



Report on the 2023 Investigations at Marco Gonzalez and Lamanai
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Overview for 2023

The main focus for this season was the site of Marco Gonzalez, where we picked up on the archaeological investigations last carried out in 2014 (Graham et al. 2017). Dr. Gabriel Wrobel spearheaded new burial excavations at the site, and Dr. Graham set up the fieldwork and acted as overall supervisor.

For those unfamiliar with the site, Marco Gonzalez is located at the southern, leeward end of Ambergris Caye, off the northern coast of Belize. This site was first excavated in 1986 (Graham and Pendergast, 1989), and was followed by several more years of excavations. The research conducted throughout these seasons have found that the site was occupied as early as the Late Preclassic period, extended to the Middle Postclassic period (Simmons and Graham, 2016), with some activity and possibly occupation in the Late Postclassic and early colonial periods. Marco Gonzalez served as the island's largest trade port, providing an economic foundation that was almost certainly one key to its long-term sustainability (Graham and Pendergast, 1989; Simmons et al., 2018). Previous research has indicated that the site not only survived but also thrived during the Terminal Classic and Early Postclassic (Guderjan, 1995). The role of Marco Gonzalez as a major trading hub placed the community in direct contact with communities along the coast, rivers, and islands throughout the Caribbean, providing access to food and trade goods (Williams et al., 2009).

The nature of occupation and commerce changed through time (Graham et al. 2017). Intensive trade in a wide range of goods, including pottery, characterises the Preclassic and Early Classic. Specialisation in salt production characterises the Late Classic. Towards the end of the Late Classic, the community represented by the mapped structures arose and focused again on trade in a wide range of goods.

Marco Gonzalez

Gabe Wrobel and Liz Graham cooperated as PIs, with Gabe focusing on burial excavations and Liz on the archaeology in general. Wrobel and Graham shared responsibilities of decision-making and logistics. Karen Pierce carried out the mapping, section drawing, and datum levels. With regard to operations, Panos Kratimenos, Aubree Marshall, and Rylee Lalonde supervised operation units in Structures 14 and 18. Sylvia Lingham supervised the clearing of the southern platform face of Str. 14, west of the central stair; Graham attended to the northern platform face; and Karen Pierce supervised excavation of the south platform face on the east side. Jim Aimers initiated preliminary ceramics analyses. Pittman carried out experimental scanning of excavation sections, although only for one day, as he was leaving Belize after his work at Lamanai. Materials exported to Michigan State comprised human skeletal material excavated by Wrobel.

Lamanai

Francesca Glanville-Wallis completed her plan, begun in the 2022 season, of test pitting along a transect from the lagoon to the western border of the reserve to learn about past land use. Michael Pittman continued non-destructive LSF (Laser Stimulated Fluorescence—carried out in 2022) of the Lamanai ceramics to determine chemical composition. Exported materials to UCL comprised soil samples taken by Glanville-Wallis. Also included is a report on the stucco frieze from Str. N10-28, carried out by Gabriele Saltaña in 2023, during the time Jorge Can was heading the reconstruction and consolidation project related to the High Temple (Str. N10-43). The study was carried out under the supervision of Christophe Helmke.

Order of the reporting

Marco Gonzalez

- 1) Site plan, location of the excavations, Operation numbers and Datum notes
- 2) Operation 23-1, 23-7, south side of Str. 14 platform (substructure)
- 3) Operation 23-2, Str. 14
- 4) Operation 23-3, Str. 14
- 5) Operation 23-4, Str. 18
- 6) Operation 23-5 north side of Str. 14 platform (substructure)
- 7) Pottery notes

Lamanai

- 1) Precolumbian land use investigations
 - 2) Further LSF experimentation
 - 3) Stucco study Str. N10-28
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Marco Gonzalez

1) Site plan, section, location of the excavations, Operation numbers and Datum notes (*Karen Pierce*)

Data Points	Structure	Datum Nail Location	Centimeters above ground surface. Note: All Structure 14 datums are equal
Site Datum	NE corner off of Structure 12	Re-bar is approximately aligned with north face of giant riser stones; ca. 2 meters north of the multi-root strangler fig trees	Level of the surface of the concrete (with embedded re-bar) is ca. 15 cm below ground surface
Datum 23-A	East side of Structure 14	West side of gumbo limbo tree	81.5 cm above ground surface (on stone)
Datum 23-B	West side of Structure 14	South side of the multi-trunk (5) tree	23.5 cm above ground surface
Datum 23-C	South side of Structure 14	South side of cut-down palm tree—left the nail in the remaining bit of standing tree-trunk	58.0 cm above ground surface
Datum 23-D	Structure 18 north side of the northern-most looter's pit at top of mound	South side of the gumbo limbo tree	38.5 cm above ground surface
Datum 23-E	Approx. 1.4 meters east of the south-east corner of Structure 14 (at SW corner of Structure 12)	Small palm tree at approx. west face of Structure 14 on south side	62.0 cm above ground surface (west side)

RE-DISCOVERED AND REPAIRED SITE DATUM

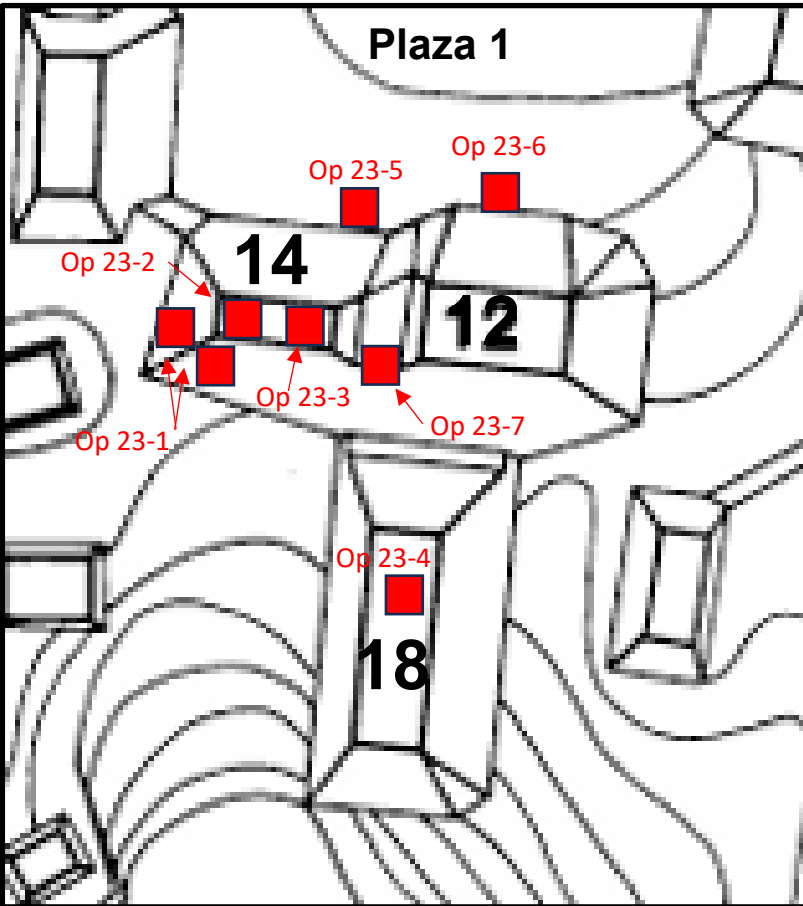
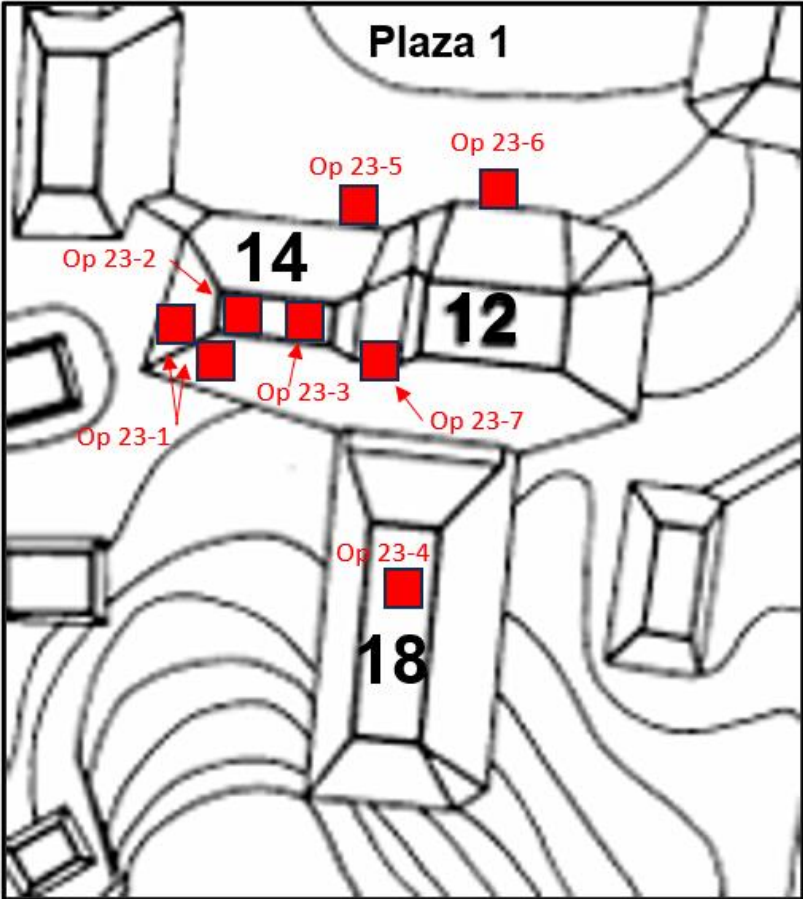
With some searching we re-discovered and exposed the original site datum, which was covered by approx. 15 cm of humus/soil. It was established in 1990 and made of re-bar set into a 27 cm diameter circular concrete pad.

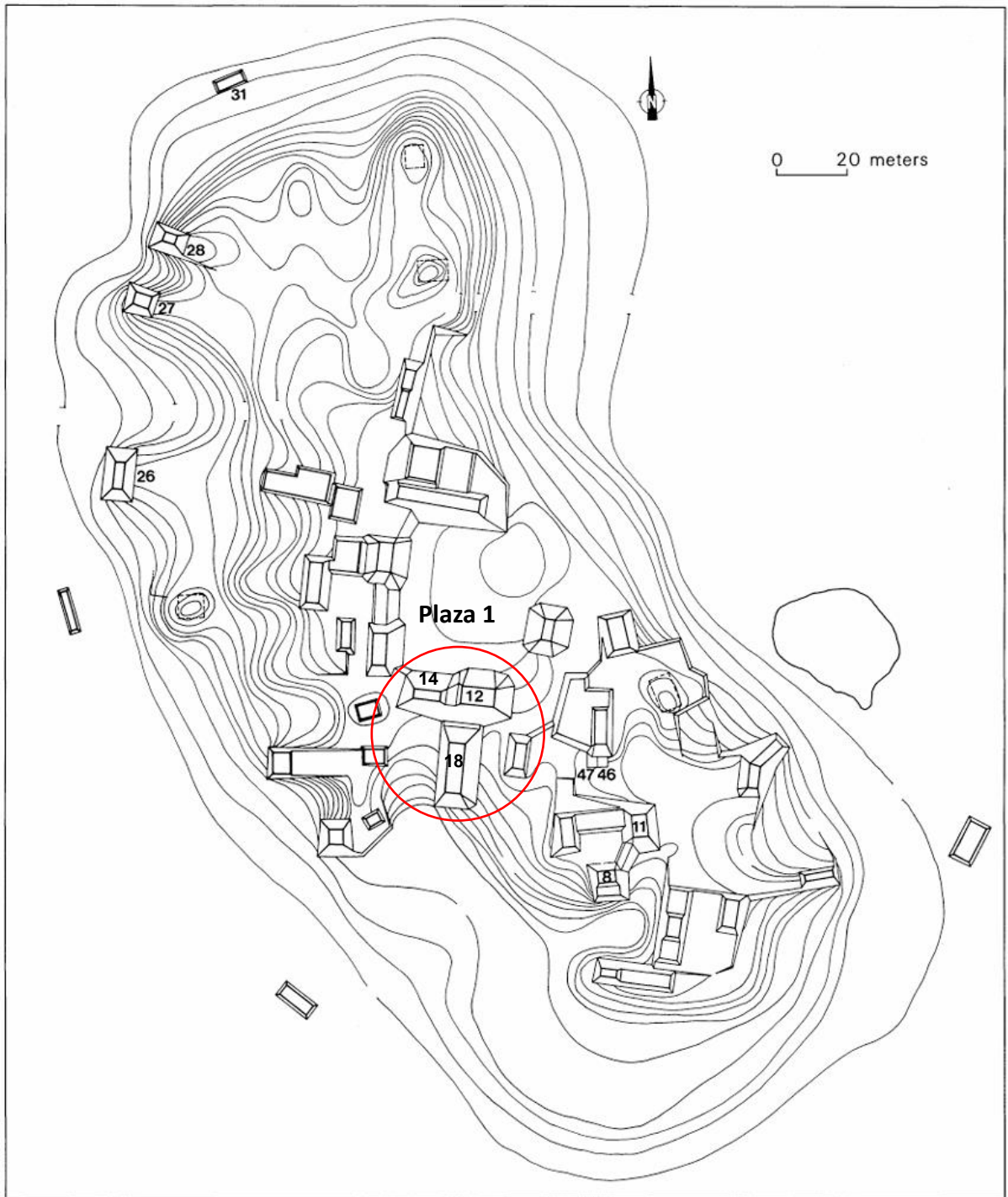
On June 14 we tied a new piece of re-bar to the old, fragile, decaying re-bar, and placed a 12 cm diameter piece of white PVC pipe over this assembly on top of the original flat circular concrete pad, and then filled it with concrete, encapsulating the new and old re-bar. The height of the new re-bar from the top of the original cement pad surface is 87 cm. The height of the new re-bar above the top of the old re-bar is 41 cm. The height of the PVC pipe above the old concrete pad surface is 33 – 34 cm.

OP NUMBERS AND LOCATIONS

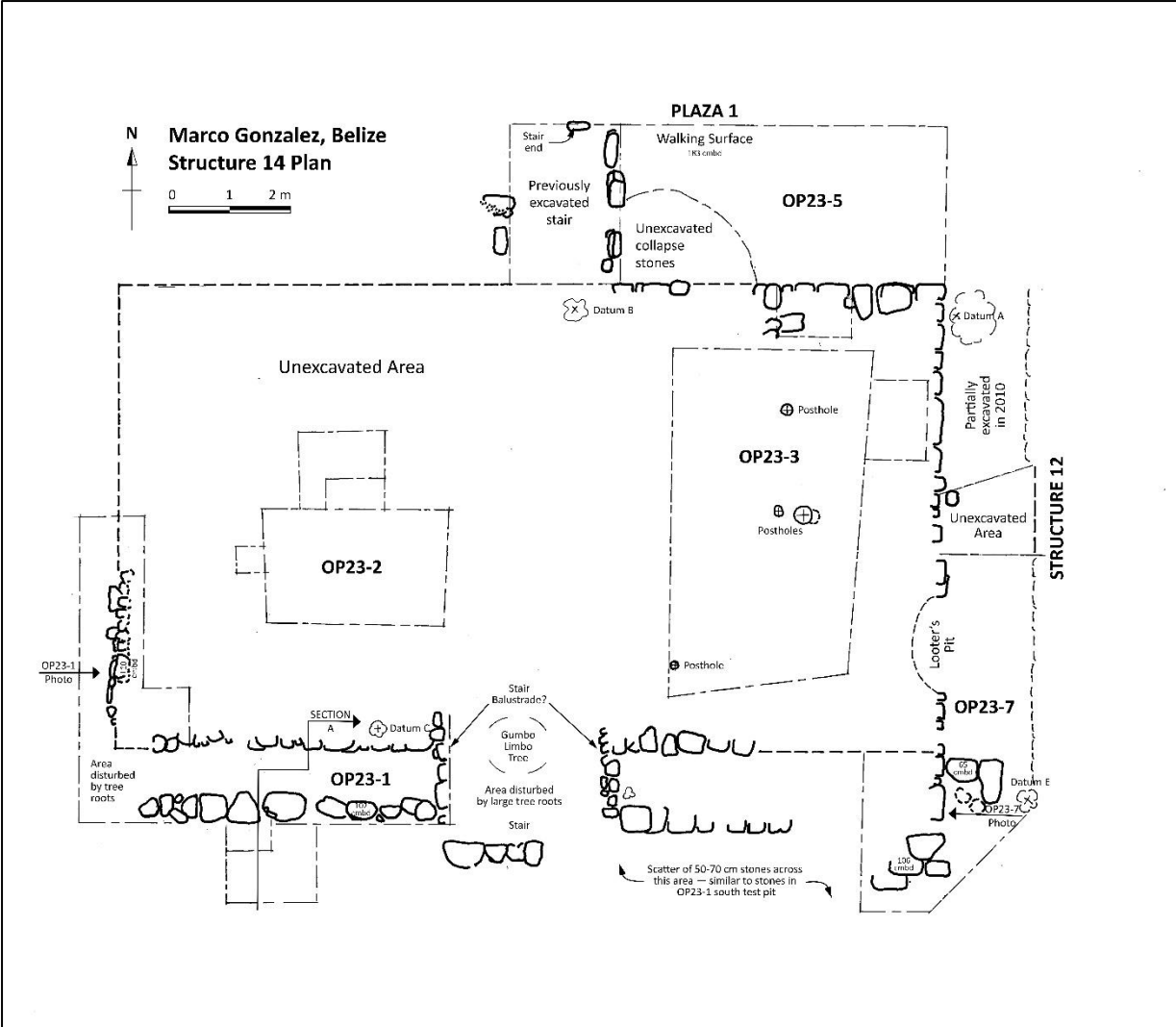
See site plan excerpt showing Structures 14, 12, and 18 for general location of 2023 Operations. See Structure 12 Plan for more precise locations.

OP Number	Location	Explanation
23-1	South face of Structure 14 at west end, and wrapping around the west face of the west side	Clearing the south and west sides extending outward from face of the platform to investigate architectural sequence
23-2	Centered at the top surface of the west end of Structure 14	Investigation of remains, structural or otherwise, associated with the superstructure that once stood on the platform surface (western half)
23-3	Top of the east end of Structure 14	Investigation of remains, structural or otherwise, associated with the superstructure that once stood on the platform surface (eastern half).
23-4	Northern-most looter's pit at the top of Structure 18	Exploratory test situated in a looter's pit; the intent was investigation of remains, structural or otherwise
23-5	North face of Structure 14 at the east side, extending north to Plaza 1	Clearing extending north from the north face of the structure: the intent was investigation of relationship of Str. 14 to Plaza 1 surface
23-6	North face of Structure 12, west of center of structure, extending north to Plaza 1	Reopening of OP 10-1 to continue investigation of relationship of Str. 12 to plaza: test pit in area of plaza to determine stratigraphic sequence.
23-7	Between the east-side face of Structure 14 and the west-side face of Structure 12 at the south end	Clearing the passageway that separates Str. 12 from Str. 14; includes some clearing of faces of respective platforms.





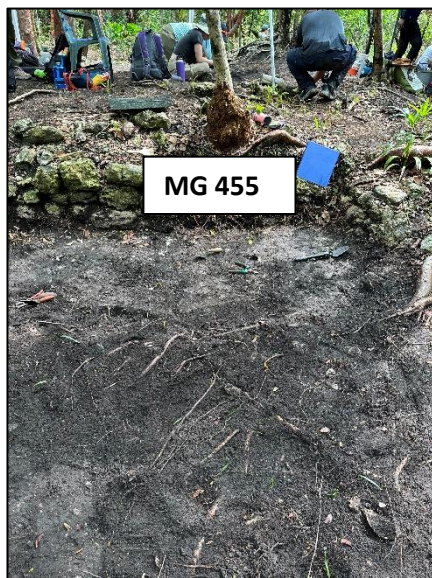
Marco Gonzalez site plan indicating the area of the 2023 field season investigations. Contour interval 10 cm; outermost contour 20 cm above sea level. Survey and drafting by Claude Belanger.



Plan of 2023 Excavation Units (Karen Pierce)

2) Operation 23-1, Op 23-7, platform of Str. 14 on the south side (*Sylvia Lingham, Karen Pierce*)

Excavations began on the 5th June 2023. Ops 23-1 and 23-7 were geared to assessing the architectural attributes and chronology of the platform, Str. 14, on its south side. Str. 14 at one time supported perishable superstructure(s). Op 23-7 was aimed at clearing the space between Str. 14 and Str. 12 and clarifying the southeast corner of the platform, but the excavation is in its initial stages. Although the structures at the site are not large, the amount of post-abandonment accumulation is staggering; relatively speaking, there is even more soil accumulation than is the case at Lamanai. Ultimately, we hope to be able to document the extent to which use of Str. 14 extended into the Postclassic and/or if the transition is reflected in changing (?) architectural modifications or additions. Until now, all the burials associated with the Str. 14 superstructure have been dated to the Terminal Classic or Late Classic based on the primary ceramics found with the interred individuals. Str. 14 was constructed towards the end of the Late Classic, probably sometime in the last decades of the 8th century. Prior to its construction, the locale was characterised by debris from extensive salt production.



Figures 23-1: 1 & 2. The photo on the left faces N and shows exposure of the upper terrace face (MG455) of the Str. 14 platform on its south side. The photo on the right faces NE and shows the junction between the stairside (MG 445) and the upper terrace face.

Op 23-1 extended from the southwest corner of the Str. 14 platform to just about the centre of the platform on the south side. Much of this area was disturbed by tree roots. MG 455 was assigned to the upper terrace on this side (**Fig. 23-1: 1,2**). As elsewhere on the site, the terrace facing stones were reefstone and the core material comprised earth mixed with artefact debris. We began by clearing the post-abandonment accumulation (PAA) (lot MG 426) to reveal more of the upper terrace face (MG 455). The clearing of the PAA revealed ceramics and worked chert and eventually, a lower, stone-faced terrace (MG 453). At this

stage, the height of MG 455 was approximately 0.96m. Initially we thought that the MG 453 terrace was either an earlier phase of construction or was simply the lower terrace of the original platform. However, further excavation indicated that MG 453 *abuted* the stone face of MG 455 and was more likely a modification of Structure 14. We exposed patches of plaster (MG 454) that must once have covered the horizontal surface of this lower terrace MG 453. Lots MG 474 and 481 refer to the core of terrace MG 453. Where the terraces run eastward and abut a stairside, the stairside lot is MG 445 (**Fig 23-1: 2**).



Figures 23-1: 3,4. The photos face WNW. They show the upper terrace face (MG 455), the emerging lower terrace face (MG 453), and the remaining plaster that probably once covered the surface of the lower terrace (M 454).

The plaster bits (MG 454, **Fig 23-1: 4**) associated with the lower terrace were underlain by a ballast layer (MG 474) (which would be expected as part of any proper construction of a plastered surface). The ballast contained significant amounts of pottery sherds (283); chert (2); shell, including worked pieces (5); animal bone (13) and worked sherds (12). Below the MG 474 ballast lay plaster mixed with pottery sherds and worked pottery sherds (MG 481). Some of the ceramics suggest an early Postclassic date, which is significant because it would mean that the platform was modified in the Early Postclassic. The lower terrace face MG 453 should extend across the entire south face of Str. 14, although where the southern stair originally stood, there is so much disturbance from tree roots that it is hard, so far, to trace the terraces beyond (east of) the stair (**Fig. 23-1: 5**). However, levels taken of the



Figure 23-1: 5. South side of Str. 14.

collapse suggest that the terraces continue. What we cannot yet confirm is whether the stairs are original to the platform on its south side or are associated with the time when the lower terrace face (MG 453) was constructed abutting MG 455. Due to time constraints, excavations to the east of MG 445—specifically the stairside—were limited to clearing PAA (MG 446) and restricted investigations into a potential salt-processing layer (MG 452).

Further archaeological evidence of Str. 14's conformation on this side (the south side) comes from a 1m x 1m test pit excavated to the south of, and exposing, the lower terrace face (MG 453) (**Fig. 23-1:6**). The test pit was excavated to reveal the extent and depth of the lower terrace face, as well as to see whether or not we could reach a plaza floor. We began by removing PAA (MG 456). The removal of MG 456 revealed a significant quantity of large stones. Due to the positioning of these stones, we believe they are likely collapse. However, some of the stones do appear to be placed in such a way that they could have constituted a surface of some kind. It may be that the collapse was re-arranged during a late time period, after abandonment of Str. 14.



Figure 23-1: 6. Test pit.

Below the PAA (MG 456) in the test pit was lot MG 459, which contained some plastery soil. The plaster could be a decayed surface or other feature related to the significant amount of stone collapse (a surface or floor or face?), but this is uncertain. MG 459 contained significant amounts of archaeological finds recovered during the sieving of soil: pottery sherds (178); chert (16); shell, including worked (4); worked sherds (2); netweights (3); obsidian (1?); and a stone potentially used for paper making. Tentative dating suggests an Early-Mid Post-Classic dating. Below lot MG 459 was MG 465, consisting of dark soil, which contained more artefacts after sieving, although considerably less than the lot above, especially considering that this lot (MG 465) had a thickness of 0.26m, compared to lot MG 459's 0.19m.

Below lot MG 465 was what we initially assumed to be the plaza floor MG 466 associated with Str. 14. Further investigations suggest it was indeed a walking surface of some kind. There was no obvious archaeological material from this layer in its depth of approximately 0.06m, which would be expected if the lot represented an occupational surface. The surface of MG 466 stood at about 1.76m below what we estimate to have been the surface of the Str. 14 platform. As we cleared away lots MG 465, MG 466, down to MG 475, we were able to observe that the lower facing stones of the lower terrace face (MG 453) were significantly larger than the upper stones, suggesting that we had indeed reached 'plaza' level. All these lots we cleared (MG 465, 466, 475), which exposed the apparently complete lower terrace face, all contained significant archaeological material; pottery sherds (64); worked sherds (6); chert (1); animal bone (75); worked animal bone (1); shell (9). Interestingly this lot (MG 475) appears to be an epicentre for animal bone, with there being some charcoal present in the soil, likely linked to the significant animal bone present.

Below MG 475 was MG 482, which also contained significant artefact material: pottery sherds (54); chert (2); Animal Bone (14); shell (3); worked pottery sherds (4). Patches of charcoal were present, also associated with the animal bone. The terrace face MG 453 ends at this lot. The indication is that MG 475 represents the original 'ground' level associated with the construction of Str. 14 and neighbouring structures, above the salt processing layer MG 484. MG 475 also contained significant charcoal presence, possibly associated with salt processing.

Excavations at this point ended due to time constraints, reaching 2.23m (lowest lot was MG 484). A Harris Matrix was assembled showing the stratigraphic relationships of the lots (**Fig. Op 23-1: 7**). Following the excavation, the soil profile was drawn in relation to the lower terrace face in order to show the extent of each lot compared to the terrace face (**Fig. Op 23-1: 8**).

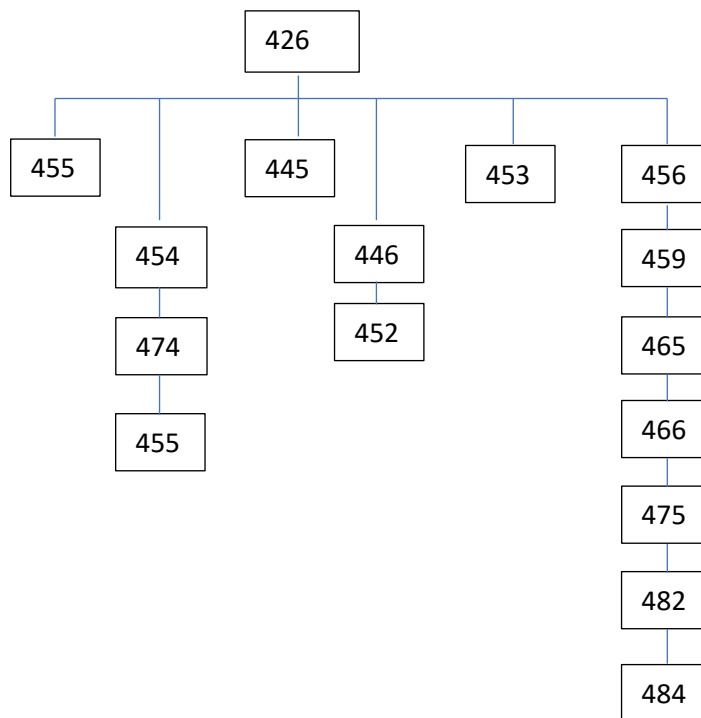


Figure Op 23-1: 7. Harris Matrix for Op 23-1.

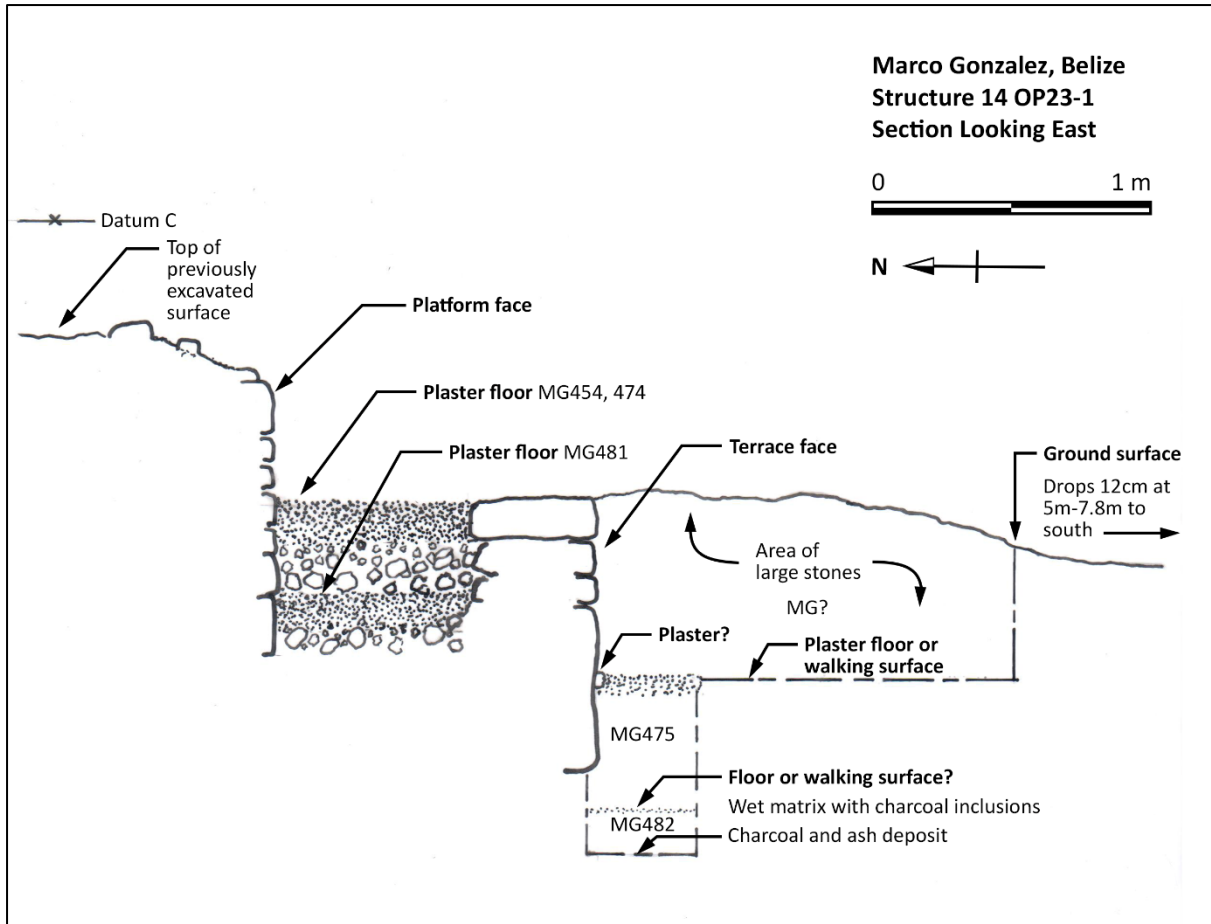


Figure 23-1: 8. Str. 14, south side of platform, N-S section showing upper and lower terrace faces and relationship to original (?) ground or walking surface,, as well as modern ground surface.

Op 23-7 was aimed at clearing the southeast corner of Str. 14 and clarifying Str. 14's relationship to Str. 12. There existed a gap between Strs. 12 and 14 that at one time seems to have been filled, but we don't know when. We cleared part of the gap back in 1990, and we found a few small side-notched points in upper levels, which would indicate a Late Postclassic/Historic presence of some sort. The points, however, may have little to do with the structures as both Str. 12 and 14 lay in ruins then. There is so much disturbance from tree roots here that dating of the deposits with any certainty, however, is not (yet) possible. Looters' holes, probably for dark earth rather than archaeological looting, has also resulted in quite a bit of disturbance.

Nonetheless, portions of a stone terrace face were cleared on the south side of Str. 14 at its eastern end; this stone face is believed to join up to MG 455 (see Op 23-1, above); that is, it is a part of the upper terrace face. We cannot yet confirm because the zone between Op 23-1 and Op 23-7, which includes the stair, remains to be excavated. It is this upper terrace face, revealed at the eastern end of the platform, that seems to turn a corner and continue along the platform's eastern perimeter, but much more overburden and collapse need to be cleared in order to confirm our observations. At this juncture, all we can say is that Str. 14's platform was extended on the south side (10th century?), but we don't know how the east side was affected. It may be that the gap between the platforms of Str. 14 and 12 was filled in at this time. Our plan is to address these problems in future work. A description of the architectural work is presented along with photos in the next two pages.



Figure Op 23-7: 1. The photo features the east face of Str. 14, looking W along the south side of the platform. At the top of the photo is the gumbo limbo whose roots have seriously disturbed the stair here. The orange meter tape is lying on one of the stones of the platform face on this (the eastern) side of Str. 14. As you can see, the face on this side seems to join the upper face (MG 455) on the southern side. So far, we have no evidence of a lower terrace face on this, the eastern, side, although the excavations have not extended deeply enough to be conclusive. The stones of the face at this locale are somewhat displaced as the result of ‘pushing’ outward by tree roots, but farther to the north (where you can see the tape extending), the disturbance is much more severe, and the upper rocks of the face have pretty much been pushed out entirely. Where you can see the white bucket and blue tarp is the location of Op 23-3.



Figure Op 23-7: 2,3: On the left (photo faces W), you can see that the eastern face at this spot has been further cleared. Peter's feet stand at the 'corner' on what is probably collapse from the southern face. What the very large stones in the foreground are associated with is yet unclear. They could be collapse, or part of a construction that links Str. 14 with Str. 12. On the right, Fig 3 faces N. This photo shows the standing face (SE corner of Str. 14 platform) that is also shown in Fig. 2. The photo also shows the gap between Strs. 14 and 12, and you can see the face of Str. 12 in the upper right-hand corner of the photo. The large stones bridging the gap are perhaps part of a construction effort that linked the two structures.

3) Operation 23-2, Str. 14 (*Aubree Marshall*)

Operation 23-2 was situated atop Str. 14 on the western side. About 30-50 cm had been excavated in the 2010 excavations but at the time, burials did not occur there. The unit measured 1m 97 cm N-S and 3m E-W. When laying out the unit, the team used datum point 23-B. The surface depths of each unit corner were as following: northwest was 56 cm bd (below datum), northeast was 40 cm bd, southwest was 44 cm bd, and southeast was 24 cm bd. In total, Operation 23-2 consisted of thirteen lots: MG 421, 447, 457, 458, 462, 476, 487, 491, 492, 493, 494, 496, and 497. All lots were screened using a ¼ inch screen.

Excavations at Operation 23-2 began on June 5th, 2023. The first lot encountered was MG 421. **Lot 421** contained backfill from previous excavations over a sheet of plastic in the northeast corner, and there were several roots and crab holes encountered. Crab holes were encountered throughout the excavation. There were rock clusters in this lot in the southeast corner, which were left in situ until they were properly mapped. Artifacts found at this level included small potsherds, charcoal, a black obsidian blade fragment, a worked chert microlithic, potentially burned chert fragments, a shell carved as a spoon, part of a metate, a biface (potential handaxe), a round net weight, and a banded piece of ceramic. The end depths of each lot corner were as follows: northwest was 61 cm bd, northeast was 58 cm bd, southwest was 53 cm bd, southeast was 56 cm bd, and the center was 58 cm bd. We did not encounter a soil change but decided to stop at this level and begin with a new lot number.

Lot 447 was located below lot 421. Lot 421 had mottling present in different regions of the unit, which could have been the remnants of a potential floor. The southwest corner had darker soil and charcoal appearing. The artifacts uncovered in lot 447 included Late/Terminal Classic ceramic sherds, charcoal, a white jewelry shell bead, worked chert fragments, salt-processing ceramics (Coconut Walk), a piece of jadeite, and a shell with cinnabar or hematite; this was later designated to lot 457 as it was left in situ until the new lot was assigned. After discussion, we determined that the red soil was more likely the result of hematite. The soil in lot 447 was very similar to lot 421. The end depths of each lot corner were as follows: northwest was 78 cm bd, northeast was 74 cm bd, southwest was 73 cm bd, southeast was 75 cm bd, and the center was 77 cm bd.

Immediately below lot 447, we encountered two lots: lot 457 and lot 458. **Lot 457** was located at the center of the northern section wall where the shell with hematite was located. A cache was quickly found. Lot 457 measured between 120 cm and 196 cm from the eastern wall of the unit. The cache extended into the section, so we extended the unit northward in search of additional cache finds (the extension was deemed **lot 462** and will be discussed below). Artifacts found in lot 457 were covered in red hematite and the artifacts were considered special finds. Artifacts found include the horse conch ocarina identified during excavation of lot 447, jadeite, potential mano, two cases of worked bone (both faunal), a faunal mandible and bone (potential fish rib), coral, worked Olive shell beads, ceramic sherds, broken shell beads, queen conch shell, two obsidian blades, an herbivore tooth, a carnivore canine, and an additional patellate shell. To the west of the cache was plaster that looked as though it could have been cut. The cache depth measured 82 cm bd to 112 cm bd.

Lot 458 was also located immediately below lot 447. However, lot 458 extended across the entire unit, with the exception of lot 457. Similar to lot 447, lot 458 had mottling in different parts of the unit, but the mottling never extended across the entire surface. Artifacts found in this layer included charcoal, Early Classic ceramic sherds, a net weight, a partial obsidian blade, fish bones, a potential stingray spine, and a Late Classic sherd with glyphs (stating “this is the drinking vessel of ...”) found at the northeast aspect of the lot in the eastern section. As this lot did not have much in the way of artifacts or soil change, we did not stop after digging 20 cm; we continued digging until we reached a soil change. Lot 458 provided sections that showed several levels of salt-processing. The end depths of each lot corner were as follows: northwest was 111 cm bd, northeast was 117 cm bd, southwest was 112 cm bd, southeast was 112 cm bd, and the center was 112 cm bd. Lots 457 and 458 were terminated at the same level.

Located in the same level as lots 457 and 458 was lot 462. **Lot 462** was a northern extension of the unit, searching for additional artifacts that were a part of the lot 457 cache. Lot 462 extended 144 cm from the southern wall of the unit. After digging through the back dirt over a sheet of plastic leftover from previous excavations, we were able to find additional artifacts associated with the cache. Artifacts were considered special finds and included ceramic sherds, an animal jaw (potentially a snapper), a queen conch shell, a worked bone in the shape of a fan handle, more worked olive shell beads, two larger circular shell beads, two ear spools, and rubber with what appears to be a fabric imprint. We then extended the lot to the west and to the east but did not find other artifacts in either direction. The end depths of each lot corner were as follows: northwest was 122 cm bd, northeast was 129 cm bd, southwest was 117 cm bd, southeast was 130 cm bd, and the center was 131 cm bd.

Immediately below lots 457 and 458 was lot 476. **Lot 476** had evidence of charcoal and plaster, representing another salt-processing layer. We moved past some of the plaster until we reached a soil change. An olla ceramic sherd was found in the southeast portion of the lot, in the eastern section. The end depths of each lot corner were as follows: northwest was 124 cm bd, northeast was 130 cm bd, southwest was 129 cm bd, southeast was 128 cm bd, and the center was 130 cm bd.

Below lot 476 was lot 487. **Lot 487** had much darker soil, with much more charcoal present. The eastern half of the unit had several large plaster chunks that were left in situ. Because of the depth of the unit and the presence of the plaster chunks, excavation was halted on the eastern half of the unit but continued on the western half. At least three faunal remains fragments were identified and collected. The end depths of each lot corner were as follows: northwest was 161 cm bd, northeast was 150 cm bd, southwest was 153 cm bd, southeast was 153 cm bd, and the center was 158 cm bd.

Lot 491 was below the western half of lot 487. The western section had the same dimensions as before, but the eastern section had new measurements: from the northwestern section to the northeastern section was 155 cm in length, and from the southwestern section to the southeastern section was 202 cm in length. These lengths were chosen due to their proximity to the plaster chunks. The soil in lot 491 consisted of light tan and almost black-mottled soil throughout. The lot was continued until a soil change was encountered; based on the profile of the eastern section, the mottling found in 491

continued below the plaster chunks. Artifacts found include ceramic sherds, some of which were identified as polychromes. The end depths of each lot corner were as follows: northwest was 170 cm bd, northeast was 161 cm bd, southwest was 156 cm bd, southeast was 159 cm bd, and the center was 157 cm bd.

The following lot was lot 492. **Lot 492** contained almost black soil, containing much more charcoal than any other lot encountered. Some areas had clusters of orange sherds, determined to be Coconut Walk ceramic sherds (**Fig. 23-2: 1**). This lot was terminated at a change in soil. The end depths of each lot corner were as follows: northwest was 176 cm bd, northeast was 164 cm bd, southwest was 172 cm bd, southeast was 165 cm bd, and the center was 165 cm bd.



Figure 23-2: 1. Coconut Walk sherd cluster

Lot 493 was located below lot 492. This level contained light grey and light tan soil that spanned the length of the lot. This lot was terminated when the soil became all light grey. The northwest corner was producing conch shells at this level. The end depths of each lot corner were as follows: northwest was 179 cm bd, northeast was 175 cm bd, southwest was 185 cm bd, southeast was 175 cm bd, and the center was 182 cm bd. The northwest corner was measured at the level of a rock protruding from the corner.

Lot 494 was below lot 493. Lot 494 consisted of several conch shells across the unit. Once removed, several plaster chunks were found and removed. Once all the plaster was removed, a new lot number was assigned (**lot 496**). Being just below the plaster chunks, **lot 496** consisted of more conch shells. There were no other artifacts found. End depths were not recorded for lots 494 or 496.

The last lot number assigned was lot 497. **Lot 497** was an STP that was created 76 cm from the eastern section (of lot 496) and 92 cm from the southern section. The hole was circular, and was 37 cm in diameter. The STP immediately hit the water. The surface of the water measured at 226 cmbd, and the end of the water measured at 276 cmbd. As we could not remove the water, we were unable to continue. A few artifacts were collected from below

the water table, which included ceramic sherds (including some with glyphs), shells, faunal remains, and a chert core. Several of the sherds collected were discoloured due to the water.

Caches or burials?

Operation 23-2 was placed on the western half of Str. 14 in anticipation of finding additional burials. However, no burials were found in the unit, which presents some challenging yet interesting questions. It is possible that some aspect of the superstructural architecture reflected a function that did not permit burials to be interred at this location. It is also possible that the artefacts recovered were once burial accompaniments, but repeated disturbance either displaced bones or caused the bones to be moved. The burials recovered in 1990 showed definitively that there was repeated disturbance of earlier burials; bones would simply be gathered and placed at one end of the new burial but often elements were missing. The burial shown in Fig. 23-2:2, excavated in 1990, is an example. It contains a primary burial but also the bones of two individuals from previous burials.



Figure 23-2: 2. Burial from the 1990 excavations showing bones redeposited from earlier burials.



Figure 23-2: 3. Some of the artefacts from Marco Gonzalez temporarily stored at the Royal Ontario Museum. The arrows point to shell ‘sequins’, probably from a jacket, that were found beneath one of the sequential floors of Str. 14 but with no clear burial association.

This makes the cache of special finds from lots MG 457 and 462 so interesting. The types of artifacts found within the cache have also been found in the burials located on the eastern half of the structure. However, some of the artifacts found in the Operation 23-2 cache have not been found in association with other burials (i.e., rubber). Hopefully, future excavations extending between Operations 23-1 and 23-2 will provide answers.

Salt-processing

Previous excavations at Marco Gonzalez (Graham and Pendergast 1989; Graham et al. 2017), as well as work at other salt-making sites (Graham 1994) provide evidence that salt-processing became important in many coastal areas of Belize during the Late Classic. Operation 23-2 provided new insight into the extent of salt-processing, as the depth of excavations exceeded previous ones. In addition to the potential hearth extending across Structure 14, we can see distinct layers of Coconut Walk ceramic sherds (the type of ceramic associated with salt-processing activities) and Maya Dark Earths (the result of anthropogenic activities and elevated levels of charcoal) can be identified in the north section (**Figs. 23-2: 3, 4**).



Figure 23-2: 4. Photo faces N. The north section shows the salt processing levels, which appear to be covering earlier hearth features constructed of reefstone.

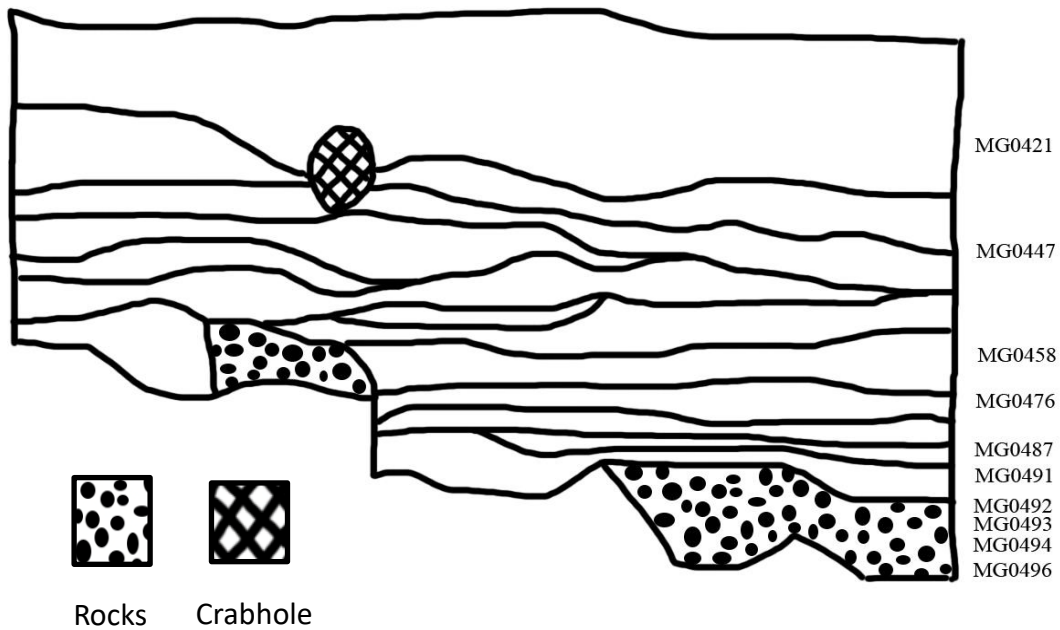


Figure 23-2: 5. Drawing of north section as seen in Fig. 23-2: 4.

Conclusions

Artifacts found in Operation 23-2 include jadeite, chert bifaces and a core, obsidian blades and blade fragments, ceramic sherds, bone fan handle, shell beads (both large and small), ear spools, rubber, faunal remains, worked shell, charcoal, and a shell ocarina. It is Graham's view that these highly likely from disturbed sub-floor burials or possibly caches of some kind. Operation 23-2 could provide new information about salt-processing activities owing to our discovery of a stone-built feature that may be a hearth. Such a hearth would have held wood fuel that was burned to drive moisture from the brine contained in the Coconut Walk bowls. Evidence of spent fuel is shown in the blackened layers of Fig. 23-2:4, and the decomposed Coconut Walk containers formed the red layers. We plan to excavate the area between Operations 2 and 3 in 2024 to expose the hearth at its full capacity.

4) Operation 23-3, Str. 14 (*Panos Kratimenos*)

Operation 23-3 comprised an approximately 6.2m (north-south) by 3.5m (east-west) excavation area located on the top of the eastern portion of Structure 14. Structure 14 itself is an approximately 7.2m (north-south) by 13m (east-west) structure located on the southern margin of the Main Plaza Group at Marco Gonzalez (see **Fig. 23-3: 1**). The structure lies on the western portion of this area, abutting Structure 12, which lies to the east. These two structures have seen the most extensive excavation undertaken at the site since the initiation of research during the 1986 field season (see Graham & Pendergast 1989), with Structure 14 continuing to be central to investigations undertaken during the 2023 field season. During previous excavation work, Structures 12 and 14 (particularly the latter) have been revealed to have been used extensively by the site's Precolumbian inhabitants for interment of the deceased, with no fewer than 38 burials having been identified within Structure 14 alone through past excavation efforts (see, for example, Graham *et al.* 2013; Simmons & Graham 2016; Kratimenos *et al.* 2023). Among these burials, a significant proportion have been of the intriguing 'ventrally-placed, legs flexed' (VPLF; after Donis 2014; see also Wrobel & Graham 2015) variety, a seemingly geographically (certain sites within the eastern Maya lowlands) and temporally (Terminal Classic onwards) constrained burial practice which has been associated with certain site's perseverance through the so-called Terminal Classic 'Collapse' (see, for example, Graham *et al.* 2013; Kratimenos forthcoming). Moreover, it is this portion of the site (Structures 12 and 14) from which the most extensive data concerning the Late Classic economic reorientation of Marco Gonzalez's inhabitants towards industrial-scale salt production (presumably for export purposes) has been derived, and which has been a focus of previous scholarly attention with regard to the formation of anthropogenic 'Maya Dark Earths' which salt manufacture contributed to, as well as the broader implications which this phenomenon has for our understanding of the long-term environmental impact of human activity on soil formation processes (see, for example, Graham *et al.* 2017, 2020; Macphail *et al.* 2017; Evans *et al.* 2021; Turner *et al.* 2021).

Building on this previous scholarship, the principle goals of the Operation 23-3 excavation on Structure 14 were threefold:

- to expand upon previous excavation efforts on Structure 14 and build upon our existing knowledge of the use of this portion of the site for interring the deceased in Precolumbian times, including further exploring the VPLF phenomenon;
- to continue to explore the geographical and temporal extent of salt-processing activities at the site, with a view to better understanding the intersite trade and exchange dynamics at play within which Marco Gonzalez was engaged;
- to trial the use of photogrammetry and 3D modelling as a first-line documentation method for archaeological excavations.

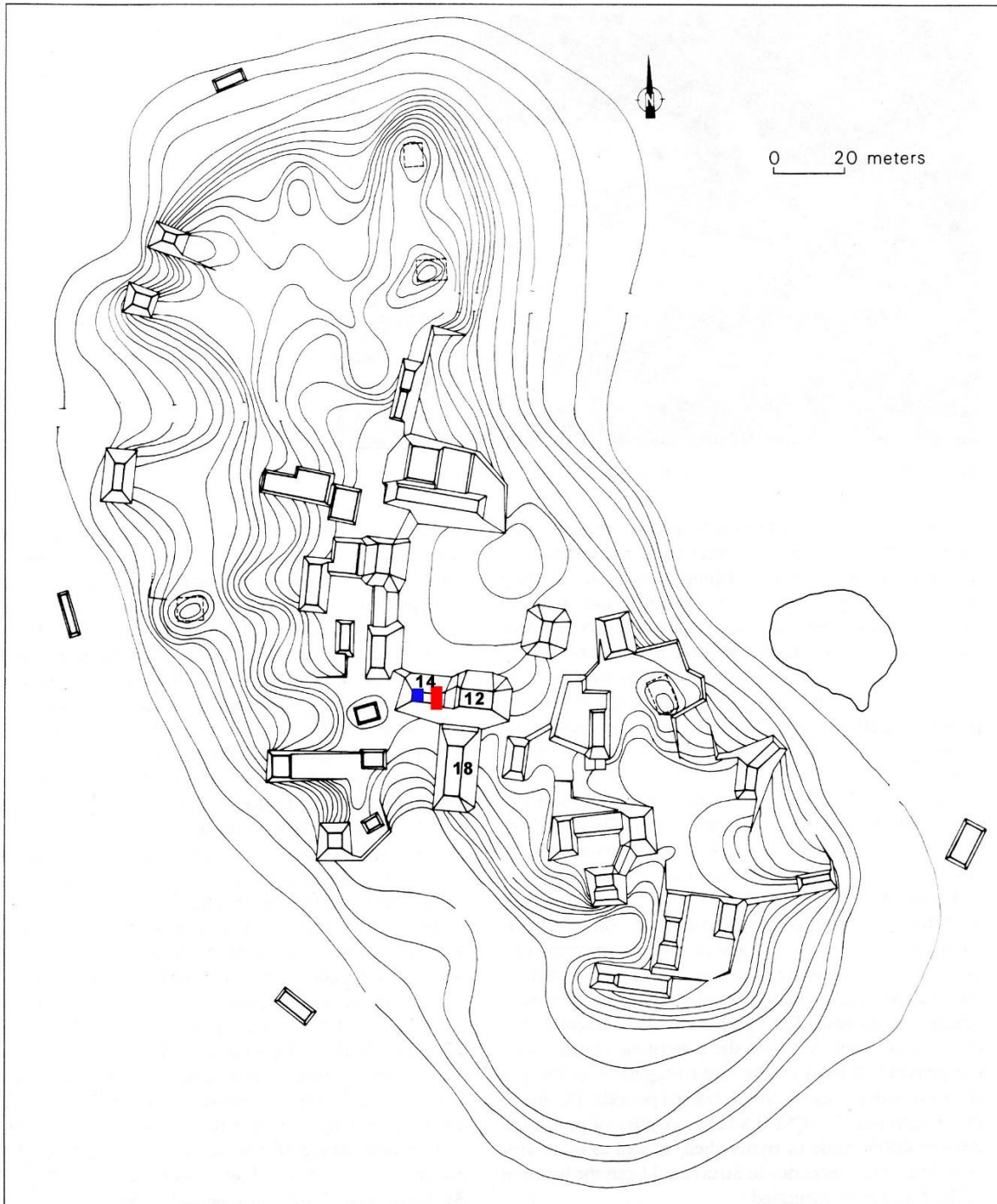


Figure 23-3: 1. Map of the Marco Gonzalez site, modified from the original by Claude Belanger. Structure 14 on the southern margin of the Main Plaza Group is labelled, as are approximate locations of Operations 23-2 (blue) and 23-3 (red) atop the structure.

Overview of excavations

Operation 23-3 was positioned to continue to explore the eastern extent of Structure 14, mirroring (albeit somewhat more extensive in area than) Operation 23-2 on the western extent of the top of the structure (see Marshall, this volume). This work sought to build on excavations undertaken in the 1990 field season – the backfill from which had to be removed before we began work – as well as other excavations conducted elsewhere on Structure 14

including Operation 10-3 during the 2010 season and test-pitting conducted during the 2013 field season.

The excavation area was approximately 6.2m (north-south) by 3.5m (east-west), placed on the easternmost margin atop the structure, with a narrow baulk left in place on the northern, eastern and southern margins of the trench, coinciding with the presence of facing stones on the edges of the structure. This was done in order to avoid interference with excavations on the north face of Structure 14 (Operation 23-5,6) and to make it easier to view the trench from above on all four sides (partially linked to plans relating to photogrammetric recording, see below).

Excavations in Operation 23-3 revealed a host of features, including a variety of postholes as evidence of the construction of different superstructures atop the platform which Structure 14 represents, concentrations of conch shells in deliberate deposits, scatters/lenses of ceramics and ash, evidence of industrial-scale salt manufacture, and five burials. Brief details of each Lot designated during these excavations are provided in *Table 1*, with descriptions and preliminary interpretations of some of the features encountered discussed thematically below. This report has been structured to detail burials (both in terms of their archaeological context and the results of preliminary osteological analysis conducted in the field), features associated with salt-processing activities at the site, and other noteworthy features revealed through excavations. Also included is a section outlining the use of photogrammetry and 3D modelling as a first-line documentation method, for which Operation 23-3 served as the proof-of-concept. Finally, some overarching preliminary interpretations are provided, contextualising the excavations undertaken within Operation 23-3 within our broader understanding of Marco Gonzalez as a site and the kinds of activities and practices undertaken by its Precolumbian inhabitants.

Table Op 23-3: 1. List of Lots associated with excavations undertaken in Operation 23-3

Lot number	Description
MG420	Scatter of human remains associated with a peri-/neonate, located in the north/northeast extent of the excavation area. Assigned burial code MG14/39.
MG423	First layer of soil encountered after the removal of backfill and plastic sheeting marking the extent of the 1990 excavations.
MG427	Assigned to the cut of the grave associated with burial MG14/40 at the northern extent of the excavation area, slightly east of centre line.
MG428	Assigned to the cut of the grave associated with burial MG14/41 in the northeastern corner of the excavation area and extending east beyond the eastern limit of the excavation area.
MG431	Disturbed mixed context encountered on the western wall of the excavation area.
MG434	Assigned to the cut of the grave associated with burial MG14/42
MG440	Small posthole encountered in southwestern corner of the excavation area and extending beyond the limit of the excavation area.
MG441	Posthole encountered immediately west of the cranium of burial MG14/40.
MG442	Central posthole cluster.

MG443	Conch shell deposit encountered just southwest of Operation centre point.
MG444	Test pit in disturbed mixed deposits in southeastern corner of the Operation.
MG448	Artefacts encountered in proximity to burial MG14/41. Ascribed a discrete lot number as they do not appear to be grave goods associated with the burial.
MG449	Heavily deteriorated plaster floor encountered throughout the excavation area underlying MG423.
MG450	Fill layer of soil underlying MG449 along the eastern portion of the excavation area.
MG451	Second heavily deteriorated plaster floor encountered on eastern portion of the excavation area, underlying MG450.
MG460	Posthole placed through the skull of burial MG14/42.
MG461	Scatter of human remains encountered just south of, although seemingly unassociated with, burial MG14/40.
MG467	Assigned to the cut of the grave associated with burial MG14/43, located just north of burial MG14/42 along the north-south axis.
MG468	Disturbed mixed contexts encountered in northwest extent of the Operation.
MG469	Posthole filled with compressed ash and shell placed through the left knee of burial MG14/42.
MG472	Fill layer of soil underlying MG451 encountered throughout the excavation area.
MG473	Heavily deteriorated plaster floor encountered throughout the Operation underlying MG472.
MG477	Layer of charcoal-rich soil underlying MG473. First salt-processing-associated layer encountered.
MG478	Posthole encountered west of MG443.
MG479	Posthole encountered east of MG443.
MG485	Large ash lens encountered at the northern edge of the Operation. Approximately in the same location as, although underlying (i.e. unassociated with), burial MG14/40.
MG488	Stone feature running entire eastern and southern extents of the excavation area. Provisionally identified in the field as the borders of an industrial salt-processing hearth.
MG489	Shell feature encountered between burials MG14/42 and MG14/43.
MG495	Considerable scatter of small ceramic sherds encountered in the northwest limit of the Operation.

Burials

Excavations within Operation 23-3 yielded five new burials, designated with burial codes MG14/39, /40, /41, /42 and /43. These discoveries contributed to a fuller picture of the mortuary practices undertaken by the inhabitants of Marco Gonzalez, adding to the existing dataset of 38 burials previously excavated from Structure 14. Interestingly, none of the five burials excavated from Operation 23-3 were interred in the VPLF position. As these burials generally appeared to be Late Classic in date – based on ceramic associations and relative

stratigraphy – this potentially suggests a temporal constriction of the emergence and more widespread adoption of the practice, at least among the individuals interred within this area of Structure 14 although this is, of course, speculative at this point in time. A fuller picture will emerge once more comparative research has been undertaken comparing these individuals to the broader burial series from Marco Gonzalez, as well as following further archaeological scientific analyses. Below, brief descriptions of each of these burials are provided.

MG14/39

The first burial encountered in Operation 23-3 was represented by a small scatter of disarticulated peri-/neonatal infant remains located immediately subsurface in the northern extent of the Operation, slightly east of the centre line. Most skeletal elements of this individual were present, including several cranial fragments. The individual's skeletal elements approximately overlay burial MG14/40; however, the precise nature of the association between the two is uncertain. While it is possible that the disarticulated (and excarnated) remains of this individual were deliberately scattered atop the MG14/40 grave immediately or shortly following burial, it seems more likely that this individual's remains were accidentally disturbed during the interment of either MG14/40 or another burial in this region of Structure 14 and that the proximity between MG14/39 and MG14/40 is coincidental rather than deliberate. Erring on the side of caution, these remains were designated a discrete burial number and have been classified as a secondary burial.

MG14/40

Burial MG14/40 was perhaps the most intriguing burial excavated during the 2023 field season. Determined through in-field osteological analysis to represent the remains of a young adult male, this individual was interred to the north of the excavation area, slightly east of the centre line, underlying the scatter of neonate remains which comprised burial MG14/39. The interred individual was placed in the grave face-up, with the torso extended, right arm extended along the length of the body and left arm over the torso. The individual's legs were crossed in a position similar to a crossed-legged seated position (see **Fig. 23-3: 2**). However, the close articulation of the remains suggested they were interred lying on their back, rather than seated before falling back after burial. The skeleton was mostly complete, with the exception of several vertebrae, the left foot and right knee. These absences were clearly post-depositional and, in the case of the foot and knee, most likely were a consequence of later inhabitants of the site accidentally cutting through the southwest edge of this grave while interring a subsequently deceased individual.



Figure 23-3:2. Orthographic projection of burial MG14/40 from Operation 23-3. Note the presence of one conch shell inkpot overlying the left hip, and the cluster of grave goods – including two obsidian bladelets, bone writing stylus and shell ear spool – placed to the east of the individual’s skull and left shoulder. Not pictured is the Macal Orange-Red vessel also associated with this burial.

Sex estimation of this individual indicated that they were probably male, based on general robusticity, particularly of long bones and the mastoid process. However, several cranial

features traditionally taken to be diagnostic of biological sex, such as the supraorbital ridge and mental eminence, were indeterminate (i.e. scoring 3 on a 1–5 scale)¹. This individual was classed as a ‘Young Adult’ as per Buikstra and Ubelaker’s (1994) classification system², with approximate age of the deceased individual estimated as early-to-mid-twenties based primarily on dental wear patterns following Lovejoy’s (1985) classification system and the lack of any clear age-related pathology or trauma to the skeletal remains (with the exception of some indications of periodontitis).

The most intriguing aspect of this burial – alongside burial position, which in itself is not unique among the Marco Gonzalez burial series – was the assemblage of grave goods interred. These comprised a complete gourd-shaped vessel, identified by project ceramicist Aimers as Macal Orange-Red (MG427/1), two obsidian blades (MG427/2), a shell ear spool (MG427/3)³, a writing stylus made from worked avian leg bone (MG427/4), two conch shell inkpots (MG427/5 and /8) and a complete bone needle (MG427/6), as well as sherds representing the majority of at least two Late-to-Terminal Classic Peten Gloss Ware orange-polychrome vessels (probably Saxche Orange-polychrome; MG427/7) – most likely originating from the Peten region of Guatemala – sherds of a Marvelita Black-on-red dish probably originating from northern Belize, and a mammal (probably deer) scapula (MG427/9).

In terms of burial position and elements of grave goods (specifically, the inclusion of a tulip-/gourd-shaped vessel), this burial bears a resemblance to burial MG14/32, excavated during the 2010 field season (see **Fig. 23-3: 3**). However, the inclusion of a variety of additional grave goods – including a writing stylus and the conch shell inkpots – in association with this burial position and the proximate discovery of several small ceramic sherds, some of which appear to feature hieroglyphic inscriptions (see **Fig. 23-3: 4**) – is perhaps the most suggestive example of which we are aware of a burial associated with writing in the Maya region. As such, our tentative working interpretation of this burial is that it represents an *ajtz’ib’* (scribe).

¹ Features diagnostic of biological sex were rated on a scale of 1 (definite female) to 5 (definite male) according to the system established by Buikstra & Ubelaker (1994). Where possible and/or useful, additional features such as gonial angle and/or eversion (White *et al.* 2011) or ischiopubic ramus shape (Phenice 1969) were also used to establish an estimate of biological sex.

² Perinate/Infant: 0-3 years; Child: 3-12 years; Adolescent: 12-18 years; Young Adult: 18-35 years; Middle Adult: 35-50 years; Old Adult: 50+ years

³ A second matching ear spool was later excavated slightly northwest of and beneath MG427, associated with Lot MG0450. Precisely how this movement of the second ear spool occurred is uncertain but there appear to be two viable possibilities. This second ear spool may have been displaced during the construction and placement of the posthole represented by MG441; however, the apparent stratigraphic contemporaneity between MG427 and MG441 and the lack of disturbance to the cranium of burial MG14/40 makes this slightly improbable. A second potential explanation was post-depositional bioturbation caused by either tree roots or burrowing crabs, both of which have had an extensive impact on the stratigraphy across all excavated portions of the site.



Figure 23-3: 3. Burial MG14/32, excavated during the 2010 field season. Note the similarities to burial MG14/40, including burial position and positioning of the limbs, orientation (head to the north) and in elements of grave goods. Both individuals were also most likely male and of similar age (20-30 years old) at time of death, based on in-field osteological assessment.



Figure 23-3: 4. Selection of decorated ceramic sherds, including some featuring hieroglyphs, uncovered in Operation 23-3. **a)** polychrome sherds, including two (left) featuring hieroglyphs, uncovered in Lot MG485 – a large ash lens encountered in the northern portion of the trench, proximate to (although underlying) burial MG14/40. **b)** a selection of polychrome sherds, including one (top row, second from left) which may represent a hieroglyph, uncovered in the fill associated with Lot MG488 – a large stone feature running the length of the eastern and southern extents of the trench which may represent the borders of a salt-processing hearth. These sherds were located along the eastern border of the trench, approximately central (on the north-south axis). Modified from original photographs taken by Collin Sauter.

MG14/41

Burial MG14/41 represents the incomplete, fragmentary remains of an adult individual for whom sex could not be confidently determined during in-field osteological analysis. Based on the general gracility of various postcranial elements recovered, this individual was possibly biologically female; however, this cannot be asserted with confidence. As can be seen in *Fig. 5*, surviving skeletal elements of this individual were virtually all postcranial and,

among those which were preserved, many were partial and fragmentary. Five teeth were identified associated with this burial – a right second mandibular premolar, a mandibular first molar, one incisor, one canine, and one additional premolar – all of which showed a significant amount of wear, leading to a tentative age classification of ‘Middle Adult’, but probably towards the upper end of this classification range (i.e. 40-50 years old).



Figure 23-3: 5. Photograph of burial 14/41, located in the northeastern corner of Operation 23-3. Note the cut of the grave of burial 14/40 to the west. The trench line (yellow string) was moved to permit excavation as this burial extended beyond the eastern border of Operation 23-3. Photograph by Collin Sauter.

The individual was positioned in the grave face-up, with legs crossed in a manner similar to burial MG14/40, seemingly with the right leg crossed over left. Limited elements (two carpal bones and a single distal phalanx) of the right hand were recovered, contextually suggesting that at least the right arm was placed over the lower torso/pelvis when this individual was interred. The remains of this individual which were recovered were fairly eroded as a function of taphonomy, but there were no visible signs of pathology or trauma present.

MG14/42

Burial MG14/42 represented a probable male individual, positioned face-up, fully extended, head positioned to the east, with the individual lying on an approximate east-west axis. The right arm of this individual was bent at the elbow, with the hand to the face, while the left arm was rested across the pelvis. The majority of this individual's skeletal elements were preserved; however, several were either damaged or extremely friable owing both to taphonomic factors and the fact that this individual appears to have been placed on the second plaster floor (MG451) encountered during excavations, resulting in a great deal of fusion and adherence to the matrix which surrounded the body. Based on this archaeological context, it appears that the interment of this individual was probably associated with remodelling efforts approximately contemporaneous with the construction of the first plaster floor (MG449) encountered during excavations – more likely prior to the construction of this floor, given the lack of any visible cut in the floor; however, this was hard to say for certain owing to its heavily degraded state.

Estimation of biological sex was conducted in the field and based on the size and shape of the individual's mastoid processes, which were graded 4-5 on a five-point scale, and general robusticity of both cranial and postcranial elements. Age for this individual was estimated as a 'Young Adult', although probably younger than the individual representing burial MG14/40. Classification as an adult, rather than adolescent, was based on the presence of an unerupted third molar, general lack of tooth wear, epiphyseal fusion and the presence of dental modifications in the form of drilling to one maxillary canine (although the inlay itself was not recovered).

Particularly interesting facets of this burial were the presence of two postholes which transected both the skull (MG460) and the left knee (MG469) of this individual, the latter of which was filled with a compacted mix of ash and small shell fragments. Given the ostensible precision with which these postholes were placed, and the damage which they, particularly the former, caused, it is of course tempting to view this as a deliberate desecratory act; however, coincidence is a more likely explanation given the profusion of postholes from successive superstructural reconstruction efforts found across Operation 23-3, particularly in the broad vicinity of burial 14/42 (see **Fig. 23-3: 6**).



Figure 23-3: 6. Orthographic projection of burials 14/42 (MG434) and 14/43 (MG 467) and associated features, including postholes through the skull (MG 460) and left knee (MG 469) of burial 14/42, a large posthole cluster (MG 442) proximately southeast of burial 14/42, and a conch shell deposit to the south (MG 443). Figure oriented east-up.

MG14/43

The final burial excavated from Operation 23-3 was the partial, heavily disturbed remains of an adult individual for whom sex could not be confidently determined owing to the partial nature of the remains (see **Fig. 23-3: 7**). General gracility of several partial elements remaining suggested the individual was possibly female; however, this could not be confirmed in the

field. This burial, which was located just north of (although disassociated with) burial MG14/42, appears to have been a primary interment which was subsequently disturbed – most likely during either the interment of the subsequent individuals (potentially burial MG14/42) or remodelling efforts undertaken on Structure 14 – given the skeletal elements which were preserved remained in broad articulation. From this context, it appears that the individual was interred face-up with at least the upper body extended and left hand placed across the pelvis. Skeletal elements recovered included very fragmentary portions of the pelvis – including a partial left acetabulum – part of the left femoral head which remained articulated with the acetabulum, and fragmentary portions of the left radius, ulna, distal humerus and several metacarpals and phalanges. Also found in proximity to this burial were a single canine, one premolar, one molar and one maxillary incisor, the latter of which was probably modified (filed), although all displayed considerable post-depositional wear and exhibited differential preservation, meaning further laboratory analysis is required to confirm that these teeth all belonged to the same individual.



Figure 23-3: 7. Burial 14/43, the partial remains of an individual of indeterminate sex (possibly female), encountered just north of burial 14/42. Photography by Gabriel Wrobel. Salt-processing activities.

One of the key objectives of excavations undertaken in Operation 23-3 was to shed further light on the industrial-scale salt manufacturing industry which appears to have become the primary economic concern of inhabitants of Marco Gonzalez during the Late Classic period. Intriguing new evidence was uncovered in this regard in the form of Lot MG 488. This feature was first exposed in the northeastern extent of the trench and initially interpreted as potential collapse of the facing of an earlier construction phase of Structure 14 or, potentially, as core material. However, as the feature was followed south, it became clear that the stones which comprised it extended the entire (north-south) length of the structure before making an abrupt westward turn at a right angle and extended along the entire east-west extent of the trench (see **Fig. 23-3: 8**). The first layer encountered in Operation 23-3 which resembled previously excavated layers associated with salt-processing activities at the site (MG 477) was confined to within the borders of this feature. MG 477 comprised charcoal-rich dark soils interlaced with lighter soils containing large concentrations of Coconut Walk Unslipped sherds, previously postulated as the shallow, expedient vessels placed over fires to evaporate water from brine and form salt cakes (see **Fig. 23-3: 9**). With these alternating levels, excavations in Operation 23-3 conformed to previously noted patterns associated with salt-processing activities. As such, our preliminary interpretation of this feature is that it represents the borders of an industrial salt-processing hearth within which salt was produced for export during the Late Classic period.

Moreover, a similar stone feature was uncovered in lower levels of excavations undertaken in Operation 23-2 (Marshall, this volume), with even clearer layering of darker charcoal-rich and lighter Coconut Walk Unslipped soils alternating evident both during excavation and in section. Similar large stones were associated with salt-processing levels in a test pit dug in Structure 14 (in an area approximately between Operations 23-2 and 23-3) during the 2013 field season. It seems possible that these three finds represent different aspects of a single feature; however, based on the excavations undertaken to date, this cannot be confirmed. It is therefore a priority to continue to explore these features in future seasons to confirm or refute their potential contiguity. If these features do indeed represent a single industrial salt-processing hearth, this will considerably bolster our existing knowledge of both the extent of salt production activities in this area of the site and the processes by which salt/salt cakes were created in this region of the *mando maya*.

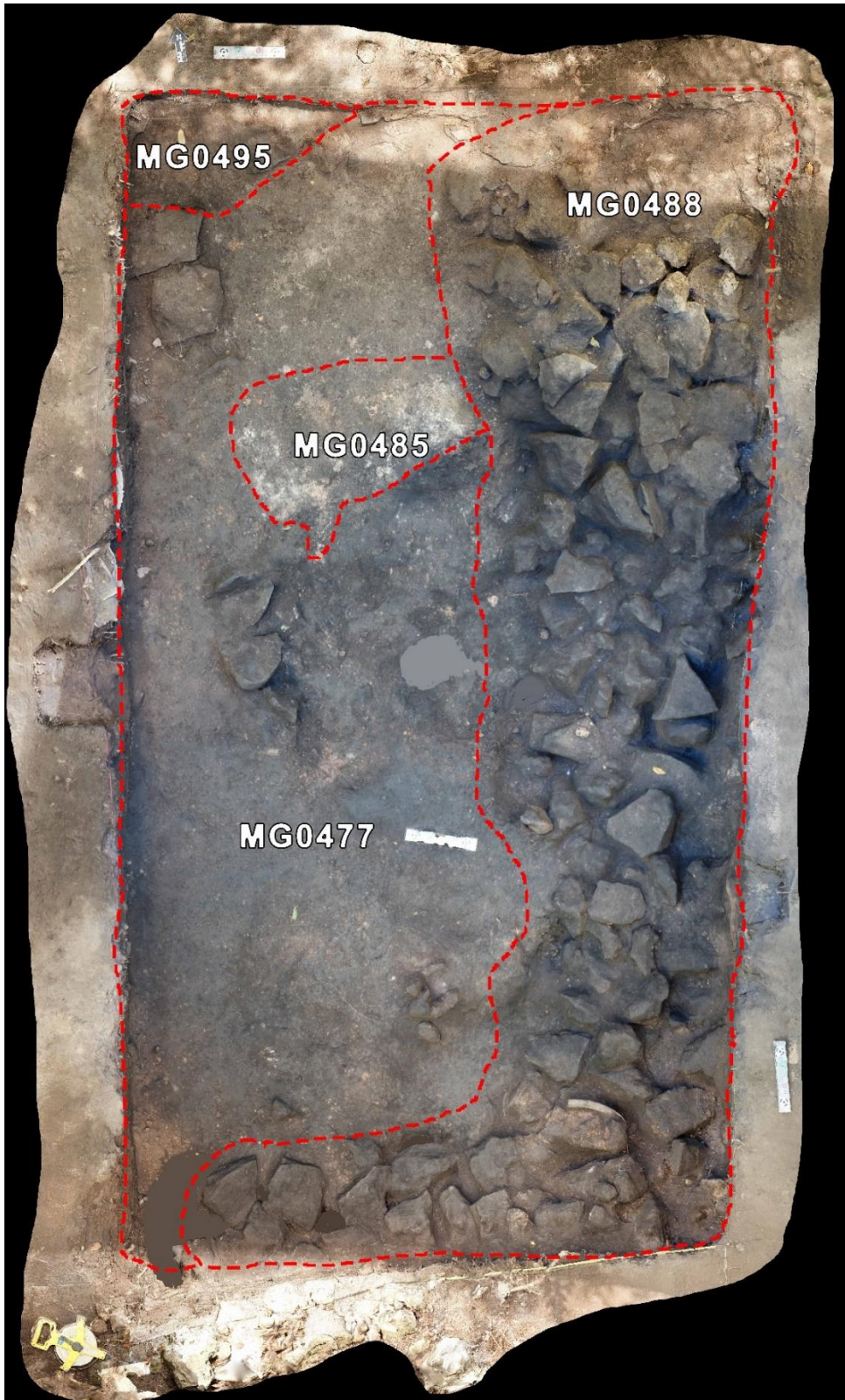


Figure 23-3: 8. Orthographic projection of the final excavated layer of Operation 23-3, prior to backfilling at the end of the 2023 field season. MG0488 represents the stone border of the hypothesised salt-processing hearth. MG 477 represents the bottom of the first stratigraphic layer associated with salt-processing activities excavated in this Operation, with the charcoal-rich darker earths encountered beginning to give way to lighter soils containing large quantities of Coconut Walk Unslipped sherds.

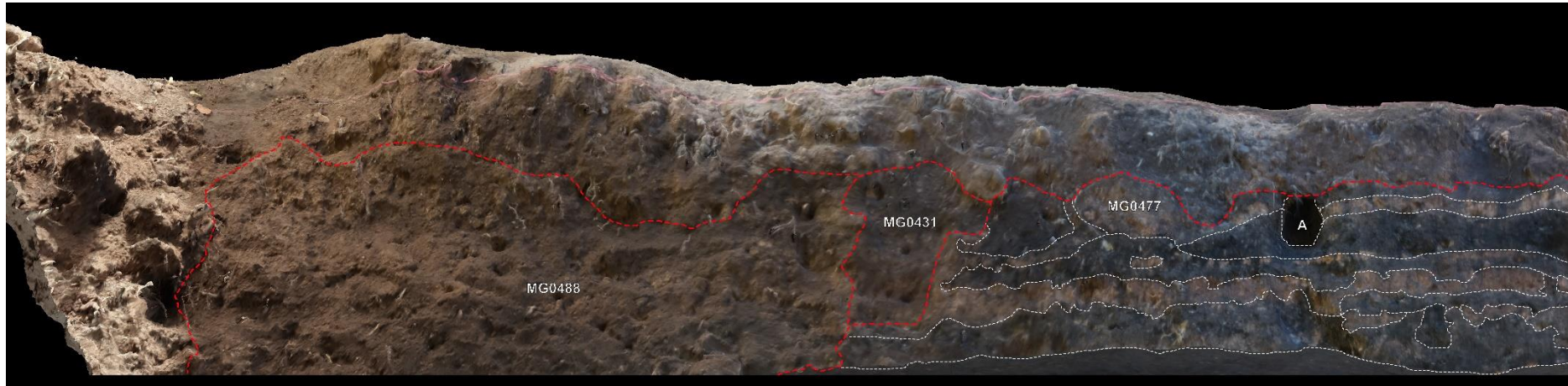


Figure 23-3: 9. Orthographic projection of the southern portion of the east-facing section of Operation 23-3, derived from the 3D model constructed of the final layer of excavations (see *Fig. 8* for annotated orthographic projection of the entire excavation unit). Lot MG 477 represents the first salt-processing associated layers encountered in this Operation. White dashed lines have been added to highlight the visible alternation between layers of dark charcoal-rich and lighter Coconut Walk Unslipped-rich layers of soil. Note also the generally disturbed nature of these contexts owing to bioturbation. Also labelled are 'A', a large crabhole encountered in the section wall, highlighted to demonstrate faunal bioturbation; MG 431, the lot number ascribed to a heavily disturbed mixed context on the western border of the trench; and MG 488, the large stone feature hypothesised to represent the borders of an industrial salt-processing hearth. Note in particular the way in which the layered salt-processing-associated strata of MG0477 are clearly confined to within the borders of Lot MG0488.

Other pertinent features encountered during excavations

While conducting excavations across Operation 23-3, several other intriguing features were encountered, the most compelling of which are summarised briefly below. These include a large deposit of conch shells arranged in what may be described as a roughly horseshoe-shaped pattern, slightly southwest of the excavation operation's centre point, just south of (albeit, associated with slightly higher stratigraphic levels than) burial 14/42; a large ash lens in the northern portion of the excavation from which several small glyph-bearing or otherwise decorated polychrome ceramic sherds were recovered; and a dense scatter of small ceramic sherds in the northwestern corner of the excavation. Some preliminary interpretations of these contexts in isolation will be offered; however, further discussion is included below (*Preliminary Interpretations*).

Just southwest of the excavation centre line, a large conch shell deposit, MG 443, was first encountered underlying MG 449, the first heavily deteriorated plaster floor level excavated (see **Fig 23-3: 10**). Further excavations showed that this conch shell feature was associated with lower stratigraphic levels: specifically, Lots 451, the second heavily deteriorated plaster floor encountered, and 472, the underlying deposit. Also exposed in proximity to the conch shell feature were two postholes: one to the west (MG 478) and one to the east (MG 479) of the deposit. The placement of the shells suggested deliberate deposition, as did the associated presence of several partial and complete shell discs within this context (see **Fig. 23-3: 11**). Shell discs of this kind have been found in large quantities across Marco Gonzalez during different excavations and, indeed, the discs recovered from MG 443 are virtually identical to shell discs excavated in greater quantities in a cache context within Operation 23-2. The uniform shape and central perforations on these shell discs suggests they were manufactured with the intention of being strung, presumably either on an item of jewellery or perhaps as embellishments on an article of clothing or headdress/diadem.

The distinctive, yet seemingly deliberate, placement of the conch shells in this pattern, the close association of stratigraphically contemporaneous postholes (see **Fig. 23-3: 12**), and the additional finds of several small, worked shell discs—which Graham calls sequins—suggests deliberate deposition, perhaps representing caching during remodelling of superstructures. That said, as the postholes proximate to MG 433 were relatively small, it seems unlikely that these represented the central supporting pillars of any perishable superstructure which may once have stood here. Similarly, the location of this potential cache within Structure 14 more broadly does not appear to hold any clear significance, such as lying upon the primary or transverse axis of the Structure, as may be expected when encountering a cache. While MG 433 was geographically proximate to burial 14/42 (lying just to the south of the burial), the two contexts do not appear to be associated, nor necessarily contemporaneous.



Figure 23-3: 10. Orthographic projection of shell deposit MG0443 after initial exposure during excavations.



Figure 23-3: 11. Examples of shell discs recovered in association with the MG 443 conch shell deposit. Modified from original photographs taken by Collin Sauter.



Figure 23-3: 12. Orthographic projection of the second excavated layer of Operation 23-3. MG 443 represents the large conch shell deposit discussed above, flanked to the west (MG 478) and east (MG 479) by postholes. MG 488 comprises the first exposure of the large stone feature which we hypothesise represents the borders of an industrial salt-processing hearth, at a time when the feature appeared more as facing collapse. MG 489 comprises the small shell feature encountered between burials 14/42 and 14/43 (which had been retrieved by the time this 3D model was constructed). MG 485 depicts the bottom layers of the large ash deposit approximately underlying burial 14/40 from which glyph-bearing sherds were derived; a small polychrome sherd left *in situ* is visible at the northern edge of the lot. The remainder of the trench displays the bottom of MG 472, before the first salt-processing-associated layer (MG 477) was fully exposed.

A further intriguing feature revealed through excavations in Operation 23-3 was a large ash lens in the northern area of the excavation unit, designated MG 485 (see **Fig. 23-3: 12**). Within this lens of relatively loose (i.e. uncompacted), grey-white ash several decorated polychrome ceramic sherds, including two rim fragments containing hieroglyphs, were discovered, as depicted in **Fig. 23-3: 4a**. These sherds are not dissimilar to the larger glyph-bearing rim sherd retrieved from the west-facing section of Operation 23-2 which bore the phrase *ujay yuk'ib'* ("it is the drinking vessel of..."). Given these ostensible similarities, it seems plausible that these sherds were originally part of a similar vessel, particularly as the two contexts were stratigraphically similar, most likely associated with the Late Classic period (MG 485 underlay MG 472 and was associated stratigraphically with MG 477, the first layer associated with salt-processing activities encountered in Operation 23-3). The presence of this large spread of ash is more difficult to interpret but most likely represents some kind of burning event, potentially intentional given its relatively (in the broader context of Structure 14) limited and contained character. As noted above, MG 485 underlay burial 14/40 (MG 427); however, these contexts were separated by several others, including MG 449, MG 450, MG 451 and MG 472. These represent two successive reflooring efforts on the structure, meaning that a direct link between the 'scribe' burial and these glyph-bearing sherds cannot be asserted. However, given the heavily disturbed nature of much of Structure 14's stratigraphy owing to various bioturbators, post-depositional movement of these sherds from later contexts cannot be discounted.

The final particularly noteworthy feature encountered within Operation 23-3 consisted of a considerable scatter of sherds encountered at the lowermost levels of excavations in the northwest corner of the excavation unit (see **Fig. 23-3: 12**). While stratigraphically equivalent to MG 477 and MG 485, this sherd scatter feature (MG 495) was distinct enough to warrant a separate lot number as it was clearly not an extension of the ash lens just east of it (MG 485), nor were the finds within – which comprised small sherds of which were not of the Coconut Walk Unslipped type – consistent with those seen elsewhere in the various layers of MG 477. MG 495 was also broadly in line with the location where we would have expected to find further stones in the form of a westward extension of Lot MG0488; however, stones were not located. The deposit overlying MG 488 in other portions of this excavation unit did yield small sherds of a variety of types in a manner not dissimilar to that encountered in MG 495 (albeit not in as dense concentrations). As such, it is possible that this lot represents the topmost levels of an extension of the stone hearth feature. Alternatively, stones similar to those seen elsewhere in MG 488 may have once been placed here but been removed to contribute to remodelling efforts on the face of Structure 14. As MG 495 was identified on the final day of excavations, further examinations of lower levels were impossible during the 2023 season; however, future excavations in this area will hopefully contribute to the construction of a clearer picture of this context.



Figure 23-3: 13. Ceramic scatter (MG 495) located in the northwest corner of Operation 23-3 at the lowest levels reached during excavations. Also pictured are portions of the large ash lens (MG 485) and the northwestern extremity exposed of the stone feature (MG 488) hypothesised to represent the borders of an industrial salt-processing hearth. Modified from a photograph taken by Collin Sauter.

Photogrammetry and 3D modelling as a first-line documentation method

Aside from the more research-oriented questions concerning mortuary practices and industrial-scale salt manufacture which excavations on Operation 23-3 sought to contribute new information towards, this Operation also served to trial novel methodological approaches. Select features uncovered were chosen to trial the efficacy of photogrammetry and 3D modelling as a first-line documentation method. To this end, several burials, particularly intriguing features, and indeed the entire excavation area, were 3D modelled at different points throughout the season to test the viability of this approach as a primary documentation method in the future. The results of this trial were encouraging, pointing to the potential of the approach for certain elements of archaeological recording; however, lessons were also learned regarding how this process can be refined in the future to ensure results consistently of the highest quality possible. Below, details of the equipment and workflow utilised are provided before discussion of the strengths, limitations, and scope for improvement in the future of these methods.

The photographs used as the basis for all 3D models created during excavations within Operation 23-3 – including three full-unit models at different points during excavation, three burials and various other features encountered during excavations – were taken using a Fujifilm X-A1 camera with a Fujifilm XF 27mm F2.8 fixed focal point lens with ISO consistently set to 200. These photographs were then input into RealityCapture where the models were rendered and textured in the highest quality possible (default ‘High Quality’ reconstruction

settings and 16k texturing). Orthographic projections were rendered using the default ‘true ortho from a textured model’ method within the software, using automatically generated estimates of height and width (generally ranging from c.25,000 pixels per dimension with ortho pixel⁴ sizes c.002 for more specific models, such as the Burial 14-40 orthographic projection [**Figure 23-3: 2**], to around 40-50,000 pixels per dimension with ortho pixel sizes c.0.0001 for full excavation area levels). These were then exported as high-quality TIFF files (generally ranging from 2-10GB in size) before post-processing (cropping, adding annotations as in **Figures 23-3: 6, 8, 9 and 12**) in Adobe Photoshop.

Results of these documentation efforts were variable, with some working exceptionally well. Photogrammetric recording of burials *in situ*, in particular, appears a very promising approach, owing to the way it faithfully preserves context. Such detailed documentation of aspects such as burial position, distribution of grave goods, grave cut, and condition of remains before retrieval are all hugely valuable aspects of contextual information which are preserved after the necessarily destructive act of retrieval. Moreover, 3D modelling provides a more detailed and immersive documentation than traditional recording methods such as illustration or photography owing to the interactivity possible through zooming in and out, changing angle, yaw and direction in order to study burial context more closely.

Similarly, the documentation of entire excavation units using photogrammetry and 3D modelling has the potential to greatly enhance the resolution of recording of the process of archaeological excavations. On average, it took between 15 and 30 minutes to take the photographs from all angles of Operation 23-3, all of which are required to construct 3D models from which orthographic projections can be rendered. As such, it seems feasible that this process could be undertaken at the end of each day’s work, which would take considerably less time than would be required for plan drawings and with a greater degree of information recorded (owing to the three-dimensional recording) than traditional photography. It is also important that models do not have to be rendered immediately and can be undertaken post-field season⁵. Moreover, although it was not an active consideration during the field season, the orthographic projections rendered from these 3D models have potential as a tool to supplement traditional section drawing to some extent, as illustrated in **Figure 23-3: 9**. The 3D model of Operation 23-3, from which the orthographic projection of the east-facing section was derived, was not constructed with the specific purpose of section drawing (or rather overlaying) in mind. However, the section derived from the 3D model is certainly serviceable for the illustration of more macro-level features. In future, a more bespoke workflow will be undertaken for section recording specifically, with refinement of the particularities of 3D modelling for different purposes hopefully serving to enhance results.

That said, there are clearly limitations to this approach, as well as scope for improvements in the future. In terms of limitations, one obvious point to consider is technology. The camera and lens used to take photographs were not exactly state of the art and better hardware may

⁴ The size of a pixel in the units of a chosen coordinate system

⁵ High quality reconstructions can take a considerable amount of time, depending on computer hardware specifications. However, ‘Preview Quality’ dense point clouds are relatively quick to render, meaning the utility of photographs can be ensured at the end of each day and, if necessary, new photographs taken at the beginning of the next work day before excavation work resumes.

be beneficial in future. Similarly, operator skill and experience are certainly important components to consider. More quotidian factors must also be taken into account. Lighting and ability to produce shade have an appreciable impact on results. Compare, for example, **Fig. 23-3: 2**, where shade to make lighting consistent was provided by colleagues holding a tarpaulin at a 45° angle and photographs were taken in the mid-afternoon, with **Fig. 23-3: 6**, where shade was provided by a blue tarpaulin suspended parallel to the excavation unit and photographs were taken closer to noon. The blue 'staining' which the latter method caused is significant. This could be negated by the inclusion of a photographic colour chart, enabling easy colour correction, in future. However, it is a worthy consideration. Similarly, prosaic factors such as the time of *the working* day when photography is undertaken can be impactful in terms of photograph quality.

In the broader perspective, 3D models (of all types) such as those constructed using data obtained during the 2023 field season also have great potential as tools of pedagogy and dissemination; however, careful consideration and consultation concerning the ethics of such approaches must be undertaken before this can be done. Disciplinary discussions around such ethical issues are still in their early stages (see, for example, Ulguim 2018; Smith & Hirst 2019; Wrobel *et al.* 2019) and, also important, specific approaches to these techniques in different areas of the world that take into account local cultural norms, indigenous perspectives, and the idiosyncratic nature of archaeological work in different places mean that no detailed universal standard is likely forthcoming. Considering the best way forward in the specific context within which the Marco Gonzalez Archaeological Project is situated is certainly a priority in the near future, now that viability of these approaches has been proven.

In short, this trial of implementing photogrammetry and 3D modelling as a primary documentation method for certain features and aspects of archaeological recording provided encouraging results. These methods, it seems, can viably be incorporated as the principle recording method for certain aspects of archaeological documentation and enhance the resolution of, or be integrated with, traditional visual recording methods. Refinements in these methods are necessary; however, they clearly represent a valuable addition to the repertoire of recording methods used at Marco Gonzalez.

Preliminary interpretations and discussion

Considered holistically, the excavations undertaken within Operation 23-3 certainly contribute to our understanding of the use of Structure 14 and the activities and lifeways of the Precolumbian inhabitants of Marco Gonzalez. In terms of Late Classic economic activities, the discovery of what we hypothesise represents an industrial salt-processing hearth is an important additional piece of information with regard to both the mechanics behind salt production at the site and the seemingly considerable economic reorientation which the Late Classic period represents for Marco Gonzalez's inhabitants compared to earlier and later periods. Further excavations are required to confirm or refute the contiguity of MG0488 in Operation 23-3 with ostensibly similar features in Operation 23-2 and test pit Operation 10-3; however, if these features do represent a single massive salt-production hearth, the knowledge will be a significant step forwards in our understanding of salt production and its relationship to Late Classic economics.

In terms of burials, all those revealed by excavations in Operation 23-3 appear, from stratigraphic context and associated grave goods, to be Late (to potentially Terminal Classic in the case of burials 14/40 and 14/41) Classic in date. As none of these burials were of archetypical VPLF type (i.e. face-down depositions), there are a couple of potential interpretations. First would be to consider the growing series of face-up, legs crossed burials as a sub-type of the VPLF phenomenon. The designation of a sub-type is plausible, given certain similarities in terms of other facets of mortuary practice such as the inclusion of certain types of ceramics within these graves. Variation in VPLF is already established, for example in the difference between legs-crossed positioning of the body as seen at Marco Gonzalez versus legs flexed straight to the hips as seen at Lamanai (see Graham *et al.* 2013), meaning that *face-up* legs-crossed positioning of the corpse may be considered just another variation in a broadened typology of this burial practice. The second potential interpretation would be to consider a narrower definition of VPLF (representing *face-down* legs flexed depositions exclusively) as part of a mosaic suite of burial practices which were in use in Late-to-Terminal Classic period Marco Gonzalez, becoming more common into the Postclassic, particularly once the site was abandoned in approximately the 13th century AD and its inhabitants relocated to San Pedro (see, for example, Graham & Pendergast 1989). Based on the current evidence at our disposal, the alternatives are really more of a typological ‘lumpers vs. splitters’ semantic argument at this stage. However, a broader series of burials across time and space at the site may help to guide interpretations.

What does seem certain, based on the novel burials recovered during our 2023 excavations is that Marco Gonzalez remains a site which defies expectations. Burial 14/40 in particular contained an array of nonlocal grave goods which would typically be interpreted as a high-status burial. However, excavations to date at Marco Gonzalez have not revealed any of the hallmarks of the influence of Classic period *k'uhul ajawob* at the site. Rather, the picture which appears to be emerging is of a site whose inhabitants were able to go about their lives with some degree of autonomy from the generally considered ubiquitous influence of these divine lords, while still enjoying a standard of living (or, at least, treatment in death) which would orthodoxly be interpreted as resulting from elite patronage. This suggests intriguing and, as yet not fully appreciated, mechanics of status acquisition at play at this site which may warrant further investigation.

Moreover, it appears that the lifeways which the inhabitants of Marco Gonzalez enjoyed were ones which was far more flexible and enduring than that under the *k'uhul ajawob* and their attendant courts further to the west. Flexibility is exhibited most clearly by the way in which Marco Gonzalez's inhabitants were able to reorient – economically, as well as presumably culturally, as the appearance of VPLF burials in the Late-to-Terminal Classic attests – far more agilely than the divine lords of the mainland, thereby ensuring their perseverance and prosperity through the so-called Maya ‘Collapse’ (which looks nothing of the sort from the perspective of Marco Gonzalez) and into the Postclassic period.

A provisional Harris matrix of lots associated with Operation 23-3 is presented below (see **Fig. 23-13: 14**), based on relative stratigraphy, inter-lot associations and material culture finds within contexts. However, as discussed above, disturbance – as a function of bioturbation, modern looting, and owing to the occupants' habit of frequently digging through earlier burials and displacing contents – are factors which must be taken into

account. Samples of charcoal and other carbon-bearing materials were taken from a variety of contexts and will be submitted for radiometric dating. Although marine reservoir effect (see, for example, Alves *et al.* 2018, 2019; Ascough *et al.* 2005; DiNapoli *et al.* 2021) will most likely have to be accounted for, this will hopefully help us confirm and refine the chronology of contexts encountered during these excavations, particularly when combined with Bayesian modelling approaches (see Hanna *et al.* 2016 for these methods as applied at Lamanai).

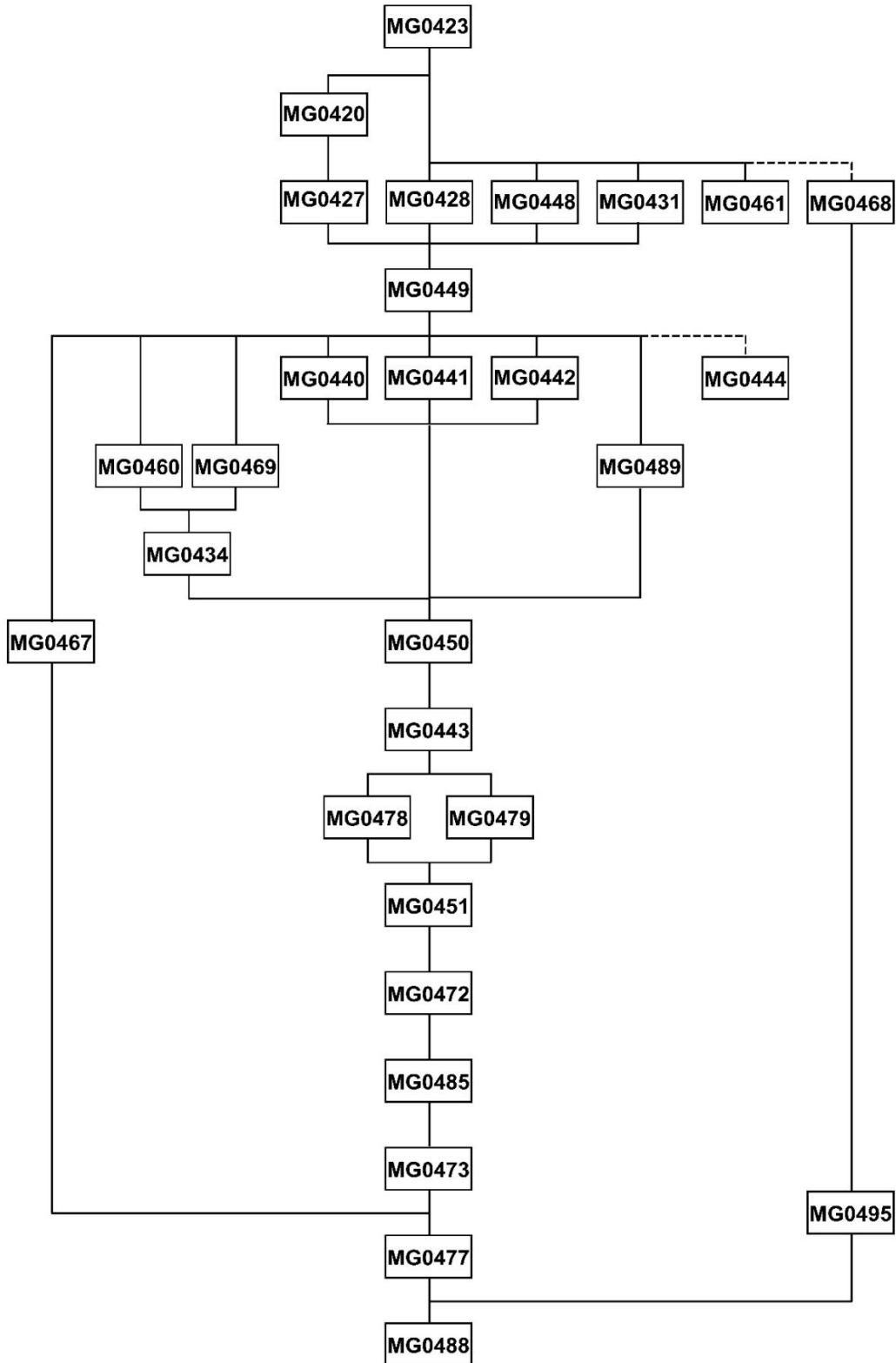


Figure 23-3: 14. Provisional Harris matrix, illustrating the stratigraphic relationships between all lots associated with excavations in Operation 23-3. The dashed lines only provisionally place MG 444 and MG 468. These two lots were heavily disturbed and mixed contexts; as such, stratigraphic association is postulated here, based on vertical stratigraphic association (i.e. when the deposits were first encountered) rather than any more meaningful context.

The excavations undertaken in Operation 23-3 appear to have initially uncovered Terminal Classic levels before reaching evidence of Late Classic use of this portion of Structure 14. Of course, excavations did not begin at ground surface but continued below levels excavated in 1990 and 2010. During the final day of excavations, it appeared that we may have been reaching the end of salt-processing remains (MG 477) within the borders of an industrial salt-processing hearth (MG 488). The salt production levels appear to predate the construction of the Structure 14 platform itself, the initial construction of which appears to date to the Terminal Classic period. As such, continuing excavations offer us the opportunity to build upon our existing knowledge of the site during the Early Classic period and investigate the extent to which the Late Classic period – so frequently cast as ‘the norm’ in the historiography of Precolumbian Maya civilisation – continues to appear as an aberration in contrast with more *longue durée* patterns of intimate engagement in long-distant trade and exchange at the site.

Conclusion

Excavations conducted within Operation 23-3 shed new light on several research questions which are central to the Marco Gonzalez Archaeological Project. Moreover, novel methodological approaches to recording and documentation of archaeological work undertaken at the site show encouraging signs regarding their potential use and refinement into the future. The picture which continues to emerge is of a site which consistently defies orthodox interpretations of the kinds of activities – and inhabitants – which should be associated with a Precolumbian Maya site of its size and “peripheral” location. In spite of its location on the eastern extremity of the *mundo maya*, Marco Gonzalez never appears to have been peripheral. True, it certainly could be considered peripheral to the dynastic warfare and internecine strife in the Late Classic period which eventually led to the disintegration of the political order of the *k’uhul ajawob* and the depopulation of many formerly prominent sites across the southern lowlands. However, by contrast, Marco Gonzalez appears to have been far more central to important aspects of long-distance maritime trade and exchange – an outward-looking perspective which apparently facilitated considerable status acquisition among its inhabitants and proved far more durable in the long run.

5) Operation 23-4, Str. 18 (Rylee Lalonde)

Marco Gonzalez, approximately 355m x 185m, is an archaeological site located on the southern tip of Ambergris Caye, Belize's largest island. In the early years, of 1984, a reconnaissance was carried out by Dr. Elizabeth Graham and Dr. David Pendergast. Two years later, in the spring of 1986, the Royal Ontario Museum conducted the first excavation with more to follow throughout the coming years (Graham et al. 2017). What was once presumably a more agreeable and lively habitation has become, in the present day, consumed by mangrove swamp. This report outlines the excavations and finds of Str. 18 for the 2023 field season.

Str. 18 was selected for investigation because a looters' pit had already penetrated and exposed the upper levels. The pit was located in the northeast corner of Structure 18. While looting typically denotes a search for goods, currently, the looting at Marco Gonzalez's seems to be associated with soil. Marco Gonzalez soil is what is known as anthropogenic soil, or 'dark earth'. This type of soil is created due to the influence of human activity, which can include, but is not limited to, human waste, food waste, and natural decomposition from burials.

The goal for excavation was to see what may have been left behind by looters. Initially, the pit was inconspicuous due to the profusion of vegetation growing up the sides and on top of the structure. The vegetation of Str. 18 was significantly dominated by gumbolimbo (*Bursera simaruba* L.), chechem or black poisonwood (*Metopium brownie*) and cabbage palms (*Roystonea oleracea*) (Graham, 1989). The size of the pit left behind by the looters was approximately 2m x 1.5m with multiple locations (4) of looter back dirt. Many general disturbances besides the action of the looters were recorded before and throughout excavations including tree and vegetation roots, and arthropod (land crab) activity.

Excavations began (on the 5th of June) by cleaning the sides of the initial unit cut into the structure by the looters and by sifting through the looters' backfill (MG 422). The lot MG 422 was located in the northeastern corner of the assumed structure. Cleaning the walls and eliminating the back dirt from the initial lot revealed a mix of both Late Classic and Early Postclassic sherds and faunal remains (marine) as well as three burials. There was evidence of crab burrowing throughout the structure. The first burial (Burial 18/2) was located in the northeastern corner of MG 422; the second (Burial 18/3) was located in the southeastern corner, and the third burial (Burial 18/4) was located within the eastern section wall.

Cleaning the section walls revealed a possible plaster surface, indicating a floor located in the middle of the lot, approximately 0.75m from the top of the unit (see datum points listed in Section 1). Excavations were continued to find additional information on the possible plaster surface within the lot. The final depth of the lot was 1.5m (MG0422) with an indication of entering a possible salt processing layer. The looter's pit contained mixed pottery sherds, including salt production pottery and 'slate ware' (McKillop, 2022). Additionally, chert, shell, and charcoal were identified within the lot.

Burial 18/2 (Fig. 23-4: 1)

Burial 18/2 was the first burial excavated in Str. 18. As previously mentioned, the straightening of the section walls within the main lot (MG0422) led to the identification of a

burial in the northeastern corner. When excavating their pit, the looters dug into a burial, cutting the individual's lower limb bones. MG 422 was extended into two additional lots MG 432 and MG 435. The approximate measurements of the burial followed a 1m x 1m unit.

MG 432 designated burial fill of 18/2. Only a few artifacts were found within the burial fill including a lithic (1) and pottery sherds (15). It is unclear if the sherds are associated with burial. However, it was speculated that pottery may have been broken and placed over the top of the individual as each piece of pot had a corresponding bone underneath. Burials excavated in Str. 14 often have a vessel placed near the upper part of the individual's body.

MG 435 was assigned to the actual burial and to any burial goods that could be shown to be in primary association with it. Burial 18/2 consisted of an adult female, articulated and well-preserved. Two artifacts were found in association with her burial: an animal tooth pendant (1) and an obsidian core (1). She was placed in a prone position with her legs tucked, resulting in the flats of her feet placed against the opposite femur. Her head was tilted to the side facing the south and her hands were located underneath the lower axial skeleton.



Figure 23-4: 1. Bur 18/2, MG 435

Burial 18/3

Burial 18/3 was the second excavated burial within Structure 18 (MG 439). When cutting the section wall (MG 422) it was noticed that fragmented bones were coming out of the lower half of the southeastern wall. While excavating there was a noticeable difference in soil colour and texture, providing a conclusion this area had already been disturbed. To get a more accurate representation of stratigraphy and context the lot (MG 438) was cut back further (MG 439). This led to some difficulty with roots as there was a palm tree located in the southeastern corner.

MG 438 consisted of looter's spoil from MG 422. Initially clearing out the corner there was more PAA present, lending to the conclusion that it may have been back dirt from MG 422. There were more salt processing sherds (Coconut Walk Unslipped) found within MG 438 as well as an incised vessel (2), obsidian core (2), Ulúa pottery (1) as well as human remain fragments.

Once the bottom of MG 438 had been levelled to the initial point where bones were identified in the section wall, a new lot number was assigned: MG 439. What was thought to be a burial seemed to be a culmination of three disarticulated individuals that had been previously disturbed; bones were deposited throughout the entire depth of the southeastern corner. Due this significant disturbance, we could not confirm where the bones had been originally buried; there is a possibility they could have resided originally in MG 422.

Burial 18/4 (Figure 23-4: 2)

In association with Burial 18/3, the looter's spoil (MG 438) was spread across the lower half of the eastern wall. In the process of looking for the second burial, the spoil was cleared away as well to keep all associated back dirt together. While cleaning away the back dirt a small vessel (1) (Fig. 23-4: 3) was found in the eastern wall approximately 40cm from the top of the unit.



Figure 23-4: 2: Bur 18/4, MG 437



Figure 23-4: 3. Found in MG 438. No discernible association with Bur 18/4; possibly associated with a burial that had been disturbed.

Further excavation was carried out to remove the pot with minimal damage. While clearing away to remove the vessel, more artifacts were found: including sherds (40) and whole pots (2), one of plumbate. The initial small pot was not associated with burial 18/4, just located within the section wall of MG 438. However, the two additional pots were associated with two more burials in the eastern wall of MG 422. The larger pot was associated with a burial, located at the head. It was decided that with the time remaining this burial would be left, as it was located underneath a palm tree. The second smaller pot was associated with Burial 18/4, located in the crook of the elbow as well as a bone ring (1). The individual in burial 18/4 was in a prone position. No head was found in association with the burial, nor the right leg. The bones that were remaining were well preserved.

Conclusions

Ending the 2023 Marco Gonzales field season there were two articulated burials and one disarticulated burial with three presumed individuals. The artifacts discovered included plenty of salt processing sherds, polychrome, and a few pieces of possible 'slate ware' amongst others. Personal belongings such as a bone ring, animal tooth pendant, and obsidian cores were found in association with the burials as well as whole pots (3) including incised pottery (2). As a coastal trading site, there were Ulua sherds from the neighbouring

area of Honduras (2) (see ceramics report). Much of what was recovered had been damaged by either previous digging activities or cast off, as most of what was documented came from looter back dirt. Marco Gonzalez area still has plenty of contributions to make to studying the lives of individuals on the island as well as Maya lowland history.

Lot numbers for Op 23-4: MG 422, 432, 435, 437, 438, 439.

6) Operation 23-5, Str. 14, north side of platform (*Liz Graham*)

The north side of the Str. 14 platform has been heavily disturbed by vegetation and presents almost more of a challenge to excavate than the south side. Post-abandonment accumulation (PAA) is considerable (characteristic of the site in general), as is the amount and extent of collapse (**Fig. 23-5: 1**). The northeast corner had been partially exposed in 2010; therefore, we began here, moved westward, and also sought to excavate to the base of the platform face that was still standing.



Figure 23-5: 1. North side of Str. 14 platform. Photo looks W.



Figure 23-5: 2. Preserved portion of the north face of Str. 14, at its east end. Photo looks SE.

Fig. 23-5- 2 shows the platform excavated to its base on the east end, and **Fig. 23-5: 3** shows the cleared collapse to be excavated next season. The final photo, **Fig. 23-5: 4** shows the east stairside of the stair that once stood on this, the north side, of the structure. The area of the stair was looted (we discovered the looters' trench in 1990), and we used the trench to penetrate the core of Str. 14 in 2010 in order to have a closer look at the salt production levels. Fortunately the stairside on the east was not destroyed. Therefore we hope in the next field season to expose more of the north platform face as well as its connection to the stair.



Figure 23-5, 3: Photo looks E. Cleared collapse with exposed portion of the northern face of Str. 14 shown at the western edge of the excavation.



Figure 23-5, 4: Photo looks SW; shows the stones of the east side of the stair that once stood on Str. 14's north side. Collapse still stands here as we had not yet excavated to platform face on this side.

What we can say at this stage is that the north side of the Str. 14 platform had only one terrace face, whereas two were cleared, or partially cleared, on the south side. Evidence suggests that the second terrace face on the south side was an addition, and core material suggests a Terminal Classic to Early Postclassic date for the addition. For the present, our hypothesis is that Str. 14 was originally built towards the end of the Late Classic and into the Terminal Classic. We will know more once we clear the remainder of collapse around the circumference. So far, we have not encountered a plaster (plaza) floor, as was in evidence in association with Str. 12; however, we found only a small plaster patch that lipped up onto one of the giant risers of Str. 12. In the case of Str. 14, we did reach what we think was the plaza walking surface, which met the base of the preserved part of the face on the north side, east end. We hope to be able to determine the original height of the platform, its western extent, and its connection to Str. 12 on the east.

7) Pottery notes (*Jim Aimers*)

Introduction

I began on Friday June 23. My *initial* sorting procedure was to separate Non-diagnostic (ND) slipped (ND and ND eroded (this included sherds that were initially unslipped as well as sherds that were originally slipped but no longer had any visible trace of slip). These were counted and bagged separately. These data were recorded. Diagnostic sherds (included striated body sherds) were bagged separate for analysis and recording later.

Some of the eroded body sherds were classified as Coconut Walk Unslipped (CWU). Criteria: thin, relatively hard with rough and irregular surfaces, orange-brown color. The paste color overlaps somewhat with the thicker and larger Tsbak Unslipped sherds.

Important types and ware, etc.

Coconut Walk Unslipped Ware

In 2016 I called CWU at Marco G Calabash Unslipped Ware (Coconut Walk Group). In the 2023 San Pedro report I called it Ambergris Coarse Ware. Names will be sorted in future.

Calabash Unslipped Ware

Calabash unslipped Ware was originally created for Rio Juan Unslipped pottery in the Postclassic era New Town Ceramic Complex at Barton Ramie (Gifford 1976) and is also found at Lamanai (Aimers personal observation). Three sequential types of Calabash Unslipped Ware, including Rio Juan Unslipped, were seriated based on form and temporal placement at Witz Cah Ak'al (Murata 2011). We suggest that Coconut Walk Unslipped be placed in this ware, for reasons we address below. Table 8.1 gives type-variety information for the three types that we created at Wits Cah Ak'al based on temporal context and formal qualities. These three types are part of a pottery tradition or, in standard type-variety terms, a sequence:

A ceramic sequence is composed of pottery types similar to each other in decorative style or manner of surface treatment (members of a single type-class) which can be shown to have developed one to another from early to late times. The types involved in a ceramic sequence, as indicators of developmental continuity involving a considerable length of time, usually transcend wares and may include type elements from any number of different ceramic systems. (Gifford 1976:12)" (Aimers, et al. 2016:151)

Table 8.1. Type-variety information for the members of the Coconut Walk ceramic sequence at Witz Cah Ak'al

Period	Late Preclassic– Early Classic (includes Terminal Preclassic)	Late-Terminal Classic	Terminal Classic– Early Postclassic
Ware	Calabash Unslipped Ware (Willey et al. 1965:384) or Coconut Walk Unslipped Ware (Graham 1994)	Calabash Unslipped Ware (Willey et al. 1965:384) or Coconut Walk Unslipped Ware (Graham 1994)	Calabash Unslipped Ware (Willey et al. 1965:384) or Coconut Walk Unslipped Ware (Graham 1994)
Group	Straight Lagoon Group	Hector Creek Group	Rio Juan Group
Type	Straight Lagoon Unslipped	Hector Creek Unslipped	Rio Juan Unslipped
Varieties	Straight Lagoon Variety	Hector Creek Variety; HCU-2 Variety	Rio Juan Variety; Variety Unspecified
System	Kakalche Unslipped Ceramic System due to similarities to Graham's (1994: 140–4) Kakalche Crude Orange Ware	Coconut Walk Unslipped Ceramic System	No system designation since we know of no analogous types with different names elsewhere

I am now reconsidering the Calabash Unslipped Ware designation for the pottery from Ambergris Caye.

Important sherds and vessels

MG 424 black modeled sherd



EG notes this is likely plumbate.



MG 427, Bur 14/40

This lot has several polychromes so I'm leaning to **Macal Orange-Red** (Tiger Run --Gifford 1976: 192 says "Tiger Run pottery, for the most part, is transitional between Early and Late Classic" BUT, the Sotero and Macal Groups are exceptions and "are best considered as occupying a position that extends from the middle of the Tiger Run Phase into an early facet of Spanish Lookout Phase"(Gifford 1976:192). He also says "there is unquestionable ambiguity over the placement of Macal and Sotero types in the Tiger Run as opposed to the Spanish lookout Ceramic Complex"

Early Late Classic makes sense here given the Saxche Orange Polychrome (Tiger Run) in Lot 427. Gifford 1976: 214 cites WBG 1965 p 365 on Macal Orange Red;

"Red to orange to yellow-brown slipped, very thin-walled, hard calcite tempered pottery which because of this attribute on technological grounds, could have been made at the site or in the general locale . . . Bowl forms never appear and the type is either represented in the form of a pottery drum (fig.225) of some kind or an equally unusual large 'brandy snifter' jar shape" (WBG 1965, p. 365). The orange-red slip can be scratched with the fingernail and exterior surfaces show many postdepositional scratches (unlike the glossy wares)". Paste is light orange or tan.

WBG 1965: 365 also wrote: "Macal Orange-red vessel shapes verge upon the exotic."

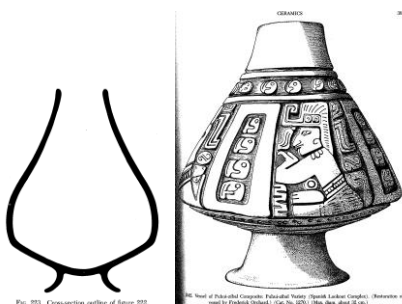


FIG. 222. Cross-section outline of figure 222.

FIG. 223. Head of Polychrome Ceramic, Polychrome Pottery (Spanish Lookout Complex) (Illustration of vessel by Frankland 1965) (See fig. 223) (From fig. 223 of 223)



These are MG 427 sherds from bichrome and polychrome vessels. [Liznote: Fill of Bur MG 14/40 or fragmented primary vessel?]



This jar is MG 438 and is from Op 23-4, Str. 18. Used to have an applied face, but it has fallen off. [Liznote: See the report, above, but this was found near a burial but could not be clearly associated with it.]



MG 438 Ulua marble fragment from Op 23-4, Str. 18. See Luke and Tykot (2007): Late to Terminal Classic "Ulua marble vases (ca. 600/650-800/850 a.d.), [are] the hallmark luxury good from the lower Ulua Valley of northwestern Honduras"

Isotopic Analysis of Newly Discovered fragments of an Ulua Valley Marble Vase at the Maya site of Pacbitun, Belize. Journal of Archaeological Science Reports (Skaggs, et al. 2019)

See Gordon 1921 (Gordon 1921)



This might be a Fine Orange imitation (shape) but it looks like slateware (motifs) (Brainerd, Fig. 72 shows slateware forms that copy Fine Orange. Classified as Thin Slate Ware: This Slate Ticul Group: **Tabi Gouged Incised** (Robles, Coba p. 205, Smith 1971). See also Puuc Slate in Brainerd Fig 47 p. 204, Fig 57. See also Edzna Pocyaxum Gouged incised same forms and decoration as Tabi. See Also Holtun Gouged Incised (Chichen Red Ware) Smith 1971:Fig20u.

See Vallo 2002 Tafel 119 for distribution map. Closest to MG are -6:Calderitas and 16 Colha (where the chert comes from) Vallo 2002 Tafel 79 shows bowls there are more examples e.g Fig 82 12

Connor 1983: 172: "COMPARATIVE: Important Cehpech Ceramic Sphere type (see general comparative discussion for Ticul Thin Slate: Xelha Variety). Tabi Gouged-incised: Tabi Variety is well represented in northwestern Maya Lowlands, including Uxmal, Kabah, and Labna (Brainerd 1958:Fig. 50, i,[1-3]; Smith 1971:154-156), Acanceh (Brainerd 1958:Fig. 18 j), and other sites (Brainerd 1958:Fig. 61, b,e,f, j). The Muyil Variety is considered by Robles (1980: 243) to have primarily a northeastern peninsula distribution. Well-represented at Coba (Robles 1980:242-243). Also present at Tancah (Sanders 1960:Fig. 11, ~[61]) and El Meco (Robles 1980:243)."

Robles 1990 Fig 46, 47

Robles 1990: 207 "Reportado en: Tancah (Sanders, 1960: fig. 11 a, 6; Smith, 1971: fig. 1 OK). El Meco (Robles, en elaboración). en el norte de Quintana Roo. En Uxmal (Smith, 1971: fig. 7t), aunque en un porcentaje muy bajo (FRC-INAH)."

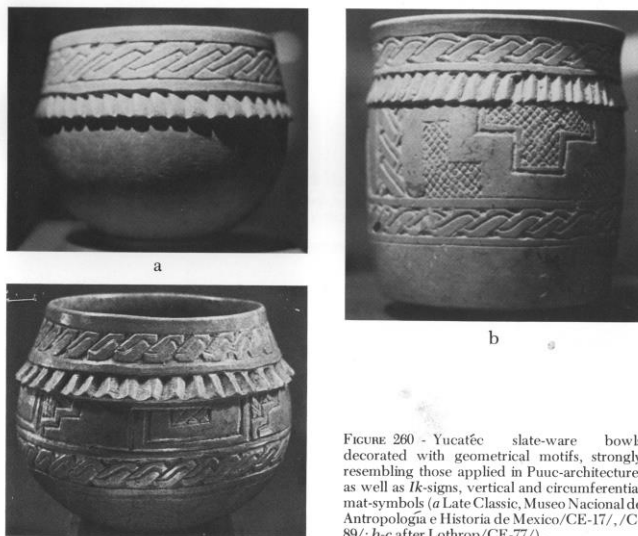


Figure 260 Yucatec slate-ware bowls decorated with geometrical motifs. . . a) Late Classic, Museo Nacional de Antropología e Historia de México/CE-17/,/C-89; b-c after Lothrop/CE-77.

FIGURE 260 - Yucatec slate-ware bowls decorated with geometrical motifs, strongly resembling those applied in Puuc-architecture, as well as Ik-signs, vertical and circumferential mat-symbols (a Late Classic, Museo Nacional de Antropología e Historia de México/CE-17/,/C-89; b-c after Lothrop/CE-77/).

Smith 1971 29-30 : “Brainerd gave this ware the same name and he illustrated (1958, p. 53; figs. 4, p; 10, h; 15, i, s; 18, j; 21, d; 32, d, e; 35, e; 48, b, d-m {possibly}; 50; 51, a-c; 61, b, e, f, j, l) most of the types. Paste composition. Fine texture, mostly saccharoidal calcite temper, and usually the same color as slip, although a few have red paste. Surface finish. Unusually well smoothed, slipped, and polished with medium luster, less waxy than Puuc Slate Ware, and generally free from blemishes except for vertical crazing which is common to all deep vessels. Other blemishes rarely encountered are fire-clouding and dendritic purple markings. The slip color is generally gray to cream, usually lighter than Puuc Slate Ware. Color readings: gray (10 YR 6/2, 7/1, 8/2; 2.5 Y 7/2), beige (10 YR 7/3), **cream (2.5 Y 8/2)**, and light brown (10 YR 6/3) usually associated with Chichen Itza.

Ticul Thin Slate from Ball 1977: 38 (Becan): “Description: Fine textured, compact, light gray paste. Fine crystalline calcite temper. Surface slipped in soapy, light brownish gray 2.5YR6/2, through light yellowish brown 2.5YR6/4, light olive gray 5Y6/2, and olive 5Y5/3, with occasional fire-clouded areas of brownish yellow 10YR6/6. Weathered slip often appears as cream (pinkish gray) 7.5YR7/2. The slip is well-bonded and extremely hard. Vertical crazing and rootlet marking occur with rarity; fire-clouding is relatively common.”

See also Fine Orange Holtun Gouged Incised.



MG 458, Polychrome bowl with glyphs. [Liznote: from Op 23-2, Str. 14).



MG 485 Black-on-Orange
Possibly **Marvelita Black-on-orange**,
a new type name at Lamanai, 2023.



MG 498 Plumbate face vessel.
[Liznote: From Str. 18, Op 23-4;
probably originally associated
with a burial but too much
disturbance of human bones to
provide a solid association.]
Classified as **Tohil Plumbate**
(possibly **Malactan Modeled**).

Important Lots

MG427/7

Scribe burial [Liznote: Bur MG 14/40] Has the gourd vessel and polychromes. There is an orange polychrome and also a black and orange dish. The black and orange dish is like Lamanai Late Classic. The black and orange predates the polychrome at Lamanai but they both have the cartoonish animals. There may be some kind of creature in the middle of this dish, but it is very hard to figure out. The orange polychrome dish has medial ridge which would suggest it is early Late Classic.

MG474

This lot was located under a plaster floor and seems to be one of the few sealed contacts at Marco Gonzalez [Liznote: MG 474 is floor ballast—underlay the plaster surface, now heavily damaged, once capping the lower terrace face, Op 23-1; plaster itself is quite fragmented but the sherds from this lot were caught up in the terrace's construction. Jim's observation that the deposit is Buk-like tells us it's Terminal Classic/Early Postclassic and therefore probably post-dates the original Str. 14 platform construction.] It is a very typical Buk era deposit with lots of Tsbak unslipped, Zakpah group, including chalices, censers, bowls, and even possibly a jar rim. There are some coconut walk on slipped rims and body sherds. One of the things that interesting about the Tsbak is that there are curvier forms and more angular forms so I wonder if the Tsbak gets more angular through time.

MG480

This is a very well preserved lot from Structure 14. It's especially important for the wide variety of well preserved Zakpah group sherds in it.

Salt production

MG458

This is one of the upper levels of salt production. [Liznote: Str. 14, Op 23-2?] There is a coarse coconut walk on slept. There's also some black and orange, but what is the most noticeable is the big increase in striated body sherds

MG476

This has the really big incurving jar rim and then another arrowhead rim jar. Also probably a trickle wear a couple of black and orange and an orange polychrome. Also a big Subin red incurving bowl like mg 373 and 365z This has that really big incurving jar rim and then another arrowhead rim jar. Also probably a trickle ware, a couple of black and orange sherds and an orange polychrome. Also a big Subin red incurving bowl like the one in lot 373 and 365.

MG492

Possible slate ware. Black bowl cwu etc

MG493

Lots of Coconut Walk Unslipped. There is a black and orange body shirt and an orange, polychrome body shirt and an orange polychrome rim. There is a very big bowl that might be coconut work on slipped because it has the orange paste. There is a possible slate ware exactly like lot 492.

MG494

The Coconut Walk Unslipped is noticeably thicker and better made in these levels. There is a tan or orange, polychrome sherd and what I have entered as an achote black sherd. There also may be a coconut walk unslipped jar rim.

Lamanai

1) Lamanai: Urban Soils and Land Use Project – 2023 Fieldwork Report (*Francesca Glanville-Wallis*)

Introduction

The 'Lamanai: Urban Soils and Land Use' project aims to examine the character and development of urbanism and urban land use at the Maya site of Lamanai, Belize and investigate the long-term impact of land-use change on soils, past and present. The fieldwork described below, carried out at the site during the 2023 field season, forms part of ARHC LAHP (London Arts and Humanities Partnership) funded doctoral research. Permits for fieldwork were kindly provided by the Belize Institute of Archaeology.

Research Objectives and Questions

The primary objective of the project is to understand the character of urban land use at Lamanai and its development over time, and to examine the impact of different land uses on soils and the landscape more broadly. In order to address the aims of the research, the following questions are posed:

- (1) What are the main landforms and soils units on site? What are the key factors and processes affecting pedogenesis across landforms/soil units?
- (2) In what way, and to what degree, have past land-use practices and associated human activities (deposition of materials, compaction, surface sealing, translocation of sediments, burning, construction, cultivation etc.) impacted the physical and chemical properties of soils and sediments?
- (3) Can different practices and activities, and their impact, be linked to various urban land-use types (civic/administrative, elite residential, non-elite residential, transport, waste disposal, open/green spaces, forest/kitchen gardens, agricultural etc.)?
- (4) Can different trajectories of land use and soil formation be identified across the landscape?
- (5) In what socio-economic contexts do observed land-use changes occur? Can any drivers of land-use change be inferred, based upon previous research at the site and the broader Maya Lowland region?

2023 Field Season

A reconnaissance carried out 2022 enabled the identification of the main landforms and soil units on site. This, together with further desk-based research, allowed for a catena to be pin-pointed, along which representative landforms and soil units, and potential past urban land uses and human activities (including civic constructions and plazas, non-elite residential constructions, open/green spaces and potential forest gardens) could be studied to explore the variability of soils across the urban landscape. Fieldwork in 2023 comprised the excavation of a series of test-pits, supplemented by sediment cores, along an SE-NW trending transect, positioned to sample 1) the different topographic positions and the

different vegetational zones that characterise the landscape at Lamanai, and 2) areas representative of different land uses. Areas explored included the shore of the lagoon, civic-ceremonial structures along the lagoon, plazas and areas between structures as well as more peri-urban areas. The transect was positioned in the northern sector of Lamanai archaeological site, starting from the edge of the New River lagoon (to the East of Structures N9-56/the Mask Temple and P9-2) and extended NW, towards Structure N8-16 (Fig. 1).

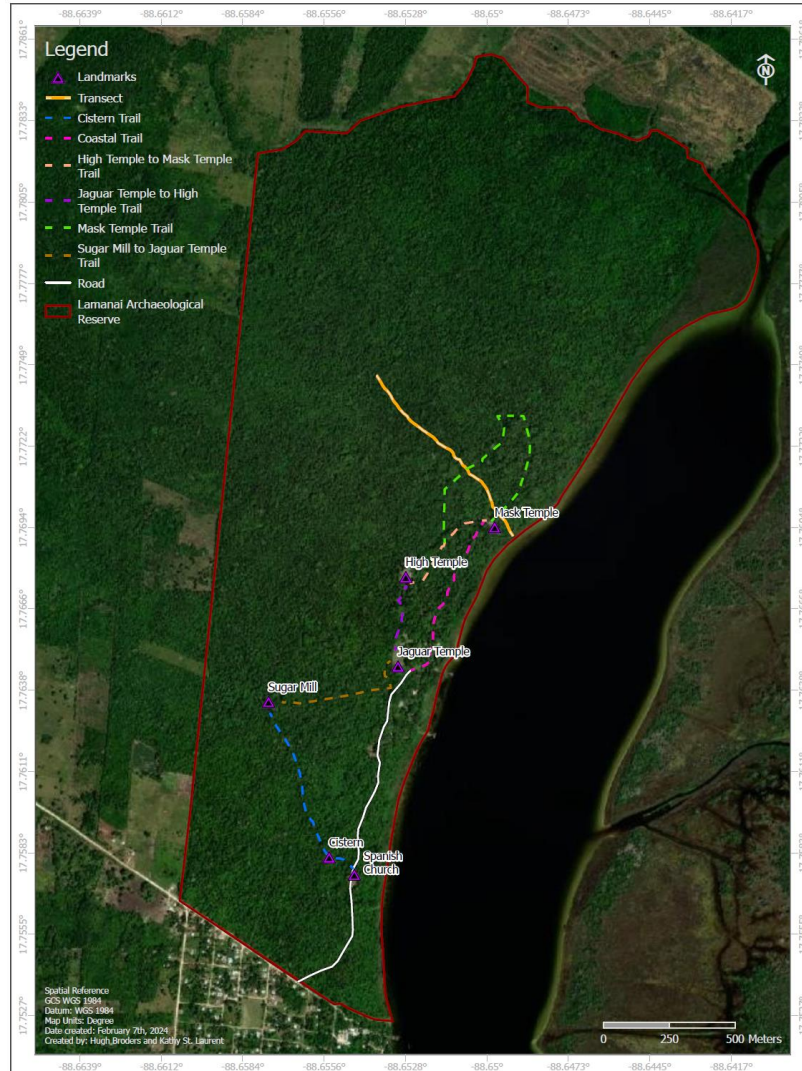


Figure 1. Location of transect (in orange) along which test-pits were positioned. [Image: Broders and St. Laurent 2024]

Field methods comprised the stratigraphic excavation of test pits focusing on the study of soil profiles. The locations of test pits were recorded using both GPS co-ordinates (using Compass 55 and Google Earth) and, as the accuracy of the GPS was problematic due to the canopy, relative to mapped structures. Test pits were excavated stratigraphically and recorded following standard single context conventions. Soil profiles were studied, described and drawn in the field and sampled for undisturbed and bulk sediment samples. Sampling for soil micromorphology (undisturbed sediment samples) focused on the collection of samples extending from the topsoil to bedrock. Whilst the best attempts were made to sample so as to gain (semi)continuous sequences, this proved difficult in practice due to the nature of the sediments and sampling was thus focused on recovering samples from the different excavation units. A series of bulk sediment samples (~150g) were

collected from soil profiles, in ~10cm increments. When the 10cm increments fell on horizon/excavation unit boundaries, the increments were adjusted to avoid boundary interfaces, as samples from these locations would likely provide results from mixed contexts and thus not provide useful information. A parallel (to the bulk samples) series of 100g sediment samples were also taken for phytolith and carbon isotope analysis, ensuring that measures were taken to avoid contamination of samples. Further surface samples were taken several meters from each test pit, in an area that had not been cleared for excavation, to provide information on current plant species. At the end of the field season, a topographic survey was conducted using a dumpy level along the transect, from the reeds along the lagoon where the first sediment core was taken to the location of OP23-7 (see **Figs. 2 and 3**).

All sediment samples collected were packed and sent to the Belize Institute of Archaeology for export permits to be acquired. Samples were then exported from Belize to the UK for laboratory analysis at the Institute of Archaeology, UCL.

Summary of Operations

Nine operations were carried out, consisting of six test-pits and four sediment cores (see **Table 1** and **Figures 2 and 3**) positioned along the transect described above.

Table 2. List of Operations carried out in 2023 at Lamanai, with the coordinates of the operations, the type of operation (test pit or soil auger core) and the type of vegetation present.

Operation	Year	GPS Coordinate	Operation Type	Vegetation Type
1	2023	17°46'8.88"N, 88°38'57.01"W	Core	Reeds
2.1	2023	17°46'9.17"N, 88°38'57.15"W	Core	Logwood
2.2	2023	17°46'9.17"N, 88°38'57.15"W	Test-Pit	Logwood
3	2023	17°46'9.35"N, 88°38'57.28"W	Test-Pit	Logwood
4	2023	17°46'9.70"N, 88°38'57.43"W	Test-Pit	Broadleaf Forest
5	2023	17°46'10.15"N, 88°38'57.64"W	Test-Pit	Broadleaf Forest
6	2023	17°46'14.22"N, 88°39'0.01"W	Test-Pit	Cohune-dominated Forest
7	2023	17°46'16.26"N, 88°39'1.66"W	Test-Pit	Broadleaf Forest
8	2023	17°46'23.32"N, 88°39'9.70"W	Core	Bajo
9	2023	17°46'25.09"N, 88°39'11.24"W	Core	Broadleaf Forest



Figure 1. Satellite image showing the location of the 2023 operations at Lamanai, positioned along the transect shown in Figure 1. The location of the Mask Temple is shown in yellow.

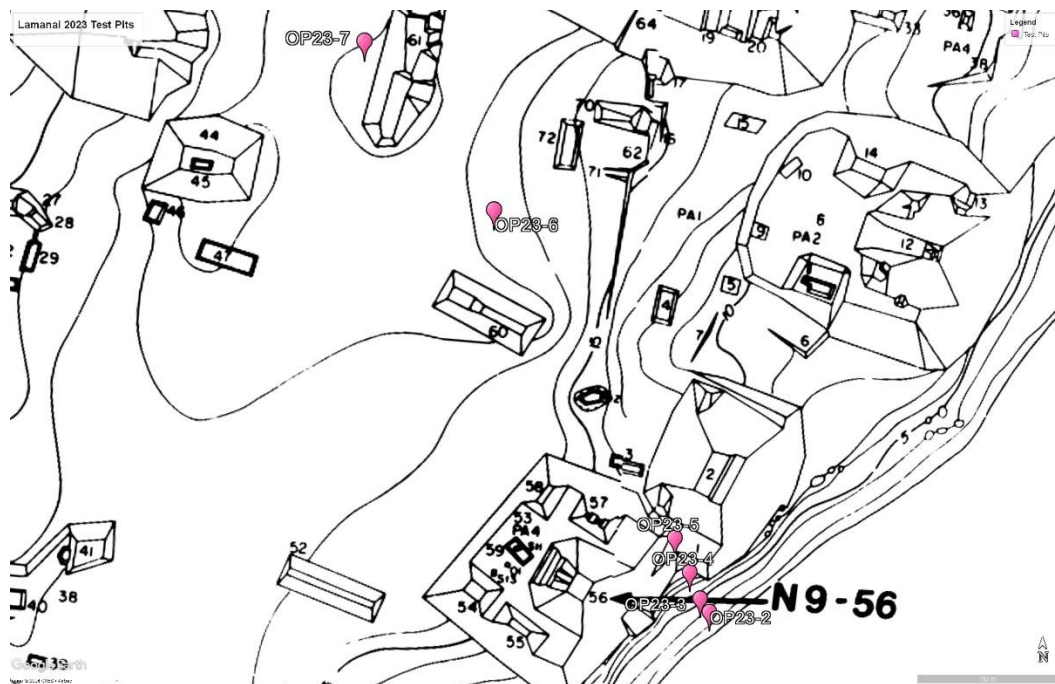


Figure 2. Locations of the test pits excavated in 2023 at Lamanai, relative to the Mask Temple and other nearby structures located in the northern centre of the site [adapted from the Lamanai map by Stanley Loten and Claude Belanger]

OP23-1

OP23-1 comprised a sediment core collected using a soil auger with a gouge auger head, positioned along the western edge of the lagoon, roughly 15m from the water's edge, in a zone characterised by reed vegetation. The core was taken to a depth of 83cm below surface (b.s. henceforth) until the auger could not penetrate any further. The resulting soil profile consisted of a 24cm thick, black, clayey silt A horizon grading to a 16cm thick, black, silty clay A2 horizon above a light brownish gray, sandy silt C horizon. Sediments became saturated with water at a depth of ~50cm, indicative of the water table level in this area. No anthropic materials or evidence of human activity were observed. Bulk sediment samples from each horizon were collected for further laboratory analyses.

OP23-2

OP23-2 comprised two sub-operations - OP23-2.1 and OP23-2.2 - located 14m NW of OP23-1 where the fringe of reeds transitions to a band of logwood. OP23-2.1 comprised a sediment core taken to a depth of 49cm b.s. until the auger (with gouge-type head) would not penetrate further. OP23-2.2 comprised a test-pit measuring 1mx1m positioned directly next to the location of the sediment core (see fig. 4). The resulting soil profile comprised a 10cm thick, black, organic-rich sandy loam A horizon above a 7cm thick, black, silty clay A2 horizon. The latter formed a clear, abrupt boundary with the underlying C1 horizon. The C1 horizon comprised a layer of light gray, silty loam, lying above a C2 layer made up of very small (~1mm) shells in light brownish gray sediment. The lower part of the profile consisted of a silty loam, light gray C3 horizon, very similar in character to the C1 horizon. The test pit was excavated to a depth of 36cm b.s., with the exception of the NNE corner which was excavated to 48cm b.s. for additional sampling, reaching the water table.



Figure 4. SSE facing soil profile of OP23-2.2 in the logwood vegetation zone on the western shore of the New River lagoon.

OP23-3

OP23-3 comprised a 1mx1m test-pit, located in the logwood zone at the base of scarp slope that leads to the platform P9-1 (between structures N9-56 and P9-2). The test-pit revealed a very different soil profile to that of OP23-2, only 6m away. The profile (see fig. 5) comprised a 9cm thick black, silty loam A horizon, with very frequent large (~5cmx5cmx4cm) gastropod shells (Apple snails). The latter horizon was underlain by a 14cm thick, black, silt (AC?) layer with very frequent small stones (between <1cm and 3cm wide) that increased in frequency with depth and very small shells (similar to those of the C2 layer OP23-2), as well as frequent larger gastropod shells (~5cmx5cmx4cm).



The surface horizons described above were formed above a layer of rubble or construction debris. It is unclear at present whether this was formed *in situ* as a result of collapse or whether it represents rubble that has been transported from further up-slope. The layer underlying the rubble/collapse layer comprised a layer of small pebbles, not dissimilar to ballast-type layers, suggesting that the rubble layer may then be *in situ* collapse of a construction layer. Block and bulk sediment analyses of these deposits should shed light on their formation.

Figure 5. SSE facing section of Op 23-3.

Below the possible layers of construction rubble, lay a concentration of medium to large stones in the WNW corner of the test pit with the possible remains of a compacted surface (with Preclassic pottery embedded within) in the SSW corner of test pit. As with the overlying layers, due to the restricted size of the test pit and the proximity to the water table (sediments were very wet and have been impacted by repeated water movement), the nature of these deposits is unclear. They may represent the remains of construction or collapse and an ancient surface or, alternatively, a mix of rubble having moved from upslope with a discrete area of compaction due to compression of sediments by overlying layers with the large underlying boulder found in the SSW of the pit. Whilst the test pit is too small to determine the exact nature of these deposits, again, soil micromorphological analysis of samples taken should shed light on the nature of the deposits.

The lower part of the test pit consisted of a series of silty gravel and clay layers with frequent fragments of plaster, charcoal, pottery sherds (Preclassic pottery). These series of layers likely represent refuse or sedimentation from the downslope movement of materials from

refuse disposal activities further upslope, such as those described in the lower profile of OP23-4 (see description below). These sediments encased large boulders exhibiting surface weathering from water (pitted surface textures). The water table was reached around 120cm b.s. and made further excavation unfeasible. Although the size of the test pit and the disturbance by water renders the contexts described above difficult to interpret with any certainty, and further open-area excavation is needed to investigate past land use in this area alongside the lagoon's edge, soil micromorphological analysis and bulk sediment analyses will shed light on the sedimentary and archaeological processes that have formed these deposits.

OP23-4

OP23-4 was located on the slope of the scarp leading up to the platform P9-1, in a zone with Broadleaf forest vegetation. The resulting profile (see fig. 6) comprised a 12cm thick very dark brown, silty clay A horizon, grading to a dark grayish brown, silty clay AC horizon with frequent small stones. Below the latter, lay a layer of construction debris/collapse above core fill comprising limestone and chert stones of varying sizes (medium to very large) encased within light olive brown, silty clay.

This core fill was constructed upon a levelled layer of refuse comprising gray, clayey silt with very frequent domestic waste materials including pottery, some bone fragments, charcoal and possible ash. Initial field observations of pottery suggest a Preclassic date to these deposits. Linear and bedded features in section indicate that this layer was formed by discrete areas/events of refuse disposal. Below the latter lay an earlier, darker clayey silt layer also with domestic refuse materials. The deposits of refuse located in the southern part of the test pit showed considerable post-depositional disturbance and mixing by roots. These deposits lay directly above bedrock comprising Sascab and harder limestone nodules, with occasional pockets of clay and pale brown, silty clay sediment veins. Excavation of this test pit was ended at a depth of 1.92m b.s.



Figure 6. Southeast facing section of Op 23-4.

OP23-5

Test pit OP23-5 was located on platform P9-1, on the lagoon-side of structure P9-2. The initial test pit measured 1m x 1m but was moved southwards and at a depth of 27cm b.s. extended to 1.5m x 1m so as to position the test pit on the shoulder of the platform and to preserve the upper weathering surface of the platform. The resulting profile (see fig. 7) comprised a 9cm thick, very dark brown, silty clay A horizon with some pottery fragments, stones above a layer of rubble underlain by finer sediment. The surface of the platform was reached below this latter sediment at a depth of 27cm b.s. in the northern half of the test-pit and comprised weathered flat-lain limestones including cut limestone, as well as remains of plaster and fragments of stucco. Below the weathered surface of the platform, the core fill consisted of large limestone (including burnt limestone) and chert stones in lime-based mortar. Below this lay an earlier phase of construction, possibly representing an earlier platform surface, comprising very large limestones and chert stones, as well as occasional granite stone, in lime-based mortar. No finds were recovered from the core construction levels other than a single very small sherd. The lowest part of the excavated profile, below the platform core, consists of earlier construction of what appears to be stairs facing southeast, running perpendicular to the Mask Temple. Open excavations would be needed to determine this and excavation of this test pit was terminated at this level, at a depth of 1.90m, to allow further excavations at a later date to explore this earlier construction and its relationship to Mask Temple and P9-2.



Figure 7. East-facing section of Op 23-5.

OP23-6

The test pit was located in a more or less level area under cohune-dominated forest, northwest of test pit excavated in 2022 (OP22-1). The profile comprised a 20cm thick, black, silty clay A horizon (possibly A1 and A2) above dark grayish brown layer with frequent stone and pottery fragments. There is evidence of disturbance in the latter layer although it is unclear from excavation alone whether these are cut features or post-depositional disturbances such as tree throws and roots. Analyses of the undisturbed block sediment sample from these contexts will give an indication of the nature of the features. These lay above a more compact pale brown, clayey silt layer with pottery fragments and bits of burnt and unburnt plaster and a concentration of stones forming layer at the bottom suggesting that this may have been a constructed packed-earth surface.



Figure 8. Northeast-facing section of Op 23-6.

Below, two earlier plaster surfaces were recovered. Both constructed surfaces consist of a lime plaster layer constructed above a ballast layer of small stones. Below the plaster and ballast layers, lay a palaeosol or ancient land surface which consisted of a buried, thick, dark grayish brown A horizon with frequent charcoal and pottery fragments. This buried A horizon graded to a very dark grayish brown colour above a buried dark yellowish brown clay B horizon containing large rocks and boulders. The boulders were too heavy to move manually so excavation of the test pit was terminated at this level at a depth of 1.69m b.s.



Figure 9. Southeast facing section of OP23-7.

OP23-7

The final test pit excavated during the 2023 field season was located at the base of Structure N9-61 (see fig. 3). The profile comprised a ~25cm thick A horizon above two plaster surfaces, both constructed on layers of stone ballast (see fig. 9). The upper-most surface comprised a relatively thin (3-5cm) plaster layer above a 10-15cm ballast layer comprising small-medium stones, chunks of burnt and unburnt plaster, and dark grayish brown, silty clay sediment. Below this lay an earlier plaster surface consisting of a 20cm thick lime plaster layer above a ballast layer made of small, medium and large stones and rocks mixed with recycled bits of construction debris (such as chunks of burnt and unburnt plaster) and occupation refuse (pottery fragment) with little, light brownish gray sediment, mostly settled in the lower part of the layer.

Burnt plaster fragments were especially concentrated in the south corner of the test pit, on the surface of the deposit. The base of the ballast layer lay above a grayish brown and pale yellow/brown layer which may represent an older, highly weathered/degraded surface. Soil micromorphological analysis of the undisturbed sediment sample taken from this layer should shed light on this.

Below the construction layers described above, lay a possibly buried surface. Frequent small fragments of anthropogenic material including pottery, charcoal were recovered within the sediment matrix but it was not immediately clear whether this was a fill/deposit (i.e. sedimentary) or whether it was a buried soil surface or truncated soil. The paler appearance and higher concentration of anthropic material compared to the palaeosol of OP23-6 may be related to the nature of anthropic activities taking place and the underlying weathering limestone found in this area. Although a large boulder was recovered within this layer in the southeast of the test pit (similar to the boulders found in the palaeosol of OP23-6), sascab was found to be underlying the layer in the north of the test pit. As with OP23-6, the boulder was too heavy to move and excavation was terminated once sascab was reached in the northern part of the test pit at a depth of 1.77m b.s.

OP23-8 & OP23-9

Two further sediment cores were taken - OP23-8 and OP23-9. The purpose of these cores was to explore soil augering/coring methods that would be suitable to the soils found on the dip slope of the escarpment. Whilst the soil auger with a gouge head proved useful for the soft sediment along the lagoon edge, soils to the west of the site are often more compact and stoney and, as determined in previous years, harder to core. Different Dutch auger heads were used as well as a post-hole digger to determine the most suitable methods of coring in this area to examine soil profiles. The post-hole digger was found to be suitable for surface soils whereas the combination auger head proved suitable to augering stoney sediments and compact clays.

OP23-8 was taken from an area exhibiting vegetation characteristic of *bajo* areas, situated to the Northeast of N9-30, next to a depression feature, most likely a natural *aguada*. The resulting profile was similar to that of OP22-6, taken in a *bajo* area during the 2022 season. The profile comprised a black, sub-angular blocky, silty clay A horizon grading to very dark gray, sub-angular blocky clay soil structure over the top 20cm which remained so until 60-70cm b.s. No coarse material was visible in the core, from surface to 60cm b.s. Between 60 and 70cm b.s., redoximorphic features were visible and the structure became massive with dark gray and light yellowish brown mottling and white-coloured concretions.

The OP23-9 core was taken further to the NE of OP23-8, in an area under Broadleaf forest vegetation. The resulting profile had a black, sub-angular blocky breaking to crumbly A horizon grading to very dark gray over the top 20cm of the core. The sediment between 20-50cm consisted of very dark gray, sub-angular blocky clay with 7-15% coarse fraction (>2mm) material before becoming massive, very dark gray clay with 1% coarse material. At depth of 70-80cm b.s., redoximorphic features were visible with light yellowish brown mottles (15% in the upper 5cm increasing to 50% in the lower 5cm) within the very dark gray, clay matrix. Pale gray concretions were also present.

Concluding Remarks

The series of test pits and sediment cores excavated at Lamanai during the 2023 field season have shed light on the degree to which the landscape has been formed by long-term changes in urban land use. Whilst detailed bulk and soil micromorphological analyses of samples collected during both the 2022 and 2023 seasons, together with C¹⁴ dating, phytolith and carbon isotope analyses, are needed to determine the nature, impact and timing of past urban land uses at Lamanai, a number of remarks can be made based on field observations and the soil profiles resulting from test pit excavations.

First, the impact of long-term construction activities on the topography of the Lamanai area is evident. Areas of presumed 'natural' surfaces or natural topography such as the scarp alongside the lagoon to the east of the Mask Temple are either constructed or the result of anthropic sedimentation. Together with the information gained from the test pits excavated in 2022, it has also become clear that land use and constructed surfaces in areas around and between buildings is not easily discernible from surface explorations and sub-surface excavation is needed to examine land use between buildings. The profiles excavated indicate that the use of areas between building changed over time and the particular use of an area at any one time is not identifiable from the surface.

Second, the palaeosols revealed in OP23-6 and the one from last season's OP22-2 are of particular interest to understanding early land use at the site and the development of urbanism. Preliminary field analysis of pottery found within these buried surfaces suggests a Preclassic date although C¹⁴ dating of carbon samples taken from both test-pits will provide more precise dating. Analyses of block and bulk sediment samples, together with carbon isotopes and phytolith analysis, will also provide information of land use and vegetation cover including evidence for cultivation, agriculture and/or land clearance during the early phases of occupation of the site. It is also hoped that analyses of samples taken from the upper-parts of the soil profiles, above lime-based construction levels, will also provide information on urban development during the Classic—Postclassic transition at Lamanai and the changes in urban land use that took place during this transition, both along the lagoon to further inland.

Third, the findings from OP23-3, OP23-4 and OP23-5 are pertinent to the role of the lagoon in the development of urbanism at Lamanai. The refuse deposits followed by later construction layers revealed in OP23-4, and the possible construction layers of OP23-3, alongside the lagoon, to the east of the Mask Temple and Structure P9-2, suggest a changing use of this area from a dump site during the earlier phases of occupation of the site to an area used for lagoon-related activities with implications for the socio-economic roles of the Mask Temple and Structure P9-2. Furthermore, evidence of earlier stairs associated with Mask Temple (below the P9-1 platform core), heading towards lagoon indicate a possible use of the structure associated with lagoon activities. Most of the research in the area has focused on excavation of the west facing sides of the monumental structures but the findings from test pits indicate that more research is needed on the lagoon side to determine the function of the buildings and the role of the lagoon in the development of urbanism in this area.

Finally, the soil profiles clearly demonstrate that the present-day forest at Lamanai has formed on a substrate influenced by past human activities and changing land uses. Analysis of the physical and chemical properties of the soils under different types of vegetation will not only contribute to our understanding how these past land use and activities have influenced the formation of surface soils but also the relation between past land uses and the composition of the modern forest. Analysis of phytolith assemblages, as well as carbon isotope analyses, from different stratigraphic units along soil profiles, will give an indication of how the vegetation on site has changed through time as a result of different land uses, and how today's forest vegetation compares to that prior to Maya urbanisation.

To conclude, once analyses of samples collected from the excavation of test pits described above have been completed, the project will provide a stratigraphic record of this part of the site, documenting the changes in land use and land cover that have occurred over time across the landscape and will contribute to our understanding of the development of urbanism during the different periods of Lamanai's history and the influence of changing urban land uses on the landscape, including the formation of the soils that now blanket the site and support the present-day ecosystem.

2) Follow-up LSF at Lamanai (*Michael Pittman*)

In 2023, I collected follow-up pXRF data to accompany laser-stimulated fluorescence data that I had collected the season before on a sample of the Lamanai ceramics. I also collected physical samples to run chemical analyses back in the lab. These data will be used to interpret the origin of otherwise hidden chemical information found under laser-stimulated fluorescence, e.g. the chemistry of detected remnant paint. I also conducted laser-stimulated fluorescence experiments at Marco Gonzalez to explore its potential use during excavations as a tool to record cryptic information e.g. fine-scale stratigraphy and chemical halos around buried objects. We are not sanguine that LSF can contribute much to the interpretation of stratigraphy in the way its detection of chemistry can help in defining the ways ceramics were made or decorated, but results from Marco Gonzalez remain, at this point in time, to be examined and analysed.



Photo shows Mike conducting pXRF (portable, non-destructive XRF) on ceramic samples in the lab

3) Revisiting the Polychromatic Stucco of Lamanai, Belize (*Gabriela Saldaña*)

Introduction

In the spring of 2023, a pilot study was conducted to assess the feasibility of undertaking a comprehensive documentation and iconographic analysis of the polychromatic stucco fragments found at the archaeological site of Lamanai, Belize. Over the course of two weeks a selection of stucco fragments was subjected to metric analyses, chromatic documentation, photography, photogrammetry, and preliminary iconographic analyses. The study was conducted as part of the Lamanai Archaeological Project under the direction of Dr. Elizabeth Graham, and with the permission of the Director of the Belize Institute of Archaeology, Dr. Melissa Badillo. The pilot study yielded significant results, which are reported below.

The primary objectives of this study are to further develop the groundwork laid by initial studies of the stucco (Shelby 2000). This includes placing additional emphasis on photographic and photogrammetric documentation, for the purposes of documentation, assessment of state of preservation as well as to eventually develop the possibility of 3D reconstructions in virtual space. Furthermore, I seek to provide detailed and empirical documentation of the polychromatic pigmentation. Ultimately, the study will also produce a more comprehensive iconographic analysis, focusing not only on individual elements but also on the various pictorial registers of the entirety of the original facade.

Background: Context and Summary of earlier work

During the 1981 and 1982 field seasons, Dr. David Pendergast of the Royal Ontario Museum, discovered a large assemblage of polychromatically painted fragments of a modeled stucco frieze, from the upper zone of Structure N10-28 (Figure 1). The frieze had been extensively destroyed by the Maya (Pendergast 1986: 231-232), with its fragments recovered south (facing the plaza) and west sides of the building. Boulder core of a subsequent Terminal Classic plaza floor served to seal the fragments. In all, circa 2000 fragments of stucco have been identified, but a more rigorous documentation project would be required to complete the inventory properly and determine the number of pieces in the collection. The fragments of stucco range in size from about 5 cm to larger pieces measuring some 36 cm long. Numerous anthropomorphic forms and profiles are present, many of which are larger than life size. In addition, glyph-like elements, borders, headdress fragments, saurian imagery, supernaturals, and other iconographic motifs and decorative forms have also been identified.



Figure 1: A selection of stucco fragments, as originally found, in situ (photos by the Lamanai Archaeological Project).

Structure N10-28 is located in Plaza N[10-3], a palace complex (known as the Ottawa Group) (**Figure 2**). The complex consists of residential and administrative buildings that date to the Late and Terminal Classic, although there is evidence of earlier construction that could not be excavated without dismantling the later buildings, as is typical of such complexes, numerous modifications were made to the structures. In fact, at one juncture, the bulk of the upper facade of Str. N10-28 was subject to partial demolition, reducing to fragments the stucco frieze that once adorned the building. Demolition took place at some point in the

Late to Terminal Classic transition to make way for other construction (Graham 2004; Shelby 2000a, 2000b). The upper portions of the structure and the remains of the stucco facade were used as construction core and thereby buried by later architecture. The inclusion of these fragments in the core, and beneath later construction materials, fortuitously enabled their preservation, and particularly their original pigmentation. The bulk of the materials from this context were assigned the lot designation of LA 1103. Although the majority of the stucco pieces likely adorned the primary southern facade of Structure N10-28, subsequent discoveries of stucco materials in the alley that separated N10-28 from the neighboring N10-15 indicate that the western and possibly eastern sides of the structure were once also embellished by smaller decorative zones.

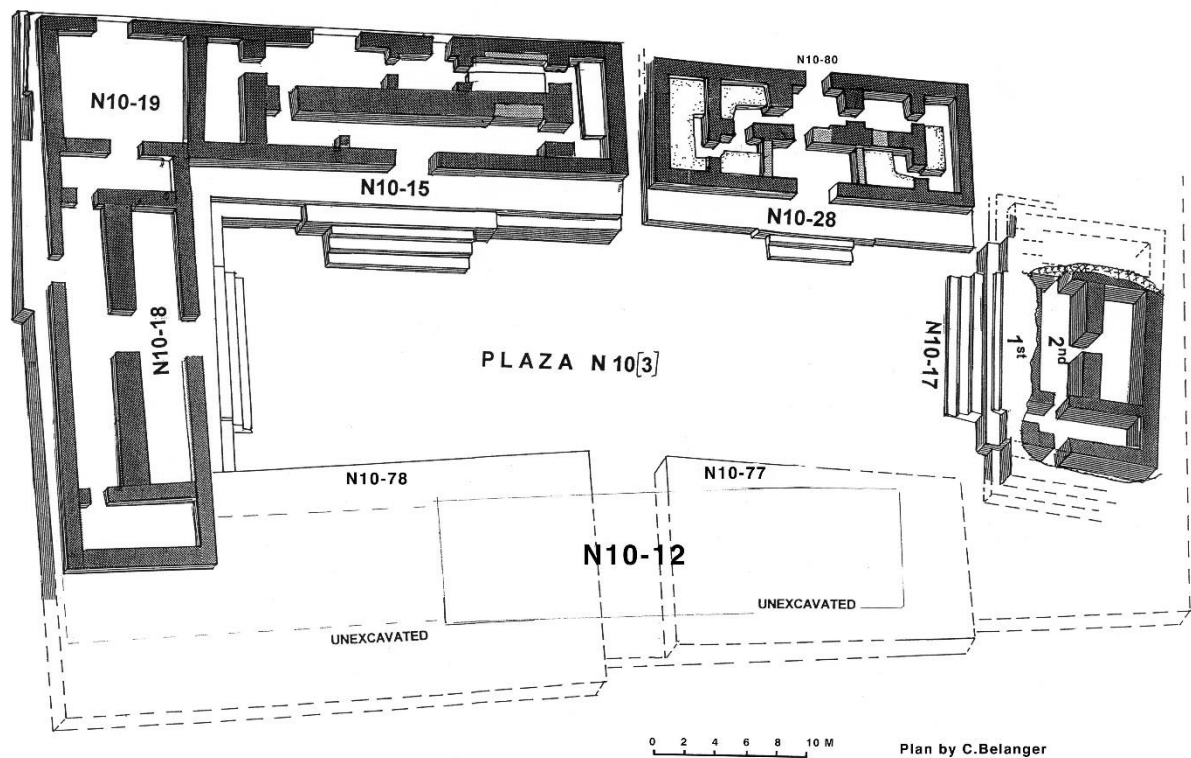


Figure 2: Isometric projection of the Ottawa Group (N10[3]) showing the location and ground plan of Str. N10-28 (plan by Claude Belanger).

Between 1998 and 2000, Thomas Shelby, then attached to the University of Alabama Museums, conducted a series of preliminary analyses of the stucco materials. The research was financially supported by the Foundation for the Advancement of Mesoamerican Studies, Inc., and summaries of his work can be found in the reports he submitted to the foundation (Shelby 2000a) and to the Lamanai Archaeological Project (Shelby 2000b). During the initial 1998 season, approximately six hundred pieces were processed. These fragments included both nondescript pieces and those with finished surfaces but were too small and indistinct to be categorized in any specific way. Bulk weights were recorded using a basic scale, estimating the combined weight of the fragments at approximately 219 kilograms (Shelby

2000a: 17). In contrast, the 2000 field season was primarily focused on the analyses of individual stucco fragments and the review of additional fragments that remained to be cataloged (Shelby 2000b). By comparing these fragments with the rest of the collection, the pieces of the western facade could be isolated and reassigned to their original pictorial groupings. By the end of the last season, as many as 2000 stucco fragments had been identified and stored in the site bodega.

Some work was also dedicated to examining the intricate designs delicately painted on many of the fragments, with some of them photographed for documentation purposes. A significant portion of the fragments within lot number LA 1103 were measured and sketched. Despite the limitations imposed by short field seasons, some significant advances were made. Although the analyses were never completed, it was hoped that a complete analysis would provide the framework for a substantive contribution to the study of Late Classic Maya iconography and its architectural setting. The following year, Shelby and Reents-Budet (2001) presented a preliminary iconographic analysis of the pictorial registers. Since then, Louise Belanger also produced some detailed watercolor reproductions of the most illustrative stucco fragments, which are included in the site guidebook prepared for Lamanai (Belanger and Belanger 2021) (**Figure 3**).

The aims of the present study are: to build on the foundations set by Shelby, with added focus on photographic and photogrammetric documentation; to produce a detailed documentation of the polychromatic pigmentation; and to advance a comprehensive and up-to-date iconographic analysis of individual elements, as well as the original facade in its entirety.

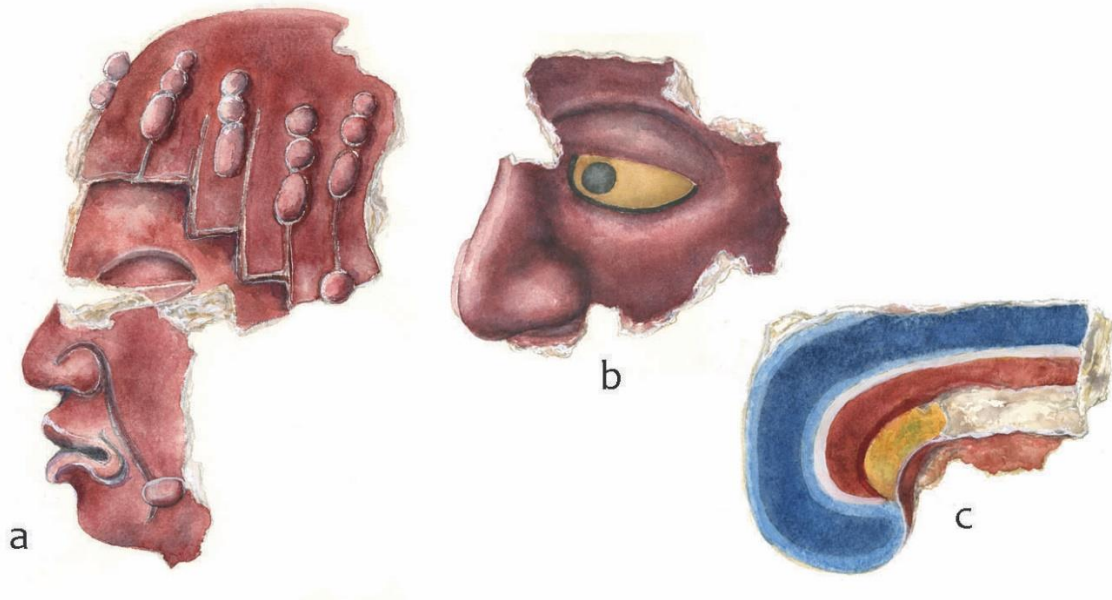


Figure 3: A selection of watercolor reproduction of the stucco from Str. N10-28 (renderings by Louise Belanger).

The Present Study: Methods

1) Measurements / Physical and Metric Characterizations

Previous research by Shelby (2000) indicated that there were approximately two thousand fragments of polychromatic modeled stucco from Structure N10-28. Although some of the provenience was lost due to a collapse in the original storage facility and a subsequent transfer to a new bodega, careful review of the fragments revealed that the modeled stucco came from the western and southern facades of Str. N10-28 (Pendergast 1985).

The assemblage is now stored in what is known as the Old Museum and was the subject of my initial review. To streamline the approaches that would be used in the study, modeled stucco fragments were selected initially, based on the presence of figurative elements, decorative appliquéés, and traces of preserved pigment. For the purpose of an iconographic analysis, these fragments were then sorted into 7 salient categories, which included the following: Floral, Zoomorphic, Anthropomorphic, Supernatural, Geometric, Framing, and Painted. This process helped with the overall organization of the database and expedited the documentation by helping to gain an overview of what was present and a sense of the thematic content of the iconographic scene. All individual specimens were designated with a number involving the site name, structure designation and fragment number (LAM-N1028-000) to facilitate identification. These designations supersede the two sets of designations that had been applied to the fragments previously, as many of the fragments no longer exhibit either prior set.

A total of sixty-six modeled stucco fragments were analyzed, and measurements were entered into a database as part of the 2023 documentation efforts. Securing measurements for each individual fragment was undertaken to document the physical characteristics, to add a frame of reference for 3D models acquired without absolute scales, and to determine the type categorizations and hierarchies according to size differences (e.g. considering distinct items of anthropomorphic body parts and assessing whether these were rendered according to homogenous or heterogeneous scales). Preliminary fragment identification was conducted to assess the iconography present; these fragments were then placed on a flat surface (to take dimensions and secure photography) in keeping with their original orientations as mounted on the facade. Measurements were taken with calipers for the smaller pieces and for larger fragments; these pieces and fragments were then placed upon an extended measuring tape affixed to the laboratory table, using the straight edges to measure off extremities. In this case, the length measured the longest side of the fragment; whereas the width measured the shortest margin. The thickness measured the depth of the object (foreground to background). All measurements were in centimeters, rounded to the nearest whole millimeter.

2) Documentation of Pigment/Chroma

Most of the modeled stucco fragments analyzed exhibited polychromatic decoration. We can thereby conclude that in antiquity, the entirety of the stucco facade was rendered with polychromatic decoration. Earlier efforts by Shelby (2000a, 2000b) likewise suggest that color was present on virtually all the pieces, identifying a range of eight different colors, including red, light blue, dark blue, yellow, black, white, green, and orange. Many of these fragments contain specular hematite within the pigment. A close examination of the pieces

also demonstrates that the facade was painted several times. At one juncture, large blue painted areas were painted over rather indiscriminately with coarse, dark red pigment, exhibiting specular hematite. The application of different layers of pigments would eventually change the coloration of distinctive elements in antiquity, which may or may not have contributed to different interpretations of the color symbolism.

There were multiple challenges present when analyzing the fragments. The first was how to tackle the documentation of polychromatic pigmentation that is still visible to this day in a systematic manner; the second was to attempt an interpretation of what the facade originally looked like; and the third was to determine what the pigment looked like in antiquity, especially since many of the pigments have eroded and are not readily visible. The little that is preserved is not representative of what the pigment originally looked like when first applied. This is due to environmental factors such as weathering and bleaching from extensive periods of exposure to the elements, including rain and the sun. In addition, some fragments are so heavily eroded that the stucco shines through the pigment, altering the color and making it appear lighter. Despite these natural erosive processes, and sun bleaching, the polychromatic pigmentation remains. This is all the more remarkable given that the stucco fragments encountered in most Maya sites in the lowlands are devoid of pigmentation due to exposure to the elements and taphonomic processes. As a result, the documentation of pigmentation on the collection of stucco recovered at Lamanai is a significant aspect of the study. Whereas previous efforts used subjective color terms to designate chromatic fields (Shelby 2000a: 70), as part of the present study it was deemed advantageous to employ a more rigorous and objective means of documenting the variation of pigment colorations.

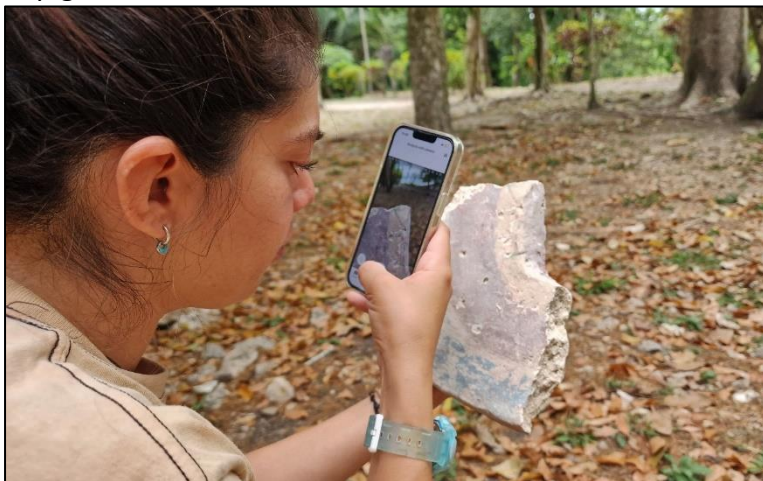


Figure 4. Using the Color Analyzer application to determine chromatic values. (Photo by Christophe Helmke)

The objective of the analysis was to determine the current state of the pigment and to assess whether the stucco fragments have undergone additional weathering since the time of first exposure (1981-1982) and first documented (1998-2000). If so, was any pigment on the fragments altered or lost? The Color Analyzer Application was used on a portable iPhone 13 Pro device to measure and document the chromatic value of the pigments, using an RGB color coordinate scheme, in real time, using the camera of the device (**Figure 4**).

Red	<p>LAM-N1028-049</p> <p>RGB R:189 G:154 B:159</p> <p>HEX #8D9A9F</p> <p>Munsell 7.9R 6.5/2.5</p>	<p>LAM-N1028-063 DRY poly.bands LG</p> <p>RGB R:133 G:113 B:115</p> <p>HEX #857173</p> <p>Munsell 8.2R 4.8/1.5</p>	<p>LAM-N1028-064 DRY poly.bands SM</p> <p>RGB R:122 G:87 B:92</p> <p>HEX #7A575C</p> <p>Munsell 5.9R 3.9/2.6</p>	<p>LAM-N1028-042</p> <p>RGB R:115 G:79 B:89</p> <p>HEX #734F59</p> <p>Munsell 10.9R 3.6/2.7</p>
	<p>LAM-N1028-039</p> <p>RGB R:153 G:104 B:114</p> <p>HEX #996872</p> <p>Munsell 2R 4.8/4.2</p>	<p>LAM-N1028-061 WITZ feature DRY</p> <p>RGB R:156 G:106 B:105</p> <p>HEX #9C6A69</p> <p>Munsell 7.9R 4.8/4.1</p>	<p>LAM-N1028-037</p> <p>RGB R:166 G:126 B:119</p> <p>HEX #A67E77</p> <p>Munsell 0.7YR 5.5/3.2</p>	<p>LAM-N1028-065 painted glyph DRY</p> <p>RGB R:131 G:97 B:96</p> <p>HEX #83E160</p> <p>Munsell 0.6YR 4.3/2.4</p>
Yellow	<p>LAM-N1028-064 DRY curved</p> <p>RGB R:215 G:175 B:116</p> <p>HEX #D7A774</p> <p>Munsell 2Y 7.2/5.7</p>	<p>LAM-N1028-011</p> <p>RGB R:212 G:185 B:144</p> <p>HEX #D4B990</p> <p>Munsell 3.1Y 7.5/4</p>	<p>LAM-N1028-037</p> <p>RGB R:190 G:174 B:149</p> <p>HEX #9EAE95</p> <p>Munsell 6.2Y 7.0/2.6</p>	<p>LAM-N1028-026</p> <p>RGB R:164 G:145 B:129</p> <p>HEX #A49181</p> <p>Munsell 1.9Y 6.0/2.1</p>
	<p>LAM-N1028-065 painted glyph DRY</p> <p>RGB R:188 G:180 B:170</p> <p>HEX #BC84AA</p> <p>Munsell 5Y 7.2/1.1</p>	<p>LAM-N1028-060 circular earflare DRY</p> <p>RGB R:200 G:189 B:169</p> <p>HEX #C8BDAA</p> <p>Munsell 7.6Y 7.6/1.9</p>	<p>LAM-N1028-059 orange/partial</p> <p>RGB R:196 G:168 B:149</p> <p>HEX #C4A896</p> <p>Munsell 0.9Y 6.9/2.8</p>	<p>LAM-N1028-032</p> <p>RGB R:160 G:148 B:128</p> <p>HEX #A09480</p> <p>Munsell 6.3Y 6.0/2.1</p>
Green	<p>LAM-N1028-037</p> <p>RGB R:132 G:140 B:125</p> <p>HEX #848C7D</p> <p>Munsell 7.6GY 5.6/1.9</p>	<p>LAM-N1028-015</p> <p>RGB R:115 G:120 B:108</p> <p>HEX #73786C</p> <p>Munsell 6.7GY 4.8/1.7</p>	<p>LAM-N1028-061 WITZ feature dry</p> <p>RGB R:112 G:117 B:113</p> <p>HEX #707571</p> <p>Munsell 0.7G 4.7/0.8</p>	<p>LAM-N1028-016</p> <p>RGB R:169 G:176 B:159</p> <p>HEX #A9B09F</p> <p>Munsell 7.1GY 6.9/2.1</p>
	<p>LAM-N1028-019</p> <p>RGB R:119 G:147 B:149</p> <p>HEX #779395</p> <p>Munsell 2.7BG 5.7/2.5</p>	<p>LAM-N1028-022</p> <p>RGB R:156 G:169 B:165</p> <p>HEX #9CA9A5</p> <p>Munsell 4.6G 6.7/1.3</p>	<p>LAM-N1028-056 Maize cob DRY</p> <p>RGB R:159 G:167 B:154</p> <p>HEX #9FA79A</p> <p>Munsell 8.2GY 6.6/1.7</p>	<p>LAM-N1028-016</p> <p>RGB R:169 G:176 B:159</p> <p>HEX #A9B09F</p> <p>Munsell 7.1GY 6.9/2.1</p>
Blue	<p>LAM-N1028-013</p> <p>RGB R:116 G:147 B:158</p> <p>HEX #74939E</p> <p>Munsell 8.3BG 5.7/2.8</p>	<p>LAM-N1028-044</p> <p>RGB R:119 G:142 B:148</p> <p>HEX #778E94</p> <p>Munsell 6.3BG 5.6/2</p>	<p>LAM-N1028-050</p> <p>RGB R:113 G:139 B:156</p> <p>HEX #718B9C</p> <p>Munsell 3.2B 5.5/2.7</p>	<p>LAM-N1028-029</p> <p>RGB R:89 G:115 B:132</p> <p>HEX #597384</p> <p>Munsell 4.5B 4.5/2.7</p>
	<p>LAM-N1028-031</p> <p>RGB R:79 G:129 B:154</p> <p>HEX #4F819A</p> <p>Munsell 5.3B 5.0/4.6</p>	<p>LAM-N1028-030</p> <p>RGB R:118 G:158 B:184</p> <p>HEX #789E88</p> <p>Munsell 6.7B 6.2/4.2</p>	<p>LAM-N1028-012</p> <p>RGB R:117 G:152 B:172</p> <p>HEX #7598AC</p> <p>Munsell 5.5B 5.9/3.5</p>	<p>LAM-N1028-049</p> <p>RGB R:120 G:158 B:165</p> <p>HEX #789E8B</p> <p>Munsell 7.3B 6.2/4.2</p>
Black	<p>LAM-N1028-060 circular earflare DRY</p> <p>RGB R:64 G:73 B:78</p> <p>HEX #40494E</p> <p>Munsell 2.6B 2.9/1</p>	<p>LAM-N1028-065 painted glyph DRY</p> <p>RGB R:52 G:65 B:74</p> <p>HEX #34414A</p> <p>Munsell 5.2B 2.5/1.5</p>	<p>LAM-N1028-021</p> <p>RGB R:64 G:78 B:87</p> <p>HEX #404E57</p> <p>Munsell 4.4B 3.1/1.5</p>	<p>LAM-N1028-061 WITZ feature DRY</p> <p>RGB R:92 G:96 B:98</p> <p>HEX #5C6062</p> <p>Munsell 1.2B 3.9/0.4</p>

Figure 5. A selection of swatches of the most representative colors (while dry).

Red

LAM-N1028-058 two semi circular	LAM-N1028-061 WITZ feature DRY	LAM-N1028-057 DRY NAL/pedestal
RGB R:188 G:142 B:143	RGB R:156 G:106 B:105	RGB R:175 G:148 B:147
HEX #BC8E8F	HEX #9C6A69	HEX #AF9493
Munsell 6.9R 6.2/3.6	Munsell 7.9R 4.8/4.1	Munsell 1.8YR 6.2/1.5
LAM-N1028-062 DRY	LAM-N1028-064 DRY poly.bands SM	LAM-N1028-056 maize cob DRY
RGB R:131 G:107 B:108	RGB R:122 G:87 B:92	RGB R:103 G:66 B:64
HEX #83B86C	HEX #7A575C	HEX #674240
Munsell 9.7R 4.6/1.8	Munsell 5.9R 3.9/2.6	Munsell 0.7YR 3.1/2.8

Light red & orange

LAM-N1028-065 painted glyph DRY	LAM-N1028-059 orange/partial
RGB R:164 G:138 B:132	RGB R:157 G:109 B:99
HEX #A48A84	HEX #9D6D63
Munsell 5.4YR 5.8/2	Munsell 1.5YR 4.9/4.1

Yellow

LAM-N1028-064 DRY curved polychromatic bands SM	LAM-N1028-058 two semi circular elements DRY	LAM-N1028-063 DRY curved polychromatic bands
RGB R:215 G:175 B:11E	RGB R:199 G:164 B:126	RGB R:204 G:182 B:148
HEX #D7AF74	HEX #C7A47E	HEX #CCB694
Munsell 2Y 7.2/5.7	Munsell 1Y 6.8/4.3	Munsell 3.6Y 7.4/3.3
LAM-N1028-062 DRY	LAM-N1028-056 DRY	LAM-N1028-061 WITZ feature DRY
RGB R:191 G:175 B:150	RGB R:199 G:186 B:162	RGB R:207 G:193 B:175
HEX #BFAF96	HEX #C7BAA2	HEX #CFC1AF
Munsell 6.2Y 7.1/2.6	Munsell 7.5Y 7.5/2.4	Munsell 5Y 7.7/1.9

Cream

LAM-N1028-059 orange/partial	LAM-N1028-060 circular earflare DRY	LAM-N1028-065 painted glyph DRY
RGB R:196 G:168 B:149	RGB R:200 G:189 B:169	RGB R:188 G:180 B:170
HEX #C4A895	HEX #C8BDA9	HEX #BCB4AA
Munsell 0.9Y 6.9/2.8	Munsell 7.6Y 7.6/1.9	Munsell 5Y 7.2/1.1

Green

LAM-N1028-063 DRY	LAM-N1028-056 Maize cob DRY	LAM-N1028-064 DRY curved
RGB R:163 G:179 B:176	RGB R:159 G:167 B:154	RGB R:179 G:167 B:137
HEX #A3B3B0	HEX #9FA79A	HEX #B3A789
Munsell 6.7G 7.0/1.5	Munsell 8.2GY 6.6/1.7	Munsell 9.1Y 6.7/3
LAM-N1028-061 WITZ feature DRY	LAM-N1028-064 DRY curved	LAM-N1028-063 DRY curved
RGB R:112 G:117 B:113	RGB R:107 G:115 B:100	RGB R:99 G:113 B:116
HEX #707571	HEX #6B7364	HEX #637174
Munsell 0.7G 4.7/0.8	Munsell 7.3GY 4.6/2.2	Munsell 5.5BG 4.5/1.4

Black

LAM-N1028-061 WITZ feature DRY	LAM-N1028-060 circular earflare DRY	LAM-N1028-065 painted glyph DRY
RGB R:92 G:96 B:98	RGB R:64 G:73 B:78	RGB R:52 G:65 B:74
HEX #5C6062	HEX #40494E	HEX #34414A
Munsell 1.2B 3.9/0.4	Munsell 2.6B 2.9/1	Munsell 5.2B 2.5/1.5

Figure 6. A selection of swatches of the most representative colors (dry) for the “painted” category of stucco fragments.

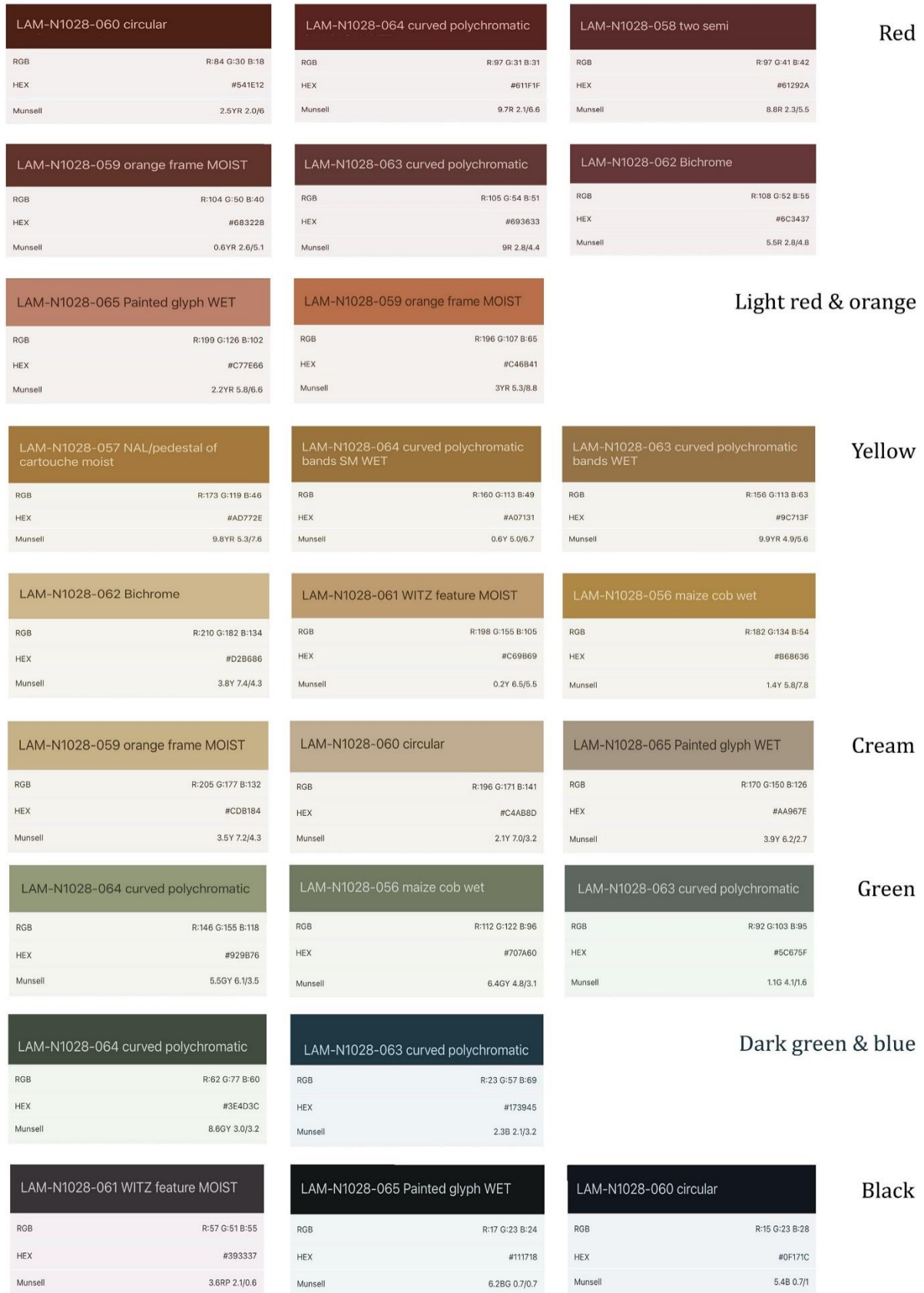


Figure 7. A selection of swatches of the most representative colors (moist) for the “painted” category of stucco fragments.

In addition, the application also provides an approximate Munsell value, which was recorded and entered into the database. Each fragment was examined in indirect light and direct sunlight to determine major differences in coloration and to assess how the light affected the readings. Because Color Analyzer reads the colors composing the image, it was deemed appropriate to document fragments under as much direct sunlight as possible, while also maintaining consistent lighting to ensure unambiguous and standardized readings. Different fields of color were distinguished upon initial review, and those measurements were secured. The pieces that fell under the “Painted” category (which presented multiple fields of color) were carefully moistened in sections to determine the variation between dry and dampened pigments. When moist, the stucco exhibited an even greater variation in colors, and these were radically different than when dry, thereby increasing the range of colors documented. Illustrative examples of the swatches of the most representative colors are presented below (**Figure 5**).

Colors were identified and segregated based on their application in separate bands and on the basis of the Color App. These include red, blue, yellow, green, black, orange, and cream. Colors such as green and red had a broad range of tones when dry versus wet (Figure 6). Green at its lightest was detected as gray and olive tones. In contrast blues registered as indigo or navy blue, but which could subjectively appear as black to the naked eye. Similarly, red ranged from mauve to burgundy tones, and could appear as a vibrant orange when moist for the flat painted pieces. At times, it was deemed necessary to separate between red and light, as well as between red and orange due to the occurrence of two juxtaposed colors on the same piece. However, chromatically these differences all fall within the general variation of a broader color. Thus the light red and the orange are still mostly part of the red tones. Likewise, with green it was also at times necessary to designate a dark green to account for two shades of green that were applied in distinct patterns on a piece. Light green is thereby only a sub-designation of the larger color term green.

Almost the entirety of the collection analyzed had shiny, reflective speckles of specular hematite, an oxide mineral that produces a sparkly purple-red pigment. Specular hematite, alternatively known as specularite, is a variation of hematite sourced from the margins of volcanic environments. Because these conditions are not found in proximity to Lamanai, it can be deduced that the materials were imported from the margins of the highlands, making the material all the more noteworthy (Straulino Mainou 2016).

3) Photographic Documentation

The photographic documentation entailed securing photographs of each piece as part of the basic inventorying of the collection. Each piece was placed on a black background and photographs were secured with a visible metric scale (Figure 7). The orientation of the pieces followed their orientation as originally found on the stucco facade and thereby required preliminary iconographic identification while preparing the piece for photography. Photographs were taken with natural light, when possible, at times complemented by artificial light to enhance certain details, depending on the piece in question and available light. The photographs were taken using a mirrorless digital camera, a Canon EOS M50 (with 24 effective megapixel resolution), with an EF-S 18-55 mm lens with an aperture of f/3.5-5.6 and built-in image stabilizer.



Figure 7. Example(s) of photographic documentation of stucco fragments. **a)** Example of a “painted stucco” showing clearly defined polychromatic bands. **b)** Part of a *pohp* or ‘mat’ sign. **c)** Part of a painted maize cob (photographs by Christophe Helmke).

4) Photogrammetric Documentation

Photogrammetric documentation was undertaken on a selection of stucco fragments. The pieces that were selected for photogrammetry either exhibited highly complex forms, which could not be properly reproduced by photography alone, or because these pieces were significant for their iconographic or epigraphic content. It would be advantageous for all pieces in the collection to be subjected eventually to complete 3D scanning for continued documentation and preservation of the fragments. At present, however, given the time required to secure sufficient photographs and to process these into photogrammetric models, this has proved to be an unfeasible undertaking. Nonetheless, as the stucco fragments are brittle and liable to continued deterioration in the future, to guarantee their preservation (even virtually) and to produce a detailed and faithful documentation of their current state, a complete 3D scanning of the entire assemblage should be conducted in the future.

It is hoped that with added 3D documentation, a virtual space can be created where the pieces are accretionally added to begin rearticulating the fragments of the facade to scale. This virtual reconstruction of the facade can be devised as a collaborative project, in which multiple researchers participate, eventually creating an open and immersive environment for all, ranging from the local community, via visitors to the site, to professional researchers. Such a collaboration has several advantages over the more labor-intensive rearticulation of fragments in the laboratory and thereby also minimizes handling of the pieces, and allows for the creation of a reconstruction that is virtual, open, with the opportunity to make additions and corrections in the future without requiring a space to exhibit the pieces, nor incurring additional curatorial costs.

As part of the 2023 efforts, a total of 6 pieces were selected for photogrammetric documentation. A combination of software applications was used to create the 3D models, including Polycam 3D scanner, which uses as its input either manually acquired photographs, video feeds, and/or LiDAR capture (Figure 8). The latter is a function that is built into the newest generation of iPhones by Apple and when coupled with the app can be readily used

to capture depth and telemetric data that are combined with the graphic input. Although this functionality is not readily available on Android phones, the app remains functional using more traditional photogrammetric captures. Regardless of the device employed for the capture of images, Polycam has the advantage of rapidly processing the models via a cloud-based server, which also stores the resulting 3D model. Despite difficulties in accessing the internet and the web in the field, the use of Polycam has allowed the rapid production of 3D models in the field and the verification that models have been properly captured. The other app that was employed in the creation of photogrammetric models is Agisoft Metashape, which remains the standard photogrammetric app in the field. The advantages of using this app is that the resulting models are of the highest possible quality, although the downside is evidently the extended processing times, which can run hours and at times days, depending on the number of photographs secured to create the model. As part of the stucco documentation, the fragments were placed on a clear background with colored stripes to enable the algorithm to distinguish between background and the foreground object. The number of photographs secured for any given model was variable and ranged between 47 and 90 photographs for any given piece. All the photographs for the photogrammetric documentation were secured with a full-frame mirrorless digital camera, a Canon EOS R, with 26-megapixel resolution. To ensure optimal depth of field and reduce *bokeh*, a fixed frame lens was mounted on the camera for all photogrammetric captures. The lens used is a wide-angle RF 24mm f/1.8 macro with image stabilization, which allows longer shutter speeds with hand-held shooting, even in low light conditions. Examples of the 3D models produced of a sample of stucco fragments are presented below.

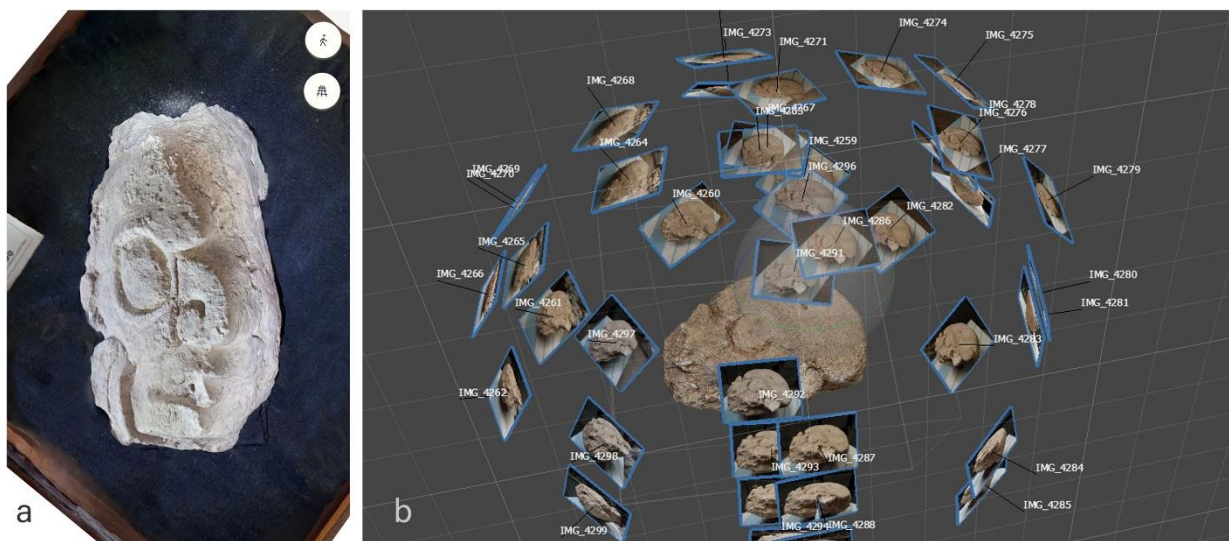


Figure 8: Screen captures of the 3D models created during the 2023 season: **a)** Using manual photographic capture using Polycam, **b)** model created on the basis of manual photography using Agisoft Metashape.

Preliminary Results and Prospects for the Future

Observations on current state of preservation

Overall, the fragments are remarkably well preserved, considering the number of years that have elapsed since these were first uncovered (1981-1982) and since these were last the

subject of analyses (1999-2000). Nonetheless, due to tropical environmental factors such as weathering and bleaching from long periods of sun exposure, as well as high humidity and frequent rainfall, deterioration of soluble components found in lime-based architectural elements has resulted (Demas 1994). Deterioration is something that has affected Maya architecture since the Classic period, and erosive processes continue to negatively affect preservation to this day.

To ensure their preservation, the stucco fragments have been moved to the bodega (Old Museum) where these are stored on well-built metal shelves designed and built by the site architect, Claude Belanger (the initial phases of this process are reported on in Shelby 2000a). Shifting to the Old Museum has enabled the fragments to be stored out of the elements, which is to say sheltered from rainfall and also away from direct sunlight. Nonetheless, it is evident that the fragments are continuing to deteriorate and as a result are brittle and fragmentary. It should also be noted that the larger sections of stucco fragments that are less burnished are partially pitted due to erosion and thereby friable, whereas the sections of stucco that are flat and burnished are less liable to breakage (as their original surfaces remain preserved).

In terms of the chroma, comparing the photographs that were secured more than two decades ago (Shelby 2000a, 2000b), it appears that the colors have diminished in intensity. As such, they are not as bright and vibrant as they were when they first came out of the soil (more than four decades ago). I suspect that continued bleaching of the fragments has occurred due to partial exposure to natural light in the storage facility. It is also clear that some fragments have been the subject of attempted restorations (due to traces of glue on fragments), efforts which have not been successful. Future curatorial efforts should aim to remove the traces of adhesive and to make new bonds between conjoining pieces.

Iconography

Among the iconographic elements, in addition to a wide array of regalia, feathers, and items of personal adornment, there are representations of a series of anthropomorphic figures, as well as deities, suggesting that the facade was embellished with a large and complex scene, perhaps one meshing historical individuals into a narrative. The few glyphic elements that remain may qualify the backdrop or setting of at least part of the scene as a mountainous one, based on small elements of the logogram *witz* (literally 'mountain,' but encompassing concepts that are significantly larger), as well as partial calendrical cartouches (Shelby 2000a; Shelby and Reents-Budet 2001). Together these may also have named the structure and provided the date of its dedication.

With this background, it was necessary to establish a series of thematic categories, thus devising seven distinct categories, namely: floral, zoomorphic, anthropomorphic, supernatural, geometric, framing, and painted. One of the difficulties with these categories was the segregation of anthropomorphic vs. supernatural, especially for representations of a supernatural entity that has an anthropomorphic form. Yet, this was possible through a close inspection of the features preserved, something that affected the previous study because the researchers did not make a distinction between one and the other. By using these categories, I was thereby forced to make identification of the representation element up front, from the onset. There was also an abundance of framing pieces, indicating that the

scene as a whole was clearly demarcated along its perimeter and may have been subdivided into distinct, quadrangular zones.

In reviewing the iconographic elements, it became readily apparent that there was a noticeable distinction between the foreground and the background. Items that were in the background were rendered on planar surfaces and visibly rendered in low relief, sometimes only decorated with relatively thin lines, whereas the items that were in the foreground generally were rendered in high relief and used stone armatures and tenons to support the stucco forms.



Figure 9: Three heads at the same scale, showing an evident difference in size between three different types of anthropomorphic figures (photographs by Christophe Helmke).

With these distinctions in place and considering the size differences in the anatomical elements, it became clear that the anthropomorphic depictions were rendered according to a tripartite scale. The largest depictions of anthropomorphic figures are rendered slightly larger than natural scale and are rendered in high relief, revealing that they were the dominant figures of the scene and formed part of the foreground of the pictorial register. In contrast, the smallest depictions of anthropomorphic figures are rendered in less than natural size and occur in the background, leaving an intermediate scale that corresponds roughly to natural scale depictions of individuals. I hypothesize that the largest anthropomorphic figures correspond to historical rulers and possibly deified ancestors, whereas the intermediate size are probably secondary figures that add to the thematic content of the primary scenes (**Figure 9**). Additionally, fragmentary glyphs are represented in the assemblage; these serve to record dates and place names or toponyms, thereby qualifying details of the iconography.

In addition, there are elements that indicate that the basal register of the iconography represented aquatic motifs, including the saurian entities (Shelby 2000a: 64-65), and an elaborate water band, as suggested by the glyph for **le**, which is a typical element of water bands (**Figure 10**).

One of the depictions of a deity had been erroneously identified as the solar deity *K'inich* (Shelby and Reents-Budet 2001), but which can now be identified as another supernatural entity. The fragment represents the head of the deity and is now on exhibit at the Visitor's Center at the site (Figure 11). What is notable about this piece is its form, presenting the head of the deity in profile, but with a highly raised lateral section behind it, as if to suggest that this head originally adorned the corner of the frieze, with the profile itself on the main southern facade and the blank section (to the right) wrapping onto the eastern face of the structure. This represents the head not of *K'inich*, but of *Chuwaaj*, the personification of the nocturnal sun, and is made evident by the shape of the eyes (which are round) and by the distinctive cruller that frames the eye and the partial "beard" that is affixed to the jaw (Schele and Miller 1986: 50-51). The deity *Chuwaaj* had a privileged place in the local pantheon at Lamanai since the infantile aspect of this deity—as represented on Stela 9—that was known as *Unen Chuwaaj* ('infant *Chuwaaj*') was one of the primary tutelary deities of the site (Christophe Helmke pers. comm. 2023).



Figure 10: The **le** sign that is used as a diagnostic element of aquatic scenes, especially of basal registers (screen capture of 3D model).

Although the iconographic analyses are on-going, when complete, these will constitute a significant contribution to Late Classic Maya iconography, especially given the amount of detail that the frieze once exhibited and its impressive scale.

3) Future: Prospects & Recommendations

In the future it would be ideal if the stucco fragments could be stored in a facility that is completely devoid of natural light to inhibit the further deterioration of the pigments, and climate controlled to reduce the effects of ambient humidity and variable temperature). It is also recommended that the fragments be subjected to a comprehensive program of 3D documentation to produce a permanent (albeit virtual) record of the assemblage. This will ensure that the assemblage can be maintained for future generations and can serve as a means to monitor the state of preservation of the specimens.

Lastly, it is hoped that a virtual environment can be established in which the 3D models of the fragments can be conjoined in order to create a reconstruction of the original facade, highlighting key elements of the pictorial registers. Such a reconstruction would create an immersive experience that could be accessible for scholars and visitors alike. Additionally, architectural reconstructions could be integrated into augmented reality interfaces, accessible via cell phones at the site, providing visualizations of architectural reconstructions of various structures, including Str. N10-28 and its stunning polychromatic frieze.



Figure 11: Profile of the deity *Chuwaaj* that personifies the nocturnal sun (photograph and watercolor by Louise Belanger).

The aims of this study have great potential in terms of cultural heritage management, as it will allow visitors to view these objects without physical contact. It is hoped that additional seasons of documentation can be undertaken that the recommendations outlined above can be implemented, and that the program of 3D documentation can become a reality.

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