4 NORTHERN BELIZE AND THE SOCONUSCO: A COMPARISON OF THE LATE ARCHAIC TO FORMATIVE TRANSITION

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The adoption of ceramics and sedentary village life are fundamental changes in the history of humankind. In all areas of the world, these developments were the precursor to population growth, full-scale agriculture and sociopolitical complexity. I explore this important transition in Mesoamerica through the comparison of the archaeological and environmental records of the Soconusco and northern Belize from 3000-800 BCE (uncalibrated). These regions represent the first and last areas of Mesoamerica where the Late Archaic to Formative transition occurred. I evaluate the different adaptive trajectories in these two lowland regions in terms of how the inhabitants of each area responded to the end of a world-wide drying event that lasted from approximately 1800-1600 BCE (uncalibrated), known in the Old World as the "4200 BP Event"

While a picture is emerging of the first ceramic using cultures in various parts of lowland Mesoamerica (e.g., Awe 1992; Blake et al. 1995; Clark and Gosser 1995; Hammond 1991; Joyce and Henderson 2001; McAnany 2004; Rosenswig 2000), their Late Archaic predecessors are known primarily from two contexts: the Soconusco (Voorhies 1976, 2004; Voorhies et al. 2002) and northern Belize (Hester et al. 1996; Iceland 1997; Iceland and Hester 1996; Loshe et al. 2005; Rosenswig and Masson 2001) (Figure 1 and 2) – although other lowland remains from this period have been reported elsewhere (e.g., Brush 1965; Mountjoy et al. 1972; Rue 1987; Wilkerson 1975; and see MacNeish 1992). The Soconusco and northern Belize represent the earliest and the latest regions of Mesoamerica where ceramics were adopted and village life documented (Table 1). Therefore, comparing the developmental trajectories of the two regions provides insight into the nature of these changes in adaptation. Why did ceramic use and village life emerge so early in the Soconusco? Why was the Late Archaic adaptation in northern Belize so successful that it was maintained for more than half a millennia longer? I begin this paper by comparing archaeological evidence from the Soconusco and northern Belize that is relevant to food production and human alteration of local environments. Then, evidence of a world wide climatic event beginning at approximately 4200 BP is reviewed (Weiss et al. 1993; Booth et al. 2005) and its relevance for Mesoamerica is explored.

Soconusco Late Archaic and Formative

The Archaic period in the Soconusco is defined by the Chantuto A (4000 - 3000 BCE) and Chantuto B (3000 - 1800 BCE) phases (Blake et al. 1995). Chantuto A is known from the single shell mound site of Cerro de las Conchas which is located in a mangrove-estuary environment and produced a number of C14 dates, but little information pertaining to the emergence of agriculture or settled life is currently available (Blake et al. 1995). The Chantuto B phase is known from five estuary shell mound sites and the upland site of Vuelta Limon which have been excavated by Barbara Voorhies (2004). The estuary sites are interpreted as seasonal resource

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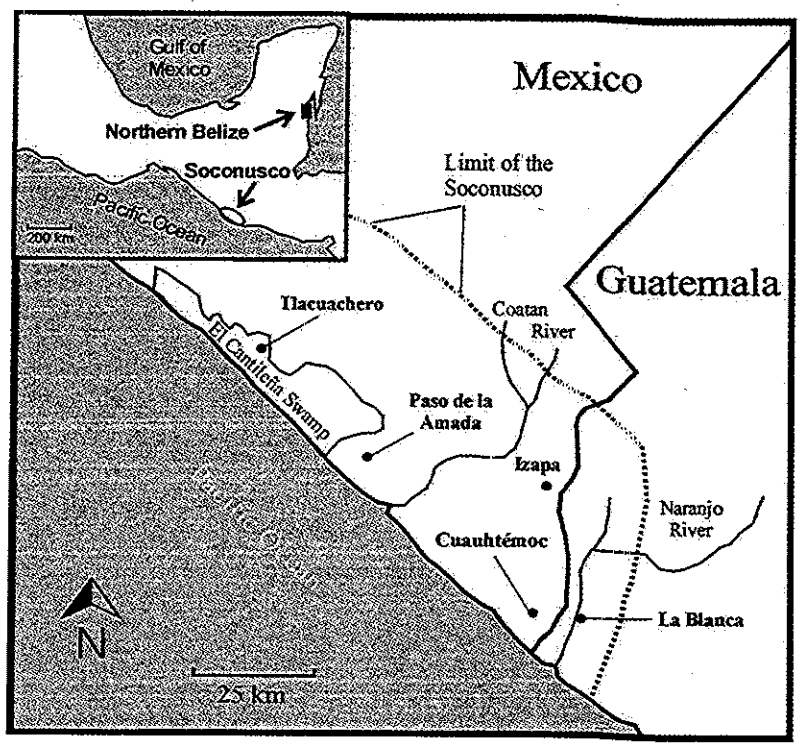

Figure 1. Soconusco Late Archaic and Formative sites mentioned in the text.

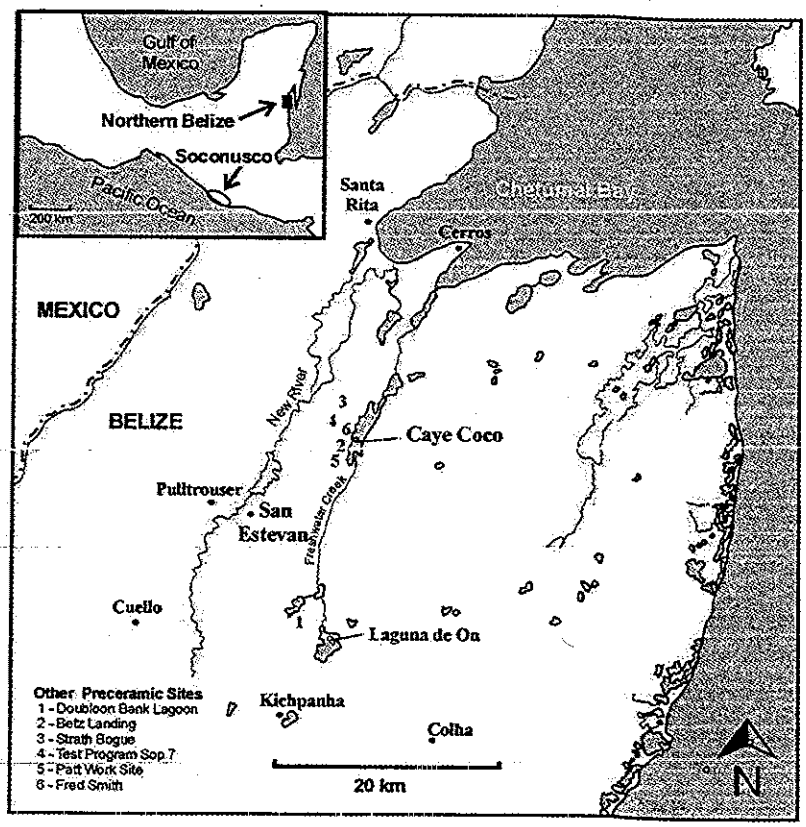

Figure 2. Northern Belize Late Archaic and Formative sites.

Years BCE	Soconusco	Northern Belize	Human-Environment Relationship
	Conchas	Swazey	First Evidence of Maize as a Staple Crop
900 1500/1600	Jocotal Cuadros Cherla Ocós Locona Barra	Late Pre-Ceramic	Intensified Horticultural Adaptation
Hiatus			4200 BP Event
1800/1900 3000	Chantuto B	Early Pre-Ceramic	Human Disturbance of the Environment

Table 1. Chronologies of the Soconusco and Northern Belize

procurement locales and Vuelta Limon as a base camp site (Voorhies 1996a, 1996b).

The site of Tlacuachero is a Chantuto B period shell middens. A large, prepared clay surface was encountered with post holes forming two oval structures, one measuring 4 x 8m (Voorhies 1976: 38; Voorhies et al. 1991). This site was seasonally occupied to procure clam, fish, turtle and other marine resources and the tools recovered included milling stones and hammer stones. In addition, 57 obsidian flakes were found at the site and trace element analysis indicates that these Archaic peoples were obtaining obsidian from Highland Guatemala (Nelson and Voorhies 1980).

Two burials have been excavated from the Tlacuachero site and one of them, an adult male, had extremely worn teeth (Voorhies 1976: 67). Isotopic analyses of these burials indicate a reliance on C4 plants, which includes maize (Blake et al. 1992). Extensive tooth wear is consistent with a diet that includes a lot of seeds and grains. However, Blake et al. (1995: 167) suggest that these isotopic results may also be due to high levels of consumption of marine resources

Phytoliths have been analyzed from the Tlacuachero midden and sediment cores indicate that a similar mangrove environment prevailed during Chantuto times. Unfortunately, no identifiable pollen was recovered from the site, nor was phytolith data pertinent to economic behavior (Micheals and Voorhies 1999: 48). Analysis from Vuelta Limon indicate that forest elements dominated the phytolith assemblage but indicators of disturbance such as grasses are also present and Voorhies (1996a: 24) states that this phytolith study documents "... evidence of probable cultigens: maize, maize crosses and squash."

There was a hiatus between the end of the Chantuto B phase (ending at 1800 BCE) and the first Barra phase ceramics (beginning at 1600 BCE). Villages and pottery use are first documented during the Barra phase and structures have been documented from at least two sites (Clark 1994: 313). During the following Locona phase, evidence of political complexity is present: a two-tiered settlement system had

emerged (Clark and Blake 1994); large, high-status residences have been documented at sites such as Paso de la Amada in the Mazatán zone of the Soconusco (Blake 1991; Clark 1994). Recent settlement and excavation data from Cuauhtémoc in the southeast end of the Soconusco (see Figure 1) help document that this was a regional phenomena (Rosenswig 2004a, 2005).

Barra phase ceramics are very finely made and all are decorated or slipped and appear to imitate the shape of gourds: 85% are tecomates and 15% are deep bowls (Blake et al. 1995: 167). Clark and Blake (1994) suggest this is due to the initial role of ceramics as prestige goods used as drinking containers at competitive feasts (see also Smalley and Blake 2003). Barra phase vessel's surface decoration is similar to what would be expected on the surface of gourds. This is in contrast to Locona and later period ceramics that have a broader range of forms and include the use of shell edges and rocker stamps impressed into wet clay in a manner not possible on a gourd surface. These developments in ceramic technology suggest that the range of functions and decoration techniques expanded as the new medium were incorporated into society.

Manos were present in the Mazatán region during the Barra phase in such low numbers that Lowe (1975) inferred, along with a lack of corn, that manioc must have been the staple crop. Minimal wear on these tools suggests that grinding was not a significant practice at this time. However, from Locona times ground stone implements increase in importance and Clark (1994: 246) has documented an inverse and gradually changing relationship between the quantity of fire cracked rock (decreasing) and the number of manos discarded (increasing) during the Early Formative period. I have been able to replicate this pattern at Cuauhtémoc (Rosenswig 2005: 166-170). This pattern suggests a gradual transition in subsistence practices as grain production gradually increases over the centuries *following* the emergence of ceramic use.

Feddema (1993:77) analyzed macrobotanical samples from four Early Formative sites and found carbonized maize remains in deposits from all Early Formative periods. AMS dating of eight of these seeds confirms their age (Clark 1994: 234). In addition, the length of cob fragments more than doubled between the Ocós and Cuadros times (Feddema 1993: 62). However, this is based on only four cobs that were complete enough to measure. The largest of these maize remains were still 40% the size of modern maize (Blake et al. 1992: 89). Maize was the most commonly recovered plant remain from Locona through Jocotal deposits but beans and avocados were also recovered from Early Formative contexts at most sites in the region (Feddema 1993: 79).

Despite the presence of corn remains, isotopic analysis from the Early Formative burials from eight different sites in the Mazatán region indicate that these individuals consumed a very limited quantity of C4 plants (Blake et al. 1992: 89). These results have been questioned due to small collagen fractions (Ambrose and Norr 1992) but reanalysis of problem samples produced the same results and even if these samples are discarded, the rest of the Early Formative burials have low C4 values (Chisholm et al. 1993). It was only from Middle Formative skeleton samples that C4 levels become significant and thus indicate maize dependence (Blake et al. 1992: 89). These isotope results are supported by new data from Cuauhtémoc where a significant increase in the overall proportion of ground stone as well as an increase in the proportion of manos and metates versus mortars and

pestles that were documented during the Conchas phases (Rosenswig 2005).

Northern Belize Late Archaic and Formative

The best defined Late Archaic sequence in the Maya Lowlands comes from work carried out at the site of Colha and nearby Cobweb swamp (Hester, 1994; Hester et al. 1996; Iceland and Hester 1996). This period is divided into the Early Preceramic (2500-1900 BCE) and the Late Preceramic (1500-900 BCE) based on the available C14 dates (Hester et al. 1996; Iceland 1997).

Colha is located at the north end of an extremely high quality chert bearing zone that was extensively utilized from Archaic times up until Spanish contact. Numerous highly patinated flakes, large blades, projectile points, sandstone bowls and constricted unifaces have been identified in a handful of sites in northern Belize. The Lowe Points has been tentatively dated to 2500-1900 BCE based on associated radiocarbon dates (Kelly 1993: 215) and is the primary archaeological characteristic of the Early Preceramic period. Constricted unifaces are associated with the Late Preceramic and have been identified as woodworking adzes (Gibson 1991) but could have also been used as a digging tool, as suggested by experimental and microwear studies (Hudler and Lohse in Iceland and Hester 1996: 13). Both activities are consistent with a horticultural adaptation. The Early Preceramic of Northern Belize is coeval with the Chantuto B phase in the Soconusco and the Late Preceramic with the Early Formative period (see Table 1)

After inadvertently encountering Preceramic components below Postclassic villages in the Freshwater Creek drainage (Rosenswig 2004b; Rosenswig and Masson 2001) we targeted these deposits at Progresso Lagoon in 2001. At the site of Caye Coco, approximately 150 m2 of distinctive orange soils (see Figure 3) containing patinated lithics from Late Archaic were encountered and two pit features as well as a single posthole were documented (Rosenswig 2002, 2004). These are the only Archaic features documented to date in northern Belize. In addition to patinated chipped stone tools and flakes, two hammer stones were recovered and evidence of worked oyster shell was also found. Excavations were also initiated that year at the Fred Smith Site on the west shore of Progresso Lagoon facing Caye Coco and many more heavily patinated tools were documented in orange soils. During the 2001 season, three other preceramic sites were documented on the west shore of Progresso Lagoon (see Rosenswig and Masson 2001).

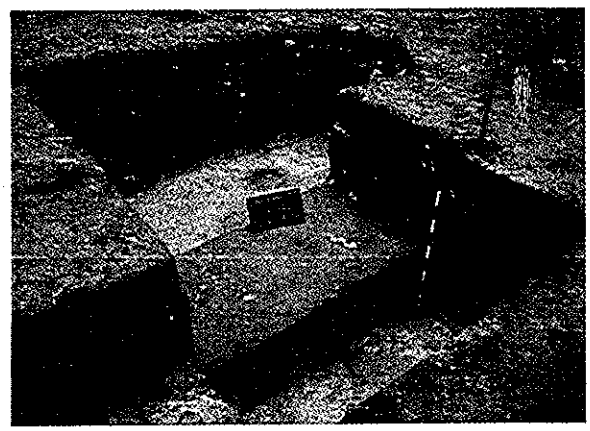

Figure 3. Orange soil horizon documented at Caye Coco in Northern Belize

The consistent association of orange soil and heavily patinated lithics in the Progresso Lagoon area make site identification much simpler. It is interesting that Lowe Points from the Ladyville 1 site were also found in a "10-15cm thick mottled orange-sand stratum" (Kelly 1993: 215). The Belize Archaic Archaeological Reconnaissance project documented a

number of sites in the area (MacNeish 1981, 1982). In 1981 and 1982, a total of 46 m2 were excavated on the west shore of Progresso Lagoon at the Betz Landing site (Zeitlin 1984). No features are reported from these excavations but a "reddish-brown soil..." 20-40 cm below the surface produced dates of 1230 +/- 85 BCE and 1275 +/- 85 BCE (Zeitlin 1984: 364). Below this layer, they documented a dark gray, aceramic clayey soil containing lithic artifacts assigned to the Late Archaic Melinda complex (Zeitlin 1984: 364). A date of 1790 +/- 800 BCE was derived from this lower level (Zeitlin 1984: 365).

On the margins of Cob Swamp, raised fields may have been constructed as early as 800 BCE to exploit the fertile swamp soil for agriculture (Jacob 1995). This corresponds to the early Middle Formative period which is the first to have ceramics in northern Belize (Hammond 1991). Pollen and radiocarbon samples were analyzed from a column sample that documented two buried fields in these raised swamp areas (Jones 1994). The lower zone contained pollen remains which indicate reduced forest coverage and increased numbers of disturbance taxa as well as a single manioc grain and date to 2500-1000 BCE. The upper ceramic bearing zone contained maize, cotton and possibly chili pollen and is dated to 1000-500 BCE (Jones 1994)

Mary Pohl and her colleagues undertook a paleoecological program of coring and excavations at a number of swamps in northern Belize and have conducted over 40 radiocarbon dates (Pohl et al. 1996). They documented maize and manioc at Cob Swamp by 3000 BCE. Yet tree pollen indicates that these cultigens were employed in high tropical forest with minor disturbance (Pohl et al.1996:363). However, John Jones' (1994) pollen analysis indicates that it was only after 1500 BCE that forest disturbance was extensive with significant increases in maize and charcoal remains.

From the earliest levels with evidence of architectural construction at Cuello, maize constituted over 80% of the macrobotanical remains recovered (Miksicek 1991: 80). Over 1100 maize cupules and kernel fragments were documented as well as carbonized fruit seeds and wood from avocado trees. Isotope analysis from Cuello indicate high levels of C4 plants were consumed and thus a reliance on maize. In addition, tuber crops were recovered including samples of manioc AMS dated to between 800 and 475 BCE (Hather and Hammond 1994).

At Cob Swamp, Middle Formative ceramics have been recovered with a date of 890 BCE. A female burial was also found with carbon isotope values that indicate maize was not a major part of her diet (Pohl et al.1996 366) – in contrast to Cuello (van der Merwe 1994 in Pohl et al.1996: 366). Faunal remains from Middle Formative contexts in Cob Swamp are consistent with such results and include terrestrial and freshwater mammals as well as birds, marine reef fish and shellfish species, the latter brought in from the coast. Therefore, as with the situation in the Soconusco, there is macrobotanical evidence of domestic plants which is earlier than the isotope results from human bone which indicates that maize was used as a staple food source. In both areas increased horticulture is documented by 1600 or 1500 BCE whereas agriculture is not documented until after 900 BCE.

There are a broad range of lithic tools present at the Late Archaic sites discussed above, including a range of unifaces, bifaces and utilized flakes, with which people did more than just cut down trees (Iceland 1997). This is not surprising as a viable adaptation should be expected to

possess lithic tool types representing a range of economic activities. Although not previously documented from preceramic contexts, oval bifaces (such as heavily patinated Late Archaic examples documented at Progesso Lagoon [Rosenswig 2002]) are similar to Formative examples documented from nearby Pultrouser swamp (see McAnany 1992: Fig 8-5, 8-6). In fact, the oval biface is the most ubiquitous tool found from the Middle Formative through Terminal Classic periods (McAnany 1992: 202). Also the use of macroblades to produce formal tools using similar trimming techniques is a another continuity between the Late Archaic and Middle Formative lithic assemblages, reported from Colha (Potter 1991: 25-26; Iceland 1997: 276).

Summary

Changes in lowland Mesoamerican human-environment relationship can be summarized as follows (see Table 1):1) Humans appear to have been engaged in small scale clearing of forests as early as 7000 BCE (Piperno 1989; Piperno and Pearsall 1998: 78); 2) After 1900/1800 BCE a hiatus begins in both the Soconusco and Northern Belize sequences; 3) By 1600/1500 BCE, the hiatus ends and a new adaptation is evident in both regions–ceramic use in the Soconusco and constricted unifaces in northern Belize with evidence of maize and other domestic plants in both regions; 4) A true agricultural adaptation evidenced by isotopic signature of high maize consumption is not documented in either region until the Middle Formative period beginning approximately 900 BCE.

Old World Collapse and a Global 4200 BP Environmental Event

In southern Mesopotamia, the Akkadian Empire collapsed at approximately 4200 BP. Based on archaeological evidence from Tell Leilan in Syria, Weiss et al. (1993: 996) argue that "imperial collapse, regional abandonment and large-scale population dislocation" corresponds to paleo-environmental data indicating a sustained, centuries-long drought. A 300 year abandonment of Tell Leilan from 4200-3900 BP corresponds to at least ten other excavated sites abandoned across the Habur and Assyrian Plains (Weiss et al. 1993: 999) and a dramatic decrease in the hectares of site occupation from this time (Weiss, et al. 1993: 1002). Tell Leilan was a northern outpost of the Akkadian Empire and during the time of this abandonment the core of the empire in Southern Mesopotamia was attacked by mobile Hurrian, Gutian and Amorite populations. During the Ur III dynasty a wall was constructed to repel the Amorites and the Curse of Akkad (written at approximately 3900 BP) tells of the barbaric Gutians who came from the mountains and laid waste to the Akkadians.

The Akkadian collapse occurred at the same time as the paleo-environmental record indicates a period of significantly cooler and dryer conditions in the area (Weiss and Bradley 2001). This record is documented in the Near East from cores in Lake Van and the Gulf of Oman (Cullen et al. 2000) as well as from speleothem analysis in Israel's Soreq Cave (Bar-Mathews et al. 1997). The 4200 BP climatic event and the collapse of the Akkadians occurred at the same time as the collapse of the Old Kingdom in Egypt, the Harrapan C3 civilization in the Indus Valley and the Early Bronze Age III period in the eastern Mediterranean (see Weiss et al 1993: note 69; Weiss and Bradley 2001: 610). The 4200 BP Event and its aftermath caused as much as a 30% reduction in precipitation in the region due to a disruption in the Mediterranean westerlies and monsoon

rainfall (Weiss and Bradley 2001: notes 9-11).

Recent paleo-environmental work from China (An et al. 2005), South America, East Africa (Thompson et al. 2002) and North America (Booth et al. 2005) all indicate that the 4200 BP Event was a world wide occurrence of dryer and cooler conditions in lower latitudes that lasted two or three centuries. The paleo-environmental record from Mesoamerica is ambiguous for this time because little work has been focused on the period before the adoption of ceramics and village life.

Mesoamerica and the 4200 BP Event

Almost all discussion of drought in Mesoamerica has focused on the Classic Period Maya collapse (e.g., Gill 2000; Fowler 2002; Fowler and Morgan 2002). A recent synthesis of world-wide collapse published in *Science* by deMenocal (2001) discusses the Akkadian and Maya collapses one after the other despite their separation by 5000 years. More relevant would have been what was occurring culturally in Mesoamerica at 4200 BP.

It is worthwhile noting that researchers have defined a hiatus in the Soconusco between Chantuto B and the Barra phase from 1800-1600 BCE (uncalibrated) and in Northern Belize between the Early Preceramic and Late Preceramic from 1900-1500 BCE (uncalibrated). When calibrated, 1800 BCE corresponds to 4200 BP. Therefore, after the 3-century long 4200 BP Event ended, the inhabitants of both the Soconusco and Northern Belize experienced a marked change in adaptation with technological innovations that reflect a much greater reliance on plant cultivation. In the Soconusco, ceramics were adopted at this time and the Formative period was initiated with the early Barra phase villages. In northern Belize, constricted unifaces began to be used and the pollen record indicates that the forests were being cleared and maize planted at an unprecedented level.

Arnold (1999) has recently noted that the earliest Formative period villages in the Isthmian Area resemble mobile Archaic adapted people except for the presence of ceramics. Clark (1994; Clark and Gosser 1995) also observes that the initial Formative technology is similar to that of their Archaic predecessors. This suggests that except for the increased archaeological visibility of Formative villages (coupled with our bias as to what ceramic use indicates) there may be less difference between the archaeological records of the Soconusco and northern Belize than is first apparent. Perhaps both regions were experiencing a similar "push" to agriculture (Richerson et al. 2001) at approximately the same time as environmental conditions improved for plant production after 3900 BP.

The 4200 B.P. drought may further help explain an odd aspect of settlement patterns in the Freshwater Creek drainage of Northern Belize. Over a number of excavation seasons, Marilyn Masson and I had documented Postclassic (some with Terminal Classic) occupations over Late Archaic deposits on the two island communities of Laguna de On and Caye Coco with no Formative or Classic period occupation in between (Rosenswig 2001, 2002, 2004b; Rosenswig and Masson 2001). If sustained drought was responsible for the end of the previous adaptation (i.e., earlier Archaic and Late Classic) then this goes a long way to explain why agriculturally adapted populations were focused on what remaining water there was in the area. Then, once precipitation increased, island and lacustrine settlement could have expanded out to newly hospitable locations.

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Reference Cited

Ambrose, S H and L. Norr
1992 On Stable Isotopic Data and Prehistoric Subsistence in the Soconusco Region. *Current Anthropology* 33: 401-404.

An, Cheng-Bang, Lingyu Tang, Loukas Barton, Fa-Hu Chen
2005 Climate Change and Cultural Response around 4000 cal yr B P in the Western Part of Chinese Loess Plateau *Quaternary Research*, in press

Arnold III, Philip J.
1999 Tecomates, Residential Mobility, and Early Formative Occupation in Coastal Lowland Mesoamerica. In *Pottery and People: A Dynamic Interaction*, edited by J. M. Skibo and G. M. Feunman, pp 157-170 University of Utah Press, Salt Lake City.

Awe, Jaime
1992 Dawn in the Land between the Rivers: Formative Occupation at Cahal Pech, Belize and Its Implications for Preceramic Developments in the Central Maya Lowlands Unpublished Ph D. dissertation, University of London, England.

Bar-Mathews, Miryam, Avner Ayalon and Aaron Kaufman
1997 Late Quaternary Paleoclimate in the Eastern Mediteranian Region from Stable Isotope Analysis of Speleothems at Soreq Cave, Israel. *Quaternary Research* 47: 155-168.

Blake, Michael
1991 An Emerging Early Formative Chiefdom at Paso de la Amada, Chiapas, Mexico. In *The Formation of Complex Society in Southeastern Mesoamerica* Edited by W.R. Fowler Jr Pp 27-45 CRC Press, Boca Raton

Blake, Michael, Brian S. Chisholm, John E. Clark, Barbara Voorhies and Michael W Love
1992 Prehistoric Subsistence in the Soconusco Region. *Current Anthropology* 33: 83-94.

Blake, Michael, John E. Clark, Barbara Voorhies, George Michaels, Michael W Love, Mary E. Pye, Arthur A. Demarest, and Barbara Arroyo
1995 Radiocarbon Chronology for the Late Archaic and Formative Periods on the Pacific Coast of Southeastern Mesoamerica *Ancient Mesoamerica* 6: 161-183

Booth, Robert K., Stephen I Jackson, Steven L. Forman, John E. Kutzbach, E A. Bettis III, Joseph Kreig and David K. Wright
2005 A Severe Centennial-Scale Drought in Mid-Continental North America 4200 Years Ago and Apparent Global Linkages. *Holocene* 15: 321-328.

Brush, C. F.
1965 Pox Pottery: Earliest Identified Mexican Ceramics *Science* 149: 194-195.

Chisholm Brian, Michael Blake and Michael W Love
1993 More on Prehistoric Subsistence in the Soconusco Region: Response to Ambrose and Norr *Current Anthropology* 34: 432-434.

Clark, John E.
1994 The Development of Early Formative Rank Societies in the Soconusco, Chiapas, Mexico. Unpublished Ph. D. Dissertation, University of Michigan, Ann Arbor

Clark, John E. and Michael Blake
1994 The Power of Prestige: Competitive Generosity and the Emergence of Rank Societies in Lowland Mesoamerica. In *Factional Competition and Political Development in the New World* Edited by E.M. Brumfiel and J. W. Fox. Pp. 17-30. Cambridge University Press, Cambridge.

Clark, John E. and Dennis Gosser
1995 Reinventing Mesoamerica's First Pottery. In *The Emergence of Pottery Technology and Innovation in Ancient Societies*, edited by W. K. Barnett and J W Hoopes, pp 209-221. Smithsonian Institution Press, Washington and London

Cullen, H M., P B deMenocal, S. Hemming, G. Hemming, F H.Brown, I Guildeson, F Sirocko
2000 Climate Change and the Collapse of the Akkadian Empire: Evidence from the Deep Sea. *Geology* 28: 379-382

deMonocal, Peter B
2001 Cultural Responses to Climate Change During the Late Holocene *Science* 292: 667-673.

Feddema, Vicki
1993 Early Formative Subsistence and Agriculture in Southeastern Mesoamerica. Unpublished Masters Thesis, Department of Anthropology and Sociology, University of British Columbia, Vancouver

Fowler, William R (editor)
2002 Special Section: Historical Climatology in the Maya Area *Ancient Mesoamerica* 13 (1): 77-170

Fowler, William R. and Molly Morgan (editor)
2002 Special Section: Historical Climatology in the Maya Area, Part 2. *Ancient Mesoamerica* 13 (2): 265-345

Gibson, Eric C.
1991 A Preliminary Functional and Contextual Study of Constricted Adzes from Northern Belize. In *Maya Stone Tools Selected Papers from the Second Maya Lithic Conference*, edited by T R. Hester and H. J. Shafer, pp. 229-237. Prehistory Press, Madison

Gill, Richardson B
2000 *The Great Maya Drought Water, Life and Death* University of New Mexico Press, Albuquerque.

Hammond, Norman
1991 *Cuello. An Early Maya Community in Belize* Cambridge University Press, Cambridge.

Hather, J. G. and N Hammond
1994 Ancient Maya Subsistence Diversity: Root and Tuber Remains from Cuello, Belize *Latin American Antiquity* 6: 120-128.

Hester, Thomas R.
1994 The Archaeological Investigations of the Colha Project, 1983 and 1984 In *Continuing Archaeology at Colha, Belize*, edited by T. R. Hester, H. J. Shafer and J. D. Eaton, pp. 1-9. Texas Archaeological Research Laboratory, University of Texas at Austin, Austin.

Hester, Thomas R , Harry B Iceland, Dale B. Hudler and Harry J. Shafer
1996 The Colha Preceramic Project: Preliminary Results from the 1993-1995 Field Seasons. *Mexicon* 18: 45-50.

Iceland, Harry B.
1997 The Pre-ceramic Origins of the Maya: Results of the Colha Preceramic Project in Northern Belize Unpublished Ph. D dissertation, Department of Anthropology, University of Texas, Austin.

Iceland, Harry B. and Thomas R Hester
1996 The Earliest Maya? Origins of Sedentism and Agriculture in the Maya Lowlands. In *The Prehistory of the Americas*, pp. 11-17, XIII International Congress of the Prehistoric and Protohistoric Sciences Vol 17, Forli, Italy.

Jacob, John S
1995 Ancient Maya Wetland Agricultural Fields in Cobweb Swamp, Belize: Construction, Chronology and Function *Journal of Field Archaeology* 22: 175-190.

Jones, John G.
1994 Pollen Evidence for Early Settlement and Agriculture in Northern Belize *Palynology* 18: 205-211

Joyce, Rosemary A. and John S Henderson
2001 Beginnings of Village Life in Eastern Mesoamerica. *Latin American Antiquity* 12: 5-24.

Kelly, Thomas C
1993 Preceramic Projectile-Point Typology in Belize. *Ancient Mesoamerica* 4: 205-227.

Lohse, Jon C , Jaime Awe, Cameron Griffin, Robert M. Rosenswig and Fred Valdez, Jr.
2005 Preceramic Occupations in Belize: Updating the Paleo-Indians and Archaic Record Manuscript in preparation for submission to *Latin American Antiquity*.

Lowe, Gareth
1975 The Early Preclassic Barra Phase of Altamira, Chiapas: A Review with New Data *Papers of the New World Archaeological Foundation* 38, Brigham Young University, Provo.

MacNeish, Richard S.
1981 *Second Annual Report of the Belize Archaic Archaeological Reconnaissance* Phillips Academy, Andover, MA.

1982 *Third Annual Report of the Belize Archaic Archaeological Reconnaissance* Phillips Academy, Andover, MA

1992 *The Origins of Agriculture and Settled Life* University of Oklahoma Press, Norman and London.

McAnany, Patricia A.
1992 Agricultural Tasks and Tools: Patterns of Stone Tool Discard near Prehistoric Maya Residences Bordering Pulltrouser Swamp, Belize. In *Gardens of Prehistory: The Archaeology of Settlement Agriculture in Greater Mesoamerica*, edited by T. W. Killion, pp 184-213. University of Alabama Press, Tuscaloosa, Alabama.

2004 *K'axob: Ritual, Work, and Family in an Ancient Maya Village* Monumenta Archaeologica 22. Costen Institute of Archaeology, University of California, LosAngeles.

Micheals, George H. and Barbara Voorhies
1999 Late Archaic Period Coastal Collectors in Southern Mesoamerica: The Chantuto People Revisited. In *Pacific Latin America in Prehistory: The Evolution of Archaic and Formative Cultures*, edited by M. Blake, pp. 39-54. Washington State University Press, Pullman, Washington.

Miksicek, C. H., E. S. Wing and S. J. Scudder
1991 The Ecology and Economy of Cuello. In *Cuello: An Early Maya Community in Belize* Edited by N. Hammond, pp. 70-97. Cambridge University Press, Cambridge.

Mountjoy, J. B., R. E. Taylor and L. H. Feldman
1972 Matanchen Complex: New Radiocarbon Dates on Early Coastal Adaptation in West Mexico. *Science* 175: 1242-1243

Nelson, Fred W. and Barbara Voorhies
1980 Trace Element Analysis of Obsidian Artifacts from Three Shell Midden Sites in the Littoral Zone, Chiapas, Mexico. *American Antiquity* 45: 540-550

Piperno, D. R.
1989 Non-affluent Foragers: Resource Availability, Seasonal Shortages and the Emergence of Agriculture in Panamanian Tropical Forests. In *Foraging and Farming: The Evolution of Plant Exploitation*, edited by D. R. Harris and G. C. Hillman, pp. 538-554. Unwin Hyman, London.

Piperno, D. R. and D. M. Pearsall
1998 *The Origins of Agriculture in the Lowland Neotropics* Academic Press, San Diego

Potter, Dan R.
1991 A Descriptive Taxonomy of Middle Preclassic Chert Tools at Caolha, Belize. In *Maya Stone Tools*, edited by T. R. Hester and H. J. Shafer, pp. 21-30. Prehistory Press, Madison, WI.

Pohl, Mary D., Kevin O. Pope, John G. Jones, John S. Jacob, D. R. Piperno, S. D. deFrance, David L. Lentz, J. A. Gifford, Mary E. Danforth, and J. K. Josserand
1996 Early Agriculture in the Maya Lowlands. *Latin American Antiquity* 7: 355-372.

Richerson, Peter J., Robert Boyd and Robert L. Bettinger
2001 Was Agriculture Impossible during the Pleistocene but Mandatory during the Holocene? A Climate Change Hypothesis. *American Antiquity* 66: 387-411

Rosenswig, Robert M.
2000 Some Political Processes of Ranked Societies. *Journal of Anthropological Archaeology* 19 (4): 413-460.

2001 Preceramic Evidence from Northern Belize and Caye Coco. In *Belize Postclassic Project 2000: Investigations at Caye Coco and the Shore Settlements of Progresso Lagoon*, edited by R. M. Rosenswig and M. A. Masson, pp. 87-95. Institute of

Mesoamerican Studies Occasional Publication No. 6. The University of Albany - SUNY.

2002 Excavation of Preceramic Components at Caye Coco and the Fred Smith Site. In *at Caye Coco and the Shore Settlements of Progresso Lagoon*, edited by A. M Delu, B. W Russell and M A Masson. Institute of Mesoamerican Studies Occasional Publication No. 7. The University of Albany–SUNY, Albany, New York

2004a Three and a Half Millennia of Settlement Changes in the Cuauhtémoc Region of the Soconusco, Chiapas, Mexico. 67th Annual Meeting of the SAA, Montreal

2004b New Archaeological Excavation Data from the Late Archaic Occupation of Northern Belize In *Archaeological Investigations in the Eastern Maya Lowlands*, edited by J. Awe, J. Morris and S. Jones, pp 267-277 Institute of Archaeology, Belize City

2005 From the Land between Swamps: Cuauhtémoc in an Early Olmec World Unpublished Ph.D dissertation, Department of Anthropology, Yale University, New Haven.

Robert M. Rosenswig and Marilyn A Masson
2001 Seven New Preceramic Sites Documented in Northern Belize. *Mexicon* 23 (6): 138-140

Rosenswig, Robert M. and Thomas W. Stafford, Jr.
1998 Archaic Component Beneath a Postclassic Terrace at Subop 19, Laguna de On Island. In *Belize Postclassic Project 1997 Laguna de On, Progresso Lagoon, Laguna Seca*, edited by M A. Masson and R. M Rosenswig, pp 81-89. Institute of Mesoamerican Studies Occasional Publication No. 2 University of Albany-SUNY.

Rue, David J.
1987 Early Agriculture and Early Postclassic Maya Occupation in Western Honduras *Nature* 326: 248-249

Smalley, John and Michael Blake
2003 Sweet Beginnings: Stalk Sugar and the Domestication of Maize. *Current Anthropology* 44: 675-703

Thompson, L. G, E Moseley-Thompson, M E. Davis, K.A. Henderson, H H Brecher, V.S Zagorodnov, I A. Mashiotta, P Lin, V.N. Mikhalenko, D R. Hardy and J. Beer
2002 Kilimanjaro Ice Core Records: Evidence of Holocene Climate Change in Tropical Africa. *Science* 298: 589-593

Voorhies, Barbara
1976 The Chantuto People: An Archaic Period Society of the Chiapas Littoral, Mexico. *Papers of the New World Archaeological Foundation* 41 Provo, Utah

1996a Subsistence Strategies on the Eve of Complexity: the Late Archaic Period in South Coastal Chiapas, Mexico. In *The Prehistory of the Americas*, pp 19-26. XIII International Congress of the Prehistoric and Protohistoric Sciences, Vol 17. Forli, Italy.

1996b The Transformation from Foraging to Farming in Lowland Mesoamerica In *The Managed Mosaic Ancient Maya Agriculture and Resource Use*, edited by S. L. Fedick, pp. 17-29 University of Utah Press, Salt Lake City

2004 *Coastal Collectors in the Holocene. The Chantuto People of Southwest Mexico.* University Press of Florida, Gainesville

Voorhies, Barbara, George H Michaels and G. M. Riser
1991 Ancient Shrimp Fishery. *National Geographic Research and Exploration* 7: 20-35.

Voorhies, Barbara, Douglas J. Kennett, John G. Jones, and Thomas A Wake
2002 A Middle Archaic Archaeological Site on the West Coast of Mexico. *Latin American Antiquity* 13: 179-200

Wilkerson, S. J. K
1975 Pre-agricultural Village Life: The Late Preceramic Period in Vera Cruz *In Studies of Ancient Mesoamerica, II*, edited by J. A Graham, pp. 111-122. Contribution 27, University of California Archeological Research Facility, Berkeley.

Weiss, H, M A Courty, W Wetterstrom, F Guichard, L Senior, R Meadow, A Curnow
1993 The Genesis and Collapse of Third Millennium North Mesopotamian Civilization *Science* 261: 995-1004

Weiss, Harvey and Raymond S Bradley
2001 What Drives Societal Collapse? *Science* 291: 609-610

Zeitlin, Robert N
1984 A Summary Report on Three Seasons of Field Investigations into the Archaic Period Prehistory of Lowland Belize *American Anthropologist* 86: 358-368

Zeitlin, R N and J F Zeitlin
2000 The Paleo-Indian and Archaic Cultures of Mesoamerica In *The Cambridge History of Native Peoples of the Americas*, Vol II Mesoamerica, edited by R Adams and M Macleod Cambridge University Press, Cambridge