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SPINNING AND WEAVING TOOLS FROM SANTA ISABEL, NICARAGUA

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Abstract

Costume is one of the most significant forms of material culture in ethnographic contexts, yet remains of cloth are extremely rare at most archaeological sites. Artifacts that typically relate to textile production include spindle whorls and bone tools. This paper summarizes results of analyses of a large corpus of whorls and a remarkably extensive assemblage of bone tools from the Early Postclassic site of Santa Isabel in Pacific Nicaragua. Ethnohistoric sources identify several Mesoamerican groups as living in the region during the Postclassic period, with the Oto-Manguean-speaking Chorotega likely candidates for the cultural group at Santa Isabel. Textiles were probably made from cotton, among other plant fibers. In addition to cloth production, we consider the importance of spinning thread for fishnets and hammocks.

Textiles have played an important role in virtually every culture of world history. They are functionally important as protection against environmental elements such as weather; they are culturally significant for the communication of social information; and they are a valued commodity exchanged commercially and as tribute. Among the Postclassic Nahua of central Mexico, textiles were even used as a standard of value, like currency. Economic anthropologists such as Fred Hicks (1994) and Frances Berdan (1987) have studied the commercial exchange of textiles within the Aztec empire. The tribute lists of the Codex Mendoza (1992) clearly indicate that cloth was one of the major items of exchange. Other studies have considered the relationship of spinning and weaving to female ideology because prominent female supernaturals were often associated with textile production (McCafferty and McCafferty 1999; McCafferty and McCafferty 1991; Sullivan 1982; Tate 1999). In fact, Mesoamerican cosmology incorporates weaving metaphors to describe such aspects as order versus chaos (Klein 1982).

Archaeologists have begun to place more significance on artifacts associated with spinning and weaving in order to infer pre-Columbian textile production while using ethnohistoric sources to interpret the social significance of cloth and its production (Brumfiel 1991, 1996; Hendon 1997; McCafferty and McCafferty 2000; Parsons 1972; Smith and Hirth 1988; Stark et al. 1998; Voorhies 1989). This has been particularly relevant to studies of female gender roles, since textile production was strongly correlated with female identity in ancient Mesoamerica (Brumfiel 1991; McCafferty and McCafferty 1991). From a more economic perspective, Elizabeth Brumfiel (1996) has attempted a nuanced interpretation of spindle whorl data to infer the relative value of tribute cloth in Postclassic Morelos. In all, textile production has become a valuable area of investigation into the Mesoamerican cultural system.

Our recent research focuses on the Greater Nicoya region of the southern Mesoamerican periphery (Figure 1). According to ethnohistorical sources, Nahuat-speaking immigrants known as the Nicarao settled on the Pacific coast of Nicaragua and northern Costa Rica, arriving in the final centuries before European contact (Oviedo y Valdés 1976; Torquemada 1978–1983 [1615]; discussed in Abel-Vidor 1981; Fowler 1989; Healy 1980; Lange 1992–1993). Prior to that, an earlier migration of Oto-Manguean speakers, known as the Chorotega, occupied the region beginning in about A.D. 800. Thus, for the 700 years prior to the Spanish Conquest, Mesoamerican groups allegedly occupied the Greater Nicoya region (Fowler 1989). Historical sources even suggest that Cholula, in the central highlands of Mexico, was the point of origin for these migrant groups and, in fact, may be the root of the term "Chorotega." The Colonial chronicler Gonzalo Fernández de Oviedo y Valdés (1976) described the fine clothing of the Nicaraguan natives, who used cotton and maguey fibers for their textiles, with the specific qualifier that the women "dressed like Mexicans."

Since 2000, archaeologists from the University of Calgary have explored the site of Santa Isabel, an Early Postclassic (Sapoa phase) center on the shore of Lake Nicaragua, investigating domestic life at Santa Isabel through the excavation of a variety of residential areas across the site (McCafferty 2008). One surprising discovery was that the site was not Late Postclassic, as initially suspected based on the existing ceramic sequence. Instead, occupation spanned A.D. 900–1250 (McCafferty and Steinbrenner 2005), more likely associating the Chorotega than the Nicarao with Santa Isabel, although other cultural elements suggest a more "native" Chibchan population. The research was designed

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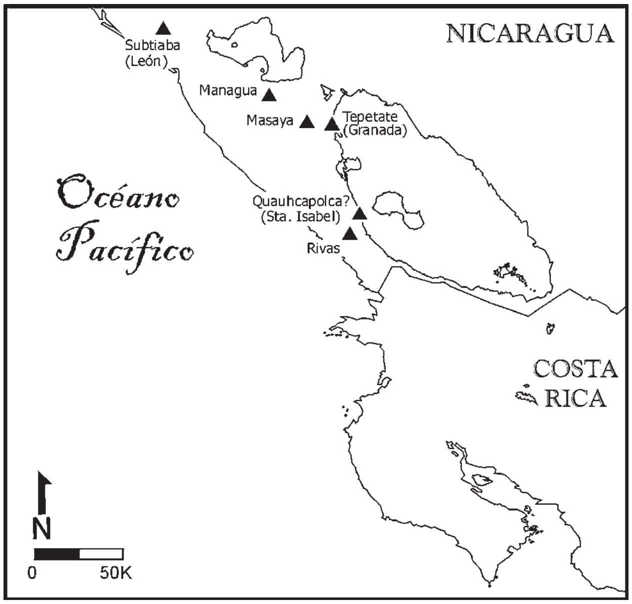

Figure 1. Map showing location of Santa Isabel in Greater Nicoya, prepared by Larry Steinbrenner.

to sample a range of archaeological house lots to approximate a demographic profile of the community. After four seasons of fieldwork, we have identified numerous house floors, cooking areas, and midden deposits, along with hundreds of thousands of artifacts. While the inference of Mesoamerican ethnicity remains problematic, we are developing an excellent database with which to discuss domestic life.

Previous work at Santa Isabel was directed by Gordon Willey and Albert Norweb in 1959 and 1961 and published by Paul Healy (1980). More recently, Karen Niemel (2003) included the site in a regional settlement-pattern survey in which Santa Isabel was identified as the paramount center during the Postclassic period. In 2000, we conducted a brief season at Mound 3 (Locus 1) in the site center, with five stratigraphic pits. From 2003 through 2005, we continued at Mounds 1, 3, 5, 6, and 8 to open a total of 110 m^2. Additionally, a 10 m grid of shovel tests provided contextual data over about 5 ha and served to identify promising excavation areas (Figure 2).

Locus 1 consists of Mound 3, a low but extensive residential mound that featured the only evidence of a plaster floor, as well as objects of exotic material and craftsmanship. Locus 2 includes Mound 6, not previously identified by Willey's original investigation. It includes several superimposed floors of packed earth and remains of wattle-and-daub walls. Mound 1 (Locus 4) is the tallest mound sampled, about 3 m high, and is very large in area, although modern housing inhibits extensive exploration. Locus 5 was minimally tested but featured a cluster of shoe-pot urn burials and two extended burials of an adult male and child. Locus 7 features several low mounds, including Mound 8, where several excavation units were placed, and featured a hearth with charred *jocote* seeds.

As a result of these excavations, we have recovered a rich assemblage of domestic artifacts, including many objects related to spinning and weaving. This study will consider spindle whorls and bone tools.

SPINDLE WHORLS

Spindle whorls are one of the prominent artifact classes found in Postclassic Mesoamerica. A working assumption is that the dimensions and shape of whorls are related to their function as flywheels during the act of twisting raw fiber into thread (McCafferty and McCafferty 2000). In an extensive study of approximately 1,000 whorls from the central Mexican site of Cholula, we have developed a methodology for measuring whorls, including diameter, height, shape (defined as the ratio of height to diameter), weight, and hole size. These different parameters result in a typology that has been used across cultures to infer the type of fiber spun and the spinning method employed (Beaudry-Corbett and McCafferty 2002; McCafferty and McCafferty 2000).

Seventy-three whorls have been recovered during the four field seasons, resulting in a density estimate of .45 per m^2 of excavation (Table 1). The Santa Isabel materials included both perforated disks ($n = 44$ [60%]) and modeled whorls ($n = 26$ [36%]; Figure 3). Two additional whorls were made of greenstone, and a large bone whorl was recovered. The perforated disks were created by reworking a potsherd into a circular form by chipping, drilling, and then grinding the edges to a smooth finish. Numerous unfinished whorls were found showing stages in the production process, either with roughly chipped sides or incomplete drilling of the center hole (Figure 4). Other whorls were modeled from clay to the desired form and often slipped. No molds for spindle whorls were found, and the relative lack of evidence for ceramic production at the site suggests that the modeled whorls may have been produced elsewhere.

The diameter of the perforated worked sherd whorls ranged from 2.1 cm to 5.4 cm, with the greatest concentration between 2 cm and 4.9 cm. The modeled whorls, by contrast, were clustered between 3.5 cm and 5.4 cm in diameter, indicating that they were generally larger than the perforated disks (Figure 5). The greenstone whorls measured 2.9 cm and 3.5 cm in diameter, while the bone whorl measured 3.7 cm.

The perforated disk whorls were very consistent in their height measurement of between .5 cm and 1.4 cm—obviously limited by the thickness of the ceramic vessels from which they were modified (Figure 6). The modeled whorls ranged in height from 1.5 cm to 3.4 cm, with distinct concentrations between 1.5 cm and 1.9 cm and another between 2.5 cm and 3.4 cm. The heights of the greenstone whorls were 2.5 cm and 2.6 cm, while the bone whorl measured 1.3 cm in height.

The perforated sherd disk whorls had a distinctively shallow shape (calculated as the height divided by diameter) of between .10 and .39, with the mean at a ratio of about .25 m (Figure 7). One perforated disk was made from a jar rim, with the greatest shape ratio of 1.04 m; it may, however, have been a bead rather than a whorl. The modeled whorls tended to be higher, with the strongest node at .30–.39, but with shape ratios continuing steadily to .80. Technical analysis indicates that a shallow whorl tends to produce a relatively slow rotation of the spindle, while a taller whorl spins faster but for a briefer period of time. The greenstone whorls had very high shape ratios of .90 and .71, indicating that they were used for specialized spinning. The bone whorl had a shape ratio of .35.

Weight was measured for all whorls; fragmentary whorls were estimated by dividing the percentage of the fragment

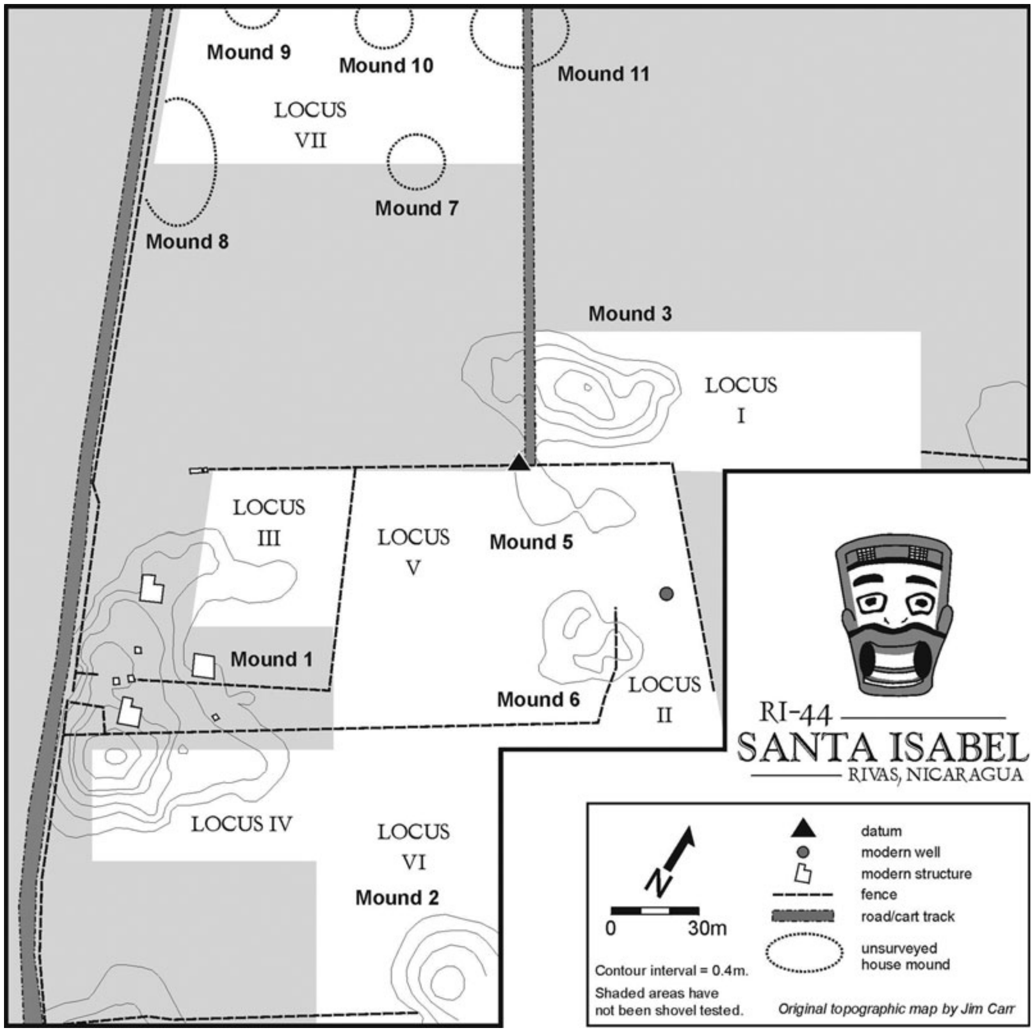

Figure 2. Santa Isabel site plan, prepared by Larry Steinbrenner.

into the existing weight. For example, if a whorl fragment weighed 2 g and was estimated to represent 40% of the original whorl, then 2 was divided by .4 to obtain a total of 5 g. Weights for the perforated sherd disks ranged from 3 g to 43 g, while the modeled whorls clustered between 20 g and 54 g, with outliers as high as 132 g (Figure 8). The greenstone whorls weighed 42 g and 48 g, while the bone whorl weighed only 14 g.

Hole size relates to the diameter of the spindle, so that the whorl can be snugly attached. Measurements were taken for both top and bottom holes, if available. The hole sizes varied from 2 mm to 10 mm, with most perforated sherd whorls' holes measuring between 4 mm and 7 mm, while the holes in modeled whorls varied from 5 mm to 9 mm (Figure 9).

Taking all of these measurements into consideration, the Santa Isabel whorls can be related to a typology established from Cholula, Mexico, using the different variables discussed (McCafferty and McCafferty 2000; Table 2). Perforated sherd disk whorls corresponded to numerous types, with the most common being types B, C, D, F, G, and H (Figure 10). Types B, C, and D are very lightweight and shallow and were likely used for supported spinning of short staple fibers such as cotton or feathers. Type G was also important as a modeled whorl and was the most abundant type overall. Type G has a medium weight and diameter, is medium to tall in height, has a medium to high shape ratio, and has a large hole; it is a versatile whorl for both supported and drop spinning to create a variety of thread qualities using a range of fiber types. The greatest number of modeled whorls did not correspond to an established type using the Cholula classification, so a new type, type K, was defined as having a medium diameter and weight, but ultra-high height and shape ratios.

Both plain and polychrome sherds were used to fabricate the perforated worked sherd disk whorls, so decoration does not seem to have been a consideration. The modeled whorls were occasionally decorated with crude incising on the flat surface (Figure 11). Incised decorations included geometric patterns and circle motifs. Two whorls had a woven motif, identical to the Mixteca-Puebla stylistic representation for textiles (McCafferty and McCafferty 2006). Another whorl fragment may depict the eye and upturned snout of a reptile. Others use a "ladder" motif to divide the whorl into quadripartite spaces.

Table 1. Santa Isabel spindle whorls

Object #	Provenience	Diameter (cm)	Height (cm)	Shape ratio	Weight (g)	Hole (cm)	Type	Form	Material PD = perforated disk M = modelled
00.1.112	N11 E30	3.3	1.3	.39	13	0.7	F2	4	PD
00.1.135.144	N20 E30	2.9	0.7	.22	4	0.3	B2	4	PD
00.1.135.143	N20 E30	3.9	0.8	.19	15	0.6	D3	4	PD
00.1.122.186	N21 E5	7.8	3.1	.39	68	0.9	—	—	M
00.1.015.249	N10 E10	—	—	—	—	0.5	—	—	M
00.1.179.241	N30 E40	3.7	1.3	.35	14	0.7	F2	6a	Bone
00.1.184.30	N21 E7	4.8	1.9	.39	21	0.8	G	2b	M
00.1.000.01	surface	6.0	2.6	.42	50	0.9	J1	6b	M
00.1.028.28	N20 E10	4.6	1.2	.26	43	0.7	G	4	PD
03.2.001.88	surface	4.3	0.8	.19	17	0.7	H	4	PD
03.2.001.168	surface	2.9	0.8	.28	4	0.8	B3	4	PD
03.2.014.5	S20 W10	3.9	0.7	.18	10	0.4	D3	4	PD
03.2.054.1	S10 E0	2.7	0.7	.26	8	—	B	4	PD
03.2.068.6	S30 E20	4.8	1.1	.23	28	0.9	G	4	PD
03.2.073.1	S60 E20	3.6	0.6	.17	5	0.6	A	4	PD
03.2.180.13	S75 E45	2.6	0.9	.35	8	0.4	B2	4	PD
03.2.210.5	S60 E55	2.1	1.1	.52	4	0.6	C	4	PD
03.2.214.18	S65 E55	3.8	1.5	.39	25	0.8	G	4	PD
03.2.1153.9	S60 E51	5.4	0.9	.17	25	0.6	H	4	PD
03.2.1156.12	S60 E51	2.4	0.6	.25	4	0.5	E1	4	PD
03.2.1700.17	S61/62 E52	2.2	0.5	.23	3	0.3	B1	4	PD
03.2.1555.10	S62 E51	5.3	1.0	.19	32	0.6	H	4	PD
03.2.1559.4	S62 E51	3.4	1.1	.32	14	0.5	F1	4	PD
03.2.1186.5	S65 E65	4.5	1.1	.24	25	0.8	G	4	PD
03.2.1671.3	S70 E46	4.1	0.6	.15	10	1.0	D3	4	PD
03.2.068.7	S30 E20	—	1.9	—	—	—	—	—	M
03.2.084.4	S0 E30	4.1	1.6	.39	24	—	G	1b	M
03.2.1276.5	S70 E61	3.8	1.5	.39	21	0.7	G	4	M
03.2.127.1	S60 E40	4.7	1.8	.38	32	0.6	G	6	M
03.2.128.19	S60 E40	4.0	3.1	.78	17	0.7	K	3d	M
03.2.146.7	S50 E30	4.1	3.2	.78	26	0.8	K	11d	M
03.2.168.23	S20 E45	4.2	3.4	.81	42	0.8	K	11d	M
03.2.1093.3	S60 E39	4.5	—	—	70	0.6	K	11d	M
03.2.1204.8	S61 E40	3.8	—	—	22	0.6	K	11d	M
03.2.1706.4	S61 E51	5.0	3.3	.66	50	0.7	K	9d	M
03.2.1700.16	S61/62 E52	3.7	3.0	.81	49	0.5	K	12c	M
03.2.1125.18	S69 E60	4.7	1.5	.32	36	—	G	—	M
03.2.1706.5	S61 E51	3.5	2.5	.71	42	0.7	K	11d	Greenstone
03.2.1189.1	S65 E55	4.8	2.7	.56	33	0.8	K	11d	M
04.2.061.03	S63 E51.5	4.6	1.0	.22	31	0.6	H	4	PD
04.2.442.01A	S72 E66	4.6	3.2	.70	41	0.4	K	9d	M
04.1.425.05	N22 E6	4.2	2.8	.67	34	0.5	K	9d	M
04.1.203.01	N23 E5	3.9	1.0	.26	16	0.5	D3	4	PD
04.1.025.05	N20 E5	2.4	1.7	.71	7	0.3	C	4	PD
04.1.385.08	N25 E11	4.0	1.0	.25	24	0.5	G	4	PD
04.5.069.01	S11 E15	2.9	0.6	.21	7	0.2	B2	4	PD

Continued

Table 1. *Continued*

Object #	Provenience	Diameter (cm)	Height (cm)	Shape ratio	Weight (g)	Hole (cm)	Type	Form	Material PD = perforated disk M = modelled
04.1.262.06	N22 E4	—	1.1	—	—	—	—	4	PD
04.1.302.14	N19 E13	—	0.9	—	—	—	—	4	PD
04.1.83.02	N20 E7	—	0.9	—	—	—	—	4	PD
04.1.124.04	N21 E5	4.5	1.0	.22	28	0.5	G	4	PD
04.1.165.02	N22 E6	3.3	0.8	.24	12	0.3	D2	4	PD
04.1.003.05	N20 E12	3.9	1.4	.36	16	0.4	F1	4	PD
04.1.321.03	N20 E19	3.6	1.0	.28	16	0.5	G	4	PD
04.4.604.04	S91 W120	2.8	0.6	.21	7	0.2	B2	4	PD
04.4.029.01	S3 E4	2.5	1.3	.52	8	0.4	C	4	PD
04.4.106	S2 E11	4.5	2.1	.47	54	0.5	G	2b	M
04.1.008.01	N20 E12	3.8	2.7	.71	39	0.4	K	9d	M
04.2.063.04	S63 E51.5	4.0	0.9	.23	10	0.5	D3	3a	PD
04.1.084.08	N20 E7	3.3	1.3	.39	20	0.5	F1	4	PD
04.1.108.02	N21 E12	2.6	1.7	.68	28	0.2	K	2b	M
04.4.084.02	S3 E11	7.6	2.0	.26	132	0.9	I	2	M
04.000.30	surface	2.5	2.6	1.04	18	0.4	—	12	PD
04.000.37	surface	5.0	1.8	.36	42	0.4	G	2	M
04.000.22	surface	3.8	1.4	.37	23	0.9	G	4	PD
04.1.382	N25 E11	2.9	2.6	.90	48	—	K	1d	Greenstone
04.4.124.17	S2 E12	4.4	1.8	.41	40	0.8	G	3c	M
05.1.017.01	N21 E12	5.0	1.9	.38	42	0.9	G	2b	M
05.1.054.01	N21 E16	4.0	1.4	.35	26	0.7	G	4	PD
05.7.108.03	N142 W123	4.4	1.1	.25	29	0.6	G	4	PD
05.7.142.3	N132 109/110	4.2	1.3	.31	28	0.7	G	4	PD
05.1.069.1	N21 E16	2.2	1.1	.50	4	0.4	C	4	PD

Three of the modeled whorls show wear marks on the edges, a possible indication that they were used in a spinning bowl. All three were of type K.

The most detailed discussion of spindle whorls from Nicaragua is found in Healy's analysis of Willey's materials excavated from the Rivas region (Healy 1980:266–268). Only two modeled whorls were recovered, of which one was from Santa Isabel. They represent what would be types G and K, with the type G whorl featuring incised decoration on the flattened surface. In contrast, Healy identified 97 "perforated potsherd discs" and 20

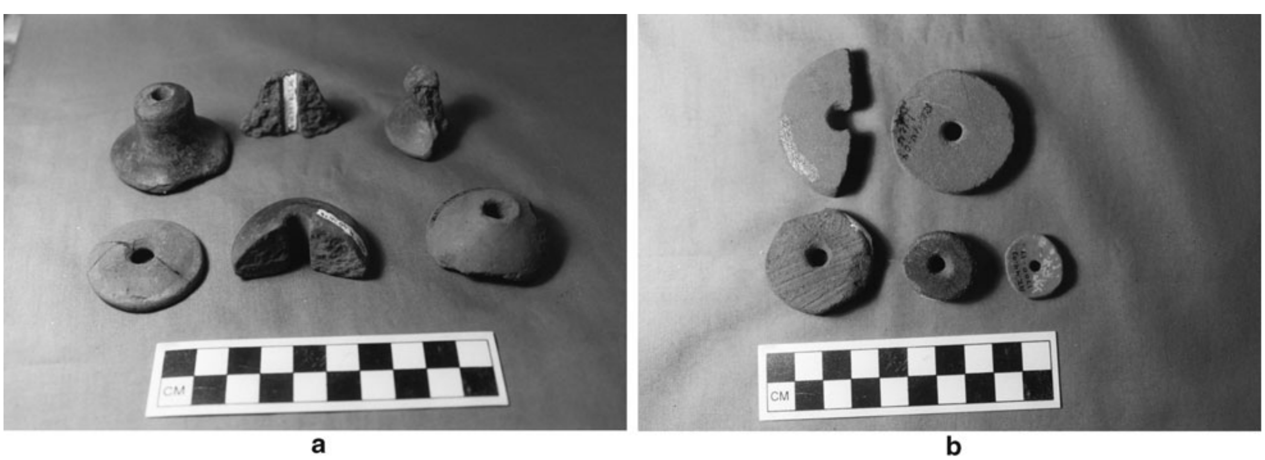

Figure 3. Santa Isabel spindle whorls.

Figure 4. Production sequence of perforated disc whorls.

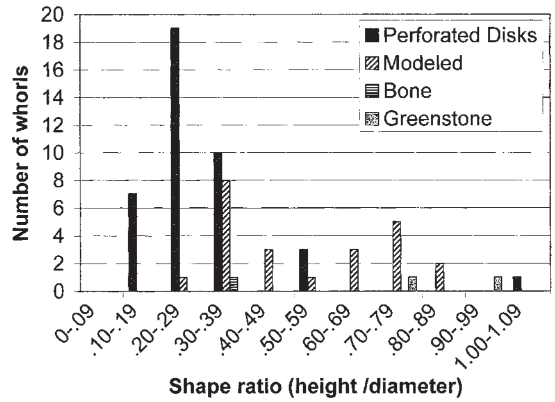

Figure 7. Graph of spindle whorl shape ratios.

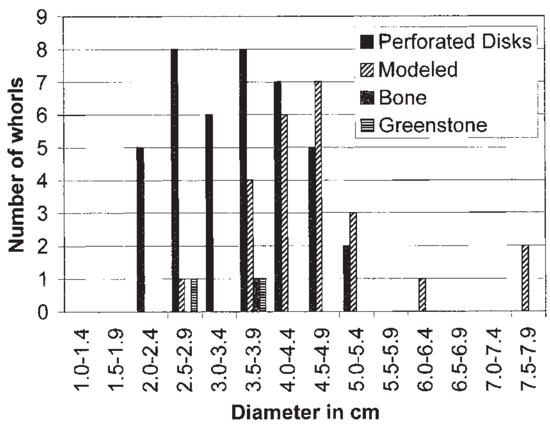

Figure 5. Graph of spindle whorl diameters.

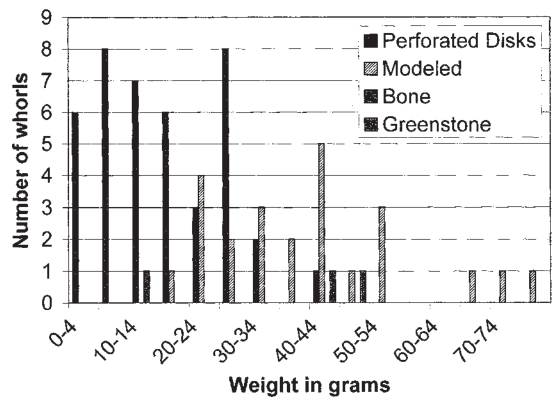

Figure 8. Graph of spindle whorl weights.

"partially drilled potsherd discs." While this ratio of modeled to reworked sherd whorls is considerably different from that identified in our analysis, it may be due in part to the inclusion of perforated disc pendants within the count, as suggested by Healy (1980:267). Perforated disc pendants are usually oval in shape, are somewhat larger than whorls, and may have one or two perforations near the edge for suspension. In our Santa Isabel analysis, perforated disc pendants were approximately 10 times more common than perforated disc whorls. However, even reducing the number of "perforated potsherd discs" by 90% still

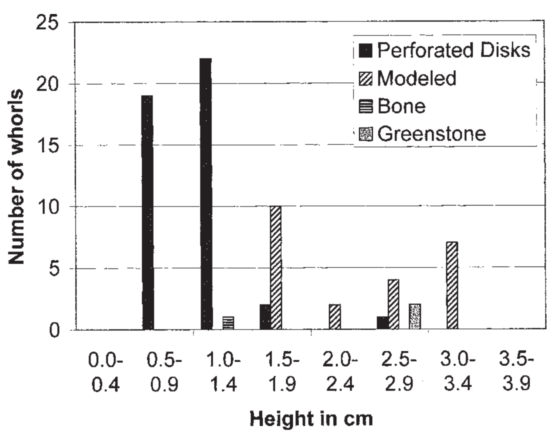

Figure 6. Graph of spindle whorl heights.

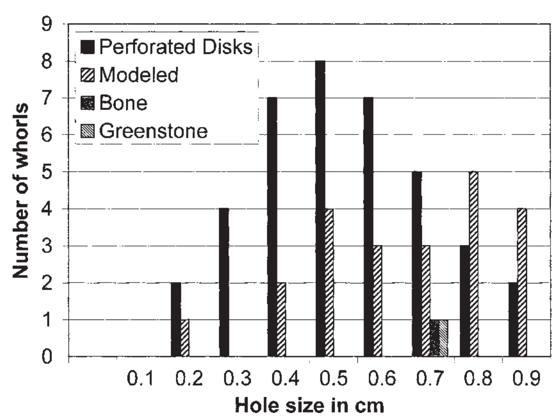

Figure 9. Graph of spindle whorl hole sizes.

Table 2. Spindle whorl typology

Type	Diameter	Height	Shape ratio	Hole Size	Weight
A	2.9–3.6 cm	4–7 mm	.17–.19	6–8 mm	5–7 g
B1	2.1–2.8 cm	7–11 mm	.28–.43	4–6 mm	4–7 g
B2	2.2–2.9 cm	7–12 mm	.29–.48	4–6 mm	4–8 g
B3	2.8–2.9 cm	8–11 mm	.32–.43	7–8 mm	6–8 g
C	2.3–2.5 cm	12–17 mm	.50–.87	2–4 mm	5–10 g
D1	3.0–3.7 cm	8–11 mm	.21–.33	7–9 mm	8–11 g
D2	3.0–3.5 cm	7–11 mm	.24–.33	4–6 mm	7–10 g
D3	3.9–5.3 cm	8–11 mm	.16–.28	6–9 mm	10–13 g
E1	2.8–3.1 cm	10–14 mm	.33–.40	4–5 mm	5–8 g
E2	2.8–3.2 cm	10–13 mm	.32–.43	3–6 mm	5–10 g
E3	2.8–3.4 cm	11–13 mm	.30–.46	7–8 mm	5–9 g
F1	3.0–3.5 cm	10–16 mm	.35–.47	4–6 mm	10–15 g
F2	3.2–4.3 cm	10–14 mm	.32–.43	7–9 mm	10–14 g
G	4.0–5.5 cm	12–22 mm	.24–.49	8–11 mm	20–40 g
H	4.2–6.0 cm	8–10 mm	.13–.19	7–9 mm	20–36 g
I	5.7–7.2 cm	12–20 mm	.19–.33	10–14 mm	50–69 g
J1	4.8–5.6 cm	19–22 mm	.35–.48	9–12 mm	40–59 g
J2	5.2–5.7 cm	22–26 mm	.37–.45	11–13 mm	60–79 g
J3	5.8–6.4 cm	24–28 mm	.32–.52	11–12 mm	80–106 g
K	2.9–5.0 cm	25–34 mm	.56–.81	5–8 mm	22–70 g

results in a disproportionate ratio of modeled to perforated sherd whorls, perhaps relating to the more regional database analyzed by Healy.

A rescue project at the Ometepe phase site of San Pedro Malacatoya, in the Granada district north of Santa Isabel, reports and illustrates six whorls from primary contexts such as burials and middens (Espinoza et al. 1999). Note that the name "Malacatoya" derives from the Nahuatl word "malacatl," which means spindle whorl. No descriptions were reported for the whorls, but in the publication they appear to include both reworked sherds and modeled whorls. Incising was the main decorative element. Designs included woven motifs and quadripartite patterns similar to patterns found at Santa Isabel.

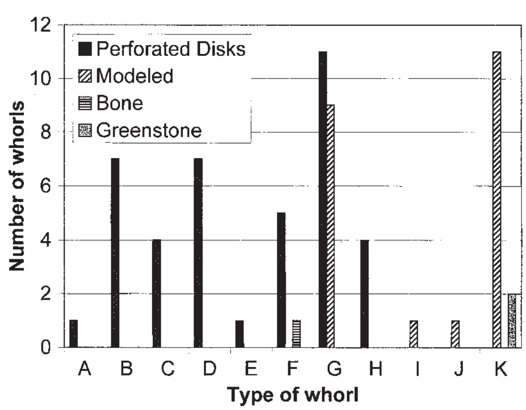

Figure 10. Graph of spindle whorl types.

Spindle whorls have also been reported from the site of Papagayo, located just over 50 km south of Santa Isabel in Costa Rica (Baudez et al. 1992:254–255). Two modeled whorls were found, one with incised decoration around the central hole. Perforated sherd discs were also found, although Claude-François Baudez et al. did not consider them whorls because of their irregular shape. Interestingly, one of the illustrated discs has the same "textile" motif on the polychrome surface as found on some of the incised whorls from Santa Isabel and on polychrome figurines, where it likely represents a costume element.

Spindle whorls have also been excavated in Cihuatan, El Salvador, an Early Postclassic site associated with the Pipil, a group of Nahua immigrants (Fowler 1989). Twenty-nine whorls were found, both mold-made and modeled, and with mold-impressed designs and black paint (Kelley 1988). No measurements were reported.

Twelve ceramic whorls were recovered from the Classic-period site of Joya de Ceren, El Salvador, which ranged from 2.2 cm to 3 cm in diameter, from 1.2 cm to 2 cm in height, from 8.5 g to 18.3 g in weight, and with a hole diameter from 5 mm to 10 mm (Beaudry-Corbett and McCafferty 2002). "From the average measurements the Ceren whorls can be described as being of very small diameter, very light weight, and high with a consistently large hole size" (Beaudry-Corbett and McCafferty 2002: 60). Marilyn Beaudry-Corbett and Sharisse McCafferty concluded that the Ceren whorls were consistent with cotton-spinning whorls, and, in fact, a cotton string was found attached to the skeleton of a duckling. A very lightweight whorl fabricated of coyol palm may indicate more specialized spinning, and a carbonized wooden spindle and bone needles rounded out the spinning-and-weaving tool kit. Carbonized remains of maguey plants suggest that maguey fiber may have also been available for spinning.

Since one of the hypotheses being tested in the Santa Isabel project relates to migration from central Mexico—and, specifically, the site of Cholula—a comparison with the Cholula whorls is appropriate. In comparison with Cholula spindle whorls, the Nicaraguan assemblage represents a far higher number of reworked sherd disks. Perforated sherds are occasionally present in Cholula assemblages, representing between 5% and 10% of all whorls. The great majority of whorls at Cholula are mold-made, with mold-impressed designs. This manufacturing technique is not found at Santa Isabel. The type K modeled whorls do not fit into any of the whorl types defined at Cholula, suggesting that a different material was being spun or that the thread was being used for a different purpose (such as fishing nets). These whorls correspond more closely to whorls from the Toluca area, known from the Codex Mendoza as an area that produced palma-fiber textiles for tribute (Berdan 1992:1:99–100). The incised designs appear on the flattened area of the Santa Isabel modeled whorls, the same design field used on the Toluca whorls.

BONE TOOLS

Exceptional conditions at Santa Isabel have preserved dozens of bone tools that cover a wide range of activities. This includes evidence for the manufacture of bone tools—for example, deer bones that were cut perpendicularly to produce tiny fish hooks (McCafferty 2008). One hundred bone objects are interpreted as tools for textile production, including needles, small and medium-size awls, picks, and battens (Table 3). Bone weaving tools were made of fish, mammal, and bird bone.

Needles are defined as having a small, cylindrical shaft that ranges from 2 mm to 6 mm in diameter (Figure 12). The complete needles ranged from 3.6 cm to 7.1 cm in length. Several included a complete eyelet. Small awls are defined as having a shaft diameter between 7 mm and 10 mm. Complete examples ranged from 5.7 cm to 8 cm in length, and none included an eyelet. Medium awls range in diameter from 1.1 mm to 1.6 mm. One complete example was recovered, which measured 9.4 cm in length. Needles and awls were highly polished and frequently heat-treated for added strength. Picks were generally flattened on one side and were used in weaving to lift the warp to create intricate patterns. They may also have been used as spacers for netted products. One pick measured 6.3 cm in length by 1.2 cm in width. Several fragments of bone battens were recovered. They are very flat and taper to a point. Although no complete battens were found, their sizes suggest that they were small and probably used to weave sashes or hair ribbons. Several fragments of greenstone battens were also found and were similar in size and form to the bone battens.

An unusual artifact class may be part of a composite tool, with a highly polished tip and a rectangular shaft (Figure 13). These artifacts have a uniform shape, but the distinctive polished tip looks like a tooth or claw. Evidence of a substance on the shaft may be remnants of glue, suggesting that the object was attached to a handle. We have tentatively identified these as another kind of awl, but until a better interpretation can be reached, this is simply called a composite tool.

A final tool type, designated a punch, was made out of the scapula of a midsize mammal. One end was sharpened to a point, and the thicker bone allowed for the application of force. Two were found, with the complete example measuring 9.1 cm in length and 3.3 cm in width. Other punches were made from deer antler tines.

Bone tools are rare in the archaeological record, and we have not found detailed descriptions from other sites in Central America. In their ethnoarchaeological study of the Maya, Brian Hayden and Aubrey Cannon (1984) describe and illustrate some bone tools that may correspond to the medium awls, and they identify them

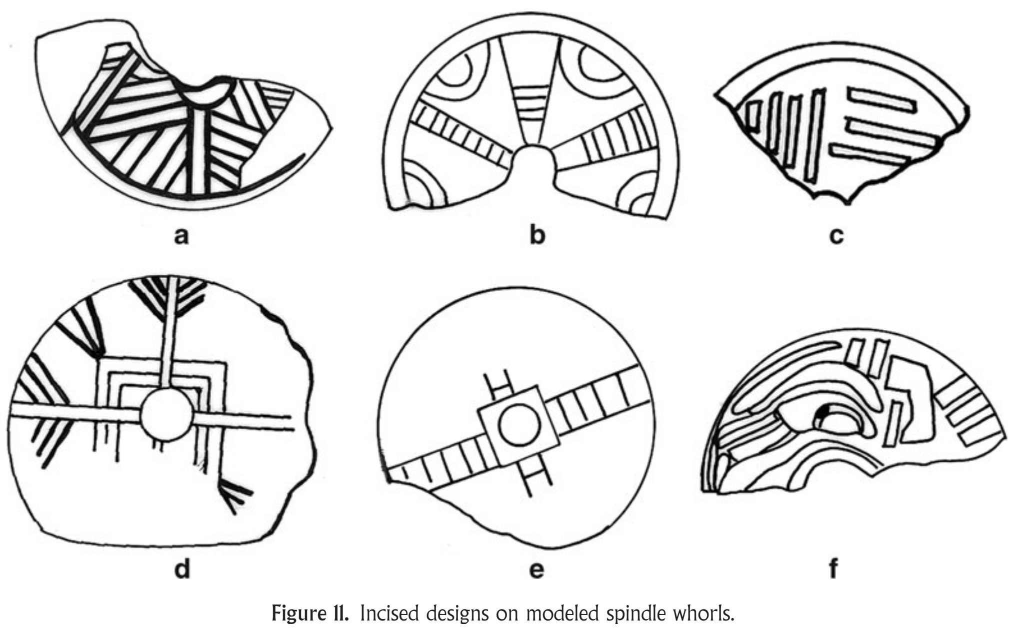

Figure 11. Incised designs on modeled spindle whorls.

Table 3. Santa Isabel bone weaving tools

Object #	Provenience	Length	Width	Material	Tool Type
00.1.136.151	N20 E30, L7			mammal	weaving pick fragment
00.1.195.148	N30 E10, L6				awl fragment
00.1.016.150	N10 E20			mammal	composite tool?
03.2.1158.12	S60 E51, L9			fish	weaving pick fragment
03.2.1158.14	S60 E51, L9			fish	needle fragment, broken at eye
03.2.1158.15	S60 E51, L9			fish	awl fragment
03.2.1206.1	S61 E40, L7			fish	needle fragment
03.2.1206.02	S61 E40, L7			fish	needle fragment
03.2.1124.9	S69 E60, L5			fish	needle fragment, broken at eye
03.2.1063.37	S70 E60, L4			fish	awl fragment, tip
03.2.1292.1	S70 E45, L3	7.2 cm	1.0 cm	fish	weaving pick (complete)
03.2.1292.2	S70 E45, L3			fish	needle fragment, tip
03.2.152.9	S60 E50				needle fragment, broken at eye
03.2.1562.1	S62 E51, L12	4.5 cm	0.4 cm	fish	needle fragment (mends with .2)
03.2.1562.2	S62 E51, L12	1.2 cm	0.4 cm	fish	needle fragment (mends with .1)
03.2.1260.4	S70 E65, L8			fish	needle fragment, tip
03.2.1290.24	S70 E45, L1			fish	needle fragment, tip
03.2.1202.2	S61 E40, L3			fish	weaving pick fragment
03.2.1292.2	S70 E45, L3			bird	needle fragment, tip
03.2.1158.15	S60 E59, L9			bird	awl fragment
03.2.1064.10	S70 E60, L10			mammal	awl fragment
03.2.1096.20	S60 E39, L7			mammal	needle fragment
03.2.1556.1	S62 E51, L7			mammal	needle fragment
03.2.1675.6	S70 E46			mammal	awl fragment
03.2.1204.7	S61 E40, L5			mammal	awl fragment
03.2.1124.16	S69 E60, L5			mammal	awl fragment (mends with .17)
03.2.1124.17	S69 E60, L5			mammal	awl fragment (mends with .16)
03.2.1125.7	S69 E60, L6	9.4 cm	1.2 cm	mammal	awl, polished tip
03.2.1186.2	S65 E65, L6			mammal	awl, polished tip
03.2.1259.7	S70 E65, L7			mammal	weaving pick, with flattened back
03.2.1295.11	S70 E45, L4			mammal	needle fragment
03.2.1210.1	S61 E40, L9			mammal	awl fragment
03.2.1555.11	S62 E51, L6			mammal	awl fragment
03.2.1097	S60 E39, L7			mammal	weaving pick, flattened back
03.2.1345.8	S59 E39, L6			mammal	weaving pick, flattened back
03.2.112	S20 E30, STP			mammal	weaving pick, flattened back
03.2.1273.8	S70 E61, L4			mammal	weaving batten, polished
03.2.1007.1	S60 E40, L7			mammal	awl
03.2.1701.45	S61/62 E52			mammal	awl, fire hardened
03.2.1233.14	S65 E64, L4			mammal	awl
03.2.1274.3	S70 E61, L5			greenstone	weaving batten
03.2.1348.1	S59 E39, L7			mammal	awl
03.2.1673.1	S70 E46, L4			mammal	needle, broken at hole
03.2.1202.1	S61 E40, L3			mammal	weaving pick
03.2.1209.11	S61 E40, L8			mammal	weaving pick
03.2.1038.17	S60 E50, L8			mammal	weaving pick
03.2.1423.13	S71 E45, L4			mammal	awl

Continued

Table 3. *Continued*

Object #	Provenience	Length	Width	Material	Tool Type
03.2.174.9	S65 E50, STP			mammal	awl
03.2.1262.4	S70 E65, L8				needle
03.2.711.2	S62 E52, floor			mammal	awl
03.2.1373.1	S71 E61, L4			mammal	needle with hole
03.2.1373.2	S71 E61, L4			mammal	awl
03.2.1637.21	S60 E52, L8				weaving pick
04.1.124.12	N21 E5, L4			fish	needle fragment
04.1.001.02	N20 E12, L1			fish	needle fragment, with eye
04.2.062.12	N20 E8, L2	4.7 cm	0.5 cm	fish	awl/punch, incised (complete)
04.1.025.02	N20 E5, L5	6.8 cm	0.9 cm	fish	needle, incised (complete)
04.2.062.13	S63 E51.5, L3			fish	needle fragment, tip
04.2.295.06	S72 E61, L9			fish	needle fragment, with eye
04.2.065.6	S63 E51.5, L6			fish	needle fragment, broken at eye
04.1.142	N21 E11, L2	4.9 cm	0.9 cm	fish	needle (complete)
04.2.422	S73 E67, L9			fish	needle with eye
04.4.562.17	S103 W120, L3/4			fish	needle tip
04.2.059.01	S72.5 E66, L8	6.4 cm	1.3 cm	fish	weaving pick (complete)
04.1.185.6	N21 E7, L5			fish	awl tip
04.4.259				mammal	needle, broken at eye
04.2.061	S63 E51.5, L2			mammal	needle fragment
04.1.204	N23 E3, L4			mammal	awl fragment
04.4.006	S0 E3, L6			mammal	needle fragment, broken at eye
04.2.062	S63 E51.5, L3			mammal	weaving pick fragment
04.2.063	S63 E51.5, L4			mammal	awl fragment
04.2.244	S71.5 E64, L4	6.3 cm	1.2 cm	mammal	weaving pick, flattened back
04.4.124	S2 E12, L4			mammal	weaving batten fragment
04.3.149.01	S39 W99, L5			mammal	awl fragment
04.2.273.5	S73 E68, L3			greenstone	Weaving batten fragment
04.1.157.1				mammal	awl fragment
04.4.506.7	S90 W120, L7			mammal	needle fragment
04.1.181.1	S3 E12, L1			mammal	awl fragment, tip
04.4.508	S90 W120, L9			mammal	needle fragment
04.1.025.7	N20 E5, L5	7.0 cm	0.8 cm	mammal	awl fragment (2 pieces)
04.4.207				mammal	awl fragment
04.1.224.1	N19 E12, L4	9.0 cm	0.8 cm	mammal	weaving pick (complete)
04.2.281	S72 E61, L4			greenstone	weaving batten fragment
04.1.001.1	N26 E12, L1	11.7 cm	1.5 cm	mammal	weaving pick (complete)
04.2.014.1	S72 E63/4, L4			mammal	weaving batten fragment
04.1.303	N19 E13, L3			mammal	weaving pick fragment
04.1.185	N21 E7, L5				awl fragment
04.1.192.01		3.9 cm	0.9 cm	fish	awl (complete)
04.1.344.01	N21 E10, L2	7.0 cm	2.1 cm	mammal	awl (complete)
04.5.108.07	S11 E10, L6/7			mammal	weaving batten fragment
04.5.108	S11 E10, L6/7			mammal	composite tool (?)
05.1.073.2	N21 E17, L4				awl fragment
05.7.024	N122 W90, STP			mammal	awl fragment, incised

Continued

Table 3. *Continued*

Object #	Provenience	Length	Width	Material	Tool Type
05.1.013.1	N21 E12, L4				awl fragment
05.1.016.01	N21 E12, L5			mammal	composite tool (?)
05.7.146.01				mammal	tapping punch (?)
05.7.108.2	N142 W123, L8			mammal	composite tool (?)
05.1.060.5	N21 E16, F17			mammal	composite tool (?)
05.1.038.6	N21 E13, L7			mammal	composite tool (?)
05.1.047	N21 E13, L10			mammal	composite tool (?)

as corn scrapers used to remove the kernels from the cob. If this association is correct, these may not be textile instruments at all. However, to date no evidence for maize has been found among the macro-botanical remains from Santa Isabel. More detailed research is needed to further evaluate the function of these artifacts.

DISCUSSION

The material culture of the Santa Isabel site includes a wide variety of artifact classes, including ceramic spindle whorls and bone tools. In part due to the exceptional preservation at the site, bone tools form a potentially important resource rarely found in pre-Columbian sites.

When plotted spatially, interesting patterns emerge. The 73 spindle whorls found were relatively evenly distributed among all site loci (Figure 14), proportional to the amount of excavated area. Further, 17 of the whorls were found in shovel test pits, and six were surface finds, so nearly one-third of the whorls came from outside the excavation areas. Locus 2 at Mound 6 had the greatest number of whorls but was also the site of the most intense excavation. Mound 3 (Locus 1) had the second-highest quantity and the second-highest amount of excavation. Similarly, there was no great distinction between areas with perforated disk whorls and modeled whorls, indicating no evidence for functional specialization in spinning technique or the quality of thread produced based on this distinction. Nine of 13 type K whorls were found at Locus 2, with the remainder at Locus 1, so some degree of specialization may exist if the type K whorls were used for a distinctive fiber type.

In contrast, bone tools were heavily localized, with Mound 6 (Locus 2) having the highest concentration of tools (Figure 15). It had 22 of 28 needles (79%), 24 of 37 awls (65%), 75% of all picks, and 100% of the battens. Mound 6 was clearly the center for textile production, while all mound areas participated in thread production.

In contrast, five of the seven composite tools (71%) were found at Mound 3 (Locus 1), while another was found in association with the adult burial of a possible lapidary from Mound 5. The dissimilarity in distribution pattern suggests that these composite tools were not part of the textile production tool kit and may have been used for some other specialized production.

Whorl types B, D, G, and K were the most common. Type B likely would have been used in supported spinning of short staple fibers such as cotton to produce thin, tightly spun thread, perhaps for warp threads or fishing nets. Type D would produce a softer and more loosely spun thread of short staple length such as cotton or feathers. While feathers do not spin well by themselves, when blended with cotton they produce a soft and brightly colored thread (McCafferty and McCafferty 2000). Type G whorls are the most versatile of whorl types, useful for either drop or supported spinning, to produce a variety of twist qualities. The newly defined type K whorls do not correspond well to whorl types associated with spinning maguey, since they are lighter than maguey whorls from central Mexico (Nichols et al. 2000; Parsons 1972). The possible association with whorl types from Toluca, perhaps used for yucca, is intriguing, but since yucca is a highland, arid-environment plant, it is probably not useful for identification of the fiber material. The morphological characteristics of type K whorls are suited for drop spinning of long stable fibers, so these whorls perhaps were used for a species of agave or a similar plant.

An unusual group of artifacts found at Santa Isabel are greenstone whorls and battens. The whorls correspond to functional types G and K, and polish on the battens may indicate use wear. However, the exotic material of these objects, including the additional labor needed to produce them, suggests that they may have been valuable objects, perhaps indicative of an elevated social status ascribed to spinners and weavers. While clear evidence of spinning and weaving as gendered activities has not been established for Postclassic Nicaragua, following a Mesoamerican model, it is likely that women were the primary producers of textiles (McCafferty and McCafferty 1991). If these greenstone tools do indicate high status, this would correspond to ethnohistorical accounts that women held high social position among the Chorotega (Werner 2000). Greenstone weaving battens are known from Costa Rica (Lange 1993:283–284, Figure 21.17a, b), including some with incised decoration reminiscent of the carved bone battens from Monte Alban's Tomb 7 (McCafferty and McCafferty 1994).

While the analysis of the material culture from the Santa Isabel project is ongoing, the rich material record that has been recovered is providing some of the most detailed information yet found for domestic life in the Greater Nicoya area and, particularly, Nicaragua (McCafferty 2008). In addition, we now have an opportunity to discuss Nicaraguan textile production at Santa Isabel and put it into a context for comparison with other sites in Central America and Mesoamerica.

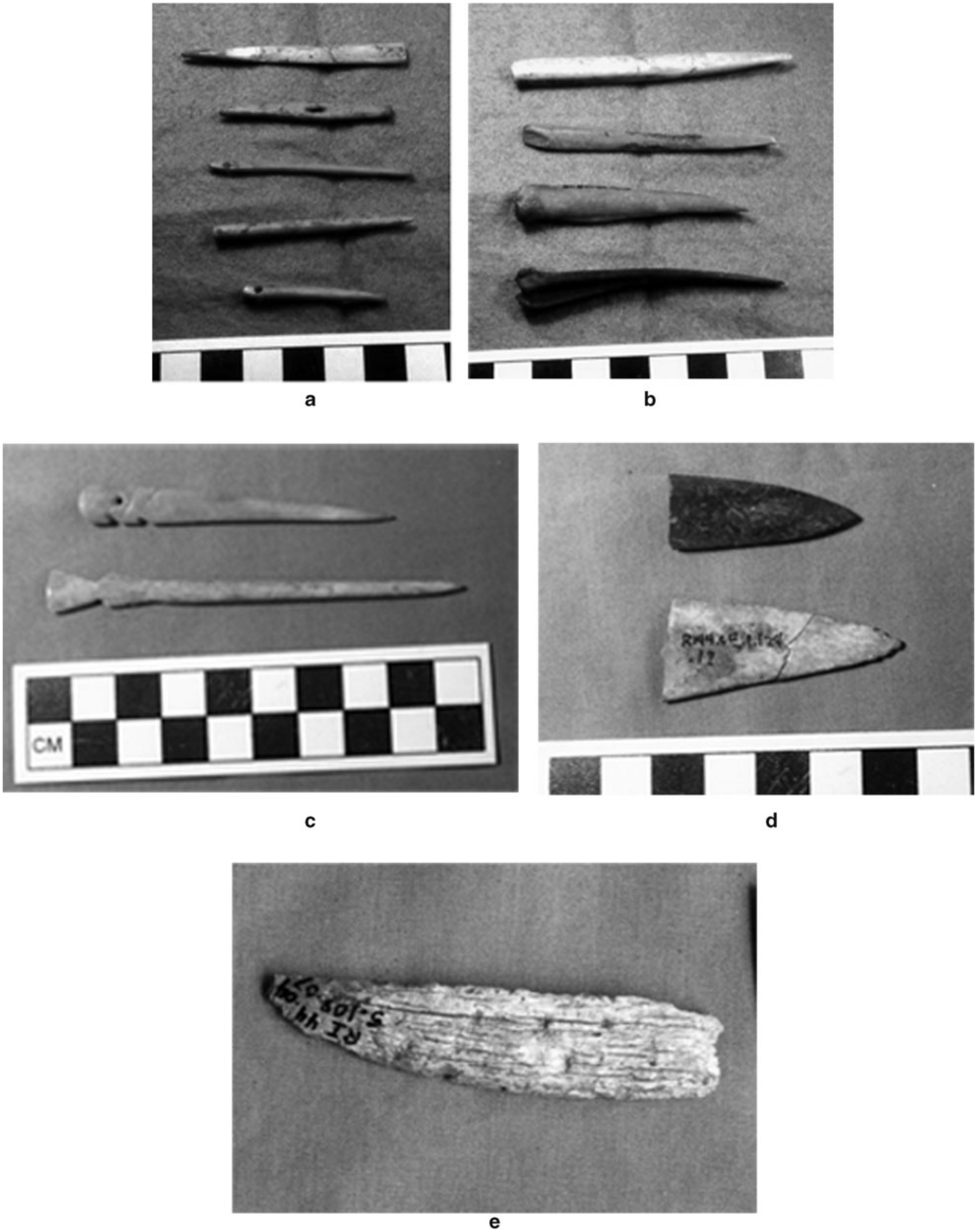

Figure 12. Bone weaving tools.

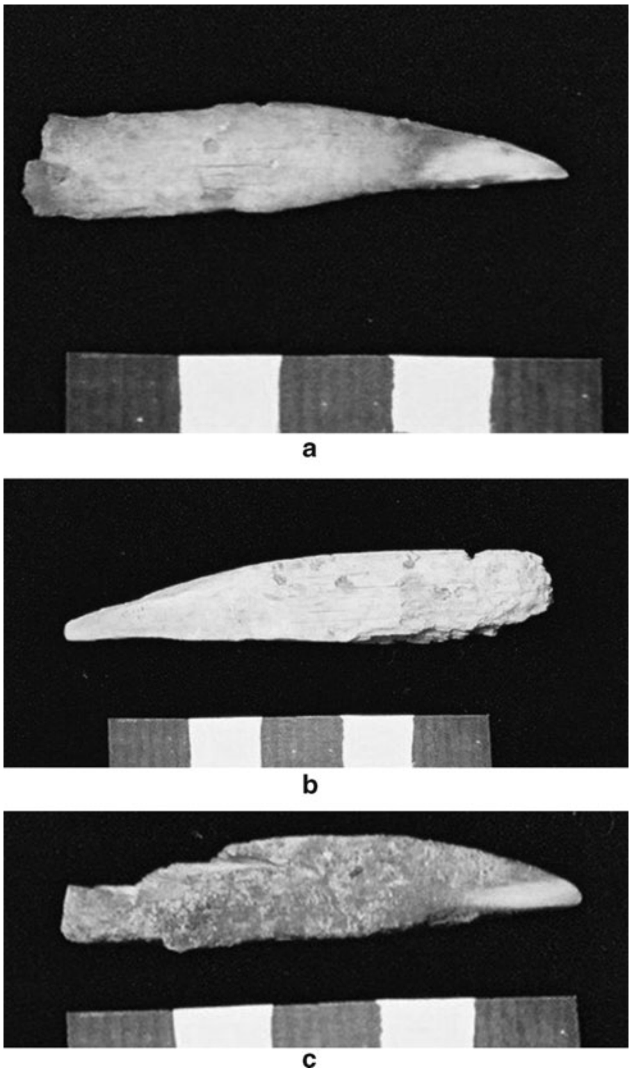

Figure 13. Composite tools.

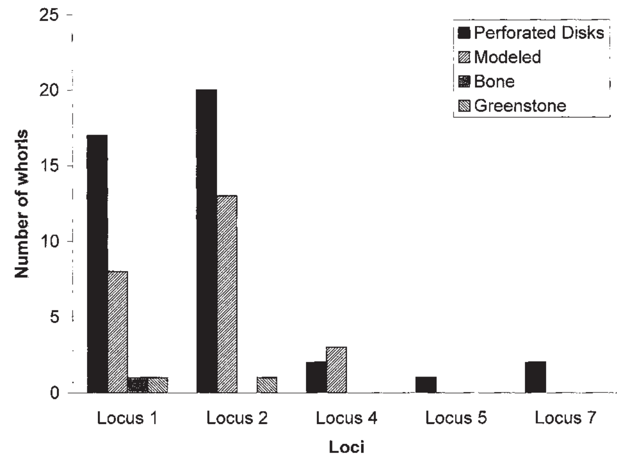

Figure 14. Distribution of spindle whorls by locus.

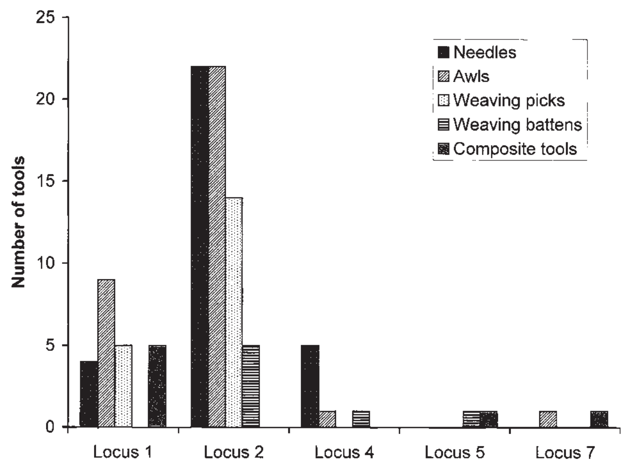

Figure 15. Distribution of bone tools by locus.

RESUMEN

La vestimenta es una de las formas más importantes de la cultura material en contextos etnográficos. Sin embargo debido a su limitada preservación, los restos arqueológicos de tela son escasos en la mayoría de sitios explorados. De manera recurrente, los artefactos asociados a la producción textil encontrados en contextos arqueológicos incluyen malacates para hilar y utensilios de hueso tallado. Este artículo presenta los resultados del análisis de material en una muestra de malacates y utensilios de hueso del periodo postclásico temprano del sitio de Santa Isabel en Nicaragua. Las fuentes etnohistóricas identifican varios grupos culturales mesoamericanos en la región durante este periodo. El grupo lingüístico otomangue, llamado también chorotega, es probablemente el grupo cultural que ocupó el sitio de Santa Isabel, Nicaragua. Los textiles probablemente fueron hechos de algodón, entre otras fibras vegetales. Además de la producción textil para vestimenta, consideramos la posibilidad de la fabricación de hamacas y redes para pescar.

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