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**Prehistoric Settlement in Eastern Micronesia:  
Archaeology on Bikini Atoll,  
Republic of the Marshall Islands**

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**Abstract**—Recent archaeological research on coral atolls in Micronesia suggest that they may have been settled contemporaneous or prior to the high volcanic islands of the region. Research on Bikini Atoll in the northern Marshall Islands has resulted in the identification of extensive prehistoric cultural deposits despite massive modern disturbance from nuclear weapon testing and construction of support facilities. These cultural deposits have been radiocarbon dated to perhaps greater than 3,000 years B.P., despite Bikini's perceived environmental marginality. The cultural remains also exhibited distinct functional specificity and illustrated the geomorphic dynamism of island landforms on coral atolls. The results of this research indicate that cultural adaptation to coral atoll environments may be of great antiquity in Micronesia.

**Introduction**

Relatively little archaeological research has been performed on the coral atolls of Micronesia, particularly those in the eastern archipelagoes of the Marshalls and Kiribati. The distribution of archaeological research has been patterned by general culture historical and processual models of human settlement in the Pacific emphasizing the overwhelming ecological significance of the high islands and the environmental marginality of coral atolls (e.g. Alkire, 1977, Bellwood 1979, Kirch 1984).

Chief among many factors which have been perceived as inhibiting long-term habitation and cultural adaptation on Micronesian atolls are: 1) limited fresh water resources, 2) lack of varied raw materials for the development of sophisticated tool assemblages, (3) lack of arable land and severely limited cultigen species, 4) susceptibility to environmental stress, sometimes catastrophic, particularly tropical storms and drought, 5) inability of atoll populations to consistently ensure surplus resources, 6) inability of small isolated populations to overcome periods of social stress such as disease and warfare, and 7) difficulty in establishing and maintaining communication and exchange networks. Although seldom explicitly stated, an underlying assumption in many of the archaeological investigations of coral atolls has been that they are recently formed geomorphic features, essentially static in shape and size (barring catastrophic events).

Although these factors cannot be discounted as having constrained human residence on some coral atolls, they do not appear to be so restrictive as to have prevented atolls from being components of the initial settlement and subsequent evolution of Micronesian cultures. Recent archaeological research in the Marshall Islands and other Micronesia atolls corroborates this new view.

### Previous Atoll Research

Modern archaeology on Micronesian atolls was initially oriented towards Polynesian outliers, guided by investigations into the origins of the Polynesian populations. Investigations at Nukuoro in the eastern Caroline Islands<sup>1</sup> established the presence of extensive stratified cultural deposits suggesting long periods of occupation (Davidson 1967, 1968, 1974). Environmental variables affecting the cultural stratigraphy, such as sea level change and storm surge encroachment, were also described. Subsequent research on Faraulep and Woleai in the western Carolines substantiated the probability for long human habitation dating from around A.D. 1000 (Fujimura & Alkire 1979). Similar deposits were identified and sampled at Ulithi (Craib 1980) and Ngulu (Takayama 1982) radiocarbon dated about A.D. 400 and 55, respectively. These investigations in western and central Micronesia suggest that habitation continued unabated from the lowest excavation levels through historic contact periods (generally most intensive in the early 19th Century). Therefore long term habitation and cultural evolution was possible on atolls despite apparent environmental limiting factors.

Relatively few archaeological studies have been performed in eastern Micronesia despite the pioneering efforts of Davidson. The most intensive of these studies was at the Polynesian outlier of Kapingamarangi, south of Nukuoro (Leach & Ward 1981). Deep stratified cultural deposits were identified on the small island of Touhou dating from about A.D. 1200. One result of this research was the identification of numerous coral rubble walls and sand-entrapment systems which appeared to have been used to accentuate island relief and increase available land area. A possible secondary effect of this prehistoric land-form modification may have been to increase the availability of potable subsurface water (the Ghyben-Herzberg lens). This may be an example of traditional cultural attempts to mitigate some of the factors thought to have inhibited longterm cultural adaptation in atolls. Such practices may have been common in the atolls of Micronesia, particularly in areas with pronounced dry seasons and/or frequent cyclonic storms.

Other research in the eastern Carolines has been performed on And Atoll, near Pohnpei (Ayes *et al.* 1981). Traditional Pohnpeian basaltic structures (*pehi*) as well as deep, stratified cultural deposits radiocarbon-dated well before the A.D./B.C. boundary have been identified. Although not yet systematically investigated, cultural deposits similar to those found on Nukuoro, Kapingamarangi, and And have been noted on Ngetik (Leach & Ward 1981, Streck unpublished observation).

Archaeological research in the eastern Micronesian atoll archipelagoes of the Marshalls and Kiribati has been extremely limited. An extensive reconnaissance survey of 12 atolls and one island was performed in 1977 (Dye 1987). This investigation included the collection of a large traditional artifact assemblage (in excess of 1,500 items), identification of probable cultural deposits, and limited test excavation. Research in the Laura area of Majuro Atoll, for example, suggested that the area may have been continuously inhabited from the A.D. 600's through modern times. Other potential longterm habi-

<sup>1</sup> For locations of islands see foldout map in this volume.

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tational cultural deposits were identified on a number of atolls, mostly in the central and southern Marshall Islands.

More intensive archaeological survey was performed on Majuro, where 133 sites were found throughout the atoll (Dye 1987). A range of site types including domestic homesteads, fishtraps, possible religious sites, and resource procurement areas were identified. A series of radiocarbon dates from cultural strata indicates that the atoll was initially settled as early as the 100's B.C. This was the first indication that human settlement on eastern Micronesian atolls was contemporaneous with, or had preceded, that on the high islands of Kosrae, Pohnpei, and Truk.

Archaeological site distribution on Majuro suggested that habitation on the eastern (windward) side of the atoll was inhibited by cyclonic and storm wave exposure. This area also lacked fish traps on the coral reef. Perhaps a more significant mitigating factor may be that this portion of Majuro contains the atolls' deep water passages and a much more restricted protecting fringing reef. These characteristics would allow greater adverse impact to the eastern islands and islets through tropical storm surge than elsewhere in the atoll.

Archaeological survey and test excavation have also been performed on Arno (Dye 1987). A total of 164 surface and subsurface archaeological sites were identified. Radiocarbon dates from test excavations indicate that the atoll was occupied from at least the A.D. 800's. Dye used the results of this investigation to formulate an atoll-wide prehistoric settlement model. Generally, the densest prehistoric habitation was posited to have occurred on the more sheltered western islands (as on Majuro) and been concentrated along the lagoon strand. Isolated homesteads and/or "worker's" residences would be found within the interior of the larger islands and on the smaller islets. Exceptions to this pattern appeared to occur when wide ocean-facing reefs were present forming sheltered micro-lagoonal environments.

Several other archaeological historic preservation compliance projects have been performed in the Marshalls, including a survey of six small islets northeast of Ebeye on Kwajalein Atoll (Athens 1984) and a proposed dock site on Majuro (Rosendahl 1977). Neither investigation was conclusive. Recent archaeological investigations on Kwajalein Atoll have been performed accompanying U.S. Army activities. Intact, though truncated, prehistoric cultural deposits have been identified beneath the present airfield runway on Kwajalein Island radiocarbon-dated to 300-400 B.C. (Shun & Athens, this volume). Possible coral pebble structural pavements, a large, diversified artifact assemblage, and possible sediments from taro cultivation were associated with this deposit. Archaeological reconnaissance and intensive survey on all the islands of Kwajalein Atoll under U.S. Army control identified extensive cultural remains on the small islets of Legan and Enewetak (Schilz 1989). These surveys identified probable surface structural remains, deep, stratified cultural deposits containing dense midden and functional features (mostly earth ovens), and several indigenous artifacts (mostly *Tridacna* spp. adzes). Radiocarbon dates suggest these small islets were inhabited from around A.D. 600.

Several descriptions of "typical" atoll settlement pattern, particularly applicable to the Marshall islands, have been presented in the archaeological literature. Many of these have emphasized island size and availability of ground water resources while attempting to standardize the settlement pattern of the entire archipelago (e.g. Alkire 1977, Athens

1984, Bryan 1972, Cordy 1979). Most of these schemata differ only slightly from those formulated for Majuro and Arno atolls (Dye 1987).

A brief archaeological reconnaissance survey of seven northern Marshall Island atolls was completed in 1988 (Thomas 1989). This resulted in the identification of prehistoric cultural deposits and the collection of indigenous artifacts on the atolls/islands of Jemo, Rongerik, Erikub, Taka, and Wotho. Limited archaeological test excavation established human residence on these environmentally "marginal" atolls from at least around A.D. 1000. The first intensive archaeological investigations to be performed in the northern Marshalls have been at Bikini Atoll (Streck 1986, 1987). Surface and subsurface reconnaissance survey and controlled test excavation have been performed in most portions of the atoll.

**Bikini Atoll: Background**

The Marshall Islands are composed of two north-south trending chains of atolls and islets (the Ralik and Ratak chains) containing a degree of habitat diversity dependent upon the size of the atoll and the amount of annual rainfall (Alkire 1978). Bikini is situated in the drier northern portion of the Marshall Islands. It receives an average of only 53 inches of rainfall a year while, for example, Arno averages 160 inches yearly.

Bikini Atoll (Fig. 1) is situated 4,000 kilometers (ca. 2,500 miles) southwest of Hawaii at 11° 35' N, 165° 25' E. It comprises a ring of 23 islands with a total land area of 8.8 km<sup>2</sup> (3.4 square miles), including the intertidal zone. The oval-shaped lagoon mea-

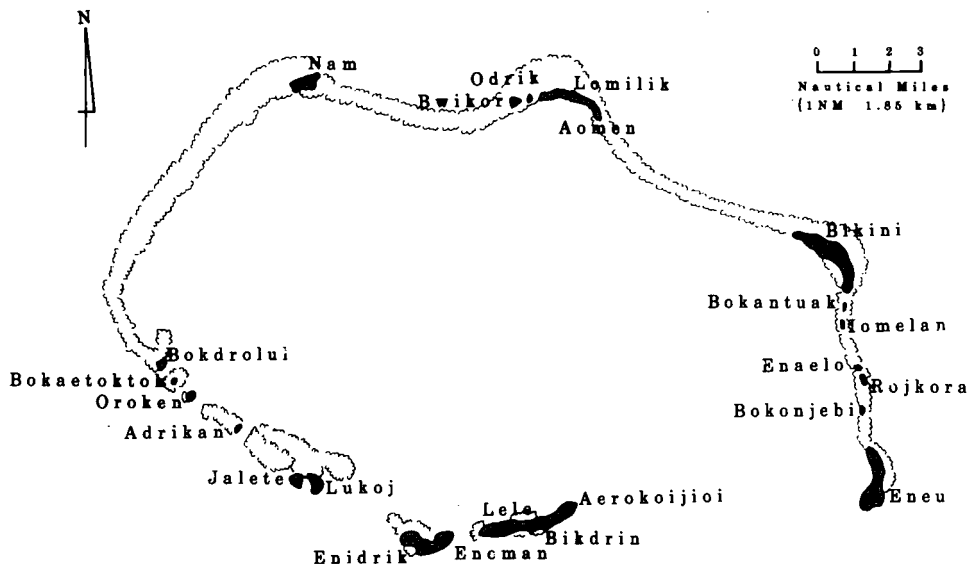


Figure 1. Map of Bikini Atoll.

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sures approximately 42 km east/west, 24 km north-south, encompassing about 630 km<sup>2</sup>. The lagoon environment exhibits a varied and abundant marine biota.

Partly as a consequence of low annual rainfall, northern atoll populations such as at Bikini engaged in gardening activities emphasizing non-labor intensive species that were tolerant to frequent droughts (Wiens 1963). They depended on the hardier crops of coconuts, pandanus, and arrowroot for subsistence, while breadfruit and taro were more important on the southern atolls (Kiste 1974). Although the incidence of cyclonic storms is slightly higher in the northern Marshall Islands, they are relatively rare and may actually be of some benefit by replenishing and maintaining the ground water supply of the larger islands (Maragos *et al.* 1973).

Contrary to the general settlement pattern noted and inferred for the southern atolls in the Marshall Islands, Bikini appears to have been more densely populated along the eastern, windward portions of the atoll (Streck 1986, 1987). Rainfall patterns and island substrate composition may be sufficiently different in the northern Marshalls, so that fresh water cannot be tapped for cultural use on the smaller islets as is common on the more southerly atolls.

Bikini Island, the largest in the atoll (227 ha or 560 acres), was the only permanently occupied area when the community was evacuated in 1946. It appears to have hosted the most extensive habitation during prehistory. The second largest island, Eneu (123 ha), possesses a larger and higher quality groundwater resource, however (Peterson 1986). Eneu, as well as the islands of Nam (53 ha), Enidrik (97 ha), and Eneman (20 ha) also may have had small permanent settlements during the premodern (pre-20th Century) era. Nam was the only island, beside Bikini and Eneu, on which definite evidence for probable prehistoric cultural deposits or indigenous Marshallese artifacts were identified.

The islands of atolls in the Marshall islands tend to have higher relief and greater average elevation than in many other Micronesian atolls. Bikini Island has an average interior elevation of 1.8–2.7 m above sea level with a maximum of 4–5 m despite massive modern land alteration. Eneu averages 1.5–3.0 m elevation.

Foreign influences, while profound in much of the Marshall Islands, appear to have had minimal social effect until 1946 on Bikini (Hezel 1979, 1983, Kiste 1974). Following defeat of the Japanese in the Pacific during World War II, the U.S. Government removed the 167 residents of Bikini in 1946 so that the atoll could be used for the testing of nuclear weapons. Considerable hardship was inflicted on the Bikinian community until they were finally settled on Kili island in 1948.

Most of the nuclear test blasts were concentrated in the western portion of the atoll, although radioactive fallout was severe on the northeastern islands following wind abnormalities during thermonuclear blast BRAVO in 1954. In 1968 the main islands of the atoll were deemed safe for settlement. Debris cleanup, replanting, and establishment of new community facilities resulted in the alteration of the land surface of most of the larger islands. In 1978, Brookhaven National Laboratory performed whole body radiation-burden examinations of some of the Bikinian resettlers which revealed unacceptable radiation levels. The resettled community was subsequently evacuated from the atoll.

The Bikini Atoll Rehabilitation Committee (BARC) was established by the U.S. Congress in 1982 to support research and advise on methods for rendering Bikini Atoll

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safe for human habitation. In addition to primary research dealing with radiological conditions and means to reduce or ameliorate conditions to within federal dosage standards, BARC has supported a wide range of environmental investigations.

### Bikini Atoll: Archaeological Resources

Archaeological reconnaissance was initially performed on 11 of the 23 islands on Bikini Atoll in 1985. Potentially significant cultural deposits and/or indigenous artifacts from ground surface contexts were noted on Nam, Bikini, and Eneu. Subsequent test excavation was performed on these islets (Streck 1986, 1987, in prep.). Archaeological excavations covered over 30 m<sup>2</sup> and included a systematically sampled volume exceeding 18 m<sup>3</sup>. An artifact assemblage composed of over 300 items (70% from subsurface context) was recovered. The assemblage includes over 200 indigenous Marshallese artifacts including shell ornaments, shell and coral tools, pearlshell fishhooks, and various other utensils. Thirty-five radiocarbon age determinations have been obtained from 25 locations on Eneu and Bikini Islands (Table 1; Figures 2 and 3). In addition, initial analysis of over 24 kg of excavated midden has been completed including copious amounts of marine mollusc shell, possible marine mammal bone, sea turtle bone, and crustacean and echinoderm remains. These data allow for the preliminary determination of chronology of human settlement, use of particular island areas, function of subsurface features, and reconstruction of probable settlement pattern during the prehistoric period on Bikini Atoll.

Several constraints governed the way the archaeological survey was performed, and recovered data were interpreted on Bikini. Among these were the physical effects of the nuclear testing and the construction of support facilities for the testing between 1946 and 1958. Direct effects of the testing included the complete destruction of several small is-

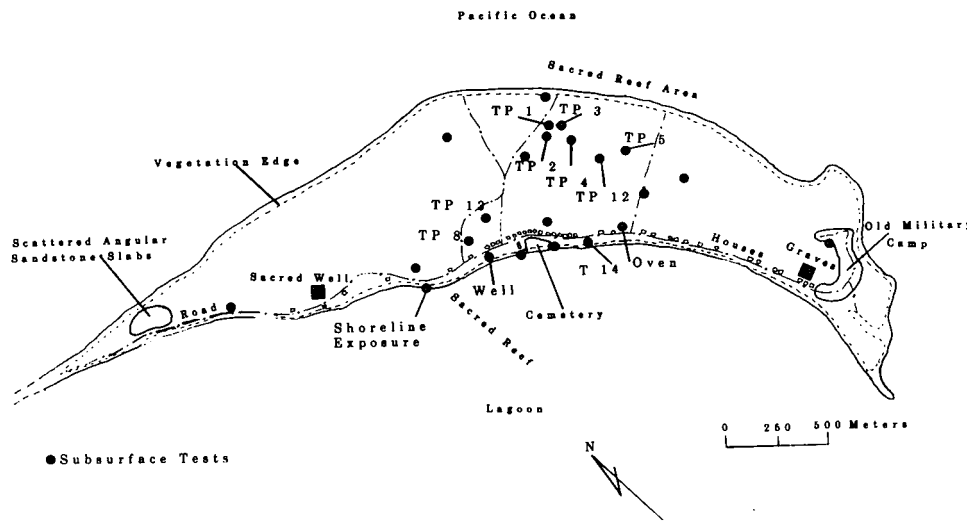
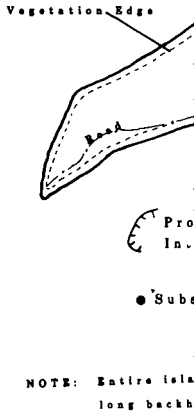


Figure 2. Bikini Island sample sites.



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