Construction Volume, Distance, and Polychrome Percentage Relationship Analyses at Tamarindito

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Abstract

Archaeological markers for status and class are used to estimate the social standing of people in the past. In the Maya area, the commentary of Spanish bishop Diego de Landa has suggested that one of these markers be the distance at which residential groups are situated from the central ceremonial plaza of the site where they reside. Past studies have indicated that construction volume and polychrome ceramic wares are also indications of status and class. These claims are investigated at Tamarindito using linear regressions to assess the relationships between construction volume, distance from the central plaza, and the percentage of polychrome wares found for forty residential groups.

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I. Background

Study of Elites

The study of an elite class or social unit has been a focus of anthropology and sociology from the earliest inceptions of the disciplines. Creating hierarchies of humans and human civilizations was a common pastime and often used to justify colonial superiority complexes. While the hierarchical comparisons between cultures and societies has vastly been disowned in current anthropological rhetoric, stratification and hierarchies do exist and are accepted within the social structure of human societies.

In archaeology, the more finite difference between social groups can be difficult to distinguish given the limited nature of preservation of material culture and interpretation. Recent research and efforts have expanded into the realm of understanding the archaeology of marginalized groups (Blackmore 2011), but much literature is still devoted to dividing ancient societies into elites and nonelites.

Elites in society can be defined as those who hold the most important cultural or influential positions in society (Antonyan). Nonelites, would by default, encompass the remaining majority of the population. However, it is important to note that human identities are not limited any singular binary system (Blackmore 2011). Investigating class on a simplistic scale can be a starting point to understand base differences in societies that leads to further inquiries.

The following project was an examination of three potential archaeological indicators of status. The goal was to determine if the three indicators – residential grouping distance to a public ceremonial site, percentage of polychrome wares found at each residential grouping, and construction volume of each residential site – had a statistically significant relationship and could then be used to determine status.

The Maya

The Maya hold a unique position in Central American studies. One of only two complex civilizations to emerge independently in a tropical rainforest (Ayala 2006), the Maya are, also, the only civilization in the Americas to have developed a fully formed writing system in Pre-Columbian times. How this civilization developed and flourish so uniquely in its environment has been of interest to archaeologists for over a century.

Fascination with the Maya is not limited to anthropologists. A common misconception that the Maya civilization collapsed, and its people entirely disappeared gives a mysterious edge to the public's understanding of this ancient civilization. While this myth may initially foster interest and a desire to study the Maya, it can dilute proper recognition of the Maya as existing peoples and cultures today.

Gaining insight into the ancient Maya is thus important to further the understanding of human history as well as reaffirming the grand history of a culture still alive today.

A Brief Introduction to the Maya Area

The Maya area is divided into three geographic and environmental areas: the Pacific Coastal Plain, the Highlands, and the Lowlands. Most relevant to this project is the Maya Lowlands, specifically the Petén region of Guatemala (Sharer and Traxler 2006).

The Lowlands, consisting of northern Guatemala, Belize, and the Yucatan Peninsula of Mexico, is the largest portion of the Maya lands. It has been postulated that this region is lacking in resources. This generalization is a mischaracterization of the Lowlands. Covered in a thick evergreen rainforest, the Maya Lowlands boast an array of plant, animal, and aquatic life and resources (Sharer and Traxler 2006). This environment fostered one of only two complex societies to independently develop in a tropical rainforest (Ayala 2006).

The lowlands are often divided into a southern, northern, and central region. Tamarindito is located in this central region, in the Petén region of Guatemala. Tamarindito, a powerful Classic site, was the focus of this project.

Emergence of the Maya Civilization

The Maya civilization begins to emerge in the Middle Preclassic (1000-400 BC) During this time, population and settlement sizes in the Maya area increase. The existing societies and cultures here also increase in complexity as mounting pressure from population created opportunities for power and deliberate social organization (Sharer and Traxler 2006).

A driving force in the Middle Preclassic for change in economic, political, and ideological structure of the society was the growing population. An increased population heightens demand for food, thus, spurring increased production and greater need for trade. (Sharer and Traxler 2006).

Moving beyond subsistence agriculture into large scale production allows more individuals to focus their energy and labor on cultural tasks rather than survival tasks. Although, an increasing population has the potential to put stress on an environment and society to provide adequate resources for is inhabitants, the additional individuals can become resource to the society themselves. Further, some individuals or groups of individuals emerge as an elite class controlling resources, trade, and labor. Evidence of their emergence and increasing complexity of Maya society through status and role, is evident in the appearance of monuments, large-scale public works, and warfare (Sharer and Traxler 2006).

Archaeological evidence of social stratification includes prestige goods being present in the archaeological record, often found concentrated in areas with connection to the elite (Sharer and Traxler 2006, Halperin and Foias 2010, Reents-Budet n.d.). These archaeological markers of class and status were examined in this project.

Maya Social Stratification

Archaeological investigation combined with Maya art history, epigraphy, and ethnohistory reveal how Maya society was stratified. The Maya were generally divided into two basic social classes: the elite and non-elite. This two-class system was likely infiltrated by a possible middle class during the Classic period. The middle class would have been composed of wealthy nonelites. Generally, however, a focus is given to the two broad classes of elite and nonelite (Sharer and Traxler 2006, Halperin and Foias 2010, Reents-Budet n.d.).

Class and status can be estimated through a variety of archaeological evidence. For instance, the total construction volume can indicate the amount of labor a residential group had access to. Larger construction volumes are thought to correlate to more wealth and higher class. Prestige and rare goods are also associated with wealth and high status. Burials and burial goods can provide evidence of specific class as well as how class is obtained. If young children in a society are buried in a manner and with items relating to status, it is hypothesized that status is inherited as they child would not have lived long enough to gain an independent status.

The former means mentioned, and others not mentioned, allow archaeologist to estimate class and status. However, it has been proposed that Maya class and status may have had a degree of fluidity. A binary system of elite and nonelite may not encompass the full range of class and statuses that existed (Halperin and Foias 2010, Reents-Budet n.d., Blackmore 2011).

The Ancient Maya Site

Of considerable importance to this project was an understanding of Maya site organization. Maya sites of considerable prominence tend to be comprised of a ceremonial center and outlying residential areas (Bullard 1960; Sharer and Traxler 2006; Becker 2004).

Maya ceremonial centers are built with architectural commonalities with one another, though regional variations do appear. The predominate base structure of ceremonial centers is a foundation of platforms created by leveling the terrain. Upon the foundations, open plazas, superstructures (such as temples or palaces), ball courts, and stelea are built (Hammond 1972).

When observing the site of Lubaantún, Norman Hammond noted that “[t]he master plan for Lubaantún seems to have called for a religious core surrounded by an inner zone of ceremonial plazas and an outer zone of residences. Such a layout follows a simple concentric-zone model, modified at Lubaantún only by the requirements of topography.” Religious centers tended to be constructed with high accessibility, while residential groups were more secluded at Lubaantún (Hammond 1972).

Maya Households

Modern Maya household tends to be organized through the nuclear family structure. It is assumed that ancient Maya household, too, would contain nuclear family units. An ancient *naah* (Yukatek Mayan word for house structure) would have consisted of adobe, stone, or wattle and daub walls of one or two rooms covered with a thatched roof. The smallest of these residential structures would cover 20 m^2. Generally, n*aah* housed the nonelite, while the elite dwelled in large masonry structures typically denoted as "palaces" (Sharer and Traxler 2006).

Other residential structures that have been found in the archaeological record include shrines, kitchens, and storage buildings. Excavations at Cerén of two Classic period households indicate that household activates were not limited to one building. Rather, households consisted of multiple structures along with gardens and agricultural fields (Sharer and Traxler 2006).

Tamarindito

Tamarindito is situated in south-western Guatemala, and, more accurately, in the Petexbatun of the Petén. It lies 1.3 km to the southeast of Laguna Tamarindito and 3.0 km west to the nearest point of Laguna Petexbatun; both lakes being the sites closest large bodies of water. Multiple other Maya sites can be found in close proximity to Tamarindito; namely Arroyo de Piedra (3.5 km west), Dos Pilas (7.0 km west), and Aguateca (7.3 km southest) (Gronemeyer and Eberl 2010; Eberl and GondAles 2016; Valdés 1997; Ayala 2006).

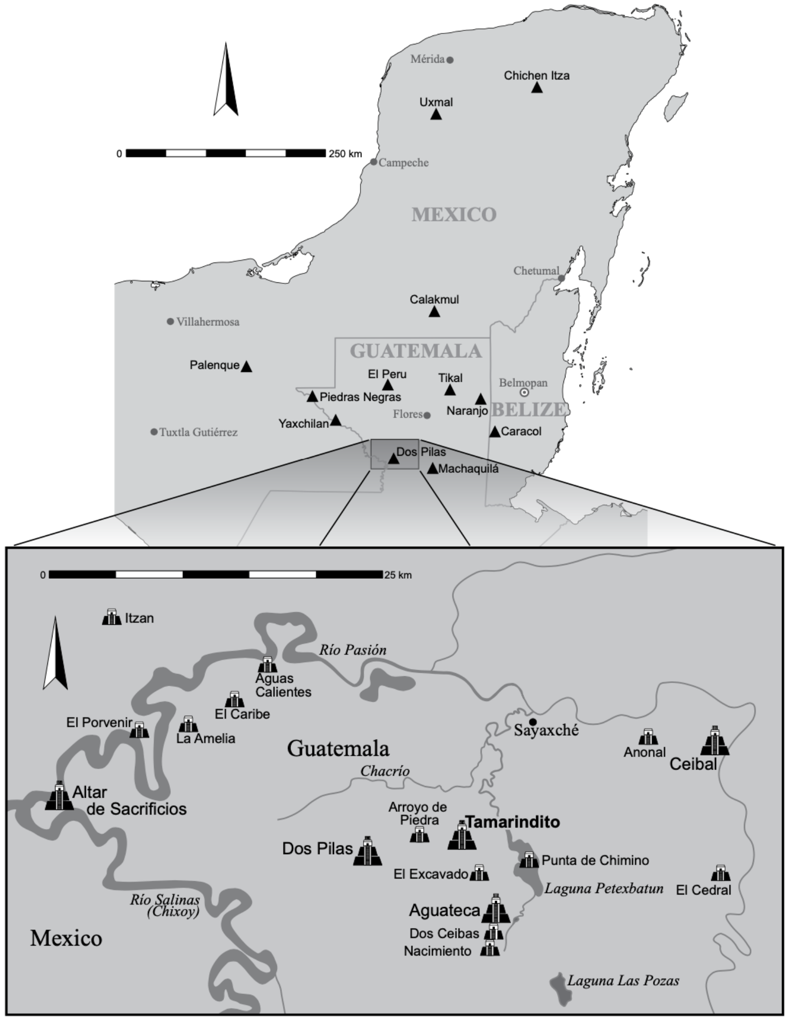

Figure 1. Map of Northern Guatemala and Maya archaeological sites (From Eberl and Gondáles 2016: Figure 1.1)

The site was first occupied during the Preclassic and continued to be occupied until the Postclassic. A royal dynasty, the Watery Scroll dynasty, ruled from Tamarindito during the Classic period. During this time, Arroyo de Piedra operated as its twin capital. This dynasty dominated the surrounding region during the 5th and 6th centuries AD until it fell to Dos Pilas in the 7th century. (Gronemeyer and Eberl 2010; Eberl and GondAles 2016).

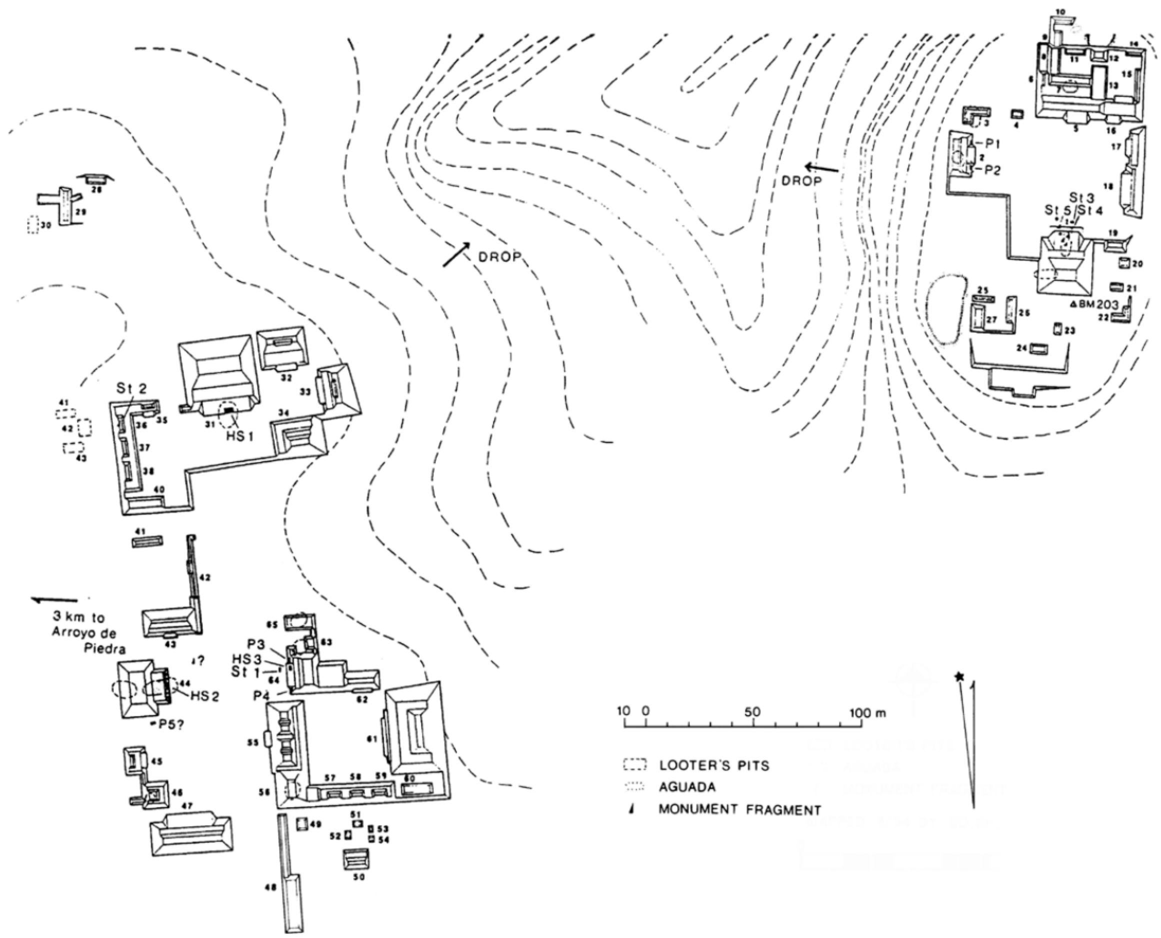

Figure 2. Map of Group A and Group B at Tamarindito's center. (From Houston 1993: Figure 2-13)

Tamarindito contains two main structure groups in its center with outlying residential groups. The center groups are known as Group A, or Cerro de Cartografia, and Group B. Group A was built upon the highest elevated ridge of the area with Group B sitting adjacent just beyond a small gully as the terrain begins to elevate once more. Both mountains, on which the sites are located, were artificially leveled to accommodate Group A and B's construction. A causeway was constructed to provide a path from Cerro de Cartografia to Group B (Gronemeyer and Eberl 2010; Eberl and Gondáles 2016; Ayala 2006).

Group A’s construction began in the Early Classic and contains several structures indicating elite use. The layout of structures A5 through A16, and the elevated platform on which they rest, indicate use as a palace. Three stelae (TAM St. 3, 4, 5) sit at the base of pyramid shaped Str. A1. Group B, on the other hand, contains structures of more public function. Plazas, residential structures, and ritual structures and spaces are present (Gronemeyer and Eberl 2010; Eberl and Gondáles 2016; Valdés 1997; Ayala 2006).

An investigation into the visibility of the structures of each group from residential areas has led to the hypotheses that Group A and B were built under the direction and desire of the elite by motivating the public. Both Plazas are visible from each residential group. The Plazas would have been physical representations and manifestations of the elite’s power. (Gronemeyer and Eberl 2010; Eberl and Gondáles 2016; Valdés 1997; Ayala 2006).

Social Organization at Tamarindito

The sixteenth-century Spanish bishop Diego de Landa recorded in his observations of the Maya that the more elite individuals resided closer to the ceremonial centers and plazas of settlements than did nonelites (Eberl and Gondáles 2016). This notion was tested with archaeological findings from Tamarindito. Status will be assumed through the Construction Volume of each residential group. The larger the volume of a group, the more access to labor and materials the group had (Masson and Lope 2004; Eberl and Gondáles 2016). Therefore, wealthier and more elite residences are likely to be larger in volume.

The relationship between Construction Volume and Distance from Plaza B was examined for evidence of a clear pattern of residence areas with greater volumes being located in close proximity to Plaza B. Further, the relationship between polychrome wares and construction volume were evaluated. If groups of greater volumes are to be the dwelling areas of the elite, then it can be hypothesized that a relationship between polychrome (a painted and often elite manufactured ceramic) (Sharer and Traxler 2006; Halperin and Foias 2010; Eberl and Gondáles 2016; Reents-Budet n.d.) wares and construction volume should exist.

II. Methods

The following statistical testing found in this section was computed using Construction Volume, Distance from Plaza B, and Polychrome Ware Percentage data from forty of forty-three residential groups at Tamarindito. The data was provided by Dr. Eberl, co-director of the Tamarindito Archaeological Project.

A Note on Statistical Tests and Values Used

Linear regressions, a predictive analysis, examines the ability of an independent variable to predict a dependent variable. Typically, this relationship is investigated using the regression equation of $y = c + b(x)$. y is the dependent variable, x is the independent variable, b is the regression coefficient, and c is the constant. One manner in which linear regressions can be used is to determine the strength of the relationship between and effect of the independent variable on the dependent variable.

To understand the strength of the relationship, a number of values are consulted. The correlation coefficient, or r-value, represents how closely related the independent and dependent variables are. R-values range from -1.0 to 1.0. The closer the value is to 0, the weaker the relationship. Positive values indicate both variables increase in value together, while negative values indicate that one variable increases while the other decreases.

Stemming from the correlation coefficient is the coefficient of the determination, or r-squared. This value, ranging from 0 to 1 is a percentage of variation between the variable that can be accounted for by the linear model.

The probability values, or p-value, indicates the likelihood that the data would have occurred randomly. The p-value ranges from 0 to 1, with smaller values – less than 0.05 – being statistically significant.

Construction Volume and Distance from Plaza B Linear Regression

The first relationship that was analyzed was Construction Volume and Distance from Plaza B. Landa postulated that Maya individuals with a higher status, or the elite, lived closer to the Plaza centers of sites (Eberl and Gondáles 2016). To test this particular statement at the site of Tamarindito it is assumed that the more elite individuals had more access to labor and materials and, therefore, would dwell in residential groups of larger construction volumes. Thus, the larger the construction volume of a residential group, the closer the group will be to Plaza B.

To test the relationship between Construction Volume (x) and Distance from Plaza B (y) a linear regression will be utilized. If there is no relationship between the variables, then the slope of the regression will equal zero. If a relationship does exist, then the slope will not equal zero.

$$H_o: B_1 = 0$$

$$H_a: B_1 \neq 0$$

Before a linear regression can be run, six assumptions about the data must be met. First, the variables must be continuous. Construction Volume is measured in m^2 and

Distance is measured in meters. Second, there must be a linear relationship between the two variables. A scatterplot is used to visual check for a linear relationship (Figure 3).

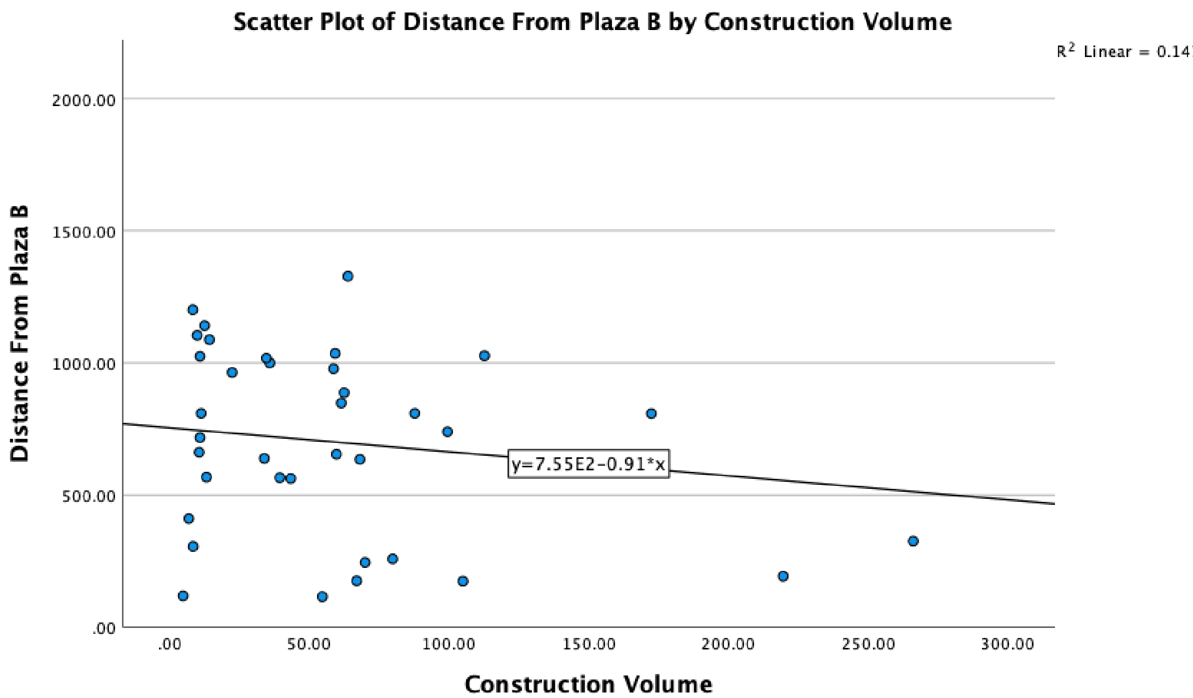

Figure 3. Scatterplot with line of best fit. Made with SPSS.

Third, no significant outliers should exist. Figure x indicates that there are no significant outliers. Fourth, the data should have independence of observations. The Durbin-Watson statistic is used to test this. Construction Volume and Distance from Plaza B had a Durbin-Watson value of 1.702, which is considered within the range of normalcy (1.5 to 2.5). Next, the data must show homoscedasticity. To meet this requirement, that data points along the line of best fit should have similar variances. This requirement has a tendency to be more difficult to verify or be met in using real world data. Finally, the data's residuals must be normally distributed. This was checked using a Q-Q Plot (Figure 4).

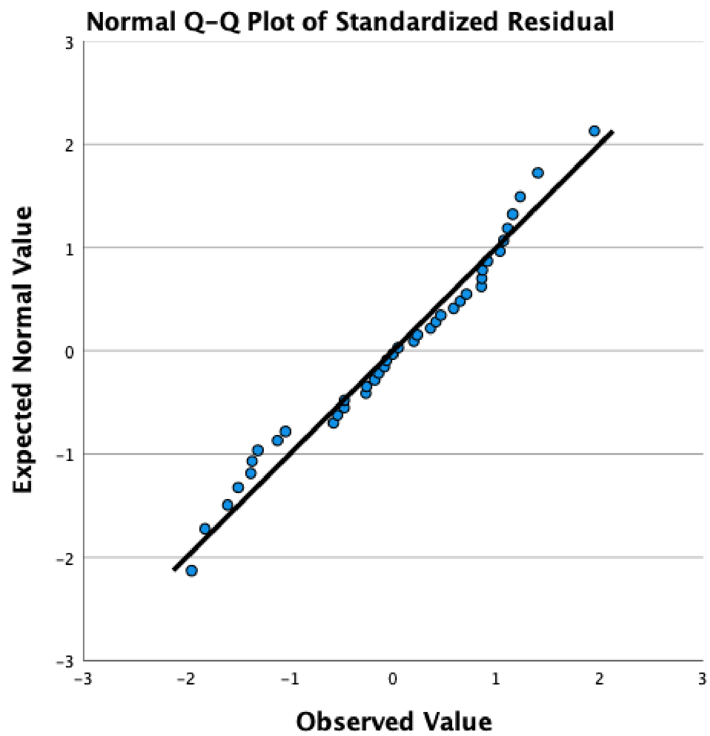

Figure 4. Q-Q Plot of Standardized Residuals for Construction Value and Distance from Plaza B. Created using SPSS

Because all assumptions were met, a linear regression can be computed. The following tables were generated (Table 1-5):

Table 1. Variables Entered/Removed Table from SPSS Linear Regression output

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Construction Volume [b]	.	Enter

a. Dependent Variable: Distance From Plaza B

b. All requested variables entered.

Table 2. Model Summary Table from SPSS Linear Regression output

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.384[a]	.147	.125	323.68301	1.702

a. Predictors: (Constant), Construction Volume

b. Dependent Variable: Distance From Plaza B

Table 3. ANOVA Table from SPSS Linear Regression output

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	687544.219	1	687544.219	6.562	.015[b]
	Residual	3981286.16	38	104770.688		
	Total	4668830.38	39			

a. Dependent Variable: Distance From Plaza B

b. Predictors: (Constant), Construction Volume

Table 4. Coefficients Table from SPSS Linear Regression output

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	754.504	59.771		12.623	<.001
	Construction Volume	-.908	.354	-.384	-2.562	.015

a. Dependent Variable: Distance From Plaza B

Table 5. Residuals Statistics from SPSS Linear output

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-65.6990	750.0542	675.4100	132.77552	40
Residual	-631.15417	631.02417	.00000	319.50628	40
Std. Predicted Value	-5.582	.562	.000	1.000	40
Std. Residual	-1.950	1.950	.000	.987	40

a. Dependent Variable: Distance From Plaza B

The Model Summary table (Table 2) provides the R value, R^2 value, and the adjusted R value. For Construction Volume and Distance from Plaza B, a R value of

.384. R values range from -1.0 to 1.0. The closer a value is to either end indicated a string positive or negative relationship, while being closer to 0 indicates a weak or no relationship. While there is a relationship based on the R value of .384, it is not a considerably strong relationship. R^2 then tells what percentage of the variation in the dependent (y) variable is caused by the independent (x) variable. Therefore, an R^2 value of .147 means that 14.7 percent of the variation in Distance from Plaza B is likely caused by Construction Volume.

The ANOVA table (Table 3) or, Analysis of Variation table, provides information about how well the regression equation fits that data. The given significance from the ANOVA table is 0.015. At a 95 percent confidence interval, $p < 0.05$, meaning the regression model is statistically significant.

The Coefficients table (Table 4) provides the necessary information for the regression equation. The regression equation to predict Distance from Plaza B from Construction Volume is as follows:

Distance from Plaza B = 754.504 – 0.908(Construction Volume)

Based on the information generated by the linear regression, we rejected the null hypotheses at the 95 percent confidence level. Though statistically significant, the relationship between the two variables is not considered a strong relationship. While some residential groups of high construction volumes are found in a close proximity to Plaza B, there is a range of variation.

Construction Volume and Polychrome Ware Percentage Linear Regression

The next relationship of concern was Construction Volume and Polychrome Ware Percentage. Continuing with the assumption that high construction volumes indicate elite status, this analysis determined whether or not there is a statically significant relationship between Construction Volume (x) and portable status or, Polychrome Ware Percentage (y).

Again, a linear regression was used to investigate a possible relationship between the two variables. A slope will indicate a relationship of some manner, positive or negative, and no slope will indicate no relationship. The hypothesis is as follows:

$$H_o: B_1 = 0$$

$$H_a: B_1 \neq 0$$

To run a linear regression, six assumptions about the data must be verified. First, the data is continuous. Construction Volume is measured in m^2 and Polychrome Ware Percentage is measured by taking the number of polychrome wares found at each residential group and dividing it by the total number of wares at the same group. Next, a linear relationship between the variable must be established. A scatterplot (Figure 5) can be used to assess this requirement visually.

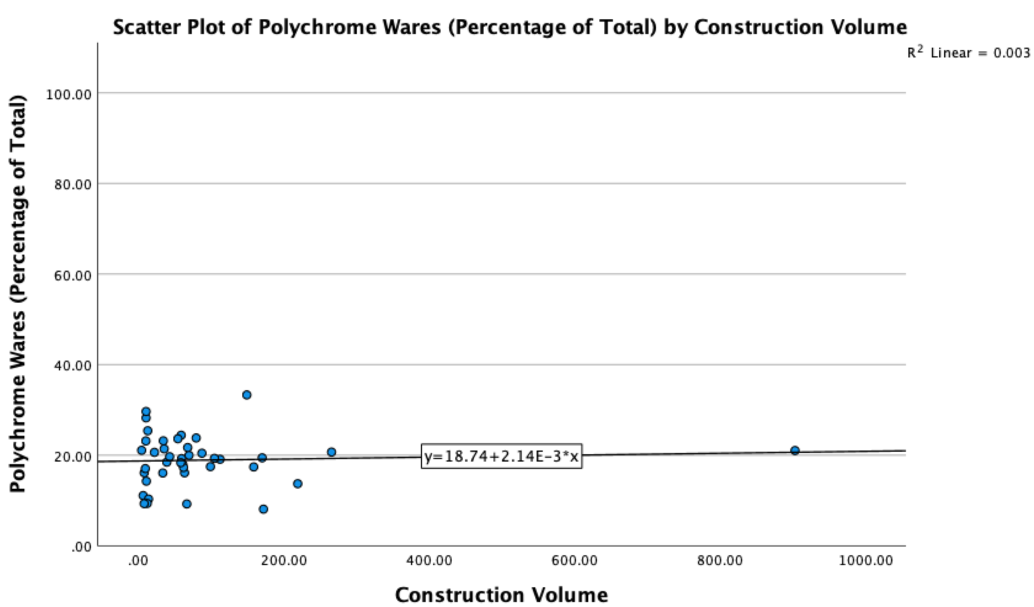

Figure 5. Scatterplot of Construction Volume and Polychrome Ware Percentage with line of best fit. Created with SPSS.

The scatterplot can be used also determine if there are any significant outliers present. For this set of data, no significant outliers are present. Next, the data must have independence of observation, which is understood through the Durbin-Watson statistic. Construction Volume and Polychrome Ware Percentage has a Durbin-Watson value of 1.604. This value is within the range of normalcy. Homoscedasticity can, again, be determined with the scatterplot. The data is deemed to have homoscedasticity. Finally, the residuals must be normally distributed. A Q-Q Plot was generated to assess this requirement (Figure 6).

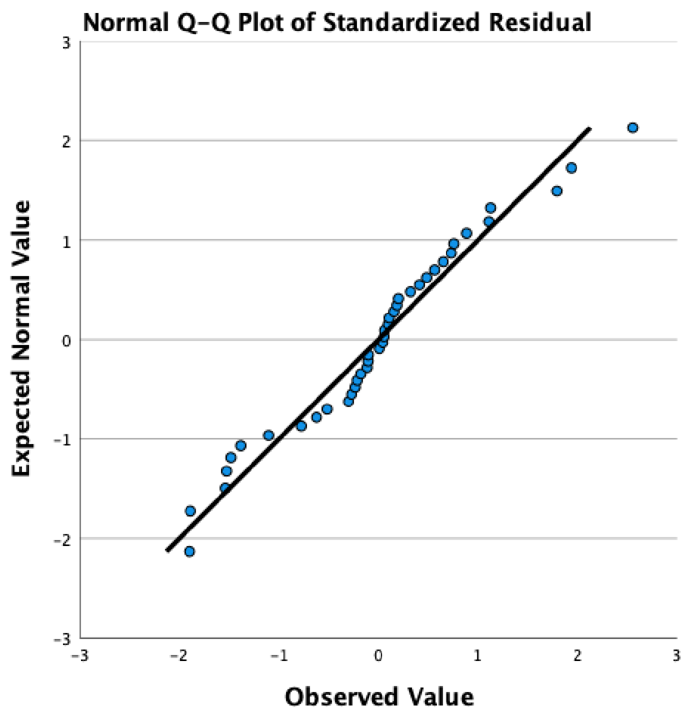

Figure 6. Q-Q Plot for the residuals for Construction Volume and Polychrome Ware Percentage. Created with SPSS.

The data set has met all six assumptions. A linear regression is now possible. The following tables were generated in SPSS (Table 6-10):

Table 6. Variables Entered/Removed from SPSS Linear Regression output

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Construction Volume[b]	.	Enter

a. Dependent Variable: Polychrome Wares (Percentage of Total)

b. All requested variables entered.

Table 7. Model Summary from SPSS Linear Regression output

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.056[a]	.003	-.023	5.63732	1.604

a. Predictors: (Constant), Construction Volume

b. Dependent Variable: Polychrome Wares (Percentage of Total)

Table 8. ANOVA Table from SPSS Linear Regression output

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.817	1	3.817	.120	.731[b]
	Residual	1207.617	38	31.779		
	Total	1211.434	39			

a. Dependent Variable: Polychrome Wares (Percentage of Total)

b. Predictors: (Constant), Construction Volume

Table 9. Coefficients Table from SPSS Linear Regression output

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	18.738	1.041		18.000	<.001
	Construction Volume	.002	.006	.056	.347	.731

a. Dependent Variable: Polychrome Wares (Percentage of Total)

Table 10. Residuals Statistics from SPSS Linear Regression output

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	18.7481	20.6702	18.9240	.31285	40
Residual	-10.99653	14.27247	.00000	5.56458	40
Std. Predicted Value	-.562	5.582	.000	1.000	40
Std. Residual	-1.951	2.532	.000	.987	40

a. Dependent Variable: Polychrome Wares (Percentage of Total)

Again, three main tables will be assessed: Model Summary (Table 7), ANOVA (Table 8), and Coefficients (Table 9). The Model Summary table gives this relationship an R value of .056. This R values indicates a very weak positive relationship between Construction Volume and Polychrome Ware Percentage. The R^2 of 0.003 suggests that only 0.3 percent of the dependent variable's variation is caused by the independent variable.

The ANOVA table provides the significance value of the linear regression. For this linear regression p = 0.001. Thus, at the 95 percent confidence level, this linear regression is statistically significant.

Finally, the Coefficients table creates the linear regression equation, which is as follows:

Polychrome Ware Percentage = 18.738 + 0.002(Construction Volume)

While the linear regression computed is statistically significant at the 95 percent confidence level, it indicates a very weak positive relationship between Construction Volume and Polychrome Ware percentage. Combined with the information obtained through the R^2 value, that only 0.3 percent of Polychrome Ware Percentage variation is likely caused by Construction Volume, we failed to reject the null hypothesis.

It is still possible that a stronger relationship between the two could exist at Tamarindito and could be discovered through the accumulation of more data from future excavations. However, at present and based on the current data available, there is not a relationship between Construction Volume and Polychrome Ware Percentage.

Distance from Plaza B and Polychrome Ware Percentage Linear Regression

The final relationship investigated is that between the Distance from Plaza B and Polychrome Ware Percentage. Based on the first linear regression (Construction Volume and Distance from Plaza B) indicating a relationship between the two variables, this final analysis will require a new assumption beyond construction volume indicating elite status. As there was a statistically significant relationship found, the assumption going into this new linear regression will be that the greater the distance from Plaza B, the lower the status. Thus, the greater the distance, the lower the percentage of polychrome wares.

The hypotheses for the linear regression of Distance from Plaza B (x) and Polychrome Ware Percentage (y) are the following:

$$H_o: B_1 = 0$$

$$H_a: B_1 \neq 0$$

A relationship between the two variables will be based on the slope of the regression. In short, the lack of a slope will indicate no relationship.

As in the previous linear regressions, six assumptions must be met: the variables must be continuous, the variables must have a linear relationship, no significant outliers should exist, there must be independence of observation, homoscedasticity must be seen, and the residuals should be normally distributed.

Distance from Plaza B is measured in meters and Polychrome Ware Percentage is measured by taking the number of polychrome wares (most often sherds) and dividing it by the total number of wares found for each residential group. Both are continuous.

The scatterplot below was used to determine that the data has a linear relationship (Figure 7):

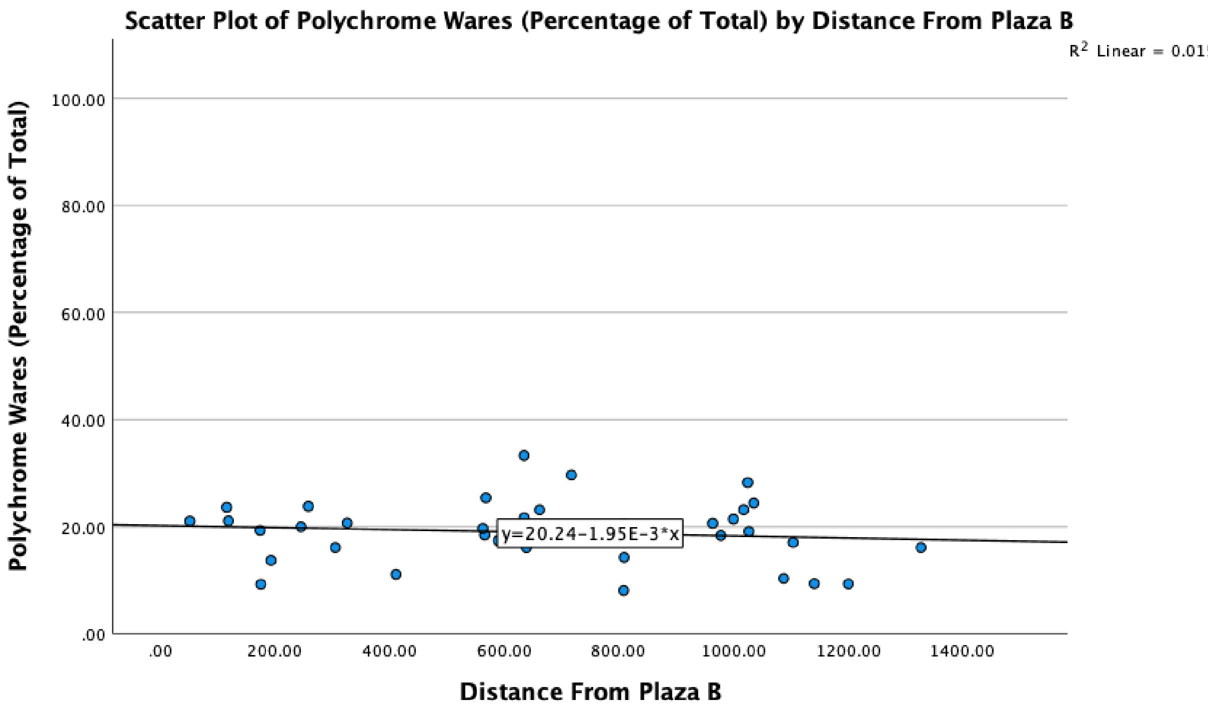

Figure 7. Scatterplot of Distance from Plaza B and Polychrome Ware Percentage. Created with SPSS.

Referencing the scatterplot again provides evidence that there are no significant outliers present.

Next, the Durbin-Watson statistic is consulted to determine if there is an independence of observation. Distance from Plaza B and Polychrome Ware Percentage has a Durbin-Watson value of 1.529. This value is within the range of normalcy.

Homoscedasticity is determined with the use of the former scatterplot. Because the variances of the data remain similar long the line of best fit, the data meets this requirement. Finally, the residuals must be normally distributed. A Q-Q Plot is generated to determine this (Figure 8):

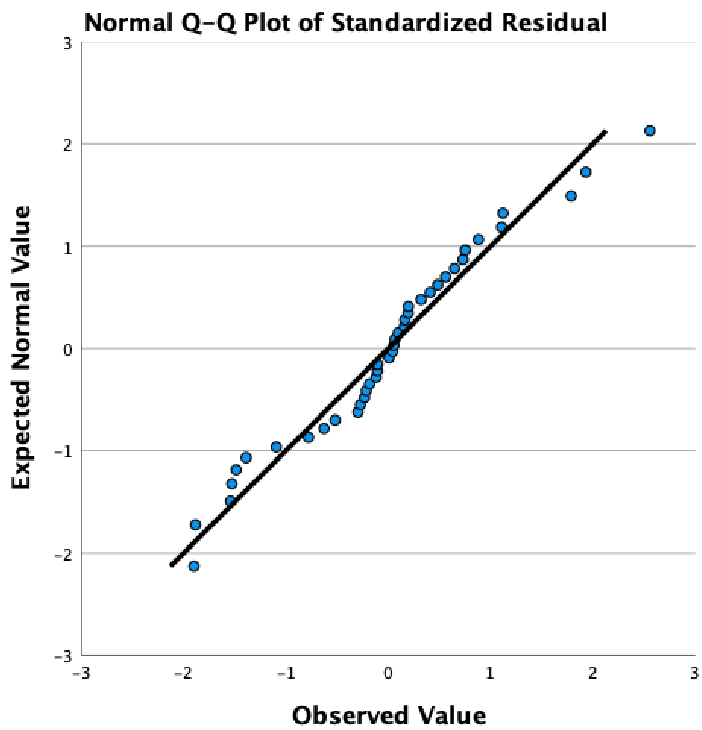

Figure 8. Q-Q plot for Distance from Plaza B and Polychrome Ware Percentage. Created with SPSS.

Having met all of the required assumptions, a linear regression can be generated. The following tables were created (Table 11-15):

Table 11. Variables Entered/Removed Table from SPSS Linear Regression output

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Distance From Plaza B [b]	.	Enter

a. Dependent Variable: Polychrome Wares (Percentage of Total)

b. All requested variables entered.

Table 12. Model Summary Table from SPSS Linear Regression output

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.121[a]	.015	-.011	5.60470	1.529

a. Predictors: (Constant), Distance From Plaza B

b. Dependent Variable: Polychrome Wares (Percentage of Total)

Table 13. ANOVA Table from SPSS Linear Regression output

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.751	1	17.751	.565	.457[b]
	Residual	1193.683	38	31.413		
	Total	1211.434	39			

a. Dependent Variable: Polychrome Wares (Percentage of Total)

b. Predictors: (Constant), Distance From Plaza B

Table 14. Coefficients Table from SPSS Linear Regression output

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	20.241	1.963		10.310	<.001
	Distance From Plaza B	-.002	.003	-.121	-.752	.457

a. Dependent Variable: Polychrome Wares (Percentage of Total)

Table 15. Residuals Statistics Table from SPSS Linear Regression output

Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	17.6525	20.1405	18.9240	.67465	40
Residual	-10.63896	14.32682	.00000	5.53238	40
Std. Predicted Value	-1.885	1.803	.000	1.000	40
Std. Residual	-1.898	2.556	.000	.987	40

a. Dependent Variable: Polychrome Wares (Percentage of Total)

The Model Summary table (Table 12) provides R and R^2. The R value for this set of data is 0.121 and indicates a very weak positive relationship between the two variables. The R^2 value of 0.015 tells that only 1.5 percent of the variation in Polychrome Ware Percentage can be contributed to Distance from Plaza B.

The ANOVA table (Table 13) provides that $p = 0.457$. This large p-value indicates that there is not a statistically significant relationship between the two variables and as a result we fail to reject the null hypothesis.

III. Conclusion

Discussion

The only null hypothesis to be rejected and the only relationship to be found statistically significant at the 95 percent confidence level is that between Construction Volume and Distance from Plaza B. However, this relationship was not considerably strong with an R value of 0.384 and an R^2 of .147. A statistically significant relationship was not found between Construction Volume and Polychrome Ware Percentage, nor Distance from Plaza B and Polychrome Ware Percentage.

The first and only relationship to be statically supported could indicate that Landa's sixteenth-century statement could have some small amount of support at Tamarindito. However, the relationship was considerably weak. The planning and construction of residentials groups are likely to be influenced by more than status. The natural terrain could inhibit particular areas of the site from being the foundations of structures. Tamarindito lies on an escarpment and has varying points of high and low elevation that could have made it difficult to build residential groups of particular sizes at preferred distances from Plaza B. Further, it is known through visual analysis at Tamarindito that Plaza B is visible from all residential sites (Gronemeyer and Eberl 2010; Eberl and Gondáles 2016; Valdés 1997; Ayala 2006). Perhaps, the visibility was more important than distance and because it is visible from all groups, then the ability to feel near to the Plaza would have been satisfied.

No relationship between Polychrome Ware Percentage and Distance from Plaza B, nor Polychrome Ware Percentage and Construction Volume seemed to exist. This leads to more questions than answers. Is polychrome not a significant measurement of status at Tamarindito? Did individuals of varying statuses have similar access to Polychrome at Tamarindito? Further, because of the weak relationship between Construction Volume and Distance from Plaza B, can either of these measures be used as status in estimates?

The lack of clear distinction of a two class – elite and nonelite – system at Tamarindito could also be evidence of a more complex social status system at this site. It has been postulated that a middle class can to be during the Classic Period. These individuals would have most likely been wealthy nonelites.

For Tamarindito, the case remains unclear for now. However, continued study and investigation of these variables and their relationships between one another at other sites in the Petén may help to bring clarity to the subject. Of particular interest should be Tamarindito's twin capital, Arroyo de Piedra. The two sites close relationship could merit a hypothesis that Arroyo de Piedra's Construction Volume, Distance from the Central Plaza, and Polychrome Ware Percentage's relationships might also not exhibit strong relationships.

Perhaps, there was an initial notion of the elite living closer to the Plaza and having larger residences. This notion may even exist at other Maya sites. But because it does not exist in a strong relationship at Tamarindito, is could be thought that non-elite had little regard for where it was deemed appropriate of their class to reside or how the elite would have preferred the site to be organized. Or, maybe, at Tamarindito class may have influenced power and access to particular elite goods (beyond polychrome), but not who one's neighbors are. These postulations and questions will only be solved through further research.

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