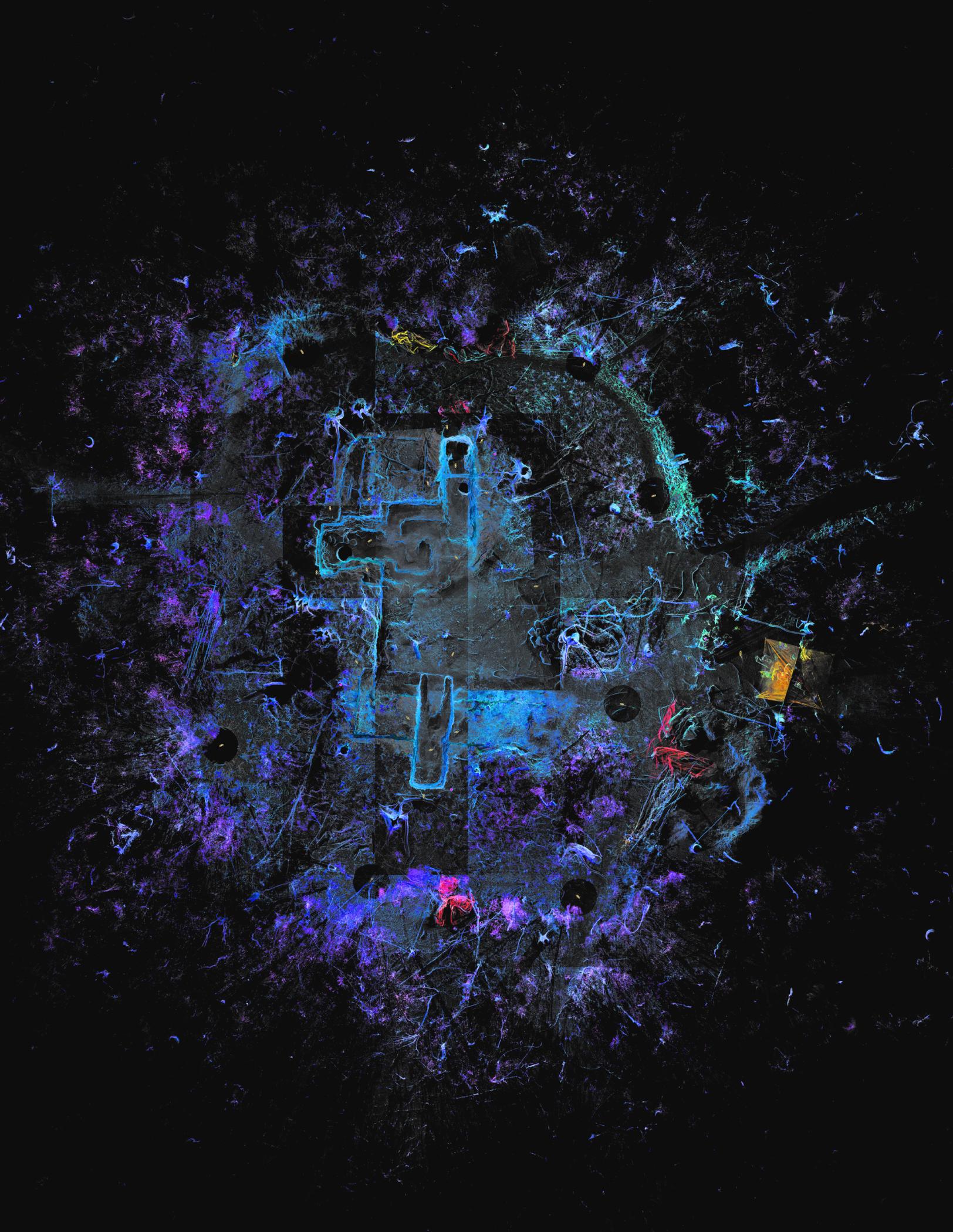


# Xno'ha Digital Survey 2017



Ben Baaske and Robert Warden

2018



2017 Field Season

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## Xno'ha Digital Survey 2017

### Abstract

The presentation of heritage sites is critically important to the perception of historical narratives. A key goal is to help both scholars and the general public to see heritage as dynamic and living. This project explores the visualization of archaeological excavations through preservation technologies, specifically photogrammetric data. Our study focuses on a patio group at the Maya site of Xno'ha (occupation dates range from the Late Preclassic to the Terminal Classic) in northern Belize, and the current excavation and photogrammetric documentation of three structures (32, 33, and 34). Sequential photogrammetry was conducted throughout the entire stratigraphic excavation of Structure 34's unit, resulting in 9 layers of photogrammetric documentation. The same process was applied to a chultun feature (single chamber) at Structure 33, creating 18 layers of photogrammetric data at regular intervals. For Structure 32, a single-phase, 3D model was generated, successfully stitching the above-ground unit to its corresponding, subterranean chultun (three chambers). Additionally, photogrammetry was used to create a plan view of the patio group area, and to create wall elevations. This methodical documentation of the process of excavation, in the span of months, records a three-dimensional time-lapse dialing back architectural conditions of the site hundreds of years.

### Introduction

The 2017 field season marked the 10th year of collaboration between Robert Warden and the Center for Heritage Conservation (CHC) at Texas A&M University with the Maya Research Program in Belize. The season focused on the Maya Lowland site of Xno'ha in Northern Belize. Work early in the season focused on a patio group of structures of Structures 32, 33, and 34. In closing the season, a team of volunteers and members of the CHC documented structures that continued excavation from previous seasons (Structures 32, 33, and 34; and Structures 100, 106, and 107) and new work at Plaza C (Structures 18, 19, 22, and 25). In addition to these structures, the team continued documentation of archaeologist trails that connect previously excavated structures within the site of Xno'ha. Documentation included terrestrial laser scanning, total data station survey, freestyle laser scanning-structured light scanning, and photogrammetry. The team also conducted extensive photogrammetry on artifacts from this season and earlier seasons.

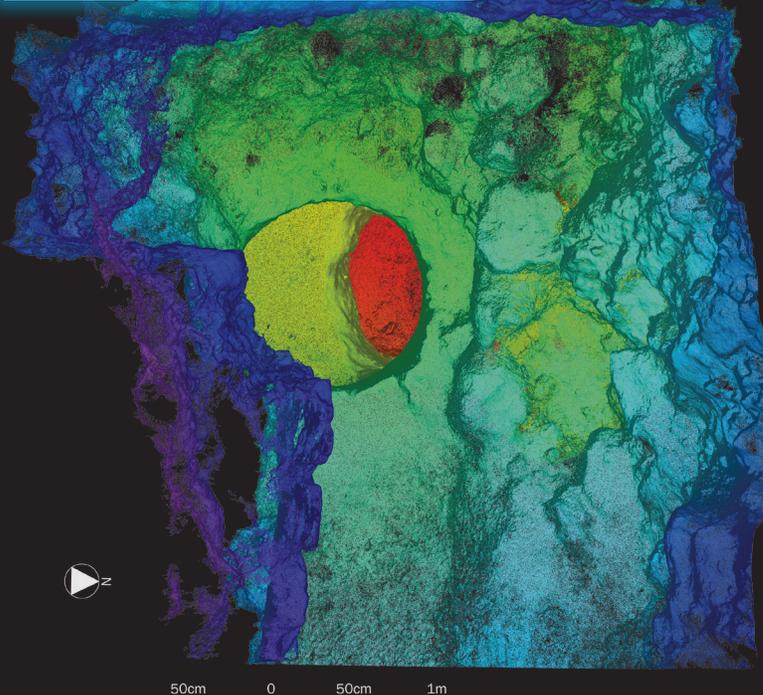
## Methods

Photogrammetry involves the capture of images to produce a digital 3D model. This digital model takes the form of a point cloud (identical to that generated using laser scanning technology), a surface mesh, and a textured surface mesh. The textured mesh can be used to generate ortho-corrected images and 3D PDFs. Surface meshes can be 3D-printed (with some minor/major editing) or brought into 3D modeling software for editing, synthesis (with other surface meshes, or modeled geometries), or the basis for 2D drawings or renderings. Point clouds generated using photogrammetry can be exported into viewing software to export an array of views and sections. Additionally, these point clouds can be used as baselines for drafting and modeling (in software like Autodesk Revit or Rhino).

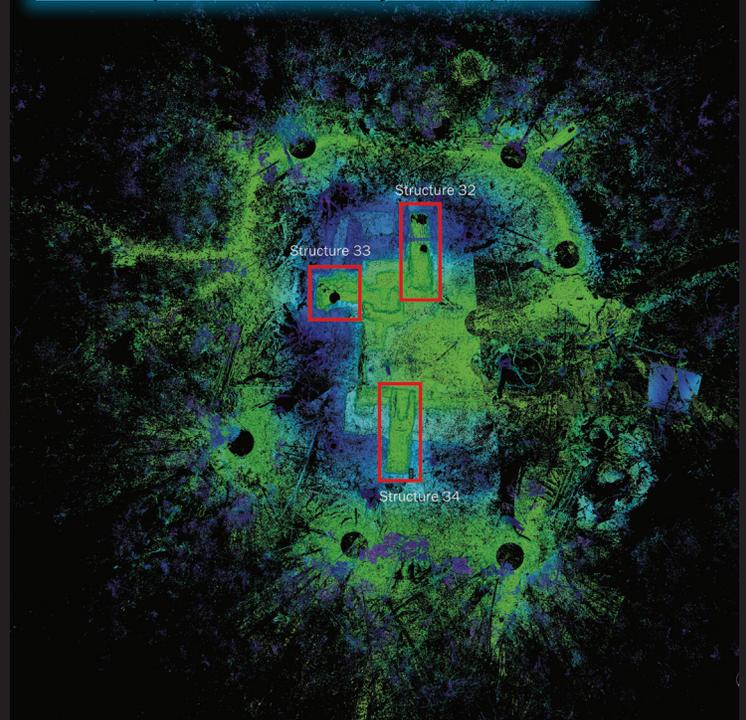
Our focus was on the documentation of the excavation process at Structures 32, 33, and 34. Our aim in conducting documentation of the excavation process was to create a 3D archive of in situ data, which would help understand artifacts in their spatial and temporal context. This site had three primary operations during the field season: (1) the excavation of Chultun 01 under Structure 33, (2) the excavation trench perpendicular to the apparent major axis of Structure 34, and (3) the 3D modeling and partial excavation of a collapsed chamber in Chultun 02 in Structure 32.

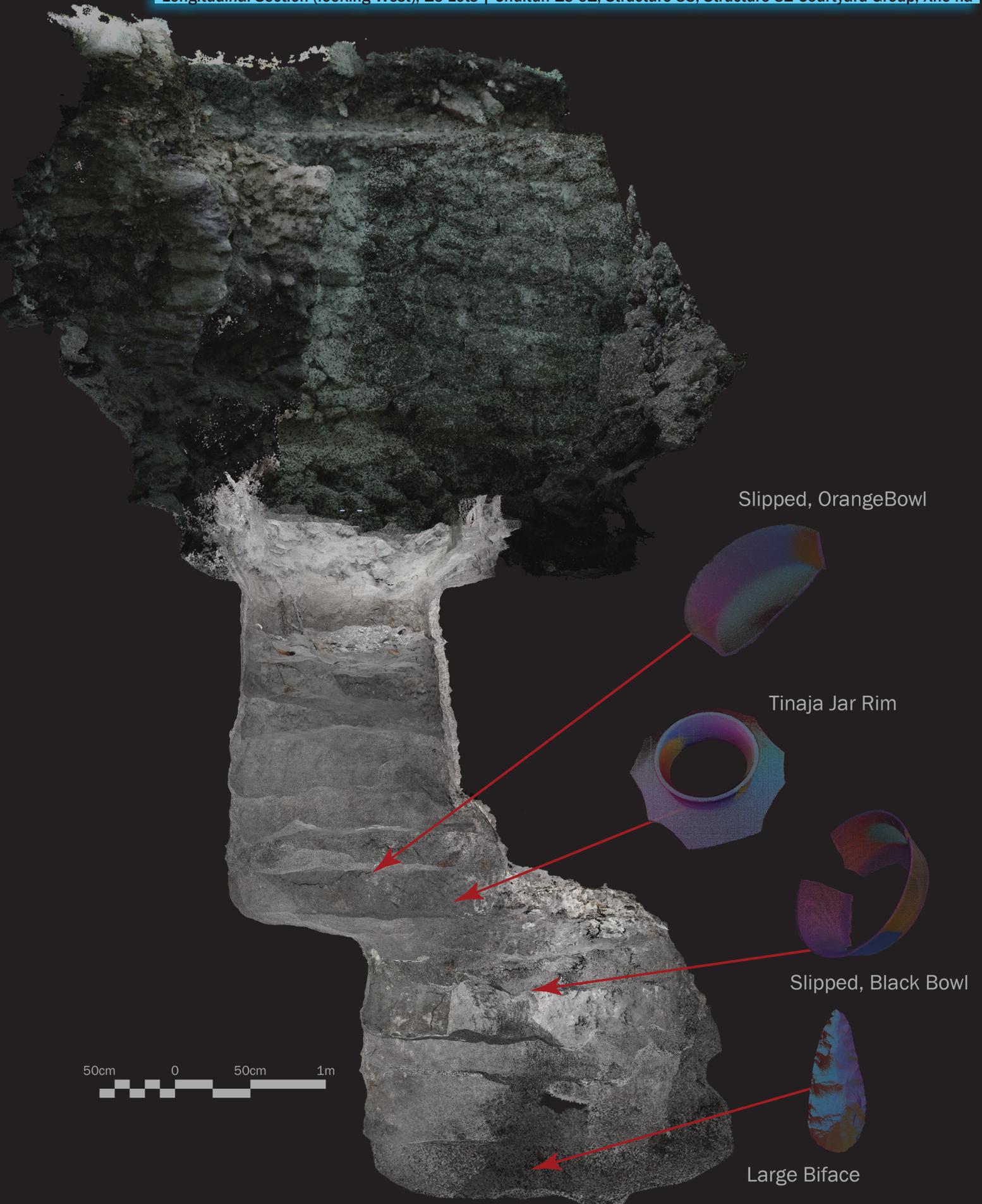
During the excavations of Chultun 01 and Structure 34, photogrammetric data (pictures captured for photogrammetric processing) was collected at regular intervals. Intervals at Chultun 01 were every 10-20 centimeters (depending on the stage of the excavation), while intervals at Structure 34 were determined by architectural features (these features, in turn, determined the lot designation). In the cases of Chultun 01 and Chultun 02, images were captured using a Canon Rebel Ti3, with manual settings, fixed lens length, and often with flash (no flash was used at Structure 34's trench, while all other above parameters were the same). Image capture followed a cyclical path, that is, camera position circled the feature area and (especially in the case of Chultun 01) spiraled down into the feature.

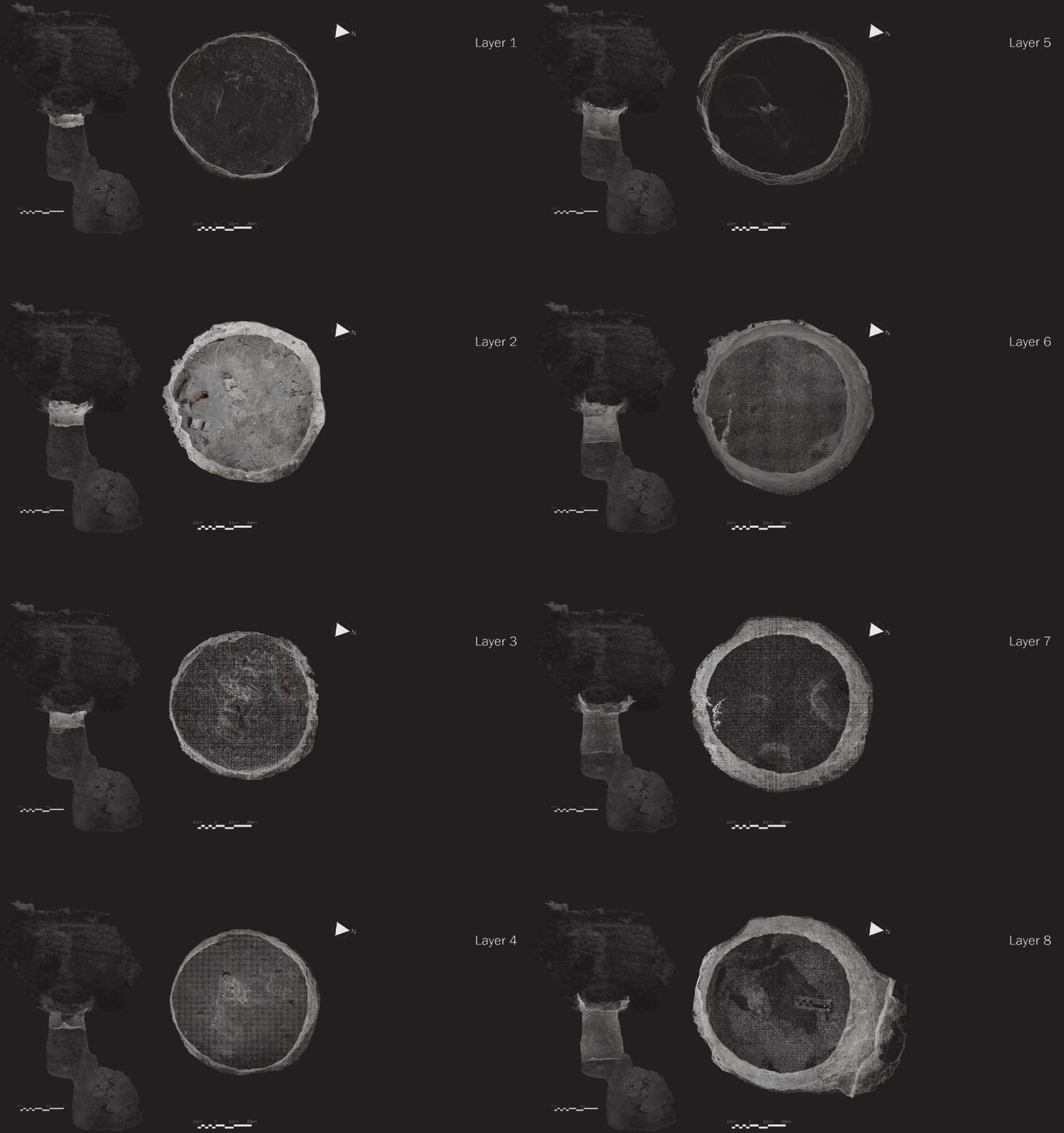
Floor Plan | Chultun 16-01, Structure 33

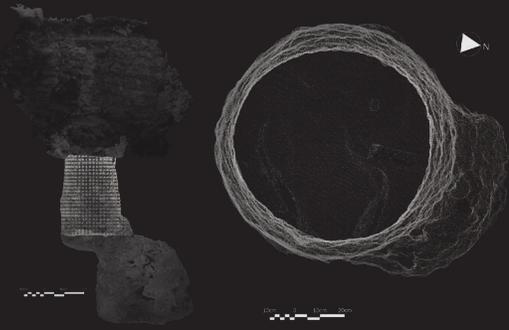


Site Plan | Structure 32 Courtyard Group, Xno'ha

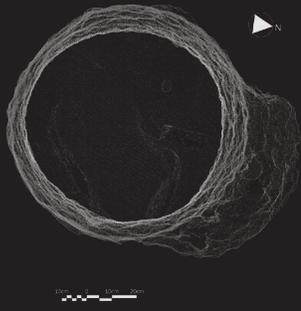




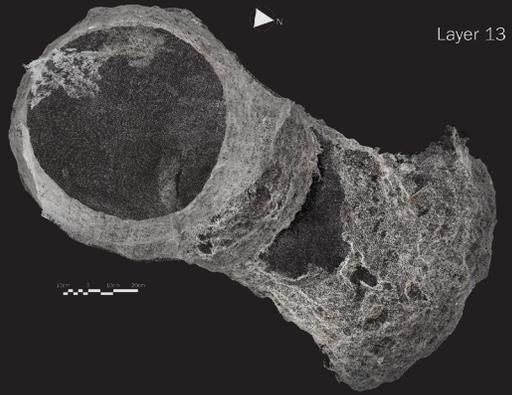




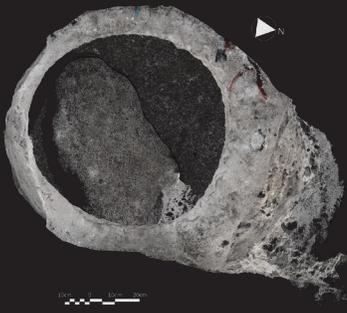
Layer 9



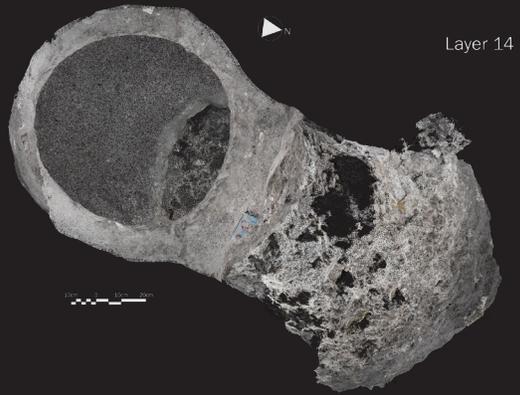
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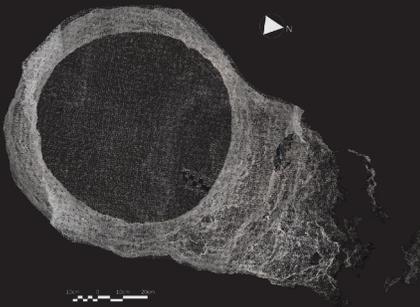
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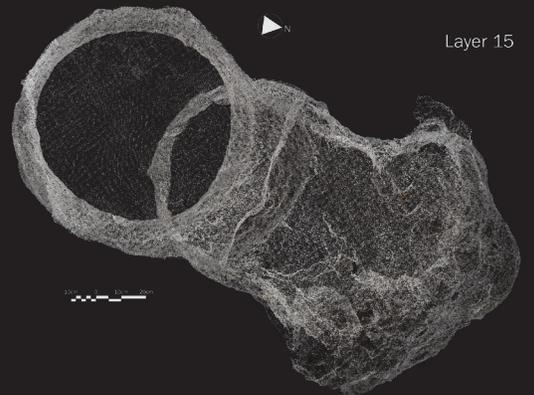
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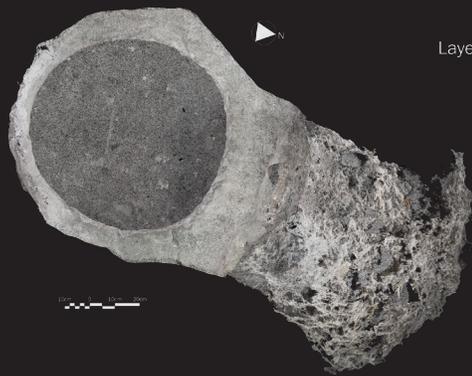
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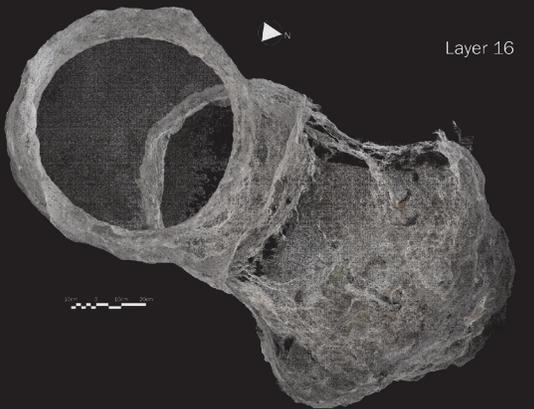
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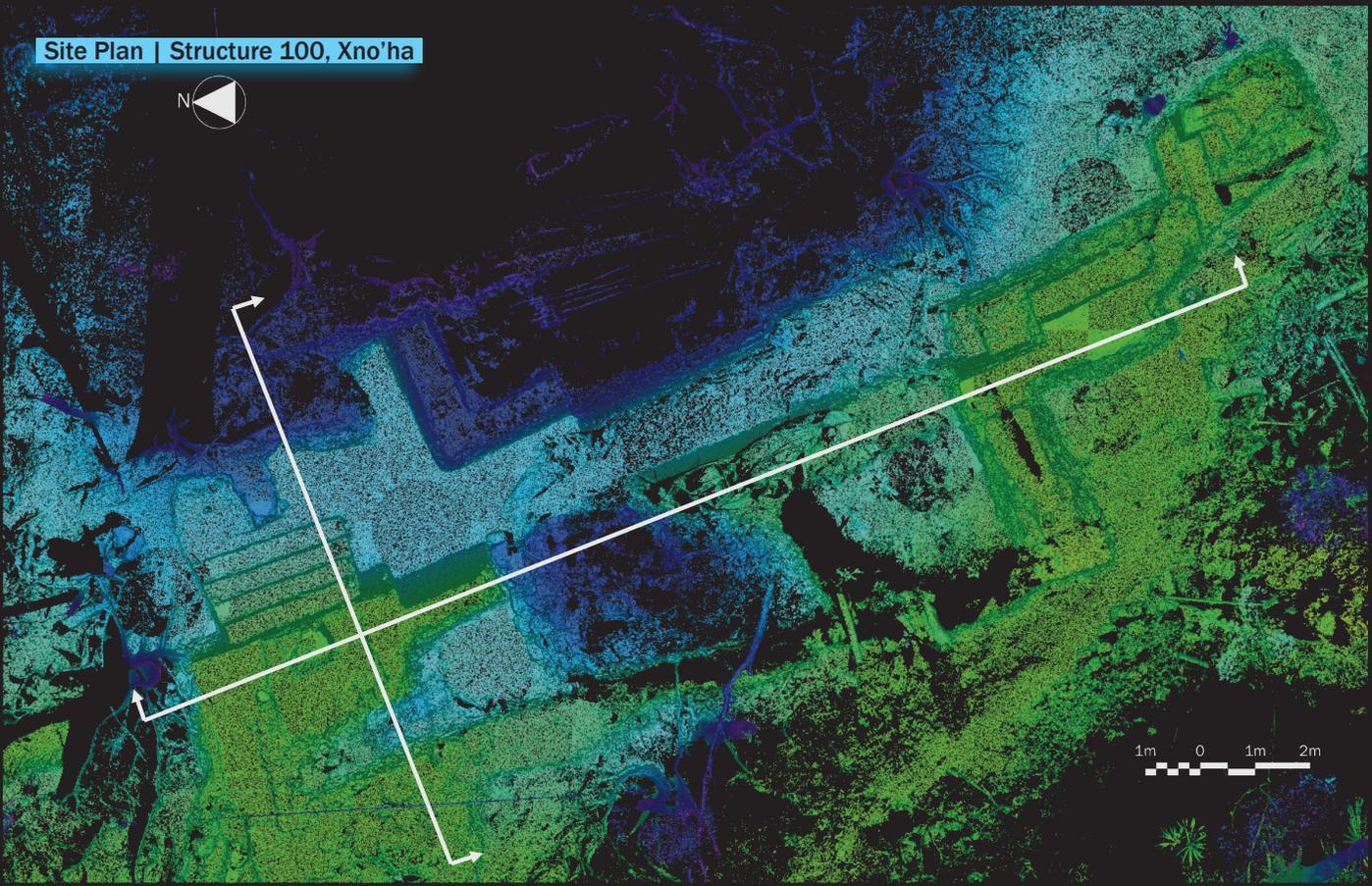
Layer 12



Layer 16



Site Plan | Structure 100, Xno'ha



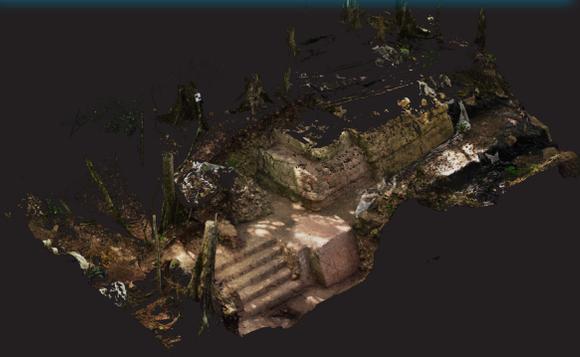
Longitudinal Section | Structure 100, Xno'ha



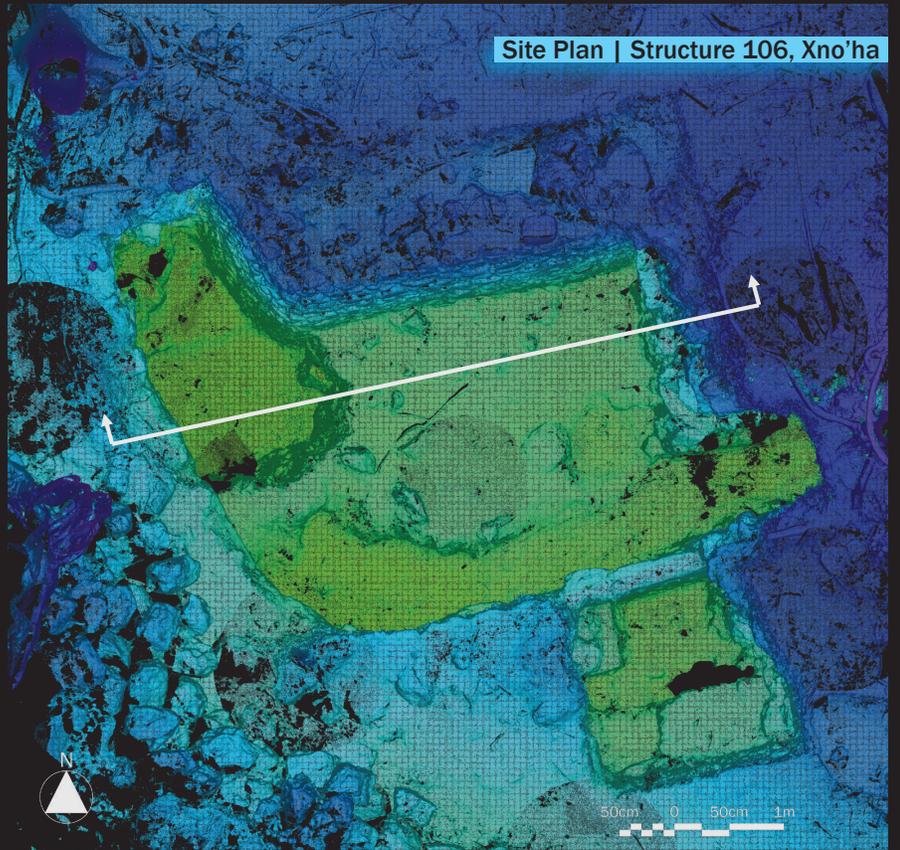
Southwest Isometric View | Structure 106, Xno'ha



Northwest Isometric View | Structure 100, Xno'ha



Site Plan | Structure 106, Xno'ha

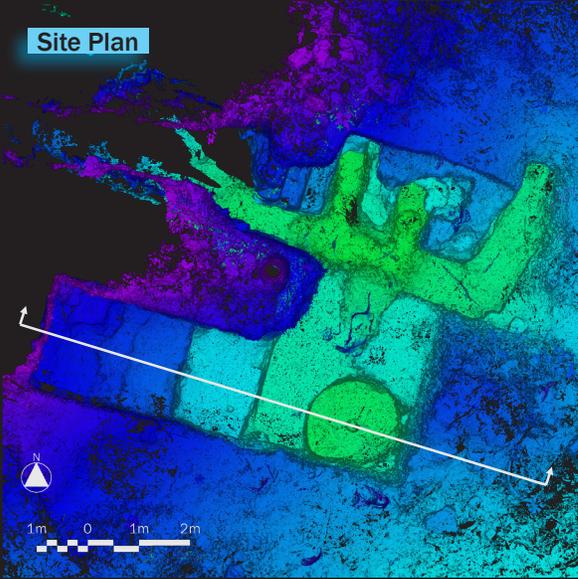


Longitudinal Section | Structure 106, Xno'ha

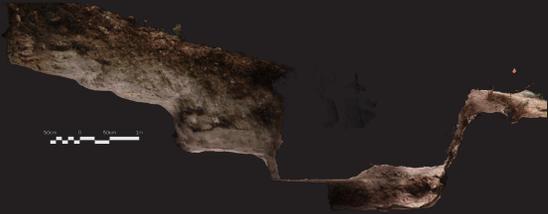


Structure 22

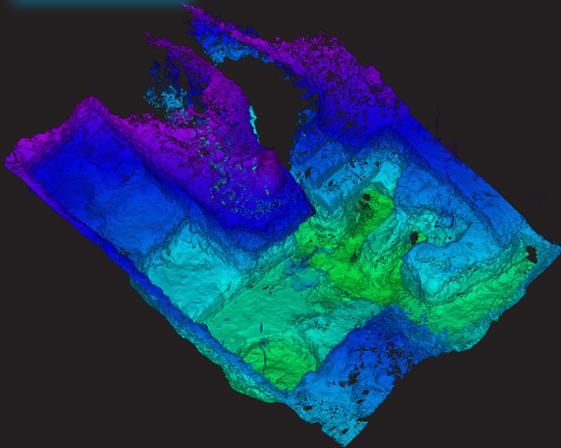
Site Plan



Cross Section

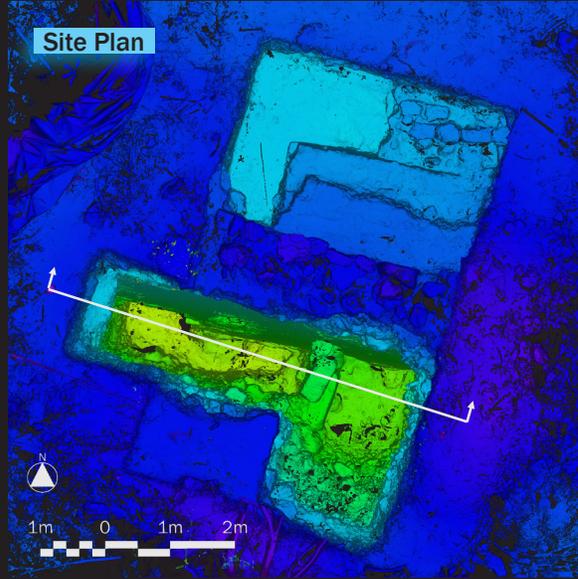


Isometric View

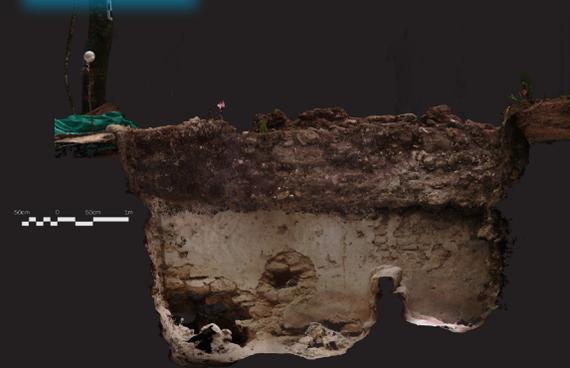


Structure 19

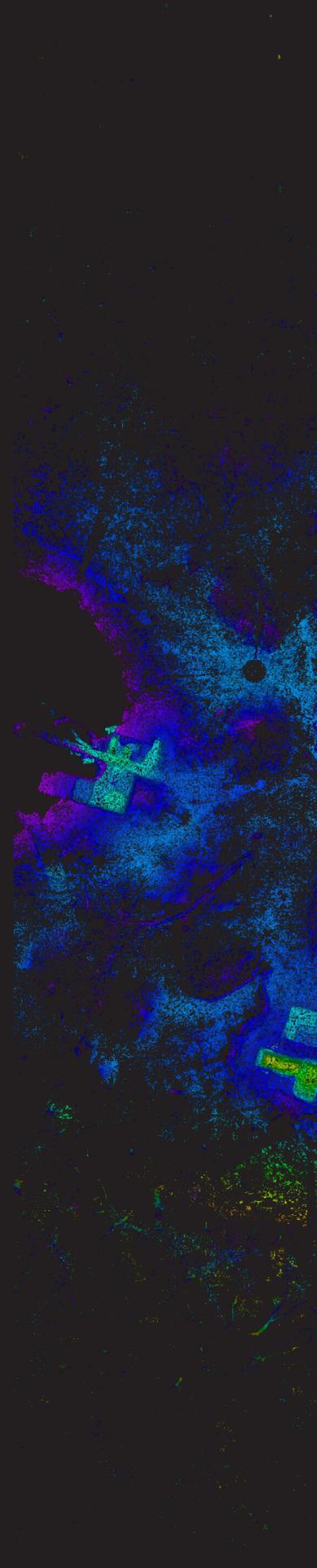
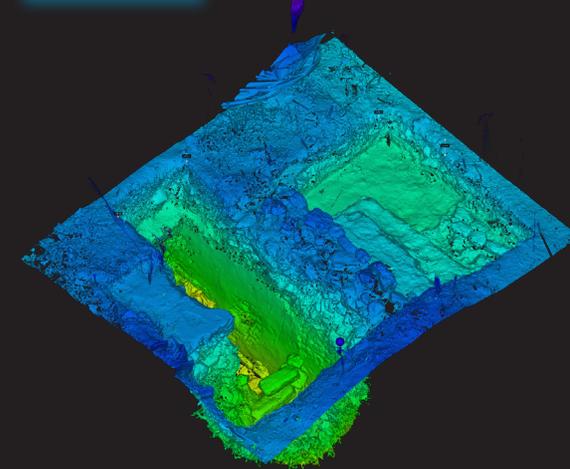
Site Plan

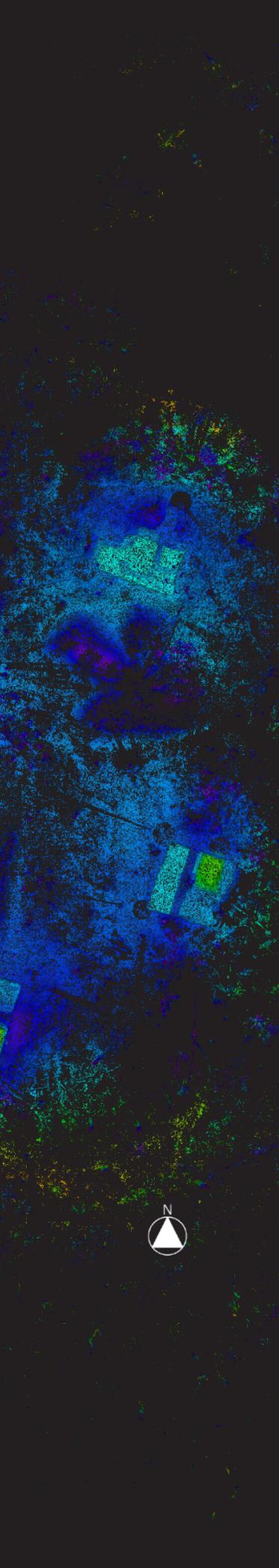


Cross Section



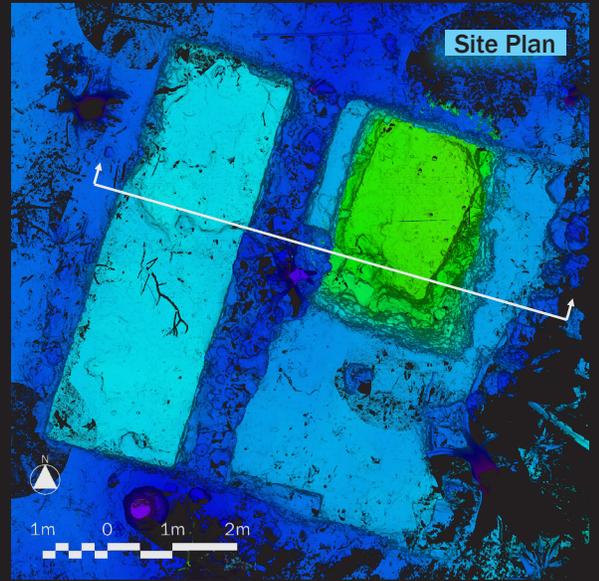
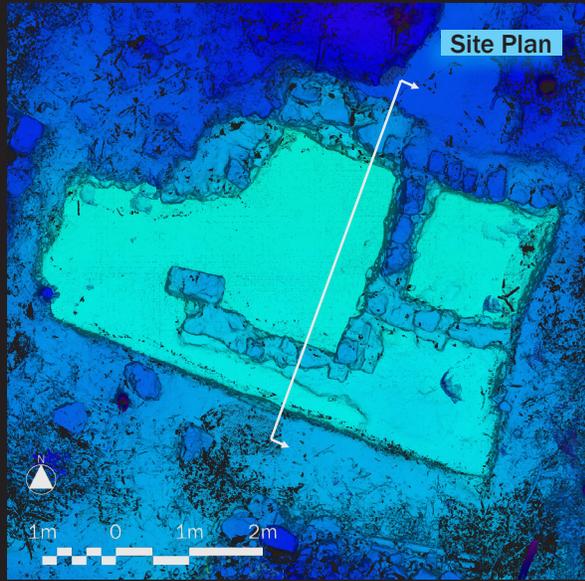
Isometric View





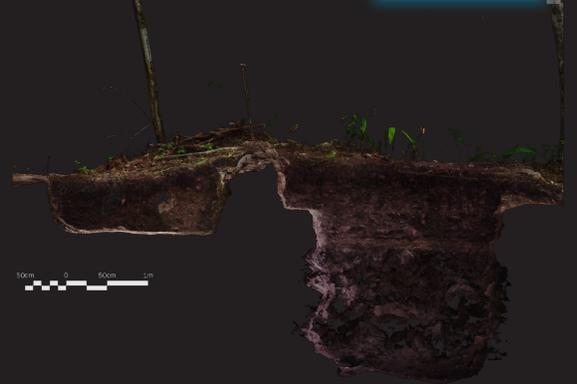
Structure 25

Structure 18



Cross Section

Cross Section



Isometric View

Isometric View

