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Terminal Classic residential histories, migration, and foreigners at the Maya site of Ucanal, Petén, Guatemala

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ABSTRACT

Early scholarship on the disruption to political dynasties at the end of the Classic period in the Maya Lowlands argued that political collapse and the new material culture associated with it were due to the invasion of Putun/Chontal peoples from the Gulf Coast. One of the sites thought to have been targeted by such an invasion was Ucanal, Petén, Guatemala. Although no excavations had been undertaken at the site when the Putun invasion hypothesis was formulated, recent archaeological research at Ucanal provides an opportunity to re-visit the question of foreigners. This paper examines residential settlement histories and isotopic values from human teeth at Ucanal to better understand the changes that occurred during the Terminal Classic period. Our research indicates that while the possibility of foreign rule remains, the invasion hypothesis cannot fully capture the complex dynamics, multi-directional movements, and pluralistic influences of this time period. Ucanal was a thriving, heterogenous city with connections to multiple regions and peoples. Individuals born outside the Ucanal region were indeed present at the site, although the ways in which foreign identities were constituted were as much about peoples' practices and performances of self (and others) as about where they were born.

1. Introduction

The Terminal Classic period (ca. AD 810-950/1000) is often recognized as a period of tremendous political and social change as many royal dynasties across the Southern Maya Lowlands collapsed and many cities and smaller settlements underwent substantial population reductions. Despite these patterns, some Southern Maya Lowland settlements continued to be occupied, and in some cases prospered during this time (Aimers 2007; Rice and Rice 2018b; Zralka and Hermes 2012). In particular, scholars have noted substantial changes in the form and style of stone monuments, epigraphic texts, architecture, and material culture at many of these sites. Some of the earliest studies attributed these new practices, objects, and buildings to foreigners from either the Gulf Coast region or northern Yucatan who invaded or migrated to these Southern Lowland sites (Adams, 1971; Chase and Chase, 1982; Culbert, 1988; Sabloff et al., 1967; Thompson, 1970). Subsequent archaeological research, however, has found little evidence of foreign invasions or large-scale population replacements, and many have suggested that local populations began to adopt new cultural and political expressions that replaced the traditional alliances, symbols, and structures of political-economic power from the Classic period (Bazy and Inomata 2017; Demarest 1997; Foias and Bishop 2005; Tourtellot and González 2004).

The stone monuments from the archaeological site of Ucanal, located in eastern Petén, Guatemala, exhibit many of the foreign-affiliated attributes noted by some of the earliest scholars, but it is only recently that the site has been systematically excavated. This paper presents newly documented settlement data from the city's residences as well as stable and radiogenic isotopic data from human teeth and fauna from the region to provide a more comprehensive examination of the changes that occurred at the end of the Classic period. The isotopic data provide a baseline chemical signature for the Ucanal region as well as initial insights into population mobility from a sample of residential burials and human teeth from ritual contexts (n = 17). Despite the small sample size of the human remains, the combined perspectives from the residential histories and isotopic analyses underscore that major population replacements by an invading group were not likely to have occurred. We argue that while the site maintained a high degree of stability over the

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course of the Late Classic to Terminal Classic periods, it was also a heterogenous city that incorporated new inhabitants and influences from different Maya regions. We suggest that a more flexible and dynamic understanding of "the foreign" and foreigners are needed to better characterize the archaeological data at Ucanal and elsewhere in the Maya area.

2. Terminal Classic changes and the question of foreign origins

2.1. Foreigners

Foreign identities have the potential to be overlapping, situational, unstable states of being, and as such are challenging to identify archaeologically. In the case of ancient Maya peoples, it is highly unlikely that foreign identities fell along the lines created by contemporary anthropologists who have designated a seemingly bounded "Maya area" based on linguistic group affiliations at the point of Western contact. Substantial ethnohistoric and epigraphic evidence suggests that ancient identities of group belonging may have heavily focused on both the political/settlement community and descent or patronym group, although they were both highly dynamic in time and space, as these entities fused together, were annexed, separated, and migrated (Carmack, 1981; Hill, 1989; Restall and Gabbert, 2017; Sachse, 2006; Watanabe, 2004; Tokovinine, 2013). Contemporary Maya language speakers often refer to those who belong to the same local identity as "true people", *hach winik* (Lacandon), *batz' iviniketik* (Tzotzil), *tojol winik* (Tojolabal), *qas winaq* (Tzu'utujil) (Beyyette and LeCount 2017; Gossen 1999:6; Scherer et al. 2018:162). "True people" differ from foreigners by their practices, values, origins, and language affiliations, and those excluded from local belonging may include other Maya language groups or communities, non-indigenous groups, and those of other nationalities. Such determinations may differ from state-mandated definitions of indigenous groups based solely on ancestry (biology) or ties to land (geography), as some have been displaced from their lands and some participate in diaspora cultures to obtain work abroad (Delugan 2010; Hutson 2009; Beyyette and LeCount 2017; Magnoni et al., 2007).

Similarly, ethnic identities, only one of multiple ways of defining outsider status, have often been treated in anthropological scholarship in primordialist/normative terms, in which identities are ascribed and inherited as particular practices, attributes, biological affiliations, and values, or in instrumentalist/situational terms, in which belonging and difference are performed, have the potential to shift based on social context and social positioning, and are maintained through both everyday and diacritical practices of affiliation with others (Barth 1969; Chan, 2005; Jones 1997; Voss 2008). As Renato Rosaldo (1988) argues, however, these are false dichotomies in that ethnic identities are often formulated through both primordialist/normative and instrumental/situationalist modes. That is, identities derive from references to timeless traditions and biological or geographic origins *and* situated performances and practices of affiliation and display that depend on social contexts and perceived advantages of belonging or not. Nonetheless, archaeological inquiries of foreign identities sometimes inadvertently focus on one or the other, as is the case with the Putun invasion hypothesis.

2.2. Foreigners in Petén during the 9th century

Early interpretations of 9th century changes in Petén proposed that an invasion of "Mexicanized" peoples took over sites such as Ceibal, Altar de Sacrificios, and Ucanal, and brought with them iconographic innovations in stone monuments as well as Fine Paste pottery from the west (Adams, 1971, 1973; Cowgill, 1964; Sabloff et al., 1967) (Fig. 1). For Sabloff et al., 1967:323, italics added), "Seibal was invaded in the earlier half of the 9th century CE by a foreign group which had links with the Gulf Coast Lowlands (Tabasco-Campeche), Yucatan, and Central Mexico. This group did not merely overrun the site, *but it established itself*

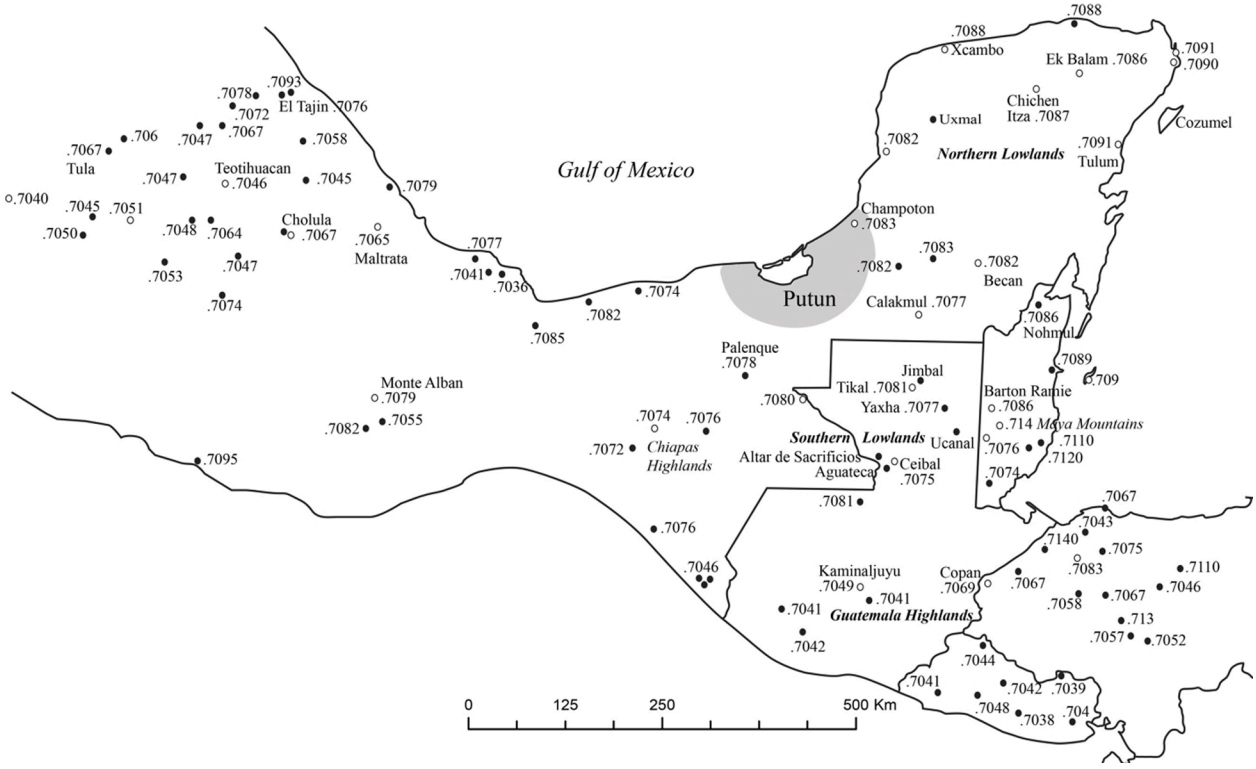

Fig. 1. Map of Mesoamerica area showing the presumed Putun (Chontal) Maya region and average strontium isotope values in Mesoamerica from fauna (black) and human (white) samples (map by C. Freiwald with data from Freiwald 2021; Freiwald et al. 2019, 2020; Freiwald and Pugh, 2018; Ortega-Muñoz et al., 2019; Price et al., 2010; Smith, 2020; Suzuki et al., 2015; Wolf et al., 2018; Wright et al., 2010; Wrobel et al., 2017).

there." Likewise, J. Eric S. Thompson viewed the intruders as Putun Maya or Chontal (stemming from *chontalli* or "foreigner" in Nahuatl, a name undoubtedly not used by these people to refer to themselves!), a "hybrid Maya-Nahuat" people from the Gulf Coast of Mexico who invaded Ceibal and Ucanal and were responsible for the "foreign" traits and motifs on their mid- to late 9th century monuments, such as warrior figures holding darts and atlatls and the use of square-framed glyphs holding Central Mexican day signs (Thompson 1970:3–44). These square-shaped glyphs, calendrical dates that often served as proper names, were inscribed on other Terminal Classic monuments, such as from Calakmul, Ixlú, and Jimbal as well as on Fine Orange molded-carved pottery (Boot 2005; Halperin and Martin 2020; Lacadena 2010).

Since early scholarship in the 1960s and 1970s, however, more intensive excavations at the site of Ceibal as well as other sites with Terminal Classic occupation have cast doubt on a 9th century invasion from peoples from the west. Ceramic production practices do not show a sharp rupture between Late Classic and Terminal Classic phase traditions (Demarest et al. 2004; Foias and Bishop 1997; Halperin 2017b; López Varela and Foias 2005). Instrumental Neutron Activation Analysis (INAA) reveals that most of the Terminal Classic Fine Paste ceramics from the Petexbatun region were locally produced in the Pasion drainage/Upper Usumacinta region rather than brought from the Gulf Coast by "foreign invaders" (Foias and Bishop 2005). Likewise, many of the Terminal Classic monuments with foreign traits often possessed an eclectic mix of Classic Lowland Maya expressions and styles alongside newly incorporated characteristics (Just 2007). For example, a newly discovered stela at the site of Ucanal, Stela 29, depicts a Terminal Classic ruler who wears a cotton warrior shirt (*ichachuipilli* in Nahuatl), garb that was relatively atypical for Classic Maya rulers, and holds a Central Mexican style atlatl and long darts, weapons often denoting foreign status, as noted earlier (Halperin and Martin 2020). The body position and rendering of the figure in relation to the darts, however, was fully anchored in Maya sculptural traditions, and other traits, such as the figure's tubular nose bar, may have been part of new "internationalized" expressions of status or belonging.

Although it is common for new architectural, art, and artifact styles to be attributed to the arrival of new peoples, this perspective often assumes a normative view of culture in which people are inextricably tied to their traditions with little maneuverability for agency, emulation, and local reinventions. As underscored by instrumentalist/situationalist approaches, foreign identities are as much performed as they are born into, and multiple influences and inspirations from far and near may form the fabric of localized ways of being (Barth 1969; Berdan 2008; Beyyette and LeCount 2017; Clammer 2015). Foreign practices, affiliations, and symbolism may be promoted when it is beneficial to do so, such as the Central Mexican adoption of Huastec warrior costumes as a way to honor the alterity and ferocity of Huastec warriors as well as a way to reward Nahua warriors when they captured their second captive (Berdan 2008:123-124). Immigrants may purposefully differentiate themselves through practices and visual cues, as was the case at Teotihuacan where an ethnic enclave of merchants lived on the eastern outskirts of the city and whose access to long-distance networks, and their professional status as traders may have been linked to their distinct identities (Spence et al. 2005; see also Stein 2002). In turn, other immigrants may choose to minimize any distinctions between them and local populations, integrating themselves more seamlessly wherein their archaeological identification can be difficult if not impossible to detect with material culture or mortuary context (Freiwald 2021; Manzanilla 2009, Manzanilla 2015; Miller 2015; Miller Wolf in review). In turn, changes in styles of clothing, architecture, among other types of material culture may have been as much about an embrace of a new political or social order, the adoption of new fashions, and worldly statements of belonging, as an affiliation with a specific group of people or place of origin (Halperin 2017a; Jordan 2016; Vail and Hernández 2010).

Nonetheless, both temporary and more permanent migrations were critical to the spread of new ideas, influences, and practices. Some scholars have argued that the emergence of a cult of Quetzalcoatl helped stimulate the spread of new Terminal Classic changes in Mesoamerica (Folan et al. 2016; López Austin and Luján 2000; Ringle et al. 1998). Although the reverence for the feathered serpent aspect of Quetzalcoatl never took hold in the Southern Maya Lowlands, elite pilgrimages to distant sacred centers and the networking of long-distant merchants between sites underscore the variable ways in which ideas, objects, and practices may have spread. One of the major contributions of this model was that it destabilized a single point of origin for Epiclassic/Terminal Classic (and later Postclassic) developments, breaking down binary logics that were often a part of invasion narratives, such as the conquest of Tula over Chichen Itza and vice versa. Nonetheless, the cult of Quetzalcoatl model often assumes that migrations were primarily temporary, such as the circular pilgrimage routes to sacred shrines by male leaders or the circuits of traveling merchants that brought prestige goods from afar, and thus largely overlooked the possibility that many people did indeed leave their homelands to settle elsewhere throughout the course of Mesoamerican history.

Beyond the myopic perspective of the movement of a handful of elite men and merchants, however, analyses of settlement patterns and isotopic analyses of human bone have the potential to provide a broader understanding of foreign influence and movement. Isotopic studies of human teeth have helped promote a resurgence in attention to migration in archaeology (Arnauld et al. 2021; Price et al. 2008) and have indicated that 10–40% of inhabitants of Maya cities included both commoner and elite individuals who were born in other regions (Freiwald 2011; Freiwald et al. 2014; Miller 2015; Price et al. 2010; Wright 2012). These data may provide important insights into migration patterns of interred individuals, although not all individuals born outside a statistically determined local region may have been considered as foreigners, and those born locally may have drawn ties to different homelands through ancestral ties or through particular practices and performances of self.

In turn, a focus on residential histories provides a perspective of when inhabitants of a city came and left, the continuities or disjunctures in occupation, as well as possible affiliations with other more distant communities as understood through domestic architectural styles. Unlike monumental public architecture, which is often constructed with particular political messages in mind and embodies the organized and collective labor of entire communities, domestic architecture has the potential to both reflect and constitute more intimate identities and affiliations. The architectural grammars of domestic buildings often engender the histories, community traditions, spatial dispositions, and aspirations of its inhabitants and the networks of friends, extended family, and specialists they get to help them construct such buildings (Ashmore 2007; Glassie 1975, 2000; Halperin and Schwartz 2016).

Some have argued that new domestic forms and layouts during the Terminal Classic period were the result of foreign peoples who brought such architectural traditions with them. For example, Marshall Becker (Becker 2003, 2009), in taking a more primordialist/normative approach to ethnicity, has suggested that residential groups with centrally placed altars (Plaza Plan 4 in the Tikal classification system) at Tikal were occupied by different ethnic groups than the local population, perhaps people with possible links to Central Mexico where central altars were common in residential patios from the Late Preclassic to Postclassic periods. Notably, all of the Plaza Plan 4 residential groups from Tikal dated to the Terminal Classic period. A recent examination of this Terminal Classic architectural pattern of residential compounds (Halperin and Garrido 2019), however, indicates that they appear both at sites in the Northern Lowlands, such as Ek Balam, Yaxkukul, and San Gervasio (Cozumel) (Bey et al. 1997 ; Houck 2004Fig. 3 Fig. A.18, A.20; Sabloff and Rathje, 1975; Smith and Bond-Freeman, 2018 Fig. 5.9), and in the Southern Lowlands, such as Yaxhá, Machaquilá, Ceibal, Jimbal, and Ucanal (Gamez Diaz 2013 Fig. 4-2; Halperin and Garrido 2019; Hermes and Zralka 2012:189, Fig. 12; Ruiz and Pavón 2011; Tourtellot 1988:87–97). Such new domestic configurations, however, may have

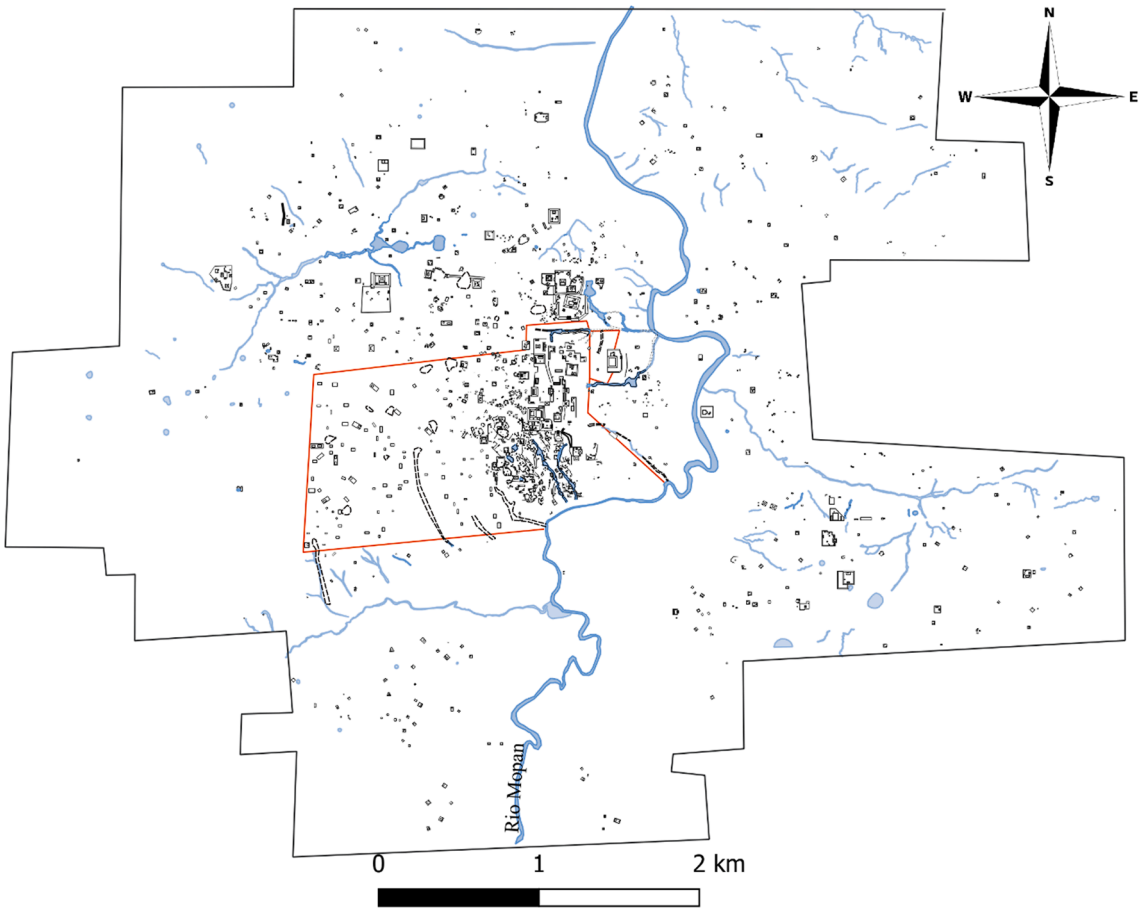

Fig. 2. Map of the site of Ucanal with red lines indicating the national park boundary and black lines as the PAU survey (2014–2019) boundary (map courtesy of the PAU project). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

been as much a way to invoke foreign networks and try out new domestic configurations as a reflection of the arrival of new migrant families.

Likewise, early research on "C"-shaped domestic buildings, which newly appeared at sites in the Maya Lowlands during the Terminal Classic, argued that they provided evidence of the intrusion of non-Petén populations into Petén (Rice 1986:332–337). Excavations of "C"-shaped domestic buildings, however, reveal that the earliest examples date to the Late Classic period (Tepejilote phase, AD 600–810 at Ceibal) in the Petexbatun/Pasion region of Petén and became more popular in the Terminal Classic period (Bayal phase, 810–950 CE at Ceibal) (Demarest 2004; Tourtellot 1988). Elsewhere in Petén, they date to the beginning of the Terminal Classic period and later (ca. AD 810 and later at Machaquilá; AD 890–1180 at Quexil) (Hermes and Zralka 2012; Iglesias Ponce De León and Ciudad Ruiz 2009:42, 53; Schwartz 2013). In northern Yucatan, examples date slightly later than in Petén: mid 10th century and later (Ek Balam, Uxmal, Sayil) (Bey et al. 1997:248; Tourtellot et al. 1992:97; Vargas De la Peña et al. 2020:369). Such chronologies suggest that the new ways of building domestic space with "C"-shaped platforms emerged first in the Petexbatun/Pasion region and spread outward from there, rather than brought into the Petén by non-Petén peoples (Rice and Rice 2018a). Thus, in order to address some of these questions and contradictions concerning the movement and migrations of peoples during the Terminal Classic period, we examine both current settlement and isotopic evidence from the site of Ucanal.

3. Residential settlement histories

The site of Ucanal, referred to as *K'anwitznal* or "Yellow Hill Place" in Classic period texts, is located in the Mopan River Valley in eastern Petén. Excavations by the Proyecto Atlas Arqueológico de Guatemala, directed by Juan Pedro Laporte, first began in 1997 and continued until 2000 and focused on the test-pitting of 15 architectural groups (5 of which were monumental, public plaza zones) (Laporte et al., 2002; Laporte and Mejía, 2002a,b; Corzo et al., 1998; Mejía, 2002). More recent investigations by the Proyecto Arqueológico Ucanal (PAU) between 2014 and 2019, directed by Christina Halperin and Jose Luis Garrido, have further documented both residential and public architectural groups as well as provided the most extensive survey of the site to date. The mapping has revealed that the site was quite extensive with a monumental and residential core of at least 7.5 km^2 and a wider periphery that extended at least to a zone of 26 km^2, straddling both sides of the Mopan River (Fig. 2). The public monumental zones are partly connected by causeways with raised parapets (low walls). They include over 12 major public ceremonial complexes, three of which have ballcourts, and urban water infrastructure systems that have been identified throughout the site (Halperin, LeMoine, et al. 2019). Excavations from 2016 to 2019 targeted 21 different zones of the city, of which 15 represent residential architectural groups. Excavations of the residential groups focused on test-pitting of middens at the edges of groups, horizontal excavations of the final phases of occupation, and vertical excavations of residential structures to obtain construction chronologies. Due to permitting and issues of access, excavations were conducted only in the forested national park zone of the site, which encompasses part of the 7.5 km^2 urban core (Fig. 3).

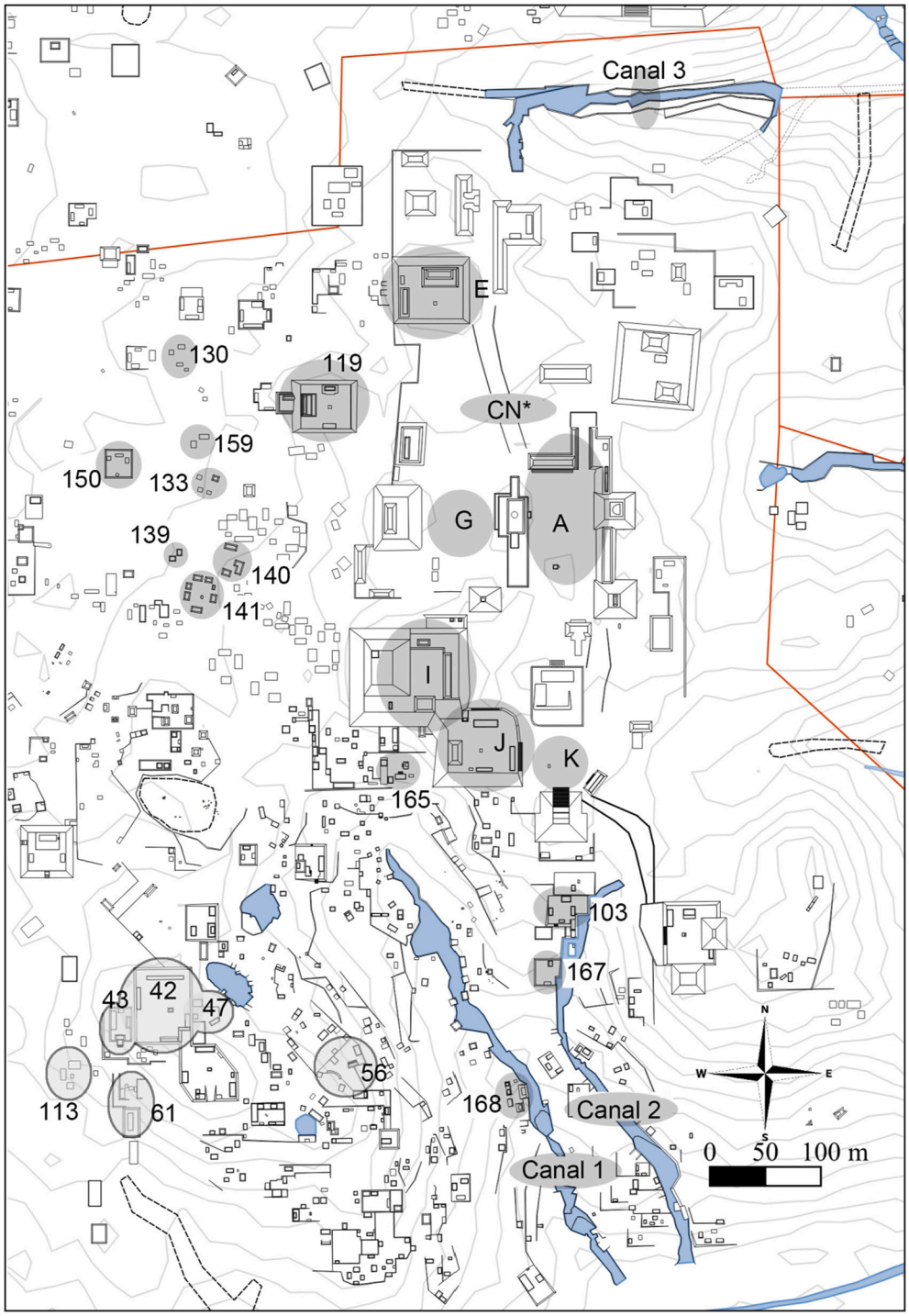

Fig. 3. Map of excavated architectural groups and features from Ucanal Sectors G-10, H-10, G-11, and H-11 (PAU survey data 2014–2019; PAU excavated areas in dark gray; Atlas excavated areas in light gray with outline; does not include Atlas excavations in Sectors H-8 and H-9).

3.1. Residential settlement continuity

Excavations reveal an overall pattern of settlement stability between the Late Classic and Terminal Classic periods. In general, the trend in settlement changes was one of incremental growth between these two periods. Of all tested architectural groups (public and residential; n = 31), 84% possessed evidence of Late Classic period construction (Kan and B'aaluum phases ca. AD 600–810), 84% possessed evidence of Terminal Classic (Winik phase ca. AD 810–950/1000) construction, and 97% exhibited evidence of Terminal Classic period occupation. Population, however, diminished significantly during the Postclassic period with approximately a third of architectural groups exhibiting evidence of Early Postclassic period occupation, although all PAU excavated groups contained some Postclassic pottery even if in very small amounts.

An examination of residential histories more specifically reveals a dense Terminal Classic occupation of the site (Table 1). All residential groups demonstrate evidence of occupation during this period, and 100% of tested structures within those architectural groups possess evidence of Terminal Classic occupation. Seventy-six percent of these

Table 1
Residential Group Histories at Ucanal with Number of Construction phases by Structure.

PAU Op. No.	Group	Structure	Postclassic occupation	Terminal Classic occupation	Terminal Classic construction phases	Late Classic construction phases	Early Classic construction phases	Late Preclassic construction phases	Late/Middle Preclassic construction phases
1	J							NA	NA
1A		J-6			1	3	2	NA	NA
1B		J-2			3?	4?	NA	NA	NA
1C		J-7 (central shrine)			1	2	NA	NA	NA
1D		J-1			3	NA	NA	NA	NA
1E		J-5			2	NA	NA	NA	NA
3	E								NA
3A		E-1			0	1	1	1	NA
3B		E-2			1	1	0	1	1
3C		E-3			0	1	NA	NA	NA
4	141							NA	NA
4B		141-5			1	1	NA	NA	NA
4A		141-8 (central shrine)			1	0	#	NA	NA
5	140						NA	NA	NA
5A		140-3			2	1	NA	NA	NA
5B		140-2			1	NA	NA	NA	NA
6	139								NA
6A		139-1			1	3	0	2	NA
9	I								NA
9A		I-1			0	1	1	1	NA
9B		I-4			0	2	0	1	NA
Atlas		I-3/I-5			1	0	0	1	NA
9C		patio floor			0	2	0	1	NA
8	133						NA	NA	NA
8A		133-4			1	1	NA	NA	NA
8C		133-1			2	0	0	1	NA
11	130								
11A		130-1			1	2	0	0	0
11D		130-4			2	2	0	0	0
12	159								
12A		159-1			2	2	0	0	#
12B		159-2			1	1	NA	NA	NA
13	119								
13A		119-1			2	1	0	1	0
13B		119-2 (central shrine)			2	0	0	1	NA
	150								NA
14A		150-1			0	2	0	1	NA
14B		150-2			1	2	0	#	NA
16	168								
16B		168-2			1	0	0	0	0
16C		168-3			1	NA	NA	NA	NA
17	167								
17A		167-1			1	1	NA	NA	NA
17B		167-2			2	2	0	0	0
18	165						NA	NA	NA
18A		165-2			2	5	NA	NA	NA
18B		165-3			2	NA	NA	NA	NA
21	103								
21A		103-1			1	2	NA	NA	NA
21B		103-2			2	3	0	0	0
Atlas	42								
Atlas		42-2			1	NA	NA	NA	NA
Atlas		42-3			0	1	0	?	
Atlas		42-5			1	NA	NA	NA	NA
Atlas		42-9 (central shrine)			1	NA	NA	NA	NA
Atlas		patio floor			0	2	0	3	0
Atlas	43						NA	NA	NA
Atlas		43-3			1	NA	NA	NA	NA
Atlas		43-4			1	1?	NA	NA	NA
Atlas	47						NA	NA	NA
Atlas		47-2	1		1	1	NA	NA	NA
Atlas		47-4			0	1	NA	NA	NA
Atlas	56								
Atlas		56-8			1	2	NA	NA	NA
Atlas		patio floor			1?	2	0	2	1
Atlas	61						NA	NA	NA
Atlas		61-3			1	1	NA	NA	NA
Atlas	81								
Atlas		81-S			1	0	0	1?	NA
Atlas		81-O			1	NA	NA	NA	NA
Atlas		81-N			0	1	0	1?	NA
Atlas		81-E			0	1	0	1?	NA
Atlas	82								NA
Atlas		82-E			0	0	0	1	NA
Atlas		83-3			0	1	NA	NA	NA
Atlas	83&84				NA	NA	NA	NA	NA
Atlas	85								NA
Atlas		85-1			0	0	0	1	NA
Atlas		85-2			1	1	NA	NA	NA
Atlas		85-3			1	NA	NA	NA	NA
Atlas		85-4			0	1	NA	NA	NA
Atlas		85-5			1	NA	NA	NA	NA
Atlas	113						NA	NA	NA
Atlas		113-2			1	NA	NA	NA	NA
Atlas		113-3			2	1	NA	NA	NA
Atlas		113-4 (central shrine)			1	NA	NA	NA	NA
	L							NA	NA
Atlas	L	L-1	1	1	2?	1	1?	NA	NA

occupation surface (no evidence of construction); NA = not excavated to bedrock, therefore earlier phases are not known.

structures were remodeled during the Terminal Classic period. Fourteen percent (n = 8) of these Terminal Classic structures were constructed on previously unoccupied space or on features that demonstrate a gap in construction during the Late Classic B'aaluum phase (ca. AD 700–810), indicating that both Terminal Classic construction and occupation expanded from Late Classic times. The remaining Terminal Classic structures, however, were remodeled constructions built on top of Late Classic B'aaluum phase (ca. AD 700–810) buildings, indicating that Terminal Classic phase populations were largely an outgrowth of these earlier households. In this sense, no major disjuncture or temporal gap in settlement is noted between the Late Classic and Terminal Classic periods.

In addition to the density of Terminal Classic occupation, some of the residential buildings were remodeled multiple times over the course of the Terminal Classic period, underscoring the longevity and prosperity of the city during this time. Twenty-five percent of excavated buildings contained two or more Terminal Classic construction phases. These finds contrast with residential histories elsewhere, such as Machaquilá, Minanha, Naachtun, Motul de San José, among other sites in which Terminal Classic construction represented either the final occupation surfaces or only single construction phases (Lamoureux-St-Hilaire, 2015; León et al., 2009; Foias and Emery, 2012; Sion, 2015). This Terminal Classic stratigraphy has helped establish early and late components of the Terminal Classic Winik phase ceramics at Ucanal paired with AMS carbon dates (Salas et al forthcoming).

3.2. New residential architectural styles

Excavations reveal that new residential architecture in the form of C-shaped superstructure foundations and domestic compounds with low, centrally-located shrines appeared at Ucanal during the late Terminal Classic period. While two C-shaped buildings (from Group 111 and 14) were noted from survey by the Proyecto Atlas Arqueológico (but remain unexcavated), PAU excavations encountered two more from the eastern sides of Groups 103, an elite residential group south of Group K, and Group 167, a more modest-sized (Rank 3, associated with commoner groups) residential group at the edge of Ucanal's Canal 1 (Fig. 4). In both cases, excavations revealed that the "C"-shaped buildings were constructed during the late Terminal Classic (late Winik) phase and overlaid earlier Terminal Classic (early Winik) phase buildings (Sub-1), as well as multiple Late Classic (Sub-2 to Sub-4) B'aaluum and Kan phase buildings, which again underscore continuity in occupation rather than abandonment and subsequent reoccupation with the new architectural forms. We suspect that more C-shaped buildings occur at the site, but are invisible from surface topography, as was the case of Structures 167–2 and 103–2. While two burials were found in Group 103, no teeth were available from these burials (one was a cremation urn burial containing the ash and bone fragments of what was likely an elite individual and another was an infant burial) for isotope sampling.

A total of 13 residential architectural groups with centrally located shrines (Plaza Plan 4 configurations) have been identified at the site of Ucanal to date, of which 6 have been excavated (Groups J, E, 119, and 141 by the PAU and Groups 42 and 113 by the Proyecto Atlas Arqueológico; this sample count does not include large, public plaza groups with small centrally-located shrines). These groups are found scattered throughout the 7.5 km^2 site core, and thus do not conform to what might be considered a neighborhood of distinctive architectural practices. They are, however, associated primarily with larger architectural groups (Rank 1 [elite] and 2 [middle-status]) with only one and possibly two belonging to the more modest Rank 3 (commoner) volumetric group size ranking at the site. None have been identified in the site's settlement periphery to date.

In cases in which ceramics were plentiful enough for reliable dating, the low, centrally located shrines within residences were constructed during the late phase of the Terminal Classic period and directly associated with the final phase patio floor. Similar to the "C" shaped structures, these final architectural additions are located stratigraphically over multiple construction phases that include both Terminal Classic and Late Classic building episodes. In the cases of elite residential Groups 119 and Group E, substantial quantities of construction fill appeared during the Late Preclassic period, with thinner Late Classic and Terminal Classic remodelings added over these labor-intensive beginnings (Cruz Gómez, 2017; Mongelluzzo, 2016). In contrast, Group J

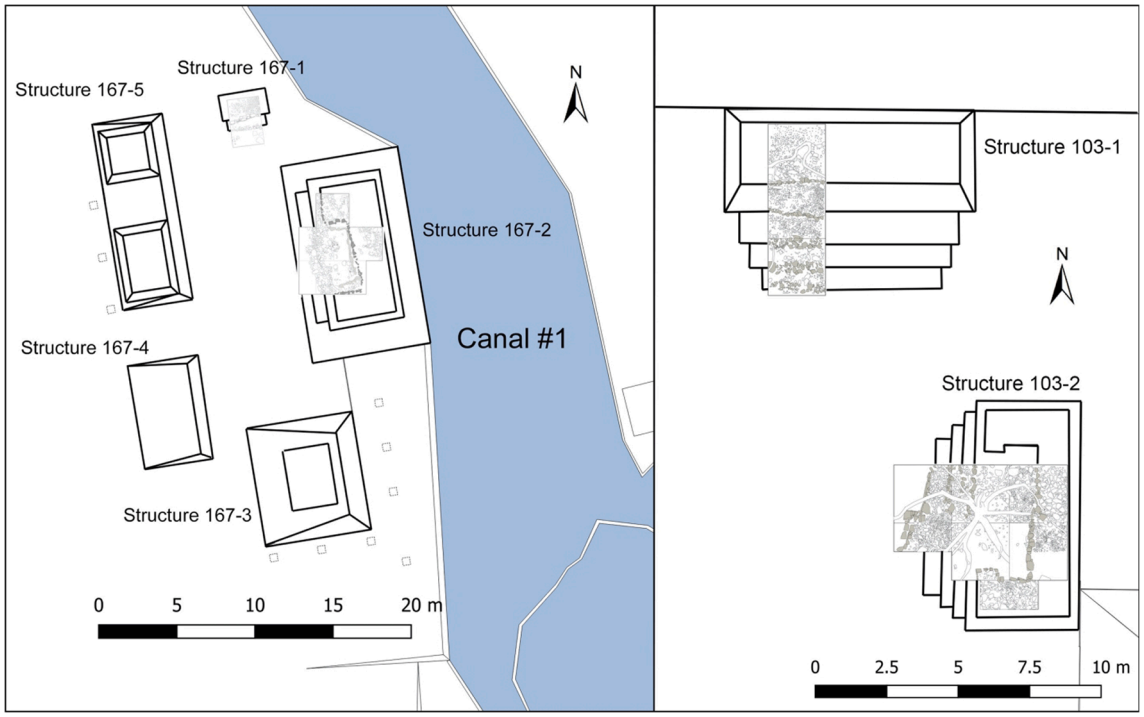

Fig. 4. "C"-shaped Structures from Group 167 (left) and Group 103 (right) (map by M. Cano, C. Halperin, and J-B LeMoine).

represents an elite residential group in which architectural remodelings were continuously active during the Late Preclassic, Early Classic, Late Classic, and Terminal Classic periods with continued occupation during the Early Postclassic period (Table 1) (Cruz Gómez et al., 2016; Halperin, Bigué, et al. 2019; Perea et al., 2019). One of the largest reorganizations of architecture in Group J occurred at the beginning of the Terminal Classic period, when a massive new platform (representing a volume of approx. 4480 m^3) was installed, elevating the group approx. 1 m above the earlier Late Classic B'aaluum building foundations. Although the full extent of these Late Classic B'aaluum buildings was not exposed, large stone blocks and vault stones from them or other buildings that had been dismantled or collapsed made up a substantial portion of the fill material (Halperin 2021). Since Terminal Classic buildings on Group J lacked standing masonry walls and roofs, this was a substantial shift from stone to wood architecture (Halperin and Garrido 2019).

The only residential group with a centrally located shrine that did not have a long history of occupation is Group 141, a medium-sized Rank 2 residence (Fig. 5). Excavated structures and the patio surface of the residential compound indicate that architecture was erected during the early Winik phase of the Terminal Classic period over a soil surface dating to the Kutz (Early Classic) and Kan (ca. AD 600–700) phases but with no clear sign of construction in this stratigraphic level. Structure 141-5′s painted and stucco interior bench was remodeled at

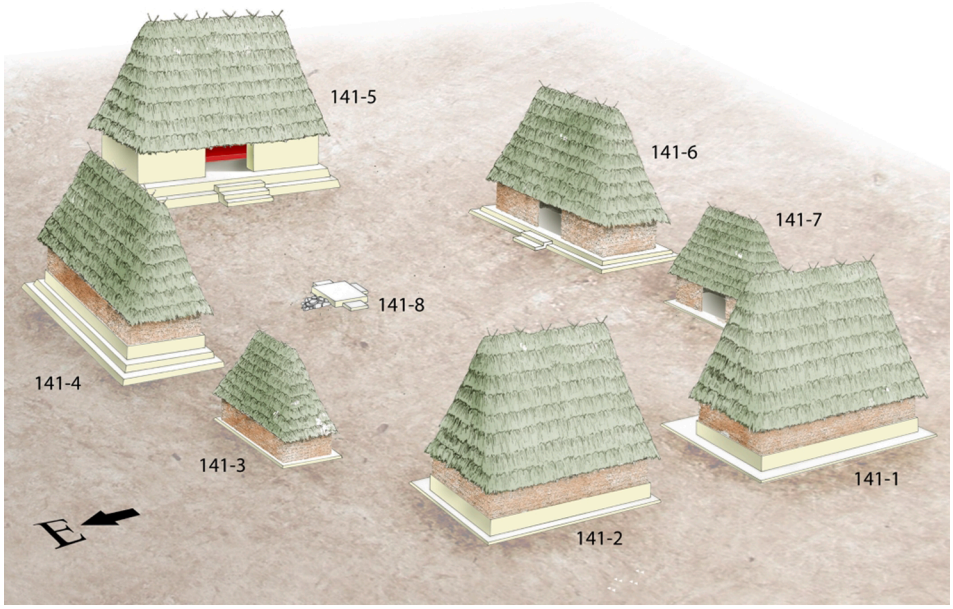

Fig. 5. Reconstruction drawing of Group 141 (note: Burials 4-1A & 4-1B were located below the rock pile at the eastern edge of Structure 141–8) (by L.F. Luin).

least twice during the Terminal Classic, underscoring the continued prosperity of its inhabitants over the course of this time period.

3.3. Burials and offerings from residential contexts

Burials were identified in both residences exhibiting new architectural styles as well as those without such diacritics. One particular burial pattern was the placement of burials and offerings at the eastern edges of the Terminal Classic centrally located residential shrines. In Group J, a stela and altar (Ucanal Stela 19, Altar 9) were placed in front of the central shrine, Structure J-7. We suspect that the stela and altar were located elsewhere previously and reset in this location at the beginning of the Terminal Classic period. The stratigraphy around these features was highly disturbed with mixed ceramic chronologies, and only a partial cache of chert eccentrics was placed at its base (Ucanal Cache #1-1). While seven eccentrics were carefully laid out flat in two even rows within the platform fill under the stela, two additional chert eccentrics of the same rose-pink translucent chert as those in the cache were found discarded in the fill near the ground surface. They were likely part of the original cache (nine is a common number of eccentrics in caches throughout the Petén), but apparently were left aside upon deposition in front of shrine J-7 (Hruby et al., forthcoming). In turn, a small building, Structure J-1, another shrine located at the far northwestern edge of the residential group and just at the entrance to Group I, contained human teeth on a small altar or pavement with evidence of burning and other disarticulated human remains along its edges and mixed with other materials indicative of ritual activities, such as burnt sting ray spines, unusually high concentrations of obsidian (and one of the few deposits in the site to contain obsidian sourced to Central Mexico), and censer fragments (Fig. 6). These materials date to the late Terminal Classic (Winik) period.

The other residential groups with centrally located shrines contained burials at the eastern side of the shrines, and are also the subject of isotope analysis described below. On the eastern side of Structure E-2 from Group E, a single adult male in his twenties with robust skeletal markers was placed in a prone position with his head to the north and legs to the south (Burial 3–1) (Fig. 7) (Miller Wolf, 2019). The burial was close to the ground surface (36–59 cm) and was disturbed by taphonomic processes. As such, the preservation was poor and only fragments of the cranium were found, although in an anatomically correct position relative to the body. No grave goods were found directly associated with the individual, although a cache of two Terminal Classic ceramic bowls placed lip to lip contained a large jadeite belt pendant sculpted into the shape of a human head (Halperin et al. 2018). An additional human tooth, also dating to the Terminal Classic, was found just above the burial within the same excavation lot, and was also sampled for isotope

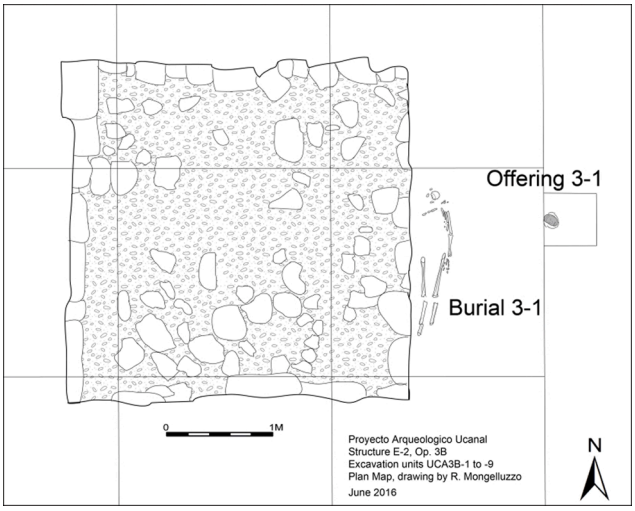

Fig. 7. Ucanal Group E's central shrine, Structure E-2, and Burial 13–1.

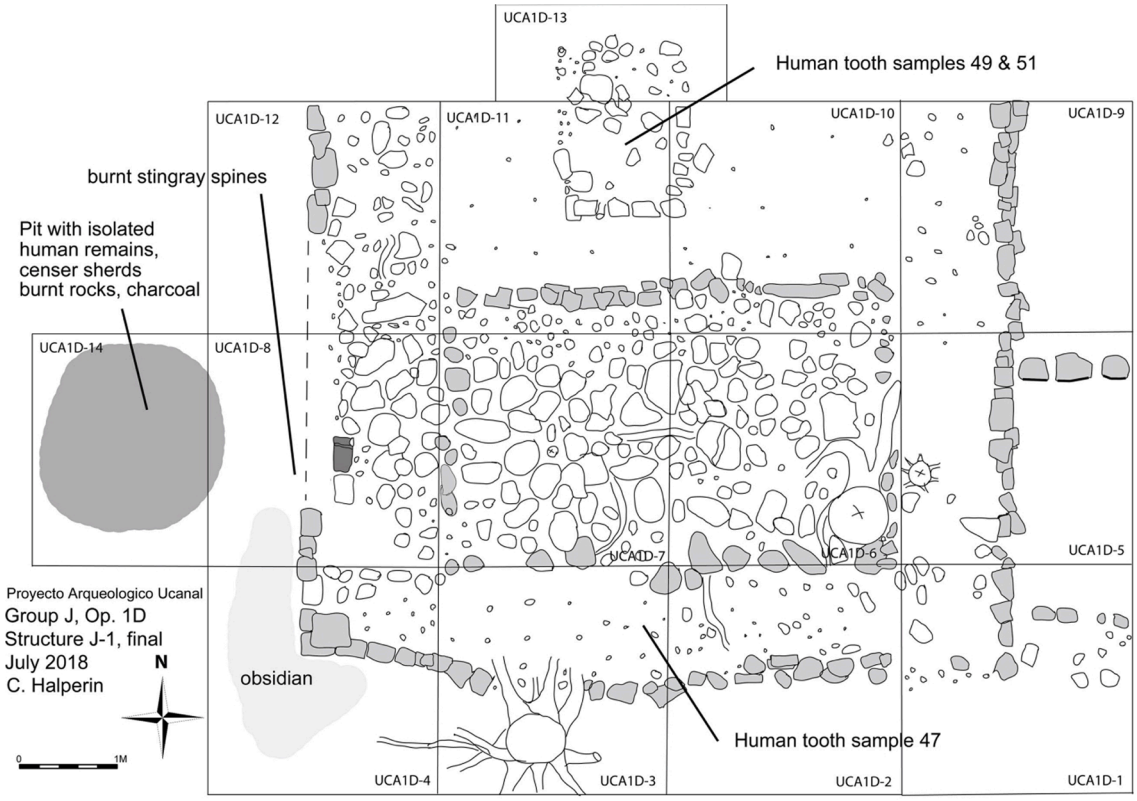

Fig. 6. Isolated human remains found on a small altar or pavement and at the edges of shrine Structure J-1 (final phase).

analysis.

In Group 141, the Terminal Classic burials from the eastern side of the group's central shrine (Str. 141–8) were buried stacked one on top of the other (Fig. 5). Next and just 50 cm north of the two burials was another pit filled with two sculpted limestone blocks (Halperin and Garrido 2019:Fig. 10). Burial 4-1B, an adult female 20–30 years old, was first placed in the small cist dug into bedrock below the eastern edge of the Group 141 central shrine. She was covered with rocks and squeezed into the pit with her limbs tightly flexed in a roughly seated position. She was accompanied by two greenstone beads. Directly above the rocks covering Burial 4-1B were the remains of a male individual 30 to 35 years old (Burial 4-1A) with a tabular oblique cranial modification, prominent muscle markers showing a heavier use of the right arm, and a supernumerary articular facet on the fifth manual phalanx, an indication of a sesamoid bone or sixth finger (Miller Wolf 2019:203). He was dismembered before being carefully placed in the circular cyst: the epiphyses of the left and right humerus, the left and right proximal tibiae, and the fibulae were all removed post-mortem, and post-mortem cut marks were noted on both clavicles and scapulae. This individual had no grave goods with the exception of a complete Garbutt Creek Red bowl that was inverted and placed over the top of the burial.

Two Terminal Classic burials were also placed stacked one on top of each other at the eastern side of the central shrine from Group 119, similar to those from Group 141 (Fig. 8). The lower burial, Burial 13–3, was a small pit containing a single cranium, the first and second cervical vertebrae, and the hyoid of a male 30–40 years old. The individual was decapitated, as indicated by the cut marks on the second cervical vertebrae with only a fragment of the odontoid process having been

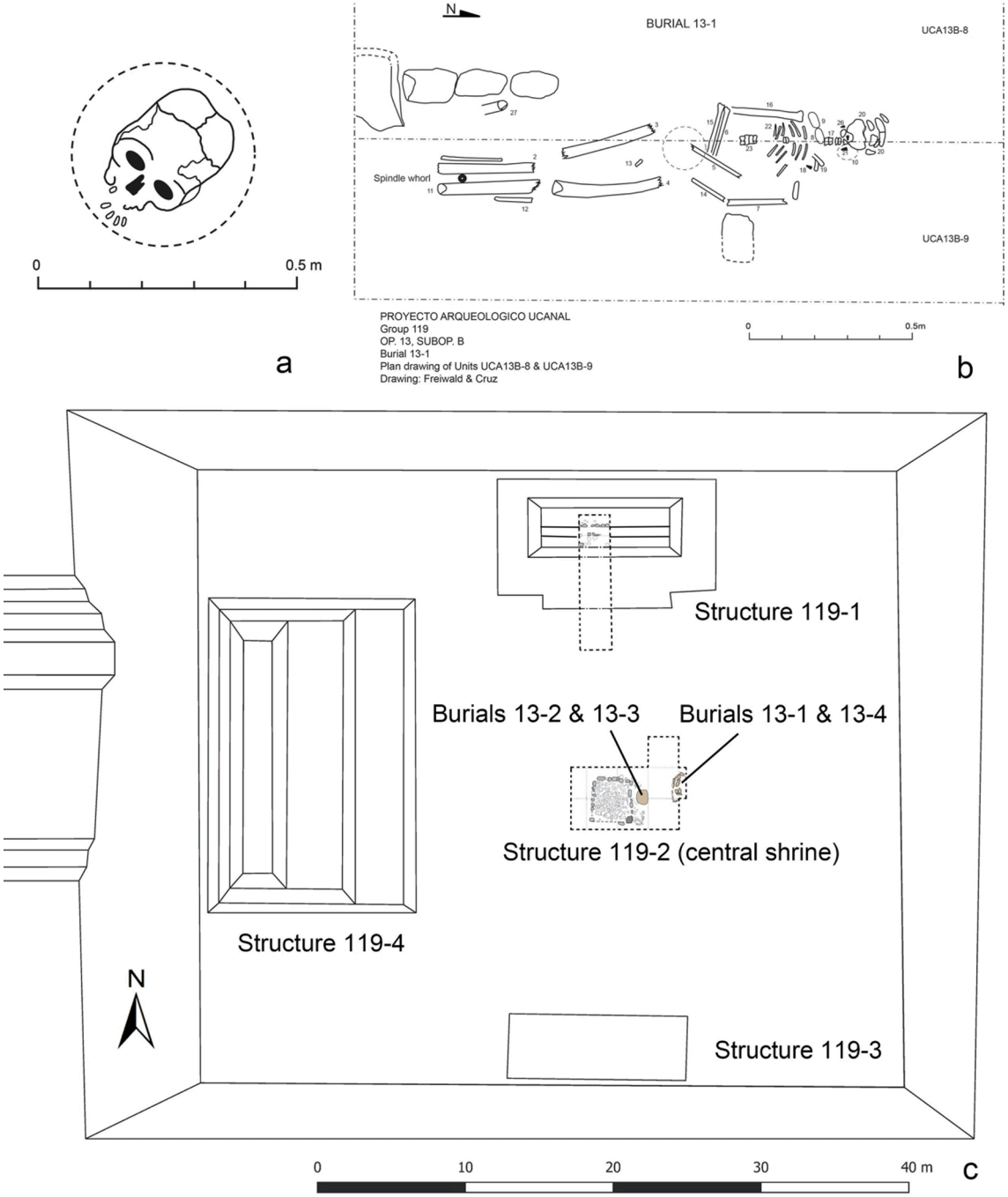

Fig. 8. Burials from Group 119: (a) Decapitated cranium, Burial 13–3, (b) Burial 13–1; (c) plan map of Group 119 showing the burial locations.

recovered (Miller Wolf 2019:209). The cranium was shaped following the tabular oblique modification form and had particularly robust mastoids, mandibles, frontal, and occipital bones, with an especially pronounced nuchal crest. Immediately above this decapitated head was a rock lined pit containing the bundled secondary burial of a single adult individual (30–35 years old; Burial 13–2), which represented a separate individual from the cranium in Burial 13–3. The skeletal remains were placed carefully with long bones together in the same orientation. The remains were relatively complete, although lacking teeth and in a bad state of preservation (Miller Wolf 2019:208–209).

Two other burials from Group 119, Burials 13–1 and 13–4, resemble more typical residential burials in that they had been placed within crypts in the fill of the patio platform floor. Their almost overlapping position (head to toe) indicate that they were buried together during the Late Classic or Terminal Classic periods. They were located 2 m to the east of Burials 13–1 and Burials 13–2, but appear to have been separate burial events from the central shrine burials. Burial 13–1 was that of an adult 30–40 years of age of indeterminate sex and buried with a single limestone spindle whorl between the legs. Burial 13–4 was an adult female in her late 20 s and early 30 s found with no accompanying grave goods except a few freshwater shells.

In addition to Burials 13–1 and 13–4, other burials from residential groups with more "traditional" architecture were also identified at the site and were also subject to isotope analysis (Table 2). All were primary burials. They include an adult (Burial 1–1) in an extended, supine position with head facing north buried with extensive grave goods and inside a crypt found within an earlier Late Classic (B'aaluum AD 700–810) phase construction episode of Group J (before it had been converted into a PP4 configuration), a child burial (Burial 11–1) in an extended supine position with the head facing east and covered with rocks within a Late Classic (Kan AD 600–700) phase building of Structure 130–4 in Group 130, a child (Burial 6–2) in an extended supine position with head facing north and buried in the fill of a Late Classic (B'aaluum AD 700–810) phase of Structure 139–1 from Group 139 and also covered with rocks, a Late Preclassic adult burial (Burial 6–3) placed in an extended supine position with the head facing south at the center of Group 139's patio platform, a Late to Terminal Classic adult female in an extended supine position with head facing north at the edge of Structure 150–2, Group 150, and a Terminal Classic child burial (Burial 8–1) placed in a seated position within an unfired ceramic vessel in the fill of Structure 133–4, Group 133. The child was interred with a necklace of beads made from jadeite, marine shell, terrestrial shell, ceramic, and human teeth. One of the perforated human teeth from this sample (Burial 8–1, Sample M2) was also analyzed for isotopes.

4. Isotope analysis

4.1. Methods

Human teeth analyzed for strontium and oxygen isotopes consisted of 17 samples including 8 that were deposited within new Terminal Classic residential architectural configurations (Plaza Plan 4) (Table 2). In addition to the human remains, 17 modern faunal samples were collected in the Mopan River Valley to establish a local strontium isotope baseline for the region (Table 3). Although there is no single way to differentiate local from non-local populations, our assessment focused on means-based statistics to identify outlying isotope values that are interpreted as evidence of migration (Price et al. 2008). These baseline samples consisted primarily of land snails, although an armadillo (*Dasypus novemcinctus*), agouti (*Dasyprocta punctata*), and cow (*Bos taurus*) were also sampled. They were collected along a transect running roughly north to south within a 20 km radius of the site of Ucanal. Five of the samples were collected directly at the site of Ucanal itself, and all were collected from directly on or within 10 cm depth of the ground surface (Flynn-Arajdal, 2019).

Strontium isotope analysis was conducted at the Geotop laboratories, a multi-university research center dedicated to the geosciences and hosted by the Université du Québec à Montreal, and followed their

Table 2
Isotope values and context information of Ucanal human remains.

No.	Op	Sub-Ob	Unit	Level	Lot	Context	$\delta^{13}C$	$^{87}Sr/^{86}Sr$	Sr error	$\delta^{18}O$	Tooth	Group	Age	Sex	Chronology (Context)	Burial Type
62A	1	B	26	13	2438	Burial 1-1	-	**0.70875**	1.07E-05	-	NLP1	J	Adult	probable F	Late Classic (B'aaluum)	primary
M11	11	D	2	8	848	Burial 11-1	-3.73	**0.70852**	0.00014322	-2.68	NRM1	130	Child, 7-8 (+2)	Indet	Late Classic (Kan)	primary
M14	13	B	9	5	1048	Burial 13-1	-3.76	0.70812	0.00012185	-3.01	XLI1	119~	Young Adult, late 20s	Indet	Late Classic/Terminal Classic	primary
M15	13	B	11	3	1054	Burial 13-3	-3.93	**0.70882**	4.4555E-05	-2.38	XLI2	119*	Adult, 30-40	M	Terminal Classic (late Winik)	primary
M13	13	B	8	5	1055	Burial 13-4	-6.94	**0.70884**	7.6632E-05	-1.37	XLM1	119~	Adult, 30-40	Indet	Late Classic/Terminal Classic	primary
M10	14	B	1	4	1118	Burial 14-1	-5.22	**0.70874**	0.00022385	-2.26	NLM1	150	Adult, 35-40	F	Late Classic/Terminal Classic	primary
M4	3	B	6	5	182	Burial 3-1	-3.85	**0.70894**	0.00163636	-2.91	XLC	E*	Young Adult, late 20s	probable M	Terminal Classic	primary
M6	4	A	7	3	484	Burial 4-1A	-3.52	0.70821	6.1498E-05	-3.02	XLM1	141*	Adult, 30-35	M	Terminal Classic	primary
60	4	A	7	5	1401	Burial 4-1B	-	**0.70874**	1.30E-05	-	NRP1	141*	Young Adult	F	Terminal Classic	primary
M7	6	A	3	10	335	Burial 6-2	-6.79	0.70829	6.9805E-05	-3.27	Nrm2	139	Child, 5-6 (+1.5)	Indet	Late Classic (B'aaluum)	primary
M9	6	A	1	9	346	Burial 6-3	-3.49	0.70835	8.0187E-05	-2.42	XLI2	139	Adult, 35-45	M	Late Preclassic	primary
M1	8	A	1	3	360	Burial 8-1	-3.63	0.70814	1.9727E-05	-2.44	Xrm2	133	Child, 5-6 (+1.5)	Indet	Terminal Classic	primary
M5	3	B	6	5	182	in fill just above Burial 3-1	-5.97	**0.71289**	1.8388E-05	-2.17	XLM2	E*	Young Adult, late 20s	probable M	Terminal Classic	secondary
M2	8	A	1	3	360	necklace of child in Burial 8-1	-0.52	**0.70909**	0.00036175	-1.54	URP2	133	Adult	Indet	Terminal Classic	secondary
47	1	D	3	3	1342	Structure J-1 shrine	-	**0.70493**	8.24E-06	-	NRP1	J*	Child, ≥8-13	Indet	Terminal Classic (late Winik)	secondary
49	1	D	11	3	1344	Structure J-1 shrine	-	0.70834	9.76E-06	-	NRM3	J*	Young Adult, ≥21-23	Indet	Terminal Classic (late Winik)	secondary
51	1	D	11	4	1347	Structure J-1 shrine	-	**0.70752**	4.79E-06	-	NLI1	J*	Child, ≥8-13	Indet	Terminal Classic (late Winik)	secondary

Gray shading represents non-burial locations (isolated human remains); X = maxillary, and N = mandibular, R/L indicate side.

Table 3
Baseline fauna samples for the Ucanal region.

Sample No.	Fauna	GPS		Nearest town/site	Sr 87/86
BL1	Snail	16° 50′ 41.29168	89° 22′ 00.15781	Ucanal	**0.70779**
BL1	Snail	16° 50′ 41.29168	89° 22′ 00.15781	Ucanal	0.70780
BL4	Snail	16° 56′ 56.92929	89° 23′ 57.05057	San Antonio, La Polvora	0.70780
BL5	Snail	16° 59′ 56.75581	89° 19′ 38.21600	La Polvora	0.70820
BL5	Snail	16° 59′ 56.75581	89° 19′ 38.21600	La Polvora	0.70818
BL5	Snail	16° 59′ 56.75581	89° 19′ 38.21600	La Polvora	0.70803
BL10	Snail	16° 43′ 45.69261	89° 20′ 19.96401	Bombillo	0.70820
BL10	Snail	16° 43′ 45.69261	89° 20′ 19.96401	Bombillo	0.70827
BL10	Snail	16° 43′ 45.69261	89° 20′ 19.96401	Bombillo	0.70809
BL12	Snail	16° 35′ 26.17451	89° 30′ 25.30152	Cruce a Dolores	0.70771
BL12	Snail	16° 35′ 26.17451	89° 30′ 25.30152	Cruce a Dolores	0.70798
BL13	Snail	16° 30′ 26.46365	89° 24′ 42.97272	Dolores	0.70776
BL13	Snail	16° 30′ 26.46365	89° 24′ 42.97272	Dolores	0.70775
BL13	Snail	16° 30′ 26.46365	89° 24′ 42.97272	Dolores	0.70788
BL16	*Dasypus novemcinctus*	16° 50’ 54.6432	89° 21’ 54.252	Ucanal	0.70885
BL17	*Dasyprocta punctata*	16° 50’ 50.7984	89° 21’ 52.380	Ucanal	0.70785
22	*Bos Taurus*	16° 51’ 52.8188	89° 21’ 27.774	Ucanal	0.70822

protocols for sample preparation and analysis (Flynn-Arajdal, 2019). Samples were first washed to remove debris in an ultrasonic bath in deionised water for a minimum of two rounds. Once dried, the surface of the tooth was abraded, and then the powdered sample was collected with a clean Dremel diamond point using a variable speed drill. The $^{87}Sr/^{86}Sr$ analyses were processed using 20 mg of tooth enamel or shell powder which was dissolved in HCl 6 N acid and dried overnight on a 100°Celsius heating plate. The remaining material was covered with 0.5 ml of HNO_3 3 N. Each of these products were washed with water in a Bio-Spin column and purified in resin Sr-Spec with HNO_3 3 N six times until only the strontium remained. The strontium was then extracted with deionised water and left to dry completely, then analyzed with a Thermo Scientific Triton Plus thermal ionization mass spectrometer. Concentrations were measured by comparing the samples against the universal NBS 987 standard (André Poirier, personal communication, 2018).

Approximately 2 mg of clean powdered enamel for oxygen and carbon isotope analysis was processed at the University of Arizona under the direction of David Dettman for a subset of the samples. The samples were measured against $\delta^{18}O$ using reference values from Craig (1957) with an automated Finnegan Delta S VG602C mass spectrometer with analytical precision of 0.11 and 2 $\sigma = 0.08$. Standards include SMOW and VSMOW. $\delta^{18}O$ is measured relative to Standard Mean Ocean Water (SMOW), determined as follows: $\delta^{18}O = 1000 \times [((^{18}O/^{16}O)\ \text{sample})/(^{18}O/^{16}O)\ \text{SMOW}) - 1]$. $\delta^{13}C$ is measured relative to marine carbonate standard PeeDee Belemnite (PBD). Ratios are expressed as $\delta^{13}C = 1000 \times [^{13}C/^{12}C)\ \text{sample} - (^{13}C/^{12}C)\ \text{standard})/^{13}C/^{12}C\ \text{standard}]$.

4.2. Results

Results of the 17 faunal specimens in the baseline sample reveal that expected values for a local population should range from 0.70757 to 0.70837 $^{87}Sr/^{86}Sr$ ($x = 0.70797 \pm 0.0002$). One value from an armadillo collected at the site (BL16; 0.70885 $^{87}Sr/^{86}Sr$) was removed from the calculation because, as a statistical outlier, it is more likely a non-local animal than a reflection of local $^{87}Sr/^{86}Sr$ variability and is supported by extensive mapping of strontium isotope values in the eastern lowlands (Fig. 9, Table 3). The range of strontium values in the sampled human population is wider (0.70493–0.71289 $^{87}Sr/^{86}Sr$) than the faunal baseline range. When two outliers are removed from the calculation (0.70493 and 0.71289 $^{87}Sr/^{86}Sr$), a third value (0.70752 $^{87}Sr/^{86}Sr$) is outside the range of the mean and two standard deviations (Fig. 10). The range of the remaining 14 values (0.70812–0.70909 $^{87}Sr/^{86}Sr$) overlaps with those of the baseline fauna with a higher average value ($x = 0.7086 \pm 0.0003$). In fact, the faunal and human datasets are statistically different populations (unpaired two-tailed student *t*-test $p < .0001$), which suggests that additional individuals in the human sample have non-local origins. These data show that individuals came to Ucanal from multiple locations as explored in the following discussion.

Oxygen isotope analyses reveal no statistical outliers in a subset of the sample (Table 2). In general, $\delta^{18}O$ values show less spatial variation in the Maya region than other isotope systems (e.g., Lachniet and Patterson 2009) and suggest that the places of origin of some Ucanal immigrants had similar values in their water sources. There is a single high outlier carbon isotope value (-0.52‰ $\delta^{13}C$) in the Burial 8–1 tooth bead, but the dietary variation in this sample does not appear to relate specifically to origin. It may also reflect weaning age differences and tooth type as well as other factors such as gender, status, and/or environment. The strontium and oxygen isotope values, however, have a moderately strong positive relationship ($r = 0.63$) when the outlying values are removed.

Nearly all of the values from isolated human teeth, or what we refer to here as non-burial contexts (4 of 5 samples), are statistical outliers from the human burial population and the faunal baseline (see gray shaded samples in Table 2) (Fig. 10). They consist of two isolated human remains from a small residential shrine (Group J, Samples 51, 47), the isolated tooth found just above Burial 3–1 (Group E, Sample M5), and an adult tooth perforated and worn as part of a necklace on a child buried in Burial 8–1 (Group 133, Sample M2), which all possessed non-local strontium isotope values.

Each of the anomalous values suggests a distinct origin for these individuals. The low strontium isotope value from an adult tooth excavated from a pit containing scattered human remains and large censer sherds (Structure J-1 shrine; Sample 51, 0.70752 $^{87}Sr/^{86}Sr$) overlaps with values from Aguateca and Ceibal in the Petexbatun region, as well as elsewhere in the Southern Lowlands and possibly parts of Petén (Palomo 2020; Sharpe et al. 2018). Even lower strontium isotope values are found at sites located on volcanic-derived soils to the south of Ucanal. Strontium isotope values for a child or young adolescent tooth from a small (approximately 1 × 1 m) pavement or altar in front of the Structure J-1 shrine (Sample 47; 0.70492 $^{87}Sr/^{86}Sr$) are similar to those from Central Mexico and the Highlands of Guatemala (Wright et al. 2010), as well as sites along the Pacific Coast from El Salvador and southern Honduras to Chiapas. In contrast, the tooth recovered above Burial 3–1 (M5, 0.71289 $^{87}Sr/^{86}Sr$) has a high value consistent with an origin in the vicinity of the Maya Mountains, the only reported area where average human values exceed 0.7092 $^{87}Sr/^{86}Sr$ (Fig. 11) (Freiwald et al., 2020; Wrobel et al. 2017). Interestingly, Burial 3-1′s prone body position is unusual in Petén, but relatively common in the Belize Valley near the foothills of the Maya Mountains (Freiwald et al. 2014; Schwake 2008; Willey et al. 1965).

Since these three samples are from isolated teeth rather than associated with a complete or nearly complete skeletal body, it is possible that post-mortem body parts were transported long-distances. Such a possibility is the most evident for the perforated adult human tooth that formed part of a child’s necklace from a non-elite residential group, Group 133 (Sample M2, 0.70909 $^{87}Sr/^{86}Sr$). They, nonetheless, still

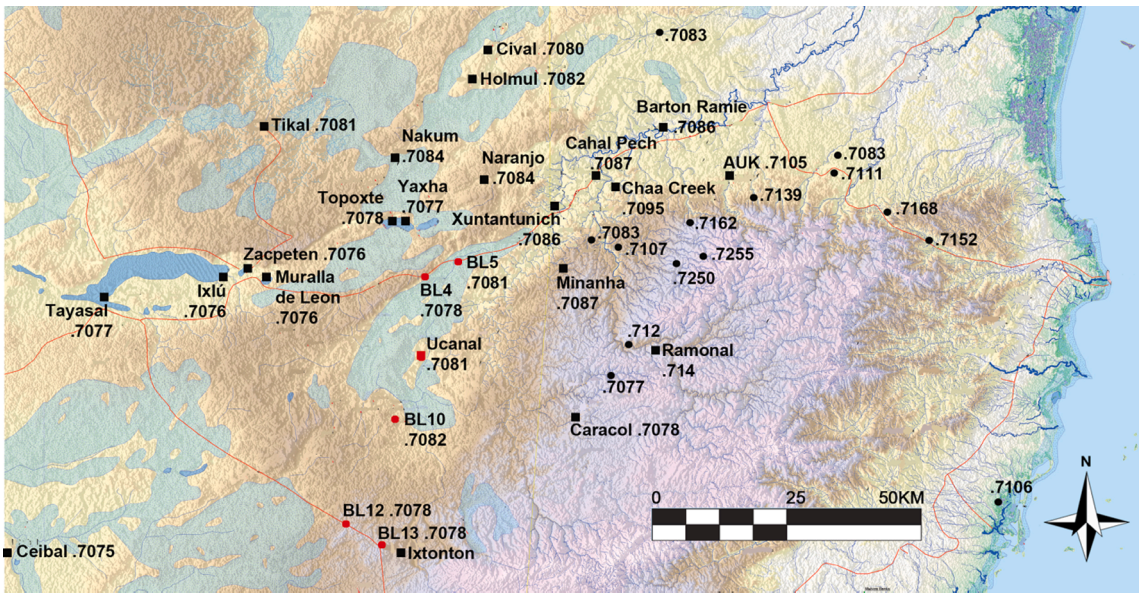

Fig. 9. PAU sampled strontium baseline average faunal values in red (see Table 3) compared with values for Petén and central Belize (map by C. Halperin and C. Freiwald, modified from Witschey and Brown 2014 with values from Cormier 2018; Flynn-Arajdal 2020; Freiwald et al., 2020, Freiwald 2021; Freiwald and Pugh 2018; Price et al. 2010; Rand et al. 2020; Sutinen, 2014; Wrobel et al. 2017). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

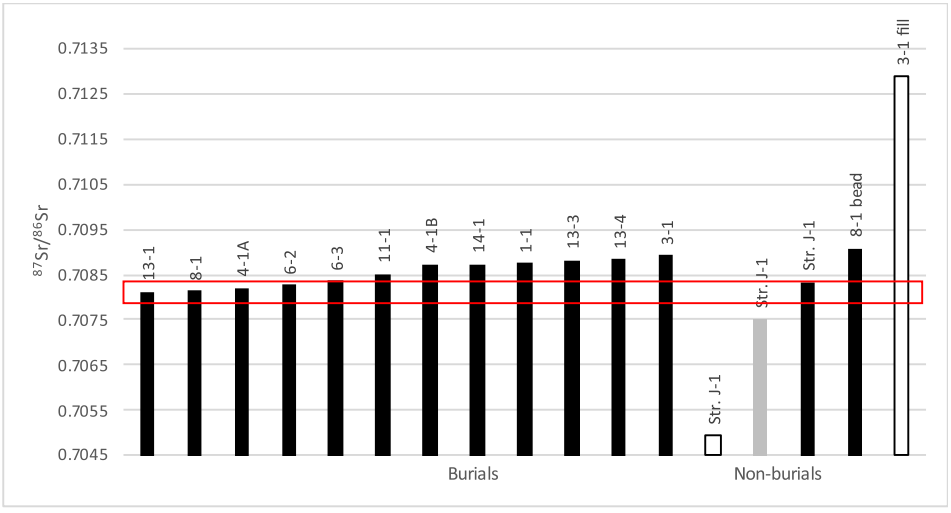

Fig. 10. Strontium isotope values of Ucanal human tooth enamel samples. Red represents fauna baseline range. White and gray bars are outlier values from the human tooth enamel sample (see Tables 2 and 3 for raw data). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

underscore connections of some nature to these regions. The isotope value is similar to those from populations on Ambergis Caye, which have an average value of 0.709 $^{87}Sr/^{86}Sr$ (n = 12 Smith 2020; see also Ortega-Muñoz et al. 2019), and to coastal Yucatecan regions in general.

Seven additional values (0.70852–0.70894 $^{87}Sr/^{86}Sr$) were not outliers from the burial population but are beyond the mean and two standard deviations from the Ucanal region faunal baseline (0.70797 ± 0.0002 $^{87}Sr/^{86}Sr$). It is possible that these individuals also were migrants because their tooth enamel values do not reflect food acquired from Ucanal's expected catchments, even considering unmapped isotopic variation and the use of imported foods such as salt or salted products (Andrews 1980; Fenner and Wright 2014; Freiwald et al. 2019; McKillop and Kazuo 2018). Moreover, using the carbon isotope values as a dietary correlate, there is no significant difference between these seven individuals and the Ucanal burials whose values fall within the faunal baseline. These high human values are similar to those found in populations across parts of the Yucatan Peninsula, including Belize, where strontium isotope values decrease from north to south and inland from the coast into the Petén (Figs. 1, 9). Belize Valley $^{87}Sr/^{86}Sr$ values average 0.7086 ± 0.0002 (n = 102) and are similar to baseline fauna in the region (mean 0.7085 ± 0.0003 [n = 17] in Freiwald 2011:86, 128), demonstrating the close match between baseline values and those found in most local populations. In all, we interpret 65% of this sample as non-local, higher than most sites in the Maya area, with the exception of published samples for Copan and Xunantunich (Freiwald et al. 2014; (Suzuki et al., 2020).

Although sample sizes are currently too small to identify general patterns with any certainty, these initial results show no obvious differences between local and non-local individuals based on sex or age. Likewise, there is no apparent evidence of differentiation between locals

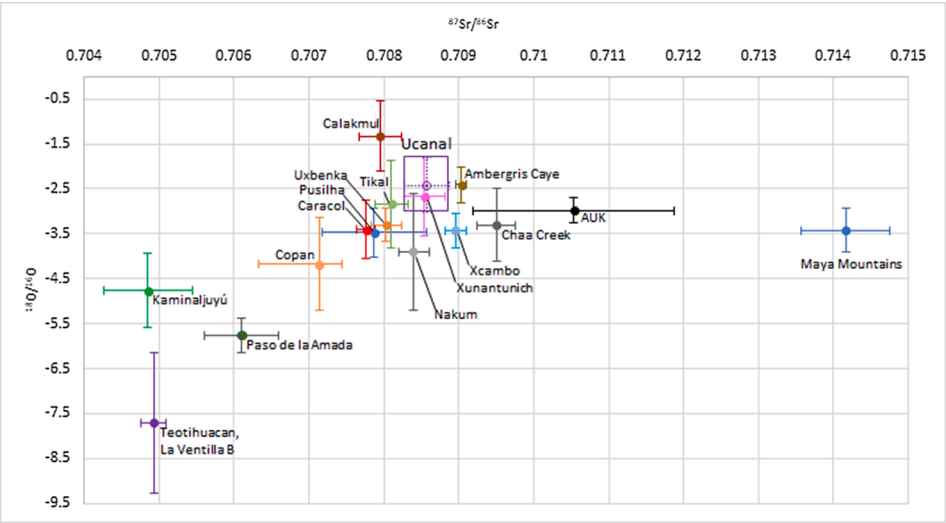

Fig. 11. Mean and standard deviation of human strontium and oxygen isotope values at select Mesoamerican sites, including Chac Balam and San Juan on Ambergris Caye, Actun Uayazba Kab (AUK), Ramonal, Bajo del Lago, and Peligroso in the Maya Mountains and other sites as named (data reported in Freiwald 2011; Freiwald and Price accepted, in revision; Nado 2017; Price et al. 2008, 2010; Rand et al. 2020; Smith 2020; Somerville et al. 2016; Trask et al. 2012; Wright 2012; Wrobel et al. 2017).

and non-locals by architectural Group Rank, a category of architectural group size based on architectural volume (Halperin and LeMoine 2019). Terminal Classic human remains (6 of 8 samples) were also found in groups with centrally located shrines known as the Plaza Plan 4 residential configuration. As noted earlier, these groups are often larger-sized compounds (Groups J, E, and 119). The decapitated cranium (Group 119, Burial 13–3) from one of these shrines raises the possibility that this type of context was an ideal location for human offerings as much as for burying inhabitants of these residential complexes. Excavations of Terminal Classic centrally located shrines at the site of Tikal also reveal a preference for the burial of isolated human crania in these contexts (Becker 2009:93, Table 5.1), although details on osteological analyses, such as evidence of trauma, are not provided.

In comparing individuals with non-local values from different time periods, the Terminal Classic contexts have higher frequencies of non-local to local individuals as compared with other time periods, although sample sizes are too small from these earlier periods (Late Classic n = 3, Late/Terminal Classic n = 3, Late Preclassic n = 1) to make generalized statements. In addition, none of the Late Classic period contexts were from shrine contexts, further making temporal comparisons difficult.

5. Discussion

The settlement and isotope analyses from recent investigations at the site of Ucanal reveal that the Terminal Classic *K'anwitznal* capital was indeed a diverse place occupied by both local and non-local inhabitants and also challenge the simplicity of the Putun/Chontal invasion model as an explanation for changes in material culture and monumental expressions during the Terminal Classic period. Firstly, the settlement patterns identified thus far underscore a general paucity of major settlement disruptions. Instead, substantial settlement stability is noted between the Late Classic and Terminal Classic periods, in which household refurbishing occurred gradually and steadily over the Late and Terminal Classic periods. Some major construction activities occurred at the beginning of the Terminal Classic period. In the case of Group J and Ballcourt #1 from Group A, the fill of these new constructions dating to the early Terminal Classic period contained stone blocks from earlier, dismantled buildings, perhaps suggesting that these were expressions of political revisionism (Halperin and Garrido 2019; Halperin 2021). These events from Group J and Ballcourt #1, however, were not contemporary with the construction of "C"-shaped residential buildings or the addition of centrally located shrines in residential groups, creating Plaza Plan 4 configurations, since these new residential configurations date later in the Terminal Classic period. They do appear to be roughly contemporary with a final addition placed on the northern end of Ballcourt #1 dating to the late Terminal Classic period. This addition consisted of a remodeling of the ballcourt stucco floor and a low wall enclosure placed at the end of the ballcourt that created a "T" shape in the ballcourt alley plan. This ballcourt form became popular at Terminal Classic sites in both the Southern and Northern Maya Lowlands, such as at Chichen Itza, Sayil, Jimbal, Xunantunich, and Calzada Mopan (Halperin et al. 2020). In this sense, the types of changes that occurred at Terminal Classic Ucanal should be considered as an extended and multi-layered process rather than as a single event (see for example, Bazy and Inomata 2017 for a similar argument at Ceibal). Chronological refinements with radiocarbon dating will undoubtedly yield more nuanced understandings of these processes in the future.

Furthermore, these new residential architectural styles were not clustered together to form a neighborhood or specific zone of the city, but were relatively dispersed throughout the site core. Although architectural indicators for marking neighborhood affiliations are relatively elusive in the Maya area (Arnauld et al. 2012; Hutson 2016:70–138), there are known cases of foreigners clustering in parts of a settlement during the Colonial period in Mesoamerica. For example, historic documents indicate that Tascala (Tlaxcala), Cholula, Tenustitan (Tenochititlan), Tatelulco (Tlateloco), Chinampa (likely Xochimilco), Quahquechula (Quauhquechollan), Teguantepeque (Tephuantepec), Tescuco (Texcoco) and Otumpa (Otumba) immigrants, who co-invaded the Guatemalan Highlands with the Spanish in the 1520s, established residential *barrios* at Ciudad Viejo and maintained these separate living arrangements for several hundred years (Matthew 2012:50–60). Likewise, Central Mexican *conquistadores* also established their own residential *barrios* in Totonicapan in the Guatemala Highlands and in the town of Villa Alta in Oaxaca (Asselbergs 2012:71). Such residential patterning is not evident at Ucanal with the existing archaeological data.

Secondly, the isotopic data underscore that non-local inhabitants and human remains found at Terminal Classic Ucanal had multiple places of origin rather than a single foreign homeland. These possible origin locations include the Maya Mountains, the Guatemala Highlands or Pacific Coast, the Southern Lowlands, and coastal Yucatan, including Belize. Some of the possible places of birth of non-local individuals may include western coastal Yucatan where the Putun Maya are known to have originated. Unfortunately, the overlap of Ucanal's baseline strontium isotope values with some parts of what is thought to be the Putun homeland (Fig. 1) provides challenges for identifying migrations from these regions and should be addressed through other comparative studies, such as lead or sulfur isotopes, in the future. Nonetheless, the

results reveal enough variability in non-local isotope values to indicate that a bi-partite narrative of a single dominant foreign group vs. local population is too simplistic. Such multi-sited connections are reinforced by the site's known trading relations with multiple regions of the Maya area, and these networks appear to have only gotten more diverse during the Terminal Classic period. For instance, Terminal Classic groundstone tools were imported from granite sources from the Maya Mountains as well as vesicular basalt sources in Highland Guatemala, albeit in smaller quantities from the latter source (de Chantal 2019; Halperin et al. 2020). Ceramics from Terminal Classic contexts also demonstrate influences from multiple regions, including type varieties typical of Petén, western Belize, and to a much smaller degree, northern Yucatan. Chemical analyses of these ceramics reveal imports from both west and east of Ucanal, highlighting the site's important role in facilitating trade between the Gulf Coast and Caribbean coastal regions (LeMoine and Halperin, 2021a, b).

Importantly, the combination of the isotope data with the archaeological contexts of the human remains provide more nuanced understandings of how foreign identities may have been constituted at the site. For example, if the human remains from the central shrine residential burials as well as from the Structure J-1 shrine were considered as offerings and, in some cases, even as victims of human sacrifice (as is most clear with Burial 13–3), it highlights how foreign identities may have also been constituted through ritualized performances. It was common in Mesoamerica for war captives from other polities and distant regions to be the subjects of sacrifice and serve as offerings to deities (Berryman 2007; Burdick 2016; López Luján and Olivier 2010; Sugiyama and Luján 2007; White et al. 2002). Bishop Diego de Landa notes that for the 16th century, Maya leaders sacrificed orphaned children, slaves, and war captives, those in society who were considered "other" (Tozzer 1941:54,123-124). In turn, children and adults from atypical contexts, such as the Cenote of Sacrifice from Chichen Itza, were overwhelmingly born in distant regions (Pacheco-Forés et al. 2021; Price et al. 2019). Those born in geographically distant places were not intrinsically foreign, but they could be made so through acts of conflict, violence, enslavement, among other performative acts or "othering". In turn, if the non-local tooth (Sample M2) that was part of a child's necklace was passed down from an ancestor of the child, it may have underscored the kin ties between this child and more distant peoples even though isotopic data indicate that the person who wore the necklace was born locally to the Ucanal region. When worn, such a necklace might have recounted the stories of such histories and distant connections.

Thirdly, migrations moved in multiple directions, complicating single-event or uni-directional movements. For example, the temporal chronologies of "C"-shaped buildings at Ucanal fit an overall pattern mentioned earlier whose movement is from south to north. The earliest evidence of this architectural style is from the Petexbatun/Pasion region at the end of the Late Classic period, and it subsequently spreads eastward and northward into Petén at places like Machaquilá, Ucanal, and the Petén Lakes region, and finally to northern Yucatan at the very end of the Terminal Classic and beginning of the Early Postclassic periods (Bey et al. 1997; Hermes and Zralka 2012; Schwartz 2013; Tourtellot et al. 1992; Vargas De la Peña et al. 2020). The direction of this pattern contrasts with other architectural evidence, such as the Terminal Classic manifestation of patio quads at Nohmul, Belize, (Chase and Chase 1982) or buildings with mosaic stone masks from the Mopan River Valley (Laporte and Mejía, 2002), both of which are interpreted as an influence from northern Yucatan to the Southern Maya Lowlands in the Terminal Classic period. Several scholars have also noted the arrival of individuals with the name or title of *Chan/Kan Ek'* to the Northern Lowlands during the Late and Terminal Classic periods, what is often taken to signify the migration of elite individuals from the Southern Lowlands where the name has longstanding roots (Boot 2005; Carter 2014:174–178; Pallán Gayol 2012:90–94; Rice et al. 2021; Rice and Rice 2004; Schele and Mathews 1998:224–225). Such migrations were then reversed during the Postclassic period, in which ethnohistoric sources recount movements from northern Yucatan to the Petén Lakes region (Jones 1989; Rice et al. 2021; Rice and Rice 2004, 2018a). The isotope data from Ucanal suggest that some of its Terminal Classic inhabitants may have migrated to the site from coastal Yucatan, perhaps underscoring that north to south, in addition to south to north, movements occurred at the Classic to Postclassic period transition. Although the temporal and spatial resolution of these possible migrations are in desperate need of refinement, multi-directional, multi-nodal movements were likely more common than is often considered.

Despite the shortcomings of the invasion hypothesis for all it may leave out, the data presented herein still leave room for the possibility that leadership at Ucanal included foreigner rulers at some point or multiple points during its history. Since the Atlas and PAU projects have not excavated any Terminal Classic elite tombs to date, the question of foreign-born leaders as identified by isotope data cannot be addressed at the moment. The name of one of the rulers of Ucanal, *Papmalil*, who was in power around AD 817–820, has an unusual name that may derive from Chontal Maya spoken along the Gulf Coast, perhaps indicating that he or his family had come from this region (Martin 2020:295–296; see also Pallán Gayol and Meléndez Guadarrama 2010:18–19). *Papmalil*'s rule, however, does not correspond to the new changes in residential and public building architecture, such as the "C"-shaped structures, Plaza Plan 4 configurations, and the "T"-shaped ballcourt addition, which occurred later.

A western connection is supported by a high frequency of Fine Orange pottery at Ucanal during the Terminal Classic period that may have been produced in the Pasion region and/or further down the Usumacinta River toward the Gulf Coast (Halperin et al. 2020; LeMoine and Halperin 2021a, b). These vessels, however, should not be thought of in normative terms as reflecting the presence of foreign peoples in a 1:1 fashion. They were found in almost every household context excavated by the PAU regardless of architectural type and were undoubtedly exchanged and gifted through multiple networks (LeMoine and Halperin 2021b). If these vessels were part of the ways in which foreignness was expressed or part of the ways in which cultural imaginaries of distant places were conjured, many different inhabitants of the city contributed to these cultural productions through their use as part of feasts, rituals, and everyday commensality. As mentioned earlier, the Terminal Classic monumental corpus at Ucanal reveals both textual and iconographic references to foreign influences, showing how being a *K'anwitznal* ruler involved adopting new emblems of power, symbolism, and ornamentation that may have referenced distant places or peoples or a new "cosmopolitan" political-religious order (Halperin and Martin 2020). In this sense, rulers at the site engaged in performances of foreignness, even if these individuals may or may not have been born in the Mopan River Valley. As Graeber and Sahlins (2017) underscore, the stranger-king model was a powerful trope of ancient kingship around the world, and the Maya were no exception.

Nonetheless, the settlement and isotopic data decenter grand narratives of bi-partite domination of one group over another in that they underscore the multiple and varied movements of what may have been families, marriage partners, captives, distant relatives, among other individuals and collectivities who came from multiple places of origin for a variety of purposes. Such movements may have been in addition to the migrations of dynastic founders or political leaders' claims of specific origins similar to other invasion narratives, such as the Teotihuacan "entrada" into the Maya area in the late 4th century. For example, at Tikal, substantial epigraphic, iconographic, and monumental evidence point to the influence of Teotihuacan leadership at the site during the Early Classic period. Isotopic evidence, however, suggests that individuals from Early Classic royal tombs were either locally born or born in regions other than Central Mexico, and residential contexts provide relatively little evidence of *Teotihuacano* occupation (Laporte and Iglesias Ponce de Leon 1990; Román Ramírez 2021; Sabloff 2003; Stuart 2000; Wright, 2005, 2012). In turn, although much has been made of the

Teotihuacan heritage of Copan's dynastic founder interred in the Hunal tomb, Yax K'uk' Mo', Central Mexico was not his birthplace, and the foreign inhabitants of Early Classic Copan came from many different regions, including the northern Lowlands, the Guatemalan highlands, the Maya Mountains, Petén, and well beyond the Maya region (Buikstra et al. 2004; Miller 2015; Price et al. 2010:200, 2014). Such finds underscore the multiple influences and homelands of Copan's inhabitants as well as the varied ways in which foreign status could be expressed, performed, or suppressed. In this sense, migrants from multiple places of origin made important contributions to the making of Early Classic Copan and their presence continued and grew into the Late Classic (Miller 2015). This was also likely the case at Ucanal with migrants from various locales who possessed different, shifting senses of foreignness or belonging. As such, residential and isotopic data often provide a more pluralistic view to complement the more top-down perspective of invasion derived from written and monumental records.

6. Conclusion

The foreign invasion hypothesis as a way to explain Terminal Classic changes at the site of Ucanal – or in the Southern Maya Lowlands in general – is too reductive to fully capture the complex dynamics, multidirectional movements, and pluralistic influences of this time period. Settlement and isotopic analyses reveal that Ucanal was a heterogenous city during this time with connections to multiple regions and peoples from the Maya area and likely even beyond. Inhabitants expressed an openness in engaging with new architectural styles as well as other social displays that signaled their ties to other more distant regions. Residential chronologies indicate that Ucanal's population was stable with small incremental growth between the Late Classic and Terminal Classic periods. New residential architectural configurations, such as "C"-shaped bench buildings and patio configurations with centrally located shrines appeared relatively late in the Terminal Classic period and were well-integrated into existing settlement occupations and arrangements. Although no major site-wide occupation disruptions or intrusions are identified that would indicate an invasion and population replacement of a single foreign group, isotopic analyses underscore that Ucanal immigrants and human remains likely had origins in places as distinct as the Maya Mountains, the Guatemala Highlands, the Petexbatun region, different zones of coastal Yucatan, and beyond. The ways in which foreign identities were produced through visual cues and practices, however, was not only situationally variable and dynamic, but also included those born locally to the region.

CRediT authorship contribution statement

Christina T. Halperin: Conceptualization, Resources, Investigation, Writing - original draft, Visualization, Project administration, Funding acquisition. **Yasmine Flynn-Arajdal:** . **Katherine A. Miller Wolf:** . **Carolyn Freiwald:** .

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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