Archaeometry Laboratory
University of Missouri Research Reactor

Neutron Activation Analysis of Archaeological Pottery from Northwest Argentina

Prepared by:
Matthew T. Boulanger and Michael D. Glascock
Archaeometry Laboratory,
University of Missouri Research Reactor
Columbia, MO 65211

Prepared for:
Marisa Lazzari
Department of Archaeology
University of Exeter
Lever Building, North Park Road
Exeter, EX4 4QE, United Kingdom

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Introduction

One hundred and nine archaeological pottery specimens were submitted by Marisa Lazzari for compositional analysis by neutron activation (NAA) at the Archaeometry Laboratory, Missouri University Research Reactor (MURR). These specimens were obtained from 17 archaeological sites located in the Catamarca province of northwestern Argentina (Table 1).

This project was subsidized in part by the Archaeometry Laboratory at MURR. In the first section of this report, we describe sample preparation and analytical techniques used at MURR. The second section reports the subgroup structure identified through quantitative analysis of the ceramic compositional dataset. The third section presents a comparison of these data to previously generated ceramic compositional data from northwest Argentina and surrounding regions. In the final section, we provide a brief conclusion and make recommendations for future provenance research.

Background

Speakman and Glascock (2004a) created six compositional groups (numbered 2–7) to describe chemical variation of 112 ceramic specimens and one specimen of geological clay. They assigned some specimens to the previously created *Ambato Valley Reference Group*[1] created (Speakman and Glascock 2004b; see also Speakman 2004). These seven compositional groups form the comparative sample that later studies of local ceramics have used (Cecil and Glascock 2006; Speakman 2005).

Outside of the immediate study area, Speakman and Glascock (2005) created 11 compositional groups (numbered 1–9, and labeled X–Y) in a sample of 414 pottery specimens and 45 clay specimens submitted by Veronica Williams. Additionally, Guillermo de la Fuente recently analyzed a large sample of ceramic artifacts from Catamarca province in northwestern Argentina. The samples of de la Fuente and Williams represent large comparative databases that may be of interest to the study of broad-scale regional exchange; however, only Williams' data are currently available for comparison[2].

[1] Later reports prepared for Giesso refer to this compositional group as the *Aguada Reference Group*, but later reports for Lazzari continue use of *Ambato*. To avoid confusion, we use the original name.

[2] De la Fuente conducted his own analysis of his data, and although his group designations and conclusions have been requested, they have not been received at the time this report was written.

Sample Preparation

The 109 specimens submitted to the University of Missouri Research Reactor (MURR) Archaeometry Laboratory were assigned alphanumeric analytical IDs (ANIDs) containing the three-letter prefix "LAZ" followed by sequential three-digit numbers 176–284 (Table 1).

Specimens were prepared for INAA using procedures established at the Archaeometry Laboratory (Glascock 1992, Glascock and Neff 2003). Fragments of about 1cm^2 were removed from each sherd and briquette. These fragments were abraded using a silicon carbide burr in order to remove glaze, slip, paint, and adhering soil, thereby reducing the risk of measuring contamination. The specimens were washed in deionized water and allowed to dry in the laboratory. Once dry, the individual fragments were ground to a fine powder and mixed in an agate mortar in order to homogenize the specimens. When possible, archival specimens were retained from each sherd for future research.

Clay specimens were fired to 700° C in a muffle furnace. After firing, the clay specimens were similarly pulverized and mixed in an agate mortar. Archival specimens of the fired clay were also kept for future research. Unused portions of clay will be discarded in compliance with the MURR laboratory's United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) and Plant Protection and Quarantine (PPQ) compliance agreement.

Two analytical specimens were prepared from each sherd/briquette fragment and clay specimen. Portions of approximately 150 mg of powder were weighed into high-density polyethylene vials used for short irradiations at MURR. At the same time, 200 mg aliquots from each specimen were weighed into high-purity quartz vials used for long irradiations. Individual sample weights were recorded to the nearest 0.01 mg using an analytical balance. Both vials were sealed prior to irradiation. Along with the unknown specimens, standards made from National Institute of Standards and Technology (NIST) certified standard reference materials of SRM-1633b (coal fly ash) and SRM-688 (basalt rock) were similarly prepared, as were quality control samples (e.g., standards treated as unknowns) of SRM-278 (obsidian rock) and Ohio Red Clay (a standard developed for in-house applications).

Irradiation and Gamma-Ray Spectroscopy

Neutron activation analysis of ceramics at MURR, which consists of two irradiations and a total of three gamma counts, constitutes a superset of the procedures used at most other NAA laboratories (Glascock 1992; Glascock and Neff 2003; Neff 2000). As discussed in detail by Glascock (1992), a short irradiation is carried out through the pneumatic tube irradiation system. Specimens in the polyvials are sequentially irradiated, two at a time, for five seconds by a neutron flux of 8×10^{13} n cm^{-2} s^{-1} The 720-second count yields gamma spectra containing peaks for nine short-lived elements aluminum (Al), barium (Ba), calcium (Ca), dysprosium (Dy), potassium (K), manganese (Mn), sodium (Na), titanium (Ti), and vanadium (V). The specimens are encapsulated in quartz vials and are subjected to a 24-hour irradiation at a neutron flux of 5×10^{13} n cm^{-2} s^{-1}. This long irradiation is analogous to the single irradiation utilized at most other laboratories. After the long irradiation, specimens decay for seven days, and then are counted for 1800 seconds (the "middle count") on a high-resolution germanium detector coupled to an automatic sample changer. The middle count yields determinations of seven medium half-life elements, namely arsenic (As), lanthanum (La), lutetium (Lu), neodymium (Nd), samarium (Sm), uranium (U), and ytterbium (Yb). After an additional three- or four-week decay, a final count of 8500 seconds is carried out on each specimen. The latter measurement yields the following 17 long half-life elements: cerium (Ce), cobalt (Co), chromium (Cr), cesium (Cs), europium (Eu), iron (Fe), hafnium (Hf), nickel (Ni), rubidium (Rb), antimony (Sb), scandium (Sc), strontium (Sr), tantalum (Ta), terbium (Tb), thorium (Th), zinc (Zn), and zirconium (Zr).

The element concentration data from the three measurements were tabulated in parts per million using Microsoft® Office Excel. Descriptive and contextual information for the specimens was appended to the spreadsheet of elemental abundances. These data are provided as an appendix to this report and as an accompanying digital file. Additional copies of these data are available upon request to the MURR Archaeometry Laboratory.

Interpreting Chemical Data

Analyses at MURR typically produce elemental concentration values for 33 elements. Values for Ni were at or below detection limits in most specimens, as is typical for most archaeological ceramics from North America. Therefore Ni is excluded from consideration in the statistical treatment of these data.

The interpretation of compositional data obtained from the analysis of archaeological materials is discussed in detail elsewhere (e.g., Baxter and Buck 2000; Bieber, et al. 1976; Bishop and Neff 1989; Glascock 1992; Harbottle 1976; Neff 2000) and will only be summarized here. The main goal of data analysis is to identify distinct homogeneous groups within the analytical database. Based on the provenance postulate of Weigand et al. (1977), different chemical groups may be assumed to represent geographically restricted sources. For lithic materials such as obsidian, basalt, and cryptocrystalline silicates (e.g., chert, flint, or jasper), raw material samples are frequently collected from known outcrops or secondary deposits and the compositional data obtained on the samples is used to define the source localities or boundaries. The locations of sources can also be inferred by comparing unknown specimens (i.e., ceramic artifacts) to knowns (i.e., clay samples) or by indirect methods such as the "criterion of abundance" (Bishop, et al. 1982) or by arguments based on geological and sedimentological characteristics (e.g., Steponaitis, et al. 1996). The ubiquity of ceramic raw materials usually makes it impossible to sample all potential "sources" intensively enough to create groups of knowns to which unknowns can be compared. Lithic sources tend to be more localized and compositionally homogeneous in the case of obsidian or compositionally heterogeneous as is the case for most cherts.

Compositional groups can be viewed as "centers of mass" in the compositional hyperspace described by the measured elemental data. Groups are characterized by the locations of their centroids and the unique relationships (i.e., correlations) between the elements. Decisions about whether to assign a specimen to a particular compositional group are based on the overall probability that the measured concentrations for the specimen could have been obtained from that group.

Initial hypotheses about source-related subgroups in the compositional data can be derived from non-compositional information (e.g., archaeological context, decorative attributes, etc.) or from application of various pattern-recognition techniques to the multivariate chemical data. Some of the pattern recognition techniques that have been used to investigate archaeological data sets are cluster analysis (CA), principal components analysis (PCA), and discriminant analysis (DA).

Each of the techniques has its own advantages and disadvantages which may depend upon the types and quantity of data available for interpretation.

The variables (measured elements) in archaeological and geological data sets are often correlated and frequently large in number. This makes handling and interpreting patterns within the data difficult. Therefore, it is often useful to transform the original variables into a smaller set of uncorrelated variables in order to make data interpretation easier. Of the above-mentioned pattern recognition techniques, PCA is the technique that most easily transforms data from the original correlated variables into uncorrelated variables.

Principal components analysis creates a new set of reference axes arranged in decreasing order of variance subsumed. The individual PCs are linear combinations of the original variables. The data can be displayed on combinations of the new axes, just as they can be displayed on the original elemental concentration axes. PCA can be used in a pure pattern-recognition mode, i.e., to search for subgroups in an undifferentiated data set, or in a more evaluative mode, i.e., to assess the coherence of hypothetical groups suggested by other criteria. Generally, compositional differences between specimens can be expected to be larger for specimens in different groups than for specimens in the same group, and this implies that groups should be detectable as distinct areas of high point density on plots of the first few components.

Principal components analysis of chemical data is scale dependent, and analyses tend to be dominated by those elements or isotopes for which the concentrations are relatively large. As a result, standardization methods are common to most statistical packages. A common approach is to transform the data into logarithms (e.g., base 10). As an initial step in the PCA of most chemical data at MURR, the data are transformed into log concentrations to equalize the differences in variance between the major elements such as Al, Ca and Fe, on one hand and trace elements, such as the rare-earth elements (REEs), on the other hand. An additional advantage of the transformation is that it appears to produce more nearly normal distributions for the trace elements.

One frequently exploited strength of PCA, discussed by Baxter (1992), Baxter and Buck (2000), and Neff (1994; 2002), is that it can be applied as a simultaneous R- and Q-mode technique, with both variables (elements) and objects (individual analyzed samples) displayed on the same set of principal component reference axes. A plot using the first two principal components as axes is usually the best possible two-dimensional representation of the correlation or variance-covariance structure within the data set. Small angles between the vectors from the origin to variable coordinates indicate strong positive correlation; angles at 90 degrees indicate no correlation; and angles close to 180 degrees indicate strong negative correlation. Likewise, a plot of sample coordinates on these same axes will be the best two-dimensional representation of Euclidean relations among the samples in log-concentration space (if the PCA was based on the variance-covariance matrix) or standardized log-concentration space (if the PCA was based on the correlation matrix). Displaying both objects and variables on the same plot makes it possible to observe the contributions of specific elements to group separation and to the distinctive shapes of the various groups. Such a plot is commonly referred to as a "biplot" in reference to the simultaneous plotting of objects and variables. The variable inter-relationships inferred from a biplot can be verified directly by inspecting bivariate elemental concentration plots.

Whether a group can be discriminated easily from other groups can be evaluated visually in two dimensions or statistically in multiple dimensions. A metric known as the Mahalanobis distance (or generalized distance) makes it possible to describe the separation between groups or between individual samples and groups on multiple dimensions. The Mahalanobis distance of a specimen from a group centroid (Bieber et al. 1976; Bishop and Neff 1989) is defined by:

where y is the $1 \times m$ array of logged elemental concentrations for the specimen of interest, x is the n × m data matrix of logged concentrations for the group to which the point is being compared with being it 1 × m centroid, and I_x is the inverse of the $m \times m$ variance–covariance matrix of group x. Because Mahalanobis distance takes into account variances and covariances in the multivariate group it is analogous to expressing distance from a univariate mean in standard deviation units. Like standard deviation units, Mahalanobis distances can be converted into probabilities of group membership for individual specimens. For relatively small sample sizes, it is appropriate to base probabilities on Hotelling's T^2, which is the multivariate extension of the univariate Student's *t*.

When group sizes are small, Mahalanobis distance-based probabilities can fluctuate dramatically depending upon whether or not each specimen is assumed to be a member of the group to which it is being compared. Harbottle (1976) calls this phenomenon "stretchability" in reference to the tendency of an included specimen to stretch the group in the direction of its own location in elemental concentration space. This problem can be circumvented by cross-validation, that is, by removing each specimen from its presumed group before calculating its own probability of membership (Baxter 1994; Leese and Main 1994). This is a conservative approach to group evaluation that may sometimes exclude true group members.

Small sample and group sizes place further constraints on the use of Mahalanobis distance: with more elements than samples, the group variance-covariance matrix is singular thus rendering calculation of I_x (and D^2 itself) impossible. Therefore, the dimensionality of the groups must somehow be reduced. One approach would be to eliminate elements considered irrelevant or redundant. The problem with this approach is that the investigator's preconceptions about which elements should be discriminate may not be valid. It also squanders the main advantage of multielement analysis, namely the capability to measure a large number of elements. An alternative approach is to calculate Mahalanobis distances with the scores on principal components extracted from the variance-covariance or correlation matrix for the complete data set. This approach entails only the assumption, entirely reasonable in light of the above discussion of PCA, that most group-separating differences should be visible on the first several PCs. Unless a data set is extremely complex, containing numerous distinct groups, using enough components to subsume at least 90% of the total variance in the data can be generally assumed to yield Mahalanobis distances that approximate Mahalanobis distances in full elemental concentration space.

Lastly, Mahalanobis distance calculations are also quite useful for handling missing data (Sayre 1975). When many specimens are analyzed for a large number of elements, it is almost certain that a few element concentrations will be missed for some of the specimens. This occurs most frequently when the concentration for an element is near the detection limit. Rather than eliminate the specimen or the element from consideration, it is possible to substitute a missing value by replacing it with a value that minimizes the Mahalanobis distance for the specimen from the group centroid. Thus, those few specimens which are missing a single concentration value can still be used in group calculations.

Results

Results of the compositional analyses are reported here in two parts: First, we discuss analysis of the current sample with reference to the compositional groups established by Speakman (2004) and Speakman and Glascock (2004a). Next, we review the data in light of previously generated compositional groups from the broader region of northwest Argentina and neighboring portions of Chile and Bolivia (Speakman and Glascock 2004b, 2005). The compositional data produced in this study are provided as an Appendix to this report, and an updated copy of the entire database (including past projects) has been provided in digital format.

Analysis of the Current Sample

Compositional data generated in the current study were combined with data generated in prior compositional analyses of pottery from the sites in the study (Cecil and Glascock 2006; Speakman and Glascock 2004a). Principal components analysis of these data suggests that greater than 90% of the cumulative variation in the dataset is explained by 10 components (Table 2); yet, only about seven of these components appear to describe analytically meaningful variation (Figure 3).

Most of the newly analyzed specimens can be assigned to one of the several previously created compositional groups. However, 35 specimens form distinct groups that have not previously been recognized in the database. In keeping with past reports, we label these newly defined groups as Group 8, Group 9, and Group 10. Figures 4–12 document the results of group assignments. Group 8 is composed of specimens with notably lower concentrations of Cr and higher concentrations of Cs relative to the extant database from northwest Argentina (Figures 7 and 10). Group 9 contains samples of similar chemistry to Group 2, but with slightly higher concentrations of transition metals such as V, Co, Cr, and Ti (Figures 9–11). Group 10, similar to Group 8, is enriched in Rb relative to Group 2 and other previously defined compositional groups. Group 10 is also depleted in Sr relative to Group 2.

Group membership probabilities were calculated for specimens comprising each compositional group using logged elemental concentrations[3]. Following Speakman and Glascock (2004a:7) probabilities were calculated for the largest compositional groups in the northwest Argentina database (Lazzari Group 2, and the Ambato Valley Reference Group). Because of the small sizes, the remaining compositional groups, were projected against the two larger groups. Group-membership probabilities are provided in Tables 3–10.

Comparison with the Expanded Database

The newly generated data were also compared against the relatively large database produced by Williams (Speakman and Glascock 2005). A PCA biplot of the combined Lazzari/Giesso/Williams dataset demonstrates that Williams' compositional groups 1, 2, and Y are distinct from the newly analyzed sample (Figure 13). A similar conclusion was reached by examining these data in bivariate elemental space (Figure 14). As such, these three groups were eliminated from further consideration.

Group-membership probabilities were calculated for the newly analyzed specimens using three of Williams' compositional groups as well as the Ambato Valley Reference Group of Giesso, and Lazzari's Group 2 (Table 11–Table 19). These compositional groups were selected because they are all of sufficient size to allow calculation of Mahalanobis distances without selecting a subset of elements or employing dimensional-reduction techniques such as PCA. The results demonstrate that most of the newly analyze specimens have their closest affinities with Williams' Group 3 which, at present, is believed to be associated with ceramic production in the province of Catamarca. Only a few samples, all of which had been previously assigned to Group 9, have notable probabilities of belonging to another compositional group. In all cases, this is Williams' Group 4 which is believed to be associated with ceramic production in Jujuy province. We therefore have some reason to believe that the newly created Group 9 may represent ceramic-production recipes non-local to Catamarca province. However, the small size of Group 9, and the failure of *all* specimens comprising it to have high group-membership probabilities for Williams' Group 4 makes us hesitant to fully consider Group 9 as definitely having attribution to Jujuy province.

[3] As Speakman and Glascock (2004a) note, it is possible to calculate group-membership probabilities for the smaller groups by reducing the dimensionality of these data through the use of PCA scores. However, as they go on to note (Speakman and Glascock 2004a:7), these smaller groups exhibit heterogeneous compositions that make this option less viable.

Conclusions

Compositional analysis of 109 pottery specimens from northwest Argentina resulted in the assignment of most specimens to extant compositional groups. An additional three compositional groups were created to describe newly documented chemical variability in the dataset. Interestingly, none of the analyzed specimens was assignable to the Ambato Valley Reference group. Moreover, comparison with the large ceramic database produced by Williams suggests that the entire newly analyzed sample has a high likelihood of representing ceramic production that is localized to the Catamarca province. Although previous analyses of clay specimens have failed to produce definitive assignments of the various compositional groups to a particular valley or geological context, based on the criterion of abundance it may be possible to associate these groups with particular regions (Table 20).

This assay of INAA has expanded the current database representing northwestern Argentina and the surrounding region. An additional three compositional groups have been defined in these data, two of which appear to be associated with the newly sampled Bolson del Arenal geographic area. Additional analyses of Formative Period pottery from this region, as well as from neighboring valleys are expected to continue to provide data useful for establishing ceramic provenance.

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Table 1. Archaeological provenience and analytical IDs (ANIDs) for the sample of pottery submitted for neutron activation analysis at MURR.

Region	Site	ANIDs
Aconquija Mountains	Antigal de Tesoro	LAZ189–191
		LAZ251–252
	Ingenio del Arenal	LAZ186-188
Cajon Valley	Bordo Marcial	LAZ207–209
		LAZ246–250
	Cardonal	LAZ192–206
		LAZ210–245
El Bolsón	Cueva Pintada	LAZ267
	El Alto El Bolsón	LAZ259–266
	La Mesada	LAZ253–258
	Los Viscos	LAZ274–278
	Morro Relincho	LAZ268–273
Santa Maria Valley	Ampajango	LAZ182
	Bañado	LAZ179
	Caspinchango	LAZ183
	Chimpa	LAZ180
	Masao	LAZ177
	Molino del Puesto	LAZ178
	Morro de las Espinillas	LAZ279–284
	Tolombón	LAZ176–185

Table 2. Principal components analysis of the newly analyzed ceramic samples from northwest Argentina. The first 10 principal components are shown, accounting for more than 90% of the cumulative variation in the dataset. Bold values indicate strong elemental loading.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10
% Variance	28.731	18.198	11.094	9.602	7.166	4.633	3.169	3.003	2.664	2.465
Cum. % Variance	28.731	46.929	58.023	67.626	74.792	79.425	82.594	85.597	88.261	90.726
Eigenvalue	0.136	0.086	0.053	0.046	0.034	0.022	0.015	0.014	0.013	0.012
Ba	**-0.299**	0.105	**-0.069**	-0.112	0.091	-0.229	-0.020	**-0.324**	**-0.694**	-0.231
Sr	**-0.282**	**0.364**	**-0.155**	**-0.255**	**0.455**	-0.134	-0.107	-0.101	**0.318**	-0.312
As	**-0.230**	**-0.594**	0.018	**-0.428**	0.195	**-0.356**	-0.195	0.152	-0.027	**0.395**
Hf	**-0.225**	-0.110	**-0.122**	0.045	0.082	0.143	-0.213	-0.138	**0.202**	-0.150
Zr	**-0.204**	-0.112	**-0.079**	0.076	0.083	0.122	-0.138	-0.148	**0.251**	-0.051
V	-0.159	0.060	0.200	-0.009	-0.092	-0.159	0.042	-0.191	0.185	0.174
Ti	-0.151	0.111	0.124	0.056	-0.113	-0.130	-0.019	**-0.260**	0.046	0.132
Cr	-0.150	0.093	**0.297**	-0.045	**-0.262**	-0.123	0.002	-0.187	0.084	0.051
Yb	-0.148	-0.138	0.123	0.230	0.052	0.090	-0.173	0.090	0.047	-0.050
Eu	-0.139	-0.073	0.155	0.110	-0.030	-0.043	0.055	0.126	0.037	-0.110
Dy	-0.126	-0.164	0.103	0.266	-0.003	-0.016	-0.060	0.063	0.042	-0.179
Ce	-0.113	-0.050	0.128	0.176	0.130	-0.015	0.218	-0.089	-0.049	0.003
La	-0.111	-0.106	0.108	0.150	0.107	-0.037	0.209	0.008	-0.042	-0.116
Nd	-0.109	-0.138	0.119	0.163	0.096	-0.021	0.117	0.055	-0.009	-0.158
Tb	-0.107	-0.151	0.161	0.243	0.054	-0.013	-0.061	0.142	-0.039	-0.097
Sb	-0.097	-0.240	**0.286**	**-0.511**	-0.004	**0.596**	**0.335**	-0.141	-0.004	-0.223
Co	-0.096	0.159	**0.322**	0.004	-0.093	-0.027	-0.064	-0.041	0.067	0.085
Sm	-0.087	-0.136	0.143	0.192	0.078	-0.017	0.096	0.062	-0.043	-0.116
Fe	-0.083	0.104	0.195	0.000	-0.059	-0.102	-0.026	-0.107	0.093	0.070
Lu	-0.074	-0.093	0.131	0.178	0.140	0.106	-0.140	0.013	0.057	0.072
Th	-0.066	-0.078	0.038	0.215	**0.278**	-0.078	0.205	-0.156	-0.032	0.001
Sc	-0.049	0.096	0.215	-0.039	-0.049	-0.078	-0.086	-0.055	0.056	0.028
Ca	-0.034	**0.321**	0.215	-0.119	**0.333**	-0.135	**0.264**	**0.593**	-0.037	0.016
Al	-0.010	-0.011	0.044	-0.037	0.007	-0.035	-0.051	-0.016	0.000	0.003
Mn	0.022	0.177	**0.364**	-0.102	0.076	**0.250**	**-0.516**	0.189	-0.099	-0.013
Zn	0.040	0.132	0.239	-0.056	-0.018	-0.061	-0.105	-0.104	0.018	0.024
Na	0.054	-0.012	**-0.178**	0.021	0.170	-0.002	0.024	-0.091	**0.354**	0.016
K	0.086	0.019	0.104	0.049	-0.044	-0.050	0.048	-0.080	-0.018	0.031
U	**0.283**	0.044	0.173	0.081	**0.496**	0.126	0.167	**-0.337**	-0.016	**0.440**
Rb	**0.289**	-0.088	0.103	0.064	0.083	-0.071	-0.121	-0.088	-0.030	-0.119
Ta	**0.340**	-0.092	0.078	0.015	**0.278**	0.035	**-0.372**	-0.137	**-0.195**	-0.182
Cs	**0.414**	-0.200	0.230	**-0.177**	-0.058	**-0.446**	0.096	-0.079	**0.243**	**-0.446**

Table 3. Mahalanobis-distance-based probabilities of group membership for specimens comprising Group 2. Probabilities are derived from elemental concentrations.

Sample ID	Ambato	Group 2	Best Group
LAZ098	0.000	99.919	Group 2
LAZ093	0.000	99.489	Group 2
LAZ117	0.000	98.136	Group 2
LAZ256	0.000	95.339	Group 2
LAZ113	0.000	93.031	Group 2
LAZ111	0.000	92.336	Group 2
LAZ069	0.000	90.120	Group 2
LAZ022	0.000	89.786	Group 2
LAZ191	0.000	89.304	Group 2
LAZ066	0.000	89.059	Group 2
LAZ073	0.000	88.651	Group 2
LAZ027	0.000	88.021	Group 2
LAZ127	0.000	87.703	Group 2
LAZ110	0.000	87.366	Group 2
LAZ109	0.000	87.321	Group 2
LAZ086	0.000	87.076	Group 2
LAZ048	0.000	86.786	Group 2
LAZ122	0.000	85.815	Group 2
LAZ061	0.000	83.501	Group 2
LAZ281	0.000	82.999	Group 2
LAZ039	0.000	81.684	Group 2
LAZ094	0.000	81.673	Group 2
LAZ120	0.000	80.891	Group 2
LAZ099	0.000	78.766	Group 2
LAZ179	0.000	78.669	Group 2
LAZ125	0.000	76.367	Group 2
LAZ067	0.000	74.812	Group 2
LAZ085	0.000	73.413	Group 2
LAZ118	0.000	70.042	Group 2
LAZ038	0.000	67.888	Group 2
LAZ251	0.007	67.877	Group 2
LAZ047	0.000	67.338	Group 2
LAZ108	0.000	61.738	Group 2
LAZ053	0.000	55.880	Group 2
LAZ058	0.000	45.560	Group 2
LAZ189	0.000	45.270	Group 2
LAZ222	0.002	38.799	Group 2
LAZ183	0.000	38.549	Group 2
LAZ075	0.000	35.774	Group 2
LAZ119	0.000	32.970	Group 2
LAZ226	0.001	29.052	Group 2
LAZ092	0.000	27.273	Group 2
LAZ279	0.000	25.393	Group 2
LAZ090	0.001	15.344	Group 2
LAZ080	0.000	11.673	Group 2
LAZ130	0.000	11.128	Group 2
LAZ030	0.000	9.597	Group 2
LAZ192	0.002	7.426	Group 2
LAZ020	0.001	6.618	Group 2
LAZ178	0.000	5.211	Group 2
LAZ197	0.001	4.946	Group 2

Table 3 continued

Sample ID	Ambato	Group 2	Best Group
LAZ280	0.000	4.928	Group 2
LAZ284	0.000	4.475	Group 2
LAZ050	0.000	4.068	Group 2
LAZ184	0.000	2.287	Group 2
LAZ037	0.000	2.275	Group 2
LAZ076	0.000	2.145	Group 2
LAZ083	0.000	1.671	Group 2
LAZ195	0.000	0.021	Group 2
LAZ105	0.000	0.019	Group 2
LAZ177	0.000	0.004	Group 2

Table 4. Mahalanobis-distance-based probabilities of group membership for specimens comprising Group 3. Probabilities are derived from elemental concentrations. Note that group-membership probabilities are exceedingly low for all specimens.

Sample ID	Ambato	Group 2	Best Group
LAZ019	6.207	0.000	Ambato
LAZ028	0.000	0.000	Ambato
LAZ029	0.000	0.001	G2
LAZ033	0.895	0.000	Ambato
LAZ045	0.000	0.000	Ambato
LAZ049	0.000	0.000	Ambato
LAZ062	0.004	0.000	Ambato
LAZ065	0.000	0.000	G2
LAZ071	0.000	0.000	Ambato
LAZ106	0.073	0.000	Ambato
LAZ131	0.000	0.001	G2
LAZ187	0.115	0.000	Ambato
LAZ188	4.268	0.000	Ambato
LAZ215	0.000	0.000	Ambato
LAZ217	0.000	0.000	Ambato
LAZ237	0.000	0.000	Ambato
LAZ260	0.080	0.002	Ambato

Table 5. Mahalanobis-distance-based probabilities of group membership for specimens comprising Group 6. Probabilities are derived from elemental concentrations. Note that group-membership probabilities are exceedingly low for all specimens.

Sample ID	Ambato	Group 2	Best Group
LAZ023	0.000	0.000	Ambato
LAZ087	0.010	0.000	Ambato
LAZ103	0.000	0.000	Ambato
LAZ152	0.000	0.000	Ambato
LAZ159	0.000	0.000	Ambato
LAZ160	0.000	0.000	Ambato
LAZ170	0.000	0.000	Ambato
LAZ211	0.000	0.000	Ambato
LAZ212	0.000	0.000	Ambato
LAZ214	0.013	0.000	Ambato
LAZ216	0.000	0.000	Ambato
LAZ218	0.000	0.000	Ambato
LAZ223	0.001	0.000	Ambato
LAZ225	0.000	0.000	Ambato
LAZ231	0.000	0.000	Ambato
LAZ232	0.035	0.000	Ambato
LAZ233	0.000	0.000	Ambato
LAZ235	0.006	0.000	Ambato
LAZ245	0.000	0.000	Ambato

Table 6. Mahalanobis-distance-based probabilities of group membership for specimens comprising Group 7. Probabilities are derived from elemental concentrations. Note that group-membership probabilities are exceedingly low for all specimens.

Sample ID	Ambato	Group 2	Best Group
LAZ025	0.000	0.000	Ambato
LAZ034	0.000	0.000	Ambato
LAZ051	0.000	0.000	Ambato
LAZ052	0.000	0.000	Ambato
LAZ056	0.000	0.000	Ambato
LAZ057	0.000	0.000	Ambato
LAZ060	0.000	0.000	Ambato
LAZ064	0.001	0.007	G2
LAZ077	0.000	0.000	Ambato
LAZ121	0.000	0.000	Ambato
LAZ182	0.000	0.000	Ambato
LAZ202	0.000	0.000	Ambato
LAZ274	0.000	0.000	Ambato
LAZ275	0.000	0.029	G2
LAZ276	0.000	0.001	G2

Table 7. Mahalanobis-distance-based probabilities of group membership for specimens comprising Group 8. Probabilities are derived from elemental concentrations. Note that group-membership probabilities are exceedingly low for all specimens.

Sample ID	Ambato	Group 2	Best Group
LAZ059	0.000	0.000	Ambato
LAZ148	0.000	0.000	Ambato
LAZ262	0.000	0.000	Ambato
LAZ265	0.000	0.000	Ambato
LAZ267	0.000	0.000	Ambato

Table 8. Mahalanobis-distance-based probabilities of group membership for specimens comprising Group 9. Probabilities are derived from elemental concentrations. Note that group-membership probabilities are exceedingly low for all specimens.

Sample ID	Ambato	Group 2	Best Group
LAZ176	0.000	0.007	G2
LAZ180	0.000	0.000	Ambato
LAZ181	0.000	0.196	G2
LAZ190	0.004	0.000	Ambato
LAZ196	0.000	0.410	G2
LAZ198	0.000	0.005	G2
LAZ201	0.000	0.000	Ambato
LAZ204	0.000	1.537	G2
LAZ205	0.000	1.383	G2
LAZ206	0.000	0.504	G2
LAZ207	0.000	0.000	G2
LAZ208	0.000	0.203	G2
LAZ209	0.000	0.292	G2
LAZ227	0.000	7.426	G2
LAZ230	0.052	0.000	Ambato
LAZ239	0.000	0.001	G2
LAZ247	0.000	0.000	G2
LAZ248	0.000	0.002	G2

Table 9. Mahalanobis-distance-based probabilities of group membership for specimens comprising Group 10. Probabilities are derived from elemental concentrations. Note that group-membership probabilities are exceedingly low for all specimens.

Sample ID	Ambato	Group 2	Best Group
LAZ026	0.000	0.000	Ambato
LAZ046	0.000	0.000	Ambato
LAZ070	0.000	0.000	Ambato
LAZ203	0.000	0.000	Ambato
LAZ210	0.000	0.000	Ambato
LAZ252	0.000	0.000	Ambato
LAZ253	0.000	0.000	Ambato
LAZ254	0.000	0.000	Ambato
LAZ259	0.000	0.000	Ambato
LAZ261	0.000	0.000	Ambato
LAZ263	0.000	0.000	Ambato
LAZ269	0.000	0.000	Ambato
LAZ272	0.000	0.000	Ambato
LAZ273	0.000	0.000	Ambato
LAZ277	0.000	0.000	Ambato

Table 10. Mahalanobis-distance-based probabilities of group membership for unassigned specimens. Probabilities are derived from elemental concentrations. Note that group-membership probabilities are exceedingly low for all specimens.

Sample ID	Ambato	Group 2	Best Group
LAZ031	0.000	0.000	Ambato
LAZ032	0.000	0.000	Ambato
LAZ036	0.000	0.000	Ambato
LAZ054	0.015	0.000	Ambato
LAZ072	0.000	0.000	Ambato
LAZ078	0.000	0.000	Ambato
LAZ112	0.000	0.000	Ambato
LAZ172	0.000	0.000	Ambato
LAZ185	0.000	0.000	Ambato
LAZ186	0.024	0.000	Ambato
LAZ193	0.000	0.000	G2
LAZ194	0.003	0.000	Ambato
LAZ199	0.014	0.000	Ambato
LAZ200	0.000	0.000	Ambato
LAZ213	0.000	0.000	Ambato
LAZ219	0.000	0.000	Ambato
LAZ220	0.000	0.000	Ambato
LAZ221	0.000	0.000	Ambato
LAZ224	0.000	0.000	G2
LAZ228	0.040	0.000	Ambato
LAZ229	0.001	0.002	G2
LAZ234	0.036	0.052	G2
LAZ236	0.000	0.000	Ambato
LAZ238	0.000	0.000	Ambato
LAZ240	0.000	0.000	Ambato
LAZ241	0.000	0.000	Ambato
LAZ242	0.000	0.000	Ambato
LAZ243	0.000	0.000	Ambato
LAZ244	0.000	0.000	Ambato
LAZ246	0.000	0.000	Ambato
LAZ249	0.000	0.000	Ambato
LAZ250	0.062	0.000	Ambato
LAZ255	0.000	0.000	Ambato
LAZ257	0.000	0.000	Ambato
LAZ258	0.000	0.000	Ambato
LAZ264	0.000	0.000	G2
LAZ266	0.001	0.000	Ambato
LAZ268	0.000	0.000	Ambato
LAZ270	0.000	0.000	Ambato
LAZ271	0.002	0.000	Ambato
LAZ278	0.000	0.000	Ambato
LAZ282	0.000	0.000	Ambato
LAZ283	0.000	0.000	G2

Table 11. Mahalanobis-distance-based probabilities of group membership for specimens in Group 4. Probabilities are derived from elemental concentrations and projected against the largest compositional groups relevant to this study.

Sample ID	Ambato Valley	Group 2	Williams Group 3	Williams Group 4	Williams Group 5	Best Group
LAZ019	6.21	0.00	**79.44**	0.00	0.00	Williams Group 3
LAZ028	0.00	0.00	0.06	0.00	0.00	Williams Group 3
LAZ029	0.00	0.00	0.46	0.00	0.00	Williams Group 3
LAZ033	0.89	0.00	**7.89**	0.00	0.00	Williams Group 3
LAZ045	0.00	0.00	0.31	0.00	0.00	Williams Group 3
LAZ049	0.00	0.00	0.17	0.00	0.00	Williams Group 3
LAZ062	0.00	0.00	1.02	0.00	0.00	Williams Group 3
LAZ065	0.00	0.00	0.24	0.00	0.00	Williams Group 3
LAZ071	0.00	0.00	0.07	0.00	0.00	Williams Group 3
LAZ106	0.07	0.00	0.23	0.00	0.00	Williams Group 3
LAZ131	0.00	0.00	1.43	0.00	0.00	Williams Group 3
LAZ187	0.11	0.00	**100.00**	0.00	0.00	Williams Group 3
LAZ188	4.27	0.00	**100.00**	0.00	0.00	Williams Group 3
LAZ215	0.00	0.00	**100.00**	0.00	0.00	Williams Group 3
LAZ217	0.00	0.00	8.45	0.00	0.00	Williams Group 3
LAZ237	0.00	0.00	0.47	0.00	0.00	Williams Group 3
LAZ260	0.08	0.00	**100.00**	0.00	0.00	Williams Group 3

Table 12. Mahalanobis-distance-based probabilities of group membership for specimens in Group 4. Probabilities are derived from elemental concentrations and projected against the largest compositional groups relevant to this study.

Sample ID	Ambato Valley	Group 2	Williams Group 3	Williams Group 4	Williams Group 5	Best Group
LAZ132	0.00	0.00	0.03	0.00	0.00	Williams Group 3
LAZ133	0.00	0.00	0.02	0.00	0.00	Williams Group 3
LAZ134	0.00	0.00	0.01	0.00	0.00	Williams Group 3

Table 13. Mahalanobis-distance-based probabilities of group membership for specimens in Group 5. Probabilities are derived from elemental concentrations and projected against the largest compositional groups relevant to this study.

Sample ID	Ambato Valley	Group 2	Williams Group 3	Williams Group 4	Williams Group 5	Best Group
LAZ074	0.00	0.00	0.01	0.00	0.00	Williams Group 3
LAZ100	0.00	0.00	0.01	0.00	0.00	Williams Group 3
LAZ102	0.00	0.00	0.04	0.00	0.00	Williams Group 3
LAZ115	0.00	0.00	0.01	0.00	0.00	Williams Group 3

Table 14. Mahalanobis-distance-based probabilities of group membership for specimens in Group 6. Probabilities are derived from elemental concentrations and projected against the largest compositional groups relevant to this study.

Sample ID	Ambato Valley	Group 2	Williams Group 3	Williams Group 4	Williams Group 5	Best Group
LAZ023	0.00	0.00	0.21	0.00	0.00	Williams Group 3
LAZ087	0.01	0.00	1.30	0.00	0.00	Williams Group 3
LAZ103	0.00	0.00	0.72	0.00	0.00	Williams Group 3
LAZ152	0.00	0.00	0.73	0.00	0.00	Williams Group 3
LAZ159	0.00	0.00	3.31	0.00	0.00	Williams Group 3
LAZ160	0.00	0.00	1.96	0.00	0.00	Williams Group 3
LAZ170	0.00	0.00	0.47	0.00	0.00	Williams Group 3
LAZ211	0.00	0.00	0.29	0.02	0.00	Williams Group 3
LAZ212	0.00	0.00	0.49	0.00	0.00	Williams Group 3
LAZ214	0.01	0.00	3.82	0.00	0.00	Williams Group 3
LAZ216	0.00	0.00	2.19	0.00	0.00	Williams Group 3
LAZ218	0.00	0.00	0.19	0.00	0.00	Williams Group 3
LAZ223	0.00	0.00	4.25	0.00	0.00	Williams Group 3
LAZ225	0.00	0.00	0.14	0.00	0.00	Williams Group 3
LAZ231	0.00	0.00	0.20	0.00	0.00	Williams Group 3
LAZ232	0.03	0.00	3.23	0.00	0.00	Williams Group 3
LAZ233	0.00	0.00	0.56	0.00	0.00	Williams Group 3
LAZ235	0.01	0.00	0.59	0.01	0.00	Williams Group 3
LAZ245	0.00	0.00	0.34	0.00	0.00	Williams Group 3

Table 15. Mahalanobis-distance-based probabilities of group membership for specimens in Group 7. Probabilities are derived from elemental concentrations and projected against the largest compositional groups relevant to this study.

Sample ID	Ambato Valley	Group 2	Williams Group 3	Williams Group 4	Williams Group 5	Best Group
LAZ025	0.00	0.00	**5.84**	0.00	0.00	Williams Group 3
LAZ034	0.00	0.00	2.96	0.00	0.00	Williams Group 3
LAZ051	0.00	0.00	**5.49**	0.00	0.00	Williams Group 3
LAZ052	0.00	0.00	**5.62**	0.00	0.00	Williams Group 3
LAZ056	0.00	0.00	**8.69**	0.00	0.00	Williams Group 3
LAZ057	0.00	0.00	2.55	0.00	0.00	Williams Group 3
LAZ060	0.00	0.00	2.70	0.00	0.00	Williams Group 3
LAZ064	0.00	0.01	2.25	0.00	0.00	Williams Group 3
LAZ077	0.00	0.00	1.13	0.00	0.00	Williams Group 3
LAZ121	0.00	0.00	0.96	0.00	0.00	Williams Group 3
LAZ182	0.00	0.00	5.10	0.00	0.00	Williams Group 3
LAZ202	0.00	0.00	1.74	0.00	0.00	Williams Group 3
LAZ274	0.00	0.00	2.73	0.00	0.00	Williams Group 3
LAZ275	0.00	0.03	0.24	0.00	0.00	Williams Group 3
LAZ276	0.00	0.00	0.24	0.00	0.00	Williams Group 3

Table 16. Mahalanobis-distance-based probabilities of group membership for specimens in Group 8. Probabilities are derived from elemental concentrations and projected against the largest compositional groups relevant to this study.

Sample ID	Ambato Valley	Group 2	Williams Group 3	Williams Group 4	Williams Group 5	Best Group
LAZ059	0.00	0.00	0.01	0.00	0.00	Williams Group 3
LAZ148	0.00	0.00	0.01	0.00	0.00	Williams Group 3
LAZ262	0.00	0.00	0.01	0.00	0.00	Williams Group 3
LAZ265	0.00	0.00	0.00	0.00	0.00	Williams Group 3
LAZ267	0.00	0.00	0.00	0.00	0.00	Williams Group 3

Table 17. Mahalanobis-distance-based probabilities of group membership for specimens in Group 9. Probabilities are derived from elemental concentrations and projected against the largest compositional groups relevant to this study.

Sample ID	Ambato Valley	Group 2	Williams Group 3	Williams Group 4	Williams Group 5	Best Group
LAZ176	0.00	0.01	0.12	2.77	0.01	Williams Group 4
LAZ180	0.00	0.00	1.20	**17.18**	0.00	Williams Group 4
LAZ181	0.00	0.20	0.13	**9.75**	0.00	Williams Group 4
LAZ190	0.00	0.00	0.12	0.00	0.00	Williams Group 3
LAZ196	0.00	0.41	0.15	0.68	0.29	Williams Group 4
LAZ198	0.00	0.00	0.52	0.02	0.00	Williams Group 3
LAZ201	0.00	0.00	1.11	0.02	0.00	Williams Group 3
LAZ204	0.00	1.54	0.27	0.34	0.00	Group 2
LAZ205	0.00	1.38	0.56	2.16	0.00	Williams Group 4
LAZ206	0.00	0.50	1.09	0.04	0.00	Williams Group 3
LAZ207	0.00	0.00	0.16	0.00	0.00	Williams Group 3
LAZ208	0.00	0.20	0.46	0.38	0.00	Williams Group 3
LAZ209	0.00	0.29	1.31	7.10	0.00	Williams Group 4
LAZ227	0.00	**7.43**	0.07	0.01	0.04	Group 2
LAZ230	0.05	0.00	0.07	0.01	0.00	Williams Group 3
LAZ239	0.00	0.00	0.02	0.00	0.00	Williams Group 3
LAZ247	0.00	0.00	0.25	0.00	0.00	Williams Group 3
LAZ248	0.00	0.00	0.11	0.00	0.00	Williams Group 3

Table 18. Mahalanobis-distance-based probabilities of group membership for specimens in Group 10. Probabilities are derived from elemental concentrations and projected against the largest compositional groups relevant to this study.

Sample ID	Ambato Valley	Group 2	Williams Group 3	Williams Group 4	Williams Group 5	Best Group
LAZ026	0.00	0.00	**5.24**	0.00	0.00	Williams Group 3
LAZ046	0.00	0.00	**6.74**	0.00	0.00	Williams Group 3
LAZ070	0.00	0.00	0.87	0.00	0.00	Williams Group 3
LAZ203	0.00	0.00	3.63	0.00	0.00	Williams Group 3
LAZ210	0.00	0.00	0.03	0.00	0.00	Williams Group 3
LAZ252	0.00	0.00	2.38	0.00	0.00	Williams Group 3
LAZ253	0.00	0.00	2.53	0.00	0.00	Williams Group 3
LAZ254	0.00	0.00	0.11	0.00	0.00	Williams Group 3
LAZ259	0.00	0.00	**7.37**	0.00	0.00	Williams Group 3
LAZ261	0.00	0.00	0.09	0.00	0.00	Williams Group 3
LAZ263	0.00	0.00	0.14	0.00	0.00	Williams Group 3
LAZ269	0.00	0.00	0.48	0.00	0.00	Williams Group 3
LAZ272	0.00	0.00	0.03	0.00	0.00	Williams Group 3
LAZ273	0.00	0.00	0.60	0.00	0.00	Williams Group 3
LAZ277	0.00	0.00	0.55	0.00	0.00	Williams Group 3

Table 19. Mahalanobis-distance-based probabilities of group membership for unassigned specimens. Probabilities are derived from elemental concentrations and projected against the largest compositional groups relevant to this study

Sample ID	Ambato Valley	Group 2	Williams Group 3	Williams Group 4	Williams Group 5	Best Group
LAZ031	0.00	0.00	2.02	0.00	0.00	Williams Group 3
LAZ032	0.00	0.00	0.54	0.00	0.00	Williams Group 3
LAZ036	0.00	0.00	0.07	0.00	0.00	Williams Group 3
LAZ054	0.02	0.00	1.48	0.00	0.00	Williams Group 3
LAZ072	0.00	0.00	0.88	0.00	0.00	Williams Group 3
LAZ078	0.00	0.00	0.17	0.00	0.00	Williams Group 3
LAZ112	0.00	0.00	0.56	0.00	0.00	Williams Group 3
LAZ172	0.00	0.00	1.06	0.00	0.00	Williams Group 3
LAZ185	0.00	0.00	1.84	0.00	0.00	Williams Group 3
LAZ186	0.02	0.00	0.34	0.00	0.00	Williams Group 3
LAZ193	0.00	0.00	0.33	0.00	0.00	Williams Group 3
LAZ194	0.00	0.00	1.33	0.00	0.00	Williams Group 3
LAZ199	0.01	0.00	6.46	0.00	0.01	Williams Group 3
LAZ200	0.00	0.00	0.86	0.00	0.00	Williams Group 3
LAZ213	0.00	0.00	1.98	0.00	0.00	Williams Group 3
LAZ219	0.00	0.00	3.22	0.00	0.00	Williams Group 3
LAZ220	0.00	0.00	0.06	0.01	0.00	Williams Group 3
LAZ221	0.00	0.00	**9.27**	0.00	0.00	Williams Group 3
LAZ224	0.00	0.00	0.64	0.00	0.00	Williams Group 3
LAZ228	0.04	0.00	0.13	0.04	0.00	Williams Group 3
LAZ229	0.00	0.00	0.05	0.03	0.00	Williams Group 3
LAZ234	0.04	0.05	3.96	0.20	0.00	Williams Group 3
LAZ236	0.00	0.00	0.10	0.00	0.00	Williams Group 3
LAZ238	0.00	0.00	0.17	0.00	0.00	Williams Group 3
LAZ240	0.00	0.00	0.64	0.00	0.00	Williams Group 3
LAZ241	0.00	0.00	0.12	0.00	0.00	Williams Group 3
LAZ242	0.00	0.00	0.06	0.00	0.00	Williams Group 3
LAZ243	0.00	0.00	2.20	0.00	0.00	Williams Group 3
LAZ244	0.00	0.00	1.40	0.00	0.00	Williams Group 3
LAZ246	0.00	0.00	1.45	0.00	0.00	Williams Group 3
LAZ249	0.00	0.00	0.18	0.00	0.00	Williams Group 3
LAZ250	0.06	0.00	4.28	0.00	0.00	Williams Group 3
LAZ255	0.00	0.00	4.50	0.00	0.00	Williams Group 3
LAZ257	0.00	0.00	1.45	0.00	0.00	Williams Group 3
LAZ258	0.00	0.00	0.59	0.00	0.00	Williams Group 3
LAZ264	0.00	0.00	0.96	0.00	0.00	Williams Group 3
LAZ266	0.00	0.00	0.18	0.00	0.00	Williams Group 3
LAZ268	0.00	0.00	0.64	0.00	0.00	Williams Group 3
LAZ270	0.00	0.00	0.63	0.00	0.00	Williams Group 3
LAZ271	0.00	0.00	2.65	0.00	0.00	Williams Group 3
LAZ278	0.00	0.00	0.08	0.00	0.00	Williams Group 3
LAZ282	0.00	0.00	1.91	0.00	0.01	Williams Group 3
LAZ283	0.00	0.00	0.28	0.00	0.00	Williams Group 3

Table 20. Summary table of group compositions by geographic region. Note that compositional groups 2, 3, and 7 appear to be centered in the Aconquija Mountains. Groups 6 and 9 appear to be centered in the Cajón Valley, and Group 10 appears to be centered in the Bolson del Arenal.

	Group 2	Group 3	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10
Aconquija Mtns.	35	23	4	5	11	2	1	4
Santa Maria Valley	16	8		3	1		3	
Cajón Valley	10	7		13	1		14	2
El Bolson del Arenal	1	1			3	3		9
Lerma Valley	1							

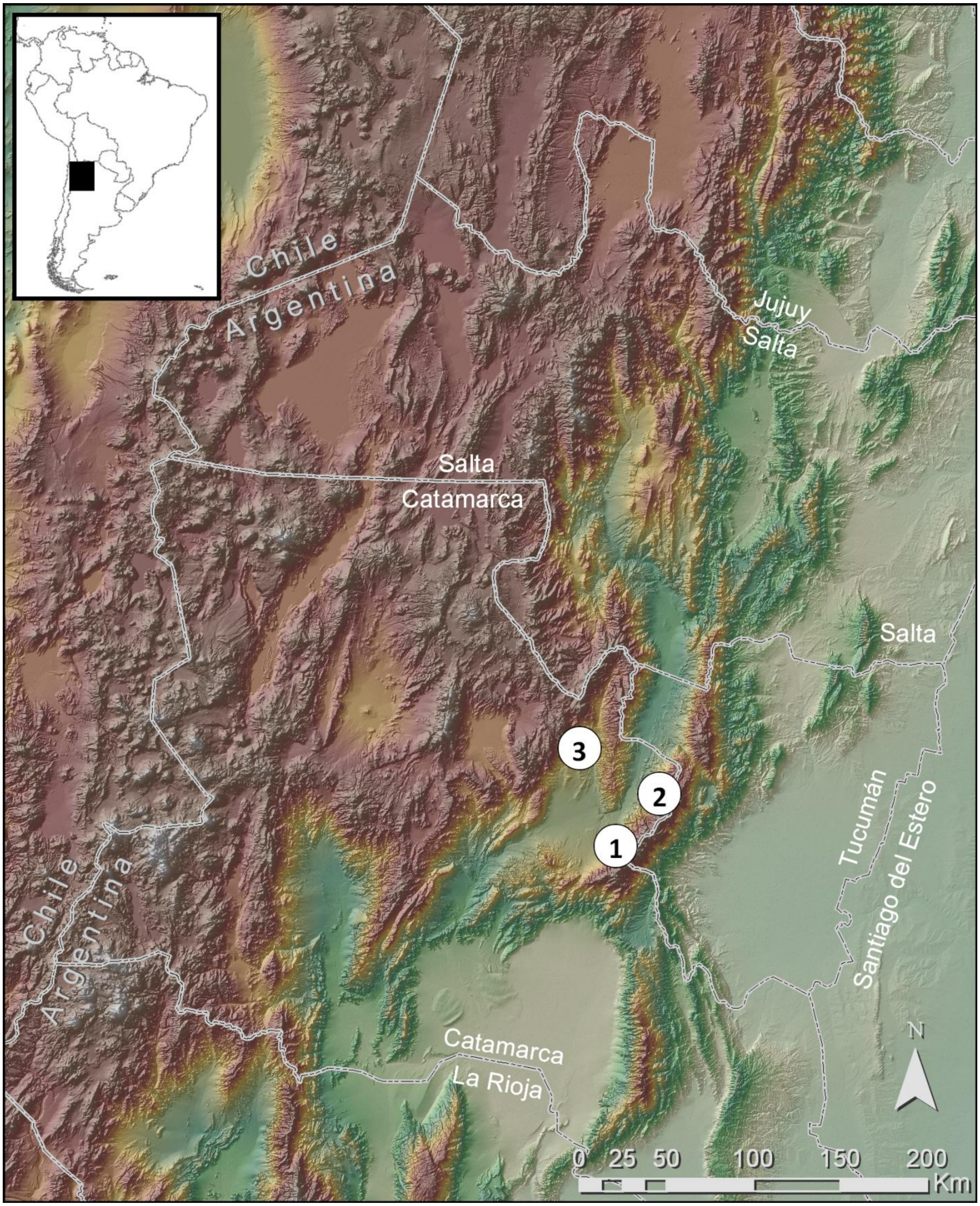

Figure 1. Map of northwest Argentina showing locations of archaeological sites sampled in this study. 1: Ingenio del Arenal; 2: Antigal del Tesoro; 3: Cardonal and Bordo Marcial;

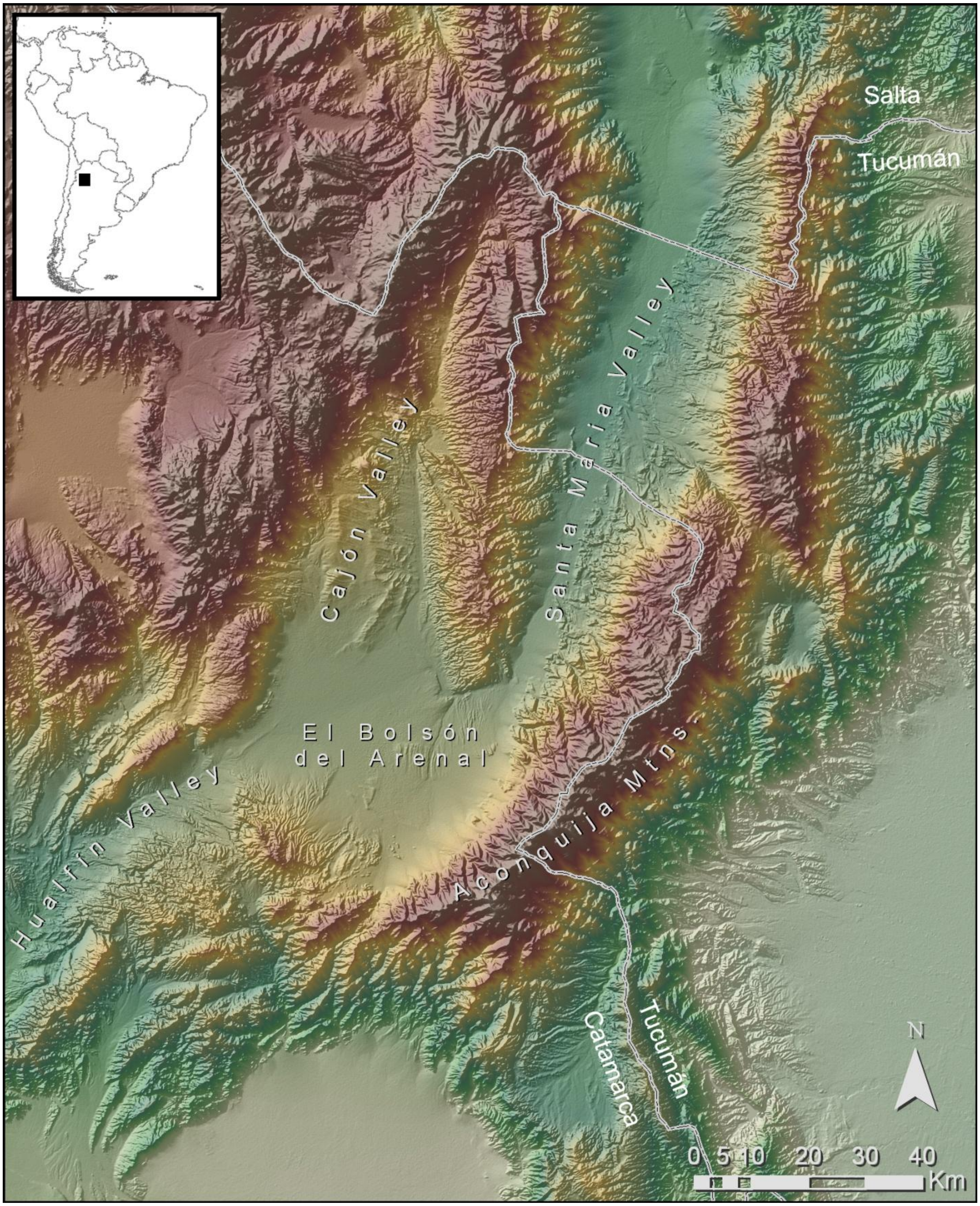

Figure 2. Map of northwest Argentina showing geographic features discussed in this report. Province borders are shown and labeled.

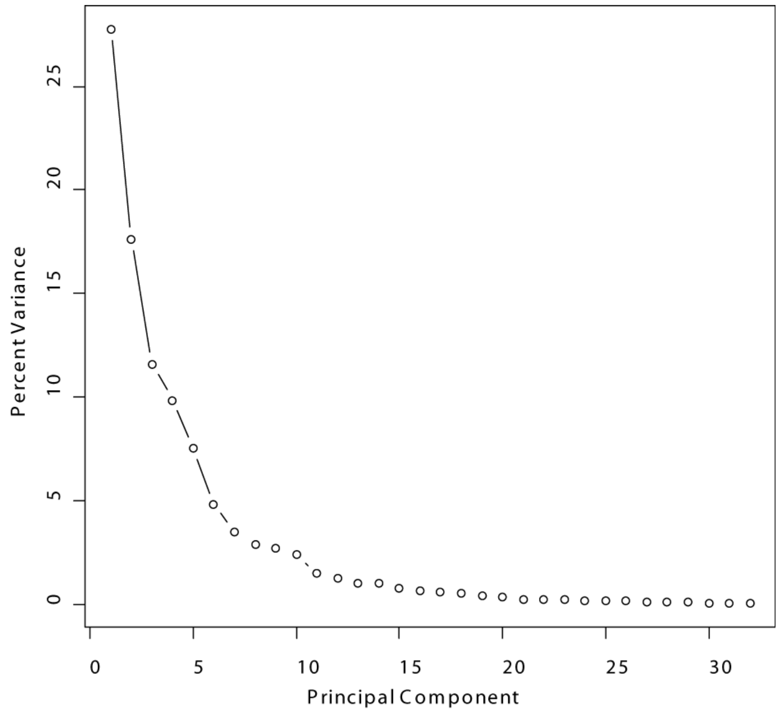

Figure 3. Scree plot of percent variance explained by principal components analysis of the ceramic sample from northwest Argentina. Note that the only the first 7–10 components appear significant.

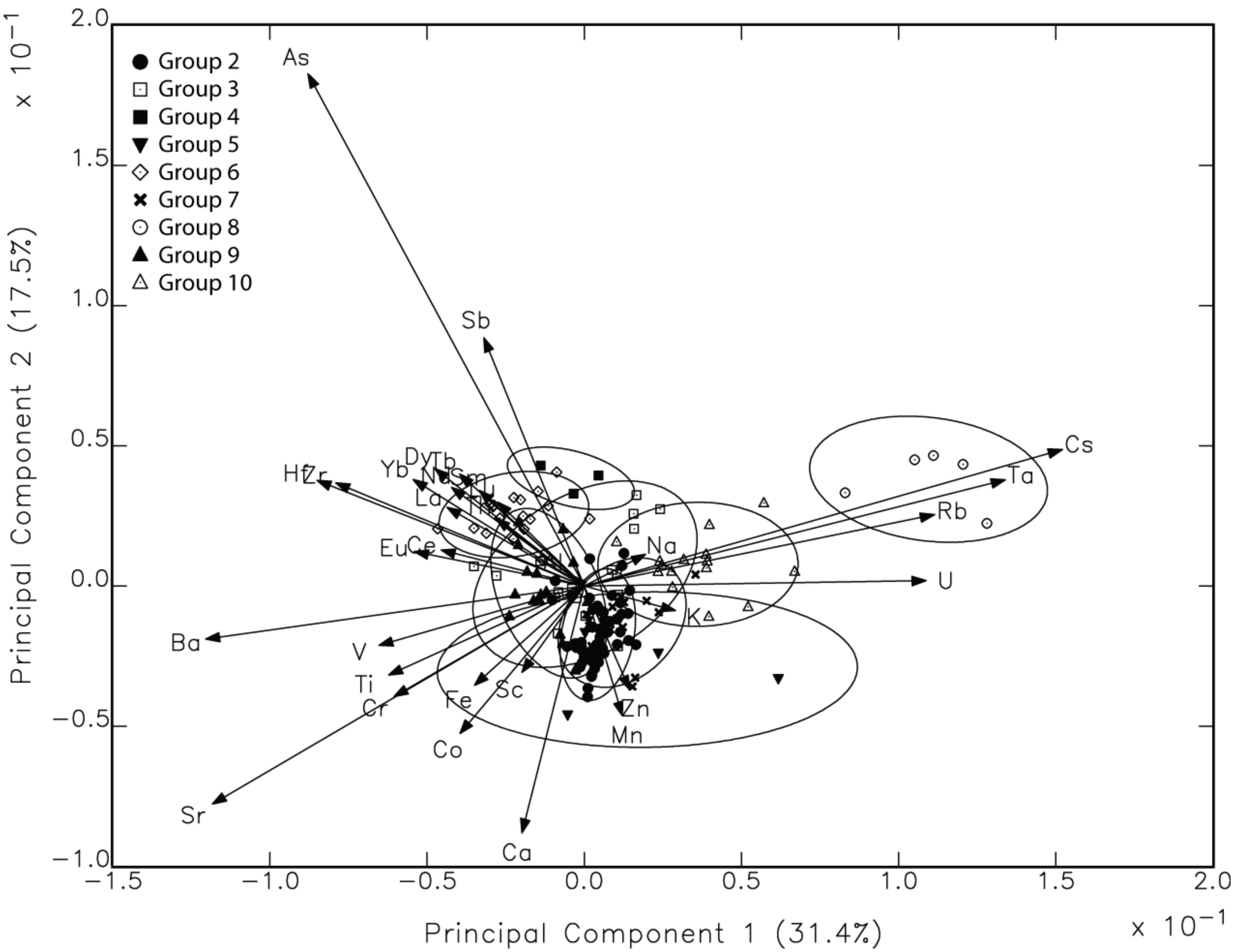

Figure 4. Biplot of principal components one and two derived from the ceramic dataset from northwest Argentina. Elemental-loading vectors are shown, and ellipses are drawn at the 90% confidence interval.

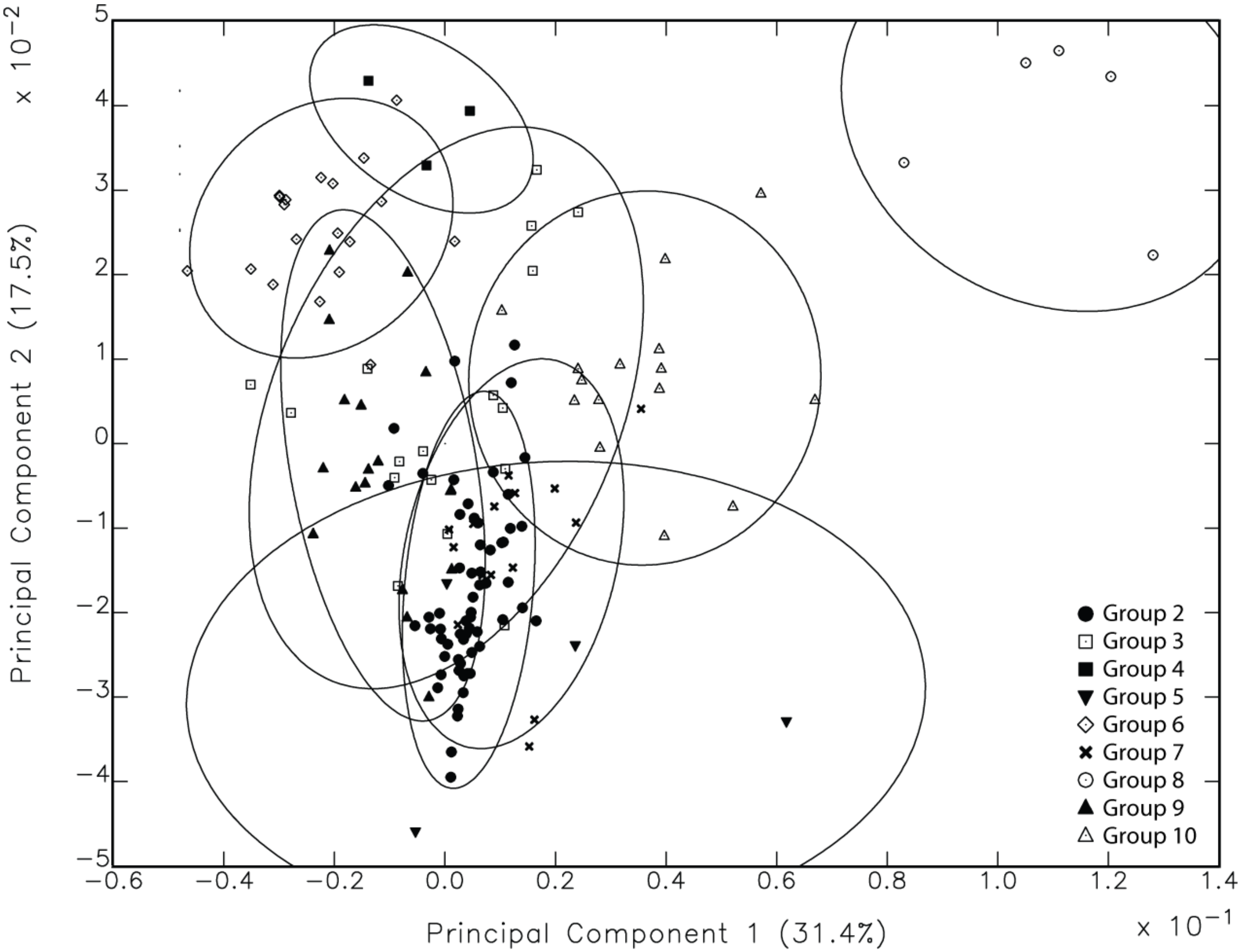

Figure 5. Plot of principal components one and two derived from the ceramic dataset from northwest Argentina. Ellipses are drawn at the 90% confidence interval.

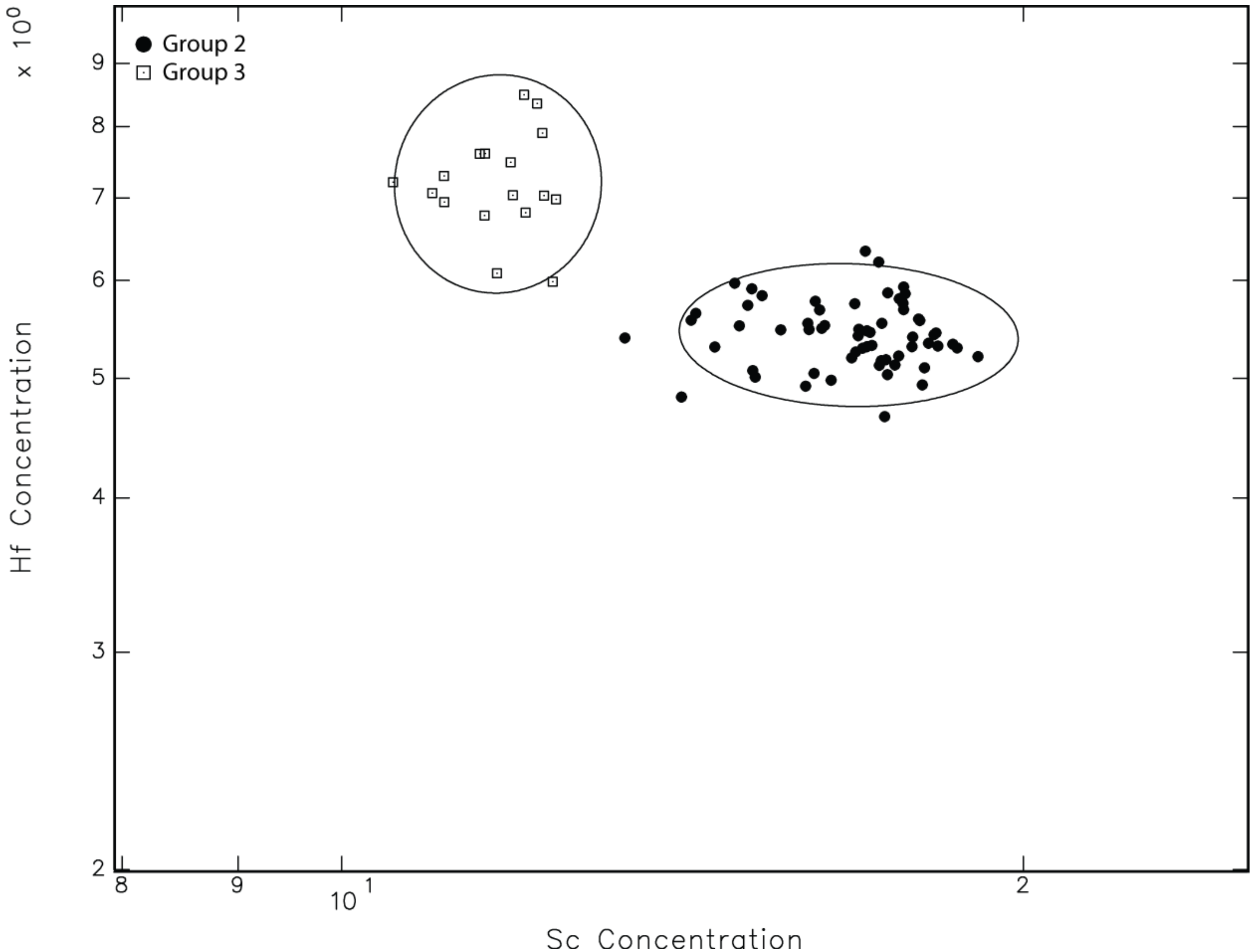

Figure 6. Bivariate plot of scandium and hafnium concentrations for the ceramic dataset from northwest Argentina. Ellipses are drawn at the 90% confidence interval.

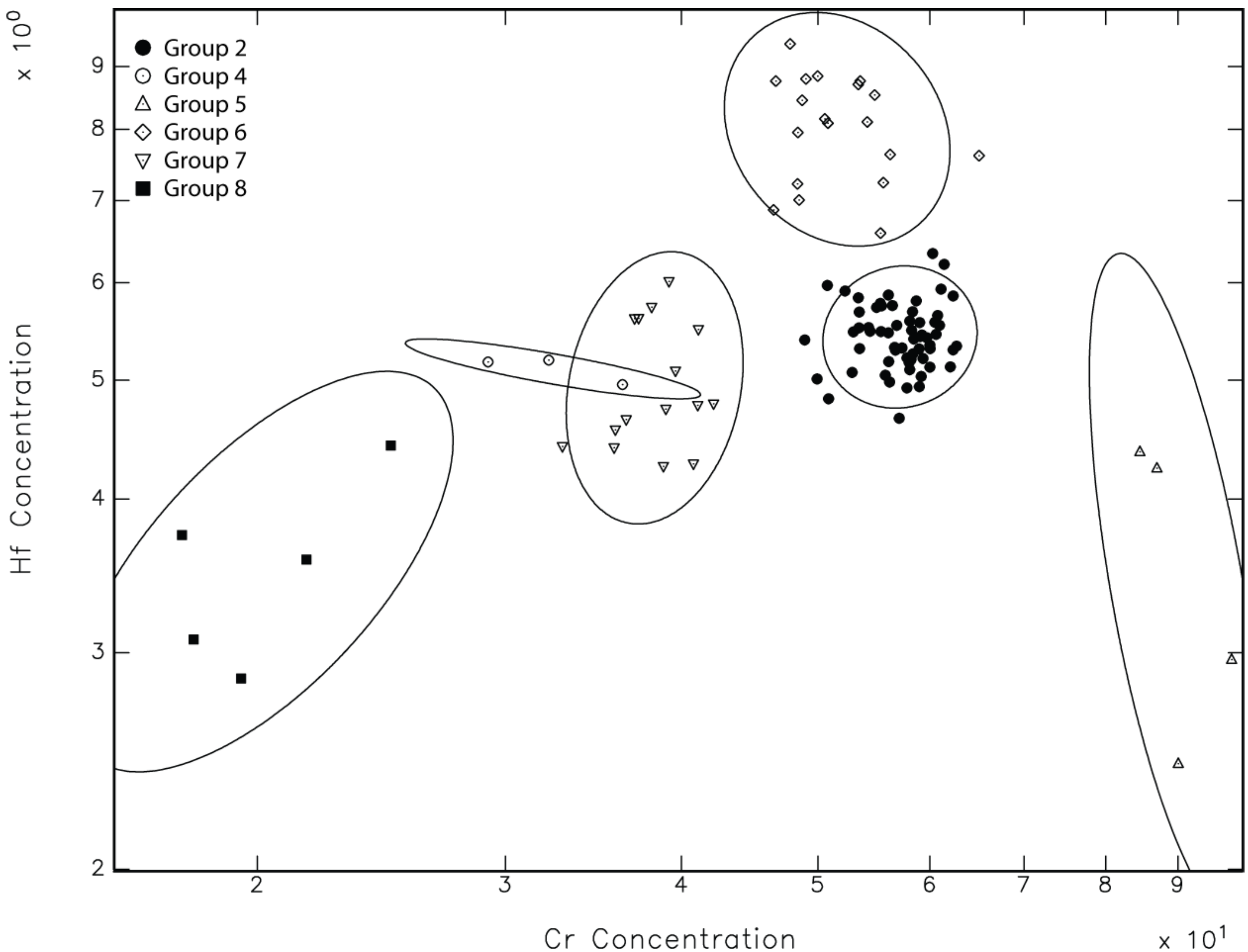

Figure 7. Bivariate plot of chromium and hafnium concentrations for the ceramic dataset from northwest Argentina. Ellipses are drawn at the 90% confidence interval.

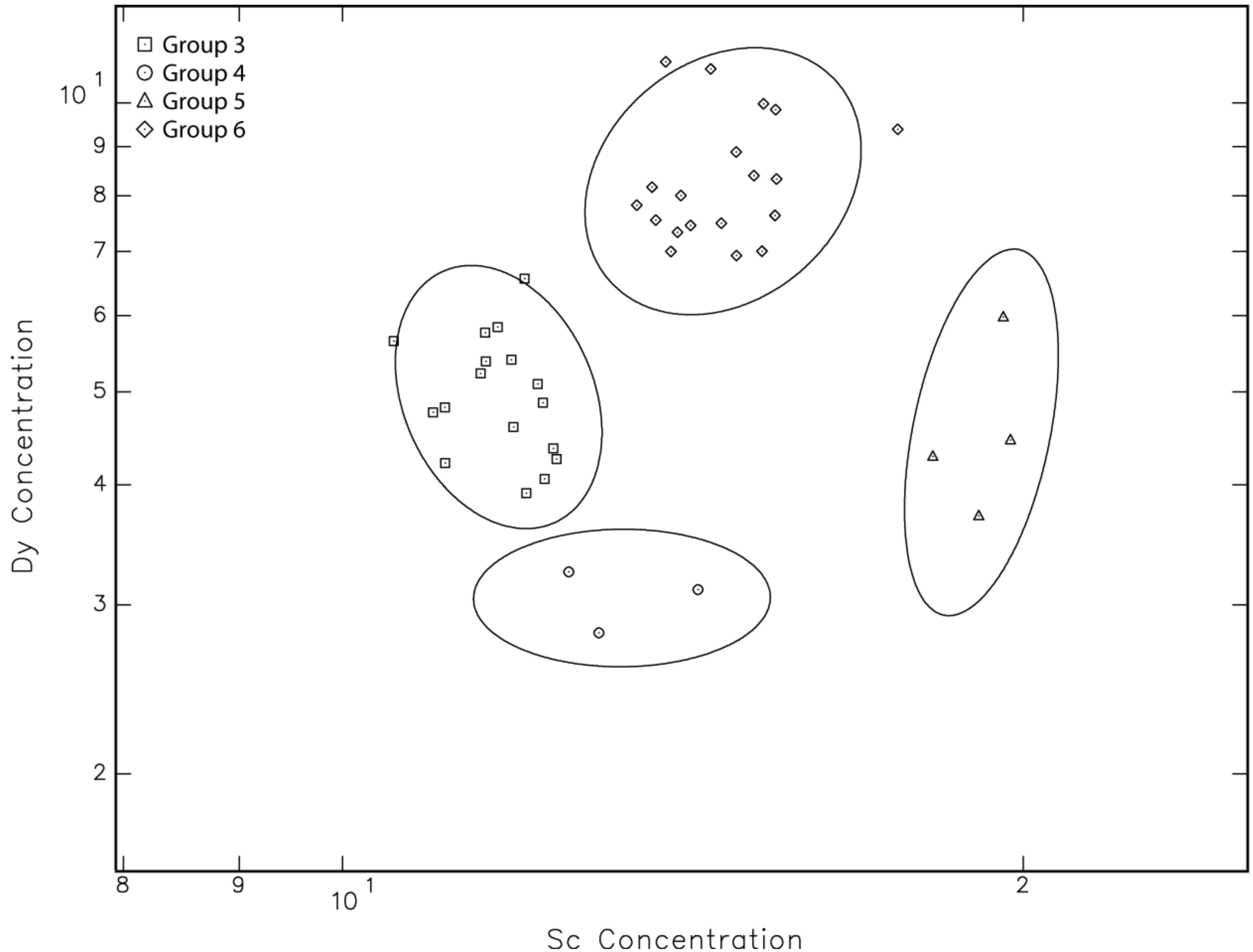

Figure 8. Bivariate plot of scandium and dysprosium concentrations for the ceramic dataset from northwest Argentina. Ellipses are drawn at the 90% confidence interval.

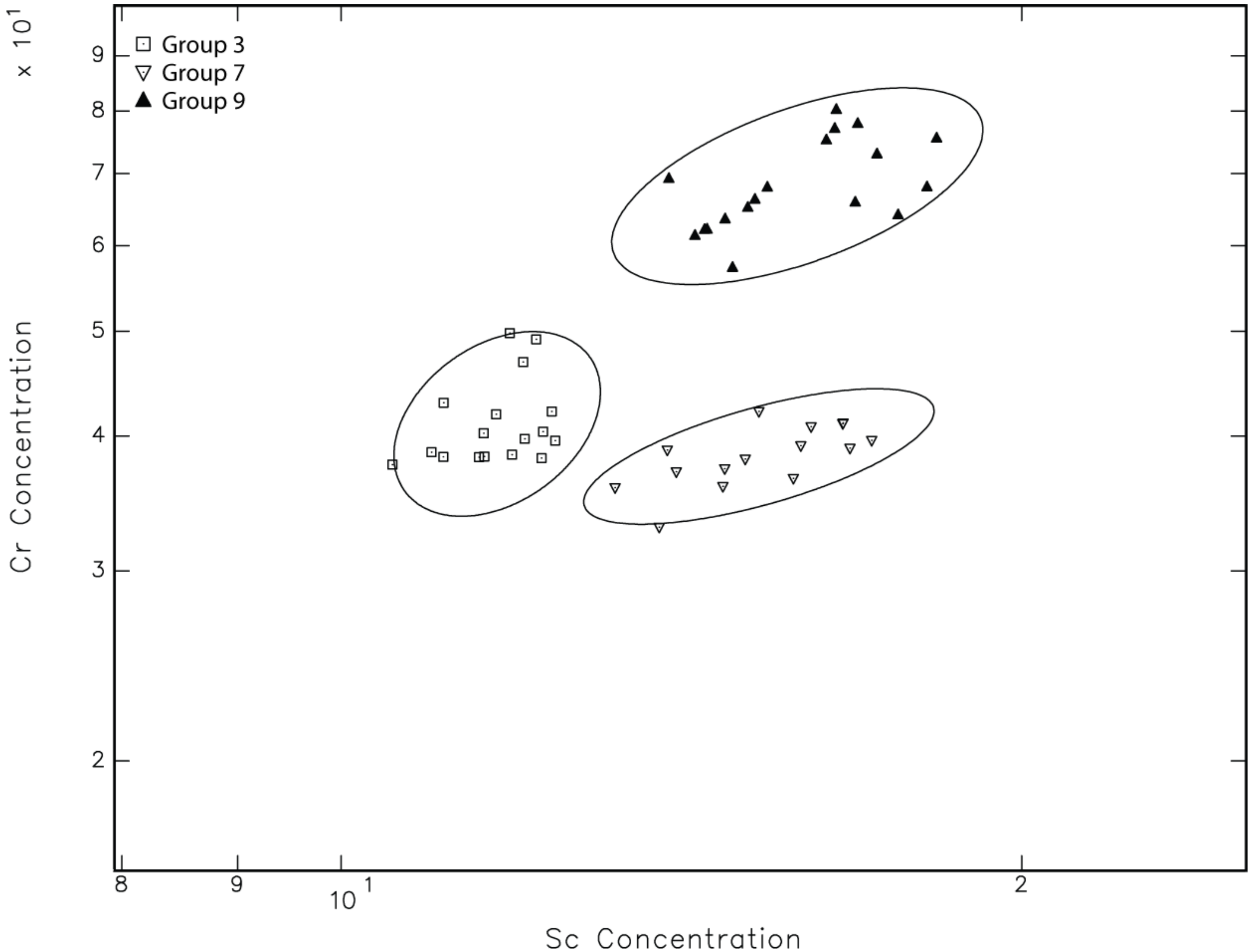

Figure 9. Bivariate plot of scandium and chromium concentrations for the ceramic dataset from northwest Argentina. Ellipses are drawn at the 90% confidence interval.

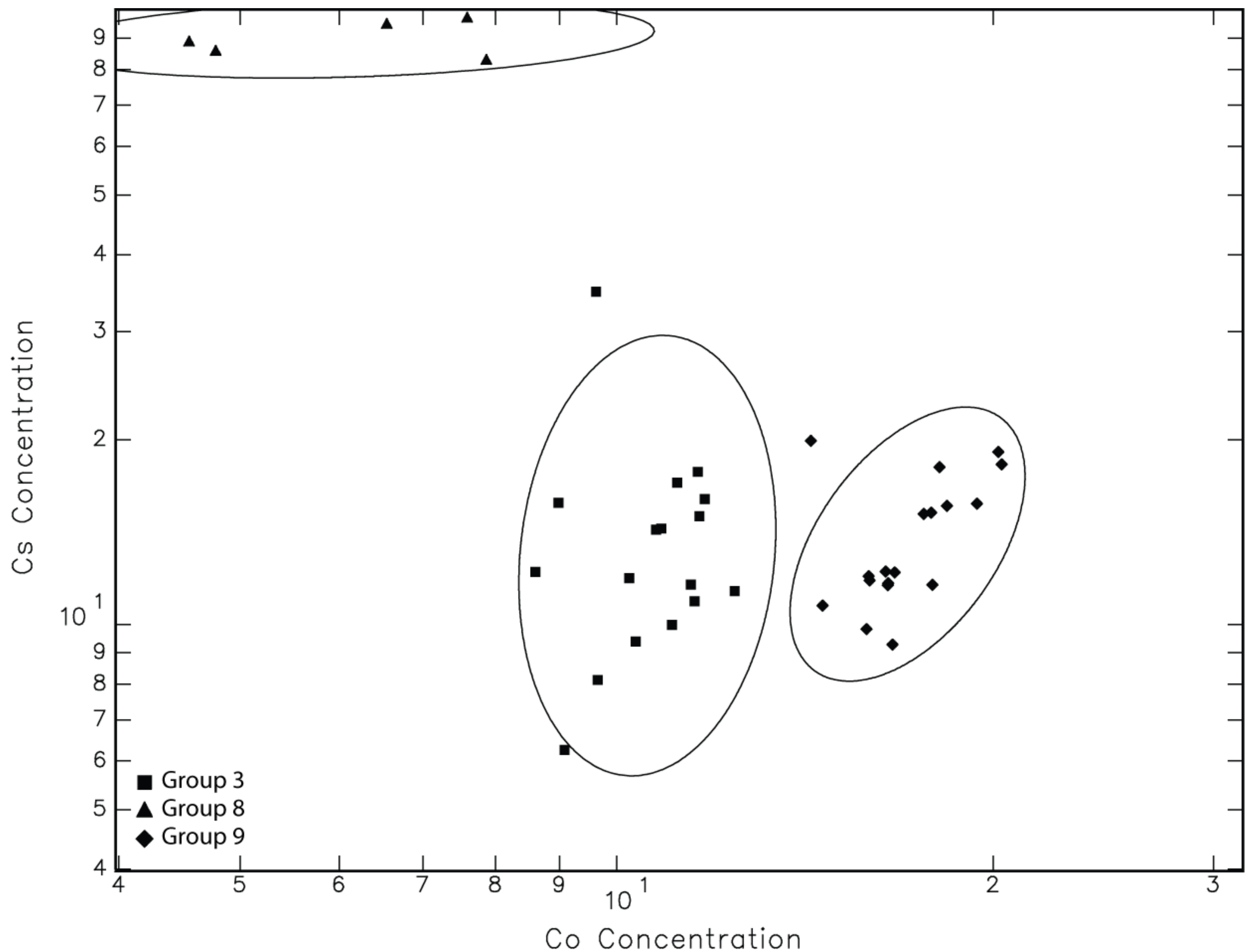

Figure 10. Bivariate plot of cobalt and cesium concentrations for ceramic specimens from northwest Argentina. Ellipses represent the 90% confidence interval of group membership.

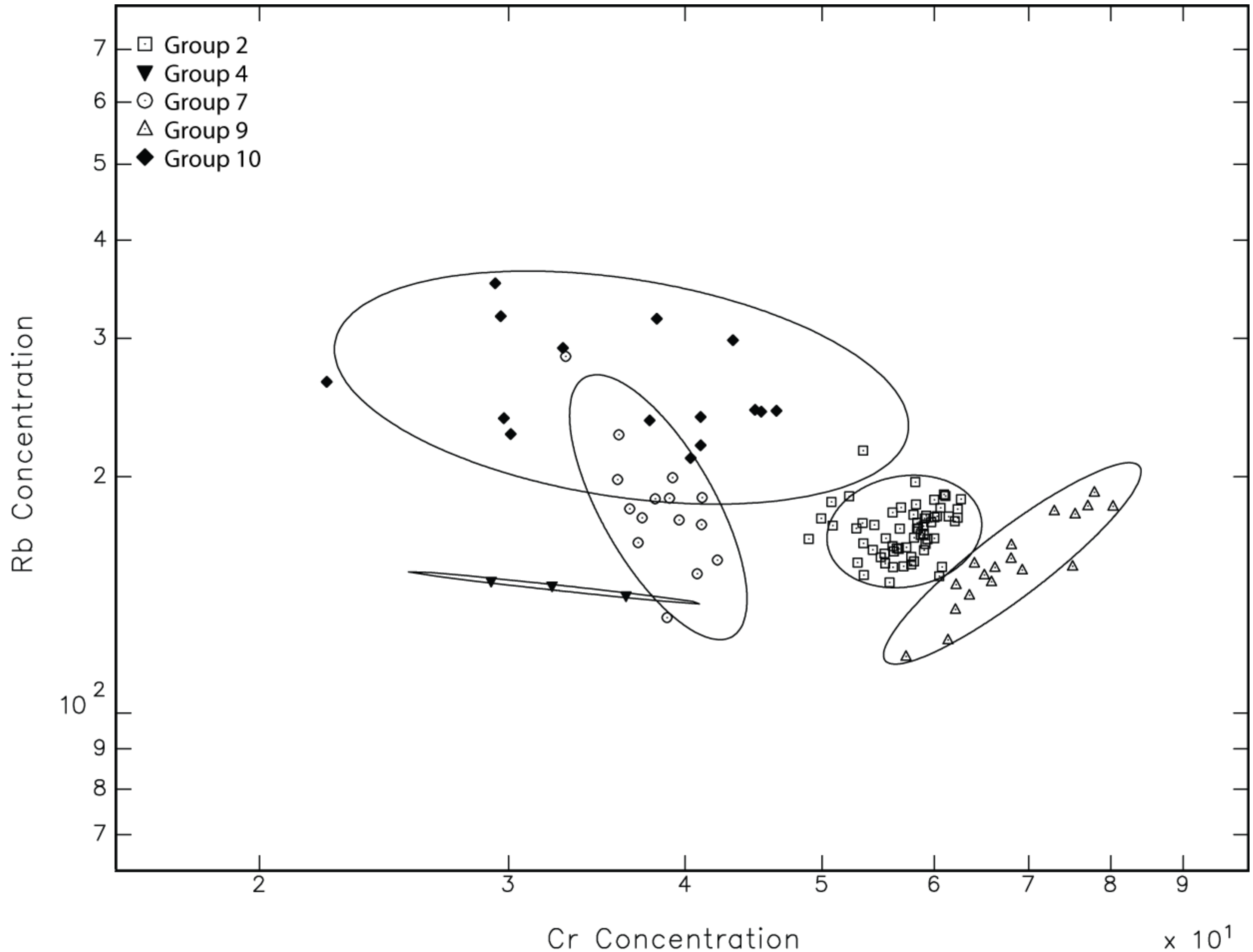

Figure 11. Bivariate plot of chromium and rubidium concentrations showing distinctions between compositional groups 2, 4, 7, 9, and 10. Ellipses are drawn at the 90% confidence interval.

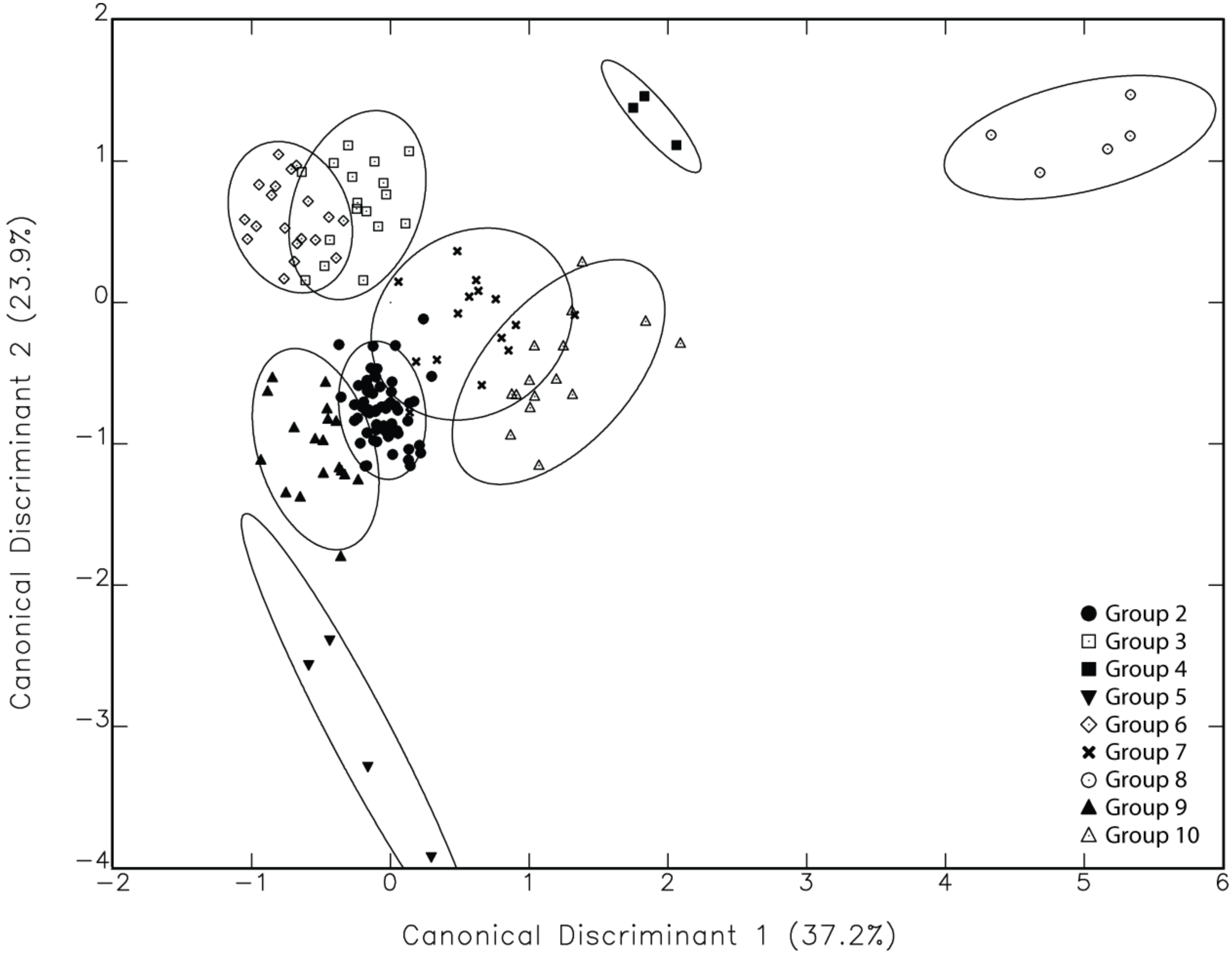

Figure 12. Canonical discriminant plot showing compositional groups defined within the Lazzari dataset. Ellipses are drawn at the 90% confidence interval. This plot explains 61.1% of the cumulative variance in the dataset.

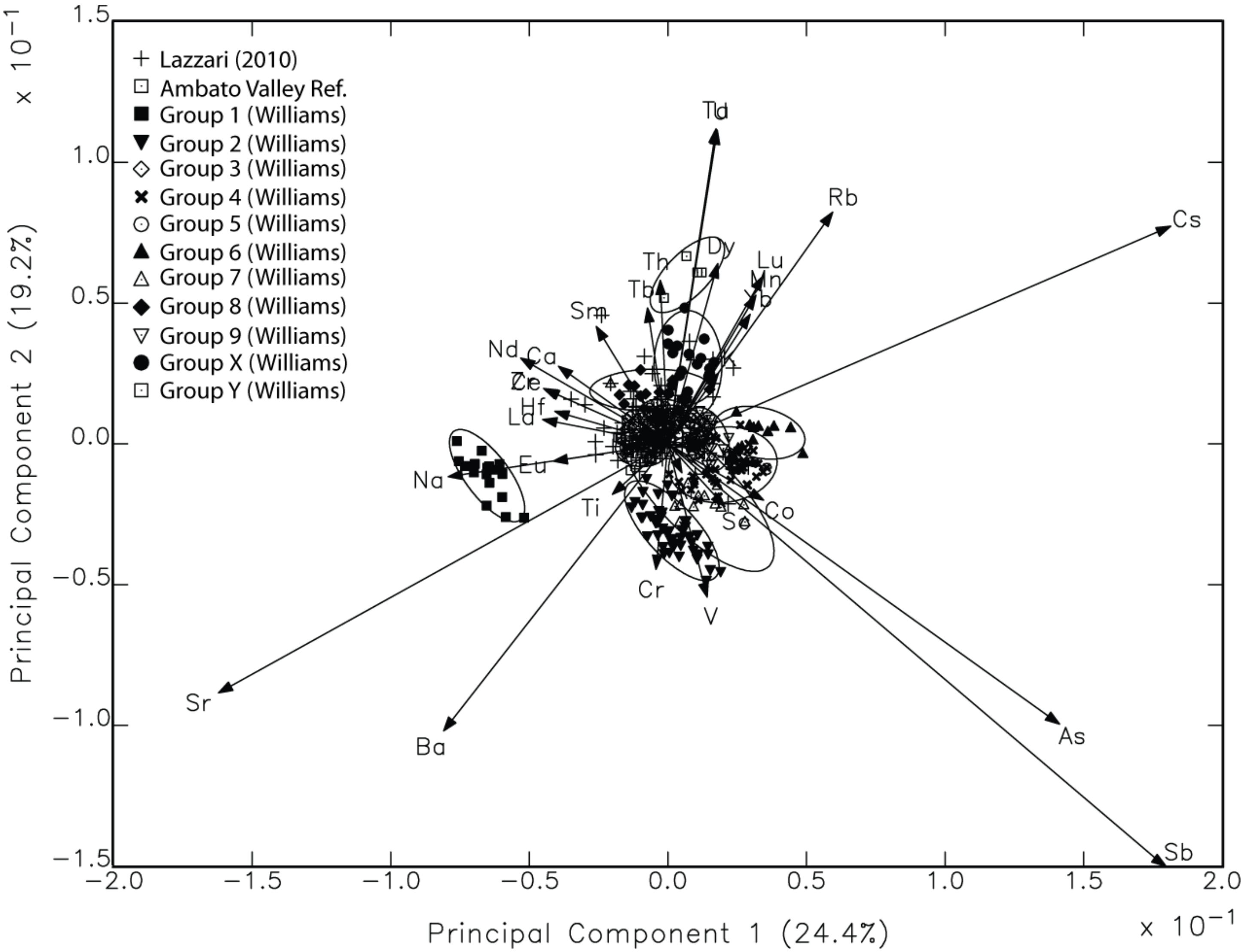

Figure 13. PCA biplot of the combined Lazzari/Giesso/Wiliams dataset. Compositional groups defined in the Giesso and Williams datasets are shown with ellipses drawn at 90% confidence intervals.`

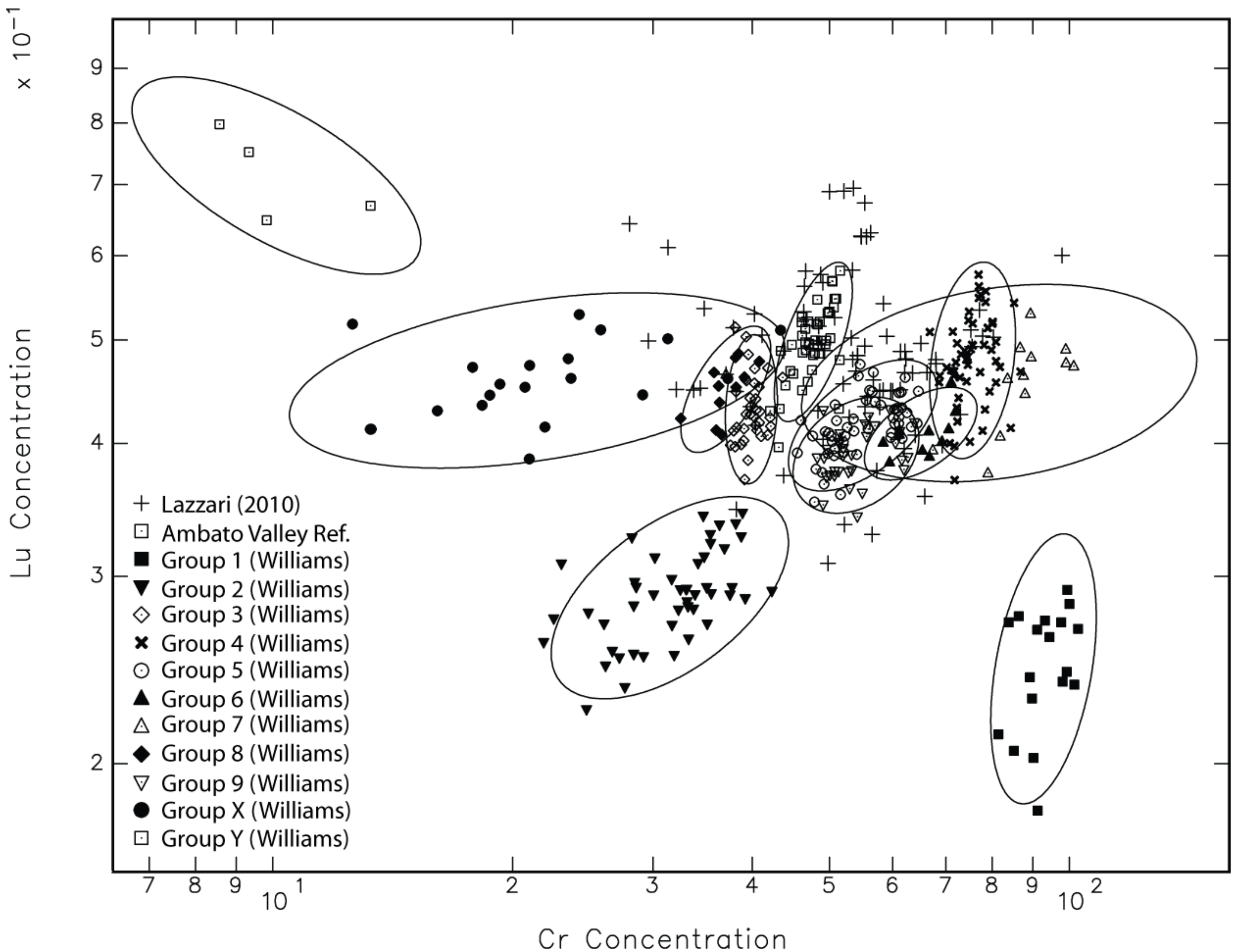

Figure 14. Bivariate plot of chromium and lutetium concentrations in the combined Lazzari/Giesso/Wiliams dataset. Compositional groups defined in the Giesso and Williams datasets are shown with ellipses drawn at 90% confidence intervals.

Appendix A

Compositional Data for Specimens LAZ176–LAZ284
Catamarca Province, Northwest Argentina
Produced at the MURR Archaeometry Laboratory, Spring 2010

ANID	Alternate ID	Country	State	Subregion	Site Name	Material
LAZ176	Tolombón 56-29	Argentina	Catamarca	Santa Maria Valley	Tolombón	Pottery
LAZ177	Masao Rec. Sup.	Argentina	Catamarca	Santa Maria Valley	Masao	Pottery
LAZ178	n/a	Argentina	Catamarca	Santa Maria Valley	Molino del Puesto	Pottery
LAZ179	n/a	Argentina	Catamarca	Santa Maria Valley	Bañado	Pottery
LAZ180	n/a	Argentina	Catamarca	Santa Maria Valley	Chimpa	Pottery
LAZ181	Tolombón 56-45	Argentina	Catamarca	Santa Maria Valley	Tolombón	Pottery
LAZ182	U5 14/196	Argentina	Catamarca	Santa Maria Valley	Ampajango	Pottery
LAZ183	n/a	Argentina	Catamarca	Santa Maria Valley	Caspinchango	Pottery
LAZ184	Tolombón 56-26	Argentina	Catamarca	Santa Maria Valley	Tolombón	Pottery
LAZ185	Tolombón 56-20	Argentina	Catamarca	Santa Maria Valley	Tolombón	Pottery
LAZ186	837-T1	Argentina	Catamarca	Aconquija Mountains	Ingenio del Arenal	Pottery
LAZ187	824-2	Argentina	Catamarca	Aconquija Mountains	Ingenio del Arenal	Pottery
LAZ188	805-9	Argentina	Catamarca	Aconquija Mountains	Ingenio del Arenal	Pottery
LAZ189	657-1	Argentina	Catamarca	Aconquija Mountains	Antigal de Tesoro	Pottery
LAZ190	711-T1	Argentina	Catamarca	Aconquija Mountains	Antigal de Tesoro	Pottery
LAZ191	638-5-3-1	Argentina	Catamarca	Aconquija Mountains	Antigal de Tesoro	Pottery
LAZ192	C230-7	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ193	C253-3	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ194	n/a	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ195	C139-T22	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ196	C46-T3	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ197	C54-T21	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ198	C70-T4	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ199	C517-T7b	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ200	C128-T12	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ201	C562-4	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ202	C583-12	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ203	C583-T1c	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ204	C250-3	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ205	C84-T3	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ206	C368-T6	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ207	C161-1	Argentina	Catamarca	Cajón Valley	Bordo Marcial	Pottery
LAZ208	C217-1	Argentina	Catamarca	Cajón Valley	Bordo Marcial	Pottery
LAZ209	C217-5	Argentina	Catamarca	Cajón Valley	Bordo Marcial	Pottery
LAZ210	C70-3	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ211	C12-28	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ212	C70-77	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ213	C27-T73	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ214	C53-T30	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery

ANID	Alternate ID	Country	State	Subregion	Site Name	Material
LAZ215	C35-T18	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ216	C145-T8	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ217	C86-T8	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ218	C108-12	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ219	C104-1	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ220	C82-1	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ221	C193-T1	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ222	C396-T1	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ223	C399-T1	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ224	C374-T2	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ225	C391-T9c	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ226	C340-T23	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ227	C431-T3	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ228	C386-T6	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ229	C412-T12	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ230	C416-4	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ231	C380-T3	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ232	C388-T8	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ233	C400-T3	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ234	C400-T1	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ235	C381-T8	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ236	C400-T2	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ237	C368-2	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ238	C330-15	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ239	C281-5	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ240	C285-T5	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ241	C321-T4	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ242	C322-T18	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ243	C242-HE 8-1	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ244	C419-1	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ245	C113-T22	Argentina	Catamarca	Cajón Valley	Cardonal	Pottery
LAZ246	C659-T2	Argentina	Catamarca	Cajón Valley	Bordo Marcial	Pottery
LAZ247	C682-T3	Argentina	Catamarca	Cajón Valley	Bordo Marcial	Pottery
LAZ248	C659-T3	Argentina	Catamarca	Cajón Valley	Bordo Marcial	Pottery
LAZ249	C660-T1	Argentina	Catamarca	Cajón Valley	Bordo Marcial	Pottery
LAZ250	C213-T3	Argentina	Catamarca	Cajón Valley	Bordo Marcial	Pottery
LAZ251	542-4	Argentina	Catamarca	Aconquija Mountains	Antigal de Tesoro	Pottery
LAZ252	541-9	Argentina	Catamarca	Aconquija Mountains	Antigal de Tesoro	Pottery
LAZ253	N40	Argentina	Catamarca	El Bolsón del Arenal	La Mesada	Pottery

ANID	Alternate ID	Country	State	Subregion	Site Name	Material
LAZ254	N39	Argentina	Catamarca	El Bolsón del Arenal	La Mesada	Pottery
LAZ255	N42	Argentina	Catamarca	El Bolsón del Arenal	La Mesada	Pottery
LAZ256	N43	Argentina	Catamarca	El Bolsón del Arenal	La Mesada	Pottery
LAZ257	N41	Argentina	Catamarca	El Bolsón del Arenal	La Mesada	Pottery
LAZ258	V57	Argentina	Catamarca	El Bolsón del Arenal	La Mesada	Pottery
LAZ259	V327	Argentina	Catamarca	El Bolsón del Arenal	El Alto El Bolsón	Pottery
LAZ260	V355	Argentina	Catamarca	El Bolsón del Arenal	El Alto El Bolsón	Pottery
LAZ261	V332	Argentina	Catamarca	El Bolsón del Arenal	El Alto El Bolsón	Pottery
LAZ262	V355	Argentina	Catamarca	El Bolsón del Arenal	El Alto El Bolsón	Pottery
LAZ263	N76	Argentina	Catamarca	El Bolsón del Arenal	El Alto El Bolsón	Pottery
LAZ264	N74	Argentina	Catamarca	El Bolsón del Arenal	El Alto El Bolsón	Pottery
LAZ265	N75	Argentina	Catamarca	El Bolsón del Arenal	El Alto El Bolsón	Pottery
LAZ266	N82	Argentina	Catamarca	El Bolsón del Arenal	El Alto El Bolsón	Pottery
LAZ267	C50	Argentina	Catamarca	El Bolsón del Arenal	Cueva Pintada	Pottery
LAZ268	C74	Argentina	Catamarca	El Bolsón del Arenal	Morro Relincho	Pottery
LAZ269	C83	Argentina	Catamarca	El Bolsón del Arenal	Morro Relincho	Pottery
LAZ270	C84	Argentina	Catamarca	El Bolsón del Arenal	Morro Relincho	Pottery
LAZ271	A31	Argentina	Catamarca	El Bolsón del Arenal	Morro Relincho	Pottery
LAZ272	A52	Argentina	Catamarca	El Bolsón del Arenal	Morro Relincho	Pottery
LAZ273	A52	Argentina	Catamarca	El Bolsón del Arenal	Morro Relincho	Pottery
LAZ274	v366	Argentina	Catamarca	El Bolsón del Arenal	Los Viscos	Pottery
LAZ275	V449	Argentina	Catamarca	El Bolsón del Arenal	Los Viscos	Pottery
LAZ276	v408	Argentina	Catamarca	El Bolsón del Arenal	Los Viscos	Pottery
LAZ277	V131	Argentina	Catamarca	El Bolsón del Arenal	Los Viscos	Pottery
LAZ278	R120	Argentina	Catamarca	El Bolsón del Arenal	Los Viscos	Pottery
LAZ279	444-7	Argentina	Catamarca	Santa Maria Valley	Morro de las Espinillas	Pottery
LAZ280	448-18	Argentina	Catamarca	Santa Maria Valley	Morro de las Espinillas	Pottery
LAZ281	448-14	Argentina	Catamarca	Santa Maria Valley	Morro de las Espinillas	Pottery
LAZ282	449-16	Argentina	Catamarca	Santa Maria Valley	Morro de las Espinillas	Pottery
LAZ283	454-6	Argentina	Catamarca	Santa Maria Valley	Morro de las Espinillas	Pottery
LAZ284	448-15	Argentina	Catamarca	Santa Maria Valley	Morro de las Espinillas	Pottery

ANID	Ceramic Type	Form	Context
LAZ176	triangulo Rojo con reborde Negro sobre ante	Sherd	
LAZ177	Recipiente globular polícromo (semejante al estilo Guachipas)	Sherd	surface
LAZ178	Marrón sobre ante	Sherd	layer
LAZ179	Recipiente abierto Rojo Pulido	Sherd	surface
LAZ180	Vaquerías? Diaguita chileno?	Sherd	surface
LAZ181	Vaquerías polícromo	Sherd	
LAZ182	Frag. policrono: cír. concentricos negros y rojo sobre ante	Sherd	Ampajango I Rec. Sup. U5 14/196
LAZ183	fragmento de cuerpo glubular Marrón sobre ante Aguada	Sherd	Mesa Redonda Excavacion en andén
LAZ184	Cuello de Tinaja Marrón sobre ante Aguada	Sherd	
LAZ185	San Pedro Rojo Grabado o Candelaría Rojo Grabado	Sherd	
LAZ186	Ollita tosca de paredes delgadas	Sherd	Compound A structure 20 test pit 1 level 8 tridi
LAZ187	Fragmento pulido con pintura roja (Condorhuasi?)	Sherd	compound A structure 20 test pit 1 level 1
LAZ188	Condorhuasi tricolor, con punto de inflexión	Sherd	surface
LAZ189	Frag. de cuello con repres. antropomorfa gris-negro pulido	Sherd	structure 16 level 5
LAZ190	Frag. con repres. ornitomorfa y policromía (Condorhuasi?)	Sherd	structure 16 C3 level 6 (tridi)
LAZ191	Cuenco pulido	Sherd	structure19 C3 level 7 (tridi)
LAZ192	olla pulida	Sherd	structure 1
LAZ193	cántaro rojo	Sherd	structure 1
LAZ194	ollita pulida	Sherd	structure 1
LAZ195	olla calciforme	Sherd	structure 3
LAZ196	cuenco pulido	Sherd	structure 2
LAZ197	vasija pulida	Sherd	structure 2
LAZ198	vasija efigie modelado quirquincho	Sherd	structure 2
LAZ199	Olla globular	Sherd	structure 1
LAZ200	modelado zoomorfo	Sherd	structure 3
LAZ201	Ollita calciforme	Sherd	structure A
LAZ202	Ollita pulida y pintada	Sherd	structure A
LAZ203	Jarrita gris incisa	Sherd	structure A
LAZ204	Vaquerías	Sherd	structure 1
LAZ205	Vaquerías	Sherd	structure 3
LAZ206	Vaquerías	Sherd	structure 5
LAZ207	Vaquerías	Sherd	surface
LAZ208	Vaquerías	Sherd	surface
LAZ209	Vaquerías	Sherd	surface
LAZ210	recipiente tosco muy delgado con pintura	Sherd	structure 2
LAZ211	borde ordinario	Sherd	structure 2
LAZ212	borde ordinario con labio recto	Sherd	structure 2
LAZ213	borde ordinario baño rojo	Sherd	structure 2
LAZ214	olla ordinaria delgada	Sherd	structure 2

ANID	Ceramic Type	Form	Context
LAZ215	Jarrita gris puilido inciso	Sherd	structure 2
LAZ216	olla ordinaria	Sherd	structure 3
LAZ217	cuenco borde engrosado con punto angular	Sherd	structure 3
LAZ218	olla tosca con cuello levemente evertido	Sherd	structure 3
LAZ219	Jarro gris pulido	Sherd	structure 3
LAZ220	Cántaro tosco	Sherd	structure 3
LAZ221	Jarro ante pulido	Sherd	structure 4
LAZ222	Ollita ante pulida	Sherd	structure 5
LAZ223	Jarrito fino ante con círculo inciso	Sherd	structure 5
LAZ224	Olla con cuello evertido	Sherd	structure 5
LAZ225	cántaro ordinario	Sherd	structure 5
LAZ226	cuenco gris pulido	Sherd	structure 5
LAZ227	jarrita gris pulida	Sherd	structure 5
LAZ228	olla ordinaria	Sherd	structure 5
LAZ229	jarra ante rojiza con labio revemente engrosado	Sherd	structure 5
LAZ230	jarra ante rojiza labio recto	Sherd	structure 5
LAZ231	olla con cuello marcado	Sherd	structure 5
LAZ232	olla ordinaria con cuello levemente evertido	Sherd	structure 5
LAZ233	olla ordinaria borde desgastado	Sherd	structure 5
LAZ234	olla ordinaria	Sherd	structure 5
LAZ235	olla ordinaria	Sherd	structure 5
LAZ236	jarrito gris	Sherd	structure 5
LAZ237	cuenco gris pulido	Sherd	structure 5
LAZ238	Olla tosca	Sherd	structure 5
LAZ239	Cuenco con modelado ornitomorfo	Sherd	structure 5
LAZ240	vaso negro pulido	Sherd	structure 5
LAZ241	Vasija antropomorfa	Sherd	structure 5
LAZ242	fragmento Río Diablo	Sherd	structure 5
LAZ243	recipiente cerrado gris pulido inciso grueso	Sherd	structure 1
LAZ244	Tipo Fino Rojo liso	Sherd	structure 5
LAZ245	Tipo Tosco Rojo liso	Sherd	structure 3
LAZ246	Jarrito Río Diablo	Sherd	structure 18
LAZ247	Botellita incisa pulida	Sherd	structure 18
LAZ248	cuenco pulido	Sherd	structure 18
LAZ249	Jarra-Cántaro ordinario delgada	Sherd	structure 18
LAZ250	Jarrita fino rojo pulido	Sherd	structure 18
LAZ251	Escudilla ante pulida	Sherd	structure 19
LAZ252	Jarra con pintura roja sobre ante pulida	Sherd	structure 19
LAZ253	ordinary ware, finer	Sherd	kitchen floor

ANID	Ceramic Type	Form	Context
LAZ254	ordinary ware, finer, burnt	Sherd	cooking vcessel on occupational floor
LAZ255	grey thick incise	Sherd	possible Rio Diablo, body
LAZ256	possible Vaquerías style	Sherd	structure plan 1, hearth bottom.
LAZ257	bicolor	Sherd	
LAZ258	fine incise buff, ordinary	Sherd	
LAZ259	ordinary grey incise	Sherd	
LAZ260	polished ordinary	Sherd	
LAZ261	grey ordinary with mica	Sherd	
LAZ262	polished ordinary buff, thick, compact paste	Sherd	
LAZ263	partially painted and incised	Sherd	occupational floor
LAZ264	polished ordinary, with feldespar	Sherd	occupational floor
LAZ265	ordinary with thick mica	Sherd	occupational floor
LAZ266	thin ordinary, orange	Sherd	occupational floor
LAZ267	ordinary, kitchen	Sherd	
LAZ268	incised 'combed', ordinary	Sherd	
LAZ269	tosco alisado	Sherd	
LAZ270	ordinary red, finely incised	Sherd	
LAZ271	red slip	Sherd	
LAZ272	incised ordinary/possible imprinted	Sherd	
LAZ273	irregular incised, red	Sherd	
LAZ274	Aguada painted	Sherd	
LAZ275	Aguada incised polished grey	Sherd	
LAZ276	Aguada (thicker incised)	Sherd	
LAZ277	ordinary ware	Sherd	
LAZ278	ordinary ware	Sherd	R120/R120/R120/R120/R120
LAZ279	Cuenco con rombos grabados con grabado interno	Sherd	test pit 3
LAZ280	Tinaja fina negro y rojo/ante	Sherd	test pit 4
LAZ281	Cuenco gris pulida con líneas grabadas oblicuas	Sherd	test pit 4
LAZ282	Olla 449-16 tosca globular	Sherd	test pit 4
LAZ283	Tinaja 454-6	Sherd	test pit 5
LAZ284	Tinaja fina superficie marrón	Sherd	test pit 4

ANID	Period	Chemical Group	As	La	Lu	Nd	Sm	U	Yb	Ce	Co
LAZ176	Formative Period	Group 9	5.7817	37.0544	0.4257	30.0147	7.1723	3.7969	2.8740	77.0450	17.8390
LAZ177	Formative Period	Group 2	5.3450	35.2667	0.5042	30.0185	6.8444	3.4862	3.3318	75.0442	15.3901
LAZ178	Formative Period	Group 2	4.9820	36.3447	0.4484	33.0326	7.1407	4.1947	2.8821	77.4896	17.9021
LAZ179	Formative Period	Group 2	5.3345	40.2153	0.4880	35.7176	7.4462	5.0145	3.2029	86.7571	18.3736
LAZ180	Formative Period	Group 9	15.4801	41.5269	0.5113	37.9363	8.5139	2.9390	3.7922	81.9537	17.8710
LAZ181	Formative Period	Group 9	12.5645	52.1161	0.4931	44.9762	9.9633	4.1256	3.6417	105.0489	19.4045
LAZ182	Formative Period	Group 7	5.0640	44.0756	0.5053	39.2685	8.4488	6.3066	3.2121	96.9821	16.7362
LAZ183	Formative Period	Group 2	5.9353	37.6496	0.4804	33.0919	7.2829	4.8712	3.1563	78.9339	16.2137
LAZ184	Formative Period	Group 2	4.6086	37.8603	0.3956	33.5702	7.2804	3.4660	2.8636	79.2504	19.9948
LAZ185	Formative Period	Unassigned	13.6352	32.3447	0.4549	26.8338	5.7356	3.1397	3.1229	74.6584	12.2968
LAZ186	Formative Period	Unassigned	8.8706	38.6462	0.4678	34.9325	7.7461	2.8583	3.1636	74.5689	12.8419
LAZ187	Formative Period	Group 3	10.9630	42.9264	0.4474	36.5554	8.0558	4.5937	3.0383	93.1049	10.3524
LAZ188	Formative Period	Group 3	9.7925	33.7630	0.4332	28.5991	6.3164	4.7537	2.7656	79.2359	11.0661
LAZ189	Formative Period	Group 2	6.3109	35.6624	0.4487	32.4305	7.2146	5.5607	2.6141	76.0049	17.2560
LAZ190	Formative Period	Group 9	9.9481	36.0533	0.4491	30.4030	6.9053	3.4992	3.0834	79.6877	16.6054
LAZ191	Formative Period	Group 2	5.2696	34.3861	0.4477	34.0768	7.0694	4.1132	3.2291	73.2822	17.4377
LAZ192	Formative Period	Group 2	6.8658	33.6530	0.4231	31.5657	6.8950	4.6322	3.2887	71.6560	17.2867
LAZ193	Formative Period	Unassigned	3.9723	32.0963	0.6944	28.9678	6.7756	3.5401	5.3481	67.0027	15.5963
LAZ194	Formative Period	Unassigned	13.0132	49.0299	0.6261	47.5120	10.8310	3.5370	4.7158	98.0242	14.3722
LAZ195	Formative Period	Group 2	4.9733	34.5725	0.4326	29.2772	6.7775	3.8443	2.8205	73.3641	16.8136
LAZ196	Formative Period	Group 9	6.4421	36.0446	0.4073	33.3752	7.5917	3.1827	3.0107	77.4078	18.3568
LAZ197	Formative Period	Group 2	5.5050	34.5230	0.4186	30.2102	7.0003	4.9231	3.2498	72.9872	17.0733
LAZ198	Formative Period	Group 9	5.4592	46.1219	0.5338	38.8961	8.9847	5.7962	3.7843	103.0279	20.3062
LAZ199	Formative Period	Unassigned	13.1240	45.9617	0.4836	40.5618	8.8691	3.5431	3.3781	91.4444	14.6562
LAZ200	Formative Period	Unassigned	19.6468	21.4432	0.4507	21.0292	4.3635	6.3979	2.2268	45.1117	10.4285
LAZ201	Formative Period	Group 9	13.1962	42.8106	0.3980	38.4894	8.2491	1.7277	3.2452	87.3486	14.2883
LAZ202	Formative Period	Group 7	4.8034	44.1085	0.4643	38.9462	8.6925	4.2778	3.1063	107.7152	13.5729
LAZ203	Formative Period	Group 10	6.1193	33.6800	0.4991	30.1201	7.2586	6.0401	3.5747	77.8132	12.4827
LAZ204	Formative Period	Group 9	7.4607	47.6652	0.4793	42.1141	9.7427	4.4190	3.5421	100.1510	16.4784
LAZ205	Formative Period	Group 9	7.3921	47.2657	0.4964	42.9492	9.6182	4.2562	3.6151	100.5334	16.6736
LAZ206	Formative Period	Group 9	6.7630	42.4026	0.4661	40.1319	8.6103	3.6863	3.1381	80.7295	14.6017
LAZ207	Formative Period	Group 9	10.6735	45.1915	0.4661	40.7965	9.3984	3.7159	2.9378	94.0698	16.4056
LAZ208	Formative Period	Group 9	8.6611	49.2486	0.4655	44.7134	10.1060	3.7026	3.5607	94.5415	15.9239
LAZ209	Formative Period	Group 9	10.1676	45.8562	0.4880	41.4787	9.1181	3.7450	3.5271	90.2523	15.8930
LAZ210	Formative Period	Group 10	8.3180	34.0803	0.3469	31.5741	7.0022	6.4976	2.2905	61.0824	7.2654
LAZ211	Formative Period	Group 6	15.5862	48.3612	0.5152	44.5590	9.8370	2.0742	4.2143	82.7108	13.0541
LAZ212	Formative Period	Group 6	15.1188	48.6316	0.5762	44.1319	10.2752	3.8041	4.3281	92.1622	12.8893
LAZ213	Formative Period	Unassigned	19.9821	39.7641	0.4884	35.0040	7.8349	3.2516	3.6279	81.0095	10.8912
LAZ214	Formative Period	Group 6	16.0289	48.8377	0.5806	42.4220	9.4435	4.4983	4.2343	91.9071	14.3949

ANID	Period	Chemical Group	As	La	Lu	Nd	Sm	U	Yb	Ce	Co
LAZ215	Formative Period	Group 3	9.9925	32.0314	0.4160	26.9352	5.6457	5.0852	2.6403	68.4994	8.6081
LAZ216	Formative Period	Group 6	21.3396	52.6476	0.6895	46.1208	10.9618	4.1241	5.2694	106.2867	13.7804
LAZ217	Formative Period	Group 3	11.8851	46.6489	0.5227	41.5436	8.6047	3.8177	3.6312	92.0797	11.4618
LAZ218	Formative Period	Group 6	20.2269	54.6449	0.6727	53.8543	11.6627	4.3719	4.7618	94.9155	12.9935
LAZ219	Formative Period	Unassigned	7.8252	42.8449	0.6111	36.5733	8.4160	6.9836	4.0325	88.5232	10.3046
LAZ220	Formative Period	Unassigned	14.3446	56.2427	0.6005	57.8386	13.1825	3.3063	4.5021	115.8876	19.8142
LAZ221	Formative Period	Unassigned	8.2502	43.7475	0.5356	37.9532	8.7324	4.0909	3.7224	97.2163	12.1846
LAZ222	Formative Period	Group 2	5.9570	34.6244	0.4428	31.9475	7.0344	4.3655	2.8891	70.0015	15.9831
LAZ223	Formative Period	Group 6	14.8450	56.9474	0.5818	56.1757	12.4143	4.0169	4.6042	91.8591	12.8817
LAZ224	Formative Period	Unassigned	16.0331	41.0490	0.3731	38.1815	8.5755	2.2421	3.0425	82.7571	10.9095
LAZ225	Formative Period	Group 6	15.3052	47.7164	0.5618	44.2360	10.1708	2.7867	4.5406	85.1509	12.7508
LAZ226	Formative Period	Group 2	5.3766	33.7509	0.4330	29.9485	6.6538	4.4161	2.6695	70.4536	14.0890
LAZ227	Formative Period	Group 9	5.3631	37.8327	0.4751	33.8270	7.6549	3.8332	3.4040	78.9045	17.5904
LAZ228	Formative Period	Unassigned	14.8308	36.1358	0.4027	32.6292	7.4974	2.6692	3.2419	75.3382	13.8584
LAZ229	Formative Period	Unassigned	7.0428	36.2348	0.3355	32.4600	7.1547	2.3487	2.6846	72.5366	13.3657
LAZ230	Formative Period	Group 9	10.3860	38.3601	0.3770	34.3521	7.7045	3.2517	3.0870	83.0465	15.8336
LAZ231	Formative Period	Group 6	25.2187	55.5081	0.6252	55.0486	12.0892	3.8019	5.2298	99.4648	12.8002
LAZ232	Formative Period	Group 6	17.3181	53.6285	0.5661	47.9958	10.7108	3.0330	4.4949	100.4462	15.0900
LAZ233	Formative Period	Group 6	21.5058	59.0981	0.6308	56.9652	12.0481	3.1467	5.0950	120.3677	14.1874
LAZ234	Formative Period	Unassigned	13.9499	42.9625	0.5023	37.3444	8.1015	3.8950	3.3204	86.6219	14.3342
LAZ235	Formative Period	Group 6	9.2373	47.6433	0.4964	44.1437	9.5322	2.6122	4.0161	91.0666	15.0656
LAZ236	Formative Period	Unassigned	12.4453	43.3615	0.5413	37.9634	8.4163	2.5619	4.2492	81.8878	13.0474
LAZ237	Formative Period	Group 3	11.5891	52.3259	0.5291	46.9105	9.9620	2.7772	4.3433	103.4877	9.6534
LAZ238	Formative Period	Unassigned	18.3105	51.8196	0.4890	48.4926	11.0435	2.4119	3.8147	90.1379	14.1378
LAZ239	Formative Period	Group 9	5.2972	35.7190	0.3565	31.9601	6.8134	3.6849	2.3017	74.7328	16.4710
LAZ240	Formative Period	Unassigned	8.1486	35.9145	0.6904	34.2887	7.5966	9.9138	3.5202	81.6312	26.7099
LAZ241	Formative Period	Unassigned	21.3328	36.0432	0.4034	36.3025	8.0669	1.7728	3.0898	85.4991	20.8518
LAZ242	Formative Period	Unassigned	4.7021	44.6812	0.4489	40.3241	8.5595	4.1297	2.9621	93.0773	11.6851
LAZ243	Formative Period	Unassigned	4.6605	44.2350	0.4495	43.7365	8.3061	3.9990	3.3942	96.2672	12.1751
LAZ244	Formative Period	Unassigned	12.2418	48.9559	0.4838	41.1040	8.4520	3.9295	3.5306	98.5250	17.3290
LAZ245	Formative Period	Group 6	23.5917	51.2526	0.6252	47.7445	10.5909	3.0088	5.0748	99.6827	13.9249
LAZ246	Formative Period	Unassigned	3.7115	63.4958	0.6432	56.6960	12.0420	7.0213	4.0852	138.7525	9.8713
LAZ247	Formative Period	Group 9	6.2537	43.7845	0.5031	38.5341	8.3929	4.1817	3.0538	90.7398	18.1085
LAZ248	Formative Period	Group 9	13.8689	47.0364	0.5046	45.3400	9.1305	4.5354	3.3128	101.1023	20.1744
LAZ249	Formative Period	Unassigned	7.1293	38.2320	0.5136	37.6218	9.0324	3.2560	4.2102	66.5546	9.7869
LAZ250	Formative Period	Unassigned	9.7587	35.8300	0.4292	32.7347	7.0448	3.5167	3.2708	75.4621	12.7833
LAZ251	Formative Period	Group 2	5.2722	35.6047	0.4798	32.0484	7.1451	4.2711	2.9814	75.3135	15.8232
LAZ252	Formative Period	Group 10	7.7423	41.7927	0.5317	36.8372	8.2453	6.9518	3.0035	89.0251	15.4141
LAZ253	Formative Period	Group 10	4.4388	27.3264	0.4228	25.7480	5.9112	5.7681	2.4625	63.8137	11.6207

ANID	Period	Chemical Group	As	La	Lu	Nd	Sm	U	Yb	Ce	Co
LAZ254	Formative Period	Group 10	3.2012	30.2478	0.4039	26.1610	6.0725	3.7184	2.4980	61.3977	9.4428
LAZ255	Formative Period	Unassigned	8.0107	35.6617	0.5058	32.6493	7.2436	4.7600	3.6640	81.1018	11.2012
LAZ256	Formative Period	Group 2	5.0135	34.3036	0.4262	32.7206	6.8700	4.1328	2.6631	75.5613	18.4874
LAZ257	Formative Period	Unassigned	6.2662	24.3900	0.3419	23.3583	5.0025	1.8696	2.6241	49.6498	11.4027
LAZ258	Formative Period	Unassigned	3.2757	45.7825	0.9875	40.8950	9.9232	11.5186	5.9926	105.2844	10.8398
LAZ259	Formative Period	Group 10	8.2803	40.4165	0.3880	35.0397	7.9610	4.5461	2.9426	82.1312	14.3953
LAZ260	Formative Period	Group 3	7.1484	38.3349	0.4150	34.8232	7.5645	3.5486	2.5438	82.7454	12.4209
LAZ261	Formative Period	Group 10	4.5227	32.5003	0.4340	30.7836	6.7096	6.6481	2.3123	69.3749	10.0487
LAZ262	Formative Period	Group 8	10.0467	26.2542	0.3146	28.1805	6.3245	16.8835	2.2784	44.0563	7.8640
LAZ263	Formative Period	Group 10	7.1121	41.9915	0.4750	40.5792	8.5361	5.8808	2.5344	91.5860	12.0657
LAZ264	Formative Period	Unassigned	6.1925	45.4256	0.4093	42.0013	8.5369	4.3101	2.4296	89.5116	10.5958
LAZ265	Formative Period	Group 8	14.8012	22.4899	0.4324	23.2385	5.4467	6.7437	1.9241	38.2280	6.5493
LAZ266	Formative Period	Unassigned	8.3189	30.0443	0.3297	26.9547	6.0137	2.5874	2.5586	60.7186	12.4169
LAZ267	Formative Period	Group 8	9.0767	19.2324	0.3760	20.4992	5.1330	6.1638	1.9071	30.2716	4.5505
LAZ268	Formative Period	Unassigned	8.1143	45.5225	0.6744	39.5229	8.3535	7.9678	3.8825	98.8304	11.3307
LAZ269	Formative Period	Group 10	5.9234	36.4284	0.5318	36.1160	7.9366	5.5990	3.0667	95.5448	11.8070
LAZ270	Formative Period	Unassigned	3.6983	48.9783	0.5016	43.2624	9.5625	4.4250	3.6294	105.4954	14.0316
LAZ271	Formative Period	Unassigned	15.9849	34.8624	0.4386	31.9178	6.7635	2.7837	3.2867	70.8586	12.3096
LAZ272	Formative Period	Group 10	9.3515	39.9264	0.5478	54.6727	13.3146	6.1705	4.3778	237.6066	14.5368
LAZ273	Formative Period	Group 10	9.0792	31.8445	0.4548	32.3518	7.7903	5.1101	3.3284	99.5042	13.7576
LAZ274	Formative Period	Group 7	5.3506	44.0780	0.5259	41.8137	8.6466	6.0674	3.1693	96.8853	16.7650
LAZ275	Formative Period	Group 7	3.3582	33.3089	0.4700	31.6201	6.8649	5.4432	2.8892	73.1926	18.0161
LAZ276	Formative Period	Group 7	2.8568	36.9300	0.4958	31.4658	7.5213	6.9571	2.9194	83.0514	18.6280
LAZ277	Formative Period	Group 10	6.8514	37.8038	0.4610	35.4253	7.6999	7.4355	2.6190	79.8258	12.6178
LAZ278	Formative Period	Unassigned	7.3233	47.5093	0.6643	43.2789	9.3813	10.8243	4.1116	98.2351	12.7151
LAZ279	Formative Period	Group 2	11.1717	37.2830	0.4480	33.5334	7.4494	4.3621	2.9700	81.0394	18.1624
LAZ280	Formative Period	Group 2	9.2129	39.7732	0.4935	38.2489	7.9175	5.5687	2.8294	86.8754	17.4978
LAZ281	Formative Period	Group 2	6.4528	33.2224	0.4587	31.9040	6.7902	5.4157	3.0795	70.7236	16.3435
LAZ282	Formative Period	Unassigned	13.4857	39.0029	0.3285	40.1745	8.0999	3.9440	2.6275	82.6036	16.8288
LAZ283	Formative Period	Unassigned	3.5098	27.9170	0.3087	22.6982	5.1084	2.5528	2.0122	54.5882	15.1054
LAZ284	Formative Period	Group 2	5.6420	38.7959	0.5248	35.6482	7.6790	6.7912	2.8293	83.8096	15.7141

ANID	Cr	Cs	Eu	Fe	Hf	Ni	Rb	Sb	Sc	Sr	Ta	Tb	Th
LAZ176	72.960	15.2101	1.3937	48229.1	4.3368	79.19	180.88	1.0730	17.2550	157.42	1.3829	0.9137	13.1523
LAZ177	58.964	23.3076	1.3009	42067.5	5.3011	0.00	172.91	0.6280	14.6131	186.11	1.4169	0.9263	12.5633
LAZ178	59.695	17.4003	1.3533	48422.1	5.4123	47.81	175.06	0.6605	16.9065	324.36	1.6727	0.9181	14.2093
LAZ179	61.414	17.9676	1.4227	49711.7	6.2119	0.00	177.95	0.8036	17.2636	293.30	1.7805	0.9557	16.7855
LAZ180	75.175	11.6082	1.5956	49357.5	6.3709	59.69	153.73	1.8351	16.3890	0.00	1.1377	1.4154	13.5330
LAZ181	75.467	15.7326	1.9816	51431.9	5.1690	0.00	179.14	1.5258	18.3368	260.86	1.3747	1.3463	15.1742
LAZ182	41.129	21.0915	1.4934	46865.9	5.4980	0.00	188.09	0.6502	16.6704	276.66	2.0076	1.2038	18.3666
LAZ183	62.333	18.0907	1.3737	47108.2	5.8524	0.00	177.19	0.6798	17.7314	241.45	1.6570	0.9860	14.8115
LAZ184	62.047	16.9295	1.3976	52063.3	5.1248	0.00	175.51	0.6685	17.5467	291.22	1.5930	0.9969	14.2460
LAZ185	51.996	12.4299	1.0517	38740.7	7.3304	27.73	123.92	0.7629	12.5722	212.95	1.5071	0.8031	13.9488
LAZ186	53.952	11.4638	1.3785	42571.5	6.6462	43.28	128.89	0.5642	14.5164	197.08	1.3814	1.2349	14.0784
LAZ187	38.166	9.3799	1.4003	36793.3	7.8991	0.00	136.33	0.6172	12.2620	244.82	1.4967	1.0190	19.8332
LAZ188	39.761	9.9964	1.1675	37077.2	6.8089	0.00	140.06	0.6309	12.0563	334.83	1.6103	0.8590	16.3154
LAZ189	58.365	17.1944	1.3029	47402.3	5.2515	38.64	174.68	0.5695	16.8604	185.68	1.7087	0.9587	14.6906
LAZ190	61.349	9.2802	1.3126	43250.5	6.8404	0.00	123.92	0.5439	14.3378	153.42	1.2418	0.8713	13.3262
LAZ191	57.796	13.8727	1.4094	48513.9	5.2129	0.00	154.64	0.4192	17.6156	264.05	1.5124	0.8609	12.6739
LAZ192	52.956	14.9343	1.3236	44891.3	5.4714	0.00	155.49	0.5900	15.6240	236.28	1.5671	0.9386	14.1729
LAZ193	53.555	12.5018	1.3012	44123.8	4.7938	50.71	167.08	0.5631	14.9621	118.37	1.3284	1.3180	11.0950
LAZ194	54.769	12.4369	1.8810	44595.9	8.5928	41.45	167.59	0.5402	15.7469	182.26	1.5658	1.6527	18.4492
LAZ195	57.798	15.2530	1.2877	46022.0	4.9268	24.68	157.99	0.4907	16.0276	352.69	1.7040	0.9354	13.7247
LAZ196	64.076	15.6081	1.3607	51241.2	4.8160	0.00	155.20	1.0154	17.6300	269.60	1.5333	0.8999	13.2662
LAZ197	56.185	16.1841	1.2713	46643.0	4.9814	0.00	160.61	0.5572	16.4480	265.03	1.7711	0.8836	14.0804
LAZ198	77.064	18.2346	1.5945	52319.4	6.0870	0.00	183.53	0.7247	16.5278	227.96	1.7237	1.1094	16.6437
LAZ199	54.225	14.6617	1.5741	39981.8	7.3196	38.13	147.36	0.8106	13.7603	209.68	1.6197	1.1433	16.3670
LAZ200	34.388	17.9675	0.8416	31986.4	3.4245	29.36	203.31	0.5616	14.6389	173.74	4.0499	0.6555	6.8905
LAZ201	69.261	19.9132	1.5519	40578.0	6.0445	0.00	152.12	0.5582	13.9624	63.76	1.0895	1.0726	13.2614
LAZ202	37.050	11.6741	1.4380	41106.4	5.6099	0.00	164.83	0.2927	14.0659	184.64	1.7585	1.1618	18.6791
LAZ203	29.622	25.3690	1.3015	38012.4	4.3646	27.34	319.95	0.4131	13.1458	104.44	2.2336	1.1462	14.7295
LAZ204	67.993	11.6726	1.7230	42982.2	5.4306	36.50	157.27	1.1646	15.4336	202.21	1.3571	1.1952	13.9492
LAZ205	65.094	12.1620	1.7986	42845.3	5.6543	31.97	149.95	1.2563	15.1266	214.38	1.3322	1.1964	14.2037
LAZ206	62.116	10.7314	1.5957	40953.0	5.1271	33.26	135.45	1.4690	14.4794	361.24	1.2396	1.0676	12.6705
LAZ207	66.244	12.1997	1.7016	44692.8	5.1470	45.92	153.24	9.4857	15.2400	219.75	1.2457	1.1282	13.0506
LAZ208	63.555	11.7904	1.7909	42015.5	5.4390	36.34	141.22	1.5690	14.7819	262.15	1.2288	1.2530	12.9658
LAZ209	62.173	11.9876	1.6878	41400.6	5.3826	0.00	145.70	1.4600	14.5164	192.46	1.2191	1.1701	13.2174
LAZ210	38.193	81.4745	0.9891	36191.1	4.6948	0.00	317.83	0.6993	11.7768	95.05	3.9928	0.8097	15.8168
LAZ211	48.472	11.5357	1.6646	39093.8	7.0055	43.39	162.04	0.5074	13.7555	144.29	1.4133	1.7179	15.8016
LAZ212	48.725	12.5676	1.6872	39790.8	8.4459	37.13	166.70	0.6095	13.8953	96.38	1.4292	1.3956	17.2198
LAZ213	43.764	11.6565	1.2451	37290.2	6.8386	0.00	150.92	0.6141	12.6629	223.69	1.3852	1.0881	18.2060
LAZ214	46.668	14.6796	1.7088	40449.0	8.7576	40.91	152.87	0.6912	14.1114	158.35	1.4515	1.3472	17.6651

ANID	Cr	Cs	Eu	Fe	Hf	Ni	Rb	Sb	Sc	Sr	Ta	Tb	Th
LAZ215	40.379	12.1825	1.0378	37958.9	7.0321	0.00	126.23	0.6729	12.2825	384.37	1.7432	0.7114	16.4869
LAZ216	49.967	13.1810	1.7803	42459.4	8.8374	39.67	152.95	0.6102	15.2021	210.25	1.4793	1.5813	20.4181
LAZ217	46.821	11.6172	1.5530	36049.5	8.4881	0.00	116.43	0.3908	12.0364	332.96	1.1997	1.3469	17.1508
LAZ218	55.361	12.6420	1.9933	45660.6	6.5834	54.70	169.29	0.7434	15.3513	259.63	1.5635	1.6341	18.8311
LAZ219	31.351	10.5730	1.0940	34073.5	4.2425	0.00	218.11	0.4488	11.2815	181.27	2.6919	1.2218	28.4695
LAZ220	97.898	10.8600	2.4538	57452.1	6.0495	61.52	167.46	1.6775	19.9560	89.46	1.2232	1.8994	15.3008
LAZ221	34.801	11.2598	1.4415	39259.3	4.7557	0.00	167.58	0.4095	12.8783	196.41	1.4565	1.4590	17.9156
LAZ222	55.802	14.2254	1.3175	45947.5	5.0448	38.81	146.60	0.6065	16.1633	313.51	1.5533	0.8774	13.8596
LAZ223	53.400	12.8952	2.0794	39101.9	8.6989	40.80	104.07	0.8950	14.0651	263.94	1.3093	1.5730	17.2078
LAZ224	43.784	9.7041	1.4459	34353.8	5.2447	37.26	154.85	0.5019	12.0086	193.83	1.1655	1.1163	15.2459
LAZ225	46.504	9.1391	1.8448	37231.5	6.8797	37.27	155.95	0.4304	13.4923	183.91	1.2521	1.5199	15.1945
LAZ226	55.387	14.1026	1.2719	44605.4	5.4747	0.00	155.08	0.4804	16.0791	272.87	1.6159	0.8508	14.1175
LAZ227	68.036	15.1345	1.4701	50641.9	5.0711	0.00	163.79	0.6152	18.1586	272.33	1.5378	1.0289	14.2787
LAZ228	51.448	9.7284	1.3393	38695.5	7.0296	26.19	161.87	0.4472	13.2933	180.33	1.2118	1.0273	13.1723
LAZ229	52.190	7.1177	1.3212	40420.0	6.1470	0.00	113.90	0.3952	13.5034	256.67	1.1410	0.8973	12.0092
LAZ230	57.310	9.8290	1.4454	45486.9	5.6273	21.85	118.01	0.5379	14.8986	188.09	1.1171	0.9941	12.6996
LAZ231	55.631	12.5196	2.0210	45471.8	7.2374	38.10	177.36	0.6458	15.5548	277.67	1.5208	1.7520	20.1756
LAZ232	49.016	13.5629	1.9511	42432.6	8.7911	45.28	139.06	0.7451	14.7051	280.18	1.5333	1.4591	18.4215
LAZ233	56.261	12.6831	1.7677	43575.8	7.6295	44.62	172.15	0.6362	15.5392	229.82	1.5116	1.8631	21.9812
LAZ234	53.216	13.7204	1.4757	39097.5	7.2899	43.36	145.92	0.8642	13.5041	211.11	1.3201	1.0494	14.9466
LAZ235	48.376	15.0463	1.7026	45574.8	7.9505	41.87	173.18	0.5903	15.3278	169.10	1.3831	1.3046	16.8951
LAZ236	58.402	8.5275	1.6568	44320.0	5.8167	49.47	114.52	0.4922	16.8662	324.26	0.9897	1.1076	14.7668
LAZ237	40.238	8.1295	1.6992	33989.1	6.7767	0.00	76.40	0.4388	11.5623	327.37	0.9356	1.5436	20.5427
LAZ238	49.286	11.5933	1.9271	40110.9	7.0696	0.00	154.22	0.6608	14.3756	109.30	1.3511	1.4405	16.9993
LAZ239	65.855	11.5909	1.3191	48342.0	5.3404	38.89	146.94	0.3577	16.8776	247.45	1.4566	0.8192	13.9254
LAZ240	52.091	10.0288	1.3187	43499.3	5.5433	57.06	134.39	1.3838	15.2767	119.38	1.6749	1.0131	13.8746
LAZ241	49.050	15.2959	1.4079	32969.9	5.9613	23.06	127.32	1.0467	12.9892	160.46	1.2076	1.1515	17.4442
LAZ242	33.771	7.0310	1.6377	38501.3	6.6134	0.00	141.54	0.2186	13.7824	216.46	1.2789	1.0973	14.8226
LAZ243	32.094	9.2701	1.4953	37863.1	5.9972	0.00	137.66	0.3432	13.3689	299.72	1.2556	1.4590	15.2505
LAZ244	54.167	13.7148	1.3992	37747.5	7.3057	30.18	138.95	0.5319	12.2206	494.25	1.4005	1.0764	18.2964
LAZ245	54.832	13.4778	1.6136	42911.7	8.5313	52.83	172.74	0.5626	14.9312	142.32	1.5340	1.4890	19.7657
LAZ246	28.028	10.6405	1.3629	31707.1	6.2556	0.00	255.08	0.2837	11.4386	157.00	2.6548	1.5317	32.6152
LAZ247	80.263	18.0403	1.5283	49438.1	5.3510	0.00	183.43	0.6369	16.5552	156.68	1.7134	1.0585	15.6559
LAZ248	77.863	19.0827	1.6474	52359.5	5.1002	0.00	191.02	0.6785	16.9218	158.01	1.6683	1.2129	16.7712
LAZ249	37.867	27.2610	1.5668	28289.9	6.0089	30.62	195.70	0.3977	10.4303	69.61	1.4113	1.4018	12.3735
LAZ250	48.321	13.0602	1.3231	40978.8	7.2490	0.00	139.57	0.6090	13.9363	234.50	1.2312	0.9414	14.5528
LAZ251	53.481	14.0693	1.3239	45145.3	5.6801	0.00	164.43	0.4487	16.2546	273.66	1.5786	0.8889	15.4328
LAZ252	46.402	31.2984	1.4473	43811.1	4.0240	0.00	242.63	0.6765	15.1050	77.16	1.9252	1.3075	15.7493
LAZ253	29.776	15.2834	0.9853	34691.8	3.6750	0.00	237.37	0.4366	12.6167	127.38	1.7234	0.7317	11.7062

ANID	Cr	Cs	Eu	Fe	Hf	Ni	Rb	Sb	Sc	Sr	Ta	Tb	Th
LAZ254	22.319	18.4484	1.0045	27392.7	3.0018	0.00	264.00	0.3033	10.2970	79.40	1.6901	0.7545	11.0902
LAZ255	33.291	11.4699	1.1652	34872.2	4.4406	0.00	204.08	0.4223	11.9283	186.41	2.1796	1.0054	21.2793
LAZ256	59.155	15.8280	1.3399	48465.5	5.0353	0.00	164.15	0.5803	17.4136	260.58	1.5873	0.8740	13.3612
LAZ257	56.195	24.7130	0.9417	42631.6	6.3198	0.00	155.18	0.5228	13.6598	116.39	1.4790	0.6631	11.5060
LAZ258	27.175	8.6416	1.0038	31710.8	6.3178	0.00	305.91	0.3681	9.9372	86.58	5.5274	1.4741	32.1623
LAZ259	44.807	29.0287	1.4302	41608.8	3.9087	0.00	243.20	0.5952	14.8260	92.80	1.9095	1.0319	14.3988
LAZ260	42.155	11.3377	1.3121	36689.0	5.9872	35.43	155.57	0.6094	12.3918	233.12	1.4314	0.8708	15.1127
LAZ261	29.355	36.2974	1.0174	30184.3	3.4945	28.87	352.64	0.4329	11.1383	82.93	3.9473	0.8455	13.5135
LAZ262	21.681	82.8570	0.9638	23065.3	3.5733	0.00	563.93	1.2060	10.7393	47.21	31.7324	0.8499	8.3190
LAZ263	32.778	25.8613	1.3118	34550.9	4.2750	0.00	291.60	0.5997	11.5842	89.31	2.8145	1.0972	17.5459
LAZ264	53.976	8.4616	1.2417	36597.6	6.5642	0.00	120.83	0.5751	12.9843	152.22	1.1884	0.9765	17.2337
LAZ265	17.687	94.7487	0.7516	20524.6	3.7400	0.00	652.96	1.1367	11.6857	63.01	7.2057	0.7752	7.6131
LAZ266	50.172	9.7285	1.1333	40364.9	6.2403	28.38	114.75	0.5632	13.2832	164.17	1.2101	0.8159	12.9883
LAZ267	19.480	88.7517	0.7768	18350.5	2.8590	0.00	481.68	1.5908	7.9708	43.32	5.7124	0.7471	6.1202
LAZ268	24.622	13.2988	1.1114	34764.2	6.1836	30.31	308.23	0.4194	11.1661	170.03	3.3280	1.2929	39.7742
LAZ269	30.104	16.8134	1.3743	34279.8	4.1005	0.00	226.57	0.3117	12.6504	106.85	1.6249	1.0724	14.2450
LAZ270	39.714	12.2325	1.5549	42598.2	8.0720	0.00	192.49	0.3665	15.2150	170.95	1.5643	1.2244	18.9418
LAZ271	43.601	9.7447	1.2056	37321.9	6.7645	19.66	116.43	0.8001	12.7383	137.18	1.1145	0.8866	12.6714
LAZ272	45.268	23.7394	2.3498	43450.7	3.4542	0.00	241.95	0.6434	15.1630	100.91	1.5081	1.8901	15.0922
LAZ273	41.019	22.2963	1.3616	40436.4	3.4479	0.00	238.15	0.6282	14.1458	129.65	1.4624	1.1098	14.0129
LAZ274	39.620	17.1018	1.5000	46783.6	5.0861	0.00	176.09	0.5112	17.1629	261.79	1.6599	1.0191	17.6793
LAZ275	40.791	14.4088	1.1942	46789.5	4.2733	26.94	150.43	0.3726	16.1374	286.30	1.5023	0.8808	15.4630
LAZ276	41.076	16.1388	1.2900	48388.2	4.7700	0.00	173.67	0.4474	16.6689	240.15	1.6122	0.8870	17.5992
LAZ277	37.757	22.9051	1.2611	36582.5	3.9758	0.00	235.79	0.7596	12.5023	65.93	2.4463	0.9330	14.8486
LAZ278	32.194	8.2259	1.6932	42226.6	7.1976	0.00	173.04	0.2562	13.2890	362.52	1.8662	1.2101	20.2027
LAZ279	60.005	18.7259	1.3718	49627.6	5.3380	47.14	186.92	0.7405	18.1583	206.70	1.6042	0.9269	15.2928
LAZ280	55.340	16.6809	1.3602	46294.5	5.7719	0.00	159.65	1.0638	16.1827	285.89	1.7795	0.9262	17.5864
LAZ281	56.740	15.1139	1.3362	46523.6	5.2874	0.00	171.65	0.3930	16.9822	268.53	1.6170	0.8595	13.7321
LAZ282	56.533	34.3160	1.3577	46873.6	4.9077	33.09	203.82	0.9007	14.1678	252.52	1.1920	0.9868	13.9143
LAZ283	49.755	17.9116	1.2852	45288.2	3.4267	0.00	144.70	0.4111	15.7454	255.35	1.0050	0.6307	6.9128
LAZ284	50.755	18.7275	1.2935	42525.0	5.9695	0.00	185.64	1.1923	14.9088	152.92	1.9425	0.8329	17.2134

ANID	Zn	Zr	Al	Ba	Ca	Dy	K	Mn	Na	Ti	V
LAZ176	115.58	111.68	92611.0	710.3	19759.8	5.0696	36483.3	970.72	12772.7	5106.6	122.18
LAZ177	106.45	147.31	87694.7	445.2	16361.0	4.7394	32289.6	945.97	12879.4	4743.2	87.36
LAZ178	109.70	143.97	84019.5	417.2	31668.7	3.7522	31687.5	1300.87	13192.6	4520.1	110.87
LAZ179	116.08	159.40	86272.3	310.0	21975.7	4.3923	30753.4	1054.00	13546.7	4421.7	91.02
LAZ180	117.24	173.81	95393.6	440.1	5627.0	5.1469	28835.0	807.67	9918.3	5650.0	102.87
LAZ181	122.77	143.04	96994.9	603.5	24262.3	6.5693	35100.3	1018.82	10577.1	4870.6	110.44
LAZ182	115.94	132.94	83322.4	355.2	28225.8	5.1570	29309.1	1132.00	13882.7	5039.8	82.55
LAZ183	103.24	171.23	85048.3	502.1	22922.3	4.3762	31788.7	908.77	13310.0	4856.0	113.38
LAZ184	129.66	135.31	90700.6	397.9	23487.0	3.8420	30861.5	978.23	10869.7	6082.1	105.68
LAZ185	88.00	182.20	87265.0	722.5	12960.9	3.8689	26681.2	653.60	10430.5	4789.8	101.40
LAZ186	101.86	161.85	84144.6	561.0	12539.3	5.6613	26893.6	612.47	11900.0	5175.9	102.58
LAZ187	69.21	210.06	86623.4	764.7	13947.0	4.8693	26628.7	609.52	14843.0	4502.5	73.48
LAZ188	77.03	166.62	91360.3	901.0	15794.7	3.9211	25963.4	687.41	13825.4	4453.4	85.00
LAZ189	111.97	154.46	81634.0	623.4	20433.6	4.0653	32853.0	1057.73	10987.8	5422.5	119.32
LAZ190	92.34	191.80	86246.6	490.2	12276.9	4.9322	22883.3	718.33	11899.6	5655.7	105.45
LAZ191	111.91	139.65	90875.5	513.7	18883.2	5.3643	31630.3	1112.48	11367.6	5807.7	97.07
LAZ192	107.18	178.82	79680.5	375.8	25222.8	3.9995	30734.7	956.50	17889.4	4830.3	87.91
LAZ193	106.06	133.22	90492.7	373.3	21690.2	6.3496	32706.2	959.86	11463.6	5490.9	94.32
LAZ194	91.39	216.56	85404.6	649.4	25483.5	4.3415	28891.9	1035.89	12758.2	5152.0	101.74
LAZ195	113.69	155.55	91617.3	524.6	13883.9	9.0908	27203.9	879.71	12335.1	5724.0	90.06
LAZ196	121.94	138.84	83738.7	693.9	24464.6	5.2930	30409.8	938.74	10432.2	5341.6	110.97
LAZ197	120.02	114.20	83258.9	545.0	24441.6	4.4788	31299.0	1021.11	14360.4	5827.0	97.48
LAZ198	122.32	175.69	89345.4	374.9	10301.9	5.3380	33545.6	816.01	12420.0	5487.8	124.92
LAZ199	95.18	197.41	85799.3	480.5	15711.3	5.1780	25999.7	748.73	13939.6	4424.1	106.90
LAZ200	79.48	82.36	108798.5	263.6	48524.1	2.8931	31769.9	928.75	7392.9	3469.2	64.35
LAZ201	84.34	140.95	78944.7	748.9	7117.7	5.3636	30526.6	544.45	10650.0	5243.2	109.41
LAZ202	89.58	145.72	79940.4	767.0	12564.5	5.0182	31785.6	734.44	12807.4	4404.0	87.50
LAZ203	97.06	113.84	82040.2	382.1	11499.1	6.2732	38775.9	698.21	10677.7	3774.9	53.57
LAZ204	106.54	140.41	87179.5	751.8	23051.2	5.6430	31223.6	889.41	9222.0	5067.6	100.36
LAZ205	99.14	166.76	89647.6	466.6	25330.2	5.7595	28898.7	862.13	8981.5	4893.3	117.57
LAZ206	92.32	162.92	85072.0	1166.0	22820.7	4.8325	28944.7	760.90	8520.2	5017.8	96.10
LAZ207	94.49	131.02	91900.2	729.3	22814.4	5.5856	34179.9	1461.88	8659.8	4969.4	103.00
LAZ208	107.67	142.89	86427.6	727.8	28424.6	6.2992	29529.8	951.27	8953.1	5628.1	98.15
LAZ209	92.07	150.15	85627.5	535.2	20952.8	5.8428	32150.4	966.68	10288.5	4877.3	111.99
LAZ210	77.29	118.91	93532.3	454.2	6896.7	3.8641	29105.3	252.21	13939.8	3652.5	96.52
LAZ211	85.36	175.02	87371.5	604.8	12046.9	7.5464	31333.0	711.60	12883.0	4995.2	89.92
LAZ212	82.74	203.51	91777.0	467.8	10503.0	11.0304	30721.7	851.91	14741.2	4869.4	100.68
LAZ213	74.77	181.85	82236.5	733.3	12609.0	5.1985	25261.3	586.33	11492.2	5415.5	96.38
LAZ214	76.09	201.28	100722.1	690.1	12460.6	8.0073	27235.3	780.79	13592.6	4908.4	107.49

ANID	Zn	Zr	Al	Ba	Ca	Dy	K	Mn	Na	Ti	V
LAZ215	82.88	183.65	91554.3	1035.4	16176.9	4.0584	22646.9	402.12	14263.8	5385.2	77.40
LAZ216	79.09	246.43	87985.1	732.8	12288.9	8.3941	26866.2	752.35	12246.2	5452.0	103.43
LAZ217	79.75	233.48	84192.4	1034.0	17268.4	6.5580	24694.1	699.56	15752.6	4548.0	87.60
LAZ218	113.05	201.10	88636.1	642.9	15985.2	9.9735	27436.6	712.80	11522.7	4671.1	124.00
LAZ219	80.82	113.48	78199.6	395.0	18200.7	6.2937	33913.1	565.62	17003.3	3198.2	70.11
LAZ220	116.84	180.48	96847.8	838.1	5827.5	8.4602	33539.7	842.33	7207.4	6089.9	150.91
LAZ221	85.52	129.87	83854.4	487.1	17944.3	6.8242	30566.4	668.88	18693.7	4029.3	85.35
LAZ222	118.80	162.82	84521.6	881.4	20764.0	4.3165	30273.0	864.62	14271.0	5707.4	94.28
LAZ223	78.41	209.82	81748.3	988.5	16574.3	7.3282	21331.2	592.44	11868.8	4725.1	97.57
LAZ224	75.53	144.18	80607.0	807.0	12459.7	6.1645	29689.2	512.73	13382.1	4652.4	73.62
LAZ225	79.95	173.57	83242.0	630.6	12021.0	7.8189	32337.7	620.91	10643.1	4653.0	85.00
LAZ226	105.78	172.96	83750.7	875.4	20455.8	4.7934	29370.9	705.05	14966.5	5706.7	101.30
LAZ227	121.26	139.59	83122.8	681.0	19448.5	5.6801	28925.3	863.94	11926.0	6477.7	110.87
LAZ228	88.48	192.04	88845.9	568.0	11471.4	5.8938	35959.4	797.51	11034.8	4471.9	106.03
LAZ229	100.39	139.70	84035.3	1091.5	17286.0	4.6330	25877.7	984.89	15313.6	5309.0	77.52
LAZ230	123.81	151.17	85956.9	687.7	12470.6	5.7777	26500.4	833.16	10006.0	4980.5	102.11
LAZ231	96.51	175.55	90513.4	563.9	14269.4	8.3246	30649.8	610.60	11776.7	5293.1	124.53
LAZ232	86.88	217.73	94676.1	764.3	15604.2	7.4931	28456.9	892.60	12835.4	5436.2	107.24
LAZ233	100.21	203.69	88071.6	587.9	13868.5	9.8339	28553.7	605.45	12485.1	4780.2	108.10
LAZ234	92.64	185.76	81903.3	751.4	13372.9	6.4257	27649.8	768.19	11696.9	4184.6	89.33
LAZ235	96.14	210.92	87699.4	530.0	12415.0	7.0033	29102.9	837.12	12170.8	5582.3	84.27
LAZ236	111.67	175.98	84098.4	973.3	15579.9	6.4095	21797.2	675.51	10029.8	5757.3	108.60
LAZ237	69.14	176.57	82647.3	672.3	15635.8	5.7596	16540.5	543.43	14260.5	4354.7	77.62
LAZ238	78.49	184.61	85271.0	469.6	11346.3	8.6237	27225.1	718.37	10456.6	5382.8	91.46
LAZ239	179.41	120.54	83002.9	765.4	15682.1	3.4639	27211.9	641.24	10963.3	5514.6	115.41
LAZ240	164.94	172.53	88984.2	0.0	29814.0	1.9232	21081.2	4206.52	6384.4	2200.0	69.89
LAZ241	71.82	145.29	85241.9	772.6	9978.0	6.2237	24297.4	525.02	5589.9	4949.7	93.14
LAZ242	93.30	177.99	81742.8	933.9	14644.7	6.1318	30684.3	524.86	15761.9	5300.7	88.72
LAZ243	97.62	152.53	74543.3	847.5	20384.8	5.8384	28862.9	681.24	16645.1	4081.7	89.95
LAZ244	99.86	186.93	75701.3	1255.8	18748.2	5.0876	24146.9	721.67	13699.7	5017.1	94.41
LAZ245	91.84	209.60	92260.8	542.1	12594.2	8.8881	30079.4	699.91	11026.8	4859.8	115.54
LAZ246	75.76	155.27	76959.6	426.7	17965.6	7.0647	31402.7	570.91	19897.3	3510.7	73.77
LAZ247	131.73	152.22	85096.9	501.5	10933.7	4.8107	36080.2	635.56	13645.9	6657.8	150.67
LAZ248	133.15	141.03	87084.1	386.3	13512.8	5.8004	33978.9	821.92	11255.9	6828.5	140.17
LAZ249	78.31	158.85	77909.9	391.2	9675.7	8.8839	28363.5	529.42	5506.8	3433.9	73.38
LAZ250	99.32	184.85	85271.7	538.1	13129.8	4.6562	26597.8	562.21	12856.3	5140.7	100.15
LAZ251	120.02	155.17	81414.5	404.6	17455.3	5.0288	30490.2	1008.70	14564.5	4464.5	89.47
LAZ252	112.77	128.12	87551.2	306.3	16832.1	5.0965	38427.0	734.91	13391.1	4989.1	92.79
LAZ253	85.32	105.69	75346.0	283.7	11359.2	3.7791	29663.6	590.64	12835.8	3824.3	68.10

ANID	Zn	Zr	Al	Ba	Ca	Dy	K	Mn	Na	Ti	V
LAZ254	79.09	101.02	74991.0	251.1	8519.9	4.4952	40480.3	501.44	16955.4	3305.4	66.28
LAZ255	87.94	124.05	78994.6	422.1	15547.3	5.5226	32521.5	796.44	14722.6	3642.5	102.33
LAZ256	115.17	126.89	85342.9	509.4	24462.3	4.2960	31092.7	1185.56	12252.9	4928.6	115.00
LAZ257	88.60	145.32	78346.1	591.6	12193.6	3.4617	21797.0	449.16	10627.5	5456.4	90.05
LAZ258	86.95	154.58	75289.1	244.3	8065.3	7.8979	33667.8	539.31	16149.6	3452.6	65.49
LAZ259	92.82	107.49	85225.3	362.1	15722.2	5.2774	39325.0	873.92	13137.7	5183.5	97.17
LAZ260	85.93	167.26	89175.6	536.6	13366.2	4.3643	27196.9	612.72	15988.8	5369.9	80.45
LAZ261	85.14	103.77	82238.9	215.6	11188.8	4.7188	36437.1	729.28	17888.0	4092.8	57.34
LAZ262	119.04	83.41	81989.2	230.9	7920.5	3.6540	29986.8	2019.47	15336.7	1802.0	28.62
LAZ263	97.19	139.29	84966.7	285.9	14948.8	4.5149	35661.4	961.13	15240.1	4337.7	82.50
LAZ264	94.11	174.36	77313.8	520.3	10458.8	5.6348	23619.5	494.31	13836.2	4384.4	73.62
LAZ265	123.42	86.72	86856.7	153.9	7349.8	3.3535	32523.3	1517.28	16181.6	1556.3	35.33
LAZ266	89.77	157.71	86368.2	393.5	10692.5	4.1629	24870.5	556.38	13489.2	5931.0	81.01
LAZ267	94.85	91.88	85957.4	99.5	6625.8	3.7637	32212.7	616.24	20885.2	1990.6	37.86
LAZ268	82.46	176.66	76751.3	345.7	12155.9	5.7566	37218.2	547.46	17027.8	3794.0	52.40
LAZ269	86.56	117.17	83406.9	361.1	13284.6	5.1969	30442.4	701.37	18459.9	3959.9	65.62
LAZ270	99.14	231.72	81063.6	397.8	16000.0	6.7680	29189.6	666.54	17588.2	5454.5	91.95
LAZ271	77.61	187.01	83432.4	567.8	8520.5	4.7195	22583.0	868.12	14250.1	4646.7	84.95
LAZ272	126.30	117.72	90940.3	354.9	14617.5	8.9668	31929.8	1097.47	14183.1	4975.4	114.42
LAZ273	121.56	96.24	89184.1	270.0	13153.2	6.3409	34109.1	817.17	15386.3	5328.5	98.57
LAZ274	95.29	137.13	84882.5	447.5	24973.5	5.5362	28999.9	1081.39	14605.7	4562.2	84.92
LAZ275	116.84	97.31	82825.9	335.0	21672.8	4.4876	32569.0	1033.18	14760.4	5721.8	91.60
LAZ276	119.34	135.64	90540.5	354.8	23935.4	5.4035	26010.8	1138.77	14323.4	5926.5	88.22
LAZ277	97.12	112.76	81304.7	406.2	13614.9	4.5799	37937.0	1049.76	14465.9	3771.6	85.43
LAZ278	82.60	209.33	102834.7	242.9	26853.5	6.7154	28791.0	808.06	15842.4	5270.3	95.36
LAZ279	123.45	131.80	85260.6	469.7	20403.2	5.0544	34994.2	1070.58	10995.7	5282.0	112.87
LAZ280	113.26	132.60	86545.3	676.1	17665.7	5.7135	33246.0	1174.54	11834.6	5518.7	94.67
LAZ281	113.36	124.61	91663.6	662.9	20079.0	4.2057	28606.4	1075.03	11802.2	5493.2	100.65
LAZ282	116.36	136.57	82164.6	306.6	25189.4	4.2516	27964.8	664.52	19460.6	4857.2	86.26
LAZ283	106.02	83.36	82793.9	379.9	17192.0	3.3004	31077.3	719.30	19626.3	5382.2	99.94
LAZ284	108.15	165.91	87204.7	419.4	16645.0	4.9164	27621.9	1085.18	13361.2	4934.5	89.01