IZAPA AND THE SOCONUSCO REGION, MEXICO, IN THE FIRST MILLENNIUM A.D.

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We present new regional settlement pattern data from the eastern Soconusco region, Chiapas, Mexico, including a detailed reconstruction of the first millennium A.D. occupation of the site of Izapa. Results from an initial campaign of light detection and ranging (lidar) data acquisition and analysis of systematically collected surface remains document the full extent of the Classic-period occupation of Izapa. These lidar and pedestrian survey data also illustrate how people were distributed across the landscape from 100 B.C. to A.D. 1000 (Hato to Remanso phases). Survey results indicate significant population increase during the Terminal Formative (A.D. 100–300) and initial Early Classic (A.D. 300–400) periods, followed by a virtual abandonment of both piedmont and low-hills survey zones from A.D. 400 to A.D. 700. The population increased in both survey zones during the Late and Terminal Classic periods (A.D. 700–1000) coinciding with the presence of a large regional center in the low-hills zone and 46 secondary centers recorded within the 400-km^2 area covered by the lidar survey. These secondary centers consist of numerous small mounds around circular or square plazas. Together, the results of the lidar study and systematic pedestrian survey offer the first glimpse of population dynamics and political organization in the area around Izapa during the first millennium A.D.

En este artículo se presentan nuevos datos acerca del patrón de asentamiento regional del este de la región de Soconusco, Chiapas, México. Se incluye una reconstrucción detallada de la ocupación del sitio Izapa durante el primer milenio d.C. Se documenta la extensión completa de la ocupación del período Clásico de Izapa, sobre la base de restos superficiales de recolecciones sistemáticas y por medio del uso de los resultados de una campaña inicial de adquisición de datos lidar (light detection and ranging). Los datos de esta prospección pedestre y de lidar también permitieron documentar cómo estuvieron distribuidos los poblados en el paisaje durante ocho fases cerámicas (Hato a Remanso), que se extienden desde el 100 a.C. al 1000 d.C. Los resultados del reconocimiento indican un poblamiento significativo durante la fase Itstapa (100–300 d.C.) del Formativo Terminal (también conocido como Protoclásico) y la fase Jarritas (300–400 d.C.) del Clásico Temprano inicial, seguido por un virtual abandono de las zonas de reconocimiento en el piedemonte y las colinas bajas durante la fase tardía del Clásico Temprano y el Clásico Medio (400–700 d.C.). Luego se documenta un aumento significativo de toda la población en ambas zonas de reconocimiento durante los periodos Clásico Tardío y Terminal (700–1000 d.C.), momento en el que se registra un gran centro regional en la zona de las colinas bajas, cerca de la actual Frontera Hidalgo, con 46 centros secundarios identificados dentro de los 400 km^2 de la cobertura del. Estos centros secundarios del Clásico Tardío y Terminal estuvieron formados por numerosos montículos pequeños que definen plazas, ya sea circulares o cuadradas. En conjunto, los resultados del estudio de lidar y del reconocimiento sistemático de la zona representan la primera aproximación registrada sistemáticamente de la organización política y demográfica en el área de alrededor de Izapa durante el primer milenio d.C.

Soconusco is one of the few regions in Mesoamerica where the Classic period is not as well studied as the Formative period. Spanning the modern border of Mexico and Guatemala (Figure 1), and occupying a narrow coastal plain and piedmont below the southern Sierra Madre mountain range, the Soconusco region contained an important trade route (Love 2007). The region is well known for its Archaic and Early Formative period occupation (Clark and Blake 1994; Lesure 2011; Rosenswig 2010; Voorhies 2004) as well as for the important first millennium B.C. centers of La Blanca (Love 2002a) and Izapa (Lowe et al. 1982). The area is also famed for its cacao production during the Postclassic and colonial periods during the second millennium A.D. (Voorhies and Gasco 2004). Nonetheless, surprisingly little is known about

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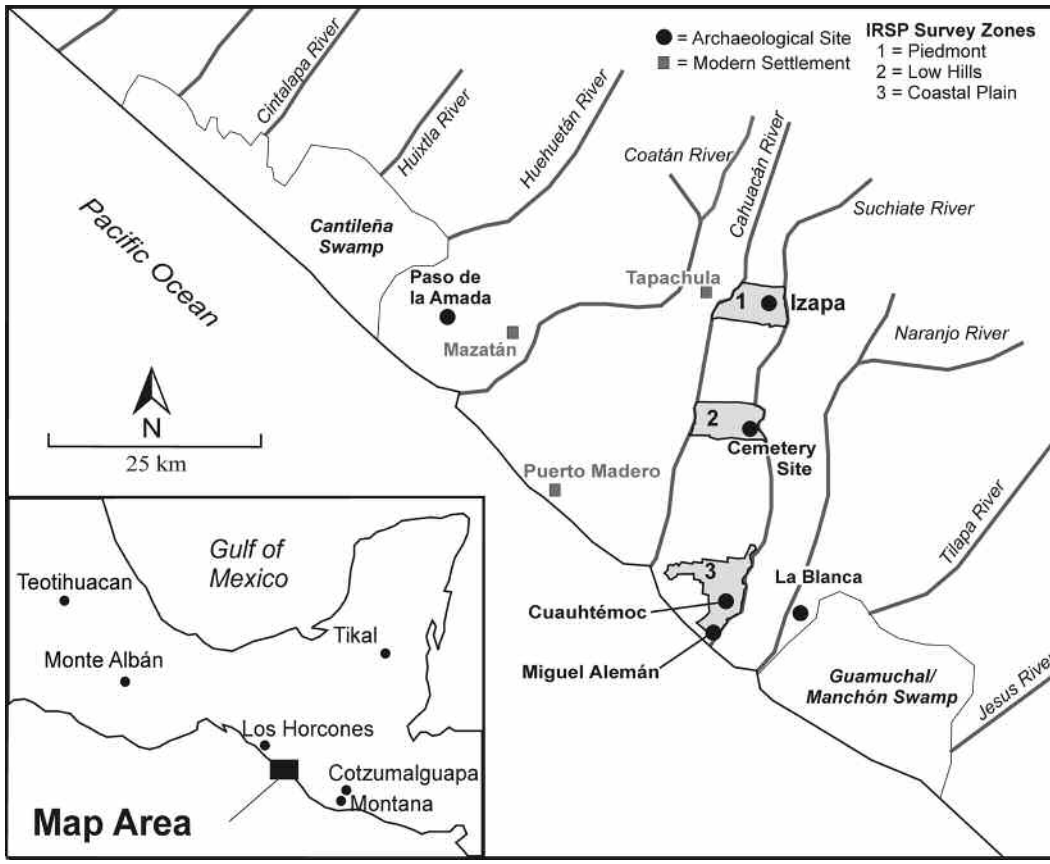

Figure 1. The Soconusco region with sites mentioned in the text and location of IRSP survey zones.

this region during the first millennium A.D. (Figure 2).[1]

Classic-period Soconusco is best known for the production of plumbate pottery. This widely traded ceramic ware is found in elite tombs throughout Mesoamerica (Dutton 1943; Neff and Bishop 1988; Shepard 1948:133) and is often associated with Fine Orange and lower Central American wares (Neff et al. 1999). Shook (1965:190) long ago noted that "the heaviest concentration of sites with this type of pottery type occurs on the Pacific coastal plain and foothills between the drainages of the Rio Tilapia in Guatemala and the Rio Coatan in Chiapas." Neff (2002, 2003) has more recently shown that San Juan and Tohil Plumbate Ware can be chemically sourced to specific river drainages within this part of Chiapas. Nevertheless, we still know virtually nothing about the political organization of the peoples that produced plumbate ceramics, or their first millennium A.D. predecessors.

In this paper, we present new regional settlement pattern data from eastern Soconusco, including a detailed reconstruction of the first millennium A.D. occupation of the site of Izapa. We examine the "Post-Formative" phases defined by Lee (1973, 1978) and the preceding Hato phase, which were associated with the later occupation of Group F at Izapa. Using results from an initial campaign of lidar (light detection and ranging) data acquisition (Rosenswig et al. 2013, 2015), we document the full extent of occupation at Izapa based on our surface survey. Our findings include new architectural features and a reevaluation of the site size on a phase-by-phase basis over the course of the first millennium A.D. We also present tallies of occupied mounds on a phase-by-phase basis from two IRSP (Izapa Regional Settlement Project) survey zones, one on the piedmont around Izapa and the other from the low-hills region (Figure 1). With the addition of a second lidar collection campaign in 2015, close

Period	Years	Phase	Developments at Izapa
Late & Terminal Classic	1000	Remanso	Major Occupation
	900	Peistal	
Early & Middle Classic	700	Metapa	Virtual Abandonment
	600	Loros	
	500	Kato	
	400	Jaritas	Substantial Occupation
Late & Terminal Formative	300	Itstapa	
	100	Hato	Disruption
	BC/AD		
	100	Guillén	Major Occupation
Middle Formative	300	Frontera	
	500	Escalón	

Figure 2. Chronology of the Izapa area.

to 400 km^2 of continuous coverage have now been collected in the region. Ground-truthing of these lidar data confirmed substantial Terminal Formative occupations, small-scale Early and Middle Classic-period occupation and large-scale occupation, with a newly recognized regional capital and 46 lower-order centers, in operation during the Late and Terminal Classic periods. The patterns reported in this paper provide a new understanding of Izapa and the Soconusco. Systematic regional settlement pattern data document changing political organization and changes in population levels in the Soconusco region for the first millennium A.D. This allows for the possibility of comparing the inhabitants of Soconusco with those of neighboring centers such as Cotzumalguapa in Guatemala (Chinchilla 2012, 2015) and more distant areas of Mesoamerica, where Classic-period societies are much better understood. The importance of these settlement data is that they provide the first glimpse of the organization of the peoples who produced plumbate wares.

The Izapa Site

Previous Work

Scholars have been aware of the site we now know as Izapa since the 1930s. Not recognizing the full spatial extent of the site, Culebro (1939:17, 31) presented drawings of two stelae from a site he called "Guillén," as well as a third stela that he attributed to the "Toltec style" from Izapa (Culebro 1939:56). All of these came, in fact, from the same site. In 1941, Izapa was next explored by researchers from the Smithsonian Institute, who recorded 30 stone sculptures in a week of work at the site (Stirling 1941, 1943). Six years later, Drucker (1948:154) excavated 12 trenches and identified plumbate pottery at the site. Drucker recognized that "sherd lots from the northwestern group of mounds seemed different" from the brown-and-black slipped sherds (that we now know date to the Formative period) he encountered in the southern part of Izapa. The New World Archaeological Foundation (NWAF) undertook four seasons of excavation in the early 1960s and documented that Izapa was a large and complex Formative-period center (Ekholm 1969; Lowe et al. 1982; Lowe et al. 2013). Members of the Mexican Instituto Nacional de Antropología e Historia (INAH) conducted research at the site in the 1990s (Gómez 1995, 1996).

The Late Formative Guillén phase (300–100 B.C.) is considered to be the apogee of the Izapa polity, a dozen plazas in use by this time (Clark and Lee 2013; Lowe et al. 1982, 2013). The construction of platform mounds and temples at Izapa resulted in the first urban center of the Soconusco region. The plazas at Izapa were lined with stelae and altars, many of which depict complex narrative scenes and legitimize rulership (Guernsey 2006). "Some time before A.D. 100, there was a violent

disruption of Izapa's growth pattern, with central sections of the community abandoned" (Lowe et al. 1982:308). Subsequent occupation shifted to Group F, north of the Formative-period site core, where a number of earlier stelae were reset.

The Izapa Regional Settlement Project (IRSP) was initiated by the senior author in 2011 to document changing regional patterns associated with the Formative Izapa polity. Three IRSP zones between the Cahuacán and Suchiate Rivers where surveyed (Figure 1). The IRSP conducted systematic surface collections in each survey zone to determine the number of occupied mounds for each temporal phase in the piedmont (Rosenswig et al. 2013) and low-hills (Rosenswig et al. 2015) zones. In the coastal plain zone, the extent of occupation was recorded in terms of area (Rosenswig 2008). These data provide the basis for reconstructing relative population changes in the Soconusco region. In 2015, IRSP collected lidar data for an additional 250 km^2 of survey area, followed by the ground-truthing of monumental centers to date their occupation. In the first half of this paper, we present our new understanding of the first millennium A.D. occupation of Izapa itself. Regional settlement patterns are discussed in the second half of this paper.

Newly Documented Architecture at Group F

Lidar and pedestrian survey provide new insights into the occupation of Group F at Izapa. Lowe et al. (1982:308) had originally identified the low mounds that surrounded this group as a Late Classic house-mound cluster. The NWAF map depicted a grouping of small mounds around the Mound 125 pyramid, a ball court and two platforms (Lowe et al. 1982:Inset). They recognized that "Group F is a later ceremonial precinct than those of the southern and central parts of Izapa, but is no less complex nor was its hegemony shorter-lived" (Lowe et al. 1982:226). The lidar data depict the mounds at Group F as forming a square courtyard measuring 170 x 200 m (Figure 3). As we describe below, this is not a unique architectural arrangement, and square courtyards, formed by dozens of small mounds, were common during the Late and Terminal Classic periods.

The inhabitants of Group F at Izapa were cognizant of the Formative-period monumental center to the south. This square courtyard is oriented on the same alignment (18 degrees east of north) as the Formative-period architecture. The NWAF also documented dozens of caches interred in the southern part of the site dating to the Classic period (Lowe et al. 1982:308). Consistent with what the NWAF had observed, the IRSP survey recovered far fewer remains from this southern area that date to the first millennium A.D. The Formative-period architecture of Group F in the southern part of the site thus seems to have served different (possibly ritual) functions after the mounds were no longer under construction (see further discussion in the Supplemental Text). Occupants of Izapa during the first millennium A.D. continued to use the Formative-period monumental center as a location to inter caches, and we infer that it would then have been considered "Old Izapa."

Results from the analysis of the lidar data revealed the presence of a previously undocumented causeway between Group F and the Formative-period monumental center of Izapa to the south. This newly recognized architectural feature measures 250 m in length and extends southward from the center of the southern edge of the square courtyard that is Group F and terminates at a platform with a small mound on top (Figure 3).[2] The NWAF designated this small mound as Mound 3 but did not recognize the platform below it or the abutting causeway. The Classic-period causeway at Izapa resembles the 3-km long causeway at the site of Cotzumalguapa, which links the northern El Baúl section of the site to the Bilbao component (originally built during the Formative period; Chinchilla 2011, 2012). Takalik Abaj, on the Guatemalan piedmont 58 km southeast of Izapa, also had a stone-paved *caminamiento* that linked two structures (Crasborn and Marroquin 2006). The causeway at Izapa likely served as a formal path for a processional route.

The tentative dating of the causeway is made possible by its spatial association with a Late Classic ritual deposit discovered adjacent to Altar 61 on the west side of the causeway (Figure 3). The deposit contained a high density of Classic-period effigy censer fragments suggesting that ceremonial activities took place repeatedly in this location (Lowe 1965; Lowe et al. 1982:239, Figure 7.2c). We have not yet undertaken excavations at this newly recognized causeway. Nevertheless, based on their reanalysis of a test pit located 45 m south

Figure 3. Northern Izapa depicted with lidar data.

of Altar 61 that was excavated in 1963, Clark and Lee (2013:3) observed that "[i]t is probable that Lee excavated through buried Middle Classic structures that saw use until Late Classic times." This test pit is located precisely where we can now see the causeway, and so provides a tentative date for it.

The IRSP piedmont zone lidar survey also documents the northern extent of Izapa. The site map made by the NWAF ends approximately 200 m north of Mound 125 (Supplemental Figure 1). Beyond this area in the piedmont survey zone, the lidar data reveal the presence of numerous small mounds extending to a stream that empties into

the Izapa River northeast of Group F. On the north side of this stream, three mounds located on a platform form a courtyard on a promontory that rises 10 m above the river. Taking advantage of the natural topography, the Classic-period residents laid down a surface of similarly sized river cobbles and created a cultural veneer over the natural rise on top of which they constructed their house group (Supplemental Figure 2). Excavations will be required to better understand this zone. Results from lidar data collection and pedestrian survey indicate that Group F and the central Mound 125 was the formal core of a square Late and Terminal Classic-period courtyard at Izapa. This formal plaza was surrounded by more informal domestic architecture, including an elevated mound group that may have been occupied by elite residents of the site.

Izapa Site Size during the First Millennium A.D.

The regional lidar data and pedestrian survey results document the full spatial extent of occupation at Izapa during the first millennium A.D. As part of the 2011 piedmont survey, all 161 mounds mapped by the NWAF were revisited for surface collections. All of the mounds documented by lidar data collection were also ground-truthed in 2011. All diagnostic artifacts encountered on the surface of each mound and in the surrounding area were collected, including rims, bases, handles, and large body sherds. This was the first time that all of the mounds at Izapa were recorded. The size estimates of Izapa we present are conservative, as not all mounds were clear of vegetation. Furthermore, the sherds collected from the mound surfaces did not necessarily represent all of the actual phases of occupation of that mound. We have little doubt that excavation would document more mounds with evidence of occupation and thus could result in larger areas of occupation. The same methods were followed in documenting all mounds so the same recovery biases affect our data in a consistent manner. The patterns we document therefore should reflect relative levels of occupation at the site through time.

For each occupational phase during the first millennium A.D., we present here the estimated size of the site in hectares, as well as the number of mounds that showed traces of occupation during particular phases (Table 1, Figure 4a–g). Temporal designations of surface-collected ceramics were made by Rosenswig and previously reported in macro-temporal periods (Rosenswig et al. 2013:Figure 6; Rosenswig et al. 2015:Figure 7). The results presented here are based on a reanalysis of these surface collections carried out during the summer of 2015 by Rosenswig and Mendelsohn. The first millennium A.D. chronology is still being worked out based on reanalysis of the NWAF collections by John Clark. Mendelsohn's (2016) dissertation work on Classic period contexts south of what we call "Old Izapa" also informs this reanalysis. Our understanding of the ceramics of the Early Classic and Middle Classic Kato, Loros, and Metapa phases is currently limited to complete offering vessels recovered by the NWAF from Mound 125a in Group F (Lee 1973, 1978; Lowe et al. 1982:146–151).

Table 1. Occupation of Izapa and the Surrounding IRSP Piedmont Survey Zone.

	Izapa		Piedmont Survey Zone
	Hectares	Mounds	Mounds
Hato	48	12	53
Itstapa	170	61	177
Jaritas	102	38	146
Kato	0	2	8
Loros	0	0	1
Metapa	0	1	13
Peistal	224	125	282
Remanso	196	83	158

The number of mounds with evidence of occupation during the first millennium A.D. at Izapa changed through time. Overall results show peaks in the total number of mounds during the Terminal Formative Itstapa and Late Classic Peistal phases (Figure 4). Relative changes in site size are reflected in the number of mounds and in the size of the area occupied by these mounds (Table 1; Supplemental Figure 3). Evidence of occupation was limited during the Hato phase, when only 12 mounds produced evidence of occupation within an area of 48 ha. Occupation rose again during the Itstapa phase (61 mounds within 170 ha) and then decreased during the following Jaritas phase (38 mounds within 102 ha). Results from the Early Classic and Middle Classic Kato, Loros, and Metapa phases indicate the virtual absence of occupation in the area of Izapa. The site of Izapa and the surrounding piedmont region (discussed

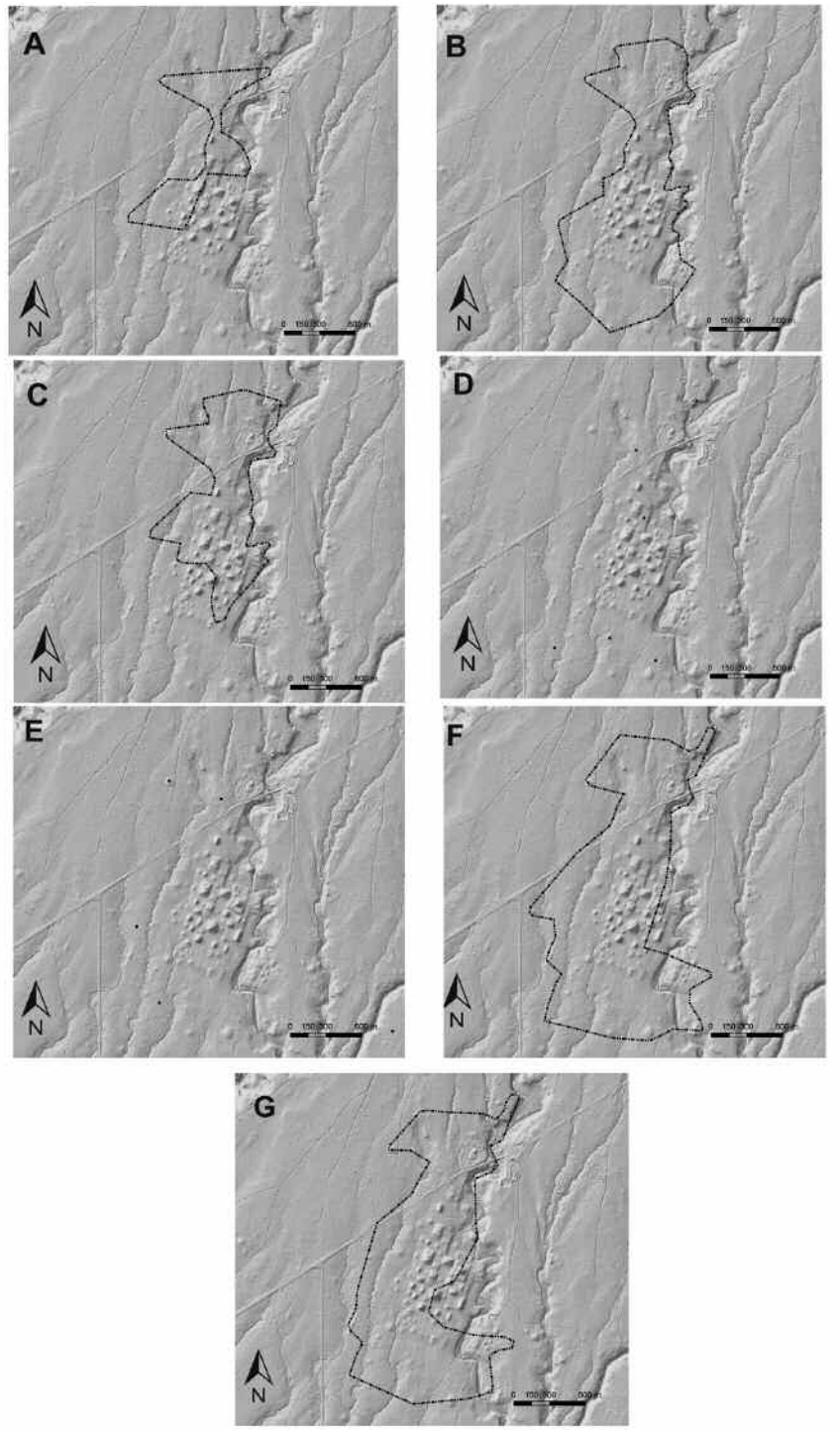

Figure 4. Izapa with the extent of mounds where remains were recovered from the (a) Hato, (b) Itstapa, (c) Jaritas, (d) Kato, (e) Metapa, (f) Peistal, and (g) and Remanso phases.

in the following section; Supplemental Figures 4 and 5) appear to have been largely abandoned during this 300-year period (A.D. 400–700). Subsequently, the occupation of Izapa increased dramatically, reaching its greatest extent for the first millennium A.D. during the Late Classic Peistal phase, with 125 mounds within an area of 224 ha. During the following Remanso phase, occupation declined to 83 mounds within 196 ha. This is less occupation than during the Peistal phase, but still higher compared to the earlier phases.

Changes in location of occupation at Izapa reveal information regarding political organization. During the Hato phase, evidence of occupation was only documented on the western and northern edges of the Formative-period monumental center (Figure 4a).[3] Site size increased significantly during Itstapa times when much of Formative-period Old Izapa, as well as of Group F, shows signs of occupation (Figure 4b.) Nevertheless, we know from NWAF (Lowe et al. 1982, 2013) and IRSP excavations (Rosenswig et al. 2014) that most construction in Old Izapa dates to the Middle and Late Formative periods. During the subsequent Jaritas phase, the southern extent of occupation contracted significantly, while the occupation around Group F remained largely the same (Figure 4c). Only a few dispersed signs of occupation were documented during the Kato phase (Figure 4d). We found no evidence for occupation during the Loros phase (thus no map) and very little evidence for the Metapa phase occupation (Figure 4e). During the Peistal and Remanso phases, the area of occupation expanded both west and south compared to earlier times (Figure 4f and 4g), and this was also when the most intensive occupation of Group F was documented with large quantities of San Juan and Tohil Plumbate pottery recovered from throughout the northern sector of the site. The IRSP survey results are consistent with previous NWAF interpretations based on excavation data, but present the first investigation of occupation at the site using systematic surface collections.

First Millennium A.D. Occupation of the Piedmont and Low-Hills Survey Zones

The IRSP documented regional occupation patterns within the piedmont and low hills survey zones. In 2011, project members visited 670 mounds in the IRSP piedmont survey zone (Rosenswig et al. 2013). During the summer of 2012, we documented an additional 413 mounds with temporally identifiable remains in the low-hills survey zone (Rosenswig et al. 2015). Readers are referred to the detailed description of our lidar and pedestrian survey methodologies in Rosenswig et al. (2013:1497–1502). In brief, lidar data, projected as a hill-shaded digital elevation model (DEM), allowed for visual identification of mounds higher than 50 cm. All mounds were visited and ceramic artifacts on the surface were collected, taking advantage of modern disturbance and erosion where possible. The temporal assessment of ceramics was used to determine the minimum phases of occupation for each mound.

Lidar data and pedestrian survey were used to infer how the relative population levels in survey zones changed through time. Although there are limits to the use of regional survey to estimate past population levels, especially in lowland Mesoamerica, it is the only way to establish regional patterns in a systematic manner (Kanter 2008; Kowalewski 2008). The use of lidar data to depict the mounds in the survey zone allowed for a much more efficient use of time than would be possible when searching for new mounds in the traditional manner of lowland Mesoamerican pedestrian survey (Ashmore 1981; Santley 1990). Because all lidar data is geo-referenced, every mound could be located in the field using GPS.

The IRSP survey of the piedmont and low hills zones is the first regional settlement project in the Soconusco region to investigate prehispanic settlement patterns in these geographical areas. As such, there are no direct comparisons to be made with previous results from other parts of the Soconusco (e.g., Voorhies et al. 2011). The number of mounds from which temporally diagnostic materials were recovered is presented in Figure 5 for each of the eight phases between 100 B.C. and A.D. 1000.

The quantity of mounds occupied in the piedmont and low hills is overall similar for each phase (Figure 5). Nonetheless, more mounds show evidence of occupation during the Itstapa and Jaritas phases than the following Kato, Loros, and Metapa phases. During the Late Classic Peistal phase, occupation reached its highest level, followed by fewer mounds with evidence of occupation during the Remanso phase. The virtual ab-

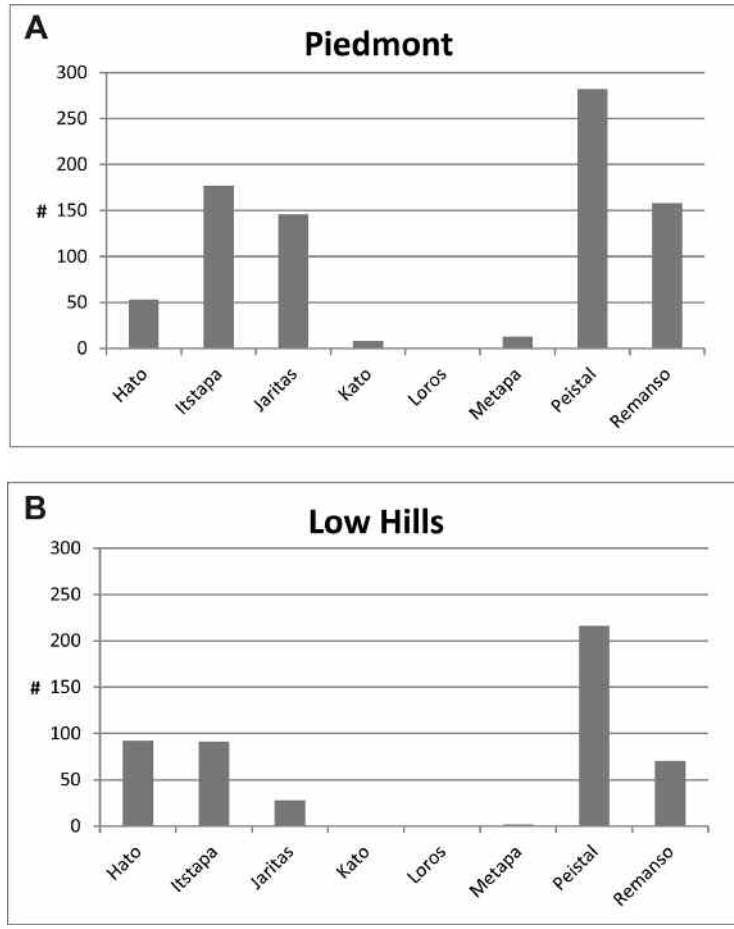

Figure 5. Bar charts of the number of mounds with occupation evidence from the Hato to Ramanso phases from the (a) piedmont and (b) low-hills survey zones.

sence of evidence for occupation during the late Early and Middle Classic occupation in the survey zones is consistent with the rest of the southern Soconusco region (Coe 1961; Love 2007:298; Rosenswig 2012; Shook 1965:186) but contrasts with what Voorhies and colleagues (2011:53–74) report from the Esquintla (Chiapas) area to the northwest. Significant Early and Middle Classic period occupation is also known from farther north in the Tonalá region at the sites of Los Horcones (Garcia-Des Lauriers 2007) and Iglesia Vieja (Kaneko 2011). To the southeast, the Guatemalan Escuintla region (and the site of Montana) was also occupied during the Early Classic period (Bove et al. 2012; Bove and Medrano 2003). In contrast, the Cotzumalguapa site on the nearby piedmont was the location of Late Formative and Late Classic centers (Chinchilla et al. 2009). The pattern of Early Classic abandonment and subsequent reoccupation during the Late Classic observed in the Cotzumalguapa region resembles settlement pattern changes around Izapa. In fact, even the construction of the Late Classic El Baúl group north of the Bilbao group at Cotzumalguapa parallels the construction of Group F to the north of Old Izapa.

Below the piedmont and low hills IRSP survey zones, systematic investigation of the coastal plain did not find evidence of an Early Classic occupation, but showed high levels of occupation during the Late Classic period (Rosenswig 2008). In the Naranjo River survey zone that defines the southeast limit of the Soconusco region, Love also reports Late Formative period occupation at El

Ujuxte and an abandonment of the area in the Early Classic. Unpublished "Late Classic settlement data show dense settlement and a multitiered settlement hierarchy capped by the site of Santa Clara" (Love 2007:301). Population peaks during the Late Formative and Late Classic periods are thus Soconusco-wide patterns.

Although occupation levels were low for the Soconusco region during the Early and Middle Classic period, the Escuintla area near Los Horcones saw uninterrupted population increase with more Early Classic occupation than during the previous Late Formative period (Voorhies et al. 2011:75–121). Likewise, Montana was an Early Classic capital surrounded by a network of lower order centers that extend through the modern *municipios* of La Gomera and Tiquisate (Bove et al. 2012). Los Horcones and Montana were both connected with Teotihuacan during the Early and Middle Classic periods (Bove et al 2012; Garcia-Des Lauriers 2007).

Differences between the piedmont and low-hills survey zones are also informative. On the piedmont around Izapa, relatively few mounds show evidence of occupation during the Hato phase followed by a significant increase during Itstapa and Jaritas times (Figure 5a). After the Late Formative Guillén-phase apogee of the Izapa center, the polity was dramatically reorganized during the Hato phase. This is reflected in the limited evidence of occupation found at the southern site center (Figure 4a). The political turmoil at Izapa had regional repercussions; with one-third as many occupied mounds during the Hato phase as during the previous Guillén phase (Rosenswig et al. 2014) or the subsequent Itstapa and Jaritas phases (Figure 5a). In contrast, there were similar numbers of occupied mounds in the IRSP low-hills survey zone during the Hato and Itstapa phases, and then significantly fewer during Jaritas times (Figure 5b). Hato-phase political disruption at Izapa and demographic decline were more dramatic across the surrounding piedmont than in the low-hills survey zone only 10 km away.

Political and demographic disruption on the piedmont during the Hato phase may have been related to the eruption of the Tacaná volcano, whose lava flow came to within 2 km of Izapa at this time (Macias et al. 2000). Settlement patterns documented by the IRSP in the low-hills survey zone suggest stable occupation for the four centuries of the Hato and Itstapa phases (100 B.C.–A.D. 300). The nearby polity of El Ujuxte, located on the coastal plain 16 km east of the Suchiate River (and 45 km from Izapa), collapsed at A.D. 100 (Love 2002b) indicating that political disruption was not a localized phenomenon at Izapa during the Terminal Formative period (Love 2007:298–299). Neff et al. (2006) identify the time from 200 B.C.–A.D. 200 as being drier than the preceding and following periods. As this timing precedes major changes in any region by a century or two, the effects of the eruption of the Tacaná volcano and the collapse of Izapa likely seem to be linked.[4]

Prehispanic occupation of the Soconusco was undoubtedly not limited only to elevated mounds. In the thickly vegetated tropical lowland environment these are often the only evidence of occupation accessible without excavation. The mound-counting methodology employed by survey projects across the Mesoamerican lowlands make precise population estimates difficult (Johnston 2004; Pyburn 1989:1–4). Because remains of earlier populations are buried more deeply than those of later occupations, earlier periods are often systematically underrepresented. Periods when mound construction was less frequent also are underrepresented when using mound counts as the basis of population estimates. Despite this, Middle Formative through Terminal Classic occupation in the IRSP piedmont and low-hills survey zones clearly does not indicate that more mounds have evidence of occupation during more recent times. We therefore assume that our results reflect changing relative numbers of people inhabiting these zones.

Late and Terminal Classic Period Mound Centers

A second campaign of lidar data collection was undertaken by the IRSP in 2015 and added approximately 250 km^2 of coverage. This campaign covered the area between the initial piedmont and low-hills survey zones, extending coverage farther to the south as well as capturing an area west of the Cahuacán River to provide a total of almost 400 km^2 of coverage (Figure 6). A total of 47 square and circular mound centers were identified

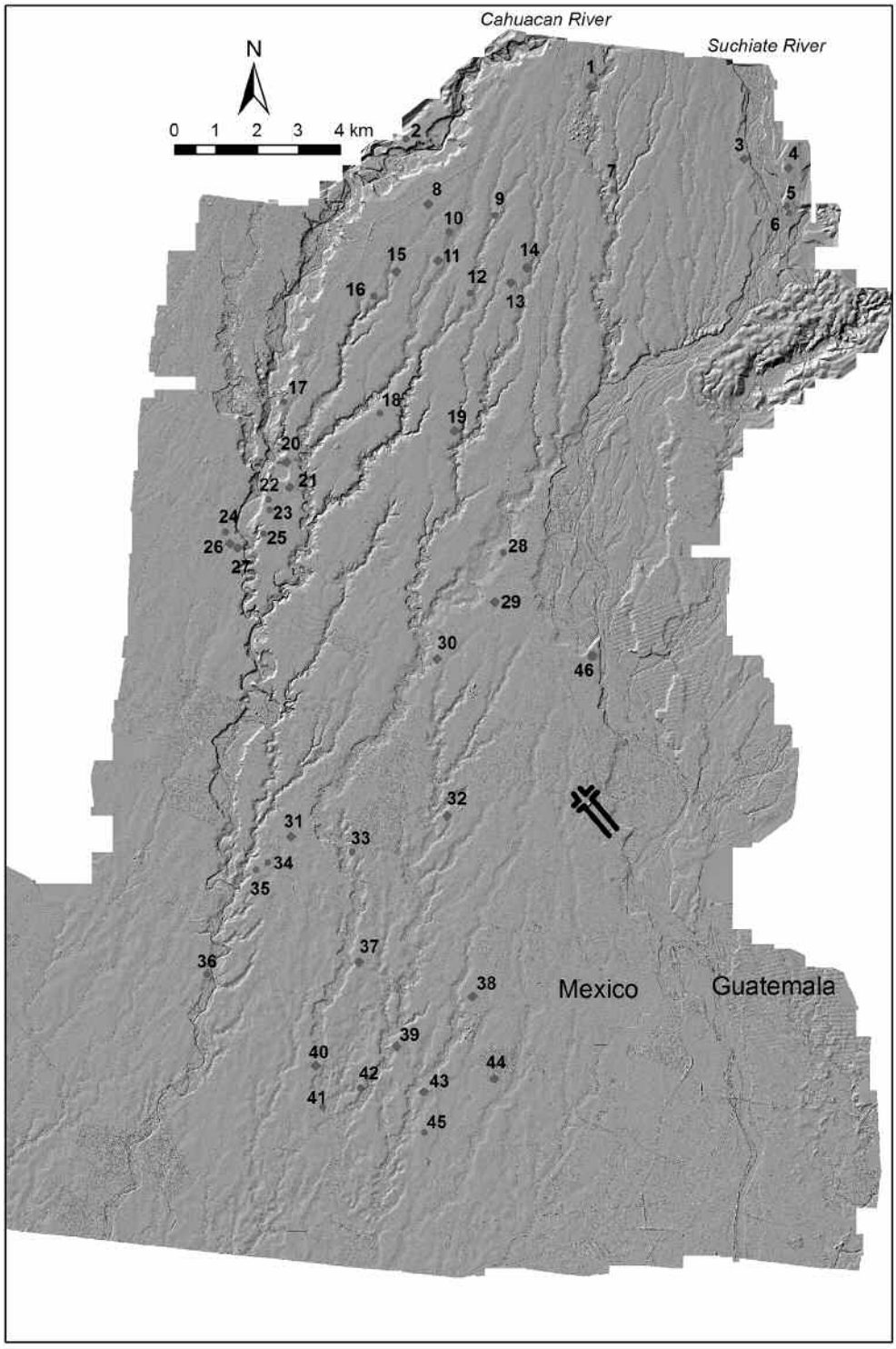

Figure 6. Total IRSP lidar coverage with the location of Late and Terminal Classic-period centers indicated.

with lidar data collection. Surface collections confirmed that 26 of these sites contained San Juan and Tohil Plumbate wares and other Late Classic and Terminal Classic ceramic wares (Table 2). Due to differences in surface visibility, it was not possible to determine occupation periods for all the mounds. Although each square and circular mound center that we visited had both Late and Terminal Classic sherds, we could not determine with confidence the number of mounds that were occupied during each phase. Thus, we tentatively consider these mound centers to have all been similarly occupied during the Peistal and Remanso phases.

A large Late and Terminal Classic capital near Frontera Hidalgo and 46 lower-order centers of roughly equivalent size (see below) were also documented by the IRSP lidar campaign. The location of these Late and Terminal Classic centers indicates that proximity to water was a determining factor in site location, because all were built within 300 m of permanent streams. Most sites are also situated away from the larger Cahuacán and Suchiate Rivers that periodically see catastrophic flooding. Shook (1965) had previously also noted that sites associated with plumbate pottery favored small tributaries.

The largest Peistal and Remanso-phase center is located in the municipality of Frontera Hidalgo near the Suchiate River (Figure 7). Because the modern community cemetery is situated on the south side of the massive 30-m-high central mound at the site, we call it the Cemetery Site (Supplemental Figure 6). We have been aware of this large mound and numerous smaller mounds in the surrounding agricultural fields that are visible from the highway for many years. Lidar data of the low-hills IRSP zone revealed that this was a formally planned site with dozens of mounds arranged to outline the shape of a cross (Figure 7). The long leg of the cross extends 1,340 m aligning northwest-southeast and is intersected perpendicularly by a second 640-m long arm, aligned northeast to southwest. The 30-m-high mound is located in the northern half of the long arm just southeast of the intersection of the two arms, its long axis aligned northeast-southwest like the shorter leg of the cross. The small mounds that outline the cross delineate an internal space of 39 ha. The southeast section of the site was disturbed and numerous mounds destroyed by the highway that runs from KM12 on the Tapachula-Guatemala highway to Ciudad Hidalgo. Several mounds also were leveled during the digging of drainage canals in a banana plantation in the northern area of the site. Late and Terminal Classic ceramics were recovered from most of the mounds at this site (including the northern area where mounds were destroyed), allowing us to infer contemporaneous occupations for destroyed parts of the site.

We visited and collected surface materials at the Cemetery Site and at 26 of the 46 proposed Late and Terminal Classic-period secondary centers (Table 2). Five of these centers (Sites 31, 32, 33, 34, and 35) were recorded by the low-hills lidar data and were surface collected in 2012 (Rosenswig et al. 2015). Five Classic-period centers were documented in the piedmont survey zone in 2011. As mentioned above, one of these Late and Terminal Classic-period centers is Group F at Izapa. Four other Classic-period centers (Sites 3, 7, 8, and 9) were documented in the piedmont survey zone and were dated by pedestrian survey (Rosenswig et al. 2013). Site 2 is located on the west bank of the Cahuacán River. Sites 4, 5, and 6 are located in Guatemala on the east bank of the Suchiate River. These four sites fell outside of the IRSP pedestrian survey zone and have not yet been visited. In the new lidar survey zones established in 2015, an additional 20 square and circular Classic-period centers were visited and surface collected (Table 2; Figure 6). To date, the IRSP has therefore visited and confirmed Late and Terminal Classic occupation of 26 of these sites. The dates of the remaining 20 sites that have not yet been visited are inferred based on consistency in size, shape, and layout of these sites with those that have confirmed Late and Terminal-Classic occupations.

With this large sample of newly identified Late and Terminal Classic-period centers a few general observations are possible. These sites have either a square or circular layout with numerous small mounds circumscribing a central plaza space that contained one or numerous mounds (Table 2). We explored the possibility that site shape corresponded to different periods of occupation but, because they all contain both San Juan and Tohil Plumbate pottery, our conclusion is that they do not. Some sites clearly have a square shape (Figure

Table 2. Dimensions and Extents of Square and Circular Centers Dating to the Late and Terminal Classic Periods.

Classic Site #	Shape	Dimensions NW to SE	NE to SW	Area m^2	ha	Site # Collection	Associated Formative Period Site Name
1	square	170	200	34,000	3.40	Iz	Izapa
2	round	121	120	14,520	1.45		
3	square	120	145	17,400	1.74	Tp 2085	
4	square	145	145	21,025	2.10		
5	round	--	--				
6	round	70	65	4,550	.46		
7	round	88	94	8,272	.83	Tp 2273	
8	square	84	95	7,980	.80	Tp 2336	
9	round	95	68	6,460	.65	Tp 2136	
10	round	80	80	6,400	.64	Tp 1601	
11	square	130	105	13,650	1.37		
12	round	102	93	9,486	.95		
13	square	140	147	20,580	2.06	Tp 1603	
14	square	111	141	15,651	1.57		
15	square	75	66	4,950	.50		
16	round	138	127	17,526	1.75	Tp 1602	
17	round	57	65	3,705	.37	Tp 1604	
18	round	78	82	6,396	.64	Tp 1605	
19	round	--	--			Tp 1606	
20	square	160	166	26,560	2.66	Tp 1607	south of unnamed Formative site
21	square	220	220	48,400	4.84		
22	round	102	93	9,486	.95	Tp 1608	south of unnamed Formative site
23	round	45	47	2,115	.21	Tp 1609	
24	square	133	--			Tp 1610	
25	round	112	102	11,424	1.14		
26	square	67	--				
27	square	75	67	5,025	.50		
28	round	91	100	9,100	.91	Tp 1611	
29	square	97	119	11,543	1.15		
30	square	145	123	17,835	1.78		
31	square	173	205	35,465	3.55	Tp 1172	Juan Molinas
32	square	116	176	20,416	2.04	Tp 1391	Tres Hermanos
33	round	78	83	6,474	.65	Tp 1204	
34	round	92	102	9,384	.94	Tp 1208	
35	round	113	118	13,334	1.33		
36	round	117	120	14,040	1.40		
37	square	99	94	9,306	.93		
38	square	116	147	17,052	1.71	LV	Las Viudas
39	square	101	98	9,898	.99	Tp 1616	
40	square	--	--			Tp 1615	
41	round	85	75	6,375	.64	Tp 1617	
42	round	85	104	8,840	.88		
43	square	105	167	17,535	1.75	Tp 1618	
44	square	115	120	13,800	1.38		
45	round	94	94	8,836	.88	Tp 1619	
46	round	93	99	9,207	.92		
					1.35	= Average ha	

8a and 8b) and others are clearly circular (Figure 8c). Intermediate variants include sites with roundish-square layout (Figure 8d) or in the form of a squared circle (Figure 8e). It is not certain that the differences in site layout recognized by us would have been conceived by those people who planned, built, and lived in these sites. If each of the small mounds on the edges of the plaza were a residence, then this would have been an efficient way to define cultural space and integrate domestic and civic-ceremonial architecture. In contrast to similarities in overall form of the

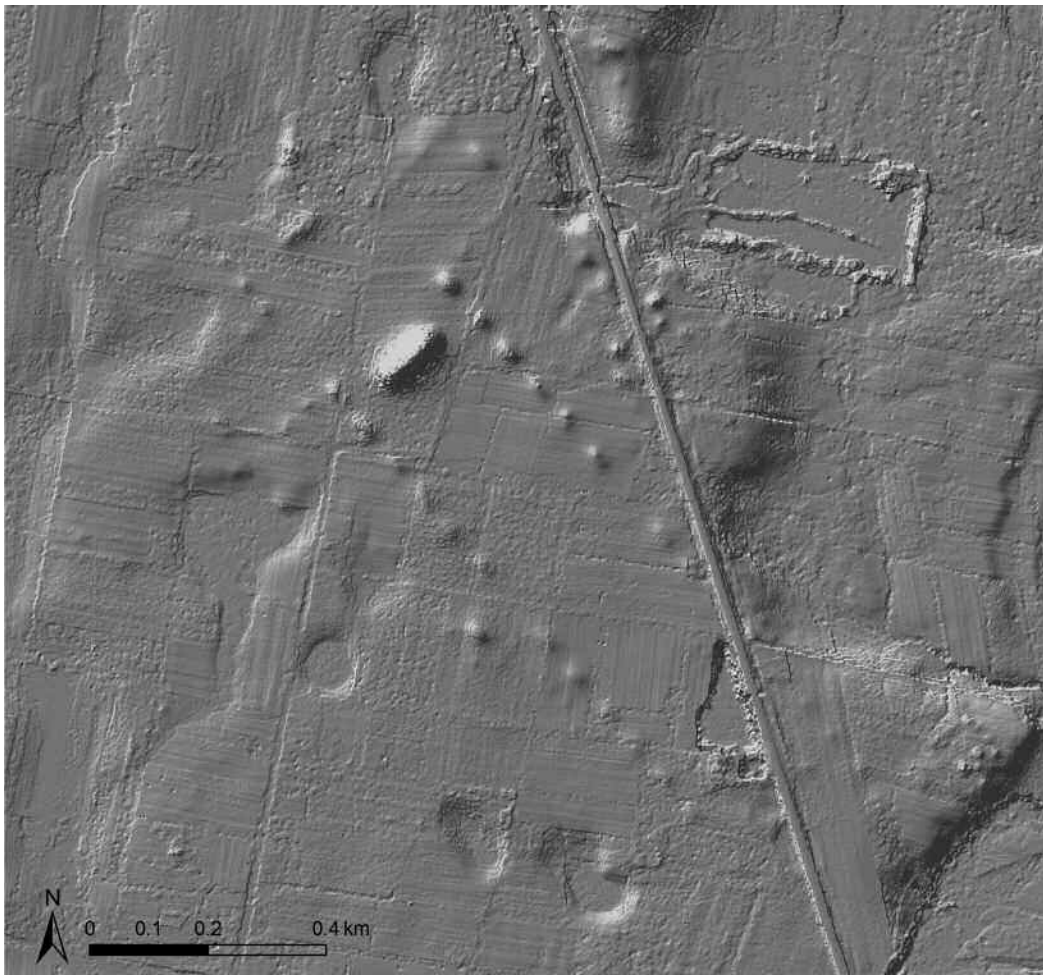

Figure 7. Lidar imagery of the Frontera Hidalgo Cemetery Site, the Late and Terminal Classic capital.

Late and Terminal-Classic centers, the layout of the plazas is variable. There is always a square or rectangular central mound. Occasionally, the large mound is built on a platform. Some centers have ball courts, such as Group F at Izapa. There is no consistency in the total number of plaza mounds, and we have not been able to recognize patterns in their location or arrangement.

The lidar data make it possible to compare the size of the 46 Late and Terminal Classic-period secondary centers. Sites were defined as either round or square based on the presence of discernible corners. Using this criterion, half of the sites were defined as round, the other half as square (Table 2). Site size was measured in ArcGIS using the hillshaded DEM at a scale of 1:4,000. Results were rounded to the nearest meter. Measurements were taken along the northwest-southeast and northeast-southwest axes of the sites following the general orientation of the square sites. Round sites were also measured this way to maintain consistency and to generate a more accurate size for more elliptical sites. We calculated site areas of square sites by multiplying the measurements of the two axes. For round sites, we averaged the two axes measurements to obtain an approximate diameter measurement, and calculated the area of a circle (πr^2). The average site area of the 46 sites is 1.35 ha. The mean area of the square sites (1.84 ha) is over twice as large as the mean area of circular sites (.89 ha). The average of all secondary centers is one-twentieth the size of the Cemetery Site, which covers 39 ha. Group F at Izapa, measuring 170 x 200 m (3.4

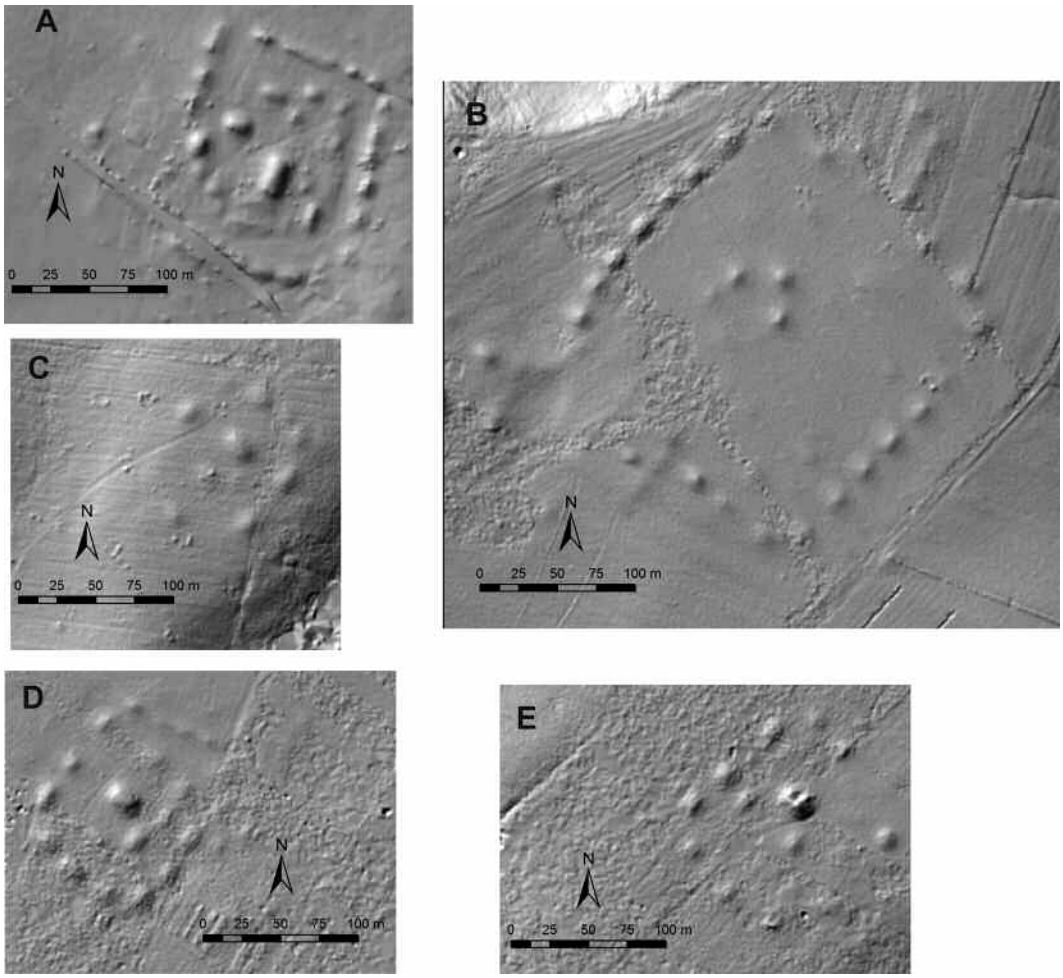

Figure 8. Examples of square and circular centers: (a) Site 3, (b) Site 21, (c) Site 42, (d) Site 29, and (e) Site 21.

ha) was one of the larger secondary centers. Site 31 was of a similar size (3.55 ha) and Site 21 was considerably larger, measuring 220 x 220 m (4.84 ha) (Table 2).

Late and Terminal Classic-period occupation in the IRSP coastal plain survey zone als was substantial. Initial survey results from a 28-km^2 area revealed that Late Classic remains cover the greatest number of hectares of any period (Rosenswig 2008). Subsequent expansion of the coastal plain survey zone to a total of 70 km^2 confirmed these initial findings. No monumental centers have been identified on the coastal plain. Recent work by Marx Navarro-Castillo (2014, 2015) shows that the site of Miguel Alemán had extensive occupation but no monumental center. One individual was interred at Miguel Alemán with 23 ceramic vessels, including numerous well-preserved cylindrical San Juan Plumbate vessels (Supplemental Figure 7). The coastal plain was thus an important part of Late Classic-period occupation of the Soconusco region. Neff (2014) has shown that the same is true of the nearby estuary.

The large spatial extent of the IRSP survey and the chronological information provided by pedestrian survey and surface collections reveal clear diachronic patterns of occupation in the Soconusco region. Two distinct settlement systems with monumental centers are associated with the Middle and Late Formative periods (700–100 B.C.) and Late and Terminal Classic periods (A.D. 700–1000). The Late Classic-period inhabitants of the

area built their centers near the six Formative period centers within the survey zone (Table 2). It would appear that the resetting of monuments at Izapa was part of a regional tradition of commemorating Formative period centers. The orientation and layout of Classic-period centers, however, appear to operate according to a new set of design principles (square and round) as well as orientation (site corners pointing in cardinal directions in contrast to the Formative-period pattern of 18 degrees east of north). Formative- and Classic-period settlement patterns documented by the IRSP reveal that settlement locations choices changed significantly in this part of the Soconusco region.

Discussion

The IRSP settlement data reveal late Early to Middle-Classic period abandonment of the region. There was widespread occupation of both the piedmont and low-hills survey zones during the preceding Itstapa and Jaritas phases. This was followed by a marked decrease in occupation during the Kato, Loros, and Metapa phases at Izapa (Figure 4d and 4e), when occupation is identified at only a few mounds across the region (Figure 5). Because the drop in population did not occur in either of the IRSP survey zones until after A.D. 400, we suggest that the Izapa region does not fit the Terminal Formative-period collapse documented elsewhere, including the Maya lowlands, between A.D. 100–250 (Grube 1995; Love 2007:298–299). Popenoe de Hatch et al. (2011) argue that demographic collapse may be related to ecological problems, including the desiccation of Guatemalan lakes, which led to a disruption of the Miraflores trade network during that earlier period.

The paucity of population documented by the IRSP survey for the period between A.D. 400 and A.D. 700 coincides with a time of intense interregional interaction (Pasztory 1978). Several researchers have highlighted this period as a time of intense cultural contact between southern Mesoamerica and Teotihuacan in central Mexico (Braswell 2003; Pasztory 1978). The NWAF used the term Middle Classic to refer to the period when Teotihuacan-style ceramic features, such as square slab supports on cylindrical vessels, appear at Izapa (Lowe et al. 1982:147). One interpretation of the population decline between A.D. 400 and 700 in the IRSP survey zone is that the influence of Teotihuacan on the Pacific Coast resulted in a major shift away from the Soconusco region in an otherwise stable occupation pattern. This is the case because subsequent Late and Terminal Classic occupation increased as architectural centers were established near the Formative-period sites (see below).

Another explanation for a gap in known occupation in the Soconusco region from A.D. 400 to 700 could be our poor understanding of ceramic typologies associated with these phases. The ceramics of the Itstapa through Remanso phases at Izapa were defined by the work of Thomas Lee (1978; Lowe et al. 1982:141–157). Lee established the ceramic chronology for these phases largely on the stratigraphic association of a series of ceramic offerings in Mound 125a at Group F of Izapa. This sequence was particularly important for the Kato, Loros, and Metapa phases, as the ceramic materials associated with these phases were never documented outside of Izapa. Early and Middle Classic utilitarian ceramics are poorly understood, which may limit our ability to identify occupation during this time.

Despite our limited understanding of the Early and Middle Classic-period ceramic phases, the IRSP survey did identify ceramic remains of the Kato (Figure 4d) and Metapa (Figure 4e) phases in the vicinity of what had been the monumental center of Izapa during the Formative period. Mendelsohn's (2016) also recovered Kato, Metapa, and possibly Loros phase ceramics in her excavations south of the monumental center of Izapa, thus further expanding our knowledge of occupation at this time.

An intriguing indicator that the Early and Middle Classic periods are not well understood in the Izapa area is the presence of square slab-feet supports on open dishes with a basal flange. Such vessels are part of the Tiquisate Ware (Supplemental Figure 8) from the Metapa phase that marks the beginning of the plumbate pottery tradition (Lee 1978:290). This distinctive Middle Classic-period form was thus part of a ceramic ware type that evolved into San Juan Plumbate Ware. It is possible that eroded and fragmented Tiquisate body and rim sherds collected during survey are mistaken for San Juan Plumbate Ware,

resulting in the underrepresentation of Metapa phase ceramic wares.

The Late Classic period saw another period of cultural change in the Soconusco region, with an overall increase in population and the occupation of a local capital (Figure 7) and 46 secondary centers (Figure 6). The importance of the Soconusco region as the center of both San Juan and Tohil Plumbate Ware production is not a new discovery (see Neff 2002, 2003), but the IRSP results presented in this paper provide initial glimpses of political reorganization and regional demographic growth during Peistal times.

Analysis of the IRSP lidar data reveals a new settlement system that was established during the Late Classic period and persisted through the Terminal Classic (Figure 6). Interestingly, mound centers were not clustered around the Cahuacán River, where chemical data indicate that San Juan Plumbate clays were mined (Neff 2002). This suggests that direct control of ceramic production was not a determining factor in site placement. Centers also do not appear to be regularly distributed across the region, as central place models would predict, based on the principle of least effort and economic rationality. Instead, clusters of lower-order centers are discernible in three or four distinct areas with no centers close to the local capital, that is, the Cemetery Site (Figure 6). Fissioning of agricultural communities experiencing population growth could account for the clustering of secondary centers with closely related individuals occupying fertile agricultural land near streams.

A third issue touched on by the presentation of these IRSP data is the age of the Remanso phase and associated Tohil Plumbate Ware. The Remanso phase was designated Early Postclassic and dated to A.D. 900–1200 with effigy vessels, hollow-foot tripod jars, low bowls, small hemispherical bowls and ladle censers being common ceramic forms (Lowe et al. 1982:153–157; Shepard 1948:4–16). The Remanso ceramic assemblage also has shallow utilitarian dishes and deep sub-spherical forms that all have flat, everted rims. These utilitarian vessels are, however, difficult to differentiate from those used during the Late Classic Peistal phase. As Lowe and colleagues have pointed out, "[t]here are no radiocarbon determinations to help fix the terminal date for the Remanso-phase occupation of Izapa" (Lowe et al. 1982:157). In fact, the only acceptable Remanso-phase date has a one-sigma range of A.D. 760–1060 with a median date of A.D. 910 (Lowe et al. 1982:Table 7.1).

The dating of Tohil Plumbate Ware (and by association the Remanso phase) depends on ceramic crossdating with the occupation of Tula and Chichén Itzá, where it occurs in the Tollan phase of the former and the Sotuta complex of the latter (Bey 1986; Bey and Ringle 2007:391–395; Smith 1971). Shook (1965:190–191) makes this clear:

> the plumbate ceramic tradition continued vigorously with a new type, Tohil, in the foothills and upper slopes in southwest Guatemala during Early Postclassic times (fig. 4a-c). Basic changes were made in paste and style (Shepard 1948) from Late Classic San Juan Plumbate. Effigy styles are strongly Mexicanized. Trade in Tohil Plumbate wares extended throughout and even beyond Mesoamerica. This time synchronizes with the dominance of the Toltec in highland Mexico and their far-flung influence.

Tohil Plumbate vessels have been found from Nayarit in northern Mexico to Panama in the south, and at the Maya sites of Chichén Itzá and Copán (Shepard 1948:105–112). Shepard (1948:1) called Tohil Plumbate "one of the most outstanding 'index fossils' for the region." The currently accepted redating of Chichén Itzá to the Terminal Classic and Tula to the Epiclassic (Kowalski and Kristian-Graham 2007) affects the end date for the Remanso phase. Aimers (2007:331–332) dates the Terminal Classic to A.D. 750–1050, noting its chronological variability across the Maya lowlands. Andrews et al. (2003) date it more restrictively in the northern lowlands to A.D. 800–1000. Further, Ringle et al. (1998) argue that the construction of Chichén Itzá dates primarily to between A.D. 700–1000. Recent reevaluations conclude that Tula was likely not the extensive empire claimed by Aztec accounts (Smith and Montiel 2001) and that significant occupation of the site was earlier than traditionally believed (Healan 2012:75–85). The lowest excavated levels with Tollan-phase ceramics at Tula are those that contain Tohil Plumbate vessels and have associated radiocarbon dates of A.D. 700–950 (Smith 2007:583–586). We do not have the data to contribute to a

discussion of the highland Mexican or lowland Maya chronologies, but we suggest that the end of Tohil Plumbate Ware production, and the occupation of the square and circular centers dated using this ware type, likely occurred during the last three centuries of the first millennium A. D.

Conclusion

Much work remains to be done before we understand the first millennium A.D. occupation of the Soconusco region. The regional data presented in this paper provide an initial step in this process by documenting how populations occupied the regional landscape during eight ceramic phases (Hato to Remanso) from 100 B.C. to A.D. 1000 (Figure 2). The IRSP survey results indicate significant increases in population levels during the Terminal Formative Itstapa (A.D. 100–300) and initial Early Classic Jaritas (A.D. 300–400) phases, followed by a virtual abandonment of both the piedmont and low-hills survey zones during later Early and Middle Classic times (A.D. 400–700). A significant population increase also occurred in both IRSP survey zones during the Late and Terminal Classic periods (A.D. 700–1000), concurrent with the occupation of a large regional center and 46 secondary centers within the 400-km^2 area covered by IRSP lidar data. The secondary centers consist of numerous small mounds outlining circular or square plazas and contained San Juan and Tohil Plumbate ceramics. These Late and Terminal-Classic period centers and changing demographic patterns provide the first glimpse of political organization in the area around Izapa. Future excavations will build on the preliminary results presented here and will enable us to understand the Soconusco region during the first millennium A.D. in a way that approaches what is known of the Maya area, the Valley of Oaxaca, or the Basin of Mexico.

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Data Availability Statement. Data may be made available upon request to senior author.

Supplemental Materials. Supplemental materials are linked to the online version of this paper, which is accessible via the SAA member login. These include the following files:
Supplemental Text.

Supplemental Figure 1. Izapa Group F depicted with lidar data revealing newly documented mounds. Gray dots with no numbers indicate mounds documented by the NWAF and numbered mounds are newly documented by the IRSP.

Supplemental Figure 2. Photograph of the newly documented large mound group north of Izapa's Group F.

Supplemental Figure 3. Size of Izapa measured as number of mounds and area over which they extend.

Supplemental Figure 4. Number of mounds with evidence of occupation from the site of Izapa and the surrounding piedmont survey zone.

Supplemental Figure 5. Correlation between the number of mounds with evidence of occupation from the site of Izapa and the surrounding piedmont survey zone.

Supplemental Figure 6. The Cemetery Site's 30-m-high central mound with tombs from the residents of Frontera Hidalgo dug into it.

Supplemental Figure 7. Late Classic period ceramics from burial documented at Miguel Alemán.

Supplemental Figure 8. Tiquisate Ware vessels with square slab feet dating to the Metapa phase.

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Notes

1. Inomata et al. (2014) have recently proposed a revised chronology for southern Mesoamerica that would push a number of Late Formative phases later in time. We will await future data from Izapa before revising the site chronology. In the Supplemental text, we address several chronological issues in more detail.

2. RMR gratefully acknowledges Payson Sheets for noticing this feature while examining the IRSP lidar data over lunch at the 2012 SAA meeting.

3. Recent reanalysis of Mound 61 redates occupation to include Hato and Itstapa phases (Clark and Lee 2013). This confirms that excavation provide a more accurate dating than surface survey. However, as the latter is not feasible on a regional scale (at least not in a single lifetime), we must accept the error range inherent in settlement survey.

4. Macias et al. (2000:1244, Table 1) date the eruption of Tacan· based on three radiocarbon dates with 1-sigma ranges of A.D. 38-216.

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