ADAPTATION AND EXCHANGES ON "CORAL" ISLANDS: DATA FROM THE BAHAMAS AND OCEANIA

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This paper constitutes an attempt at delineating similarities and differences among prehistoric cultural traditions in insular tropical environments. While it has often been suggested that the amount and quality of ethnohistoric and linguistic coverage in the Caribbean area are a poor reflection of the types of information available for Oceania, the interest in subsurface investigations in the latter region (on atolls) is barely two decades old. Until the mid-1970s much of Micronesia was *terra-incognita*, and there are still many islands, particularly in the atoll/raised coral categories awaiting the spade of the archaeologist.

The fact that "true" atolls are absent in the West Indies should not divert us from the potential contributions that might arise in comparing human adaptation to constraints imposed by calcareous environments. On several occasions, Watters (1981, 1982, 1983) drew attention to the advances made by Pacific archaeologists in the area of subsistence; we might also add social organization and social complexity. Because of various limitations in the use of ethnographic data by their Caribbean counterparts and the benign neglect of a "seaward perspective", it was concluded that much could be learned from the work being accomplished in Oceania.

THE INSULAR SETTING

In order to select geological units that are comparable, one also needs to consider the quality of both ethnographic and archaeological sequences, as well as the areal distribution of coral islands. In effect, this study focuses on three "Coral Clusters" or "Coral Complexes" for which there is a fairly adequate record of prehistoric and protohistoric cultural developments. The Bahamian chain, comprising the modern polities of the Commonwealth of the Bahamas and the Turks and Caicos Islands, are therefore compared to three atoll/raised coral groups in Oceania: parts of the Tongan Archipelago, the Tuamotus, and the Central Carolines (Figs. 1-4). An overview of the geological history of the various groups is provided to highlight the constraints imposed by the environment and to aid in understanding the strategies devised by human populations to deal with those limitations.

The Bahamas are composed of old carbonate deposits and accretionary sands, which attained present-day conditions about 5000 B.C. (Sauer 1950b: 331; Nicholson 1976:22). The limestone plateau consists of calcium carbonate deposited by chemical processes. The resulting oolithic grains, which precipitated out of the shallow waters, overlie more ancient coralline sands and algae that first established themselves along the shallow edge of the continental shelf following the opening of the Atlantic.

Craton (1968:14-15) distinguishes three types of coral reef formations: fringe reefs, barrier reefs and coral atolls. Fringe reefs are the most common, with barriers and atolls having a more restricted distribution. The Bahamian atolls are of particular interest, since they are very small in size (sizes of the islets) and contrast to the profusion of this island type in Oceania, particularly in Micronesia. Atolls, moreover, do not necessarily support islands, as the Micronesian banks and shoals of the Caroline Islands illustrate.

Only three atoll-like formations have been defined as such in the Bahamas: Hogsty Reef, Mira-por-vos Islets, and Cay Sal Bank (Bryan 1953: 26). Hogsty Reef consists of a reef-enclosed lagoon with two sand cays (islets), supporting no poulation (Lands and Survey Dept. 1974). The reef extends for about 10 km from west to east and is 5 km wide (Columbia Lippincott Gazetteer of the World 1962:792). Mira-por-vos is described by Bryan (1953) as a "kite-shaped shoal with cay and rocks." They pose a serious hazard to present-day navigation. Cay Sal Bank, stretching ca 105 x 66 km in its greatest dimensions, has a number of cays around its edges, the largest of which attains about 16 m in length, with the highest elevation recorded at 3 m (Goldberg 1983). As reported in 1974, there were three individuals living in the area. While not qualifying as atolls *per se*, the islands of Great Inagua and Mayaguana bear some resemblance to Pacific atolls in the nature of the ridges that outline their shores and in their low interiors that are permanently or seasonally flooded (Keegan 1985:80).

Given present-day conditions, the islets would not have encouraged settlement. According to an estimate for Oceanic atolls, an island less than ca .106 x .106 km would not be capable of supporting a permanent population because of the size of its freshwater lens (Ghyben-Herzberg lens). A thorough survey by Granberry confirmed that assumption (Keegan 1985:197).

While Oceania lacks the type of island limestone formations found in the Bahamas (with the exception of some Torres Strait Islands, formerly part of Sahul), one island group does bear similarities: the Tongan Archipelago, specifically the uplifted coral and foramineferal limestones of Tongatapu, 'Eua, and Vava'u. These islands are quite fertile, owing to blankets of volcanic ash fall from neighboring high islands (Hoffmeister 1932:17). Oceanic raised reefs (which have been subjected to seismic activity or volcanic eruptions) often become severely eroded because of the action of slightly acidic rainwater on soluble limestone, thus creating cavernous features (Thomas 1963:19).

The Tuamotu Archipelago.of Eastern Polynesia and the Central Carolines of Micronesia consist mostly of atolls lying less than 8 m above sea level. They are compared to the Bahamas because of the numerous similarities in human responses to depauperate terrestrial organic components.

On Tonga and Vava'u former shorelines bearing evidence of human occupation have been identified several meters inland, and thus indicate tectonic movements (Davidson 1979:86). Similar observations have been made for parts of Micronesia.

The likelihood of human presence in the Caribbean prior to 5000 B.C. was suggested by Rouse and Allaire (1978:465), although the earliest carbon date is still about 2500 B.C. for Hispaniola. Preceramic occupation of the Bahamas during periods of lowered sea levels by Florida migrants would be expected, but the evidence for the settlement of the Florida Keys now makes it doubtful.

ENVIRONMENTAL CONSTRAINTS AND SUBSISTENCE STRATEGIES

Coral islands are generally characterized as impoverished, despite extensive reef flats or lagoons (Bellwood 1979:7). While irrigation may not be feasible on atolls, it is possible to create microhabitats for the cultivation of taro by tapping freshwater lenses (Kirch 1979:304; Chazine 1985).

Humans have at some point colonized even the most marginal types of environment in Oceania, such as the Line and Phoenix Islands (Emory 1934b). Some communities have succeeded in establishing long-term survival strategies, although population replacement caused by recurrent factors such as hurricanes or severe drought must have taken place (Davidson 1970). A coral reef, being porous, will retard dissipation of freshwater, because of its lower density than saltwater, thus creating a freshwater lens. At low points this lens may rise above the surface, but its purity is contingent on the amount and frequency of rainfall and the size of the island (Alkire 1978:11). In the case of uplifted islands, it may be more difficult to tap this lens, even if the raised area is sufficiently large.

The Tuamotus receive an average of between 114 and 152 cm of rain a year. Coral islands that receive less than 76 cm will not support more than 15 or 20 plant species (Alkire 1978:13, 17). The major hazard in the Central Carolines stems from hurricanes. Those in excess of 160 km per hour may raise the sea 5-6 m and consequently destroy the vegetation and severely disturb the freshwater lens. Even in areas of high rainfall, it may take up to 10 years to recover (Alkire 1978:14). Other factors influencing plant growth include isolation, the prevailing winds and currents, flight patterns and habits of birds, land crustacea, and of course the impact by humans, their domesticates and stowaways such as the rat (Fosberg 1953:3). Some raised reefs may yield phosphate deposits (Lampert 1968), and the weathered reef may make somewhat better soils than on atolls. But unless rainfall is abundant, we have seen that both water supply and irrigation become problems (Thomas 1963:36). While irrigation was presumably practiced only on a limited scale by manioc farmers, it could have increased maize yields in the southern sub-area. Low rainfall would prohibit this, however (Keegan 1985:169, 220).

In the Pacific coconuts and pandanus, being salt-tolerant, may have already been established on atolls before the arrival of man. Particularly for *Cocos nucifera*, whose floating ability has been documented (Ward and Allen 1980), one could make a case by suggesting that palm trees would be a prerequisite for successful colonization and initial survival on certain atolls (Christophersen 1927:39). Taro, like coconuts, are perennial crops, whereas breadfruit and pandanus can be preserved by Oceanic atoll populations (Alkire 1978:30).

In the Bahamas the low nutrient requirements for manioc would have encouraged year-round production. Intercropping of other cultigens (e.g., sweet potatoes, yams, cocoyams) can increase yields. On the other hand, protein-rich supplements, such as maize, beans, and groundnuts are seasonal (Keegan 1985:166, 169). Moreover, the cost of storing maize for year-round consumption is great.

Tropical cyclones occur more frequently in Tonga and in the Central Carolines than in the Tuamotus (Visher 1925:27; Thomas 1963:28). The pattern of hurricanes in the Atlantic-Caribbean area follows a northward and northwestward path at the first opportunity irrespective of longitude and time of year. Islands in the Bahamas often receive the brunt of one of the dozen or so annual West Indian tropical storms. Every 10 or 15 years the Turks and Caicos are affected by one of these major hurricanes (Craton 1968:12; Sears and Sullivan 1978:21).

As would be expected for oceanic islands, the prehistoric terrestrial mammalian fauna in the Bahamas was limited to the hutia and cave dwelling bats. Evidence for domestication of the former is lacking. The Lucayans were successful in introducing the domestic dog, although its use as food remains questionable (Keegan 1985:108). It has been suggested that large numbers of avifaunal extinctions occurred during the late Pleistocene (Olson and Hilgartner 1982). However, the small percentages of terrestrial faunal remains in archaeological sites may well indicate rapid decline since initial colonization (Keegan 1985:108). In many parts of Oceania, the extinction of bird species, particularly flightless varieties, is often correlated with human and animal predation as well as habitat destruction. The low reproductive rates of these birds precluded their domestication (Cassels 1984; Olson 1986). Coral island populations were thus compelled to rely heavily on marine resources. The waters surrounding the Bahamas provided many reef and estuary fish species, sea turtles, monk seals, conchs, and other mollusks.

The northern Bahamas were more hospitable. However, the low mean temperatures during the winter months, which would have destroyed manioc stems, may partially account for the low site density in the region (Sears and Sullivan 1978:21). More sites on Grand Bahama and Andros have been identified in recent years (Hoffman 1985:174). Future discoveries might indicate that climatic factors were more favorable during the settlement period.

The impact of human communities on the atoll ecosystem in Oceania is exemplified by extensive coconut groves for the exportation of copra and by taro pits, including the deposit of debris from such digging to form mounds and ridges. The nearest New World relative to taro is the genus *Xanthosoma*, called "yautia" or "malanga" in the Caribbean (Sauer 1950a:511), but it was not reported by Columbus. However, what appears to be the American yam (*Dioscorea trifida* also known as *D. brasiliensis*) is described in Cuba. Other traditional domesticates among Lucayan Taino at contact include potatoes, arrowroot, beans, pepper, peanuts, manioc, aloe, and cotton, to mention a few (Las Casas 1893; Rouse 1948:520). Bitter manioc figures prominently as a storable food, but sweet manioc may have been very important at lower population densities (Keegan 1985:126).

Man-made disturbance on coral islands also includes disposal of dead vegetative debris through burning or by transfer into the sea, which may result in losses of organic matter. It is also true that disposal of personal body waste through excretion in shallows or on tide-washed reef flats can also result in the removal of additional nutrients (Wiens 1962: 456).

Besides direct human predation on certain bird species, domestic animals, insects, and rats (in the Pacific region) have also contributed in reducing the number of indigenous species, such as land crabs. Reef/lagoon ecosystems are generally less affected by human intervention (Vayda 1963:166), but there are cases where overfishing, gathering or capture of certain marine life forms has led to the near extinction of species (e.g., green turtles, pearl oysters, and *Trochus* snails) (Wiens 1962:457). Finally, there are cultural activities in the form of burial mounds and architectural features, such as the ritual platforms of the Tuamotus.

MATERIAL CULTURE

In a recent address, Kirch (1985) indicated that islands were especially inviting for the study of evolutionary divergence in groups of phylogenetically related lineages. The Lapita and Polynesian dispersals across the Pacific were the focus of his inquiry. Kirch identified four processes that influenced evolutionary trajectories: "1) the founder effect or drift; 2) environmental selection contingent upon colonization; 3) long-term environmental constraints, including stochastic processes and human-induced change; and 4) demographic transitions, particularly the so-called r/K selection continuum" (Kirch 1985:6).

Given differences in the order of magnitude for distances between islands (and in relation to continents) in the West Indies and Oceania, it would appear that the significance of drift in the Caribbean was overshadowed by other contingencies, such as selection pressure attributed by the specific varieties of insular environments. The West Indian insular stepping stones also allowed for more frequent contacts between communities and with adjacent continental areas. For instance, Lucayans were acquiring pots and other items from the Greater Antilles (Southey 1968:9).

Because coral islands lie in tropical zones, it would be appropriate to focus on technological convergence in light of similarities of marine resources belonging to the same genera, order, or families (Watters 1982:7). The paucity of fishhooks in West Indian sites can be explained in light of ethnoarchaeological studies on Niuatoputapu, Tonga. The occurrence of *Scarus* spp (parrotfish) in the two areas throws light on exploitative strategies as they relate to the peculiar anatomical characteristics of the parrotfish jaw apparatus. In Tonga, *Scaridae* are taken by spear or nets. Watters (1982:7) has observed the use of rifles and spearguns to capture this fish on the Antillean island of Barbuda. Evidence of fishing gear may come in the form of *Cypraea zebra* (Measled cowrie), the dorsa of which have been removed, presumably to manufacture weights for dip nets (Watters 1982:7). Poulsen (1970:44) has identified cowrie-cap octopus lures from Tonga and other Polynesian islands.

It is not surprising that given the environmental conditions in West Polynesia (extensive reef flats), only a few simple one-piece fishhooks, cowrie-cap octopus lures, and other lure shanks have turned up in archaeological sites (Poulsen 1970:45). The same can be said about fishing techniques in the Tuamotus, where hand collecting and the use of spears, nets, and traps predominated (Emory 1975:187-188). For the Bahamas specifically, we are told that spears and the bow and arrow were utilized for fishing (Rouse 1948:544). It should be noted that two wooden fishhooks have been recovered from a cave on Crooked Island.

Coral islanders in Oceania made an extensive use of shell implements, especially *Tridacna maxima* for the manufacture of adzes and chisels. *Tridacna* clams gained wide acceptance in Micronesia, even when stone was readily available (apart from the Marianas) (Poulsen 1970:36). Micronesians displayed their preference by utilizing the exterior surface of the shell to form the back of the blade, whereas Polynesians were more inclined to orient the inside to the back (Poulsen 1970:42). The hinge section was selected for the manufacture in Tonga. While this required more work, the end product was also more durable (Poulsen 1970:44). Emory (1975:109) noted the general uniformity of *Tridacna* shell types throughout the Tuamotus, which may be regarded as an indication of limited possibilities offered by this material.

The numerous uses of *Strombus gigas* or Queen conch (the closest functional equivalent to the Indo-Pacific *Tridacna*) have been described by Keegan (1984:16), although celt tools made from the shell's thick lip seem to occur in low frequencies throughout the area, including the Bahamas (see Sears and Sullivan 1978:9). Keegan (pers. comm. 1985) cites four hypotheses for their low incidence: "1) poor preservation; 2) misidentification in cases where the shell lip lacks discernible edge grinding; 3) the lesser abundance of *Strombus* around certain islands, such as Antigua (cf. Olsen 1974:167); and/or 4) differences in the ways *Strombus* celts and stone tools were curated."

Lambis lambis, or Spider conch, is an Oceanic gastropod resembling *Strombus* by the size of its lip (Melvin 1966), although adzes from this shell do not occur as frequently as *Tridacna* (B. Moir, pers. comm. 1985). Both *Tridacna* and *Strombus* were significant components of insular diets. *Cassis rufa*, a Helmet shell of Oceania, was utilized for making adzes and chisels in the Tuamotus (Emory 1975:110). *Cassis* shells were also used as containers on Lamotrek, Central Carolines (Fujimura and Alkire 1984:92). The West Indian *Cassis tuberosa* and *madagascarensis* served to fashion implements resembling carpenter's scissors. *Murex pomum* (Apple murex) of the Caribbean may have been used for its dye (Sutty 1978:195).

SITE DISTRIBUTION

Prior to J. Davidson's excavations on Nukuoro (a Polynesian Outlier in Micronesia), it was assumed that any evidence of past occupation on atolls would be obliterated by hurricanes and tidal waves. Moreover, the limited space would have compelled the dumping of refuse in the sea. Notwithstanding those perceived limitations, it was from a small islet located on a reef near Maupiti, Society Islands, that a series of "Archaic" East

Polynesian burials were discovered (Emory and Sinoto 1964). Pacific atolls nevertheless attracted attention by the presence of stone structures, such as *marae* (ritual platforms), house pavements, and cairns (Emory 1934a:3, 1939:42-47). The island of Middle Caicos has also yielded evidence of pre-Columbian ceremonial plazas (Keegan 1985:220), but the remainder of the Bahamas chain is largely devoid of architectural features. Archaeologists might perhaps focus on the discovery of weir traps, which could be lying in the shallows near village sites and in channels between islets. Emory (1934b:23) described such traps made from blocks and fragments of coral, built up to rise several centimeters above water at high tide. One advantage in doing fieldwork in the Tuamotus resided in the fact that the traditional names and precise locations of such features were known to the inhabitants.

While deeply stratified sites are rare in the West Indies and in Tonga (Rouse 1977:8; Davidson 1979:107), activity areas of over 1 m in depth have been located in the Bahamas (Sears and Sulivan 1978:9). Davidson (1967a: 364) excavated cultural deposits attaining 3 m, and deep sites were also identified for Ngulu in the Western Carolines (some below sea level, suggesting tectonic activity) (Intoh 1981:77-78) and for the raised coral island of Nissan in Melanesia (M. Spriggs, pers. comm. 1986).

The success of Davidson's work may be partly attributed to the position of Nukuoro outside the normal path of hurricanes. Subsequent research in the Central Carolines has even demonstrated that stratified deposits could be preserved on atolls located in the typhoon belt (Fujimura and Alkire 1984).

While there is the obvious advantage of having a circumscribed land area for reconstructing the culture of an atoll, the clustering of activities can make their identification quite difficult. Another major problem lies in the burrowing action of land crabs.

Contemporary settlement patterns on Mokil and Pingelap Atolls in the Eastern Carolines were similar to Nukuoro, in that a single village, marked by a higher elevation and surrounded by taro pits, is located on the lagoon shore of one of the islets (Davidson 1967b:82-83). A similar distribution was noted for Ulithi (Craib 1981:49, 53), with settlements correlated with the widest portion of an islet, which also corresponded to the best freshwater lens in which taro swamps could be excavated. Trails and open spaces within a vallage are paved with a thin layer of coral rubble. Craib also noted a reduction in the number of inhabited islets as a result of documented hurricanes. The greatest damage to cultural features, however, appears to relate to the local fauna and flora, particularly the root systems of large *Ficus* trees which expand under platforms and burials (Craib 1981:51).

Bahamian settlements follow a similar pattern. Islands oriented along a N/S or NW/SE axis present a marked leeward side from the prevailing winds and currents, thus allowing the formation of sandy beaches with low energy bays, tidal flats, and estuaries. As would be expected for coral islanders, settlement distribution is essentially coastal.

COLONIZATION AND TRADE

The expansion of Austronesian speakers across Island Southeast Asia, Melanesia, and then to the far corners of Polynesia, may have been caused by a number of factors (e.g., conquests by neighboring groups, voyages of exiles, desire for adventure). The most dramatic episode of this colonizing process relates to the rapid spread from the Bismarck Archipelago to Western Polynesia--a distance of 5000 km within a span of perhaps 300 years. The Antilles extend for about 1300 km, but it took twice as long for the Taino Arawak to disperse from South America to the southern Bahamas. While aceramic Ciboney groups were known historically from western Cuba and from southwest Haiti and northwest Hispaniola, there is at present no evidence of preceramic occupation anywhere in the Bahamas.

De Booy (1912:88) suggested that initial settlement was the result of Carib incursions in the Greater Antilles, which forced the more peaceful Taino to migrate north. This position is no longer tenable in light of early dates for the Bahamas and the Carib traditions that took place only a few centuries before Columbus (Gullick 1980:464).

Winter et al. (1985:84-85) argued that one of the reasons for expansion may have been to follow the flight patterns of migrating birds, notably the flamingo (the flamingo island of Great Inagua lies about 100 km from the coast of Cuba). Another theory postulated initial colonization by seasonal visitors, who presumably realized the advantages of exploiting the salt pans and dried conchs in the Turks and Caicos for export to Hispaniola (Doran 1958:397). Recent economic-demographic analyses on the timing of settlements suggest a more plausible model for expansion (Keegan 1985:297).

For Micronesia, early dates for the western "high" islands of Saipan, Belau, and Yap (Pellet and Spoehr 1961:332) contrast significantly with the sequences in the Central Caroline atolls. It has been suggested that, given a choice, people will generally avoid settlement on atolls. On the other hand, an offshoot of the Austronesian Lapita expansion may have been anxious to leave the malaria-infested region of Melanesia to colonize Kiribati (the Gilberts) and the Marshall Islands (Riley 1981).

Linguistic reconstructions for Proto-Malayo-Polynesian reveal a complex seafaring technology, which included the sail and the outrigger (Blust 1976:21). This undoubtedly facilitated the rapid dispersal of the Lapita Cultural Complex. Its bearers, who were already acquainted with the insular world, proceeded to discover many different island types, varying in size and in resources. Generally speaking, however, the farther east, the smaller and more impoverished the island. Upon reaching Tonga, the ancestors of the Polynesians maintained trading relationships with Fiji right down to historic times (Kirch 1984:239). About 500 years ago, the island of Tongatapu had elaborated a complex social structure, which culminated in political hegemony over the entire archipelago and further afield.

The colonizing sequence for the Central Carolines is still not clearly understood, but linguistic data indicate a link with Nuclear Micronesian, which can ultimately be derived from eastern Melanesia. Again, there is

ample evidence for a sea-oriented economy and possible prior knowledge of atoll life (Kiribati, Marshalls), although archaeologists have barely scratched the surface in those areas.

The Tuamotus seemed to have been colonized from the Society Islands. In spite of the paucity of wood, the Tuamotuans, like the Caroline Islanders, were skilled navigators (Finney 1979:348). It should be noted that in spite of the apparent absence of the sail in the Caribbean prior to European contact (McKusick 1960), the Indian dugout canoes in the Bahamas, some capable of holding up to 40 people, were able to guide Columbus to the Greater Antilles (Las Casas 1893:39, 45).

The Colonizer model for the Lapita phenomenon (Green 1982) encompasses settlements that are widespread and culturally homogeneous. For the Bahamas, however, the evidence seems to fit the Supertramp model characterized by rapid population growth and by a strong emphasis on moving on to a new settlement location. This model is supported by the large number of sites in the south-central Bahamas, where rapid expansion was no doubt promoted by the fragile character of high ranked terrestrial resources and the short water passages (Keegan 1985).

We can attest to the presence of homogeneous Lucayan culture and language at contact, due in part to the environmental homogeneity of the Bahamas Archipelago, although Columbus seemed more impressed by the cotton mantles and bands, as well as the gold pieces worn by the inhabitants of Fernandina (Long Island) (Southey 1968:9). Prehistorically, both the Meillacoid and later Chicoid pottery styles reflect close ties with the Greater Antilles (Winter et al. 1985:89).

The rates of change for Lapita are characterized by elements of rapid dispersal, resistance to extinction or cultural replacement, and frequent interactions among communities at distances up to 600 km. Green (1982) cites the causal variables for his model, which assume the following characteristics: a generalized economy with both marine and horticultural components, effective colonizers, skillful voyagers, rapid population growth, and effective communication networks.

For the Bahamas, we can also speak of a generalized economy with perhaps a stronger emphasis on high ranked terrestrial resources in the early stages of settlement, causing rapid expansion. The Lucayans were effective colonizers in that they adapted quite well to a calcareous environment, but did encounter situations of severe drought and must have become victims of hurricanes. In addition, they may have had to contend with the winter cold on the northern islands, a condition not found in the calcareous settings of Oceania. The Lucayans were quite skillful navigators and maintained contact with the Greater Antilles. Given the paucity of ethnographic data, however, little is known on intra-archipelago exchanges. For that reason, it is difficult to decide on Alkire's categories of "Coral Clusters" and "Coral Complexes". The environmental homogeneity of the archipelago would limit exchanges at the local level (i.e., with communities close at hand). However, given the relative proximity of the islands, particularly in the central area, and the possible uneven distribution of clay for ceramics, together with the

distribution of Greater Antillean exports in the central and southern Bahamas and the aforementioned environmental hazards throughout the island chain, the concept of a "Coral Complex" may still be valid.

The Tuamotus were initially organized into small clusters until they were incorporated in a "Coral Complex" when Tahiti extended its influence. The Central Carolines lie in an area of high rainfall and high productivity, having supported some of the densest populations of any coral islands of the Pacific. Most of the atolls are less than 160 km apart and were reached by sophisticated crafts (Alkire 1978:114-115). On the other hand, they were susceptible to devastation by hurricanes; hence cooperation was essential. In addition, the islands varied in size and production potential (Ayres and Haun 1983:7).

The Central Carolines were also incorporated into the *sawei* exchange system of the Yap Empire. The Yapese lineage heads of a particular district claimed ownership of the outer islands or districts from which representatives came to pay tribute. The tribute consisted of woven fibers, sennit, shells, etc. In exchange the coral islanders received food and returned to their homes when the seasonal winds would return. The system ensured cooperation in the distribution of resources between atolls and districts (Alkire 1978:119). These exchanges were sustained because it was thought that the Yapese would otherwise send hurricanes in the direction of the atolls.

In the "Coral Complex" situation, competitive raiding is not adaptive, since hurricanes would weaken a group so that it would no longer be capable of raising an army of sufficient size. The Marshall complex can be understood by differences between the drier north versus the wetter south, although competition was more prevalent because of the absence of hurricanes.

As opposed to atolls, Tongatapu and the Bahamas possessed clay sources. Deposits of Bahamas Red Loam appear to have been distributed by wind-carried soils at a probable rate of 5 cm per 1000 years. Clay concentrations are created by the leaching of calcium carbonate, leaving the clays behind. Present concentrations are greatly reduced owing to intensive cultivation during the last century (Hoffman 1986:167). The "decline" of Lapita pottery in Oceania has fascinated researchers for quite some time, but space precludes a review of explanatory models (cf. Claridge 1984; Leach 1982; Irwin 1981; Frost 1979).

While we witness a similar decline in the craft of ceramic manufacture in the Antilles, best exemplified by Suazoid ceramics, a recent analysis of Bahamas pottery (Keegan, pers. comm. 1985) revealed a high degree of complexity, exhibiting only poor outward quality because of the poor quality of the materials available. Compared to certain areas of Oceania, neither the Bahamas nor the other islands in the Caribbean abandoned ceramic technology entirely. We can only speculate on whether or not they were actually heading toward becoming aceramic.

Rapid population growth in the Bahamas Archipelago seemed to have occured during the terminal period. In Oceania, atolls specifically and

small, relatively isolated islands in general might have witnessed repeated instances of population replacement, or at the very least, were more susceptible to external influences (Vayda 1959:820-821). In the Bahamas, Chicoid pottery appears by about A.D. 1250, but this refers to a movement of a dominating ideology which had only minor influences.

CONCLUSION

Several aspects pertaining to general adaptation to a calcareous environment were examined. We have seen many similar responses in the classic sense of technological convergence, but also differences, particularly for some aspects of dispersal of the type presently defended for the Lapita expansion.

By the time Bahamas archaeology in specific and West Indian prehistory in general reach the stage of reconstructing more precisely the social and ideological subsystems, there will have developed, hopefully, less of a dependence on Oceanic parallels. In the meantime, however, let us continue to pool our resources in order to make the field of island archaeology a more active and vigorous discipline.

ACKNOWLEDGEMENTS

I wish to thank William F. Keegan and Matthew J. Spriggs for their helpful comments and criticisms on earlier drafts of this paper.

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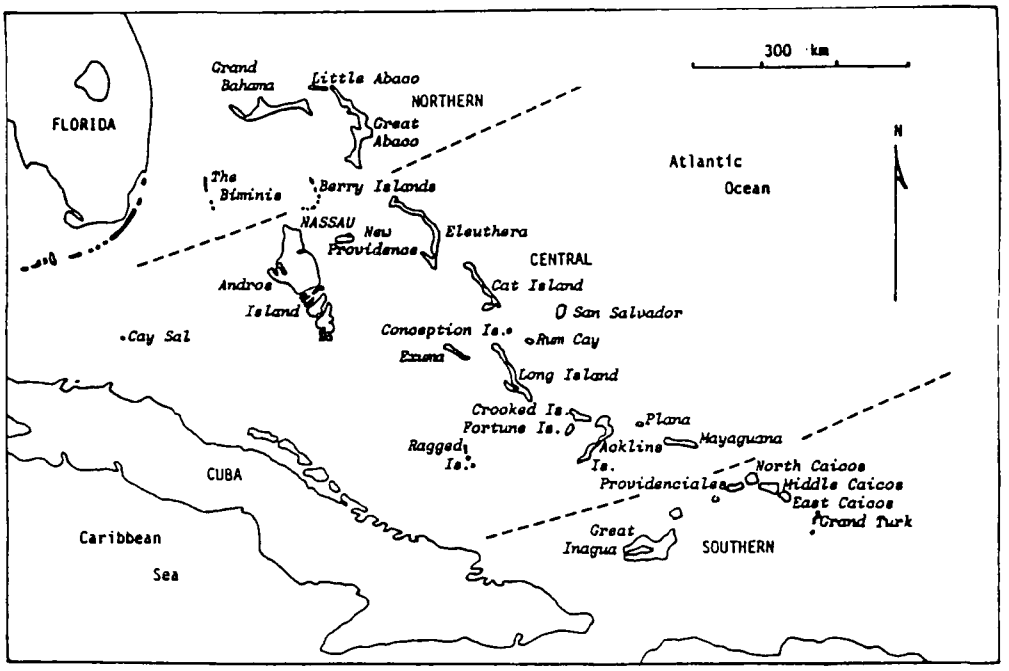

Figure 1. The Bahamas Archipelago (Winter et al. 1985).

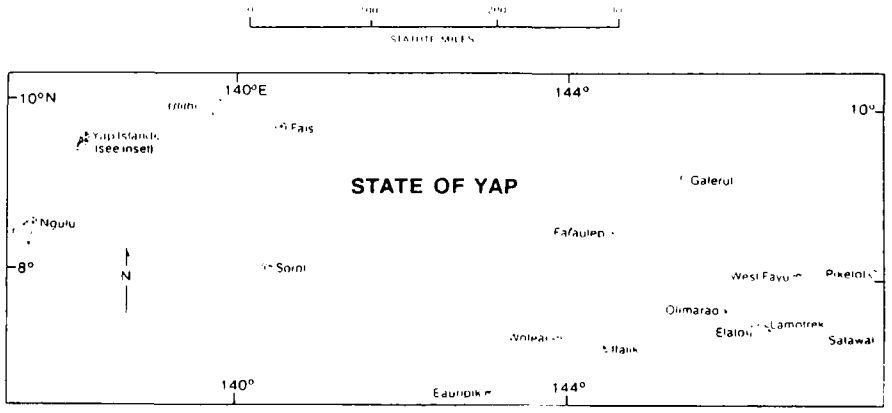

Figure 2. The Central Carolines (Motteler 1986).

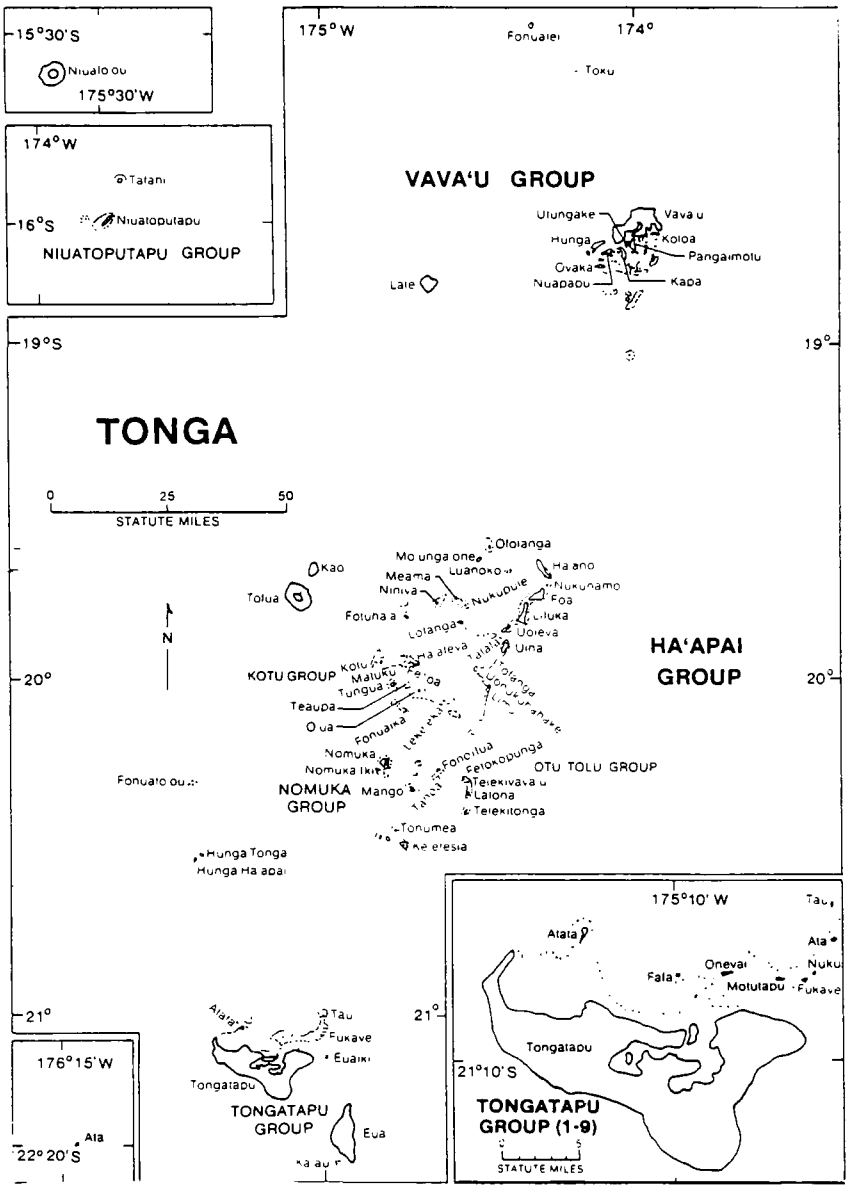

Figure 3. The Tongan Archipelago (Motteler 1986).

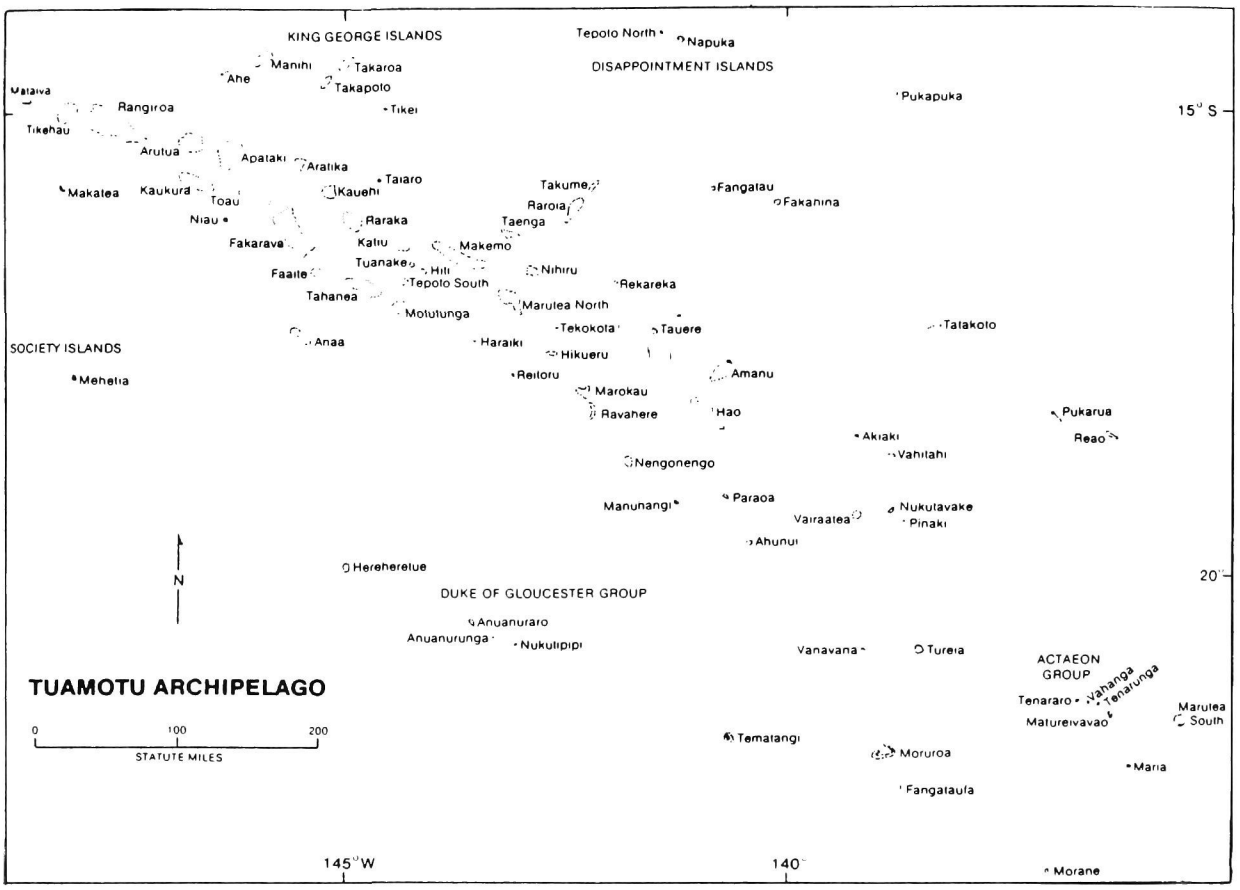

Figure 4. The Tuamotu Archipelago (Motteler 1986).