Title: The Organization of Production for Inka Polychrome Pottery from Pachacamac, Peru

Author: James A. Davenport – jdavenp@unm.edu – MSC01-1040 1 University of New Mexico
Albuquerque, NM 87131

Abstract: This study investigates the organization of production for Inka Polychrome pottery used at the Temple of the Sun, Pachacamac. Inka Polychrome pottery was critical to imperial strategies for managing state power in the provinces. It was highly standardized in appearance yet is known to have been produced at many locations throughout the empire by Inka and subject potters. Pachacamac was an important political and ideological location on the central coast that was transformed by the Inka after C.E. 1470 into a major imperial center. To evaluate the production and source of pottery at Pachacamac, a sample of 149 ceramics in local, Inka Polychrome, and Regional Inka styles were evaluated using neutron activation analysis to identify compositional groups. Attributes related to the production and decoration of these ceramic artifacts were recorded and statistically compared between groups. Compositional data from this analysis was also compared to compositional data from ceramics excavated from other South American sites and analyzed at the Lawrence Berkeley National Laboratory. Results found that multiple groups of potters at multiple places (some of which are local) produced this pottery, and small amounts of pottery are being imported.

Keywords: Inka, Andes, ceramics, compositional analysis, organization of production, neutron activation analysis, Pachacamac

Highlights:

- Inka Polychrome pottery was highly standardized yet was produced throughout the empire by subjects.
- A large amount of Inka Polychrome pottery was found at the Temple of the Sun at Pachacamac.
- Compositional analysis of this pottery indicates its production occurred in multiple locations.
- Multiple groups of potters, some local, were entrusted by the Inka state to produce this pottery.

1. Introduction

Material culture is a key component of many strategies used by empires in the creation and maintenance of state power among their subjects. In larger territorial empires, this production is not consolidated in the imperial core but is decentralized and, in the case of the Inka empire, done in part by subject artisans. In the Inka empire, material culture in imperial styles, especially Inka Polychrome pottery, was standardized in design and form, despite this diverse production. This research asks the question: how was the production of Inka Polychrome pottery organized? To address this question, attribute analysis was combined with Neutron Activation Analysis for 149 ceramic artifacts from the site of Pachacamac on the central coast of Peru. Pachacamac had a long history of occupation and use and was a major Inka provincial center after around C.E. 1470. Both Inka and local decorative styles of pottery were analyzed to determine if this pottery was produced locally or elsewhere, and how the potters who produced it were organized by the Inka state.

2. Background

In the Late Horizon (C.E. 1400 – 1532), *Tawantinsuyu*, “the land of the four corners” and the empire of the Inkas, expanded rapidly across Andean South America to encompass roughly 2 million km² and an estimated 12 million subjects belonging to around 80 different subject polities (D’Altroy 2015; Morris and von Hagen 2011). Strategies of managing these subjects, and the degree of Inka investment and presence, varied from place to place (Alconini 2008; D’Altroy 1992). Though the relationships of subjects with the state varied widely, there were some commonalities of inclusion in the Inka empire that were rooted in the Andean ideal of reciprocity. These were the Inka’s requirement of labor as tribute from subjects, and gifts given to subjects by the Inkas, either in feasts and rituals where food and drink were provided (Hastorf 2007) or as prestige goods given to local elites (Costin and Earle 1989; Lau 2019; Murra 1980). These both required objects made in imperial styles, including textiles, metalwork, and pottery.

Inka material culture was decorated in distinct, recognizable imperial styles, with motifs shared across multiple media. Inka Polychrome pottery, an ubiquitous part of the imperial material assemblage, was highly standardized and produced with a limited number of forms and designs (Bray 2003:123; Fernández 1971, Meyers 1975; Rowe 1944). These objects communicated the Inka empire’s power and hospitality (Morris 1991). Material objects in imperial styles play an important role in the statecraft of empires worldwide, as a means of communicating state power and connecting subject populations to the state (Boozer 2010; Bray 2018; D’Altroy 2018; Khatchadourian 2016; Sinopoli 2003). Ethnohistorical and archaeological evidence indicates that these objects were produced by subjects serving their state-mandated labor requirements either near their home communities or as *mitmaq*—subjects permanently relocated to different parts of the empire to serve state needs (Alconini 2013; Cremonte et al. 2015; Espinoza 1970, 1983; Hayashida 1998; Murra 1980; Spurling 1992; Williams and Lorandi 1986). Inka pottery also moved around the empire, typically in short distances (Alconini 2013) but sometimes to far-flung locations (Bray et al. 2005). How, then, did the Inka organize the production of this pottery, which was highly standardized, instantly recognizable, and produced and distributed widely? To address this question, I examine the organization of production for Inka Polychrome pottery from Pachacamac, Peru.

Pachacamac occupies around 500 hectares where the Lurín River meets the Pacific Ocean on the Peruvian Central Coast (Figure 1). Its occupation dates to at least the Early Intermediate Period (C.E. 200 – 600) (Franco and Paredes 2016). During the Late Intermediate Period (C.E. 1000 – 1400), Pachacamac was the home of a powerful oracular non-human being or *wak’a* which was consulted by individuals from across the empire, including the emperor, or *Sapa Inka* (Curatola 2008, 2015). Pachacamac was also the political center of the Ychsma polity, a hierarchical society centered on the Lurín and Rimac valleys (Eeckhout 2013; Marcone 2010; Marsteller et al. 2017; Shimada 1991). When it was subjugated by the Inka around CE 1460-1470 (Marsteller et al. 2017), Pachacamac received a high level of imperial investment because of its importance (Marcone 2010). This included the renovation of existing structures

and the construction of new ones (Figure 2; Franco 1996; Marcone 2004, 2010; Marcone and López-Hurtado 2002; Sánchez 2000; Shimada 1991; Shimada et al. 2010; Tiballi 2010:97) so that Inka-sponsored activities promoting the state's power and interests, including feasts, rituals, and ceremonies, could be enacted (Coben 2006, 2012).

For this research, statistical analyses of quantitative and qualitative attributes of 149 ceramic artifacts are combined with characterization data from Neutron Activation Analysis (NAA). The ceramic artifacts included in this study were excavated from a midden on the southeastern face of the Temple of the Sun. They include Inka Polychrome Pottery and the contemporary and preceding local styles of Ychsma and Lima pottery (Segura 2004; Vallejo 2004, 2011). Local styles are used to compare the elemental composition between Inka Polychrome pottery and pottery styles that originate in the region. NAA data are also compared to data on Peruvian ceramics from the Lurín Valley and Cuzco that were analyzed at the Lawrence Berkeley National Laboratory (LBNL) and are published through the Digital Archaeological Record (tDAR) (Boulanger 2012, 2013, 2016).

2.1. Inka Pottery

It is important to distinguish between Inka pottery—that is, all pottery used by the Inka in the production of state-sponsored activities—and Inka Polychrome pottery. Inka Polychrome is highly standardized and adheres to specific canons of form and design. Many “hybrid Inka,” “regional Inka” or “local Inka” styles existed throughout the empire that combined local manufacturing traditions with either the forms or designs of Inka Polychrome. Originating in the Cuzco basin, Inka Polychrome pottery was produced in a few set forms of varying size (Figure 3; Bray 2003) and decorated with a limited suite of primarily geometric designs applied in specific locations (Fernández 1971), though variations did exist. It is visually distinctive and highly recognizable. Some of these forms ranged widely in size. For example, *urpus*, also known as “aríbalos,” a long-necked pointed-bottom vessel with a flaring rim used for serving *chicha*, a maize beer (Hayashida 2019), have been found at Pachacamac as miniature vessels less than 10 cm, and as large vessels over a meter in size. Of the suite of forms for Inka Polychrome pottery, only a few are frequently seen in provincial locations (Bray 2003). These include serving vessels such as plates and bowls, and *urpus*. The designs on Inka Polychrome were generally geometric, repeating, abstract, and in some instances shared with other media (Bray 2017; Cummins 1993). These designs may have been communicative (Cummins 1993) or empowered the pots as non-human agents in imperial strategies of control (Bray 2017). It has been suggested that the decorations of Inka Polychrome pottery could transmit information as a semasiographic system (Cummins 1993), reflect the Andean worldview (Allen 2015) or correspond with geographical or political units within the empire (Cummins 2007).

Recent research into Inka pottery production (e.g., Alconini 2013; Costin 2016, 2018; Gotliko et al. 2016; Hayashida 2019; Páez and Sardi 2014; Williams et al. 2016) and Inka ceramic workshops (D’Altroy et al. 1998, 2007; Donnan 1997; Hayashida 1995, 1998, 1999; Lorandi 1991; Mackey 2003; Quave 2012, 2017; Spurling 1992) has greatly expanded our knowledge. Workshops varied in organization and scale, and multiple types with different purposes existed (Zasada 1985), to provision, for example, state-sponsored feasting events (Mackey 2003), elite palace contexts (Quave 2012, 2017) or provincial administrative centers (Hayashida 1995, 1998, 1999; Lorandi 1991). At some locations pottery was centrally produced and distributed to nearby settlements (Alconini 2013; Cremonte et al. 2015; Williams et al. 2016). While much Inka pottery was produced locally (e.g. Williams et al. 2016), small amounts of Inka Polychrome pottery traveled between major Inka centers (D’Altroy and Bishop 1990) and in some cases, like the *qhapaq hucha* mountaintop sacrifices, pottery sourced to disparate locations in the empire was found together (Bray et al. 2005). Through the *qhapaq ñan* road system, pottery and other goods could be transported great distances (Jenkins 2001). Standardized plates and bowls were stackable and more easily transported than closed forms (D’Altroy and Bishop 1990).

2.2. Pachacamac

At the time of Spanish conquest, Pachacamac was a major Inka center on the central coast of Peru. It was the location of an important oracular *wak'a* consulted by Inka emperors and the destination for pilgrimages from across the empire (Curatola 2015). In the Late Intermediate Period, Pachacamac was the center of the Ychsma polity, which was centered on the Lurín and Rimac valleys (Marcone 2010; Marsteller et al. 2017). Ychsma pottery is present throughout the central coast and was likely made using several clay sources in these valleys (Makowski et al. 2015). After Pachacamac was subjugated, the Inkas completely renovated the site's ceremonial core, constructing the Pilgrim's Plaza, the Mamacona convent, and the Temple of the Sun (Figure 2; Franco 1996; Makowski 2015; Marcone 2004, 2010; Marcone and López-Hurtado 2002; Sánchez 2000; Shimada 1991; Shimada et al. 2010; Tiballi 2010). This renovation was likely the most monumental by the Inka on an existing layout (Hyslop 1990) and was motivated by the cultivation of coca in the *chaupi yunga* of the Lurín valley (the piedmont zone between the dry coast and the Andes), the pan-regional influence of the *wak'a* (Cornejo 2000, 2002; Marcone 2010; Rostworowski 1999) and the large amount of tribute it received from pilgrims (Urton 2015).

Inka spaces at Pachacamac were used for state-sponsored rituals, ceremonies, feasts, and events. The Temple of the Sun was the second-most important religious structure in the empire after the principal sun temple, the *Qorikancha* in the capital Cuzco (Cobo 1990 [1653]). The Mamacona convent was a building where *aqlla* ("chosen women" taken as children from conquered groups who produced textiles, food, and drink for ceremonies at Sun Temples) lived, produced crafts, and carried out state-sponsored rituals (Cieza de Leon 1864a:87; Cobo 1990[1653]:89; Covey 2008; Tiballi 2010; Vega 1961:80). The events that occurred in these spaces required Inka style objects, including Inka Polychrome pottery. Were these objects made at Pachacamac, or brought there from other Inka centers?

Investigations into textiles from Pachacamac show that Inka-style textiles made with local materials were produced using different technological styles, and textiles were also produced using non-local materials (Frei and Bjerregaard 2017; Tiballi 2010, 2014). Evidence for local production of other imperial style textiles may lend support for the local production of Inka Polychrome pottery as well. Citing ethnohistoric documents, Hyslop writes that only a few areas in the empire (including the area around Pachacamac) had artisans capable of "replicating state ceramics with extreme accuracy" (1993:341). A recent study of pottery from the Lurín Valley using Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry (LA-ICP-MS) to analyze clays (Makowski and Oré 2014; Makowski et al. 2008, 2015) found three distinct compositional groups, and each group was comprised of Ychsma and Inka styles. Each group contained multiple macroscopically defined paste groups as well. This study also found similarities between these groups and raw clay sources in the Lurín and Rimac Valleys.

2.3. Research Questions

Inka Polychrome pottery played an essential role in the imperial project, facilitating the reciprocity necessary to manage relationships with subjects. While there have been many recent studies about pottery production in the Inka empire, the distinctive Inka Polychrome pottery remains less understood, especially in provincial locations. Inka Polychrome pottery was highly standardized, yet its production was decentralized and occurred throughout the empire. In established Inka provincial centers, the occurrence of Inka polychrome pottery is low. Inka Polychrome pottery makes up just 2.13% of the assemblage from Huánuco Pampa (Morris et al. 2011:227) and 8% of the assemblage from Hatun Xauxa (Costin 2002:211), two important Inka provincial centers. In contrast, 30% of the Sun Temple assemblage is Inka Polychrome (Strong et al. 1943). These contexts and excavations are not directly comparable due to differences in scale, scope, methods of excavation, and locations and contexts within these sites. Nonetheless, Pachacamac is a provincial location where Inka Polychrome pottery is found in abundance, and understanding the production organization of this pottery will provide valuable information about the Inka political economy and how the Inka met the need for this essential craft. To understand the organization of this production, this research addresses several related questions. First, was Inka Polychrome pottery produced locally at Pachacamac (or elsewhere in the lower Lurín Valley)? Second, were there multiple loci of production for Inka Polychrome pottery, and if so, are there discernable

decorative differences in pottery from different production origins? Finally, how does the assemblage of Inka Polychrome pottery relate to other sites in the Lurín Valley? To address these questions, NAA combined with statistical analysis of attributes are applied to a sample of Inka Polychrome and local styles of pottery excavated from a midden on the Northeast Face of the Temple of the Sun at Pachacamac (Figure 2).

3. Materials and Methods

3.1. Sample

This study utilizes artifacts from a historic excavation that are currently curated in museum collections. While the excavation was not designed with this research in mind, nor was it carried with modern best practices, this collection is still a valuable repository of information for Andean archaeologists. There are extensive archaeological collections in museums in North and South America and Europe which have great potential for new inquiries into past cultures (Carmichael 2020; Gotliko et al. 2016).

The study sample was recovered between July 23 and October 10, 1941, in an excavation led by William Duncan Strong (Strong et al. 1943). The project was supported by the Institute of Andean Research. The team included Strong, his then graduate student Gordon Willey, and John M. Corbett. The goal was to build upon the work of Max Uhle (1991 [1903]). Forty-four years prior to Strong's work, Uhle mapped much of the ceremonial core of Pachacamac and excavated at several areas throughout the site, establishing a chronological ceramic sequence for the central coast. By digging at a midden at the Inka-constructed Temple of the Sun, Strong hoped to uncover an uninterrupted ceramic sequence with all of the types identified by Uhle. Strong excavated a trench roughly 24 meters long, 12 meters deep, and 8 meters across (Figures 4, 5). The first portion of this trench, "Cut 1," was removed all at once, and then "Cut 2" was removed along the southern wall of Cut 1. Despite the presence of clearly defined stratigraphic layers, Cut 2 was removed in 1 meter square and ½ meter deep "blocks" (Strong et al. 1943:44). Strong and his team excavated a total of 24,038 ceramic artifacts, of which 4,119 were diagnostic. While some undiagnostic material was discarded in the field, the majority of this material is currently curated at the American Museum of Natural History in New York.

Strong did not identify a complete, uninterrupted sequence of ceramic types in the trench, but rather uncovered two distinct contexts: the first was a midden dating to the Late Horizon which corresponded to the use of the Temple of the Sun, and the second was a cemetery dating to the Early Intermediate Period, from which over 100 individuals were removed. In their analysis of the ceramic artifacts, the authors identified three style categories, some of which contained subgroups. The first category, "Inca," contained forms and designs that are identified today as Inka Polychrome pottery. The second category, "Inca-Associated," was the term used for material in the more recent context which was not Inka Polychrome. This included local Ychsma styles as well as other contemporary styles used by the Inka, such as blackware from the north and south coasts of Peru and Chancay black-on-white originating in the north-central coast of Peru. "Inca-Associated" also contained hybrid Inka pottery which combined elements of Inka and regional styles. "Interlocking," a term coined by Kroeber (1926) in a study of Uhle's ceramics from Cerro de Trinidad in the Chancay Valley, was the third category. It included all the material from the earlier context and now is better classified as Lima and Nievería styles, though other styles are present as well. The distinction between the two contexts is evident when the frequencies of the different categories by excavation block are plotted (Figure 4). While the assignment of ceramics into these categories was mostly correct, poor control over stratigraphy and a still-developing understanding of these styles and their attributes led to occasional misassignments, especially between "Inca Associated" and "Interlocking" categories.

At the American Museum of Natural History, 472 ceramic artifacts from this collection were analyzed for a number of qualitative and quantitative attributes related to their form and decoration (Table 1). This number is regrettably smaller than the total number of artifacts excavated; however many of the

diagnostic artifacts were sent to other museums as type collections in exchanges during the 1940's, and the remainder of the collection is uncatalogued and inaccessible to researchers. Material from this collection that is catalogued is stored in boxes by type (e.g., a box of *urpu* sherds) irrespective of excavation block information. Sampling for this study was limited by these restrictions. From artifacts available for research, the sample was selected through preferencing any Inka or more recent material, as well as forms (plates, jars, and bowls) typically used for serving which are also the most common forms in this assemblage.

3.2. Neutron Activation Analysis

A sample of 149 artifacts from the analyzed collection were evaluated using Neutron Activation Analysis (NAA) at the University of Missouri Research Reactor (MURR). This sample was chosen based on several criteria: 1) representation from each of the three categories identified by Strong ("Inca," "Inca Associated," and "Interlocking"); 2) representation of the forms present in the larger sample of analyzed pottery; and 3) to have representation from multiple locations within "Cut 2" from blocks excavated from different stratigraphic descriptions. Earlier "Interlocking" material was included to identify for what is "local" in the absence of clay sources. The sample was chosen to be roughly representative of the distributions of the total artifacts analyzed, keeping in mind the biases in what was collected and what is curated (Table 2).

The main goal of compositional analysis is to identify distinct homogeneous groups within the analytical database. NAA is a bulk compositional analysis, meaning that pastes, including clays and aplastic inclusions like temper, are homogenized prior to evaluation. These groups may be assumed to represent distinct sources of materials (Weigand et al. 1977). When samples from the source material are not available, indirect methods such as the criterion of abundance can be used (Bishop et al. 1992). Procedures for NAA at MURR are described elsewhere in detail (Glascock 1992, 2019). To briefly summarize, a section roughly 2 cm² in area was removed, and all surfaces of the sherd were scraped off using a tungsten-carbide drill burr to account for glazing or slipping of the surface, contamination during use, and surface leaching or contamination during the artifact's time in the soil (Glascock 1992:13). The scraped piece was brushed clean and washed in deionized water, dried, and then crushed into powder using an agate mortar and pestle. The powder was dried in an oven at 100°C for 24 hours and stored in a desiccator before being put into a 2/5-dram high-density polyethylene vial and irradiated for five seconds. After 25 minutes passed, the samples were placed a fixed distance away from a high-resolution germanium detector, which counts the emitted gamma rays for 12 minutes, allowing determination of the yields of the elements Al, Ba, Ca, Dy, K, Mn, Na, Ti and V. Two weeks later, the samples were transferred to a high-purity quartz vial and irradiated for 24 hours. After seven additional days, the vials were washed with nitro-hydrochloric acid, placed in test tubes, and counted for 2000 seconds, allowing the determination of As, La, Lu, Nd, Sm, U and Yb. Four weeks later, the samples were counted again for 10,000 seconds, allowing the determination of Ce, Co, Cs, Eu, Fe, Hf, Ni, Rb, Sb, Sc, Sr, Ta, Tb, Th, Zn and Zr. During this process, known reference standards of SRM-1633a (coal fly ash), SRM-688 (basalt rock), SRM-278 (obsidian rock), and Ohio Red Clay (a standard developed for in-house applications) were also sampled to ensure that the process was accurate (Glascock 1992).

There is much detailed discussion of the interpretation of compositional data from archaeological ceramics (e.g., Baxter and Buck 2000; Bieber et al. 1976; Bishop and Neff 1989; Glascock 1992, 2019; Harbottle 1976; Neff 2000). Statistics were performed and groups were formed from only the 149 samples evaluated at MURR. Preliminary groups were formed through a combination of bivariate and multivariate techniques, including hierarchical cluster analysis, scatter plots, and principal components analysis (Baxter 1992; Baxter and Buck 2000; Neff 1994, 2002). Group membership was then refined to create statistically homogenous core groups based on the multivariate probability of group membership, calculated using Mahalanobis distance (Bieber et al. 1976; Bishop and Neff 1989). Lastly, non-core members were either assigned to groups or assigned as outliers based on discriminate function analysis and other measures of group membership (Glascock 1992).

3.3. Attribute Analysis

After compositional groups were identified using the analyses described above, the groups were examined and compared. Groups were first evaluated for styles (using the categories Inka Polychrome, Regional Inka, or “Local” styles including both earlier Lima and Nievería and later Ychsma) and forms (closed forms like bottles, jars (such as *urpus*) and ollas, and open forms including plates, and shallow bowls) using chi-squared goodness of fit tests to determine if any groups were significant in these variables. For this analysis, “Regional Inka” is defined as vessels which combine aspects of Inka Polychrome (e.g., form, or design elements) with styles local to the central coast or elsewhere, including the north-central coast (Chancay-Inka) or the north coast (Chimú-Inka), both of which are present at Pachacamac. For the chi-squared goodness of fit tests, P values were set at 0.05. Statistical comparisons were then made of attributes across groups. These comparisons determined whether there were any attributes related to either production or decoration that corresponded with distinctions in group membership, especially between similar styles and forms in different compositional groups. Quantitative values (rim diameter, wall thickness, wall angle) were analyzed using Model II one-way ANOVA tests (Van Pool and Leonard 2011:154). Qualitative attributes were analyzed using chi-squared goodness of fit tests. P values were set at 0.05.

3.4. Comparative Data from the Lawrence Berkeley National Laboratory

Between the 1960s and 1990s, the Lawrence Berkeley National Laboratory (LBNL) in Berkeley, California analyzed over 12,000 archaeological and geological samples using Neutron Activation Analysis and X-ray fluorescence (Asaro and Adan-Bayewitz 2007; Boulanger 2012). Included in this number were 166 archaeological ceramics from Peru. These ceramics range broadly in time period and location and were contributed to LBNL for analysis either from the Phoebe A. Hearst Museum of Anthropology (then called the Lowie Museum of Anthropology), or from contemporary archaeological projects in Peru. These data have been digitized and uploaded to the Digital Archaeological Record (tDAR) by Matthew Boulanger (Boulanger and Lawrence Berkeley National Laboratory 2014). In digitizing these data, Boulanger (2012, 2013) has made available descriptive information about the artifacts, including time period and style, as well as photographs (Boulanger and Lawrence Berkeley National Laboratory 2011).

Of the 166 archaeological ceramics from Peru that were analyzed at LBNL, there are 43 that provided an interesting point of comparison with the data from Pachacamac presented in this study. Thirteen sherds from Cuzco in Inka Polychrome style were evaluated at LBNL. These sherds were collected from Saqsaywaman or from the surface around the city by Max Uhle and were from the collections of the Hearst Museum. Additionally, LBNL analyzed 14 sherds from the Strong excavations at Pachacamac that were sent to the Hearst Museum from the American Museum of Natural History in an artifact exchange. The material from Pachacamac analyzed by LBNL is primarily Inka Polychrome. Also of interest to this study are 16 sherds from four sites upriver in the Lurín Valley that were collected by Thomas C. Patterson and the members of the Lurín Valley Project (Figure 6; Feltham 1983; Löffler 2018). These sherds are either Inka Polychrome or local styles and are (from west to east) four from Pampa Flores (PV48-12), four from Avillay (PV48-137B), five from PV48-164A, and three from PV48-345B. From an analysis of surface ceramics, these sites all were occupied during the Late Intermediate Period and Late Horizon, and Avillay and PV48-164A had surface ceramics in Colonial styles as well (Löffler 2018). The route between Pachacamac and another major Inka center, Hatun Xauxa, passes through the Lurín Valley and through these sites. Pampa Flores was an Ychsma political center 14 km northeast of Pachacamac that saw significant Inka presence; ~10% of diagnostic ceramics examined at the site were Inka or Inka-associated styles (Capriata et al. 2016:199). Avillay is a settlement associated with a hilltop shrine that may have been constructed by the Inka (Cornejo 1995).

The data from LBNL are comparable to data collected at MURR using conversion factors calculated by MURR in an intercalibration exercise (Glascock 2019:5). Previous comparisons between data from the two labs have been successful (Burger et al. 2019). Data from LBNL do not include all the elements that are detected through NAA at MURR. Missing from the LBNL data are counts for Al, V, Sr, Zr, and Nd. Statistical methods applied to form groups and determine group membership probabilities for the data from MURR were calculated including these elements, but they were removed before comparison between the two datasets was made. In order to visually compare these datasets, a separate Principal Components Analysis was calculated only on the 149 samples run at MURR but without the values for elements not present in the LBNL.

4. Results

Three distinct compositional groups were identified (Figures 7, 8; Table 2). Sixteen ceramic artifacts (10 Inka Polychrome, 2 Regional Inka, and 4 in local styles) are outliers and could not be assigned with certainty to any group. Data can be found in Appendix A. Group membership probabilities based on Mahalanobis distance can be found in Appendix B.

Results from Principal Component Analysis (Figure 9) indicated that the elements that are positively loaded for PC#1 are Cs, As, and Sb; for PC#2, La, Ce, Cr, Ta, and Th; and for PC#3, Na, K, and Ba. Because NAA is a bulk compositional analysis and these data include both clays and aplastic inclusions, the elemental differences that define the groups may be a result of either different clay sources or different proportions of clay and temper. The geology of the lower Lurín valley is a mix of shales, sandstones, and clay deposits with intrusive igneous outcroppings of andesite, granodiorite, and tonalite (León and De La Cruz 2003). The importance of these elements in defining groups and their concentration in the data (Appendix A) supports these being trace elements present in clays, and the groups founded on utilization of different clay sources rather than the use of different tempers or ratios of tempers and clays.

4.1. Group 1

Group 1 is comprised of 67 sherds. A majority of this group ($n = 54$, 80.5%) are local styles. Nine are Inka Polychrome and an additional 4 are Regional Inka. Of the 13 Inka Polychrome and Regional Inka members of Group 1, 10 are open forms (7 plates and 3 bowls) and 3 are closed forms (all in local styles of indeterminate forms).

4.2. Group 2

Group 2 is comprised of 55 sherds. There are no local styles present in this group, and 34 are Inka Polychrome while the remaining 21 are Regional Inka. This group contains 30 (54.5%) open forms and 25 (45.5%) closed forms. Of the open forms, 29 are plates and one is a bowl. There are 7 *urpus*, and 18 closed form sherds of indeterminate forms.

4.3. Group 3

Group 3 is comprised of 11 sherds. All sherds in Group 3 are Inka Polychrome, there are no local or Regional Inka styles present. This group contains 1 open form, a plate. The other 10 (90.9%) members of this group are *urpus*.

4.4. Comparative Data

Several trends are evident when comparing data from Pachacamac ceramics with data from LBNL. Ceramics from Pachacamac that were analyzed at LBNL plotted primarily within groups

identified at MURR (Figure 10), demonstrating the comparability of these data collected at different labs. Additionally, some of the ceramics from other sites in the Lurín valley (Pampa Flores, Avillay, and PV47-164A) analyzed at LBNL fit within Groups 1 and 2 (Figure 10). Lastly, ceramics from Cuzco plotted entirely separate from these groups (Figure 11).

A previous study which compared these data to compositional data collected at MURR from the Cuzco region found that a sherd from Pachacamac and a sherd from Avillay analyzed at LBNL had compositional similarity to a group from Cuzco (Burger et al. 2019:109). Treating the LBNL Cuzco data as a group, one *urpu* outlier from this study fits statistically with these data (catalog no. 41.1/8971 A03, labeled on Figure 8).

Though direct comparison is not possible, is still worthwhile to compare the results of this research with those from recent work comparing ceramics from the Lurín valley and clay sources from several valleys on the central coast (Makowski and Oré 2014; Makowski et al. 2008, 2015). That research, which evaluated only clays and not pastes using LA-ICP-MS, identified three distinct compositional groups which contained variation in decorative style as well as in macroscopic pastes, potentially indicating different potting practices or technologies were employed using the same clay. In PCA of these data, the authors identified K, Fe, Cu, Zn, As, Rb, Sr, Sb, Cs, Ba, Hf, Pb, and U as the elements that best discriminate the three groups (Makowski et al. 2008:276). Not all of these elements were detected using NAA, however of those that were, many of the same elements contributed strongly to variance in this research. It is likely that clay sources in the lower and middle Lurín valley (and possibly the Rimac valley) that were tied to compositional groups in Makowski et al.'s (2015:150) study were also utilized to produce the pottery analyzed by this study.

4.5. Statistical Analysis of Attributes

After groups were identified, statistical evaluations were made to determine if there were any attributes, stylistic or metric, that corresponded with group membership. In a chi-squared goodness of fit test, the distribution of Inka Polychrome and Regional Inka plates, *urpus*, and bowls across the groups was found to be significant ($p < 0.001$). While no form is only found in a single compositional group, each group contains a form in a higher proportion than the others (bowls in Group 1, plates in Group 2, *urpus* in Group 3). A chi-squared goodness of fit test was made to compare the decoration color schemes of Inka Polychrome (e.g., black, white, and red versus black and white versus white and red, etc.) across the groups and found the distribution to be not significant ($p = 0.735$).

Metric measurements and decorative attributes were also statistically compared among similar Inka Polychrome forms between groups. Among plates, no attributes were statistically significant: ANOVA tests for rim diameter, wall thickness, and wall angle and chi-squared goodness of fit tests for rim form, burnishing, incising, fire clouding, and wear for Inka Polychrome and Regional Inka plates showed no statistically significant differences between groups. Similarly, among *urpus*, no attributes were statistically significant when compared across compositional groups.

Decoration was compared between similar forms across the groups in two ways. First, color scheme was recorded as the base color or slip and what other colors were painted on the surface (e.g., black on white, black and white on red, etc.). Second, specific design elements in distinct areas were recorded and compared. These areas are, for plates: the band around the rim (typically a row of triangles pointing inward bounded by one or more lines) and a band across the center, which typically features a type of quatrefoil design. For *urpus*, the areas are: the design on the neck of the vessel (when present), a central band which typically features a type of quatrefoil design, and two panels that flank this central band, which is typically either repeating bands of downward facing triangles or a stylized plant (often called “fern”) design. Attributes of these motifs that were recorded were the colors, shapes, and number of lines of the different elements. There was no color scheme that was unique to any group, and any design motif present in Group 1 was also present in Group 2 (Figure 12). There were unique designs present in Group 2, though this group contained more Inka polychrome pottery than the others.

The sample size of Inka Polychrome between the groups may be too small for any statistically significant trends to appear, however there is not one attribute, nor metric, nor design pattern or color combination, that can reliably be used to distinguish Inka Polychrome pottery as a member of any of these identified compositional group. It is likely that multiple groups of potters were producing this Inka Polychrome pottery. The differences in elemental composition between the groups reflects either differences in location of raw materials, both clay and aplastic additions, or differences in raw material selection and processing, a step of the production process that often varies group to group. Some of the attributes included in this study, such as surface decoration and finishing, are high visibility attributes which can be easily copied or reproduced without communication between potters (Zedeño 1994).

5. Discussion and Conclusions

Inka Polychrome pottery was critical for the state to enact reciprocity in its provinces. It was distributed and produced widely by subject potters throughout the empire. In examining the ceramic assemblage from the Inka-built Temple of the Sun at Pachacamac, several conclusions can be drawn about how production was organized.

First, Inka Polychrome pottery was produced locally, either at Pachacamac or elsewhere in the Lurín Valley. Pottery production workshops or locations have been hypothesized (e.g. Menzel 1964, 1977) but have not been located archaeologically. Though raw material sources from these places were not included in this study, compositional similarity between local styles and Inka Polychrome pottery in Group 1 supports local production. Second, there are multiple groups of potters producing the Inka Polychrome pottery from the Temple of Sun. These groups may have been working at multiple production loci and using compositionally distinct sources of clay or temper. It is also possible that they could have been utilizing the same raw materials but different recipes or methods for processing. Furthermore, it is possible that the same potters were using different processes or technologies to produce different types of vessels. Group 3 is comprised primarily of *urpus*, though Third, there are no attributes, morphometric or decorative, that can be used to distinguish Inka Polychrome pottery from different compositional groups. There are also no Inka Polychrome forms that are exclusive to any group, however it is possible that there was a preference or bias for producing different Inka Polychrome forms at the different production loci. Lastly, these loci made pottery for both Pachacamac and other sites in the Lurín valley. Archaeological research at several of these sites indicates they settled or expanded by the Inka, and their position along the state road *qhapaq ñan* likely facilitated the movement of pottery between these sites and Pachacamac. While there may have been some movement of pottery between Cuzco and Pachacamac, a large majority of Inka Polychrome pottery that was sampled in this project (~98.5%) was not made in the capital region. Sherds that were statistical outliers to any group may represent importation from other centers of Inka Polychrome pottery production, such as the Chíncha Valley (including the La Centinela-Tambo de Mora complex) to the south or Hatun Xauxa and Huánuco Pampa in the highlands. Without raw material sources or local styles of pottery as members, Groups 2 and 3 cannot be assigned a location with certainty, though given the number of ceramics within these groups it is likely that they were also produced locally in the central coast.

These conclusions are in accordance with, and build upon, previous work examining the organization of production for pottery of the central coast (e.g., Makowski and Oré 2014; Makowski et al. 2008, 2015) and for Inka Polychrome (e.g., D'Altroy and Bishop 1990). The organization was complex. The Inka entrusted multiple groups of potters (some of them local) in multiple places with the creation of Inka Polychrome pottery for the Temple of the Sun at Pachacamac, and imported small amounts of pottery as well. As these objects were necessary for state-sponsored events in the provinces, these data about their production improve the understanding of how the Inka empire provisioned its efforts within its subject territories and populations. Based on these results, potters laboring for the state to produce Inka polychrome pottery may have been a mix of full-time, attached specialists who were either local or relocated *mitmaq* potters, and part-time potters serving labor obligations. While investigation into Inka Polychrome pottery has expanded greatly in recent years, this research highlights a need for continued

study into Inka Polychrome pottery's production and use, both at Pachacamac and elsewhere in the provinces. Potters may have been retrained by the Inka empire to create Inka Polychrome pottery. This pottery could have also been produced by *mitmaq* potters relocated to Pachacamac from elsewhere in the empire, or by itinerant potters. Additional investigation into other steps of the production sequence will help in understanding the relationship between subject potters and the state.

Acknowledgements

Work performed in the Archaeometry Laboratory at MURR was supported in part by grants from the National Science Foundation (1415403, 1912776) and a grant from the University of New Mexico's Office of Graduate Studies. At the American Museum of Natural History, I thank David Hurst Thomas, Charles Spencer, Sumru Aricanli, and Kristen Mable for their support and help with the study loan of this material. I thank Michael Glascock, Jeff Ferguson, and the Archaeometry Laboratory staff at MURR for assisting with sample preparation and data analysis. I also thank Michael Glascock and Matthew Boulanger for the tremendous amount of work in preserving and digitizing the LBNL data. I thank Frances Hayashida, Sarah Thomson, three anonymous reviewers, and George Milner for providing helpful feedback on this manuscript. As the author of this paper, I am responsible for its contents, errors, and any unintentional misinterpretations.

Figures

Figure 1. Map of Peru with Pachacamac and other sites mentioned in the text.

Figure 2. Map of the ceremonial core of Pachacamac with notable structures and places labeled. The location of Strong et al.'s excavations in 1941 is also identified.

Figure 3. Standardized forms of Inka Polychrome pottery. After Meyers 1975.

Figure 4. Schematic outline of Cut 2 blocks, with stratigraphic layers observed during excavations. After Strong et al. 1943:43, Fig. 5. (color)

Figure 5. Percentages of Inka/Inka-Associated and Early Pachacamac style ceramic artifacts by excavation block. Based on data from Strong et al. 1943. (color)

Figure 6. Sites in the Lurín Valley from which archaeological ceramics were analyzed using NAA at LBNL.

		Group 1	Group 2	Group 3	Outliers
Inka Polychrome	Plates	41.1/8966 V06	41.1/8966 V01	41.1/8966 V04	41.1/8966 V05
	Bowls	41.1/8966 T02	41.1/8966 T04		
	Urupus		41.1/8966 U03	41.1/8966 U09	41.1/8966 U16
	Local	41.1/8971 A01, 41.1/8980 U03			41.1/8980 T

Figure 7. Examples of pottery from each group. (color)

Figure 8. Bivariate plot of Neutron Activation Analysis data using Principle Components Analysis. Circles are members of Group 1, squares are members of Group 2, triangles are members of Group 3, and upside-down triangles are outliers which could not be assigned to any group. Black points are Inka Polychrome sherds, grey points are Regional Inka, and white are local styles. Ellipses represent 90% confidence intervals. This figure is presented at the same scale as figures 10 and 11 to allow for comparison between them. The outlier ceramic artifact with catalog no. 41.1/8971 A03, most likely to be from Cuzco, is labeled.

Figure 9. Principal Components Analysis, calculated with all 32 elements detected at MURR on the 149 samples analyzed at MURR. Vectors correspond to the variance contributed by each element detected. Ellipses represent 90% confidence intervals for Groups 1, 2, and 3.

Figure 10. Data from ceramic artifacts from Pachacamac and four sites in the Lurín Valley that were analyzed at LBNL are overlaid over the 90% confidence interval ellipses for the groups from this analysis.

Figure 11. Data from ceramic artifacts from Cuzco that were analyzed at LBNL are overlaid over the 90% confidence interval ellipses for the groups from this analysis.

Figure 12. Examples of similar design motifs in Group 1 (AMNH catalog no. 41.1/8966 V03) and Group 2 (AMNH catalog no. 41.1/8966 N). (color)

Attribute	Description
Rim Diameter	Measured using a rim diameter chart in centimeters
Wall Thickness	Measured using calipers in millimeters
Wall Angle	Measured from rim profile drawing in degrees
Rim Form	Rounded, Squared, Pointed, or Lipped
Wiping/Scraping	Presence and Location
Slip	Presence and Location
Burnishing	Presence, Location, and Direction
Incising	Presence and Location
Fire Clouds	Presence and Location
Paint	Munsell values for colors, Location, and scheme
Wear	Presence and Location

Table 1. Attributes of ceramic artifacts analyzed for this study.

	Total Collection	This Study	Group 1	Group 2	Group 3	Outliers
Open Forms	181	56	15	29	1	6
<i>Plates</i>	98	47	12	28	1	6
<i>Bowls</i>	60	7	6	1		
Closed Forms	273	93	53	25	10	10
<i>Urpus</i>	80	24	2	10	10	5
Indeterminate	18					
Inka Polychrome	164	65	9	34	11	10
Regional Inka	234	28	4	21		2
Local Styles	69	56	54			4
Total	472	149	67	55	11	16

Table 2. Counts of ceramic forms from the collection that was analyzed and what is included in this study. Categories for Inka Polychrome, Regional Inka, and Local Styles roughly correspond to Strong et al.'s (1943) categorizations of the ceramic styles, however some artifacts that were assigned to "Inca Associated" and "Interlocking" by Strong were mis-identified and reassigned to the correct groups prior to this analysis.

References Cited

- Alconini, S., 2013. El Territorio Kallawayaya y el Taller Alfarero de Milliraya: Evaluación de la Distribución e Intercambio Interregional de la Cerámica Inka Provincial. *Chungará (Arica)* 45, 277–292. <https://doi.org/10.4067/S0717-73562013000200005>
- Alconini, S., 2008. Dis-embedded centers and architecture of power in the fringes of the Inka empire: New perspectives on territorial and hegemonic strategies of domination. *Journal of Anthropological Archaeology* 27, 63–81. <https://doi.org/10.1016/j.jaa.2007.08.002>
- Allen, C.J., 2015. The Whole World is Watching: New Perspectives on Andean Animism, in: Bray, T.L. (Ed.), *The Archaeology of Wak'as: Explorations of the Sacred in the Pre-Columbian Andes*. University Press of Colorado, Boulder, pp. 23–46.
- Asaro, F., Adan-Bayewitz, D., 2007. The History of the Lawrence Berkeley National Laboratory Instrumental Neutron Activation Analysis Programme for Archaeological and Geological Materials. *Archaeometry* 49, 201–214. <https://doi.org/10.1111/j.1475-4754.2007.00296.x>
- Baxter, M.J., 1992. Archaeological use of the Biplot--a Neglected Technique?, in: Lock, G., Moffett, J. (Eds.), *Computer Applications and Quantitative Methods in Archaeology, 1991*, BAR International Series. Tempvs Reparatum, Archaeological and Historical Associates, Oxford, pp. 141–148.
- Baxter, M.J., Buck, C.E., 2000. Data Handling and Statistical Analysis, in: Ciliberto, E., Spoto, G. (Eds.), *Modern Analytical Methods in Art and Archaeology*. John Wiley & Sons, Inc., New York, pp. 681–746.
- Bieber, A.M., Brooks, D.W., Harbottle, G., Sayre, E.V., 1976. Application of Multivariate Techniques to Analytical Data on Aegean Ceramics. *Archaeometry* 18, 59–74. <https://doi.org/10.1111/j.1475-4754.1976.tb00145.x>
- Bishop, R.L., Lange, F.W., Lange, P.C., Abel-Vidor, S., 1992. Compositional Characterization of the Nicaraguan Ceramic Sample, in: Lange, F.W., Sheets, P.D., Martinez, A., Abel-Vidor, S. (Eds.), *The Archaeology of Pacific Nicaragua*. University of New Mexico Press, Albuquerque, pp. 135–162.
- Bishop, R.L., Neff, H., 1989. Compositional Data Analysis in Archaeology, in: Allen, R.O. (Ed.), *Archaeological Chemistry IV, Advances in Chemistry Series*. American Chemical Society, Washington, pp. 57–86.
- Boozer, A., 2010. Memory and microhistory of an empire: Domestic contexts in Roman Amheida, Egypt, in: Borić, D. (Ed.), *Archaeology and Memory*. Oxbow Books ; David Brown Book Co, Oxford, UK : Oakville, CT, pp. 138–157.
- Boulanger, M.T., 2016. Recycling Data: Working with Published and Unpublished Ceramic Compositional Data, in: Hunt, A. (Ed.), *The Oxford Handbook of Archaeological Ceramic Analysis*. Oxford University Press, pp. 72–84. <https://doi.org/10.1093/oxfordhb/9780199681532.013.6>
- Boulanger, M.T., 2013. Salvage Archaeometry: Lessons Learned from the Lawrence Berkeley Laboratory Archaeometric Archives. *SAA Archaeological Record* 13, 14–19.
- Boulanger, M.T., 2012. Digitization of the Lawrence Berkeley Laboratory Archaeometric Archives: Status Update and Availability Announcement. *Society for Archaeological Sciences Bulletin* 35, 4–7.
- Boulanger, M.T., Lawrence Berkeley National Laboratory, 2014. Peru Ceramics: Chemical and Descriptive Data. tDAR id:365503. doi:10.6067/XCV83X8547
- Boulanger, M.T., Lawrence Berkeley National Laboratory, 2011. Peruvian Ceramics: Photographs. tDAR id:365533. doi:10.6067/XCV8VX0FJ2
- Bray, T.L., 2018. Partnering with Pots: The Work of Objects in the Imperial Inca Project. *CAJ* 28, 243–257. <https://doi.org/10.1017/S0959774317000828>

- Bray, T.L., 2003. To Dine Splendidly: Imperial Pottery, Commensal Politics, and the Inca State, in: Bray, T.L. (Ed.), *The Archaeology and Politics of Food and Feasting in Early States and Empires*. Kluwer Academic, New York, pp. 93–142. https://doi.org/10.1007/978-0-306-48246-5_5
- Bray, T.L., Minc, L.D., Ceruti, M.C., Chávez, J.A., Perea, R., Reinhard, J., 2005. A compositional analysis of pottery vessels associated with the Inca ritual of capacocha. *Journal of Anthropological Archaeology* 24, 82–100. <https://doi.org/10.1016/j.jaa.2004.11.001>
- Burger, R.L., Salazar, L.C., Glascock, M.D., 2019. The Analysis of Inca Pottery from the Cuzco Region: Implications for the Provisioning of Ceramics for Machu Picchu and Other Inca Sites, in: Glascock, M.D., Neff, H., Vaughn, K.J. (Eds.), *Ceramics of the Indigenous Cultures of South America: Studies of Production and Exchange through Compositional Analysis*. University of New Mexico Press, Albuquerque, pp. 97–111.
- Capriata Estrada, C., Zambrano Anaya, R., Solís Curi, A., 2016. La ocupación inca en Pampa de las Flores: continuidad, transformación y abandono de arquitectura pública en el valle de Lurín durante el Horizonte Tardío, in: *Actas I Congreso Nacional de Arqueología*. Ministerio de Cultura, Lima, pp. 197–207.
- Carmichael, P.H., 2020. Nasca Pottery Production: Retrospect and Prospect. *Ñawpa Pacha* 40, 1–29. <https://doi.org/10.1080/00776297.2020.1732590>
- Cieza de Leon, P. de, 1864. *The Travels of Pedro de Cieza de Leon, A.D. 1532-50*, contained in the First Part of his *Chronicle of Peru*. Burt Franklin, Publisher, New York.
- Coben, L.S., 2012. *Theaters of Power: Inca Imperial Performance (Anthropology)*. University of Pennsylvania, Philadelphia.
- Coben, L.S., 2006. Other Cuzcos: Replicated Theaters of Inka Power, in: Inomata, T., Coben, L.S. (Eds.), *Archaeology of Performance: Theaters of Power, Community, and Politics*. AltaMira Press, Oxford, pp. 223–260.
- Cobo, B., 1990. *Inca Religion and Customs*. University of Texas Press, Austin.
- Cornejo, M., 2002. Sacerdotes y Tejedores en la Provincia Inka de Pachacamac. *Boletín de Arqueología PUCP* 6, 171–204.
- Cornejo, M., 2000. La Nación Ischma y la Provincia Inca de Pachacamac. *Arqueológicas* 24, 149–173.
- Cornejo, M., 1995. Arqueología de santuarios Inkas en la Guaranga de Sisicaya, Valle de Lurín. *Tawantinsuyo* 1, 18–28.
- Costin, C., 2018. Gender and Status in Inca Textile and Ceramic Craft Production, in: Alconini, S., Covey, A. (Eds.), *The Oxford Handbook of the Incas*. Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780190219352.013.14>
- Costin, C.L., 2016. Introduction, in: Costin, C.L. (Ed.), *Making Value, Making Meaning: Techné in the Pre-Columbian World*, *Dumbarton Oaks Pre-Columbian Symposia and Colloquia*. Presented at the Pre-Columbian Studies Symposium “Making Value, Making Meaning : Techné in the Pre-Columbian World,” Dumbarton Oaks, Washington, D.C, pp. 1–30.
- Costin, C.L., 2002. Production and Exchange of Ceramics, in: D’Altroy, T.N., Hastorf, C.A. (Eds.), *Empire and Domestic Economy, Interdisciplinary Contributions to Archaeology*. Kluwer Academic Publishers, New York, pp. 203–242.
- Costin, C.L., Earle, T., 1989. Status Distinction and Legitimation of Power as Reflected in Changing Patterns of Consumption in Late Prehispanic Peru. *American Antiquity* 54, 691–714.
- Covey, R.A., 2008. The Inca Empire, in: Silverman, H., Isbell, W.H. (Eds.), *Handbook of South American Archaeology*. Springer, New York, pp. 809–830.
- Cremonte, M.B., Maro, G., Díaz, A.M., 2015. Acercamiento a la Producción y Distribución del Estilo Inca Pacajas: Un Estudio Arqueométrico de las Pastas. *Chungará (Arica)* 0–0. <https://doi.org/10.4067/S0717-73562015005000029>
- Cummins, T., 2007. Queros, Aquillas, Uncus, and Chulpas: The Composition of Inka Artistic Expression and Power, in: Burger, R.L., Morris, C., Matos Mendieta, R. (Eds.), *Variations in the Expression of Inka Power: A Symposium at Dumbarton Oaks 18 and 19 October 1997*. Dumbarton Oaks, Washington, pp. 267–312.

- Cummins, T., 1993. La representación en el siglo XVI: La imagen colonial del Inca, in: Urbano, H. (Ed.), *Mito y Simbolismo en los Andes: La Figura y La Palabra*. Centro de Estudios Regionales Andinos “Bartolomé de Las Casas,” Cusco, pp. 87–136.
- Curatola Petrocchi, M., 2015. Oracles, in: Urton, G., von Hagen, A. (Eds.), *Encyclopedia of the Incas*. Rowman & Littlefield, Lanham, pp. 206–211.
- Curatola Petrocchi, M., 2008. La función de oráculos en el Imperio inca, in: Curatola Petrocchi, M., Ziolkowski, M.S. (Eds.), *Adivinación y oráculos en el mundo andino antiguo*. Fondo Editorial Pontificia Universidad Católica del Perú, Lima, pp. 15–69.
- D’Altroy, T.N., 2018. Empires reconsidered: current archaeological approaches. *asian archaeol* 1, 95–109. <https://doi.org/10.1007/s41826-018-0005-4>
- D’Altroy, T.N., 2015. *The Incas*, 2nd ed. Wiley Blackwell, Oxford.
- D’Altroy, T.N., 1992. *Provincial Power in the Inka Empire*. Smithsonian Institution Press, Washington.
- D’Altroy, T.N., Bishop, R.L., 1990. The Provincial Organization of Inka Ceramic Production. *Am. antiq.* 55, 120–138. <https://doi.org/10.2307/281498>
- D’Altroy, T.N., Lorandi, A.M., Williams, V.I., 1998. Ceramic Production and Use in the Inka Political Economy, in: Shimada, I. (Ed.), *Andean Ceramics: Technology, Organization, and Approaches*, MASCA Research Papers. University Museum of Archaeology and Anthropology, University of Pennsylvania, Philadelphia, pp. 238–312.
- D’Altroy, T.N., Williams, V.I., Lorandi, A.M., 2007. The Inkas in the Southlands, in: Burger, R.L., Morris, C., Matos Mendieta, R. (Eds.), *Variations in the Expression of Inka Power*. *Dumbarton Oaks*, Washington, pp. 85–133.
- Donnan, C.B., 1997. A Chimú-Inka Ceramic-Manufacturing Center from the North Coast of Peru. *Latin Am. antiq.* 8, 30–54. <https://doi.org/10.2307/971591>
- Eeckhout, P., 2013. Change and permanency on the coast of ancient Peru: the religious site of Pachacamac. *World Archaeology* 45, 137–160. <https://doi.org/10.1080/00438243.2012.759516>
- Espinoza Soriano, W., 1983. Los Mitmas Plateros de Ishma en el País de los Ayarmaca siglos XV - XIX. *Boletín de Lima* 30, 38–53.
- Espinoza Soriano, W., 1970. Los Mitmas Yungas de Collique en Cajamarca Siglos XV, XVI y XVII. *Revista del Museo Nacional* 36, 9–57.
- Feltham, P.J., 1983. *The Lurín Valley, Peru, A.D. 1000-1532 (Archaeology)*. University of London, London.
- Fernández Baca, J., 1971. *Motivos de Ornamentación de la Cerámica Inca Cuzco*. Librería Studium S.A., Lima.
- Franco Jordán, R.G., 1996. *El Templo del Sol de Pachacamac: Esplendor y Poder*. DPI, Lima.
- Franco Jordán, R.G., Paredes Botoni, P.F., 2016. *Templo Viejo de Pachacamac: Dioses, Arquitectura, Sacrificios y Ofrendas*. Fundación Augusto N. Wiese, Lima.
- Frei, K.M., Bjerregaard, L., 2017. Provenance investigations of raw materials in pre-Columbian textiles from Pachacamac; strontium isotope analyses, in: Bjerregaard, L., Peters, A. (Eds.), *PreColumbian Textile Conference VII*. Zea Books, Lincoln, pp. 387–297.
- Glascock, M.D., 2019. Compositional Analysis of Archaeological Ceramics, in: Glascock, M.D., Neff, H., Vaughn, K.J. (Eds.), *Ceramics of the Indigenous Cultures of South America: Studies of Production and Exchange through Compositional Analysis*. University of New Mexico Press, Albuquerque.
- Glascock, M.D., 1992. Characterization of archaeological ceramics at MURR by neutron activation analysis and multivariate statistics, in: Neff, H. (Ed.), *Characterization of Ceramic Pastes in Archaeology*. Prehistory Press, Madison, pp. 11–26.
- Golitko, M., Sharratt, N., Williams, P.R., 2016. Open-Cell Ablation of Killke and Inka Pottery from the Cuzco Area: Museum Collections as Repositories of Provenience Information, in: Dussubieux, L., Golitko, M., Gratuze, B. (Eds.), *Recent Advances in Laser Ablation ICP-MS for Archaeology, Natural Science in Archaeology*. Springer Berlin Heidelberg, Berlin, Heidelberg, pp. 27–52. https://doi.org/10.1007/978-3-662-49894-1_3

- Harbottle, G., 1976. Activation analysis in archaeology, in: Newton, G.W.A. (Ed.), *Radiochemistry: A Specialist Periodical Report*. The Chemical Society, London, pp. 33–72.
- Hastorf, C.A., 2007. Archaeological Andean Rituals: Performance, Liturgy, and Meaning, in: Kyriakidis, E. (Ed.), *The Archaeology of Ritual*, Cotsen Advanced Seminar. Cotsen Institute of Archaeology, Los Angeles, pp. 77–108.
- Hayashida, F.M., 2019. Crafting Beer Jars for the Inca on the North Coast of Peru, in: Glascock, M.D., Neff, H., Vaughn, K.J. (Eds.), *Ceramics of the Indigenous Cultures of South America: Studies of Production and Exchange through Compositional Analysis*. University of New Mexico Press, Albuquerque, pp. 51–53.
- Hayashida, F.M., 1999. Style, Technology, and State Production: Inka Pottery Manufacture in the Leche Valley, Peru. *Latin Am. antiq.* 10, 337–352. <https://doi.org/10.2307/971961>
- Hayashida, F.M., 1998. New Insights into Inka Pottery Production, in: Shimada, I. (Ed.), *Andean Ceramics: Technology, Organization, and Approaches*, MASCA Research Papers. University Museum of Archaeology and Anthropology, University of Pennsylvania, Philadelphia, pp. 315–335.
- Hayashida, F.M., 1995. *State pottery production in the Inka provinces (Anthropology)*. University of Michigan, Ann Arbor.
- Hyslop, J., 1993. Factors influencing the transmission and distribution of Inka cultural materials throughout Tawantinsuyu, in: Rice, D.S. (Ed.), *Latin American Horizons: A Symposium at Dumbarton Oaks*, 11 and 12 October 1986. Dumbarton Oaks, Washington, pp. 337–356.
- Hyslop, J., 1990. *Inka Settlement Planning*. University of Texas Press, Austin.
- Jenkins, D., 2001. A Network Analysis of Inka Roads, Administrative Centers, and Storage Facilities. *Ethnohistory* 48, 655–687. <https://doi.org/10.1215/00141801-48-4-655>
- Khatchadourian, L., 2016. *Imperial Matter: Ancient Persia and the Archaeology of Empires*. University of California Press, Oakland.
- Kroeber, A.L., 1926. The Uhle Pottery Collections from Chancay. *University of California Publications in American Archaeology and Ethnology* 21, 265–304.
- Lau, G.F., 2019. An Inka Offering at Yayno (North Highlands, Peru): Objects, Subjects and Gifts in the Ancient Andes. *CAJ* 29, 159–179. <https://doi.org/10.1017/S0959774318000409>
- León Lecaros, W., De La Cruz Matos, O., 2003. Memoria Descriptiva De La Revisión Y Actualización De Los Cuadrángulos De Mala (26-J), Lurín (25-J) Y Lima (25-L). INGEMMET.
- Loffler, G., 2018. *Post Middle Horizon Ceramic Styles in the Lurín Valley of the Central Coast of Peru (Anthropology)*. University of California, Riverside, Riverside.
- Lorandi, A.M., 1991. Evidencias en torno a los Mitmaquna Incaicos en el N.O. Argentino. *Anthropologica* 9, 213–243.
- Mackey, C., 2003. La Transformación Socioeconómica de Farfán bajo el Gobierno Inka. *Boletín de Arqueología PUCP* 7, 321–353.
- Makowski, K., 2015. Pachacamac--Old Wak'a or Inka Syncretic Deity? Imperial Transformation of the Sacred Landscape in the Lower Ychsma (Lurín) Valley, in: Bray, T.L. (Ed.), *The Archaeology of Wak'as: Explorations of the Sacred in the Pre-Columbian Andes*. University Press of Colorado, Boulder, pp. 127–166.
- Makowski, K., Ghezzi, I., Guerrero, D., Neff, H., Jiménez, M., Oré, G., Álvarez-Calderón, R., 2008. Pachacamac, Ychsma Y Los Caringas: Estilos E Identidades En El Valle De Lurín Inca, in: Pinedo, O., Tantaleán, H. (Eds.), *Arqueología de la Costa Centro Sur Peruana*. Avqi Ediciones, Lima, pp. 267–316.
- Makowski, K., Ghezzi, I., Neff, H., Ore, G., 2015. Networks of Pottery Production and Exchange in the Late Horizon: Characterization of Pottery Styles and Clays on the Central Coast of Peru, in: Druc, I.C. (Ed.), *Ceramic Analysis in the Andes*. Deep University Press, Madison, pp. 139–155.
- Makowski Hanula, K., Oré Menéndez, G., 2014. Alfareros de aquí o de allá: Identidad estilística y tecnológica en el valle de Pachacamac (costa central peruana). *Rev. Esp. Antropol. Am.* 43, 515–536. https://doi.org/10.5209/rev_REAA.2013.v43.n2.44021

- Marcone Flores, G., 2010. Highland Empires, Lowland Politics: The Central Peruvian Coast and its Relation to Pan-Andean Empires, in: Cutright, R.E., López-Hurtado, E., Martín, A.J. (Eds.), *Comparative Perspectives on the Archaeology of Coastal South America*. Center for Comparative Archaeology, University of Pittsburgh, Pittsburgh, pp. 127–145.
- Marcone Flores, G., 2004. Cieneguilla a la llegada de los Incas: Aproximaciones desde la historia ecológica y la arqueológica. *bifea* 715–734. <https://doi.org/10.4000/bifea.5330>
- Marcone Flores, G., López-Hurtado, E., 2002. Panquilma y Cieneguilla en la Discusión Arqueológica del Horizonte Tardío de la Costa Central. *Boletín de Arqueología PUCP* 6, 375–394.
- Marsteller, S.J., Zolotova, N., Knudson, K.J., 2017. Investigating economic specialization on the central Peruvian coast: A reconstruction of Late Intermediate Period Ychsma diet using stable isotopes: Marsteller et al. *Am. J. Phys. Anthropol.* 162, 300–317. <https://doi.org/10.1002/ajpa.23117>
- Menzel, D., 1977. *The Archaeology of Ancient Peru and the World of Max Uhle*. R. H. Lowie Museum of Anthropology, University of California, Berkeley.
- Menzel, D., 1964. Style and Time in the Middle Horizon. *Ñawpa Pacha* 2, 1–105. <https://doi.org/10.1179/naw.1964.2.1.001>
- Meyers, A., 1975. Algunos Problemas en la Clasificación del Estilo Incaico. *Pumapunku* 8, 7–25.
- Morris, C., 1991. Signs of Division, Symbols of Unity: Art in the Inka Empire, in: Levenson, J.A. (Ed.), *Circa 1492: Art in the Age of Exploration*. National Gallery of Art, Washington, pp. 521–528.
- Morris, C., Covey, R.A., Stein, P., 2011. *The Huánuco Pampa Archaeological Project Volume I: The Plaza and Palace Complex*, Anthropological Papers of the American Museum of Natural History. American Museum of Natural History, New York.
- Morris, C., von Hagen, A., 2011. *The Incas*. Thames & Hudson, London.
- Murra, J.V., 1980. *The economic organization of the Inka State*, 1979 ed. ed, Research in economic anthropology. JAI Press, Greenwich, Conn.
- Neff, H., 2002. Quantitative techniques for analyzing ceramic compositional data, in: Glowacki, D.M., Neff, H. (Eds.), *Ceramic Production and Circulation in the Greater Southwest: Source Determination by INAA and Complementary Mineralogical Investigations*, Monographs. Cotsen Institute of Archaeology, Los Angeles, pp. 15–36.
- Neff, H., 2000. Neutron Activation Analysis for Provenance Determination in Archaeology, in: Ciliberto, E., Spoto, G. (Eds.), *Modern Analytical Methods in Art and Archaeology*, Chemical Analysis Series. John Wiley & Sons, Inc., New York, pp. 81–134.
- Neff, H., 1994. RQ-Mode Principal Components Analysis of Ceramic Compositional Data. *Archaeometry* 36, 115–130. <https://doi.org/10.1111/j.1475-4754.1994.tb01068.x>
- Páez, M.C., Sardi, M.L., 2014. Changes in pottery production under Inca rule in a frontier site in the Tafi Valley, Argentina: a mineralogical analysis. *Ñawpa Pacha* 34, 61–78. <https://doi.org/10.1179/0077629714Z.00000000014>
- Quave, K.E., 2017. Imperial-Style Ceramic Production on a Royal Estate in the Inka Heartland (Cuzco, Peru). *Latin Am. antiq.* 28, 599–608. <https://doi.org/10.1017/laq.2017.41>
- Quave, K.E., 2012. *Labor and Domestic Economy on the Royal Estate in the Inka Imperial Heartland (Maras, Cuzco, Peru) (Anthropology)*. Southern Methodist University, Dallas.
- Rostworowski de Diez Canseco, M., 1999. *History of the Inca Realm*. Cambridge University Press, Cambridge.
- Rowe, J.H., 1944. *An Introduction to the Archaeology of Cuzco*. Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University 27, 1–69.
- Sánchez Borjas, Á.E., 2000. Relaciones Sociales Serrano Costeñas Durante el Intermedio Tardío en el Valle Medio del Río Lurín. *Arqueológicas* 24, 129–147.
- Segura Llanos, R., 2004. La cerámica Lima en los árboles del Horizonte Medio y algunas notas para el debate, in: Villacorta, L.F. (Ed.), *Puruchuco: Un Homenaje a Arturo Jiménez Borja*. CONCYTEC, Lima.

- Shimada, I., 1991. Pachacamac Archaeology: Retrospect and Prospect, in: Pachacamac and Pachacamac Archaeology. The University Museum, University of Pennsylvania, Philadelphia, pp. XV–LXVIII.
- Shimada, I., Segura Llanos, R., Goldstein, D.J., Knudson, K.J., Shimada, M.J., Shinoda, K.-I., Takigami, M., Wagner, U., 2010. Un Siglo Después de Uhle: Reflexiones sobre la Arqueología de Pachacamac y Perú, in: Kaulicke, P. (Ed.), Max Uhle (1856-1944): Evaluaciones de sus investigaciones y obras. Fondo Editorial Pontificia Universidad Católica del Perú, Lima, pp. 109–150.
- Sinopoli, C.M., 2003. Echoes of Empire: Vijayanagara and Historical Memory, Vijayanagara as Historical Memory. Blackwell Publishers, Malden.
- Spurling, G., 1992. The organization of craft production in the Inka state: The potters and weavers of Milliraya (Anthropology). Cornell University, Ithaca.
- Strong, W.D., Willey, G.R., Corbett, J.M., 1943. Archeological Studies in Peru, 1941-1942, Columbia Studies in Archeology and Ethnology. Columbia University Press, New York.
- Tiballi, A., 2014. Weaving the body politic: the indegration of technological practice and embodied social identity in the late prehispanic Andes, in: Arnold, D.Y., Penelope Dransart (Eds.), Textiles, Technical Practice, and Power in the Andes. Archetype Books, London, pp. 140–158.
- Tiballi, A., 2010. Imperial Subjectivities: The Archaeological Materials from the Cemetery of the Sacrificed Women, Pachacamac, Peru (Anthropology). State University of New York, Binghamton, Binghamton.
- Uhle, M., 1991. Pachacamac: A Reprint of the 1903 Edition, in: Pachacamac and Pachacamac Archaeology. The University Museum, University of Pennsylvania, Philadelphia, pp. 1–103.
- Urton, G., 2015. Pachacamac, in: Urton, G., von Hagen, A. (Eds.), Encyclopedia of the Incas. Rowman & Littlefield, Lanham, pp. 212–213.
- Vallejo Berríos, F., 2011. La Problemática de la Cerámica Ychsma: El Estado de la Situación y Algunos Elementos de Discusión. Revista Chilena de Antropología 0. <https://doi.org/10.5354/0719-1472.2009.14166>
- Vallejo Berríos, F., 2004. El estilo Ychsma: características generales, secuencia y distribución geográfica. bifea 595–642. <https://doi.org/10.4000/bifea.5165>
- VanPool, T.L., Leonard, R.D., 2011. Quantitative Analysis in Archaeology. Wiley Blackwell, Oxford.
- Vega, G. de la, 1961. The Incas: The Royal Commentaries of the Inca Garcilaso de la Vega 1539-1616. The Orion Press, New York.
- Williams, V., Lorandi, A.M., 1986. Evidencias funcionales de un establecimiento incaico en el noroeste argentino. Comechingonia 4, 133–149.
- Williams, V.I., Santoro, C.M., Speakman, R.J., Glascock, M.D., Romero Guevara, Á.L., Valenzuela, D., Standen, V.G., D’Altroy, T.N., 2016. Instrumental neutron activation analysis of Inka and local pottery from northern Chile’s Atacama Desert. Journal of Archaeological Science: Reports 9, 481–492. <https://doi.org/10.1016/j.jasrep.2016.08.028>
- Zasada, M., 1985. Producción artesanal en el Tawantinsuyu. Estudios Latinoamericanos 10.
- Zedeño, M.N., 1994. Sourcing Prehistoric Ceramics at Chodistaas Pueblo, Arizona: The Circulation of People and Pots in the Grasshopper Region, Anthropological Papers of the University of Arizona. The University of Arizona Press, Tucson.

Appendix A. Data from Neutron Activation Analysis for 149 ceramic artifacts from the Temple of the Sun, Pachacamac.

Appendix B. Group membership probabilities based on Mahalanobis distance values for each group of the 149 ceramics evaluated using Neutron Activation Analysis.

Catalog No.	Style	NAA Group	NAA Na	NAA Al	NAA K	NAA Ca	NAA Sc	NAA Ti	NAA V	NAA Cr	NAA Mn	NAA Fe
41.1./8986 A	Local	Group 1	18063.6914	94084.3594	19870.5156	22664.0508	16.4371	3422.1208	133.386	28.1192	777.9109	43585.3945
41.1./8986 B	Local	Outlier	15337.0225	100499.0391	19842.8711	10660.6426	17.733	6097.8472	200.5445	27.0869	277.6961	46116.4766
41.1./8986 C	Local	Group 1	18372.2441	101091.0781	21088.4707	22794.0703	19.9839	5628.5986	170.7391	48.517	1080.6401	63009.3047
41.1./8986 D	Inka Polychrome	Outlier	15066.0078	98300.2031	19829.6934	17627.5488	16.1832	5024.606	173.0135	27.3597	513.2002	41054.0664
41.1./8986 E	Local	Group 1	20237.207	85033.0469	20828.1699	26917.9648	16.4636	5751.1401	141.6206	26.2528	1156.1273	47905.0078
41.1./8986 F	Regional Inka	Group 2	18799.9922	87064.4375	26403.082	16159.4453	13.4593	4137.8008	132.4023	21.724	501.6965	38799.4258
41.1./8986 G	Local	Group 1	20042.4629	82259.1797	21192.8535	29145.6875	15.2333	4797.7715	118.94	22.4573	741.5826	45683.0703
41.1./8986 H	Local	Group 1	21857.5566	86206.5859	19325.3574	30056.875	15.5071	4131.2544	132.5261	23.6546	937.1865	44250.3789
41.1./8986 I	Local	Group 1	20119.1426	83282.6875	17779.7051	28873.8984	17.7932	5115.1206	159.0639	29.964	1020.193	53896.6484
41.1./8986 J	Regional Inka	Group 1	20335.5859	85259.3359	18261.6641	23571.8945	15.3987	3915.7737	105.4846	20.6134	707.0782	42737.6172
41.1./8986 K	Local	Group 1	19552.2578	78418.4609	16432.9434	29683.8516	15.9157	4436.2285	139.0956	25.6199	1145.4122	55366.3828
41.1./8986 L	Regional Inka	Group 2	18153.1211	88852.7266	22778.5586	24357.1074	14.1926	3847.4067	104.9738	20.8169	823.1028	40455.0977
41.1./8986 M	Local	Group 1	20248.5625	83041.4141	18122.4258	30622.3926	14.9588	6168.6411	166.2354	27.3205	1098.7943	51002.4609
41.1./8986 N	Inka Polychrome	Group 1	20309.082	87032.4063	17609.1523	21667.3516	15.0927	5096.3076	141.5307	23.1317	604.6949	46097.2891
41.1./8986 O	Inka Polychrome	Group 2	19055.1445	82129.6797	23844.748	17815.8184	13.4194	4456.2925	126.4351	23.1964	830.4357	42145.7734
41.1./8966 A	Inka Polychrome	Group 1	20019.1035	90275	20951.8887	20390.8262	14.9489	4313.7891	119.7631	20.6906	549.033	37661.1406
41.1./8966 B	Regional Inka	Group 2	20496.6465	85264.6641	26972.9609	23956.959	13.0954	4409.5776	119.2098	23.9111	615.592	36230.7109
41.1./8966 C	Inka Polychrome	Group 2	16642.6523	85979.9844	22699.1133	23073.1133	15.1427	4808.3979	141.8811	26.9846	682.5104	47373.4805
41.1./8966 D	Regional Inka	Group 2	17457.6934	88054.3672	24663.8652	14447.2354	14.4953	4703.666	143.0356	24.1871	571.9283	44326.582
41.1./8966 E	Inka Polychrome	Group 2	14691.582	91050.4375	18293.3711	28288.9102	25.9545	5379.4268	273.8785	27.8026	1269.6636	69485.4297
41.1./8966 F	Inka Polychrome	Group 1	19199.6523	88056.2813	18290.9609	25699.7129	17.4311	6873.3198	170.4453	30.7311	702.4906	48634.6211
41.1./8966 G	Inka Polychrome	Group 2	17468.9492	86521.3047	23796.9883	21264.6445	14.7735	4950.249	131.1494	22.2609	684.1591	47003.4063
41.1./8966 H	Inka Polychrome	Group 2	20471.459	91075.2891	25205.1738	19669.8809	14.2956	5138.8364	118.7625	23.0317	653.8193	41865.918
41.1./8966 I	Inka Polychrome	Outlier	17796.6875	82546.5078	19560.3242	28389.2578	18.3919	7796.186	217.0977	41.9142	1096.0122	62331.8828
41.1./8966 J	Inka Polychrome	Group 1	17139.2285	90330.0313	21086.0176	27513.7266	15.4965	5362.5024	148.1857	26.5319	788.8879	45453.9766
41.1./8966 K	Inka Polychrome	Group 2	17591.3438	91196.9219	24173.541	18472.6816	14.0469	4595.833	135.8492	23.1663	628.196	43569.457
41.1./8966 L	Inka Polychrome	Group 2	18682.1055	84797.3984	22710.7813	19414.4434	14.9169	4913.2871	144.3329	24.3316	652.7463	44271.0352
41.1./8966 M	Inka Polychrome	Group 2	20555.7617	85140.3438	23767.248	20272.8906	15.1154	4532.4121	116.0387	24.5437	558.3726	39165.7148
41.1./8966 N	Inka Polychrome	Group 2	16017.2715	89969.3906	23214.7285	19897.5234	14.1259	4391.6958	125.4457	25.6536	644.1494	42314.2227
41.1./8966 O	Inka Polychrome	Group 2	18162.3301	89142.9453	21313.4746	18134.127	13.6255	4379.4653	130.2934	22.6561	576.0869	39214.8984
41.1./8966 P	Regional Inka	Group 2	16956.3027	88665.3438	21931.9746	18304.4023	15.1426	5067.5269	155.4982	26.1621	742.1724	50344.8867
41.1./8966 Q	Regional Inka	Group 2	21709.3379	87234.375	29158.1543	24156.7207	13.4286	3388.0869	108.0071	19.5547	896.8598	38889.2031
41.1./8966 R	Inka Polychrome	Group 2	20749.2656	91512.4688	31650.1641	24489.6016	15.0046	4412.439	127.3737	25.4344	738.6851	43125.1758
41.1./8966 S	Inka Polychrome	Group 2	20568.1973	88390.3047	23850.1016	21084.6738	14.8225	4279.4722	140.5899	23.515	780.5476	46822.1914
41.1./8969 A	Regional Inka	Group 2	20065.2461	91318.6875	24829.8438	20990.4531	14.2863	5314.4614	143.1305	23.5646	683.8161	40590.5781
41.1./8969 B	Regional Inka	Group 2	19200.8281	89527.2188	25130.1367	17397.4863	13.794	4918.9702	121.6764	21.9444	704.0128	43465.9141
41.1./8969 C	Regional Inka	Group 1	21658.1504	85170.3516	21854.3926	24327.0117	15.0023	4925.4229	128.3774	24.2374	1008.6094	45669.6328
41.1./8969 D	Regional Inka	Group 1	21305.6621	98499.3438	20995.5176	21912.668	17.1686	4910.665	148.3068	24.13	670.9137	44377.2695
41.1./8969 E	Regional Inka	Group 2	17266.8496	93425.2344	24696.9941	17326.6504	14.8031	4610.3472	138.779	23.9894	958.3704	46066.7266
41.1./8969 F	Regional Inka	Group 2	20831.0801	88372.7266	27791.6367	16514.4238	14.2996	5285.7314	118.8453	21.9734	625.657	48308.3828
41.1./8980 A	Local	Group 1	21903.6055	83766.9922	20345.8652	29029.1777	15.0939	5007.2793	141.1525	26.569	1122.6526	46015.8242
41.1./8980 B	Local	Group 1	22872.668	85771.9141	19925.0332	34387.2031	14.8533	4317.1328	111.0149	24.1367	953.5272	42894.3047
41.1./8980 C	Local	Group 1	21960.1699	90025.5391	19830.75	26366.6367	16.7121	6207.5229	139.6979	26.2676	739.3054	46229.3711
41.1./8980 D	Local	Group 1	21703.877	87746.3984	20064.6563	29669.4512	15.9835	5990.3159	150.4966	26.1411	1052.4995	50416.6875
41.1./8980 E	Local	Group 1	22829.0137	81490.7109	17811.4668	30544.1504	15.4428	6004.9814	158.5973	26.3231	977.1554	47826.9102
41.1./8980 F	Inka Polychrome	Group 2	19017.1816	92701.4375	23346.252	17794.8418	15.2126	5460.5532	129.8371	23.1126	480.1427	38804.625
41.1./8980 G	Local	Group 1	22490.582	82548.8203	19035.1172	27500.6738	14.7994	5070.0244	148.6218	23.9759	980.2906	41001.1406
41.1./8980 H	Local	Group 1	22771.6113	89127.0859	16951.9297	31768.5488	15.8853	5658.7998	152.8431	25.9737	652.9881	39153.5508
41.1./8980 I	Regional Inka	Group 2	20489.0156	87891.3516	32177.5391	17251.2129	13.4494	5630.397	138.3653	21.7231	554.294	39988.4023
41.1./8980 J	Local	Group 1	22700.1172	82670.4297	21492.9063	33482.168	15.2884	6113.855	147.3528	26.2066	1079.7125	48080.9492
41.1./8980 K	Local	Group 1	20734.9453	82222.1719	18121.6211	26830.7109	16.4113	5649.9531	159.0867	29.1053	1274.2076	52512.3633
41.1./8980 L	Local	Group 1	21262.9434	86967.8047	18742.3906	28970.4961	15.8682	5450.0889	153.2631	26.9143	1163.1342	52250.5703
41.1./8980 M	Local	Group 1	21709.3867	85007.4453	21400.4824	28664.7559	15.879	5682.2031	173.9732	27.1269	928.3678	54113.6016
41.1./8980 N	Local	Group 1	20860.2852	82282.0547	20160.7852	28206.5313	15.4756	4610.5444	147.9967	25.183	1201.205	52717.6758
41.1./8980 O	Local	Group 1	19986.4199	93817.9297	15581.3535	20237.5957	17.3696	5044.6099	153.0036	25.6861	787.9705	50818.1094
41.1./8980 P	Local	Group 1	20202.2363	92246.6875	19509.2031	24509.6973	16.4196	5570.0161	134.9538	24.3275	705.6859	41130.9922
41.1./8980 Q	Local	Group 1	21528.4414	86894.3047	19180.1426	29347.791	17.0229	5984.7021	173.4169	30.5884	1272.0486	54037.957
41.1./8980 R	Local	Group 1	21170.5332	89255.6953	19429.5957	29234.6523	16.5338	5632.6533	137.8227	27.4266	819.762	49829.0508
41.1./8980 S	Local	Group 1	22041.7461	79245.1797	18757.252	26416.3047	15.0003	5397.897	153.5627	24.9217	821.8127	51443.6016
41.1./8980 T	Local	Outlier	13972.7314	97382.1563	25377.2969	15828.0889	16.1488	5143.6162	154.3855	24.813	354.6789	26545.6348
41.1./8972 A	Local	Outlier	17707.7832	89167.1953	21564.9063	21197.0645	16.6671	5968.0352	162.5476	23.7276	896.4315	52784.2227
41.1./8972 B	Regional Inka	Group 2	18600.8867	18600.1406	24608.834	17680.7148	14.5966	5208.145	126.5946	22.4682	659.0797	44178.8672
41.1./8972 C	Regional Inka	Group 1	23245.4922	79599.3203	32591.1777	26322.8457	14.2254	4307.6592	96.7364	19.3258	847.0394	42223.4375
41.1./8972 D	Regional Inka	Outlier	20627.0625	82303.6016	33246.293	24377.2539	10.8866	3626.6665	69.3469	18.1344	728.5889	31480.6406
41.1./8972 E	Local	Group 1	20914.2207	84800.6094	21377.666	20567.1309	15.2076	4471.6924	116.8054	20.9287	878.5835	45272.375
41.1./8972 F	Local	Group 1	20141.8809	85559.5703	20241.0195	21588.3711	15.2763	5186.769	108.8634	21.8159	804.5471	40921.7969
41.1./8966 T01	Inka Polychrome	Group 1	19739.3164	82445.125	20360.1582	25795.6855	15.6988	5157.4961	127.0792	22.4704	687.5964	42683.6445
41.1./8966 T02	Inka Polychrome	Group 1	20294.8145	95337.1641	20815.6016	23988.0684	15.5675	3940.5396	111.373	23.9948	769.0014	41948.1406
41.1./8966 T03	Inka Polychrome	Group 2	20416.8438	87104.9766	24754.2676	20445.2773	14.1992	5095.4248	114.2517	20.1504	701.5502	42141.2422
41.1./8966 T04	Inka Polychrome	Group 2	20393.1855	88211.25	29265.2969	19417.1504	13.6232	4529.145	120.441	20.718	594.6764	39583.8516
41.1./8966 U01	Inka Polychrome	Group 2	21362.9648	84377.3359	28663.5664	17638.3887	13.5992					

41.1/8966 U06 Inka Polychrome Group 3	16082.2129	87725.1328	19792.1641	38281.6211	27.7869	6862.4668	358.5498	29.7798	1218.2688	72408.0859
41.1/8966 U07 Inka Polychrome Group 3	16307.7656	87697.0781	15006.3633	34109.3398	28.3395	6252.5396	253.6553	25.4433	1120.1157	62035.5703
41.1/8966 U08 Inka Polychrome Group 3	15904.2607	92247.875	18786.1289	33812.0859	31.993	9102.6152	362.6278	30.2493	1264.2682	77184.125
41.1/8966 U09 Inka Polychrome Group 3	16072.75	87449.2266	16481.3633	32630.0078	28.9024	5845.1064	265.4294	26.0679	1164.8315	68436.25
41.1/8966 U10 Inka Polychrome Group 3	17066.75	87694.8906	18832.8457	36408.0508	27.8768	5441.9692	286.0431	24.3668	1100.0948	63514.3359
41.1/8966 U11 Inka Polychrome Group 3	15252.5879	83681.4297	34545.1836	16897.5684	26.6152	7673.2837	398.2108	30.0672	1324.8132	74172.3672
41.1/8966 U12 Inka Polychrome Outlier	19559.4297	84298.6094	29171.7832	43425.3359	13.2073	3975.9307	105.9107	20.9739	840.6714	39221.6992
41.1/8966 U13 Inka Polychrome Group 2	18009.6855	91752.1563	19478.9395	15.8471	15.8471	5362.6006	132.095	22.1767	681.355	45199.8125
41.1/8966 U14 Inka Polychrome Group 3	16020.6826	88295.9063	19363.8906	33434.9141	29.3387	6084.8569	297.577	26.2183	1250.6498	69186.0234
41.1/8966 U15 Inka Polychrome Outlier	19044.623	79195.9609	27773.9922	23585.1875	13.0935	5087.1094	116.0471	29.5244	622.2515	39119.6875
41.1/8966 U16 Inka Polychrome Outlier	19314.4375	81000.6172	20030.9707	27717.0078	18.5582	7456.333	247.1288	54.0604	998.3005	64950.293
41.1/8966 U17 Inka Polychrome Outlier	19271.6914	81694.7344	16396.1094	28264.7734	18.9832	6638.3872	234.433	49.1109	961.7241	67519.7969
41.1/8966 U18 Inka Polychrome Group 2	18892.7754	79429.9297	27274.375	22799.166	11.1959	3677.8845	80.4715	18.5946	624.2714	33192.9766
41.1/8966 U19 Inka Polychrome Group 2	19164.5	78251.9297	28717.1484	25151.3633	12.4026	4009.365	96.3518	20.2419	729.8903	37606.2617
41.1/8966 U20 Inka Polychrome Group 2	24271.1836	83367.3125	28809.8711	19777.3691	15.9733	3814.178	110.1395	23.2924	678.7064	41827.2969
41.1/8966 V01 Inka Polychrome Group 2	17991.0879	86424.3594	21464.4316	19854.9785	14.11	4356.5635	138.6676	21.238	560.4012	42973.0195
41.1/8966 V02 Inka Polychrome Group 2	20604.0254	85697.8906	27299.8086	20243.9219	13.9536	5313.2002	114.3994	19.9188	718.478	40277.4102
41.1/8966 V03 Inka Polychrome Group 1	18876.2715	83517.2344	20424.3516	27082.8086	15.1184	5593.9604	138.8669	24.5255	954.2666	46431.7734
41.1/8966 V04 Inka Polychrome Group 3	16244.7129	88860.1328	16531.9375	38868.2539	28.6837	5149.9785	254.8471	24.6429	1044.9358	61070.3672
41.1/8966 V05 Regional Inka Outlier	20470.1094	89139.7188	23896.6445	18617.4258	15.4846	5571.7949	136.4666	23.6926	818.8748	46888.3945
41.1/8966 V06 Inka Polychrome Group 1	22290.7715	85219.9688	23612.7227	23018.3477	14.6662	4809.8003	116.3744	21.3748	1007.5503	43764.9727
41.1/8966 V07 Inka Polychrome Group 2	18055.5605	94404.5078	24703.3574	16853.459	15.2819	4986.2388	124.549	23.7065	600.486	41813.6328
41.1/8966 V08 Inka Polychrome Group 2	20964.3457	87935.5234	33007.3398	18487.2422	14.4746	4899.2153	132.9991	23.3391	615.8845	39108.0469
41.1/8966 V09 Inka Polychrome Group 2	19728.0918	79987.7422	24113.293	16759.8477	14.3074	5811.8613	165.962	24.445	587.4225	47133.4648
41.1/8966 V10 Regional Inka Group 2	20724.3867	90175	25069.8027	22137.6055	14.975	5349.5513	123.6015	23.9573	622.0576	42296.332
41.1/8966 V11 Inka Polychrome Group 1	18631.5293	84788.4766	23160.9629	25988.248	17.5214	7292.606	199.8149	34.1975	917.8452	50041.5547
41.1/8966 V12 Inka Polychrome Outlier	14349.9824	95815.0234	27714.4434	18901.2051	16.5905	6336.0552	217.444	32.2778	681.4392	62181.9023
41.1/8966 V13 Inka Polychrome Group 2	21269.6953	84367.0547	24925.707	23812.0586	14.7454	4948.8564	124.2021	22.4491	740.5843	42943.4961
41.1/8966 V14 Inka Polychrome Group 2	19846.8887	81497.3906	21237.1406	22245.2285	14.0094	5131.7866	121.5302	22.9393	576.1624	39375.8633
41.1/8966 V15 Inka Polychrome Group 2	19292.334	87426.0938	23800.2852	18476.8926	15.0158	4358.2861	121.7326	23.0148	704.4312	42943.8789
41.1/8966 V16 Inka Polychrome Outlier	16923.2129	92534.7969	18375.5859	33100.043	24.4732	5907.1191	193.5241	29.9922	1220.9979	57978.0039
41.1/8966 V17 Inka Polychrome Outlier	20519.5254	91853.5781	16042.9482	31303.834	21.8301	6264.2954	237.504	46.521	1153.4949	64809.3125
41.1/8966 V18 Inka Polychrome Group 2	20291.3164	84086.4844	22647.7383	17946.5645	13.6317	4347.2554	124.2739	21.0304	512.7707	40226.4531
41.1/8966 V19 Inka Polychrome Group 2	19604.7754	82592.6563	22830.3672	21332.9414	14.4198	5606.6025	125.5534	22.7156	510.8174	33830.1602
41.1/8966 V20 Inka Polychrome Group 2	19263.7598	85993.5156	23637.1836	17982.8965	13.7786	5397.1733	123.9453	23.6611	541.4062	37869.2891
41.1/8966 V21 Inka Polychrome Group 2	19978.3945	83590.7969	21313.3594	16814.7188	13.2653	5005.7725	129.0123	21.7645	531.183	38206.8242
41.1/8966 V22 Inka Polychrome Group 1	19707.7949	87158.6328	22998.6973	26277.5078	16.8099	5077.8555	156.3246	31.4175	1000.6358	54343.4844
41.1/8971 A01 Local Group 1	19962.2246	84176.5781	26243.5977	29921.4473	15.6963	6662.668	193.8291	28.8723	1222.3347	53941.3945
41.1/8971 A02 Local Group 1	22214.4082	86543.0625	22889.0664	26622.832	15.4432	5687.9839	136.7565	24.1584	1482.1925	48991.6563
41.1/8971 A03 Local Outlier	14030.8691	72815.75	37702.6641	35267.3828	12.1707	4742.5273	122.9775	50.8749	696.6665	40811.1055
41.1/8971 A04 Local Group 1	24330.3223	86099.2344	28458.9414	24939.334	14.711	4994.8096	126.126	20.0486	856.3983	42397.6406
41.1/8971 A05 Regional Inka Group 2	18434.3262	86199.0625	21545.5801	17657.5156	14.3789	6022.2217	141.7023	23.0914	688.9363	41042.7969
41.1/8971 A06 Regional Inka Group 2	18322.0137	92223.7031	24327.5156	15315.5781	14.8074	4480.4399	127.6449	21.1657	690.1272	44624.3984
41.1/8980 U01 Local Group 1	21001.2207	91809.3125	20356.2637	24509.6152	15.1308	5708.3042	142.3891	26.0826	731.0954	48057.4609
41.1/8980 U02 Local Group 1	20843.1523	82406.7109	20038.0723	26989.2852	15.2175	4847.5552	135.3362	26.9047	1373.6444	46173.668
41.1/8980 U03 Local Group 1	20229.1758	83450.1875	20273.5781	26427.9668	16.5002	4672.0444	30.0318	30.0318	974.7334	57697.4375
41.1/8980 U04 Regional Inka Group 2	16937.5938	88170.9219	23236.8359	18716.0137	15.6838	5972.2241	170.318	25.5971	800.4019	53520.2344
41.1/8980 U05 Regional Inka Group 2	18741.7793	88944.9844	21189.7793	24795.6094	17.2472	5027.9722	138.0308	24.3259	719.1392	44859.0195
41.1/8980 U06 Regional Inka Group 2	18247.0723	87618.9453	20648.1738	24558.2129	16.871	4803.5376	131.8661	24.4573	720.9163	44287.168
41.1/8980 U07 Local Group 1	19787.4766	83594.4297	16941.5527	31820.9844	16.2378	5759.4238	164.678	27.0812	1168	53816.9844
41.1/8980 U08 Local Group 1	21380.5977	83921.6328	18858.8184	27375.834	16.252	5697.916	134.7542	26.349	1435.6205	50502.668
41.1/8980 U09 Local Group 1	19474.4961	90922.3438	21644.1172	25671.5098	16.5751	5544.4263	142.2365	27.6487	1087.9326	51361.543
41.1/8980 U10 Local Group 1	19884.5469	89814.4063	23399.4844	22338.5391	16.0697	4591.6865	104.1237	24.2127	617.8326	48665.0039
41.1/8980 U11 Local Group 1	21314.8047	83608.0078	22468.7344	27711.8184	16.2605	5574.8071	151.3981	29.5379	1276.1934	52973.1445
41.1/8980 U12 Local Group 1	20086.2461	86001.7031	20346.2285	28291.0195	17.0991	5522.415	158.441	27.4368	1106.838	51147.0781
41.1/8980 U13 Local Group 1	20331.3594	83252.4297	20070.0215	29107.5664	16.0651	5713.1138	160.2467	29.5076	1061.5493	54105.5195
41.1/8980 U14 Local Group 1	21932.3594	85431.7031	20550.3574	31720.4141	15.6597	4864.6919	142.5517	25.2468	1286.072	49925.1016
41.1/8980 U15 Regional Inka Group 2	17960.6445	89343.9844	24709.832	21414.7598	13.9547	5460.7334	123.668	23.5494	754.0835	42352.0039
41.1/8980 U16 Local Group 1	21288.5156	83451.1875	19477.834	29536.9355	15.4148	5694.0381	147.1113	26.3864	1123.8368	50005.1914
41.1/8980 U17 Local Group 1	22522.1816	83100.9453	17821.6074	31273.1738	15.2431	4371.9507	152.801	25.6323	740.1975	43700.4375
41.1/8980 U18 Local Group 1	22105.9648	83463.5859	29963.5273	20309.2695	15.4517	6013.249	145.0466	27.4339	956.1178	48487.3477
41.1/8980 U19 Local Group 1	20048.084	82012.375	18478.0957	29705.0449	13.8193	4966.2051	122.3323	21.6473	1134.1869	49559.2422
41.1/8980 U20 Local Group 1	20857.7129	82387.5625	18208.8438	31556.627	15.5357	5637.5293	154.1374	30.5171	898.0543	50058.2656
41.1/8980 U21 Local Group 1	22410.5176	84542.7969	20777.6211	29674.2734	15.0796	5879.5107	149.8171	26.6193	843.8003	46525.1484
41.1/8980 U22 Local Group 1	23314.9336	84286.4531	17653.7129	28632.0137	15.9995	5622.1445	156.2525	27.0129	904.7119	44679.8906
41.1/8980 U23 Local Group 1	22451.791	85462.3828	20170.0254	26006.9297	15.8388	4680.478	128.2433	27.2474	740.227	39463.6719
41.1/8980 U24 Local Outlier	19796.4512	91633.7813	25479.2695	22038.3066	15.505	5371.1694	155.7555	25.6554	742.128	43293.0547
41.1/8980 U25 Local Group 1	22601.8301	84215.7266	21482.084	26484.498	15.8829	5254.0078	149.4142	26.5891	884.4598	42940.168
41.1/8980 U26 Local Group 1	22196.25	85985.3281	22237.0508	31573.6152	16.5157	5650.7427	173.9335	29.0145	937.4288	51024.3984
41.1/8980 U27 Regional Inka Group 2	18272.2148	94050.4141	26157.4121	21134.8574	14.6129	4825.7036	131.6075	25.0006	505.436	36116.2344
41.1/8980 U28 Local Group 1	21283.7773	83573.3906	20172.9043	26428.0039	16.2143	4962.0796	145.8159	25.9971	942.8275	46493.9961
41.1/8980 U29 Regional Inka Group 2	23934.8516	94478.6641	29980.0762	18716.9844	14.5618	4624.6582	122.0541	21.0028	667.1002	38589.6211
41.1/8980 U30 Local Group 1	20810.459	84279.5938	17078.8809	28273.1113	15.6493	5126.1128	156.3001	27.1706	1074.5264	50466.7891
41.1/8980 U31 Local Group 1	22658.2598	93752.75	21199.1113	23369.6055	17.7572	4161.6895	148.4658	27.0584	659.0071	37911.8789

NAA Co	NAA Ni	NAA Zn	NAA As	NAA Rb	NAA Sr	NAA Zr	NAA Sb	NAA Ba	NAA Cs	NAA La	NAA Ce
17.0343	0	126.7066	15.5771	106.5562	287.3862	127.7669	2.3767	564.6923	13.4597	27.5692	55.8343
11.9563	0	84.0274	77.6139	115.2705	226.7632	205.2054	24.0155	585.5811	51.0166	26.7115	56.3728
18.5309	0	140.9473	32.8329	88.9542	224.424	145.8629	3.0992	382.0027	13.4952	29.7733	61.1139
13.1349	0	107.8052	17.3002	120.3522	324.0318	170.6228	8.3389	582.8313	41.3158	29.2847	58.8953
14.4476	0	103.0588	23.2437	77.993	292.5424	114.8143	2.7637	503.1685	13.8027	28.9288	59.3551
12.3865	21.7446	97.5914	31.4699	119.0655	284.2768	103.268	4.408	618.1199	26.3311	24.1043	49.381
14.7853	0	99.5091	20.8538	88.4711	395.7945	86.7655	2.781	504.6906	12.3119	22.4807	45.0425
14.968	0	95.2108	14.332	83.9069	372.9228	136.4491	2.6671	518.0521	12.0896	25.7413	51.5179
16.4579	0	102.4418	13.708	87.713	312.7547	222.0335	3.0314	525.0261	12.2822	28.8381	58.8916
14.3769	0	97.5459	18.9583	94.7759	363.0329	97.6481	2.6871	527.754	15.0569	25.0448	50.456
16.7319	0	102.3808	25.319	80.7804	339.5831	136.1277	2.9221	387.1375	15.3307	28.3164	56.2236
15.0847	0	136.7335	21.2216	124.2725	330.7462	117.422	3.5777	637.966	28.9802	22.9239	47.9604
13.488	0	90.1919	15.3216	75.583	331.7249	221.3748	2.4889	456.7498	10.7203	27.1706	53.9336
14.0703	0	100.8492	10.6268	75.8367	287.4093	101.6557	2.7824	650.339	12.7229	19.8979	40.7457
13.6749	0	124.4054	39.0885	118.5435	297.0472	121.0971	4.7608	554.1337	33.127	25.49	51.3041
11.9967	0	98.0704	17.3796	84.4454	279.9924	109.9608	3.1494	544.1517	15.7579	24.1418	50.8766
11.6144	36.174	109.6364	11.8815	117.1986	327.7368	121.5227	3.31	588.6735	29.685	24.6714	49.3689
14.8445	0	128.5697	33.8906	121.4471	278.1516	128.9364	4.7405	557.309	27.2938	26.4768	53.954
14.7671	27.4709	116.4175	25.8221	126.1123	272.6161	142.599	4.3123	534.629	23.3378	26.7674	55.1779
24.1261	0	142.519	64.0937	111.5739	243.3636	107.9439	5.488	567.7217	33.55	23.72	49.1423
12.2532	0	103.789	14.209	76.7324	284.5813	178.7212	3.4302	469.4581	12.785	38.1162	75.5437
13.2805	0	128.0494	33.7709	124.1121	323.9915	129.2619	4.7208	655.358	28.5069	25.7214	51.4905
13.2212	0	109.848	21.5311	110.832	344.2434	154.4016	3.6409	699.7016	18.8053	25.1628	50.5522
14.226	0	100.8793	20.9027	76.8082	346.9611	329.3097	3.44	434.356	11.2839	37.7787	73.9745
14.6254	0	102.9278	23.5627	100.2398	321.1057	143.3373	3.6579	481.0865	18.9604	29.1591	61.4046
14.4986	28.3636	122.7605	32.9789	125.1381	319.1605	123.7879	4.5208	536.8618	25.9022	26.9952	56.0059
13.4268	0	129.2639	32.3574	117.9713	350.5432	121.4632	4.8787	755.405	27.7958	29.4526	59.0254
13.0341	0	142.9752	30.412	145.2963	332.1572	143.905	4.8762	1018.2375	41.8467	24.764	51.0462
13.9443	0	113.6933	31.3376	283.1436	147.0503	617.3955	4.5101	617.3955	25.3686	25.1856	49.2821
12.3127	0	99.5656	25.7969	121.8934	335.1096	134.6246	4.4248	640.6361	27.6774	25.9605	52.4809
14.9049	0	134.6439	73.8223	131.039	529.0925	135.2051	6.1763	561.8801	41.2601	28.7138	58.9492
12.9775	0	103.6427	22.1427	107.3923	324.6254	100.6876	2.8749	548.5585	20.829	25.6751	50.9769
13.3435	0	136.7595	35.9424	122.1261	318.9885	100.8387	4.9465	651.5341	31.0713	25.4416	51.6465
14.8706	44.2439	118.7208	36.0261	116.2191	431.0092	107.5725	5.0708	748.2468	30.0357	28.3615	56.1971
12.8239	16.8502	116.8122	17.2046	120.9308	380.8995	130.2923	5.6599	714.0549	30.4071	27.9563	55.3938
13.3844	22.8097	119.5706	32.4518	122.7045	307.133	118.136	5.1081	524.7087	32.112	27.5609	56.7486
13.475	0	106.3132	21.1789	86.792	334.8827	110.7007	2.6751	473.1265	11.9302	25.8539	53.3057
14.0868	0	102.3985	10.3428	82.1691	299.4915	128.4831	2.978	633.1033	14.2861	26.8791	53.3528
15.2372	0	136.0264	71.0776	139.4168	356.7122	131.1385	5.9905	828.9913	40.8642	27.4365	55.9358
14.908	0	124.0975	67.3009	126.4181	296.7062	152.4279	6.2338	628.4527	29.1895	24.8026	50.0097
14.174	0	98.296	20.5228	77.94	400.3662	170.5532	2.7245	510.4357	12.7775	23.9983	48.8576
13.6339	0	99.7807	22.9403	83.2123	416.409	127.7851	2.9249	618.1974	13.746	23.0041	46.3911
14.2788	0	99.1892	22.0188	82.619	382.8227	160.6641	3.3544	600.8831	17.1494	27.6495	55.9919
13.5776	0	97.7864	10.8559	76.8906	368.3917	155.728	2.4217	551.6716	11.2695	29.8329	59.9527
14.4836	0	105.7905	9.5935	77.6924	416.8568	147.9277	2.5514	606.8522	11.961	25.128	50.8543
14.2775	0	133.1281	23.5216	123.3159	344.4214	106.9254	4.7103	749.6613	36.8609	28.0914	57.1486
12.2184	0	82.9469	11.8265	76.7877	353.2858	115.2219	2.2995	566.1613	10.8503	28.5449	57.1101
12.1666	0	83.2485	14.2867	78.4273	321.2943	145.1912	2.9113	563.374	12.2577	23.9561	49.3922
11.9633	0	111.441	16.2561	126.868	292.902	115.5639	4.6341	666.8695	30.5584	25.9016	51.7205
13.4867	0	88.4614	13.9778	76.6901	359.3483	176.5372	2.4109	469.7506	12.058	25.9451	53.2187
17.2138	0	105.2831	11.8629	77.7029	327.435	144.0243	2.4985	547.6552	15.5814	30.1414	57.4546
15.1673	0	105.6572	19.899	72.907	349.3133	148.3305	2.7221	542.2958	14.3308	26.7309	54.3783
15.822	0	110.0192	14.0294	73.3292	368.7716	181.3234	3.1773	669.6334	14.3375	27.0847	55.0582
16.7589	0	110.4161	18.0082	76.6968	443.4402	122.8817	2.8769	566.8168	14.417	25.3472	50.3972
17.9808	0	97.8502	23.506	75.086	334.4663	97.677	3.7266	683.6632	13.6399	28.5146	60.305
16.5226	0	119.5163	12.9099	82.3465	413.0325	154.9683	3.3081	552.0624	13.5685	25.4145	52.3758
16.0283	0	107.8526	21.826	79.1305	335.5123	221.8899	2.8238	491.6786	14.9097	30.8765	61.9178
15.0713	23.6592	111.1992	15.6392	74.9908	440.3656	178.352	2.7903	486.8232	14.9288	30.5323	65.1151
14.119	0	107.7238	16.898	72.5927	390.2005	176.3055	2.6947	582.8557	11.7268	25.1826	49.4215
8.8949	0	80.8326	11.099	113.7389	325.7414	160.1658	9.4146	721.1031	43.8941	32.054	59.1665
17.0827	0	135.6804	58.0021	124.5952	281.4812	116.8684	5.7371	650.7291	31.0317	26.1792	53.143
14.2853	31.0833	130.0925	48.6679	121.7648	324.5269	174.3381	6.1297	754.8389	29.0794	28.3089	57.4246
14.2504	0	95.9169	18.3005	87.1046	355.7406	123.4383	2.6087	550.3759	12.2607	21.9886	44.6283
11.3514	0	112.6592	12.144	108.1906	333.5615	117.9963	3.3693	609.8328	22.6579	21.4497	42.0302
15.2377	0	100.7236	26.4946	95.0095	353.3795	152.5651	2.8242	416.5862	13.0929	22.7324	48.0271
14.0426	0	101.2898	23.5837	83.0041	311.2914	135.4546	3.0012	563.8624	15.5085	23.8551	49.8641
13.6844	0	102.5465	17.506	79.795	282.4675	122.6994	2.8018	558.4006	13.1663	25.3177	51.6702
13.7954	0	103.7214	15.0675	93.1475	269.5083	154.5921	2.6197	620.5109	14.3979	21.3013	45.2365
14.1152	0	123.5669	42.2152	125.8071	315.3749	110.3599	4.9544	636.9275	27.3689	26.5194	53.281
12.7144	0	118.4766	24.0132	109.2599	304.213	113.4695	4.5727	611.6786	25.7855	26.7091	53.454
14.8411	0	122.4397	28.9765	122.1617	281.9005	103.2563	5.4383	675.3499	29.0407	26.4759	63.0789
20.5675	0	125.8399	26.8601	79.1807	303.8495	72.9121	3.7533	500.2117	22.0703	17.0035	35.0858
13.2874	0	117.1107	35.6799	112.7135	273.9783	111.1702	5.2327	695.3174	28.1581	27.2814	54.8813
20.9056	0	125.8276	26.1689	80.8836	182.3336	98.0634	4.1164	487.9743	19.7978	19.6249	40.7325
20.3967	0	152.9707	24.6049	90.7714	217.2346	64.1386	4.0889	437.4979	21.8262	20.0791	41.4602

24.4734	0	148.7623	21.8825	89.3956	281.9689	93.9047	4.3012	542.4434	21.7964	20.8855	42.8812
21.5985	0	142.3051	21.682	90.9286	217.3374	62.61	3.924	444.3392	25.9825	19.5079	39.7054
24.8105	0	149.2678	24.7261	88.2608	220.7067	77.8565	4.4549	660.3281	21.9938	22.9918	45.8043
23.2758	0	152.5425	34.6114	94.7359	191.2144	83.3698	3.9563	439.4153	21.206	19.1109	39.6949
21.085	0	132.2151	27.6978	83.9697	230.2997	104.5404	3.3907	511.8685	20.8178	17.5442	36.3522
23.9746	0	140.6923	22.9236	86.4057	221.5791	107.8982	4.3976	568.0947	21.1493	20.9102	42.3392
13.2831	0	115.0158	58.6124	114.3457	313.353	134.392	4.4492	614.2502	22.919	24.5008	49.2293
14.833	0	140.8146	38.4091	129.0184	274.1224	117.3542	4.6166	678.7478	27.704	25.8282	50.218
24.4005	0	131.7204	26.7059	96.7732	238.7496	87.1227	3.9774	468.2465	23.1496	20.7744	41.7924
12.7648	0	113.2281	20.797	103.9147	323.6529	157.0621	2.7965	562.2209	22.7467	42.3646	81.6241
13.7657	0	109.5193	14.1851	75.2118	278.5478	273.5988	3.9752	518.021	12.4817	46.0867	85.5597
14.514	0	111.945	17.0376	78.4073	252.3504	270.61	3.9043	558.0567	13.4193	37.1521	72.7606
11.1092	0	115.6672	13.271	109.24	284.3357	104.4987	3.3351	588.8307	21.646	23.4538	45.7478
12.5325	0	116.4757	18.2941	117.6666	356.1307	93.0758	4.05	709.1443	24.8938	24.4703	48.9095
12.9048	0	97.1054	22.0003	100.2179	271.5089	123.4823	3.9963	565.7212	14.8924	22.4633	46.9564
13.3892	0	120.7395	24.4893	108.207	321.6695	104.4411	5.2132	775.6077	25.3795	27.9101	56.1857
12.5077	0	95.4552	30.6376	107.3673	293.6094	126.8163	4.2409	710.2851	16.8441	25.2988	51.1887
14.1812	0	117.4366	21.8613	104.3606	351.7198	134.6021	2.9991	656.7072	17.509	28.6243	57.0576
21.837	0	126.5847	22.7288	92.3427	292.7978	102.6168	3.3035	477.0542	25.711	18.914	39.7523
14.4401	0	101.7159	34.4918	114.9987	305.9963	216.4517	5.5359	655.1904	25.9555	29.9349	60.4714
14.1695	0	85.1725	27.6835	88.5121	359.6913	127.7836	2.8533	671.9363	11.3578	22.6071	47.1061
13.9257	0	116.0138	27.8703	112.5342	274.0016	137.7402	4.565	685.3503	28.5786	30.8987	61.8707
13.2121	0	121.8981	32.036	125.8962	278.2059	127.9071	4.3833	722.9438	29.4751	25.993	53.9154
13.523	0	125.5445	32.5805	108.3223	328.5442	182.2896	6.2063	823.0562	26.7785	27.4875	55.5259
13.8496	0	122.1017	35.7712	120.7041	328.2799	116.1245	4.9335	655.1602	33.5319	27.9313	57.5772
12.5345	0	96.6993	15.9772	82.5002	295.3927	205.1758	3.4407	603.8439	13.4845	30.5394	62.1387
19.7175	0	122.1788	25.4895	116.0596	413.8655	167.9174	4.9515	626.2979	37.6687	31.226	64.2033
14.1236	0	101.5467	58.8864	103.7858	336.0208	95.3182	5.9132	718.3664	22.4287	29.4602	59.3431
11.3505	0	116.7812	21.2274	104.9869	355.0309	105.514	4.3461	713.2829	22.8631	25.0548	48.9706
13.783	0	116.0276	38.8612	122.3936	280.7617	120.602	5.4387	644.9674	32.4291	31.51	62.0831
21.6236	0	155.0823	20.969	93.1586	228.4851	160.7174	3.5891	531.7084	25.5136	22.8331	48.3981
30.1571	0	156.6022	33.6659	82.6644	212.6055	154.0539	8.2301	501.3327	26.2877	31.4181	67.5612
12.5476	0	110.7311	27.7282	111.5576	305.4083	140.9533	5.426	716.299	26.8468	25.7754	51.0904
9.6903	0	132.0451	23.9119	113.3231	372.115	113.7696	4.3755	774.1826	27.8497	29.089	57.2273
10.9383	33.4083	108.8118	28.1063	115.5958	272.9246	147.9656	4.8665	714.0955	29.7685	27.2083	53.2747
11.2582	0	109.4038	34.7966	112.4836	321.9939	152.4857	5.4185	710.846	29.2275	27.0205	52.376
15.4069	0	110.5714	26.9095	80.9687	364.4966	178.6489	2.9222	627.5989	10.8927	28.5743	56.8224
14.6398	0	90.0071	25.1072	79.4965	304.973	221.9791	3.1576	600.3685	11.0676	30.1784	59.0386
15.0132	0	124.5878	12.0352	86.7651	322.5785	146.5929	2.6674	704.2319	12.1629	29.4874	58.3212
13.7115	23.432	109.4646	28.0744	112.3415	175.8425	135.1417	2.6503	477.8222	14.7264	30.7097	63.0281
13.4442	0	94.9957	23.1737	89.1003	320.6828	109.6085	2.6406	599.1503	12.7953	23.7325	49.2437
12.9473	0	111.9794	18.2018	123.4832	358.0549	136.7189	5.1097	691.7383	30.4279	28.2285	56.5685
14.8729	0	107.1161	18.6579	115.0667	311.2607	132.7679	6.6079	725.9169	29.8061	26.9862	54.9666
15.8373	0	90.6203	12.8307	77.7131	343.4554	113.577	2.7472	686.3246	14.663	25.8403	51.7832
13.2369	0	89.4385	16.4083	77.84	340.3031	143.6886	2.6408	704.0642	13.3821	30.2582	60.4974
16.0495	0	93.6587	13.3345	71.8511	352.3246	167.673	2.8745	629.9074	13.758	32.0691	63.5498
16.6658	0	120.7038	19.7872	110.4289	306.0373	115.0481	4.5432	696.2302	32.9528	28.9953	56.4002
14.6556	0	120.4081	23.0736	100.1158	358.0145	130.5488	4.8721	760.7028	31.007	32.7877	65.6617
14.1998	0	119.2466	20.9575	105.4099	336.8437	112.9627	4.8491	765.9382	31.1226	31.0297	63.16
16.6011	0	102.7588	15.5678	76.8569	350.5955	157.9717	2.8103	671.2999	15.2247	26.0269	53.337
15.9128	0	94.2039	11.0209	78.612	299.7326	130.7754	2.517	666.529	14.9073	26.8811	54.1185
17.9042	0	119.4542	17.7765	94.3793	313.9072	154.0167	2.7651	671.0892	12.726	25.1957	51.2413
13.3045	0	99.3613	12.5739	76.5442	257.8113	110.7379	2.7939	607.178	16.4494	21.9307	44.1566
15.1653	0	92.6823	21.3219	82.7537	333.9893	183.809	2.9642	677.9037	14.0326	30.7711	61.151
15.6708	0	92.6849	14.5747	81.4899	331.6477	160.1349	2.8897	635.0301	14.7832	28.1151	56.9226
15.658	0	94.9284	12.8466	81.3364	317.7856	126.3003	2.6339	673.281	13.9911	26.6366	53.2155
15.4401	0	95.1026	26.8842	78.3871	470.9512	124.3401	2.8752	700.2542	14.4012	27.9309	54.7273
15.2958	0	124.2005	11.0996	114.7542	338.3119	120.2151	4.0924	684.9268	27.0373	26.7516	53.7033
13.9241	0	87.8665	15.245	73.6208	363.8712	131.075	2.6137	648.0687	11.5478	25.7315	50.5557
13.7175	21.4961	89.0156	13.9931	70.3109	346.8346	150.8994	2.6094	627.7167	11.3467	23.0457	46.1703
14.827	0	85.2625	15.4484	73.7446	364.4258	129.7715	2.7492	629.534	11.34	27.7062	55.6555
15.0328	0	88.2128	20.0134	75.9684	378.1513	82.3654	2.5417	655.9901	12.3475	25.8706	51.5098
14.8672	0	86.8696	12.3377	74.3641	385.9949	132.4389	2.6405	606.5876	11.4786	27.0508	54.117
14.2838	0	103.4826	16.172	73.9092	315.7836	193.9671	2.7197	638.0427	11.9895	34.3459	64.2017
14.4342	0	97.8831	14.7202	72.6037	352.0869	155.4774	3.0255	640.8644	11.7364	26.8138	53.9921
12.8812	0	103.5797	13.0363	74.8152	343.9253	116.5394	2.6182	599.7785	12.2227	27.1443	54.5177
13.0249	0	130.5634	16.7101	111.4178	362.1089	156.66	4.4984	685.6223	21.3981	30.1002	58.3665
16.8001	0	102.8118	28.0614	76.6485	319.4877	179.1214	3.0564	559.377	14.0065	29.7292	58.5954
15.8651	0	113.1407	14.1493	75.483	352.5329	164.0815	2.7518	607.485	13.9206	31.8444	62.4797
12.7734	0	124.5554	7.3453	121.1318	363.2874	146.5891	5.485	712.1056	28.0462	26.1946	52.947
13.4219	0	109.0134	20.5083	73.3728	304.3091	128.2711	2.8715	655.5246	12.2762	26.1822	53.2255
12.7473	0	134.7996	18.806	123.2756	373.7016	130.858	4.0822	799.9765	24.8762	27.7487	53.6665
16.263	0	105.7266	24.7638	76.6142	342.534	137.9365	2.7381	692.0304	14.7217	26.342	54.0726
12.3647	0	106.0453	14.988	75.68	334.4469	170.5407	3.1491	654.3848	15.2222	21.8901	47.444

NAA Nd	NAA Sm	NAA Eu	NAA Tb	NAA Dy	NAA Yb	NAA Lu	NAA Hf	NAA Ta	NAA Th	NAA U
28.7333	5.5908	1.1176	0.6699	3.6832	2.0898	0.4023	4.1341	0.5373	14.2248	4.2917
21.3059	5.6517	1.0899	0.6906	3.4699	2.0879	0.5627	5.9913	0.9328	15.0285	9.1579
27.5471	5.9506	1.2754	0.8067	4.0469	2.635	0.4031	6.2096	0.8134	11.5112	2.9862
24.7162	6.0179	1.3273	0.7317	4.1216	2.1116	0.4805	5.2053	0.7273	12.8801	4.4028
24.2378	5.7664	1.2334	0.6804	3.618	2.137	0.3684	4.8582	0.7209	9.4736	2.9217
22.411	4.745	1.0785	0.5997	3.2497	2.1914	0.3308	4.5008	0.6893	10.6366	2.506
22.5106	4.5195	1.0603	0.534	3.4383	1.8242	0.2577	3.5089	0.5531	8.9488	2.3899
21.1533	4.8556	1.126	0.5929	3.2228	1.9847	0.3204	3.9072	0.7025	9.5486	3.0987
27.9738	5.6523	1.2128	0.6188	3.5916	2.2974	0.4053	8.2239	0.7794	15.4106	3.3446
21.2741	4.6794	1.0121	0.552	3.2056	1.8631	0.3195	4.2564	0.5975	10.1128	2.7348
23.8053	5.2086	1.165	0.6362	2.9307	1.9703	0.306	4.5464	0.6655	9.2436	2.8003
19.3061	4.5824	1.1043	0.5702	3.1725	1.8585	0.2826	4.1582	0.5654	9.6909	2.3649
24.6457	5.2851	1.1694	0.6272	3.6475	2.1044	0.374	8.5575	0.7235	8.8089	3.3354
19.2914	4.1116	0.9647	0.4694	3.2095	1.6951	0.2796	4.7562	0.5767	8.9321	2.5504
26.2603	5.0473	1.0975	0.5778	3.3999	1.8007	0.3171	4.7444	0.743	10.5762	3.8105
23.0303	4.9976	1.1177	0.6286	3.7883	2.08	0.3288	4.39	0.6261	9.7224	3.2135
21.3234	4.6903	1.0768	0.5105	3.3699	1.805	0.2984	4.2187	0.6631	9.0847	2.6046
23.0492	5.0484	1.1351	0.6071	3.1263	1.8457	0.3233	5.5255	0.7536	10.4405	3.54
25.8389	5.1102	1.0962	0.6101	3.2545	1.8927	0.3093	4.7642	0.692	11.231	3.0625
22.5502	4.9676	1.1561	0.591	3.4442	2.1473	0.3356	4.3347	0.5826	9.4585	2.7208
32.3962	6.2217	1.2381	0.6908	4.1708	2.4394	0.412	7.5915	0.7995	12.2611	4.2274
24.2817	4.9401	1.0897	0.5549	3.1949	1.7566	0.3294	4.8791	0.6654	11.9604	2.9773
25.1738	4.8535	1.0876	0.5442	2.8442	1.9693	0.3003	6.6436	0.6524	10.2363	3.8586
31.0801	6.5888	1.3109	0.7711	4.1485	2.7193	0.5469	13.9513	0.9884	10.9318	3.5081
25.9384	5.811	1.2082	0.6957	3.7689	2.1785	0.3862	6.0614	0.7743	10.057	3.3674
25.5245	5.2434	1.1268	0.6578	3.4435	1.8639	0.3375	4.7743	0.7486	11.0865	2.7209
24.9548	5.2868	1.1011	0.655	3.3068	2.1779	0.3128	5.3635	0.6716	10.9296	2.9146
21.4458	4.7431	1.0555	0.5776	2.9021	1.7327	0.2928	4.6472	0.6332	10.2519	2.1551
21.4963	4.7216	1.0495	0.5937	3.3396	1.7688	0.2881	4.7169	0.7062	10.4231	2.8262
20.2598	4.7555	1.0727	0.5555	3.3471	1.8316	0.3244	5.0356	0.708	10.8611	2.9608
26.8654	5.525	1.154	0.6811	3.4506	2.047	0.3485	5.7227	0.7664	14.2677	3.503
20.3704	4.7023	1.0719	0.5651	3.2059	1.9327	0.3219	4.2101	0.5881	9.5532	2.2875
24.7317	5.0121	1.1359	0.6201	2.8003	1.8298	0.2942	5.0093	0.7202	10.3315	2.8696
27.7254	5.4509	1.2366	0.6982	3.5328	2.0198	0.3285	4.5698	0.7119	10.346	2.7534
26.7758	5.1404	1.1563	0.614	3.6678	1.9345	0.3487	5.4447	0.6871	10.5239	2.161
25.3355	5.3172	1.1879	0.6015	3.3777	1.8574	0.3171	5.21	0.696	10.6334	3.0946
24.9633	5.06	1.0753	0.6055	3.104	1.8151	0.3302	5.5194	0.6646	9.8199	2.7931
24.6454	5.3632	1.1766	0.6461	3.8993	2.4668	0.3612	4.7318	0.651	10.3447	3.3957
24.775	5.2978	1.179	0.6217	3.328	1.8563	0.3366	4.9634	0.7213	11.4647	3.1136
24.7528	4.8978	1.0994	0.5789	2.8087	1.7533	0.3166	5.3539	0.6801	10.7085	2.8785
18.7528	4.7825	1.0825	0.5562	2.7645	1.9195	0.3392	6.371	0.64	9.3634	3.3642
17.2173	4.5284	1.0005	0.4993	2.9714	1.6653	0.3236	5.1354	0.6362	9.8277	3.4807
28.4316	5.4036	1.1791	0.6485	3.3692	2.3854	0.3746	6.9484	0.6668	10.3292	3.1872
28.7486	5.3749	1.1509	0.6023	3.3478	1.9627	0.367	6.4216	0.6732	10.9234	3.6364
24.6818	5.0372	1.1733	0.6406	3.5464	2.0249	0.3238	5.1448	0.6547	8.9532	3.2957
25.5901	5.5907	1.2332	0.6211	3.8131	2.201	0.3564	5.0503	0.6641	11.5238	3.3255
26.3355	5.5006	1.1648	0.6966	3.8042	2.0705	0.3794	4.3365	0.595	8.8919	4.5904
21.0522	5.3293	1.1426	0.6677	3.5836	1.979	0.377	4.445	0.6682	9.0238	5.2601
25.2495	4.9159	1.1207	0.5531	3.2962	1.7349	0.3025	4.4987	0.7315	10.3486	2.9218
21.6849	5.1186	1.1255	0.6294	2.8481	1.9466	0.3589	6.2233	0.6831	9.1983	3.081
23.4954	5.1827	1.1888	0.5864	4.1188	2.1457	0.3242	5.303	0.6543	10.1428	2.3421
20.691	5.0832	1.1477	0.614	3.6451	2.0478	0.3155	5.7997	0.6576	10.2498	2.7368
24.7156	5.5281	1.2182	0.6957	3.6458	2.3173	0.3438	6.5633	0.6483	16.9753	3.8959
27.3816	4.8387	1.0944	0.5283	3.2158	1.9775	0.275	4.7859	0.6083	9.6481	2.2889
25.2723	5.8374	1.317	0.738	4.2165	2.5273	0.4061	4.415	0.6276	15.2356	3.0766
27.8187	5.1184	1.19	0.6229	3.5176	2.1115	0.3354	5.0725	0.6717	10.4888	2.7714
24.7162	5.779	1.3005	0.6897	3.8332	2.3462	0.3554	8.2118	0.7456	9.3277	2.891
24.512	6.341	1.4052	0.7798	4.682	2.48	0.3845	5.6061	0.698	9.9368	3.0896
19.2174	4.7089	1.0999	0.5719	2.9918	1.8801	0.3016	5.8738	0.6284	8.3429	2.4767
22.5853	4.996	1.0471	0.5385	3.1603	1.9304	0.4211	5.5891	0.7449	12.9485	5.3299
21.5688	5.1004	1.1657	0.6004	3.4457	1.8757	0.2561	4.5379	0.719	11.5122	3.2125
24.4826	5.3804	1.2427	0.6523	3.2203	1.8956	0.3097	5.4197	0.7077	11.1259	2.8441
18.5905	4.3592	0.9702	0.4978	2.577	1.932	0.2158	4.0483	0.5854	9.4529	2.2787
18.6018	3.9348	0.9898	0.4322	2.3645	1.4584	0.2295	3.3854	0.5383	8.5865	2.216
20.9121	4.5334	1.0462	0.54	2.9592	2.0107	0.3112	5.0105	0.6221	9.8513	2.1993
21.5887	4.8026	1.0917	0.6129	2.7975	1.8472	0.351	4.1161	0.6256	9.8532	2.7862
21.6963	5.1013	1.1236	0.7471	3.2603	1.92	0.3267	3.8235	0.6193	9.3393	2.5711
18.0253	4.4804	0.9677	0.5431	3.3956	2.2887	0.3218	5.0456	0.5844	9.7776	2.4985
23.5464	5.1068	1.1341	0.6112	3.3781	2.1143	0.3145	4.7058	0.6823	10.7048	2.5444
26.6619	5.0435	1.1508	0.6495	3.2333	1.7644	0.2986	4.3368	0.6591	10.0607	2.2798
20.4836	4.9725	1.1	0.7014	3.4789	2.1868	0.277	4.4673	0.7322	10.8617	3.3087
15.4736	3.7769	0.9387	0.5206	2.9579	1.8326	0.2424	2.9741	0.4485	6.4989	1.4591
23.7188	5.1677	1.1891	0.6587	3.6877	1.8415	0.3003	4.7096	0.7203	10.6848	3.2717
17.7408	4.3784	1.0456	0.5462	3.6797	1.7757	0.3022	4.2761	0.5411	12.5858	2.5514
21.0957	4.4572	1.0658	0.5097	3.5555	1.8891	0.3075	3.8533	0.5325	8.7456	2.7373

18.9928	4.5493	1.0568	0.6066	4.3746	1.9639	0.2663	3.6176	0.5495	8.5204	1.8089
17.4303	4.3498	1.0573	0.6153	3.525	1.916	0.3019	3.9041	0.5049	7.317	1.9425
16.2913	4.8536	1.0984	0.7406	4.6377	2.1571	0.3404	3.8826	0.5579	9.3083	2.036
18.2866	4.4163	1.015	0.5304	3.8093	2.0488	0.2863	4.2794	0.5135	7.7179	1.784
14.6209	3.962	0.9679	0.7598	3.2664	1.8125	0.2935	4.3354	0.5036	7.3425	1.7314
20.5456	4.5084	1.0911	0.5541	3.6735	2.0588	0.3512	4.4853	0.5188	7.6338	1.8678
21.0778	4.8707	1.0727	0.8907	3.1784	1.7454	0.2935	4.2267	0.6602	9.6644	3.1917
23.8747	5.024	1.1013	0.6486	3.4651	2.26	0.2911	4.7271	0.7098	11.4193	2.5037
15.8354	4.6036	1.0692	0.6662	3.1908	1.9636	0.3207	4.1673	0.532	8.0021	2.0435
33.1745	5.7999	1.0442	0.7015	3.1761	2.2659	0.2802	5.9757	0.7984	14.2421	3.5127
36.2211	7.3015	1.3666	1.025	4.6884	2.8574	0.4669	13.0725	1.0484	12.0103	3.9951
32.2367	6.9639	1.3493	1.0173	3.865	2.7675	0.4694	11.4513	1.0577	13.4131	4.3418
20.6917	4.4308	1.0209	0.4637	2.7046	1.4569	0.2644	3.6235	0.5845	8.9228	2.4565
20.5174	4.7249	1.139	0.5897	2.9191	1.7632	0.2583	4.0366	0.618	9.2493	2.1231
20.8509	4.5367	1.033	0.4931	2.6659	1.8958	0.2686	5.081	0.5937	9.4772	2.4611
24.0325	5.3901	1.2768	0.6697	3.9255	1.9002	0.277	5.53	0.7303	10.5608	3.1153
22.2862	4.9388	1.1084	0.5993	3.3474	1.8662	0.2762	5.0147	0.6242	10.2385	2.6819
22.4962	5.154	1.1578	0.6548	3.6446	2.0207	0.2901	5.6994	0.6801	10.2209	2.3969
16.22	4.0502	1.012	0.517	3.3889	1.9001	0.2644	3.6162	0.4753	7.2332	1.4749
27.2823	5.8321	1.2589	0.7551	4.077	2.2993	0.3672	8.4185	0.6898	11.0971	2.7645
21.0324	4.6929	1.0679	0.7862	3.3561	1.7933	0.2678	4.5604	0.5915	10.6352	2.5775
27.4344	5.3355	1.1223	0.616	3.4303	1.9365	0.3142	5.0535	0.733	11.8949	3.0206
21.1814	4.9488	1.0929	0.6107	3.4746	1.912	0.2742	4.8979	0.6865	10.4533	2.4704
25.2714	5.3419	1.1811	0.6631	3.9272	1.9363	0.3359	7.2351	0.8358	11.5345	2.6756
25.3414	5.3249	1.2024	0.5612	4.0691	1.826	0.2894	4.337	0.6913	10.0977	2.3573
25.0628	5.9785	1.2776	0.7576	4.5391	2.4802	0.3979	8.4455	0.8325	15.2287	4.2991
27.7847	6.51	1.501	0.8427	4.7996	2.3194	0.3866	7.5404	0.9005	12.0734	4.1131
24.1906	5.4233	1.2196	0.8421	3.359	2.0024	0.2753	4.1244	0.6943	9.8974	2.4659
22.2739	4.8803	1.1137	0.6078	3.6694	1.8487	0.2649	4.5316	0.6495	9.0672	2.2388
26.0132	5.3453	1.1646	0.5659	3.3488	1.8329	0.2776	4.5734	0.7148	10.6553	2.7955
22.2961	5.3916	1.1936	0.708	4.3353	2.5546	0.3586	4.5092	0.547	11.7835	2.4048
30.2801	6.5795	1.3159	0.8379	4.7614	2.7009	0.3811	7.1354	0.7976	12.0406	3.0403
22.7517	4.9988	1.1751	0.5998	3.4554	1.7638	0.2807	4.7022	0.6875	9.9561	2.6509
24.1997	5.2018	1.1811	0.7519	3.7532	1.9484	0.3018	5.4665	0.7004	10.3119	2.611
21.662	4.9331	1.1048	0.6085	3.3609	1.7319	0.276	4.8846	0.7098	10.7157	2.6759
23.0817	5.1317	1.1259	0.6339	3.367	1.7394	0.302	5.6177	0.7118	12.6209	3.4246
22.5767	5.3835	1.1143	0.9863	3.8718	2.059	0.3453	6.5743	0.7173	13.3172	3.1203
24.8825	5.6188	1.1968	0.8216	4.0523	2.4449	0.4005	9.3029	0.9718	10.0691	2.6538
25.2215	5.208	1.1233	0.6921	3.4489	2.0041	0.2865	5.7611	0.6189	9.9222	2.6852
26.5178	6.1398	1.4298	1.2335	6.7187	3.1548	0.4565	4.4821	0.9758	10.1433	3.3065
19.6605	4.661	1.0103	0.5694	2.7803	1.8688	0.2715	3.8871	0.5916	9.5161	2.3883
24.4326	5.2291	1.1467	0.6027	3.1455	1.801	0.2698	4.7549	0.6668	11.0896	3.3081
25.9316	5.7227	1.2732	1.0307	4.0158	2.1853	0.3529	4.9003	0.6922	11.6857	3.1773
22.0118	4.7983	1.08	0.5809	3.1107	1.7883	0.2722	4.5064	0.591	10.275	2.3069
28.6249	6.1088	1.3127	0.7643	4.0252	2.3965	0.3784	5.269	0.6195	9.5226	4.2593
26.5836	5.7589	1.2394	0.6981	4.0152	2.3747	0.3178	6.1518	0.7006	9.5444	2.4933
25.311	5.0791	1.0154	0.5107	3.4754	2.1926	0.3298	5.1579	0.7726	15.7007	3.601
28.3375	6.3597	1.3893	1.0443	4.1304	2.2714	0.3687	4.1492	0.6948	10.6488	2.9733
29.8248	6.2391	1.398	0.785	4.2347	2.2155	0.3828	4.6425	0.7633	10.8184	3.0457
23.8355	5.1937	1.1853	0.643	4.0008	2.0612	0.3185	6.2222	0.673	9.4373	3.2783
22.4628	5.2413	1.1575	0.6422	3.1417	2.1168	0.3343	5.7159	0.699	9.339	2.2764
22.9339	5.0795	1.1395	0.6288	3.6631	1.9945	0.2863	5.6298	0.6465	10.7557	2.4846
20.0039	4.1899	0.9509	0.5966	3.0262	1.7612	0.2897	4.2165	0.5921	9.3403	2.3162
27.5017	5.7262	1.2662	0.7228	3.8499	2.1841	0.3295	7.0254	0.7239	9.5336	2.5246
25.502	5.5313	1.2396	1.0443	3.7503	2.1753	0.328	6.0036	0.7447	9.3172	2.6447
24.3915	5.38	1.196	0.8779	4.0032	2.1449	0.3174	6.4457	0.7003	9.0352	2.5049
21.5595	5.2453	1.1546	0.6843	3.1331	2.0104	0.3124	5.6602	0.6114	10.1486	3.6481
24.4489	5.2174	1.2397	0.6232	3.8664	1.7876	0.2866	4.9611	0.6451	9.7714	2.4146
23.9496	4.906	1.0867	0.6576	3.3198	2.0006	0.28	5.2796	0.7999	8.9517	2.8945
21.2371	4.6974	1.0843	0.6526	3.6991	1.9321	0.3086	6.4541	0.5908	8.9017	3.4995
26.8403	5.3665	1.182	0.6615	3.622	2.0525	0.3092	5.6492	0.7369	10.4066	2.7998
24.601	4.9222	1.1268	0.644	3.3335	1.8846	0.2907	3.6979	0.5881	8.4322	2.2528
25.9797	5.236	1.1587	0.6336	3.368	2.1014	0.3311	4.9248	0.6596	8.6749	2.6366
26.9285	5.4111	1.1238	0.8145	3.6708	2.037	0.3801	5.762	0.6387	10.6213	2.788
23.0829	5.2869	1.2128	0.6376	3.7006	2.1541	0.2954	5.6236	0.6419	9.2223	2.6965
25.4359	5.3241	1.159	0.6231	3.5652	2.1755	0.4022	4.0106	0.6556	9.1707	4.4574
26.1152	5.2674	1.132	0.847	3.4267	2.0403	0.386	5.4536	0.6569	12.2156	3.9971
27.5123	5.7822	1.2614	0.7266	4.1191	2.2948	0.4062	5.6255	0.6707	9.2615	3.5162
24.5813	5.5492	1.2277	0.7271	3.6006	2.4247	0.3268	5.9125	0.7736	9.4621	2.9389
23.2405	5.1307	1.1862	0.6172	3.2962	1.9696	0.3665	4.2547	0.691	10.1849	3.6607
23.2108	5.33	1.1529	0.8751	3.2704	2.2135	0.3192	4.9768	0.7405	9.7119	4.2207
23.9569	5.1881	1.183	0.7562	3.2454	2.1072	0.2858	4.3286	0.6228	10.6743	2.9473
25.9162	5.4908	1.2277	0.8614	4.2137	2.4634	0.3218	5.1395	0.6253	14.3949	3.0333
22.5964	4.9431	1.1352	0.951	3.1329	2.2212	0.3095	5.0064	0.6448	10.0516	4.0256

Catalog No.	Style	Group 1	Group 2	Group 3	Best Group
41.1/8986 A	Local	1.096	0.004	1.063	Group 1
41.1/8986 B	Local	0.000	0.000	0.061	Outlier
41.1/8986 C	Local	0.000	0.000	2.227	Group 1
41.1/8986 D	Inka Polychrome	0.000	0.109	0.177	Outlier
41.1/8986 E	Local	88.716	0.026	0.909	Group 1
41.1/8986 F	Regional Inka	0.011	50.293	0.393	Group 2
41.1/8986 G	Local	68.741	0.122	0.995	Group 1
41.1/8986 H	Local	91.254	0.042	0.685	Group 1
41.1/8986 I	Local	23.528	0.000	1.095	Group 1
41.1/8986 J	Regional Inka	73.540	0.515	1.660	Group 1
41.1/8986 K	Local	28.746	0.048	0.751	Group 1
41.1/8986 L	Regional Inka	0.001	59.147	1.029	Group 2
41.1/8986 M	Local	25.915	0.000	0.656	Group 1
41.1/8986 N	Inka Polychrome	1.141	0.003	2.660	Group 1
41.1/8986 O	Inka Polychrome	7.503	0.003	2.660	Group 2
41.1/8966 A	Inka Polychrome	0.000	63.092	0.597	Group 1
41.1/8966 B	Regional Inka	42.972	3.395	4.922	Group 2
41.1/8966 C	Inka Polychrome	0.000	44.964	0.524	Group 2
41.1/8966 D	Regional Inka	0.002	25.222	0.593	Group 2
41.1/8966 E	Inka Polychrome	0.050	34.151	0.517	Group 2
41.1/8966 F	Inka Polychrome	0.000	0.000	1.925	Group 1
41.1/8966 G	Inka Polychrome	18.342	0.000	2.386	Group 2
41.1/8966 H	Inka Polychrome	0.001	99.753	0.555	Group 2
41.1/8966 I	Inka Polychrome	0.351	6.064	1.784	Outlier
41.1/8966 J	Inka Polychrome	2.208	0.000	1.697	Group 1
41.1/8966 K	Inka Polychrome	8.488	0.239	4.166	Group 2
41.1/8966 L	Inka Polychrome	0.014	93.228	0.559	Group 2
41.1/8966 M	Inka Polychrome	0.001	99.827	0.566	Group 2
41.1/8966 N	Inka Polychrome	0.000	7.952	0.183	Group 2
41.1/8966 O	Inka Polychrome	0.009	88.928	0.478	Group 2
41.1/8966 P	Regional Inka	0.002	92.299	0.506	Group 2
41.1/8966 Q	Regional Inka	0.000	7.510	0.390	Group 2
41.1/8966 R	Inka Polychrome	0.825	16.176	3.496	Group 2
41.1/8966 S	Inka Polychrome	0.000	70.823	0.422	Group 2
41.1/8969 A	Regional Inka	0.000	64.792	0.874	Group 2
41.1/8969 B	Regional Inka	0.000	50.958	0.338	Group 2
41.1/8969 C	Regional Inka	0.000	97.479	0.413	Group 1
41.1/8969 D	Regional Inka	84.664	0.081	0.873	Group 1
41.1/8969 E	Regional Inka	68.310	0.508	2.944	Group 2
41.1/8969 F	Regional Inka	0.000	26.393	0.325	Group 2
41.1/8980 A	Local	0.000	57.348	0.286	Group 1
41.1/8980 B	Local	42.735	0.000	0.791	Group 1
41.1/8980 C	Local	22.799	0.004	0.923	Group 1
41.1/8980 D	Local	44.767	0.214	3.893	Group 1
41.1/8980 E	Local	48.413	0.000	0.479	Group 1
41.1/8980 F	Inka Polychrome	76.820	0.001	0.568	Group 2

41.1/8980 G	Local	0.000	54.803	0.301	Group 1
41.1/8980 H	Local	20.524	0.000	0.346	Group 1
41.1/8980 I	Regional Inka	2.967	0.000	1.154	Group 2
41.1/8980 J	Local	0.000	87.109	0.262	Group 1
41.1/8980 K	Local	65.484	0.000	0.712	Group 1
41.1/8980 L	Local	44.478	0.001	0.849	Group 1
41.1/8980 M	Local	96.294	0.007	0.856	Group 1
41.1/8980 N	Local	68.353	0.002	1.290	Group 1
41.1/8980 O	Local	55.262	0.005	0.658	Group 1
41.1/8980 P	Local	0.015	0.000	0.876	Group 1
41.1/8980 Q	Local	86.182	0.541	2.506	Group 1
41.1/8980 R	Local	71.947	0.000	1.323	Group 1
41.1/8980 S	Local	85.857	0.001	1.263	Group 1
41.1/8980 T	Local	64.697	0.003	1.196	Outlier
41.1/8972 A	Local	0.000	0.000	0.100	Outlier
41.1/8972 B	Regional Inka	0.000	72.898	0.638	Group 2
41.1/8972 C	Regional Inka	0.000	78.970	0.304	Group 1
41.1/8972 D	Regional Inka	9.933	0.968	1.923	Outlier
41.1/8972 E	Local	0.000	3.836	0.879	Group 1
41.1/8972 F	Local	22.127	0.412	2.111	Group 1
41.1/8966 T01	Inka Polychrome	87.835	5.650	3.359	Group 1
41.1/8966 T02	Inka Polychrome	73.776	1.176	2.563	Group 1
41.1/8966 T03	Inka Polychrome	64.844	3.496	4.122	Group 2
41.1/8966 T04	Inka Polychrome	0.002	98.977	0.564	Group 2
41.1/8966 U01	Inka Polychrome	0.005	97.578	0.445	Group 2
41.1/8966 U02	Inka Polychrome	0.000	74.964	0.306	Group 3
41.1/8966 U03	Inka Polychrome	0.000	0.000	25.384	Group 2
41.1/8966 U04	Inka Polychrome	0.001	93.753	0.415	Group 3
41.1/8966 U05	Inka Polychrome	0.000	0.000	89.989	Group 3
41.1/8966 U06	Inka Polychrome	0.000	0.000	88.134	Group 3
41.1/8966 U07	Inka Polychrome	0.000	0.000	87.793	Group 3
41.1/8966 U08	Inka Polychrome	0.000	0.000	51.890	Group 3
41.1/8966 U09	Inka Polychrome	0.000	0.000	45.441	Group 3
41.1/8966 U10	Inka Polychrome	0.000	0.000	11.919	Group 3
41.1/8966 U11	Inka Polychrome	0.000	0.000	61.679	Group 3
41.1/8966 U12	Inka Polychrome	0.000	0.000	59.007	Outlier
41.1/8966 U13	Inka Polychrome	0.000	0.000	1.310	Group 2
41.1/8966 U14	Inka Polychrome	0.002	80.920	0.458	Group 3
41.1/8966 U15	Inka Polychrome	0.000	0.000	19.824	Outlier
41.1/8966 U16	Inka Polychrome	0.000	0.000	1.085	Outlier
41.1/8966 U17	Inka Polychrome	1.940	0.000	2.142	Outlier
41.1/8966 U18	Inka Polychrome	5.780	0.000	2.885	Group 2
41.1/8966 U19	Inka Polychrome	0.003	13.194	0.943	Group 2
41.1/8966 U20	Inka Polychrome	0.001	48.254	0.778	Group 2
41.1/8966 V01	Inka Polychrome	17.008	15.790	2.388	Group 2
41.1/8966 V02	Inka Polychrome	0.002	86.536	0.578	Group 2
41.1/8966 V03	Inka Polychrome	1.878	40.831	1.619	Group 2

41.1/8966 V04	Inka Polychrome	33.373	1.044	3.881	Group 3
41.1/8966 V05	Regional Inka	0.000	0.000	50.207	Outlier
41.1/8966 V06	Inka Polychrome	0.001	0.153	0.453	Group 1
41.1/8966 V07	Inka Polychrome	22.306	0.067	0.917	Group 2
41.1/8966 V08	Inka Polychrome	0.001	74.537	0.415	Group 2
41.1/8966 V09	Inka Polychrome	0.000	56.165	0.275	Group 2
41.1/8966 V10	Regional Inka	0.000	2.045	0.269	Group 2
41.1/8966 V11	Inka Polychrome	0.000	97.168	0.360	Group 1
41.1/8966 V12	Inka Polychrome	41.536	0.000	3.484	Outlier
41.1/8966 V13	Inka Polychrome	0.000	0.156	0.348	Group 2
41.1/8966 V14	Inka Polychrome	0.001	4.499	1.053	Group 2
41.1/8966 V15	Inka Polychrome	0.059	57.775	0.803	Group 2
41.1/8966 V16	Inka Polychrome	0.000	95.587	0.383	Outlier
41.1/8966 V17	Inka Polychrome	0.000	0.015	8.233	Outlier
41.1/8966 V18	Inka Polychrome	0.000	0.000	1.640	Group 2
41.1/8966 V19	Inka Polychrome	0.000	89.250	0.346	Group 2
41.1/8966 V20	Inka Polychrome	0.000	87.891	0.375	Group 2
41.1/8966 V21	Inka Polychrome	0.000	90.920	0.269	Group 2
41.1/8966 V22	Inka Polychrome	0.000	52.355	0.344	Group 1
41.1/8971 A01	Local	62.629	0.000	0.992	Group 1
41.1/8971 A02	Local	8.091	0.000	1.775	Group 1
41.1/8971 A03	Local	52.770	0.000	0.710	Outlier
41.1/8971 A04	Local	73.444	1.626	1.936	Group 1
41.1/8971 A05	Regional Inka	0.000	52.480	0.490	Group 2
41.1/8971 A06	Regional Inka	0.000	77.693	0.355	Group 2
41.1/8980 U01	Local	70.713	0.114	2.019	Group 1
41.1/8980 U02	Local	33.424	0.000	0.462	Group 1
41.1/8980 U03	Local	86.713	0.000	1.182	Group 1
41.1/8980 U04	Regional Inka	0.000	3.118	0.789	Group 2
41.1/8980 U05	Regional Inka	0.000	3.196	0.817	Group 2
41.1/8980 U06	Regional Inka	0.000	33.201	0.796	Group 2
41.1/8980 U07	Local	58.356	0.002	0.882	Group 1
41.1/8980 U08	Local	67.787	0.001	0.786	Group 1
41.1/8980 U09	Local	97.054	0.012	1.496	Group 1
41.1/8980 U10	Local	26.753	7.511	4.283	Group 1
41.1/8980 U11	Local	74.769	0.000	1.322	Group 1
41.1/8980 U12	Local	54.011	0.000	1.540	Group 1
41.1/8980 U13	Local	52.081	0.001	1.196	Group 1
41.1/8980 U14	Local	13.316	0.001	0.468	Group 1
41.1/8980 U15	Regional Inka	0.001	17.434	0.659	Group 2
41.1/8980 U16	Local	97.068	0.002	0.557	Group 1
41.1/8980 U17	Local	70.525	0.001	0.833	Group 1
41.1/8980 U18	Local	91.507	0.002	0.626	Group 1
41.1/8980 U19	Local	28.286	0.002	0.384	Group 1
41.1/8980 U20	Local	93.677	0.003	0.602	Group 1
41.1/8980 U21	Local	77.690	0.000	1.214	Group 1
41.1/8980 U22	Local	95.739	0.004	0.944	Group 1

41.1/8980 U23	Local	53.255	0.006	0.787	Group 1
41.1/8980 U24	Local	0.054	9.567	1.232	Outlier
41.1/8980 U25	Local	91.718	0.003	1.491	Group 1
41.1/8980 U26	Local	91.721	0.000	1.434	Group 1
41.1/8980 U27	Regional Inka	0.000	0.222	0.300	Group 2
41.1/8980 U28	Local	84.302	0.006	0.883	Group 1
41.1/8980 U29	Regional Inka	0.000	93.621	0.637	Group 2
41.1/8980 U30	Local	72.227	0.008	0.671	Group 1
41.1/8980 U31	Local	27.325	0.023	5.273	Group 1