



IMAGING AND VISUALIZING MAYA CAVE SHRINES IN NORTHERN QUINTANA ROO, MEXICO

CREACIÓN DE IMÁGENES Y VISUALIZACIÓN DE SANTUARIOS MAYAS EN CUEVAS DEL NORTE DE QUINTANA ROO, MÉXICO

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Abstract:

Innovative imaging and visualization techniques allow for the capture and display of features or objects within their broader spatial contexts. With respect to Maya cave architecture, high-resolution panoramic visualization and the production of 3D models can be powerful analytical tools, enabling the evaluation of potentially meaningful relationships between natural features and constructed features within a cave. A collaboration between the Instituto Nacional de Antropología e Historia (INAH) in Quintana Roo and the University of California, San Diego involves a study of at-risk cave shrines. Initial comparative and multiscale analyses across terrestrial and subterranean environments provide insight into the form, function, and meaning of Postclassic cave architecture in the northeastern Maya lowlands.

Key words: 3D documentation, Maya, caves, shrines, Mexico

Resumen:

Innovadoras técnicas de captación, creación de imágenes y visualización permiten la captura y exposición de entidades u objetos dentro de sus contextos espaciales. En cuanto a la arquitectura maya en cuevas, las panorámicas de gran resolución y la creación de modelos 3D se convierten en potentes herramientas de visualización y análisis que permiten la evaluación de potencialmente significativas relaciones entre las características naturales y construcciones humanas dentro de las mismas. Una nueva colaboración entre el Instituto Nacional de Antropología e Historia (INAH) en Quintana Roo y la Universidad de California en San Diego contempla estudiar santuarios rupestres en riesgo. El análisis inicial a través de los entornos terrestres y subterráneos proporciona información sobre la forma, función y significado de la arquitectura postclásica maya en cuevas de las tierras bajas del noreste Maya.

Palabras clave: Documentación 3D, Maya, cuevas, santuarios, México

1. Introduction

The Caribbean coast of Quintana Roo provides a unique glimpse into Maya ritual practice and notions of sacred space on the eve of the Spanish conquest. Architecture, like iconography, offers a palpable link between the constructed ceremonial spaces of surface sites and the intensively used and often physically transformed subterranean realms.

Many archaeological sites along the coast are well known for their enigmatic temples and shrines, and it is within this architectural canon that regional cave shrines

appear to reside. Late Postclassic buildings in Quintana Roo are typically crude affairs, coated with multiple layers of stucco plaster and typically painted blue-green and red. The high, corbelled vaults of the Classic Period are absent; instead, buildings are capped by low, simple vaults or beam-and-mortar roofs. Interiors are sometimes graced with spectacular murals executed in the so-called Mixteca-Puebla style. Temple facades are typically encircled by characteristic moldings and often support high-relief stucco sculptures.

Shrines can be, in essence, miniature temples – as they contain many of the interior and exterior architectural

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details of temples, but executed on a smaller, cruder scale. Only a few examples of such structures have been formally reported in caves along the Quintana Roo coast (Andrews and Andrews 1975; Leira and Terrones 1986; Martos 2002). Another category of constructions in caves include more open structures or masonry features and may closely resemble the altars or “thrones” found within temples at surface sites (Rissolo 2004).

The relationship between caves and surface architecture in the Maya area has received considerable attention over the past two decades (Brady 1997). Both the physical co-association between cave and structure and its symbolic significance have gone largely unrecognized at a number of recorded and reported sites. A reassessment of this broadly shared pattern in northern Quintana Roo, including the consideration of more recently identified examples, emphasizes a complementary or parallel tradition involving the incorporation of East Coast Style architectural elements characteristic of Postclassic temples into the construction of cave shrines (Rissolo 2004). Such spatial and stylistic interrelationships reaffirm the integral role of caves in site configuration and ritual practice.

2. Recent and On-Going Research

Innovative imaging and visualization techniques allow for the capture and display of features or objects within their broader spatial contexts. With respect to Maya cave architecture, high-resolution panoramic visualization and the production of 3D models can be powerful analytical tools, enabling the evaluation of potentially meaningful relationships between natural features – be they entrances, pools of water, or speleothems – and constructed features within a cave. Given their remarkable stylistic correspondence to Postclassic temple architecture, cave shrines and altars provide compelling and unambiguous evidence for religious practice in the cave environment. Initial comparative and multiscale analyses across terrestrial and subterranean environments – facilitated, in part, by specific visualization techniques – provide insight into the form, function, and meaning of Postclassic cave architecture in the northeastern Maya lowlands.

In collaboration with the state office of the Instituto Nacional de Antropología e Historia (INAH), we had the opportunity to thoroughly document an at-risk cave shrine near the town of Puerto Aventuras in March 2014. The name of the cave is not officially reported here, but will be referred to as “Oratorio.” Our integrative and multimodal approach to imaging and visualization was developed by the Center of Interdisciplinary Science for Art, Architecture, and Archaeology (CISA3) at the University of California, San Diego. Our efforts associated with the Cueva de Oratorio served as a trial application of our image acquisition, processing, and visualization workflow in the cave context (Hoff *et al.* 2015) and are being expanded to include other Maya shrines and altars that are currently at risk of vandalism or destruction.

The cave itself can be described as a large rockshelter, which opens onto a broad shallow sinkhole or area of collapse. This twilight cave is well decorated and slopes downward to pools of water along its deeper periphery. Just inside the dripline, and facing the expansive

entrance, is a remarkably well constructed and well preserved Late Postclassic shrine. The miniature masonry building is 2.8 m on side and 1.6 m high and rests atop a low plinth, which is supported by a basal platform (loose rubble core) that conforms to the slope of the cave floor. The single doorway is spanned by a stone lintel (with inset panel) and the flat beam-and-mortar roof is encircled by a three-part molding. A seated plastered figure (perhaps a deity) was once affixed to the roof above the doorway; all that remains are its legs, which hang over the molding. Also, the roof appears to have been adorned at one time by stone almenas; however, only one remains intact (in the NW corner).

Exterior and interior surfaces are finely plastered. A layer of organic growth on the shrine’s exterior surface makes it difficult to determine whether or not it was once painted. Interior surfaces are unpainted and remain bright white. Inside the shrine, the intact roof beams are striking in their degree of preservation and integrity. Paired center beams (laid back to front, and resting on tie beams set into the walls) carry tightly-spaced transverse beams. A plastered bench along the rear interior wall of the shrine once held a venerated object, which has since been torn from its purchase.

Three primary imaging modalities have so far been used in our investigation of cave shrines within their physiographic and speleological contexts. The CAVEcam produces high-resolution stereoscopic spherical panoramas, which can be viewed in 3D via immersive environments or personal VR headsets. CAVEcam field photography enables the archaeologist to view cave architecture within its broader context and within a single panorama. Such navigable point-of-view panoramas can capture and allow for seamless and uninterrupted visual movement within and between light and dark areas, entrances, cave floors and walls, speleothems and other natural as well as cultural (or culturally modified) features.

Terrestrial laser scanning (TLS) and image acquisition for structure-from-motion (SfM) photogrammetry have been conducted in tandem – producing complementary 3D data that combine trusted geometry and photorealism. In cave environments where adequate lighting for photogrammetric techniques can be challenging, TLS is particularly valuable (especially with respect to documenting the morphology of the cave itself). We produced 35 scans in Cueva de Oratorio, totaling approximately 1.5 billion points. These coordinates have become the digital “scaffold” into which photogrammetric point data can be integrated and onto which CAVEcam panoramas can be draped. The resulting models (Figs. 1, 2) enable the archaeologist to view and evaluate cave architecture in its entirety as well as make critical measurements and conservation-related recommendations.

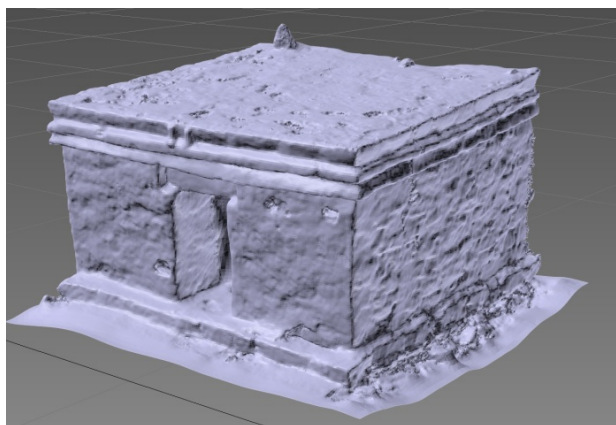


Figure 1: Mesh of the shrine in Cueva de Oratorio.



Figure 2: Side-view section of shrine in Cueva de Oratorio.

3. Concluding Remarks

The ancient Maya appropriated and transformed subterranean spaces in ways that were both patterned and imbued with meaning. The interplay between natural features or spaces and cave architecture reveals a tendency to conceptualize caves in a manner that is consistent with emic notions of the built environment (Rissolo 2003, 2005). Evaluating these relationships involves documenting (and being able to view) architecture within its environmental context. Continuation of our research in Quintana Roo will not only serve to digitally preserve these unique cave shrines, but will provide for current and future comparative analyses of constructed features related to ancient Maya ritual practice in caves.

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