The potters' perspectives: A vibrant chronology of ceramic manufacturing practices in the valley of Juigalpa, Chontales, Nicaragua (cal 300 CE - present)

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4 Fieldwork methods

The fieldwork portion of this research aimed to obtain a sample of the lives of the dwellers of the valley of Juigalpa that was representative enough to allow for the composition of a chronological narrative of their experiences. In order to achieve this goal, I applied a combination of methods and techniques that were integrated into a cohesive research plan involving three separate steps. First, a systematic, high-intensity, full-coverage surface survey was conducted in a 52 sq km area, mainly north and south of the town of Juigalpa, to obtain a preliminary map assessing the distribution of the traces of human practices throughout the research area. Second, mapping of all mounded sites within a 47 sq km subarea was undertaken to better understand the interaction between humans and environment, embodied in architecturally modified sites, in combination with the data obtained during the survey regarding places lacking in visible surface architecture. In particular, special attention was given to documenting distribution, morphologies and spatial arrangements of man-made structures. Third, 52 stratigraphic pits were excavated in eighteen different sites throughout the valley. A total of 28 radiocarbon assays were dated through AMS.

The fieldwork component of this project was comprised of five different field seasons, undertaken between January 2015 and September 2016. In total, ten months were spent in the city of Juigalpa, Chontales, Nicaragua, together with a large team of collaborators that included bachelor, masters, and PhD students from universities around the world, who made the workload achievable in such a short period. All the survey and mapping data was processed by Alejandro Arteaga (2017) at the Universidad Nacional Autónoma de México. Additionally, an extra month was spent in Juigalpa in January 2017 to inventory all the materials retrieved during the excavations. Finally, a one-month study trip through Nicaragua took place in January 2018, where a survey of archaeological museums in the country was conducted. The main goal of this final survey was to create a photographic dataset allowing the comparison not only of ceramic materials, but also other types of industries between regions; to further understand the connections, continuities, and discontinuities in pre-Hispanic habitual practices among different regions.

4.1 SAMPLING STRATEGIES IN THE FIELD

Based on the discussions outlined in Chapter 2 (section 2.2.3), Aguas Buenas (AB) was chosen as the starting point for a microregional survey, and the valley of Juigalpa—where the site is situated—was therefore selected as the focus of this research. Once this decision was made, fieldwork methods were conceived as sampling strategies aimed at obtaining a representative dataset to fulfil these research objectives. In this case, the "representativeness" of the sample was conceptualized according to the debates outlined in Chapter 3, where isolated traits of ceramic vessels cannot account for the complexity and capriciousness of technological change and human experience. Therefore, sampling for this research implied answering questions tailored to help determine which archaeological sites were sufficiently relevant to excavate and which ones were not, and how this relevance could be defined.

Therefore, sampling strategies for this book did not start at the lab but were designed prior to fieldwork with the future laboratory work, along with its specific research questions, in mind. This chronology building effort did not start with excavation loci designed in response to divergent research aims and goals or with piles of sherds laying on tables at the lab, but with the questioning of which places would be more adequate to retrieve these ceramics from, and why. Consequently, different methodological choices led to the retrieval of the material universe studied in this manuscript, and these choices are connected to but also depart from the problems inherent to lab work, where the material traces of past human communities are classified. In other words, the ceramic dataset examined in Chapter 7 was a direct product of sampling different archaeological contexts, in which both pre-Hispanic and post-contact pottery fragments were collected.

Sampling is defined as "(...) the science of controlling and measuring the reliability of information through the theory of probability" (Binford 1964, 427); simply put, choosing elements from a larger population or universe of elements to allow the formulation of inferences applicable to the population as a whole (Drennan 2009, 80). In line with this, the terms population and universe refer to a well-defined set of objects and to sample then means to select objects from this well-defined population (Schumacker & Tomek 2013, 43). Apart from that, there are different types of sampling strategies:

1. **Probabilistic sampling**, in which "(...) every unit in the set (population) has an equal probability to be selected for the sample" (Lee Abbott & McKinney 2012, 105). Consequently, these units are representative of the studied population, and the way of selecting these units from the population will determine the type of probabilistic sampling:
   a) *Simple Random Sampling*: all units of the population are included, so they share the same chances of being chosen.
   b) *Systematic Random Sampling*: similar to the first, but with an additional step in which the first unit is selected randomly and then every other unit is systematically selected.
   c) *Stratified Random Sampling*: when the study is more complex and several variables need to be taken into account, first groups are created according to these variables, and then random sampling is applied.
   d) *Cluster Sampling*: instead of the unit, the starting point consists of groups of units, to which a random sampling is applied. Since not all clusters necessarily have the same size, the method called Probability Proportional to Size (PSS) is applied. This method calculates a fraction related to the size of the sample in order to establish sampling (Lee Abbott & McKinney 2012).
2. **Non Probabilistic Sampling:** this strategy cannot be used in order to produce generalizations about a population since its representativeness is not guaranteed. There are several types of non-probabilistic sampling:
   a. *Convenience Sampling*: it is not really a sampling strategy because groups of units are used to make generalizations but are not a representative sample of a universe.
   b. *Quota Sampling*: it is similar to Stratified Random Sampling, but in this case the sample is not selected randomly.
   c. Snowball sampling: also not representative of the whole population, since units—in this case individuals—refer to other individuals for the survey (Lee Abbott & McKinney 2012).

In order to avoid a biased sample, which would invalidate this study (Drennan 2009) and would also result in the same problems faced by previous authors in the area (Gorin 1990), the methodological approach of this research consisted in a complete research in the statistical sense. Therefore, all units of the studied population were initially included (Blom 1989).[53] However, the research process through which the universe of materials to be studied was designed comprised various steps that combined different sampling strategies. Consequently, the methodological steps that were carried out in the field started up with a surface survey, followed by mapping of mounded sites, and stratigraphic excavations—which correspond to Stratified Random Sampling and Cluster Sampling strategies.

53 See Chapter 6 for a detailed account of laboratory sampling techniques.

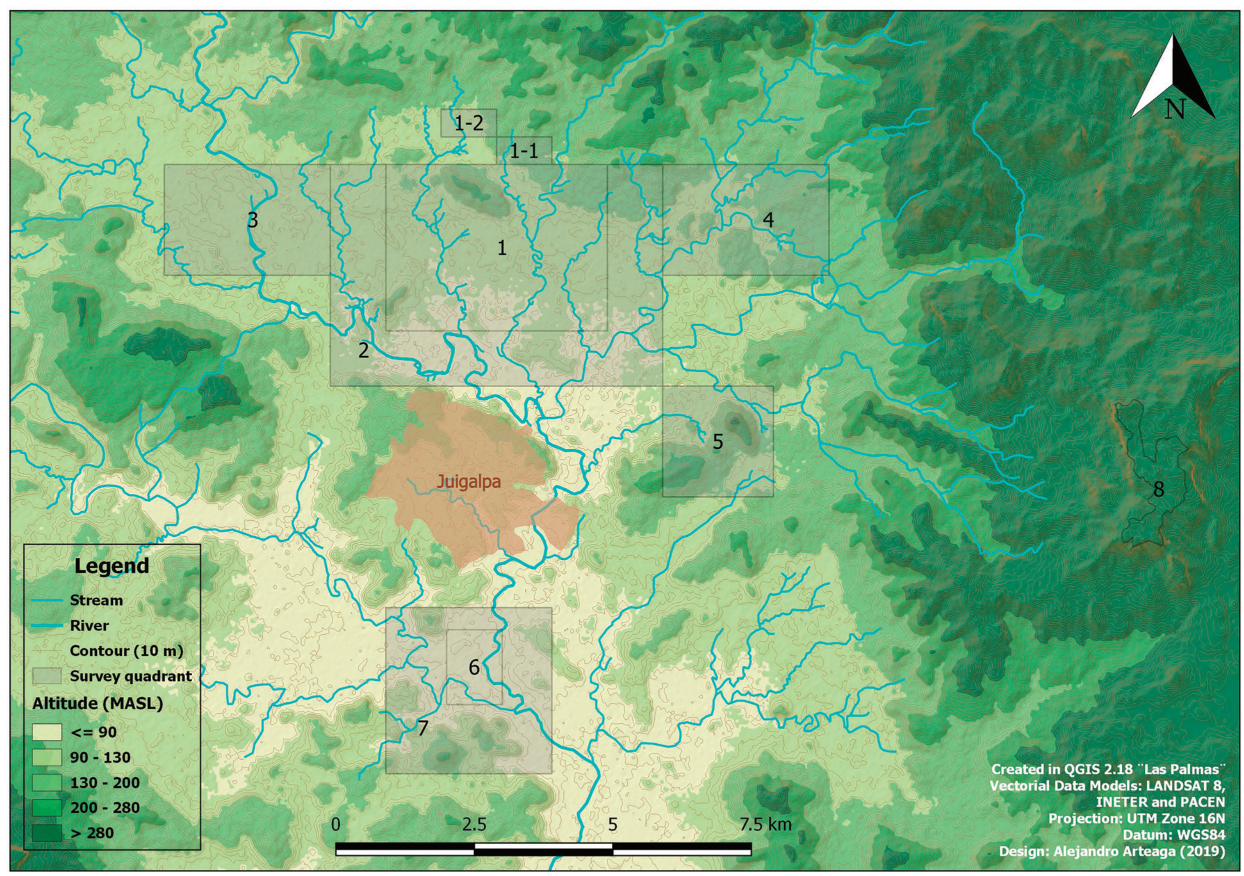


Figure 12: Map of the research area showing the different survey quadrants (credit: Alejandro Arteaga).

4.1.1 SYSTEMATIC SURFACE SURVEY

Survey areas

This section of the study consisted of a pilot reconnaissance of the research area, for which a surface survey was conducted in the valley of Juigalpa, surrounded by the Cordillera de Amerrisque. The first stage of the pilot survey, conducted in February 2015, took place in an arbitrary 12 sq kilometer rectangle around and to the south of Aguas Buenas (Quadrant 1, UTM E 6 76 000 m - 6 80 000 m / N 13 41 000 m - 13 44 000 m, see **figure 12**). Two random survey extensions to the north, of 0.5 sq km each, were added in order to include a sample of the highlands that seemed to serve as a natural northern boundary of Aguas Buenas. The preliminary results of this first pilot survey confirmed the hypothesis—outlined in Chapter 2—that the general settlement patterns view of this region was biased by the survey methodologies applied in past projects. In particular, Gorin and Rigat (1988) stated that ancient settlements were circumscribed to the margins of the rivers. However, an overview of the first lines of evidence identified after this first pilot survey suggested otherwise. Settlements not located next to the rivers were omitted by this previous research (Gorin & Rigat 1988; Gorin 1990) due to the simple fact that survey transects were restricted to the river margins, excluding other geomorphological settings. Consequently, even though the survey area proposed for this study was indeed a river subbasin, it would include different elements of the local landscape, such as plains, low hills, hills (El Monte, Guarumo, María Dominga), mounts and ridges (Cerro de La Cruz, Cerro Aguas Calientes, Güegüestepe).

Additionally, previously known archaeological data was also taken into account, so the area around La Pachona was integrated so as to combine research methodologies and scopes with Vlaskamp's sub-project at PACEN as well as with Gorin's (1990) results, which were partially based on excavations at La Pachona. In total, the rest of the research area was divided into seven different survey quadrants (numbered 2 through 8). Quadrant 2 consisted of an extension of the survey to the area immediately surrounding Aguas Buenas in a U-shape, UTM coordinates E 6 75 000 m / 6 76 000 m – N 13 41 000 m / 13 44 000 m; E 6 75 000 m / 6 81 000 m – N 13 40 000 m / 13 41 000 m; E 6 80 000 m / 6 81 000 m – N 13 41 000 m / 13 44 000 m. The main goal of this section was to study the distribution of traces of human practices with special attention on continuities and discontinuities of the patterns identified within Aguas Buenas' immediate surroundings.

In order to grasp settlement dynamics throughout the different river basins in the region, systematic survey was conducted in Quadrants 3, 4, 6, and 7. Quadrant 3 consisted of an extension towards the west (UTM coordinates E 6 72 000 m / 6 75 000 m – N 13 42 000 m / 13 44 000 m) in order to include the Mayales river banks. Quadrant 4, on the other hand, is an expansion to the east, towards the Carca stream, UTM coordinates E 6 81 000 m / 6 84 000 m – N 13 42 000 m / 13 44 000 m. Quadrants 6 and 7 were located south of the Juigalpa valley, and they were designed to encompass the El Cóbano community, which includes the Cuisalá river, UTM coordinates E 6 76 000 m / 79 000 m – N 13 33 000 m / 13 36 000 m.

For outlining Quadrants 5 and 6, other factors were taken into account, such as topographic markers, different altimetries, testimonies by locals for Cerro de la Cruz, and previous archaeological reports concerning Cerro Los Andes (Gorin 1990; Geurds 2009). Quadrant 5 consisted of a survey around and on top of the Cerro de la Cruz, UTM coordinates E 6 81 000 m / 83 000 m – N 13 38 000 m / 13 40 000 m, 230 m.a.s.l. Locals share stories about Cerro de La Cruz, which include elves living at its top, the existence of a magical border dividing our world from the supernatural one, narratives about losing the ability to find the way back home and to speak, as well as the mysterious disappearance of people and or/their belongings. Even though these stories are not directly or necessarily related to the mounds present on the top of the mountain, locals are aware of the archaeological evidence as well. Finally, Quadrant 8, UTM coordinates UTM E 6 89 822m – N 13 37 332 m (central point), was the last section chosen for survey, which was included to encompass all the geomorphological units within the research area, including the Amerrisque mountains. This portion of the survey, Cerro Los Andes, featured the highest elevation (approximately 800 m.a.s.l.) and was relevant to our research because it supposedly corresponds to the earliest phases defined by Gorin (1990). In sum, the systematic pedestrian survey covered an area of 52 sq km, in an attempt to achieve a microregional perspective for the valley of Juigalpa. Therefore, both margins of the Mayales river shores were included, as well as the Carca permanent stream and the Cuisala river. Different altitudes were incorporated into the sample as well.

As mentioned above, the main goal of the surface survey consisted of the systematic recording of all traces of human practices visible on the surface within the research area, so as to later design a solid sampling strategy to select excavation loci for redefining the local chronology. Consequently, the methodology applied included a pedestrian survey,

- of total coverage (Kowaleski & Fish 1990; Stark & Showalter 1990; Donner & Hernández Arana 2011; Donner *et al.* 2018), meaning that all terrains were accessed, even those that featured dense vegetation or other physical obstacles. In case of such reduced access, transects were walked at a 40-meter distance between team members, grouping them in couples to warrant safety and efficiency. Landowners provided access to all of their lots, so total coverage was achieved;
- of high-intensity (Stark & Showalter 1990; Donner & Hernández Arana 2011; Donner *et al.* 2018). Team members walked straight lines with a 20-meter distance between them, to ensure a detailed inspection of the surface.[54]

Data was recorded using hand Global Positioning System (GPS) devices, which used the World Geodetic System 1984 (WGS84) to georeference finds. A GPS point was taken for all mounds, surface

54 The distance between team members was calculated in relation to the average mound diameter in the research area, which generally does not exceed 10 meters. Walking with 20 meter gaps then ensures a sufficient rate of parallel visibility necessary for optimal identification of surface archaeological materials (Stark & Garraty 2008).

scatters (ceramics, chipped stone, ground stone), petroglyphs, sculptures, basalt columns, mortars, and fossils. All observable landscape modifications, such as stone alignments, roads, or pathways, were also recorded. All artifacts, mounds, and surface scatters were photographed, but surface materials were not collected. Apart from the digital recording methods, a table was filled out by each team member in a notebook, which contained waypoint number, easting and northing coordinates (UTM), picture number, find category, date, and observations. Specific codes were utilized for each artifact category to allow fast, systematic recording (see Donner *et al.* 2018). During these preliminary stages of the research, characterization of materials was done in relation to raw materials (i.e. ceramics and rock), combined with technology and end product (chipped stone, ground stone, petroglyphs, sculpture). Also, every occurrence of surface material was classified as a "scatter", and every anthropogenic elevation was called a "mound".

Surface survey data processing and analysis was undertaken by Alejandro Arteaga (2017), using ArcGIS to create different layers for each type of find. Accordingly, observation and analysis of the differential distribution and interrelationships between surface materials—but also incorporating topography and water sources, for example—allowed for the formulation of distribution patterns and distances between sites, both mounded and un-mounded. For this book, observations will be centered around surface ceramics in relation to mapped and excavated sites, both by PACEN and by other projects (Gorin 1990).

4.1.2 METHDOLOGY FOR MAPPING OF MOUNDED SITES

Due to the multiplicity of surface finds, and especially the distribution of surface ceramics,[55] a decision was made to prioritize mounded sites in order to generate a map of the different places within the research area where architectural investment was recorded. This map was conceived as a necessary previous step to plan further excavations beyond the sites surrounding Aguas Buenas. In order to achieve accurate data resolution and a thorough record of the sites, the team led by Alejandro Arteaga returned to all the sites that were previously recorded during the survey in order to register, measure, and photograph every single mound. This task was also completed on foot and applied a higher intensity than the surface survey, conducting the inspections of mounded sites in walking transects separated by 5 meters (Arteaga 2017; Donner *et al.* 2018). This strategy not only allowed recording the mounds, but also other features, such as the distribution and density of surface materials and their relationship to soils and topography, among others.

Three guidelines were utilized to orient the pedestrian inspection, as follows:

1. Mound recording was conducted per land lot following the orientation of fences but avoiding a biased division of sites based on modern boundaries. Once a parcel was covered, further survey was conducted in the surrounding ones (Arteaga 2017, 92).
2. When architecture followed a certain orientation, the distribution of patterns of the mounds was used to "predict" the location of further structures that were barely visible on the surface (Arteaga 2017, 92).
3. When rivers, streams, or creeks were associated to mounds, their beds were followed on both margins (Arteaga 2017, 92).

Mounds were also recorded using a hand GPS device, with one waypoint at the center of each mound, which was named using a combination of the initials of the land owner, the lot number expressed in Roman numerals—sometimes a single landowner possessed multiple parcels—and the mound number written in Arabic numbers. In the case of mounds located on hilltops, their known name was applied for mound labeling, because these geomorphological units, such as Güegüestepe, Aguas Calientes, or Guasimosolo, are known local landmarks. Some exceptions were used when the names of landowners could not be ascertained. This coding system allowed for the creation of a database with a unique nomenclature for each mound and architectural feature, which also included photographs with scale and north arrow indicating magnetic north. Sketches were drawn to point out mound shapes, relations to surface scatters, geomorphological features, and modern modifications (i.e. roads, houses, fences).

In the beginning, mound recording was attempted using the forms specially designed by Auzina (2018) for Aguas Buenas. This template included all of the criteria necessary to answer specific questions about that particular site, such as frequency and distribution

55 See Chapter 5.1.

Mound No.	General Information			
	Site Name			
Photo No.	Land Owner			
	Date			
Camera	Team			
	Visibility			
Waypoint No.	Ground	H	M	L
	Parallel	H	M	L

Mound Measurements			Orientation	Current use of the land
Width	Min	cm		Farming
	Max	cm		Household
Height	Min	cm		Pasture
	Max	cm		Forest

Material Culture		YES	NO	
Type of Finds	Density			Detail
C	L (1-20)	M (21 - 40)	H (>40)	
CS	L (1-20)	M (21 - 40)	H (>40)	
O	L (1-20)	M (21 - 40)	H (>40)	
GS	L (1-20)	M (21 - 40)	H (>40)	
F	L (1-20)	M (21 - 40)	H (>40)	
MT	L (1-20)	M (21 - 40)	H (>40)	
Other	L (1-20)	M (21 - 40)	H (>40)	
P	YES NO	On mound	Surroundings	
BC	YES NO	On mound	Surroundings	

Mound Morphology				
Shape	Circular	Oval	Other	
Steepness	0-35°	35-55°		55-90°
Slopes	Uniform	Irregular	Pendient to:	
Top	Round	Flat: cm		
	Surface level	Elevated	Other	

Relationship to Landscape				
Adjusted to landscape feature	Floodplain	Slope	Hilltop	Foothill
	hillplain	riverbank	plain	
Relative mound location	river	elevation	site-design	unidentified
Bedrock Outcrop	YES	NO	On Mound	Surroundings

Conservation Status	H	M	L	Unidentified

Undisturbed					
Anthropic	Fence	Road	plough	Construction	Looting
	Other				
Natural	Trees	Animal burrow	Insect	Other	

Construction Materials						
Composition	Stone	Stone-sediment		Sediment	Sediment-Stone	
Soil texture	Clay	Silt	Sand	Gravel	Tuff	Ash
Consistency	Sandy	Clayish	Powdery			
Color						
Rock type	Col Basalt	Ex Bedrock	R-stones	Sandstone	Limestone	Other
Stone size	Top	S (0-20cm)	M (20-40 cm)		L (>40 cm)	No stones
	Slopes	S (0-20cm)	M (20-40 cm)		L (>40 cm)	No stones
	Foot	S (0-20cm)	M (20-40 cm)		L (>40 cm)	No stones
Stone circles	YES	NO				
No. Circles:	Circle 1	full	semi	partial		N W S E
	Stone Size	S	M	L		T F S A
	Distance stones	Together	<1 m	>1 m		
	Circle 2	full	semi	partial		N W S E
	Stone Size	S	M	L		T F S A
	Distance stones	Together	<1 m	>1 m		
	Circle 3	full	semi	partial		N W S E
	Stone Size	S	M	L		T F S A
	Distance stones	Together	<1 m	>1 m		

Mound Type	
Circumbscribed leveled elevation	Small Pile of Rocks
Elevated Foundation	Stone Wheel
Pile of Rocks	Other

Sketch Map

/\ North

Comments

Figure 13: Mound recording form.

of surface materials, morphological characteristics of each mound including measurements, as well as general topographic attributes, among others. However, after finishing mound recording around Aguas Buenas, Alejandro Arteaga suggested redesigning the form with a twofold argument. First, and as mentioned above, the research questions guiding mound recording practices at Aguas Buenas were very specific and site oriented, while the inquiries driving the surface survey of the whole research area were broader. Second, variability in mound morphologies, composition, construction techniques, site configurations, and relation to landscape also required recording a wider spectrum of attributes. In particular, variables necessary for a settlement pattern study were added (Arteaga 2017). As a result, a new form was developed collaboratively with the participation of all team members, using the knowledge obtained during the pedestrian survey. However, the majority of the criteria from the original form were maintained in order to design a database that could include the mounds already recorded by the project. The form went through various changes before reaching its final format (**figure 13**), and the major modifications are outlined in Appendix 1.

The extension of the research area beyond the first 12 sq km belonging to Quadrant 1 resulted in higher variability in architectural remains related to mound design, construction materials and techniques. This variability required increased flexibility in recording methods to allow for the inclusion of additional variables in order to exhaustively secure the documentation of all observable surface variation, while also facilitating quantification in the processing and analyzing of data. Even though the multiplicity of variables was challenging for processing and analyzing the mound database, it was necessary for achieving the goal of systematic documentation. Instead of forcing the variables to match pre-designed forms, the form itself consisted of a methodological exercise in which all team members, from Bachelor, Masters, and PhD students, to local workers, participated through collective observations and discussions. As such, these protocols, in addition to the results of the survey, can serve as a proxy for future mapping endeavors in central Nicaragua, as well as other regions of the country.

For processing and analyzing the data recovered through systematic mapping, Leontien Talboom (currently a PhD student at University College London) designed a Microsoft Access database following the variables of the paper form used in the field. Sketch maps were digitized using *Adobe Illustrator*. Also, Alejandro Arteaga created a georeferenced database using ArcMap 10.2 by ESRI in order to generate maps according to the different attributes of each mound.

4.1.3 STRATIGRAPHIC EXCAVATIONS

The selection of the different loci for stratigraphic test pits implied strategic sampling at two different levels. First, the choice of which sites to excavate; and second, consistency in the diversity of specific areas within the sites to sample. The combination of these two sampling levels was designed to match the objectives of this study. As the research progressed, sampling techniques were further refined, so the development of strategies regarding the selection of excavation loci can be divided in three different moments:

- ***2015A Excavations***: these test pits were conducted during the second field work season—summer of 2015—and were all located in Quadrant 1. Consequently, the hierarchized variable was spatial, aimed at recovering a representative sample of Aguas Buenas materials, as well as some of the sites surrounding it.
- ***2015B-2016A Excavations***: these excavation units were dug between the autumn of 2015 and the winter of 2016; their selection was based on relative chronological criteria according to surface materials—both ceramics and architectural features.
- ***2016B Excavations***: these excavations, aimed at widening the data universe both synchronically and diachronically, took place in the summer of 2016. Since the main objective consisted of securing the acquisition of a representative sample for the history of ceramic manufacturing practices within the valley of Juigalpa, a spatiotemporal criterion was applied for sampling locations.

2015A Excavations

Understanding both geological and cultural stratigraphy was extremely important for a chronologically driven study, so the main goal of the first excavations within this research program consisted of the realization of stratigraphic test pits in diverse locations within and beyond Aguas Buenas, in order to establish and compare the different stratigraphic profiles. Consequently, the first locations for excavation were selected after a detailed study of the distribution of the surface materials, recorded during the surface survey season undertaken in the winter of 2015. The results of the surface survey were examined taking into account the general and specific aims of this research, so eight different excavation loci were selected for the fieldwork season of the summer of 2015 (**figure 14**). Sites representing various combinations of surface materials were chosen:

- A site with mounds, ceramics, petroglyphs, ground stone, and chipped stone (Aguas Buenas, UTM E 6 78 841 m – N 13 43 885 m).
- A site with mounds, ceramics, petroglyphs, and chipped stone (La Zarcita, UTM E 6 76 510 m – N 13 43 365 m).
- A site featuring mounds, ceramics, petroglyphs, and ground stone (Lázaro Villegas, UTM E 6 78 655m – N 13 43 364).
- A site yielding ceramics, chipped stone, and ground stone (Sebastián Ríos, UTM E 6 79 069 m – N 13 43 084 m).
- A site containing mounds, ceramics, chipped stone, and a basalt column (La Aventura, UTM E 6 7 6019 m – N 13 41 073 m).
- A site with only mounds visible on the surface (Alberto Obando, UTM E 6 78 037 m – N 13 43 937 m).
- A site featuring only chipped stone and ground stone on the surface (Jerry Hernández, UTM E 6 77 405 m – N 13 42 608 m).
- A site with only chipped stone surface materials (La Vaina, UTM E 6 76 807 m – N 13 41 988 m).

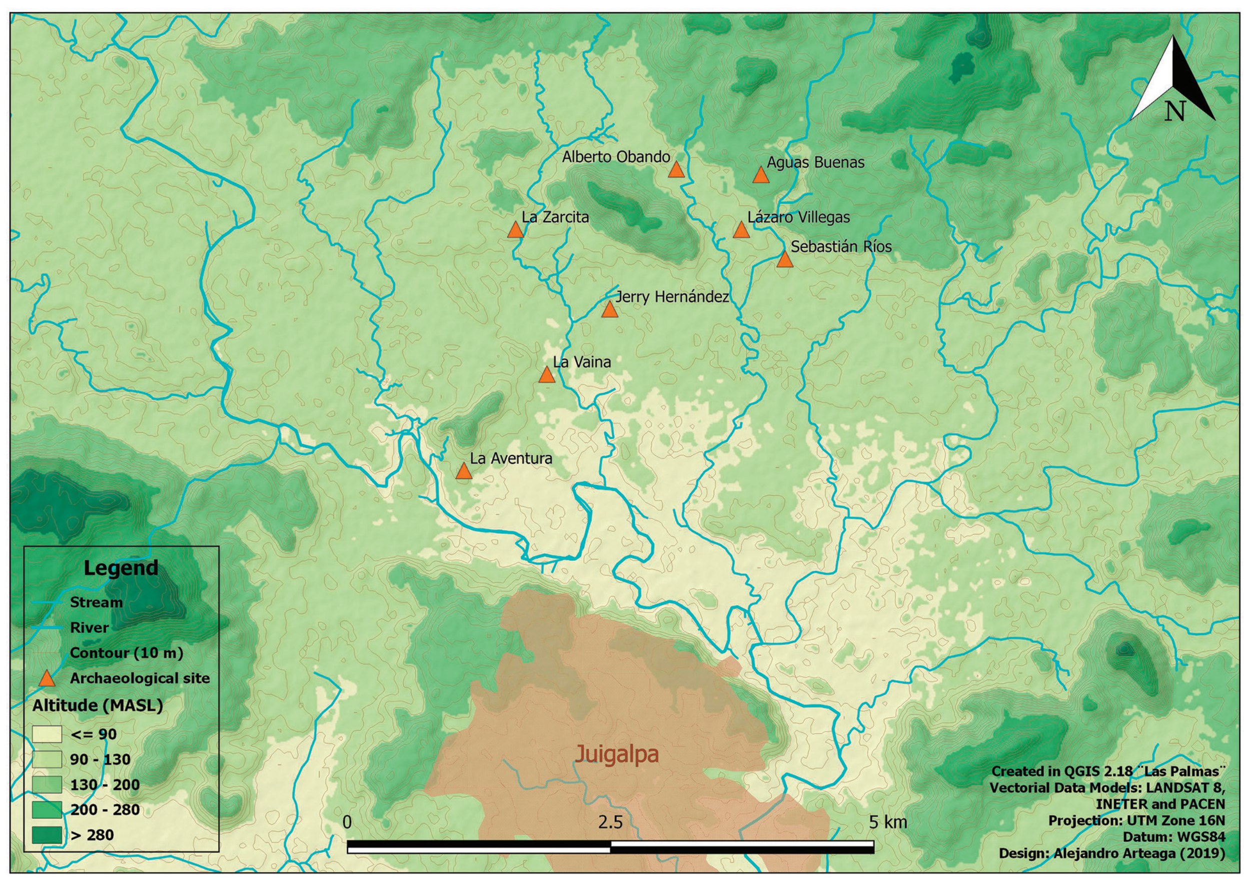


Figure 14: 2015A Excavations (credit: Alejandro Arteaga).

During this stage of the research, no typology was available for classifying the sites, and no spatial analysis of the systematic survey data was yet ready.[56] However, a systematic sampling strategy was applied, so the combination of presence and absence of various surface materials was established as a preliminary hierarchy of attributes for choosing which sites should be sampled. Material culture at the two un-mounded sites (La Vaina and Jerry Hernández) excavated during the 2015A season was extremely scarce. In contrast, a higher frequency of finds was retrieved from sites featuring architecture. For this reason, the decision to favor mounded sites was made, with the exception of Sebastián Ríos Histórico (see below).

56 Results are now available in Arteaga (2017) and Donner *et al.* (2018).

2015B-2016A Excavations

The main goal of these excavations was to stratigraphically sample two sites that evinced possible late—colonial and historical—surface materials. In order to construct a chronology extending through to the present, sampling these sites was a priority. Two different sites, which yielded diverse material culture remains on the surface, were sampled accordingly (**figure 15**):

- *Sebastián Ríos Histórico*. This site was selected because, even though it did not feature architectural remains, surface ceramics yielded materials preliminary dated between the sixteenth and the twentieth century (**figure 16**), mixed with pre-Hispanic pottery and chipped stone fragments. Colonial ceramics were exclusively identified on the San Gabino hill, so the inclusion of

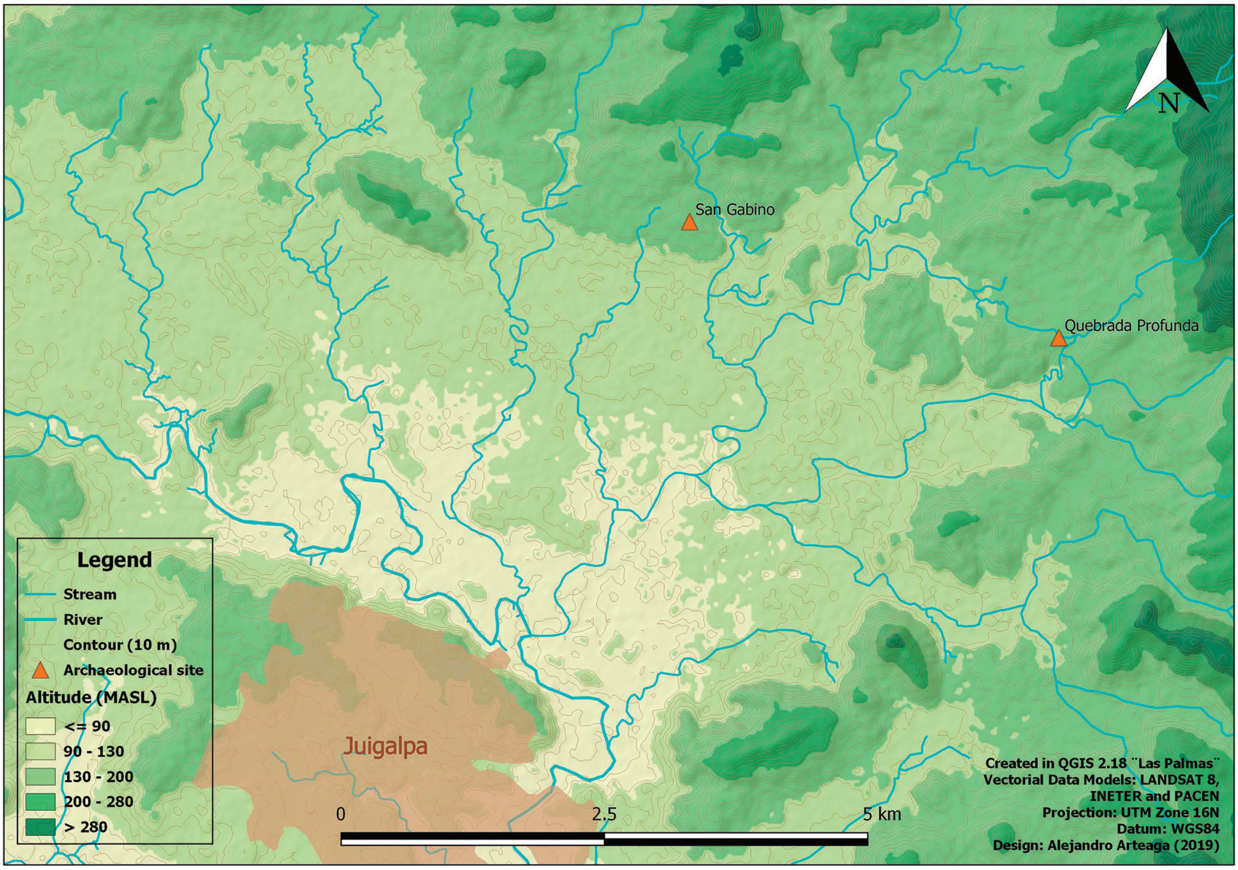


Figure 15: 2015B-2016A Excavations (credit: Alejandro Arteaga).

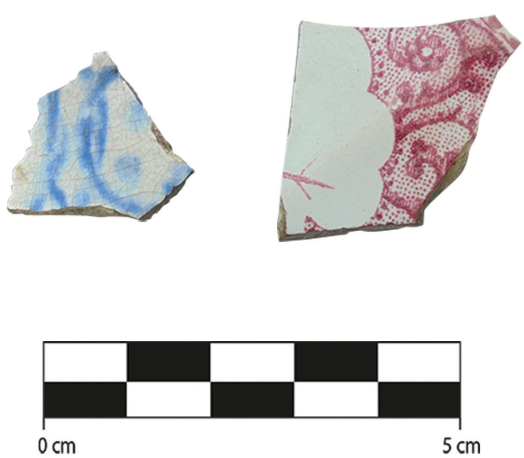


Figure 16: Post-contact ceramic sherds identified at Sebastián Ríos Histórico.

this context ensured the characterization of ceramic manufacturing operational sequences after the European invasion. The study of the technological changes experienced by pottery production is of extreme relevance to understand strategies of resilience and embodied resistance.

- *Quebrada Profunda*. This site was selected mainly due to spatial and architectural features. To begin with, it includes three different mounded areas: Southern, Central, and Northern. Within the Central area, a quadrangular structure was recorded by Arteaga (2017), which was preliminary interpreted as historical. Excavations were planned for each area within the site to ensure a comparison of the different sections, as well as to the materials recovered at Sebastián Ríos Histórico.

Cluster	Site codes	UTM E	UTM N	No of mound clusters	No of mound clusters excavated	Names of the clusters excavated
A	RDOI, RDOII, RDOIII,OP, WMI, WMII, WMIV, WMV, CAO, EV	6 81 860 m	13 44 000 m	3	3	Rosa Dolores Oporta (RDO)
		6 82 811 m	13 43 230 m			Oporta (OP)
						Wilder Marín (WM)
B	AM, AMII, WG	6 81 000 m	13 42 580 m	2	1	Alcides Montiel (AM)
		6 81 160 m	13 42 280 m			
C	SRRI, SRRII, CV, GSI, GSII, EM, EMI, Sabana Grande, JFA, OSI, OSII, OSIV, OSH, RLI, NC	6 79 640 m	13 41 450 m	4	2	Sabana Grande (LD)
		6 81 660 m	13 40 000 m			Piedras Grandes (JOR)
D	RAI	6 77 330 m	13 40 555 m	1	1	Roberto Amador (RAI)
		6 77 550 m	13 40 460 m			
E	UBI, UBII, UBIII, UBIV	6 72 770 m	13 44 170 m	1	1	Barillas (UBI)
		6 73 400 m	13 43 740 m			
F	Los Andes	6 89 300 m	13 39 690 m	4	None	N/A
		6 90 350 m	13 37 140 m			

Table 3: Sites tested during the 2016B excavations.

2016B Excavations

For this last stage of the excavations, the complete map of mounded and un-mounded sites within the research area was complete, except for Quadrants 6 and 7, which were left aside because they correspond to the community of El Cóbano, which is outside of the valley, and materials excavated at La Pachona by Vlaskamp were already available for comparison. According to the map showing the distribution of mounded sites within this subarea,[57] excavations were planned in six different areas (A, B, C, D, E, and F). The concept of mound cluster was applied for defining sites and excavation areas following Arteaga (2017). Even though the use of the term site is subject to debate (Willey & Phillips 1958; Hurst Thomas 1975; Foley 1981; Binford 1982; Dunnell & Dancey 1983; Dunnell 1992; Ingold 1993),[58] it became a useful category to refer to mounds grouped within a 75 m range, as characterized by the spatial analysis conducted by Arteaga (2017). The different locations for excavation are summarized in **table 3**.

Cluster A is formed by three groups of mounds (RDO, WM, and OP) plus some isolated mounds, all situated on the northeasternmost section of the research area, along the Copelito-Carca stream. While RDO and WM are located east of a meander of this body of water, OP is placed west of it. Excavations were conducted at the three different sites to establish their chronology as well as to understand spatial configurations and possible practices associated to the sites. Architectural remains combined low platform mounds with larger elevated foundations, geometric arrangements—WM and RDO—as well as large mounds surrounding flat terrains, at least for RDO and OP. Surface materials were visible, especially around larger mounds.

Cluster B comprises two sites or mound groups (AM and WG) that are situated on the southeasternmost portion of a super cluster that includes Aguas Buenas

57 See Chapter 5.2, page 90, **figure 26**.

58 See Herrera Malatesta (2018, 24-30) for a detailed examination.

and surrounding sites forming a block of mounded sites with a northwest to southeast orientation—following the geomorphology possibly associated to a fault—that spans for almost 5 km from La Zarcita (excavated in the summer of 2015) to AM and WG. These two sites feature a certain level of geometric architectural arrangement, combining low platforms with larger structures. At AM, the flat terrain surrounded by mounds does not include three larger mounds in the center—like in RDO or OP—instead, a single larger mound (ALMII12) is located next to a large low platform (ALMII13), which yielded the only visible surface materials. The rest of the site—as well as WG—featured no surface materials.

Cluster C is comprised of four groups of mounds (Arteaga 2017) located at the south of the research area in association to the meandering Carca stream. Monumental sculpture fragments were observed during the surface survey exclusively at two sites throughout the research area, both belonging to this supercluster: Sabana Grande and Piedras Grandes II. Excavations were planned for both groups (LD or Sabana Grande and Josefa Ocón Robleto or Piedras Grandes II), in order to gather comparable materials from mound groups that were different in terms of spatial arrangement, morphology, and ubiquity of surface materials. While Sabana Grande featured high densities of archaeological materials at the surface, Piedras Grandes II yielded low frequencies of surface ceramics. Also, previous work at the site (Magnus 1975b) and observations conducted in the field derived from the preliminary grouping of Sabana Grande with other clusters featuring high surface material densities in combination with diagnostic Pacific Nicaragua materials, such as Roberto Amador and La Pachona. The materials excavated by Magnus (1975b) were dated to the Potrero phase, according to Gorin's chronology (Gorin 1990). In contrast, Piedras Grandes II seemed to evidence lower impact practices. Therefore, excavations were planned for both sites with the working hypothesis of synchronicity, in order to compare such spatially close sites, which could have been inhabited by the same communities of potters.

In order to gather a representative dataset comparing similar and divergent contexts, cluster D, corresponding to the Roberto Amador site, was sampled for excavations. This site is located south of a meander of the Mayales river, less than a kilometer north of the town of Juigalpa. While mounds vary in morphology and size, surface materials are abundant, which is a tenet shared—as mentioned above—with only a few other sites within the research area. Accordingly, a stratigraphic test pit was realized at the site.

Cluster E is comprised of the mounds of Barillas, an archaeological site previously excavated by Magnus (1975b) and ascribed to the Cuapa phase according to Gorin's (1990) sequence. The site is situated by the Mayales river, and it was sampled for excavations due to its spatial arrangement, the quantity, types, and sizes of mounds, as well as its medium density of surface materials. Apart from that, Barillas is the only site that features a petroglyph outside of the geomorphological unit where Aguas Buenas is situated, evincing continuity in two-dimensional rock carving practices throughout the valley.

Excavations at Cluster F, at Cerro Los Andes, were programmed due to the differential mound morphologies (Geurds 2009), combined with the fact that Gorin (1990) used materials at the Gregorio Aguilar Barea Museum with a provenance from Los Andes for defining the Mayales I and II phases, the earliest in his chronology. Since these contexts lacked stratigraphic excavations and both phases were not dated through absolute techniques, a systematic survey immediately followed by stratigraphic excavations was planned. However, land owners only allowed the team to conduct the surface survey and did not grant permission for excavations. Therefore, archaeological materials and radiocarbon dates were not retrieved. However, a first map of the complete distribution of mounded sites on the plateau of the mountain was achieved, although this data is still being processed.

In summary, the 2016B excavations were concentrated in five different sections within the research area, covering both the Carca stream and the Mayales river bank, the areas with the highest concentrations of surface ceramics, the sites that are part of larger clusters as well as "isolated" mounded sites, and several spatial configurations combined with different mound morphologies. The next step was to select comparable contexts within the sites for sampling strategies.

Methodology

Since the main goal of the stratigraphic excavations was situating mounded sites in specific time intervals through the study of their geologic and cultural stratigraphy, interventions within structures were not planned for the first seasons of excavations. Once

the architectural and spatial datasets were partially processed and analyzed, a limited number of mounds at specific sites were selected for sampling materials used as filling for construction purposes in order to draw comparisons with off-mound assemblages and also confirm or discard synchronicity between on- and off-mound materials.
Accordingly, several excavation strategies were combined in order to study the stratigraphic profiles of the different sites, as well as to ensure the comparability of the ceramic materials retrieved. Therefore, three different types of test pits were excavated, whose dimensions and shapes varied according to their location, objectives, and material densities at the surface, as well as geomorphological associations:

1. **2x2m stratigraphic test pits.** Three different criteria were applied to place these excavation units:
    a) On flat portions of terrain surrounded by mounds, always taking into account their location relative to the central or largest mounds. The goal of these pits was the evaluation of open flat spaces, which probably served as access to structures, general pedestrian circulation between mounds, and areas for gathering, as well as for daily, seasonal, and nonroutine practices. Excavations aimed at identifying floor levels, which are common in flat surfaces surrounded by architectural remains, to be stratigraphically used as temporal markers between materials retrieved below and on top of them.
    b) At the "*backyard*" of the largest mound. If the flat open areas described above are indeed places for the abovementioned practices, then it is important to excavate the opposing backside of the mounds as well to assess possible differences between the two contexts. The main goal of these excavations was to compare and contrast the materials found in the open flat areas with the ones retrieved "behind" the mounds. If the open areas were used for communal practices, it is feasible that more private habitual practices, including trash disposal, could have taken place behind the mounds. For example, as larger mounds require a high architectural investment, one could expect larger concentrations of materials around them. Of course, cleaning practices might disturb depositional processes, but comparative test pits would aid in understanding potential spatial differences in off-mound settings.
    c) In areas where surface materials are found in high or medium frequencies. For unmounded sites, such as Sebastián Ríos Histórico, for instance, excavation units were placed in sections with high densities of surface materials.
2. **3x1 m approximation trenches.** The main goals of these test pits consisted in the identification of floor levels immediately related to architectural remains and the foundations of structures, as well as the differentiation between off-mound and filling materials and the study of construction techniques. Also, these excavations aimed to test Arteaga's preliminary mound typology, which was based only on surface observations (Arteaga 2017). Apart from that, they allowed for the dating of different types of mounds to establish chronological relationships and consequently to propose, maybe at a future stage of PACEN's research, a chronology for mound building practices.
3. **1x1m stratigraphic test pits.** Small excavation units aimed at obtaining stratigraphic profiles were programmed in the following cases:
    a) Sites associated to intermittent streams that lacked architectural remains and surface ceramics, such as Jerry Hernández and La Vaina, and that also featured clayish soils resulting from alluvial processes. In these cases, the test pits aimed to secure a stratigraphic column to determine whether earlier traces of

Site Code	

General Information	
Supervisor:	
Date:	

Context	
Site	
Owner	
Reference Point:	
UTM E:	
UTM N:	
No. Photos:	

Terrain Use			
Pasture	SI		NO
Field	SI		NO
Type of cultivation			
Plowing	SI		NO
Orientation of Plowing			
Burning	SI		NO
Restos siembra	SI		NO
Loose stones	SI		NO
Many?	SI		NO
Visibility at eye height	A	M	B
Visibility at ground level	A	M	B
Type of soil			
Type of grass			
Type of trees			

PACEN 2016
Cédula
Sitio

E	1
Measurements	
Location	
Description	
Levels exc	
Stratigraphic Units exc	

E	2
Measurements	
Location	
Description	
Levels exc	
Stratigraphic Units exc	

E	3
Measurements	
Location	
Description	
Levels exc	
Stratigraphic Units exc	

E	4
Measurements	
Location	
Description	
Levels exc	
Stratigraphic Units exc	

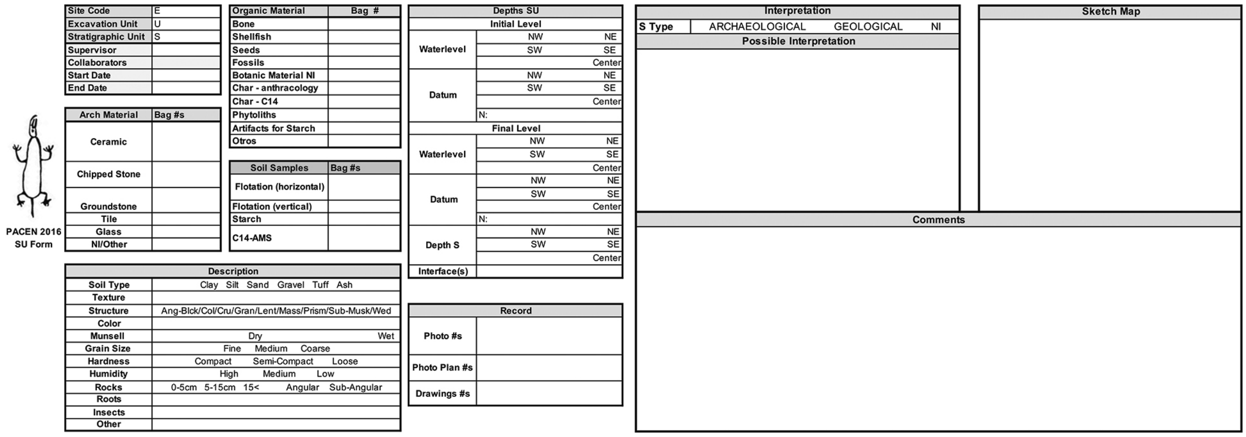
Terrain description - Comments

Figure 17: Definitive site form for excavations.

human presence in the area might have been buried by depositional processes.

b) Sites that did feature mounds but are located on elevated portions of alluvial terraces in association to clayish soils—also the product of alluvial processes. These excavation units aimed to study the geologic stratigraphy of clayish soils in combination with shifts in human-environmental interactions related to possible flooding events associated to the Mayales river.

Once the excavation unit was situated within the spatial arrangement of the site, the excavation procedure started with the layout of the units. For this, orientation to the magnetic north—using a compass and the Pythagorean system—was always followed, except for the approximation trenches, which were oriented according to the mound(s) spatial logic. Data recording was undertaken in three different forms: one per site (**Appendix 2**), which included location, general description of the site, and excavation units; one for each arbitrary 10 cm level (**Appendix 3**); and one for each stratigraphic unit or interphase (**Appendix 4**). However, after the 2015A excavation season, it was necessary to reduce the number of forms, so the arbitrary level form was eliminated, and the site (**figure 17**) and stratigraphic unit (**figure 18**) forms were redesigned to their final format. The new forms, which were based on the experience of the first excavations, were specifically tailored to thoroughly describe stratigraphic units combining layer and level data in order to interpret the excavation dataset according to Harris' premises (Harris 1989; 1993). Therefore, the new stratigraphic unit form was organized in different sections, including general data, depth, description, presence of different types of materials (and their bag numbers), information regarding the documentation team, interpretations, and sketch drawings. In the case of identifying interphases, a different form was filled out and stored together with its corresponding stratigraphic unit.



PACEN 2016
SU Form

Site Code	E
Excavation Unit	U
Stratigraphic Unit	S
Supervisor	
Collaborators	
Start Date	
End Date	

Arch Material	Bag #s
Ceramic	
Chipped Stone	
Groundstone	
Tile	
Glass	
NI/Other	

Organic Material	Bag #
Bone	
Shellfish	
Seeds	
Fossils	
Botanic Material NI	
Char - anthracology	
Char - C14	
Phytoliths	
Artifacts for Starch	
Otros	

Soil Samples	Bag #s
Flotation (horizontal)	
Flotation (vertical)	
Starch	
C14-AMS	

Description	
Soil Type	Clay Silt Sand Gravel Tuff Ash
Texture	
Structure	Ang-Blck/Col/Cru/Gran/Lent/Mass/Prism/Sub-Musk/Wed
Color	
Munsell	Dry Wet
Grain Size	Fine Medium Coarse
Hardness	Compact Semi-Compact Loose
Humidity	High Medium Low
Rocks	0-5cm 5-15cm 15< Angular Sub-Angular
Roots	
Insects	
Other	

Depths SU		
Initial Level		
Waterlevel	NW	NE
	SW	SE
		Center
Datum	NW	NE
	SW	SE
		Center
	N:	
Final Level		
Waterlevel	NW	NE
	SW	SE
		Center
Datum	NW	NE
	SW	SE
		Center
	N:	
Depth S	NW	NE
	SW	SE
		Center
Interface(s)		

Record	
Photo #s	
Photo Plan #s	
Drawings #s	

Interpretation			
S Type	ARCHAEOLOGICAL	GEOLOGICAL	NI
Possible Interpretation			

Sketch Map

Comments

Figure 18: Definitive stratigraphic unit form for excavations.

The new sections included in the final version of the stratigraphic unit form are the following:

- Additional details regarding measurements below the *datum*. During the 2015A excavations, several units were located on slopes, so it became necessary to record different hypsometries within the test pits in detail.
- Systematization of the different types of soil according to local nomenclature (clay, silt, sand, gravel, tuff, ash, etc.), granulometry (fine, medium, coarse), hardness (compact, semi-compact, loose), humidity (low, medium, high), and size of excavated rocks.
- A special section was created in order to include the list of bags corresponding to soil samples related to macrobotanical analysis (flotation) and microbotanical analysis (starches and phytoliths). Apart from that, specific forms were designed for the quantification of all bags containing soil samples. Additionally, a section was added to record samples for organic sediment dating through AMS.
- A segment of the form was included to document the picture numbers for orthophotos, since this georeferenced recording procedure became a systematic part of the excavation methodology from the 2015B season on.
- The form included a new section on interpretations of stratigraphic units, which allowed excavators to hypothesize whether they are geological or natural, as well as providing other insights.

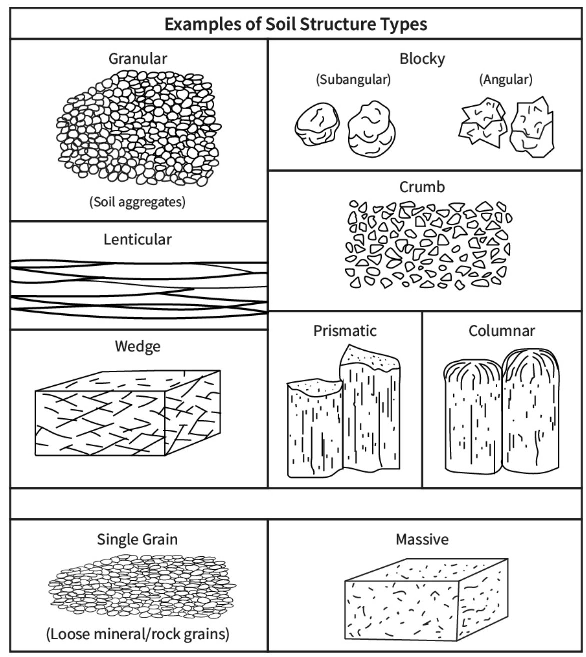


Figure 19: Soil structure macroscopic description chart (redrawn from Natural Resources Conservation Service 2020).

During the 2016B excavation season, a section for describing the structure of the stratigraphic units was included in the form, following simple macroscopic criteria visible on the units' profiles as well as during the excavation process (**figure 19**). This classification later aided—together with other soil characteristics, such as color, depth, and grain size, among others—

in the identification of soil horizons. Soil horizons were defined in Chapter 5 according to the guidelines established by the Food and Agriculture Organization of the United Nations (Jahn *et al.* 2006).

Apart from these forms, documentation included a photographic record (always including a white board with contextual information as well as a north arrow and a scale) of the beginning of each excavation unit; of each stratigraphic unit (plan), feature, and find; of the conclusion of the excavations; and of the closure (backfilling) of the pit. These pictures were complemented by the orthophotographic record mentioned above, which followed the same criteria, including all stratigraphic units, different moments within the excavation process, and select features and finds. A photogrammetric recording of the excavation units was also conducted during the 2016B excavations. Plan drawings for each arbitrary metric level, as well as of all finds and features, were carried out using a 1:10 scale. In the case of an absence of finds, rocks, or other elements, layers were sketched and described. All profiles of the excavation units were photographed and drawn at either 1:10 or 1:20 scale. All data recorded with the Total Station was also documented in a paper form especially designed for that purpose to avoid data loss.

Excavation techniques combined two different strategies: arbitrary 10 cm levels and stratigraphic units. If a change in layer was detected, a different stratigraphic unit was started, regardless of the metric level. However, materials from the same stratigraphic unit belonging to a different metric level were bagged separately. Consequently, strict stratigraphic control was ensured during all excavations. Additionally, all excavated sediment was sieved separately by stratigraphic unit, using a 10.0 mm sieve, and features as well as all contexts that yielded finds and zooarchaeological remains were sieved with a 5.0 or 3.0 cm sieve. All archaeological materials were stored in plastic bags and labeled with the name of the project, the site, the excavation unit, stratigraphic unit, arbitrary level, type of material contained in the bag, person responsible for the documentation, team members, date, and bag number.

To facilitate the recording process, all levels were referred to with Arabic numbers, while stratigraphic units (both geological and archaeological) were named using Roman numerals. Also, stratigraphic unit nomenclature was homogenized by site, except for Aguas Buenas, which is the largest mounded site—both in the number of structures as well as in the surface area that it covers—so a higher stratigraphic variability was expected. Therefore, if an excavation unit did not feature one stratigraphic unit present in other pits, the enumeration of the layers would still follow the absent layer. For example, in test pit 1 at La Aventura (ELAU1), layer IV was excavated, while test pit 2 (ELAU2) lacked it. Therefore, at ELAU2, the layer immediately below stratigraphic unit III was named V, with the aim to avoid repeated layer numbers with different stratigraphic characteristics at a single site.

At all sites, sediment samples for flotation as well as for microbotanical analysis were retrieved. Also, when large ceramic fragments (>5 cm), or chipped stone and ground stone artifacts (complete or semi-complete) were identified, photographs and drawings were made, and their 3D location within the pit was recorded using the Total Station. These finds were retrieved using surgical gloves to avoid contamination, and they were wrapped in aluminum foil and stored in the shade to avoid overheating, humidity, and fungal growth. These samples were taken for later microbotanical analysis. Charcoal fragments with potential use for radiocarbon dating were stored in double plastic bags, wrapped in aluminum foil, and labeled with all contextual data. Other measures to avoid contamination were taken during the excavation process and included the prohibition of eating or smoking near the pits, as well as the obligation to wash hands and shake off food crumbs from clothes after the lunch break.

Documentation with Total Station included the four corners of each unit at surface level, as well as systematic recording of the beginning and end of each layer at 20 cm intervals along the profile walls of the pits. Also, finds, features, and the datum were recorded. If the excavation unit was an approximation trench, complete Total Station documentation of the mound was conducted before, during, and after the excavation. This way, all necessary data for creating 3D models of the excavation units, and therefore of the stratigraphic columns, as well as intra- and inter-stratigraphic relationships, was recovered.

For closing the units, a thick plastic layer was placed on top of the last excavated level, then modern coins were placed, and then a 5 cm layer of sand was laid on top. Finally, the pit was covered using the excavated sediment. In order to avoid sinking of the sediments used for filling and its consequent deterioration due to humidity, sediment was tamped down every 40 cm. For these same reasons, the covering sediment layer was 5 to 10 cm above ground level.

Once materials were taken to the fieldwork lab, a form with the list of bags and materials was filled in by each unit supervisor, which included contextual and content data. All materials were washed using water and hands, only applying toothbrushes on the edges of ceramic sherds. After cleaning, they were dried in a shaded area on top of folded cardboard boxes, bagged in clean plastic bags, and stored in plastic boxes separated by site and excavation unit. All boxes were labeled and inventoried.

Apart from cleaning and storing archaeological materials, lab work during excavation seasons included the digitization of all forms filled out in the field, upload and organization of the photographic archive, digital redrawing of paper drawings in *Adobe Illustrator*, and the digitization of fieldwork diaries.