Micronesica Suppl. 2: 231–240, 1990

Archaeological Investigations on Kwajalein Atoll, Marshall Islands, Micronesia

KANALEI SHUN and J. STEPHEN ATHENS

International Archaeological Research Institute, Inc.
949 McCully St., Suite 5, Honolulu, HI 96826

Abstract—Extensive archaeological investigations were undertaken along the entire length of the Kwajalein airfield taxiway. Intact prehistoric deposits were documented, and numerous artifacts and archaeological samples were recovered. A lower sediment layer provides evidence for initial human settlement and land use on Kwajalein Islet beginning sometime around 100 B.C. to AD 1.

Introduction

A project of archaeological subsurface testing and monitoring was undertaken in June and July of 1987 by the authors on Kwajalein Atoll, Republic of the Marshall Islands. This project, conducted under contract with the U.S. Army Corps of Engineers, Pacific Ocean Division, Fort Shafter, Hawaii, was performed prior to construction activities associated with upgrading the airfield taxiway and parking aprons on Kwajalein Islet. A total of 55.9 square meters of excavations was carried out additional excavations may be undertaken in the future. Controlled sampling of archaeological sediments was an important aspect of this research; 6,800 liters were screened through ¼ and ⅛ inch sieves. Twelve indigenous artifacts were recovered from the excavations, and another 55 were retrieved from disturbed surface locations and bulldozer spoils. In addition, numerous samples of charcoal and midden were obtained, along with soil and pollen samples.

The purpose of this paper is to provide a summary of the preliminary results of the first major archaeological investigations on Kwajalein Atoll. This project also happens to be one of the relatively few archaeological projects undertaken in Eastern Micronesia, which we believe adds to the timeliness and significance of our results. The environmental diversity of the atoll chains of Eastern Micronesia has not always been fully appreciated. It is our hope that the present investigations of Kwajalein Islet will contribute to the documentation and understanding of the variability in prehistoric settlement and adaptation in this large and heterogeneous region of coral atolls.

The Setting

Kwajalein, the world's largest atoll, is situated roughly in the middle of the westerly Ralik chain in the Marshall Islands. It lies between 8° 40′ and 9° 30′ north latitude, and between 166° 40′ and 167° east longitude. This location places Kwajalein Atoll roughly in the middle of a north-south trending rainfall gradient. In the relatively dry north, for example, Eniwetok Atoll receives just over 1,340 mm of rain annually. This contrasts with Jaluit Atoll in the better-watered south, which receives just under 3,990 mm annually—

almost 3 times as much rain as Eniwetok (Weins 1962). Kwajalein Atoll receives 2,710 mm of rain annually, much of which falls from May through November. This is sufficient to provide relatively good growing conditions for the chief Micronsian food plants of coconut, pandanus, breadfruit, and giant swamp taro (*Cyrtosperma*). As Weins (1963) has observed, rainfall plays a pivotal role in the ecology of low islands—more so than tropical storm and typhoon frequency. Hence, it may be expected to have a very significant effect on human settlement in the region. Strong northeasterly to southeasterly prevailing winds blow from December to April.

Kwajalein Atoll comprises 93 islets (Fig. 1) with a total land area of only 14.8 km^2 (Global Associates 1986). The three largest islets of the atoll—Kwajalein Islet, Roi-Namur, and Ebadon—form the apices of the atoll's triangular shape. The longest side of the triangle, oriented approximately northwest to southeast, is between Kwajalein and Ebadon Islets. It has a straight-line distance of 121 km (Global Associates 1986).

Crescent-shaped Kwajalein Islet is located at the southern end of the atoll (Fig. 1). The lagoon side of the islet faces north and west. There is no deep water pass on either side of the islet. Prior to major land reclamation efforts in the 1960s, Kwajalein Islet measured roughly 4.5 km long by 0.5 km wide, giving it a total area of 2.2 km^2. The reclamation work added land to the lagoon side and to the two ends of the islet (Fig. 1), resulting

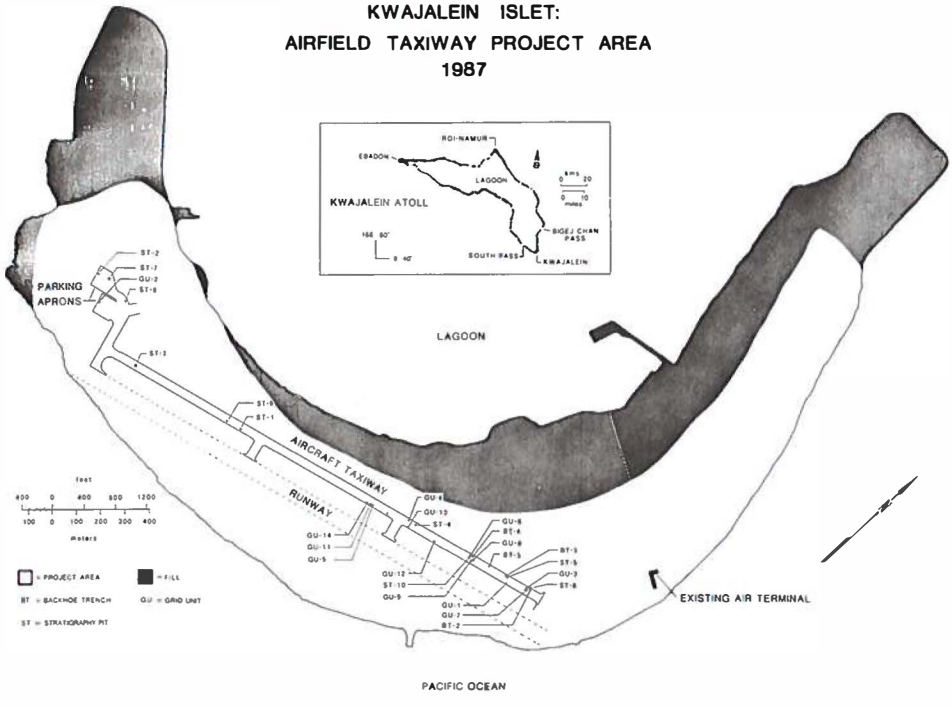

Figure 1. Map of Kwajalein islet showing project area and location of recent land reclamation.

in an increase of half as much again of land area, to approximately 3.1 km^2 (Global Associates 1986).

Historical Background

Kwajalein Atoll received comparatively little attention in the geographic literature prior to World War II, which is somewhat surprising considering its size. The earliest accounts of Kwajalein Atoll are shrouded in uncertainty. It was probably sighted by the Spaniard de Villalobos in 1542 and probably by another Spaniard, de Arellano, in 1565 (Hezel 1979). John Mertho, a British captain, is officially credited with discovering the atoll in 1804, naming it Catherine Island. However, this atoll actually may have been Lae, a small atoll to the west of Kwajalein (Hezel 1979).

Somewhat later accounts of Kwajalein Atoll are more definitive. The atoll is cited as the site of the "massacre" in 1850 of two passengers from the British ship, *William Melville* (Hezel 1979). Twelve years later, in 1862, natives of Kwajalein on 60 canoes boarded an unnamed whaleship and demanded tobacco, causing a commotion; the chief was shoved overboard by a seaman, and the rest of the natives fled in terror when a cask of spruce beer exploded (Hezel 1979). These two events appear to have been the highlights of early historic period contact, as Kwajalein Atoll is seldom mentioned in the literature after this point. The atoll was evidently a virtual backwater throughout the period of German administration from 1885 to 1914 (Athens 1984), though it is likely that there was copra trading.

In October 1914, the Japanese took over from the Germans the administration of most of Micronesia, including the Marshall Islands. By 1944, in the midst of World War II (WW II), Kwajalein Atoll had become the headquarters for the Japanese 6th Base Force, with principal military installations on Kwajalein and Roi-Namur Islets (Bell Telephone Laboratories 1974). At this time, Kwajalein Islet had a 5,000-ft long airstrip, which was being turned into a bomber strip. The airstrip was constructed in the middle of the western half of the islet. The islet also had a port on the lagoon side.

During WW II, roughly 4,000 Japanese soldiers and several hundred Korean labor troops and at least 200 civilian administrative workers were stationed on the islet (Bell Telephone Laboratories 1974). The Japanese had turned the atoll into a stronghold, and Kwajalein Islet had become the "nerve center for all bases in the Marshalls, through which shipping, supplies, and reinforcements flowed to the other atolls." It was this nerve center that the United States assaulted in the early months of 1944 as part of "Operation Flintlock."

Operation Flintlock included the naval and air bombing and continuous artillery firing on Kwajalein Islet as a "softening-up" procedure before the landing of some 31,000 U.S. troops and reserves. It has been estimated that during this period each square foot of the islet received 100 pounds of bombs and shells. Despite this intensity of firepower, it took four days for the invasion to totally subdue the Japanese defensive force. The net effect of the invasion of Kwajalein Islet is aptly summarized by an Army observer describing the aftermath of the bombardment: "[t]he entire island looked as if it had been picked up to 20,000 feet and then dropped" (Bell Telephone Laboratories 1974: 11). The list of

casualties from the invasion of Kwajalein islet included over 2,500 Japanese and just over 80 American soldiers killed and over 500 Americans wounded. The battleground of Kwajalein Islet has since been placed on the U.S. National Register of Historic Places (see Denfeld 1980).

Immediately after the invasion of 1944, the U.S. Navy Seabees repaired and reconstructed the old Japanese airstrip. The bomb craters and surface irregularities were filled with battle debris and vegetal matter, which then became part of the foundation fill for the reconstructed airstrip. The airstrip was also lengthened to 6,300 ft, and a parallel taxiway was constructed on the lagoon side. Since then, the airstrip has been upgraded and resurfaced several times, and terminal facilities have been added on the eastern end.

Kwajalein Islet has been used since WW II as a U.S. military missile range and is presently under the command of the U.S. Army. Its name was recently changed from Kwajalein Missile Range (KMR) to United States Army Kwajalein Atoll (USAKA). During the course of its development for use as a missile range, the islet has been almost entirely leveled and stripped of its native vegetation. Most of Kwajalein Islet is now taken up with housing and other facilities, including storage, office, and recreation areas to accommodate the approximately 1,800 civilian and military personnel.

Archaeological Background

The intensity of modern landscape change combined with WW II activities led many investigators to believe that any evidence for prehistoric or early historic activities on Kwajalein Islet would have been obliterated. Consequently, no archaeological subsurface investigation was attempted until recently. The initial effort took place when a reconnaissance survey with limited subsurface auger testing was conducted by Watanabe (1986) of the U.S. Army Corps of Engineers, Honolulu District. This survey focused on an area that included the very northern edge of the original islet. A dark gray-to-black buried soil layer was observed, and Watanabe (1986: 4) concluded that the layer "could contain cultural materials dating from World War II and possibly earlier periods of Kwajalein Island occupation."

Another subsidiary study conducted in 1984 re-examined data from soil tests that were undertaken in 1960 and 1970 by the U.S. Navy and U.S. Army Corps of Engineers for the reconstruction of the taxiway. The presence of subsurface layers containing organic material was noted (Dept. of the Army 1984). However, it was not until the present project that intact archaeological remains became known on Kwajalein.

Archaeological Investigations

The taxiway investigated during the present project measures a little over 6,300 ft (1,921 m) long and 125 ft (38 m) wide (Fig. 1). It is oriented roughly east-west and is parallel to the present runway on the lagoon side. The parking aprons, which are attached to the northwest end of the taxiway, were also investigated. The aprons together cover an area of approximately 600 by 600 ft (200 by 200 m).

Construction work in the project area entailed the removal of asphalt pavements covering the taxiway and parking aprons. Earth removal within the project area was under-

taken to a depth of approximately 1.3 m below surface (this was subsequently refilled and compacted). Mechanical excavations along the fringing edges extended to only about 0.3 m below the surface. In effect, all of this heavy equipment work provided a lengthy exposure of subsurface deposits in a transect parallel to the shoreline and through the middle of the islet. Suitable areas for archaeological testing and excavation were thereby located in an efficient manner over a broad area. Because of massive prior disturbance on the islet, this approach to archaeological field investigations proved to be most advantageous; otherwise it could have been very difficult and time-consuming to locate archaeological deposits of interest.

Archaeological excavations documented several intact subsurface cultural deposits above the coralline and culturally sterile marine sand and coral substrate of the islet (Fig. 2). At least two of these subsurface layers, confined entirely to the eastern half of the right-of-way, were obviously prehistoric, containing cultural materials such as charcoal, shell and faunal remains, and in several excavation units, indigenous artifacts. The upper prehistoric layer, possibly extending over an area as wide as 200 m, appeared to be a coral pebble and cobble paving. The lowest cultural layer overlies a culturally sterile, cemented coralline substrate (Fig. 2). This 20 cm thick cultural layer, consisting of a gray hard-pan clayey matrix, is discontinuous and lies within the zone of a fluctuating fresh water lens (the Ghyben-Hertzberg lens). The layer contains a few coral pebbles and cobbles, and it

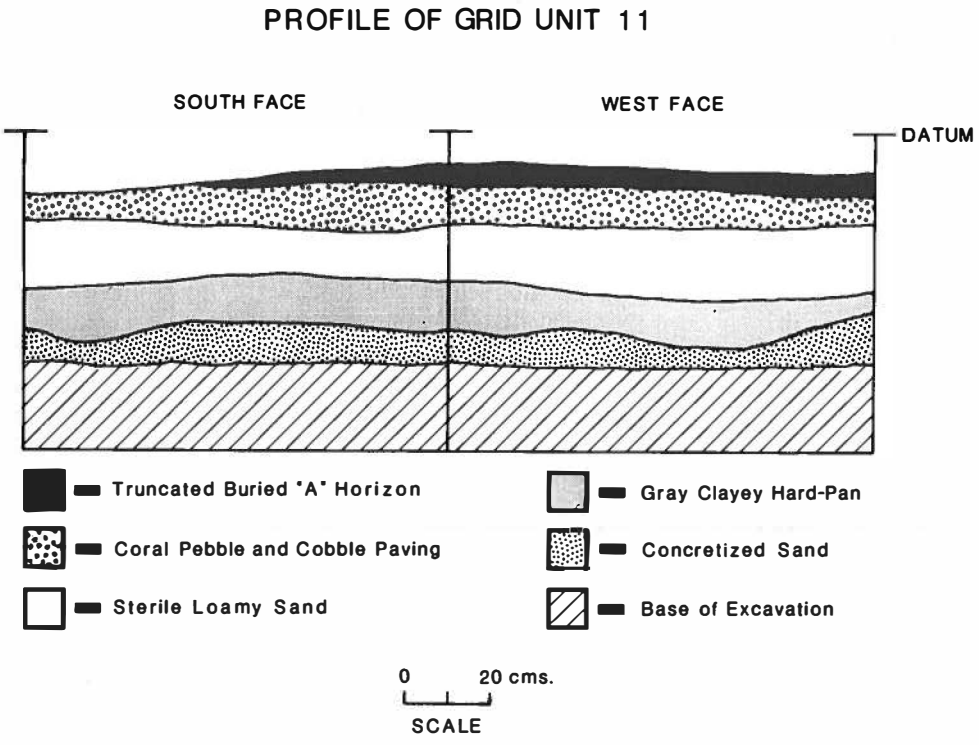

Figure 2. Profile of Grid Unit 11 showing layers discussed in text.

nearly covers the eastern half of the corridor around the central sections of the original islet. Large charcoal pieces, charcoal flecks, and in several instances, faunal remains—most likely those of turtle—were embedded in the matrix. No artifacts were retrieved. Two charcoal samples from the layer had calendric dates of A.D. 40–355 and 140 B.C.–A.D. 255 (95 percent confidence interval; calibrated by Klein *et al.* 1982 and adjusted for isotopic fractionation).

Determining the mode of deposition and the function of this layer has been problematic. No such layer, or anything similar to it, was found in recent excavations on Arno (Dye 1981), Majuro (Riley 1981), or Bikini (Streck 1986, 1987). Nor have we been able to correlate the layer with any soil descriptions available for the Marshall Islands (Wiens 1962). It is evident from the composition of the matrix that at the time of deposition it must have been in solution or fluid enough form to accommodate the embedded charcoal pieces and faunal remains. Later, the matrix with the suspended cultural materials, turned into a hard-pan. The periodic inundation of the matrix by the fluctuating fresh water lens probably contributed to this soil formation process. We are inclined to believe that this layer represents a natural interior swamp prior to extensive human manipulation for taro cultivation, though perhaps it is the remnant of a developed taro swamp. In any case, the layer's characteristics support the notion that it represents a colonization stage or a time of initial settlement of Kwajalein islet. Thus, it appears that Kwajalein was first occupied at least by the first century B.C. Soil and pollen studies are underway in an attempt to further clarify the nature of the clayey hard-pan.

The two early dates from Kwajalein Islet accord well with the earliest dates from two *um* or earth oven excavations on Majuro Atoll (Riley 1981), located roughly 500 km to the southeast of Kwajalein Atoll. However, the Kwajalein dates are about 500 years earlier than those obtained from Arno Atoll (Dye 1981), which is southeast of Majuro. In sharp contrast, the Kwajalein dates are much later—by about a thousand years—than the earliest sequence of dates from Bikini Atoll (Streck 1987, this volume), which is situated about 400 km to the northwest. Thus, the radiocarbon dates from the Marshall Islands so far show an intriguing sequence of occupations with the earliest in the dry northern atolls and later occupation in the wet south. This sequence is tentative, of course, and could change as more investigations are conducted. However, it may be found that a pattern of continuous use of the very limited available land on atolls has hindered the preservation of early deposits and sediment layers.

The cultural layer consisting of coral pebble and cobble paving (Fig. 2) is present only in the central portions of the original islet. It overlies the gray clayey hard-pan described above, separated from it in most cases by an apparently sterile, loamy sand layer. This paving, ranging in thickness from 5 to 10 cm, also lies within the zone of a fluctuating fresh water lens, indicating that the level of the water table has risen since this layer was deposited. The layer possibly extends for over 200 m. This paving may represent more than one occupation. Artifacts retrieved from it included several pearl shell (*Pinctada* sp.) fishhook fragments, several worked or cut pearl shell fragments, a shell bracelet segment, coral abraders and files, a shell bead, and a *Tridacna* spp. adze fragment and a preform. The layer also contained midden remains of a marine shell, fish bones, and charcoal.

The indigenous artifacts collected from the surface came from the area encircling the center of the original islet. Post-European contact period artifacts were also present in this area. Excavations, however, produced historic period artifacts only from the upper, disturbed layers and from the truncated buried A-horizon soil layer; no post-contact artifacts were retrieved from the intact cultural layers underlying the buried A-horizon. The surface indigenous artifacts included *Tridacna* and *Cassis* spp. adzes and adze fragments, coral abraders or files, worked pearl shell, and an elongate shell weaving implement (Fig. 3).

Figure 3. Sample of collected artifacts. Top Row (left to right): 1) *Cassis* chisel; 2) *Cassis* adze; 3) *Tridacna* adze preform; 4) *Tridacna* adze. Upper Middle Row: 5), 6), and 7) *Tridacna* adzes; 8) *Tridacna* adze fragment. Lower Middle Row: 9) *Tridacna* adze preform; 10) coral abrader/file; 11) shell ornament; 12) worked pearl shell. Bottom Row: 13) pearl shell fishhook tab; 14) shell bead; 15) shell weaving implement.

Similar artifact types and assemblages have been collected from archaeological investigations in Arno (Dye 1981), Bikini (Streck 1987), and other atolls of the Marshall Islands (Rosendahl 1977); the weaving implement from Kwajalein is unique.

Settlement and Land Use

The depositional sequence of the intact layers recorded along the construction corridor provides several clues to the islet's formation processes and settlement pattern. The course sand layers at the western extreme end of the original islet suggest that this area was built up by marine deposition. To the east, roughly a quarter of the way toward the center of the original islet, the upper layers consist of a truncated buried A-horizon overlying a layer of fine-grained sand with almost no gravel. The fine-grained sand grades into a layer of coarser-grained sand with increasingly more coral rocks which further grades to a very gravelly beach deposit. This sequence suggests that the mode of deposition of the upper layers was either aeolian or the result of a becalmed lagoonal marine environment. The lower layers resulted from a high energy environment. Going further east to the central portions of the original islet, one encounters the concretized coralline substrate layer which immediately underlies the cultural layers mentioned above. A buried A-horizon is also present.

The settlement pattern that may be inferred from these data points to initial human occupation and use of the islet in and around the center of the islet. Wiens (1963: 160–1) observes that "the best sites for breadfruit are the more central locations, somewhat lagoonward of the geographical center of the islet where the greater thickness of the fresh water lens also makes this area the site of most taro pits." Subsequent prehistoric occupations of the islet, at least as evidenced by the coral pebble and cobble paving layer, appear to have continued in this central section. The western section of the islet, or the fringing areas near the western end of the original islet, began to be used only later, during the proto-historic/historic periods, when the buried A-horizon in the upper layers was deposited.

Streck (this volume) argues that the archaeological evidence from Bikini Atoll suggests that the islets of Bikini and Eneu have undergone major phases of accretion and erosion since human occupation. Kwajalein Islet may also have undergone similar phases of accretion and erosion since initial human occupation, which may be one reason for the later use of the western portions of the islet. If atoll land use is closely associated with the availability of water, as Wiens (1963) suggests, then the change in the water table since initial human occupation must be considered significant for the settlement pattern of Kwajalein Islet. Certainly, as Streck (this volume) has stressed, the traditional notion that island land masses, particularly the atolls, are "static geomorphic units through time" needs to be reconsidered in light of archaeological data.

Acknowledgements

We are grateful to Joyce Bath, Arthur Saxe, and Chuck Streck for their comments and suggestions on various aspects of this paper. They are, of course, not responsible for the content. We also sincerely and warmly thank Darlene Moore for her help with typing the symposium draft of this paper at a time when we were essentially out of time.

References

Athens, J. S. 1984. Archaeological reconnaissance survey of 6 islets at Kwajalein Atoll, Marshall Islands. Report prepared for Sea Engineering, Inc. Honolulu.

Bell Telephone Laboratories. 1974. The battles of Kwajalein and Roi-Namur. The Interceptor, Kwajalein.

Denfeld, D. 1980. An historic site survey of Kwajalein Missile Range, Kwajalein Atoll, Marshall Islands. Report prepared for U.S. Army Corps of Engineers, Pacific Ocean Division, Honolulu. Pacific Studies Institute, Guam.

Dept. of the Army, Pacific Ocean Division, Corps of Engineers. 1984. Airfield pavement design analysis: upgrade aircraft taxiway parking apron, Kwajalein Airfield, KMR, Marshall Islands. Corp of Engineers, Fort Shafter, Hawaii.

Dye, T. S. 1981. Archaeological survey and test excavations on Arno Atoll, Marshall Islands. Dept. of Anthropology, B. P. Bishop Museum, Honolulu.

Global Associates. 1986. Analysis of existing facilities. Report prepared for U.S. Army Strategic Defense Command (USASDC), Kwajalein Missile Range, Kwajalein Atoll.

Hezel, F. X. 1979. Foreign ships in Micronesia. Historic Preservation Office, Trust Territory of the Pacific Islands, Saipan.

Hezel, F. X. 1983. The First Taint of Civilization: a History of the Caroline and Marshall Islands in Pre-Colonial Days, 1521–1885. Univ. of Hawaii Press, Honolulu.

Klein, J., J. C. Lerman, P. E. Damon & E. K. Ralph. 1982. Calibration of radiocarbon dates: tables based on the consensus data of the Workshop on Calibrating the Radiocarbon Time Scale. Radiocarbon 24: 103–50.

Riley, T. J. 1981. Final report on archaeological survey and testing, Majuro Atoll, Marshall Islands. Historic Preservation Office, Trust Territory of the Pacific Islands, Saipan.

Rosendahl, P. H. 1977. Archaeological survey in the Marshall and Eastern Caroline Islands: a completion-of-fieldwork progress report on the Kelton-Bishop Museum Expedition to eastern Micronesia. Department of Anthropology, B. P. Bishop Museum, Honolulu.

Streck, C. F., Jr. 1986. Interim report: archaeological investigations on Eneu Island, Bikini Atoll, Republic of the Marshall Islands. USACOE-POED-PV, Fort Shafter, Hawaii.

Streck, C. F., Jr. 1987. Archaeological reconnaissance site survey of the islands of Bikini Atoll, Republic of the Marshall Islands, Micronesia. Bikini Atoll Rehabilitation Committee, Berkeley.

Watanabe, F. K. 1986. Archaeological reconnaissance for family housing dwellings, FY1987–1989 increments, Kwajalein Island, Kwajalein Missile Range, Kwajalein Atoll, Marshall Islands. Dept. of the Army, U.S.A. Ballistic Missile Defense System Command, Huntsville.

Wiens, H. J. 1962. Atoll Environment and Ecology. Yale University Press, New Haven.

Wiens, H. J. 1963. Some effects of geographic location upon land utilization in the coral atolls of Micronesia. Anthropol. and Soc. Sci. 3: 157–62.