22 PRECERAMIC CULTURAL HISTORY IN SOUTHERN BELIZE AND ITS ENVIRONMENTAL CONTEXT

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This paper presents the environmental context for Early Holocene cultural developments in southern Belize and describes three archaeological sites that are producing evidence of human activities starting at the end of the last ice age and continuing until the advent of agriculture. It is well known that humans colonized Central America by at least 10,500 BC, and likely earlier (Chatters et al. 2014; Kennett et al. 2017). Central America formed a bottleneck for humans migrating from North to South America, and given its diverse geology, climate, and tropical resources it is not surprising that people successfully exploited this region throughout the Holocene. We focus this discussion primarily on the context for early humans in southern Belize, but also draw broadly on well-documented archaeological accounts from elsewhere in the region.

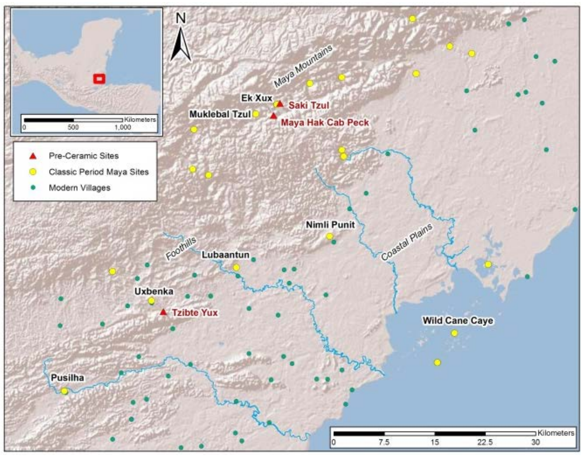

Figure 1. Map showing the locations of the three pre-ceramic sites located in southern Belize as well as better known Classic Period Maya centers. The central topographic feature in the region is the Maya Mountains, which are not as well-known as the more accessible foothills sites.

Introduction

Humans have been active agents in southern Belize throughout the Holocene. Their presence dates back to the initial colonization of the New World. The first Mesoamericans arrived in the region 10 millennia prior to the development of urban populations, and some of them settled in southern Belize. The earliest known communities in southern Belize are Ek Xux located in the Maya Mountains, Uxbenká in the foothills (Prufer et al 2017), and small coastal trading communities (McKillop 1996), with the earliest occupations in the Late Preclassic. Other centers did not develop until the end of the Early Classic period ca. AD 400 (Nimli Punit, Pusilhá and Quebrada de Oro) or the Late Classic ca. AD 700 (Lubaantun, Xnaheb, Muklebal Tzul, and a host of smaller centers). By AD 750 there were at least 40 centers with public architecture in southern Belize, with largely independent rulers and significant populations dispersed across the agriculturally rich hills and valleys.

However, a growing body of research suggests that human presence in the region is much older and that the cultural adaptations in the Classic Period built on the strategies used by people throughout the Holocene. Below we provide background for the physical and climate context of the arrival of humans into the region, and preliminary results of work in several rockshelters in southern Belize that are expanding our knowledge of the first people to arrive in Central America.

Geographical Setting for Southern Belize

Southern Belize (Figure 1) is a geographically distinct region in Central America with a diverse set of geological and biotic resources that has facilitated a 13,000-year history of human occupation. Physically, the region is circumscribed by the Maya Mountains to the west, a series of swampy *bajos* to the south along the Temash and Mojo rivers, the Caribbean Sea to the east and inhospitable pine-barrens to the north. It is one of the wettest places in the Americas, receiving over 4000 mm of rainfall annually, more than double the precipitation of the Petén and seven times as much as the northern Yucatan Peninsula (Douglas et al. 2015). It is also a seasonal desert (Haug et al. 2003) where for several months each year there is little-to-no rainfall and evaporation exceeds precipitation.

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Geologically, the region is complex. The central topographic feature, the Maya Mountains, were formed by Devonian sub-aerial volcanic activity characterized by lava flows, pyroclastic activity and volcanoclastics, some locally altered hydrothermally, and by the Pennsylvanian-Permian Santa Rosa Group of argillaceous and arenaceous sediments and carbonates. The eastern slope, bounding the Bladen River, is aproned by Tertiary and Cretaceous limestones of the Coban Formation (Petersen et al. 2012). Combined with high precipitation during the quaternary the result is a hydrologically carved network of caves and cockpit karst overlaying earlier volcanics that have been central to the lives of all people who have lived in these landscapes. The interior valleys of the Maya Mountains also have a complex geological history. The upper reaches of many tributaries have volcanic and metamorphic float, and soil pedogenesis in the alluvial valleys incorporates sedimentary as well as volcanic materials, making them a rich agricultural landscape, often surrounded by near vertical mountains hosting different biotic communities and productive potentials (Dunham and Prufer 1998).

The foothills region, which was home to many of the Classic Period centers as well as most of the modern Maya speaking agricultural villages, has a different geological history. Known as the Toledo Formation (or the Toledo Uplands), these rolling hills are composed of Late Cretaceous-Early Tertiary turbidite conglomerates with interbedded sandstones, mudstones, volcanics, and volcanoclastics, with sediments likely originating from the Coban volcanic arc migration (Cornec 1986). In some portions of the Toledo formation, particularly near several major Classic Period centers (Uxbenká, Lubaantun, and Nim li Punit), hilltops are dominated by soft interbedded tertiary bedrock exposed through weathering and human mediated agricultural clearing. When cleared of vegetation as part of an agricultural cycle pedogenesis is rapid, with calcareous sandstone and mudstone breaking down rapidly (over a scale of weeks to months) as it is exposed to temperature and moisture differentials and rootlet activity (Culleton 2012). The result is an almost renewable source of high quality soils for farming and there is little need to engage in landscape intensification techniques like terracing to conserve soils (Prufer et al. 2015).

Interspersed across this hilly landscape are massive karst ridges rising over 250 m above the Toledo Formation. These limestone remnants are late Tertiary – early Cretaceous La Cumbre carbonate megabreccias (Cornec 1986), possibly formed during the collapse of the platform paleoscarp immediately following the KT-boundary Chicxulub impact event (Bralower, Paull, and Leckie 1998). The coastline and pine-forest to the north are quaternary in age and are composed of chert/quartz terraces as well as alluvial river terraces and sand bars. Pleistocene and Holocene karstification of the Cretaceous-Tertiary limestones have produced some of the key features used by humans as they colonized and modified these landscapes in southern Belize. These include the rockshelters occupied during the Paleoamerican and Archaic periods and the incredible subterranean cave landscape that formed a key component of the Mesoamerican worldview (Prufer and Brady 2005).

Climate Setting for Southern Belize

The climate context provides a critical framework for understanding past cultural adaptations (Figure 2). Annual rainfall in southern Maya lowlands is primarily controlled by the seasonal migration of the inter-tropical convergence zone (ITCZ) with marked meridional contrast (Haug et al. 2001), whereby southern Belize receives considerable rainfall each year, often in excess of 4,000 mm (Ridley et al. 2015). Mean annual temperature is approximately 26 degrees C. During the winter dry season (February-May) evaporation frequently exceeds precipitation. Given its location relative to the equator, at the northern margin of the annual ITCZ migration, southern Belize is sensitive to even small variations in the mean position of the ITCZ and its rainfall distribution (Lechleitner et al. 2017; Ridley et al. 2015). Other climate modulators that play significant roles in the precipitation variability of the region include changes in the strength of the North Atlantic high and variability in El Nino–Southern Oscillation (ENSO). High sea level

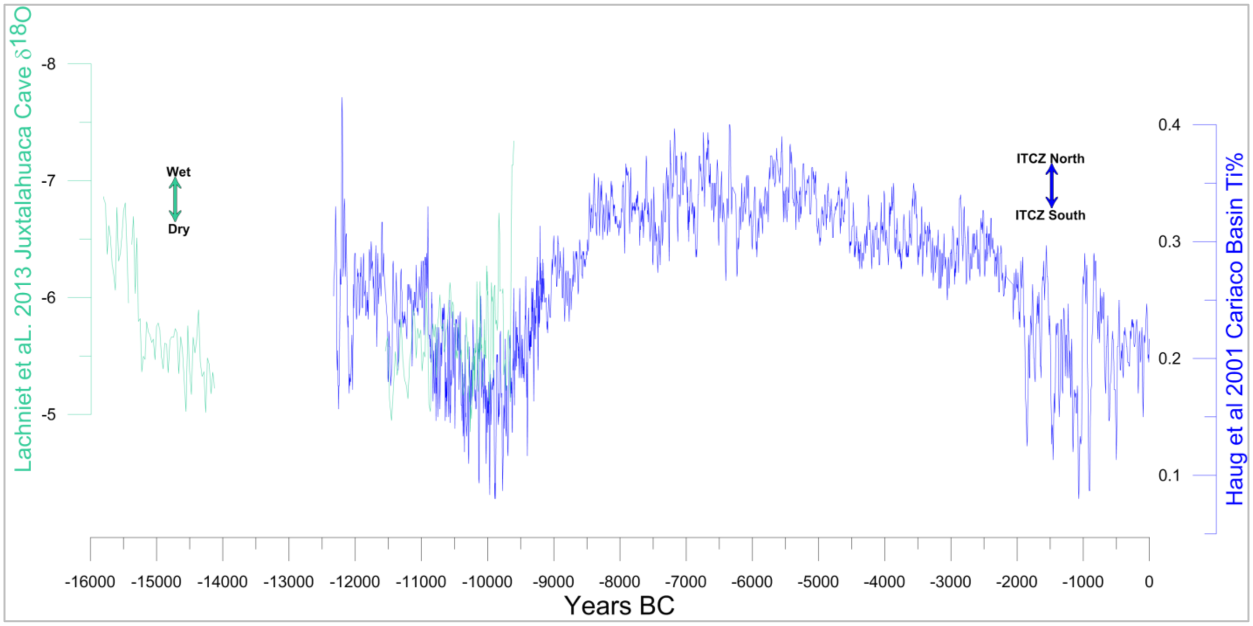

Figure 2. Two records of climate variability during the early colonization of Central America. The Cariaco basin titanium density record records rainfall sediment runoff into an anoxic closed basic off the coast of Venezuela (Haug et al. 2001) as a proxy for the north—south migration of the ITCZ. The Juxtalahuaca oxygen isotope record is a paleorainfall proxy from a speleothem in central Mexico (Lachniet et al. 2013).

pressures (SLP) in the North Atlantic High lead to stronger trade winds. This results in cooler than normal sea surface temperatures (SST) and reduced Caribbean basin precipitation that has decadal scale variability through the North Atlantic Oscillation (NAO, (Proctor et al. 2000). This variability is clearly exhibited in our records covering the past 2000 years (Lechleitner et al. 2017; Smirnov et al. 2017). At shorter timescales, ENSO exerts strong inter-annual precipitation variability in the Central American tropics, establishing a zonal seesaw SLP and SST pattern across the eastern Pacific and western Atlantic region. The result is that during ENSO+ (lower SLP and higher SST) periods it is usually dryer and warmer along the Central American coastline during the rainy season (Zhu et al. 2012), resulting in drought conditions on severe but short time scales.

Paleoclimate data strongly suggest that climate conditions are significantly different today than when the first humans arrived in the region. The Cariaco shallow marine record off the coast of Venezuela (Peterson et al. 2000; Haug et al. 2001) provides a proxy for changes in the position of the ITCZ. The Cariaco reflectance and Ti concentration data suggest that the climate context for the first human movements into the neotropics was during a period that was dryer (Haug et al. 2001) and cooler (Grauel et al. 2016) than conditions during the Holocene. Shallow lake records from Petén (Escobar et al. 2012) also show a dry Late Pleistocene to Younger Dryas interval. This is supported by numerous studies in lower Central America and tropical South America (Piperno 2011a; Piperno and Jones 2003).

Two rainfall reconstruction records provide a general paleoclimate backdrop for the Late Pleistocene, and there is one continuous record through the Holocene, though it cannot be considered a "local" record but rather a more general indication of low latitude rainfall patterns in the sub-tropical Americas (Figure 2). The Cariaco Basin Ti (Haug et al. 2001) concentration data reflect hydrologic changes in the Orinoco River drainage basin of the northern coast of South America. These result from shifts in the position of the ITCZ driven by insolation variability. The other common feature is a shift towards wetter conditions during the early Holocene and then a trend toward drier conditions, especially the Cariaco Ti record, later in the Holocene related to insolation changes in the strength of the regional monsoon. This record is relevant for understanding changes in rainfall distributions in the late Pleistocene through late Holocene and is the longest continuously resolved ITCZ record for the New World. The Juxtalahuaca $\delta^{18}O$ speleothem record (Lachniet et al. 2013) from Central Mexico is a bit closer to southern Belize and is one of the few records of the North American Monsoon covering parts of the late Pleistocene and Younger Dryas. Although it is discontinuous, it shows general agreement with the Cariaco ITCZ reconstruction as being drier prior to 10,000 BC, reflecting broad hemispheric trends of low latitude paleoclimate.

Mesoamerican Foragers before agriculture

The initial New World colonists that arrived in Central America by at least 12,500 BC (Braje et al. 2017) encountered a very different, and far less tropical, environment than today. At that time the landscape was comprised of "heterogeneous, even patchy, vegetation across small distance scales; and stretches of forest alongside water courses in regions where forests were significantly reduced" (Piperno 2006:286). Pollen and macrofossil plant data suggest the structure of forests may have already been tropical, but the distribution of these was less than in the modern climate regime and vegetation was more diverse than simple Pleistocene grassland/Holocene forest dichotomies would suggest (Piperno 2011a). Confronted with a greater diversity of large mammals and a wider range of riparian forest and grasslands humans would have initially adapted to ecosystems that were far different than today. By 9,000 BC conditions were becoming wetter and warmer and, in the Petén, there is evidence that closed canopy forests were undergoing anthropogenic burning (Renssen et al. 2009; Anderson and Wahl 2015) with mixed herbaceous and woody plants being represented in charcoal records. Pre-agricultural burning peaks between 6,000 and 4,000 BC (Schüpbach et al. 2015) during the Holocene Thermal Maximum, arguably the warmest and wettest period of the Holocene (Renssen et al. 2009), and likely reflects increased anthropogenic burning. After 8,500 BC the abundance of higher-ranked plant and animal resources declined as rainforest overtook many Pleistocene open areas where game would have fed on scrub and grasses (Piperno and Pearsall 1998).

The Paleoamerican Period (> 13,500 BC – 7,000 BC) is the least understood period in the Maya region. Initial colonists into the New World arrived in North America prior to 13,500 BC, spreading rapidly along the Pacific coast, and reaching southern Chile by 13,000 years ago (Braje et al. 2017; Dillehay et al. 2017). This rapid southward migration was accompanied by significant eastward movements in North America, evidence of which has recently emerged in Florida and Montana (Halligan et al. 2016; Rasmussen et al. 2014). The now well documented early colonization of tropical South America, perhaps as early as 12,500 BC (Brandini et al. 2017; Suárez 2017) necessitated the movement of people through middle and lower Central America. Human presence has been well documented in Panama (Ranere and Cooke 1991) and Costa Rica (Swauger and Mayer-Oakes 1952; Snarskis 1979), Nicaragua (Waters 1985), Honduras (Kennett et al. 2017; Scheffler et al. 2012a), and Highland Guatemala (Brown 1980; Gruhn et al. 1977).

In Mesoamerica, drier conditions to the north of the tropical Maya lowlands have facilitated the identification of Paleoamerican surface sites, including locales in central, west, and north Mexico (Ochoa 2012; Gonzalez et al. 2015; Sanchez and Carpenter 2012). In the Maya Lowlands, with high precipitation and extensive tropical foliage, fewer surface sites have been identified and almost no stratified sites are known. One exception is El Gigante rockshelter (Kennett et al. 2017; Scheffler et al. 2012a), a large rockshelter in western Honduras on the periphery of the Maya Lowlands. There, stratified deposits document occupation from 7,000-9,000 cal BC, and include well preserved macrobotanical remains as well as evidence of hunting and food preparation. In the northern Yucatan peninsula, a near-complete human skeleton was found with extinct fauna in a submerged cave (Chatters et al. 2014). The minimum age of this skeletal material is 10,000 BC based on U-series dates of small calcite florets that had precipitated on bone before the skeleton was submerged by rising sea and ground water levels. Those dates are supported by an abundance of Pleistocene faunal remains also found in the submerged chamber.

The Archaic Period is better documented, particularly outside of the Maya area in central and western Mexico, where studies have examined the origins of agriculture, diet changes in coastal settlements, and the emergence of social complexity (Flannery 2002; Kennett et al. 2010; Lesure 2011; MacNeish and Nelken-Terner 1983; Rosenswig 2014; Rosenswig et al. 2015; Smith 1997; Voorhies et al. 2002). In the arid regions of northern Mexico, where ground visibility and site detection is not hampered by dense tropical vegetation, there is a long history of research into Archaic Period adaptations (Guadalupe and Carpenter 2012). In the tropical Maya region however, far less is known about tropical adaptations during this time (Kennett et al. 2010). Recent studies suggest a gradual adoption of domesticated plants by 4,000 BC (Rosenswig et al. 2014), although in the Soconusco full-scale maize agriculture may not have been adopted before 1,000 BC (Rosenswig et al. 2015) even though sedentary agricultural communities are present by 1,500 BC. Between 8,000 – 3,000 BC the gradual processes of plant domestication were underway in Central America with evidence for human cultivation of native crops including maize (*Zea*), manioc (*Manihot*), arrowroot (*Maranta*), and yams (*Dioscorea*) in parallel with the exploitation of wild resources by transitional hunter gatherers (Greaves and Kramer 2014; Piperno 2011b). Recent studies have also emphasized the importance of the transition to the Archaic as a time of mixed and flexible subsistence economies, as evidenced by a broad range of wild plant foods and early domesticates at El Gigante rockshelter in Honduras (Scheffler et al. 2012b; Kennett et al. 2017).

As noted by Rosenswig (2014:142) the "spotty nature of Archaic-age archaeological data from Mesoamerica means that what we know is likely not representative of the range of peoples and the variety of adaptations that existed across the region" particularly the broadleaf forests of the tropical Maya lowlands, and especially for the Early Archaic (8,000-5,000 BC). A wide range of cultural changes occurred during the Archaic, with a general trend towards increased reliance on plants as a source of food and changing environmental conditions that may have favored plant tending and agriculture. Thus, social changes were likely mediated by subsistence changes, and these were driven by demographic pressure, environmental change, and socioeconomic competition (Winterhalder and Kennett 2006). The period from 8,000 to 6,000 BC is generally considered to have been wetter and warmer, prior to a drier interval lasting until 3,500 BC (Mueller et al. 2009). This suggests that the transition to agriculture spanned several phases of significant climate and environmental change with the relationships between them poorly constrained.

Preceramic Foragers in Southern Belize

Three sites largely define what we know about the preceramic foragers in southern Belize. All three are rockshelters. All three are located near to permanent sources of water, and all three have evidence of food processing, tool making and tool use, and mortuary activities (Figure 1). Here, work at these shelters is summarized and in future volumes of the RRBA we will present more detailed accounts of the data analysis and interpretation.

Mayahak Cab Pek and Saki Tzul are two large rockshelters located in an interior valley of the Maya Mountains in the Bladen Nature Reserve (BNR), a protected wilderness area where there has been minimal human disturbance of archaeological sites. These rockshelters are located over 30km from the nearest modern settlements. Their remoteness along with the protected status of the BNR (access to the Nature Reserve is limited to only scientific researchers with required permits) has greatly facilitated preservation of the archaeological record.

Both rockshelters were first investigated in 1998 by the Maya Mountains Archaeological Project (MMAP). At that time, shallow excavations at both sites produced shallow burials (Figure 3), abundant faunal remains, evidence of stone tool production, and were thought to be local mortuary sites used by residents of two nearby Classic Period sites, Ek Xux and Muklebal Tzul (Saul et al. 2005; Dunham and Prufer 1998). The 1998 excavations at both rockshelters were

Figure 3. Photo of Prufer and archaeologist David Goldstein in excavation Unit 34/35 in 1998. This Protocolassic burial was generally the deepest level reached prior to the start of the BPAAP.

constrained by a short field season and were limited to the top 100 cm of sediments and did not penetrate below ceramic levels (Prufer 2002).

From 2014 to 2017 the Bladen Paleoindian and Archaic Archaeological Project has revisited both sites and conducted more extensive excavation. Both rockshelters have deep deposits of cultural materials dating to the period prior to 10,000 BC (Figure 4) and continuing through the Classic Maya collapse at ca. AD 800-1000. Though the two rockshelters are located 1.4km apart, both have similar stratigraphic sequences and contain similar assemblages of artifacts and biological remains dating to the late Pleistocene. Both rockshelters have dry sediments and large overhangs, reflecting that little if any direct rainfall affects their contexts. Sediment formation differs significantly from surface sites in that water transport is not a major contributing factor. Sediments are deposited as a result of microbial and physical breakdown of the limestone cliff, wind-blown pollens and plant materials, animal activity, and anthropogenic activities, with the

Figure 4. View of the massive cliff wall of Saki Tzul rockshelter. The site is over 1200 m2. The overhanging wall provides significant shelter from the elements.

bulk of the Holocene deposits likely resulting from the latter. The dry aeolian nature of the rockshelters also helps to explain the excellent preservation of unburned bone, other organic materials and the very minor presence of root activity in a tropical environment (Figure 5).

Mayhak Cab Pek is an east facing shelter with approximately 160 m^2 sheltered, while Saki Tzul has a south aspect and has approximately 890 m^2 sheltered. Both have approximately 3.5 m of deposits that primarily consist of midden fill replete with faunal bone, carbonized plant

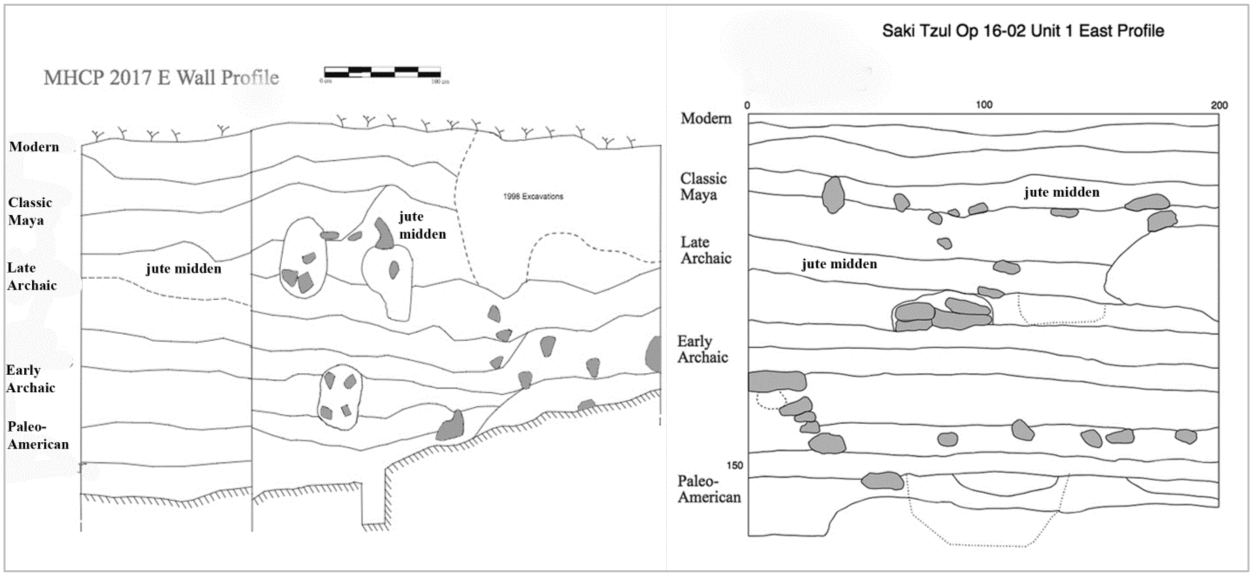

Figure 5. Profiles drawings from both Maya Hak Cab Pek and Saki Tzul showing similar stratigraphic sequences and across all times period.

materials, chipped stone, ground stone, terrestrial snail shells, and many millions of small spire-lopped *jute* (Pachychilus sp.) riverine snail shells, all of which appear to have been consumed as a food.

Stratigraphy at both rockshelters is relatively undisturbed and consists of Classic Period Maya deposits overlaying dense *jute* midden fill dating to the middle and late Archaic (5k-2.5k BC). Below this are early Archaic and Paleoindian contexts with a gradual decline in *jute* shell but abundant faunal, human, paleobotanical, and lithic remains. Human burials have a wide range of orientations, positions, and degrees of completeness, but are mostly primary interments that were placed in very shallow depressions and covered with either sediments or small river cobbles. Burials are found in all time periods and consist of males and females and range from neonates to older adults. Preliminary analysis of faunal remains suggests only small shifts in species composition over the Holocene, but a likely change in selection or preference from larger mammals in the early part of the record to smaller mammals in the later part (Orsini 2016). To date, only 8.4 m^2 at MHCP and 10.6 m^2 at ST have been excavated.

The excavations at Mayahak Cab Pek and Saki Tzul complements previous work we conducted in the Rio Blanco Valley, near to the Classic Period center Uxbenká. There, excavations in the small rockshelter Tzib te Yux from 2012-2015 documented an Archaic to Paleoindian chronology and cultural materials dating to before 10,500 BC (Prufer et al. 2017). Combined with geomorphological testing we have evidence of an occupation lasting well over 10,000 years in that small interior valley. Unfortunately, the record from Tzub Te Yux is truncated and the top 5000-6500 years were removed, likely as an effort mining the jute shell middens by residents of the Classic Period center.

Combined, these three records suggest strongly that the signal of pre-ceramic human activity is well preserved in some rockshelter deposits that are not affected by fluvial or erosion. It also indicates that there can be excellent preservation of some organic materials, primarily bone and carbonized plant materials. With ongoing analytical research, we will present more detailed interpretations of these shelters in future RRBA publications.

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