

ARCHAEOLOGICAL SURVEY OF PERIPHERAL SETTLEMENTS ON THE SOUTHERN MARGINS OF MESOAMERICA: USING LASER TOTAL STATIONS, GPS, AND GIS TO MAP ANCIENT SETTLEMENTS IN EASTERN HONDURAS, C.A.

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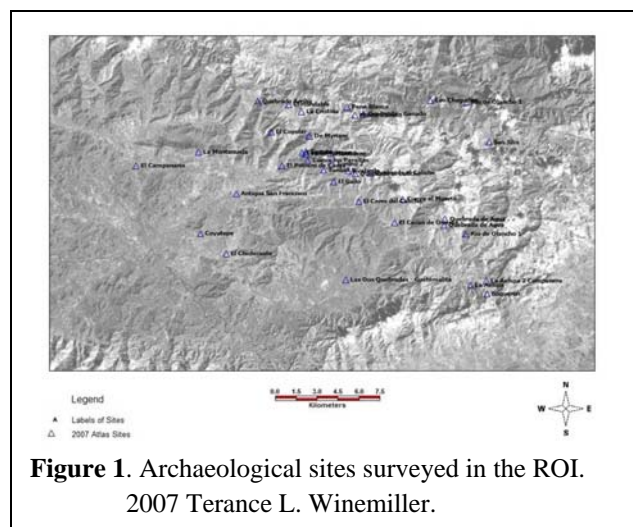
ABSTRACT

In this paper, we present the results of an ongoing survey and mapping project in the Department of Olancho, Honduras, C.A. The project included reconnaissance of the area to determine settlement density and selective mapping of the archaeological remains of two ancient settlements, Chichicaste, and Dos Quebradas. During field operations, 44 archaeological sites were registered using a GPS data collector (Figure 1). Two sites were surveyed and mapped with a Laser Total Station and GPS. Survey data were processed to improve positional accuracy and integrated into a geographic information system. The GIS was designed to house and analyze an additional 11,000 artifacts collected during systematic survey. Data layers were developed for remote sensing imagery, prehistoric architecture, modern architecture, mounds, artifact distributions, hydrologic and physiographic information, modern fences, gates, and roads, and other cultural features. A site reference grid with a base quadrant size of one hectare was established for each site map. To facilitate spatial reference, each 100 by 100 meter unit was assigned an alphanumeric label. The GIS incorporates tables for map features or objects and a relational geo-database containing object attributes. Spatial and attribute queries as well as thematic maps were employed to discover differential distributions of artifacts, temporal periods of site development, and functional relationships between artifacts and features across the site surface. The method we developed enabled us to display variable distributions of artifacts and structures by class, type, and chronological period.

Key words: Honduras, archaeology, GIS, GPS, three-dimensional.

INTRODUCTION

Since 1970, numerous survey and reconnaissance projects have taken place in eastern Honduras (Brady, et al 1995, 2000; Begley 1999; Healey 1984; Reyes Mazzoni 1976). Archaeological remains were discovered in caves (Talgua and Catacamas, Tribuna 2006) and the river valleys and plains east of Copan (Hendon and Joyce 1993; Hendon and Lopiparo 2004; Joyce 1986). However, we still know little about the density and distribution of settlements and nature of the prehistoric social groups that once inhabited modern day Olancho, Honduras. The relative absence of monumental stone architecture and urban space and dearth of material evidence for exchange networks, high art, and hieroglyphic writing in eastern Honduras has led a number of researchers to conclude that the ancient inhabitants were organized in less complex, and less advanced social groups than their neighbors to the west and south (Lange and Stone 1984a, 1984b; Strong 1948; Stone 1941, 1957, 1984; Willey 1971, 1984).



Accordingly, evidence for complexity found in the region is likely to be described in degrees of a “*Maya-ness*” that could only have resulted from diffusion and borrowing from high civilizations to the west. Similarities in physical geography to areas west and south and common ideological elements do exist (Bonta 2001, 2003; Helbig 1965; Messenger 1997; Stevens 1964; Steward 1948a, 1948b; West 1964a, 1964b; Willey 1971; Zúñiga Andrade 1990). The findings of our archaeological research in the region suggest that groups inhabiting eastern Honduras were not marginal and participated exchange networks that involved distant neighbors while preserving their unique cultural identity. We argue that eastern Honduras represents a distinctive cultural region, yet to be delimited, that developed internally and exchanged elements of material and ideological culture with neighbors to the west and south while playing a role in the development of the area (Brady, et al 1995, 2000; Begley 1999; Reyes Mazzoni 1976, 1977).

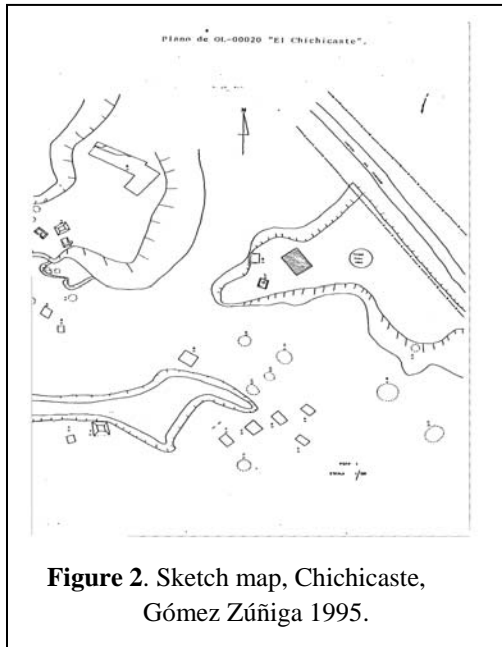


Figure 2. Sketch map, Chichicaste, Gómez Zúñiga 1995.

MAPPING OF ARCHAEOLOGICAL SITES IN EASTERN HONDURAS

Archaeologists and explorers have noted the presence of archaeological remains in eastern Honduras for the over a century.

Early explorers visiting the region collected artifacts and meticulously noted the number and form of mounded architectural remains in field logs; see (Strong 1933). The existence of Chichicaste and Dos Quebradas has been known but no maps were drawn of these sites until near the end of the 20th century. The first, a sketch map of Chichicaste was drawn by Gómez Zúñiga in 1995 and remains unpublished (Figure 2). The site of Dos Quebradas was mapped and published in site reports by Cruz Castillo and Rodríguez-Mota in 2005 and 2006 (Figure 3). The Dos Quebradas maps reveal 28 numbered structures and 15 oval shaped mounds in five groups. Essentially, the spatial data available to identify the cultural and physical traits that render eastern Honduras unique from other parts of pre-Columbian Latin America in a scientific way is woefully inadequate. Our work which includes a GIS and maps representing the frequencies and distributions of architecture and artifacts is the first research project in eastern Honduras to employ spatial science in an effort to characterize the region as it existed in ancient times.

THE SITES

Geologically, the valleys and plains where Chichicaste and Dos Quebradas are located are surrounded by foothills and mountains containing red Lutite dating to the Upper Cretaceous Period. These features form part of the regional tectonic formation known as the Angels Valley Group. Blocks and dikes of porphyry, andesite, silica, and limestone compounds are locally present. White quartz veins formed into geode aggregates occur throughout the area as well.

The site of Chichicaste covers approximately 500 hectares and Dos Quebradas 1.5 square kilometers. Most of the constructed features we observed at Chichicaste and Dos Quebradas served as foundations for other features or structures but do not contain visible stone retention walls. For this reason, we report these features as terraces. By and large, the most

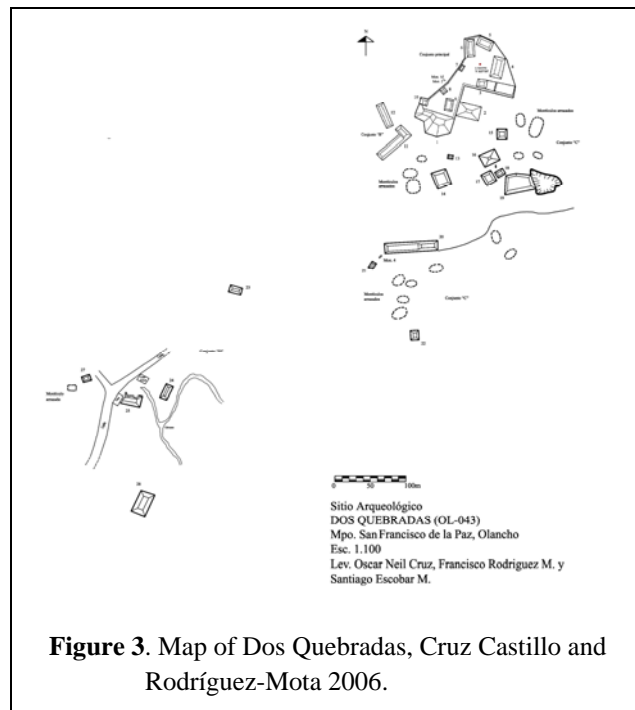


Figure 3. Map of Dos Quebradas, Cruz Castillo and Rodríguez-Mota 2006.

common settlement feature we found at both sites is a relatively small, 0.25 to 2.0 meter tall, 3.0 to 5.0 meter diameter, circular to oval-shaped earthen mound having concentrations of surface cultural materials. The observed modal height of these mounds in undisturbed contexts is at-or-near 1.0 meter. Evidence collected in direct association with these features indicates that the lowest variants are the remnants of taller mounds which have been reduced by agricultural activity. In some locations eroded cuts reveal that a mixture of compacted earthen fill and discarded cultural materials was used in construction. Hardened clay daub fragments found on these mounds represent the remains of wattle and daub domestic structures constructed on top of these raised earthen features. In other parts of Honduras analogous basal features with cobble veneers have been found. Strong, Kidder and Paul (1938: 31, Fig. 4) noted similar structures at the site of Naco, Honduras. Future excavations of undisturbed mounds are needed to determine if cobble veneers are present. At both Chichicaste and Dos Quebradas we discovered the remnants of mounds near modern villages that had been mined to extract materials to fabricate adobe bricks. Examination of mud bricks in several modern houses revealed a marked amount of prehistoric cultural inclusions.

Chichicaste

Chichicaste (Figure 4) is located 5.80 kilometers south of the modern town of San Francisco de la Paz and 8.40 kilometers west-northwest of Dos Quebradas. The site is situated on the southern side of a hill that lies adjacent to a tributary of the Telica River known as *Quebrada* Chichicaste or El Chorro. *Quebrada* in *Spanish* translates as creek. Gómez Zúñiga (1995) classified Chichicaste as a category 1 site with a settlement area covering a maximum area of 100.00 meters in length. Although the site core is located within the limits of property owned by Jorge Calix, our survey revealed a contiguous extended domestic settlement area covering a little over one-half square kilometer. In 1995, Hasemann (1991, 1992) explored the site as part of the Talgua Archaeological Project (Gómez Zúñiga 1995; Beaudry-Corbett 1995). Beaudry-Corbett, Henderson, and Joyce (1993) analyzed ceramic artifacts collected by Hasemann from two stratigraphic test units excavated at the site. Unfortunately, the analysis and subsequent reports do not provide locations of excavations or stratigraphic descriptions of the units. Based upon archaeomagnetic data, ceramic comparison, and obsidian hydration measurements, Beaudry-Corbett (1995) suggested that the site was occupied from approximately 300 B.C. to A.D. 800-900. In 2003, archaeologist Eric del Valle visited the area and reported the existence of the site.

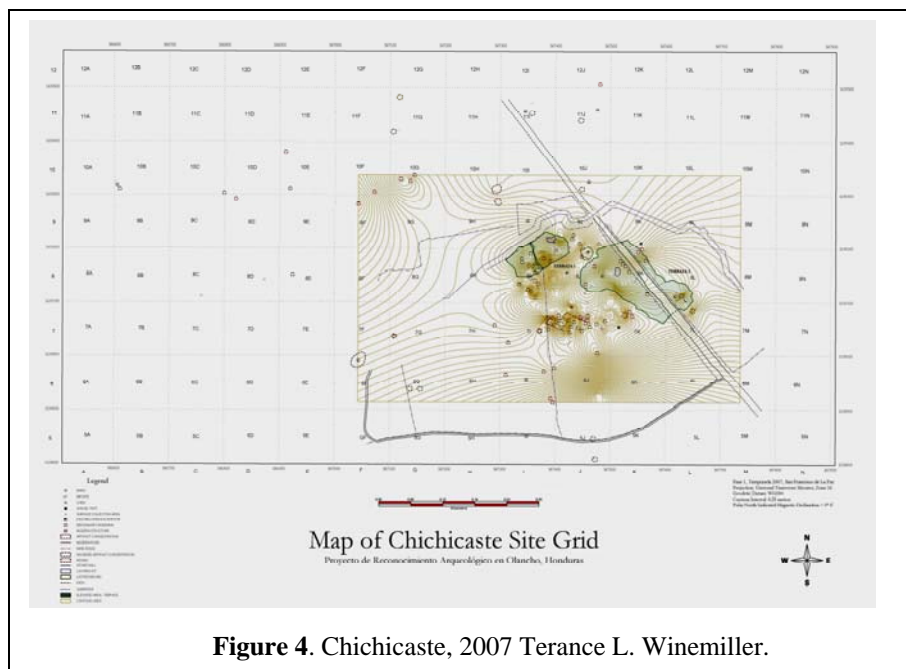


Figure 4. Chichicaste, 2007 Terance L. Winemiller.

We mapped a total of 53 structures at Chichicaste using a laser total station and GPS data collector. The site can be roughly divided into three zones, artificial terraces, lowlands, and naturally elevated areas. Settlement features were mapped in all three zones. Our initial clearing and survey operations revealed that a history of modern human activity in combination with natural processes is causing significant loss of archaeological data. In addition to

numerous looters' pits, we found extensive erosion and large slumps along the creek which bounds the northern edge of the site core. In some areas, several low mounds have been leveled by modern activity. This section of the site is littered with *metate* fragments (stone platforms used to grind corn and seeds) and *manos* (hand stones used with *metates*), obsidian flakes, and ceramics scattered about by the plow. North of a modern residence located on the site, the current property owner excavated an area covering approximately 410 square meters, digging into the side of mound and collecting cultural materials. A portion of these artifacts were subsequently turned over to IHAH and are now stored in Tegucigalpa and Juticalpa. Unfortunately, the excavation was not controlled and provenience unrecorded. Additional looting pits and trenches were discovered in central, southern, and eastern sections of the site as well. A large open trench was discovered on the northern terrace west of the aforementioned excavation. According to Gómez Zúñiga (1995), the excavation contained a prehistoric oven which was excavated by the owner. Reportedly, the oven contained a burial with the remains of a child and carbonized maize cobs.

The architectural core contains three major architectural groups surrounding a low area or *bajo*. Two terraces define the northern and eastern boundaries for the architectural core. Terrace 1, a 50 meter wide by 100 meter long 1.0 meter high feature, is located on a natural elevation of the terrain alongside the south bank of the Chichicaste Creek. The creek has cut down between 10.0 and 15.0 meters below and 5.0 meters into the northern edge of this feature. The cut in this area provides evidence to suggest that this terrace might have been veneered with cobbles. Cultural materials and fill have washed out into the creek. Seven semicircular mounds containing concentrations of cultural materials are grouped atop the western sides of Terrace 1. Five of the seven structures share a common patio area.

Terrace 2 is the largest feature at Chichicaste and defines the eastern most boundary of the core. A modern highway bisects this structure along its north-south axis. The two hectare feature contains semicircular extensions located on its northwest and southeast corners. At its highest point this terrace rises 6.0 meters above the surrounding terrain. Several large stones found on the west side might represent the remnants of a ramp; however, excavation is needed to clarify function. At the southeast corner of Terrace 2 we found a semicircular mounded area that supports the remains of an abandoned modern adobe house. Parallel stone alignments resembling a medial stairway were discovered on the southern face of the mounded area. The remains of five additional low mounds were discovered on top of Terrace 2 as well.

Group 3 defines the southwest boundary of the central core. This group contains 15 mounds varying in height from 0.25 to 0.50 meters. Virtually all of these features located in open areas are heavily damaged by agricultural activities or cattle pasturing. Analyses of associated artifacts collected in this group suggest that these mounds served the same purpose as their counterparts on Terrace 1. Another grouping of seven mounds was located few meters south of Terrace 1. Mounds in this group are arranged around a relatively flat plaza or commons. Five mounds were mapped between Terraces 1 and 2. These are situated along three sides of a level plaza which opens to the east.

The low poorly drained central section of the site contains cultural materials without visible mounded areas. Shovel tests in the area revealed a depositional layer of soil washed in from surrounding terraces and hills. Test excavations in this basin are necessary to determine whether mounds or cultural materials are preserved beneath the surface. During foot survey outside the central area we discovered 35 artifact concentrations in areas lacking and evidence of mounds and mapped an additional 15 mounds.

We completed 50 dog leash units covering a total surface area of 353.25 square meters in the site core. A total of 6,371 artifacts was recovered, 79.11 percent (5,040 pieces) from dog leashes and the remaining 20.89 percent (1,331 pieces) from general reconnaissance operations. The collection includes ceramic fragments, a ceramic modeled pendant, groundstone artifacts including mutates and *manos*, obsidian flakes, glass, and shell.

Dos Quebradas

Dos Quebradas also known as "Guatemalita" (Cruz Castillo and Rodríguez-Mota 2005) is located approximately 11.50 kilometers south-southeast of San Francisco de la Paz. A modern village having the same name is constructed on a portion of the site. Dos Quebradas is located in the 9 kilometer long Los Charcos intermountain basin. The area contains thick alluvial deposits in lower elevations. Strong (n.d.[1933]; 1948) described the site in his field notes and collected surface materials during his visit. The area was reconnoitered by Valles Pérez in 2003 and surveyed by Cruz Castillo and Rodríguez-Mota in 2005 and 2006(Cruz Castillo 2007). Other reports note the presence of stone architecture and polychrome ceramics (Beaudry-Corbett et al. 1997; Reyes Mazzoni 1976, 1977; Strong n.d [1933]: 143; Cuddy 2007). Preliminary maps drawn by Cruz Castillo and Rodríguez-Mota (2005, 2007) reveal 28 numbered structures and 15 oval shaped mounds in five groups. We re-mapped and integrated these features into a revised map of Dos Quebradas.

We mapped the central zone of Dos Quebradas with a laser total station oriented to benchmarks having known geographic coordinates (Figure 5). Elevation and coordinates for benchmarks were established with a Trimble GPS data collector. To insure sub-meter accuracy of benchmark coordinates, positional readings were collected at two-second intervals over a period of one hour at each location then differentially corrected using base station data provided by CORS. Beyond the site core, features were mapped using only Trimble GPS data collectors.

We collected cultural materials over an area covering approximately 67.0 hectares. The current site map of Dos Quebradas contains numerous structures clustered in several architectural groupings. The Principal Groups contain 20 structures covering an area of 7.30 hectares. We adopted a numerical system for structures implemented by IHAH with the exception of two instances. In order to establish continuity in the labeling of architectural groups we labeled the “Main Group” as Group A and Group B.

Without excavation data derived from operations in Group A and B structures we cannot differentiate basal structures from platforms. For that reason, we opted to define basal features as terraces until excavations can be accomplished to determine whether retention walls are present. Large stones were found on - or around five structures and the southern face of a slope which forms the northwestern edge of an elite compound that includes Groups A and B. The presence of these stones suggests that they were incorporated into mounded constructions as a durable veneer to prevent erosion or served as ramps. Excavations will clarify the function of stone elements in this area.

Unlike Chichicaste, Dos Quebradas has a distinct two-tiered architectural pattern and *stela* (stone monument) tradition. The geographic position of three terraces and one tall mound in the site core restricts access to an elite plaza area that contains four of six plain monolithic slabs (plain *stelae*) found at the site. In addition, a majority of the monumental architecture and tallest mounds at Dos Quebradas are clustered around two Groups, A and B. The site core is surrounded by clusters of low domestic earthen mounds as described above. For these reasons, we argue that at some point, society at Dos Quebradas was stratified. Ceramic and lithic distributions support this generalization as well. Comparison of artifacts reveals variation in the spatial distribution of fine ware and course ware ceramics which favors fine wares in the elite core and course wares in non-elite contexts. Pachuca obsidian is differentially distributed as well. Six stone monoliths (Figure 6) that appear to be the remains of flat stelae were observed at the site. IHAH investigators previously reported four of these monuments (Cruz Castillo 2007). Although toppled, one monolith located in the central elite plaza rests on top of a standing rectangular carved base. Bases for the remaining monuments were not located.

Group A contains three terraces and one enclosed plaza. The largest terrace forms a reversed “L” shape with the long leg following a southwest-northeast orientation and the short leg trailing northwest-southeast. This terrace provides a level elevated surface which served as a foundation for eight structures. In some places deep washouts in the feature reveal an interior fill consisting of a mixture of unconsolidated earth and artifact debris. The terrace covers an area of 9,070 square meters. A low plaza is situated on the western side of Terrace 1. A smaller terrace forms the northwestern boundary of this plaza. Irregular quarrying cuts along the northeast face of a slope to the northeast of this small terrace indicate that the rise served as a bank of material for construction of Groups A and B. A third terrace located northwest of Group A, is connected to the north slope of the same elevation.

Structure 1 is the tallest of three pyramidal-shaped mounds we mapped at Dos Quebradas. Topographic survey revealed subtle indications of corners on four sides. None of pyramidal features contain visible evidence of medial stairways. Structure 2 a similar pyramidal mound with a height between 9.0 and 10.0 meters is located 25.0 meters



Figure 5. Mapping with laser total station, (left). Recording artifact positions with GPS data collector, (right).

northeast of Structure 1. A narrow passage between Structures 1 and 2 connects the eastern extension of Terrace 1 to a second private space to the north of Structure 2. A possible ramp providing access to Terrace 1 from the east is located in this area as well. A concentration of hardened red clay and daub fragments containing concave-shaped impressions of bindings and wooden poles was discovered on Structure 2 indicating that the mound might have been topped with a perishable structure. Excavation is needed to clarify the presence of these materials on the mound.

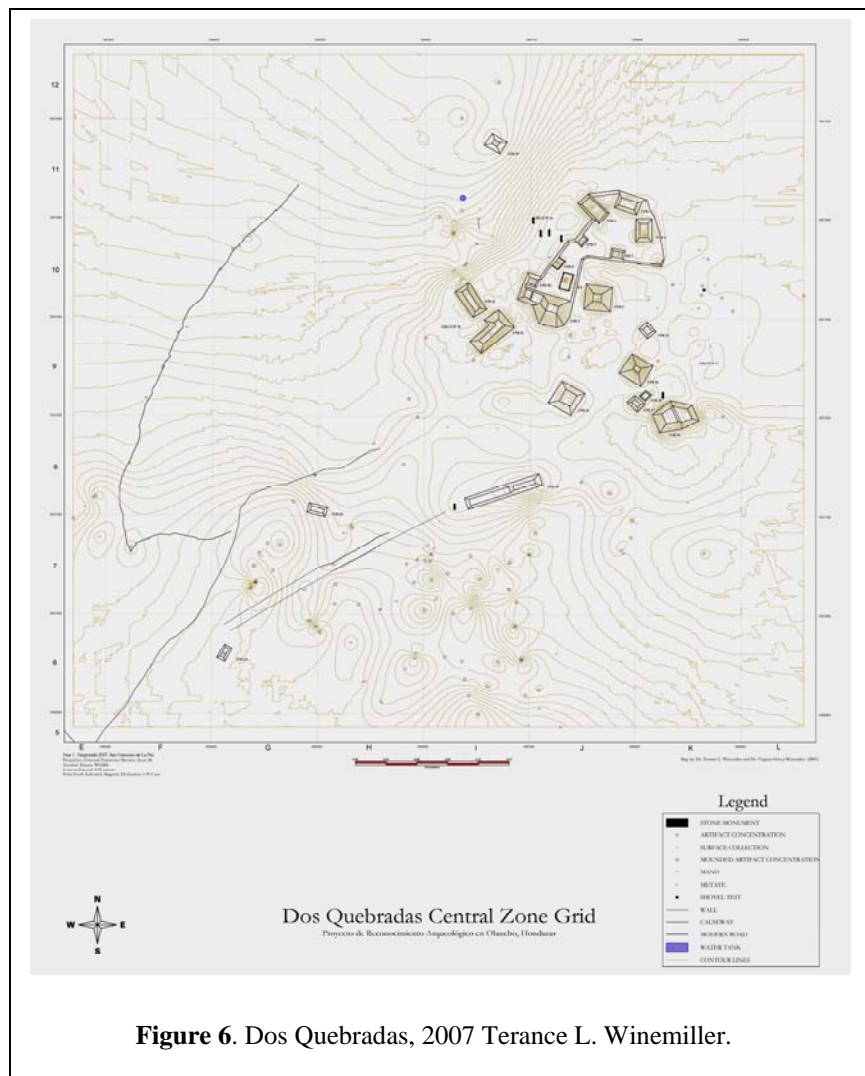


Figure 6. Dos Quebradas, 2007 Terance L. Winemiller.

Group B contains two elongated features, L-shaped structure 11 and linear structure 12, constructed from compacted earthen fill. These structures are elevated 5.0 to 6.0 meters above the plaza level. Structure 11 appears to have supported a minimum of three perishable structures. The remains of two structures were discovered atop Structure 12.

Group C contains six structures. Structure 19 to the southeast of the elite center is located adjacent to an artificial depression that appears to have provided fill for construction. Preliminary calculations indicate that the negative volume of material represented by this depression approximately offsets the volume of fill required to construct Structure 19. With the exception of structure 15, the remaining structures in this group are mounds with flat elevated surfaces rising to heights ranging between 1.0 and 5.0 meters. Observations indicate that these features likely served as basal structures for perishable buildings.

Four structures were mapped south of the site center. Structure 20 is a two-tiered elevated feature measuring 77.0 meters in length and 8.0 meters in width that appears to have served as a basal platform for perishable structures. This feature marks the southern extent of monumental core-zone architecture at Dos Quebradas. A 7.5

meter wide stone lined and surfaced linear feature was discovered 60.0 meters southwest of Structure 20. We were able to trace this feature on the surface for a distance of 55 meters to the southwest toward a portion of the site occupied by several structures and an architectural group. If extended southwest toward Group D and northeast for 60 meters along its current azimuth, this feature would link Structure 20 and Monument 4 to Group D. We are reluctant to label the feature a causeway until excavations can be completed. Structure 29 is situated 50 meters northwest of the central plaza. The orientation of this structure and its strategic position perched above Group A suggests that it might have been a functional part of the central elite architectural complex. A group of four low mounds were located 100 meters southwest of Structure 29 and mapped as well.

A total of 67 low domestic mounds were mapped outside the central core at Dos Quebradas. The largest concentration is located south of structure 20. Each mound was associated with a concentration of cultural materials. At this point in the analysis, we are unable to establish with any level of certainty whether the low mounds were occupied during the same period of time as elite areas.

We collected cultural materials from 55 dog leash units, representing a total area of 388.57 square meters. Additional cultural materials were collected during foot survey of areas outside architectural groups. A total of 5,192 artifacts were collected, 54.22 percent from dog leashes, and 45.78 percent from general collections. Artifacts collected included ceramic fragments, ground stone artifacts, obsidian blades, cores and flakes, greenstone beads, a bone fragment, glass fragments, and several modern coins.

METHODS AND ANALYSIS

Maps are valuable tools for archaeological analysis. Our project is the first to develop accurate regional maps and site maps of Chichicaste and Dos Quebradas. For our purposes two types of maps were essential to achievement of project goals. Planimetric maps were used to reveal the distribution of archaeological features. These maps served as base maps to display various thematic distributions (Figure 7). Completed vector maps of architecture and artifact frequencies were converted to raster format for development of grid surface maps and 3D visualizations. Relative elevation is used in archaeological research to find features that might not be visible during ground survey operations. Accurate topographic site maps reveal subtle variations in relative elevation which can indicate human agency. The development of planimetric and topographic maps of Chichicaste and Dos Quebradas was a major goal of our research program.

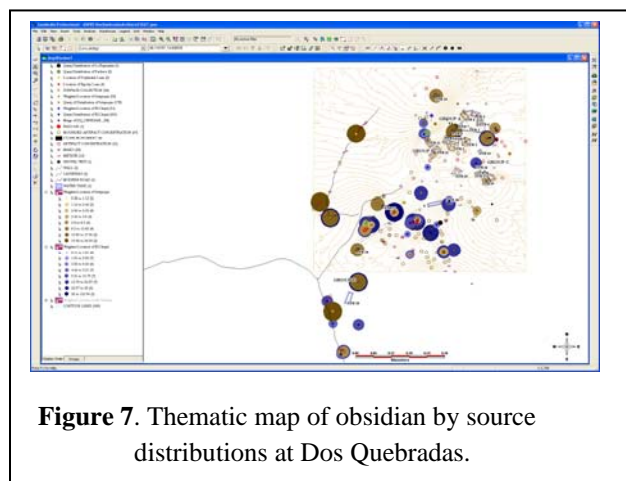


Figure 7. Thematic map of obsidian by source distributions at Dos Quebradas.

In addition to data collection equipment, several programs were employed to accomplish this task. The core GIS for housing, mapping, and spatial analysis of project data was designed in GeoMedia Professional 6.1. We collected positional data with Trimble GeoXT and Geo Explorer III data collectors and a laser total station. Dense scrub made it difficult to set up the laser total station in most areas. Consequently, the portability of GPS data collectors proved highly beneficial. For that reason, we ultimately opted to map remaining areas at the sites solely with GPS data collectors. Artifact distributions, surface collections (dog-leashes), and some features were recorded as point data. Roadways and paths were recorded as line features. Mounds, platforms, and terraces were recorded as polygons. Positions recorded were imported into Pathfinder Office, processed to improve accuracy by application of differential correction and calculation of a centroid for each array. Prior to calculation of centroids, outliers in each cluster of readings were removed from the array manually. The derivative positions were exported to ESRI shapefile format. Coordinate and elevation information were extracted from ESRI files in Microsoft Excel. Positions for line and polygon readings housed in dBase files within ESRI shapefiles were imported into Excel and converted into useable coordinates and elevations. Completed datasheets were attached to a Microsoft Access geodatabase in GeoMedia Professional. Points representing positions were then geo-coded in GeoMedia Professional and output to a topographic data table. To improve accuracy of topographic maps and avoid large areas containing void cells,

topographic information was mined from point data recorded in the field for all three vector feature classes in our data dictionary.

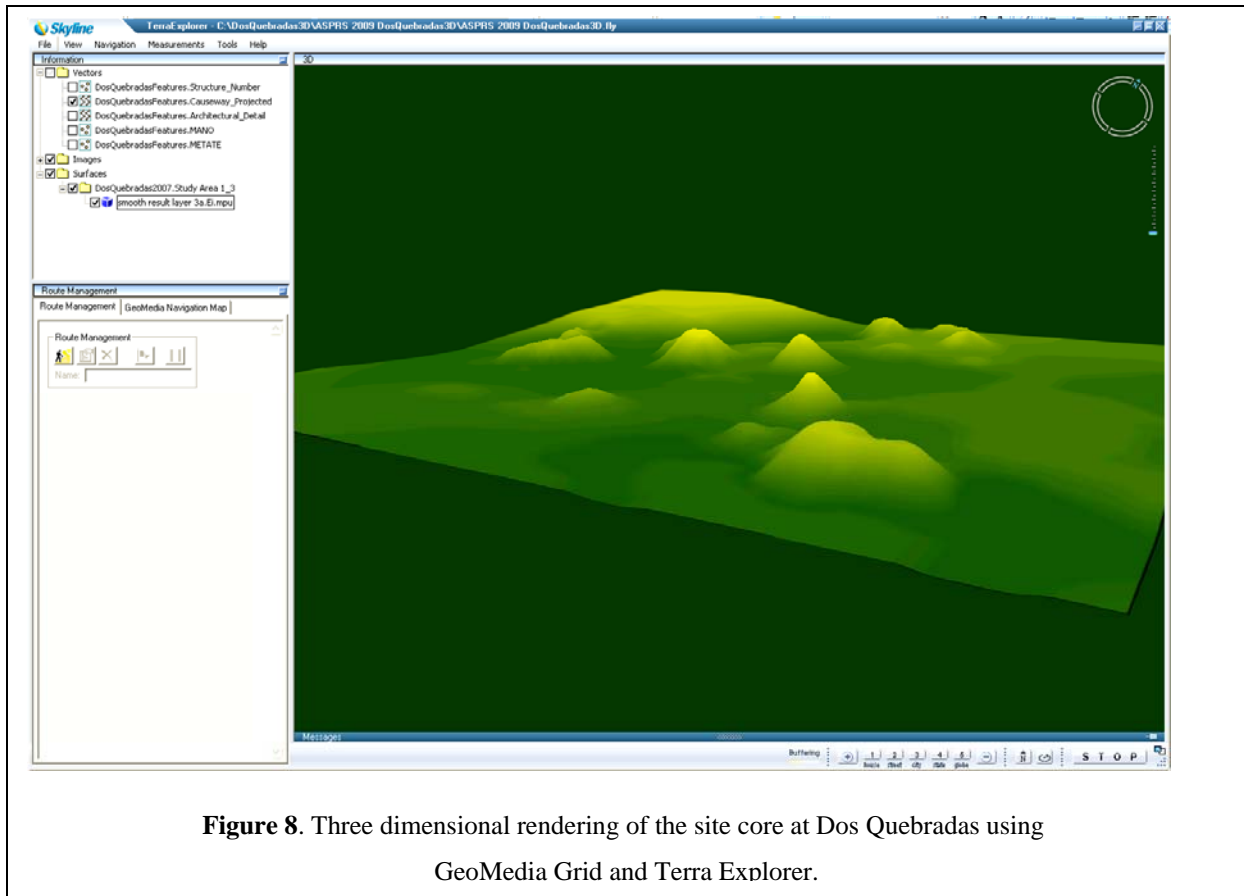


Figure 8. Three dimensional rendering of the site core at Dos Quebradas using GeoMedia Grid and Terra Explorer.

Conversions of point data from vector to raster format and grid surface analyses were completed in GeoMedia Grid 6.1.1 to facilitate a variety of visual and analytical tasks. Three dimensional DEMs were created using GeoMedia Grid. Derivative files were either rendered in ENVI 4.6.1 or in GeoMedia Grid 6.1.1 using TerraExplorer 5.1.2 to construct 3D visualizations (Figure 8). Three dimensional models were used to infer relationships between features and groupings. Coordinate data are stored in Universal Transverse Mercator, WGS84 geodetic datum. All locational data were merged and geo-coded as point features in the GIS, and exported to a feature table in an Access database. Landsat Thematic Mapper subsets and AIRSAR radar data where available were classified using computer-aided supervised and unsupervised techniques as well as visually interpreted to pinpoint the location of archaeological features in the area and elsewhere throughout the ROI. To carry out surface analysis, a grid, each covering approximately one hectare of land surface, was defined, see Figures 4 and 6, and plotted over site locations in the GIS. Location frequencies of artifacts were averaged by quadrat and displayed as variable RGB (red, green, blue) values to pinpoint areas of highest density. In subsequent seasons, data derived from grid surface analyses are used to determine excavation sites. In addition to their use as the basis for 3D visualization, digital elevation models created with GeoMedia Grid 6.1.1 were used in line of sight tests (Figure 9).

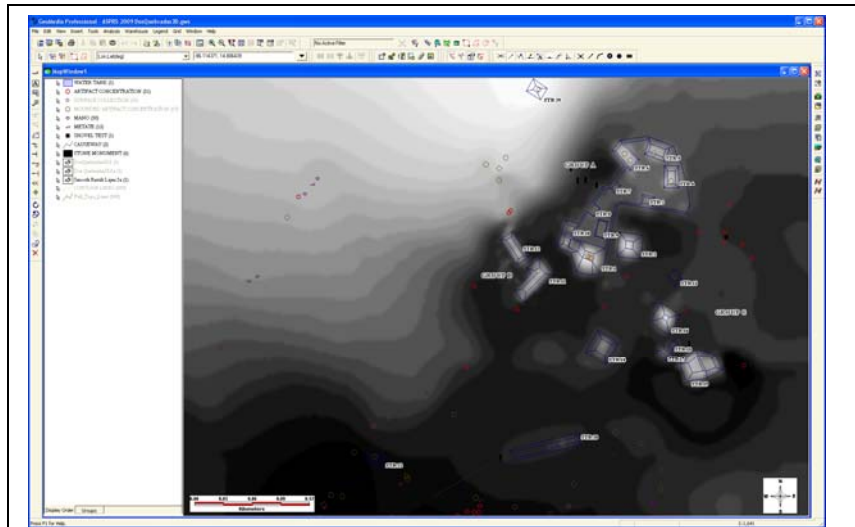


Figure 9. DEM of the site core at Dos Quebradas rendered using GeoMedia Grid 6.1.1.

ACKNOWLEDGEMENTS

This work was funded in part by Auburn University at Montgomery Research Grant Council and the Percy Sladen Memorial Fund of Great Britain. Fieldwork was carried out with the permission of the Honduran Institute of History and Anthropology, IHAH, Tegucigalpa, Honduras and assistance from IHAH regional office in the state of Olancho. Landsat Thematic Mapper TM data were provided by NASA Earth Science Scientific Data Purchase (SDP). Shuttle Radar Topography Mission SRTM and AIRSAR radar data were courtesy of NASA/JPL-Caltech. Software and support were provided by the Intergraph Corporation's Registered Research Laboratory (RRL) Program.

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