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Relating Oceanography to Antillean Archaeology: Implications from Oceania

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Introduction

The significance of prehistoric maritime adaptations has become an increasingly provocative topic among archaeologists world wide as comments following Yesner's (1980) article clearly demonstrate. Moseley's (1975) hypothesis about the maritime foundation of Andean civilization has been controversial since it was published, and within the past year alone two critiques of it have appeared (Wilson 1981; Raymond 1981). Edited volumes specifically addressing prehistoric maritime adaptations have been compiled recently for the Arctic (Fitzhugh 1975), Pacific (Casteel and Quimby 1975), and Middle America (Stark and Voorhies 1978). In the Caribbean region growing interest in prehistoric maritime adaptations corresponds to the increased attention at the global level.

Elsewhere (Watters n.d. b) it has been argued that Caribbean archaeologists should adopt a "seaward perspective" to counter a pervasive terrestrial bias in past studies and thereby gain a fuller understanding of prehistoric cultural adaptations in the Antilles. Adoption of a seaward perspective can complement the dominant landward view without supplanting it. Relationships between oceanography and prehistoric archaeology, whether addressing prehistoric peoples' interactions with the ocean (maritime adaptations) or the effects of ocean processes on the archaeological record (post-depositional history), are just beginning to be examined in the Caribbean (Watters 1981).

The purpose of this paper is to bring to the attention of Caribbean archaeologists some pertinent studies concerning maritime adaptations and ocean processes in Oceania, a region where research linking oceanography and prehistoric archaeology is further advanced. This paper briefly reviews prior maritime-related work in the Antilles, demonstrates the applicability of Oceanic studies to the Caribbean, provides a credible theoretical framework, and addresses the need for re-evaluating previously gathered data; it builds upon my aforementioned discussions of links between the disciplines, ocean processes affecting the archaeological record, reasons for the pervasive terrestrial bias, and the aspects of maritime adaptations that Antillean archaeologists currently are neglecting. This discussion more directly pertains to the insular part of Caribbean America--especially to the smaller islands of the Lesser Antilles and Bahamas--than to fronting continental landmasses in South and Central America.

Prior Caribbean Research

Some indicators of a maritime adaptation have long been noted in the Caribbean region- for example, the presence of marine shells and shell tools in sites. A century ago Cope (1883: Plate I, Fig. 12) illustrated a shell celt or adze found in a shipment of paleontological specimens sent to him from Anguilla by the Dutch naturalist H.E. van Rijgersma (Holthuis 1959). Rainey (1940) distinguished the Crab Culture from the Shell Culture on the basis of stratigraphic variation of predominant species in Puerto Rican sites. Since then the dichotomy has been observed elsewhere in the region (e.g., Goodwin n.d.). Marine invertebrate and vertebrate remains identified from a number of Antilles sites have been used to infer species' preferred habitats, zones ex-

ploited by humans, and information about diet (Wing 1968, 1969, 1973, 1977; Wing et al 1968; Wing and Scudder 1980; Jones 1980a, 1980b).

Other topics relating oceanography to prehistoric archaeology in the Antillean region include studies about paleoecology (Carbone 1980), overwater migration routes (de Hostos 1922; Rouse 1960; Cruxent and Rouse 1969), aboriginal watercraft (McKusick 1960; cf. Johnstone 1980:231-235), *corrales de pesca* (Fernández Méndez 1976; cf. Vega, 1980, for an "ethno-archaeological" account) and ceramic style distributions associated with passages between Greater Antilles islands (Rouse 1951). A session on island biogeography was included for the first time in 1979 at the Eighth International Congress for the Study of Pre-Columbian Cultures of the Lesser Antilles.

Initial progress has been made in the study of prehistoric maritime adaptations in the Caribbean and many of the topics investigated are similar to those of interest to Oceanic archaeologists. The depth and detail of Oceanic studies surpass the Antilles research, however, and integration of relevant data from oceanography and other sciences certainly is further advanced for many areas in the Pacific. Data are scarce or nonexistent for the Antilles in some cases, but data that are available are not being considered or at least not incorporated in other instances.

Comparative studies between the two regions or any of their subregions are not yet in order, at least not on a comprehensive level. Nevertheless, Antillean archaeologists who are interested in the maritime aspects of cultural adaptations and in ocean processes can benefit from research undertaken by their counterparts in Oceania. Methodologies used, data gathered, and interpretations made there potentially are useful for guiding similar kinds of studies in the Antilles.

Theoretical Background

Patrick V. Kirch of the Bishop Museum in Honolulu is one of the foremost proponents of applying the concept of cultural adaptation to the prehistory of Polynesia and more generally Oceania, and a Caribbean archaeologist reading his articles is struck by the potential applicability of many of his ideas. His major statements on theoretical and methodological issues of cultural adaptation have appeared recently (Kirch 1980a, 1980b). Regarding the central concept, he says: "In essence, cultural adaptation means the selective retention of a set of behavioral strategies from a wider range of behavioral variation" (Kirch 1980a:39).

Kirch emphasizes the concepts of environmental diversity, variability, and constraint. Environmental diversity certainly is not a new concept in Oceania where the occurrence of the Andesite Line, the distinction between continental and oceanic islands, and the classification of the latter as low, high, and intermediate islands have long been noted. Kirch (1979:304) is more concerned with microenvironments or microhabitats to which human populations adapted in more circumscribed areas such as individual islands or island groups. Arguing that environmental variation should be seen as a function of time as well as space, he lists four kinds of environmental changes that Polynesian societies faced: (a) differences in the environmental conditions they encountered when colonizing, (b) the geomorphological changes of the island masses, (c) short-term, recurrent climatic perturbations (e.g., droughts, cyclones), and (d) changes induced by humans themselves whether intentional or unintentional (Kirch 1980a: 43-44).

Coupled with environment diversity is the concept of constraint, which involves "...the limiting factors of environment that *constrain* the potential range of behavioral variability--" (Kirch 1980b:123, emphasis in original). In other words, only certain behavioral strategies from the wider range available to humans will be effective in coping with the constraints or stresses imposed by any given environment. Because the concept of "limiting factors" has created so much debate in anthropology at least since Meggers' (1954) paper, it is necessary to belabor the point and allow Kirch to further elucidate this idea in his own words:

> All these (constraining or limiting) factors have the potential to induce a state of stress, in which existing behavioral strategies are no longer adequate and new and different strategies must be melded from the potential range of behavioral variation, which is otherwise selected against (Kirch 1980a:39).

Noting that environmental constraint is not synonymous with "environmental determinism," he illustrates with the following example:

> While irrigation as a technique may be part of a population's cultural repertoire, the absence of permanent streams on a specific island is a constraint that necessarily channels the adaptive strategy of the population; it does not, however, direct that strategy along a no-alternative course (Kirch 1979:304).

Humans have developed the ability to modify the natural environment and alter or perhaps even eliminate the impact of a constraint thereby limiting the severity of a limiting factor. However, other limiting factors may appear and impose different constraints.

Kirch emphasizes that environmental constraints acted in the ocean realm as well as on land. He says: "The extent to which any Polynesian culture emphasized cultivation or marine exploitation was, to some extent, always constrained by local environment" (Kirch 1979:292), and he

argues that the adaptive strategies that were selected were closely attuned to the microenvironments present on any given island or group of islands. Also, environmental constraints were not the same on all islands or in adjacent waters and consequently colonizers were faced with different limiting factors that in turn selected for new behavioral strategies.

This section has drawn heavily on Kirch's ideas but it is necessary to point out that, while most of the extracted information involves aspects of the environment alone, in his articles Kirch goes on to discuss important considerations (e.g., population dynamics, sociopolitical structures, subsistence patterns) that are beyond the scope of this paper. Although others also are studying maritime-related aspects of Oceanic prehistory, we chose to emphasize Kirch's work because it effectively melds the concept of cultural adaptation with an ecological approach to island prehistory.

Implications From Oceania: Environmental Changes

All four kinds of environmental change encountered by Polynesian societies theoretically have counterparts in the Antilles region. Two of Kirch's examples illustrate this point.

His discussion of colonization of the Marquesas by settlers from the Tonga-Samoa region of western Polynesia nicely illustrates the first four kinds of change, the varied environmental conditions faced by Polynesian colonizers (Kirch 1973; 1980a). In their homeland in western Polynesia they practiced a wide variety of marine exploitation strategies (shellfish gathering, spearing, netting, fish poisoning, weirs, angling) in the lagoons and broad reef flats characteristic of that area. Upon moving into the Marquesas where rocky coasts are extensive but lagoons and developed reefs are uncommon, the settlers encountered a new set of environmental constraints that made procurement strategies, which had been highly effective in western Polynesia, much less so in the central region. Earlier assemblages at Marquesan sites yield an assortment of varieties of one-piece fishing gear reflecting a period of experimentation in adapting to the new environmental constraints. In later sites, however, a single dominant form recurs, a highly standardized one-piece jabbing hook that was selectively retained because of its proven effectiveness in taking fish along the rocky shores. This was a *revolutionary* change during which "...selective pressures are strongest, and most likely to induce the greatest range of behavioral variability" (Kirch 1980b:125).

Colonizers in the Antilles likewise faced differing environmental conditions on various islands. Individual islands, island groups, and adjacent shelves, which all too often are perceived as being very much alike, actually display considerable environmental diversity. Terrestrial, marine, freshwater, and estuarine environments are dissimilar even among nearby islands such as the low-lying limestone island of Barbuda and the volcanic island of Montserrat barely 100km apart (Watters n.d.a). Certainly Cuba, with a land area comprising over half of the total of all Antillean islands, has environmental conditions very different from smaller islands in the eastern Caribbean or Bahamas. Only recently have studies examining the importance of microhabitats in Antillean prehistory begun to appear (e.g., Veloz Maggiolo 1976-77; Goodwin n.d.: 379-474). A baseline physiographic study of Antillean islands, equivalent for example to Thomas' (1963) work on the Pacific, is still lacking.

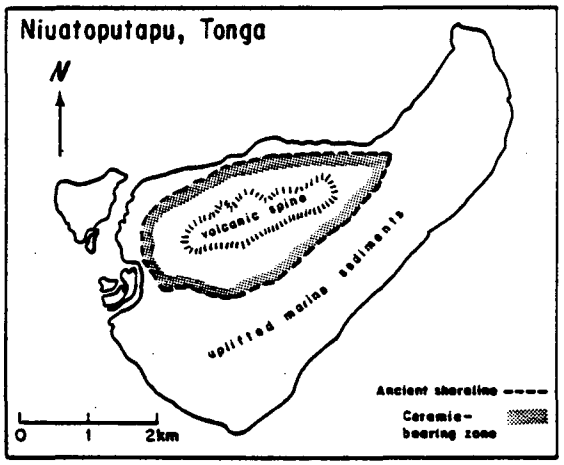

Figure 1: Distribution of Lapita-Style Pottery along an ancient shoreline now shifted inland because of tectonic uplift of adjacent marine sediments (After Kirch 1980a).

Kirch (1978) also provides an excellent example of geomorphological changes in the island masses, the second of the environmental changes faced by Polynesian societies. His research verified the restricted distribution of Lapita pottery to a raised beach terrace at the base of the volcanic spine on Niuatoputapu, an island in the Kingdom of Tonga (Fig. 1). Here the ceramic-bearing zone is now located well inland; more recently deposited aceramic sites occur on raised marine sediments in the area intervening between Lapita pottery and the present coast. Kirch determined

the size of the island has doubled since initial Lapitoid occupation (ca. 1000 B.C.) as a result of tectonic uplift of the marine sediments. The uplift moved the ancient coastline and the ceramic-bearing zone inland from their original positions thereby creating the odd site distribution. Perhaps more significantly, it considerably reduced the area of exploitable reefs and lagoons. Thus, a tectonic event causing emergence of land from the sea gradually resulted in new enivronmental constraints for the Marquesans. In nearby Samoa where an early site is submerged in nearshore waters (Davidson 1979:86) land *subsidence* has changed the geomorphology of that island since initial colonization.

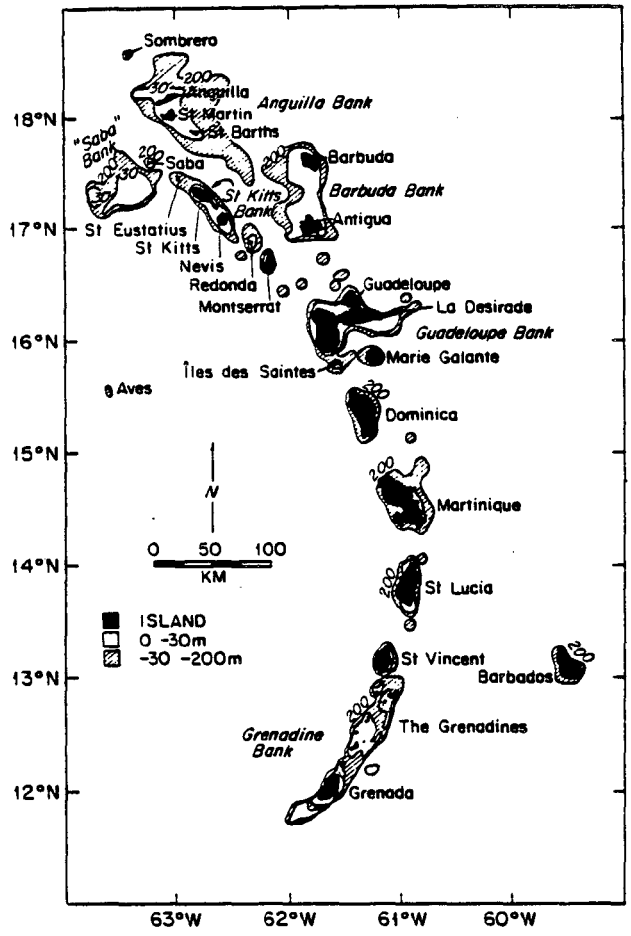

Figure 2: Islands and insular shelves on the Lesser Antilles Banks (After Defense Mapping Agency, 1978).

The Caribbean region also is tectonically active particularly near the Lesser Antilles where the floor of the Atlantic Ocean is being subducted beneath the Caribbean lithospheric plate. Although rates of subsidence or uplift and probably changes in island geomorphology in the eastern Caribbean have yet to be determined, the possible occurrence of submerged sites on the expansive shallow shelves surrounding islands on the Anquilla, Barbuda, St. Kitts, "Saba," and Grenadine banks (Fig. 2) cannot be summarily dismissed (Watters n.d.b).

Suggestive Similarities

Comprehensive comparisons between the Antilles and Oceania are not yet in order but some interesting similarities bear mentioning. They are not presented in the form of testable hypotheses but instead are suggestions to stimulate research in potentially fruitful areas of study.

Deeply stratified, multicomponent sites are relatively rare on some smaller islands of the Lesser Antilles. Shallow sites representing different periods of occupation occur near one another (and sometimes overlap slightly) but finding different components stratigraphically above one another at a single locality is not common on some small islands. A similar distribution was discovered in the ceramic-bearing zone on Niuatoputapu in Tonga where "the zone is 'horizontally stratified', so that different areas have differing ages and respective ceramic components" (Kirch and Dye 1979:68). If this pattern recurs on small islands in Oceania and the Antilles, it may reflect an adaptive strategy useful on such islands in both regions although it also may have been "adaptively neutral" (Kirch 1980b:110).

Gradual loss of ceramic technology occurred in Polynesia between about 1500 B.C. and A.D. 300 (Kirch 1980a:41); in the Antilles there is a general degradation in the quality of pottery but not a complete loss of ceramic technology from the earlier Saladoid through the post-Saladoid periods. In the Bahamas, which appear to have been the last island group settled, at the time of Columbus' first contact, pottery was of very poor quality. The native population may have been in the process of abandoning ceramic technology entirely, and they might have done so had they not been decimated shortly thereafter.

Biogeographers have noted the impoverishment of terrestrial fauna and flora species in both Oceania and the Antilles. Generally speaking, because of this impoverishment and because soils were not well suited for horticulture, marine resource utilization was greatest on the lower lying islands of Oceania and the Antilles. For example, Marquesas' faunal assemblages evince heavy reliance on marine resources especially during the settlement period (Kirch 1979: 298; 1980a:45). In the Caribbean "... in locations where marine resources are abundant and land and freshwater resources are rare--as on small islands and on the mainland coast--people depended primarily on the sea for animal protein" (Wing 1977:52). Even among small

islands, however, marine resources were variably used. Faunal assemblages from some sites on reef-strewn Barbuda contain abundant and varied finfish and shellfish remains while Montserrat, which lacks developed reefs, does not (Watters n.d.a).

These are only some of the suggestive similarities between the Antilles and Oceania, but they are sufficient to demonstrate that studies in one area have relevance to research and interpretation in the other. Other likenesses that can be noted briefly include the common occurrence of large shell middens, the similarity of some shell tools, and presence of shellfish and finfish of the same genera, orders, or families in both areas.

Re-Evaluating Evidence

Studying relationships between oceanography and prehistoric archaeology, adopting a seaward perspective, and investigating the paleoecology of the Caribbean are important for comprehending cultural adaptations of prehistoric Antillean peoples. New innovative research is required to reach this goal but at the same time Antillean archaeologists should re-evaluate materials already gathered. The following comments are presented more to stimulate reflection than to suggest foregone conclusions.

Fishhooks, harpoon heads, gorgets, net weights, and other technomic implements surviving in the archaeological record of Oceania are primary evidence for marine resource exploitation and maritime adaptation. Polynesian fishing gear has been a major focus of study to the extent of "...taking the central place occupied by pottery elsewhere in world prehistory" (Kirch 1980a:45). Fishing gear is scarce in Antillean sites, however, in striking contrast to sites in areas of Polynesia. Descriptions of fishing gear are not common in Caribbean archaeological reports despite the fact that fish remains are abundant in some sites and ethnographic records (cf. Rouse 1948:535, 550) of netting, angling, poisoning, spearing, harpooning, and use of weirs and bow and arrow attest to a wide range of techniques having been used. Although it can be argued that preservation of some items such as cordage from nets or lines is unlikely except under extraordinary circumstances, this does not adequately account for the absence or scarcity of durable shell or bone fishing gear.

An ethno-archaeological study on Niuatoputapu may provide a feasible explanation, at least in part, for the absence of fishhooks on some Caribbean islands. Kirch and Dye (1979:56, 67-68) found that parrotfish (*Scarus* sp.) are taken primarily by spear at night in torchlight or by nets. They are not taken by hook and line angling because the anatomical structure of the Scaridae jaw (used to eat coral polyps) is such that a hook would be entirely ineffective. Certain reef-encumbered islands in the Antilles possess sites where shallow reef species, including Scaridae, account for a large proportion of the minimum number of individuals represented (e.g., 64% at Mill Reef site on Antigua; Wing and Scudder 1980:Table 2). If spearing or netting were the major techniques employed in taking these fishes, then fishhooks would not be expected to occur (or should be minimally represented) in the site deposits and their absence or scarcity would not be as enigmatic as might be originally thought. Today, on Barbuda, techniques for taking parrotfishes include shooting them with a rifle and spearing them with a speargun.

However, there is another reason why previously gathered materials need to be re-examined. Some artifacts occurring in the archaeological record may be identified incorrectly. Kirch and Dye (1979:69) recovered a cowrie shell (*Cypraea moneta*) from which the dorsum was removed; they suggest it may have functioned as a weight for a dip net. Similarly altered cowrie (*Cypraea zebra*) and cowrie-helmet (*Cypraecassis testiculus*) shells have been observed in assemblages from Barbuda. Re-examination of some of the numerous modified shells from the Antilles, which generally are regarded as ornaments, may reveal that they served a more technomic function as net weights.

Though they have yet to be recorded in faunal assemblages, remains of spiny lobsters (*Panulirus argus*, and the rarer *P. guttatus* and *P. laevicauda*) may occur in Antillean archaeological sites without being recognized as such. In New Zealand, archaeological research had gone on for a century before spiny lobster (*Jasus* sp.) mandibles were first identifed from middens (Leach and Anderson 1979:144). Mandibles and occasionally antennae parts were preserved; the exoskeleton generally had decomposed. Because *Panulirus* mandibles may occur in Antillean faunal assemblages particular attention should be paid to sites on islands where spiny lobster fisheries remain important today, as at Barbuda (Peacock 1974).

While intriguing similarities in prehistoric maritime adaptations do exist between Oceania and the Antilles, one must also take note of differences that in some ways are as interesting as the similarities between the regions.

Inter-Regional Differences

The vast difference in size between Oceania and the Caribbean is the most obvious dissimilarity as a glance at a world map or globe will confirm. The area of Oceania is on the order of fifteen times that of the Caribbean, and certainly is an order of

magnitude greater. Some Pacific archipelagoes are separated by thousands of kilometers of open ocean, whereas in the Antilles islands generally are visible one from another because intervening passages are narrower (on the order of 40 km.).

In a geomorphological sense there are some similarities in island types between the two areas such as oceanic islands built by submarine volcanic activity. Indeed, the Lesser Antilles arc is said to be "typically" Pacific in character. At least one important Pacific island type--the "true" atoll--is absent in the Caribbean region although small atoll-like coral islands have been noted (Bryan 1953:26-27).

There are differences in the applicability or utility of methodologies. Similar methodologies involving linguistic analysis, ethnohistoric observations, and ethno-archaeological research have been attempted in both regions with differing degrees of success. To date, results in Oceania surpass those in the Caribbean. Perhaps part of the reason is signified most markedly by statements in the introduction of *The Prehistory of Polynesia:*

> It should be remarked that all the contributors constantly draw on historically observed ethnographic practices or customs in arriving at their conclusions. Their employment of observed data underlines a basic fact of Polynesian research: there the present is the past to a greater extent than almost anywhere else. In Polynesia the linguists, the archaeologists, and the ethnographers can still talk to, and draw data freely from, one another (Jennings: 2).

These statements serve as a poignant reminder of the inherent limitations we face when interpreting the prehistory of the Caribbean. To cite one example, ethnohistoric observations about maritime adaptations by early expeditions in the Pacific are more useful than are accounts by early European discoverers, explorers, and chroniclers in the Caribbean region.

However, distinctions must be made in the Caribbean region between the applicability of these methodologies in the Antilles (and Bahamas) and on the mainland areas of South America. Relatively rapid and almost complete extermination of indigenous peoples, cultures, and languages within the Antilles proper, followed by wholesale replacement by transplanted African, Asian, and European populations with different languages and cultures, seriously curtails, if not precludes, such studies. However, in northeast South America where native peoples have survived, the potential usefulness of linguistic, ethnographic, and ethno-archaeological studies is far greater.

The sequence of island types encountered by colonizers in the two regions is dissimilar. In a general west-to-east movement from Melanesia to Polynesia, one finds a trend toward reduced island size, declining habitat diversity, a geological change from metavolcanic island arcs to oceanic islands, and greater impoverishment of faunal and floral species (Kirch 1980a:40). In the Caribbean this sequence does not hold, at least not for the generally accepted south-to-north movement of ceramic-bearing Saladoid populations from northern South America. This sequence originates on the continent, then goes from a continental island (Trinidad) through the smaller volcanic islands of the Lesser Antilles to the larger, geologically

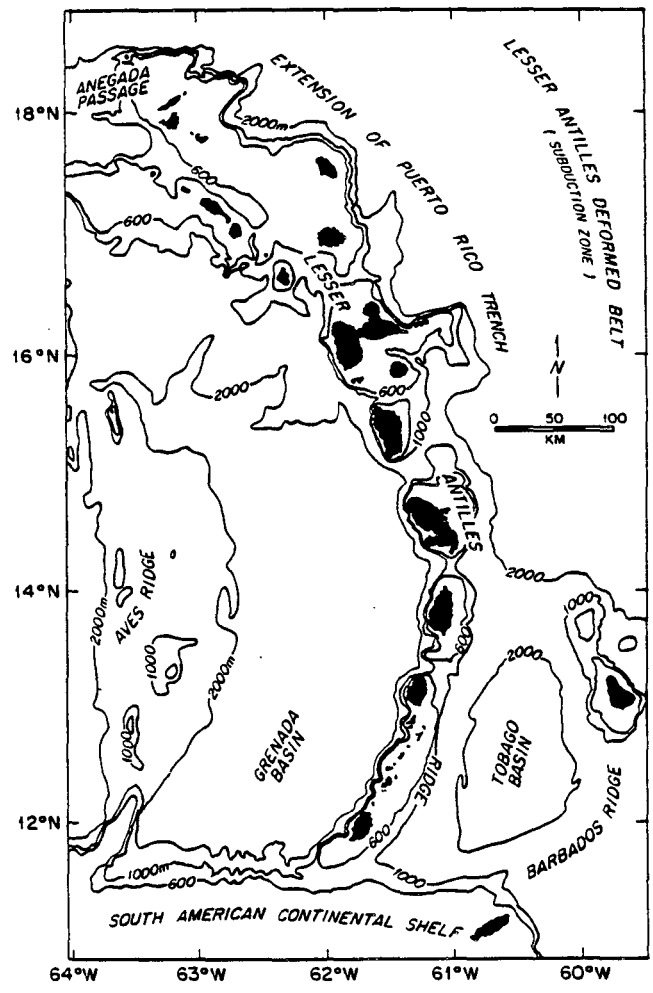

Figure 3: Bathymetry and physiographic features of the eastern Caribbean (isobaths below 2000 meters not shown).

more complex Greater Antilles, and finally terminates into the low-lying carbonate islands comprising the Bahamas. Human migration in the Antilles certainly involved watercraft and could not have been via a connecting "land-bridge" of any sort. Bathymetric contours (Fig. 3) clearly indicate depths exceeding -600m at several places along the Lesser Antilles Ridge, which is far too deep to allow connection of islands according to any sea level curve. Watercraft were used in both colonizations but the distances traversed were vastly different.

Summary

In this paper and others (Watters 1981, n.d.b, n.d.c) it has been argued that Antillean archaeologists, to gain a fuller understanding of prehistoric cultural adaptations, should adopt a seaward perspective, investigate relationships between oceanography and archaeology, and examine pertinent studies from other insular areas. Consideration of maritime aspects should complement, not replace, terrestrial concerns, however, because prehistoric Antillean peoples' cultural adaptations were oriented toward land and sea.

It also is important for archaeologists to understand that dynamic ocean processes have affected past human populations in ways that may not be readily apparent, even when one has an appreciation of the relationships between the disciplines. An example of this would be an outbreak of ciguatera in one species imposing an environmental constraint to which a population adapted by procuring a different species, not affected by ciguatera. The shift from one species to another, as evidence of the adaptive response, should be observable in the archaeological record. But tangible evidence of the environmental constraint itself--the ciguatera--probably would not be discernible even among remains of the affected species.

As archaeologists gain knowledge of the complexity of relationships between oceanography and prehistory, whether they investigate maritime adaptations or ocean processes that affect the archaeological record, they will develop increasingly sophisticated cultural adaptation models. In this sense, maritime adaptations will continue to be a provocative topic especially when data warrant comprehensive inter-regional comparisons.

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