Radiocarbon Evidence for Initial Early Formative Period Occupation in Coastal Oaxaca, Mexico

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Seven AMS radiocarbon dates (1950–1525 cal BC) from controlled contexts demonstrate Early Formative period occupation in coastal Oaxaca, Mexico. These dated elements from the site of La Consentida include hearths, occupational surfaces, carbon adhering to pottery from a midden, and human bone collagen processed with XAD purification. They were excavated from primary contexts and do not represent redeposited materials. An eighth sample, dated to the Middle Formative period, is considered postoccupational. The diversity of dated deposits and features, their distribution, and their overlapping calibrated ranges indicate settlement by an initial Early Formative period village.

Keywords: Formative period, Oaxaca, radiocarbon

En este informe se detalla la procedencia de siete fechados radiocarbónicos obtenidos por AMS (1950–1525 cal aC) que muestran una ocupación del período Formativo temprano en la costa de Oaxaca, México. Los elementos fechados del sitio La Consentida incluyen fogones, superficies de ocupación, carbón adherido a la cerámica proveniente de un basurero y colágeno óseo humano procesado con purificación XAD. Estas muestras fueron obtenidas de contextos primarios y no representan materiales redepositados. Una octava muestra, fechada en el período Formativo medio, se considera post-ocupacional. La diversidad de depósitos y elementos fechados, su distribución y sus rangos calibrados superpuestos ponen en evidencia el asentamiento de una aldea del período inicial del Formativo temprano.

Palabras clave: período Formativo, Oaxaca, fechados radiocarbónicos

Decades of research have indicated that, during the transition from the Mesoamerican Archaic (7000–2000 BC) to the Formative period (2000 BC–AD 250), there occurred early stages of the adoption of sedentism, agriculture, and social complexity (e.g., Blake and Clark 1999; Killion 2013; Lohse 2010). Early Formative period sites have been investigated in several regions (Figure 1a), including the Soconusco, the Gulf Coast, the Basin of Mexico, the Tehuacán and Oaxaca Valleys, and the Maya Lowlands (e.g., Arnold 2009; Ebert et al. 2017; Flannery and Marcus 2003; Lesure 2011; MacNeish 1992). Despite significant research, much of the Pacific coast of Mexico remains underrepresented among Early Formative period studies.

In this report, I present radiometric evidence from the site of La Consentida (RV-72) in coastal Oaxaca, Mexico. Seven AMS radiocarbon dates from controlled contexts, in conjunction with human burials, earthen architecture, lithic and ceramic artifacts, and remains of domestic structures (Hepp 2015; Hepp et al. 2017), indicate a village occupation in a region that has produced relatively little Early Formative period evidence (though see Brush 1969; Kennett et al. 2008; Reyes González and Winter 2010; Zárate Morán 1995; Zeitlin 1979).

Background

La Consentida is located 6.5 km from the Pacific coast in the lower Río Verde Valley of Oaxaca.

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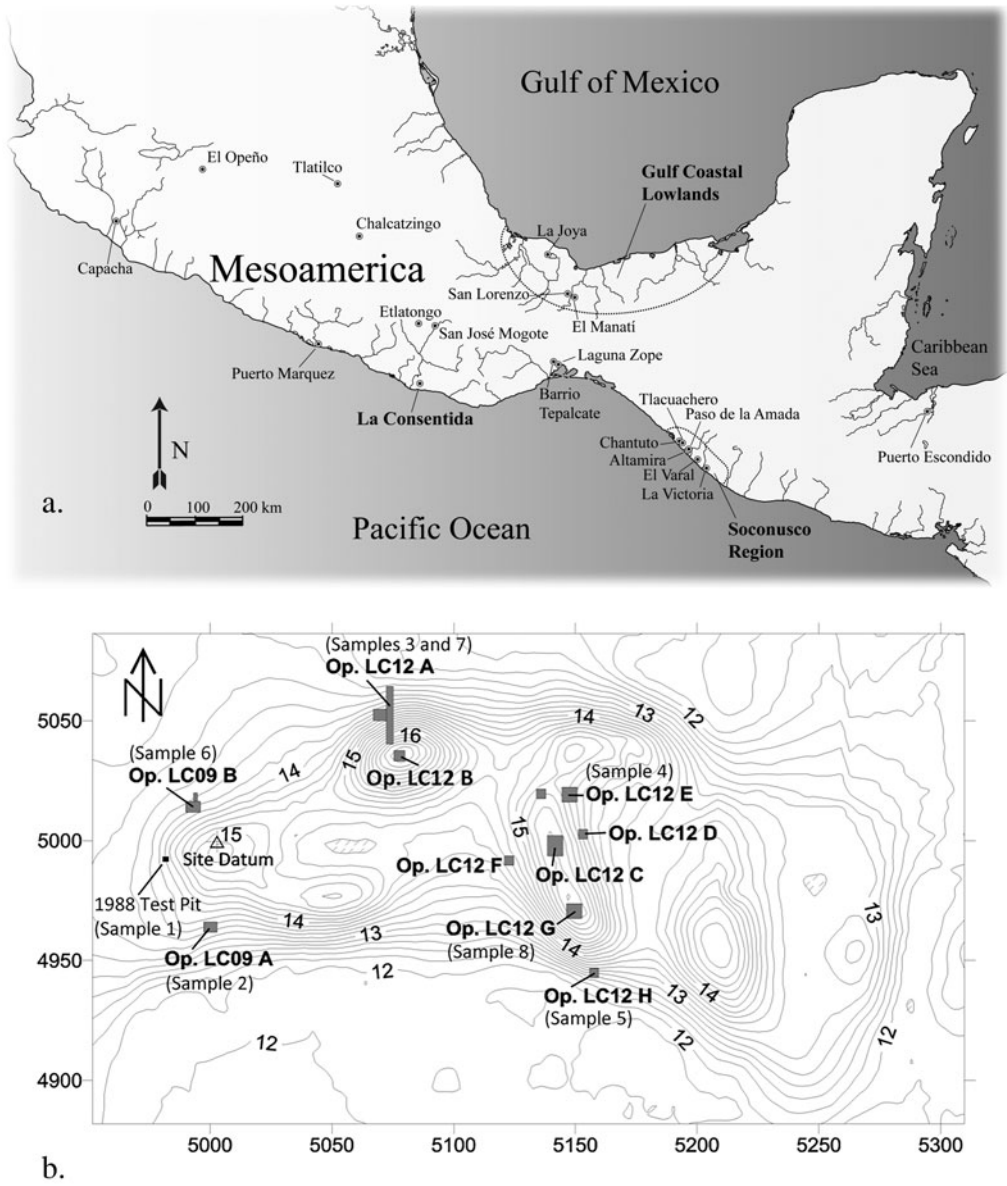

Figure 1. Maps: (a) key Archaic and Early Formative sites; (b) excavation operations at La Consentida. Contour interval is 20 cm. Numbers on contour lines indicate meters above sea level.

Currently a rich agricultural zone, the region experienced significant ecological change during the Holocene (Joyce 2010). During the Early Formative period, La Consentida was likely positioned 4 km from an open bay, which later became estuaries (Goman et al. 2013). Although coring studies indicate maize cultivation and anthropogenic land clearance by the Late Archaic, human occupation was likely sparse in the region until the Middle Formative period (Joyce and Goman 2012). La Consentida was initially reported following regional survey and test excavation in the 1980s (Joyce 1991). The La Consentida Archaeological Project (LCAP) began in 2008 (Hepp 2015). The site covers 4.5 ha and is dominated by Platform 1, an earthen

feature measuring approximately 300 x 100 x 5 m. Excavations at La Consentida represent the only study of primary Early Formative contexts along a 300-mile stretch of the Pacific coast.

LCAP excavations in 2009 and 2012 took place in 10 operations examining domestic areas, earthen architecture, middens, and mortuary contexts (Figure 1b). These studies were designed to investigate transitions in mobility, subsistence, and social organization. Because achieving these aims hinges on a sound chronology, collecting radiocarbon samples from secure contexts has been a primary concern of the LCAP. Dates produced from those samples have been rounded to 5-year increments and calibrated (Reimer et al. 2013; Stuiver and Polach 1977). These dates differ slightly from those presented elsewhere (Hepp 2015:Table 1.1) because of the use of updated calibration conventions.

Results

Collectively, La Consentida's seven Early Formative period AMS radiocarbon dates calibrate to 1950–1525 cal BC (2σ probability; Table 1; Figure 2a). These samples were derived from stratigraphically controlled deposits and do not represent "floating" or redeposited materials. A previously published date of 3480 ± 60 BP (Beta-131037; wood charcoal; $\delta^{13}C = -24.4‰$), or 1950–1640 cal BC, was recovered from a floor or occupation layer in the western portion of Platform 1 in 1988 (Joyce 2005:17). LCAP excavations have recovered all other samples discussed here.

Two radiocarbon samples were collected from hearths sealed between earthen architectural strata in Operations LC09 A and LC09 B. The LC09 A-F4 hearth dates to 3480 ± 40 BP (AA92453; carbon-rich sediment; $\delta^{13}C = -24.0‰$), or 1900–1690 cal BC, and was located between the A-F5 and A-F3-s3 fill layers (Figure 2b). The LC09 B-F15 hearth was in a similar stratigraphic position to LC09 A-F4. It dates to 3360 ± 45 BP (AA92454; carbon-rich sediment; $\delta^{13}C = -25.2‰$), or 1755–1525 cal BC, and was located between B-F16 and B-F14. These dates permit a conservative estimate of the advent of earthen architecture because the hearths intruded into, and thus postdated, the earliest anthropogenic fill. This interpretation is supported by the mixed nature of the fill containing ceramic artifacts, bone, and obsidian, which differentiates it from underlying riverine deposits (Hepp 2015). Because excavations were separated across the site, it is not yet clear if the architecture began as a single platform or as several low mounds that were later incorporated into Platform 1. Ceramic fragments from LC09 A-F4 also support an early date for pottery. These "Tlacuache phase" ceramic artifacts (Hepp 2015) represent the earliest identified component of the regional ceramic chronology.

Another sample dated to 3445 ± 35 BP (AA101267; plant charcoal; $\delta^{13}C = -27.2$), or 1885–1665 cal BC, comes from charcoal found on an occupational surface in Operation LC12 A at the interface between the A-F19 fill and the overlying A-F18 fill (Figure 2c). Refitting ceramic sherds, obsidian, burned daub, and animal bone lying horizontally at this interface suggest materials accumulated during occupation atop A-F19, rather than items mixed into the overlying fill. This date is similar to that of the LC09 A-F4 hearth, excavated more than 100 m away. These dates are indicative of a broad trend in which earthen architecture experienced occupation between construction episodes in about the eighteenth and nineteenth centuries cal BC. Three of the earliest dates were recovered from the western portion of Platform 1 (in the 1988 test pit, Operation LC09 A, and Operation LC12 A), perhaps indicating that the site was occupied there first.

Another sample from Operation LC12 A demonstrates the area's changing use over time. After its initial earthen construction, the community used this area as one of two known mortuary contexts in which, collectively, at least 14 individuals were buried (Hepp et al. 2017). Burial B12-I14 contained the remains of a female aged 45–50 years. Like other burials at La Consentida, enamel and collagen from B12-I14 produced stable isotopic evidence for a mixed diet incorporating maize. The stable nitrogen isotope ($\delta^{15}N$) values (7.0‰ from dentin and 6.6‰ from long bone) do not indicate significant marine resource reliance or a reservoir of "old carbon" affecting the dates (DeNiro and Epstein 1981).

Table 1. AMS Radiocarbon Dates from La Consentida.

Sample	Excavation Area and Unit	Stratum or Feature	Lab Number	Material	Uncalibrated Date	$\delta^{13}C$, ‰	Calibrated Date (2σ)	Context
1	1988 test pit	Capa 5	Beta-131037	Wood carbon	3480 ± 60	−24.4	1950–1640 cal BC	Floor or occupation layer
2	LC09 A, 3B	A-F4	AA92453	Carbon-rich sediment	3480 ± 40	−24.0	1900–1690 cal BC	Hearth between fill layers
3	LC12 A, 0E	A-F19	AA101267	Plant charcoal	3445 ± 35	−27.2	1885–1665 cal BC	Occupation layer
4	LC12 E, 1C	E-F10	AA101269	Carbon-rich sediment	3435 ± 45	−25.5	1885–1635 cal BC	Hearth or burning feature
5	LC12 H, 0A	H-F4-s2	AA104836	Plant charcoal	3420 ± 35	−15.5	1880–1840 cal BC ($p = 0.08$) 1825–1795 cal BC ($p = 0.04$) 1785–1625 cal BC ($p = 0.84$)	Burned food adhering to interior of ceramic jar fragment
6	LC09 B, 1B	B-F15	AA92454	Carbon-rich sediment	3360 ± 45	−25.2	1755–1525 cal BC	Hearth between fill layers
7	LC12 A, -3Q	Burial B12-I14	PRI-5423A/B	Bone collagen	3335 ± 20	Not available	1690–1600 cal BC ($p = 0.76$) 1585–1530 cal BC ($p = 0.20$)	Human bone processed with XAD purification
8	LC12 G, -1E	Structure 2	AA101268	Carbon-rich sediment	2435 ± 35	−21.6	755–680 cal BC ($p = 0.22$) 670–610 cal BC ($p = 0.11$) 595–405 cal BC ($p = 0.63$)	Above domestic structure floor

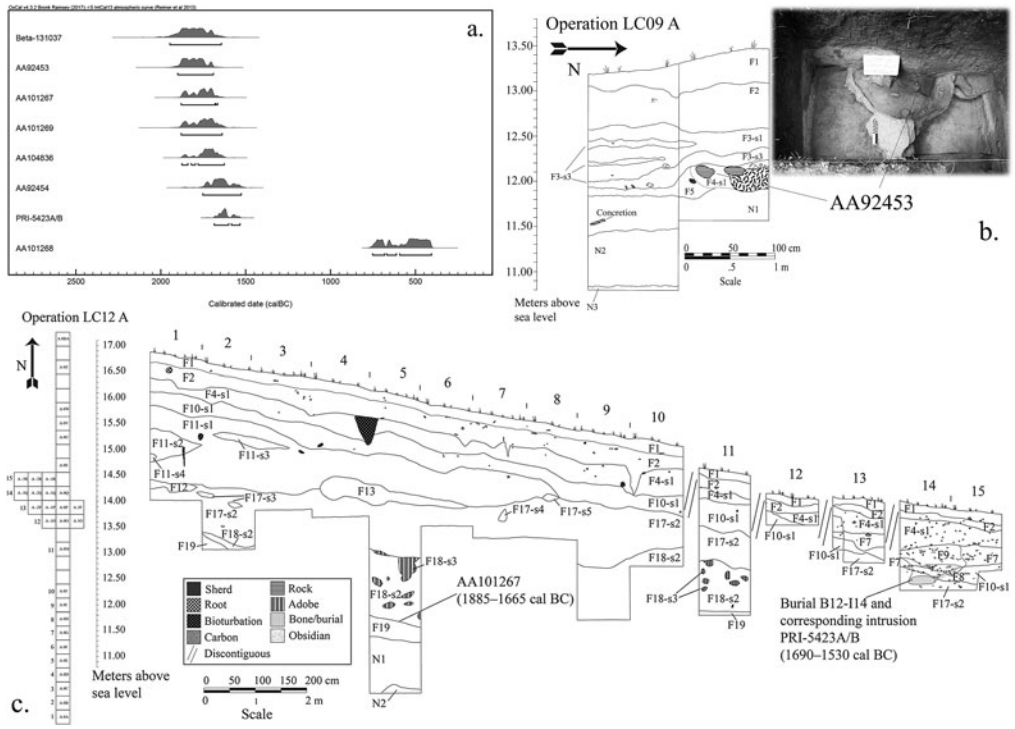

Figure 2. Calibrated dates and dated contexts: (a) AMS radiocarbon dates from La Consentida; (b) profile and plan image of LC09 A-F4 hearth; (c) Operation LC12 A excavation profile showing dated occupational surface and burial B12-I14.

Collagen from B12-I14 has provided the first direct date from human remains at La Consentida. Radiocarbon dating of bone is challenging because such porous materials may absorb carbon from the surrounding matrix. XAD purification removes exogenous carbon to permit the dating of bone collagen itself (Stafford et al. 1991). Two femur samples from B12-I14 were submitted to XAD purification and dated to 3310 ± 25 BP (PRI-5423A [H6]; human bone), or 1660–1510 cal BC, and 3375 ± 30 (PRI-5423B [H6]; human bone), or 1750–1610 cal BC (Cummings 2017). Combining these results with the OxCal v.4.3.2 R_Combine command produces a date of 3335 ± 20 (PRI-5423A/B [H6]; human bone), or 1690–1530 cal BC. Although the lab declined to include $\delta^{13}C$ values, fractionation was completed. Excavation profiles (Figure 2c) demonstrate that AA101267 (Sample 3) and PRI-5423A/B (Sample 7) occurred in stratigraphic sequence. Sample 7 was recovered in a burial pit intrusive to F17-s2, which postdates the F19/F18-s2 interface dated by Sample 3.

Farther to the east, another dated sample comes from a hearth or burning feature (LC12 E-F10) in a midden (E-F9 and E-F11) excavated in Operation LC12 E (Figure 3a). The sample dates to 3435 ± 45 BP (AA101269; carbon-rich sediment; $\delta^{13}C = -25.5‰$), or 1885–1635 cal BC. This date helps contextualize finds from the midden, including a figurine from within the dated feature; pottery; and faunal remains.

Another date of 3420 ± 35 BP (AA104836; carbonized food; $\delta^{13}C = -15.5‰$), or 1880–1625 cal BC, comes from burned food adhering to the interior of a jar fragment from a midden excavated in Operation LC12 H (Figure 3b). This midden was unique in that its pottery consisted almost exclusively (93.1%) of undecorated jars. Based on refitting sherds from up to 60 cm apart in depth, this midden was deposited quickly. Like ceramic artifacts from the LC09

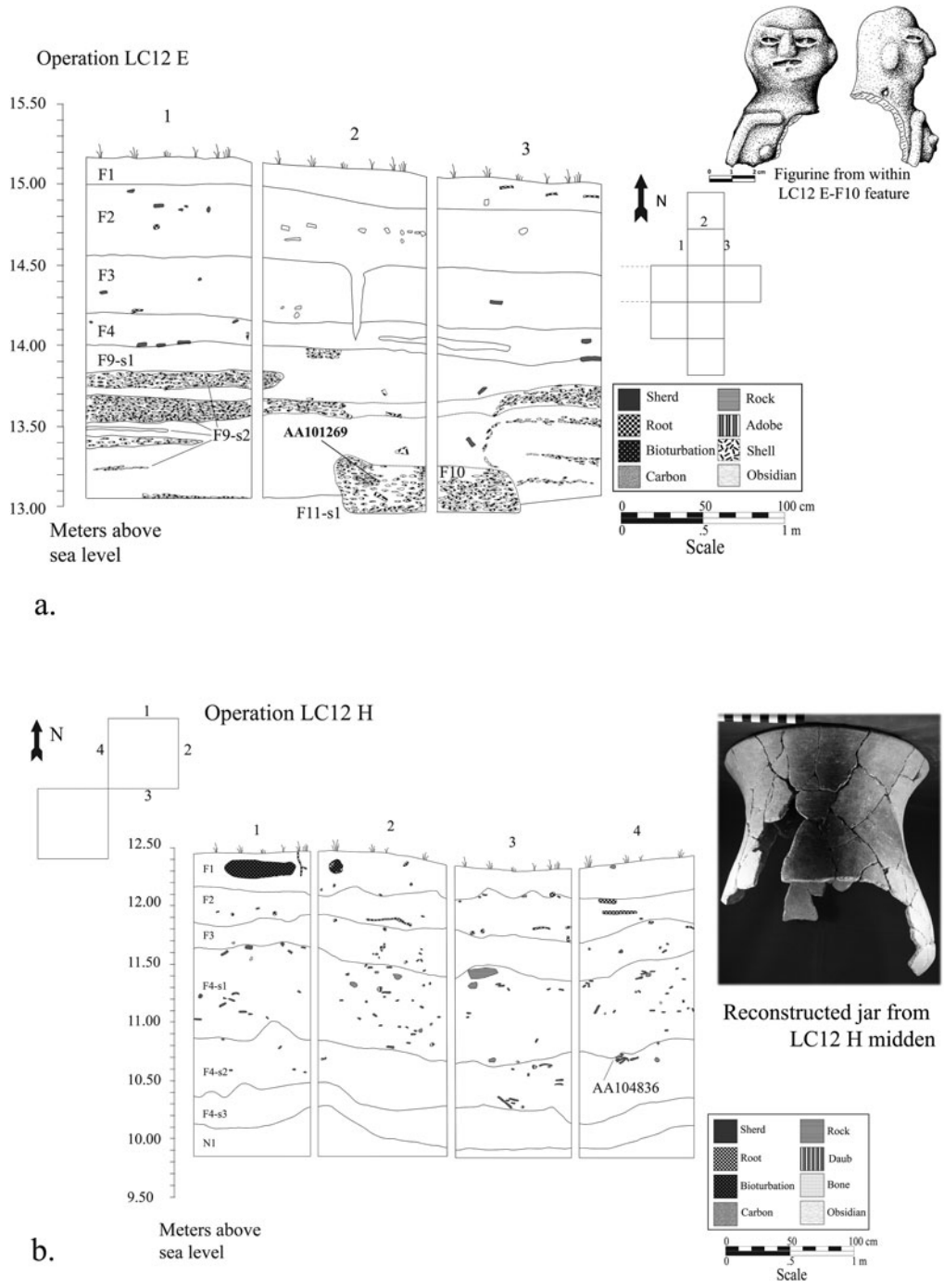

Figure 3. Dated contexts: (a) Operation LC12 E excavation profiles and illustration of figurine from dated feature; (b) Operation LC12 H excavation profiles and photograph of reconstructed ceramic jar from midden.

A-F4 hearth, the LC12 H sample permits a conservative estimate of the date of initial pottery production at the site. This sample also implies that the dates cannot be dismissed based on the "old wood" problem (Schiffer 1986): because these carbonized remains are likely from food,

rather than from old and reused wood, they suggest a specific and datable event.

An eighth sample was excavated from above the floor of Structure 2, a domestic building in Operation LC12 G. This sample returned a Middle Formative date of 2435 ± 35 BP (AA101268; carbon-rich sediment; $\delta^{13}C = -21.6‰$), or 755–405 cal BC. This sample is considered suspect based on its shallow deposition (approximately 35 cm below the modern surface) and possible exposure to postoccupational fires.

Conclusion

Seven radiocarbon samples with overlapping calibrated ranges were collected from controlled contexts at La Consentida. These dates indicate a village occupation at the onset of the Early Formative period. Dated hearths and occupational surfaces permit estimates of the initiation of earthen architecture. Carbon from a jar fragment and pottery from a hearth indicate the early production of ceramic artifacts. Human bone collagen processed with XAD purification represents direct evidence of human occupation. Documentation of these samples aids ongoing interpretations of the settlement practices, material culture, diet, funerary practices, and social organization of an Early Formative period village community on Oaxaca's Pacific coast.

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Data Availability Statement. Supporting data are available in the author's dissertation (Hepp 2015), in publications (e.g., Cummings 2017; Hepp et al. 2017), and in manuscripts in possession of the author. Excavated materials are curated in Cuilapan, Oaxaca.

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