

Finds in Belize document Late Classic Maya salt making and canoe transport

Heather McKillop*

Department of Geography and Anthropology, Louisiana State University, 227 Howe-Russell Geoscience Building, Baton Rouge, LA 70803-4105

Edited by Jeremy A. Sabloff, University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia, PA, and approved March 9, 2005 (received for review November 18, 2004)

How did people in preIndustrial ancient civilizations produce and distribute bulk items, such as salt, needed for everyday use by their large urban populations? This report focuses on the ancient Maya who obtained quantities of salt at cities in the interior of the Yucatan peninsula of Mexico, Belize, and Guatemala in an area where salt is scarce. I report the discovery of 41 Late Classic Maya saltworks (anno Domini 600–900) in Punta Ycacos Lagoon on the south coast of Belize, including one with the first-known ancient Maya canoe paddle. The discoveries add important empirical information for evaluating the extent of surplus salt production and river transport during the height of Late Classic civilization in the southern Maya lowlands. The discovery of the saltworks indicates that there was extensive production and distribution of goods and resources outside the cities in the interior of the Yucatan. The discovery of a wooden canoe paddle from one of the Punta Ycacos saltworks, Ka'k' Naab', ties the production of salt to its inland transport by rivers and documents the importance of canoe trade between the coast and the interior during the Late Classic. Archaeological discovery of multiple saltworks on the Belizean coast represents surplus production of salt destined largely for the inland Peten Maya during their Late Classic peak, underscoring the importance of non-state-controlled workshop production in pre-Industrial societies.

ancient Maya | canoe trade | workshop production

The discovery of 41 Late Classic (anno Domini 600–900) Maya saltworks in Punta Ycacos Lagoon on the south coast of Belize adds a new dimension to our understanding of economies in ancient civilizations. The research shows that there was extensive production outside urban areas and beyond the control of the dynastic royal Maya leaders in those cities. Entrepreneurs in southern Belize located saltworks near the natural resource, the sea. They produced a surplus for trade in response to the needs of urban consumers in the interior of the Yucatan peninsula where salt, a basic biological necessity, was scarce. Activities at the saltworks focused on the production of salt by workers who lived at nearby coastal settlements. Production was beyond the control of the Late Classic Maya state at cities in the interior of the Yucatan. Bulk inland transport of salt along rivers by canoe is supported by the discovery of a full-sized wooden canoe paddle at K'ak' Naab', one of the Punta Ycacos saltworks.

This type of production contrasts to the workshops attached to royal courts at Maya cities, where elite goods were produced for the dynastic Maya leaders and other elites (1). The saltworks also are distinct from the cottage industry style of household workshops at Colha, where stone tools were mass-produced for trade (2). Colha and the Punta Ycacos saltworks were located outside urban areas near natural resources used in workshop production and reveal the extent of non-state-controlled production in the ancient Maya and other civilizations.

Background

Saltworks previously discovered in Punta Ycacos Lagoon, a large salt water lagoon in Paynes Creek National Park, Belize, were marked by the presence of artifacts on the seafloor (3). The salt

artifacts included the fragmentary remains of jars and bowls used to boil seawater to produce loose salt or salt cakes. One of the vessel supports was embedded at an angle in a clay base indicating the positioning of the vessel supports. Excavations at the Stingray Lagoon saltworks revealed a large fire hearth of charcoal, along with salt-making pots. Measurements of pottery indicated the salt pots were standardized in their dimensions, suggesting the mass production of salt. The previous study also shows variability among the four saltworks, suggesting that there were distinct work groups. However, with only four saltworks, the extent of production along the coast and its potential impact for supplying the Maya at the interior cities were undetermined.

Was there enough salt produced by the boiling method along the coast of Belize to satisfy the inland demand for this basic daily necessity during the Late Classic? The boiling method was a common method of making salt historically and ethnographically worldwide (4, 5). Salt was produced by the same method elsewhere along the Belize coast at Northern River Lagoon, Ambergris Cay, Kakalche, and Placencia (3, 6–9). The Belize coast was closer to the Late Classic area of Maya civilization in the southern Maya lowlands than the salt flats on the northern coast of the Yucatan, where salt was produced by solar evaporation (6, 10). If the Belize coast supplied salt for the Late Classic inland Maya, then there was bulk transport from the coast to the interior, arguably by boat from the coast along rivers to the interior of the Yucatan.

Sixteenth century Spanish explorers to Central America disrupted ancient Maya canoe trade and travel that had endured for more than a millennium (Fig. 1). This travel included sea travel around the Yucatan (11–13) but also shorter-distance travel along inland waterways in Belize, Mexico, and Guatemala, supplying the Maya in the interior at large urban cities with marine resources (8, 14, 15). Settlement of offshore islands underscores ancient Maya familiarity with boats and sea travel. Boats were necessary for transportation to island sites located off the coasts of Belize and the Yucatan, including near-shore islands, such as Isla Cerritos, Wild Cane Cay, Moho Cay, and Frenchman's Cay (14–17), islands located farther from the mainland, such as Ambergris Cay, and Cozumel (8, 13), sites >40 km offshore on the Belize barrier reef, such as Hunting Cay, and sites on atolls beyond the reef.

Although no full-size wooden canoes have been recovered from ancient Maya sites, there are artistic depictions of ancient Maya canoes, including fisher folk paddling canoes shown on a mural from Chichen Itza (18) and mythical figures paddling canoes that are incised on bones from a burial from Tikal (19). In addition, there are miniature models of boats from Altun Ha, Moho Cay, and from two saltworks in Punta Ycacos Lagoon (3, 15, 20). Together with the settlement of offshore islands, various canoe-related artifacts from the Maya region indicate that the ancient Maya traveled by canoe. However, this evidence does not

This paper was submitted directly (Track II) to the PNAS office.

*E-mail: hmckill@lsu.edu.

© 2005 by The National Academy of Sciences of the USA

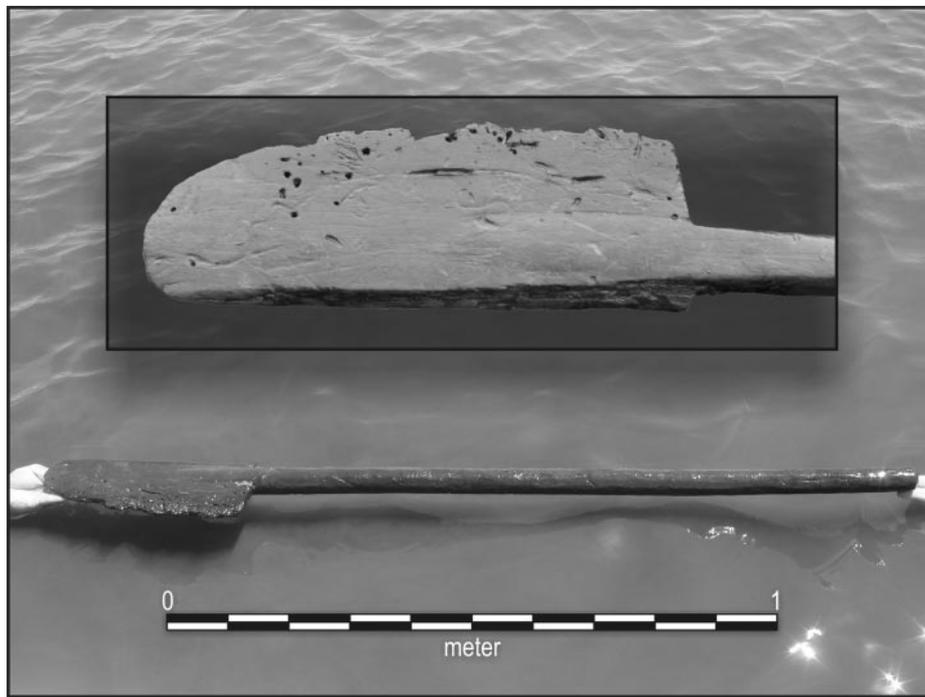


Fig. 2. Photograph of paddle from K'ak' Naab', Belize. (Inset) Close-up view of paddle blade.

construction wood, along with abundant salt-making artifacts. Detailed mapping of the wooden structure and associated pottery at Chak Sak Ha Nal and the other saltworks will elucidate the size, layout, and variability of the wooden structures and the patterning of artifacts used in salt production.

Salt-Making Artifacts. Pottery used in salt production dominates the ceramics, which resemble ceramics from the previous study (3). These ceramics includes potsherds from bowls and jars used to boil seawater in pots over fires and solid clay cylinders used to support the pots over fires. Most of the clay cylinders were fragmentary, with two complete cylinders measuring 32 and 33 cm in length, respectively, indicating the height vessels were placed above a fire. Clearly, with 45 saltworks, an infrastructure including wooden structures, and the potential for discovery of additional saltworks in areas of the lagoon not yet surveyed, salt production was indeed extensive.

K'ak' Naab' Paddle. The recovery of a wooden canoe paddle from the K'ak' Naab' site ties the production of salt in Paynes Creek to its transportation by canoe. In the absence of any ancient Maya wooden canoes, the paddle represents previously uncharacterized primary evidence of prehistoric Maya boat travel and navigation. The K'ak' Naab' site has a wooden structure containing salt-making artifacts, with the paddle nearby. Potsherds extend over an area of $\approx 10 \times 15$ m and are embedded in the mangrove peat. The paddle blade protruded from the mangrove peat into the overlying silt. The edge of the paddle blade in the silt was worm-eaten, but the remainder of the paddle was undamaged. Eight wooden posts found in the preliminary survey at K'ak' Naab' are similar in diameter (20–30 cm) and fresh in appearance, like posts at other sites in the lagoon.

Similar in shape to paddles shown in artistic depictions elsewhere in the Maya area (18, 19), the K'ak' Naab' paddle shows the actual size of paddles used by the Late Classic Maya: Carved from a single piece of wood, the paddle is 1.43 m long, with a round shaft that is 5 cm in diameter (Fig. 2). The grip is rounded and smooth, with flaking scars visible, such as could

have been produced by a chert adze recovered from the site. The upper edge of the blade flares at a 90-degree angle to the shaft. The blade extends 8 cm from the shaft on one side, but only 2 cm on the other side. The blade of the paddle is rounded at the tip. A raised area on one side of the blade, 1.40 cm high, continues the shape of the shaft.

The paddle was carved from a species of *Manilkara*, probably *Manilkara sapote* in the family Sapotaceae. Although waterlogged, the wood is fresh in appearance, preserving the original light brown color of the wood. Sapotaceae wood also was identified from Late Classic midden deposits at the nearby island community of Wild Cane Cay (25). A wooden spear from Actun Polbilche cave, Belize, was made from *M. sapote* (26). Although *M. sapote* is better known for its sap that provided chicle for chewing gum, the wood is a durable hardwood. Deciduous hardwoods do not grow in the mangrove ecosystem surrounding the lagoon or on the adjacent pine savanna (27). However, they form the rainforest south of Punta Ycacos Lagoon, along Deep River.

Radiocarbon dating and analysis of associated ceramics date Belize salt production and canoe travel to the height of Late Classic Maya civilization, when the demand for salt was greatest in the interior cities of the Peten. A radiocarbon date of $1,300 \pm 40$ B.P. (sample no. Beta-192705, Beta Analytic, Miami) from a sample of the grip end of the paddle concurs with the age of the associated ceramics from K'ak' Naab'. The radiocarbon age of the paddle, corrected by $^{13}\text{C}/^{12}\text{C}$, with a 2 sigma calibration is calculated at *anno Domini* (A.D.) 680–880. A radiocarbon date of 1300 ± 60 B.P. (sample no. Beta-192704, Beta Analytic, Miami) from a wooden post at the nearby Sak Nuk Naj saltworks corroborates the Late Classic age. The radiocarbon age of the post, corrected by $^{13}\text{C}/^{12}\text{C}$, with a 2 sigma calibration is calculated at A.D. 670–960. Both dates are within the range of the calibrated radiocarbon date of A.D. 670–870 (2 sigma; sample no. Beta-69869, Beta Analytic, Miami) from the Stingray Lagoon site (Fig. 1), which is located in the larger western arm of the lagoon (3). The radiocarbon dates fit with the Late Classic age of the ceramics. No earlier or later ancient Maya sites or

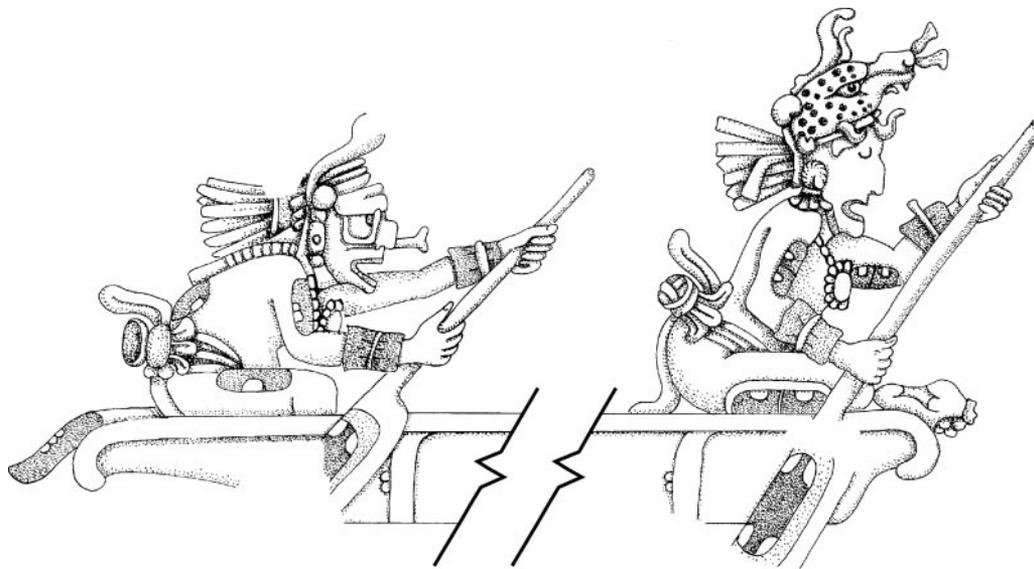


Fig. 3. Classic Maya paddles depicted on incised bone from Burial 116 in Temple 1 from Tikal. (Courtesy of Mary Lee Eggart.)

historic sites were discovered. There is no evidence of modern settlement or use of the shallow eastern arm of the lagoon.

Examples from Art and Ethnohistory. The K'ak' Naab' paddle corroborates the shape of paddles shown in ancient Maya art, which is different from modern Maya and other paddles. Artistic depictions show paddles and their use in canoes, with most images showing sacred activities, such as the ancient Maya Paddler Gods' role in delivering the maize god from the primordial sea at the moment of the creation of the world. Pictorial depictions incised on bones from Late Classic Burial 116 in Temple 1 at Tikal (19) show the Stingray Paddler god and the Jaguar Paddler god paddling a canoe (Fig. 3). Like the K'ak' Naab' paddle, their paddles have a straight handle without an expanded grip. The blades are straight along the upper side, rounded at the sides and at the tip. The scene indicates that Classic Maya held paddles by the shaft, with one hand near the top and the other hand above the blade. Other artistic depictions of canoeists paddling are known from Piedras Negras, recording a Yaxchilan emissary's trip downstream to attend a ruler's accession to the throne (28). Similar paddles are depicted in a scene on a painted mural dated to the Postclassic at Chichen Itza (18).

The virtual identity of the artistic depictions of paddles with the shape of the K'ak' Naab' paddle suggests that artistic representations of canoes in the same images show the accurate shape of canoes used by the ancient Maya. Miniature models of boats, similar in shape to the pictorial depictions, have been recovered from several Classic Maya sites, including canoes carved from manatee rib bone from Altun Ha and Moho Cay (15, 20), and examples in clay from Orlando's Jewfish and Stingray Lagoon, previously investigated saltworks in the western arm of Punta Ycacos Lagoon (3).

Implications. The association of the wood structures with abundant salt-making debris is evidence for some kind of storage facility or production infrastructure. Pottery at the site indicates that salt was produced by boiling seawater in pots over fires. Indeed, salt-making may have taken place indoors, as occurs ethnographically at the modern highland Maya community of Sacapulas, Guatemala, located at a salt spring (5). The Paynes Creek wooden buildings were used in the production, storage, and distribution of salt, made by boiling seawater in pots over

fires, as indicated by the abundant broken salt-making pottery vessels inside the structures.

The discovery of the K'ak' Naab' paddle ties the production of salt to its transport in canoes. The paddle is new evidence about the size and technology of Late Classic Maya canoe paddles and the first primary evidence of water-borne navigation of the ancient Maya, corroborated by artistic depictions (18, 19, 28).

Radiocarbon dates and ceramics link the paddle and Late Classic salt-making sites together in time, which helps make the case that bulked surplus was produced for transport. The abundance of salt-making artifacts and the lack of domestic refuse, burials, and food remains, in contrast to their common recovery at settlements on the coast, indicates that the saltworks were places where salt was produced for use elsewhere. The extent of Late Classic coastal salt production occurred when there was the greatest demand for salt at inland cities. The coastal saltworks were abandoned at the same time as the collapse of the Late Classic civilization in the southern Maya lowlands and the abandonment of the inland cities. Settlement continued on the coast, where salt making was associated with part of household production at Wild Cane Cay and Frenchman's Cay, island trading ports near Punta Ycacos Lagoon.

Several lines of evidence link this surplus salt and the Peten interior. The presence of unit-stamped pottery (with impressed decorations on vessel shoulders) and clay figurine whistles from inland sites at the Paynes Creek saltworks reinforces the significance of the coastal-inland trade of salt and other commodities at the height of the Classic Maya civilization. The distribution of unit-stamped pottery extends from the south coast of Belize to cities in the interior of Belize and the adjacent Peten of Guatemala, notably Lubaantun, Pusilha, Seibal, and Altar de Sacrificios (3). In addition to salt, other resources produced on the Belize coast include a variety of marine resources in demand by the inland dynastic Maya, including stingray spines used in ritual bloodletting, conch shells used as horns (principally queen conch, *Strombus gigas*, and *Turbinella angulata*), and seafood (fishes, manatee, and sea turtle), all found at inland cities (3, 14, 20, 21). Cacao is grown extensively today on the mainland coast, with a cacao bean from Frenchman's Cay indicating its local use and trade in antiquity. The Late Classic Maya at inland cities also imported goods and resources from more distant areas, notably obsidian, a common import to the Late Classic trading port of Wild Cane Cay off the coast of Punta Ycacos Lagoon (21).

Conclusions

The discovery of 41 saltworks and an ancient wooden canoe paddle demonstrate there was extensive, non-state-controlled salt production and the means of transport by canoe to inland Maya cities. In general, the subsistence economy of the Late Classic Maya was more complex than previously considered and included mass production of goods outside urban areas and beyond state control. This finding is important because it furthers our understanding of premodern, indigenous systems of production and exchange, in particular the extent of political control of the economy. The Punta Ycacos research indicates that salt production on the coast of Belize was extensive, dated to the height of Maya civilization when inland demand for salt was at its greatest, and that the production and canoe transportation of salt were locally controlled by the coastal Maya instead of the geographically distant Maya state at cities in the interior. In addition to the Paynes Creek saltworks, salt production is documented elsewhere along the coast of Belize (Fig. 1), suggesting that the Belize coast provided a closer source of salt than that produced on the north coast of the Yucatan. The discovery of the canoe paddle from K'ak' Naab' documents that the transportation of salt was by water, a viable option for moving bulky resources up nearby rivers to supply the large populations of the Late Classic cities in the interior of the southern Maya lowlands.

Work on inundated coastal archaeological sites pays off by adding to what we know about ancient production and exchange, especially in a period so far removed from European accounts.

The discovery of 41 new saltworks brings the total to 45 saltworks in Punta Ycacos, with only part of the lagoon investigated so far. This research adds commensurately to our knowledge of the extent of salt produced along the Belizean coast during the Late Classic, when demand at interior cities was greatest. The 2004 discovery of salt production associated with wooden buildings provides new information on the infrastructure of salt production. At least some aspect of the boiling and storage of pots or salt took place indoors, as is known ethnographically at the highland Maya community of Sacapulas, where brine from a salt spring is boiled in wooden buildings and the equipment and fuel are stored indoors (5, 29). The association of salt production artifacts with wooden buildings and a canoe paddle broaden our knowledge of ancient production and trade and underscore the information about ancient cultures worldwide that can be recovered from peat bogs and other unusual environmental settings that preserve wood from the distant past.

I thank Mark Robinson, Kevin Pemberton, Bretton Somers, and John Young for participation on the field team; Jaime Awe, John Morris, Wil Maheia, Paul Carpenter, Amber Carpenter, Harry Gomez, Wallace Young, and William Schmidt for valuable assistance during field work; Denise Rousseau, Mark Ford, Robert Tague, Jr., and Charlotte Cavell for useful comments on the manuscript; and Regis Miller (Wood Identification Laboratory, U.S. Department of Agriculture) for identifying the wood. Field work was carried out under license and assistance from the Belize Institute of Archaeology and with the cooperation of the Toledo Institute of Development and the Environment. This work was supported by a faculty research grant from Louisiana State University.

- Inomata, T. (2001) *Curr. Anthropol.* **42**, 321–349.
- Shafer, H. J. & Hester, T. R. (1983) *Am. Antiq.* **48**, 519–543.
- McKillop, H. (2002) *Salt: White Gold of the Ancient Maya* (Univ. Press of Florida, Gainesville).
- Adshad, S. A. M. (1992) *Salt and Civilization* (St. Martin's, New York).
- Reina, R. E. & Monaghan, J. (1981) *Expedition* **23**, 13–33.
- Andrews, A. P. & Mock, S. B. (2002) in *Ancient Maya Political Economies*, eds. Masson, M. A. & Freidel, D. A. (Altamira, New York), pp. 307–334.
- Graham, E. (1994) *The Highlands of the Lowlands: Environment and Archaeology in the Stann Creek District, Belize, Central America*, Monographs in World Archaeology 19 (Prehistory, Madison, WI).
- Graham, E. A. & Pendergast, D. M. (1989) *J. Field Archaeol.* **16**, 1–16.
- MacKinnon, J. J. & Kepecs, S. M. (1989) *Am. Antiq.* **54**, 522–533.
- Andrews, A. P. (1983) *Maya Salt Production and Trade* (Univ. of Arizona Press, Tucson).
- Healy, P. F., McKillop, H. I. & Walsh, B. (1984) *Science* **225**, 414–417.
- Hammond, N. (1972) *Science* **178**, 1092–1093.
- Sabloff, J. A. & Rathje, W. L., eds. (1975) *A Study of Changing Pre-Columbian Commercial Systems*, Monographs of the Peabody Museum of Archaeology and Ethnology 3 (Harvard Univ. Press, Cambridge, MA).
- McKillop, H. (1996) *Ancient Mesoamerica* **7**, 49–62.
- McKillop, H. (2004) in *The Ancient Maya of the Belize Valley*, ed. Garber, J. F. (Univ. Press of Florida, Gainesville), pp. 257–272.
- Andrews, A. P., Asaro, F., Michel, H. V., Stross, F. H. & Cervera, P. (1989) *J. Field Archaeol.* **16**, 355–363.
- McKillop, H., Magnoni, A., Watson, R., Ascher, S., Tucker, B. & Winemiller, T. (2004) in *Archaeological Investigations in the Eastern Maya Lowlands*, eds. Awe, J., Morris, J. & Jones, S. (Inst. Archaeol., Belmopan, Belize), pp. 347–358.
- Thompson, J. E. S. (1951) *J. R. Anthropol. Inst.* **79**, 69–78.
- Triak, A. S. (1963) *Expedition* **6**, 2–18.
- Pendergast, D. M. (1979) *Excavations at Altun Ha* (R. Ontario Mus., Toronto), Vol. 1.
- McKillop, H. (2005) *In Search of Maya Sea Traders* (Texas A&M Univ. Press, College Station).
- Gischler, E. & Hudson, J. H. (2004) *Sediment. Geol.* **164**, 223–236.
- Macintyre, I. G., Littler, M. M. & Littler, D. S. (1995) *Holocene History of Tobacco Range, Belize, Central America*, Atoll Research Bulletin 430 (Smithsonian Inst., Washington, DC).
- Shinn, E. A., Hudson, J. H., Halley, R. B., Lidz, B., Robbin, D. M. & Macintyre, I. G. (1995) in *The Atlantic Barrier Reef Ecosystem at Carrie Bow Cay*, eds. K. Rutzler, K. & Macintyre, I. G. (Smithsonian Inst., Washington, DC), pp. 63–75.
- McKillop, H. (1994) *Ancient Mesoamerica* **5**, 129–140.
- Pendergast, D. M. (1974) *Excavations at Actun Polbilche, Belize*, Archaeology Monograph 1 (R. Ontario Mus., Toronto).
- Johnson, M. S. & Chaffey, D. R. (1974) *An Inventory of the Southern Coastal Plain Pine Forests, Belize*, Land Resource Study No. 15 (Land Resour. Div., Surrey, U.K.).
- Marcus, J. (1991) *Am. Antiq.* **56**, 526–527.
- McKillop, H. (1995) *Lat. Am. Antiq.* **6**, 214–228.