of uncommon shape, this ware could be from the Mosna region. Similarly, three volcanic-tempered ceramics form a subgroup joining local Group 1, but they are probably of different origin. These are Janabarriu circle-stamped bowl 3787b, Chakinani jar 3744, and atypical red-slipped jar 3742c. Bowl 3787b and jar 3744 lack the typical welded tuff fragments of the local group, but display the same monomineralic grains. They have a high Cs content, suggesting a nonlocal origin. Furthermore, jar 3744 has a slip containing quartz unlike any other local slip, while the use of volcanic temper in bowl 3787b is uncommon during Janabarriu times.

Three ceramics from Chavín and Pallka bottle P23 (Group 3) cluster separately from the intrusive local Group 2. These are Urabarriu bowl 3786c with intrusive paste, Urabarriu decorated olla 3780a with volcanic temper, and volcanic-tempered jar 3783a with graphite slip over a textured body. The latter is probably a Chakinani ware. The Cs content of these ceramics is not significantly high, but the mineralogy differs from the local intrusive or volcanic groups. The varied mineralogy of this group suggests at least two distinct production areas. The two volcanic-tempered wares lack the welded tuff fragments of the local group and have pyroxene crystals in the clay matrix. They could be regional productions from the White Cordillera. Bottle P23 found at Pallka has a more acidic-intrusive paste than the local Chavín granodiorite paste and could not have been made in Chavín.

Two other volcanic-tempered wares do not cluster with the local volcanic group. Their high cesium content suggests a nonlocal origin. This is the case for Janabarriu oversized bowl 3764b and atypical jar 3786g. They are found in the chemical clusters 7 and 5, suggesting an origin outside the Mosna Valley. The origin of bowl 3764b is discussed below.

The final clearly nonlocal group is the mica group (Group 8, Table 3). The white mica flakes in the clay matrix come from crushed quartz-muscovite schist fragments added to the clay by the potter. This mineralogical composition is foreign to the Mosna Valley geology. A high Cs content was expected for this group, but it is relatively low (6.38, 7, and 11 ppm) due to the metamorphic origin of the temper. In this group, the elemental composition for the Janabarriu circle-impressed bowl 3775a differs from that measured for the two Urabarriu wares, suggesting a different origin.

Table 5 summarizes these results. Nonlocal ceramics at Chavín de Huantar vary in form, paste composition, and date, as will be detailed below. The provenance diversity for volcanic-tempered wares bears particular significance when considering the production scenario throughout the Chavín occupation of the site. Compositional diversity suggests multiple nonlocal origins. Nonlocal wares reach 30 percent, and up to 40 percent, if one considers the wares included in the chemical groups 3 through 8. However, the local production of several ceramics in the fine ware Group 4 and mixed composition Group 5 cannot be ruled out.

Local Production at Chavín de Huantar and Local Geology

Local geology and the abundance criteria (Harbottle 1982; Shepard 1968) determine the local character of a group. Groups 1 and 2 (Table 3) consist of ceramics with mineral compositions matching the local geology. They are termed "local groups" and represent 22.2 and 23.4 percent of the Chavín sample. Part of Group 4, characterized by a sedimentary paste, is certainly also local. The three main petrographic groups identified in Chavín ceramics (volcanic, intrusive, and sedimentary) are composition types found within a 20 km radius of the site (Figure 4).

The local geology consists of Quaternary alluvial and glacial deposits at the bottom of the valley, sedimentary rocks of Late Jurassic age (Chicama Formation: dark shale and dark limestone, sandstone and tuff), and Lower Cretaceous sedimentary rocks (Oyón Formation and Goyallarisquisga group: shale, slate, coal seams, limestone quartzite, and arenite) on the valley slopes (Cobbing et al. 1996:73–74; Turner et al. 1999). Sediments with minerals and rock fragments of

Table 5. Non-local Ceramics at Chavín de Huantar.

Atypical wares with high Cs content - N 6/81 (7.4%)		
3708A	outlier	pellitic untempered paste; decorated light gray bowl, Chak period
3742c	Gr 1	C1, red slip jar, prob. Urab period
3748b	Gr 4	B1, mix sed, volc, intr.; Urab red slipped jar
3755a	Gr 4	F mix sed, few intr, no hornblende; Mosna orange slip bowl with red paint
3764b	Gr 7	C1 many micas in the paste; Jan oversized red slipped bowl
3786g	Gr 5	C1 pyroclastics, very coarse grains; incised jar
Chavín style non-local wares with high Cs - N 8/81 (9.9%)		
3741d	Gr 7b	B2; black olla
3744	Gr 1	C3 coarse volc sand, no tuff, crushed quartz slip; oxidized Chak jar
3755c	Gr 7	F fine-sand grains of basic intrusive origin in mica paste with mixed lithics (intr, sed, volc); Chak bottle
3774	Gr 4	D; reduced Chavín bowl
3783d	Gr 4	B1; Jan red slip bowl
3784d	Gr 4	B1; Jan circle-and-dot black bowl
3787b	Gr 1	C3 Jan circle-and-dot black bowl
B21	Gr 4	B1 grains perpendicular to walls; Jan circle-and-dot brown bowl
Atypical wares with normal Cs content (cluster separately from the "local" wares) N 5/81 (6.1%)		
3762	Gr 5	granitic material, not from White Cordillera; bichrome bottle chamber, zoned red with graphite, probably Jan
3784f	Gr 6	B1; incised bottle chamber, dull beige paste and very fine walls
3787a	Gr 6	F; fragment from square red bottle
3787B	Gr 6	A2; black bowl with red paint within incision
3790	Gr 6	B1; incised bowl
Chavín style wares, normal Cs content (cluster separately from the "local" wares) N 4/81 (4.9%)		
3765a	Gr 5	granitic temper, medium to coarse sand grains; Chavín bottle
3775a	Gr 8	E; Jan circle-and-dot bowl, brown micaceous slip
3785	Gr 8	E; Urab? Body fragment with interior net impressions
3786f	Gr 8	E; Urab red slip jar

Legend: A1, A2 Material of basic to intermediate intrusive rock in the paste.
B1, B2, B3 Material of sedimentary origin in the paste.
C1, C2, C3 Material of volcanic origin (pyroclastics) with embayed quartz, plagioclase, green hornblende,brown biotite, and welded tuff fragments (in C1).
D Acid intrusive rock fragments and very altered minerals, very coarse grains.
E Paste tempered with quartz-muscovite schist fragments.
F Fine paste with few inclusions of mixed origin and fine to medium sand grains.
Urab = Urabarriu, Chak = Chakinani, Jan = Janabarriu, sed = sedimentary, intr = intrusive; volc = volcanic.

mixed sedimentary composition are found at the valley bottom.

The White Cordillera is composed of a granodioritic-tonalitic batholith, intruded into volcanic and sedimentary sequences (Cobbing et al. 1981; Egeler and De Booy 1956). Green hornblende is a chief component of the White Cordillera granodiorite (Robert Strusievicz, personal communication 1999) and is found in quantity in the thin sections from the Chavín intrusive group. Glaciers cover the peaks of the White Cordillera above 5,000 m elevation (Bodenlos and Ericksen 1955; INGEMMET 1995; Turner et al. 1999).

Sources of magmatic material are less extensive than intrusive rocks around Chavín. Volcanic compositions in the form of ignimbritic material and tuff fragments outcrop to the south in the Mosna headwater (Cobbing et al. 1996). Dacitic extrusives with welded tuffs outcrop 10 km south of Chavín at Pampa Junin (Egeler and De Booy 1956), a tributary of the Río Mosna, 1 km above the junction with Quebrada Tambillo on the road to Catac-Chavín. Rhyolitic tuff is also reported as stocks northeast of Chavín, above San Marcos near the Antamina mine (Bodenlos and Ericksen 1955). Green hornblende is present within the volcanic tuff

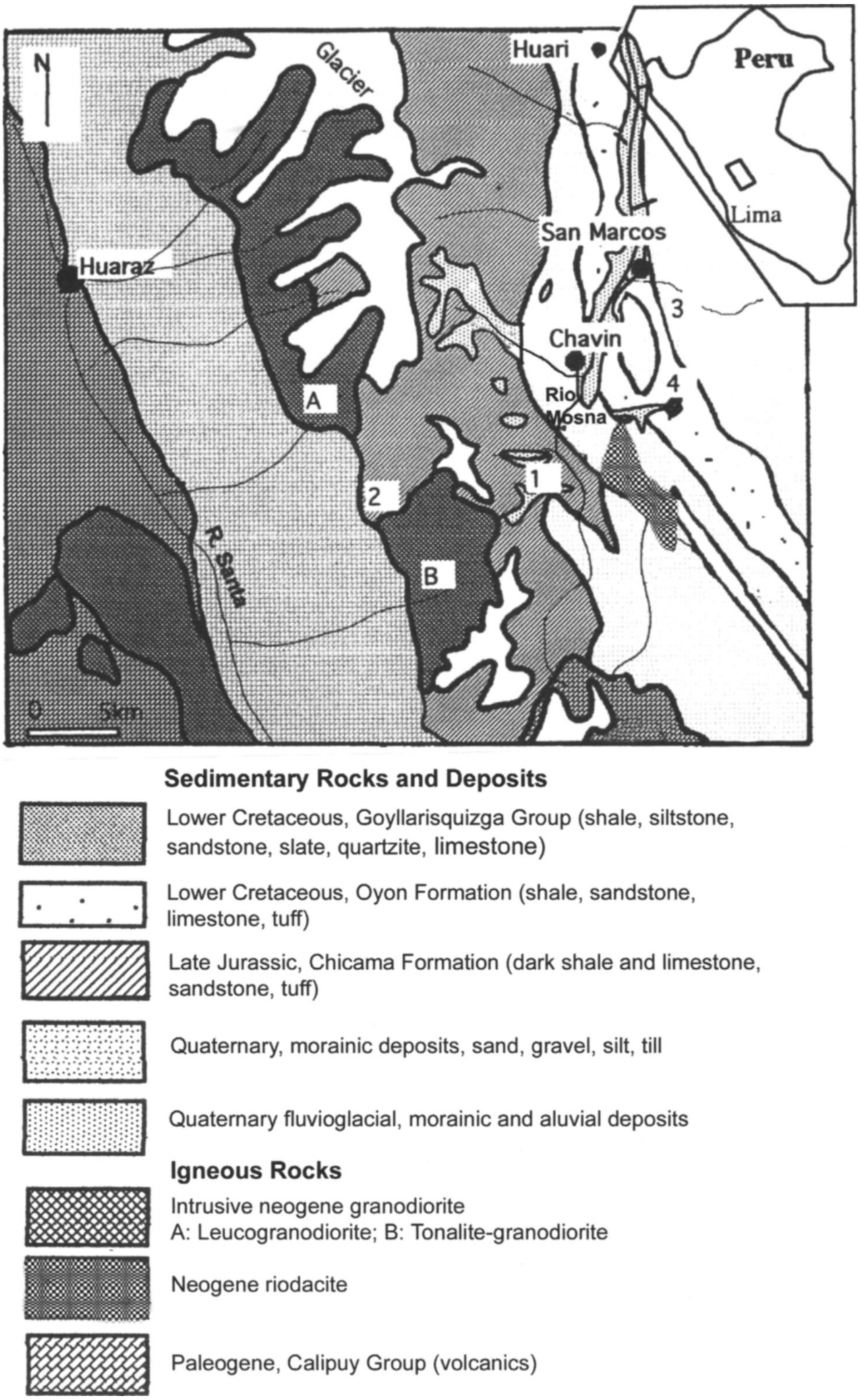

Figure 4. Geology of the Chavín de Huantar area (After Turner et al. 1999, Figure 2; Druc 1998, Figure 5; Cobbing et al. 1996, Map 20i). 1. Pampa Junin volcanics (dacitic tuff); 2. Quilloc volcanics (Rhyolite, dacite); 3. Atamina-Contonga volcanics (rhyolite); 4. Cerro Torregaga (riodacite).

fragments and in the paste of the volcanic-tempered sherds. This is peculiar because hornblende is normally brown in volcanics. Ignimbritic tuffs from the Black Cordillera have no hornblende (Robert Strusievicz, personal communication 1998 and 1999), which rules out a provenance west of the Río Santa for the tuff-tempered sherds found in Chavín.

Other sources of volcanic tuff are closer to the site. The Late Jurassic Chicama Formation underlying the Mosna Valley is composed of volcanic tuff along with dark shale, dark limestone, and sandstone (Figure 4; Turner et al. 1999:48–49). Although this formation could have been a source for the Chavín potters, its mixed sedimentary and tuff composition does not match the paste of the volcanic group. However, boulders of volcanic tuff are reported around the site and along the river banks (Turner et al. 1999:55), and they may be part of a rock fall or landslide from the upper valley slope to the east. Unfortunately, there has been no petrographic analysis of these boulders. However, it is likely that the local potters used these soft tuff rocks as tempering material.

The use of volcanic tuff was not restricted to pottery production. Two different kinds of porous volcanic tuff were used for carving some of the columns and tenonned heads of Chavín (Turner et al. 1999:55). It is likely that the potters were aware of this stone carving "industry" and may have benefited from it by using tuff debris. This implies that they would not have needed to go too far to get their tempering material, if stone carving was a local activity, as suggested by the amount of stone sculptures in Chavín.

There may well have been multiple ceramic production locations or workshops within the resource areas described above, which in turn may account for compositional variations related to spatial distributions. Ignimbritic or pyroclastic deposits represent a good example of such compositional variability, as their mineral assemblages vary by depth of deposit flow and distance from the source. This can account for the chemical heterogeneity observed within a single cluster. However, to confirm the location of the procurement areas, intensive sampling and petrographic analysis of sand and clay samples should be conducted to identify petrofacies (Miksa 2000).

Ceramic Production through Space and Time in Chavín

Eleven ceramic samples from the ancient settlement to the north and from around the ceremonial center were included in the analysis. They are dispersed through the hierarchical classification, together with those from the ceremonial area, suggesting that the chemical composition of the sherds is not linked to spatial distribution within the site area as a whole. In other words, no particular workshop was producing exclusively for the residential or ceremonial area or using a different source location. Variations are noted, however, with regard to paste composition linked to a particular occupation phase.

Ceramic Production during the Urabarriu Phase. Volcanic material is prevalent in Urabarriu and Chakinani ceramics (Group 1, Table 3). Only a few ceramics were produced with intrusive or sedimentary material. The few Janabarriu sherds tempered with volcanic material are probably nonlocal. The diversity of pastes within the volcanic group and the domestic character of the wares (ollas and jars) suggest a different production scenario than for later periods. The chemical diversity and the domestic character of the volcanic wares (ollas, bowls, a few jars) during the Urabarriu phase point to the existence of multiple small-scale producers around and above Chavín, while fine bowls and bottles were produced in or brought into the valley. Volcanic material resists thermal stress well (Rice 1987; Shepard 1968), which suits the domestic character of the Urabarriu wares. These wares reflect a demand for simpler, less-diverse forms than those of later periods. This pattern of multiple local production locations also is observed for other sites and is associated with compositional diversity within the coarse ware inventory, while fine bowls and bottles have a more homogeneous compositional profile (Chapdelaine et al. 1995; Druc 1998a). Burger notes the coarse execution of domestic wares from the highland sites surrounding Chavín de Huantar, which contrasts with a finer quality of production for the local wares in Chavín, suggesting the existence of different workshops supplying the hamlets and the center (Burger 1984:185). No paste analysis of ceramics from the highland sites was conducted, but the present analysis and ethnographic evidence suggest the presence of several potting communities that may have produced for the Chavín population or for intra-village consumption. As stated earlier, ceramic production during the Urabarriu phase might have been linked to or benefited from volcanic stone carving for the temple, indicating that at least some of the workshops were located close to the center.

Ceramic Production during the Chakinani and Janabarriu Phases. The use of volcanic resources declined, and half of the ceramics were tempered with sedimentary material or a mixed temper (sedimentary, volcanic, and intrusive fragments in the paste) during the Chakinani phase. Intrusive material from the White Cordillera was mostly used during Janabarriu times to produce all types of wares. Only a few ceramics have a sedimentary or volcanic paste. This suggests a switch in resource areas and workshop locations, and the exploitation of intrusive materials from resource areas west of Chavín, along the flanks of the White Cordillera. Workshops at the time of the maximum extent of Chavín de Huantar (390–200 B.C.) were probably located to the west, in agreement with the distribution of modern potting villages along both sides of the White Cordillera (Druc 1996, 2001).

No temporal variation is observed for the mixed-composition and fine-paste ceramics (Group 4). This was also seen in an earlier study based on a larger sample than the one used for INAA (Druc 1998a). These ceramics were probably produced in small quantity throughout the occupation of the ceremonial center or were brought from production centers outside the Mosna Valley. The present chemical analysis suggests that some of these ceramics were not produced locally.

Paste and Ceramic Style

Another research venue is the correlation of style and paste composition. No particular paste formula was reserved for the manufacture of a specific ware style. The circle-and-dot decorated wares common to the Janabarriu phase occur in different clusters, displaying different chemical and mineral compositions, both local and nonlocal, ruling out centralized production. The stamped wares were produced with different materials: volcanic, intrusive, mixed lithologies, sedimentary, and even metamorphic. Of the eight stamped ceramics tested, five are nonlocal.

The 12 stylistically atypical wares in the sample from Chavín de Huantar (3 bottles, 3 bowls, 5 jars, 1 olla) also display a variety of pastes. They are tempered with sedimentary (2 jars, 1 bottle, 1 bowl), welded tuff (3 jars and 1 olla), or intrusive materials (1 bottle and 1 bowl), and two are fine-paste bowls. They appear in different chemical clusters, suggesting different origins. The style and high Cs content in half of the atypical wares suggest that they were brought to the site. Also suggested as nonlocal are some 18 Chavín-style sherds, which cluster with ceramics from sites other than Chavín or are outliers. These are bottles, plain and decorated bowls, two circle-dot bowls, a quartz-slipped jar, and a black olla. They vary in mineral composition (volcanic, intrusive, sedimentary, and pellitic) and often present a high Cs content.

It is interesting to note the rarity of ollas and absence of coarse ware in the nonlocal ceramics. Instead, the majority of the nonlocal ceramics are nondomestic wares, liquid or transport containers (jars/bottles) and bowls, with fine walls, often decorated, and with good surface finish. Their ceremonial function or offering status is not demonstrable but can be presumed. The compositional differences and styles suggest the existence of different contexts of ware circulation. Distribution networks for ceramics apparently do not apply here. Neither the production nor the distribution of ceramics appears to have been controlled or organized. Rather, ceramic distribution apparently was the result of occasional events. Because Chavín de Huantar was an important religious and economic center, local and nonlocal products must have circulated at particular occasions as gifts or offerings, or have been acquired during fairs. It is also possible that some of the nonlocal wares could have been brought to Chavín as containers and were not the exchange product per se.

Interregional Relationships

Relationships with Pallka in the Casma Valley and with the Callejón de Huaylas are suggested by the analysis. Several ceramics from Chavín occur along with ceramics from Pallka in compositional Group 5. The Pallka sherds have an intrusive temper of granitic composition different from the granodiorite/tonalite type found in Chavín. It is difficult to ascertain the origin of this mixed Pallka-Chavín group. The atypical style of several ceramics in this group and their subclustering within Group 5 suggest a nonlocal origin for bottle 3762, jars 3764a and 3786g, and bowl B20. Bottle 3762 is decorated with graphite over red, a style called Wacheqsa by Lumbreras (1977, 1993) and supposedly from the Cupisnique region on the north coast or corresponding highlands. However, the use of graphite decoration is also known from the Kotosh-Huanuco region, southeast of Chavín (Burger 1984; Lumbreras 1993).

Bottle 3765a was originally attributed to the coast by discriminant analysis using x-ray fluorescence data (Druc 1998a). It is now grouped with Pallka sherds, regardless of the clustering method, even when samples from the coastal sites of Ancón and Garagay are included. The Casma Valley is the probable provenance site of this bottle. This placement is more in agreement with bottle style at both sites and, above all, with petrographic analysis (unavailable for this sample at the time of the XRF analysis). Pallka bottle P23 with fine intrusive paste clusters in Group 3 with Chavín outliers, separately from the other Pallka sherds. Its origin, however, is not Chavín de Huantar, due to its mineral composition that does not match local Chavín mineralogy.

Along with the sherds from the ceremonial center of Huaricoto in the Callejón de Huaylas is the oversized bowl 3764b. It is a large red-slipped bowl tempered with pyroclastic-ignimbritic material and welded tuff fragments at a time (Janabarriu phase) when this type of temper was no longer used in the region of Chavín de Huantar. The presence of an andesite fragment in the paste suggests that the material came from a volcanic rock of the Tertiary Calipuy Formation. This rock type is not found near Chavín. The mineral composition of this bowl is consistent with sources of volcanic tuff and ignimbrite common in the Callejón de Huaylas (Robert Strusievicz, personal communication 1999; Cobbing et al. 1996). The Callejón is easily reached through a mountain pass just above Chavín. The provenance of this bowl, however, is not the small ceremonial center of Huaricoto, judging from the lack of mineral similarity with the ceramics from that site.

Several other ceramics from Chavín cluster separately from the Chavín local groups (#3744, 3742c, 3787b, 3755a, and B21) or from samples from the coast. Many of these come from atypical ceramics, whose style or mineral composition suggests a nonlocal provenance, as yet unidentified. These sherds have been discussed in relation to their high Cs content. The Mosna Red-over-Orange painted sherd in Group 4 is also of unattributed origin. Its style suggests a northern provenance, from the region of Pacopampa (Lumbreras 1993). Last, the fine sand-paste Chakinani bottle 3755c and sedimentary paste olla 3741d are linked to samples from the coastal sites of Ancón and Garagay. Their mineralogy, however, is different from the coastal paste found in Ancón and Garagay (Druc et al. 2001) and rules out a central coast provenance.

Conclusions

Prior chemical analyses hinted at the wide compositional diversity of the ceramics in Chavín de Huantar. Further petrographic analysis and INAA studies allow this diversity to be linked to production scenarios changing over time, and to a considerable amount of nonlocal wares. Several observations on ceramic production can be made at the local and interregional levels. According to chemical and mineral analyses, several centers of production were supplying the ancient settlement and ceremonial center of Chavín de Huantar. At least three large production areas can be proposed: two in the local highlands south and west of Chavín and one in the valley bottom. Several workshops were probably active in each area, as suggested by the internal heterogeneity of the compositional groups. Also, many production centers must have been in use at different time periods. The use of ignimbritic-pyroclastic material, often with welded tuff fragments, is observed during the Urabarriu phase, the first occupation phase at Chavín de Huantar. The workshops using this material were probably located up to 12 km from the resource area (estimated distance based on ethnographic data, Druc 1996), south and southeast of Chavín, and northeast of the site above the village of San Marcos (Figure 5). Some of the workshops also could have been located near the site, using tuff boulders scattered along the Mosna river banks, or tuff debris from volcanic stone-carving activity. Later in time, during the maximum extension of the site, the tendency was to use intrusive raw materials, and the workshops must have been located west of the settlement, using materials from the slope of the White Cordillera.

The third production area is characterized by the

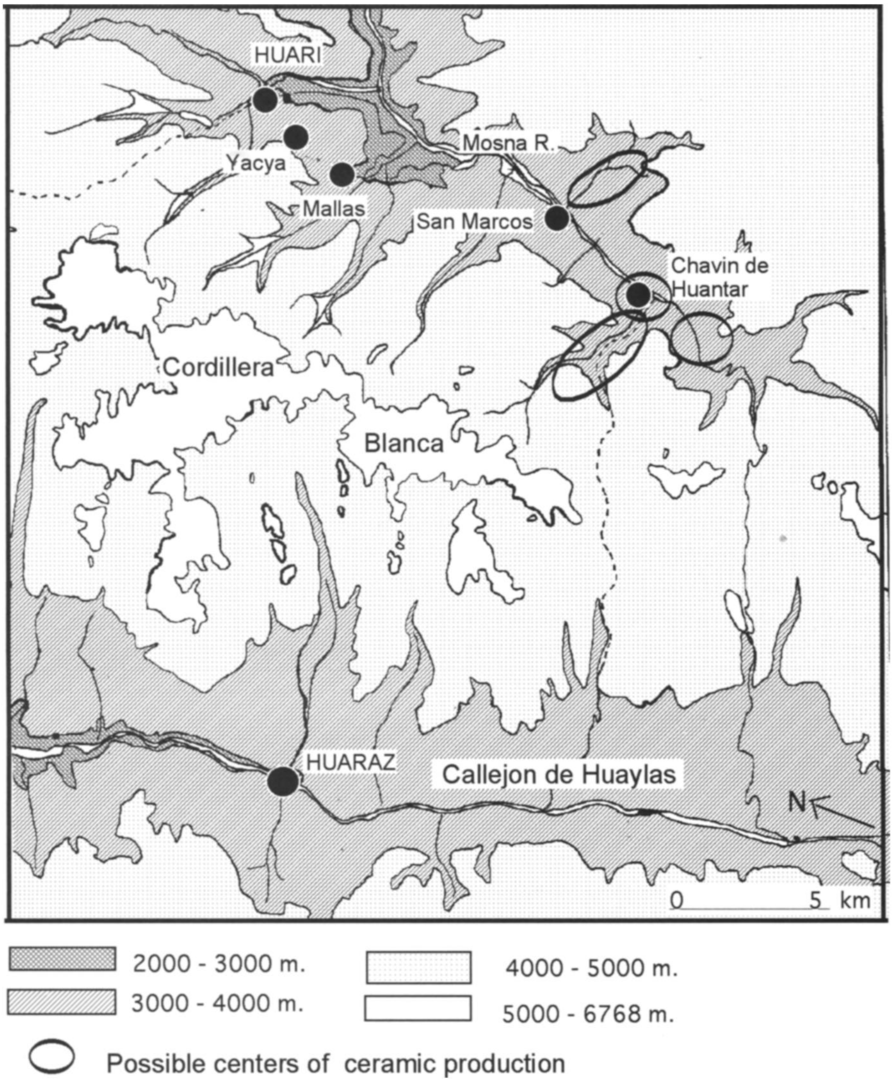

Figure 5. The Chavín region and possible ceramic production areas suggested by the analysis.

use of sedimentary material and the production of fine paste ceramics. However, production must have been low and the workshops few and located near the site of Chavín, in the valley floor or just above it. The workshops in this area were engaged in small-scale production of bottles and decorated bowls throughout the existence of the site.

The workshops located higher up in the valley on the slope of the Cordillera rarely produced bottles. During Urabarriu times, when volcanic material was predominantly used, the most common wares were ollas and bowls. As the site grew and became more important, local ceramic production became more diversified and intrusive material was used to produce a wider range of ceramics, including bottles and jars. The shift in procurement area and workshop locations cannot be explained based on paste analysis alone. Resource exhaustion, landslides that buried sources, or technological changes are possibilities. However, among more probable factors were the economic expansion of the site, population growth, higher demand for ceramic products, and the establishment of new potters, who perhaps were from the Callejón de Huaylas and more familiar with the intrusive materials.

This production pattern corresponds to the observed development of Chavín de Huantar. During the Urabarriu phase, the settlement was small and located immediately north of the ceremonial area. Chavín grew during the Chakinani phase to an estimated 15 ha and to 42 ha during the Janabarriu phase, with the settlement extending south of the ceremonial center (Burger 1984, 1992). The ceremonial center alone covered some 1.5 ha in the early periods to 5 ha at its maximum extent. Several villages above the valley floor and in the highlands surrounded Chavín. The highland villages appear to have been occupied mainly during the Urabarriu phase, at a time when volcanic resources were used for ceramic production. Archaeological evidence shows a dispersed population during the Urabarriu and Chakinani phases, and a more concentrated and dense occupation during Janabarriu times, reflected in the ceramic production pattern. During the Urabarriu phase, the diversity of volcanic pastes suggests dispersed ceramic providers, probably responding to low demand. A more diverse and intense production is suggested during the Janabarriu phase, when the valley was more heavily populated. The absence of atypical wares in the volcanic and intrusive groups is in accordance with the hypothesis of local highland production for utilitarian ware.

The region providing the Chavín de Huantar population with utilitarian ware must have extended well beyond the site. Until the early 1970s, potters from Yacya and Mallas (Figure 5), 30 km north in the highlands above the lower Mosna Valley, walked to Chavín to barter their pots (Druc 1996; Richard Burger, personal communication 1998). These conclusions support Burger's hypothesis of the Chavín Temple drawing services and goods from communities up to the lower Mosna Valley and southern Callejón de Huaylas (Burger 1984:249). In addition to the religious importance of the ceremonial center, Chavín must have been a central place for fairs and exchange of local and interregional products, including ceramics. Economic and cultural interactions explain the wide diversity of pastes and variety of origins of the ceramics in Chavín.

At the level of interregional interactions, the importance of Chavín de Huantar is demonstrated by the number of atypical and nonlocal wares from the Urabarriu phase on. None of the sites analyzed previously (Pallka, Huaricoto, Ancón, Garagay [Druc 1998a; Druc et al. 2001]) show this diversity of paste and numbers of atypical and nonlocal wares, attesting to the interregional scope of interactions with the ceremonial center. Most nonlocal wares are bottles and fine bowls that were probably not destined for domestic use in view of their style, decoration, and rarity. One bottle may be from the ceremonial center of Pallka in the coastal valley of Casma, while a large bowl probably comes from the Callejón de Huaylas, on the other side of the White Cordillera. About a third of the nonlocal wares are non-Chavín in style and may come from cultural areas outside Chavín influence whose inhabitants were aware of the religious center of Chavín de Huantar.

This INAA study yields a clearer picture of ceramic production and interactions in Chavín de Huantar. However, none of the conclusions presented here could have been reached solely on the basis of neutron activation. Petrographic and geological data were very important in interpreting the chemical results, along with stylistic information. By combining these different sets of data more information can be extracted from paste analysis.

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