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Instrumental neutron activation analysis of Inka and local pottery from northern Chile's Atacama Desert

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ABSTRACT

This paper presents the results of bulk chemical compositional analyses of ceramic pastes through Instrumental Neutron Activation Analysis (INAA), which is the most precise method available for this kind of research. The analyses were carried out on 94 fragments of pottery from several archaeological sites in northern Chile's Atacama Desert. We aimed to examine the possible origins of pottery vessels distinguished by Inka and local styles within the process of the Inka State expansion into the territories south of Cusco, known as Collasuyu. On the basis of these analyses, we discuss the idea that the State introduced to the zone pottery with Inka iconographic styles from the Lake Titicaca region (more than 500 km away). But, more important, the State seems to have encouraged the replication of State pottery standards by local artisans, who consciously or unconsciously maintained certain traditional procedures. This means that skilled local artisans imitated Inka iconographic style but using paste of local origin. These results show the importance of archaeometric analysis of high-prestige fine Inka and local pottery as it sheds light on how the State managed their political strategies, their impact on the prehistoric polities of northern Chile (NCh).

1. Introduction

1.1. Regional background and relevant research questions

The expansion of the Inka throughout the Andes has been highlighted though the presence of conspicuous cultural material that included architecture, textiles, metal objects and distinctive Inka polychrome pottery, among other raw items (Alconini, 2013; Hyslop, 1990). We believe that marginal territories like the northern Chile were incorporated into the empire, although no major architectural projects were undertaken (Adán and Uribe, 2005; Muñoz and Chacama, 2010; Santoro et al., 2010b; Uribe and Urbina, 2009; Williams et al., 2009; Zori and Urbina, 2014). We think that pottery played an important role in this process, both by moving high-prestige fine pottery from regional productive political centers, and by endorsing State standard pottery making techniques for local replicas. More specifically we propose that certain vessels from State pottery productive centers in the Titicaca region, more than 500 km away, were brought into the coast and valleys of northern Chile by long distance networks of exchange and alliances (Ballester and Gallardo, 2011; Romero, 2002; Santoro et al., 2010a; Villanueva, 2015).

We particularly refer to the elegant Inka vessels and their provincial versions that were produced either through the labor-intensive efforts of local potters or the creation of pottery productive centers staffed by specialized artisans who served the State as *mitmaqkuna* (Espinoza Soriano, 1970; Murra, 1978). It is uncertain, however, where Inka vessels were produced and what mechanisms of distribution and consumption were carried out. At State administrative centers, Inka pottery was repeatedly used for commensal hospitality, to serve beer and food, or as containers for offerings at shrines and human burials (Ceruti and Reinhard, 2009; Morris, 1995; Morris and Thompson,

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1985). In provincial territories such as Northwest Argentina (NWA) and northern Chile (NCh), Cusco polychrome and its variations were used in everyday activities, as well as in specialized contexts, such as particular compounds in provincial centers, cemeteries, and shrines. The Inka used these prestige goods to enhance the role of the State as sponsor and other managerial policies applied by the Inka to maintain and enhance their power and control over constantly expanding territories (Calderari and Williams, 1991; Ceruti and Reinhard, 2009; Couso et al., 2011; D'Altroy et al., 2007; Raffino, 2004; Williams, 2010; Williams and Lorandi, 1986).

Inka polychrome ceramics varied in style and manufacturing techniques from one province to the next (Calderari and Williams, 1991; Hayashida et al., 2003; Julien, 1983; Morris, 1972). This was the consequence of the spatially limited circulation of Cusco pots with polychrome styles and the reliance on local potters for its production (Alconini, 2013; D'Altroy and Bishop, 1990; Spurling, 1992). Conversely, great stylistic and compositional variation among the provinces should be expected. One way to sort this out is through instrumental neutron activation analysis (INAA), aiming to identify whether Inka style vessels were locally made, or whether they were brought from specialized centers of production and distribution over a large regional area.

In short our research is intended to improve the knowledge and explanations for the political milieu of the Inka State government and productive policies enforced across provinces. In particular, we looked for regional patterns of ceramic production and distribution during the Inka period in an attempt to demonstrate that, among the transformations brought about by the Inka State, pottery production was changed by introducing new technologies and iconography that were reworked by local artisans who, consciously or unconsciously, incorporated certain traditional procedures.

1.2. Regional setting

The territories of the Pacific littoral, the coastal valleys, high Andean valleys and high Andean plateau of NCh (Fig. 1) maintained a relatively low population density as general and chronic hyper arid conditions limited the possibilities a large-scale and intensive agricultural and pastoral production. This would seem to explain the minimal State investment in those territories. Consequently, considering the environmental constraints and applying Murra's (2002) vertical model, Llagostera (2010) has suggested that the Inka State controlled the territories of NCh through Caranga, Lupaqa, Colla, and Pacaje political groups from the Titicaca basin. These polities had demographic and economic capacities to confront the problems of maintaining productive operations over territories outside of their native lands in the highland, during pre-Inka times (Covey, 2000; Murra, 2002; Santoro et al., 2010b; Schiappacasse et al., 1989).

Before Inka control, the societal groups of NCh and southernmost Peru were socio-politically interdependent, whereas political and economic arrangements between local leaders did not trigger the formation of highly hierarchical and stratified social structures ruled by paramount chiefs. Instead, each local leader controlled small segments of territories and people within a coastal valley, a possible section in the coast, and a section in the upper part of the valley (Romero, 2002; Santoro et al., 2010b). The highlands were part of a different political system. The political and economic alliances between pre-Inka polities was sealed through certain cultural actions reflected, for instance, in the use of common iconography for pottery, textiles, and rock art, which helped to create and maintain social bonds, internal negotiations, and eventually solve disputes. It may also have created a common front to negotiate with, or contend against, the more powerful and larger Altiplano or highland groups, which were permanently eager to gain access to the attractive and diverse resources of the tropical forest and coastal Pacific lowlands (Murra, 2002).

This local political network started to be transformed in the 14th century when Topa Inka Yupangui conquered the province of Pacaxes, a territory contiguous to the province of Arica. Topa Inka carried out some geopolitical reorganization, designating land for maize cultivation in the valleys and coast of Arica and Arequipa (Jiménez de la Espada, 1965). This political decision may have allowed Altiplano people to control the lowlands, a political and economic desire that could not be

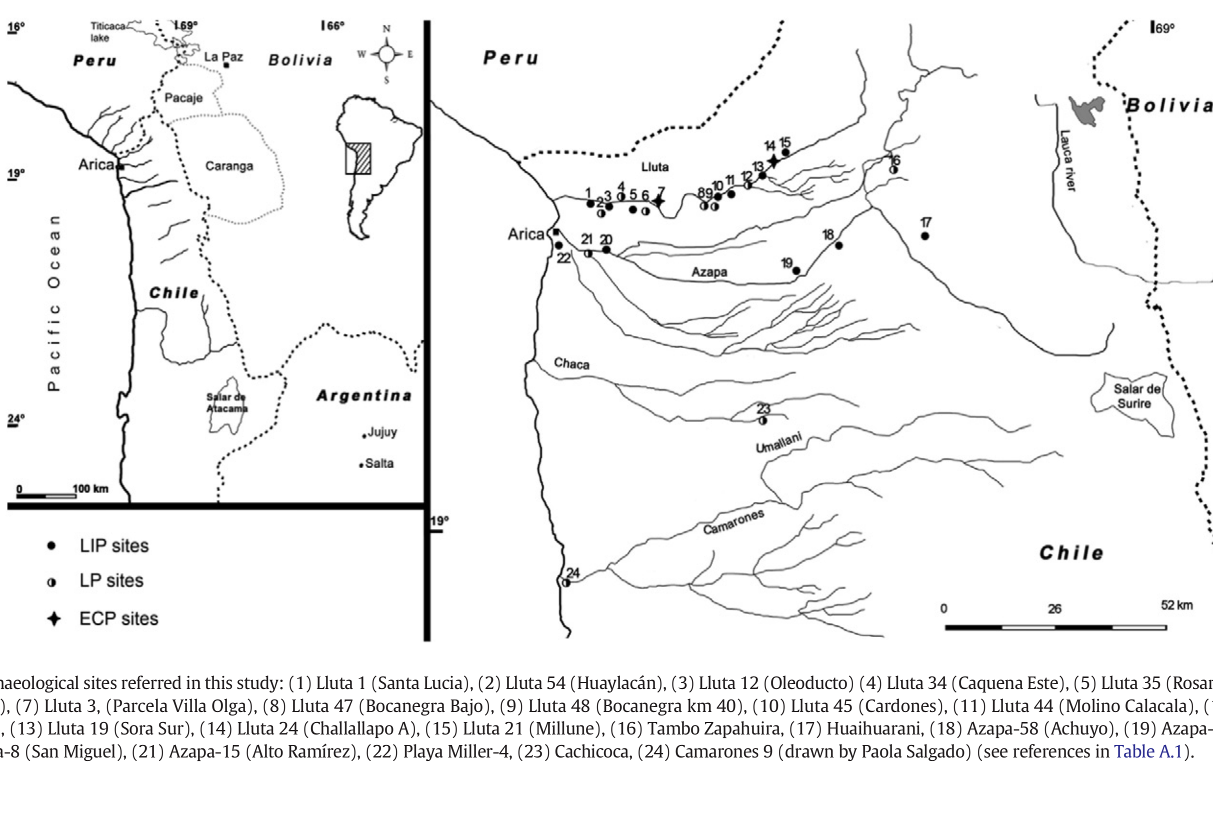

Fig. 1. Archaeological sites referred in this study: (1) Lluta 1 (Santa Lucia), (2) Lluta 54 (Huaylacán), (3) Lluta 12 (Oleoducto) (4) Lluta 34 (Caquena Este), (5) Lluta 35 (Rosario 1), (6) 36 (Rosario 2), (7) Lluta 3, (Parcela Villa Olga), (8) Lluta 47 (Bocanegra Bajo), (9) Lluta 48 (Bocanegra km 40), (10) Lluta 45 (Cardones), (11) Lluta 44 (Molino Calacala), (12) Lluta 41 (Chapisca), (13) Lluta 19 (Sora Sur), (14) Lluta 24 (Challallapo A), (15) Lluta 21 (Millune), (16) Tambo Zapahuira, (17) Huaihuarani, (18) Azapa-58 (Achuyo), (19) Azapa-50 (Chilpe), (20) Azapa-8 (San Miguel), (21) Azapa-15 (Alto Ramírez), (22) Playa Miller-4, (23) Cachicoca, (24) Camarones 9 (drawn by Paola Salgado) (see references in Table A.1).

Table 1
Paste characteristics of Late Intermediate Period pottery clusters and styles (*after Romero, 2002, 2005; Santoro et al., 2001).

Cluster	Styles	Origin	Paste*
Arica	San Miguel, Pocoma and Gentilar	Local previous pottery tradition	Standard 400: a rather rough temper paste, with medium density of quartz temper and rocks of black and gray color, in similar proportions fired in a regular oxidizing environment. Standard 100: has similar density and size temper to those of Standard 400 and 500. This paste is used in domestic pottery.
Serrano	Charcollo	High Andes valleys of Arica and in the highland of Tacna	Standard 500: hard paste burned in an oxidant environment; show a fine temper of white, orange, or brown color
Black/Red	Chilpe	Highlands	Standard 220: fine grain clay and temper burned at high temperature in an oxidant firing

materialized before as they did not have the political and economic power to maintain long-distance territorial control (Covey, 2000; Llagostera, 2010; Murra, 2002; Stanish, 1992).

1.3. Pottery styles and chronology

We present the pottery styles from NCh for the Late Intermediate Period (LIP, 1000–1400 CE), the Late Period (LP, 1400–1530 CE) and the Posthispanic Period (PHP, 1530–1700 CE). Three stylistic clusters are known for the LIP: Arica, Serrano, and Black on Red. It is important to note that these styles are no exclusively of the LIP because, as seen in many parts of the Andes, local pre-Inka style continued during the LP (Ixer et al., 2014; Santoro, 2016; Schiappacasse et al., 1989; Schiappacasse and Niemeyer, 1989; Sillar and Dean, 2002; Williams, 2004). Conversely, LIP pottery styles could be present at both LIP and LP sites. In contrast, Inka pottery styles will be only present at LP sites. The PHP, represented by the Indigenous Post Hispanic style, are found at LP site either (see Table A.1).

1.3.1. Late Intermediate Period (1000 to 1400 CE) pottery styles

The LIP pottery is composed by Arica, Serrano and Black/Red clusters, including different styles, which are summarized in Tables 1 and 2.

The **Arica cluster** encompasses three classic polychrome styles: San Miguel, Pocoma and Gentilar (Fig. 2), which evolved from the previous local pottery tradition (Romero, 2002; Romero, 2005; Santoro et al., 2001; Schiappacasse et al., 1989; Uribe, 1999).

The **Serrano cluster** of high Andes valleys, known as Charcollo style (Romero, 2002) (Fig. 3). They are common in the upper valleys of Arica and in the highland of Tacna (Gordillo, 1996). It resembles the Estuquiña style, applied upon the slip of deep bowls, in the highlands of the Osmore basin (Stanish, 1992).

The **Black/Red cluster** includes the Chilpe style (Schiappacasse et al., 1989). Vessels were made with high-quality technique, distinguishing it as imported goods from the highlands. Similar designs are described for the Pacaje context in the highland of Bolivia (Pärssinen and Siiriäinen, 1997), as well as for other pre-Inka sites in NCh and the Lake Titicaca basin (Fig. 4).

1.3.2. Late Period (1400–1530 CE) pottery styles

Currently, the Inka styles include Inka Polychrome, Inka Black/Red, Inka Red (Inka Red Coat) and a well-known style called locally as Saxamar and regionally as Inka-Pacaje (Albarracín-Jordan, 1996; Cremonte et al., 2015; Ryden, 1947). In contrast to the paste of the Arica and Serrano clusters, the vessels of this cluster were made with the finest paste, standard 210, 220, and 500. Paste 210, burned at high temperatures, yielding a high quality pottery with a bright orange color and a polished surface, which typically characterize them along the Andes. Pastes 220 and 500 are represented in fewer quantities. Standard 100 (medium temper, reductive firing) was another paste used for manufacturing of Inka pottery.

The **Inka-Pacaje or Saxamar** style is characterized by highly stylized *llamas* densely displayed in a spiral form inside bowls, the polished

Table 2
Late Intermediate Period pottery styles (after Uribe, 1999; Santoro et al., 2001, and Romero, 2002, 2005).

Style	Paste	Decoration/color	Designs	Surface treatment	Common forms	Varieties
San Miguel	Standard 400	Tricolor. Red and black, over a white coat	Discontinuous decoration, in fields or panels, predominantly quadripartition. Geometric motifs: sawn, zigzag, scrolls, spirals, wavy lines	Coated polished	Jars, jugs, bowls and *mates*	
Pocoma (Pocoma-Gentilar)	Standard 400	Bicolor. Red and black over a burnished “natural dull terracotta” surface without slip	Continuous decoration predominance of tripartition. Sawn in V, circles, scrolls S, crosses, hooks, triangles	Uncoated polished	*Mates* and pitchers	
Gentilar (Pocoma Gentilar B)	Standard 400	Tricolor. Black, red, and white applied over a burnished reddish surface, or discontinuous panels with red slip	Continuous decoration, predominance of tripartition with greater complexity in the form and compositions of designs: triangles, spirals, wavy lines, crosses, diamonds, biomorphic motifs	Uncoated polished	Jars	
Charcollo	Standard 500	Red irregular lines or spots over a natural brownish surface	No recognizable design pattern: spots of sprinkled aspect, diluted lines, and thick red spots an brushstrokes	Smoothed with frequent brushing	Jars and pots	Serrano Crude Red variety: pale color covered with an irregular application of red slip both in the interior and the exterior of the vessels
Chilpe	Standard 220	Bicolor. Black motifs over a red surface natural or painted	Geometric designs: spirals, lines with triangles, serpent-like lines, crosses, and semi-circles; drawn parallel and close to the rim, and inside of the vessels	Polished with or without red slip	bowls	Perpendicular Black/Red variety: straight, diagonal, waving lines, triangles, and crosses perpendicular to the rim Vilavila variety: combination of straight and undulating lines, parallel to the rim, repeated at certain intervals

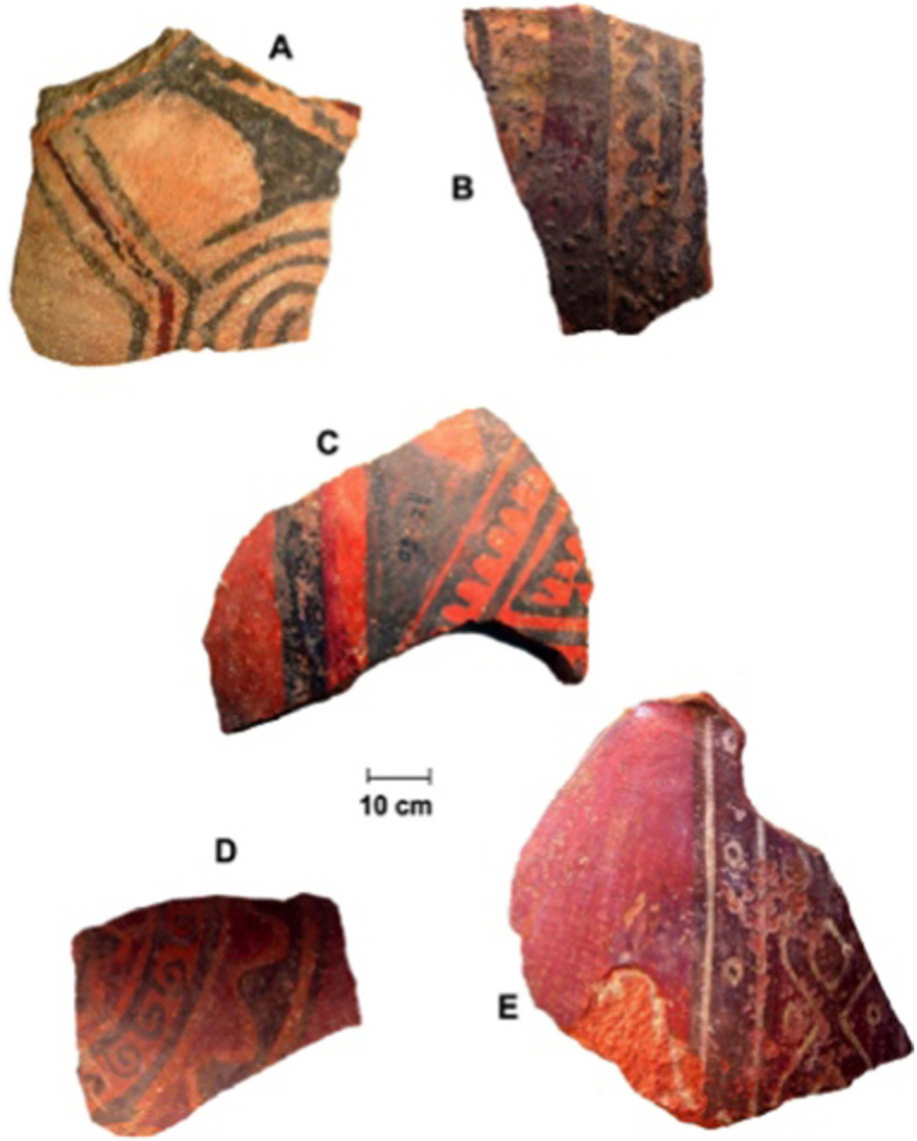

Fig. 2. The Arica cluster styles, Late Intermediate Period (1000 CE to 1400): (a–b) San Miguel (samples VIW (VIW: Lab code, see Table A.1.) 435 and VIW 367, see Table A.2), (c) Pocoma (sample VIW 374), (d–e) Gentilar (samples VIW 375 and VIW 393).

surface of which is covered with a red slip. A variety of this style corresponds to designs of black circles with white or black dots inside over the same type of surface, and displayed in the same way as the *llamas*. The **Inka Polychrome** style shows straight linear designs in black, red and white applied over a polished red surface. These fine vessels, typical of the Inka State industry south of Cusco, may have been possibly produced in specialized centers of *ollero* (pottery maker) communities; (Murra, 2002) in the Lake Titicaca basin, which avoided the need to bring them from Cusco. The **Inka Black/Red** variant is composed of straight linear black designs applied to a polished surface or covered with a red slip. In some cases, fine black lines were painted on the lip of the vessels, giving them a typical expression. The **Inka Red** or **Inka Red Coat** variant corresponds similarly to vessels made with paste standard 210, polished and covered with a red slip. It is recognized among bowls and aryballoids, which do not have any other sort of decoration (Fig. 5).

The **Indigenous Post Hispanic** style (IPH 1530 to 1700 CE) was made in early colonial times, maintaining pre-Columbian techniques and paste characteristics, although lacking the typical local decoration. This pottery is vitrified and is morphologically similar to some Spanish Colonial pottery. The paste of this ceramic was classified as Standard 1000, which has fine grain clay paste with temper burned at high temperature in an oxidant environment. They were manufactured by wheel. We integrate this pottery style in this analysis as an example of the continuity of local pottery production into colonial times.

2. Materials and methods for instrumental neutron activation analysis

2.1. The analyzed data from the valleys of northern Chile

Ninety-four fragments of pottery from NCh that constitute the subject of this report is a subset of a larger batch of sherds from Argentina and Bolivia (n = 459, Table 3), which were analyzed as a whole leading to the compositional groups in relation to which the sample results of NCh are examined. The discussion of this sample subset, considered as an independent analytic unit, enable us to study some issues on Inka expansion to the south (Williams et al., 2016, unpublished data). The entire samples belong from Inka provinces in NWA (in the modern Salta, Jujuy, and Catamarca provinces), NCh, and the Bolivian Altiplano. Samples from NWA (n = 306) come from Inka and pre Inka excavated sites and surface collection (Williams et al., 2016). Samples from Bolivia

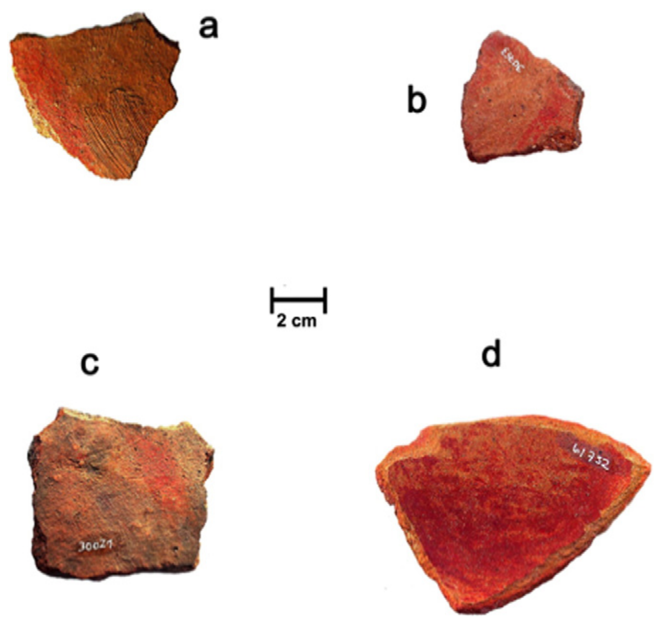

Fig. 3. The Serrano, high Andes valleys, group pottery styles, Late Intermediate Period (1000 CE to 1400): (a–c) Charcollo style (samples VIW 392, VIW 417, and 420, see Table A.2), (d) Serrano Crude Red style (sample VIW 411).

(n = 14) come from a large archaeological collection excavated by Adolph Bandelier in Lake Titicaca in the Peru and Bolivia high Andean plateau by the end of the 19th century (Bandelier, 1910: 2006–2008, Plate XLVIII).

This surface and stratigraphic collections that include pottery are stored in the American Museum of Natural History, from where we obtained the sample analyzed here. Both the Argentinian and Bolivian samples were gathered systematically, as we specifically look for typical

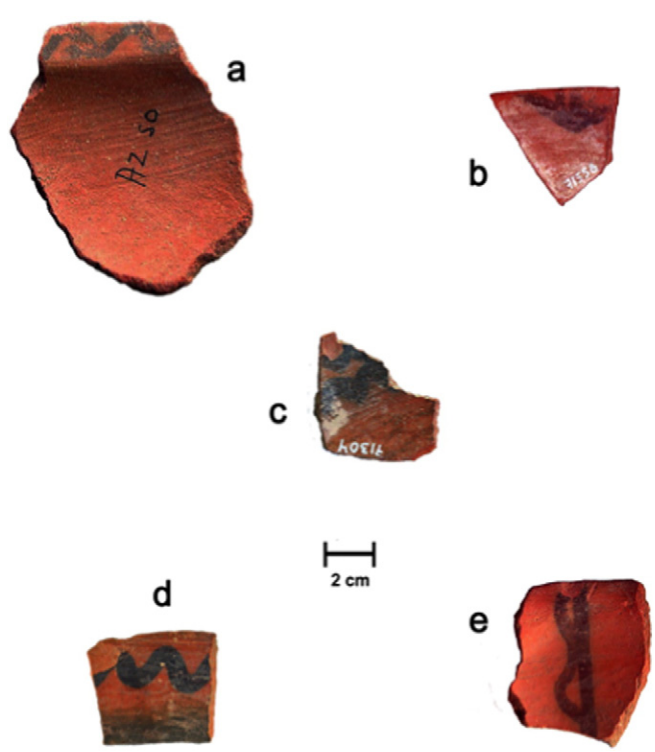

Fig. 4. The Black/Red group, Late Intermediate Period (1000 CE to 1400): (a–d) Chilpe style (samples VIW 370, VIW 396, 397, and 412, see Table A.2), (e) Perpendicular Black/Red variety or Vilavila style (sample VIW 390).

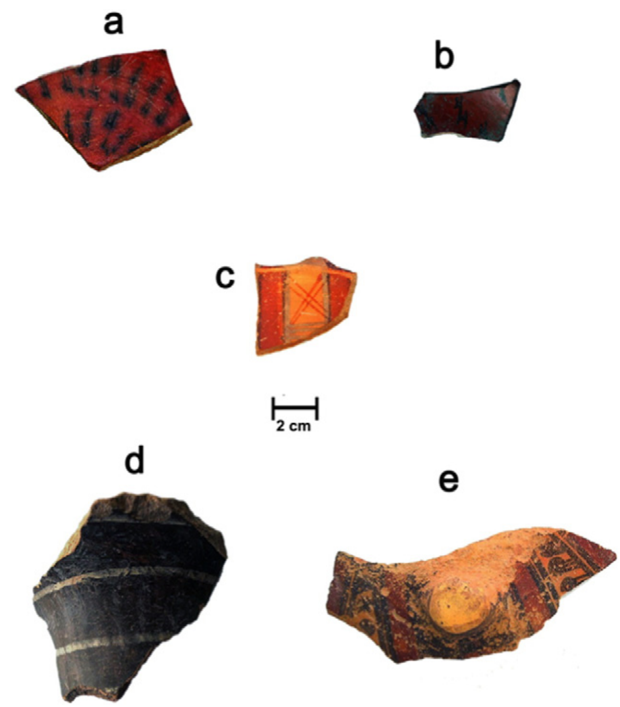

Fig. 5. The Inka pottery styles, Late Period (1300–1530 CE): (a–b) Saxamar or Inka-Pacaje style (Samples VIW 406 and VIW 424, see Table A.2), (c–e) Inka Polychrome style (samples VIW 405, VIW 409, and VIW 410).

Inca and pre-Inka vessel fragments. The larger sample includes clay (n = 45), which were solely obtained in Salta (Calchaquí valley), Catamarca (Andalgalá region) and Jujuy (Yavi). We did not have the opportunity to collect and analyzed clay samples from NCh and Lake Titicaca basin, and it should be consider in the future.

Northern Chile samples were selected from 23 sites located in the valleys of Azapa, Lluta, and Camarones, and the high Andes valleys of Arica (Fig. 1; Tables A.1 and A.2), which cover a wide geographic area and assure that all the ceramic styles (LIP, LP and PHP) were represented in the sample. The selected sites have been identified as LP and LIP based on the occurrence of Inka and LIP style pottery. All these materials are stored at the Museo Arqueológico Universidad de Tarapacá, in Arica, Chile, and were obtained by systematic archaeological studies, carried first by the end of the sixties (Dauelsberg, 1995 [1960]; Focacci, 1995 [1961]). Later, from 1997 to 2000 we carried full coverage survey, surface collection and excavations in the Lluta Valley, which has provided the material sample for this study. Samples from the other sites in the valleys of Camarones, Azapa, and Chaca were obtained from collections in the Museo Universidad de Tarapacá (full references for sites description are provided in Table A.1).

The specific samples for this study were selected systematically to assure a good representation of LP and LIP styles. Forty-eight samples come from thirteen sites that belong to the LIP (1000–1400 CE). Forty-three samples come from nine sites that correspond to the LP (1400–1500 CE), whereas the latest three samples come from two PHP sites (1500–1700 CE) (Fig. 1; Table A.1).

Table 3
Frequency distribution of the large batch of analyzed samples.

	Pottery	Clay	Total
Chile	94	–	*94*
Argentina	306	45	*351*
Bolivia	14	–	*14*
Total	*414*	*45*	*459*

2.2. Technical methods for the chemical composition of pottery

The neutron activation analysis consists of two irradiations and a total of three gamma counts. It constitutes a superset of the procedures used at most other NAA laboratories (Glascock, 1992; Neff, 1992; Neff, 2000). Pottery samples and clays were prepared for INAA using standard procedures at MURR. Fragments of about 1 cm^2 were removed from each sample and abraded using a silicon carbide burr in order to remove glaze, slip, paint, and adhering soil, thereby reducing the risk of measuring contamination. The samples were washed in deionized water and allowed to dry in the laboratory. Once dry, the individual sherds were ground to powder in an agate mortar to homogenize the samples. Two analytical samples were prepared from each source specimen. Portions of approximately 150 mg of powder were weighed into clean high-density polyethylene vials used for short irradiations at MURR. At the same time, 200 mg of each sample was weighed into clean high-purity quartz vials used for long irradiations. The technical method used to conduct the analysis corresponds to a bulk chemical compositional study of the ceramic pastes through INAA, which is the most precise method available at present for determination of the provenience of ceramic. Statistical analysis was subsequently carried out on base-10 logarithms of concentrations on the remaining 28 elements. Use of log concentrations rather than raw data compensates for differences in magnitude between the major elements, such as Ca, and trace elements, such as the rare earth or lanthanide elements (REEs). Transformation to base-10 logarithms also yields a more normal distribution for many trace elements. The interpretation of compositional data obtained from the analysis of archaeological materials is discussed in detail elsewhere (Baxter, 1994; Bieber et al., 1976; Bishop and Neff, 1989; Glascock, 1992; Harbottle, 1976; Neff, 2000) and will only be summarized here.

The main goal of data analysis is to identify distinct homogeneous groups within the analytical database. Based on the provenance postulate (Weigand et al., 1977), different chemical groups may be assumed to represent geographically restricted sources. The ubiquity of ceramic raw materials usually makes it impossible to sample all potential "sources" intensively enough to create groups of known to which unknowns can be compared. Compositional groups can be viewed as "centers of mass" in the compositional hyperspace described by the measured elemental data. Groups are characterized by the locations of their centroids and the unique relationships (i.e., correlations) between the elements. Decisions about whether to assign a specimen to a

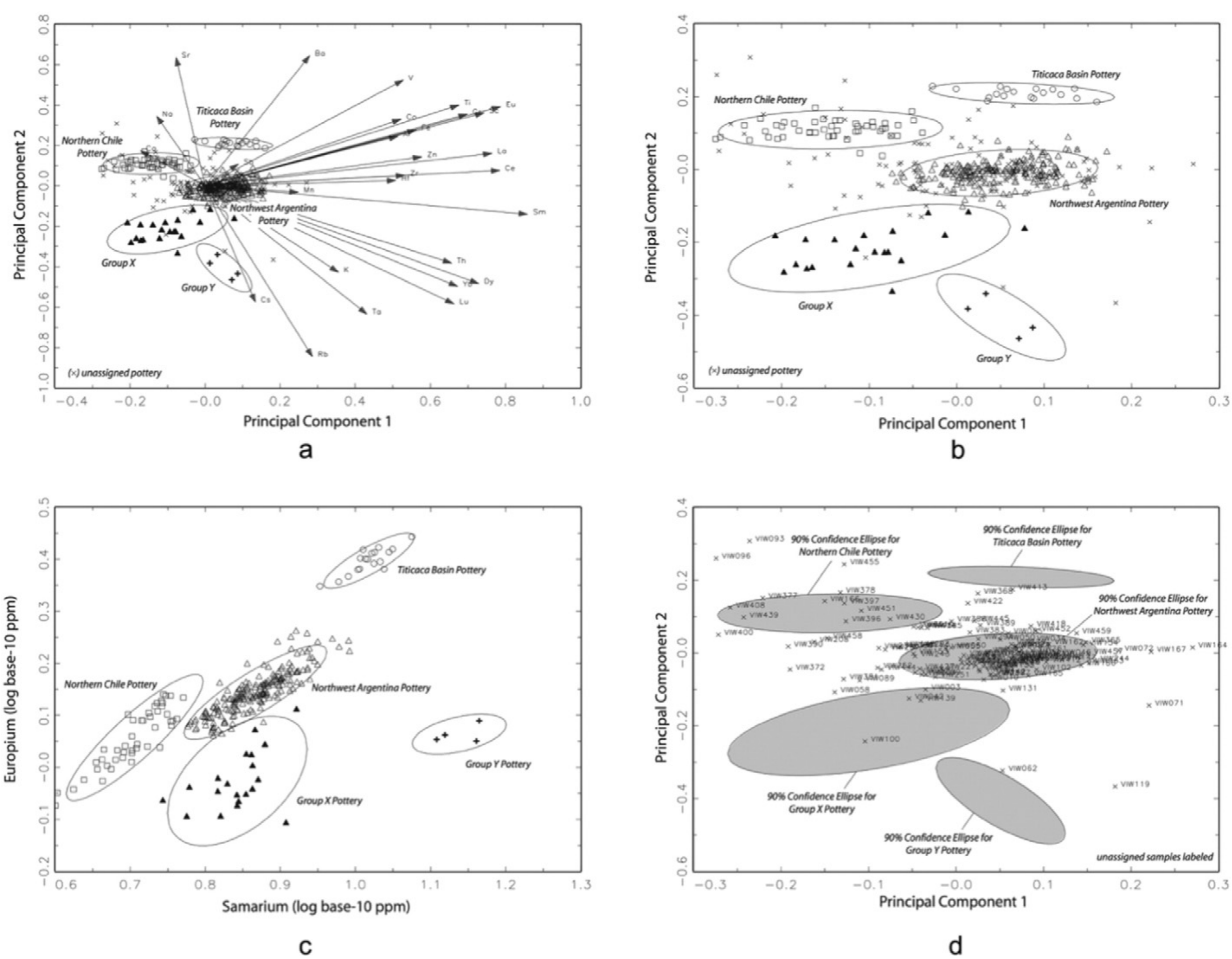

Fig. 6. (a) correlation-matrix biplot of principal component 1 and 2 based on PCA of the entire sample dataset (n = 414). Ellipses represent the 90% confidence interval for group membership; (b) correlation-matrix plot of principal component 1 and 2 based on PCA of the entire sample dataset (n = 414). Ellipses represent the 90% confidence interval for group membership; (c) plot of samarium and europium base-10 logged concentrations for pottery from NCh, the Titicaca Basin, NWA, and two unknown production areas (pottery Group X and Group Y). Ellipses represent the 90% confidence interval for group membership; (d) correlation-matrix plot of principal component 1 and 2 based on PCA of the entire sample dataset with unassigned specimens projected against 90% confidence ellipses for the groups.

particular compositional group are based on the overall probability that the measured concentrations for the specimen could have been obtained from that group.

Initial hypotheses about source-related subgroups in the compositional data can be derived from non-compositional information (e.g., archaeological context, decorative attributes, etc.) or from application of various pattern-recognition techniques to the multivariate chemical data. Some of the pattern recognition techniques that have been used to investigate archaeological data sets are cluster analysis (CA), principal components analysis (PCA), and discriminant analysis (DA). The PCA biplot affords a means for assessing the contributions of various elements to the identified subgroup structure. Each of these techniques has proper advantages and disadvantages, which may depend upon the types and quantity of data available for interpretation.

Whether a group can be discriminated easily from other groups can be evaluated visually in two dimensions or statistically in multiple dimensions. A metric known as the Mahalanobis distance (or generalized distance) makes it possible to describe the separation between groups or between individual samples and groups on multiple dimensions. Lastly, Mahalanobis distance calculations are also quite useful for handling missing data (Sayre, 1975). When many specimens are analyzed for a large number of elements, it is almost certain that a few element concentrations will be missed for some of the specimens. This occurs most frequently when the concentration for an element is near the detection limit. Rather than eliminate the specimen or the element from consideration, it is possible to substitute a missing value by replacing it with a value that minimizes the Mahalanobis distance for the specimen from the group centroid.

3. Results of instrumental neutron activation analysis

The analyses at MURR produced elemental concentration values for 32 or 33 elements in most of the 414 analyzed pottery samples. Data for Ni in most samples was below detection limits (as is the norm for newest World ceramic analyses) and was removed from consideration during the statistical analysis. In addition, As, Nd, U, and Tb have higher counting errors. In order to minimize variation within the dataset, these elements were removed from consideration.

A PCA biplot based on the correlation matrix of the complete data set (N = 414) is shown in Fig. 6d. PCA resulted in the identification of five groups: four large groups and one smaller group. Interestingly, these chemical groups correspond to broad geographic zones—Titicaca Basin (Group-1), NCh (Group-2), NWA (Group 3), and an unknown area (Groups X and Y) most of which samples comes from NW Argentina. A similar pattern can be seen in Fig. 5, a plot of samarium and europium concentrations. Chemical groups assigned to particular geographic zones do not mean that they were archeologically collected from that area.

Group 1 (n = 18) is assumed to represent pottery produced in the Titicaca basin based on the fact that 9 of the 15 analyzed samples from Titicaca are assigned to Group-1 (Williams et al., 2016). Of the 9 samples assigned to this group, seven are from NCh archaeological contexts and one is from a site in Salta Province. Comparison of Group-1 with D'Altroy and Bishop's (1990) INAA for southern Peruvian Inka pottery (specifically the Lake Titicaca pottery samples), previously analyzed at Brookhaven National Laboratory, provide further support that Group-1 pottery originates from the Titicaca basin.

Group 2 (n = 48) is comprised almost exclusively of pottery recovered from sites in NCh. Because this group includes pottery from so many different Chilean sites, it is probable that may subsume multiple compositional groups. Additional sampling will aid in evaluating the homogeneity of this group. Currently, the most conservative approach is to treat this as a single analytical unit until additional analyses from NCh become available.

Group 3 (n = 203) that constitutes the bulk of the analyzed sample (from NWA) forms a large macro-group.

Group X (n = 20) corresponds exclusively from one Inka site in NWA. Group Y (n = 4) also come from different sites in NWA (Williams et al., 2016). Although unassigned specimens (n = 121) are problematic, the approach taken herein is similar to that taken by most INAA laboratories and serves to minimize incorrect group assignments by leaving marginal specimens unassigned (Neff et al., 2006; Fig. 6b).

In reference to the Chilean sample (n = 94) the compositional analysis shows that they distributed within the three of five chemical groups listed above: Group-1 (8.5%), Group-2 (46.8%), Group 3 (5.3%). Thirty-seven samples were unassigned (39.4%; Table 4), which means that they were marginal to all groups (less than 1% probability of membership), or that they showed compositional affiliations with more than one group (high probabilities in multiple groups). Our cut-off for group membership is generally 1%, a general rule applied by most INAA MURR projects. Moreover, it could be a specimen that if included in a group to which it apparently belonged might have obscured distinctions between groups that were otherwise well discriminated. A PCA biplot based on the correlation matrix of the five chemical groups are shown in Fig. 6a–b. A similar pattern can be seen in Fig. 6c, a plot of samarium and europium concentrations. Other compositional groups related with the total batch of pottery fragments and clay samples (both from NWA) and from Bolivia are not presented here (Williams et al., 2016) . Moreover, sherds are represented by the individual data points assigned to a particular group. There is no point in designating them separately.

Half of the sample of NCh is comprised of Inka pottery cluster (48.9%), while 26.6% belong to the Arica cluster, and only 14.9% are Black on Red cluster. The Serrano cluster represents 5.3% of the sample (Table 4). Eight Chilean fragments belong to **Group 1** (see Table A.1). Seven of these are Inka polychrome style, and the remaining one is Inka Red style (Table 5). In this group distinct Inka forms, open and closed, are represented. Comparison of Group 1 with D'Altroy's Mantaro Valley and Titicaca basin samples (analyzed at Brookhaven National Laboratory, BNL) provides further support that Group 1 pottery originated in the Titicaca basin (Bishop and Neff, 1989; D'Altroy and Bishop, 1990).

Table 4
Frequency and proportions of compositional chemical groups among pottery clusters of NCh sample.

		Pottery cluster						Total chemical group	
		Arica	Inka	Black on Red	Posthispanic	Serrano	Undecorated	N	%
Chemical group	Group 1		8					**8**	8.5%
	Group 2	22	11	4	2	4	1	**44**	46.8%
	Group 3		5					**5**	5.3%
	Unassigned	3	22	10		1	1	**37**	39.4%
Total pottery cluster	N	**25**	**46**	**14**	**2**	**5**	**2**	**94**	
	%	26.6%	48.9%	14.9%	2.1%	5.3%	2.1%		100.0%

Table 5
Distribution of pottery styles through chemical Groups of NCh sample.

	Group 1		Group 2		Group 3		Unassigned		Total	
Late Intermediate Period	N	%	N	%	N	%	N	%	N	%
Arica		**0,0%**	**22**	**50,0%**		**0,0%**	**3**	**8,1%**	**25**	**26,6%**
Gentilar		0,0%	8	18,2%		0,0%	1	2,7%	9	9,6%
Pocoma		0,0%	5	11,4%		0,0%		0,0%	5	5,3%
San Miguel		0,0%	8	18,2%		0,0%	2	5,4%	10	10,6%
San Miguel T		0,0%	1	2,3%		0,0%		0,0%	1	1,1%
Black on Red		**0,0%**	**4**	**9,1%**		**0,0%**	**10**	**27,0%**	**14**	**14,9%**
Black/Red		0,0%	1	2,3%		0,0%	2	5,4%	3	3,2%
Black/Red Perpendicular		0,0%		0,0%		0,0%	1	2,7%	1	1,1%
Chilpe		0,0%	2	4,5%		0,0%	5	13,5%	7	7,4%
Vilavila		0,0%	1	2,3%		0,0%	2	5,4%	3	3,2%
Serrano		**0,0%**	**4**	**9,1%**		**0,0%**	**1**	**2,7%**	**5**	**5,3%**
Charcollo		0,0%	3	6,8%		0,0%		0,0%	3	3,2%
Serrano Crude Red		0,0%	1	2,3%		0,0%	1	2,7%	2	2,1%
Undecorated		**0,0%**	**1**	**2,3%**		**0,0%**	**1**	**2,7%**	**2**	**2,1%**
Undecorated		0,0%	1	2,3%		0,0%	1	2,7%	2	2,1%
Late Period										
Inka	**8**	**100,0%**	**11**	**25,0%**	**5**	**100,0%**	**22**	**59,5%**	**46**	**48,9%**
Inka Black/Red		0,0%		0,0%		0,0%	2	5,4%	2	2,1%
Inka Polychrome	7	87,5%	2	4,5%		0,0%	6	16,2%	15	16,0%
Inka Red	1	12,5%	1	2,3%	4	80,0%	8	21,6%	14	14,9%
Inka Red Slip		0,0%		0,0%	1	20,0%	1	2,7%	2	2,1%
Saxamar		0,0%	8	18,2%		0,0%	3	8,1%	11	11,7%
Saxamar B		0,0%		0,0%		0,0%	2	5,4%	2	2,1%
Posthispanic		**0,0%**	**2**	**4,5%**		**0,0%**		**0,0%**	**2**	**2,1%**
Indigenous Post Hispanic		0,0%	2	4,5%		0,0%		0,0%	2	2,1%
Total	**8**	**100,0%**	**44**	**100,0%**	**5**	**100,0%**	**37**	**100,0%**	**94**	**100,0%**

Forty-four fragments belong to **Group 2**, which is entirely composed of pottery recovered from sites in NCh. Because this group includes pottery from so many sites, it probably subsumes multiple compositional groups (Table A.1 and Table 4). Additional sampling will aid in evaluating the homogeneity of this group. Currently, the most conservative approach is to treat this as a single group until additional analyses from NCh are available. Stylistically, Group 2 is represented mainly by the Arica ceramic cluster (San Miguel, Early San Miguel, Pocoma and Gentilar styles), with 50% of the cases, followed by Inka (25%) and Black on Red clusters (9.1%) (Table 5).

Five fragments belonging to **Group 3** are Inka Red Slip (Table 5). This Group primarily comprises provincial Inka pottery from Salta, and, to a lesser extent, from Catamarca, Jujuy, and the Titicaca basin archaeological sites (Williams et al., 2016). Group 3 is somewhat heterogeneous and may include pottery from more than one production locale. Fragments unassigned to a chemical group mostly correspond to Inka styles (59.5%), and, secondly, to Black on Red style (27%) (Table 5).

According to Table 5, where the distribution of pottery styles through chemical groups is displayed, 25 cases of Arica ceramic styles, 22 are relatively well represented in Chemical Group 2. Only 3 samples are unassigned, of which two correspond to the San Miguel style and one to the Gentilar style (Table 5).

Regarding the Inka styles (46 cases), it is observed that some diversity is found in Group 2. Of the eleven samples of the Saxamar or Inka Pacaje style, eight belong in Group 2 and three in Unassigned Chemical Group. From the eight specimens assigned to Group 1, seven correspond to the Inka Polychrome style and one to the Inka red style. Five specimens are assigned to Group 3, and four correspond to the Inka Red style and one to Inka Red Slip, most of them aryballus. Therefore, the Inka styles might be referenced to the following chemical groups: Group 1 to Inka Polychrome, Group 2 to Saxamar and Group 3 to Inka Red. Lastly, the Inka style specimens grouped in the Unassigned Chemical Group include several imperial styles, from which the Inka Polychrome and Inka Red styles stand out (Table 5).

Table 6
Chronological distributions of chemical Groups in NCh sample.

	Group 1		Group 2		Group 3		Unassigned		Total	
Period	N	%	N	%	N	%	N	%	N	%
LIP/LP		0.0%	30	68.2%		0.0%	14	37.8%	44	46.8%
LP	8	100.0%	12	27.3%	5	100.0%	23	62.2%	48	51.1%
PHP		0.0%	2	4.5%		0.0%		0.0%	2	2.1%
Total	8	100.0%	44	100.0%	5	100.0%	37	100.0%	94	100.0%

Regarding the 14 Black on Red samples, the majority (n = 10) corresponds to the Unassigned Group, and four to Group 2. In the unassigned Group, five correspond to the Chilpe style, the remaining sample (n = 5) belong in minor number to the other substyles (i.e. Black/Red, Black/Red Perpendicular and Vilavila; see Table 5). The four samples left show affinity with Group 2 (see Table 5). Only two samples come from a site assigned to the Post Hispanic Period (2.1%; see Table 6).

The 8 samples in Group 1 fully correspond to the LP. Group 2, in contrast, is majority made with samples from the LIP/LP (68.2%), but also includes LP samples (27.3%) as well as from the PHP (4.5%). Group 3 exclusively contains samples of sites assigned to the LP Inka styles (n = 5). Unassigned samples mostly come from LP sites (62.2%) and, to a lesser extent from the LIP (37.8%) (see Table 6).

Finally, the comparison of the clay samples from NW Argentina was made with the larger reference groups. The results show poor match with all of the reference groups—in part because these analyses are derived from untempered raw clays that have not been refined (as would have presumably been the case in large State-controlled Inka workshops). When the NWA clays are projected against the 90% confidence ellipses for the NCh, Titicaca Basin, NWA, X, and Y compositional pottery groups, most of the clays plot within the NWA ellipse. None of the clays exceed 1% probability of membership in Groups 1 and 2 indicating that that clay is a poor match with these groups. Future research must include clay samples from northern Chile and Bolivian Altiplano to strengthen the relation between pottery and raw material sources data.

4. Discussions and conclusion

In this manuscript we examined the role of pottery in the expansion of the Inka State into the territories south of Cusco, known as Collasuyu, based on the results of INAA of 94 fragments of pottery from several archaeological sites in NCh.

The INAA demonstrates that ceramic samples belong to three of the five chemical groups established for larger samples that cover Bolivian Altiplano and NWA (Williams et al., 2016). The results could be viewed in the context of the political trends that occurred during Inka and pre Inka times. Eight fragment pots of the batch belong to the chemical Bolivian Altiplano Inka Group 1, and correspond, exclusively, to the Inka Polychrome and Inka Red. These vessels are easily recognized for their physical and iconographic characteristics (fine grain paste and temper, oxidant burnish, finely polished surface, with red slip, geometric designs in white, black and red). No Arica local and Serrano styles where made with paste of Group 1. Samples of this Group come from LP locations at the Lluta and Azapa valleys and one from the Inka Tambo of Zapahuira in the Andean foothill. These locations are well known for their relation with Altiplanic groups and the Inka State (Gallardo, 2013; Muñoz, 2005; Pärssinen and Siiriäinen, 1997; Santoro et al., 2010b; Williams et al., 2009). This means that Group 1 vessels were possibly made in State pottery centers somewhere at the Lake Titicaca basin, in the Bolivian Altiplano (Alconini, 2013; Spurling, 1992). The distribution of Inka Polychrome vessels over NCh may have occurred through some of the mechanisms of exchange and control of the State (Durston and Hidalgo, 1997; Gallardo, 2013; Santoro et al., 2010a).

The wide territorial dispersion of the Inka pottery seems to indicate that the State was able to maintain and enhance its control over the territories of NCh, and that the political arrangements were accepted and shown by local potters that imitated Inka style pots using paste (Group 2) of local origin. In other word, the symbols of power embedded in the Inka pots were reproduced by skilled local artisans that learned how to make vessels similar in style to the original Inka ones, but with local paste, that we could sort out through the INAA. One interpretation for this emulation could be that in a later phase of the Inka State administration, local artisans learned to reproduce the State standard for pottery making. Thus, although they did not have the clay raw material used in the highlands to make Inka Polychrome vessels (Group 1), they worked hard with the local clay raw material (Group 2) to make Inka vessels with its typical imperial appearance. In this way they combined traditional manufacturing techniques. Vessels made with paste of Group 2 integrate mainly Saxamar or Inka Pacaje, and in a lesser extent, Inka Polychrome and Inka Red styles corresponding to the LP, as well as local pottery styles like the Arica styles (San Miguel, Pocoma, Gentilar, and Late San Miguel), Serrano styles (Huaihuarani, Serrano Crude Red), and Black on Red styles (Chilpe and Perpendicular Black on Red, and Vilavila). This means that the local pottery production lasted throughout the LP and did not disappear. By learning how to make vessels similar in style to the original Inka one, the local artisans reproduced the symbols of power embedded in the Inka pots, but with local paste that we could sort out through the INAA. In other words, although they did not have the fine highland clay raw material used in to make Inka Polychrome vessels, they worked hard with local clay to make vessels with its typical imperial appearance.

In this way traditional manufacturing techniques and foreign styles were combined. Group 2 paste was used for Saxamar or Inka Pacaje, Inka Polychrome and Inka Red styles vessels corresponding to the Late period, as well as local pottery styles like the Arica styles (San Miguel, Pocoma, Gentilar, and Late San Miguel), Serrano styles (Huaihuarani, Serrano Crude Red), and Black on Red styles (Chilpe and Perpendicular Black on Red, and Vilavila). This means that the local pottery production lasted throughout the Inka period and did not disappear. It is certainly a product made under the Inka State standards (see Table A.1).

Another perspective for the exchange networks and labor organization of the State is the appearance of Red Inka vessel made with NWA paste of Group 3, which may correspond to long distance traffic goods, which was not unusual as *mullu* was brought from the southern coast of Ecuador to the valleys and highland of Arica (Ceruti and Reinhard, 2009; Murra, 2002; Santoro et al., 2010b).

In sum, the analyses have been successful in identifying compositional groups that can be tied to specific geographic regions within the southern Andes as we seen for NCh although future research should focus on the refinement of these chemical groups. Such research will undoubtedly lead to a better understanding of Inka pottery production and distribution in the Southern Andes. We also suggest that future research include a petrographic component to determine if a combined mineralogical and chemical approach can provide a better resolution than what we have shown here, given that studies of sand, rock, and volcanic tempers may yield insights that the INAA analysis could not provide. Future analyses of pottery from NCh will facilitate the identification of additional compositional groups, thereby enabling many of these samples to be assigned to a compositional group.

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Table A.1
Frequency of samples by site and periods: Late Intermediate period and Late period (LIP/LP), Late Period (LP), and Late period and Posthispanic period (LP/PHP).

Site LIP/LP	Site type	Period	# samples
Lluta 1 (Santa Lucía)[a]	Cemetery	LIP/LP	1
Lluta 21 (Millune)[a]	Camp	LIP/LP	1
Lluta 12 (Oleoducto)[a]	Camp	LIP/LP	2
Lluta 44 (Molino Calacala)[a]	Camp	LIP/LP	2
Lluta 45 (Cardones)[a]	Cemetery	LIP/LP	2
Playa Miller-4[b]	Cemetery	LIP/LP	2
Azapa-8 (San Miguel)[c]	Cemetery	LIP/LP	3
Azapa-50 (Chilpe)[a]	Camp	LIP/LP	5
Azapa-58 (Achuyo)[a]	Camp	LIP/LP	6
Lluta 19 (Sora Sur)[a]	Camp	LIP/LP	6
Lluta 35 (Rosario 1)[a]	Camp	LIP/LP	8
Huaihuarani[d]	Camp	LIP/LP	10
Lluta 54 (Huaylacán)[e]	Cemetery	LIP/LP	3
Subtotal		13 sites	48
Site LP			
Tambo Zapahuira[a]	Camp	LP	2
Camarones 9[e]	Cemetery	LP	2
Lluta 41 (Chapisca)[a]	Camp	LP	2
Lluta 48 (Bocanegra km 40)[a]	Cemetery	LP	2
Lluta 36 (Rosario 2)[a]	Camp	LP	3
Lluta 47 (Bocanegra Bajo)[e]	Cemetery	LP	3
Lluta 34 (Caquena Este)[a]	Camp	LP	6
Azapa-15 (Alto Ramírez)[a,f]	Cemetery	LP	10
Cachicoca[a]	Camp	LP	10
Subtotal		9 sites	43
Sites LP/PHP			
Lluta 24 (Challallapo A)[a]	Camp	LP/PHP	1
Lluta 3 (Parcela Villa Olga)[a]	Camp	LP/PHP	2
Subtotal		2 sites	3
Total		24 sites	94

[a] Archaeological studied by our team. Sites in the Lluta valley correspond to a full coverage survey. The other sites were found through rather systematic and opportunistic surveys (Santoro et al., 2000).
[b] Archaeological excavations by Guillermo Focacci during the 1980's (Hidalgo and Focacci, 1986).
[c] Excavation carried out by Guillermo Focacci in 1960 (Focacci, 1995 [1961]).
[d] Surface collection by Dauelsberg (1983).
[e] Unpublished excavations by Dauelsberg during the 1980's.
[f] Excavation carried by Guillermo Focacci 1960 (Focacci, 1981).

Table A.2
Descriptive features of the 94 pottery fragments analyzed from 23 archaeological sites the lowland and highland of Arica (* after Romero, 2002; Santoro et al., 2001) (see Fig. 1).

Lab #	Id	Ceramic Style	Provenience	Paste*	Chemical Group	Shape	Fragment sherd
VIW 366	1	Pocoma	Azapa-8	220	Group 2	Jar	Body
VIW 367	2	San Miguel	Playa Miller-4	400	Group 2	Jar	Body
VIW 368	3	San Miguel	Azapa-8	400	Unassigned	Jar	Body
VIW 369	4	Gentilar	Playa Miller-4	220	Group 2	Jar	Body
VIW 370	5	Chilpe	Azapa-50	400	Group 2	Bowl	Rim
VIW 371	6	San Miguel	Azapa-50	400	Group 2	Jar	Body
VIW 372	7	Vilavila	Azapa-50	500	Unassigned	Bowl	Base
VIW 373	8	Gentilar	Azapa-50	220	Group 2	Jar	Body
VIW 374	9	Pocoma	Azapa-50	400	Group 2	Jar	Body
VIW 375	10	Gentilar	Azapa-8	220	Group 2	Jar	Body
VIW 376	11	Undecorated	Lluta 54	400	Group 2	Closed pot	Body
VIW 377	12	Undecorated	Lluta 54	100	Unassigned	Closed pot	Body
VIW 378	13	Inka Polychrome	Azapa-15	220	Unassigned	Pot bowl	Rim
VIW 379	14	Inka Polychrome	Azapa-15	220	Unassigned	Pot with handle	Rim
VIW 380	15	Saxamar	Camarones-9	210	Unassigned	Flat bowl	Rim
VIW 381	16	Inka Red	Camarones-9	210	Unassigned	Aryballus,	Rim
VIW 382	17	Saxamar	Azapa-15	210	Group 2	Flat bowl	Body
VIW 383	18	Inka Black/Red	Azapa-15	210	Unassigned	Pot	Rim
VIW 384	19	Saxamar	Azapa-15	210	Group 2	Flat bowl	Rim
VIW 385	20	Inka Red	Azapa-15	210	Unassigned	Flat bowl	Rim
VIW 386	21	Inka Red	Lluta 54	210	Group 1	Aryballus	Rim
VIW 387	22	Inka Red Slip	Azapa-15	100	Group 3	Closed pot	Body
VIW 388	23	Saxamar	Lluta 34	210	Unassigned	Flat bowl	Rim
VIW 389	24	Inka Polychrome	Lluta 47	210	Unassigned	Flat bowl	Rim
VIW 390	25	Vilavila	Lluta 19	220	Unassigned	Bowl	Rim
VIW 391	26	Inka Red	Lluta 34	210	Unassigned	Aryballus	Rim
VIW 392	27	Charcollo	Lluta 19	500	Group 2	Closed pot	Body
VIW 393	28	Gentilar	Lluta 19	400	Group 2	Jar	Body
VIW 394	29	Gentilar	Lluta 45	220	Group 2	Jar	Body
VIW 395	30	Vilavila	Lluta 44	220	Group 2	Bowl	Rim
VIW 396	31	Chilpe	Lluta 44	220	Unassigned	Bowl	Rim
VIW 397	32	Chilpe	Lluta 41	220	Unassigned	Bowl	Rim
VIW 398	33	Indigenous Post Hispanic	Lluta 3	1000	Group 2	Dish	Rim
VIW 399	34	Saxamar	Tambo Zapahuira	210	Group 2	Flat bowl	Body
VIW 400	35	Serrano Crude Red	Lluta 19	220	Unassigned	Bowl	Body
VIW 401	36	Inka Polychrome	Lluta 48	210	Group 2	Aryballus	Rim
VIW 402	37	San Miguel	Lluta 19	400	Group 2	Jug	Body
VIW 403	38	Saxamar	Lluta 47	210	Group 2	Bowl	Rim
VIW 404	39	Inka Polychrome	Lluta 34	210	Group 1	Bowl	Rim
VIW 405	40	Inka Polychrome	Lluta 34	210	Group 1	Flat bowl	Rim
VIW 406	41	Saxamar	Lluta 3	210	Group 2	Flat bowl	Base
VIW 407	42	Indigenous post Hispanic	Lluta 24	1000	Group 2	Dish	Body
VIW 408	43	Chilpe	Lluta 19	220	Unassigned	Bowl	Rim
VIW 409	44	Inka Polychrome	Lluta 41	210	Group 1	Aryballus	Neck
VIW 410	45	Inka Polychrome	Lluta 34	210	Group 1	Aryballus	Body
VIW 411	46	Serrano Crude Red	Lluta 12	500	Group 2	Bowl	Base
VIW 412	47	Chilpe	Lluta 45	210	Unassigned	Bowl	Rim
VIW 413	48	San Miguel	Lluta 48	400	Unassigned	Jar	Body
VIW 414	49	Inka Red	Lluta 47	210	Unassigned	Aryballus	Rim
VIW 415	50	Saxamar	Huaihuarani	210	Group 2	Bowl	Rim
VIW 416	51	Saxamar	Azapa-58	210	Unassigned	Bowl	Rim
VIW 417	52	Charcollo	Huaiharani	300	Group 2	Jar	Body
VIW 418	53	Inka Polychrome	Huaihuarani	210	Unassigned	Flat bowl	Rim
VIW 419	54	Pocoma	Huaihuarani	400	Group 2	Jug	Body
VIW 420	55	Charcollo	Huaihuarani	400	Group 2	Jug	Body
VIW 421	56	Gentilar	Huaihuarani	220	Group 2	Jar	Rim
VIW 422	57	Chilpe	Huaihuarani	220	Unassigned	Bowl	Rim
VIW 423	58	San Miguel	Huaihuarani	400	Group 2	Jug	Body
VIW 424	59	Saxamar	Huaihuarani	210	Group 2	Bowl	Body
VIW 425	60	Chilpe	Lluta 35	220	Group 2	Bowl	Rim
VIW 426	61	Inka Polychrome	Lluta 35	210	Group 1	Bowl	Base
VIW 427	62	Black/Red	Lluta 36	220	Unassigned	Jar	Body
VIW 428	63	Pocoma	Lluta 35	400	Group 2	Jug	Body
VIW 429	64	Gentilar	Lluta 35	220	Group 2	Jar	Body
VIW 430	65	Inka Red	Lluta 36	210	Unassigned	Aryballus	Rim
VIW 431	66	San Miguel	Lluta 36	400	Group 2	Jar	Body
VIW 432	67	Inka Polychrome	Tambo Zapahuira	220	Group 1	Aryballus	Body
VIW 433	68	Inka Red	Undetermined	210	Group 3	Aryballus	Body
VIW 434	69	Inka Red	Undetermined	210	Group 3	Aryballus	Rim
VIW 435	70	San Miguel	Azapa-58	400	Group 2	Jug	Body
VIW 436	71	Inka Red	Lluta 21	210	Group 3	Aryballus	Body
VIW 437	72	Saxamar	Lluta 35	210	Group 2	Bowl	Rim
VIW 438	73	Pocoma	Azapa-58	400	Group 2	Jar	Body
VIW 439	74	Gentilar	Lluta 35	220	Unassigned	Jar	Body
VIW 440	75	San Miguel	Lluta 35	400	Group 2	Jar	Body

Table A.2 (*continued*)

Lab #	Id	Ceramic Style	Provenience	Paste*	Chemical Group	Shape	Fragment sherd
VIW 441	76	Inka Red	Lluta 34	210	Group 3	Aryballus	Rim
VIW 442	77	Black/Red	Huaihuarani	220	Group 2	Jar	Body
VIW 443	78	San Miguel T	Lluta 1	400	Group 2	Jar	Body
VIW 444	79	Saxamar B	Lluta 35	210	Unassigned	Flat bowl	Rim
VIW 445	80	Inka Red	Azapa-58	210	Unassigned	Aryballus	Body
VIW 446	81	Gentilar	Azapa-58	220	Group 2	Jar	Body
VIW 447	82	San Miguel	Lluta 12	400	Group 2	Jar	Body
VIW 448	83	Inka Polychrome	Azapa-58	210	Unassigned	Flat bowl	Base
VIW 449	84	Inka Red	Azapa-15	210	Group 2	Aryballus	Handle
VIW 450	85	Inka Polychrome	Azapa-15	210	Group 1	Flat bowl	Base
VIW 451	86	Inka Black/Red	Azapa-15	210	Unassigned	Flat bowl	Body
VIW 452	87	Inka Polychrome	Undetermined	210	Unassigned	Flat bowl	Rim
VIW 453	88	Inka Polychrome	Undetermined	210	Group 2	Aryballus	Body
VIW 454	89	Inka Red	Undetermined	210	Unassigned	Aryballus	Body
VIW 455	90	Inka Red Slip	Undetermined	500	Unassigned	Flat bowl	Rim
VIW 456	91	Black/Red	Undetermined	210	Unassigned	Flat bowl	Body
VIW 457	92	Saxamar B	Undetermined	210	Unassigned	Flat bowl	Body
VIW 458	93	Black/Red Perpendicular	Undetermined	220	Unassigned	Flat bowl	Rim
VIW 459	94	Inka Red	Undetermined	220	Unassigned	Flat bowl	Rim/base

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