

CIRCULAR REASONING IN MOUND BUILDING? LARGE-SCALE PLANNED CONSTRUCTION PATTERNS AT THE AGUAS BUENAS SITE (A.D. 400–1525)

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This paper discusses pre-Hispanic mound construction and the archaeological recording of such features in central Nicaragua. Mounds are a common feature of Central American sites that have attracted the interest of archaeological research from its antiquarian stages onwards. However, recording these mounds has been fragmentary and varied. As the archaeological record only presents a partial remainder of the material past, the haphazard recording of these remains only fragments the dataset even more. This paper briefly considers stone and earthen mounds and explicates the recording of mounds in so far as to propose a method that can create a solid and comparable dataset. Ongoing archaeological research at the pre-Hispanic site of Aguas Buenas in central Nicaragua forms a case study for the proposed methodology.

Pre-Hispanic Mound Building in Nicaragua

In many ways, Nicaragua is a land of contrasts. In archaeology, this has been most apparent through historical records that mention a Pacific side with a material culture showing Mesoamerican influences and the culturally variable central and Caribbean regions, all of which also show significant geographical contrasts. Geographically, the country is divided by a late Tertiary mountain range running northwest to southeast and the lower lying areas on either side have different geomorphological and archaeological backgrounds (Wallace 1997:99; Geurds 2011:5). The western part of the country borders on the Pacific Ocean and contains the two great lakes as well as plains and active Quaternary-era volcanoes. From the eighth century onward, the mentioned Pacific side,

together with northwestern Costa Rica, is referred to as the Greater Nicoya Subarea (Norweb 1961, 1964). Archaeological investigations have focused on this region (for an overview see McCafferty and Steinbrenner 2005). The contrast with the eastern part of the country is substantial. This area forms the Caribbean watershed and is the drainage area for a great number of rivers. The archaeology of the Caribbean region is largely unknown, except for the pioneering studies along the Caribbean coast (Gassiot and Estévez 2004; Magnus 1974; Matilló 1993). The climate of the entire country falls into Koeppen's Amw classification, showing precipitation in all months in the Caribbean except for a short dry spell during February and March, and with most of the rainfall clustered there between September and November (Lange 1984:40). Ash fall from the active volcanoes creates young and thick soils in the Pacific region, while central Nicaragua, deprived of the ashes due to easterly winds, shows weathered soils due to leaching (Lange et al. 1992:6).

From the early days of archaeological prospecting, as well as today, references to "mounds" are frequent in Nicaragua. Arguably the most visible aspect of the archaeological record, stone and earthen mounds of varying sizes are present in a large number of early reports and later academic publications. But what is specifically referred to by the term "mound" is unclear and requires further subdividing. Mound construction is the default sign to identify pre-Hispanic archaeological sites in most of Nicaragua. The mounds vary in size, composition, and formation patterns, but are such prominent features that they merit research into their construction techniques, functionality, and meaning. Noninvasive methods like surface survey, simple 2D mapping, and drawing produce most information on mounds. Additionally, test

pits, placed to recover chronologically diagnostic material culture, yield data on mounds. Overall though, mounds are rarely studied explicitly by means of extensive excavation in Nicaragua. The labor-intensive and time-consuming aspect of mound excavation may play a role in this. Recording the cultural landscapes that are formed by the mounds is often done in a limited fashion and varies greatly between research projects—from photography to (sketch) drawings or just detailed written description—resulting in the fragmentation and variation in the dataset that is created. This dataset also lacks the topographical and contextual information needed to analyze and interpret the mounds.

The local climate and geology have a decisive influence on mound construction. In the central Nicaraguan area, where soils are thin and bedrock is regularly exposed due to its undulating nature, mounds are constructed on or near surfaces where the bedrock is visible. Mounds are often constructed of rocks or sediment depending on their location and the best available materials. When interpreting mounds, the slope and sediment depth have to be taken into account as well as the relation of the mound to other natural or manmade features. Research into mounds also has the aspect of morphological analysis, including categorization according to shape and size, as well as a spatial research component, determining the shortest paths to nearby features like water sources or other sites.

References to Mounds: Nineteenth-Century Travelers

References to mounds in Nicaragua by nineteenth-century adventurers and travelers include the terms "cairn" and "calpules."¹ Other than referring to anthropogenic constructions of stone and earth, all these terms lack a precise definition. Mounds and platforms came to the attention of

travelers in Nicaragua during the second half of the nineteenth century. Beginning with the journey of Austrian traveler Emmanuel von Friedrichsthal through Chontales and Ometepe in 1839 (Friedrichsthal 1841; Taracena and Sellen 2006; Geurds 2010), and followed by North American archaeologist Ephraim Squier (1852), British Museum collector Frederick Boyle (1866), English explorer Bedford Pim and German botanist Berthold Seemann (1869), and, finally, English naturalist Thomas Belt (1874) were among those early adventurers and naturalists observing archaeological remains in Pacific and central Nicaragua. Their attention was predominantly focused on documenting stone sculpture and excavating burial sites in search of intact archaeological objects and human remains; hardly an exception to the practice of those times. These activities invariably resulted in the first references to structures visible on the surface.

Pim and Seemann concluded that the indigenous communities of central Nicaragua only built constructions in locations with close access to water: “The Indians never selected ill-drained sites for their villages, and many of the most healthy towns built by the Spaniards in America are in localities originally selected by Indians” (Pim and Seemann 1869:126). Furthermore, according to Pim and Seemann, villages were set up in circular form, placing houses toward the center and tombs in the periphery. Although it is not explicit whether they are alluding to villages based on archaeological sites, the reference to tombs does indicate so. They also argue that no monumental structures were ever built:

The Indians who before the Spanish conquest inhabited Nicaragua did not construct any large temples or other stone buildings, as some of the other natives of Central America have

done. From what I saw, it would seem that in three ancient Chontales villages the houses were in the center, and the tombs, placed in circles around, formed the outskirts [Pim and Seemann 1869:127].

Systematic References to Mounds

When focusing on central Nicaragua, work explicitly focused on mounds is exceedingly limited. In 1975, an archaeological research program directed by Richard Magnus was initiated in central Nicaragua, based on prospecting and testing of various sites in the surroundings of the town of Juigalpa, the capital of the Chontales province. The work conducted is centered on brief surveys and test excavations in roughly a dozen sites and can best be characterized as a preliminary assessment study (Richard Magnus, personal communication 2012). Nonetheless, the work conducted by Magnus is rigorous and has produced some interesting data, even though it remains largely unpublished. At the Cerna site, situated on a hill overlooking the town of Acoyapa, five 2-by-2 m test pits were dug in the principal mound, measuring 16-by-8 m. Also, at the Copelito site, located roughly 10 km north of Juigalpa, Magnus excavated 3 2-by-2 m pits, cutting in half one of the 40 mounds that make up the site.

At both sites, the natural deposits consist mostly of large rocks with no noticeable stratigraphy. Magnus, therefore, proceeded in the excavations using artificial stratigraphic levels. At the Sabana Grande site, located about 4 km northeast of Juigalpa, Magnus records about 15 mounds of roughly equal dimensions. A pair of 2-by-2 m test pits reached a depth of 1.65 m, encountering walls, a stone floor, and a hearth (Magnus 1975).

Site Layout Development

From the above, it can be concluded that archaeological site layout is understudied in central Nicaragua. In wider Nicaragua, existing site pattern data show mound groups to be either round or oval, between 5 and 25 m in diameter and up to 4 m high, made of earth and stone. These groups tend to circumscribe semicircular open spaces (Lange et al. 1992). What little is known points to a gradual development in terms of the total number of mounds and changes in the variability of mound morphology present at each site. For the entire pre-Hispanic sequence, non-burial sites are typically found in plains or valleys with direct access to water flows. For the period of A.D. 400 to 800, the type-site in the central region is El Tamarindo (Espinoza and Rigat 1994:Figure 4). This site consists of some 15 stone and earthen mounds not patterned in any particular way, likely demonstrating the result of a gradual accrual of mounds. The site features a larger mound in the center of the site. For the period of A.D. 800 to 1200 and also after A.D. 1200 and up to the time of the Spanish Conquest, a gradual increase in the amount of stone mounds per site is observed. Also noteworthy is the gradual definition of an open area surrounded by mounds, which has been interpreted as a space for community activities (Espinoza and Gorin 1994:151). The only clear division between site layout is noted for the Cuapa phase: In this final ceramic phase, the amount of stone mounds increases considerably. Until now, the site of San Jacinto, near the contemporary town of Cuapa, best represents this phenomenon and also seems to be built in such a way as to indirectly define a central open area.

The Mounds of Aguas Buenas

The Aguas Buenas site (N-CT-Jp-001) is located about 3 km north of Juigalpa. The site was

initially located by a Nicaraguan team of the *Dirección de Patrimonio Histórico* and subsequently mentioned by Frederick Lange and Payson Sheets during a brief inspection in 1983 (Lange et al. 1992:49). Franck Gorin and Dominique Rigat did the most recent inspection of the site, previous to the present project, as part of their dissertation fieldwork (Gorin 1989:191–192). This last visit yielded the mentioned diagnostic surface finds consistent with the Cuapa ceramic phase (A.D. 1400–1600) in the local sequence, as proposed by Gorin. Limited to a single sector of the site were Cuisalá (A.D. 400–800) and Potrero (A.D. 800–1200) phase surface finds. During the inspections by Sheets and Lange as well as Gorin and Rigat, the substantial size of the site is noted, as is the presence of petroglyphs distributed across the exposed bedrock around the mounds. Thus, this early research focused on efforts to date Aguas Buenas, while describing and documenting the mounds and petroglyphs that make up most of the visible remains (Lange et al. 1992:49; Rigat 1992:547–558). This research has recently been expanded on by Geurds, who has worked in the area since 2007 and with a specific focus on Aguas Buenas since 2009.

In 2009, a preliminary mapping campaign using handheld GPS equipment indicated the presence of potentially more than 300 mounds, as well as a large number of petroglyph panels, visible in exposed bedrock sections. In May 2011, a modest start was made to systematically record surface structures and petroglyphs. As a first activity, an unsystematic survey of the site focused on locating concentrations in surface materials and the presence of mounds. As a first outcome, preliminary counts yielded over 540 circular stone and earthen mounds of divergent diameters, heights, and general footprint in the immediate vicinity and wider surroundings of



Figure 1: Visibility of the mounds from the field .

Aguas Buenas. GIS-based processing of the handheld GPS receiver data quickly made apparent the completely new aspects of Aguas Buenas in the wider known archaeological record of Nicaragua. Mounds at Aguas Buenas are, in their majority, positioned to form several parallel concentric semi-circles. Also, a single rectangular alignment was recorded consisting of about 25 mounds in the central sector of the mentioned semi-circles. The diameter of the inner circle is about 250 m and the outer circle seems to reach some 500 m. The mounds vary in size from 6 to 18 m in diameter and 1 to 5 m in height. This entire complex of the mounds is distributed across a slightly undulating terrain cut by a creek in the northeast area of the site. A detailed

documentation effort of the petroglyph panels resulted in over 45 records of panels showing at least 116 motifs. These petroglyphs were used as a case study to improve rock art documenting techniques (Vlaskamp 2012; Vlaskamp, this volume).

The intriguing configuration of the mounds and the large number of petroglyphs led to the decision that the site had to be more accurately and completely recorded. The rugged terrain with rough, undulating bedrock and thin layers of soil makes the configuration of the large majority of the surface structures close to impossible to observe while standing in the field (Figure 1). Furthermore, there is a large difference in altitude on the site created by hills and a creek that has



Figure 2a: A differential GPS Base Station .

cut through the relatively soft bedrock. This, again, makes the configuration of the mounds unusual, considering some mounds are placed on the slope of a natural hill and adjusted in their construction to accommodate the natural sloping. Such measures, to adjust mound form to unfavorable positions necessitated more energy in construction and planning. Such decisions, while still poorly understood at this stage, point to the possible underlying premises for building the mound complexes at Aguas Buenas. Therefore, fieldwork in 2012 included a start to the high-accuracy recording of the site and its landscape features to create a Digital Elevation Model (DEM).

The model uses differential GPS (dGPS) equipment. This takes highly accurate GPS measurements, and can record at set intervals while surveying the site. The equipment used in



Figure 2b: A differential GPS Rover.

2012 was a TopCon dGPS set, consisting of a base station and a portable rover. Two-meter interval measurements achieved a sufficiently detailed map of the elevation levels of the surface and the mounds. Of every mound encountered, surveyors took several extra measurements in a spiraling walking direction from the base to the top. This motion direction ensures high detail slope recording. Ideally, the completed model would be combined in a GIS with other information about the site, like a traditional map and satellite imagery, as well as the results of test excavations and petroglyph analysis.

A dGPS set consists of two parts, a static base station and a portable rover (Figures 2a and 2b). Differential Global Positioning Systems use relative positioning techniques, which combine and process the satellite readings received from two or more receivers to calculate the receivers' coordinates with high accuracy. To establish this position, the receiver measures the distance between it and at least four satellites. The

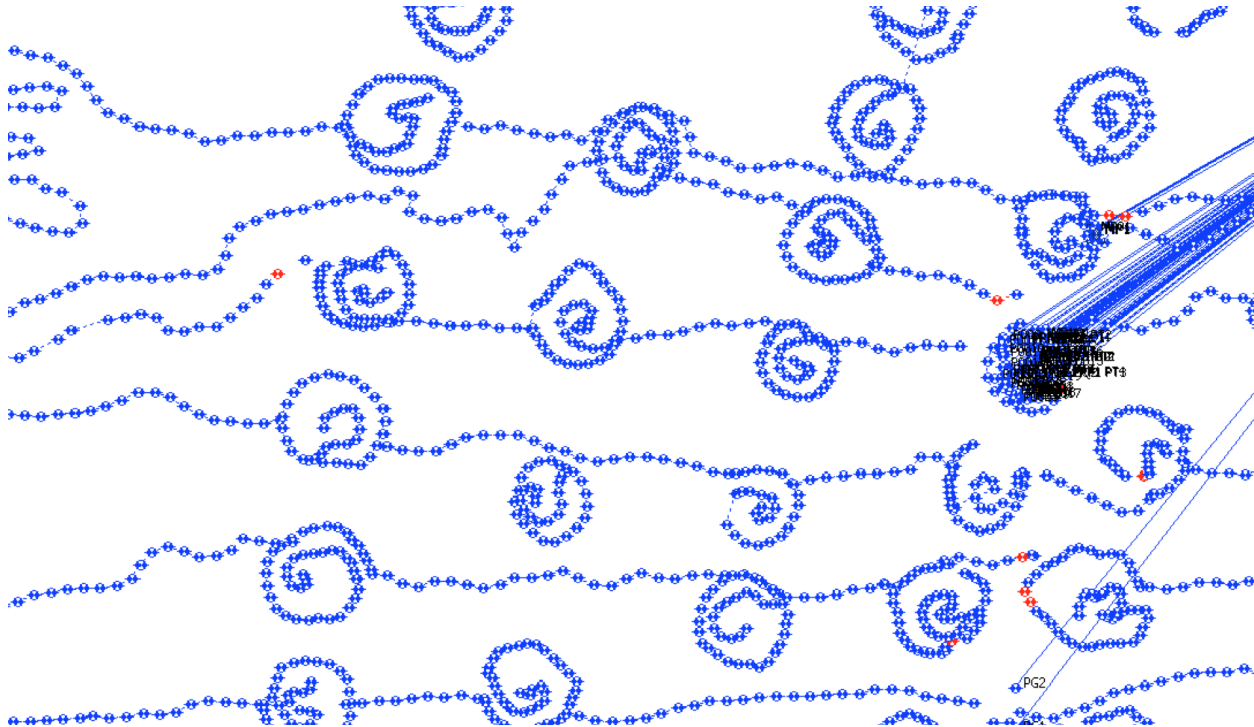


Figure 3: Close-up of the northwest quadrant recordings, each dot represents a reading taken.

accuracy of a position primarily depends on the satellite geometry (Geometric Dilution of Precision, GDOP). The more satellites in view, the stronger the signal and the lower the DOP number, the higher positioning accuracy. When using a single satellite system (GPS or GLONASS), the minimum number of satellites is four, while in a mixed satellite scenario (GPS and GLONASS) the receiver must lock into five satellites to account for the different time scales used by these systems.

With dGPS surveys in the most traditional approach, one receiver communicates from a known surveyed location (an official position with known coordinates) with a second device, referred to as the base station. Another receiver, referred to as the remote receiver or rover, is placed at an unknown location. As the base station collects satellite data, it measures the carrier and code-phases to accurately compute

and verify its location. Then, the base station receiver transmits this information via a radio link to the rover or remote receiver. The rover applies the transmitted measurement information to its observed measurement of the same satellites. Using the known location of the base station, the rover compares the data it receives from the base station to the data it logs from satellites and applies correction algorithms to accurately measure a new point (Terpstra 2012). Real-Time Kinematic (RTK) allows for real-time communication between base station and the rover via radio signals. Any detected signal anomalies or atmospheric disturbances are directly mitigated and corrected to achieve highest positioning accuracy. Alternatively, the data is recorded and stored for post-processing at a later time. The accuracy with which the dGPS can record at the given interval is around 3 mm when it maintains a solid link between the base

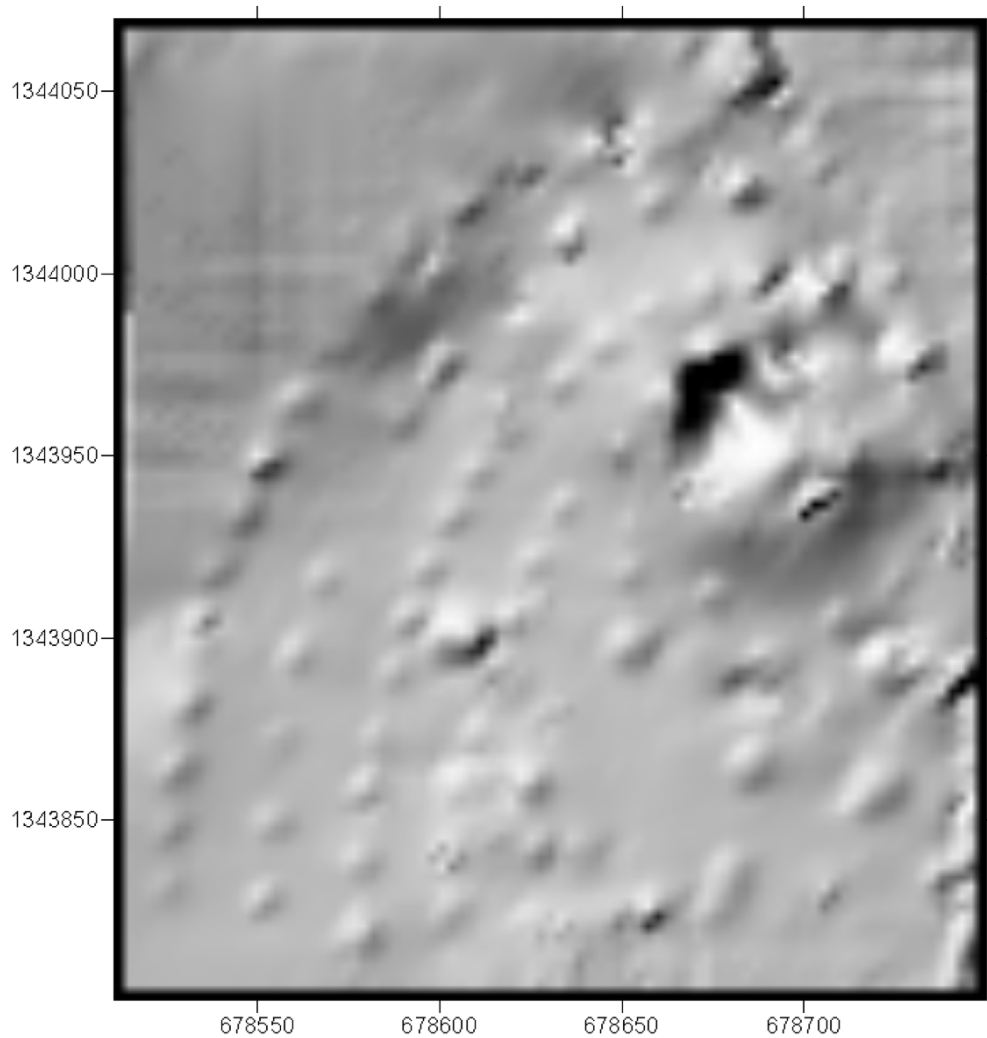


Figure 4: Shadow model of the northwest quadrant at the Aguas Buenas site.

station and the rover. This 3 mm discrepancy applies to both horizontal and vertical readings, thus presenting the researcher with a detailed and accurate recording is useful for it can be used for landscape modeling or georectification.

For the project at Aguas Buenas, use of the dGPS was preferable over the use of other recording equipment like a Total Station or Robotic Total Station due to its ease of use. The rover is easy to carry around, whereas the base station only has to be set up once every recording

session. As well, the readings are accurate as they do not involve human bias, and a single operator can record a large area at set intervals. Several choices determined regarding the recording method at Aguas Buenas. To bring out the smaller surface structures and subtle changes in landscape morphology, readings occurred along a straight line every 2 m. The recording is generally done per agricultural field to limit logistical difficulties in climbing fences with the equipment. Depending on surface slope and

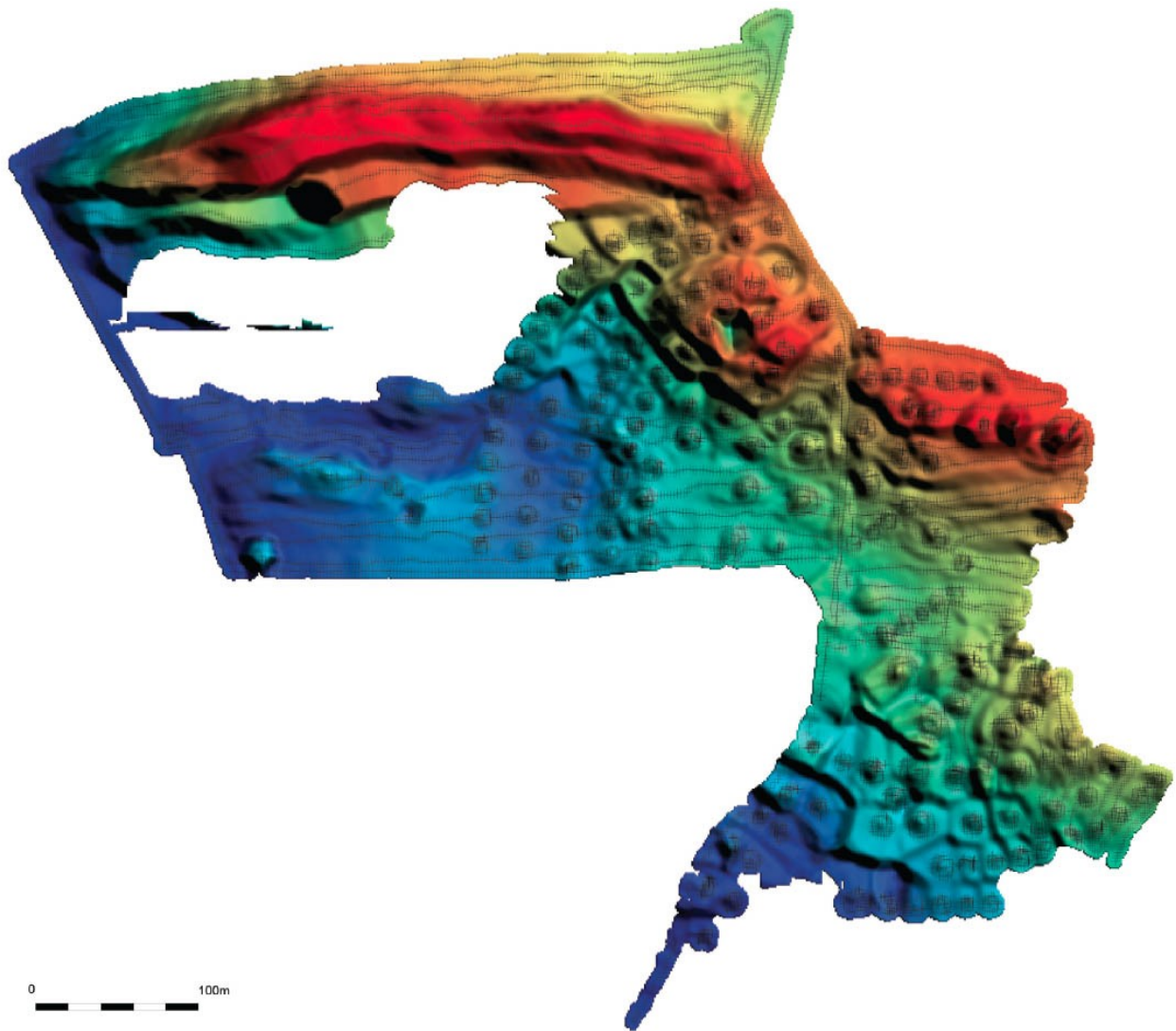


Figure 5: Preliminary and partial DEM of the Aguas Buenas site .

accessibility, field crossings consisted of alternating east to west walking transects, 2 to 7 m apart. Whenever a mound was encountered, readings were two seconds apart, starting by circling the base of the mound and then spiraling upward to record the slope and height (Figure 1). This ensured accurate recording of the slope of the mound, even of the smallest mounds, as well as the accurate recording of the shape. This accuracy is later used to categorize mounds according to size and morphology.

In the spring of 2012, surveyors recorded the northwest and southeast quadrants of the main concentric circular pattern of the site using the dGPS, to shed more light on the layout. These recordings resulted in a shadow model and a DEM of these partial site sectors, clearly showing the mounds and the landscape (Figures 4 and 5). The arching configuration is most clearly discernable in the northwest quadrant of the model, showing seven arches consisting of multiple surface structures each can be discerned.

A few preliminary observations are possible on the basis of this initial work: The structures seem to be of a comparable size within each arc and, moreover, spaced relatively equally throughout the arches. Secondly, the morphology of the mounds does seem to vary more between the various concentric formations when compared to the morphological variability within one concentric formation. The central area of the site shows a rectangular layout of mounds, surrounding a possible plaza, with irregularly spaced small and low mound structures. The southwest quadrant is less straightforward in its composition but also shows a roughly arching configuration, comparable to the northwest quadrant. There also seems to be a relation between the mounds and areas showing surface bedrock and petroglyph panels, but the model will need further refinement and completion to provide more insights into this.

As these first results show, much information can be gleaned from accurate recording in the form of a DEM. While time-consuming, the use of this accurate recording method at sites across Nicaragua and other areas in Central America can provide a consistent way of analyzing site morphology and context. A consistent dataset like this can provide a basis for comparison and contrast of the various sites across the country. Therefore, we will continue the creation of this DEM for Aguas Buenas in the coming years until its completion.² In the end, the GIS created for Aguas Buenas can form the basis on which similar recording can occur at other sites. Comparable data from sites can form a basis for work at a broader scope, comparing sites throughout the area and region to be able to sculpt our understanding of the architectural choices present in the area in pre-Hispanic times, but comparison can also provide us with a better understanding of a given case study as we can

generalize and thus recognize the unique characteristics. Apparent already is that the decisions to create a built landscape were not strictly guided by domestic or funerary motifs, a certain level of monumental expression clearly plays a part in this cultural practice, countering the early ideas by Pim and Seemann.

Discussion

When following general archaeological conventions of site hierarchy analysis, and if at least two levels of hierarchy existed, we can preliminarily conclude that Aguas Buenas occupied a clear place at the top of this hierarchy, with its far greater size and the significant number of individuals involved in its construction. While other sites in Juigalpa's Mayales River Valley are less extensive than Aguas Buenas, the known corpus of stone sculptures points to sustained efforts going into the creation a monumental material culture. This raises the question of what a site such as Aguas Buenas represented in ceremonial terms for regional cultural integration, perhaps attracting people from the wider surroundings in periodically adding to the unparalleled building project that this site would eventually become.

In central Nicaragua, smaller low-density centers may show a significant presence of public sculptures, such as is the case at El Gavilán, for example (Geurds 2011). In contrast, a far more extensive site like Aguas Buenas seems to express monumentality in a different way. These dynamics need further study but already warrant the conclusion that conventional site hierarchy models are unsuitable for the case of central Nicaragua. Instead, it suggests that habitation and ceremonial sites evidence alternative expressions of complexity, perhaps emphasizing proxies of monumental sculpture, such as petroglyph complexes, as is the case at Aguas Buenas

(Vlaskamp 2012). Furthermore, apparent hierarchical distinctions among sites in the undifferentiated pre-Hispanic societies of central Nicaragua, as documented in ethnohistorical sources (Van Broekhoven 2002), cannot be explained as a feature of political control.

As yet, much ground remains to be covered in reaching an understanding of the form and development of pre-Hispanic sites in Nicaragua, and certainly in its central region. Although we have tried to limit ourselves to this latter area in this brief initial report, substantial questions remain. First, we need a better handle on the coevality of mounds and mound clusters at a single site. The apparent agglutinative growth of sites, documented for the large majority of sites in central Nicaragua, leaves open the possibility of postulating seemingly long-term cultural practices of mound building. For now, the Aguas Buenas site remains the only exception to this pattern. Second, the next step for research at Aguas Buenas is to begin executing a full-coverage systematic field survey of the site and its hinterland, in part to determine if the construction activities and possible occupation spread throughout some or all sectors of the site at the same time or not.³ Third, there is a need to determine the meaning of the variability in the large number of stone mounds present at this site⁴, which likely filled a central role in an exchange network that included the Pacific coast, northern Nicaragua, and possibly also extended into mountains to the east and the Caribbean lowlands beyond.

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Notes

¹ “Calpules” is etymologically related to “calpulli” or “calpolli”. Calpolli denotes a constituent part of the larger spatial organizational unit “altepetl” in Aztec society (Smith 2013: Chapter 6). Its occurrence in vernacular in Nicaragua is likely due to the Nahuatl speaking individuals that accompanied the Spanish upon arrival in Nicaragua.

² Since presenting this paper, mapping at Aguas Buenas progressed and the final complete map was produced in early 2016 and will be published in the near future.

³ Between 2013 and 2016 full coverage pedestrian surveys yielded additional data on the wider valley context of Aguas Buenas. Various publications are forthcoming on this research.

⁴ A morphological description of individual mound structures at Aguas Buenas is currently underway.

References Cited

- Belt, Thomas
1874 *The Naturalist in Nicaragua: A Narrative of a Residence At the Gold Mines of Chontales; Journeys in the Savannahs and Forests. With Observations on Animals and Plants in Reference to the Theory of Evolution of Living Forms.* John Murray, London, England.
- Boyle, Frederick
1866 *Ride Across a Continent: A Personal Narrative of Wanderings through Nicaragua and Costa Rica.* 2 vols. Richard Bentley, London, England.
- Espinoza, Edgar, and Dominique Rigat
1994 Gran Nicoya y la región de Chontales, Nicaragua. *Vinculos: Revista de Antropología*

- del Museo Nacional de Costa Rica* 18/19:139–156.
- Friedrichsthal, Emmanuel von
1841 Notes on the Lake of Nicaragua and the province of Chontales in Guatemala. *Journal of the Royal Geographical Society* 11:97–100.
- Gassiot Ballbè, Ermengol, and Jordi Estévez
2004 Seis años de arqueología en la costa atlántica de Nicaragua: Descubrimiento de un pasado inédito. *Bienes culturales: Revista del Instituto del Patrimonio Histórico Español* 3:217–226.
- Geurds, Alexander
2010 La llamada Estela de Friedrichsthal: Una estela prehispánica del Centro de Nicaragua. *Mi Museo y Vos* 4(15):6–10.
2011 Materials and Materiality of Megaliths in Nicaragua. Paper presented at the 76th Annual Meeting of the Society for American Archaeology, Sacramento, California.
- Gorin, Franck
1989 Archeologie de Chontales, Nicaragua. 3 vols. Unpublished Ph.D. dissertation, Université de Paris I, Sorbonne, France.
- Lange, Frederick W. (editor)
1984 *The Archaeology of Lower Central America*. School of American Research Advanced Seminar Series. University of New Mexico Press, Albuquerque, New Mexico.
- Lange, Frederick W., Payson D. Sheets, Anibal Martinez, and Suzanne Abel-Vidor (editors)
1992 *The Archaeology of Pacific Nicaragua*. University of New Mexico Press, Albuquerque, New Mexico.
- Matillo Vila, Joaquín
1993 Los ‘conchales’ de Punta Mico. In *30 años de arqueología en Nicaragua*, edited by Jorge E. Arellano, pp. 17–18. Museo Nacional de Nicaragua and Instituto Nicaragüense de Cultura, Managua, Nicaragua.
- Magnus, Richard W.
1974 *The Prehistoric Cultural Relationships of the Miskito Coast*. Unpublished Ph.D. dissertation, Department of Anthropology, Yale University, New Haven, Connecticut.
- 1975 Present Archaeological Research in Chontales, Nicaragua, Its Implications for the Prehistory of Lower Central America. Unpublished manuscript on file, Banco Central de Nicaragua, Managua, Nicaragua.
- McCafferty, Geoffrey G., and Larry L. Steinbrenner
2005 Chronological Implications for Greater Nicoya from the Santa Isabel Project, Nicaragua. *Ancient Mesoamerica* 16(1):131–146.
- Norweb, Alfred H.
1961 The Archaeology of the Greater Nicoya Subarea. Unpublished manuscript on file, Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge, Massachusetts.
- 1964 Ceramic Stratigraphy in Southwestern Nicaragua. *Proceedings of the 35th International Congress of Americanists* 1:551–561. Mexico City.
- Pim, Bedford C. T., and Berthold C. Seemann
1869 *Dottings on the Roadside in Panama, Nicaragua and Mosquito*. Taylor and Co, New York.
- Rigat, Dominique
1992 Préhistoire au Nicaragua: Région Juigalpa. 3 vols. Unpublished Ph.D. dissertation, Université de Paris I, Sorbonne, France.
- Smith, Michael E.
2013 *The Aztecs*. Third Edition. Wiley, New York.
- Squier, Ephraim G.
1852 *Nicaragua; Its People, Scenery, Monuments, and the Proposed Interoceanic Canal*. 2 vols. D. Appleton & Co., New York.
- Taracena Arriola, Arturo, and Adam T. Sellen.
2006 Emanuel Von Friedrichsthal: Su viaje a América y el Debate sobre el Origen de la Civilización Maya. *Peninsula* 1(2):49–67.
- Terpstra, Denise
2012 *Koroneia's 'Bishop's Palace'*. Unpublished Bachelor's thesis, Leiden University, Leiden, Netherlands.
- Vlaskamp, Roosmarie J. C.

2012 *Rock Solid: Rock Art Analysis and Documenting at Aguas Buenas (AD 400-1600) Nicaragua*. Unpublished Bachelor's thesis, Leiden University, Leiden, Netherlands.

Wallace, David R.

1997 Central American Landscapes. In *Central America: A Natural and Cultural History*, edited by Anthony G. Coates, pp. 72–96. Yale University Press, New Haven, Connecticut.

ROCK SOLID? BATTLING ROCK ART RECORDING METHODS AND INTERPRETATION AT THE PRE-HISPANIC SITE OF AGUAS BUENAS, CENTRAL NICARAGUA (A.D. 400–1525)

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Rock art has been the subject of archaeological studies for many years. Ever since the discovery of paintings in caves in southern Europe, images created on stone by peoples from the past have captured our imagination. Over the last 60 years, archaeologists have developed and tested many new research methods, most of which focused on one primary but elusive question: How old is it? However, many of these methods are problematic in their application to rock art, as stone has proven difficult to date (Keyser 2001:117). Especially in American archaeology, rock art studies remained underdeveloped compared to other categories of archaeological research, and even more so when compared to rock art research in other areas of the world, for example in France, Sweden, and Australia (Whitley 2001:10–9). The methods and examples discussed in this paper will center on petroglyphs instead of pictographs, for the convenience of the available dataset and case study.

In Nicaragua, pre-Hispanic rock art has been the focus of systematic archaeological research

from the 1980s to the present day. There are some mentions in early studies from the nineteenth century (Squier 1852; Flint in Lothrop 1926) and the first and early second half of the twentieth century (Lothrop 1926; Haberland 1966; 1970). These researchers focused on the visible petroglyphs on the islands of Ometepe and Zapatera in Lake Nicaragua (for the most recent research on this subject see Baker 2010). The department of Chontales, where the pre-Hispanic site of Aguas Buenas (N-CT-Jp-001) is located, was intensively surveyed during the 1980s and 1990s and is suggested to be the region with the largest number of petroglyphs in Nicaragua (Matilló Vila 1968a; Rigat 1992; Gorin 1989) (Figure 1a and 1b). Aguas Buenas was part of these surveys and Rigat (1992:547–559) mentions finding 31 localities of petroglyphs accompanied by detailed drawings (Figure 2).

In recent years, Geurds (2009) started to further investigate Aguas Buenas. During his field surveys, he noted the rapid deterioration of the petroglyphs visible in the landscape and also