

[Supplementary material]

Technologies of urbanism in Mesoamerica: the pre-Columbian bridges of Cotzumalhuapa, Guatemala

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Ground-penetrating radar prospection at the Ichanhuehue causeway

After the remains of the Ichanhuehue bridge were noticed in 2011, Hector Neff and James T. Daniels undertook ground-penetrating radar (GPR) prospection to test the presence or absence of a causeway linking the probable bridge with the El Baúl acropolis. The results confirmed that the stone walls along the course of the Santiago River were abutments for a bridge.

The association with causeways is one of the clearest indications that the stone walls found at several locations along river courses at Cotzumalhuapa served as abutments for bridges. The causeways are invisible on the ground surface, and were initially traced by systematic shovel testing and excavations. Beginning in 2006, a series of field schools organised in collaboration with Hector Neff and Carl Lipo, and their students from California State University, Long Beach, made it possible to apply geophysical prospection methods at Cotzumalhuapa. GPR proved especially useful because it revealed the cobblestone pavements of causeways and other subsurface features with much clarity (Chinchilla Mazariegos *et al.* 2008; Safi *et al.* 2012).

GPR prospection was conducted in March 2011, in a 50 × 50m quadrangle located 122m west of the Ichanhuehue bridge (Figures S1 & S2). The area was chosen because it was relatively flat, and located along the probable direction of a causeway leading from the acropolis to the bridge. Field survey was conducted with a GSSI SIRveyor SIR-20 unit with a 400MHz antenna. The data were processed using GPR-Slice software, to generate time slices that provide horizontal maps of the GPR reflections at different depths. Figure S3 shows two time slices, at estimated depths of 0.49–0.75m, and 0.73–99 m, respectively.

The causeway is visible in both time slices, indicated by parallel lines of high reflection that run from the south-west corner to the centre of the eastern side of both time slices. The orientation of these lines is consistent with the expected orientation of a causeway running from the El Baúl acropolis to the Ichanhuehue bridge. They probably correspond to stone parapets along the edges of the causeway. The low reflection of the inner part suggests that the causeway did not have a cobblestone pavement. Elsewhere at Cotzumalhuapa, cobblestone-paved causeways appear as solid bands of high reflection. The width of the probable causeway is about 10m, corresponding well with other causeways at Cotzumalhuapa.

Additional high-reflection alignments appear in the north-eastern corner of the prospection unit, and are especially visible in the 0.73–0.99m time slice. These linear features are perpendicular to the causeway, suggesting that they correspond to the walls of buildings that adjoined it on the northern side. Further excavation to test these features, and the causeway itself, is desirable. The findings of GPR prospection provide definite evidence of the presence of a causeway in this sector, and support the interpretation of the walls found along the river as abutments for a bridge. An additional piece of evidence that offers further support for the presence of a causeway in this sector is the discovery of El Baúl Monument 76 in 2008—prior to the discovery of the Ichanhuehue bridge (Figure S4). The sculpture appeared during agricultural work and was removed to the El Baúl Archaeological Museum without detailed documentation. Its provenance was reported by Edwin Orlando Galindo, the keeper of this sector for the sugarcane plantation, who has repeatedly proved to be a perceptive and reliable collaborator for archaeological work. The slab shows a frontal portrait of the Cotzumalhuapa god of death. This genre of sculpture is consistently found in association with causeways (Chinchilla *et al.* 2008; Chinchilla & Cruz 2016).

The causeway probably continued on the eastern side of the Santiago River. This is a hilly sector that remains unexplored archaeologically, except for the colonial ruins of the church of the former town of San Francisco Ichanhuehue, which was abandoned in the eighteenth century (Chinchilla 1998). The discovery of a finely carved sculpture in the Cotzumalhuapa style suggests that this was an important sector associated with the Late Classic city, probably linked to the El Baúl acropolis by the Ichanhuehue causeway and bridge. The sculpture shows a reclining male character with a fiery speech scroll issuing from the mouth. He holds a skeletal deer by the antlers and forelegs. The sculpture has an inscription that may correspond to a date or

a calendrical name (Chinchilla 2011). It was found approximately 730m east of the Ichanhuehue bridge, and removed by looters in 2000. Its present whereabouts are unknown, but a photograph (Figure S5) that was obtained, allows some consideration of the original location of the sculpture.

Altogether, these observations have enabled us to identify the causeway that led from the El Baúl acropolis to the Ichanhuehue sector to the east of the Santiago River. The Ichanhuehue bridge allowed a safe crossing, connecting El Baúl with an important peripheral sector of the Late Classic city.

References

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<https://doi.org/10.1002/gea.21414>

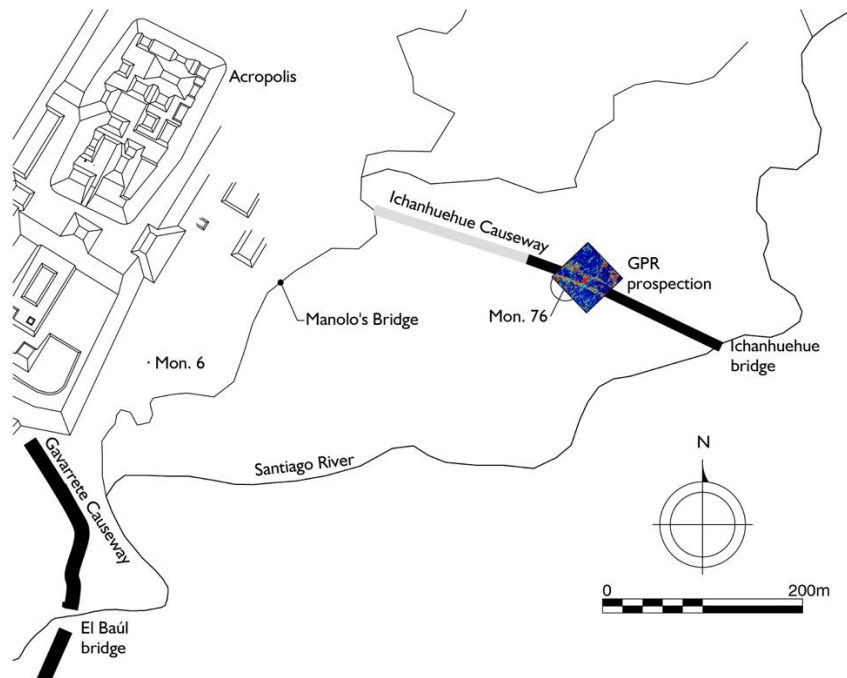


Figure S1. Location of the GPR prospection area. The light grey section of the Ichanhuehue causeway is hypothesised but unconfirmed (drawing by Oswaldo Chinchilla Mazariegos).

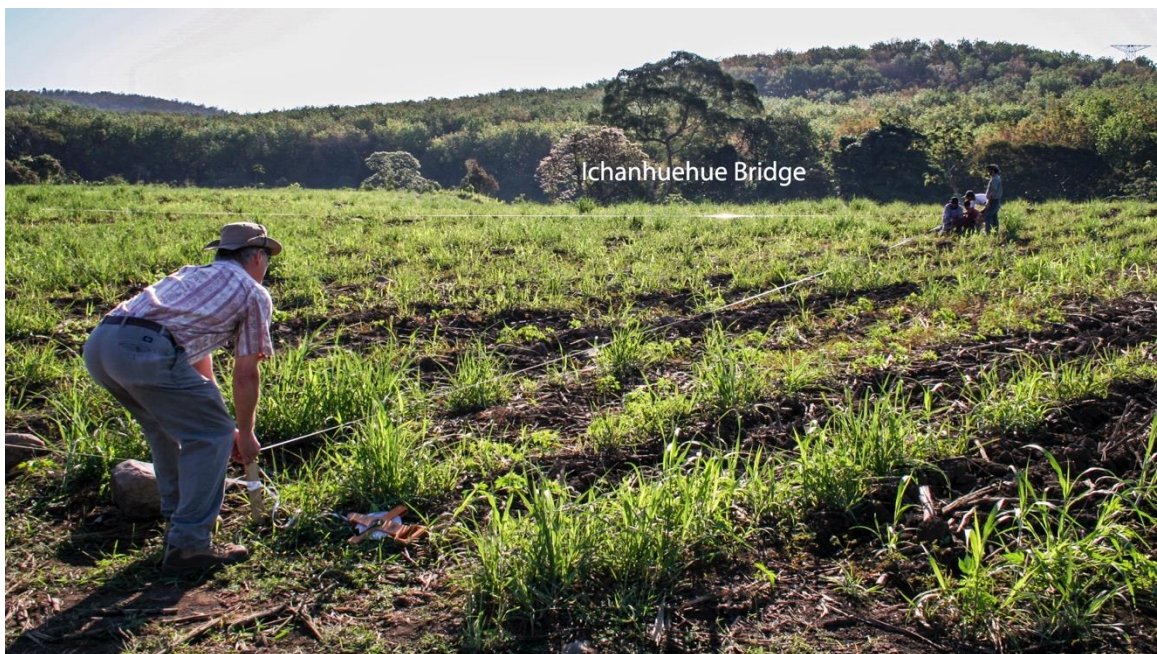


Figure S2. View to the east, showing the location of the Ichanhuehue bridge across the river gorge in the background while the GPR quadrangle is being measured out (photograph by Oswaldo Chinchilla Mazariegos).

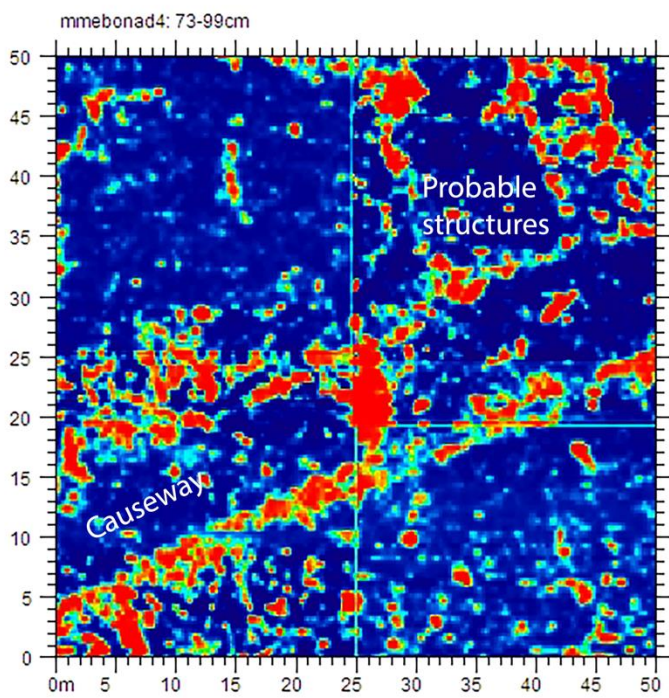
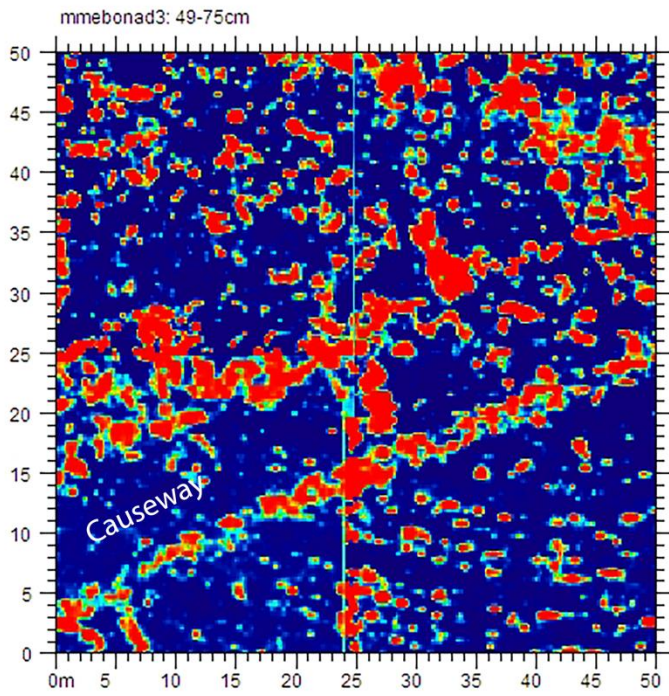


Figure S3. GPR time slices, at estimated depths of 0.49–0.75m (above), and 0.73–0.99m (below) (graphs by Hector Neff).



Figure S4. El Baúl monument 76 showing the Cotzumalhuapa god of death (photograph by Oswaldo Chinchilla Mazariegos).



Figure S5. Sculpture found in the Ichanhuehue sector, east of the Santiago River (photograph courtesy of Lionel Maltés).