Inagua Archaeology

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Introduction

Great Inagua Island occupies a strategic position in the northern West Indies. Straddling the passage between Cuba and Hispaniola, Great Inagua is the apex in an equilateral triangle that defines the Windward Passage. Inagua's location is important in two regards. First, if one branch of the Ceramic Age colonization of the northern West Indies proceeded along the north coast of Hispaniola to Cuba, then Great Inagua is the likely first landfall in the Bahama archipelago. Second, Irving Rouse (1992) has conclusively demonstrated that cultural developments in the West Indies are focused on inter-island passages. It is therefore likely that the first Inaguans participated in the interchange between western Hispaniola and eastern Cuba across the Windward Passage.

With those themes in mind, Dr. Steven Mitchell and I conducted an archaeological and geological survey of Great Inagua in 1984. The Inagua investigation was one of several comprehensive surveys we conducted in the south and central Bahama Islands between 1982 and 1987 (Keegan 1983a, 1983b, 1988; Keegan and Mitchell 1983, 1984a, 1984b; Keegan, Williams, and Seim 1990; Mitchell and Keegan 1987). The results of the Inagua survey were summarized in my dissertation (Keegan 1985), but the details were never fully published. There was no compelling reason to elaborate on that summary until I reinvestigated archaeological sites on Great Inagua in 1992 and 1993. The 1992-1993 investigations developed out of a contract with U.S. Customs. U.S. Customs was preparing to build an Aerostat base on Great Inagua. Because Inagua is ecologically and archaeologically sensitive, the Bahamas National Trust asked Customs for an external review of the archaeological impacts of the Aerostat project. This evaluation was conducted in September 1992 (Keegan 1993), and again in March 1993.

The present report has three objectives. First, the probable importance of Great Inagua in West Indian prehistory is discussed.

Second, the investigations conducted in 1984, 1992, and 1993 are reported in detail. Third, complete reports for the 13 archaeological sites on the island are appended. It is clear in this report that much additional work needs to be done. Great Inagua has not been completely surveyed and Little Inagua has not been investigated at all. Moreover, the 1992-1993 investigations showed that even those areas that were surveyed previously merit additional attention. Lastly, many of the sites are difficult to assess given the limited amount of material comprising their surface scatters. Test excavations at all of these sites are needed. Great Inagua is a huge island; it will consume enormous energies before its prehistory is fully revealed.

Environmental Background

Great Inagua is located between 20.9° to 21.4° North latitude and 73° to 73.9° West longitude in the Commonwealth of the Bahamas. With an area of 1544 square kilometers it is the third largest island in the archipelago. However, Lake Windsor comprises almost one-quarter of the interior, and most of remaining area is dominated by low, swampy terrain. The highest elevation is 33 meters. Despite its large size, there is only one settlement, Matthew Town, located in the southwest corner of the island. The population today numbers less than 1500. The major industry on the island is Morton Salt, which operates a huge solar distillation facility just north of town. That industry was modernized by the Erickson family in the 1930s (Erickson 1987). Much of the rest of the island is a National Park managed by the Bahamas National Trust for the protection of a large flamingo colony. In addition, the island was, quite accidently, the site of the first natural history study undertaken in the Bahamas (Klingel 1940).

During our 1984 survey we discovered that the more things change, the more they stay the same. Less than half of the island's coast is accessible by road. In the west the road ends at the Bahama National Trust camp at Union Creek, an hour drive from Matthew Town; to the east, 4-wheel drive vehicles have recently extended the road past South East Point. The island remains a haven for local hog and pigeon hunters and fishermen. Our 1984 survey took us to end of the road in both directions (approximately 130 km or 80 miles).

For the purposes of investigating the prehistory of the Bahamas, investigators have found it useful to identify three biomes (Sears and Sullivan 1978; Keegan 1992). The boundaries between these biomes conform to the 800, 1200, and 1500 mm rainfall isohyets, and also reflect minor differences in seasonal temperature fluctuations. The combination of rainfall and temperature have contributed to modern differences in vegetation. In the northern subarea the vegetation is characterized as subtropical moist forest with yellow pine (**Pinus caribaea** v. **bahamensis**). The central subarea is tropical moist forest dominated by mahogany (**Swietenia**) woodland. The southern subarea, which includes Great and Little Inagua, the Turks and Caicos Islands (except

North Caicos), Ragged Island, and the southern tip of Acklins Island is characterized by tropical very dry forest. In contrast to the northern islands, with their distinct wet (May/June to October) and dry seasons, there is a pronounced drier break (July to August) in the April/May to October/November rainy season (Little et al. 1977:9). October is the wettest month.

In the southern islands the constant trade winds exert a pervasive influence on life zones (see Klingel 1961). While long-term records are not available, the average wind speed in the southern islands is somewhat higher than the average for the northern islands (cf. Halkitis et al. 1980). Doran (1955) reports that tropical storms occur at an average of about one every four years. Only three hurricanes were recorded between 1871 and 1963.

The wind affects the environment by increasing evaporation and transpiration. The early settlers of this sub-area found that the removal of trees increased the evaporation rate, which in turn increased the yields from solar distillation of salt. Land clearance contributed to the rapid dessication of the landscape, and its affect on soil fertility has prevented natural reforestation. When the islands were forested, the forest cover limited nutrient leaching, diffused rain drops, maintained cooler soil temperatures, provided litter at a faster rate than decay, and acted to neutralize the alkaline carbonate matrix (Webster and Wilson 1966). Deforestation reversed those processes and exposed the soil to direct insolation and rainfall, which further reduced the amounts and availability of plant nutrients (Roosevelt 1980).

On Great Inagua, potential evapotranspiration is 2.5 times higher than average rainfall (Little et al. 1977). For plants, especially those with stomata adapted to xeric conditions, that difference is significant only when an alternative source of water is not available (e.g., groundwater). All of the southern islands presently lack well-developed groundwater resources, although localized freshwater lenses do occur. Groundwater levels were probably significantly higher prior to human colonization. The best evidence for higher groundwater tables comes from Pine Cay, Caicos Islands, which has the only standing freshwater ponds in this sub-area. There are presently seven ponds on the cay, but an eighteenth century French navigation manual reported the presence of a large "lagoon" with enough freshwater for 50 ships crews (Bellin 1768). The dissection of this lagoon reflects modern construction activities and increased aridity from land clearance.

Previous attempts to correlate prehistoric occupations with environmental variables have given primary attention to the arid character of the modern environment. Sears and Sullivan (1978), for example, cite the occurrence of ponds that produce salt through solar distillation. However, it should be noted that solar salt production was not limited to the southern sub-area. Commercial salt production was conducted on Long Island, Rum Cay, Little Exuma, Eleuthera, Cat Island, and San Salvador in the central sub-area; and on New Providence, the Berry Islands, and several small cays in the northern sub-area (Bahamas Department of Archives, 1980).

Agricultural land in the southern islands is limited to the western shores, and the modern settlements on Great Inagua, Mayaguana, and the Turks and Caicos Islands are largely restricted to the western sides of these islands. Vegetation along the eastern windward shores tends to be stunted, xerophytic, and salt tolerant. Higher average wind speeds have contributed to the development of a low (c. 1 m) vegetation that is visibly bent by the wind. As Gilbert Klingel (1961:178) expressed it: "Life flowed all in one direction." With the Atlantic Ocean as a potential fetch, ocean swells break on the near shore reefs in a cascade of spray. This salt spray is carried on the tradewinds, and at times produces the effect of rainfall on shore. Because rainfall is, for the most part, limited to summer convective showers, the windward east coasts receive less rainfall. Convection cells are generated over sun-heated landmasses and shallow banks. When the heated air penetrates cooler levels of the atmosphere, cumulus clouds are formed. Rainfall would be evenly distributed if these clouds were stationary, but the tradewinds, which are at their strongest in the summer, form the clouds into a narrow band which is directed to the west-northwest (Little et al. 1977; Sullivan 1981).

Paleoecological and geological evidence point to higher levels of rainfall and deeper soils in the past (see Carbone 1980). The best example is found in Conch Bar Cave on Middle Caicos where solution features in the cave were produced when acidic water dissolved the limestone walls of this enormous cavern. A higher level of rainfall would have been required to produce the observed effect, and a deeper soil layer was necessary to neutralize the carbonate matrix and to acidify the water that passed through the soil. Even though higher rainfall levels and soil fertility probably maintained a more verdant vegetation, a clinal variation from east to west would, even then, have characterized the environment. The windward shore would have supported low, stunted tropical woodland and thornbrush with cacti and other succulents. Moving to the west, canopy height would have increased with woodland vegetation dominating thornbrush.

Great Inagua has many qualities that would have promoted aboriginal settlement. Despite modern conditions, the island would have supported a more verdant vegetation, especially along the west coast. Abundant marine resources are found along the coast, and especially in the large protected tidal creeks. Lake Windsor may have supported marine fish and mollusks prior to the development of salt works. [The original salt works on the island were located near South West Point and on Red Salt Pond near Union Creek.] Rainfall was probably somewhat higher, soil fertility better, and the island is outside the main track of tropical storms and hurricanes.

Today, the vegetation can be divided into three basic categories or formation types. The sandy soils along the coast support a "whitelands" vegetation which is dominated by pioneer species such as sea grapes, grasses, purslane, and Palmetto palms. Since their introduction during historic times, the Australian Pine (**Casuarina litorea**) and coconut palm (**Cocos nucifera**) have proved to be successful colonists of this zone. "Coppice" vegetation, comprised of tropical hardwoods and shrubs, dominates the interior and more developed soils. Along the margins of ponds and estuaries mangroves, buttonwoods, and similar species comprise a "pond-type" vegetation. Differences in vegetation have proved important in identifying archaeological sites (Sullivan 1981), the majority of which occur in areas of coppice vegetation.

Four coastline types are important for the archaeology of Great Inagua (see Keegan 1991b): sand beaches, eolianite, beach rock, and tidal creeks. Sand beaches are composed of unconsol-idated accumulations of marine sediments. Beaches are important because they provided unimpeded canoe landings for the Amerindian inhabitants of the islands. Most archaeological sites in the archipelago are located on or adjacent to sand beaches. Eolianite is composed of cemented sediments that have eroded into sharp dissected surfaces punctuated by sharp pinnacles (e.g. "dog-tooth" limestone). Only minor changes have occurred in eolianites during the past 500 years.

Beach rock is composed of poorly cemented marine sediments. It is formed beneath sand dunes through the cementation of sand, crushed shell, precipitates, and other beach materials. Its age can be estimated from color, texture, and degree of cementation. Fossil beach rock terraces attest to higher eustatic sea levels (prior to 35,000 years ago), and extensions of beach rock into the sea attest to periods of lower relative sea level. There is no evidence of tectonic uplift. Recent beach-rock formations have incorporated modern artifacts such as nails and bottle caps. Archaeological sites are common above recent beach rock formations, but are usually absent from the vicinity of older formations.

Tidal creeks are the Bahamian equivalent of estuaries -- coastal lakes with an outlet to the sea. They are not, however, true estuaries because they lack a freshwater influx (Sealey 1985). Mitchell's (1986a, 1986b) studies of the evolution of coasts from bays to tidal creeks to lakes have demonstrated that many coastal lakes were actually tidal creeks during the period of prehistoric settlement. In 60 cases, Mitchell found that modern lakes that were tidal creeks 500 to 1000 years ago have evidence for Lucayan settlement, while lakes that were lakes during that period do not (Mitchell and Keegan 1987; Keegan 1991b).

Initial Colonization of the Bahamas

The Bahama archipelago was first settled during the Ostionoid expansion that began from western Puerto Rico about A.D. 600 and concluded in Cuba and Jamaica about A.D. 1200 (Keegan 1992; Rouse 1992). Some date the colonization of the Bahamas to around A.D. 800, coincident with the development of Meillacan

Ostionoid pottery on the north coast of Hispaniola (Sears and Sullivan 1978; Sullivan 1981). Meillacan pottery is common in Bahamian sites, while its predecessor Ostionan Ostionoid pottery is virtually absent (cf. Hoffman 1967; Sullivan 1981; Berman and Gnivicki 1991). Others date the timing of initial colonization to at least a century earlier; the opinion favored by myself on the basis of demographic indicators (Keegan 1985, 1992). This difference of opinion may soon be resolved. Excavations directed by Mary Jane Berman and Perry Gnivecki at the Three Dog site, San Salvador, have yielded two of the earliest radiocarbon dates yet obtained for a Bahamian site. An earlier date obtained by Richard Rose from the Pigeon Creek site from turtle bone may be affected by the marine reservoir effect and isotopic discrimination (see section on radiocarbon dates, below).With calibrated ages in the mid-eighth to ninth centuries A.D. they offer some support to the pre-Meillacan settelement thesis. In addition, Berman has identified some of the potsherds in the lowest levels of the site as being Ostionan Ostionoid. A full evaluation of these materials must await the publication of their analyses (Berman and Gnivecki 1991). However, it should be noted that Rouse (1992) gave his support to their findings in his recent book.

When considering the timing and location of initial coloni-zation it is worth considering possible motives. At first glance, the small size and arid conditions of the southern Bahamas would seem to offer few enticements to people living on the much larger and wetter islands of the Great Antilles. For that reason, convential wisdom has held that the Bahamas were settled out of necessity: Either the islands of the Greater Antilles had filled to capacity and colonists were literally pushed into the Bahamas (Sears and Sullivan 1978), or Island Carib raids on the Greater Antilles caused people to flee to the Bahamas to escape the onslaught (Craton and Saunders 1992), or the presence of a crucial dietary mineral, salt, attracted colonists who sought to control its trade (Sullivan 1981). None of these explanations is satisfactory.

In the first place, the population in the Greater Antilles at the time the Bahamas were colonized would have been relatively small. The fact that the population seems to have grown rapidly until Spanish contact contradicts the filled-to-capacity explanation (cf. Cook and Borah 1971; Henige 1978). Second, the Island Carib never expanded beyond the Windward Islands of the Lesser Antilles, and their development occurred many centuries after the Bahamas was colonized (Rouse 1992). Furthermore, as the Spanish learned, the Tainos were quite capable of defending themselves against foreign intrusions. Finally, although salt may have been a major trade good during late Classic Taino times, its importance and stimulating influence would not have been felt until several centuries after the Bahamas were colonized.

Despite their smaller size and drier climate, the southern Bahamas would have been very attractive to root crop horticul-turalists. As discussed above, the prehistoric vegetation would have been characterized by tropical woodlands or tropical forest, and even if rainfall was not appreciably greater, the taller tropical vegetation would have acted to retain water and make the islands significantly less dry. The soil would have been richer, given almost two million years of undisturbed development, and the sandy soils would have been well-suited for the type of root-crop cultivation that was practiced by Ostionoid peoples. Moreover, manioc, their stable cultigen, produces more starch when the rainy season is follwed by a pronounced dry season (Roosevelt 1980).

With regard to the first arrivals, the easily hunted land animals would have occurred in high density due to the absence of predators and competitors. Seasonal aggregations of monk seals and green turtles would have provided an abundant food source that was easily harvested. The smaller sizes of the Bahama islands were actually an advantage for people who relied on the sea for a substantial portion (perhaps 50%) of their food (Keegan and DeNiro 1988). Marine animals of all types would have been more abundant and more readily accessible than they were on north-coast locations in the Greater Antilles. In sum, the abundance of marine and terrestrial resources in the Bahamas combined with the more favorable climate and vegetation provide strong support for the conclusion that these islands would have been attractive to Ostionoid colonists.

Another aspect that remains to be shown is the **source** area for the initial colonists. I have emphasized a single source of colonists because the prehistoric Bahamas seem to have a single Pottery ware (Mann 1986). I cannot accept that multiple migrations from separate sources would not have produced multiple wares, even given the apparent technological constraints. It is possible that multiple wares will be identified, we presently have only a rudimentary knowledge of Palmetto ware and its constituents. Until multiple origins are demonstrated, I will concentrate on identifying a single source.

With regard to pottery, the similarities between pottery in the northern Lesser Antilles and Palmetto ware in the Bahamas, first mentioned by Hoffman (1967:125) should be reexamined. With the date for Saladoid colonization of the West Indies being pushed back into the last half of the first millennium B.C., the long pause between their arrival in Puerto Rico and their expansion into Hispaniola grows longer. If the frontier in eastern Hispaniola was a function of a hostile indigenous population, it is possible that the largest islands of the Greater Antilles were by-passed and the Bahamas were settled directly from the Virgin Passage (eastern Puerto Rico/Virgin Islands area). Although the distance is substantial (about 400 miles), it is not impossible, especially if the final step in the jump was first attempted eastern Hispaniola. Furthermore, in addition to similarities in pottery manufacture (shell-tempered wares) and decoration, the islands are of similar size and have similar marine and terrestrial resources.

In my book (Keegan 1992), I described three other possibilities, Cuba to Long Island, Hispaniola to the Caicos, and Hispaniola to

Great Inagua. These will be reviewed briefly to incorporate comments that my discussion elicited. When I began conducting research in the Bahamas, one of the first theories I heard was that the initial colonists came from Cuba. Trying to pin this theory on a particular investigator proved daunting. In 1978, Sears and Sullivan (1978:22) noted that "The Bahamas were first settled in Zone III between 800 and 1000 A.D. by Arawaks who made Meillacoid pottery from either Hispaniola, Cuba, or both." Yet, both Sears and Sullivan had discarded the Cuba connection by 1981 (Sullivan 1981).

In writing about this theory (Keegan 1988, 1992), I turned to a paper by Winter, Granberry and Liebold (1985) because they discussed Cuba as a **possible** source of colonists and because Winter had presented a paper in 1982 in which he seemed to favor a Cuban source area (recently published as Winter and Gilstrap 1991). The context in which I cited their work offended both Winter and Granberry, although I meant no offense. Winter (1989) responded in a Letter to the Editor of the **Journal of the Bahamas Historical Society**. Granberry (1993) responded in a review of my book, in which he stated, "I know of **no** professional Lucayanist who subscribes, would subscribe, or has ever subscribed to such a Cuba-Long Island initial "Taino" settlement hypothesis" (Granberry 1993:59; emphasis in original). It is with pleasure that I put this phantom theory to rest, with apologies to those I offended.

Whether Cuba or Hispaniola (or the Virgin Passage area) was the source of colonists remains an open question. Several possibilities need to be explored. First, because Rouse (1992) has shown that cultural developments were centered on inter-island passages it might be more accurate to view colonists as originating in the Windward Passage rather than on Hispaniola or Cuba. In other words, their homeland was not defined by insular boundaries.

Second, Granberry has shown that the Lucayan name for Great Inagua (**Inawa**) glosses as "Small Eastern Land," and the Lucayan name for Grand Turk (**Abawana**) glosses as "First Small Country" (Granberry 1991:10). He then uses other surviving names to trace two migration routes into the Bahamas. One is from Hispaniola through Grand Turk, the other is from Cuba to Great Inagua and from there to Ragged Island into the central Bahamas (Long Island). These routes are discussed in turn.

The earliest scientific archaeology in the southern Bahamas was conducted by Shaun Sullivan in the mid 1970s (1976, 1980, 1981). Sullivan's discoveries on Middle Caicos led him to suggest that the Caicos Islands were the first to be settled. He also concluded that the eastern Caicos (East Caicos, South Caicos) and the Turks group were never inhabited because their climate was too dry. Recent investigations have shown that the eastern Caicos and Turks group were inhabited (Keegan et al. 1990; Keegan 1991a). Ongoing investigations in the Turks and Caicos are providing the data needed to evaluate both Sullivan's and Granberry's suggestions regarding the colonization of the Bahamas. Although additional details must await the completion of the National Geographic Society sponsored project "Precolumbian Cultural Interactions in the northern West Indies," it has already been reported that a Taino outpost dating to the early 13th century A.D. was established on Grand Turk (Keegan 1992b).

With regard to the central Caicos as the site of initial colonization, Sullivan used three data sets to support this hypothesis: settlement patterns, pottery analysis, and ecological factors (Sullivan 1981). Elsewhere I have argued that the data do not support an early intrusion into the Caicos, but rather reflect a late period expansion of Antillean Taino hegemony into the periphery (Keegan 1991b, 1992a). I will not recount that argument here. At present, there is not sufficient evidence to support the Turks or Caicos Islands as the location of the initial Taino colony in the Bahama archipelago.

According to Rouse (1986, 1992), the Ostionoid expansion across northern Hispaniola to Cuba stalled on the Cuban frontier. One result was a growing population in stuck western Hispaniola that was ready to avail itself of the Bahamian outlet only 90 kilometers (54 miles) to the north. Moreover, given his reclassification of pottery styles, the frontier that Rouse identified in this area might be better reclassified as a passage area. In other words, if Palmetto ware developed directly out of an Ostionan Ostionoid tradition, then its origins may be traced to the Windward Passage, and the colonization of the Bahamas could date to before the development of Meillacan Ostionoid pottery around A.D. 800 (see Berman and Gnivecki 1991; Rouse 1992).

Taino expansion along the north coast of Hispaniola and onto Cuba may be the key to the colonization of the Bahamas. The problem remains finding archaeological evidence that matches that expected of the first colony. The 1984 archaeological survey Great Inagua provided a partial breakthrough. Great Inagua had been ignored previously because the architects of an earlier colonization model did not have time to survey the island. In their summary of Bahamas prehistory, William Sears and Shaun Sullivan (1978) simply concluded that Great Inagua must have been too dry to have ever supported permanent settlement. Our survey uncovered evidence for permanent habitation sites.

Great Inagua is a better candidate for the first colony than is the Caicos for several reasons. Inagua is larger and is closer to both Hispaniola and Cuba. Moreover, if salt were the motive behind colonizing these islands (Sullivan 1981), Great Inagua is at least equally likely because it has more substantial salt-producing ponds than does the Caicos. Great Inagua also has a higher likelihood of being contacted from Hispaniola.

Two factors are of immediate importance (Keegan and Diamond 1987; Held 1993). The first is distance; the second is maritime conditions that influence travel (e.g., wind, waves, and currents). With regard to distance, none of the southern Bahamas are visible from Hispaniola. However, signs of these islands in the form of weather patterns and bird migrations (especially flamingoes) would indicate the presence of islands to those who knew how to interpret the signs. In terms of measured distance, Great Inagua is the closest Bahama Island to the Greater Antilles being only about ten kilometers (six miles) farther from Hispaniola than is Cuba.

Maritime conditions can be divided into the categories of wind direction, wind intensity, and ocean currents. The net effect of these three factors is to favor voyaging from east to west. The primary factor is the easterly trade winds which are dominant about two-thirds of the year. These winds are complemented by the northwesterly trending Antilles Current which flows through the islands at between 0.5 to 0.9 knots. These winds and currents today move a variety of floating objects onto beaches in the southern Bahamas. On the windward beaches of Great Inagua and Mayaguana, the author has observed wooden statues and spoons, dugout canoes, and a canoe paddle of apparent Haitian origin. A Haitian source has been proved in one case: rocks trapped in the root system of a palm tree that washed ashore on Great Inagua have been shown to match the unique geologic assemblage in the vicinity of Cap Haitien (Keegan and Mitchell 1986). If the Tainos on Hispaniola simply let the winds and currents take them where they would, they would have drifted to Great Inagua.

Wind, waves, and ocean currents interact to either favor passage between islands, by pushing the craft along its intended course, or they may impede travel by blowing from some angle to the direction of travel thereby deflecting the canoe from its intended course. If voyages from Hispaniola to the southern Bahamas were timed to coincide with favorable marine conditions, travel to Great Inagua would have been favored about 281 days per year, while travel to the Caicos Islands would have been favored on about 91 days per year. Great Inagua was an easier target than the Caicos Islands because it is both closer and more accessible. Great Inagua is the logical first colony, but logic is not by itself sufficient proof. Before addressing the question of whether Great Inagua was the first island colonized, the results of archaeological surveys and excavations on the island will be reviewed.

Archaeological Survey of 1984

From June 23 to July 5, 1984, Dr. Steven Mitchell and I conducted an archaeological and geological survey of Great Inagua. Because the island had not been extensively surveyed, our objective was to cover as much of the island as possible. In sum, we covered almost 130 km (80 miles) of the coast. The speed of the survey prevented us from covering all of the areas as thoroughly as we would have liked, but it proved sufficient in providing an overview of much of the island. Moreover, as previous and subsequent surveys have shown, we were likely to have encountered at least the largest sites in the areas we examined. To provide as complete an account of the survey as possible my field notes from the survey are presented below.

23 June. We arrived on Great Inagua and arranged housing. It was afternoon by the time we set out. We surveyed from Matthew Town to South West Point and up to the public warehouse. From there we hiked the road back to Matthew Town. From town the beach is eolianite rock to just beyond the lighthouse where it turns to sand. The soil is extremely sandy, but looked tan near the channel excavations. Shells occur along the beach. Three punched conch shells were found in different locations, but no midden or pottery was observed. The beach around the corner from South West Point has been building steadily. Today there are between 4 and 6 fossil dunes preserved. Viewed from the air the shore has a corrugated appearance. The vegetation is whitelands and all of the fossil dunes were each examined in several places. No sites were found. The beach here is littered with all sorts of flotsam, including dense mats of seaweed.

Bahamas National Trust turtle camp at Union Creek.

24 June. Jimmy Nixon drove us to the Bahamas National Trust (BNT) Field Station at Union Creek. Steve went to examine the tidal creek while I walked along the road to Smith Sloop Point. The beach to Black Wood Point is sand, but very narrow with the tidal creek behind. There are lots of shells along the beach and the road, but most show evidence of having washed up. The soil is very sandy. Beyond Black Wood Point the shore turns to very thick beach rock about two-meters wide in massive blocks. Areas along the beach look suited for settlement, except for the beach rock and narrow width of the beach. No evidence of sites was found.

25 June. Steve and I hiked north across the causeway onto a large cay. Most of the coast is sand beach, but beach rock occurs between the ruins and the next point. We examined areas all along the beach and found one site (GI-1) at the northern of two areas of casual cultivation. The site begins about 7 meters behind a sand beach which fronts on a shallow marine flat with dense beds of **Thalassia** turtle grass. The site is near the mouth of a former opening into Union Creek. A dense scatter of shell covers the site, including **Strombus**, **Codakia**, **Cittarium**, **Chiton**, **Fasciolaria**, **Tellina**, **Nerita**, and coral. Pottery is widely scattered and small in size. The 22 sherds we observed were collected; including 13 imports and 9 Palmetto ware. In general the imports are larger, two sherds were decorated rims. Small limestone (firecracked) rocks also occur along with shells that appear to be burned. The site extends across the 10 foot contour (circa 20 meters) and is about 100 meters long. This dune offers protection from the wind. The soil is sandy covering sandy loam with numerous crab burrows. The vegetation is coppice with hardwoods and Palmetto palms. As we returned to the BNT field station we took a second look at places along the way.

26 June. We left the BNT Field Station in the morning and began the hike back to Matthew Town. Because the coast up to Smith Sloop Point had been surveyed, we began the survey there. We immediately found a site . The site (GI-2) extends from the point to the margin of Red Salt Pond, a distance of about 80 m. It is about 15 m wide. There is a dense scatter of **Strombus**, **Codakia**, **Cittarium**, **Chiton**, and **Nerita**. Palmetto ware and imports occur in low frequency. There is a sand beach on the western side of the point and beach rock to the east. The site is disturbed by the road which runs from the main road out to the end of the point. The soil is grey and supports a mixed whitelands/coppice vegetation with hardwoods and Palmetto palms intermixed. The site may have been cultivated at one time and is purposely kept cleared. The marine environment is a broad, shallow **Thalassia** grass flat. Red Salt Pond was a tidal creek when the site was occupied.

Union Creek.

I continued along the road and examined areas of casual cultivation but found no other evidence for prehistoric activities. About midway down the pond there is a marshy area with mangroves that was once an opening into the pond. On a dune just west of this opening and just inland from the road, we found a site. The site (GI-3) measures about 100 m by 20 m. The densest scatter occurs on the side of the dune overlooking the pond. The shell scatter includes **Strombus**, **Codakia**, **Cittarium**, **Chiton**, **Tellina**, and **Nerita**. Twelve potsherds were observed; all were imports. A large griddle sherd was recovered. The soil is grey, and supports a mixed whitelands/coppice vegetation with interspersed Palmetto palms, hardwoods, and pond-type (buttonwoods, mangroves) vegetation. There is a large shallow bay in front of the site and access to the offshore reef.

We continued along the road. When we reached the North West Point peninsula Steve walked to the point along the beach while I took the road to the south, which cuts directly across to the opposite shore. No sites were found by Steve on his trek to the north. After crossing the peninsula I walked up and met Steve at North West Point and we examined areas along that shore together. The bay here is a high energy with beach rock, rubble, and large boulders along the shore and tossed up onto the dune. There are groves of coconut palms all along the shore. Returning to the junction in the road, I first walked through a coconut grove along the back side of the pond. The land is low and probably floods periodically. No evidence of sites was found. At the road junction just west of Red Salt Pond I found a single Palmetto ware sherd in a coconut grove (GI-4). The area is highly disturbed by roads, sand intrusion from the beach, and coconut plantings. Surface visibility is poor due to palm fronds, coconuts, and dense vegetation. The shell scatter includes includes **Strombus**, **Codakia**, **Cittarium**, **Chiton**, **Tellina**, **Fasciolaria**, and **Nerita**, and corals along with beach wash. The scatter is quite large and extends from the north-south road to the pond. The size of the site cannot be determined because the area has been used for many years (a pipe stem was found along the road). The hardwoods are very large in this area, and the soil is sand covering tan sandy loam. The sea in front of the site gets deep quickly with the reef located just offshore. The shore changes from sand beach to beach rock just beyond the site. We hiked about a mile closer to town and set up camp for the night. The mosquitoes have been horrible.

27 June. About a mile north of the Morton Salt Works at the only break in the ancient beach rock there is a short stretch of sand with a field and three disused houses behind the road. The field has been cultivated in the past and presently is covered by dense fallow vegetation. Four import sherds (one is either a griddle or historic), separated by a total of 60 m, were found (GI-5). includes **Strombus**, **Codakia**, **Chiton**, and **Tellina** were observed on the surface along with beach wash and numerous small limestone rocks. The site's size cannot be determined from this survey. Surface visibility is poor, the mosquitoes intolerable, and there are few crab burrows to bring material up from beneath the surface. The sea is very deep in front of the site and there is access to a near-shore reef.

The area of the salt works was highly modified during salt-pan construction. The beach is beach rock until it changes into fossil reef toward the point. We followed the road to the southwest cutting off the point. The area where the road forks near the beach was carefully examined, but the land is very low and apparently floods periodically. The bay is high energy with storm-tossed rock along the intertidal zone. Just behind the coastal dune is a permanent swash which continues up to the airport. Just north of the road to the airport a single Palmetto ware sherd (GI-6) was found in a field that has been cultivated in the past. The field is covered by six-foot tall fallow vegetation. The soil is sandy covering tan sandy loam. The density of plant growth and leaf litter

Steve Mitchell hiking between salt piles at the Morton Salt facility.

obscure the surface. There are lots of rocks in the field and they appear to be aligned. A little shell occurs on the surface (**Strombus**, **Codakia**, and beach wash), but it does not appear to be from a midden. Crab activity in the area is limited. The site is across the road from a sand beach. The water rapidly gains depth from shore. We returned to town by following the rock coast.

28-30 June. We remained in Matthew Town for three days waiting to arrange transportation to South East Point. During this time I went out by the airport to re-examine GI-6. No additional material was found in the 15 minutes I had to look. After 15 minutes of looking I was approached by a police officer who felt compelled to examine my permit in detail. I was compelled to return to town and to wait several hours while they attempted to call Nassau. Until recently Great Inagua has been a busy trans-shipment point for drugs being smuggled from South America to the U.S. The Bahamas police force had recently cleaned up Great Inagua, but they were still sensitive about activities in the vicinity of the airport. We were asked not to return to the vicinity of the airport until we were ready to leave the island. We also examined the cemetery and the sand beaches among the rock shore in Matthew Town. Nothing was found. These sand beaches appear to be the product of historic construction.

1 July. At 1:00 am we climbed aboard Essoud Cartwright's four-wheel drive truck for the trip to South East Point. We stopped to stash food and water along the way and reached our destination at 3:30 am. In the morning we walked west to a small point which offers some protection to a small shallow bay. There is a narrow dune between the beach and seasonally flooded swash. There are dense concentrations of mollusc shells on the dune, especially includes **Strombus**, (many of which are punched) **Codakia**, **Cittarium**, **Chiton**, and **Chama** also occur. There are numerous small limestone rocks, and many of the rocks and shells appear burnt. No pottery was found despite a very careful examination of the dune along its entire length. This may be a resource procurement area. Discouragements to permanent settlement are the rough water in the bay, exposure to strong easterly trade

Great Inagua's manual lighthouse.

winds, low rainfall levels, salt spray, sandy soil, and stunted hitelands and coppice vegetation. Perhaps the strongest factor is the lack of a protected beach landing. Wave refraction around the small point would make conditions in the bay rough on most days. There were whitecaps in the bay on this day.

In the afternoon we walked north to the southern end of the pond. Today the pond has been filled with air-borne sediments. The eastern shore is extremely windy. The vegetation is low and stunted and grows on very sandy soil. Nothing was found, which did not surprise us. The intertidal mollusc populations in this area appear to be undisturbed by human predation. Therefore, they may reflect resource availability at the time the Bahamas were first colonized by the Tainos (see intertidal mollusc counts, below).

After returning to camp we discovered the remains of a palm near the crest of the beach. Within its roots was soil and rocks, and rocks were also scattered in a 50 cm diameter area around the root. The rocks are all from outside of the Bahamas (see Keegan and Mitchell in 1986). A rock measuring 10 cm by 5 cm by 2.5 cm thick was found in a cavity near the base of a large hardwood tree which had washed ashore nearby.

2 July. We hiked from South East Point to a point about one mile east of the start of Lantern Head peninsula. Up to this point the coast is buffeted by the easterly tradewinds and is washed by strong surf. The reef comes close to shore. From our camp we hiked to Gun Point. Here there is a small bay that gets some protection from the point. Even with this protection the bay had small white-capped waves on the ebbing tide. The area did, however, appear suited for settlement. The soil is very sandy and the vegetation is mixed whitelands/Palmetto woodland. The coastal dune has been covered by beach wash. Near the base of the point we found punched conch on a former beach which is 5 meters behind the present beach. The dune is backed by a pond that has filled with windborne sediments. No evidence of a midden or pottery was found. Almost all of the dune from Gun Point to the high dunes at its western end was surveyed.

Returning to camp I then surveyed southwest to the beginning of Lantern Head peninsula. The reef departs from the shore just west of Gun Point and a broad shallows occurs in the bay. Much of this is exposed mud flats at low tide. The shells of economically significant mollusks are found washed up on the beach. The soil on the dune is very sandy and supports whitelands vegetation with Palmetto palms. Sand is continuously blown onto the dune while its face is being eroded by the sea at high tide. No evidence of midden accumulation or pottery was found along this stretch. The dune is quite narrow and is backed by the former pond so it would afford little area for cultivation. Just west of our camp mangroves and pond-type vegetation attest to the former connection of the pond to the sea. In several locations the beach is littered with punched conch.

3 July. We hiked the road to the other side of Lantern Head Harbour. We did not survey Lantern Head peninsula. Steve examined the tidal creek and found it to be devoid of mollusks, both recent and fossil. I examined the shore and areas behind the ponds nearby. The back sides of these ponds have rock shores and low coppice vegetation. The shore is eolianite backed by a low dune that would be awash in high water. At such times the ponds behind the dune, which today are dry, would flood.

We continued along the road and made camp at Sandy Point. The entire area does not appear suited for settlement. A high ridge occurs along most of the coast and is covered by coppice and stunted coppice vegetation, depending on wind velocity in the area. Behind the dune is a low area of xerophytic, salt-tolerant vegetation in an area that floods periodically. In front of the ridges are ponds, lakes, tidal creeks, or low areas that have either standing water or flood periodically. Most of the ponds we observed are dry with a thin crust of salt. Continuing to the shore one encounters a narrow dune ridge along the beach. This dune supports whitelands vegetation. Sand is being blown and washed onto the dune. Permanent settlements are unlikely because of the lack of suitable agricultural land. However, the areas surveyed support good fishing and shellfishing grounds so temporary procurement camps may have been established in the area. We did not find any evidence for such camps.

4 July. We hiked along the road to a point west of Conch Shell Point. Here we established camp in the picnic ground built by Essoud Cartwright . We examined the shore near Conch Shell Point but found no evidence of a site. The dune is quite high along much of the shore and the reef is close to shore making the sea quite rough. Up to Conch Shell Point the coastal zone is as described yesterday.

Just to the southeast of Cartwright's camp we found a site (GI-7). The soil is sandy and has been dug up by donkeys and crabs, but these depressions and holes are quickly covered. Although the area is fairly open, little occurs on the surface. Two import sherds were found, and a wide area is covered by a light scatter of shells: **Strombus**, **Codakia**, **Cittarium**, **Chiton**, **Tellina**, and limpets. The site could be large, up to 100 m by 15 m, as shell covers at least this size area. However, the paucity of potsherds makes the size impossible to determine without test excavations. The shell scatter covers the entire dune width. The soil is sandy, but supports a good growth of coppice vegetation that continues into the interior. The beach is sand with beach rock in the inter-tidal zone. Beach rock is today forming in this area. Southeast of this point the reef continues to the west while the shore trends to the north, forming a large shallow area with Thalassia seagrass beds. We examined the area to the north for a short distance. Shell was clearly visible, but no pottery was found. Punched conch occur in both areas and in the beach rubble southward on the coast.

5 July. We left camp and hiked along the road which cuts the back side of the coastal dune. Shell continues in this area, but no pottery was found. The road traverses Salt Pond, which today is mostly dry, although it is wet just below the surface. At Salt Pond Hill we visited the cave site (GI-8) reported by Krieger. The cave is in the smaller hill (20 foot contour) to the west of the 101.8 foot elevation hill. The cave opens to the east, but the opening is filled with small limestone rock rubble. The 10-m long tunnel ends in a large chamber about four meters in diameter. There are four openings to the surface above the tunnel and a large opening above the chamber. There is about five centimeters of water covering the bottom of the chamber. Cave earth has been dug from the cave. We found six import sherds on the surface above the cavern near the main skylight. All appear to be from the same vessel. Krieger (1937:98) reported, "Hand-molded figure heads which occur as handles joined to the earthenware bowls of the island Arawak were not seen there [on Long Island] but were noted on the thin-walled red ware pottery recovered from the Salt Pond Hill cave, Inagua." We continued along the road which follows on the inside of the dune above the pond. The road cuts into the dune. Along the road we found Palmetto ware and imports scattered for 500 meters along the road. **Strombus**, **Codakia**, **Tellina**, **Fasciolaria, Nerita**, and corals occur along the cut face; as do small limestone (firecracked) rocks. White sandy soil covers tan sandy loam. The vegetation is whitelands with low coppice. The site is focused on the pond, which may have been a tidal creek 1000 years ago, but is likely to have been closed for at least 500 years. The beach in front of the site is sand, and the reef is a good distance offshore. Near the western end of Salt Pond we found five Palmetto ware sherds (two fit together) in a small cluster. They may all be from one vessel. The only shell in the area was **Strombus**. The site is in the same setting as GI-9. We returned to Matthew Town where our survey ended.

Aerostat Archaeology

As part of their drug interdiction program, U. S. Customs selected a location at North West Point on Great Inagua to build an Aerostat base. Because construction of the base will impact a 30 acre tract in an archaeologically sensitive area, the Bahamas National Trust asked that an archaeological investigation of the proposed base be conducted. U. S. Customs graciously agreed, and the proposed base location was investigated by a research team consisting of Corbett Torrence, Barbara and Paul Toomey, under the direction of the author. The investigation was conducted with the assistance of the Bahamas National Trust and with a permit issued by the Department of Archives, Ministry of Eductation and Culture, Nassau. A small site with a single import sherd was found during the course of the survey (GI-11). The details of the 1992 survey are reported in Keegan (1992b), and are summarized below. Because the archaeological site was to be destroyed by base construction, the author returned to Great Inagua in March 1993 and excavated most of the site. The details of this excavation are reported here.

Surface scatter at site GI-11.

On September 28 and 29, 1992 we conducted a pedestrian walkover survey in which the ground surface was visually examined. This technique was selected because the proposed base had been previously cultivated. Casual cultivation increases the probability that archaeological remains will be brought to the surface. Moreover, archaeological sites in such areas tend to be easy to locate because the high frequency of mollusc shells in their deposits make them highly visible. During the survey areas were swept clear of leaf litter to improve surface visibility and shallow tests were dug to look for evidence of anthropogenic (human modified) soils. Because more than 90% of the known pre-Columbian sites in the Bahamas are within 100 meters of the beach, our initial investigations focused on areas immediately adjacent to the beach. We next investigated the area which abuts the main road, and then moved into the center of the proposed base along a jeep trail that bisects the property. We completed the survey by investigating along the two interior sand dunes which run parallel to the beach. These transects covered all of the main vegetation zones and landforms on the proposed base. In addition, we examined cleared garden plots to the west of the base, and a known site to the east.

The investigation resulted in the discovery of one small archaeological site in the center of the proposed base. The site, designated GI-11, is on the jeep trail which bisects the property. GI-11 is along an old dune line approximately 300 meters from the beach. It is roughly circular surface scatter about five meters in diameter. The surface scatter was composed of conch shell (**Strombus gigas**), West Indian top shell (**Cittarium pica**), nerites (**Nerita** sp.), chiton plates (**Chiton** sp.), and valves of tiger lucine clams (**Codakia orbicularis**). These shells comprise the typical suite of shells in precolumbian Bahamian sites. The only definite artifact of human origin was a single piece of pottery. The pottery was heavily encrusted with calcium carbonate (caliche), which suggests that it may be quite old. The examination of a fresh break showed small white pieces of temper, which suggested that this was a sherd of Palmetto ware.

Test excavations (30 cm square) were dug on four sides of the site just beyond the surface scatter. Soil from the tests was sieved through 1/4 inch mesh screen. No artifacts were found below the surface. A trowel test made in the middle of the deposit also failed to reveal subsurface deposits. A representative collection of materials was made, and it was determined that no additional excavations would be necessary. The following materials were collected: 1 potsherd, 2 firecracked limestone rocks, 2 pieces of **Cittarium pica**, 6 chiton plates, 8 fragments of **Strombus gigas**, 1 **Cerion** shell fragment, 3 **Codakia** valves, 1 **Tellina radiata** valve, 2 small bivalves, 1 fragment of **Nerita**, 2 pieces of coral, and one-half of a fish otolith. These items have been deposited in the Department of Archives, Nassau.

Based on the single "Palmetto ware" potsherd, the suite of mollusc shells, the size of the scatter, the absence of subsurface deposits, and a location at least 300 meters from the beach, GI-11 was diagnosed as a farmstead. Farmsteads are sites at which small shelters were maintained in agricultural fields (Keegan 1992). Because farmsteads are usually located within 3 kilometers of larger sites (i.e., they are satellites of more permanent villages), we investigated the coastline near the proposed Aerostat base. Surveys conducted elsewhere in the Bahamas have revealed that larger sites (villages and hamlets) occur in pairs at regular intervals along the coast (Keegan 1992). Once a pair of villages or hamlets was established, no other sites would occur for a substantial distance. Thus, if such larger sites occur in the area, then it is less likely that any ever existed on the Aerostat property. Our survey of the adjacent coastline revealed a large site, which was identified as part of GI-3 (Keegan 1985), with a surface scatter extending along the road for more than 500 meters. The site is about 3 km from the Aerostat site. Eighteen small import sherds were collected from the surface of GI-3. These sherds have been deposited in the Department of Archives, Nassau, following petrographic analysis at the Florida Museum of Natural History.

The artifacts that were collected from the surface of the Aerostat site were analyzed at the Florida Museum of Natural History. The pottery was examined by Ann Cordell, Director of the Ceramic Technology Laboratory at the Florida Museum of Natural History. She examined the sherd at 70X magnification with a binocular microscope and fiber-optic light source. The microscopic analysis of the sherd from the Aerostat site (GI-11), revealed the presence of very small clear quartz inclusions. In addition, the white flecks, which to the naked eye appeared to be shell, are actually opaque white quartz. Other noncarbonate minerals were also observed (e.g., feldspar). A piece of the sherd was then immersed in hydrochloric acid; no reaction was observed. When subjected to similar acid immersion, a Palmetto ware sherd from the collections produced a violent bubbling and released a white gas. This analysis demonstrated that the Aerostat sherd has a noncarbonate temper and matrix and must therefore have been brought to the Bahamas from elsewhere. In addition, the sherd had similar ingredients to a group of sherds from GI-3.

Because laboratory analyses revealed that the sherd was not Palmetto ware, the significance of the site increased substantially. Funding to return to the site was requested, and approved. The goal was to determine the possible function of the site. For instance, the presence of satellite settlements in a sedentary agrarian economy, like that of the Lucayans, was expected so the discovery of a small scatter of shell with a single 'Palmetto ware" sherd was not unusual. Similar sites with only one or a few import sherds are unusual (see Sullivan 1981). They might reflect seasonal visits from the Greater Antilles, the first settlements established during the initial colonization of the island and/or archipelago, or the might be satellites of larger Antillean Taino settlements established during the expansion of the Taino chiefdoms after A.D. 1100. A second look at the site was even more critical because the site was slated for development.

Setting and excavation units at GI-11.

I returned to Great Inagua by myself on March 13, 1993. The main purpose of this trip was to excavate site GI-11. In addition, sections of the Aerostat base had been cleared since our survey in September so I used this opportunity to look for sites along these new cut lines. Lastly, because I had use of a vehicle and was staying at the Bahamas National Trust camp at Union Creek, I made brief visits to the other known sites in the area (GI-2, GI-3, GI-4). While driving between Union Creek and Matthew Town I noticed a shell scatter along the road between Black Wood Point and Smith Sloop Point. This location was given the number GI-13 because a single import sherd was observed (described below).

At GI-11, a grid was established with the main north-south axis (grid north) along the jeep trail. The surface scatter is concentrated in a 3 m (north-south) by 6 m (east-west) area. One-meter squares were marked out over this concentration. These squares were excavated by trowel as a single level to a depth of 15 cm. The soil is light brown in color, with occasional spots of grey in which shell is decomposing, to a depth of 8 cm. Below 8 cm the soil changes to pink sand. All of the artifacts (i.e., shells) are within 9 cm of the surface. Because the soil was very sandy it was impossible to miss the shall artifacts. For that reason the soil was not screened. Every scrap os shell from the excavation units was collected. Only one possible feature was noted, a roughly circular, small, dark stain with little depth in N7E1. It may simply be the remnants of a burned stump. Casual cultivation has been practiced in this area up until recently. I completed units N6W1, N6E0, N6E1, N7E1, N7W1, and N8W2, the morning of March 14th. The following morning I dug units N6E2 and N9W2, which are on either side of the jeep trail. N6E2 slopes up to 9 cm above the surface of the road, and the southwest corner of N9W2 is 6 cm higher than the road surface.

Excavations at GI-11.

Several 30 cm square test pits were also dug. A test pit at N0E0 had pink sand soil from the surface to 60 cm below surface (bs). The only object in the unit was a small **Strombus gigas** spire apex (top of a queen conch shell). Because site GI-12 (described below), located about 70 m to the west, is actually 20 meters north of the dune on which GI-11 is situated, I tested the area north of GI-11 at 10, 15, and 20 meter intervals. In the units 15 and 20 meters north, the soil is light color and sandy. At 10 m north there was 10 cm of light sand covering brown sandy loam which changed to pink sand at 30 cm bs. All of the test units were dug to 70 cm bs.

In sum, the site is composed almost entirely of burned shell whose small size is best described as pulverized. Tests excavations indicate that the site is limited to a surface scatter that covers an 18 square meter area along the jeep trail which bisects the Aerostat base. One imported potsherd is the only artifact of definite human manufacture on the site. Comparison of this sherd with imports from other sites in the area suggest that it is Taino. My conclusion is that the site is a satellite of a larger site in the vicinity (perhaps GI-3), which was probably used as a farmshelter. The burned shell is the remains of meals prepared in the field.

On the afternoon of March 14th I walked the cut lines that were made after we gave the U.S. Customs Service a conditional construction clearance. The cut lines are about 5 meters wide, and extend around the perimeter of the property with several additional cuts extending inward toward the center of the property. Trees and a thin layer of topsoil were pushed to the side of the cuts at intervals. About 70 meters to the west of the jeep trail on which GI-11 is situated there is a cut which begins on the beach side of the property (north) and forms a large cross, ╬, ending in the vicinity of the center of the property. In the top of this cross (south) I found a dense scatter of burned shell, including **Strombus gigas**, **Cittarium pica**, and chiton plates along with firecracked limestone rocks. No pottery or other artifacts were found. Even in the absence of diagnostic artifacts this shell scatter was clearly a site (GI-12). The site is about 250 meters from the sand beach. No other evidence for aboriginal activities was found elsewhere on the cut lines, not even in places where the cuts cross the dune with which GI-11 and GI-12 are associated.

I returned to GI-12 the following morning (March 15th) and troweled a one-meter square in the center of the most concentrated deposit in the hopes of finding some diagnostic artifact. This concentrated deposit occupies a 9 meter square area on the western side of the top of the cross. The soil is very black in contrast to the surrounding light tan sand and brown sandy loam. The very black soil goes from the surface to 10 cm bs; it contains most of the burned shell, and one fish bone was also observed. From 10 to 20 cm bs there is a transition zone of dark gray soil, below which the soil is light color (yellow) sand. The unit was dug to 60 cm bs. Other shells and coral are scattered around the area. I dug one 30 cm square test pit on the eastern side of the top of the cross near a scatter of coral. The soil here is brown sandy loam; no artifacts or shell were encountered. A test pit in the bush just west of the cut line and four in the cardinal directions around, but off, the black deposit, had neither shell nor other artifacts below the surface. The soil was predominantly brown sandy loam to a depth of 20 cm with light sand below to a depth of 60 cm.

The only materials collected from GI-12 were three large fragments of burned queen conch shell (2 lips and 1 columella). These were radiocarbon dated (see radiocarbon dating section, below), and gave a corrected and calibrated age range [minimum (calibrated age) maximum] of: A.D. 1040 (1174) 1270. Like its neighbor, GI-11, it is likely that GI-12 was a satellite of a larger site and that its deposit reflects farming activities in the area. Both sites are too recent to reflect mollusc collecting sites which would, more appropriately, be located closer to the coast.

After finishing at GI-11 and GI-12, I made a brief stop at GI-3 to collect samples for pottery analysis and radiocarbon dating. Along most of the coast the road runs right along the beach until it reaches a spot where the beach and pond almost meet. The pond obviously had an opening in this location in fairly recent past. From this juncture the scatter of shell and pottery along the road extends 425 meters to the southwest. I collected one import sherd (10.6 g in weight) from this area. I dug four 30 cm square tests in search of shells for radiocarbon dating. One test unit and two additional scrapings were made along the road. These revealed a very shallow soil deposit covering beach rock. Three test units in the previously cultivated fields behind the road revealed deep (c. 40 cm) sandy-brown loam. No artifacts were found in any of the test pits, which suggests that the deposit along the road is either a scatter created during the construction of the road, or that the site was completely destroyed by the road. At present, the former seems more likely. Two queen conch shells were collected from the surface. Both shells were punched and both came from the fallow fields between the road and the pond. One of these shells had a Triton's trumpet spire wedged into its aperture. For that reason it was selected for dating. The corrected and calibrated date from this shell is A.D. 1320 (1433) 1510 [minimum (calibrated age) maximum, at two standard deviations]. Which means there is a 95% statistical probability that the sample dates to between 1320 and 1510.

The site also continues to the north beyond this pond/sea juncture, although the road here runs behind a coastal dune and along the margin of the pond. I collected five import sherds, including one sharply inturned rim (almost 90°), and one very small Palmetto ware sherd. The import sherds have a total weight of 38.8 grams; the Palmetto sherd weighs 6.9 grams (Table 2). Two **Codakia orbicularis** valves found near each other, and believed to be from the same animal, were also collected for possible C14 dating. They are 3 cm in diameter and weigh 100.5 grams. The dune between the beach and the road is quite wide here so the site could be quite large. However, the high density of sites along this coast makes it difficult to distinguish where each starts and stops. For instance, the single Palmetto ware sherd from this area may indicate that Palmetto is present, albeit unobserved, to the southwest, or the Palmetto ware may come from the Smith Sloop Point site (GI-2), which is no more than 300 meters to the north.

I made a brief stop at Smith Sloop Point to reacquaint myself with the site. It appears that part of the point was bulldozed recently and washing out of a cut I found a very large fragment of a Palmetto ware bowl. This bowl, if circular, had at least a 42 cm diameter and was about 20 cm deep (Table 2). A second large Palmetto ware bowl fragment has nearly straight sides, with at least a 15-mm-thick base. If this base was flat, then not all large-thick-flat Palmetto ware sherds come from griddles. Four import sherds were collected, one of which has fine-line oblique alternating incision along the rim above the shoulder (Meillacan style). The pottery is described further in Table 2. Most of the pottery that was observed was not collected. The potsherds on this site are much larger than those observed on most other Lucayan sites. In addition, mollusc shells and fish bones were observed on the surface.

In the late afternoon I made a brief stop in the vicinity of site GI-4, but was unable to relocate the site. I then stopped along the coast near Smith Sloop Point and collected nerites and chiton for allometric and nutritional analyses (see intertidal mollusc counts, below). In the vicinity of Union Creek, I collected 17 **Codakia orbicularis** for similar analyses.

Driving from the BNT Union Creek Camp to the Traveler's Rest for dinner, I noticed a shell scatter in the road between Black Wood Point and Smith Sloop Point. A brief investigation of the area revealed a single import sherd on the side of the road. The scatter occupies a relatively small area, and I was able to examine the entire extent of the shell scatter in a short period of time. The dune between the road and the coast is fairly wide here, and because the road cuts the back side of the dune, the site could be quite large. I was not prepared to investigated the site further, and because the sun was setting so I marked the location, assigned a site number, GI-13, and quit for the day. The next morning I departed from Inagua.

Table 2. Characteristics of pottery collected from Great Inagua.

No. Color/Source Thick (mm) Weight (gm)Comments

GI-2 surface collection, 1993, 23 sherds.

1 brown import 4.7 24.0 fine-line, alternating oblique incised between shoulder and rim

1 brown import 6.0 32.3

1 red-brown import 3.5 2.4 triangular, pointed rim

1 orange import 6.2 41.7

1 Palmetto ware 7-10.3* 307.6 22 x 10 cm sherd from large casuela with triangular pointed rim

1 Palmetto ware 11-18.3* 235.0 10 x 10 cm sherd from large straight-side, open-mounth, flat-bottom bowl

17 Palmetto ware 8-12.5* 87.0 small sherds, some may be from casuela

GI-3 surface collection, 1992, 8 sherds.

1 brown import 5.3 9.6

1 brown import 6.8 5.7

1 gray import 4.5 22.2 small flared-lip bowl

1 gray import 5.2 8.1

1 orange import 7.1 4.9

1 orange import 6.4 3.4

1 orange import 6.1 1.2

1 orange import 7.9 1.8

GI-3 surface collection, 1993, 7 sherds.

1 Palmetto ware 13.9 6.9 small, thick sherd

1 orange import 8.0 10.6

1 orange import 7.9 12.6

1 brown import 6.2 7.3

1 brown import 5.3 5.3

1 brown import 6.9 9.0 sharply inturned flat rim

1 brown import 5.1 4.2

GI-11 surface collection, 1992, 1 sherd.

1 orange import 5.5 4.1 caliche encrusted

*Note: minimum-maximum thicknesses are given for Palmetto ware sherds because they exhibit substantial variation.

Radiocarbon Dates

Two radiocarbon dates were obtained during the course of the Aerostat Project. The dates, from sites GI-3 and GI-12, were of **Strombus gigas** shells. The analysis was done by Beta Analytic, Inc., Miami, FL, between March 22 and April 21, 1993. Before reporting these dates, a word on radiocarbon dating and the calibration of radiocarbon dates is warranted.

All living tissues contain carbon; it is the major building block of life. Carbon enters the food web through plants which convert the carbon in the atmosphere into energy and tissues in a process called photosynthesis. Three different forms of carbon occur in the atmosphere, and all three are incorporated into living tissues. These different forms, called isotopes, differ according to their atomic weight, a value that is determined by the number of neutrons in the atom. Two of the carbon isotopes C12 and C13 (with 12 and 13 neutrons respectively) are stable, they do not break down. The third is a radioactive form of carbon, C14, which does break down. Carbon-14 breaks down with a half-life of 5568 years. As long as the tissue is living, the total amount of C14 remains constant because its loss is balanced by the uptake of new C14. But when the organism dies, its C14 clock begins to tick. No new C14 is added and the C14 in the tissues begins to decline at the above mentioned half-life. This means that after 5568 years half of the C14 in a sample is gone; half of what remained is gone after an additional 5568 years; half of that after another 5568 years; and so on. By measuring the amount of C14 remaining in a sample it is possible to determine its age.

Radiocarbon dates are reported as a mean date and a standard deviation. As the Beta Analytic report states:

These dates are reported as RCYBP (radiocarbon years before 1950 A.D.). By international convention, the half-life of radiocarbon is taken as 5568 years and 95% of the activity of the National Bureau of Standards Oxalic Acid (original batch) used as the modern standard. The quoted errors are from counting of the modern standard, background, and sample being analyzed. They represent one standard deviation statistics (68% prob-ability), based on the random nature of the radioactive disintegration process. Also by international conven-tion, no corrections are made for DeVries effect, reservoir effect, or isotopic fractionation in nature, unless specifically noted above.

It has long been recognized that C14 does not have a homo-geneous distribution in either time or space. The activity of the radioactive isotope of carbon in atmospheric carbon dioxide has varied over time. Moreover, because carbon is stored in a variety of reservoirs (e.g., atmosphere, sea water, ponds, etc.) the concentration of C14 available to its plant consumers can vary substantially. In addition, the plants themselves can vary in their use of carbon isotopes. Efforts to take this variability into account when interpreting radiocarbon dates have taken two forms. One is a C13/C12 correction; the other is calibration curves which take into account temporal variation in C14 concentrations.

The C13/C12 correction is an extremely accurate measurement of the ratio between heavier (C13) and lighter (C12) carbon isotopes compared to a standard and reported in parts per thousand (per mil). This ratio is important because the relative proportion of heavy and light isotopes in the sample can vary substantially. For example, plants which use the Calvin photosynthetic pathway (C-

3) have been shown to discriminate against the heavier isotopes of carbon (C13 and C14), while tropical grasses (e.g., maize, sugar cane) which use the Hatch-Slack photosynthetic pathway (C-4), show no such discrimination. As a result, C-4 plants are enriched in C14 relative to C-3 plants and will give radiocarbon dates that are as much as 400 years too young (Creel and Long 1986). A similar situation occurs in **Thalassia** seagrass meadows which are enriched in the heavier carbon isotopes. This enrichment is passed along to the animals which live in this environment (e.g., **Strombus gigas**, **Codakia orbicularis**). By measuring the isotopic ratio of a sample, the original concentration of radioactive carbon can be calculated and the sample age corrected accordingly. In the samples from Great Inagua, these corrections amounted to 450 years for GI-3 and 460 years for GI-12. These corrections mean that the sample ages were actually 450 and 460 years older than direct measurement of the shells would suggest. Although not as dramatic as seagrass mollusks and C-4 grasses, all samples may have isotopic corrections (e.g., charcoal samples from Grand Turk had corrections which added 10 years to the sample age).

The isotopic correction by itself is not enough. The date must also be calibrated. [It should be noted that dates must be corrected before they can be calibrated.] As Stuiver, Pearson, and Braziunas (1986) point out:

The calculation of the age of the sample assumes that the specific activity of ^{14}C in atmospheric CO_2 has been constant. However, this is not true. The ^{14}C activity in the atmosphere and other reservoirs, and thus the initial activity of the samples dated, has varied over time. A calibration curve is necessary to convert radiocarbon ages into calibrated calendar years (cal years). By measuring the radiocarbon age of tree rings of known age it is possible to construct calibration curves for the last 9,200 years for samples in equilibrium with atmospheric CO_2. Computer modeling has provided a similar calibration curve for marine samples.

In sum, samples must be calibrated to obtain an accurate date (Pearson 1987; Davis 1988). Fortunately, this task has been simplified by the "Calib & Display" computer program which produces instantaneous calibrations (Stuiver and Reimer 1986). The calibrated dates presented below were calculated using this program.

The **Strombus gigas** shells submitted for dating were treated in the following way (letter from Dr. Jerry Stipp, Beta Analytic, Inc., April 21, 1993):

A portion of each sample was selected and then washed, scrubbed and abraded to remove any soil matrix or loose weathered carbonate material. This was followed by repeated applications of acid solutions to dissolve away all outer layers. Sample GI-15 [renumbered GI-12] appeared to be recrystallized throughout and we discussed this condition with you; the decision was to proceed as the recrystallization was probably the result of heat. With the exception of that anomaly, all other analytical steps including syntheses and countings proceeded normally.

The results are:

Site:GI-3

Material dated: Strombus gigas

Lab number: Beta-61909

Radiocarbon age 480 ± 60 b.p.

C13/C12 ratio +2.0 per mil

C13 adjusted C14 age 930 ± 60 b.p.

Calibrated C-14 age, 2 sd minimum (calibrated age) maximum:

A.D. 1320 (1433) 1510

Site: GI-12

Material dated: Strombus gigas

Lab number: Beta-61910

Radiocarbon age 800 ± 50 b.p.

C13/C12 ratio +2.6 per mil

C13 adjusted C14 age 1,260 ± 50 b.p.

Calibrated C-14 age, 2 sd minimum (calibrated age) maximum:

1040 (1174) 1270

These dates indicate that: 1. The **Strombus gigas** shell collected from the surface of GI-3, chosen because it was punched and had a Triton's trumpet spire wedged in its aperture, has a 95% statistical probability of dating between A.D. 1040 and 1270, with a calibrated age of 1174; 2. The burned **Strombus gigas** shells (2 lips and one columella) collected from just beneath the surface in the black midden earth of GI-12 has a 95% statistical probability of dating between A.D 1320 and 1510, with a calibrated age of 1433.

Intertidal Mollusc Counts

Intertidal mollusc populations were counted on two separate occasions. The first was in July 1984, the second in March 1993. On July 1st, 1984, while surveying the beach near South West Point, we realized that the intertidal mollusc populations were probably as pristine as we would find anywhere in the West Indies today. South West Point is extremely remote, and is today visited only by the few hunters with 4-wheel drive vehicles who come to hunt pigeons and hogs. The beach in this area is a two-meter-wide slab of beach rock. Counts were made of three intertidal mollusks on an ebbing tide.

1. **Nerita** spp. Only the largest nerites were collected. Hundreds of reticulate nerites were passed over. The collection was made on a two-meter wide beach-rock shore that was washed by surf. A 15 by 10 by 10 cm container was filled in five minutes with a total of 175 snails.

2. **Chiton** spp. In two counting episodes I observed about 100 chitons in a 10 square meter area. In one 38 cm diameter basin I counted 48 snails. Additional counts were made on other parts of the beach with the lowest estimate being 50 snails per 10 square meters.

3. **Cittarium pica**. A timed counting was undertaken on the beach north of South East Point. The snails were not collected, but collection would involve simply picking the animal off the rock. To simulate collecting a snail was counted when it was within reach. Over a 40 meter stretch of 2-m wide beach rock I counted 189 snails in 3 minutes 15 seconds. All of the snails counted were of good size. Less systematic counts further down the beach gave similar results.

On March 13, 1993, 302 nerites were collected in ten minutes from the beach rock shore near Smith Sloop Point. As with previous collections, the largest snails were collected first. The collection had no observable impact on the nerite population. In addition, six chitons were also collected. It was my intention to collect 100 chitons, but very few were observed. These collections were made to obtain samples for a more accurate allometric equation relating shell size and weight to meat weight, and to obtain flesh for proximate nutritional assays. Proximate analysis measures Calorie, protein, fat, and moisture content. These measurements are important for estimating economic returns from prehistoric mollusc collecting.

Conclusions

In their 1978 overview of Bahamas prehistory, William Sears and Shaun Sullivan concluded, "The Inaguas, Grand Turk and associated cays, and East and South Caicos do not appear to have been settled because they are too dry to support an agricultural population" (Sears and Sullivan 1978:21). Archaeological surveys conducted in 1984, 1992, and 1993 by the author and his assistants have demonstrated that that conclusion is wrong (Keegan 1991a, 1992a). Thirteen prehistoric sites have been located along the almost 130 kilometers (80 miles) of Inagua's coastline that was surveyed. At least five of these sites reflect settled occupations (GI-1, GI-2, GI-3, GI-7, and GI-9). Moreover, two others (GI-11, GI-12) appear to be farmsteads, which reflect satellite activities associated with a long-term, permanent habitation.

Although a substantial section of the island's coast has been examined, there is a great deal left to do. In addition to the lack of surveys along the northern shorelines, the sites that are already known require additional study. All of the sites have a high frequency of imported pottery. The sites should, therefore, inform us with regard to cultural interactions between the Bahamas and Greater Antilles, especially as this island helps to define the Windward Passage. The two radiocarbon dates suggest that there was a Antillean Taino presence on the island as early as the 12th century A.D. Moreover, this Taino presence may have been independent of the Lucayan occupation of the island. Future research will focus on collecting the data needed to address issues on colonization, settlement, and inter-island exchange.

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