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Research Article

Striking distance: Investigating the epigraphy and geography of a Late Classic Maya war

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Abstract

We present a photogrammetric model and new line drawing of Sacul Stela 3 at the ancient Maya site of Sacul 1, Guatemala. Although virtually illegible in person and from photographs, the inscription on the eroded stela can largely be read or reconstructed in the 3D model. Our reading confirms a previous argument that the kingdom based at Sacul 1 was attacked in A.D. 779 by forces from the site of Ucanal. Traveling by night, warriors from Sacul retaliated with a raid at dawn next day on an unidentified site and, months later, followed up with an attack on Ucanal itself. The same narrative appears substantially on a well-known monument, Ixkun Stela 2, but there are differences between the two texts which suggest that Sacul and Ixkun had their own sculptors and record-keepers and which offer insights into the implications of verbs (*pul,* "to burn" and *ch'ak,* "to chop") commonly attested in Classic Maya accounts of war. We then present the results of GIS analysis which suggests that the site area of El Rosario (between Sacul 1 and Ucanal) is an appealing candidate for the unidentified site mentioned in the stela text.

Resumen

Algunas inscripciones jeroglíficas mayas clásicas discuten ataques militares contra lugares nombrados que no se conocen de otras inscripciones y que no han sido identificados con asentamientos documentados arqueológicamente. Este artículo trata de un ejemplo: un pueblo desconocido, que aquí llamamos "Wi'il" según una lectura parcial de su nombre jeroglífico, ubicado en la vecindad del sitio de Sacul 1, ahora en la municipalidad de Dolores, en las Montañas Mayas de Petén, Guatemala. En el año 779 d.C., Wi'il fue involucrado en una guerra entre la dinastía Juluup, basado en Sacul 1, y el reinado de K'anwitznal, cuyo capital fue la ciudad de Ucanal 36 km al norte.

La municipalidad de Dolores cuenta con por lo menos tres reinados antiguos. El más antiguo era Ho'kab', fundado en 81 d.C., con dos capitales en los sitios de Ixtonton e Ixtutz (Carter et al. 2022; Mathews 1976; Prager 2013:265). Luego, cerca de los inicios del siglo VIII d.C., fue establecido el reinado de Juluup, probablemente bajo el patrocinio de Naranjo, con que los monumentos de Sacul 1 comparten elementos textuales e iconográficos (Carter y Santini 2019). Otro reino que fue subordinado a Naranjo durante los principios del siglo VIII era K'anwitznal, conquistado por Naranjo en 698 d.C. Pero en 744 d.C., Naranjo mismo fue subyugado por Tikal. Como resultado de esta derrota, K'anwitznal quedo como líder de una alianza reducida que incluyó Juluup y el sitio de El Chal, al oeste. Esta alianza se colapsó en 779 d.C., cuando el gobernante de Juluup fundió su proprio reinado vasallo, el tercer reinado en la región de Dolores, con el sitio de Ixkun como su capital.

En respuesta a este acto agresivo, el rey de K'anwitznal le hizo la guerra contra Juluup. La cuenta más completa del conflicto se da en la Estela 2 de Ixkun, donde leemos que los guerreros de K'anwitznal "quemaron" (*puluyi*) un lugar lladmado Juluupil, seguramente Sacul 1 o algún asentamiento cercano, en el día 9.17.9.0.13, 3 Ben 6 Kayab, es decir, 22 diciembre, 779 d.C. El texto nos dice que, la misma noche, guerreros de Juluup realizaron una acción recordada con un glifo no descifrado que probablemente indica que viajaron portando fuego. En la madrugada del próximo día, los de Juluup atacaron a Wi'il. El verbo relevante es *ch'ahkaj pe't*, "el territorio fue cortado." Dos *winales* y 10 días después del asalto contra Wi'il, Juluup atacó a K'anwitznal mismo y quemó (*puluyi*) un parte del sitio.

En el verano de 2022, dos de los presentes autores usaron fotogrametría para documentar la Estela 3 de Sacul 1. La estela está erosionada y cubierta con microflora, pero usando los programas Agisoft Metashape y Blender, fue posible virtualmente quitar el liquen y leer o reconstruir la mayoría del texto. Resulta que la Estela 3 de Sacul 1 cuenta la misma historia como la Estela 2 de Ixkun, con algunas diferencias menores que sugieren que los dos reinados tuvieron sus proprios escultores y guardianes de la historia.

A continuación, usamos el programa ArcGIS Pro para sugerir posibles candidatos para el sitio de Wi'il, lo que supusimos tiene que ser ubicado relativamente cercano de Sacul 1, al norte en la dirección de Ucanal. Basado en nuestro análisis, creemos que la mejor posibilidad es el sitio de El Rosario, ubicada a sola tres horas a pie desde Sacul 1.

Classic Maya hieroglyphic inscriptions on monuments and portable objects sometimes describe military conflicts between kingdoms. Some inscriptions record the occurrence and outcomes of battles but do not specify where they took place. In others, we read of attacks (*pul*, "to burn," or *ch'ak*, "to chop") or invasions (*och ch'een*, "to enter the cave/ town") against named settlements. Other texts name sites on the landscape from which such attacks were staged. Unfortunately, in many instances, the locations named in these historical accounts are not known from other inscriptions and have not been identified with archaeologically documented settlements.

One example, well known to epigraphers, comes from Lintel 2 of Temple IV at Tikal, whose text records a war launched in A.D. 744 by Tikal against the rival kingdom of Naranjo. One part of the inscription states that the king of Tikal "descended" (*ehmey*) with his armies from an unidentified site, presumably located closer to Tikal than to Naranjo, and traveled to a settlement called Tuub'al (Zender 2005:14). Tuub'al was not far from Naranjo and had at times been under that kingdom's sway (Martin and Grube 2008:76–77), but by 744, Tikal's forces were able to occupy the town and to use it as a staging site for their assault against Naranjo. "One dawn" (*juun pas*) after arriving at Tuub'al, the Tikal army attacked Naranjo on the Classic Maya New Year's Day, routing the defenders and occupying the city (Martin 1996; Stuart 2004). The site of Nakum, located between Tikal and Naranjo on the easiest route through the Holmul River valley, has emerged as the strongest candidate for Tuub'al (Helmke 2020:31; Martin 2020:169–170, 412:note 20). This interpretation highlights the importance of natural travel routes in Classic Maya warfare, as well as the element of surprise and the value to attackers of a secure site from which to launch a raid or invasion.

A lesser-known, parallel case is that of an ancient town somewhere in the vicinity of the site of Sacul 1, in the Maya Mountains of southeastern Peten, Guatemala (Figures 1 and 2). In A.D. 779, this town was involved in a war between the Juluup polity based at Sacul 1 and its erstwhile overlord, the ruler of the K'anwitznal kingdom whose capital was the center of Ucanal 36 km to the north (see Mathews 1976). According to a monument commemorating that war, the mystery site—which we will call "Wi'il" here after a partial reading of one hieroglyphic attestation of its name—was within a single night's march from the Sacul kingdom. From historic context, we infer that it was located north of Sacul 1, in the direction of Ucanal. In this article, we present a second monument—this one located at Sacul 1 itself—which also described the Juluup-K'anwitznal war, and we use GIS analyses to suggest possible candidates for Wi'il.

## Archaeology and political history of the Dolores region

Geographically, the Dolores region can be divided roughly in half, a division that approximately corresponded to political territories during at least the Late Classic period. The western part of the area has gentler terrain and wide, flat-bottomed valleys and plateaus. The royal capitals of Ixkun, Ixtonton, and Ixtutz are located in this area, each next to an area of relatively flat land suitable for farming. The eastern portion is more rugged, interrupted by the narrow Mopan, Xaan, and Sacul river valleys; here, there is only one wide valley, the Valle de la Esmeralda, of comparable size and agricultural potential to the valleys to the west. A fourth capital, the site of Sacul 1, sits on adjoining hills overlooking the Sacul valley.

Ixtutz and Ixkun were described in the archaeological literature in the mid-nineteenth century after a visit by the Guatemalan explorers Eusebio Lara and Colonel Modesto Méndez (Ritter 1853). Alfred Maudslay published a map of Ixkun, photographs of its Stela 1, and drawings of the stela by Annie Hunter at the turn of the twentieth century (Maudslay 1889–1902:vol. 2, Plates 67–69). Sylvanus Morley and Herbert Spinden visited Ixkun in 1914 and later published additional monuments (Morley 1937–1938:vol. 5, Plates 49 and 93). Further documentation and site mapping were carried out at all four local capitals in the early 1970s by Ian Graham and Eric von Euw for the Corpus of Maya Hieroglyphic Inscriptions (CMHI; Graham 1980), and a team led by Merle Greene Robertson conducted mapping and rescue archaeology at Ixtutz during the same period (Robertson 1972).

From 1987, the Atlas Arqueológico de Guatemala (AAG), a Guatemalan national project originally directed by Juan Pedro Laporte Molina and Juan Antonio Valdés Gómez, has carried out site documentation and targeted excavations at sites in the Dolores region and other parts of Peten, including the sites of Ixkun and Sacul 1 with which we are concerned here (e.g., Laporte and Mejía 2005, 2006). Phil Wanyerka and Héctor Escobedo collaborated closely with AAG on the inscriptions of Ixkun and Sacul (Laporte et al. 2005, 2006). Working independently, Marc Zender (2002) published a reading and interpretation of Ixtutz Stela 4. Following Laporte's death, AAG's vital contributions to Maya archaeology have continued under the direction of Lilian Corzo, with Mara Antonieta Reyes overseeing operations at Dolores. In their ongoing Contributions to Mesoamerican Studies project, Bruce Love and Meghan Rubenstein have documented monuments from Ixtutz (Love and Rubenstein 2017), Sacul (Love and Rubenstein 2018a), and Ixkun (Love and Rubenstein 2018b). Nicholas Carter and colleagues have put forward new interpretations of the
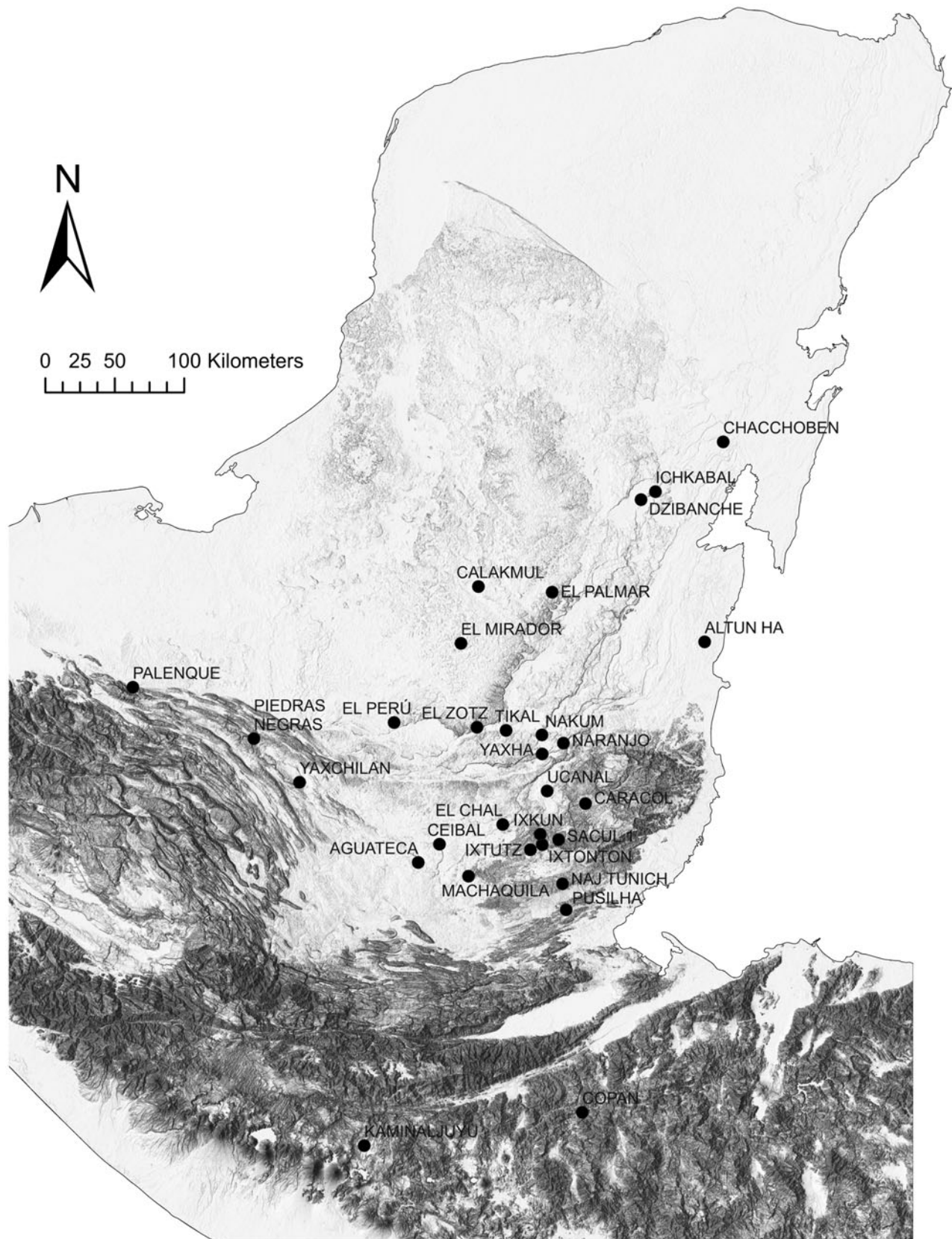
Figure 1. Map of the Maya region showing sites mentioned in this article and other relevant sites. Map by Carter.
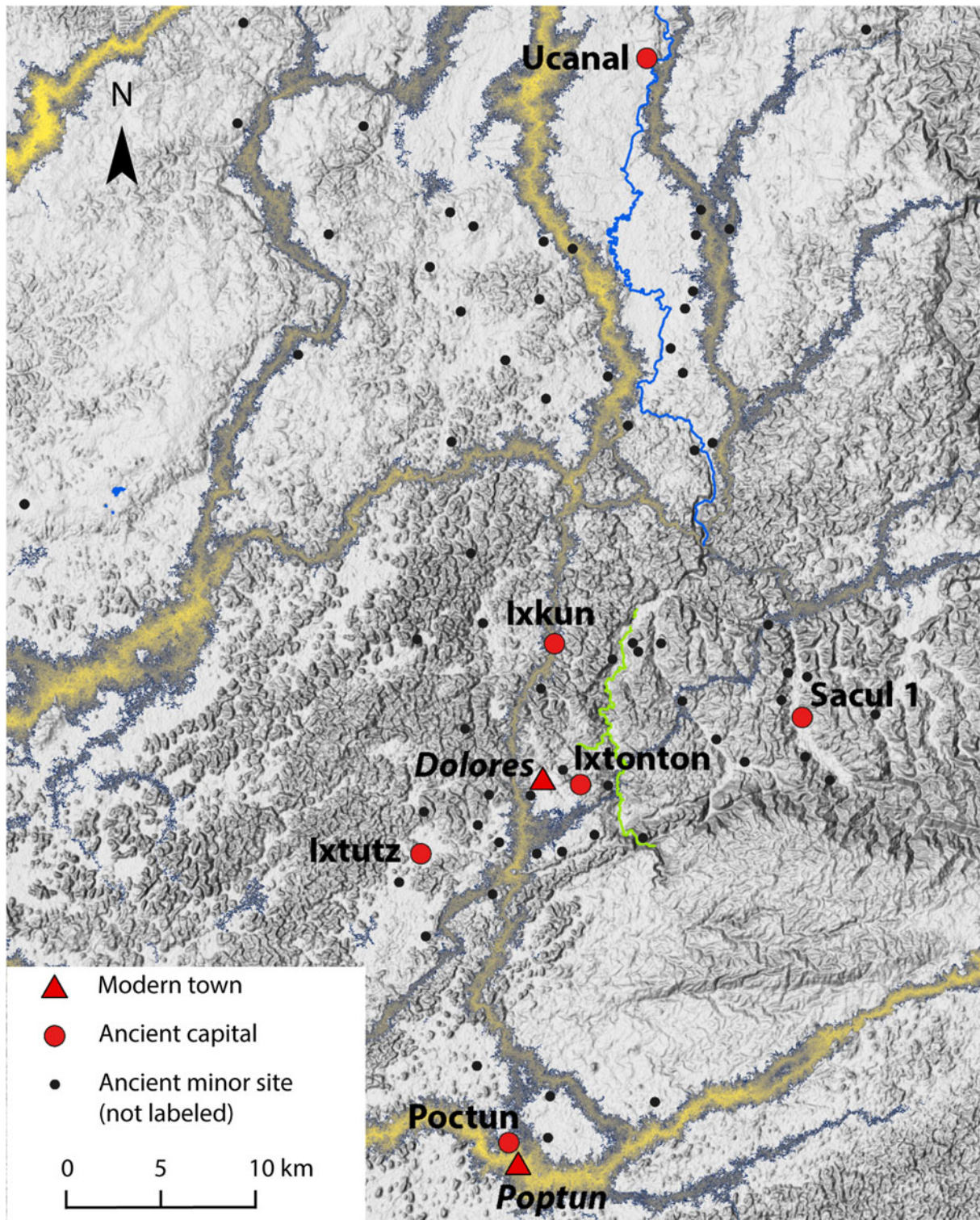
Figure 2. Map of archaeological sites around the modern town of Dolores, Peten, Guatemala, showing FETE least-cost paths with no load and cost determined by effort (see Carter et al. 2019). Map by Krause and Carter.

archaeological and epigraphic data that foreground the agency of and relationships among political actors, together with the importance of natural travel routes to the Dolores region's historical trajectory (Carter 2016; Carter and MacLeod 2021; Carter and Santini 2019; Carter et al. 2019;

Carter et al. 2022). The following discussion of the area's political history derives from these interpretations.

In the western part of the Dolores area, the sites of Ixtonton and Ixtutz were home, from the Late Preclassic period until about the end of the ninth century A.D., to

the Ho'kab' ("Five Lands") dynasty (Carter et al. 2022; Mathews 1976; Prager 2013:265). As discussed by Prager, a passage on Stela P at Pusilha, Belize, may describe the accession of the first Ho'kab' king in A.D. 81 at a site called Chicha' ("Maguey Grinder"; Stuart 2014, 2018), which may have been El Mirador (unpublished presentation by Stanley Guenter, cited in Wanyerka 2009:384), Kaminaljuyu (van Akkeren 2019), or Ichkabal near Dzibanche (Martin and Velásquez García 2016:30, n27). At present, we have no evidence for a kingdom in the eastern half of the Dolores region prior to about A.D. 700. We think this is the approximate date for the foundation of a new royal dynasty, Juluup (from *jul*, "to pierce"), that ruled from the site of Sacul 1 (Figure 3a). The suggestion is based on a reference to one of its rulers, K'iyel Janab', as "fourth in the lordship" on Sacul Stela 1, carved in A.D. 761. Given an average reign of about 22.5 years for each ruler, as seems to have been the case at Copan and Palenque (Martin 2020:76–77), the royal line would have started around the beginning of the eighth century.

Two stelae at Sacul 1 are highly similar in their iconography and textual content to monuments at the larger city-state of Naranjo to the north (Carter and Santini 2019), and in fact, the earliest firm date associated with a Juluup ruler (A.D. 731) comes from a polychrome bowl probably produced at Naranjo (Object 424 in the collection of the Museo Popol Vuh, Guatemala; K3394 in Justin Kerr's [2022] photographic database; see Carter and MacLeod 2021). We infer that Juluup had a close and probably subordinate

Figure 3. Emblem Glyphs of (a) the Juluup dynasty at Sacul, from Naj Tunich Drawing 29, and (b) the K'anwitznal dynasty at Ucanal, from Ucanal Stela 4. Drawings by Carter.

relationship to the Naranjo court during the early years of the dynasty.

Another kingdom that was subordinate to Naranjo in the early eighth century was K'anwitznal ("Yellow/Ripe Mountain Place"; Figure 3b), with its capital at Ucanal, between Naranjo and Sacul 1. A Naranjo army conquered K'anwitznal in A.D. 698, and its ruler ?Kokaaj B'ahlam I was brought back as a prisoner and probably sacrificed in 702. Ten years later, the young king of Naranjo installed a new ruler at K'anwitznal, a namesake of his predecessor; loyal to Naranjo, ?Kokaaj B'ahlam II ruled until at least 760. At the time of its victory over K'anwitznal, the Naranjo kingdom was part of an alliance centered on the powerful kingdom of Kaanul, based in that period at Calakmul (Martin and Velásquez García 2016). We think that the minor kingdoms of the Dolores region were likewise part of that network, responsible to Kaanul either directly or through intermediaries such as Naranjo (Carter 2016; Carter and MacLeod 2021). But in 744, Naranjo itself was defeated and subjugated by Kaanul's great rival, the Mutul kingdom of Tikal (Martin 1996; Martin and Grube 2008:78–79).

The defeat was a crushing blow to the Kaanul network, and it thrust political independence and local hegemony upon the ruler of K'anwitznal. By 760, ?Kokaaj B'ahlam II appears as the head of a reduced, local alliance, with K'iyel Janab' of Juluup and a ruler at El Chal—to the west —as his vassals (Carter 2016:244). It was in this historical context that Sacul Stela 1 was commissioned, recording the gift of "feathers" (*paach*) and a "palanquin" (*piit*) from ?Kokaaj B'ahlam II to K'iyel Janab'. The stela itself—carved from slate in an ornate style contrasting with the other, limestone monuments at Sacul 1—may well have been produced by K'anwitznal sculptors.
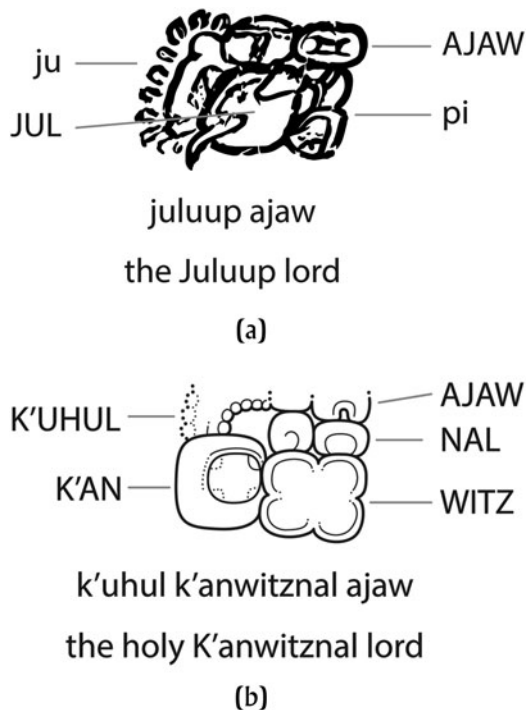
The Juluup–K'anwitznal war

The alliance between Juluup and K'anwitznal broke down by A.D. 779, when K'iyel Janab' sponsored the foundation of his own vassal kingdom at the site of Ixkun. By this time, ?Kokaaj B'ahlam II had evidently been succeeded by a new ruler ("Eight Skull"), and K'iyel Janab' chose this time to assert his power. According to Ixkun Stela 12, the new vassal king of Ixkun—a man named Yukuul Kan Ahk—was first "consecrated" or "gifted" (*k'uhb'aj*) in April of that year, marking his rise in status, and he subsequently "settled" (*kajayi*; Beliaev 2014) or "arrived" (*k'otoyi*; Stephen Houston, personal communication to Nicholas Carter, 2015) at Ixkun. Stela 12, dedicated in 780, corresponds stratigraphically to major construction events at Ixkun that transformed the site from a minor settlement like others in the Dolores area into a small capital with a royal palace and additional plazas. These construction projects would therefore have accompanied the events described on the stela, or occurred very soon after them (Carter 2016:242, 245–246; Laporte and Mejía 2005:160; Laporte et al. 1994:34–35).

From the perspective of Juluup's neighbors, the establishment of the Ixkun kingdom was a provocative act. To

"Eight Skull" of K'anwitznal, for K'iyel Janab' to sponsor a vassal king must have constituted a declaration of independence and a deadly insult. For Ho'kab', with its capital of Ixtonton west of Juluup and south of Ixkun on the Dolores Plateau, the danger was even more direct: an important north–south travel and trade route through the Maya Mountains passed through Ho'kab' territory, and Ixkun lay directly on that route (Carter et al. 2019:95), so the Juluup-Ixkun alliance could have blocked travel or claimed tolls from merchants passing through.

We think it was in response to this aggressive move that "Eight Skull" made war on Juluup. The most complete account of the conflict comes from Ixkun Stela 2 (Figure 4), where we read that K'anwitznal's forces "burned" (*puluyi*) a place called Juluupil—surely Sacul 1 itself or one of the settlements nearby—on 9.17.9.0.13, 3 Ben 6th Kayab, or December 22, 779. Although a monument at Ixkun records this event, we know that Juluupil is not Ixkun because Ixkun Stela 12 provides a quite different name for that site (Carter 2016:245).

The Ixkun Stela 2 text then tells us that the same night (*u tz'akaj yihk'in*, "the night was set in order"), warriors from Juluup performed an action recorded with an undeciphered logogram that depicts a person carrying the glyph for "fire" in a tumpline. This "fire-carrying" glyph has elsewhere been interpreted as describing a kind of attack (Brady and Colas 2005:159–160; Colas 1998). However, it is only attested twice in the corpus—here and in Drawing 82 at the cave of Naj Tunich—and we understand the latter text as describing a ritual visit to the cave, not a war. We therefore suspect that this logogram simply refers to carrying fire, and that in this instance, it means that the Juluup war band traveled by torchlight. The next day (*juun pas*, "one dawn [later]"), they attacked another settlement, named in glyph blocks C5 and D5 of the inscription, and put it to the axe (*ch'ahkaj pe't*, "the territory was chopped"). The name of this town has not been read fully, but it does include the spelling **wi-'i-IL**, and it will therefore be referred to here as "Wi'il." Maya scribes had a variety of options for counting forward by smaller units of days than 20, some of which had specific uses or connotations: *heen* or *heew*, used as part of Distance Numbers; *lat* for small numbers; and *b'ix* for counts of five or seven days (Stuart 2012). The expression *juun pas*, used on Ixkun Stela 2 and Sacul Stela 3, has elsewhere been interpreted as meaning that an event took place specifically in the morning (e.g., Hoppan 2018:268; Zender 2005:14). We think this is likely true in this context because the Juluup warriors had traveled overnight.

Stela 2 goes on to tell us that on 9.17.19.3.4 2 K'an 12th Pop (written 1 Akbal 12th Pop)—10 days and two winals after his attack on Wi'il—Juluup raided Ucanal itself (*puluyi K'anwitznal*). From other monuments—Ixkun Stela 1 and Sacul Stela 6—we learn that K'iyel Janab' followed up with an attack on the Ho'kab' kingdom, taking at least one royal captive (Carter and Santini 2019) and apparently securing his new domains. The Ho'kab' court may have relocated for a time to Ixtutz, west of the Dolores Plateau, given that their ruler undertook a series of monumental constructions there in the years following the war (Carter et al. 2022).

This account supersedes earlier interpretations of Ixkun Stela 2 in which Ixkun itself was understood as the aggressor, carrying out unilateral attacks first against Juluup and then Sacul (Laporte and Mejía 2005:158). Evidence that the interpretation presented here is correct is found on Stela 2 itself, where the Emblem Glyph of "Eight Skull" is legible as that of the K'anwitznal dynasty (Carter 2016:247). Further evidence comes from Sacul Stela 3, in whose badly eroded inscription we can still discern an account of some of the same events discussed on Ixkun Stela 2.

Sacul Stela 3

Sacul Stela 3 is a limestone monument now lying on the ground in Group A at Sacul 1, protected by a thatched roof. The stela is broken into two large sections that are riddled with cracks and covered with a thin layer of lichen. The inscription on the exposed front face consists of 41 glyph blocks arranged in three large panels with rounded corners. The top panel contains nine glyph blocks in a grid three blocks wide by three blocks tall; the left two columns of the grid are read together in the usual zigzagging order of Maya inscriptions, followed by the right-hand column, read straight from top to bottom. The other two cartouches have 16 glyph blocks that are arranged four by four and read in two double columns. All the glyphs are badly eroded, and they tend to become less legible toward the bottom of the stela. Together, the erosion and the light and dark patches of lichen make the text all but impossible to read either in person or in color or black-and-white photographs.

Ian Graham sketched Stela 3 and photographed it under raking light in the 1970s for the Corpus of Maya Hieroglyphic Inscriptions in the Peabody Museum at Harvard University, and Carter did the same in 2018. These lighting conditions clarified a few signs in the upper panel, suggesting the possibility that Stela 3 also dealt with the Juluup-K'anwitznal war; however, the lower panels remained unreadable. In 2022, two of the present authors and a colleague documented the stela again using photogrammetry. Conditions for the work were suboptimal: lighting was inconsistent, the ramada under which the monument lay had been fenced off with barbed wire, and the researchers were experiencing the effects of drinking bad water at Ixkun a day or two previously. Nevertheless, the 261 digital photographs acquired were adequate to build a three-dimensional model of the monument using Agisoft Metashape. Errors in the photography or photogrammetric modeling process introduced some artifacts into the model not present on the actual stela: tall, thin spikes and unsightly carbuncles, but these were almost completely limited to the very edges of the model and did not afflict the glyphs.

After building the model, the View mode was changed to Model solid, removing all actually existing colors from the model, including those of the microflora that obscured the details of the text. Then, the monochrome model was exported as an .OBJ file and opened in Microsoft's 3D Viewer app (version 7.2107.7012.0). By adjusting the position of the virtual light source in the model, it was possible to
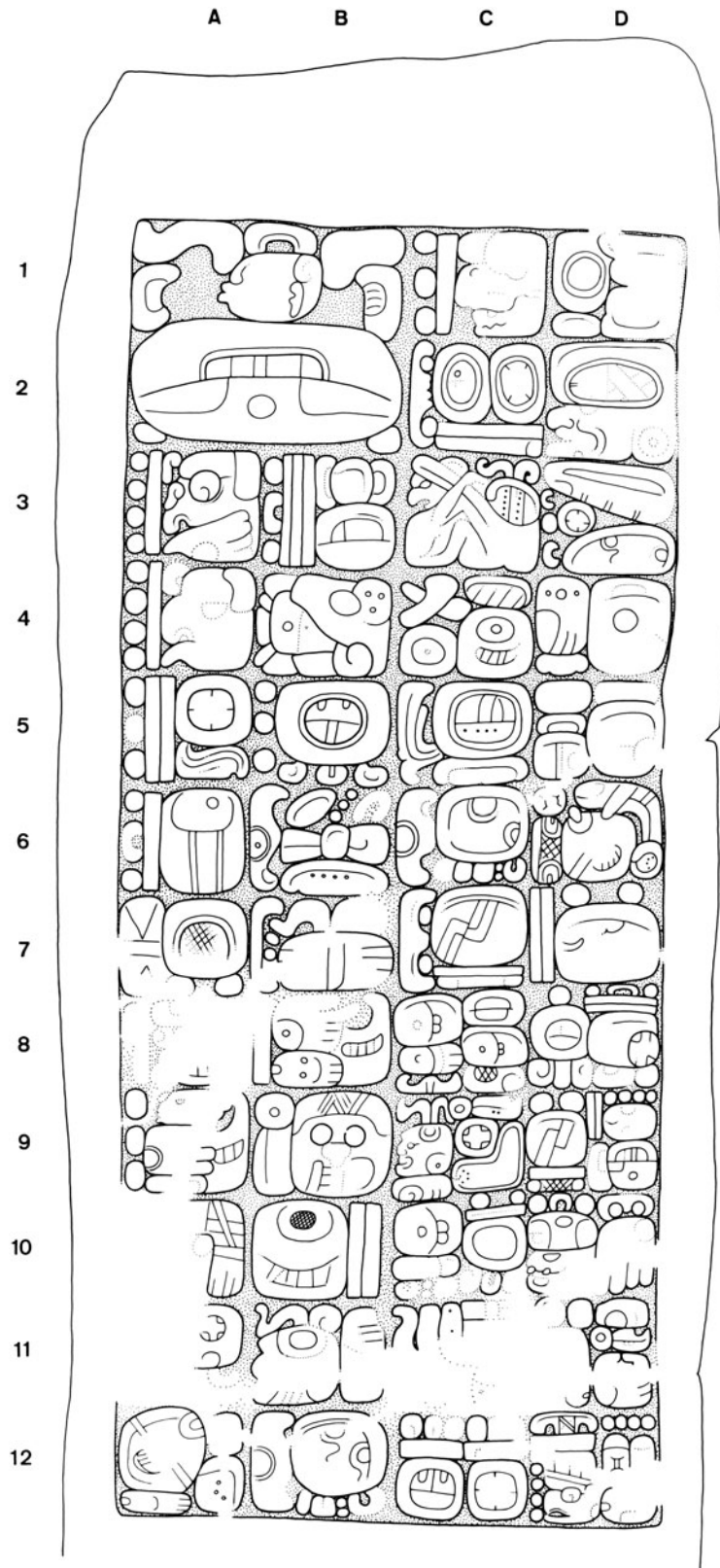
Figure 4. Ixkun Stela 2. Drawing by Ian Graham, © President and Fellows of Harvard College, Peabody Museum of Archaeology and Ethnology, PM # 2004.15.6.4.2 (digital file # 99310039).

recreate the experience of examining the text under raking light—this time, crucially, without the lichen. This technique dramatically improved legibility, so much that almost the entire inscription could be read or reconstructed. Only 14 of the 41 glyph blocks could not be read at all (11 of them in the lower panel), and the content of most of the illegible blocks could still be inferred with high confidence from the context of the surrounding glyphs and by comparison to Ixkun Stela 2.

To check the accuracy of these readings and to generate better-quality images with more complex lighting, the .OBJ file was next converted to a .BLEND model in Blender 3.5. The photogrammetric artifacts were removed in Sculpting mode, mainly using the Pinch and Inflate/Deflate tools, with the Mask tool used to protect the glyphs from alteration during the process. The cleaned-up model permitted improved renderings of the model with raking light from multiple angles (Figures 5 and 6). After close study of the glyphs, a line drawing of the monument (Figure 7) was prepared in Adobe Illustrator using a Wacom drafting tablet and corrected based on additional details revealed in the Blender model.

Reading Sacul Stela 3

Here, we present our reading of the Sacul Stela 3 inscription. As is usual epigraphic practice, transliterations are presented in boldface with logograms in majuscule and syllabograms in minuscule letters. Transcriptions into Classic

Figure 5. Monochrome photogrammetric model of Sacul Stela 3 rendered in Blender 3D.

Mayan are in italic script, and translations into English are in ordinary type. For the sake of epistemic transparency in reading this eroded text, square brackets are used here to indicate signs that are completely destroyed or illegible, and, in transcriptions, morphemes like *te'*, which we think were obligatory in the spoken language but are rarely found in written form. We reconstruct such signs from contextual clues when possible and use ellipses when not. Asterisks denote signs that are sufficiently well preserved to suggest a reading but damaged enough that the identification is not fully certain. Question marks mean that although we can identify the sign to some degree of security, we do not propose a definite Classic Mayan reading.

The inscription opens with a Calendar Round date of 3 [Ben] 6th Kayab, in glyph blocks A1 and B1, consistent with the date 3 Ben 6th Kayab given on Ixkun Stela 2 for the attack against Juluup. The verb that follows at A2 is **PUL-yi**, with the diagnostic flames rising from the head of **PUL**, for *puluyi*, "it got burned." Glyph block B2 should give the name of the place burned, and here we can discern details of the logogram **JUL**—the head and point of an awl, and an internal curve—probably conflated with syllabic **lu as a phonetic complement. Below **JUL-(*lu)** we see the outlines of syllabic **pi. Here, then, we have *Juluup*, the name of Sacul's ruling dynasty; this may be an underspelling for *Juluupil*, the form we see on Ixkun Stela 2.

Based on the Ixkun Stela 2 inscription, we ought next to find out who carried out the attack on Sacul. Indeed, at position A3, we discern ***U-*KAB'-*ji-*ya** for *u kab'ijiiy*, "he oversaw it." On the Ixkun stela, the attacker is "Eight Skull," but here we have **4-PIIT-*ta** for *kan piit*, "Four Palanquins." "Numbered palanquin" titles are attested for lords of several polities in the southern and eastern lowlands that were in communication in the Late and Terminal Classic periods. K'iyel Janab' of Sacul is called "Eight Palanquins" on Sacul Stela 1, whereas lords of Sak Muk, in the area of Chetumal Bay and inland, are "Six Palanquins" (Carter and MacLeod 2021:7; MacLeod and Sheseña 2013). Members of Ceibal's royal family who collaborated with a ruler of Ucanal to enthrone a new king at Ceibal in 829 are called "Four Palanquins" and "Eight Palanquins" (Carter 2014:197). Likewise, Ruler 1 of Ixkun takes the title "Eight Palanquins" on Ixkun Stelae 1 and 4. Sacul Stela 3 indicates that Ucanal also participated in this nominal or titular convention. Substituting *kan piit* for "Eight Skull's" personal name here may rhetorically distinguish "Four Palanquins" people at Ucanal from "Eight Palanquins" people at Sacul and Ixkun.

The text then moves to block C1, which reads **1-PAS**, *juun pas*, "one dawn later." The Calendar Round date for the next day follows, as expected, at C2 and C3, reading 4 [*Ix] 7 Kayab. All of this closely parallels Ixkun Stela 2, except that the reference to nocturnal fire-carrying is omitted, and the person or persons responsible for the attack against Juluup are named differently on the two monuments. The text in the middle cartouche should therefore begin with an account of the counterraid against Wi'il on 4 Ix 7 Kayab. In fact, we do see a martial verb, *puluyi*, "it got burned," at position D1.
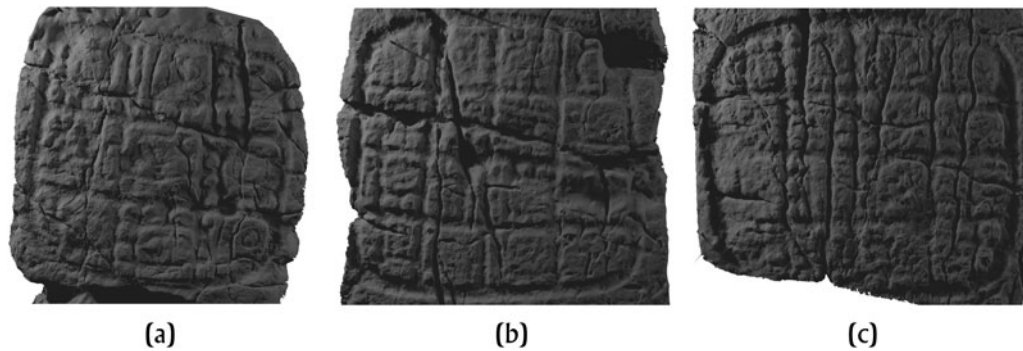
Figure 6. Details of Sacul Stela 3 rendered in Blender 3D: (a) upper panel; (b) middle panel; (c) lower panel.
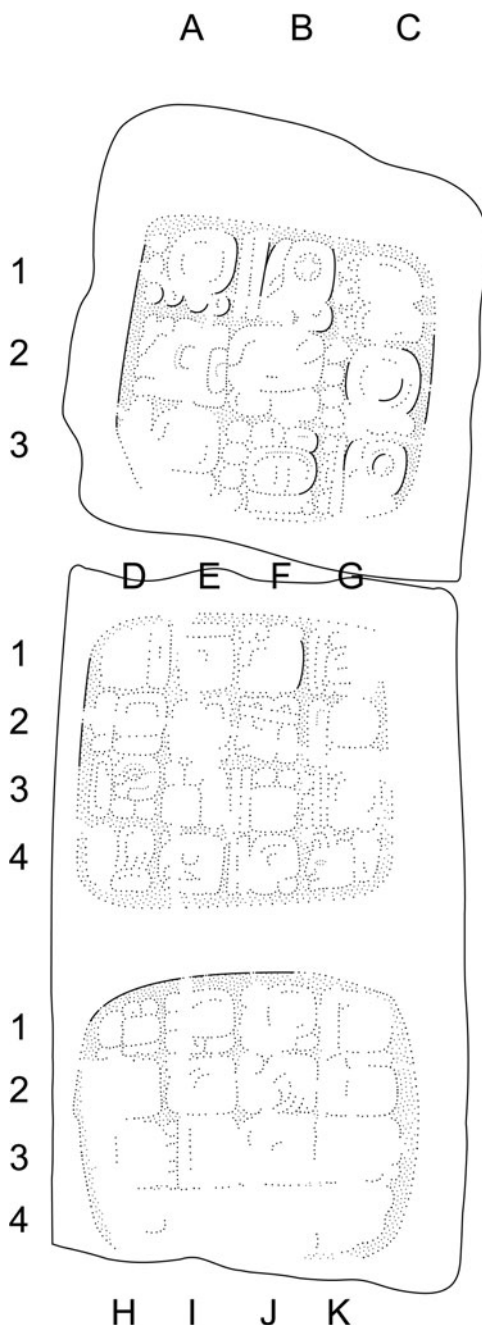

Figure 7. Line drawing of Sacul Stela 3. Drawing by Carter.

We would expect the name of Wi'il, the presumed target of this revenge attack, to have followed. Erosion and two intersecting cracks have damaged glyph blocks E1, D2, and E2, but elements of what survives resemble parts of Wi'il's name on Ixkun Stela 2: the apparent numeral **5** in E1 and probably ***wi** and ***'i** in D2. Consequently, we think this is the same early morning raid on Wi'il described on Ixkun Stela 2.

Glyphs at position E2 are consistent with *U and *KAB' for *u kab'ijiiy*, "he oversaw it," in which case, K'iyel Janaab's names and titles should follow. At D3 we see the "captor of" expression U-CHAN-*nu, followed at E3 by some eroded glyphs that should have named a prisoner. The name of K'iyel Janab' comes next, in D4 and E4. Outlines and internal details of signs at **F1** are likewise consistent with ***JUL** and ***AJAW**, so we reconstruct this as the Juluup Emblem Glyph. Another of K'iyel Janab's titles—*naah ho' chan ?mukuut/?eb'eet*, "Great Five Skies Messenger(?),"—also attested on Sacul Stela 1—appears in blocks G1 and F2. The "Banded Bird" sign in this title has been an enduring puzzle to epigraphers (Stuart 2005:133–136); Houston (2018:104–105) reads it as *eb'eet*, "messenger," whereas Bíró and colleagues (2020) propose *mukut*, "designer, planner, administrator."

The glyphs at G2 can be reconstructed as *U-*TZ'AK-[AJ], given that a Distance Number of eight days and two winals occurs at F3. That takes the narrative forward in time to 9.17.9.3.7, 13 Ik 10th Pop, a date given in glyph blocks G3 and F4. The verb PUL-*yi (*puluyi*, "it got burned") occurs at G4, and the name of the target begins the bottom glyph panel on the stela, in position H1. That name is badly eroded, but the outlines are consistent with [K'AN-na-WITZ-NAL] (*K'anwitznal* or Ucanal), and we think that this passage very probably records the same attack on Ucanal described on Ixkun Stela 2.

As on Ixkun Stela 2, we would next expect to read about the person who oversaw the assault on Ucanal. The Ixkun monument does not specify his name but does give the Juluup Emblem Glyph, so we believe it was K'iyel Janab'. Here on Sacul Stela 3, we find the outlines of [U-KAB-ya] for *u kab'ijiiy* at I1. K'iyel Janab's name phrase would have been in positions H2 and I2, but it is totally eroded.

The rest of the lower panel is almost unreadable, but much of it can be reconstructed from context clues and a few legible glyphs. We see three dots and at least one bar

—the numerals 8, 13, or 18—in block I3. This is probably part of a Distance Number counting forward 18 days and 14 winals from the attack on Ucanal to the same 9.17.10.0.0 period ending commemorated on Ixkun Stela 2. Traces of a Calendar Round date, presumably 12 Ahau 8 Pax, survive at J1 and K1, followed at J2 by the "scattering" glyph *CHOK.

In sum, the surviving text on Sacul Stela 3 records the same sequence of events as Ixkun Stela 2: the raid by Ucanal on Sacul, the counterattack at dawn on Wi'il, the subsequent revenge assault on Ucanal, and the half-k'atun celebration of A.D. 780. However, there are small but interesting differences between the two accounts. The Sacul stela places the attack on Ucanal 48 days after the raid on Wi'il, whereas the Ixkun text says it happened 50 days later. Perhaps scribal error best explains the discrepancy, because there are other calendrical mistakes on Ixkun Stelae 2 and 12 (Carter 2016:246). The different dates would add to evidence from monumental formats at both sites that even though Ixkun was founded as a vassal of Juluup, and even though monuments at both capitals deal with some of the same events, Ixkun had its own sculptors and did not rely on artisans from Juluup.

Another difference is that Sacul Stela 3 uses the verb *pul*, "to burn," in place of the "territory chopping" expression used on Ixkun Stela 2 to describe the counterassault on Wi'il. That is not surprising, because we can well imagine that fire and axes were both involved in many an ancient assault, but it is perhaps important to the study of Classic Maya war that "chopping" and "burning" could both describe the same historical event: they emphasize different aspects of the action but apparently do not denote conceptually distinct kinds or intensities of attack.

Importantly for the political history of the Dolores region during the Late Classic period, this reading confirms Carter's (2016) earlier interpretation of Ixkun Stela 2: that, contrary to some previous readings (e.g., Laporte and Mejía 2005:158), it does not record a series of three attacks by Ixkun against other sites, but rather a "revenge narrative" of a war between a Sacul–Ixkun alliance and another alliance headed by Ucanal. After K'iyel Janab' of Sacul secured independence, the story of the war was so significant for his alliance with Yukuul Kan Ahk of Ixkun that it was commemorated on public monuments at both capitals.

A transliteration, transcription, and translation of the stela text follows:

A1–B1   3-[BEN] 6-(K'AN)-a-si
hux b'en wak [te'] k'anasiiy
On 3 Ben 6th Kayab

A2–B2   PUL-yi JUL-(*lu)-*pi
puluyi juluup
Juluup got burned.

A3–B3   *U-*KAB'-*ji-*ya 4-PIIT-*ta
u kab'ijiiy kan piit
He oversaw it, Four Palanquins.

C1   1-PAS
juun pas
One dawn later,

C2   4-*IX
kan hiix
on 4 Ix

C3   7-(K'AN)-a-si
huk [te'] k'anasiiy
7th Kayab,

D1–E1   PUL-yi 5-[...]
puluyi ho' [...]
it got burned, [name phrase of Wi'il?]

D2–E2   *wi-*'i-[IL] *U-*KAB'-[ya]
wi'il u kab'ijiiy
Wi'il. He oversaw it,

D3–E3   U-CHAN-*nu [...]
u chanahn [...]
the captor of [...],

D4–E4   [k'i]-*ye-*le JANAB'
k'iyel janab'
K'iyel Janab',

F1–G1   *JUL-[pi]-[AJAW] NAAH-5-[CHAN]-[na]
juluup ajaw naah ho' chan
the Juluup lord, the Five Great Skies

F2–G2   ?EB'EET/?MUKUT *U-*TZ'AK-[AJ]
?eb'eet/?mukut u tz'akaj
messenger(?)/administrator(?). The count is

F3–G3   8-2-WINIK-*ya 13-*IK'
waxak [heew] ka' winikjiiy huxlajuun ik'
eight days and two score days to 13 Ik

F4–G4   10-(*K'AN)-JAL-wa PUL-*yi
lajuun [te'] k'anjalaw puluyi
10th Pop. It gets burned,

H1–I1   [K'AN-na-WITZ-NAL] [U-KAB-ya]
k'anwitznal u kabijiiy
Ucanal. He oversaw it,

H2–I2   [...] [...]
[...]
[...]

H3–I3   [...] *18-[...]
[...] [...]
[...] 18 [...]

H4–I4   [...] [...]
[...] [...]
[...]

J1–K1   12-[AJAW] 8-[PA'AX]
lajchan ajaw waxak [te' pa'ax]
On 12 Ahau 8th Pax

J2–K2   *U-*CHOK [...]
u chok[ow] [...]
he scatters [...]

J3–K3   [...] [...]
[...] [...]
[...]

J4–K4   [...] [...]
[...] [...]
[...]

GIS analysis

We next wanted to identify known archaeological sites as potential candidates for the ancient town of Wi'il. Three

premises limit Wi'il's possible location. First, it must be fairly near Sacul 1, because Ixkun Stela 2 tells us that warriors from Juluup traveled at night and attacked at dawn, within 12 hours after setting out. Second, we suppose that the Juluup army would have traveled more slowly at night than during the day, even with torchlight and moonlight. Finally, Wi'il was almost certainly located north of Sacul 1, in the direction of Ucanal. The territories to the east and south of Sacul 1 were not, as far as we understand, either controlled by K'anwitznal or allied with it in 779. Conceivably, the attackers could have come from the west —from El Chal, a K'anwitznal subject, or from the Ho'kab' kingdom of Ixtonton and Ixtutz, which was at this time friendly to K'anwitznal or at least a common enemy of Juluup (Carter and Santini 2019). But if that were the case, we would expect them to have raided Ixkun instead of the Sacul Valley or on their way to Juluup territory, and there is no epigraphic evidence for such an event. With these considerations in mind, we turned to geographic analysis to suggest a likely location for Wi'il.

Human movement over space is limited by the unevenness and slope of the terrain, access to roads or well-maintained footpaths, as well as barriers such as rivers, lakes, or dense vegetation. Although we can only make assumptions about vegetation density within the Maya Mountains in A.D. 779, we can use our understanding of slope angle and human walking speed to determine pedestrian travel times over the regional landscape. There are many ways to model and predict walking speed based on slope, including one of the earliest models, Naismith's rule, which considers the additional time needed to walk uphill (Naismith 1892). More commonly, GIS models use some version of Tobler's hiking function, which focuses on three factors: maximum speed, modification of speed depending on slope, and the slope in which the maximum speed is reached (Márquez Pérez et al. 2017; Tobler 1993). Using these parameters, Tobler's function predicts that a speed of 6 km/hr is achieved by the hiker when traveling on a slight downhill slope (an angle of –2.9°). Therefore, a slight decline increases the speed of movement, and an increase in slope leads to slower movement along a surface (Tobler 1993). These values have been scrutinized and adjusted for different studies, including sports performance, modern transport and access, and archaeological modeling (Buda et al. 2022; Goodchild 2020; Márquez Pérez et al. 2017; White and Barber 2012). Recognizing that there are many unknowns—including past vegetation dynamics, human performance, a need for stealth, navigation around barriers, and access to trails—we simply used the current version of Tobler's hiking function using Distance Accumulation (Spatial Analyst toolbox) in ArcGIS Pro (Kwon and Graham 2021). This provided a framework by which to understand pedestrian travel time between Sacul 1 and other sites.

We obtained location data for ancient Maya sites in the region from MayaGIS (Witschey and Brown 2010) and the Atlas Arqueológico de Guatemala (Laporte 1997), with some adjustments by Carter (Carter et al. 2019). We used a 30 m spatial resolution digital elevation model (DEM) created from the Shuttle Radar Topography Mission (SRTM)

elevation dataset. We used Distance Accumulation in ArcGIS Pro's Distance tools, which calculates accumulated distance for each cell from a starting point. We defined the vertical factor using a model based on Tobler's hiking function (Kwon and Graham 2021). For this model, we did not treat local rivers as barriers, because the upper Xaan, Mopan, and Sacul Rivers are shallow and could readily have been crossed, especially during the dry season. After the distance accumulation was generated (in hours per meter), we overlaid least-cost paths modeled in Carter and colleagues (2019). We chose to overlay least-cost paths "from anywhere to anywhere," or FETE (Carter et al. 2019; White and Barber 2012) with no load, with cost determined by effort, to further enhance our understanding of travel options on the landscape for the Juluup-K'anwitznal war. The model is presented visually in Figure 8.

Based on our model, we think that the site of El Rosario 1 or its outlying settlement of El Rosario 4 are the best candidates for Wi'il. The El Rosario site cluster is the closest settlement to Sacul 1 that lies both in the direction of Ucanal and outside of Juluup's likely territorial control. It is approximately 15 km north of Sacul 1 and 20 km south of Ucanal— about 12 km closer to the Juluup capital than Calzada Mopan, which was previously suggested as a plausible site for Wi'il by Carter and colleagues (2019:96). In our model, El Rosario is only three hours from Sacul 1 on foot, perhaps four or five at night if travel conditions were bad. It also lies on a least-cost path between Sacul 1 and Ucanal. By local standards, El Rosario 1 is a substantial settlement, with monumental architecture and smaller dependent sites (Laporte 1997:457), and we expect that it would have been able to host a force from K'anwitznal in preparation for the attack on Juluup. Moreover, between El Rosario and the northernmost settlements identified as probably belonging to the Juluup kingdom—Mopan 3-E, Xaan Abajo, and Limones—there is a gap of about 20 km within which no ancient settlements have been identified. If this gap is real, rather than an artifact of incomplete exploration in a remote part of Peten, then it may well correspond to a Late Classic frontier between the Juluup and K'anwitznal realms. A relatively large town on that frontier would make a logical staging site for a raid.

Finally, in order for an army from Ucanal to reach Sacul 1 in December 779, and for forces from Sacul 1 to strike back at Ucanal in February of the following year, both kingdoms alternately would have needed to exert some measure of control over the intervening territory. In the case of the initial attack, the distribution of archaeologically documented settlements makes us think that El Rosario was probably part of K'anwitznal's traditional domains. But for Juluup to secure partial control of the route to Ucanal for the retaliatory raid would have required taking and holding El Rosario, killing or driving away part of its population, reaching some coerced agreement with its rulers, or some combination of these possibilities. Ample evidence indicates that Classic Maya war sometimes targeted entire settlements for destruction, including the slaughter or abduction of civilians (e.g., Demarest et al. 1997; Inomata 1997; Wahl et al. 2019).
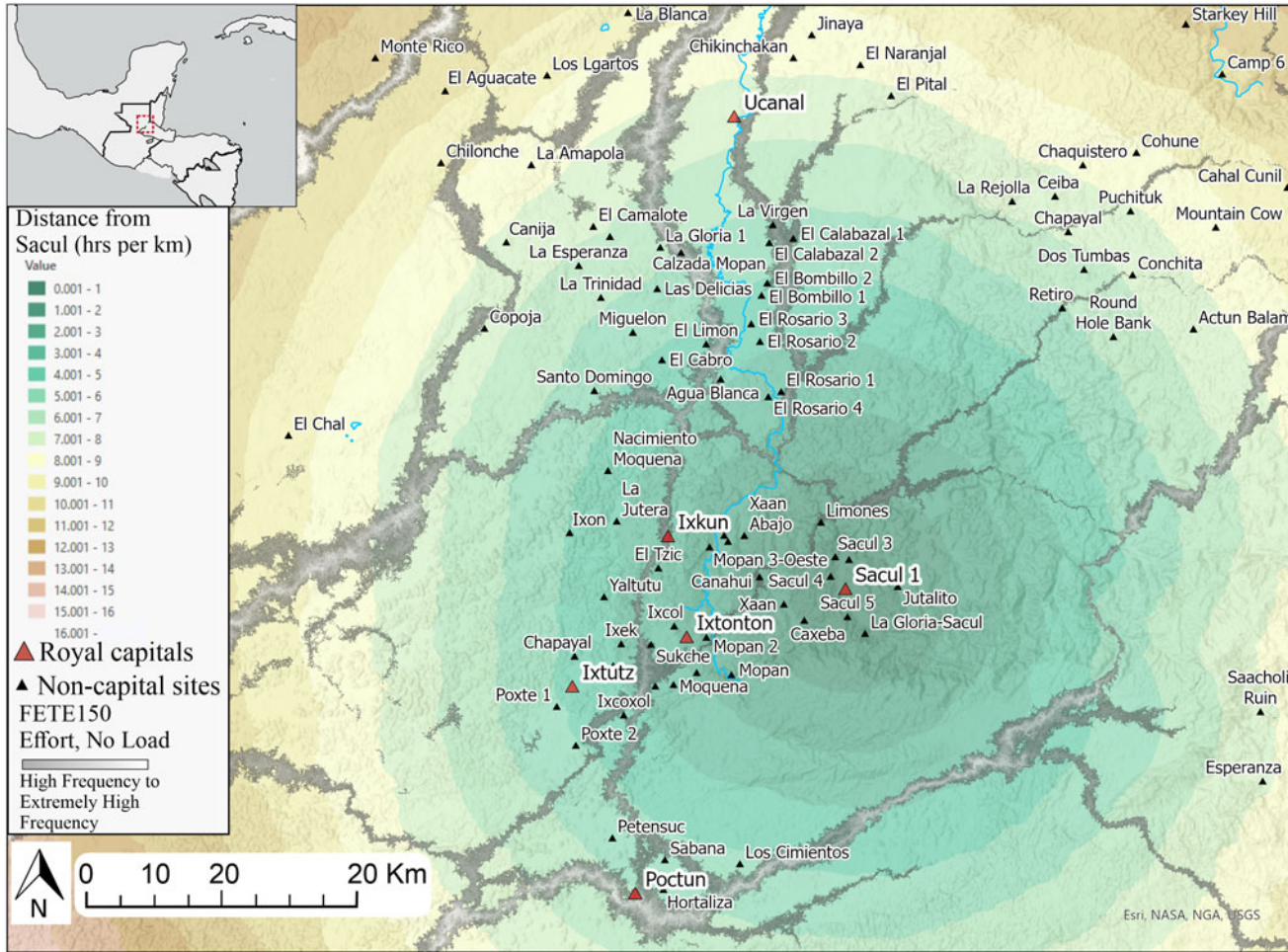
Figure 8. Travel time from Sacul 1 with FETE least-cost paths. Map by Krause using elevation data from the Shuttle Radar Topographic Mission, and travel cost data generated for Spatial Archaeometry Research Collaborations by Kristin Safi and Devin White (Carter et al. 2019).

Conclusions

In this article, we presented a new 3D model, line drawing, and nearly complete reading of Stela 3 from Sacul; and we used GIS analysis to infer something about the geography of the war discussed on that stela and its companion monument, Ixkun Stela 2. This work adds to the growing list of cases in which 3D documentation of ancient texts affected by erosion or obscured by microflora has been able to recover information not readily accessible with the unaided eye (e.g., Helmke et al. 2022; Prager et al. 2020; Vepretskii and Beliaev 2020). Despite the occasional exigencies of fieldwork, photogrammetry is an effective, efficient, and inexpensive method for documenting and clarifying such texts.

The reading presented here makes several contributions to our understanding of Classic Maya warfare in general and to the history of the Dolores region in particular. From the use of *puluyi* on Sacul Stela 3 and *ch'ahkaj pe't* on Ixkun Stela 2, we can infer that the words "burning" and "chopping" of settlements do not necessarily describe two different kinds of military assault. At the level of local history, we were able to add K'anwitznal to the list of kingdoms whose elites used one of the "numbered palanquin" titles, along with Ceibal, Ixkun, Juluup, and Sak Muk. Our reading confirms Carter's (2016) interpretation of Ixkun Stela 2 and shows that the revenge narrative that the two monuments relate functioned as a kind of historical charter for the alliance between Juluup and Ixkun and for their independence from K'anwitznal. At the same time, differences in the chronology of Sacul Stela 3 and Ixkun Stela 2 suggest that different sculptors were responsible for those monuments, and that each site may have had its own, relatively autonomous group of artisans and history keepers.

The attack on Wi'il, an important event in the independence war, raised the question of where that settlement was located. Using Tobler's hiking function and other GIS methods, we made the case that it corresponds to the site area of El Rosario, on the Mopan River between Ucanal and the Sacul Valley. If our proposal is correct, it has some implications for ongoing discussions about the role of outlying settlements in ancient Maya raiding and warfare (e.g., Helmke 2020; Hernandez and Bracken 2023). In the scenario suggested here, El Rosario first served K'anwitznal as a staging ground for an attack on Juluup; then, El Rosario was attacked in turn and neutralized or co-opted in some way in preparation for Juluup's subsequent revenge attack on K'anwitznal. This would add further support to the proposal that hinterland settlements had a defensive function, standing between royal capitals and foes from outside (Alcover Firpi and Golden 2020; Hernandez 2023; Scherer and Golden 2009). Perhaps, by falling into enemy hands, such settlements could also become liabilities.

Our proposal also suggests a line of future archaeological research. Investigations at the site of Witzna, a site in eastern Guatemala said in an inscription at Naranjo to have been subject in A.D. 697 to the same kind of "burning" attack as Wi'il, found evidence of intense fires that destroyed all major structures sometime in the late seventh century, followed by a steep drop in local population (Wahl et al. 2019). Excavations at El Rosario might likewise find archaeological evidence of Juluup's attack in 779. If so, the extent of the damage and any demographic impact could present a useful comparandum to the data from Witzna. If the evidence indicates devastation and demographic decline, that would be a point in favor of the idea that *puluyi* events in the hieroglyphic corpus were frequently devastating attacks. On the other hand, limited or no archaeological evidence of the attack would imply either that El Rosario was not Wi'il, or that both *puluyi* and *ch'ahkaj* can describe assaults of varying destructiveness, ranging from flying raids to the complete ravaging of settlements.

Finally, the distance accumulation model presented here and the least-cost pathway models in a previous article (Carter et al. 2019) raise the question of whether travel between some of the sites involved in the events discussed above was facilitated by artificial roads or impeded by fortifications or barriers. Walls blocking natural travel paths between hostile polities have been identified in the Usumacinta region (e.g., Golden et al. 2008:265), and watchtowers are attested in the rural landscapes of northern Peten (Garrison et al. 2019:136). Nearer to our study region, an expansive system of causeways connects the ancient city of Caracol to its subordinate towns (Chase and Chase 2001). Remote sensing and on-the-ground survey and excavation might clarify whether formal roads likewise linked Ucanal and Sacul 1 to their dependent settlements or to one another, and whether the epigraphically documented conflict between K'anwitznal and Juluup prompted the construction of surveillance and defensive architecture.

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