RECONSTRUCTING POTS-RECONSTRUCTING LIVES:
Analysis and Reconstruction of Ancient Ceramics from Ecuador

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ABSTRACT

Through the analysis of pottery, archaeologists are able to gain insight into the society of an ancient civilization. Ceramics that may have belonged to the Guangala, a people that lived between 100 B.C. and 800 A.D., were uncovered at an excavation site in Ecuador. It is believed that these vessels may have been used in the production, storage, and serving of chicha, a light beer that was instrumental in the everyday life of the Guangala. The sherds of pottery found at the excavation site were reconstructed and analyzed using functional analyses. Through comparative analysis, it has been found that the measurements of the pottery appear to match the dimensions of pottery known to have been used for chicha. Further research in the form of residue analysis can now be conducted to verify these results.

INTRODUCTION

Archaeology is more than just the process of digging up preserved artifacts. Instead, it is the science of looking through artifacts into the world of an ancient people. Archaeologists believe that humans live a patterned lifestyle that often reflects the traditions that people followed. These traditions usually involve material possessions that are left behind as artifacts. The science of archaeology is based upon finding and piecing together these artifacts. Based upon the patterns observed in the study of these artifacts, archaeologists can then make educated guesses about what the artifacts were used for. Once the significance of an artifact is found, the past behaviors of a people can then be uncovered.

The ceramic artifacts or sherds being analyzed here were found on the southern coast of Ecuador and date back to the Guangala period (100 B.C.-800 A.D.). In the case being presented, these ceramic pot sherds were pieced together and the reconstructed pots examined. The pots were first analyzed through functional analysis, then by comparative analysis. Functional analysis involves looking at the form, size, texture and use wear evidence of the ceramic pot. Form was analyzed using set standards that were found in books about pot reconstruction. These standards relate the form of a pot to the shape of familiar vessels. The results of the comparison gave us possible ideas for pot function. Analyzing the size of a pot involved taking part of a reconstructed vessel and creating an image of what the complete vessel looked like. This was accomplished both by hand and by AutoCAD, a computer program. More specifically, it was done by studying various aspects of the vessel, such as the rim size and the radius of curvature. Meanwhile, texture was analyzed by mineralogical analysis to determine what kind of ceramic paste was actually used.

Comparative analysis gives hints to pot functions in the same way that functional analysis did. It involves looking at ethnographic and archaeological literature to find pots similar to the ones being studied. Based on similarities between the pots, educated guesses are made regarding possible functions of the vessel being studied.

The excavation site is located in a village called El Azúcar. The archaeological site from which the pots were recovered is labeled as site 47. When the site was found it appeared as a layer of ash and soot. Digging deeper revealed it to be a trash dump that the Guangala used to throw away organic garbage, broken stone, and ceramic possessions. Digging deeper revealed a series of pots and items that did not appear to be trash. A solid clay floor was then discovered. This means that long ago, before site 47 was a trash dump, it was an ancient Guangalan house. Based on the artifacts found, it was evident that for some unknown reason the family had to leave their home. Pots and materials that were too big to carry or already broken were left on the floor. Everything needed for daily life was found in the bottom layer of site 47. This layer, the layer that contained only artifacts from a Guangalan family, is where our pots were found.

It is believed, based on observations of related modern indigenous people, that these people had a cultural tradition of producing and drinking chicha, an ancient form of alcohol. Based upon the functions assumed by the analysis of the pots, hypotheses can be made about whether the vessels were actually used for making or drinking chicha. Subsequent residue analysis will confirm our hypotheses. Consequently, we will then be able to support or rebut the long-held belief that chicha was widely consumed by the Guangala, giving scientists a clue into their cultural past. From the observations that will be made in this experiment, along with the assumption that human behavior is patterned, we can arrive at certain conclusions about Guangalan culture and lifestyle.

Modern Ecuadorian society is apt to give insight into the history of the Guangala because Ecuador is considered a microcosm of South America, both geographically and socially. In present-day Ecuador, chicha continues to play a central role in both feasting and social gatherings. Drinking chicha appears to be a constant ritual shared by the people who can produce and consume this beer daily while still considering it sacred. We have analyzed the customs of the people for whom brewing and serving chicha is a tradition.

Several terms must be defined to gain a complete understanding of functional analysis. The most important parts of the pot for the purposes of functional analysis are the rim and the areas adjacent to the rim. A rim is defined as the part of a vessel closest to the orifice, or aperture. It includes the lip, which is the part farthest from the base. The circumference of a pot can be estimated even if only part of the rim is available, making the rim as important to the reconstruction of a pot as the edges are to the completion of a jigsaw puzzle (*see* Figure 1).

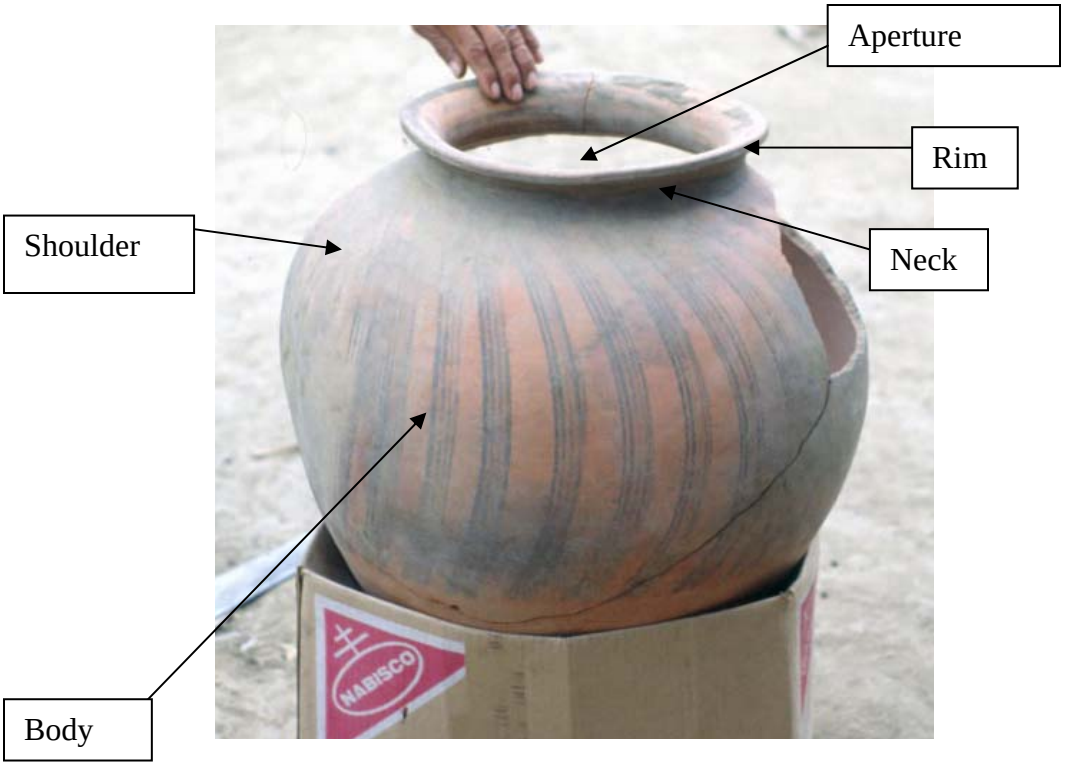

Figure 1: Terms: Key parts of a pot.

Ceramic is one of the most commonly studied forms of artifact. Its durability and practicality make it extremely common on archaeological sites. There are three general categories of investigatory methods for pottery (ceramic used for containment): technological, functional, and stylistic. Technological analyses are aimed at discovering how the pot was made. Meanwhile, functional analyses are meant to determine what the pot was used for. Finally, stylistic variability encompasses all variation that does not affect the pot's utilitarian purpose [1].

BACKGROUND

The Guangalan tribe's location on the southern coast of Ecuador has impacted its culture and social behavior. The Guangala people were farmers, fishers, and hunters who ate maize, manioc, squash, peppers, fish, deer, and "cui" (guinea pigs). Neighboring contemporary groups such as the Inca were known to supplement their meals with chicha, a light beer, which they drank casually on a regular basis. Chicha was also considered a sacred drink, as well as an efficient way to preserve the nutritious contents of its ingredients. Since it was fermented and thick, its texture was very similar to lumpy porridge with a low alcohol content. Thus, this made chicha more of a meal than simply a drink; it was custom to drink a bowl of chicha after a long day's work or during a fiesta.

Chicha is the traditional alcoholic beverage found in South America. Upon seeing the process of production, the Spaniards named the drink chicha, or saliva. It can be dated back at least 1,500 years, to the Andean people before the Spanish conquest. In addition, it has been said

to have “played a vital role in ceremonies, social events, political negotiations, religious affairs and even labor” [2]. Producing chicha is a complicated process. First, the product being used to make the chicha must be fermented. In order to make the brew, the base ingredients of the chicha, which could be berries, corn, rice, or manioc root (also known as yucca or cassava), are crushed in a rough mortar or dish. While fermenting, women take the product out of the pot and chew all of the ingredients to increase the fermentation process by drawing out the sugars. Following this treatment, it is boiled to finish the cooking process, and then stored with additional water in large storage jars. However, the chicha must be drunk as soon as possible because it can spoil in as little as seven days. The average person usually consumes anywhere from six to twelve liters of chicha a day [3, 4].

Spanning from the past to the present, alcohol has always been an important part of different cultures [5]. Alcohol has been drunk “since pre-historic times for a variety of hygienic, dietary, medicinal, religious and recreational purposes” [6]. Above all, alcohol facilitates group meetings and religious festivals [7]. Chicha, in particular, is not a drink limited to a specific region. Though the ingredients may vary depending on the flora of the local environment, chicha has been made in various societies throughout time, including the Amazonian and the Incan societies. Even the conquistadors partook in chicha rites. It is possible that chicha was consumed at all Guangalan festivals. One possible reason as to why the Guangala incorporated chicha into their everyday lives is that alcohol affects the mind and body in many different ways. As a psychoactive substance, alcohol affects conscious decisions and behavior. [8]. If the blood alcohol level is between .03 and .12, the person consuming the alcohol experiences a state known as euphoria. This state of euphoria causes a person to become self-confident and daring. Therefore, the individual is able to problem-solve and hold conversations, even though decision-making skills are less acute than normal. Moreover, people are more sociable when consuming alcohol because alcohol depresses the behavioral inhibitory center in the cerebral cortex of the brain [9]. During meetings, people might want to be in this state of mind, so that they can express what they really feel. There is no way to definitively prove that the Guangala drank chicha for these reasons, but finding evidence that they did drink it regularly would support these ideas.

By helping to keep the general peace and mediating disputes, chicha provided a routine way to maintain an atmosphere of cooperation during social gatherings in historic and modern Ecuadorian societies. Politics were intertwined with collective customs and the principles of the people. This type of informal ruling system was structured according to social networks. The husband built relationships with others through social gatherings and by adhering to set customs. Proper orders of business could not be conducted without chicha; in fact, chicha gave status to the Ecuadorians in the same way that money gives status to Americans [5]. Villagers had to make vast amounts of chicha at feast times. In order to make enough chicha, sufficient ingredients were necessary. If a host could not serve the amount of chicha that a guest wanted, both the host and the guest would experience a lowering in their social and political status. It was also frowned upon for a guest to ask for more chicha than a host had to offer [10]. The order in which guests were served chicha was determined by the individual’s status within the community. At the same time, the physical distance that a guest sat from a host showed the relation the person had to the host, or the guest’s rank in society [11]. Women were responsible for the chicha; they gathered the ingredients, made the chicha, and served the chicha. At

meetings, “no one spoke until she served *chicha* beer in large, beautifully painted pottery bowls” [11]. When prestigious families held gatherings in their houses, the number of chicha jars and bowls in the house denoted the status of the family [5].

The pottery made by women was as important as chicha in village politics. Different groups of people had unique designs on their pots, or their own specific ways of making them. Networks of friendships were formed around the relationship of these different designs or ways of making pots. Different groups with different designs become allies. These allies lived so closely together that if one family moved, the other friends were expected to follow. If allies changed their associations, people were also prompted to move to a new home. As allies, these people learned to do daily activities together. Although men may have been responsible for creating relationships with new people, the women created networks supporting the families. These networks were used to obtain information about what went on in town, to monitor problems within the society, and to propose solutions to any problems that may have arisen. Moreover, the networks also acted as a support system for family and friends. In fact, women were considered to be better political mediators than men because they had built strong networks of support [11].

The process of making pottery likely played an intrinsic role in the lives of the Guangala women, as it does in the lives of the indigenous peoples of Ecuador in modern times. By ethnographic analogy, the process used today can shed light on the pottery making processes of the Guangala. First, modern women dig up a lump of moist clay called mungalpa to form the pot. The pottery is usually made starting from the base and working upward. Women make all ceramics by hand. It is amazing that they are able to create such flawless ceramics with their hands. Decorating is the next step in the process. One potter was observed to use pieces of hair from a boy in her family for the bristles of a brush. A strand of bamboo was used for the handle. The thickness of the brush was determined by how much hair was taken from the boy. Next, the woman used the brush to decorate a wet clay pot. It was decorated near a fire to solidify the decoration as it was made. If a pot is small, a small fire is constructed and the pot is fired over it. Bamboo and wood are put all around it and set on fire. Everything goes up in flames, causing the pot to solidify. Because the fire can be so intense, it is common for pots to crack in the rapid firing. After they are decorated, they are placed inside a larger broken pot known as a sagger. The sagger is covered with hot ashes and a fire under the pot is stoked. In about half an hour, the fired bowl is lifted out and coated with a resin [12].

Larger pots are more cumbersome to fire. They have to be dried over a fire indoors before the firing process begins. Large pots called mocahuas are fired outside on a tripod of three saggers for about 30 minutes. Oftentimes, the rapid firing process leads to cracking. Cracks are repaired using a resinous pitch called pungora [12].

Serving bowls are elaborately embellished. More intriguingly, few bowls have anything in common, except for their comparative forms and sizes, meaning that designs are unique for each bowl. Women are responsible for the individual designs, which might, upon further examinations of the pottery affiliated with chicha, indicate that there are some other roles women have in the political structure.

METHODS/MATERIALS

Form and function analysis is the process of reconstructing whole or partial pots from sherds, and using the reconstruction to estimate the size, shape, and possible function of a pot. In this study, partial pots are assembled, hand-sketched, and lastly reconstructed using AutoCAD. The estimated sizes obtained from this analysis, known as metric analysis, are then used in the comparative analysis.

When reconstructing pots, the rim tells us the most about the size of the pot and its function. The size of the orifice, along with the wall curvature, tells us how large the vessel was, while the type of ceramic used indicates what the pot may have been used for.

The neck and shoulder, if available, will give insight to the shape of the pot. The neck is the vertical restriction of the opening above the pot's maximum diameter, while the shoulder is an area below the pot's maximum diameter, but below the neck or rim.

The central tenet of form and function analysis is that once a pot is at least partially reconstructed, inferences can be drawn about its function. Form is directly related to function. Vessels with orifices that are small compared to their height are known as closed or restricted vessels or jars [5] and were generally used for liquid storage and pouring [5]. On the other hand, vessels that have wide orifices with respect to their height are known as open vessels and were generally used for serving liquid, resembling what we refer to as bowls [5].

Hence, a relatively flat vessel or dish with a large rim and a jagged surface would be indicative of use in the mashing process of chicha production. The mash is subsequently added to water in a large porous vessel with a wide aperture to heat. Thick, permeable walls are necessary in order to withstand heat without cracking. Also, the aperture has to be large for easy stirring and ladling. Thus, the function of such pottery gives us insight into the necessary forms of the ceramic. With the addition of saliva or another fermenting agent such as yeast, the fermentation process begins, continuing for a few days (the duration depends on the size of the batch). Once the chicha was made, it is poured into storage pots, which also need large apertures for easy ladling. In porous vessels, the flow of air across the pores of the vessel walls cools the chicha and allows it to stay below room temperature. People then use small bowls to cup the chicha out of the jars and drink it either ceremoniously, socially, or during work. The type of bowl depends on the occasion; these bowls are usually smooth and of a dense texture with a minimal amount of voids. However, the more intricate ones are probably used during ceremonies and important social gatherings. Obviously, the function of the pot relates directly to the pot's appearance and properties.

Archaeologists also use the technique of cross-mending, which is an analytical tool that aids in arranging pottery pieces together that were found at the same site. Cross-mending is a beneficial, yet harmless way, to analyze and construct larger, more complete vessels from a pile of sherds. Similar characteristics, such as surface texture, thickness, vessel form, paste characteristics, pattern, rim curvature, and height are used as clues in this process. The pieces of a pot cannot be assembled randomly. Instead, there are orientation rules that define exactly how

the sherds should be positioned and techniques used by archaeologists that allow for easy reconstruction. For example, rim sherds are always assumed to be positioned so that the orifice is horizontal and faces upwards. The most important orientation convention is the stance. A pot is at stance if it is oriented as if it were resting on a surface. Rims are stanced by being placed on a flat surface so that the greatest amount possible of lip rests on the surface. Meanwhile, the horizontal plane of the orifice is represented by the flat surface [13]. By attaching the pieces together, archaeologists can get a sense of the shape of the pot. This jigsaw puzzle can go on for a long time, but when the pot is complete, the accomplishment is significant. When pieces are found that fit perfectly together, they are glued in place. However, this is only done when they fit exactly, because restored pieces require more storage space than tiny sherds.

The texture of the pots is also an important consideration when determining function. This form of analysis, called petrography, is quantified by the ratio of different components of ceramic. In order to perform petrography, the ratio of coarse rock to fine clay to void space is measured; this measurement reveals a lot of information about the pot. For example, pots used for cooking generally are coarsely textured, with numerous large rocks. Pots used for liquid storage have numerous large rocks and void spaces, in order to allow for "breathing" and to keep the liquid cool. However, pottery used for serving might have a finer texture, which would consist of a minimal number, if any, large rocks, few void spaces, and a majority of clay.

In addition, residue and soot marks can be used to identify the function of the pot because traces of what once occupied the pot may still be preserved. Chemical tests will narrow down what type of material the pot was used for, but since most pots were multi-functional, this method is somewhat insufficient. "Use-wear" studies, however, help us to decipher whether the pottery was used for "stirring, scraping, mixing, grinding, pounding, washing," etc. Burn marks and other attenuations give information pertaining to function as well. In the case of chicha, a variety of ceramics were used since there were so many steps involved in the process. Grinding, heating, storing, and drinking of chicha were all involved in Guangalan culture. Hence, ceramic identification involves examination and analysis of an array of pottery.

It is imperative that an archaeologist notice the smallest marks to gain the most insight into a pot's past. When looking at a particular stain or scratch on a vessel, it is necessary to determine whether the attenuation was caused by wear or nature. "Recently, a number of archaeologists have argued that messages about ceramic function can be found on the archaeological ceramics themselves" [5]. Once an archaeologist decides whether a mark has meaning, it is still a difficult task to understand that particular implication. There are several ways to conjecture what caused a mark to be made. First, it is extremely helpful when there are still people making and using a particular type of pottery. Comparing artifacts to pots that are in use by a group of people is called ethnoarchaeology. If people are in fact still using a certain kind of pottery, it can be informative to observe what markings they make on a pot and then to compare them to an artifact's markings. Unfortunately, it is not always the case that a group of people is still using pottery that is similar to that of older societies. In that case, there are other methods to examine markings on pots involving experimentation on ceramics. These three techniques are often used hand in hand because in any situation where there is conveniently a group of people to compare an artifact to, it is still more accurate to also use chemical experimentation.

After the partial reconstruction of a vessel, there are many techniques for further analysis. If part of a rim can be found, the diameter of the orifice can easily be determined. Using a chart of diameters, we were able to line up the rim to match the curvature of best fit. The same was accomplished vis-à-vis the diameter of the aperture and the diameter of the vessel at its widest section. Using calipers and rulers, measurements of thickness and length were made. With these measurements, we were able to draw proportional models of the vessels on paper. After drawing the various pieces on graph paper, they were either scanned into the computer or photographed and imported into AutoCAD (Automated Computer Assisted Drafting). Using this program, the shapes of the pots were extrapolated using just a few pieces. The use of AutoCAD allowed us to explicitly depict pots and their shapes so that we could better understand what they were used for. Much of this technology can draw the pot with 99% accuracy using just the rim and a few wall sherds. Usually, these computerized versions of our pots matched the measurements we had made by hand earlier. The computer models served to give us a better look at what the entire pot looked like, not just a few glued-together sherds. The detailed computerized versions allowed us to extract information that would not have been possible with just pencil and paper.

The comparison between a pot's side and top drawings is crucial for functional analysis. Since it is accepted to a certain degree that form equals or at least relates directly to function, understanding the shape of a pot can lead to knowledge of its uses. If the pot is tall and narrow, we assumed that it was most likely used for storage whereas a low, wide vessel was probably used for eating. While it is very important to realize that form does not always equal function (because pots can be multi-functional), taking note of basic characteristics, such as whether a pot has an open or closed rim, or is narrow or wide, provided us with probable guesses about its uses [5].

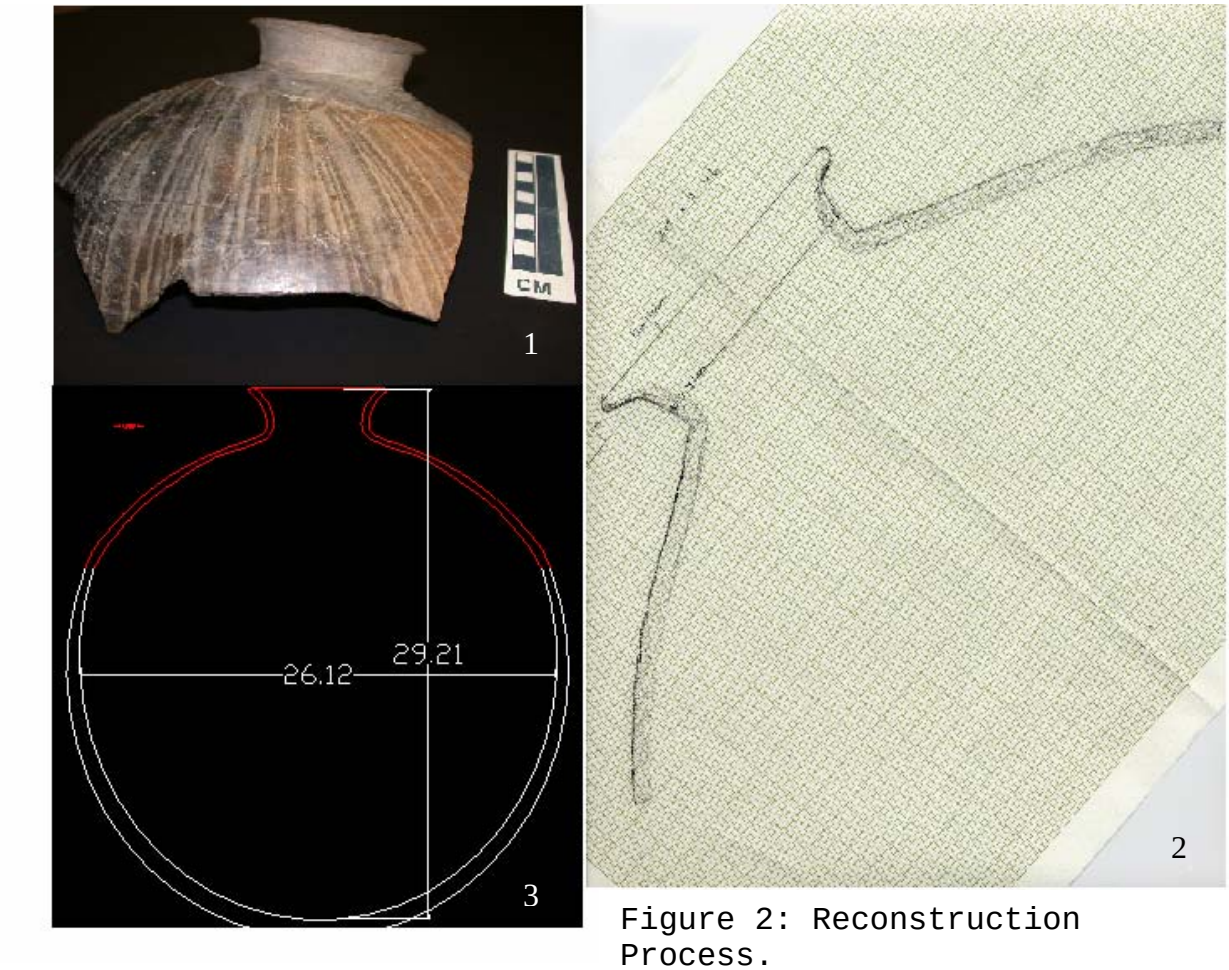

Figure 2: Reconstruction Process.

Frame 1 shows a sherd that will be sketched.

Frame 2 shows a hand sketch of the sherd, which will be scanned into AutoCAD.

Frame 3 is an example of a reconstruction made in AutoCAD using vector analysis.

The details that were determined using AutoCAD included the extraction of even the minutest details. The images were enlarged, rotated, and carefully analyzed for form (and thus, function). The computer software facilitated the computations of area and volume by providing more accurate measurements to work with. By including a large amount of measuring points and then using vector analysis, accurate recreations of the vessels were produced. Measuring points were a useful asset as well. The number of measuring points was proportional to the precision with which the data can be calculated.

Mineralogy is a useful technique to help determine the specific properties and uses of a pot. The pots were analyzed using a mineralogical polarizing light microscope. By taking a thin section of the surface of a pot (circa thirty microns thick) and examining it under the microscope, the raw materials used to create the vessels were analyzed. Ceramic vessels are formed of clay, rocks, and open pores, called voids. These components display distinct visual properties under the microscope. The polarizing lens only allows for the absorption of certain colors for specific substances. The diffractive properties of the rocks enabled them to be easily distinguished, and ratios of course material (rocks) to fine material (clay) to voids could be obtained. This ratio provides a measure of texture, which relates to function. For example, a vessel with a prevalence of voids and rocks creates a porous texture with more resistance to temperature change and cracking or better liquid cooling properties. In order to obtain the ratios of these components, we compared representative areas of each specimen under the microscope with standard density illustrations.

Another measure of the texture of a pot is porosity. Porosity is the ratio of the volume of pore space to the total volume of the piece. True porosity measures the actual pore space; apparent porosity measures the relative volume of the pore space. In low- fired pottery the difference between true and apparent porosity is negligible. Because the pots used in this study are low-fired, apparent porosity is a useful measurement.

Porosity is important because pore space helps determines density, resistance to thermal shock, and strength, among other characteristics. By varying the porosity, a potter can change the chemical properties—and thus the possible functions—of a pot. In other words, porosity is related to pot function. For example, some porosity is good in cooking vessels, to reduce thermal stress. If the vessel is not porous enough, it will be susceptible to thermal shock; if it is too porous, boiling liquids may evaporate through the pores. Vessels used to store liquids would probably be fairly porous in order to regulate the temperature of the stored liquid. Low porosity should be exhibited by serving vessels, which are typically dense.

The apparent porosity is determined by comparing the amount of empty space in a certain volume of pot to total volume. The amount of empty space can be found by comparing the weight of a dry sherd with the weight of the same sherd saturated with water. A simple formula for percent apparent porosity is $P=[(S_f-W_f)/V_f]x100$, where P is percent apparent porosity, S_f is the weight of the saturated sample, W_f is the weight of the dry sample, and V_f is the volume of the sample. First W_f is obtained by weighing the sample after drying it in an oven for twenty minutes. Then, the sample is placed in boiling water for an hour, so that water fills all the pores. The sample is left to cool after being boiled; once it is cool the surface water is wiped off and the

sample is weighed. This weight is S_f, the weight of the saturated piece. By subtracting W_f from S_f, the weight of water that fills the voids is obtained.

The volume is found by measuring the amount of water displaced by the sample. After S_f is recorded, the saturated sample is weighed first suspended in air then suspended in water. The difference between these two values is the weight of water displaced by the sample. The weight of displaced water divided by the density of water is the volume of displaced water, which is equal to the volume of the sample (V_f). Once S_f, W_f, and V_f are measured, the formula can be used to calculate percent apparent porosity.

We drew ethnoparallels once the pots were quantitatively analyzed. Ethnoparallels are similarities between the usage of artifacts in one culture and the usage of artifacts in another culture. There are many examples in the ethnographic record of chicha pots and their dimensions. If the dimensions of the reconstructed pots were similar to the dimensions of known pots, the results of such comparative analysis suggested that the reconstructed pots were used for production of alcohol—in this case, chicha.

RESULTS

Table 1-1 shows the use-wear observations made on the pots. The wearing on certain pots is an important clue to use. For example, pots that were used for storage will have spalling or deterioration due to the lime used for the corn or the hard water. In addition, pots that were commonly used for cooking have scraped lips due to stirring, internal wearing, and burn marks on the bottom surface and occasionally the sides. Finer pots, such as those used for serving, usually do not have any of the wearing characteristics. This knowledge was used to make assumptions, which established a basis for more evidence to justify the hypotheses.

The first step in the interpretation of results was to sort the pots by type. In this study, the ratio of pot height to diameter was used to determine the type of pot. All types of pot have a characteristic height-to-diameter ratio. Dishes should have a height-to-diameter ratio that is between one-third and one-fifth. The ratio for bowls is one-third to one. Collared jars have height-to-diameter ratios that are greater than one, meaning that the jar is taller than it is wide. Table 1-2 shows the height-to-diameter ratios and the categories thus inferred [3].

Next, the pots were classified in Table 1-3 based on the assumptions made in Table 1-2. Comparative analysis of capacities was conducted on the vessels. The capacities of the tested pots were matched with capacities of known types of pots. For example, T4G2-Orange Jar 1 was classified as a kenti vacu, because its capacity is 5.6 L and the capacity of a kenti vacu is usually about 5.0 L. Category was also taken into account; the capacity of T4G3-Jar 2 closely matched that of a pasqua kencha, but pasqua kenchas are bowls and T4G3-Jar 2 is definitely a jar. The general function of the specific pot types is known. For example, once T4G2-Orange Jar 1 was classified as a kenti vacu, it was categorized as an olla. The specific functions of the pot types are also known; therefore, once the specific pot types were determined, the pots were classified as chicha pottery or other pottery. Table 1-3 shows the specific functions of the analyzed pots.

Based on the comparative data, eleven of the thirteen pots are believe to have been used for chicha. Two serving bowls are not related to chicha; one is a kencha and the other is a kencha vacu. Of the eleven chicha pots, one is for serving, five are for storage, one is for fermentation, one is for cooking, and three are for mashing chicha ingredients.

Due to the aforementioned characteristics shared between the categories of our pots, a margin of doubt exists in our interpreted results. We can, however, be fairly certain in expecting that all the vessels except for the ordinary serving bowls (used for food and water) are affiliated with chicha to some extent.

CONCLUSION

Functional and ceramic analysis was conducted on pottery excavated in western Ecuador. The results show that eleven of thirteen analyzed pots are connected to chicha production and consumption. Therefore, it is safe to conclude that chicha was indeed a significant part of ancient Guangalan culture. However, to definitively prove that the pots were used for chicha, residue analysis needs to be conducted on the pieces most likely to have been used for chicha.

Many interesting anthropological aspects are intertwined with the study of ceramics. The paper approaches the behaviors of the Guangala and how they parallel that of the other indigenous cultures of the region. Archaeology is essentially a scientific way of identifying patterns in past societies. This study uses the procedures of archaeometry to find, measure, compile and reassemble the traces of Ecuadorian heritage that remains to us.

DATA/RESULTS

Data Tables

Table 1-1: Use-wear Analysis

Vessel Name	ASSUMPTIONS:				EVIDENCE:			
	Wear	Abrasions	Spalling	Burns	Wear	Abrasions	Spalling	Burns
T4G1-My Bowl	None	None	None	None	None	None	None	None
T4G1-Deep Bowl	None	None	None	None	None	None	None	None
T4G1-Serving Bowl	None	None	None	None	None	None	None	None
T4G1-Orange Bowl	None	None	None	None	None	None	None	None
T4G2-Orange Jar 1	None	None	Yes	None	None	None	Very evident	None
T4G2-Orange Jar 2	None	Only around the aperture due to holding	Along the inside surface	None	None	Yes, due to storage and on outer neck due to the tying of the lid.	Yes, along the inside	None
T4G2-Big Jar	Scratch marks on the inside from cooking utensils, and some on the bottom from mashing	Yes, from utensils	Not much, only from boiling liquids	On the bottom surface	Yes, as assumed	Yes, as assumed	Yes, as assumed	No, but the sherd was of the rim

Table 1-1: Use-wear Analysis (cont'd)

Vessel Name	ASSUMPTIONS				EVIDENCE			
	Wear	Abrasions	Spalling	Burns	Wear	Abrasions	Spalling	Burns
T4G2-Black Tan Jar	None	None	A little from storing liquids	None	None	Marks from the production process	Very Little	None
T4G3-Biggest Jar	Yes, from usage	Yes, from stirring	None	Yes, because used for cooking	Yes, wearing under the rim	Scratched by rim	None	Yes, burns are from cooking because the cross-section is not burned but interior and exterior are
T4G3-Thin Jar	Yes	Possibly	None	Yes, because used for cooking probably	Wear underneath lip	No scrapes on rim	None	Should be, but we only have a rim sherd
T4G3-Smallest Jar	Yes	Possibly	None	Yes, probably used for cooking	Charred interior and exterior	None	None	Yes, burned on interior and exterior not cross-section
T4G2-Dish 1	Yes, from mashing	None	None	None	Yes, more worn father from rim	None	On outside, not interior	None
T4G3-Dish 2	Yes	Possibly	None	Yes	Severely worn, more so in center	Very Little	None	Yes, has fire cloud

Table 1-2: Height to Diameter Ratios

Name	Use	Diameter (cm)	Height (cm)	Height to Diam. Ratio (%)	Assumption
T4G2-Dish 1	Mashing	32	5.0	15.63	Dish
T4G3-Dish 2	Mashing	30	7.6	25.33	Dish
T4G1-Orange Pot	Serving	18.57	5.21	28.15	Dish
T4G1-Serving Pot	Serving	12.51	5.23	41.81	Tazon/Bowl
T4G1-My Pot	Serving	16.02	7.22	45.07	Tazon/Bowl
T4G1-Deep Pot	Serving	10.72	8.27	77.14	Tazon/Bowl
T4G2-Big Pot	Fermentation	46	20	43.48	Jar
T4G3-Pot 3	Storage	18	18.9	105	Jar
T4G3-Pot 2	Storage	16	21.3	133.13	Jar
T4G2-Orange Pot 1	Storage	18	25.2	140	Jar
T4G3-Pot 1	Cooking	22	46	209.09	Jar
T4G2-Orange Pot 2	Storage	12	27	225	Jar
T4G2-Black Tan Pot	Storage	7.56	29.21	386.37	Jar

Table 1-3: Capacity Analysis

Measured Values						Standard Values						
Name of Pot	Rim Dia.	Aper. Dia.	Thickness	Height	Capacity (L)	Aper. Dia. Range	Height Range	Capacity	Function	Used for chicha	Specific Name	Standard Name
T4G1-Serving Pot	12	12	0.5-0.8	6.2	0.64			0.7	Food Bowl	No	Kencha vacu	Tazon
T4G1-My Pot	16	16	0.4-0.5	8.5	1.45	16.8-21.2	5.9-7.6	1.2	Serving chicha	Yes	Kenpo vacu	Tazon
T4G1-Deep Pot	10	10	0.4-0.5	8	1.73			1.7-2.8	Regular Bowl	No	Kencha	Tazon
T4G2-Orange Jar 24	12	8	0.6-1.1	27	4.3			5.0	Storage	Yes	Kenti vacu	Olla
T4G3-Jar 3	18	16	0.4475-0.535	18.9	4.4			5.0	Storage	Yes	Kenti vacu	Olla
T4G2-Orange Jar 1	18	8	0.5-0.9	25.2	5.6	18.8-22.6	15.6-42.0	5.0	Storage	Yes	Kenti vacu	Olla
T4G3-Jar 2	16	11	0.425	21.3	6.5			5.0	Storage	Yes	Kenti vacu	Olla
T4G2-Black Tan Jar	8	6	0.6-0.8	29.21	9.46			11.1	Storage	Yes	Kenti anitama	Olla
T4G2-Big Jar	46	40	1.0-1.4	20	33.4			29.0	Fermentation	Yes	Kenti anicha	Olla
T4G3-Jar 1	22	17	0.45	46	49.3	21.5-41.5	22.5-54.0	80.2	Cooking	Yes		Tinaja
T4G1-Orange Dish	18	18	0.3-0.7	5	N/A				Mashing	Yes	Mashing Dish	Dish
T4G3-Dish 1	32	32	0.8	5.0	N/A				Mashing	Yes	Mashing Dish	Dish
T4G3-Dish 2	30	30	0.9	7.6	N/A				Mashing	Yes	Mashing Dish	Dish

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