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OR WORKS?

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## SHELL MOUNDS IN THE SOUTHEAST: MIDDENS, MONUMENTS, TEMPLE MOUNDS, RINGS, OR WORKS?

William H. Marquardt

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*Focusing on the southeastern United States, I provide some alternative perspectives on shell mounds previously interpreted as architectural features, temple mounds, and feasting sites. The same pattern of deposition often inferred to indicate mound construction—darker-colored, highly organic strata alternating with lighter-colored, shell-rich strata—can be accounted for by domestic midden accumulation and disposal of refuse away from living areas. Observed abundances of particular shell species can result from local or regional ecological conditions. Site complexes interpreted as architectural may have evolved largely in response to short-term climate changes. Shell rings on the Georgia and South Carolina coasts probably functioned to conserve and store unconfined water. To understand ancient shell mounds, we need a sediment-oriented approach to the study of mound deposits and more attention to the environmental contexts in which shell mounds accumulated.*

*Este estudio se enfoca en el sudeste de los Estados Unidos, impartiendo nuevas perspectivas sobre montículos de conchas situados en esa región que previamente han sido interpretados como características arquitectónicas, montículos-templos, y sitios para banquetes ceremoniales. Una pauta característica de deposición que se ha usado frecuentemente para deducir la construcción de un montículo—estratos de color oscuro con abundante materia orgánica alternando con estratos más claros con gran abundancia de conchas—se puede explicar como producto de la acumulación de desechos domésticos y la eliminación de otros desechos lejos de las áreas de residencia. La preponderancia que se ha notado de especies particulares de conchas puede ser producto de condiciones ecológicas locales o regionales. Los complejos de yacimientos que se han interpretado como formas arquitectónicas podrían haber evolucionado en reacción a cambios climáticos a corto plazo. Los montículos de conchas en forma de anillos situados en las costas de Georgia y Carolina del Sur probablemente funcionaron para conservar y guardar agua. Para comprender estos antiguos montículos de conchas, se requiere un acercamiento al estudio de sus depósitos que se enfoque en los sedimentos, y una mayor atención a los contextos ambientales en que dichos montículos se acumularon.*

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A shell mound is a sediment that is attributable at least in part to the action of humans and that contains at least some mollusk shells. By *sediment*, I mean the term as it is used by geologists and geoarchaeologists, that is, “particulate matter that has been transported by some process from one location to another” (Stein 2001:6). To characterize a sediment, one needs to know the origin of its contents, the agent of transport, the environment of its deposition, and its post-depositional alteration (Stein 2001:10).

Among the shell mounds of Kentucky, Tennessee, Alabama, Mississippi, South Carolina, Georgia, and Florida, variously called “shell middens,” “shell mounds,” “shell heaps,” “shell rings,” and “shell works,” there is great diversity. This is equally true of shell mounds in other parts of the

world, where archaeologists are applying innovative techniques and approaching their sites from many different scales and research designs.

Recently, in part because of increased interest in the emergence of complexity among fisher-gatherer-hunter societies and in part because of the realization that certain shell and earthen mounds in the southeastern United States are considerably older than previously thought, archaeologists have proposed functional interpretations for mounds—such as feasting, monumentality, burial ceremonialism, and identity signaling—and some have argued that sociopolitical systems would have had to be complex to plan and coordinate such constructions (e.g., Gibson and Carr 2004).

The large earthen mounds of the Middle Archaic and Late Archaic as well as many of the shell rings

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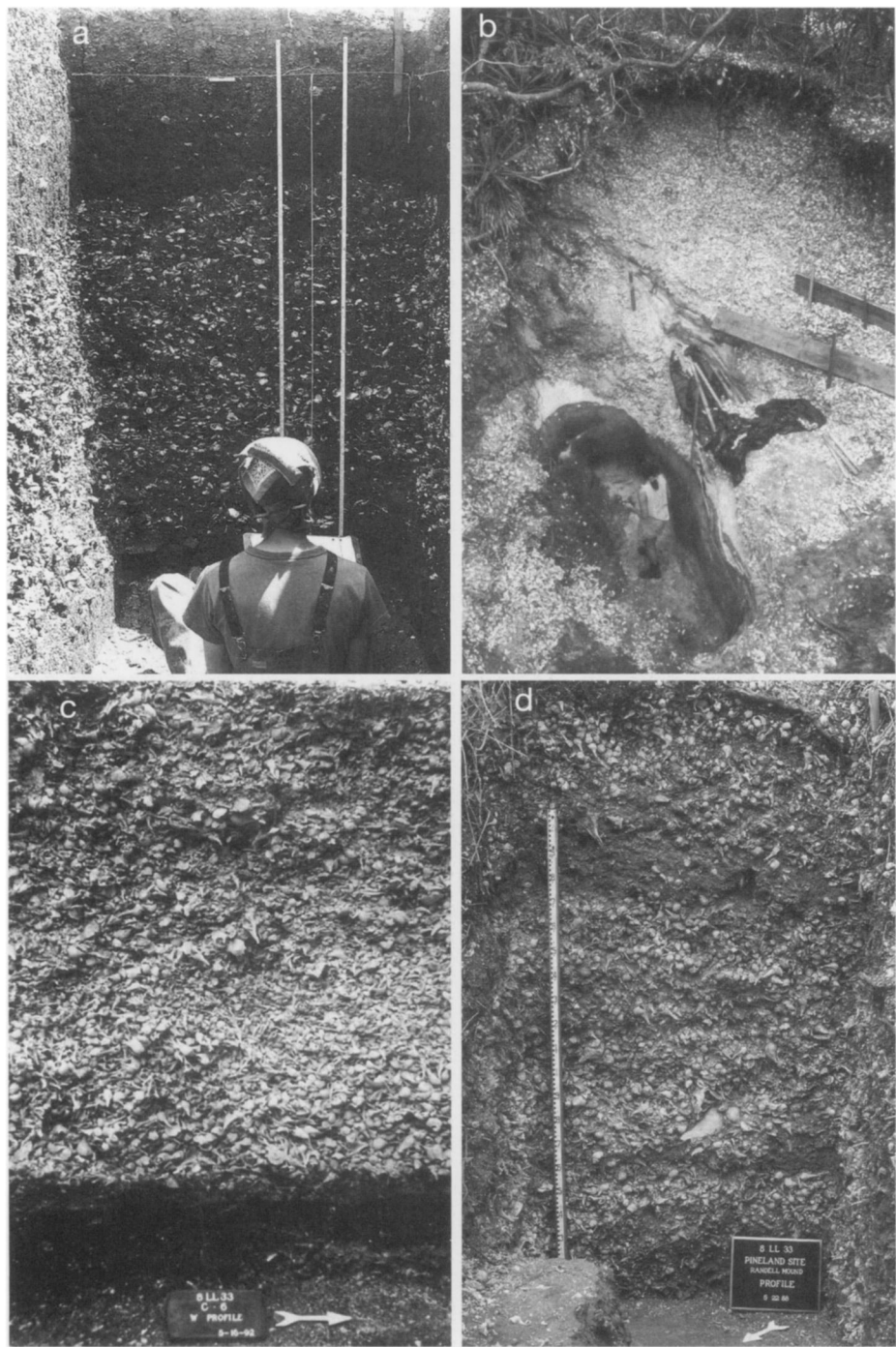
Figure 1. Locations of sites mentioned in this paper. Illustration by Sue Ellen Hunter.

and shell-mound complexes of the Archaic and more recent periods have been referred to as “monuments” or examples of “monumental architecture” by a number of scholars (e.g., Anderson 2004; Russo 2004, 2006; Sassaman and Heckenberger 2004). In the most general sense, a monument is an object established “to keep alive the memory of a person or event” (e.g., McKechnie 1983:1166). In archaeological usage, the main defining feature of monumental architecture is “that its scale and elaboration exceed the requirements of any practical functions that [it] is intended to perform” (Trigger 1990:119).

These various studies are stimulating and interesting, but I have become troubled by inconsistent use of terminology for describing shell mounds, and by the logic of their functional interpretation. If two scholars can observe the same stratification and

interpret it in two distinct ways, then they have different *a priori* assumptions or they have different perceptions of the data they are observing and of what they signify. These are matters of *epistemology*—how we apprehend the observable world and achieve certainty about what we have perceived; in other words, “how we know, and how we know we know” (Watson et al. 1971:3).

In this paper, I restrict my comments to shell mounds, as defined above. Figure 1 shows the locations of the sites mentioned. A wide variety of sites in the Southeast can be called shell mounds. In Figure 2a, which shows a portion of the Carlston Annis shell mound in western Kentucky (15BT5), note that the amount of freshwater mussel shell varies from place to place, and disappears altogether in the layer just below the plow zone. Although the percentage of shell by volume varies from 1 to 88



**Figure 2.** A variety of shell mound sediments: (a) Carlston Annis Shell Mound, 15BT5, western Kentucky, Operation E, east profile, showing mussel-shell-bearing midden overlain by shell-free midden; profile is being drawn by Linda Gorski; (b) Horr's Island, 8CR208, southwest Florida, Trench 19 extension, facing west, showing midden composed predominantly of oyster shells that accumulated on top of Pleistocene-age dune sand; (c) Pineland Site Complex, 8LL33, Brown's Complex, Excavation Unit C-6, west profile, showing midden composed predominantly of marine snails overlying dark, highly organic sandy sediment; (d) Pineland Site Complex, 8LL33, Randell Complex Mound 1, Excavation Unit A-1 profile, facing south; shells are mostly of marine snails.

percent, on average this mound is 17 percent mollusk shell, 15 percent sandstone, 39 percent air, 6 percent water, and 23 percent matrix (dirt) (Stein 2005:127). Sites such as Carlston Annis and Indian Knoll (15OH2) contain subsistence remains; multiple human and dog burials; and artifacts of stone, bone, and shell but although they are type sites for the familiar "Shell Mound Archaic," they are not composed predominantly of shell, nor is shell the main constituent of any of the so-called shell mounds of western Kentucky (Marquardt and Watson 2005:631–632).

Some shell mounds have far higher concentrations of shell, or at least parts of those sites do. In Figure 2b, a Southwest Florida coastal shell mound on Horr's Island (8CR208) is shown during initial testing. Here the sediment is composed predominantly of oyster shells. In Figure 2c, from Southwest Florida's Pineland Site Complex (8LL33), a discrete layer of mollusk shells, in this case mostly of small marine snails, appears in dramatic contrast to a sandier, darker, less shelly stratum beneath it. Finally, in Figure 2d from another shell mound at Pineland, dense layers of shell with little sand alternate with darker, sandier sediments with fewer shells.

In the broadest sense, all four sets of sediments are "shell mounds": accumulations of particulate matter that contain at least some shell. But when do shell mounds qualify as monuments? As ceremonial sites? As temple mounds? As indicative of feasting behavior? What makes a shell mound a "shell work" or a "shell ring"? I argue that much depends on the initial assumptions of the analyst and on her or his calculus of verification.

### Critique

*When are shell mounds "middens," and how can we tell if they are "constructed," as opposed to accumulated?*

Many shell mounds are middens, if by midden we mean an accumulation of debris.<sup>1</sup> In such cases, the shells are the discarded remains of mollusks that have been consumed by people. They are thrown out along with unwanted animal parts, uneaten plant remains and byproducts, wood charcoal and ashes from cooking fires, stones, broken tools and pottery, and other detritus.

Within coastal Florida shell-mound sites, often within the same mound, some deposits contain a relatively high density of animal (mostly fish) bones, charcoal, ash, etc., while others are composed mainly of shell. In interpreting similarly distinctive shell-mound sediments, some archaeologists interpret the darker-colored, highly organic layers to be evidence of living surfaces or activity areas (i.e., habitation middens), and the lighter-colored sediments having high densities of shell to be evidence of mound-building (e.g., Russo 2004:61–62; Sassaman 2003; Thompson 2007:100). In other words, sparser shells in darker sediments are evidence of living areas and discard, whereas high concentrations of shells in lighter-colored sediments are evidence of mound construction.

Archaeologists who interpret shell-dense layers as the results of feasting cite as evidence the shape of the accumulation (circular or semicircular) and the character of the sediment ("piles of shell containing little to moderate amounts of soil"; Russo 2004:36, 40). For example, Russo writes that "if shell is deposited quickly, as opposed to the gradual accumulation of daily meals discarded underfoot, relatively less evidence should be found of crushing, wind-borne sand, surface fires, artifacts, fauna drawn to exposed shell (e.g., land snails), and other sub-aerial indicators of human or natural activity" (2004:53). In other words, we will expect to find "unconsolidated strata of shell ... having little to moderate amounts of soil ... and with little or no evidence of hearths, pits, crushing, or other human activities aside from garbage disposal" (Russo 2004:43).

Russo's scenario is plausible, but human behavior other than feasting can account for the accumulation of unconsolidated strata of shell. Ethnographic data (summarized by May 2005) suggest wide variation in how shellfish and other detritus are processed, including everything from disposal next to dwelling areas (e.g., Andamanese, Bororo, Nootka, Yahgan) to systematic deposit of refuse away from living areas (e.g., Anbarra, Maori, Tlinkit). The Anbarra build a fire on discarded shells, let it burn down, then place fresh shellfish on top of the hot shells and cover them with vegetation. This simple earth oven can prepare ample shellfish for a large group gathering (Meehan 1982:89). However, the Anbarra also accumulate shell-rich middens by sweeping habitation areas

several times a month and depositing the detritus away from their living areas (Gould 1980:221–223; Meehan 1982:114–116). Both patterns of behavior would result in the deposit of shell-rich sediments.

Another possible explanation for the accumulation of prodigious amounts of bivalve shells that does not involve feasting is exemplified by the Pomo of coastal northern California. The Pomo collect mussels in the summer months, steam them, skewer the meat on seaweed or grapevine, sun dry them, and then trade the mussel meat to interior groups. The Nootka of the North American northwest coast also preserve boiled or roasted mussels by smoking them on skewers, then trading the meat or consuming it later. The Yuki live on northern California coastal middens half the year and spend half the year in the interior, to which they transport large quantities of dried mussels. It is observed that their accumulated coastal middens contain little other than discarded valves. Archaeologically, this might be interpreted as “clean” or “unconsolidated” shell (see May 2005:73–79 for further discussion and references).

I suggest that a pattern of light-colored, shell-dense, unconsolidated layers alternating with darker-colored, more organic, more consolidated, less shell-dense layers can be manifested from frequent deposition of garbage if that garbage is deposited away from the active living area. Sediments subsequently encountered by an archaeologist can have become “clean” shell, or “loose” shell, or “unconsolidated” shell, as archaeologists often describe these deposits, without having been deposited ceremoniously or intended as monuments. In the case of Southwest Florida shell mounds, we often find that deposits containing many shells alternate vertically with darker, sandier deposits with few shells or mostly crushed shells, more artifacts, and more evidence of posts, pits, and fires. For example, for the Southwest Florida Vanderbilt site (8CH12), Bullen and Bullen write that “relatively clean shell zones” represent “a rapid accumulation of shells discarded from a nearby living area” (1956:8). In Schiffer’s (1972:161–162) terms, such deposition would represent “secondary refuse.” The following sequence of processes could account for such an accumulation of distinctive, alternating sediments (see Figure 3):

1. Shellfish remains, fish remains, plant remains,

and uneaten cooking residues are deposited as secondary refuse in a dump area away from the living area.

2. Any fresh (uncooked) meat is quickly carried away by sea birds and opportunistic and scavenging mammals, such as raccoons (see Wing and Quitmyer 1992 for a quantified illustration of this phenomenon). Uncooked meat that begins to rot may be claimed by carrion-eating birds. Land snails that feed on detritus may visit the midden, and rodents may carry away small pieces of edible organic matter that have been broken down to manageable size. Any remaining fresh and cooked food remains are then attacked by insects and bacteria, further erasing visible indications of the diverse dietary remains that were first dumped. In South Florida coastal settings, rain and warm temperatures further contribute to the process of breaking down soft organic materials by animals and plants.

3. After a period of time, what is left are the hardest materials: the mollusk shells, the densest bones, the hardest charred wood and seeds, and the occasional broken piece of pottery or stone that was discarded in the dump. Any uneaten foods, especially those that were not fully cooked, have long since disappeared. There may be some ash and charcoal scattered among the discarded shells, but there is little in the way of sand among these shells and other dense particles other than sand tracked to the dumping area by humans or animals or transported to the dump by erosion. There may also be supplementary organic matter from feces excreted by animals that walked through or flew over the dump, but this too will be broken down, scattered in the wind, eroded away, or dissolved into the shell matrix. (See Figure 3.)

4. Later, people may decide to relocate from one village to another or from one part of a village to another. The former dump would offer a well-drained, elevated location for their new living area, and they may construct a house. They may process and cook food, dry their nets, and perform various other domestic activities, and they may discard materials on top of the old dump. To the archaeologist who later excavates the area, the resulting habitation sediment looks very different from the subadjacent old-dump sediment. The habitation-derived sediment contains more sand and less shell, is more darkly stained, is higher in carbon, phosphorus, and nitrogen, and may contain evidence of

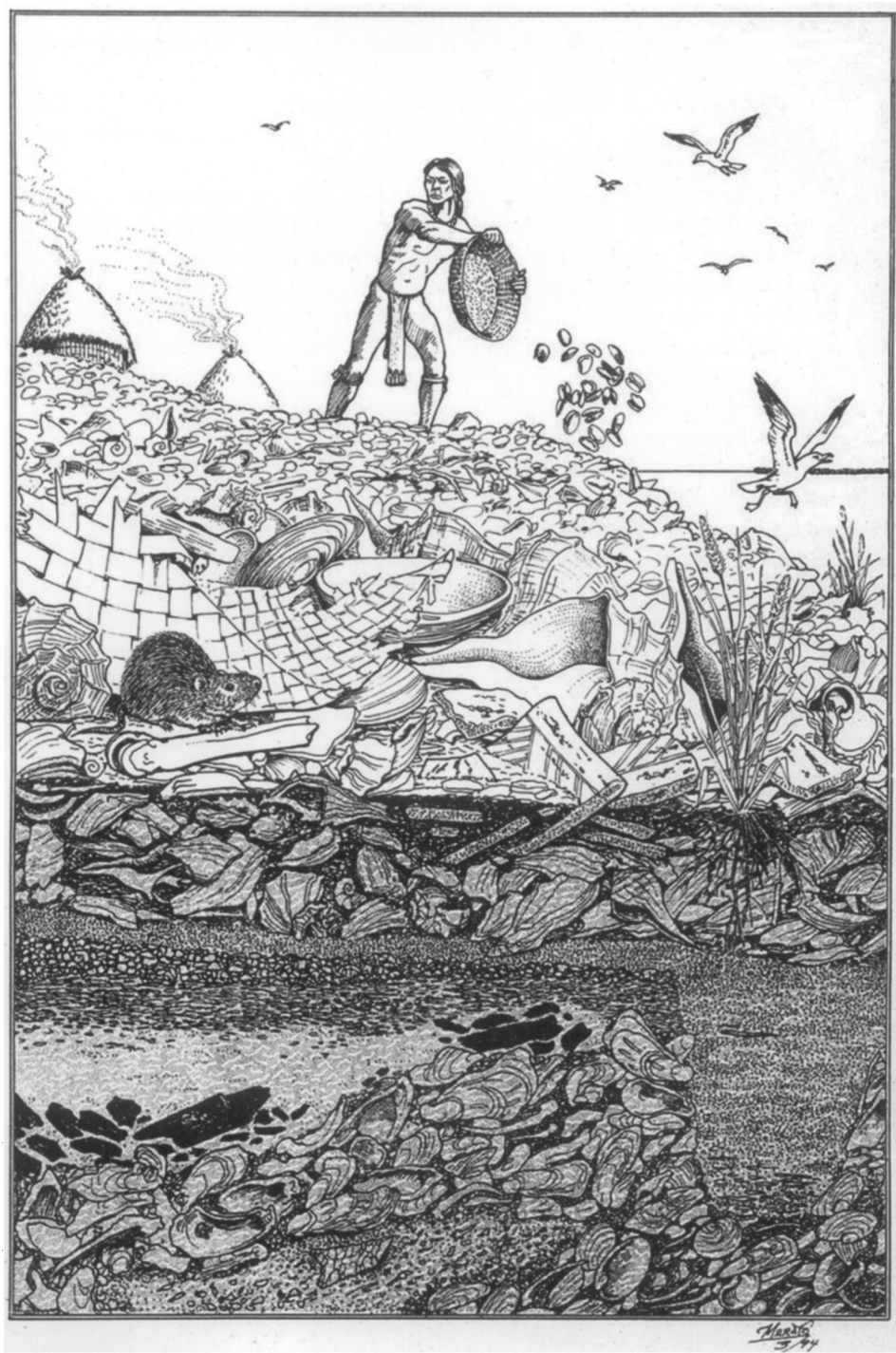
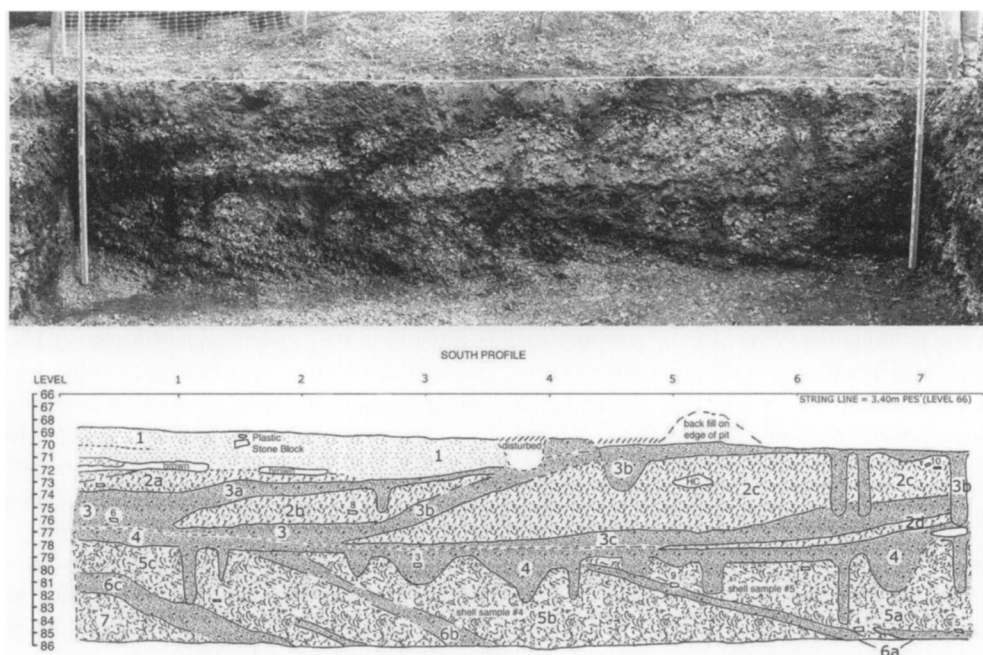


Figure 3. Artist's conception: discard of shells and other refuse in a southwest Florida village. Drawing by Merald Clark.





**Figure 4.** Pineland Site Complex, 8LL33, southwest Florida, Brown's Complex Mound 4, septic drainfield salvage, south profile. Pictured profile is about 7.5 m (horizontal)  $\times$  1.8 m (vertical).

fires, tool making, and domestic facilities, such as posts for net-drying racks and smoking racks. Some food debris may also be deposited in these living areas, but most of the shells and other food remains are carried away on a regular basis to a nearby dump.

This would be my proposed interpretation of the stratification of Brown's Complex Mound 4 at Pineland, exposed in 2006 because of the unfortunate machine excavation for a septic drainfield on private property (see Figure 4). Note the alternating strata containing more shell and less shell. While some of my colleagues might interpret this stratification as evidence of mound-building or feasting, I see it as evidence of long-term domestic use by a coastal fisher-gatherer-hunter society. In this particular case, artifacts in context were few because of the excavation of the large pit using heavy equipment, but artifacts from several time periods salvaged from backdirt confirm radiocarbon dates from the profiles, and together show that the layers accumulated over an appreciable period of time, about seven hundred to eight hundred years (Marquardt and Walker 2008).

Archaeologists sometimes refer to "clean shells" as evidence of purposeful mound construction

episodes. For example, in stratigraphic cross-sections from the Harris Creek site (8VO24) in north-central Florida, we see references to "clean shell" and "clean, small snail" (Aten 1999:140, 142). In this context, "clean" means "shell with little or no clastic or organic sediment matrix" (Aten 1999:143). Randall and Sassaman follow this same convention, referring to "capping" the Hontoon Dead Creek Mound (8VO214) with "whole, clean shell" (2005:101). Russo (2004:43) also refers to clean shell, loose shell, or unconsolidated shell in describing shell-ring sediments.

In my opinion, interpretation of so-called "clean shell" as evidence of purposeful mound construction is *unsubstantiated* unless it can be clearly demonstrated that the shell-rich sediments are not middens. I am not challenging the interpretation of purposeful accumulation; i.e., I believe that people intended to pile up their shells and other debris. What I am questioning is the notion that dense accumulations of shell are invariably evidence of purposeful mound construction, not evidence of purposeful discard behavior.

The photo shown in Figure 2c is from the Pineland Site Complex, specifically from Opera-



tion C in the Brown's Mound Complex, located between Mounds 1 and 2. Contrasts in these sediments are dramatic and highly visible. Very dark, organic, sandy sediment with post molds underlies a massive stratum composed predominantly of relatively small, unconsolidated marine snail shells.

Again, some archaeologists would interpret the lower, dark sediment as a midden or living area over which purposeful mound-building subsequently took place. Instead, I interpret the upper, shell-rich sediment as a midden. Why? Let us consider the shelly layer as a *sediment*, and inquire about (1) the origin of the materials, (2) how they got there, (3) how long the sediment took to accumulate, (4) what the environmental conditions of deposition were, and (5) what happened to the materials after they were deposited.

First, the shells are from Pine Island Sound, the vast shallow estuarine system on which the Pineland Site Complex is located. On the basis of an analyzed fine-screened 50 × 50 × 10 cm sample (deFrance and Walker 2010), there are in fact 34 different taxa of mollusks represented in the shelly sediment, 11 of which can be assumed to have been food sources. But most of the volume of the sample comprises small marine snail shells. Of the 3,100 mollusks (minimum number of individuals, or MNI) that were identified, 934 are (mostly juvenile) crown conchs (*Melongena corona*). There are also appreciable numbers (MNI) of lightning whelks (*Busycon sinistrum*, 649), pearwhelks (*Busycotypus spiratus*, 379), eastern oysters (*Crassostrea virginica*, 194), ribbed mussels (*Geukensia demissa*, 175), and tulip shells (*Fasciolaria* sp., 126).

Second, they got there because people collected them alive and brought them there and deposited their shells in that place. But there are more than just shells, there are also bones. Sixteen taxa of fish are represented in the sample, as well as one each of turtle, bird, and rodent. Generalizing from the sample, and in spite of the outward appearance of "clean shell," Walker projects that the 4 m<sup>3</sup> of shelly sediment we excavated contained the remains of 6,880 fish (Walker and Marquardt 2010).

So, there are many shells, but there are also many fish bones, and even some pottery. If "clean shell" is "shell with little or no clastic or organic sediment matrix" (Aten 1999:143), then the sediment in Operation C is clean shell, but it is primarily

a dump of food remains, and all of the shellfish and fish represented are of taxa common in nearby Pine Island Sound.

Third, calibrated radiocarbon dates suggest that the shelly sediment accumulated between A.D. 630 and 780, during what we locally call the Caloosahatchee IIA period. Highly similar sediments across the site complex, and in fact within a number of other shell-mound sites in the Pine Island Sound region, also date to this same time interval. Such similarity in shell species and sediment characteristics occurring in many places at one time begs for an explanation. Were people suddenly afflicted with a desire to collect literally millions of small marine snail shells to build their midden-mounds up higher? Were they seized with such a need for self-aggrandizement that they threw big parties with small snails? Before we get carried away with visions of monumentality, complexification, or ceremonialism, let us ask ourselves what was going on climatically during the Caloosahatchee IIA period, and how does that differ from the period that immediately preceded it, the latter part of the Caloosahatchee I period. So, fourth, what were the environmental conditions of deposition?

Caloosahatchee IIA (A.D. 500–800) coincides with the cool Vandal Minimum climatic episode and a known sea-level regression (in Southwest Florida called the Buck Key Low; see Table 1). At a finer scale, the period is punctuated by three abrupt regressions, each more severe than the last (Tanner 1991, 2000; Walker 2010). Zooarchaeological samples from throughout Charlotte Harbor and Pine Island Sound point to changes in species abundance and a lowered salinity probably associated with the lower sea level (Walker 1992:279–289).

There is also a regionwide increase in the opportunistic, wide-ranging crown conch. Adult crown conchs thrive when they are able to prey on weakened oyster populations. Being sessile, oysters are unable to respond quickly to lowering sea levels, making them vulnerable to the mobile crown conchs and lightning whelks. Pine Island Sound is only 30–120 cm deep even today, so given a sea-level regression of .5 m or more during the Caloosahatchee IIA period, we should not be surprised to see evidence of stress on a human population that depends on netting fish and gathering shellfish. When the sea level fell, the fish simply moved out

Table 1. Climate Episodes, Sea-level Episodes, and Cultural Chronologies for South Florida and the Greater Southeast, ca. A.D. 1-1700.

Time	Global Climatic Episode	Southwest Florida Sea Level	Glades Area of South Florida	Southwest Florida	Greater Southeastern United States
A.D. 1650-1700			Glades IIIc		
A.D. 1600-1650			A.D. 1600-1750	Caloosahatchee V	Protohistoric
A.D. 1550-1600				A.D. 1500-1750	
A.D. 1500-1550	Little Ice Age	Sanibel II Low	Glades IIIb		
A.D. 1450-1500	A.D. 1200-1700	A.D. 1200-1850	A.D. 1400-1600		Late Mississippian
A.D. 1400-1450				Caloosahatchee IV	A.D. 1400-1500
A.D. 1350-1400				A.D. 1350-1500	
A.D. 1300-1350			Glades IIIa		Middle Mississippian
A.D. 1250-1300			A.D. 1200-1400	Caloosahatchee III	A.D. 1200-1400
A.D. 1200-1250				A.D. 1200-1350	
A.D. 1150-1200			Glades IIc		
A.D. 1100-1150			A.D. 1100-1200		Early Mississippian
A.D. 1050-1100	Medieval Warm Period	La Costa High			A.D. 1000-1200
A.D. 1000-1050	A.D. 850-1200	A.D. 850-1200	Glades IIb	Caloosahatchee IIB	
A.D. 950-1000			A.D. 900-1100	A.D. 800-1200	
A.D. 900-950					
A.D. 850-900					
A.D. 800-850			Glades IIa		
A.D. 750-800			A.D. 750-900		Late Woodland
A.D. 700-750				Caloosahatchee IIA-late	A.D. 500-1000
A.D. 650-700	Vandal Minimum	Buck Key Low	Glades I-late	A.D. 650-800	
A.D. 600-650	A.D. 500-850	A.D. 500-850	A.D. 500-750		
A.D. 550-600				Caloosahatchee IIA-early	
A.D. 500-550				A.D. 500-650	
A.D. 450-500					
A.D. 400-450					
A.D. 350-400					
A.D. 300-350					
A.D. 250-300	Roman Warm Period	Wulfert High	Glades I-early	Caloosahatchee I	Middle Woodland
A.D. 200-250	350 B.C.-A.D. 500	100 B.C.-A.D. 500	A.D. 1-500	500 B.C.-A.D. 500	100 B.C.-A.D. 500
A.D. 150-200					
A.D. 100-150					
A.D. 50-100					
A.D. 1-50					

to deeper waters, while the immobile oyster populations were exposed, weakened, and preyed on by opportunistic whelks and conchs, whose populations exploded from A.D. 500 to 800. Juvenile crown conchs do not prey on oysters, but grow to maturity in shallow sea-grass flats such as those adjacent to the Pineland Site Complex (see Walker 1992:285-289, 2000:122-123 for discussion and references). In short, compared to late Caloosahatchee I deposits at Pineland, we see smaller and less diverse fish in the IIA sediment and a great abundance of small, carnivorous conchs and whelks, not because people went out and got "clean shell" to build up their mounds higher but because fish resources became scarce and small conchs and

whelks became highly abundant. In short, the shelly sediment is midden, not monument.

Although there are compelling reasons to interpret the described sediments at Pineland as midden sediments, not constructed mounds, I do not dispute that the people meant to pile up the shells where they did. But I do not see any evidence for purposeful or ceremonial mound-building, given parsimonious and empirically supported explanations that suggest a local source for the shells, a food-waste character of the deposit, an appreciable time period during which the shells were deposited, and environmental factors that account for the ready availability of shellfish and scarcity of fish. I have similar concerns about interpretations

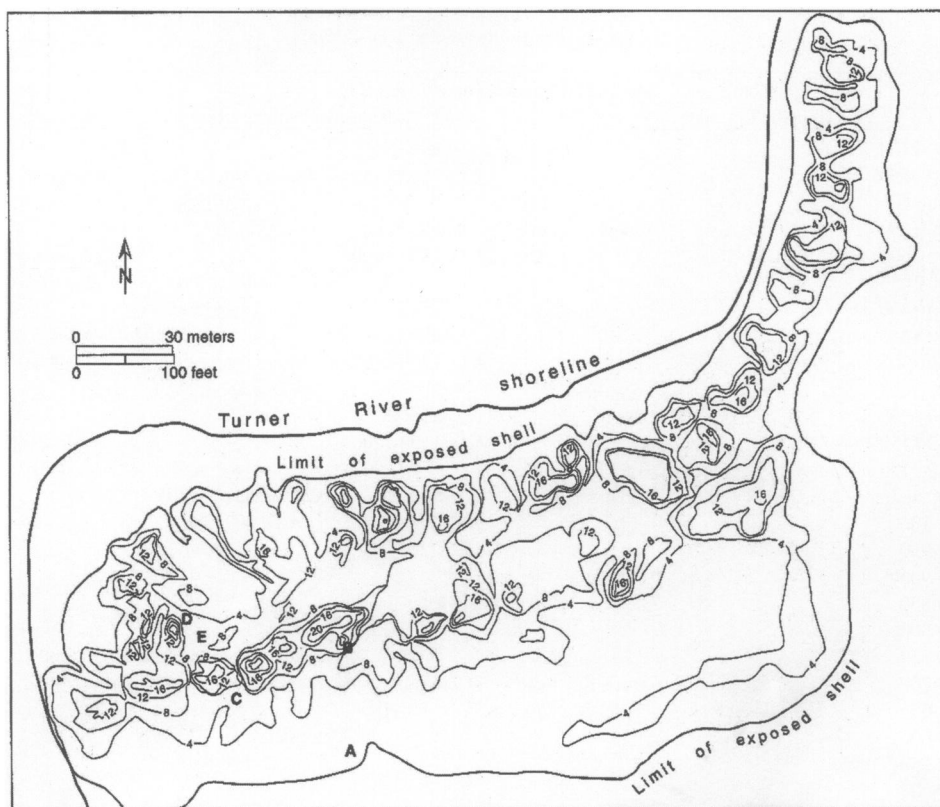


Figure 5. Turner River Mounds, 8CR2, southwest Florida. Contour map after Sears (1956:48–49) and Griffin (2002:255), contours in ft.

of dense shell sediments as evidence of feasting. I do not deny that feasting may have occurred at times, nor do I claim that the presence of materials other than shell rules out interpretation of sediments as construction fill. But in the absence of evidence, I question the inference that so-called “dense,” “clean,” “loose,” or “unconsolidated” shell sediments *necessarily* indicate feasting or monument-building.

#### *When Are Shell Mounds Shell Works?*

The term *shell work* is used in South Florida in a sense analogous to “earthwork”; it connotes purposeful mounding, deposition, or redeposition of shell-bearing sediments to form preconceived shapes. By contrast, shell middens are accumulated marine shell not thought to be arranged elaborately. In the National Park Service classification, a shell work is defined as “marine shells in complex arrangements of mounds, ridges, and flat areas” (Griffin 2002:274–275; Taylor

1985:12–20). Sites fitting this description are found mainly in the coastal zones of Charlotte Harbor-Pine Island Sound and in the Ten Thousand Islands to the south of that region, and they date to ca. 2000–500 B.P.

One example of a shell work site is the Turner River site complex (8CR2), shown here as Figure 5. Located near the mouth of Turner River, the site was first described by Hrdlička in 1922, later mapped and tested by Sears (1956), and visited again in 1984 by Taylor (1985) and his colleagues. It consists of 19 shell mounds 5 to 6 m high, predominantly composed of oyster shells. Inland from these shell mounds is a series of 12 or more mounds 2–3 m high, said to be composed mostly of dark earth, with a higher artifact content than that of the shoreline oyster shell mounds. Sears’s Test B in one of these mounds exposed mostly small oyster shells, but his tests D and E revealed 35 to 45 cm of black midden with sparse shells and relatively high counts of pottery, bone, and charcoal.

The Turner River site complex was occupied from Glades I-late through Glades IIa, or ca. A.D. 500–900, coinciding with the Vandal Minimum climatic episode, a cool and relatively dry time associated with a lowered sea level (see Table 1). One explanation might be that the shoreline oyster-shell mounds are the result of feasting or purposeful monument-building. However, one should not rule out a more mundane and practical explanation: the pattern may be the result of repeated occupation by family groups who dumped their oyster shells at the shoreline and lived some 40–50 m away from the shoreline. This would account for the lower, dark-earth, relatively shell-free middens and the higher, “clean-shell” oyster mounds without involving ceremonial, political, or social-complexity explanations. Keeping the oyster-shell dumps separate from the living area would achieve at least three practical results: people would not have to endure the stench and flies that would be attracted to the garbage dumps; they would be more protected from diseases that might be borne by birds, insects, and other animals; and the high oyster mounds would provide a buffer against flooding.

Finally, the climatic context of the deposition of these sediments ca. A.D. 500–900 is precisely the time of the relatively cool and dry Vandal Minimum that brought lower sea levels and river levels to coastal South Florida. An observation of William Sears is of interest. He describes “apparent growth [of the settlement] ... toward the water, with some indications of not only water-edge, but over-water habitation” (1956:59). He states further that “the indications of growth toward the water ... are perhaps not too surprising in view of the environment and ecology of the area, including the rather obvious fact that the sea provided the bulk of the food.”

Sears’s insightful comments were made without the benefit of today’s more detailed knowledge of climate changes and sea-level fluctuations that affected South Florida coastal sites. We now know that sea level erratically decreased from A.D. 550 to 850 (Stapor et al. 1991; Tanner 2000; Walker et al. 1995). The decline in water level during this period may have fostered a movement of the settlement “toward the water” in the sense that the residents did so to maintain the same distance from the water’s edge that had proved practically appropriate and culturally acceptable to them. As sea level plunged to its lowest point around A.D. 850

(see Tanner 2000:93), the Turner River site may have been abandoned completely because of deteriorating oyster and fish resources.

This is speculative on my part, but it is a testable hypothesis. If true, then one would expect a progression of more and more recent radiocarbon dates toward the north (toward the shoreline), and if the oyster populations were in decline by ca. A.D. 800, one would expect to see increased evidence for predation on the oysters and a dramatic increase in numbers of marine snails such as crown conchs, which thrive when oyster populations are stressed. This pattern was observed by Griffin (2002:37–38) at Onion Key (8MO49) and Turkey Hammock (8MO82), located in the Florida Everglades. Griffin interpreted his data as evidence for a fall in sea level.

Some so-called shell work sites are large and complex. For example, the 24-ha Russell Key site complex (8CR17) includes mounds, ridges, plazas, canals, and courts. Its radiating, protruding, symmetrical shell-midden finger-ridges are dated by Schwadron (2010) to 1400–940 B.P. (A.D. 550–1010), which falls mainly within the Vandal Minimum climate episode (ca. A.D. 500–850), a cooler and drier time associated with a locally significant sea-level regression (Marquardt and Walker 2009; Tanner 2000; Walker 2000, 2010; Walker et al. 1995). At Russell Key, there are no less than six individual water courts: low, flat, level areas surrounded by berms of shell-midden deposits. Schwadron has documented that the berms and water courts are contemporaneous. They date from A.D. 550 to 900, precisely within the Vandal Minimum. During a low-water interval, hydrostatic pressure would decrease and water flow from artesian springs would diminish. I speculate that the courts may have been deepened during a time of lowered water table to serve as water-retention features, with the removed sediments being heaped up as surrounding berms.

In sum, shell works are extensive complexes of mounds, ridges, and flat “courts” that have forms and features somewhat similar to one another. Schwadron has begun an ambitious and impressive investigation of shell mound complexes in South Florida that will surely shed light on these interpretive issues. As do many others, Schwadron unequivocally views shell works as indicators of “monumentality, ceremonialism, and perhaps

sacred places and landscapes" (2010). I agree that there are political, economic, social, and military reasons for high places and for the patterning of individual settlements, but there can also be mundane, practical reasons.

Functional interpretations of shell works based solely on inference are less than convincing. We cannot know the formational history of the various topographic features of such site complexes by observing their outward appearances. As Milner reminds us, "the complex form of a complete site does not necessarily mean that its various parts—mounds, buildings, and the like—were carefully, consistently, and unerringly positioned in accord with a fixed plan that originated with the first occupants of a particular spot" (2004:306).

*When Are Shell Mounds "Temple Mounds," or "Platform Mounds"?*

So far, I have alluded to interpretations of shell mounds that include purposeful construction and coordinated labor. Some scholars attribute the term *temple mound* to certain shell mounds. To take one example from the southwest coast of Florida, Widmer writes that "temple mounds appear by A.D. 500 in large villages directly on the estuarine fringe. By A.D. 800, temple mounds are found at all large village sites in this area. Mounds are constructed of sand and/or marine shell, with many formed from marine shell washed up after storms or hurricanes" (2002:389–390).

In more than 25 years of working in coastal southwest Florida, I have yet to observe a mound in any large village site dating to the A.D. 800 time horizon that I would unequivocally interpret as a temple mound. There are dedicated burial mounds after A.D. 1000, but they are made up almost entirely of sand, their only shell inclusions being fragmented or perforated whelk-shell dippers.

In support of the temple interpretation, Widmer (1996:24) cites post molds on the summit of Mound C at the Key Marco site (8CR48), a "truncated pyramidal" shape, and a covering of pen shell fragments. In the absence of additional information, however, one cannot rule out a residential function for these structures. After all, ethnohistoric accounts tell us that the historic-period Calusa lived in structures on top of hills (Hann 1991:288) or in large communal structures (Hann 1991:168), and that the leader's house could comfortably hold 2,000

people (Solís de Merás 1964:145). Widmer's post molds need not necessarily indicate a temple.

I know of no shell mounds that are formed predominantly from shells washed up after storms. It is true that remains of shellfish and echinoids from littoral zones are sometimes found in middens, and in extraordinary circumstances these middens contain surf clams, sea urchins, and other intertidal-zone animals that may be derived from unusually severe storm episodes. Widmer writes that the slopes of Mound C at Key Marco "were covered by a veneer of nacreous pen shells that would make the mound sparkle in sunlight" (1996:24, see also 2002:391). Pen shells (*Atrina* sp.) are indeed found on local beaches after storms, but they are also a food source. The adductor muscle of a pen shell is large, tender, and delicious when eaten fresh; it tastes much like a scallop.

Widmer found eight articulated shark vertebrae, which he infers to mean that a mound "served as a platform for a temple and/or chiefly residence" (2002:391). Shark remains are found throughout the shell middens of Southwest Florida. Several kinds of sharks served as sources of food, medicine, and raw materials for tool manufacture from at least the Middle Archaic period to the contact period (see Kozuch 1993; Milanich et al. 1984:281–287; Quitmyer and Massaro 1999). Shark meat, however big a piece, does not imply political or religious domination.

For Mound A of the Key Marco site, Widmer (1996:20–21) interprets field-observed (i.e., unanalyzed) levels of distinctive shellfish as construction episodes, two that contain surf clams (*Spisula solidissima*) and pen shells and a third that contains large lightning whelks. The levels he investigated date to the Glades I-late and Glades IIa periods (A.D. 500–900). Again, both the high-salinity, surf-dwelling surf clams and pen shells are edible and can be collected, and their shells are often deposited on beaches during Gulf storms. The waters near the Key Marco site are more saline than those in Pine Island Sound, so it is not unreasonable to expect more reliance at Key Marco on shellfish tolerant of higher salinity. As for large lightning whelks, deposits are not uncommon in Southwest Florida middens of various time periods, and these probably represent opportunistic collecting of gravid females in season. These whelks were valued as food, and shells of particularly robust ones were

made into a wide variety of useful tools and containers (Marquardt 1992:192–211).

In short, I am dubious about the evidence for platform or temple-mound construction in Southwest Florida ca. A.D. 500–900. Until more convincing evidence is presented, I prefer to think that the faunal remains represent discarded byproducts of food consumption. Convincing evidence for temple mounds or constructed platform mounds might include radiocarbon-dates confirming deposition of older on top of younger midden material (what Luer [2007:40] calls “tertiary refuse”), or identifiable remains of structures on the tops of mounds within which special ritual items can be identified. Without such supplementary evidence, there is no compelling reason to interpret flat-topped surfaces as anything but habitation mounds.

#### *Why Are Some Shell Mounds Ring-Shaped (Circular or Semicircular)?*

For over a century, archaeologists have pondered the phenomenon of “shell rings”: circular, C-shaped, or U-shaped shell mounds found in wetland settings primarily along the coasts of South Carolina, Georgia, and Florida during the period ca. cal 5000–3500 B.P. The term *ring* is something of a misnomer because very few that have been mapped approach a perfect circular shape (Russo 2006:E–17). Common to all the rings is a curvilinear shell-bearing sediment that surrounds an area of little or no shell; the interior is often called a “plaza” (Russo 2006:E–17). The closed end of the ring generally contains the highest volume and elevation of shell-bearing deposits (Russo 2006:E–23).

Although it has long been recognized that the rings are typically composed of occupational debris—oyster shells, fish bones, broken pottery, ashes, charcoal, and the like—the quasi-circular or semicircular shapes have led some archaeologists to infer a ceremonial function (Waring and Larson 1968:273). Russo (2002:85) calls them “ceremonial villages,” and writes (2006:E–24) that their primary use seems to have been as monuments. Others (e.g., Trinkley 1985) interpret them as the accumulated middens left by egalitarian people who lived in circular or arc-shaped settlements. Saunders (2002:85) sees no contradiction, arguing that the rings served both habitation and ceremonial purposes.

There is much variation among sites called shell rings. Those of South Florida are large and either curvilinear or U-shaped, those of northeast Florida are circular to horseshoe-shaped, and those of the Georgia and South Carolina coasts are smaller and either circular or C-shaped (Russo 2006:E–9). In preparing a National Historic Landmark thematic study, Russo (2006) brings together older and more recent literature, radiocarbon dates, and topographic maps for 33 shell ring sites, providing the most systematic study yet of the shell ring phenomenon. In Russo’s (2004:41) view, many if not all of the rings are evidence of public feasting rituals, that is, overt displays of consumption that served to affirm social relations. Russo (2002:87, 2004:36–43; Russo and Heide 2003:42–43) combines aspects of Grøn’s (1991) social space model with Hayden’s (2001) prestige technology model to argue that shell rings are the results of public feasting that served as a social bonding mechanism. A testable implication of Russo’s ceremonial shell-ring hypothesis is that shells, high-status resources, and special artifacts would be expected with more frequency at places predicted to be the location of leaders (Russo 2002:86–88, 2004:49). Such confirming information has not been found, but few shell rings have been tested systematically, much less extensively excavated. In Hayden’s definition, feasting is “any sharing between two or more people of special foods (i.e., foods not generally served as daily meals) in a meal for a special purpose or occasion” (2001:28). Russo (2004:45) acknowledges that oysters, no matter how many are consumed at a gathering, cannot be considered anything but daily food, but suggests that other foods—perhaps deer meat—may prove to be indicative of status differentiation with additional excavations at shell rings.

The timing of the shell rings is significant in that they are phenomena of the Mid-Holocene Cool Period, ca. 5000–3500 B.P. and thus associated with low sea levels (Marquardt 2010; see Tanner 1993). This means that they were not in intertidal zones during the time of their occupations. Contrary to Russo, I do not believe that shell rings are principally feasting locales. Instead, their distinct forms result from human interaction with local hydrology and topography, and have much to do with resolving the dilemma of living near reliable estuarine and marine resources while guaranteeing

access to adequate freshwater in times of dry climate.

The stratification within coastal shell rings strongly suggests a domestic midden interpretation. At a shell ring (9LI231) on St. Catherines Island, Georgia, the strata alternate between relatively shell-dense layers and dark, sandy layers (Sanger and Thomas 2010). This nearly circular ring measures 70 m in diameter and .25 to 1.0 m high, with a central shell-free "plaza" 34 m across. The ring is composed of varying concentrations of domestic refuse, and includes oyster and other shells; animal and plant remains; fiber-tempered pottery; stone, bone, and shell tools and fragments; and baked clay objects. The ring, like many others, is rich in domestic features. The center contains few artifacts but there is evidence of large circular "pits." The intermediate zones have little or no evidence of human activity.

On St. Simons Island, Georgia, less than 50 km south of St. Catherines, the Cannon's Point (9GN57) shell ring was occupied year-round by people who net-fished, gathered, and hunted. The inhabitants exploited diverse aquatic habitats and deposited shell-bearing middens, oyster comprising the vast majority of the shellfish remains. In addition to oyster shells, the ring middens contained fiber-tempered pottery, some lithic, bone, and antler artifacts, animal and plant remains, and a few human bones. The centers of the rings revealed very sparse cultural materials and no features (Marrinan 2010). As with the St. Catherines Island ring, there is ample evidence for domestic accumulation and discard by fisher-gatherer-hunters, which probably accumulated in a fashion similar to the process I describe earlier in this paper (Figure 3).

In my view, shell rings such as those on St. Catherines and St. Simons islands are not monuments or the residues of extravagant feasting but, instead, domestic middens that owe their temporal placement to a distinct episode of sea-level regression within the Middle Holocene period, and their spatial placement to the need for freshwater during a cool and dry climatic episode. It is true that the middens (especially the ones on the Georgia and South Carolina coasts) are circular or semicircular in shape, and this fact requires explanation. Recent interpretations attribute to the circles either ideological significance or political aggrandizement

through competitive feasting (Russo 2004; Sanger 2010; Sanger and Thomas 2010; Sassaman 2004:261–262; Schwadron 2010). I do not deny that shell rings were formed intentionally, nor that people lived on them, but I suggest an alternative, practical reason for their shape and topographic placement.

If the Archaic ring middens were occupied only during times of relatively low sea level, then the ring interiors may have functioned to confine groundwater and rainwater. Times of low sea level are typically associated with relatively cool and dry conditions. The Late Archaic coastal inhabitants had plentiful food sources in nearby aquatic habitats, but could not have lived long without a dependable supply of freshwater. The St. Catherines ring is situated on a freshwater creek and the Cannon's Point ring on a high marsh, but in times of exceptionally dry conditions, their flows would have been curtailed, and a reliable auxiliary supply of freshwater would have been essential.

In the interior of the St. Catherines Island shell ring, Sanger and Thomas "uncovered 49 features inside the interior plaza, ... 36 of which are large, circular 'pits' with straight walls and flat bottoms" (2010). They note that these pits seem too large to be the remains of posts. I suggest that the pit features with straight walls and flat bottoms may be the remains of wells dug when water supplies were exceptionally low. The ring-midden deposits surrounding the interior "plaza" result from people carrying out their daily activities and depositing their garbage away from where they collected their water. The interior is, thus, not a plaza or an arena but a water tank built to capture and store unconfined freshwater.

I first proposed the water-capture hypothesis in a paper published by the American Museum of Natural History (Marquardt 2010). Subsequently, through the courtesy of Michael Russo, I was made aware of the work of Douglas Middaugh (2009), who had independently tested this very same idea on the Sewee Shell Ring (38CH45) in South Carolina. Today, the ring is partially filled in by fine to coarse sandy sediments and frequently inundated by tidewater, but it would have been high and dry during the Mid-Holocene Cool Period, ca. 5000–3500 B.P., when sea level was at least .8 m and as much as 3.0 m lower than today's. It consists of about 2,900 m<sup>3</sup> of mollusk shells (primar-



ily oyster) and other materials (Russo and Heide 2003). Like other South Carolina rings, the internal “plaza” has a general absence of refuse and only a sparse concentration of shell. It is estimated that during the time of its occupation and use, the Sewee ring would have been about 1 m high. Today it measures about 75 m in outside diameter, with a central “plaza” approximately 25 to 31 m in diameter (Middaugh 2009).

Middaugh carefully mapped the remaining structures, including three distinct berms and a slough shell structure. He then set two baselines designed to bisect the features. R-R' bisected the central “plaza” and middle and upper weirs, while S-S' bisected the slough shell structure and adjacent slough. Along these baselines he collected data on surface and subsurface water heights. He also monitored rainfall, and measured its effect on groundwater elevations and salinity.

The reader is directed to Middaugh's (2009) paper for details, but the main conclusions are as follows:

1. There are significant positive correlations between surface and subsurface water heights and land elevations.

2. Increases in unconfined groundwater heights and decreases in salinity within the Sewee Shell Ring were correlated with prior-week rainfall amounts.

3. Previous to the accumulation of the present-day sediment, the Lower Weir and the interior of the ring could have retained water up to 1 m deep.

4. There is a stepwise salinity gradient along baseline R-R' associated with the upper and lower weirs, indicating that the weirs could have functioned in the past to dam and/or filter freshwater.

5. The Sewee slough shell structure, which bounds the southwest side of the main ring, is contiguous with the upper weir, suggesting a human-constructed dike or dam feature designed to control the flow of unconfined coastal freshwater.

6. In spite of being partially filled in with sediment since its abandonment more than 3,000 years ago and in spite of a rise in sea level that has brought saltwater to its doorstep, the Sewee Shell Ring functions even today to accumulate potable freshwater with salinities low enough to sustain humans.<sup>2</sup>

7. The center of the Sewee ring contained sand but almost no shell or other materials. This is very similar to the situation at other investigated ring

sites in South Carolina (Fig Island, Chester Field, Small and Large Ford shell rings on Hilton Head, Lighthouse Point, Stratton Place), Georgia (on Sapelo Island, St. Catherines Island, and St. Simons Island), and Northeast Florida (Guana).

8. The Sewee ring is situated adjacent to a freshwater stream that flows into the slough. Similar topographical and hydrological conditions can be observed at the nearby Auld shell ring. Freshwater springs or sloughs are also found in proximity to the Chester Field, Kempfer Place, Sapelo, Cannon's Point, St. Catherines, and Guana rings, suggesting that the rings were located to maximize access both to freshwater from the interior and marine food resources from the estuarine and littoral zones.

Russo observes that “all shell rings were originally placed on dry land adjacent to marshes, but not in the marshes themselves” (2006:E-59). Although shell rings such as Sewee and others on the Georgia and South Carolina coasts are situated near freshwater sources today, their occupation is restricted to ca. 5000–3500 B.P., a time of low sea level and cool, dry climate when access to potable water would have been at a premium. The fact that shells of ring sediments are predominantly oyster indicates that freshwater and saltwater intersected and mixed nearby because oysters are estuarine animals. In my view, Middle Archaic people understood enough ecology to settle near ample food resources and freshwater, and enough hydrology to create circular and C-shaped shell-bearing ridges that functioned to constrain freshwater and make it accessible to the community's inhabitants.

The rings themselves were composed of midden material, that is, detritus from daily food consumption and other day-to-day activities, and the interiors of the rings were kept clean because they functioned as communal water storage areas. Judging from pits excavated by Archaic people within the interior of the St. Catherines Island shell ring, sometimes the central tanks within the shell rings must have gone dry, necessitating digging down to reach the water table. In times of plentiful water flow, freshwater probably stood within the rings' interiors.

In sum, the Georgia rings, South Carolina rings, and perhaps some of the northern Florida rings probably functioned to accumulate and store freshwater. I am less convinced about the putative

“rings” of South Florida, which are more extensive and less circular in shape. I believe that the circular shell rings of Georgia and South Carolina are purposeful accumulations, but that it is unlikely they are the products of repeated competitive feasting of the sort documented for the U.S. Northwest Coast, nor need we attribute their shapes to political aggrandizement or a particular level of socio-cultural integration, tribal or otherwise.

### Summary and Conclusions

There has been a recent trend toward explaining mound-building in the Southeast as motivated principally by political posturing or mystical ceremonialism. This leads to a kind of “mumbo-jumbo” archaeology that attributes sociopolitical and ceremonial complexity to Archaic and Woodland-period peoples while simultaneously denying them the ability to solve practical problems communally by applying ecologically sound engineering principles. In this paper, I offer a corrective to this imbalance. Many interpretations of shell mounds as architectural features, temple mounds, and feasting locales are based on unsubstantiated inference. There are often environmental reasons for the increased availability of certain foods and the decreased availability of others, as well as for the shape and placement of various mounded shell-bearing topographic features.

In this paper, I describe and illustrate a scenario in which dark, highly organic sediments with sparse shell content can alternate with lighter-colored, shell-dense sediments without recourse to purposeful mound-building as an explanation. I provide a detailed example of Caloosahatchee IIA-period shell-mound stratification at the Pineland Site Complex in Southwest Florida that can be explained as midden accumulation in spite of the fact that the stratification fulfills the criteria that some scholars use to characterize a constructed mound. I describe the various strata as sediments, specifying the origin, transport agent, and environment of deposition for each, and situate the dated layers within broader geomorphological (Charlotte Harbor/Pine Island Sound), biological (a shallow, seagrass-rich estuary), climatic (the cool, dry Vandal Minimum), and sea-level (the Buck Key Low episode) contexts. I then critique interpretations of shell works and temple mounds

in Southwest Florida and shell rings on the coasts of Georgia and South Carolina, arguing that the forms taken by these various structures might have had much to do with solving practical problems and responding to climate conditions.

It is understandable that consideration of abrupt climate changes has come only recently to archaeology because previous to the past 15 years, authoritative information on shorter-term climate changes and sea-level fluctuations (i.e., those on the order of 50 to 100 years) was in short supply. Archaeologists were thus more inclined to explain massive deposits of shells as evidence of feasting, ceremony, or monumental architecture. But literature on abrupt climate changes and short-term sea-level fluctuations is far more available and reliable than it was even a decade ago (see Marquardt 2010; Marquardt and Walker 2009; Walker 2010), and it should be taken into consideration. I am not suggesting that environmental factors explain everything. I do believe that archaeologists should thoroughly investigate shell-mound sediments (origin, transport agent, environment of deposition, and postdepositional alteration) and the climatic contexts in which those sediments accumulated before inferring mound-building, shell-work architecture, feasting, or temples.

Precontact people were certainly smart enough to erect monuments and coordinate labor. They could surely comprehend enough geometry, material science, and hydrology to build mounds if they chose to. I do not deny that people purposefully piled shell and other debris in patterns that made cultural and practical sense to them. But I prefer to adopt a skeptical viewpoint about inferences of monumentality, feasting, or temple functions. I want to be convinced that there is sound temporal control to justify interpretations of short-term construction episodes. I want to know that the shell-mound contents themselves have been evaluated as sediments: that is, what are the relative abundances of their constituents? I want to know where the sediments came from, what brought them there, and what happened to them once they were in place. Finally, I want to be sure that there are not local-environmental or regional climatic factors that might account for the abundance of shells that at some point became parts of shell-bearing sediments.

There seems to be a felt need on the part of some

southeastern U.S. archaeologists to attribute tribal or chiefdom levels of social organization to people who accumulate earthen and shell mounds (e.g., Anderson 2004; Russo 2004; Sassaman and Heckenberger 2004), while others are not so certain (Crothers 2004; Crothers and Bernbank 2004; Saunders 2004, 2010; White 2004). I believe that most shell-mound constructions and other paleo-engineering projects were undertaken to solve practical problems or to respond to opportunities or challenges presented by abrupt climate changes (i.e., changes that took place on the order of 50 to 100 years).

Of course, the choice of a particular response (a shell ring, a water court, a mound, or a canal) also changes the environment, which can lead to further adaptations and cultural adjustments. For example, a shell ring may be built to capture freshwater, but it may also convey other advantages: a better view, relief from flying insects, or a place of refuge during floods. It may even impress the neighbors, and lead to opportunities for aggrandizement or political or economic advantage. But at its most basic level, if it conserved water for drinking and cooking during a dry climate episode, this in large part explains its form, composition, position on the landscape, and placement in time.

Are shell mounds, shell works, and shell rings monuments? Perhaps some of them are, and perhaps some initially built for practical reasons later took on sociopolitical or ceremonial importance. To understand ancient shell mounds, we should consider sociohistorical dimensions, but we should not rule out mundane and practical explanations. In investigating the latter, we stand a better chance of success when we take into account fine-grained climate records and employ sound scientific principles from ecology, geomorphology, sedimentology, hydrology, and geochemistry as well as quantification of shell-mound constituents by zooarchaeologists, archaeobotanists, and pedoarchaeologists. If we are to move beyond inductive surmises in interpreting shell mounds, we need a sediment-oriented approach to mound formation–deformation studies and closer attention to the environmental contexts in which shell mounds accumulated.

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## References Cited

- Anderson, David G.  
2004 Archaic Mounds and the Archaeology of Southeastern Tribal Societies. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by J. L. Gibson and P. J. Carr, pp. 270–299. University of Alabama Press, Tuscaloosa.
- Aten, Lawrence E.  
1999 Middle Archaic Ceremonialism at Tick Island, Florida: Ripley P. Bullen's 1961 Excavations at the Harris Creek Site. *The Florida Anthropologist* 52:131–200.
- Barlow, Paul M.  
2003 *Ground Water in Freshwater-Saltwater Environments of the Atlantic Coast*. U.S. Department of the Interior, U.S. Geological Survey, Circular 1262. Reston, Virginia.
- Bullen, Ripley P., and Adelaide K. Bullen  
1956 *Excavations on the Cape Haze Peninsula, Florida*. Contributions of the Florida State Museum, Social Sciences, No. 1. Gainesville.
- Crothers, George M.  
2004 The Green River in Comparison to the Lower Mississippi Valley during the Archaic: To Build Mounds or Not to Build Mounds? In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by J. L. Gibson and P. J. Carr, pp. 86–96. University of Alabama Press, Tuscaloosa.
- Crothers, George M., and Reinhard Bernbank  
2004 The Foraging Mode of Production: The Case of the Green River Archaic Shell Middens. In *Hunters and Gatherers in Theory and Archaeology*, edited by G. M. Crothers, pp. 401–422. Center for Archaeological Investigations, Occasional Papers 31. Southern Illinois University, Carbondale.
- deFrance, Susan D., and Karen J. Walker  
2010 The Zooarchaeology of Pineland. In *The Archaeology of Pineland: A Coastal Southwest Florida Site Complex, A.D. 50–1710*. Institute of Archaeology and Paleoenviromental Studies, Monograph 4. University of Florida, Gainesville, in press.
- Gibson, Jon L., and Philip J. Carr (editors)  
2004 *Signs of Power: The Rise of Cultural Complexity in the Southeast*. University of Alabama Press, Tuscaloosa.

- Gould, Richard A.  
1980 *Living Archaeology*. Cambridge University Press, Cambridge.
- Griffin, John W.  
2002 *Archaeology of the Everglades*. University Press of Florida, Gainesville.
- Grøn, Ole  
1991 A Method for Reconstruction of Social Structure in Prehistoric Societies and Examples of Practical Application. In *Social Space: Human Spatial Behavior in Dwellings and Settlements*, edited by O. Grøn, pp. 100–117. Odense University Studies in History & Social Sciences No. 147. Coronet Books, Philadelphia, Pennsylvania.
- Hann, John H.  
1991 *Missions to the Calusa*. Introduction by W. H. Marquardt, translations by J. H. Hann. University of Florida, Gainesville.
- Hayden, Brian  
2001 Fabulous Feasts: A Prolegomenon to the Importance of Feasting. In *Feasts: Archaeological and Ethnographic Perspectives on Food, Politics, and Power*, edited by M. Dietler and B. Hayden, pp. 23–64. Smithsonian Institution Press, Washington, D.C.
- Hrdlička, Aleš  
1922 *The Anthropology of Florida*. Publications of the Florida State Historical Society No. 1. Florida State Historical Society, Deland.
- Kozuch, Laura  
1993 *Sharks and Shark Products in Prehistoric South Florida*. Institute of Archaeology and Paleoenvironmental Studies, Monograph 2. University of Florida, Gainesville.
- Luer, George Mather  
2007 Mound Building and Subsistence During the Late Weeden Island Period (ca. A.D. 700–1000) at Big Mound Key (8CH10), Florida. Ph.D. dissertation, Department of Anthropology, University of Florida, Gainesville.
- Marquardt, William H.  
1992 Shell Artifacts from the Caloosahatchee Area. In *Culture and Environment in the Domain of the Calusa*, edited by W. H. Marquardt, pp. 191–227. Institute of Archaeology and Paleoenvironmental Studies, Monograph 1. University of Florida, Gainesville.
- 2010 Mounds, Middens, and Rapid Climate Change During the Archaic-Woodland Transition in the Southeastern United States. In *Trend, Tradition, and Turmoil: What Happened to the Southeastern U.S. Late Archaic?* edited by D. H. Thomas and M. C. Sanger, pp. 253–272. Anthropological Papers No. 93. American Museum of Natural History, New York.
- Marquardt, William H., and Karen J. Walker  
2008 Archaeological Salvage at Brown's Complex Mound 4, Pineland Site Complex (8LL1902), Pineland, Florida, October 2007. Report submitted to Chris and Gayle Bundschu, Florida Bureau of Archaeological Research, Office of the State Archaeologist, and the Lee County Historic Preservation Board. Randell Research Center, Florida Museum of Natural History, University of Florida, Gainesville.
- 2009 Southwest Florida During the Mississippi Period. In *A New Look at the "Mississippi" Period in Florida*, edited by K. H. Ashley and N. M. White. Manuscript on file, Anthropology Division, Florida Museum of Natural History, University of Florida, Gainesville.
- Marquardt, William H., and Patty Jo Watson  
2005 The Green River Shell Mound Archaic: Conclusions. In *Archaeology of the Middle Green River Region, Kentucky*, edited by W. H. Marquardt and P. J. Watson, pp. 615–647. Institute of Archaeology and Paleoenvironmental Studies, Monograph 5. University of Florida, Gainesville. (Distributed by University Press of Florida.)
- Marrinan, Rochelle A.  
2010 Two Late Archaic Period Shell Rings, St. Simon's Island, Georgia. In *Trend, Tradition, and Turmoil: What Happened to the Southeastern U.S. Late Archaic?* edited by D. H. Thomas and M. C. Sanger, pp. 71–102. Anthropological Papers No. 93. American Museum of Natural History, New York.
- May, J. Alan  
2005 Ethnographic and Ethnohistoric Suggestions Relevant to the Middle Green River Shell Middens. In *Archaeology of the Middle Green River Region, Kentucky*, edited by W. H. Marquardt and P. J. Watson, pp. 71–85. Institute of Archaeology and Paleoenvironmental Studies, Monograph 5. University of Florida, Gainesville. (Distributed by University Press of Florida.)
- McKechnie, Jean L. (supervisory editor)  
1983 *Webster's New Twentieth Century Dictionary* (second edition). Dorset & Baber, Cleveland.
- Meehan, Betty  
1982 *Shell Bed to Shell Midden*. Australian Institute of Aboriginal Studies, Canberra.
- Middaugh, Douglas P.  
2009 Putative Structures and Salinity Gradients at the Sewee Shell Ring, South Carolina: Evidence for Ancient Control of Freshwater Resources. *Journal of the North Carolina Academy of Science* 125(3):87–102.
- Milanich, Jerald T., Jefferson Chapman, Ann S. Cordell, Stephen Hale, and Rochelle A. Marrinan  
1984 Prehistoric Development of Calusa Society in Southwest Florida: Excavations on Useppa Island. In *Perspectives on Gulf Coast Prehistory*, edited by D. D. Davis, pp. 258–314. University Press of Florida, Gainesville.
- Milner, George R.  
2004 Old Mounds, Ancient Hunter-Gatherers, and Modern Archaeologists. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by J. L. Gibson and P. J. Carr, pp. 300–315. University of Alabama Press, Tuscaloosa.
- Quitmyer, Irvy R., and Melissa A. Massaro  
1999 Seasonality and Subsistence in a Southwest Florida Estuary: A Faunal Analysis of Precolumbian Useppa Island. In *The Archaeology of Useppa Island*, edited by W. H. Marquardt, pp. 99–128. Institute of Archaeology and Paleoenvironmental Studies, Monograph 3. University of Florida, Gainesville.
- Randall, Asa R., and Kenneth E. Sassaman  
2005 *St. Johns Archaeological Field School 2003–2004: Hontoon Island State Park*. Laboratory of Southeastern Archaeology, Technical Report 6. Department of Anthropology, University of Florida, Gainesville.
- Russo, Michael  
2002 Architectural Features at Fig Island. In *The Fig Island Ring Complex (38CH42): Coastal Adaptation and the Question of Ring Function in the Late Archaic*, edited by R. Saunders, pp. 85–97. Report prepared for the South Carolina Department of Archives and History. Electronic document, [http://www.nps.gov/seac/shellrings/fig\\_web.pdf](http://www.nps.gov/seac/shellrings/fig_web.pdf), accessed June 10, 2009.
- 2004 Measuring Shell Rings for Social Inequality. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by J. L. Gibson and P. J. Carr, pp. 26–70. University of Alabama Press, Tuscaloosa.
- 2006 *Archaic Shell Rings of the Southeast U.S.* National His-

- toric Landmarks Historic Context. Southeast Archeological Center, National Park Service, Tallahassee. Electronic document, <http://www.nps.gov/history/nhl/Themes/Archaic%20Shell%20Rings.pdf>, accessed June 10, 2009.
- Russo, Michael, and Gregory Heide  
2003 *Mapping the Sewee Shell Ring*. Report submitted to the Francis Marion and Sumter National Forests, South Carolina. Southeast Archeological Center, National Park Service, Tallahassee. Electronic document, [http://www.nps.gov/history/seac/shellrings/Sewee\\_Web.pdf](http://www.nps.gov/history/seac/shellrings/Sewee_Web.pdf), accessed June 12, 2009.
- Sanger, Matthew C.  
2010 Leaving the Rings: Shell Ring Abandonment and the End of the Late Archaic. In *Trend, Tradition, and Turmoil: What Happened to the Southeastern U.S. Late Archaic?* edited by D. H. Thomas and M. C. Sanger, pp. 201–216. Anthropological Papers No. 93. American Museum of Natural History, New York.
- Sanger, Matthew C., and David Hurst Thomas  
2010 The Two Rings of St. Catherine's Island: Some Preliminary Results from the St. Catherine's and McQueen Shell Rings. In *Trend, Tradition, and Turmoil: What Happened to the Southeastern U.S. Late Archaic?* edited by D. H. Thomas and M. C. Sanger, pp. 45–70. Anthropological Papers No. 93. American Museum of Natural History, New York.
- Sassaman, Kenneth E.  
2003 *St. Johns Archaeological Field School 2000–2001: Blue Spring and Hontoon Island State Parks*. Laboratory of Southeastern Archaeology, Technical Report 4. Department of Anthropology, University of Florida, Gainesville.  
2004 Complex Hunter-Gatherers in Evolution and History: A North American Perspective. *Journal of Archaeological Research* 12:227–280.
- Sassaman, Kenneth E., and Michael J. Heckenberger  
2004 Crossing the Symbolic Rubicon in the Southeast. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by J. L. Gibson and P. J. Carr, pp. 214–233. University of Alabama Press, Tuscaloosa.
- Saunders, Joe  
2004 Are We Fixing to Make the Same Mistake Again? In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by J. L. Gibson and P. J. Carr, pp. 146–161. University of Alabama Press, Tuscaloosa.  
2010 Late Archaic? What the Hell Happened to the Middle Archaic? In *Trend, Tradition, and Turmoil: What Happened to the Southeastern U.S. Late Archaic?* edited by D. H. Thomas and M. C. Sanger, pp. 237–246. Anthropological Papers No. 93. American Museum of Natural History, New York.
- Saunders, Rebecca  
2002 *The Fig Island Ring Complex (38CG42): Coastal Adaptation and the Question of Ring Function in the Late Archaic*. Report prepared for the South Carolina Department of Archives and History, Columbia. Electronic document, [http://www.nps.gov/seac/shellrings/fig\\_web.pdf](http://www.nps.gov/seac/shellrings/fig_web.pdf), accessed June 10, 2009.
- Schiffer, Michael B.  
1972 Archaeological Context and Systemic Context. *American Antiquity* 37:156–165.
- Schwadron, Margo  
2010 Prehistoric Landscapes of Complexity: Archaic and Woodland Period Shell Works, Shell Rings, and Tree Islands of the Everglades, South Florida. In *Trend, Tradition, and Turmoil: What Happened to the Southeastern U.S. Late Archaic?* edited by D. H. Thomas and M. C. Sanger, pp. 113–148. Anthropological Papers No. 93. American Museum of Natural History, New York.
- Sears, William H.  
1956 The Turner River Site, Collier County, Florida. *The Florida Anthropologist* 9:47–65.
- Solís de Merás, Gonzalo  
1964 *Pedro Menéndez de Avilés, Adelantado, Governor, and Captain-General of Florida: Memorial*. Facsimile reproduction of 1570 edition. University Presses of Florida, Gainesville.
- Stapor, Frank W., Jr., Thomas D. Mathews, and Fonda E. Lindfors-Kearns  
1991 Barrier Island Progradation and Holocene Sea-Level History in Southwest Florida. *Journal of Coastal Research* 7(3):815–838.
- Stein, Julie K.  
2001 Archaeological Sediments in Cultural Environments. In *Archaeological Sediments in Context*, edited by J. K. Stein and W. R. Farrand, pp. 1–28. University of Utah Press, Salt Lake City.  
2005 Formation Processes of the Carlston Annis Shell Midden. In *Archaeology of the Middle Green River Region, Kentucky*, edited by W. H. Marquardt and P. J. Watson, pp. 121–151. Institute of Archaeology and Paleoenvironmental Studies, Monograph 5. University of Florida, Gainesville. (Distributed by University Press of Florida.)
- Tanner, William F.  
1991 The “Gulf of Mexico” Late Holocene Sea Level Curve and River Delta History. *Transactions of the Gulf Coast Association of Geological Societies* 41:583–589.  
1993 An 8000-Year Record of Sea-Level Change from Grain-Size Parameters: Data from Beach Ridges in Denmark. *The Holocene* 3:220–231.  
2000 Beach Ridge History, Sea Level Change, and the A.D. 536 Event. In *The Years Without Summer: Tracing A.D. 536 and its Aftermath*, edited by J. D. Gunn, pp. 89–97. British Archaeological Reports, International Series 872. David Brown Book Company, Oakville, Connecticut.
- Taylor, Robert C.  
1985 *Everglades National Park, Archeological Inventory and Assessment, Season 3: Interim Report*. National Park Service, Southeast Archeological Center, Tallahassee, Florida.
- Thompson, Victor D.  
2007 Articulating Activity Areas and Formation Processes at the Sapelo Island Shell Ring Complex. *Southeastern Archaeology* 26:91–107.
- Trigger, Bruce  
1990 Monumental Architecture: A Thermodynamic Explanation of Symbolic Behavior. *World Archaeology* 22:119–132.
- Trinkley, Michael B.  
1985 The Form and Function of South Carolina's Early Woodland Shell Rings. In *Structure and Process in Southeastern Archaeology*, edited by R. S. Dickens, Jr. and H. T. Ward, pp. 102–118. University of Alabama Press, Tuscaloosa.
- Walker, Karen J.  
1992 The Zooarchaeology of Charlotte Harbor's Prehistoric Maritime Adaptation: Spatial and Temporal Perspectives. In *Culture and Environment in the Domain of the Calusa*, edited by W. H. Marquardt, pp. 265–366. Institute of Archaeology and Paleoenvironmental Studies, Monograph 1. University of Florida, Gainesville.  
2000 A Cooling Episode in Southwest Florida During the Sixth and Seventh Centuries A.D. In *The Years Without Summer: Tracing A.D. 536 and its Aftermath*, edited by J.

- D. Gunn, pp. 119–127. British Archaeological Reports, International Series 872. David Brown Book Company, Oakville, Connecticut.
- 2010 The Pineland Site Complex: Environmental Contexts. In *The Archaeology of Pineland: A Coastal Southwest Florida Site Complex, A.D. 50–1710*. Institute of Archaeology and Paleoenvironmental Studies, Monograph 4. University of Florida, Gainesville, Florida, in press.
- Walker, Karen J., and William H. Marquardt  
 2010 Excavations and Chronostratigraphy at Southwest Florida's Pineland Site Complex: 1988–1995. In *The Archaeology of Pineland: A Coastal Southwest Florida Site Complex, A.D. 50–1710*. Institute of Archaeology and Paleoenvironmental Studies, Monograph 4. University of Florida, Gainesville, Florida, in press.
- Walker, Karen J., Frank W. Stapor, Jr., and William H. Marquardt  
 1995 Archaeological Evidence for a 1750–1450 B.P. Higher-Than-Present Sea Level Along Florida's Gulf Coast. In "Holocene Cycles: Climate, Sea Levels, and Sedimentation," Special issue edited by C. W. Finkl, Jr. *Journal of Coastal Research* 17:205–218.
- Waring, Antonio J., Jr., and Lewis H. Larson, Jr.  
 1968 The Shell Ring on Sapelo Island. In *The Waring Papers: The Collected Works of Antonio J. Waring, Jr.*, edited by S. Williams, pp. 263–278. Papers of the Peabody Museum of Archaeology and Ethnology 58. Cambridge, Massachusetts.
- Watson, Patty Jo, Steven A. LeBlanc, and Charles L. Redman  
 1971 *Explanation in Archeology: An Explicitly Scientific Approach*. Columbia University Press, New York.
- White, Nancy Marie  
 2004 Late Archaic Fisher-Foragers in the Apalachicola-Lower Chattahoochee Valley, Northwest Florida-South Georgia/Alabama. In *Signs of Power: The Rise of Cultural Complexity in the Southeast*, edited by J. L. Gibson and P. J. Carr, pp. 10–25. University of Alabama Press, Tuscaloosa.
- Widmer, Randolph J.  
 1996 Recent Excavations at the Key Marco Site, 8CR48, Collier County, Florida. *The Florida Anthropologist* 49:10–25.
- 2002 The Woodland Archaeology of South Florida. In *The Woodland Southeast*, edited by D. G. Anderson and R. M. Mainfort, Jr., pp. 373–397. University of Alabama Press, Tuscaloosa.
- Wing, Elizabeth S., and Irvy R. Quitmyer  
 1992 A Modern Midden Experiment. In *Culture and Environment in the Domain of the Calusa*, edited by W. H. Marquardt, pp. 367–373. Institute of Archaeology and Paleoenvironmental Studies, Monograph 1. University of Florida, Gainesville.

## Notes

1. The English word *midden* is derived from the Danish *mødding*, which a modern Danish-English dictionary translates as "dung hill." The same dictionary also includes *køkkenmødding*, which it defines as "kitchen midden." Publications as early as 1851 in the late nineteenth century used the term *køkkenmødding* to refer to Late Mesolithic shell middens, and J. J. A. Worsaae drew a sharp contrast between the Old Stone Age shell middens and New Stone Age megalithic tomb sites.
2. Freshwater is conventionally defined as having a total dissolved-solids concentration of less than 1,000 mg/L, whereas water with concentrations above this threshold are considered to be saltwater. Water containing more than 2,000 to 3,000 mg/L of total dissolved solids is considered too salty to drink. The U.S. Environmental Protection Agency defines acceptable domestic drinking water as containing total dissolved solids of less than 500 mg/L (Barlow 2003:8).

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