CERAMICS of the INDIGENOUS CULTURES of SOUTH AMERICA

STUDIES OF PRODUCTION AND EXCHANGE THROUGH COMPOSITIONAL ANALYSIS

EDITED BY
Michael D. Glascock
Hector Neff
Kevin J. Vaughn



Ceramics of the Indigenous Cultures of South America

Studies of Production and Exchange through Compositional Analysis

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MICHAEL D. GLASCOCK, HECTOR NEFF, AND KEVIN J. VAUGHN

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Instrumental Neutron Activation Analysis of Archaeological Pottery from Mendoza, Central Western Argentina

NURIA SUGRAÑES, MARÍA JOSÉ OTS, MICHAEL D. GLASCOCK, AND GUSTAVO NEME

INTRODUCTION

The development of ceramic technology in central western Argentina has been dated to about 2000 years BP. Since then, ceramics have experienced temporal and spatial variations in technological styles (Lagiglia 1997; Sugrañes and Franchetti 2012). In part, this variation was due to differences in cultural, social, and economic organization. The Atuel and Diamante River basins constitute an ecological transition between the El Monte and the Patagonic environments, traditionally highlighted as the frontier between the sedentary farmers to the north and the mobile hunter-gatherers to the south (Figure 21.1; Table 21.1; Lagiglia 1977). However, this static model is contradicted by recent studies that discuss, for instance, the relevance of maize consumption and foraging strategies in the farmers' diets in the north (Ots et al. 2016) and the mobility patterns of hunter-gatherers in the south (Gil et al. 2011).

This chapter presents the results of archaeometric characterization by instrumental neutron activation analysis (INAA) of pottery sherds from two different areas in Mendoza Province. The goal is to identify ceramic compositional groups that may inform on past mobility and exchange systems in the Andean frontier between farmers and hunter-gatherers in South America. The study analyzes pottery from archaeological sites in the Tunuyán, Diamante, and Atuel River basins (Table 21.1) located in the northern and southern sectors of Mendoza Province (Figure 21.1). These represent the first analyses of pottery by INAA in the Mendoza region, although previous studies of provenance and exchange routes have been conducted elsewhere in Argentina and Chile (de la Fuente et al. 2015; Falabella et al. 2015; Plá 2009; Ratto et al. 2002; Sanhueza et al. 2004, among others).

CENTRAL WESTERN ARGENTINA

Environmental and Contextual Information

The province of Mendoza is located in central western Argentina between 33° and 37° south latitude. It is characterized by a semiarid environment and rugged topography (Capitanelli 1972). The presence of the Andes to the west has a strong influence on precipitation, temperature, and the distribution of flora and fauna. The main rivers originate in the Andes and drain eastward, irrigating the arid landscapes. From north to south, the rivers are the Mendoza, Tunuyán, Diamante, Atuel, and Grande.

The regional landscape has a strong contrast in the availability of water resources according to altitude. Water is a critical resource in the eastern plains where the sources are limited to the river courses. Meanwhile, in the highlands, water is abundant due to the presence of many streams and lakes. Rainfall is not distributed uniformly

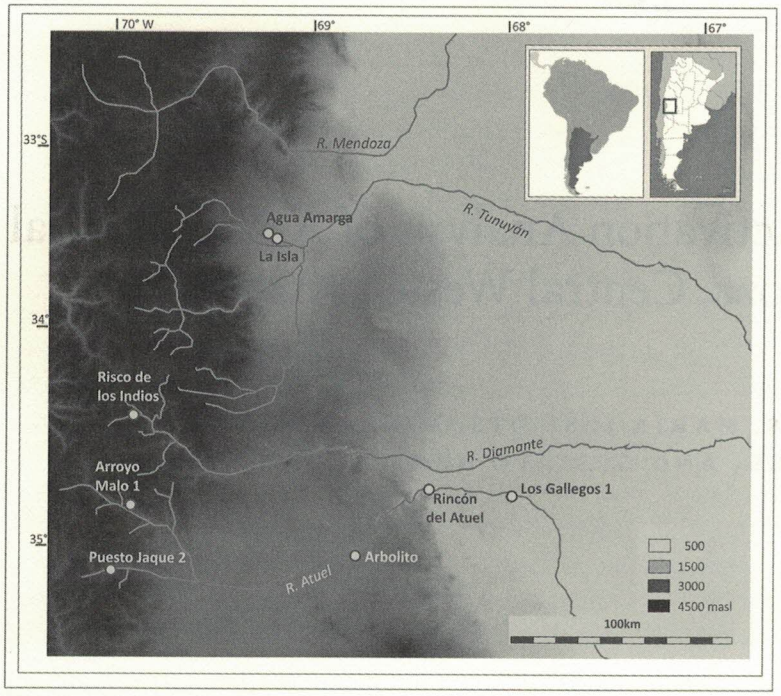


Figure 21.1. Map of Mendoza province with archaeological sites from Tunuyán, Diamante and Atuel River basins. Map by Pablo Cahiza.

TABLE 21.1. ENVIRONMENTAL AND ARCHAEOLOGICAL CONTEXTS OF SHERDS ELECTED FOR INAA

SITES	REGION	TOTAL SHERDS	INAA SHERDS	GPS LOCATION		ALTITUDE (M ASL)	DATE
Risco de los Indios (RI)	Diamante River basin: Highland	284	17	34°23'36.6" S	69°52'22.9" W	2,400	500±26 BP
Arroyo Malo 1 (AMA1)	Atuel River basin: Highland	127	17	34°51'01" S	69°53'11" W	2,000	560±65 BP
Puesto Jaque 2 (PJ2)		21	9	35°10'42" S	69°59'07" W	1,970	646±42 BP
Arbolito (AR)	Atuel River basin: Lowlands	321	25	35°5'52.8" S	68°44'15.1" W	1,300	970±36 BP
Rincón del Atuel 1 (RA1)		1,642	25	34°45'31" S	68°22'14" W	747	330±60 BP
Los Gallegos 1 (LG1)		27	10	34°47'43.31" S	67°57'8.15" W	525	1217±37 BP
Agua Amarga (AA)	Tunuyán River basin: Piedmont	4,040	20	33°28'18.5" S	69°11'29.3" W	1,180	450±50 BP
Puesto la Isla (PLI)	Tunuyán River basin: Piedmont	642	10	33°29'55.4" S	69°08'59.7" W	990	580±50 BP

and increases with altitude but also with a marked seasonality. In the mountains, rainfall occurs mainly during the winter (an average of 500 mm), while in the eastern plains, rainfall occurs mostly during the summer (ca. 250 mm). Therefore, resources are heterogeneously distributed on the landscape. Four ecological systems are present in the region: highlands, foothills, plains, and Payunia. The latter is characteristic of the southern province (Figure 21.1). In general terms, paleoclimatic reconstruction based on palynological, charcoal, glacial, and sedimentological proxy data suggest that weather conditions for the last 3,000 years have been similar to those of the present (D'Antoni 1983; Markgraf 1983; Páez et al. 2010; Stingl and Garleff 1985; Zárate 2002).

Archaeological Background and Ceramic Variability

Mendoza Province was populated by hunter-gatherers as early as about 11,000 years BP (García 2005; Lagiglia 2002; Neme and Gil 2008, 2012). Significant changes have been identified in the archaeological record for the Late

Holocene, especially during the last 2000 years BP. However, those changes were different between northern and southern Mendoza in terms of cultural processes. North of the Diamante River, human groups incorporated domestic plants with a diminished residential mobility, probably establishing sedentary villages with a low-level food production economy (Smith 2001) in the foothills of Valle de Uco (Cahiza and Ots 2014; Ots et al. 2016; but see Gil et al. 2011). Meanwhile, in southern Mendoza, Patagonian hunter-gatherers continued to practice a mobile way of life (Neme and Gil 2012).

The frontier zone between the Diamante and Atuel River valleys is characterized by an ambiguous archaeological record, where hunter-gatherer sites are found along with sites of small farming groups. While there are domestic plant remains in some places, the isotopic, archaeofaunistic, and macrobotanical records indicate a limited reliance on domesticated resources.

Apparently, exchange between farmer and hunter-gatherer societies took place frequently in this farming boundary. Pottery, domesticated plants, and obsidian were among the most frequent goods moving between the northern and southern regions (Lagiglia 1978, Neme and Gil 2005, Salgán 2015). The incorporation of ceramic technology into the society's repertoire began approximately 2000 years BP and spread almost immediately throughout the entire region (Sugrañes 2017b). Apparently, this process was independent of the expansion of agriculture (Sugrañes and Franchetti 2012).

Many authors (Canals Frau 1956; Lagiglia 1977, 1978, 1997; Sugrañes and Franchetti 2012) describe different styles of pottery in the region, which in some cases are associated with cultural groups. The most outstanding styles identified in northern sites are the Agrelo style (fifth through fourteenth centuries AD) and the Viluco style (fifteenth through seventeenth centuries AD).

Agrelo-style pottery is coarse earthenware with gray color fired in a reducing atmosphere, smoothed, and sometimes decorated with incisions. The pottery was utilitarian. The most frequent shapes are globular restricted and unrestricted pots, in both large and small sizes.

Viluco-style pottery is associated with later occupations. It originated during the period of Inca regional domination (Ots 2008) and was distributed throughout the region, even during Hispanic times (Lagiglia 1978). However, the origin and the organization of production and distribution of this style are still under debate (Bárcena and Román 1990; Lagiglia 1978; Ots and Cahiza 2016; Prieto and Chiavazza 2009). Viluco-style pottery is a red, smoothed earthenware created by firing in an oxidizing atmosphere. Decorated pieces are polished and painted, mainly with typical Inca shapes such as bowls (*puco*), glasses or cups (*kero*), and bottles (*aribaloide*) as sumptuary goods, sometimes found in funerary contexts. Utilitarian pieces are globular restricted vessels. This style is sometimes associated with another Inca regional style called Diaguita.

Four ceramic types were identified in southern Mendoza (Lagiglia 1977, 1997). However, this characterization has been criticized by some archaeologists (Falabella, Sanhueza et al. 2001; Sugrañes 2017b). Nihuil and Overo types were related to hunter-gatherers and characterized as part of the same pottery tradition, with a different areal distribution. Overo was related to the Andean hunter-gatherer groups, while Nihuil was associated with the same groups who occupied the plains during the winter. Both types were characterized as utilitarian pottery, globular unrestricted and restricted pots, smooth with some polished surfaces, and in some cases, with incised decorations on the neck (Lagiglia 1997; Sugrañes and Franchetti 2012). In the lowlands, Nihuil types were characterized by sherds only. This explains why there is no clear idea about the shapes of the vessels (Sugrañes and Franchetti 2012). The types were identified as Arbolito, Atuel, and Atuel Cepillado (Lagiglia 1977). These types were also utilitarian (but see Sugrañes 2017a, 2017b) and are characterized by smooth surfaces, light colors, and in some cases, the bases have basketry molds (Lagiglia 1977; Sugrañes and Franchetti 2012). The Atuel Cepillado type has a particular decoration characterized by brushing the surface to produce a brilliant surface due to the use of mica as a temper.

Pottery from central and north Chile were also identified in the region, including the Llolleo, Aconcagua, and Diaguita types. All are fine pottery, well manufactured with painted decoration. Pots, jars, and bowls are the most common shapes of vessels from these traditions found in the region (Falabella et al. 2007; Falabella and Stehberg 1989).

Selected Areas and Samples

To explore mobility strategies and exchange systems, we used INAA to characterize a sample of ceramics. Pottery sherds from eight archaeological sites located in northern and southern Mendoza Province were sampled. The sites from the north are located in the Tunuyán River basin

(Agua Amarga and Puesto La Isla sites), while the sites from the south include one in the highlands of the Diamante River basin and five in the Atuel River basin.

Northern Region: Tunuyán River Basin

Ceramics selected for INAA came from two sites: Agua Amarga (AA) and Puesto la Isla (PLI) (Table 21.1; Figure 21.1) located in the Uco Valley in the central-west area of the Mendoza Province. In this area, settlement and spatial patterns for different ecological settings are being studied to investigate demographic increases and the increased concentration of sites in the Andean foothills during the final prehispanic centuries (Cahiza and Ots 2014). AA and PLI are the most outstanding sites in the foothills, due to the dimensions, recurrence, and diversity of occupations and activity areas. Both sites are consistent with occupation by sedentary farmers living in small villages (Cahiza and Ots 2014; Ots et al. 2016).

Located at 1,180 m asl, AA is the largest site with an area of 52 ha. It is a multipurpose, residential site and was occupied from the twelfth through the sixteenth centuries AD (Ots et al. 2011, 2016). Both domestic (Ots et al. 2011) and mortuary contexts (Lagiglia 1976, 1978) were found. Multiple occupations were identified, also associated with pottery components of the Agrelo style dating to about 800 years BP and the Viluco and Inca styles dating to about 450±50 years BP. It is proposed that the site was an Inca enclave because of the high frequency of Inca pottery (Viluco and Diaguita styles), among other features (Ots and Cahiza 2013). Exchange and other interaction strategies between AA and other sectors in the region are being studied, mainly to investigate the sources of Inca pottery (Ots and Cahiza 2016) and obsidian artifacts (Cortegoso et al. 2012; Salgán et al. 2015).

PLI is a residential site located 7 km east of AA at 900 m asl. It was occupied from 580±50 years BP until the Inca period (ca. AD 1480–1560), and it was also associated with Agrelo, Viluco, and Diaguita Inca pottery components, as well as a style from central Chile called Aconcagua.

At both sites, domesticated archaeobotanical remains were identified. In AA, three varieties of *Zea mays*, *Phaseolus vulgaris*, and *Cucurbita* sp. were found in a refuse deposit (Ots et al. 2011). In PLI, a variety of *Zea mays* and tillage tools were discovered (Ots et al. 2016). These contexts and environmental features such as temperature, rainfall, and soil, among others, suggest local production of these domesticates. Low-level food production was complemented by hunting and gathering of local resources.

Southern Region: Diamante and Atuel River Basin

The Diamante and Atuel River basins cross west to east through several environmental zones with complementary resources and at different altitudinal levels (Table 21.1; Figure 21.1). Ceramic samples from six archaeological sites in this region were selected: Risco de los Indios (RI), Arroyo Malo 1 (AMA1), Puesto Jaque 2 (PJ2), Arbolito 1 (AR), Rincón del Atuel 1 (RA1), and Los Gallegos 1 (LG1). The first site is located in the Diamante River basin (highlands), while the remaining sites are located at different elevations along the Atuel River basin (Table 21.1; Figure 21.1).

RI is located at 2,480 m asl, and it has 29 residential features containing abundant floral, faunal, lithic, and ceramic materials (Morgan et al. 2016). Neme et al. (2016) indicate that the site was intensively used about 500 BP (calibrated date) as a residential base for multiple family groups focused on guanaco hunting. This hunting strategy was supplemented by locally available wild flora and fauna as well as domesticated plants (beans) transported from the lowlands.

AMA1 and PJ2 are multipurpose open sites located at 2,000 and 1,970 m asl, respectively. Both sites were base camps for hunter-gatherers, used around 600 years BP, from which guanaco hunting and wild plant processing were the main activities (Llano and Neme 2012; Neme 2007; Sugrañes 2017b). The sites of AR and RA1 are residential bases located on the plains with an intensive use, dated about 1200 and 1500 years BP (Gil et al. 2008; Lagiglia 1977; Sugrañes 2017b). Both sites show several domestic activities including grinding, hunting, spinning work, and probably pottery manufacture. At RA1, 13 kilns were found (Gil et al. 2008; Lagiglia 2006; Sugrañes 2017b). Finally, LG1 is a multipurpose site located on an Atuel River terrace with an ephemeral archaeological record (Sugrañes 2017b), where grinding and hunting activities took place.

HUMAN MOBILITY AND EXCHANGE STRATEGIES

Technology is an adaptive system, which allows one to anticipate and organize the lifestyles of societies (Nelson

1991). Societies adopt strategies to manage environmental and social conditions such as storage, mobility patterns, and exchange (Bettinger 1991; Binford 1980; Janetski 2002; Jochim 1981; Kelly 1995; Renfrew 1977, among others). Ceramic manufacture is a high-cost technology related to social and subsistence strategies including risk management and mobility, among others (Eerkens 2003). This is a common feature at farmers' archaeological sites, but it does not appear in hunter-gatherer settlements.

Some models have been proposed to recognize mobility and exchange strategies by using the attributes from the remains of archaeological ceramics (Beck 2009; Bright and Ugan 1999; Eerkens 2003, 2008, 2011, 2012; Hughes 2011; Janetski 2002; Renfrew 1977; Simms et al. 1997, among others). These strategies are considered ways of managing risk in times of scarce resources. In general, mobility is related to bioproductivity and distribution/production of food resources (Bettinger 1991; Binford 1980; Kelly 1995), and exchange is taken as "interaction" between groups for several reasons (e.g., social, technological, or subsistence). In variable environmental conditions, especially in arid contexts, moving helped minimize risks (Morgan 2009) and required "flexible strategies" (Goland 1991) incorporating logistical and residential mobility. But in other cases, interaction between groups generated reciprocity bonds for uncertain times, particularly between hunter-gatherers and farmers, and provided access to alternative resource areas (Eerkens 2012; Pallo and Borrero 2015). These relations were maintained through delayed return gifting that anticipated future needs (Janetski 2002).

In this sense, pottery from farmers and hunter-gatherers will have attributes that differentiate each kind of subsistence strategy. These differences tend to optimize the use of this technology among these societies in relation to the degree of mobility, cooking practices, and social differences. Simms et al. (1997) propose that increased investment in ceramics is associated with decreased mobility. They suggest that pottery with thinner walls offers advantages in terms of resistance to thermal stress and thermal conductivity. Finer inclusions increase the resistance to fractures that can occur as a result of mechanical stress and/or heat, making it possible to produce thinner walls. Finally, smoothing the pieces increases the abrasion resistance and allows greater impermeability. These qualities indicate a greater investment of time and effort in ceramic manufacture. The authors incorporate the variability of raw materials in different types of sites including base camps, camps for short stays, and longer-term residential base camps. Hunter-gatherer groups typically develop a ceramic technology characterized by the use of a greater variety of raw materials than sedentary farmers.

Eerkens (2003, 2008) suggests that the pottery of hunter-gatherers will be narrower at the mouth, slightly thinner, more often rough on the exterior surfaces, and more finely tempered in areas where people are more residentially mobile. However, this relationship varies among the different attributes and is related to alternative intended functions and design constraints on pots. Finally, Beck (2009) believes that the vessels made by neighboring agriculturalists may often be as well suited to the tasks and settlement patterns of mobile groups as vessels made by the mobile groups themselves. So, the differences between the two could be related to settlement systems rather than only being typological.

MATERIALS AND METHODOLOGY

A total of 133 ceramics sherds from eight archaeological sites from the Tunuyán, Diamante, and Atuel River basins were sampled and analyzed by INAA (Table 21.1). Typological and technological variability was considered in selecting the sample for analysis, with an effort to include all types present at the archaeological sites under consideration. The analysis was performed at the Archaeometry Laboratory at MURR according to standard procedures described in chapter 1 of this volume.

Compositional analysis identified 33 elements, and multivariate statistical methods were applied to identify the similarities and differences between specimens and groups of specimens. Pattern recognition methods such as cluster analysis, scatterplots of the original data in two or three dimensions, and principal component analysis (PCA) were employed to form discrete chemical groups (Baxter 1994; Glascock 1992; Glascock et al. 2004; Neff 2000). The Mahalanobis distance probability measure was used to check the distinctiveness of those groups and contrast the results with archaeological data.

For processing of data, we used the MURRAP program from the Archaeometry Laboratory (see description in chapter 1). Cluster and PCA analyses were first carried out on the separate ceramic sets from each area—in the north and south of the Mendoza Province—and later, a new PCA with samples from both regions was carried out keeping the labels of earlier groups. Finally, results were

screened to determine whether they were consistent with other archaeological data, such as technological attributes and geographical location.

Assumptions

For this work, some assumptions were necessary to interpret the chemical data. First, according to the "provenance postulate," vessels made of clay from a particular source should be chemically more alike than vessels made using clays from different sources (Bishop et al. 1982). Second, the most common source of clay for pots in a particular region is assumed to be local rather than external. Arnold's (1985) research argues that potters usually used clays from 1 km to 7 km away, but, purposefully, potters make use of clays with different chemical signatures from the same area (Eerkens 2001). In this sense, the goal pursued here (definition of compositional groups) is not tied to geographical provenance. A chemical group strongly represented at a site (over 50%) would be considered local, while underrepresented groups would be considered nonlocal (Eerkens 2001). This assignment is tentative and can be modified by future analyses that suggest otherwise.

RESULTS

Most of the ceramic samples analyzed (94%) were assigned to discrete chemical groups (Table 21.2). Only six samples could not be assigned to a group, and we considered these samples to be outliers. Most of the groups contain between 2 and 10 specimens, and 2 of the groups have 40 and 43 samples, respectively.

For the Tunuyán area, five groups and three outliers were identified (Figure 21.2). Four of the groups include pottery from PLI. Pottery from the AA site was present in all groups. Samples in Group A ($n = 7$) are technologically homogenous; all of them are included in the Viluco Inca type. Group B ($n = 10$) and Group C ($n = 5$) are very heterogeneous, with specimens having different technological attributes corresponding to the Viluco and Agrelo types. Group B is most frequent in the AA site. Group D ($n = 3$) is composed only of Agrelo specimens from both sites. Group E ($n = 2$) is composed of Viluco specimens from the AA site. Outliers were identified only in PLI; all of them ($n = 3$) are Chilean types such as Aconcagua and Diaguita.

For the Diamante and Atuel River basins, six groups and three outliers were identified. Specimens from Group 1 ($n = 7$) and Group 2 ($n = 4$) match the Atuel Cepillado type from the sites at RA1 and AR. They appear to have been locally made in the lowlands (Lagiglia 1977). Group 3 ($n = 43$) is the largest group and is composed of specimens from all sites in the Atuel River basin. It is characterized by high iron concentrations, but also higher amounts of Sc, Mn, and V. Typologically, this group is related to the Nihuil and Overo types. Moreover, samples from central Chile and probably Inca types are ascribed to this group (Rojo Pulido, Aconcagua, and Marrón Pulido).

Group 4 ($n = 4$) has samples only from RA1 and is very homogenous. Group 5 ($n = 40$) is the second most abundant group and was found at all sites except PJ2. The remaining groups are technologically similar and related to the Arbolito, Atuel, and Agrelo types. Group 6 ($n = 2$)

TABLE 21.2. CHEMICAL GROUPS IDENTIFIED BY ARCHAEOLOGICAL SITE

SITES	CHEMICAL GROUPS												TOTAL
	Tunuyán River Basin					Diamante and Atuel River Basins							
	A	B	C	D	E	1	2	3	4	5	6	Outliers	
AA	5	8	3	2	2								20
PLI	2	2	2	1								3	10
LG1								1		9			10
RA1						4		8	4	6	2	1	25
AR1						3	4	6		12			25
PJ2								9					9
AMA1								5		11		1	17
RI								14		2		1	17
Total	7	10	5	3	2	7	4	43	4	40	2	6	133
	(5.3%)	(7.5%)	(3.8%)	(2.3%)	(1.5%)	(5.3%)	(3.1%)	(32.3%)	(3.0%)	(30.1%)	(1.5%)	(4.5%)	(100%)

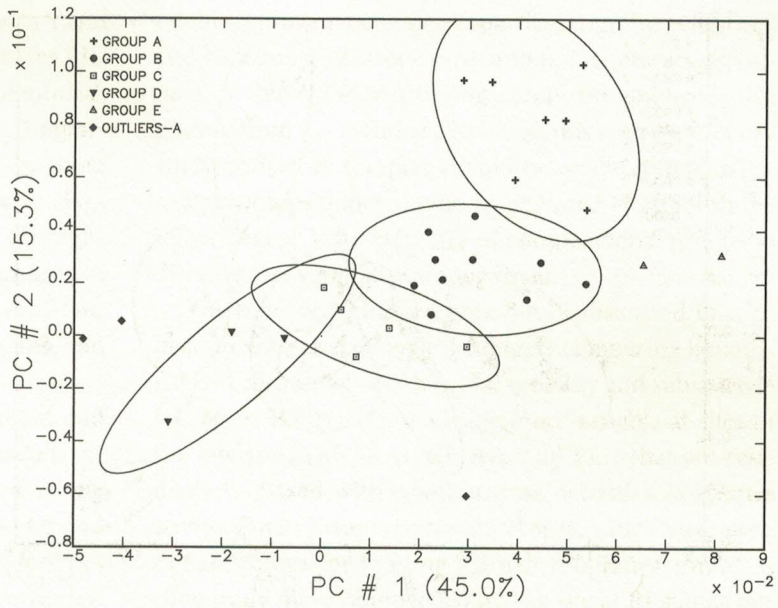


Figure 21.2. Compositional group distribution on PC#1 and PC#2 for sherds from the Tunuyán River basin. Ellipses represent the 90% confidence level for membership in each group.

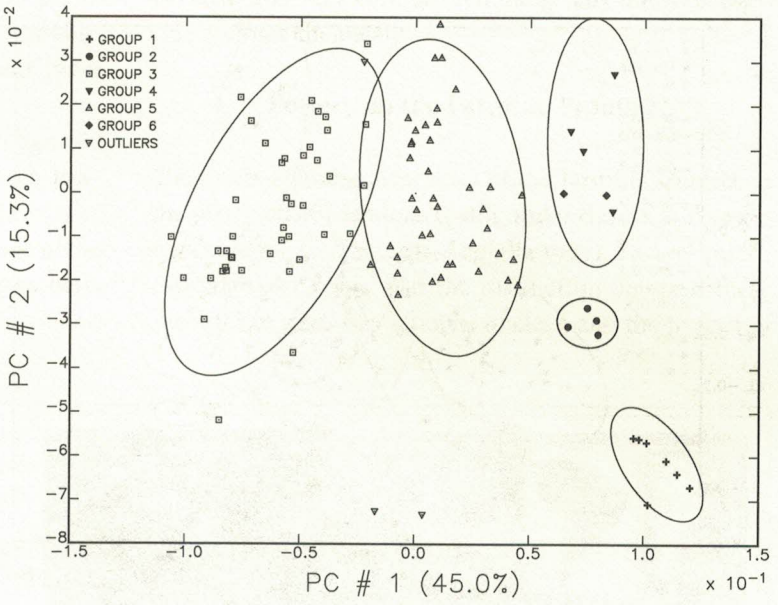


Figure 21.3. Compositional group distribution on PC#1 and PC#2 for sherds from the Diamante and Atuel River basins. Ellipses represent the 90% confidence level for membership in each group.

consists of Viluco sherds from RA1. In PCA (Figure 21.3), the chemical groups on the right-hand side (Groups 1, 2, 4, and 6) are separated from the other group by elements related to high amounts of various alkali feldspar minerals (Jelmer Eerkens, personal communication 2016). Finally, outliers from RI, AMA1, and RA1 are associated with different types: Atuel, Viluco, and Arbolito, respectively.

We ran a new PCA with all of the samples, keeping their group labels. The first two principal components (PCs) explain 65% of the variance in the sample. A plot of the first two PCs is shown in Figure 21.4 for chemical groups of the Tunuyán River basin (Groups A–E, Outliers) and the Diamante and Atuel River basins (Groups 1–6, Outliers). Figure 21.5 shows that sites from the southern lowlands (AR and RA1) are the most variable chemically. On the other hand, AMA1 and PJ2 are the most homogeneous.

Groups A, 1, and 2 are distinct chemical groups separated from the entire sample (Figure 21.4). Group 3 and two outliers from PLI have the same chemical composition (Figure 21.5). Groups 4, 6, and E were combined together on the plot, but they have different compositions (Figure 21.4). Finally, Groups 5, B, and C could be combined into a single chemical group, while Group D

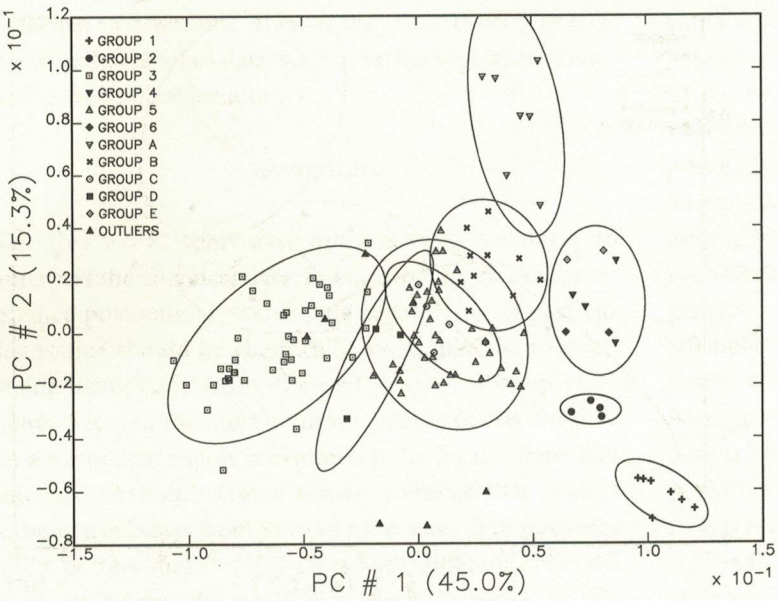


Figure 21.4. Compositional group distribution on PC#1 and PC#2 for sherds from all groups from both areas, north and south of Mendoza province. Ellipses represent the 90% confidence level for membership in each group.

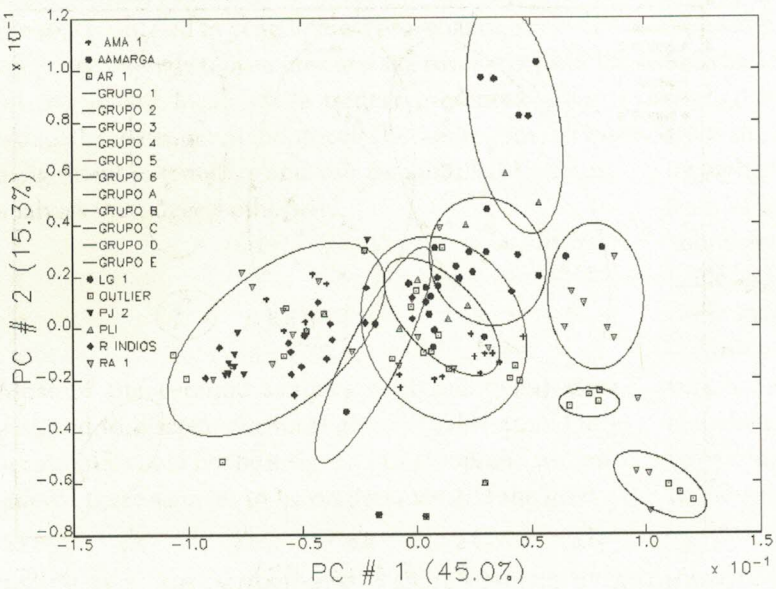


Figure 21.5. Compositional group distribution on PC#1 and PC#2 for sherds from both areas, separately by sites. Ellipses represent the 90% confidence level for membership in each group.

is separated by the elements U, Th, and Cr as shown in Figures 21.4 and 21.5. These groups show great technological variability subsuming both the northern types, Viluco and Agrelo, and the southern types, Atuel and Arbolito.

DISCUSSION

This initial application of INAA to ceramics from Mendoza Province provides some basis for discussing regional interaction patterns (Figure 21.6). In the Tunuyán River basin, compositional groups B and C, which include 50% of the samples (Figures 21.4 and 21.6), were perhaps locally made. Group A has the highest percentages at both sites and is chemically separated from the rest of the sample. As technological and typological attributes suggest, they probably originate in the Uspallata Valley, approximately 100 km north of these sites (Ots 2008). Although they are represented in small percentages in this study, technological and typological features of Groups D and Group E suggest that Group D could be local to the sites of AA and PLI, and Group E may be local to site AA.

In the case of the Diamante and Atuel River basins, we can observe some trends. Groups 1, 2, 4, and 6 were

identified only at the sites of AR and RA1. Groups 3 and 5 were present at almost all sites in the basin (except PJ2, where Group 3 was the only pottery group identified; Figure 21.6). We can observe some differences comparing highlands and plains. Sites from the plains are more chemically variable than those from the highlands (Figures 21.5 and 21.6). Group 3 is most frequent in the highlands and decreases to the east. Group 5 is abundant in the plains but has low percentages in the highlands. Thus, we suggest that Group 3 was local to the mountains, and Group 5 was local to the plains.

Considering the sample from both the northern and southern areas, other interpretations can be made (Figure 21.6). Groups 5, B, and C can be considered as one chemical group, with a strong presence at the center and southern Mendoza plains. Group 3 corresponds to types from both the eastern and western sides of the Andes. This case is very interesting because Chilean pottery of this group is technologically and typologically variable, notwithstanding chemical similarity with local types (Nihuil and Overo).

Two large regional chemical groups were recognized in the highlands and the northern and southern lowlands, which can be explained by geological similarities in the formation and history of clays in this latitude of the Andes. In the case of the pottery that we analyzed here, sources are not sufficiently differentiated to allow us to establish provenance of each particular group (Glascock and Neff 2003; Glascock et al. 2004). Despite the usefulness of INAA for identifying compositional groups in pottery from the Mendoza Province, this is an exploratory study and more samples should be analyzed and other analytical techniques should be explored to establish the mineralogical characteristics of compositional groups to discriminate variability among them.

The trends highlighted here can be discussed in connection with archaeological contexts comparing latitudinal and altitudinal variables and mobility and subsistence strategies. Pottery is chemically more variable at sites in the lowlands (AR, RA1, RI, AA, and PLI) that are residentially based with multipurpose activities (Sugrañes 2017b). Pottery from the highland sites, which were used as base camps for hunting animals (Sugrañes 2017b), is chemically more homogeneous. The site at RI stands out because it is very diverse technologically and typologically but not chemically.

Pottery on the Farming Frontier

The limits and characteristics of the farming frontier in the province of Mendoza is still under debate (Gil 1997–1998, 2003; Gil et al. 2011; Lagiglia 1999). Several publications have shown that the distinction between these subsistence strategies remains unclear, and the impact of

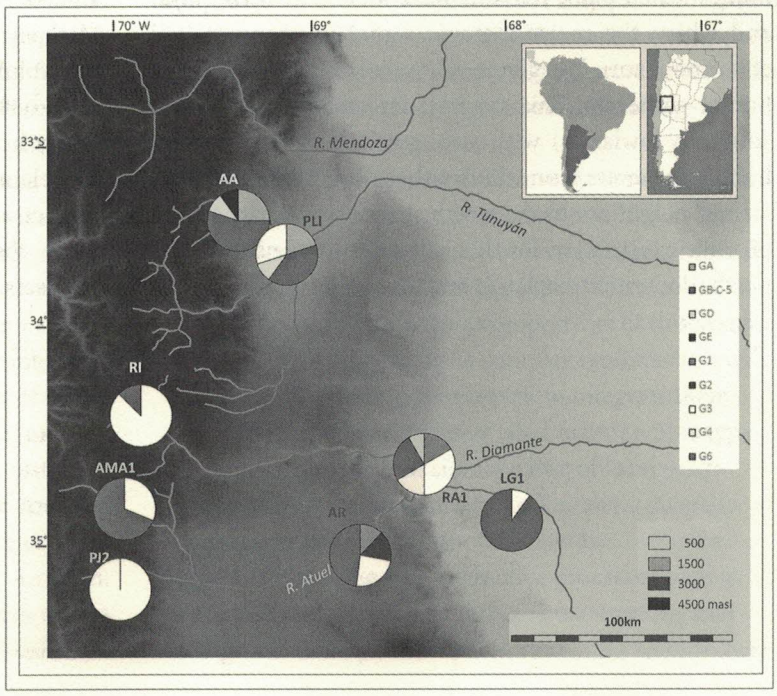


Figure 21.6. Chemical groups in the north and south of Mendoza province. Map by Pablo Cahiza.

domesticates in the diet of the human groups of the area was never important (Gil et al. 2009, 2011). Instead, hunting and gathering probably remained the most important food source even in the northern sites (Ots et al. 2016), and in many cases, some of the domestic plants could have arrived at the sites by exchange between farmers and hunting neighbors (Gil 1997–1998, 2003). This interaction between hunter-gatherers and food producers was very common around the globe, helping to reduce risk and providing required resources (Headland and Reid 1989; Layton 2001; Layton et al. 1991; Winterhalder and Goland 1997).

One item of exchange was pottery, which sometimes was moving with the plants and other goods. The INAA results show strong differences in the distribution of the chemical groups in northern and southern Mendoza Province. Some of the chemical groups are only present at northern sites (Groups A, D, and E), and others (Groups 1, 2, 4, and 6) are only present in the south. However, there are some chemical groups that are represented in both subregions, suggesting important connections between the two

The same chemical groups (Group 5, B, and C) are represented in AA, PLI, LG1, RA1, and AR, which could be related to several possible patterns of movement or interaction. AA and PLI were agricultural villages, later related to the Inca occupation (but see Gil et al. 2009, 2011). Meanwhile, the RA1 site and surrounding areas, where domesticated plant remains were identified (*Zea mays*) and where the maize isotopic signal is strongest (Gil et al. 2009, 2011; Lagiglia 1999), were occupied by mobile hunter-gatherers. This suggests an area (northern and southern lowlands) with strong relationships between hunter-gatherers from the southern lowlands and their farmer neighbors to the north. Exchange systems are a possible explanation for this pattern too. Items from the north (domesticated plants) and the south (obsidian) were common on opposite sides of the "frontier." These kinds of interactions allow societies to acquire resources that they are unable to achieve in other ways (Jochim 1981). Other explanations are associated with Beck's hypothesis (2009) about catchment strategies where hunter-gatherers took ceramics from farmers.

Other processes were taking place in the highlands. Chemical homogeneity is unexpected since technological and typologically contexts show a variable ceramic set, with presumed different origins. Sites from the mountains in southern Mendoza (all sites without domesticates) share fewer chemical groups with the northern sites, but Chilean types and eastern Andean types are represented in the same chemical groups. Falabella, Planella, and Tagle (2001) state that resources of the eastern highlands were exploited by Chilean families during the summer. Thus, the Overo type may derive from the western Andes pottery traditions. Another explanation is that chemical similarities may be explained by the process of clay formation in the Andes. In spite of this, we can suggest that movement of goods and social interactions between the hunter-gatherers from the south and farmers from the north of Mendoza were more common than the current evidence might indicate.

ACKNOWLEDGMENTS

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