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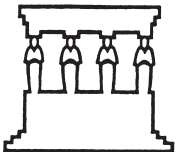

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CERAMIC ANALYSIS OF LACONIAN PROTOGEOMETRIC POTTERY FROM TEGEA AND AMYCLAE

Introduction

A natural development of the recent excavation campaign at Tegea was to develop and implement a research project employing chemical composition analysis for the ceramics recovered. This research was intended to address questions concerning, among other things, ceramic production sources and distribution systems. The large quantity of Laconian Protogeometric (Laconian PG or Laconian "Dark Age" [LDA]) pottery recovered at the site made this research approach particularly attractive. Up until recently, Laconian PG was known almost exclusively from sites in Laconia (especially Amyclae, but also from other Laconian sites, such as Artemis Orthia, Athena Chalkioikos, the Heroon). The exceptions to this were the existence of a few sherds from Tegea and Asine, sites outside of Laconia, but still within the Peloponnese.[1] Now, with over 1000 (catalogued and uncatalogued) Laconian PG sherds excavated from Tegea,[2] the picture has changed dramatically.

Key features of Laconian Protogeometric wares include a repertoire of distinctive shapes, with an apparent preference for carinated skyphoi; rectilinear ornament, often in two superimposed registers; horizontal grooves and ridges used as decoration; a distinctive reddish yellow or reddish fabric; and usually, but not always, shiny metallic black paint.[3]

Many thanks to Dr Ian Whitbread, then Director of the Fitch Laboratory at the British School at Athens for agreeing to take on this project. Thanks are also due to Dr Matthew Ponting for conducting the analysis at the Fitch Lab and for his critical role in interpreting the results. I am grateful also to the many graduate students who assisted me in selecting the objects for analysis and attending the meetings in Athens, etc. including Teresa Moreno and Tracey Verkuilen. I am also most grateful to my research assistant, Thomas Fenn, for his invaluable help in this project and for assisting me in my understanding of the results of the ceramic analysis. (M.E. Voyatzis)

[1] Voyatzis, *Sanctuary,* 67 no. P9, pl. 4, fig. 8; B. Wells, *Asine* II, *Results of the excavations east of the Acropolis 1970–1974,* Fasc. 4: *The Protogeometric period*, Part 2: *An analysis of the settlement* (*SkrAth* 4°, 34.4.2), Stockholm 1983, 42, 124; Coulson, *Dark Age pottery*.

[2] See section **iii** (Voyatzis), 224–58.

[3] For further discussion, see section **iii** (Voyatzis), 224–30.

An important question that immediately arose was the place of production for the Laconian PG pottery found at Tegea. Voyatzis observed that some of the sherds from Tegea appeared to have different traits to the typical examples found in Laconia. Based on this observation, she suspected that it could have been locally manufactured in imitation of the style from Laconia. In order to pursue this question further, Voyatzis contacted Dr Ian Whitbread, then the Director of the Fitch Laboratory at the British School at Athens, in 1996, to help develop a viable ceramic analysis project proposal. Work began on this project in late 1997 with the chemical analyses conducted by Dr Matthew Ponting, then the Chemistry Fellow at the Fitch Laboratory. The results of these analyses and our interpretations follow.

An initial selection of 87 fine, decorated pottery sherds, ranging in date from the 10th to the 8th century B.C., was chosen for destructive chemical analysis. At the time, the pieces included 21 Laconian PG (LDA) sherds from Tegea, 25 Laconian PG (LDA) sherds from Amyclae in Laconia (from collections in the American School of Classical Studies in Athens and the British School at Athens), 21 Protogeometric to Early Geometric (PG/EG)[4] sherds from Tegea, and 20 Middle Geometric to Late Geometric (MG/LG) sherds from Tegea. (See *Tab. 1.a–b*[5]) The Tegean Laconian PG sherds all came from the bothros (or sacred pit), located in front of the two Geometric temples. The standard PG–MG material was uncovered in both in the bothros and the metal workshop above it, as well as from the Geometric temples. The selected Late Geometric sherds came only from the area of the two Geometric temples (Buildings 1 and 2).

The project was designed to test the following hypotheses:

1) – that the Laconian PG pottery from Tegea and that from Amyclae were made in two different production centres;

[4] This number includes one sherd that may be Submycenaean (**C-LH 17**); see section **iii** (Voyatzis), 199 and 202.

[5] The numbers for the Tegea material reflect the initial classificatory attributions of the sherds. After reexamination of the material and upon receiving the preliminary results of the chemical analysis of the sherds, some sherds were reassigned.

2) – that the composition of the Laconian PG pottery from Tegea is the same as that of the PG–LG pottery from the site, suggesting a common origin for this material, but different to the Laconian PG from Amyclae;

3) – that the Laconian PG fabrics from Tegea and Laconia have the same composition, which, in turn, is the same as the Tegean PG/EG. (If so, we must broaden our definition of what Laconian PG actually is);

4) – that the Laconian PG from Tegea and the standard PG–LG from Tegea all have the same composition, indicating continuous local pottery production from at least 900 B.C. (If, for example, the LG is different from the Laconian PG and EG from Tegea, then we may conclude that there were different, yet still possibly local, clay beds being used.)

Analytical procedure

Samples utilized for analysis were removed from the ceramic vessels by drilling with a diamond-impregnated drill, and collecting the resulting powder. Subsequently, this powder was oven dried at 105ºC. After drying, 30 mg from each sample was weighed into a platinum crucible, to which 90 mg of lithium metaborate was added. These were mixed in the crucible and then fused in a muffle furnace at 1050ºC for 25 minutes. The fused bead was subsequently dissolved in dilute nitric acid. Analysis was conducted utilizing inductively coupled plasma atomic emission spectrometry (ICP-AES) with a 40 MHz Free-running 1 kW generator Perkin Elmer Plasma 400 instrument.

The instrument was calibrated for 18 elements (Na, Mg, Al, Si, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Zn, Sr, La and Ce). Calibration was carried out using two multi-element standards prepared from commercial analytical single element solutions and matrix matched. Instrumental drift was monitored using multi-element solutions prepared in the same way as the calibration standards and inserted every ten samples. A standard reference material (IAEA Soil 7) was prepared in exactly the same way as the pottery samples and included at the beginning and end of each batch.

Instrumental precision is generally 1–3% relative, with this figure increasing as the respective detection limits are reached. Manufacturer's specifications and publications assessing instrumental performance inevitably report optimistic data acquired under ideal conditions, using single element aqueous solutions (Pollard and Heron 1996, 48). Accuracy and precision figures calculated on replicate analyses of the multi-element standard reference materials which are spread across all the analyses, is obviously a more realistic way of assessing data quality (Heyworth *et al*. 1991). This is especially true when a large number of samples from several chronologically spaced batches are being compared. In particular this is the case for the analyses of ceramics and glass, where the complex nature of the sample dissolution methods will inevitably produce solutions with high total salt content (Potts 1995, 183). Consequently, precision and accuracy for the data presented here were calculated using 30 independent samples of the reference material, Soil 7, which were spread across all the analyses. The average precision of analysis for the major elements (> 1%) is 5%, minor elements (> 100 parts-per-million [ppm]) is 7%, and for trace elements (< 100 ppm) it is 23%. These figures are in agreement with other similar studies (Heyworth *et al*. 1991, 146).

The accuracy of the analysis can also be estimated against the certified values for the standard reference material. The average margin of error for the major elements is 2%, for the minor elements 3%, and for trace elements it is 10%. The trace element accuracy, however, is misleading, because the accuracy becomes significantly poorer the closer we get to the limit of detection. Again the accuracy of the figures achieved here is consistent with those published in other studies (Heyworth *et al*. 1991, 146).

Statistical analysis methods

Following the chemical composition analysis, the data generated were examined by several comparative techniques. These included comparison by simple bivariate plots of the raw elemental weight percentage data and by simple statistical comparisons. Additionally, multivariate statistical analysis was employed utilizing principal components analysis (PCA)[6] of the standardized raw chemical data (Baxter 1994, 45–6).

The PCA examines the co-variation between the elemental data; if a set of elemental variables possesses some underlying common component, then the implication is that their values are correlated with one another (*i.e*. they are closely related to one another). The more closely related the elemental variables are in any one component, the stronger the common component will be, and the more meaningful that component will be on its own as a substitute for the original variables. The resulting components can then be compared in bivariate and trivariate plots.

Canonical discriminant function analysis (DA) was also employed to explore relationships between the principal components and the chronological data within the assemblage. This technique assumes the prior existence of distinct and known groups within the dataset (Baxter 1994, 185–6), and, therefore should be used with caution. The best discrimination occurs when the means of each group are widely separated with small intra-group variances so that the individual cases for each group are tightly clustered about the group centroid (Baxter 1994, 189). Chemical composition data included in various PCA and DA comparisons comprised combinations of all of the analyzed pottery sherds from both Tegea and Amyclae.

[6] Principal Components Analysis (PCA) was performed using the SPSS v10.0 for Windows software.

Results and discussion

The elemental composition data for the major and minor elements were converted to oxide weight percentages, while the trace elements were left as pure element values and reported in parts per million (ppm) of the element. The results of the chemical composition analysis can be found in *Tab. 1.a–b*. As mentioned above, compositional data for 18 elements were sought during chemical analysis, although only 17 of these elements were utilized for statistical comparisons. The measurements for silica (SiO_2), the dominant oxide in all samples analyzed, were not utilized in the multivariate statistical dataset to avoid the "closure" problem of data summing to 100% (Baxter 1994, 73).

General trends

Initially, the results were examined using simple bivariate plots of the raw elemental oxide composition data to explore general trends within the analysis dataset. Through these plots it was apparent that even gross elemental oxide comparisons, such as aluminium (Al_2O_3) vs manganese (MnO) oxide (*Fig. 1*) or calcium (CaO) vs manganese (MnO) oxide (*Fig. 2*), illustrated some very real and distinct separations within the analyzed ceramic assemblage. For example, when examining the Tegean pottery in *Fig. 1*, it is clear that the Laconian PG pottery type forms its own chemical group, comprising on average combined higher aluminum oxide and lower manganese oxide contents than the remaining dataset. These Laconian PG specimens plot discretely away from the majority of the remaining Tegean specimens, particularly the Middle and Late Geometric specimens. Likewise, the Amyclae Laconian PG pottery specimens share a virtually identical elemental oxide composition correspondence with the Tegean Laconian PG pottery, and as a result also plot discretely away from the reminder of the Tegean pottery dataset.

This pattern of chemical distinction between the Laconian PG types, from both Tegea and Amyclae, and the contemporary and later pottery types from Tegea is found in other elemental oxide composition comparisons as well. For example, *Fig. 2* illustrates a similar chemical separation between the Laconian PG specimens from both Tegea and Amyclae and the remaining Tegean pottery samples: the Laconian PG specimens clearly have significantly lower calcium oxide contents. These patterns are not reproduced by every bivariate comparison, suggesting that certain elemental oxides are more characteristic of some chemical groupings than others. For example, the Laconian PG specimens in the analyzed assemblage tend to have higher concentrations of aluminium and lower concentrations of calcium, while the opposite is true for most of the Middle and Late Geometric specimens. (*Figs 1–2*) This is almost certainly a factor of the geology of the original clay sources utilized to manufacture the pots as well as differences in clay preparation processes and manufacturing technologies employed within different production workshops (see discussion below).

Principal Component Analysis (PCA)

Based on these simple bivariate comparisons, it was deduced that real and potentially significant chemical distinctions existed within the analyzed pottery assemblage. As a result, these distinctions have been utilized to explore questions concerning manufacturing source(s) (including raw material source variability as well as technological production differences) and distribution networks. To this end, the compositional data was subjected to multivariate statistical analysis as discussed above.

Initially, principal component analysis (PCA) was employed on the chemically analyzed Tegean and Amyclaean pottery dataset. The PCA resulted in five principal components with elemental variable correlations greater than those produced simply by chance (*i.e.* "Eigenvalues" greater than 1). These five components accounted for 70% of the total variance within the 17 elemental oxides compared. The first two components accounted for almost 42% of the total assemblage variance, while adding the third component increased this to almost 55% of the total assemblage variance. Component values in these percentage ranges are typical when using this many variables in principal component analyses (Baxter 1994, 62).

To examine the relationship of the newly derived components, bivariate comparison plots were generated for the five components. Since the first three components accounted for the majority of the total assemblage variance, however, they proved to be the most illustrative when viewed as bivariate plot comparisons. The elements which were most important in defining the first principal component (in decreasing order of importance) were aluminum, strontium, calcium, titanium, zinc, potassium and vanadium. All of these elements had strong positive correlations with the exceptions of strontium and calcium, which had strong negative correlations. Likewise, the second component was defined by strong positive correlations of cobalt, manganese, iron and lanthanum and by a strong negative correlation of these elements with sodium.

When examining a bivariate plot of these first two components (*Fig. 3*), similar patterns to those exhibited by the raw oxide weight percentage comparisons are apparent. Again, the Laconian PG pottery from both Tegea and Amyclae share strong chemical similarities. (*Figs 1–2*) Likewise, the Laconian PG pottery from both sites generally exhibits a strong separation from the remaining specimens in the pottery analysis dataset. It is important to note the position of this Laconian PG chemical cluster in relation to the principal component axes and the remaining samples. (*Fig. 3*) The Laconian PG cluster's position on the right side of the x-axis (the

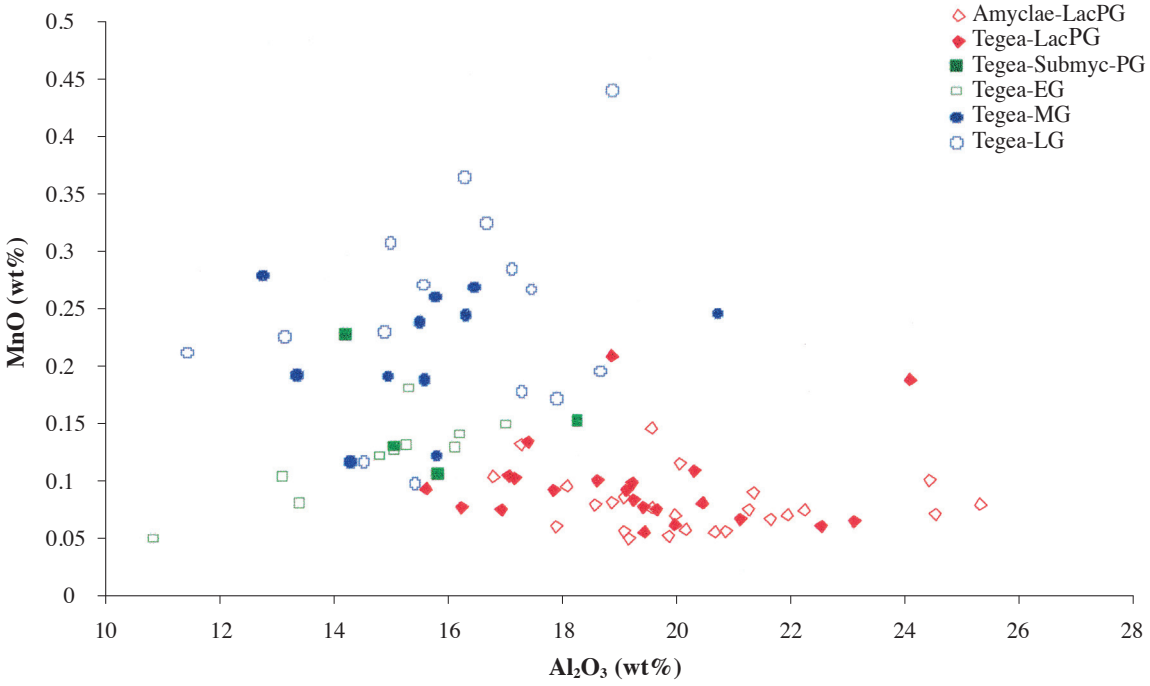

Figure 1. Bivariate plot of aluminium oxide versus manganese oxide weight percentages. Note how the Laconian Protogeometric sherds generally contain higher aluminium and lower manganese percentages, while the Middle and Late Geometric sherds generally contain the inverse proportions of these two oxides.

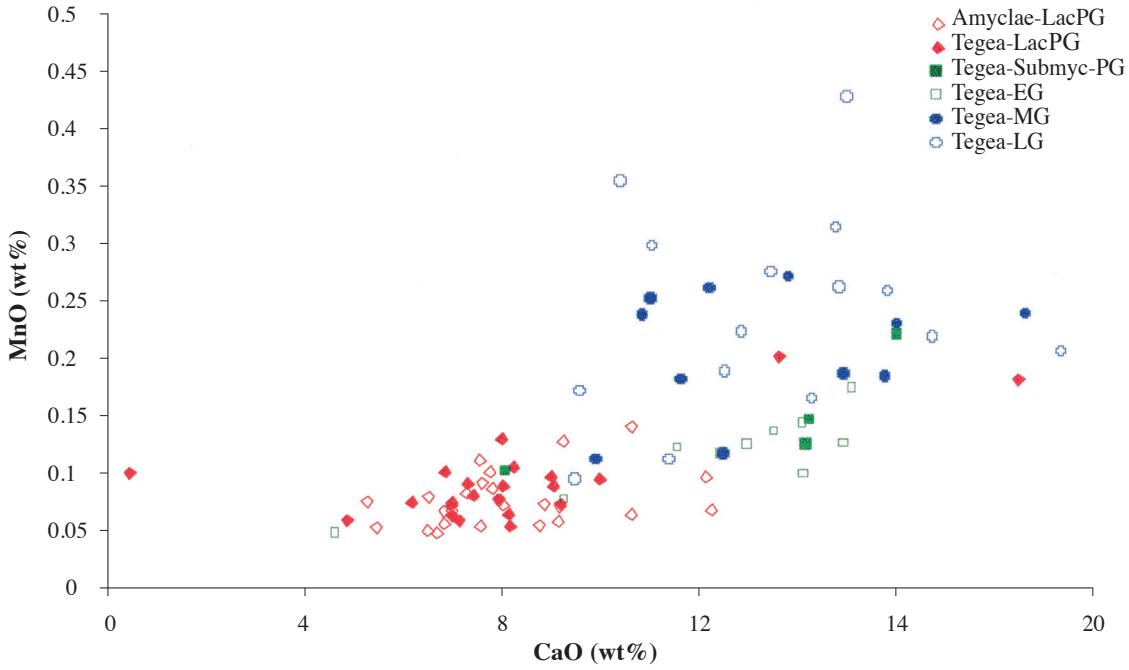

Figure 2. Bivariate plot of calcium oxide versus manganese oxide weight percentages. Note how the Laconian Protogeometric sherds generally contain lower calcium and manganese oxide percentages, while the Middle and Late Geometric sherds generally contain higher proportion of both of these two oxides.

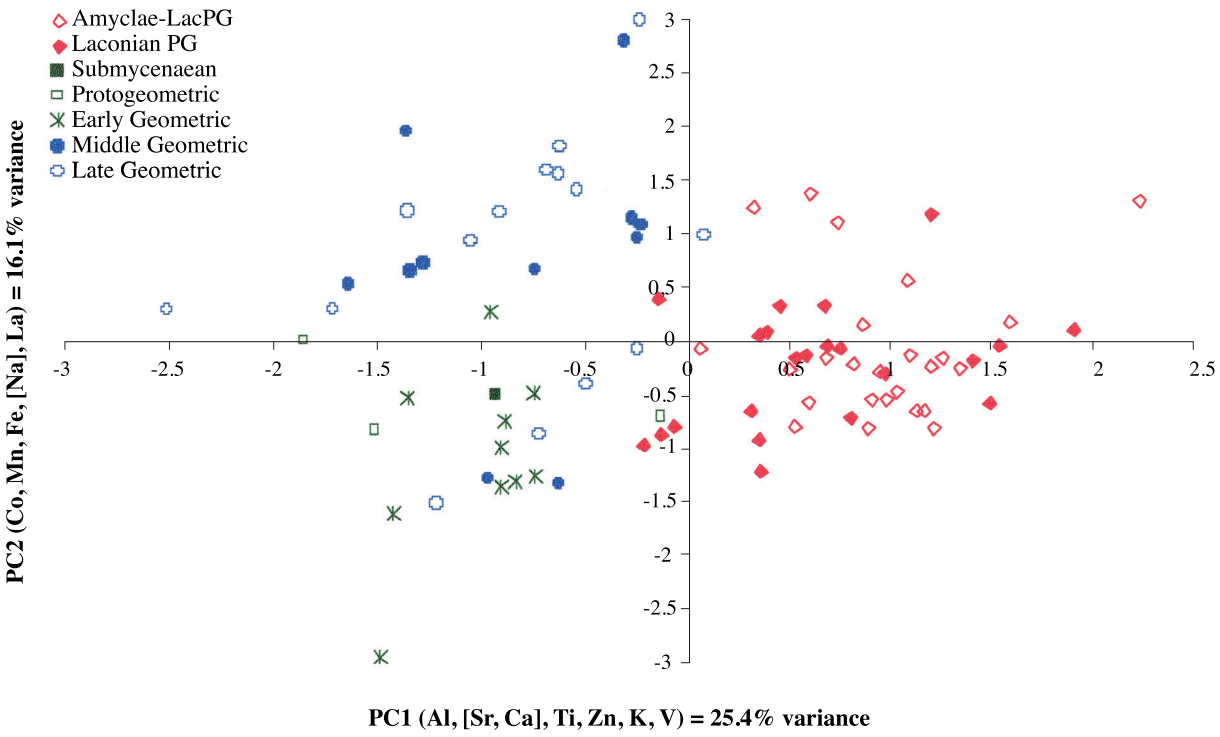

Figure 3. Bivariate plot of first two components resulting from principal component analysis of the sherds from Amyclae and Tegea. These two components account for 41% of the total variance. Note that the elements in brackets indicate negative correlation while the remaining elements have positive correlations.

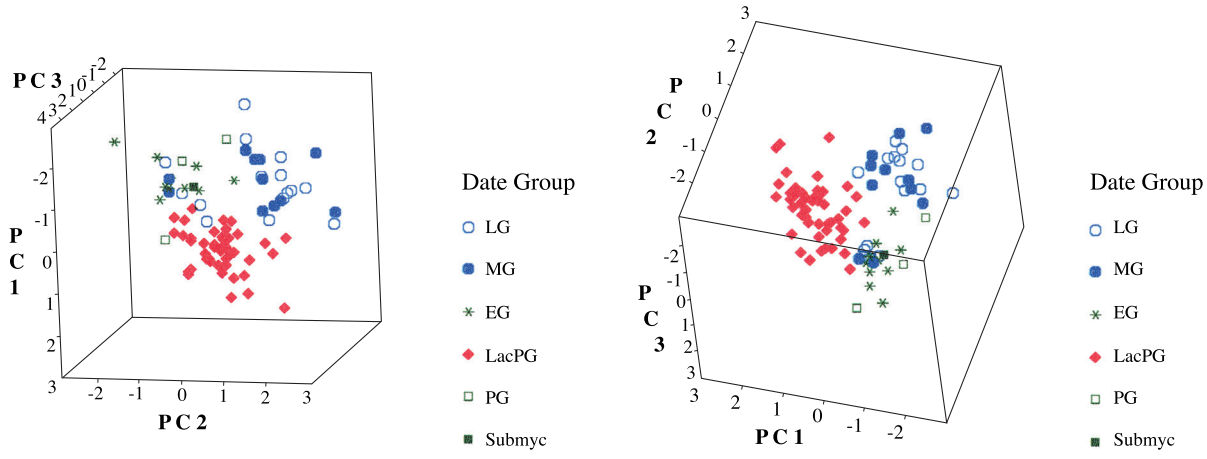

Figure 4. Trivariate plot (3D-plot) of the first three components resulting from principal component analysis of the Tegean and Amyclae pottery. These three components account for 55% of the total variance. Note how the three potential chemical groups generally remain distinct when rotated in three-dimensional space.

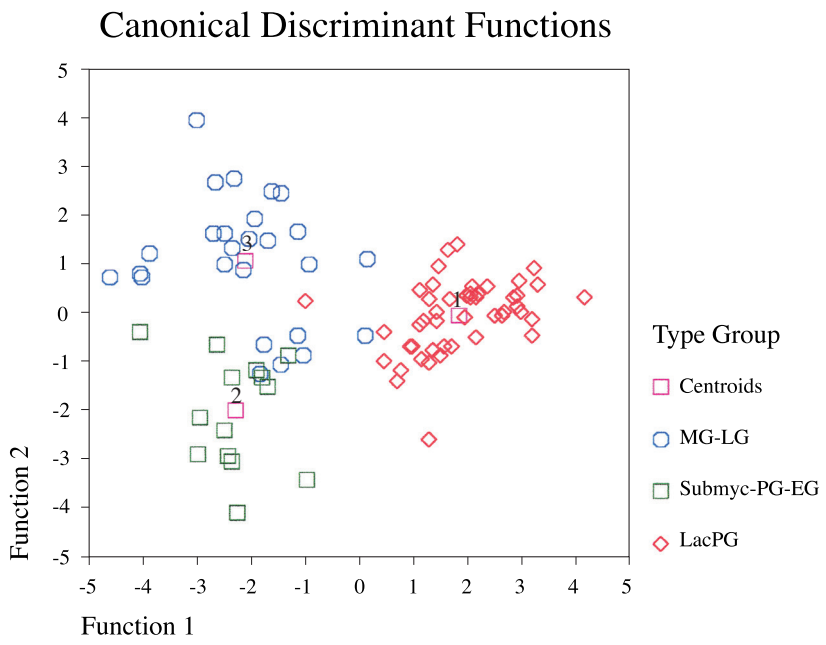

Figure 5.a. Bivariate plot of the first two functions resulting from discriminant analysis of the pottery from Tegea and Amyclae with the type group assignments.

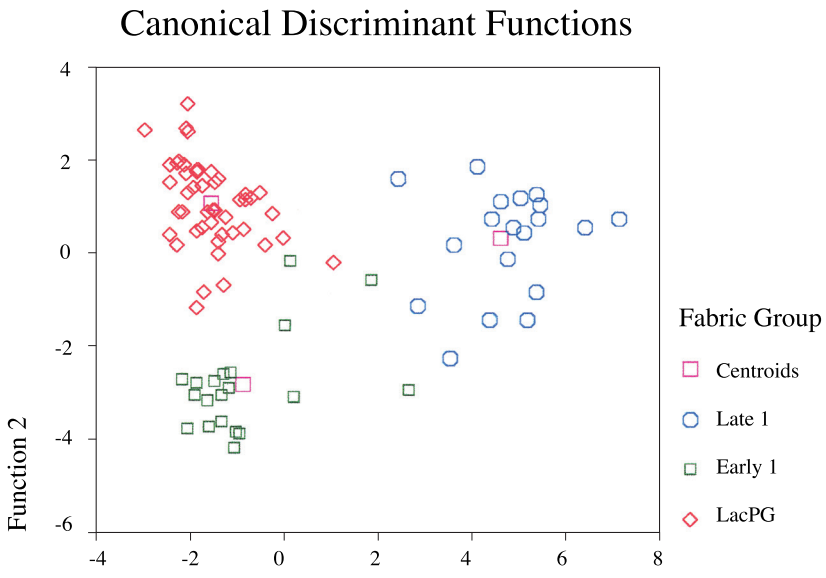

Figure 5.b. Bivariate plot of the first two functions resulting from discriminant analysis of the pottery from Tegea and Amyclae with the fabric group assignments (*i.e.* principal component analysis chemical groups).

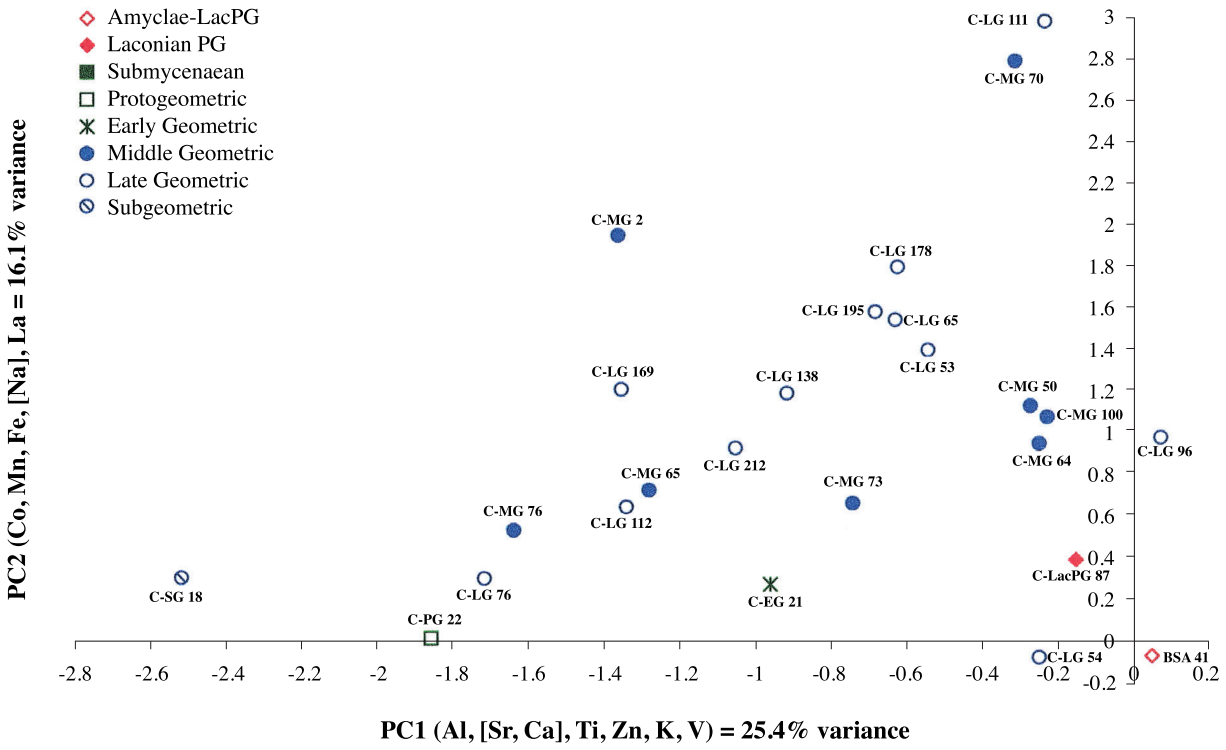

Figure 6.a. Upper left quadrant of bivariate plot of first two components resulting from principal component analysis of the sherds from Tegea and Amyclae. These two components account for 41% of the total variance. Note that the elements in brackets indicate negative correlation while the remaining elements have positive correlations.

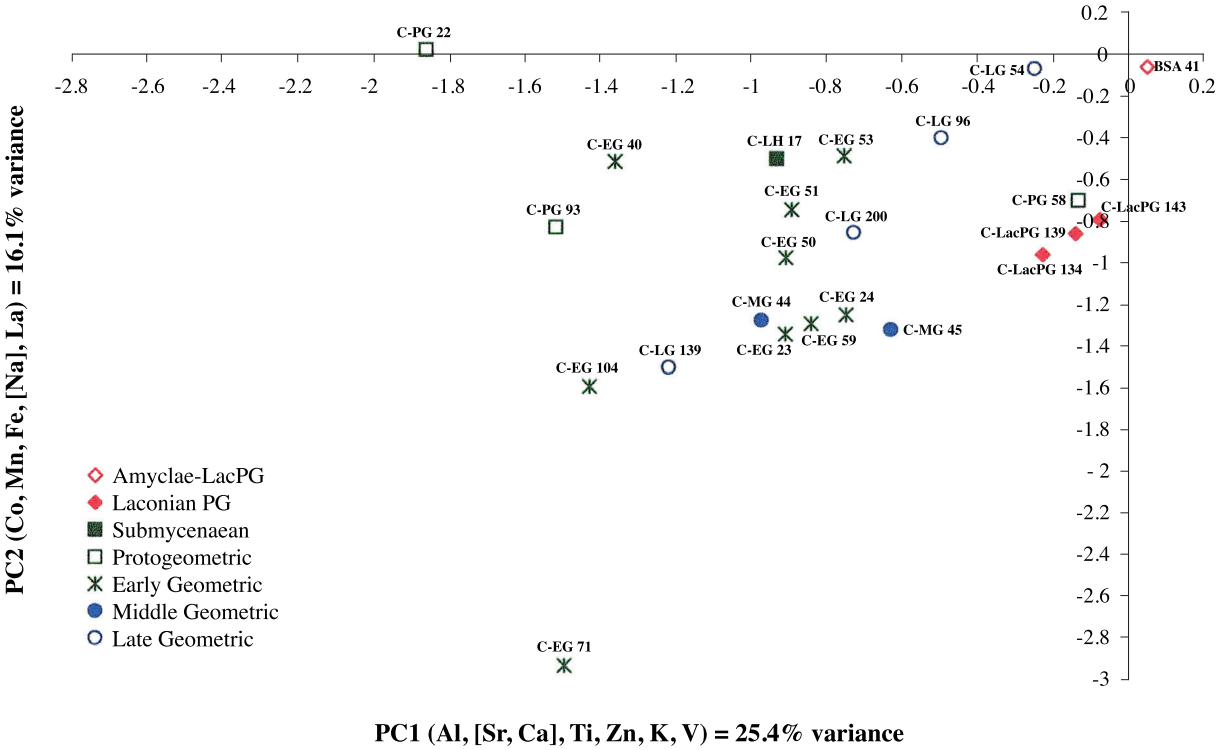

Figure 6.b. Lower left quadrant of bivariate plot of first two components resulting from principal component analysis of the sherds from Tegea and Amyclae. These two components account for 41% of the total variance. Note that the elements in brackets indicate negative correlation while the remaining elements have positive correlations.

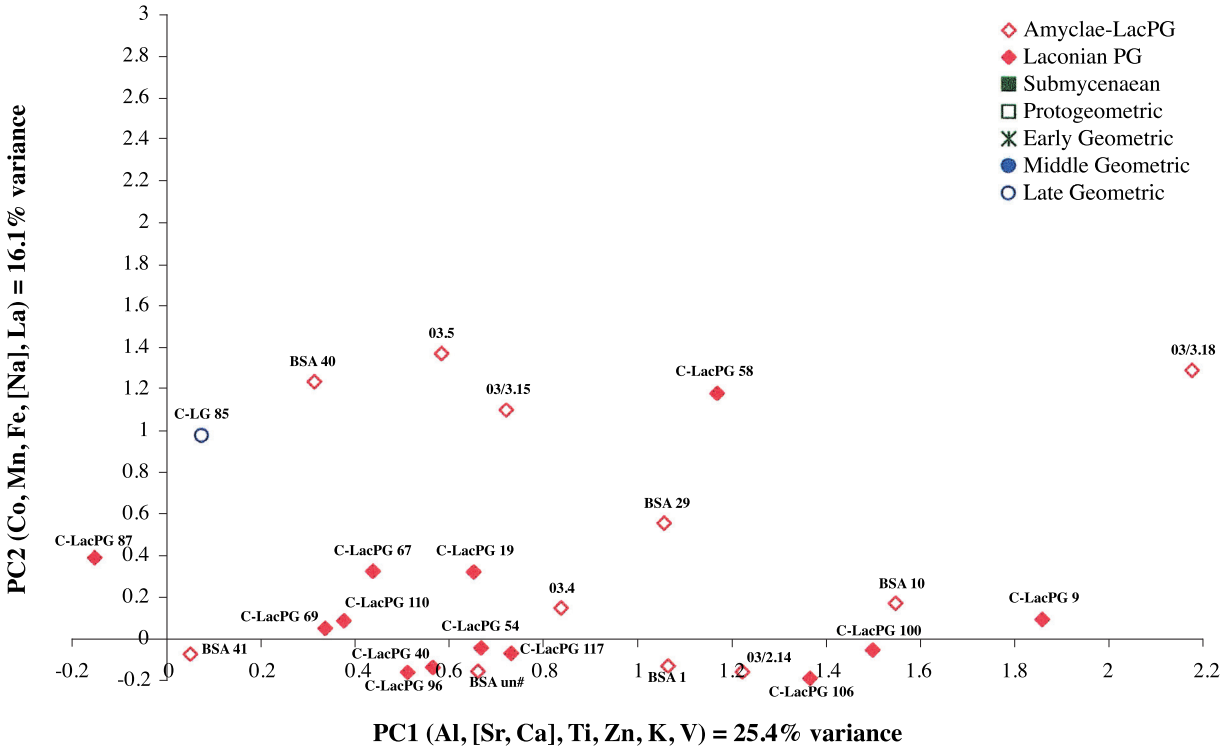

Figure 6.c. Upper right quadrant of bivariate plot of first two components resulting from principal component analysis of the sherds from Tegea and Amyclae. These two components account for 41% of the total variance. Note that the elements in brackets indicate negative correlation while the remaining elements have positive correlations.

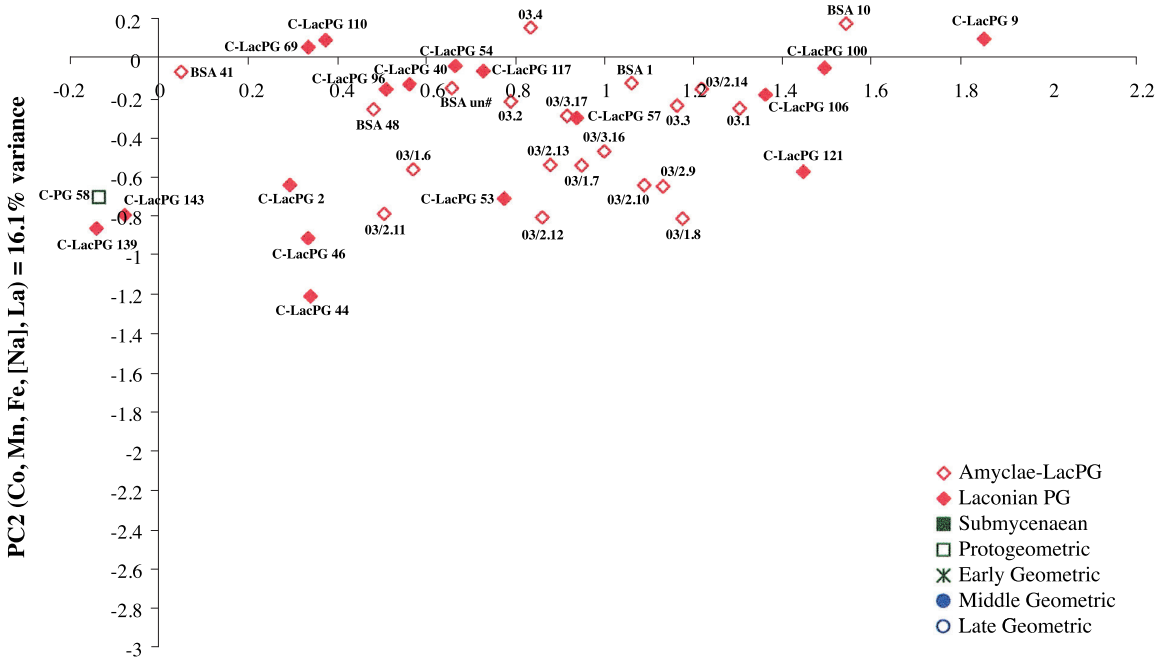

Figure 6.d. Lower right quadrant of bivariate plot of first two components resulting from principal component analysis of the sherds from Tegea and Amyclae. These two components account for 41% of the total variance. Note that the elements in brackets indicate negative correlation while the remaining elements have positive correlations.

positive side of PC1) indicates that the Laconian PG pottery from both Amyclae and Tegea generally contains higher proportions of aluminum and potassium and lower proportions of calcium than the remainder of the analyzed pottery dataset. A somewhat higher proportion of sodium within the Laconian PG chemical group also has pushed this cluster slightly into the lower right quadrant of the graph (*Fig. 6.d*), *i.e.* into the negative side of PC2 (y-axis). To explore whether these apparent clusters are a factor of the two-dimensional bivariate plots or represent real three-dimensional clusters, the third component was added to the graph and it was plotted in three dimensions. (*Fig. 4*) The two views presented in *Fig. 4* illustrate that the cluster of Laconian PG specimens maintains its separation and integrity from most perspectives within the three-dimensional views, *i.e.* PC3, included in the graphical representation. Likewise, one may observe clear separation of the remaining sherds into two generally discrete clusters which maintain their integrity in three dimensions. (See further discussion of these clusters below.)

What is the significance of this Laconian PG cluster in relation to the rest of the dataset? First it indicates that the Laconian PG pottery from both sites examined, Tegea and Amyclae, share distinct and common geochemical compositions, compositions which no doubt strongly reflect the geological source(s) of the raw materials used to produce the pottery. The producers of this Laconian PG pottery also may have employed technological knowledge and methods, different from those of the other pottery producers represented in the analysis dataset, which may have altered the final geochemistry of the Laconian PG pottery. Ultimately, the producers of the Laconian PG ceramics found at Tegea and Amyclae appear to have shared common or similar raw material sources, as well as possibly processual methods, resulting in geochemically similar pottery.

Using PCA analysis, the Laconian PG cluster is striking in its separation from the remainder of the chemical dataset; however, important information is also contained in the remaining data. One such piece of information is that all other analyzed non-Laconian Protogeometric pottery specimens, with the exception of one, plot on the left side of the x-axis, the negative side of PC1. (*Fig. 3*) Furthermore, there is a general temporal trend in the distribution of the specimens on the left side of the graph from earliest in the lower left quadrant (*Fig. 6.b*) to latest in the upper left quadrant (*Fig. 6.a*). For example, 20 Middle and Late Geometric sherds (ca. 77% of analyzed MG/LG specimens) plot in the upper left quadrant (*Fig. 6.a*), while only six Middle and Late Geometric sherds (ca. 23% of analyzed MG/LG specimens) plot in the lower left quadrant of the PCA graph (*Fig. 6.b*). In contrast, 12 Submycenaean/Protogeometric/Early Geometric sherds (ca. 86% of analyzed such specimens) plot in the lower left quadrant (*Fig. 6.b*), while only two typologically similar sherds (ca. 14% of those analyzed specimens) plot on or above the x-axis in the upper left quadrant of the PCA graph (*Fig. 6.a*). This pattern suggests that not only do the geochemical compositions of these ceramics vary geographically between production loci, but also that there appears to be a temporal component to the geochemical composition shift as well. Whether this chemical shift is due to technological and procedural differences through time, or simply to geological raw materials and geographical sources, is unclear at this stage.

Discriminant Analysis (DA)

Based on these initial apparent groupings resulting from the PCA analysis, the pottery analysis dataset was divided and each specimen assigned a potential "source" group identification of 1, 2 or 3. These group designations were made twice. One set of group assignments is based on purely chronological/typological criteria (*i.e.* "type"), since the three chemical groups of the PCA analysis tended to divide mainly along those boundaries. The second set of group assignments is based on the apparent chemical affinity of the PCA clusters, *i.e.* ceramic "fabrics" (*Tab. 3.a–b*), and as such the six Middle and Late Geometric sherds plotting with the Submyc/PG/EG group in the lower left quadrant on the graph (*Fig. 3*) were also assigned to that chemical group. The first set of group assignments comprised: 1) the Laconian PG pottery from both Tegea and Amyclae (Laconian PG = Type 1); 2) the Submycenaean, Protogeometric and Early Geometric pottery (Submyc/PG/EG = Type 2); and 3) the Middle and Late Geometric pottery (MG/LG = Type 3). The second set of group assignments comprised 1) the Laconian PG pottery from both Tegea and Amyclae (Laconian PG = Fabric 1); 2) the Submycenaean, Protogeometric and Early Geometric pottery plus the six Middle/Late Geometric sherds that plot within and adjacent to this cluster (Early 1 = Fabric 2); and 3) the remaining Middle and Late Geometric pottery (Late 1 = Fabric 3).

Following these group assignments the compositional data were reexamined twice using discriminant analysis (DA), once for each set of group designations. *Fig. 5.a–b* represent bivariate graphs of the first two discriminant analysis functions for each of the two different group assignments with the symbols keyed to their group assignment. Note in both figures the excellent separation of nearly all of the specimens into one of the three groups assigned. A few scattered specimens fall into a central zone between all three clusters leaving their group or typological assignments in question. In general, the group assignments based on the principal component clusters of fabrics (*Fig. 5.b*) separate better, form tighter clusters, and leave fewer questionable sherds in the central zone than the group assignments based purely on chronological/typological criteria, *i.e.* type (*Fig. 5.a*).

The discriminant analysis method statistically compares each individual chemical data value from each case in the dataset to each other case and also to each case's group assignment and arrives at a determination as to whether

the group classification is statistically significant. Using the groups based purely on chronological/typological assignments the DA analysis determined that 92% of the specimens (n = 80) were assigned to a statistically significant group, while only seven sherds were reassigned to different groups. However, using the PCA group assignments that percentage increases to 96.6% of the specimens (n = 84) being correctly assigned with only three reassigned. (*Tab. 3.a–b*; see discussion below.)

The results from the discriminant analysis provide two important contributions to the research. First, by examining the chronological/typological group assignments, we can see that the groups maintain their distinctive integrity quite well. This again suggests that there is a temporal-geochemical correspondence within the analysis dataset. In other words, there is a shift both typologically and temporally between the raw materials and/or procedural methods employed in production of the pottery found at Tegea (and Amyclae, with regards to the Laconian PG sample). A further important detail is that the Submyc/PG/EG group appears to divide into two subclusters, a lower and an upper one. (*Fig. 5.a–b*) It is the upper subcluster that is most interesting as it incorporates a few MG/LG sherds as well as possibly a Laconian PG sherd. This upper subcluster may be our closest guess for a local Tegean pottery production cluster (see more on this below).

The second important contribution from the DA results is a confirmation that the fabric group assignments based on the PCA results maintained their integrity very well during discriminant analysis. Only three sherds were reassigned by the DA analysis (*Tab. 3.a–b*), and these three sherds have some anomalous characteristics, which suggest that they would not fit well into any of the groups (see discussion below).

Specific trends: Principal Component Analysis

Some clear patterns are apparent from a general examination of elemental oxide and PCA bivariate plots of the analyzed ceramic dataset. It is unclear, however, if these general patterns of clusters are the only ones in the dataset. At first glance, there are no obvious subgroups within the three general clusters, although there are a few outliers or stragglers around the periphery of all three clusters. Does this mean that all of the pottery from each of these three clusters was produced by associated workshops utilizing similar raw material sources? Not necessarily. The first way to explore this question is to examine the three clusters for subdivision or subgroups, and to examine the outliers to understand their separation from the rest of the dataset. In order to facilitate the identification of subgroups, we should consider other data generated during macroscopic analysis of the pottery. Combining these two datasets for comparison revealed a few interesting patterns within the PCA bivariate plots, first on a smaller scale, then as the overall general trends.

Laconian PG pottery

There is no denying the clear separation of the Laconian PG pottery cluster from the rest of the dataset. Within the Laconian PG cluster, however, one might argue that there is more separation than similarity between the Laconian PG specimens from Amyclae and Tegea. This might deserve further investigation, but since we lack detailed macroscopic analysis data for the Amyclaean specimens, we must exclude them from the remainder of the discussion concerning the cluster analysis of the Laconian PG from Tegea.

After removing the Amyclaean specimens from the cluster, the Laconian PG specimens from Tegea do seem to have some subgroups within the overall Laconian PG cluster. For example, a few stray Laconian PG pieces fall on the lower left edge of the Laconian PG cluster *(Fig. 6.b–d)* and share common features of decoration and shape. Sherds **C-LacPG 134**, **139** and **143** are all likely from Laconian PG pyxides. Sherds **C-LacPG 134** and **139** are both from shoulder areas, with distinctive rectilinear ornament and grooves in the shoulder, while sherd **C-LacPG 143** is a fragment from a pyxis lid. This cluster of pyxis fragments of Laconian PG type is unique. That it occurs on the fringe of the Laconian PG cluster and in the lower left quadrant of the PCA graph (*Fig. 6.b*) is also interesting. The lower left quadrant of *Fig. 3* comprises primarily PG/EG material with a few scattered MG/LG sherds. Even more intriguing is the fact that the three pyxis sherds cluster with a fragment from a large PG pyxis typical of Attic LPG and clearly *not* Laconian PG. It has dogtooth decoration and a characteristic globular shape (**C-PG 58**), unknown in the Laconian PG repertoire.

This group of four pyxides suggests to us that we may be looking at a geochemical cluster or subgroup resulting from these vessels originating in a common workshop. It is noteworthy that up until now no examples of Laconian PG style pyxis fragments have been found in Laconia.[7] This fact makes the Tegean examples all the more anomalous and important. In fact, when examining the spectrum of pottery found at Tegea from the Protogeometric through the Middle Protocorinthian years (over 300 years!), one sees that pyxides were well represented in the assemblage at every stage. If we are indeed looking at the products of a common workshop, we also may suggest that the workshop of this production may be distinct from the Laconian PG production source(s) of the remaining Laconian PG specimens. Furthermore, we are unable to determine whether this cluster of pyxides represents local production, since it is possible that the "Attic" characteristics of the single

[7] Coulson, *Dark Age pottery* mentions no Laconian PG pyxides at all from Laconia. See the discussion of this shape in Laconian PG in section **iii** (Voyatzis), 229.

PG piece could be local imitation of an Attic style. If the place of production of these pyxides is somewhere else in Laconia, it would explain the Laconian PG connection, but it would be surprising, since there is virtually no ceramic evidence from Attica known in Laconia in the Late Protogeometric period, *i.e.* at the end of the 10th and early 9th centuries B.C. It is therefore more likely to be closer to Tegea, where there is considerable evidence for Attic influence in this period.[8]

Another outlier of the Laconian PG cluster is sherd **C-LacPG 87**, a cup rim with handle and much of profile preserved. It is decorated with brown, shiny paint, has horizontal bands on the vertical handle, solid paint on the body, and a reserved band on the interior at the rim. This is the only one in the Laconian PG cluster, it is the only Laconian PG specimen in the upper left quadrant of the PCA graph (*Fig. 6.a*), and it is the only specimen in the analysis cluster with a surface Munsell colour of 7.5YR 8/6. This cup does not plot near any other Tegean cup in the analysis dataset, nor does it plot near any of the other analyzed sherds from the same stratigraphic context, including two other Laconian PG sherds. In fact, the next closest Laconian PG specimen is from Amyclae, although this specimen also happens to be a cup. Chemically, this specimen contains less aluminum and potassium oxides and more calcium oxides then the nearly all the Laconian PG sherds, with the exception of the pyxis cluster, interestingly enough. Another coincidence is that one of the Laconian PG pyxis sherds (**C-LacPG 139**) in the pyxis cluster is from the same stratigraphic context as this lone Laconian PG cup. All of these pieces of evidence suggest that this Laconian PG cup also may represent the existence of another workshop, possibly related to the sources of the production of pyxides.

Another potential Laconian PG subgroup comprises sherds **C-LacPG 2, 44** and **46**, which plot in a roughly vertical line on the lower left edge of the main Laconian PG cluster. (*Fig. 6.d*) These specimens are all from skyphoi, two share the same stratigraphic context from the bothros and the same surface Munsell colour (7.5YR 7/6), while the third originates from the next lower level in the bothros and has a very similar Munsell color (5YR 6/6). They also have a similar type of rectilinear decoration in registers. The next closest specimens are two Laconian PG sherds from Amyclae and the cluster of pyxides. It is possible that these three skyphos sherds from Tegea form another subgroup within the Laconian PG cluster.

Submycenaean, Protogeometric, Early Geometric pottery

The group in the bottom left quadrant appears to be the "local" group. (*Fig. 6.b*) There is a degree of consistency here in terms of fabric, date and shape. There are many open shapes of Early Geometric date and simple style, and also a small number of later pieces. This group may possibly be "local" for several reasons: the clustering of the PG and EG material is fairly tight, the fabrics are similar, the decoration is simple for the most part, and where there is figured decoration (*i.e.* in the LG sherd with horses and birds), it is in keeping with the already known pieces from the French excavations at Tegea that are thought to be "local" in fabric and style.

One of the outliers from this group, sherd **C-EG 71**, plots at the bottom of the PCA graph in the lower left quadrant (*Fig. 6.b*), and is well separated from all other specimens in the analysis dataset. This sherd is from the only kantharos in the dataset. However, the reason for this sherd appearing as an outlier is due to a low total in the chemical analysis: its compositional total is over 40% lower then the average analysis total. (See *Tab. 1.a*) Therefore, the sherd must be eliminated from further consideration of potential geochemical clusters.

Middle/Late Geometric pottery

The group in the upper left quadrant of the PCA graph shows the lowest tendency to cluster (*Fig. 6.a*), although its presence as a group in this portion of the graph does show that the specimens in this quadrant share some similarities. Most obvious is that the quadrant is comprised mainly of MG and LG style specimens. Only two PG/EG pieces share an apparent association with the rest of the specimens in this quadrant. The fabrics and decoration of these MG and LG style sherds, however, suggest much greater variety than the other groups. This greater variability in fabric and decoration may mimic the geochemical variability in the scatter, but additional analyses would be required to explore that question. Sherd **C-MG 50** may well be a Corinthian import; it plots away from all other samples in the analysis dataset, and it has a characteristic Corinthian style MG decoration. Sherd **C-LG 195** may be an Argive import, in terms of its decoration and fabric; the piece depicts a file of Argive-style long-necked birds.

Sherd **C-SG 18** is a very unusual piece in every way and is an outlier in this group. It comes from a large, closed vessel and is painted with touching spiral circles. It is probably Subgeometric. The compositional total for this specimen is slightly lower than average for the analysis dataset, but its position on the far left side of the graph (*Fig. 6.a*) is due more to ratios of certain elemental oxides than to a low total. The calcium oxide total for this sherd is nearly double the average for the analysis dataset, while the other positive driving element oxides in the first principal component are all low for this specimen. Therefore, its position as a significant outlier in the analysis dataset is driven more by geochemistry and thus may represent a discrete production locus.

[8] See the discussion of Protogeometric pottery in section **iii** (Voyatzis), 202–3.

Interpretations

After several iterations of PCA using various inter- and intra-assemblage comparisons and following the two DA comparisons, the authors are convinced that the separation of the three general chemical groups is real and not an artificial result created through the sampling methods, chemical analysis or statistical methods employed. Therefore, the separation of these three groups (and the stray pottery sherds between the groups) needs to be explained within the archaeological contexts.

One approach to explaining the geochemical variation represented in the PCA plots is to explore it from the geological and technological perspective. From this perspective the differences between the three main pottery clusters derive from the geology and geochemistry of the raw materials utilized to produce the pottery, and how those raw materials were processed (*e.g.* how they were treated, combined and thermally altered). The Laconian PG pottery groups which originated in Tegea and Amyclae have very similar chemical signatures, distinct from the remaining pottery dataset, suggesting commonalities in the raw material and in the manufacturing techniques utilized in their production. It is thus possible to suggest that the Laconian PG pottery from both Tegea and Amyclae may have been produced at one or more common locations of pottery production. Furthermore, since the Laconian PG pottery group is almost completely separate from all the other Tegean pottery specimens, it seems likely that the source of the Laconian PG pottery production was situated in some location(s) other than Tegea, conceivably somewhere in Laconia. This assertion follows the assumption that at least some of the pottery which was chemically analyzed in this research was manufactured in Tegea. Therefore, a "Tegean" cluster must lie somewhere within the PCA bivariate plots. Since we would assume that any Laconian PG pottery manufactured at Tegea would fall within the Tegean cluster, and since it seems unlikely that all the Laconian PG pottery from both Tegea and Amyclae was manufactured at Tegea, it follows that probably none of the Laconian PG pottery (with the possible exception of some of the outliers, such as the pyxis cluster) was produced at Tegea. Whether the production source for this Laconian PG pottery was Amyclae, however, cannot be determined from the present dataset.

Again, following the geological and technological perspective, the remaining two PCA "groups" should have been manufactured at one or more location(s) distinct from those where the Laconian PG pottery was produced. Thus they could represent pottery produced either locally at Tegea and/or imported from outside Tegea. The second grouping of pottery resulting from PCA lies in the lower left quadrant of *Fig. 3* and mainly comprises the Submycenaean, Protogeometric and Early Geometric pottery with a handful of Middle and Late Geometric sherds. Because of the chronological range represented in this grouping, these specimens represent the strongest potential for a local Tegean pottery-production cluster. The separation of this grouping from the Laconian PG cluster, a presumed import group, indicates a separate raw material/production source(s) from the later.

There are several reasons for believing that the core of the pottery in this group represents local Tegean manufacture. The clustering of the PG and EG material is quite tight, the fabrics are similar, the decoration is simple for the most part, and where there is figured decoration (as in the LG sherd **C-LG 195** with horses and birds), it is in keeping with the already known pieces from Tegea which have been deemed to be local.[9] Some of the MG pieces have unparalleled, yet simple decoration (such as **C-MG 44**), and a case could certainly be made for its local production. Our impression is that the local Tegea workshop had some connections with workshops in Laconia which produced Laconian PG pottery in PG/MG, and it may well have even been a channel for more standard (*i.e.* Argive) motifs reaching Laconia. This local Tegean workshop also certainly maintained connections with Argive PG/LG schools, as reflected in the shapes and decoration of the pieces in this group. That Tegea's local style is derived from Argive is generally assumed in the literature,[10] and this association between Tegean and Argive ceramics is additionally supported by these chemical results.

Outside of typology/chronology, the third pottery grouping is characterized by an absence of uniformity, as can be seen from the results from the PCA analysis; these are the sherds in the upper left quadrant of *Fig. 3*. This grouping, which consists almost exclusively of Middle and Late Geometric pottery types, also clearly represents production workshops distinct from both the Laconian PG production loci and the pottery in the lower left quadrant of *Fig. 3*. It is possible that this third grouping represents pottery imported into Tegea following the transition to the Middle Geometric period and especially in the Late Geometric period. Alternatively, it could represent a dramatic geological and/or technological shift in local resource exploitation and production, although the separation from the other groupings is so clear that this seems unlikely. Since the chemical compositions within this third major pottery grouping are clearly distinct from the remainder of the dataset, it seems more likely that, if local, it represents another raw material source distinct from the original, potentially local, PCA chemical grouping. It is more likely, however, that the third PCA grouping represents imported pottery from one or more production workshops distinct from the potential local Tegean pottery production cluster (*Fig. 6.b*) as well as from the imported Laconian PG pottery. If this third grouping represents all imported ceramics (distinct from the Laconian imports), it suggests that imported pottery

[9] Voyatzis, *Sanctuary*, 64; P. Courbin, *Céramique géométrique de l'Argolide* (*BEFAR* 208), Paris 1966, 500–2, 549 n. 5; Dugas, *Sanctuaire,* 395.

[10] See Courbin, last note; also J.N. Coldstream, *Geometric Greece*, London 1977, 156; Voyatzis, *Sanctuary*, 83–4.

was entering Tegea perhaps as a result of increased activity at the sanctuary, which is then reflected in more pottery dedications from further afield during the Middle and Late Geometric periods. This third grouping may not reflect the scale of local pottery production at Tegea, but rather a preference of travelers to Tegea for bringing their own pottery when making dedications. This helps to explain why only a handful of Middle/Late Geometric sherds match the chemical signature of the potentially local pottery grouping. It does clearly suggest, however, that the context from which the pottery was recovered at Tegea, and from which the analysis specimens are but a subset, is heavily comprised of externally derived material culture, much as one might expect within a sanctuary context. The "looseness" of the clustering of these MG/LG sherds also suggests that this clustering probably represents more than one, probably several, production loci. Unfortunately, our sample size from this category of pottery types is too small to generate a more accurate assessment of the potential number of subgroups represented within this broad general group. We are probably dealing with Argive and Corinthian imports as well as regional subgroups within these larger categories.

Conclusions

In conclusion, the results of the chemical analysis of the 87 pottery sherds from Tegea and Amyclae appear to represent three major chronological and typological trends. Before we summarize these trends, we should reexamine our original hypotheses to see where we stand in light of these results.

1) – that the Laconian PG pottery from Tegea and that from Amyclae were made in two different production centres.

There are significant similarities between the geochemical compositions of the Laconian PG pottery from both sites; however, the production source(s) for the Laconian PG pottery from both Tegea and Amyclae cannot be determined from the present dataset. Furthermore, it is impossible to determine at this stage in the chemical analysis whether the Laconian PG pottery from these two sites originated at the same workshop(s). *Fig. 3* illustrates how the Laconian PG pottery from both sites share very similar positions in the graph with some overlap. Despite this overlap in the Laconian PG cluster, there also is some separation as well as what appears to be some sub-grouping in the overall cluster. The sub-group of the pyxides discussed above is such an example. Therefore, it seems likely that several workshops were producing the Laconian PG pottery recovered from Tegea and Amyclae. Because of the geochemical similarity in the Laconian PG cluster, however, the workshops may have been located at the same site or in the same region and shared common clay source(s). Methodological variability within each workshop also may account for some of the geochemical variability apparent in the finished ceramic sherds. Ultimately, both the Tegean and Amyclaean Laconian PG pottery appear to have originated from production workshops utilizing clay sources that were distinct from the stylistically and chronologically contemporaneous and later ceramic types found at Tegea.

2) – that the composition of the Laconian PG pottery from Tegea is the same as that of the other PG through LG pottery from the site, suggesting a common origin for this material, but different from the Laconian PG from Amyclae.

The composition of the Laconian PG pottery from Tegea (as well as from Amyclae) is clearly distinct from the PG–LG pottery at the site. *Fig. 3* illustrates the clear separation of the Laconian PG pottery from the stylistically and chronologically contemporaneous and later ceramic types at Tegea. There can be little doubt from *Fig. 3* that the Laconian PG pottery found at Tegea was produced in different workshops from the remaining pottery types found at the site. Based on the significant geochemical distinction it seems that the raw materials originated from different sources as well.

3) – that the Laconian PG from Tegea and Laconia both have the same compositions, which, in turn, are the same as the Tegean PG/EG pottery.

There is no indication that the Laconian PG pottery from Tegea and Amyclae has the same composition as the PG/EG sherds from Tegea, with one notable exception. *Fig. 3* illustrates that the PG/EG sherds from Tegea (but not the Laconian PG) generally cluster in the lower left quadrant of the graph (*i.e.* the possible local group). The exception to this is a Protogeometric pyxis sherd which plots with three Laconian PG pyxis sherds. This sub-group of pyxides (see discussion above) may represent a specific workshop, possibly located at Tegea, which began production during the Protogeometric period and may have continued into later periods. Generally, however, there is almost no overlap between the Laconian PG pottery and the PG/EG pottery from Tegea.

4) – that the Laconian PG from Tegea and the standard PG–LG from Tegea all have the same composition, indicating continuous local pottery production from at least 900 B.C.

The Tegean pottery represented in the chemical dataset was clearly produced in different workshops using different raw material sources. Distinct geochemical clusters (and even sub-groups) can be seen in *Fig. 3*, indicative of multiple workshops. These clusters also demonstrate geochemical patterns characteristic of typological as well as chronological variability within the Tegean pottery assemblage. The one exception to this is the cluster of sherds in the lower left quadrant of the PCA graph (*Fig. 6.b*), which shows considerable variability through time and ceramic type while still maintaining a

relatively similar geochemical signature. This one cluster of pottery sherds from Tegea (including the pyxis sub-group discussed above) quite likely represents local production in two or more workshops in Tegea which shared enough common raw materials and processing methods to make a similar geochemical signature.

In sum, it is clear that the Laconian PG pottery forms its own discrete geochemical cluster from the rest of the dataset. The overwhelming majority of the Laconian PG ceramics shares a remarkably similar geochemical signature. Their place(s) of production remain uncertain at present, but this style of pottery was almost certainly primarily manufactured somewhere in Laconia.

A second general clustering of pottery, potentially representing local Tegean production, can be identified in the lower left quadrant. (*Fig. 6.b*) A third general clustering of pottery located in the upper left quadrant (*Fig. 6.a*) probably represents imported pottery from several different production workshops.

It is clear, however, that while there are general grouping trends in the dataset, these general trends may obscure smaller specific trends and subgroupings. At least three and probably as many as a dozen different pottery production workshops may be represented within the Tegean pottery analysis dataset.

Future chemical analyses could further define and refine the existing chemical groupings described here, as well as help to identify specific smaller trends and subgroupings at Tegea. For example, analyses of additional pottery types (*e.g.* miniature pottery) and other ceramic materials (*e.g.* terracotta figurines) could provide a more complete data set of potential geochemical clusters. Additionally, new analyses from the categories already represented from within and outside the site would serve to further define the existing clusters and sub-groups. Finally, chemical analyses of raw materials (*e.g.* clays, tempering materials, etc.) in the vicinity of Tegea as well as analysis of production debris from Tegean pottery workshops could provide more definitive links to actual sources or raw material(s) and production.

Literature:

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Pollard and Heron 1996 = A.M. Pollard and C. Heron, *Archaeology and chemistry,* Cambridge 1996.

Potts 1995 = R.J. Potts, *A handbook of silicate rock analysis,* New York 1995.

Sherd ID	Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	Sc†	TiO_2	V†	Cr_2O_3	MnO	Fe_2O_3	CoO	NiO	Zn†	Sr†	La†	Ce†
03/1.6	1.13	2.14	18.6	55.8	2.88	7.84	17	0.958	129	0.025	0.080	7.08	0.003	0.013	157	211	44	103
03/1.7	1.00	2.93	20.1	56.8	3.56	7.43	21	0.876	153	0.046	0.115	7.91	0.004	0.643	131	181	19	97
03/1.8	1.08	2.14	22.3	55.6	3.70	9.06	22	1.005	131	0.038	0.074	8.20	0.003	0.094	153	182	22	90
03/2.9	1.05	2.25	22.0	61.6	3.00	6.89	24	0.980	139	0.026	0.070	7.82	0.003	0.050	161	177	24	116
03/2.10	1.19	3.00	21.4	57.5	3.92	7.69	22	0.933	154	0.039	0.090	8.21	0.004	0.027	147	190	20	84
03/2.11	0.82	2.78	19.6	60.5	2.94	8.74	23	0.930	152	0.035	0.076	7.80	0.003	0.022	127	186	19	100
03/2.12	1.00	2.19	19.1	61.3	2.72	8.64	23	1.084	150	0.024	0.057	7.67	0.002	0.014	151	207	27	120
03/2.13	0.95	2.63	19.1	63.3	3.16	7.19	23	1.004	151	0.036	0.086	7.89	0.003	0.025	136	195	26	127
03/2.14	1.17	2.29	20.2	60.8	3.16	6.72	19	1.044	154	0.026	0.058	7.85	0.004	0.081	158	204	39	111
03/3.15	0.45	2.04	24.5	50.9	1.45	12.0	27	1.005	165	0.029	0.100	7.93	0.004	0.017	165	191	43	117
03/3.16	1.20	1.87	21.3	56.6	3.61	7.91	21	0.779	127	0.033	0.075	7.81	0.004	0.015	173	157	35	87
03/3.17	0.90	2.30	21.7	56.6	2.73	10.5	22	1.019	149	0.030	0.067	8.10	0.003	0.016	149	186	23	129
03/3.18	0.52	1.67	25.4	56.3	2.81	5.19	24	0.895	206	0.035	0.078	10.60	0.004	0.019	180	109	48	101
03.1	1.06	2.20	20.0	59.8	3.13	6.72	18	0.990	163	0.027	0.070	8.11	0.003	0.025	166	185	33	129
03.2	0.87	1.76	20.9	64.2	2.60	7.46	21	0.828	138	0.042	0.056	7.50	0.004	0.027	166	163	33	101
03.3	1.05	2.17	19.9	60.1	3.04	6.40	19	1.055	146	0.026	0.052	7.61	0.004	0.014	150	179	36	127
03.4	1.08	1.87	24.6	53.3	2.92	12.1	20	0.753	166	0.028	0.071	7.94	0.004	0.016	176	229	30	89
03.5	0.86	2.98	19.6	60.1	2.92	10.5	29	0.800	172	0.046	0.145	8.65	0.006	0.032	169	225	40	104
BSA no #	1.00	2.43	18.9	67.5	3.00	6.42	18	1.049	134	0.027	0.082	7.56	0.004	0.019	131	241	41	122
BSA 1	0.80	2.33	19.2	62.1	2.87	6.59	19	1.060	144	0.027	0.050	7.07	0.004	0.444	159	191	45	95
BSA 10	0.87	2.16	20.7	66.2	3.07	5.38	21	1.125	168	0.027	0.055	8.04	0.004	0.013	152	173	43	123
BSA 29	0.94	3.15	18.1	64.9	3.31	7.48	20	0.905	146	0.042	0.095	8.01	0.006	0.966	166	190	38	90
BSA 40	0.84	3.31	17.3	61.9	3.05	9.13	20	0.884	153	0.042	0.132	9.06	0.007	0.032	136	222	34	111
BSA 41	0.67	3.03	16.8	61.3	2.86	7.66	19	0.925	145	0.038	0.104	7.32	0.004	0.023	113	237	42	105
BSA 48	0.91	2.27	17.9	60.6	2.83	9.04	20	1.075	125	0.027	0.061	7.34	0.004	0.014	137	208	40	108

Table 1.b. Analysis data for the chemical composition of sampled pottery from Amyclae.
All analyses were recoded in oxide weight percentage; trace elements with very low composition contents were recorded in parts-per-million (ppm) and indicated by the † symbol.

Sherds of Fabric Group 1:

Tegea (all Laconian Protogeometric):
C-LacPG 2, 9, 19, 40, 44, 46, 53, 54, 57, 58, 67, 69, 87, 96, 100, 106, 110, 117, 121, 134, 139, 143

Amyclae (all Laconian Protogeometric):
BSA, nos 1, 10, 29, 40, 41, 48, No number
ASCSA, nos 03/1.6, 03/1.7, 03/1.8, 03/2.10, 03/2.11, 03/2.12, 03/2.13, 03/2.14, 03/2.9, 03/3.15, 03/3.16, 03/3.17, 03/3.18; 03.1, 03.2, 03.3, 03.4, 03.5
See below for information on the sherds.

Sherds of Fabric Group 2:

Tegea:
Submycenaean: **C-LH 17**
Protogeometric: **C-PG 22, 58, 93**
Early Geometric: **C-EG 24, 40, 50, 51, 53, 71, 104**
Early Geometric II: **C-EG 21, 23, 59**
Middle Geometric: **C-MG 44, 45**
Late Geometric: **C-LG 54, 96**
Late Geometric II: **C-LG 139, 200**

Sherds of Fabric Group 3:

Tegea:
Middle Geometric I: **C-MG 50, 73**
Middle Geometric II: **C-MG 76**
Middle Geometric II – Late Geometric**: C-MG 2, 64, 65, 70, 100**
Late Geometric: **C-LG 53, 85, 112, 138, 169, 178, 195, 212**
Late Geometric II: **C-LG 76, 111**
Late Geometric – Early Protocorinthian: **C-LG 65**
Subgeometric: **C-SG 18**

Laconian Protogeometric sherds from Amyclae:

British School at Athens collection:

Seven sherds were analyzed.
BSA no. 1 = Coulson, *Dark Age pottery*, no. 295. Large rim sherd from a krater.
BSA no. 10 = Coulson, *Dark Age pottery*, no. 271. Rim sherd from a skyphos.
BSA no. 29 = Coulson, *Dark Age pottery*, no. 408. Handle and body from an open vessel.
BSA no. 40 = Coulson, *Dark Age pottery*, no. 348. Full profile with handle from a cup.
BSA no. 41 = Coulson, *Dark Age pottery*, no. 321. Rim and body sherd from a cup.
BSA no. 48 = Coulson, *Dark Age pottery*, no. 169. Rim sherd from a flaring skyphos.
BSA no number = Coulson, *Dark Age pottery*, no. 441. Body sherd from closed shape.

American School of Classical Studies at Athens collection:

The 18 sherds from Amyclae which were selected from drawer C01 at the ASCSA for analysis did not have any catalogue numbers indicated. So, it is not clear how the numbers listed above (presumably assigned by the Fitch Lab when they did their analysis), relate to my notes regarding these sherds.

Table 2. PCA fabric group assignments for pottery from Tegea and Amyclae.

"Type" Groups		Predicted Group Membership			Total
		1	2	3	
Original Count	LacPG	46	0	1	47
	Submyc–PG–EG	0	14	0	14
	MG–LG	2	4	20	26
%	*LacPG*	*97.9*	*0*	*2.1*	*100.0*
	Submyc–PG–EG	*0*	*100.0*	*0*	*100.0*
	MG–LG	*7.7*	*15.4*	*76.9*	*100.0*

The ""Type" groups are: Type 1, the Laconian Protogeometric pottery from Tegea and Amyclae; Type 2, the Submycenaean, Protogeometric and Early Geometric pottery; Type 3, the Middle and Late Geometric pottery.

"Fabric" Groups		Predicted Group Membership			Total
		1	2	3	
Original Count	LacPG	46	1	0	47
	Local 1	1	18	1	20
	Local 2/Import?	0	0	20	20
%	*LacPG*	*97.9*	*2.1*	*0*	*100.0*
	Local 1	*5.0*	*90.0*	*5.0*	*100.0*
	Local 2/Import?	*0*	*0*	*100.0*	*100.0*

The "Fabric" groups are: Fabric 1, the Laconian Protogeometric pottery from Tegea and Amyclae; Fabric 2, the Submycenaean, Protogeometric and Early Geometric pottery plus the six Middle and Late Geometric sherds that plot within and adjacent to this cluster (Early 1 = Fabric 2); and Fabric 3, the remaining Middle and Late Geometric pottery (Late 1 = Fabric 3). (See *Tab*. 2)

Tables 3.a (above), b (below). Discriminant analysis classification results. Note that of the 87 analyzed sherds assigned to the three chemical groups based on PCA results, 92% (*Table 3.a*) and 96.6% (*Table 3.b*) of the original groups cases were correctly classified when subjected to the discriminant analysis.