Pre-Mamom Pottery Producers in the Heart of the Yucatan Peninsula

Productores de cerámica Pre-Mamom en el corazón de la península de Yucatán

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Abstract: Recent research in the Maya Lowlands has revealed substantial new evidence for the first pottery producers at about 1000-600 bc, during the early Middle Preclassic period. This comparatively late adoption is a special case in Mesoamerica, where pottery appeared elsewhere up to a millennium earlier. Although archaic lifeways had long been established in the region, and pottery technology was likely known to some archaic communities, these new data reveal the complex set of circumstances that prompted the shift to ceramic production across the Yucatan Peninsula, Peten, and Belize. This article reviews these data from the perspective of the upland region of central and southern Yucatan, known as the Elevated Interior Region (eir). Its rather complex early settlement links the eir to contemporary pottery industries throughout the peninsula, suggesting well-established exchange sys-

tems were in place even as the first populations chose to settle more permanently on the landscape. Most significant among these cultural shifts was the increasing dependence on maize foodways as a primary subsistence strategy. Intensive maize agriculture has not been documented in Mesoamerica much before 1000 BC, yet ceramic technology was adopted independently of its use in other areas. Current evidence suggests, however, that the two were linked in the Maya Lowlands, where a relatively rapid transition took place as horticultural communities became more dependent on maize crops, followed waterways to settle more permanently on the landscape, and began producing pottery locally.

Keywords: Maya Archaeology, Pottery Analysis, Middle Preclassic, Yucatan Peninsula, Peten.

Resumen: Investigaciones recientes en las Tierras Bajas mayas han revelado evidencias novedosas y sustanciales de los primeros productores de cerámica alrededor de 1000-600 a.C., durante el período Preclásico Medio temprano. Esta adopción relativamente tardía es un caso especial en Mesoamérica, ya que en otras partes la cerámica apareció hasta un milenio antes. Aunque las formas de vida arcaicas habían estado establecidas durante mucho tiempo en la región, y la tecnología de la cerámica probablemente era conocida por algunas comunidades del Arcaico, estos nuevos datos revelan un complejo conjunto de circunstancias que impulsaron el cambio a la producción de cerámica en la península de Yucatán. El presente artículo revisa estos datos desde la perspectiva de la región central y meridional de Yucatán, conocida como Región Interior Elevada (RIE). Los asentamientos tempranos y relativamente complejos vinculan la RIE con las industrias cerámicas contemporáneas en toda la península, sugiriendo que los sistemas de intercambio ya estaban establecidos cuando las primeras poblaciones optaron por asentarse de manera más permanente en el paisaje. El más significativo de estos cambios culturales fue la creciente dependencia de la alimentación con maíz como estrategia principal de subsistencia. Aunque la agricultura intensiva basada en el maíz no ha sido documentada en Mesoamérica mucho antes del año 1000 a.C., en otras áreas la tecnología cerámica fue adoptada independientemente de esta práctica. Sin embargo, los datos actuales indican que ambos fenómenos estaban relacionados en las Tierras Bajas mayas, donde tuvo lugar una transición relativamente rápida, a medida que las comunidades hortícolas se volvieron más dependientes del cultivo de maíz, siguieron las vías fluviales para asentarse de manera más permanente en el paisaje y comenzaron a producir cerámica localmente.

Palabras clave: arqueología maya, análisis cerámico, Preclásico Medio, península de Yucatán, Petén.

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Although the shift to pottery production happened earlier in other parts of Mesoamerica, the impetus for its near simultaneous adoption across the entire lowland

Maya region is a special case that has remained elusive until very recently (Brown and Bey, 2018; Rosenswig *et al.*, 2015). Over the last decade, however, researchers encountered new evidence for the earliest ceramic producers at sites throughout the region (Andrews, Bey and Gunn, 2018; Inomata *et al.,* 2013; Walker, 2023). These new data provide burgeoning evidence for the complex set of circumstances that prompted the shift to ceramic production across the Yucatan Peninsula. The upland region of central and southern Yucatan provides an important case study to examine the distribution of early pottery using communities.

Identifying the First Potters in the Maya Lowlands

The idea that a complex social order existed among the Preclassic Maya is not new (Estrada-Belli, 2011; Freidel, 1979), but recent evidence has pushed back its date of origin (Brown and Bey, 2018; Freidel *et al.,* 2017; Inomata *et al.,* 2020). If the adoption of ceramic technology is seen as a proxy for a shift in regional lifeways, then we now know it began between 1200 and 1000 BC in the lowland Maya region, the beginning of the Middle Preclassic period (Table 1), when communities started producing pottery in the context of an already robust Archaic cultural milieu (Lohse, 2010). Pottery technology was probably known to the preceramic horticulturalists and foragers living in the region, yet its rapid adoption likely paralleled dramatic changes in subsistence strategies, agricultural systems, exchange networks, and residential patterns. Most significant among these cultural shifts involved the increasing dependence on maize foodways as a primary subsistence strategy (Blake, 2015; Blake *et al.,* 1992; Inomata *et al.,* 2015; Rosenswig *et al.,* 2015: 95). Intensive maize agriculture has not been documented in Mesoamerica much before 1000 BC, yet ceramic technology was adopted independent of its use in other areas (Clark and Cheetham, 2002; Rosenswig, 2010). Current evidence suggests, however, that the two were linked in the Maya lowlands, where a relatively rapid transition took place as horticultural communities became more dependent on maize crops, settled more permanently on the landscape, and began producing pottery locally.

The success of these new lifeways opened the vast karst landscape of Yucatan to permanent settlement. Along with a new focus on the maize cycle, communities became more engaged in trading networks, acquiring nonlocal goods such as jade, obsidian, and marine shell, and gathering new ideas about container technology. With its focus on the maize cycle, the basic tenets of Maya epistemology undergird these changes, and were expressed in early iconographic representations, some borrowed from their Mesoamerican neighbors, and some developed independently (Garber and Awe, 2009). They were revealed at scale in the proliferation of E Group architectural plans at new settlements, a layout designed to track the seasonal planting cycle for maize as agricultural intensification began (Milbrath, 2017; Reese-Taylor, 2017; Šprajc, 2021a). The demand for

permanent water sources also compelled early farmers to devise large scale water management systems in some areas (Dunning, Beach, and Luzzadder-Beach, 2012; Dunning *et al.,* 2022).

Early ceramic complexes across the Maya region show remarkable conceptual similarity, despite variation in locally available materials for pottery production. In most cases for which we have data, ceramic technology arrived fully developed, indicating that it was borrowed from elsewhere, not independently invented in the Maya region (Rosenswig, 2010). The early complexes discussed below provide burgeoning evidence that a recognizably Maya tradition may have begun as early as 1000 BC, coeval with the arrival of pottery technology.

Now that a significant number of individual pottery sequences are available to study, we can view the data at a comparative scale. This high-altitude view is the result of new survey techniques, particularly lidar, and the ground-truthing that follows imaging the topography (e.g., Canuto *et al.,* 2018; Inomata *et al.,* 2020; Reese-Taylor *et al.,* 2016; Šprajc *et al.,* 2021, 2022); we now consider the landscape both at a vast scale and in high resolution. Like binocular vision, these perspectives improve our focus, leading to new insights about all time periods, including the first pottery producers, their communities, and their individual and collective histories.

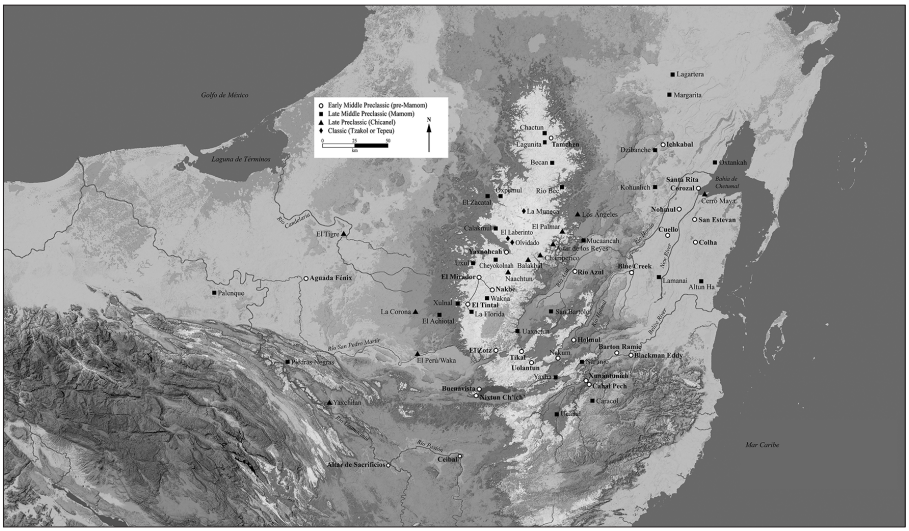

Figure 1. Map of the central and southern Yucatan highlighting early Middle Preclassic settlements.

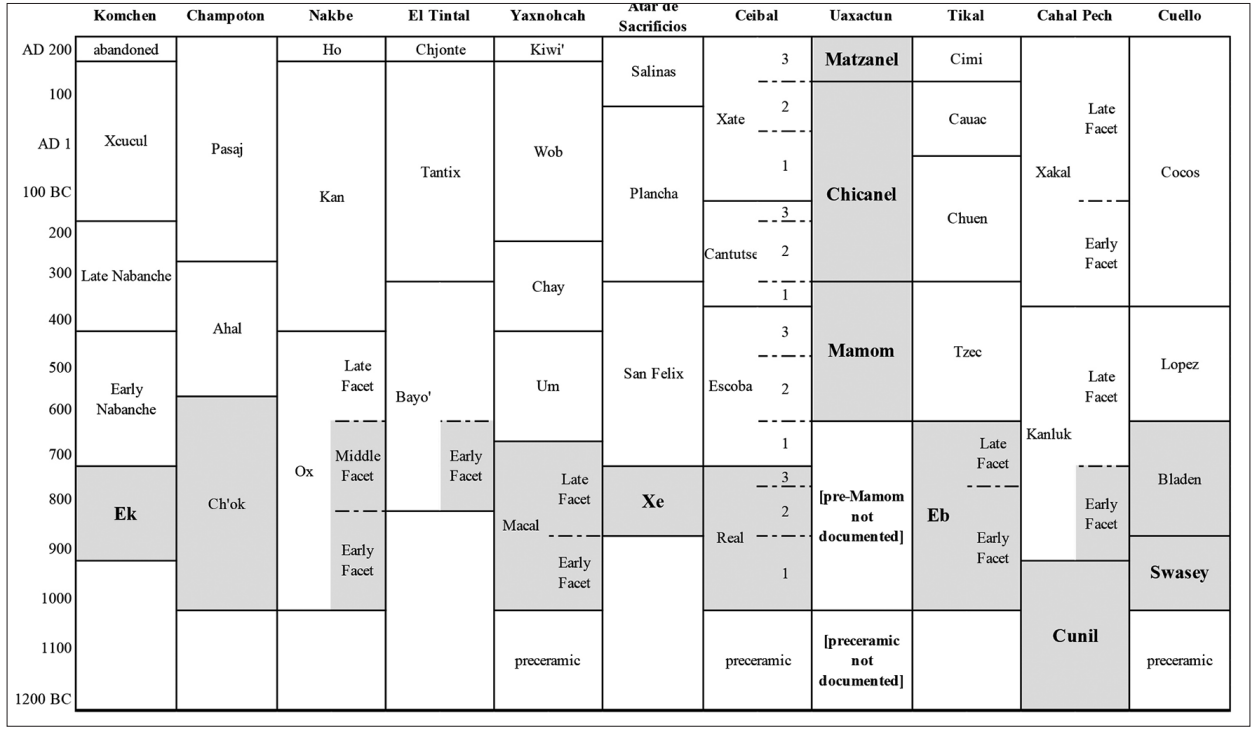

Table 1. Selected Early Middle Preclassic ceramic complexes from the Maya lowlands.

A Word about Methodology

The Type: Variety/ mode system (TVM) for pottery analysis used in this research was established originally on Maya material (Willey *et al.,* 1967), and, after more than fifty years, there is a substantial literature available for researchers to use. Most modern researchers recognize TVM as one of many tools for ceramic analysis. At the site level, TVM is most helpful in developing a chronology. At the regional level, TVM has been useful in comparing groups of sites which share the same potting tradition. As Maya pottery studies generally focus on well-established communities embedded in a wide exchange network, its utility for studying the first pottery producers might be questioned. Nonetheless, it was TVM that first identified the pre-Mamom period (Adams, 1971), and TVM that undergirds the new complexes described in this paper. These early potters may have relied on smaller regional networks, but they shared potting traditions from the beginning that can be recognized by sherd comparison and literature review.

The Elevated Interior Region

Recent research in the heart of the Elevated Interior Region (EIR) provides a concise case study (Šprajc, 2008, 2021b; Šprajc *et al.,* 2014, 2021, 2022). As first defined by Nicholas Dunning and colleagues (2012), the EIR is essentially the "backbone" of the Yucatan Peninsula, comprising a complex, weathered carbonate region up to 300 m in elevation that snakes through the middle of the peninsula from the Sierrita de Ticul in the northwest to Lake Peten Itza in the south, and is characterized by a profound lack of perennial surface water. Today this region includes a relatively unexplored forested area incorporating a large, protected biosphere reserve, a designation that led to greater exploration by archaeologists and environmental scientists (Domínguez *et al.,* 2012).

The EIR extends over 380 km north-south, and measures some 140 km east-west at its widest expanse; the portion discussed here encompasses the southern 200 km. The adjacent landscape drops off abruptly at some fault scarps, and more gradually elsewhere, until it meets the north, east, and west coastal plains of Yucatan. Although mostly unpopulated now, this was not the case in the past. Calakmul, for example, once anchored an extensive megalopolis, probably unparalleled in the Maya world of the seventh century AD (Carrasco, Vázquez and Martin, 2009; Folan, 1992). River systems drain the EIR at its central and southern margins, beginning as seasonal streams in the interior and becoming perennial where charged by springs along the margins. To the east, they debouch into Chetumal Bay and the Caribbean Sea; to the west they flow into the Laguna de Términos and the Gulf of Mexico. To the north, the porous karst topography lacks rivers but is riddled with complex cave systems and underground aquifers (Bauer-Gottwein *et al.,* 2011). Except at the deepest cave levels, life there becomes impossible when seasonal water sources created by rainfall dry up (Dunning, Beach, and Luzzadder-Beach, 2012).

The EIR forms a geographic barrier limiting communication between east and west, yet it is clear Preclassic inhabitants found ways to circumvent it. First, they navigated around it on the river systems of the southern lowlands. Some of the earliest pottery producers lived along the banks of the Usumacinta, Belize, Holmul, Hondo, and New rivers. Second, bajos drained by seasonal rivers provided some east-west pathways across the southern and central EIR as well as providing important soil resources for early horticulturalists. Finally, Preclassic inhabitants of the EIR built roads (*sacbeob* in Yucatec) to help navigate the hills and bajos within it (Chiriboga, 2020; Hansen *et al.,* 2018), creating access between some settlements that lacked river transport (e.g. Graham, 1967; Schreiner *et al.,* 2015; Suasnávar, 1994).

Human groups traversed much of the Maya lowlands during the Paleolithic and Archaic periods (Lohse, 2010; Prufer *et al.,* 2017), yet it is unclear how preceramic inhabitants interacted within the EIR. Two recent radiocarbon dates from Yaxnohcah document burning events across the site centuries before the first potters at 1430-1280 cal BC (3100 +/- 30 BP, Beta-414238, ICA 17C/1221). Similar early dates have been reported by Richard Hansen from El Mirador (Hansen, 2005: 57). Though research on this period is scant in the EIR, it seems plausible that semi-mobile populations could have practiced horticulture in the context of a seasonal round on the fringes of bajos by this time; they are in evidence in riparian areas of northern Belize at least a millennium earlier (Hammond, Cartwright Gerhardt, and Donaghey, 1991: 57; Lohse, 2010). At present, however, there is no definitive evidence for preceramic settlement in the heart of the EIR.

The EIR can be subdivided into three culturally distinct sub-regions from north to south: the Puuc-Chenes region, the extended Río Bec zone (RBZ), and the Central Karstic Uplands (CKU). This article specifically focuses on recent early Middle Preclassic research in the two southern regions (Figure 1). The division between the RBZ and the CKU is based on geographic and cultural parameters that link sites within each sub-region (Figure 1). As detailed below, the RBZ aligns culturally with communities to the north, however, the CKU aligns with communities to the west (Middle Usumacinta) and south (central Peten).

Linked to the Gulf of Mexico by the Rio Champoton drainage in the northwest, the extended RBZ is characterized by broad conical hills and linear ridges interspersed with small basins. Much of the upland terrain is comprised of relatively deep, fertile soils; consequently, large sections of the RBZ consist of extensively modified rural landscapes with high population densities (cf. Hutson *et al.,* 2021). Well known sites in this sub-region include Rio Bec and Becan. Recently identified sites such as Chactun and Tamchen lie in a northern extension that may have cultural characteristics that distinguish them from the traditionally defined Río Bec core zone (Šprajc, 2015, 2021b; Šprajc *et al.,* 2021, 2022).

The CKU was dominated by Calakmul and El Mirador. This region is characterized by the highest elevations in the Yucatan peninsula, delimited by a series of escarpments on its eastern boundary that rise to more than 300 m. West of

this hilly wall, a province of small basins and ridges steps down to the coast, linked to the Gulf of Mexico by the Rio Candelaria and the Rio San Pedro Martir basins, and to Chetumal Bay by the Rio Hondo drainage. Sites in the CKU share a material culture extending back to the pre-Mamom period (Reese-Taylor, 2017, Reese-Taylor *et al.,* 2022; Walker 2023). Mexican sites delimit the CKU to the north at Oxpemul and El Zacatal, and to the east at El Palmar. Guatemalan sites mark the southern boundary at El Pesquero and the western perimeter at El Achiotal.

Early Middle Preclassic Ceramic Complexes and Spheres

Although ceramic technology appeared across much of Mesoamerica between 2000-1000 BC, it arrived later in the Maya lowlands, ca. 1200/1000-600 BC. The principal lowland Maya ceramic sphere names, originally from Uaxactun (Smith, 1955), now refer to much of the southern Maya lowlands (Table 1), beginning with Mamom sphere (600-300 BC). Subsequent research identified earlier, more diverse material dating to 1200/1000-600 BC, which does not fit within a single ceramic sphere and is collectively referred to as "pre-Mamom."

Five principal pre-Mamom ceramic spheres encircle the EIR, each named for the ceramic complex of the site at which it was first identified (Walker, 2023; Figure 2; Tables 1, 2). To the east, the rivers of northern Belize had been settled for many generations by preceramic horticulturalists before the first potters began their work (Lohse, 2010). Swasey sphere ceramics were defined there by Duncan Pring (1977) and Laura Kosakowsky (1987) in research at Cuello. Swasey sphere materials have been identified at over a dozen sites in the region, but distribution is generally restricted to sites on the river systems that debouch into Chetumal Bay. Similarly, the Cunil ceramic sphere is restricted to the upper Belize River and its tributaries. Cunil complex was first defined at Cahal Pech (Awe, 1992) and has since been identified at several sites. Characterized by ash-tempered pastes, Cunil pottery was produced locally, but some vessels, particularly dishes with incised decoration on wide horizontal rims, were traded into parts of Peten. As in northern Belize, evidence is accruing of continuity between the preceramic and ceramic populations in the Belize River Valley (Awe, 1992: 40).

Near the southern boundary of the EIR, Eb complex was first defined by Patrick Culbert at Tikal (Culbert, 1977; Culbert and Kosakowsky, 2019). Subsequent work by the Proyecto Nacional Tikal (Laporte and Fialko, 1993, 1995) produced significant deposits of Eb material. Researchers in central and southern Peten identified numerous sites affiliated with Eb sphere, yet a detailed chronology is not yet clearly delimited. This incomplete picture probably reflects the actual complexity of the pre-Mamom ceramic economy in the region.

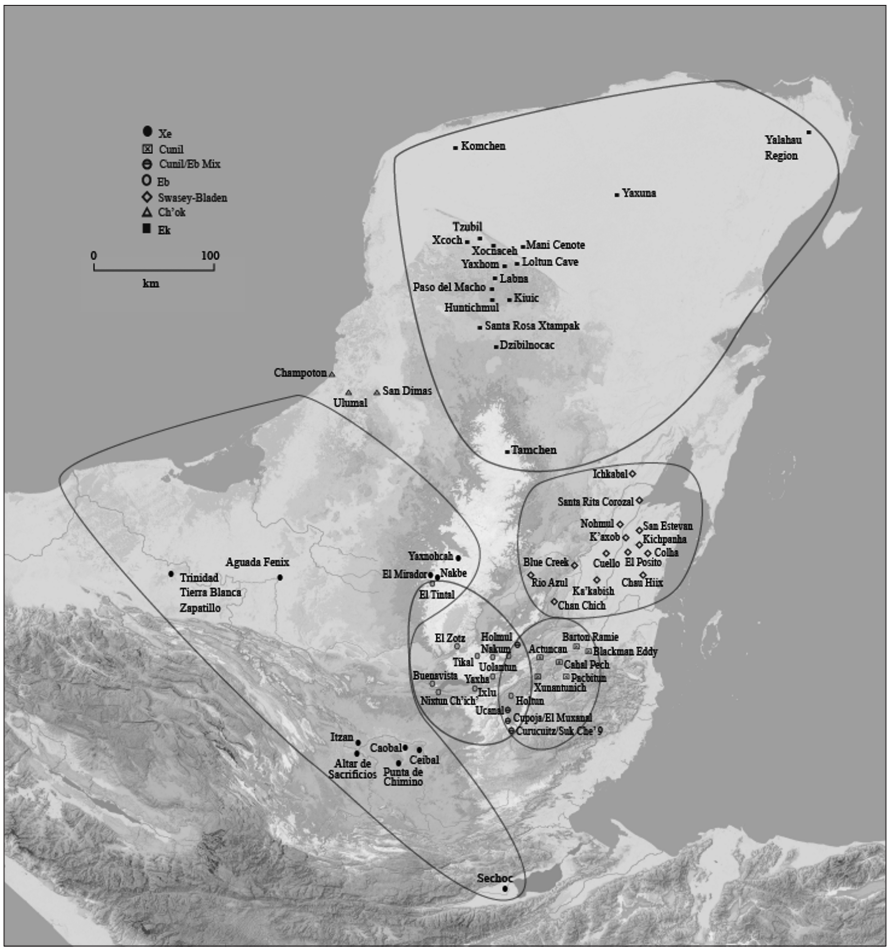

Figure 2. Map of the Maya lowlands highlighting early Middle Preclassic ceramic spheres.

South of the EIR, Xe ceramic sphere was originally defined by Richard Adams at Altar de Sacrificios (Adams, 1971). Later work upstream on the Rio Pasion at Ceibal (Seibal; Sabloff, 1975) produced earlier Real Xe material, which Takeshi Inomata dated with great precision (Inomata, 2023; Inomata *et al.,* 2013). Most recently, Inomata identified Xe-like material at Aguada Fenix on the Middle Usumacinta drainage (Inomata *et al.,* 2020). This massive 1.4 km long platform, serendipitously discovered in the corner of a lidar survey map, produced consistent pottery dates back to 1200 BC. In addition to pushing back the beginning date for Xe sphere, it is now clear Xe sphere spanned much of the Usumacinta drainage. The discovery of Xe material in the central EIR at Yaxnohcah makes more sense in light of the Aguada Fenix discovery.

The fifth pre-Mamom ceramic sphere, Ek complex, was defined by Will Andrews at Komchen in northern Yucatan (Andrews, 1988), and more recently placed within the pre-Mamom period (Andrews, Bey, and Gunn, 2018). Within the last decade, Ek sphere and Ek-related material has been reported across the northern plains, including at Yaxuna (Stanton *et al.,* 2023), all producing early Middle Preclassic radiocarbon dates. The densest cluster of settlements identified so far is in the Puuc Hills, including the large Preclassic sites of Xcoch, Xocnaceh, and Yaxhom (Brown and Bey, 2018). Ek sphere pottery recently recovered from Tamchen extends its southern range.

Although very little pre-Mamom pottery has been identified in any part of Quintana Roo, Ek sphere shares specific modes with Swasey pottery, such as pattern-burnishing and a monopod bottle form, suggesting a wider ancient tradition was established along coastal Quintana Roo, influencing ceramic production as far south as northern Belize. Sandra Balanzario (personal communication, 2019), for example, reports that early Middle Preclassic pottery is present at Ichkabal, in southeastern Quintana Roo, but the material has not been analyzed to type level. If this connection is correctly extrapolated, Ichkabal may fall within the Swasey ceramic sphere, as suggested on the map (Figure 2).

Just west of the northern EIR sub-region, a recent survey along the Rio Champoton basin by Jerald Ek revealed early Middle Preclassic pottery from which he defined Ch'ok complex (Ek, 2015). This material does not fit precisely within the five major spheres so far described. Based on his analysis, however, Ch'ok complex appears to be more closely related to contemporary complexes to the south, thus marking the Río Champoton drainage as a southern limit to Ek sphere influence along the Gulf coast.

Early Middle Preclassic Sites Recently Reported in the Heart of the EIR Río Bec Zone

The RBZ includes several well-known sites, such as Becan and Rio Bec (Figure 1). Based on present evidence, none of these sites dates earlier than Mamom sphere (Ball, 1977, 2014; Taladoire *et al.,* 2013; Webster and Ball, 2021). North of Becan, however, lies the northern extension of the Calakmul Biosphere Reserve. Recent explorations led by Ivan Šprajc in this portion of the reserve identified several new sites and relocated the site of Lagunita (Ball, 1977: 124; Šprajc, 2015, 2021b; Šprajc *et al.,* 2022). Two of the most important new sites identified are Chactun, whose Late-to-Terminal Classic florescence may have been related to the decline of Calakmul, and Tamchen, a site with a significant Preclassic component.

Tamchen is a small but important center with substantial Preclassic and Classic architecture. Its name, "deep well," comes from an unusual cluster of over 30 wells and *chultun* features situated along a north-south line east of the main plaza. Šprajc and colleagues (2021) suggest they may have been constructed ori-

ginally as a method to access ground water in a portion of the site where it ran underground very close to the surface. The site core is comprised of several plazas, one containing what originally may have been an E Group, anchoring three conjoined plazas (Šprajc, 2021b). Excavations in 2018 revealed pre-Mamom pottery at the bottom of test pit L28-2, which was excavated on the central axis in the plaza fronting the eastern building of the group (Structure 3). This excavation revealed a continuous occupation sequence to bedrock, including pre-Mamom pottery in primary context at the lowest level (Šprajc *et al.,* 2022).

The second deposit of pre-Mamom material was encountered three km south of central Tamchen in a test into patio group L31-c (Šprajc *et al.,* 2022), which was situated on a hill within a terraced suburban setting. The test pit (L31-1) was placed in an analogous position to L28-2, in front of the east building of the closed quadrangle. In this case, pre-Mamom material was found mixed with later Mamom and Chicanel pottery, in association with a Late Preclassic offering (Dzul, 2020: 157). The very bottom lot of the excavation, however, was virtually all pre-Mamom.

Ceramic analysis by Sara Dzul (2020) revealed that the Tamchen pre-Mamom complex is related to the Ek sphere of northern Yucatan (Table 2). Principal types include Kin Orange-red, Xbox Orange-on-cream, and a series of undesignated burnished types distinguished by their unslipped surface colors, including gray, pink, and buff-brown. The gray burnished type may be analogous to Komchen's Almeja group (Andrews 1988; Andrews, Bey and Gunn, 2018). Incised design, particularly patterned geometric incision (crosshatching), was a common surface treatment. The Tamchen pre-Mamom material seems to be closely related to the Laapal complex recently reported from Yaxuna (Stanton *et al.,* 2023), including the same slipped and burnished types. As no prior pre-Mamom material has been identified anywhere near the RBZ, Tamchen is an important first link between the central EIR and north central Yucatan at such an early date.

Central Karstic Uplands

During the Late Preclassic period, the site of El Mirador dominated the CKU. El Mirador entrepreneurs invested extensively in massive public work projects (Hansen *et al.,* 2018, 2022) including building *sacbeob* connecting it to nearby communities. To the east of this network of sites is the large site of Naachtun. Founded in the Late Preclassic period (Walker, 2013), Naachtun's rise in the Terminal Preclassic period corresponded to the collapse of El Mirador itself, and significant population movement may have been involved in its initial settlement. At about the same time, new communities sprang up or expanded at several locations to the northeast, including Balakbal and Champerico, that may have benefitted from population displacements associated with El Mirador's collapse. Other than Šprajc's (2008) survey, none of these sites have been tested archaeologically, so it is not clear if any of them had Middle Preclassic communities.

		Slipped Groups							Unslipped Groups			Principal Characteristics of Materials		
Complex	Site	Red	White	Cream-Buff	Black	Brown	Orange	Bichrome	Unslipped	Striated	Burnished	Paste Characteristics	Slip Characteristics	Original Source
Ek	Komchen	Kin Orange- red							Achiotes	Chancenote	Almeja	oxidized fine gray to tan pastes in burnished groups; coarser Achiotes paste	thin red slip applied over burnished surface	Andrews, 1988
Ch'ok	Champoton	Yax	Chanpet				Cansayab	Sak Chak Red-on-white, Sak Ek' Black-on-white	Xkeulil	Chanpeten		variable, some with reduced cores	thin, matte white slip predomina-tes; orange and red less common	Ek, 2015
Xe	Altar de Sacrificios	Abelino	Huetche		Crisanto			Toribio Red-on-cream	Achiotes			reduced black, poorly sorted paste cores in slipped groups; coarser Achiotes paste	matte white slips predominate in the south; matte red slips predominate at Yaxnohcah; black slip less frequent	Adams, 1971
Eb	Tikal	Unnamed (red)	Bil	Baatz (tan)	Unnamed (black)	Boolay	Ainil	Haleb (red-on-cream)	Canhel	Cabcoh	Calam (buff self-slip)	variable, often fine-inclusions paste; mostly carbonate; some yellow pastes; minority with dark cores	thin monochrome slips, some flaky	Culbert and Kosakowsky, 2019
Cunil	Cahal Pech	Uck		Cocoyol	Chi			Mo Mottled	Sikiya			distinctive ash temper predominates	dull red slip dominates, then cream; black slip is rare	Awe, 1992
Swasey	Cuello	Consejo		Tiger	Machaca		Chicago	Pettiville Red-and-cream	Copetilla		Patchchacan (type)	reduced black fine paste cores in slipped groups; oxidized variable paste cores in unslipped group	slightly glossy red slip over thin white base slip predominates; thin orange slips are distinctive; cream and black slips less frequent	Pring, 1977; Kosakowsky, 1987

Table 2. Principal pre-Mamom ceramic groups from selected spheres.

Because of the massive Late Preclassic overburden at El Mirador, little Middle Preclassic material was encountered in excavations there, except at the Sacalero and Cascabel groups (Hansen *et al.,* 2018: 155). Hansen and colleagues also reported Middle Preclassic material at several subordinate sites, including Nakbe, Wakna, La Florida, and Xulnal, however, most of this material appears to date to the late Middle Preclassic Mamom era. Ceramicist Donald Forsyth originally described the Ox complex at Nakbe as a single complex spanning the entire Middle Preclassic period, 1000-300 BC (Forsyth, 1993; Table 1). Later, Ox complex was subdivided into three facets (Hansen, 2005). Early Ox (1000-800 BC) is more or less equivalent with early facet pre-Mamom elsewhere, and middle Ox (800-600 BC) corresponds to late facet pre-Mamom; late Ox is fully within Mamom sphere. Forsyth's (1993) publication dealt primarily with the late Ox pottery. The pre-Mamom component was small by comparison, and has yet to be formally described, although several recent articles mention it briefly (Hansen, 2005: 57; Hansen, 2018: 343; Hansen *et al.,* 2018: 155-156).

The pre-Mamom material found in primary context at Nakbe stems from excavations in the eastern E Group, situated at the end of the Kan causeway (Hansen 2018: 344-345, Fig. 8.4). Ox material was collected from all the buildings excavated on this platform (Structures 47, 48, 49, 51, 53). The best early and middle Ox contexts, however, came from excavations on the west side of Structure 51, the eastern building of the E Group. These excavations (51C, 51G-I, 51K-L) revealed a sequence of events down to early Ox contexts comprised of packed earthen floors with patterns of postholes carved into bedrock. Above these, middle Ox materials were associated with buildings that had elongated low walls with roughly hewn stones and thin, poorly-made plaster flooring. Daub found in these contexts implies perishable superstructures had been built above the wall stubs (Hansen *et al.,* 2018: 151-152).

Although early and middle Ox pottery has not been described systematically, the vessel forms and surface treatments illustrated by Hansen (2005: 59-60, Figs. 5.5, 5.6; Hansen *et al.,* 2018: 157, Fig. 7.4) are consistent with pre-Mamom pottery technology elsewhere. Forms include narrow-necked jars, tecomates with incision below the rim, and low, flaring sided bowls. Preslip and postslip incised design and zoned fingernail impression are common surface treatments. Hansen reports red rim bands on the unslipped exteriors of some forms, particularly tecomates. Although Hansen does not provide type names, he suggests (Hansen *et al.,* 2018: 155) that the material is more similar to Xe sphere than it is to pre-Mamom spheres in Belize (Swasey or Cunil) or Yucatan (Ek). Based on this general assessment, Nakbe and El Mirador are designated as tentative members of Xe sphere on the Maya lowlands map presented here (Figure 2). This sphere association is not surprising in light of the Xe sphere affiliation of nearby Yaxnohcah and the newly discovered site of Aguada Fenix to the west.

El Tintal is located southwest of Nakbe, at the terminus of the 23 km long Graham *sacbe* originating at El Mirador. First mapped by Hansen's Mirador Basin

Project (Mejía *et al.,* 2005), El Tintal's unusual settlement pattern consists of an extensive Late Preclassic community, situated on the fringes of the large Chacamat Lagoon. Additionally, the site epicenter east of the lagoon is ringed by a ditch of similar date. Since 2014, this interesting site has been investigated by the Proyecto Arqueológico El Tintal (PAET). After six excavation seasons, detailed maps have been produced based on new lidar (Acuña and Matute, 2020: Appendix; Chiriboga, 2020) that highlight the extent of settlement in the region.

Middle Preclassic material was reported in limited quantities at El Tintal by prior researchers, particularly at Plaza A, located west of the principal triadic group, as well as in the ballcourt just north of it (Hernández *et al.,* 2016: 342-343). PAET excavators encountered a pure Middle Preclassic context in Plaza A, west of the principal triadic group. Test pit 500A-39 was a 1.5 x 1 m unit placed in the southeast corner of Plaza A in 2018 (Pérez, 2019: 68-70). The test was intended to explore the relationship between the floors of Plaza A and the construction sequence of the adjacent basal platform of the triadic group. The test pit reached 1.5 m and encountered four stratigraphic levels. The lowest of these, Level 4, produced 26 sherds (Pérez, 2019: 76) that dated exclusively to the late Middle Preclassic period.

Recent analysis by Silvia Alvarado Najarro identified another Middle Preclassic context that pertains to the earliest construction phase of platform 13N-P1, an acropolis situated just north of the Perimetric Ditch. Unit 500B-3, a 2017 test into the lower patio of 13N-P1 (Acuña, 2017: 134-139), revealed a sequence of sealed floors from the Late Classic back to the Middle Preclassic. Ceramics recently analyzed from levels 6-8 revealed a pure Middle Preclassic context, sealed by a contemporary thick stucco floor.

In addition to these two sealed Middle Preclassic contexts, a small quantity of Middle Preclassic pottery has been recovered in mixed contexts at several locations in the primary settlement east and west of Chacamat Lagoon. In these contexts, Middle Preclassic material was mixed with later pottery, mostly from the Late Preclassic period. In addition, radiocarbon samples collected in these lots confirm the Late Preclassic date of deposition. Acuña suggests that the relatively shallow stratigraphy found in most excavation units at El Tintal accounts for some of the significant mixing. In any case, the Middle Preclassic community at El Tintal must have been much smaller than the major Late Preclassic settlement.

El Tintal's ceramic sequence begins with the Middle Preclassic Bayo's complex (Acuña and Alvarado, 2019; Table 1). All Bayo's types reported in the 2014-2017 excavation seasons correspond to the Mamom sphere. Since publication, the 2018-2019 ceramic lots have been analyzed, and some earlier excavations were reviewed. As a result, new types were identified. Several deposits across the site produced late facet Eb sphere types, including Ainil Orange, Boolay Brown, and Savana Orange.

Although preliminary, this suggests early interaction between El Tintal and sites south of the CKU, such as El Zotz, which sits on the southern perimeter of

the karst plateau. Ainil Orange and Boolay Brown were originally defined in Eb complex at Tikal (Culbert and Kosakowsky, 2019) and have been identified widely across central Peten at Eb sphere sites (Figure 2). The presence of Eb complex types mixed with waxy wares in an early facet Bayo's context at El Tintal signals a likely late Eb sphere date of 800-600 BC. Savana Orange was also identified in the most recent excavations and represents another significant tie to the south and east. Recent research summarized by Michael Callaghan (2023) documented that this ash tempered ware was produced at sites in the Belize River Valley and distributed into eastern Peten, but only rarely moved farther west or north. Savana Orange was in production in the Belize River Valley by 700 BC, if not earlier (Callaghan, 2023). Thus, this very preliminary evidence suggests that El Tintal may have been in operation as a significant trading community by 700 BC, near the end of the pre-Mamom era.

Situated on the northern flank of the Bajo Laberinto, Calakmul served as the Classic period anchor for the Central Karstic Uplands; however, no pre-Mamom component has been identified there. When Walker visited the INAH Ceramoteca in Merida in 2014, and asked for the pre-Mamom collection from the Calakmul region, she was shown a tiny box that held perhaps a dozen smallish sherds. That said, the extensive Bajo Laberinto is precisely the kind of environment that probably attracted early communities somewhat reliant on horticulture. Thus, it was not much of a surprise when pre-Mamom pottery was discovered at Yaxnohcah in 2014 in the plaza of the Brisa E Group.

The large urban center of Yaxnohcah sits at the southeastern margin of the Bajo Laberinto, in the heart of the EIR. Yaxnohcah was reported as a major center in 2004 by Ivan Šprajc (2008: 66-77) during his general survey of southeastern Campeche. Subsequently, Kathryn Reese-Taylor and Armando Anaya Hernández began work there in 2011. Since then, the Proyecto Arqueológico Yaxnohcah (PAY) has completed nine seasons of excavation. PAY researchers are investigating issues related to the Preclassic period, in particular, settling on the landscape, initiating large scale farming, and developing the water management features to support an urban population (Dunning *et al.,* 2022; Reese-Taylor *et al.,* 2022). Yaxnohcah means "la primera ciudad" in Yucatec and was originally named by Šprajc (2008: 66) as the first large site they encountered in 2004. Somewhat ironically, it now reflects the site's predominant Preclassic architecture, documented at up to 20 civic complexes located in an urban core that spans at least 40 km^2 (Figure 3). Yaxnohcah's population exploded during the Late Preclassic (400 BC-AD 200; Table 1), when it was probably self-governing (Reese-Taylor, 2017). Although substantial Classic occupation ensued, it took on the character of a Calakmul suburb by the Middle Classic, coeval with the rise of the Kaanul dynasty seated there.

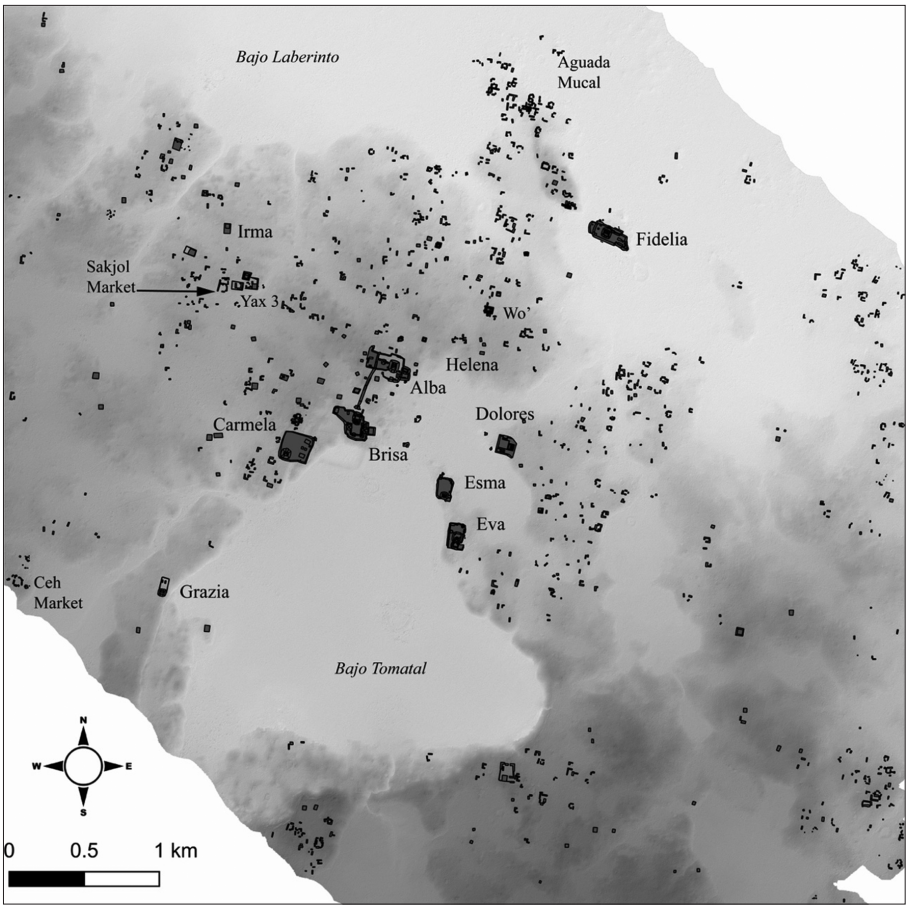

Figure 3. Map of Yaxnohcah.

Early Middle Preclassic settlement was substantial at Yaxnohcah, consisting of occupation along the fringes of two major bajos, the Tomatal to the south, and the Laberinto to the north, separating Yaxnohcah from Calakmul (Figure 3). Unlike some sites where pre-Mamom materials are found deeply buried in only a few contexts, early Middle Preclassic Macal materials have been found throughout the settlement, often within a meter of the surface. Lidar mapping facilitated the discovery of myriad low mounds and water features, which were essentially invisible by ground survey, and some of these features have produced early Middle Preclassic material (Reese-Taylor *et al.,* 2016, 2022).

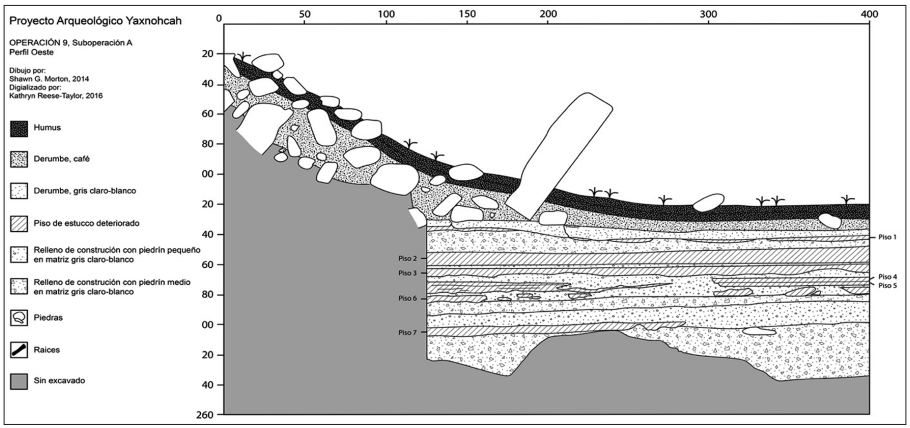

Figure 4. Brisa Plaza OP 9 profile. Illustrated Shawn Morton, digitized by Kathryn Reese-Taylor.

Although a few pre-Mamom sherds surfaced in prior years, evidence for a discrete Macal component was discovered in 2014 at the Brisa plaza, in front of the western building of the E Group (Morton, 2016). The test trench revealed a series of seven plaza floors, the lowest of which sealed unmixed early Middle Preclassic material (Figure 4). Macal complex was defined as a member of the Xe sphere based on this excavation (Walker, 2016). Of 1104 sherds collected, 516 were assigned to Macal complex. Subsequently, the lidar map revealed Helena platform, where a second substantial unmixed Macal deposit was located in a plaza near the western mound of a later ballcourt. Macal material encountered about a meter below ground surface was associated with the lowest floors and bedrock modifications, including a circular capstone-like feature which proved to be sitting atop bedrock (Flores, 2016: 74, Fig. 7.9). This deposit alone produced over 1500 Macal complex sherds.

Macal complex is fully within the Xe ceramic sphere (Table 2), although there are some differences between Macal Xe and complexes in the Usumacinta basin (Walker, 2016). The major Xe monochrome slipped groups are represented, including Abelino (red), Huetche (white), and Crisanto (black; Figure 5). In general, slips are matte to slightly lustrous, and sherd cores reveal the same poorly sorted pastes with predominantly reduced black cores. A distinctive character of the Abelino group is that wide mouth jars tend to have a thin matte red wash applied to a poorly smoothed paste surface, while bowl and dish forms tend to have a thin white underslip beneath the red slip. The jars, then, are closer to the original Abelino definition, while the bowls share a double slipping mode noted on Consejo (red) group vessels of the Swasey sphere. The Macal slips, however, are matte rather than glossy, suggesting a closer relationship to Xe sphere. Macal complex also includes bichrome vessels, specifically, Toribio Red-on-cream (Figure 5b). These bowls have a cream underslip and red overslip on a portion of the vessel. Double-slipped Abelino sherds are

indistinguishable from the red slipped portions of Toribio Red-on-cream sherds, a nuance not easily rendered within the type: variety/mode classification system.

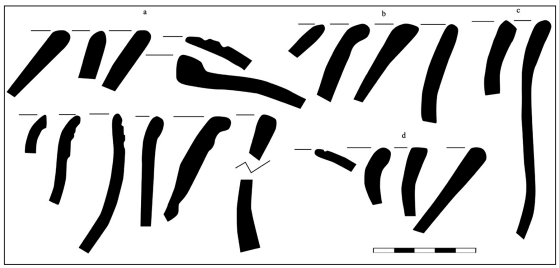

Figure 5. Macal complex ceramic profiles: (a) Abelino group; (b) Toribio group; (c) Huetche group; (d) Crisanto group. Illustrated and digitized by Debra S. Walker and Kathryn Reese-Taylor.

Dating Macal complex is somewhat of a puzzle at present. Based on stratigraphic relationships, Macal complex ceramics can be divided into two facets, but there are no radiocarbon dates for the early facet. By cross-correlation with other sites, early facet Macal can be interpolated to approximately 1000-850 BC. The early facet Macal sample includes postslip incision, as seen on a Comistun Incised (Huetche group) rim segment excavated in 2019 (Figure 6a). In addition, no utilitarian material, either unslipped or striated, has been found in early facet Macal deposits, although an Abelino Red deep jar form exists with light preslip brushing on the exteriors. With only serving and storage vessels present, it seems logical that some food processing and cooking traditions were maintained from the preceramic period. Alternatively, it is possible that excavations to date overlooked contexts containing residential cooking debris.

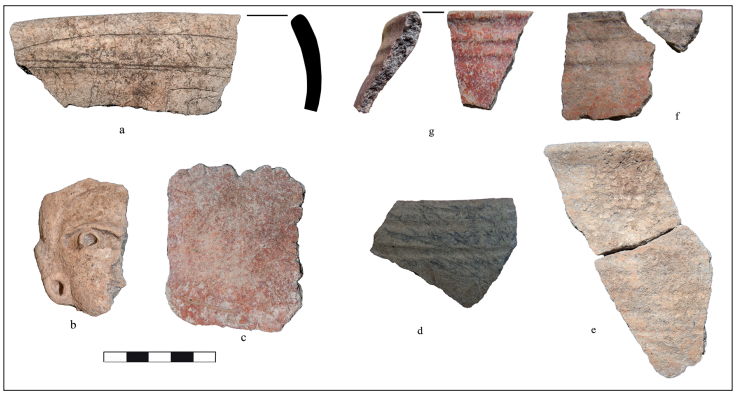

Figure 6. Macal complex ceramics: (a) Comistun Incised from OP 18E-15; (b) Figurine fragment OP 18C-19; (c) Reworked Abelino Red sherd from OP 18C-12 exhibiting possible feather motif; (d) Unnamed black on buff tecomate from OP 18A-11; (e) Edmundo Fluted from OP 9A-31; (f) Setok Fluted from OP 9A-32; (g) Setok Fluted from OP 15A-13.

Three radiocarbon dates from three separate contexts suggest a late facet Macal date range of 850-650 BC. A single radiocarbon sample drawn from one artifact concentration within the Helena platform (OP 18E-15) produced a late facet Macal date of 800-545 cal BC 2540+/-30 BP, 19C/0917; Vázquez *et al.*, 2020). In addition, excavations at two water features returned late facet Macal dates. One of these samples was collected near the Brisa Reservoir, a 28 000 m^2 Middle Preclassic construction discovered on the lidar map just south of the E Group, and dates to 790-540 cal BC (17OS/1235, 2510+/–30 BP; Dunning *et al.,* 2022; Reese-Taylor *et al.,* 2022). Another stems from excavations at Aguada Mucal, a reservoir in a small pocket bajo on the southern edge of the Bajo Laberinto, with a date of 775-475 cal BC (Beta-550213, 2480+/-30 BP).

The late facet Macal sample is more robust, exhibiting characteristics of Ceibal's Real 2/3 facets. Late facet Macal sherds are invariably mixed with Achiotes Unslipped utilitarian jars, early striated jars and tecomates (Sapote Striated: Añejo Variety), as well as early forms of Mamom waxy slipped types such as Juventud Red (Figure 7). Another unique feature of late facet Macal is found in two transitional types. Clear Slip over Matte Red sherds have a solid red paste core and thin slip or wash in the same red (10R 5/6) color. Over this, a thick, clear waxy slip seems to have been added, particularly on sherd exteriors. The waxy slip adheres poorly to the underlying red slip surface and flakes off easily, revealing the matte red slip below. This type probably represents early experimentation with waxy slipping technology before pigment was added to the recipe, presaging the thick red Juventud group slips characteristic of Mamom-era ceramic technology. A similar cream-slipped version was also identified in small numbers. Although the designation is still preliminary, the possible *in situ* development of a waxy slipping tradition that dominated Maya ceramic technology for centuries is clearly significant: Yaxnohcah may have been one of the locations where waxy monochrome slipping technology was first invented.

Although Macal complex exhibits the hallmarks of Xe sphere, Yaxnohcah seems to have been a crossroads in antiquity, as a variety of imported types have been tentatively identified in small quantities. Imports from Ek sphere include Almeja Gray; from Eb sphere Calam Buff and Cob Red-impressed; and from Cunil sphere various thick ash-tempered bowl sherds, similar to Uck Red and Chi Black. As for other categories of material remains, Macal lots have produced obsidian blade segments, but, to date, no cores or chipping debris. Perhaps obsidian exchange in the central EIR was more focused on finished blades than on cores. To date, no conch shell or jade has been tied to Macal deposits.

Yaxnohcah has much to tell us about the development of pottery technology. Besides producing vessels for food and beverage processing, Macal potters produced ceramic figurines typical of the pre-Mamom style, complete with punched eyes, although all examples ($n<10$) are fragmentary (Figure 6b). As at other sites, the pottery fabric and red slip for these figurines was similar to the material used to make pots. Pottery sherds also entered the refuse stream for the first time, and

crafters found new ways to recycle broken pottery. Some sherds, especially vessel bases, were crafted into discs, probably to function as vessel lids. One more esoteric example from a rectangular Abelino Red vessel base fragment was carefully crafted with 13 scallops carved along two edges (Figure 6c). The scalloped edging on this unique piece suggests an avian feather theme, such as the harpy eagle crest described by James Garber and Jaime Awe (2009: 152, 154, Fig. 3).

Figure 7. Initial sort of late facet Macal complex ceramics from OP 51F-16.

When local potters began to establish their craft at Yaxnohcah, ceramic failures were no doubt common. Several failures have been encountered in Macal contexts. At Helena complex, for example, several ($n<10$) poorly fired sherds may stem from initial experimentation with local production. They are unslipped, low-fired, misshapen, and they crumble rather than break. These sherds were found mixed in platform fill above aceramic strata that overlay bedrock. In addition to reflecting initial experimentation with ceramic production, these deposits represent the first use of broken pots as construction fill. This new fill source was comprised of very small pot sherds, crumbs really, embedded in a small pebble

matrix. No similar mound fill has been encountered to date in other excavations at Yaxnohcah.

Discussion

Based on the story now coming into view, the EIR played a pivotal role in the development of the lowland Maya tradition from the very beginning. As a geographic feature, the EIR was both a crossroads and a barrier to ancient commerce. Riverine settlements and river transport had fueled settlement and exchange systems across Mesoamerica during the Early Preclassic period. Because the EIR lacked perennial rivers, however, agrarian settlers invested in water management infrastructure beginning in the Middle Preclassic period, as at Yaxnohcah, in tandem with a greater dependence on maize agriculture. The longevity of many of these cities marks the success of their water management strategies.

With the benefit of new lidar maps and expanded survey, we can now develop a high-resolution view of life in the EIR at 1000 BC. Communities throughout the uplands developed a ceramic economy that was already embedded in regional exchange, so that even the most ancient pottery producers of the EIR were diverse. The extended RBZ interacted with communities to the north, sharing modes with Ek sphere ceramics from their northern trading partners. Stanton (2017: 454-455, Fig. 14.1) has described Middle Preclassic exchange routes between the north coast and southern lowlands, highlighting one route that runs through Yaxuna and follows the spine of the EIR down to Yaxnohcah. Tamchen would certainly have been a stop on that overland route. Based on the distribution of Xe sphere pottery, preceramic communities in the central EIR interacted with potters from the Middle Usumacinta River drainage to the southwest. Evidence for this relationship is the documentation of Xe ceramics at Yaxnohcah, and probably at Nakbe and El Mirador, around 1000 BC. Finally, toward the end of the pre-Mamom period, an explosion of regional exchange in central Peten reached El Tintal. It was at the end of the pre-Mamom period that this region became a literal crossroads for north-south and east-west exchange routes. Yaxnohcah was an important central place at this time, but, just to the south, Nakbe and El Mirador were expanding rapidly on a trajectory toward dominance during the Late Preclassic period. The roots of that rapid growth, and the centrality of the EIR to that trajectory, suggest that upland communities were at the core of defining early lowland Maya complexity during the Middle Preclassic period.

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