# ARCHAEOLOGICAL AND PALEOENVIRONMENTAL EVIDENCE OF EARLY SETTLEMENT IN PALAU

David J. Welch

International Archaeological Research Institute, 2081 Young Street, Honolulu, Hawai'i 96826, USA

*ABSTRACT*

*Recent archaeological and paleoenvironmental investigations in Palau have produced radiocarbon dates for human presence far earlier than that reliably documented by previous research. Colonization of the islands certainly dates back at least 3,000 and perhaps over 4,000 years. Both paleoenvironmental and archaeological evidence indicates surprisingly early and extensive use of the upland areas of the main island of Babeldaob. While each set of dates provides some confirmation of the other set, they are not completely in agreement in terms of the time of colonization or the form of adaptation to the island environment. This paper examines the context of these early dates and what they suggest in terms of the time of human settlement, the effect of early human settlement on the natural environment of Palau, and cultural change in Palau before 1500 years BP. An effort is made to correlate the paleoenvironmental and archaeological evidence to produce an acceptable early cultural sequence for Palau.*

This paper is a preliminary attempt to synthesize recent data from two methods of investigation, traditional archaeological survey and excavation on the one hand and paleoenviromental coring on the other. The goal is to understand the initial settlement and early expansion of human populations in the Palauan archipelago, focusing primarily on the largest island of the group, Babeldaob. The approach adopted here is one that seeks not only to examine the data derived from recent investigations in Palau by archaeologists from International Archaeological Research Institute, Inc. (IARII), but also one that endeavours to present a bit of the process by which our thinking about early Palauan settlement evolved as new data emerged over the course of the investigations.

The Palau Islands, an arc of islands, mostly volcanic in the north and uplifted limestone reef in the south, form the westernmost archipelago in Micronesia (Figure 1). Babeldaob, near the northern end of the group, is a 40 km long, 15 km wide volcanic island with a rolling hilly interior, sloping down to narrow coastal plains largely dominated by mangrove swamps. The climate is hot and rainy year round, although rain is heaviest from May through November.

Following Palau's independence in 1994, several public works projects were undertaken, including the emplacement of a rural water system in various villages, the installation of new telephone cables throughout the islands, a proposed relocation of the capital, and the planned construction of a new road (the Palau Compact Road) to link the villages of Babeldaob with the main population center on the island of Koror. These projects required archaeological survey, testing, data recovery, and monitoring, and resulted in a tremendous increase in the data available concerning Palau's past (e.g. Beardsley 1996, 1997; Wickler *et al.* 1997; Liston *et al.* 1998a, 1998b, 1988c). In addition all these projects incorporated oral historical research of Palauan traditions as an element in the evaluation of archaeological site significance (e.g. Basilius and Tellei 1996; Tellei *et al.* 1998).

While incorporating information from many of these projects, this paper is based largely on the results of the archaeological work conducted in 1996 and 1997 for the Palau Compact Road project on Babeldaob. This project has provided unusual opportunities for large-scale research of the Palauan past. Because the road will essentially encircle the island of Babeldaob, the project has allowed sampling of sites in geographic locations spread across the entire island, and, as a result, required us to contend with the diversity of the Palauan archaeological record. Along its route, the road corridor passes through nearly all of Babeldaob's terrestrial environmental zones, from mangrove swamps, coastal wetlands and taro fields, and forested hill

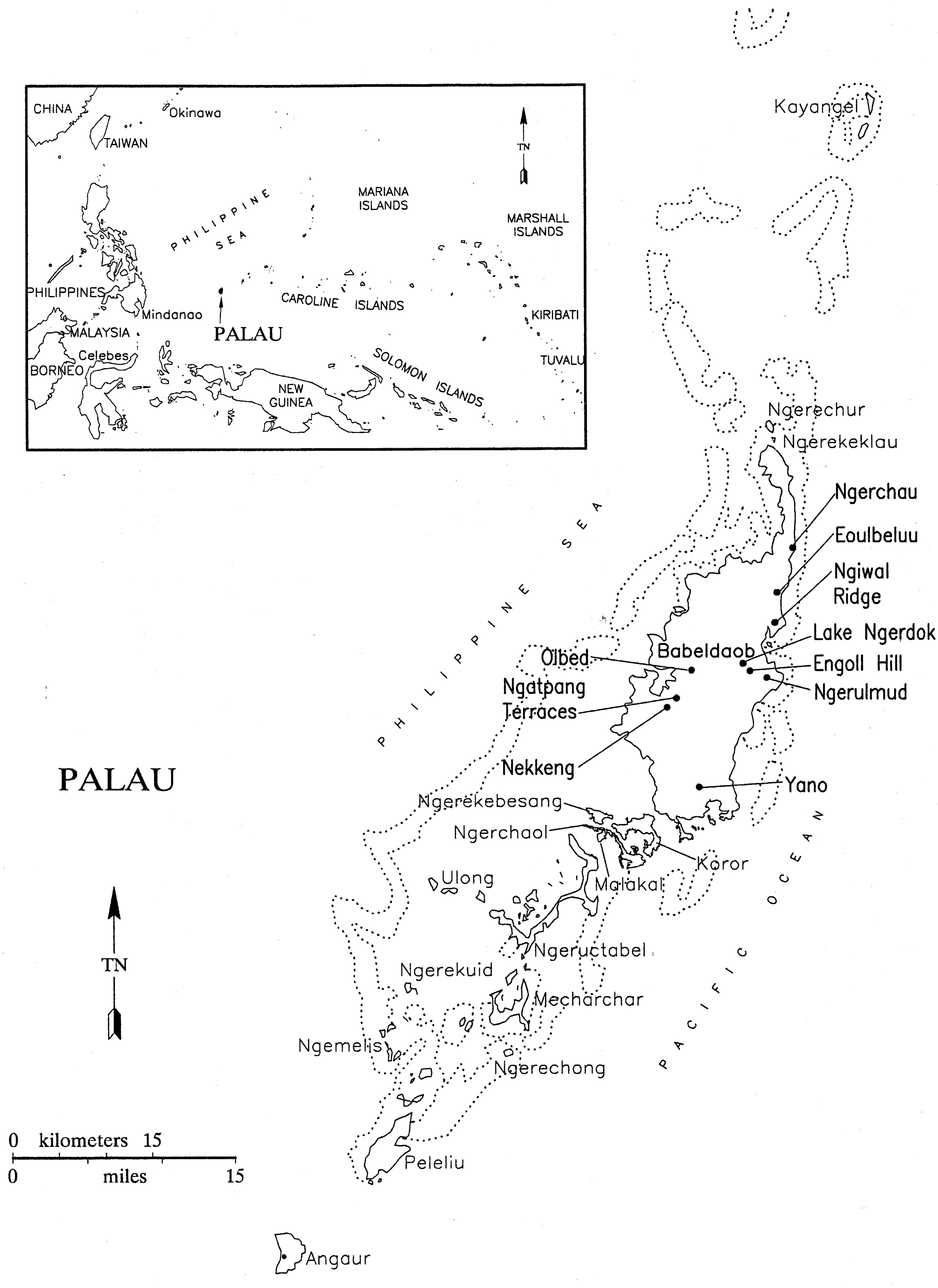


*Figure 1: Map of Babeldaob showing location of early archaeological sites and sediment coring locations.*

slopes to ridgeline grassland savannas. Traditional Palauan sites seem to vary significantly typologically from zone to zone, reflecting both the potential cultural uses of the different resources of each zone and the changing patterns of human use of the environment over the course of Palauan prehistory and history. Thus, the 110 traditional Palauan sites investigated during this work represent a sample of nearly all the known prehistoric site types. Seventy-six radiocarbon dates have been obtained from excavations and sampling of exposed cuts, close to doubling the number of radiocarbon dates from Palau.

Because of potential damage to wetland environments, paleoenvironmental coring of wetland sediments has been included as part of the project, allowing the collection of data for interpreting the climatic and environmental record of the middle and late Holocene. The paleoenvironmental coring has provided a second method, complementing the archaeological, for discerning and interpreting the impact of human settlement on the natural environment of Palau.

As a result of this work, the IARII Palau research team has begun to develop a new chronological framework in which to discuss change and adaptation in Palauan culture (Figure 2). Prior to our research, Masse (1989, 1990) had developed a sequence, based on a careful consideration of the radiocarbon dates available a decade ago; this sequence was accepted during the early 1990s as best reflective of the archaeological data. Masse's analysis indicated that no dates earlier than 2000 BP could be regarded as reliably dating a cultural context and thus cast doubt on what had generally been accepted as most likely: that Palau had been colonized, like the Mariana Islands, 3,000 or more years ago. Following the 1996 survey phase of the Compact Road project, Wickler proposed a new sequence on the basis of 16 radiocarbon dates from that survey, showing a sequence of pre-2000 BP colonization, early settlement, terrace construction and abandonment, and village settlement (Wickler *et al.* 1998). However the results of the paleoenvironmental coring and the data recovery project with more than 60 additional dates indicate the need for further modifications of this sequence, pushing back even further the time of human colonization. A preliminary version of a revised sequence, still under formulation and revision, is shown in Figure 2.

The first definitive evidence that indicated the need to rethink and extend back in time the cultural sequence was found during a survey of the proposed capital relocation site (Liston *et al.* 1998a), and that site will be discussed first.

## INVESTIGATIONS AT NGERULMUD HILL, THE CAPITAL RELOCATION SITE

In August 1996 Kaschko undertook archaeological survey in Melekeok in eastern Babeldaob of a hilltop (Ngerulmud Hill) proposed as the site of a new capital for Palau (Liston *et al.* 1998a) (see Figure 1). Previous reconnaissance of the area had revealed only the presence of World War II Japanese defensive positions. However, intensive survey and detailed study of the hill led to the conclusion that the hilltop had once been completely or partially surrounded by a moat or ring-ditch. The ditch itself is today quite shallow, only 10 to 20 cm deep, but its moisture retention capabilities have resulted in vegetation of a brighter green than on the rest of the hillside, making its presence obvious when viewed from the proper angle (Figure 3).

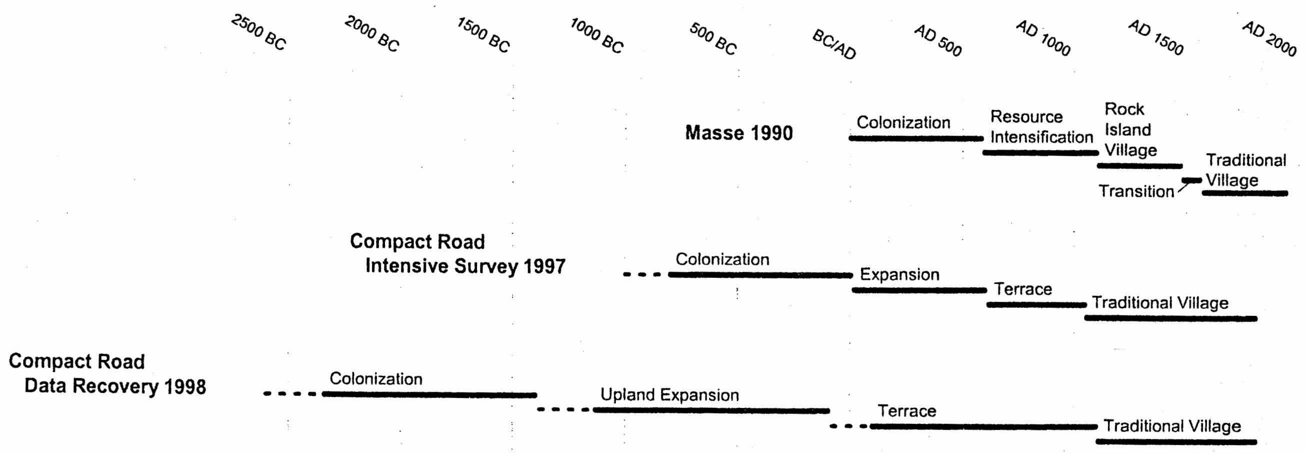


*Figure 2: Proposed sequences of cultural periods for Palau.*

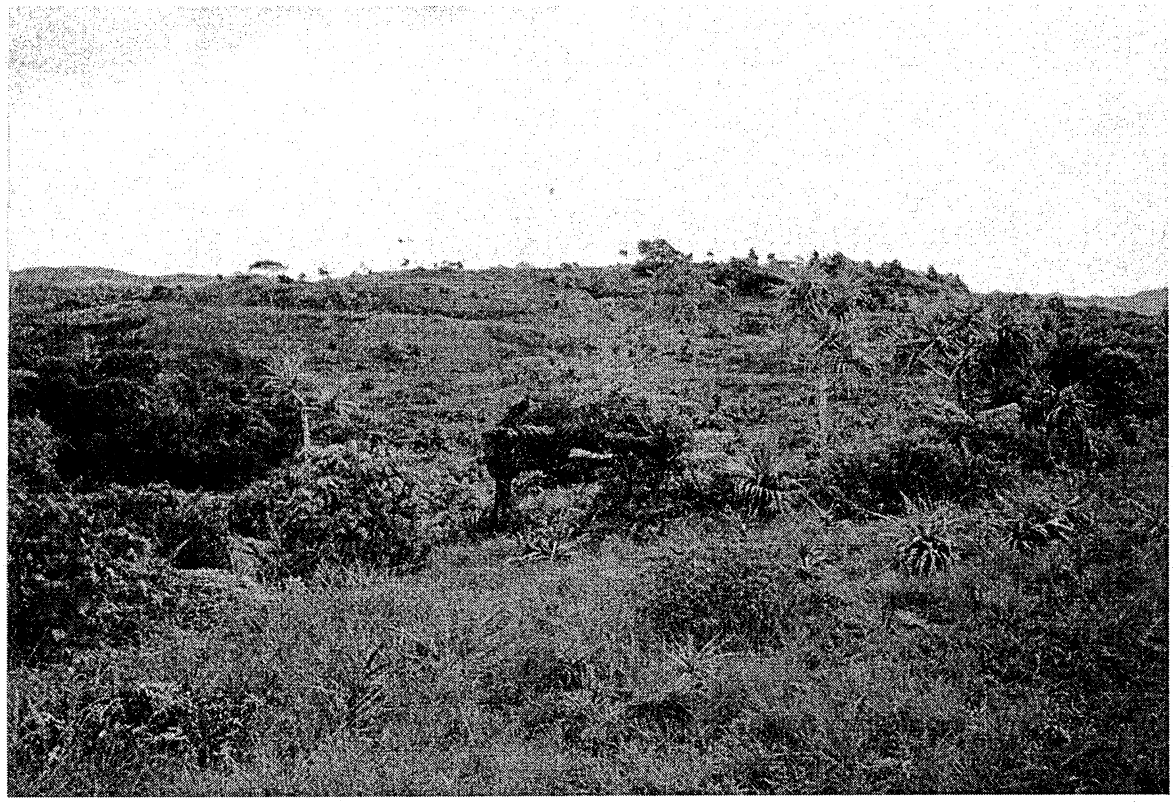

*Figure 3: Ring-ditch at the Ngerulmud Hill site.*

The find was exciting because of the absence of any previous record of this type of feature in the archaeological literature or oral history of Palau, in spite of the many descriptions of dramatic landscape changes effected by prehistoric Palauan societies. The identity of the feature as a ditch was confirmed through its profile in the bank of a road that cuts across the hilltop.

While crown and brim terrace tops in which a ditch surrounds a small elevated crown are common, well-recognized, and dominant features in the Palauan cultural landscape, Ngerulmud Hill is unusual and does not fit the usual crown and brim type. The ditch partially encloses a quite large area, 100m in diameter, that appears to be a natural hilltop rather than an artificially shaped crown. Also, unlike most crowns, which cap a series of stepped terraces, no other terraces are directly associated with the ring-ditch. We initially interpreted the feature as a fortified defensive position most likely related to the period of intensive warfare that is known to have characterized the late prehistoric and early historic periods in Palau and in which Melekeok was the leader of one of the warring confederations.

However, this interpretation was called into question and our interest in the site intensified when the results of the radiocarbon dating of three charcoal samples were received. The charcoal was recovered from cultural deposits exposed in the high road bank and from the side walls of a World War II Japanese trench dug within the enclosed portion of the hilltop. Two samples dated to the early first millennium AD and one to the late first millenium BC (see Table 1). Given the scarcity of dates greater than 2000 years old associated with archaeological materials and Masse's questioning of the validity of those few early dates, the results were quite surprising. The charcoal from these samples seemed to be securely associated with pottery sherds and a few stone flakes.

The pottery itself was unusual compared with that found in earlier excavations on Palau, with the assemblage dominated by very thin (2 to 7 mm thick) sherds, black in paste, and generally with dark surfaces, although cleaning and closer examination revealed that most had previously had lighter colored oxidized surfaces which had largely eroded away. A histogram clearly shows the thinness of these sherds relative to more typical Palauan assemblages (Figure 4).

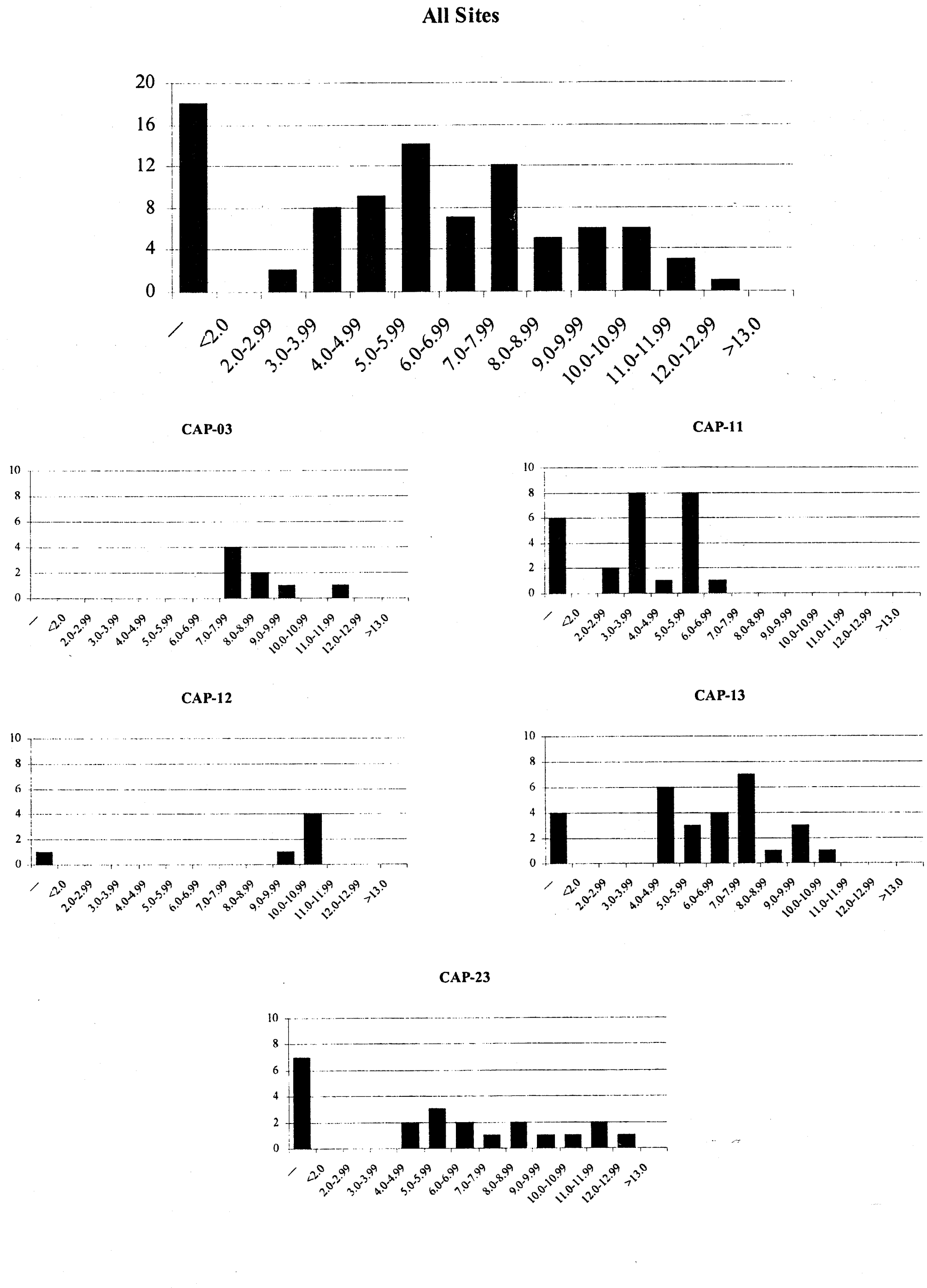


*Figure 4: Histogram of sherd thickness from Capital Relocation project. CAP-11 is the deposit dominated by thin black pottery (Liston* et al. *1998a:79).*

Table 1: Early radiocarbon dates from Palau archaeological sites

| Sample No. | State and Site No. | Site Name or Type, Sample Context and Associated artifacts | Wood Taxa and Weight of Dated Charcoal | Convention al Age BP | Calibrated C14 Age | Reference |
|---|---|---|---|---|---|---|
| *Fortified Hilltop Sites* | | | | | | |
| Beta-96305 | Melekeok ME-11:1 | Ngerulmud Hill cultural deposit in WWII trench wall; pottery and lithics | Unidentified 1.0 g | 2180 ± 60 | 375-65 BC | Liston *et al.* 1998: 84 |
| Beta-96307 | Melekeok ME-11:1 | Ngerulmud Hill cultural deposit in road cut; pottery and lithics | *cf. Pongamia pinnata, cf. Soneraatia alba, cf. Intsia bijuga*, 7.2g | 1770 ± 110 | AD 145-600 | Liston *et al.* 1998: 84 |
| Beta-96306 | Melekeok ME-11:1 | Ngerulmud Hill fortified hilltop posthole; no artifacts | Palm, *cf. Intsia bijuga*, and unidentified 18.6 g | 1670 ± 90 | AD 20-540 | Liston *et al.* 1998: 84 |
| WK 5932 | Melekeok ME-6: T1 | Engoll Hill buried cultural deposit; pottery | *cf.* Coconut 1.3 g | 1746 ± 72 | AD 115-450 | Liston 1999: B-1 |
| WK 5931 | Melekeok ME-6: T1 | Engoll Hill buried cultural deposit; pottery | Coconut shell 2.3 g | 1690 ± 80 | AD 145-545 | Liston 1999: B-1 |
| WK 5933 | Melekeok ME-6: T1 | Engoll Hill sediments filling in ditch; pottery | Coconut shell 1.6 g | 1640 ± 100 | AD 210-635 | Liston 1999: B-1 |
| WK 5930 | Ngiwal NI-1:T2 | Unnamed moated site redeposited fill in ditch around site; pottery | *cf.* Legume 4.2 g | 1530 ± 60 | AD 425-640 | Liston 1999: B-6 |
| *Dates Greater than 2000 BP with Thin Black Pottery* | | | | | | |
| Beta 100023 | Ngaraard NA-1:10 | Eoulbeluu Village, deposit in road cut 90-100 cm bd; pottery | Unidentified 0.03 g | 2500 ± 70 | 790-415 BC | Wickler *et al.* 1998: 89 |
| WK 5941 | Ngiwal NI-1:T10 | Terrace, redeposited cultural horizon; pottery | Unidentified 1.0 g | 2459 ± 67 | 770-400 BC | Liston 1999: B-7 |
| WK 6467 | Ngaraard NA-2:T4 | Imengel, deposit beneath WK5906 deposit; pottery and 1 lithic artifact | Unidentified 0.03g | 2474 ± 67 | 775-410 BC | Liston 1999: B-2 |
| WK 5939 | Ngaraard NA-1:T5 | Unnamed site lower cultural deposit; pottery and lithics | Mangrove 0.2 g | 2091 ± 68 | 355 BC-AD 70 | Liston 1999: B-2 |
| WK 5906 | Ngaraard NA-2:T4 | Imengel, deposit beneath earthen platform; pottery and lithics | Coconut shell 0.06 g | 2050 ± 66 | 345 BC-AD 115 | Liston 1999:B-2 |
| WK 5929 | Ngiwal NI-1:T6 | Ridgeline lower cultural deposit, pottery | Coconut shell 0.02 g | 2222 ± 69 | 400-95 BC | Liston 1999: B-6 |

*Table 1 continued ....*

*...Table 1*

| | | | | | | |
|---|---|---|---|---|---|---|
| *Additional Dates Greater than 2000 BP* | | | | | | |
| WK 5937 | Ngiwal NI-1:T9 | Terrace, Deep ditch pre-terrace deposit; no artifacts | Seed parenchyma 0.07 g | 3050 ± 73 | 1440-1110 BC | Liston 1999: B-7 |
| WK 5904 | Ngatpang NT-3:9a | Ngerdubech Village, below terrace, pottery and lithics | Coconut shell 0.02g | 2994 ± 70 | 1410-1000 BC | Liston 1999: B-6 |
| WK 5926 | Ngatpang NT-3:10 | Cultural layer before terrace construction; pottery and lithics | *cf. Macaranga caroliensis* 0.2 g | 2809 ± 72 | 1130-810 BC | Liston 1999: B-6 |
| WK 6468 | Ngatpang NT-3:10 | Terrace fill, charcoal from pre-terrace activity | Unidentified 0.1 g | 2717 ±58 | 945-795 BC | Liston 1999: B-6 |
| WK 6469 | Ngatpang NT-3:10 | Terrace fill, charcoal from pre-terrace activity | Palm and unidentified 0.2 g | 2334 ± 60 | 535-200 BC | Liston 1999: B-6 |
| WK 5920 | Ngaraard NA-4:6 | Rois Terrace, fill of small pit at burial complex; no artifacts | *cf. Casuarina litorea* 0.55 g | 2015 ± 68 | 185 BC-AD 130 | Liston 1999:B-3 |
| WK 5928 | Ngiwal NI-1:T6 | Ridgeline upper cultural deposit; pottery and lithics | Coconut shell 0.05 g | 2053 ± 70 | 200 BC-AD 120 | Liston 1999: B-6 |

## RESEARCH IN EASTERN BABELDAOB FOR THE COMPACT ROAD

Research associated with the construction of the Compact Road in eastern Babeldaob has confirmed that the results of the Ngerulmud Hill survey were not mistaken, nor do they represent a unique situation. Two sites first identified during the Compact Road survey as Japanese World War II defensive positions were revisited after the Ngerulmud Hill survey and reassessed as smaller ring-ditch sites. At least one more ring-ditch has been identified along Ngiwal Ridge north of Melekeok. The thin black pottery is common on the surface of these sites and in the side walls of Japanese WWII defensive positions dug at or near the sites.

The thin black pottery was also found in abundance in an archaeological deposit located 70 to 110 cm below surface in a bulldozer road cut that lacerated part of the traditional village of Eoulbeluu in southern Ngaraard. Charcoal associated with this pottery yielded a radiocarbon date of 2500±70 BP, in line with the earliest date from Ngerulmud Hill (Kaschko 1997). The site also contained, unfortunately disturbed from its original context, a red-on-buff painted sherd, a type of decoration rare in Palau, but also found on vessels recovered from a burial cave in Koror, associated with a comparable radiocarbon date (Beardsley and Basilius this volume).

Given these results, research during the data recovery phase of the Compact Road project, especially in eastern Babeldaob, focused on excavating backhoe trenches across the ditches at the hilltop site of Engoll Hill in Melekeok and the ridgeline ring ditch site in Ngiwal, recovering dating samples associated with these ditches, and obtaining additional dates from deposits containing the thin black pottery.

The ring-ditch features on these fortified hilltops, when tested, have proven to be quite massive subsurface constructions – measuring up to 7 m in original depth and containing over 4 m of in-filled sediments (Figure 5). The dating results from these excavations, while consistently early, have been more in line with the later (i.e., early first millennium AD) dates from Ngerulmud Hill than the earliest date. Radiocarbon dates on coconut shell, obtained in one case from sediment that appears to have filled the base of the trench soon after construction, and in two cases from pit features buried on the crown under backdirt excavated from the ring-ditch, date to between 1400 and 1900 years ago (see Table 1, Liston *et al.* 1998c).

Surveys in eastern Babeldaob have also identified a perhaps functionally related as well as contemporaneous feature type, the ridgetop linear "barrier slashes" or ditch-cuts, which have similar subsurface dimensions as the hilltop ring-ditches, but are located along the ridge crests which provide the logical routes of access to the fortified hilltop sites. This feature type has yet to be directly tested and dated, but at least two of these features are located on ridge-top approaches to the Ngerulmud Hill site (Kaschko 1998).

Excavations in 1997 yielded even earlier dates than those from the first year of fieldwork. In eastern Babeldaob, one very early calibrated date of 3390 - 3060 BP has been obtained from excavation of a backhoe trench through the lower bank of a terrace in Ngiwal, with charcoal recovered from a layer pre-dating terrace construction. No cultural material was

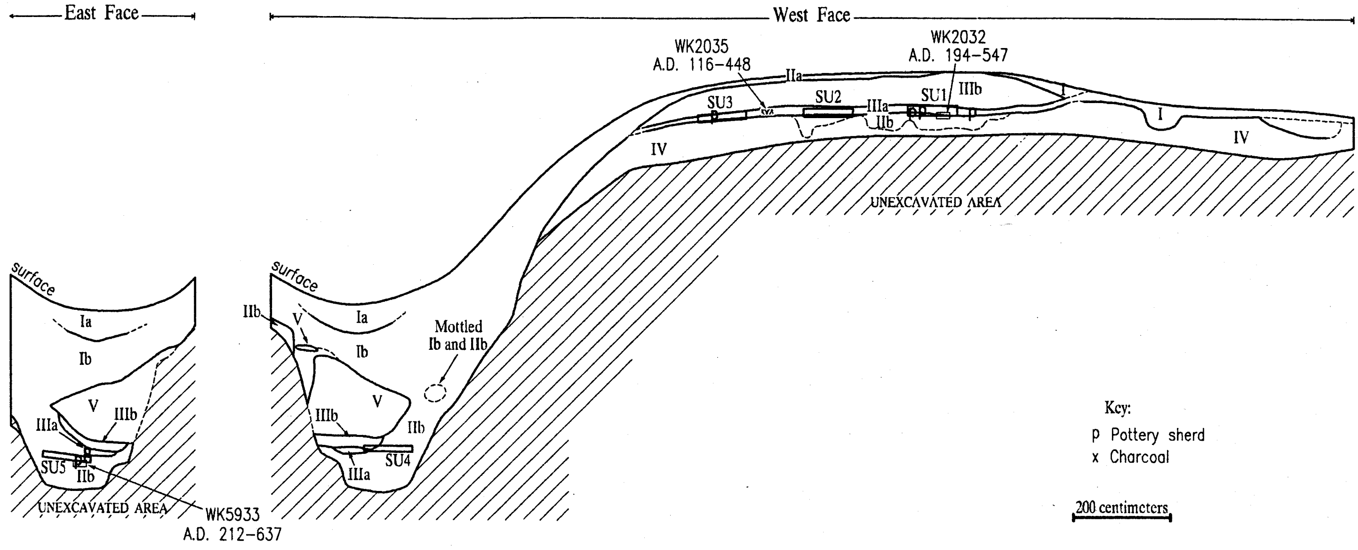


*Figure 5: Profile of ring-ditch and hilltop at Engoll Hill with location of radiocarbon dating samples (Liston* et al. *1998c:101).*

associated with the charcoal, which was collected from the soil filling a possible water channel, perhaps reflecting early agricultural activities on the hillslope.

Radiocarbon dates associated with thin black pottery deposits outside hilltop fortifications range between 2500 and 1700 BP (see Table 1). These buried cultural deposits occur primarily in ridgetop locations, though at least one is located on the coast. These sites lack major structural features, such as ditches, terraces, or platforms (Kaschko 1998, Liston *et al.* 1998c). Except for the earliest dated site, where no pottery was recovered, all sites in eastern Babeldaob with radiocarbon dates greater than 2000 years BP contain thin black pottery in association with the dated charcoal.

Additional dates earlier than 2000 years BP, including a calibrated date of 3360 - 2950 BP on carbonized coconut shell from a pre-terrace layer, have been obtained from two sites in Ngatpang, but interpreting the context for many of these dates remains problematic. While the context and association of individual charcoal samples are not always as ideally secure as desirable for radiocarbon dating, it is important to note that there are now 11 fourth millennium BP and 2 third millennium BP calibrated dates from cultural contexts on Babeldaob (see Table 1).

## PALEOENVIRONMENTAL CORING: SEDIMENT, POLLEN, AND CHARCOAL EVIDENCE

As part of the research associated with the Compact Road and other projects, cores were extracted by Stephen Athens and Jerome Ward from wetland sediments at 22 locations, 15 of them around the island of Babeldaob. The coring was undertaken to provide a record of the Holocene environment of Palau, delineating any climatic changes, sea level fluctuations, geomorphological alterations, and vegetation changes as a base line for understanding human adaptation to the island, as well as yielding a record of human impact on the environment through settlement, agriculture, and other land uses. A particular concern is the origin of the upland grasslands and savannas, which are distributed rather patchily over 20% of Babeldaob's surface, the question being whether these are natural or the result of human land use activities.

Initial interpretations of the paleoenvironmental record were based on three analyzed cores from widely separated areas on the island (Athens and Ward 1998a; Ward *et al.* 1998). The Olbed core was recovered from a taro patch located in a low area between two agricultural terraces near the edge of the mangrove swamp on the northwest coast in Ngeremlengui. The Yano Farm core was recovered from a floodplain along the edge of a slow-flowing river in a prime agricultural area in Airai near the south end of the island, approximately 1 km upstream from the coast. The Lake Ngerdok core was taken from a crocodile-infested upland freshwater pond located along the upper reaches of the Ngerdorch River in Melekeok on the eastern side of the island, near one of the fortified hilltop sites.

The results indicate several episodes of what are interpreted as significant human impacts on the environment. The prominent changes are variations in the sedimentation rates, the fluctuations in the frequency of grass and forest palynomorphs, indicating expansion and contraction of the savannas, and increases through time in the microscopic charcoal particle count. Also important is the presence of a few pollen grains of Palauan cultigens.

The base of the Olbed core dates back to nearly 8000 BP, while the Yano core dates back to about 7000 BP. Until 4500 BP or slightly later, forest vegetation seems to have been dominant at both locations, and there is little evidence suggesting climatic change in either the Olbed or Yano core. The charcoal particle counts are very low, although even such low counts are unexpected in the absence of humans or volcanoes.

Between 4500 and 4200 BP the counts of charcoal particles and pollen from savanna indicator plants begin to increase slightly. In a pollen sample from the Olbed core, taken from directly above a radiocarbon sample dated to 4600 - 4200 BP, one grain of coconut pollen, which had not been present in any of the earlier samples, was found. Together these bits of evidence were interpreted as possibly indicating initial human colonization of Palau.

The date from the base of the Lake Ngerdok core indicates that sediment begins to accumulate in the Ngerdok Basin around 3900 BP and the rate increases rapidly at Yano from 3800 - 3300 BP (Figure 6). Increased sedimentation may have been due to a significant tectonic uplift of Babeldaob which geological evidence suggests may have occurred after 4000 BP. About 3000 BP there is a period of rapid sediment accumulation in the Lake Ngerdok Basin; however, this increase may reflect clearance of upland forest areas for agriculture rather than natural causes, as there is additional evidence to support such an interpretation.

This additional evidence consists of a dramatic change that occurs late in the fourth millennium BP, as savanna indicators increase strongly in all cores, most clearly in the Olbed core (Figure 7). About this time at all locations, the frequency of pollen of grasses, *Lycopodium*, and *Pandanus* increases greatly, while pollen of forest trees declines precipitously. As well as a major increase in savanna plants, the charcoal particle count increases significantly. There is also evidence for an increasing abundance of coconut at this time. These changes occur first at Olbed (beginning by 3500 BP and peaking at 3100 BP) and a little later in time at Yano (3100 to 2600 BP). At Lake Ngerdok between 3400 and 2800 BP savanna indicators increase in frequency, charcoal particles increase, and the sediment accumulation rate accelerates; however, the various changes do not coincide as closely in time with one another, as at Yano and Olbed.

There is, interestingly, an apparent decline of the savannas and forest regeneration around 2500 BP, accompanied by a reduction in the quantity of charcoal particles at Olbed and Lake Ngerdok but not at Yano. At present, it is difficult to explain this change in the composition of the vegetation communities, a change which would seem to signal decreased human activity in the uplands.

In any event this reduction is followed around 2000 BP by an apparent new expansion of the savanna (again most clearly shown in the Olbed core, but also visible in the Lake Ngerdok core). The count of charcoal particles increases greatly. This expansion continues for over a thousand years and may be associated with the construction of the fortified hilltop sites and with terrace construction. A later decline in the savanna about 600 - 700 years ago may be associated with terrace abandonment, a topic that is addressed elsewhere (Liston and Tuggle 1998; Welch and Wickler 1998).

The evidence from these three cores suggested the possibility of human colonization of Palau a thousand years earlier than indicated by the archaeological evidence. It also suggested that the limited archaeological evidence of upland settlement by 3000 BP perhaps reflected a much more radical transformation of the environment than suspected. In order to evaluate this unexpected evidence, additional radiocarbon dating of these cores and analysis of two other

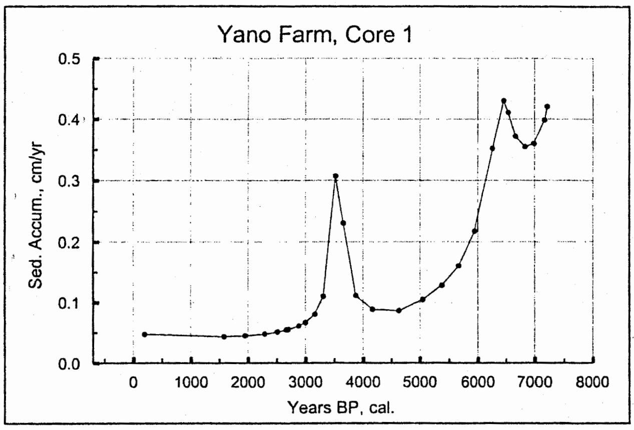


*Figure 6: Graph of sedimentation accumulation rate for the Yano core (Athens and Ward 1999:40)*

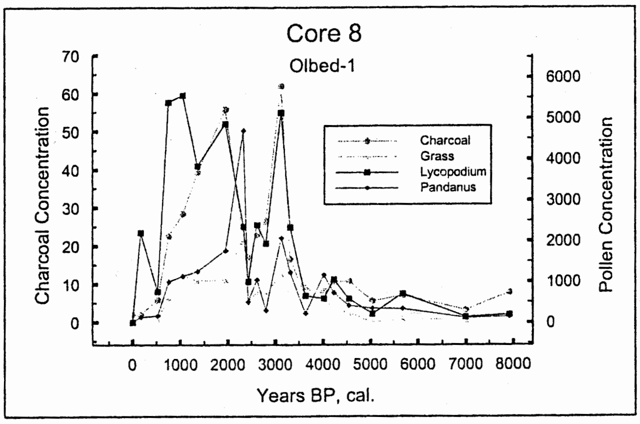


*Figure 7: Graph of concentrations of charcoal particles and pollen of main savanna indicators over time at Olbed coring location (Athens and Ward 1999:107).*

cores, from Ngerchau and Nekkeng, was conducted during the second phase of work on the Compact Road. This research has yielded critical evidence which has led to refinement and modification of some of the original conclusions (Athens and Ward 1999). The Ngerchau core was taken from a taro field behind the eastern coastal sand berm near Ulimang in Ngaraard on the northern peninsula of the island, while the Nekkeng core was extracted from a sedge wetland (a former taro pondfield) along the margins of the wetland surrounding Ngeremeduu Bay in Aimeliik on Palau's west coast.

It is in respect to the evidence relating to possible human colonization around 4500 - 4200 BP that the new evidence from the Ngerchau and Nekkeng cores is most important (Athens and Ward 1999). The Nekkeng core, extending back as early as the Yano core, contained one grain of coconut pollen in each of the three sampled intervals dating between 7200 and 4600 BP, suggesting that coconut may well have been indigenous to Palau and not brought in by the first human colonists, as the Olbed evidence initially suggested. However the Nekkeng core did show an increase in the coconut pollen count after about 4300 BP, corresponding with the time of its appearance at Olbed. Coconut pollen also becomes quite abundant in the Ngerchau core about this time.

While coconut may not have been introduced, palynomorphs of two other cultigens first appear between 4500 and 4200 BP. *Areca* palm (*Areca catechu*) pollen is found in the Nekkeng core in a sample dated to between 4400 and 4200 cal BP. Swamp taro (*Cyrtosperma chamissonis*) appears in the Ngerchau pollen record at this same time, with 8 grains counted in 3 samples dating between 4500 and 4200 BP. Multiple radiocarbon dates confirm the chronology of this core.

A date of 4500 - 4200 BP for initial human settlement of Palau is certainly earlier than expected (given that settlement of the Marianas seems to have occurred around 3500 BP) and a thousand years earlier than any dates from archaeological sites. It is therefore perhaps necessary to provide a more detailed argument to substantiate our inferences that the paleoenvironmental data indicate such early settlement of Palau and subsequent substantial human impact upon the natural environment of the island.

## HUMAN VERSUS NATURAL CAUSES AS THE EXPLANATION OF CHANGE

Hunter-Anderson in particular has argued that many of the environmental phenomena in the Pacific that are interpreted as the result of human impact, especially the presence of grasslands, are in fact attributable to natural factors. The following discussion summarizes reasons for arguing that this is not the case on Babeldaob and that the evidence of environmental change contained in the paleoenvironmental record largely reflects human colonization and inland expansion.

First, the earliest significant evidence for savanna plants coincides with the first appearance of two cultivated plants. In the three cores with sediments that date earlier than 4500 BP, the evidence points to the complete dominance of forest trees with extremely low pollen counts for *Pandanus*, *Lycopodium*, and grasses. For the entire period when there is little likelihood that humans were present, there is no evidence for grasslands on Babeldaob. Our argument, as first presented (Athens and Ward 1998a; Ward *et al.* 1998), was based on only three cores and noted the simultaneous appearance of coconut pollen and a small increase in savanna indicators about 4300 BP at Olbed. We were concerned with the weakness of the argument, since it was based on the recognition of only one grain of coconut pollen. On the one hand, this raised the fear of contamination or movement of the grain from higher in the column, and, on the other hand, there was the possibility that, as on Guam (Ward 1994; Athens and Ward 1999), coconut might be indigenous to Palau and not evidence of human presence. Based on the subsequent analysis of the Nekkeng core, it is in fact now clear that coconut was present on Palau prior to human colonization (Athens and Ward 1999). However, the presence of *Areca* palm and swamp taro pollen in the Nekkeng and Ngerchau cores at the same time as the first increase in savanna plants supports the appearance of humans at this time.

Secondly, there is evidence of an increase in the charcoal particle counts after about 4500 BP and a substantial increase after about 3500 BP, coinciding with changes in the frequency of the pollen of savanna plants (see for example Figure 7). Could this charcoal be the result of natural fires? This seems unlikely on an island as wet as Palau that lacks volcanic activity, although the identification of very low counts of charcoal in the cores prior to 4500 BP might suggest this as a possibility. However, it is possible that what has been recorded as charcoal prior to human settlement may in fact be lignite, which is quite common in Palau and quite similar to charcoal in observable characteristics, leading readily to mis-identification. However tests to demonstrate that the particles are lignite have so far proved inconclusive. Nevertheless, the simultaneous increase in charcoal with the increase in pollen of savanna plants and the appearance of definite human cultigens certainly suggests human impact as the causative factor.

The more substantial decline in forest vegetation and the savanna expansion in the late fourth millennium BP is also interpreted as the result of human clearing for several reasons. First, the beginning of the substantial increase in savanna indicators does not coincide from core to core. If a climatic change were responsible, we would expect to see the change occurring simultaneously in all four regions sampled by the coring. Secondly, the increase in savanna indicators is associated with a tremendous upsurge in the charcoal particle count, almost certainly indicating human presence. Finally, the timing of the change does not fit the timing of climatic changes evidenced on other islands in the Pacific.There is no evidence for a widespread change to dry climatic conditions in the Western Pacific at this time; on Tinian, in contrast, there is evidence of a change to wetter conditions around 3500 BP (Athens and Ward 1995, 1998b; Ward 1994, 1995).

## INTERPRETING AND INTEGRATING THE ARCHAEOLOGICAL WITH THE PALEO-ENVIRONMENTAL RECORDS

The archaeological evidence for earlier settlement of Palau than previously accepted (i.e., pre-2000 BP), while both exciting and satisfying (in that it pushed initial colonization back closer to the time of colonization of the Mariana Islands, where both archaeological and paleo-environmental evidence indicate settlement by 3500 years ago or earlier), created some uncomfortable problems. Why were most of the earliest dates from ridgetop locations rather than coastal margins, where richer agricultural soils and easy access to marine resources would seem to favor settlement? And why would relatively complex sites with features that suggest a major defensive purpose be among the earliest sites?

In regard to these problems, the paleoenvironmental data suggest some answers, demonstrating the value of such research in Pacific archaeology. Inland expansion becomes clearly evident in the archaeological record during the third millennium BP, but the coring data suggest that the expansion may have begun late in the fourth millennium BP. If human expansion inland from the coast began as early as 3500 years ago in some areas and continued gradually over several centuries, then the beginning of construction of massive earthworks by 2000 BP or even a few centuries earlier would not be a sudden and aberrant type of development, difficult to explain in terms of acceptable models of cultural development. Instead it could be seen as one expectable result of sufficient time for the natural attainment of the level of population and social complexity needed to support such constructions. However, if one accepts that expansion of the savannas in itself is indicative of inland expansion of populations, one must therefore expect even earlier initial settlement. The late fifth millennium BP appearances of swamp taro and *Areca* palm, increases in coconut, and the slight increase in charcoal particle counts and savanna indicators represent the first, still tentative, evidence for this initial settlement around 4500 BP.

This evidence, while needing further substantiation, actually suggests a sequence that fits in well with models of what might ideally be anticipated for human colonization of a new island . It allows time for many centuries of settlement and population growth focused on the coast prior to expansion onto the interior ridges behind the coasts. This is a period of settlement that has been and may continue to be difficult to recover archaeologically on Palau, given sea level changes, a possible erosional episode associated with a major tectonic uplift event between 4000 and 3000 BP, soils that are destructive to much archaeological material, the scarcity of charcoal in older sites, the high rates of sedimentation, and recent human modifications. While earlier sites have not been found, at least three coastal sites have been identified with materials that date to the period of inland expansion.

What kind of land use pattern was probably associated with these third and early fourth millennium BP dates? The increase in savanna plants and decline of the forest tree pollen, the scattered presence of charcoal, the lack of definite structural or landscape modification remains suggest dispersed homesteads with an agricultural system based on arboriculture and perhaps swidden gardens. We might expect dependence on breadfruit, yams, dryland taro, bananas, and coconut, a pattern not greatly different from what we find historically on other wet volcanic Micronesian islands such as Kosrae and Pohnpei.

This pattern changed, probably around 2000 BP, with the construction of fortified hilltop sites and, at about the same time, the construction of the sculpted terraces that dominate the landscape today. So, in effect, the ring-ditch site on Ngerulmud Hill, the site that first alerted us to possible early settlement probably represents the end of a long period of adaptation to a new island environment, involving settlement change and expansion. These ring-ditch and terrace sites mark the emergence of societies of increasing complexity in Palau following perhaps 2500 years of human adaptation to this island archipelago.

## ACKNOWLEDGEMENTS

The primary research on which this paper is based was conducted by International Archaeological Research Institute, Inc., under contract to the U.S. Army Corps of Engineers, Pacific Ocean Division for archaeological survey and data recovery of the Palau Compact Road; work completed for Winzler & Kelly Engineers, the Palau National Communication Corporation, and Hawaii Architects, Inc. has contributed supporting data. The research has been the work of a large team of skilled archaeologists that I've had the good fortune to work with on these projects and whose results I've attempted to synthesize here; particularly important in contributing to this paper has been the work of

Michael Kaschko, Stephen Wickler, Jolie Liston, David Tuggle, Felicia Beardsley, Stephen Athens, and palynologist Jerome Ward.

## REFERENCES


Athens, J. Stephen and Jerome V. Ward. 1995. Paleoenvironment of the Orote Peninsula, Guam. *Micronesica* 28(1):51-76.

Athens, J. Stephen and Jerome V. Ward. 1998a. Paleoenvironmental and Prehistoric Landscape Change: Wetland Sediment Cores. *Intensive Archaeological Survey for the Palau Compact Road, Babeldaob Island,Palau, Vol. IV*. Draft report prepared for the U.S. Army Corps of Engineers, Pacific Ocean Division, Ft. Shafter, Hawai'i. Honolulu: International Archaeological Research Institute, Inc.

Athens, J. Stephen and Jerome V. Ward. 1998b. *Paleoenvironment and Prehistoric Landscape Change: a Sediment Core Record from Lake Hagoi, Tinian, CNMI*. Report prepared for Pacific Division, Naval Facilitities Engineering Command, Pearl Harbor under contract with Belt Collins Hawaii, Honolulu: International Archaeological Research Institute, Inc.

Athens, J. Stephen and Jerome V. Ward. 1999. The Holocene Paleoenvironment of Palau. *Archaeological Data Recovery for the Compact Road, Babeldaob Island, Republic of Palau, Volume IV*. Draft report prepared for the U.S. Army Corps of Engineers, Pacific Ocean Division, Ft. Shafter, Hawai'i. Honolulu: International Archaeological Research Institute, Inc.

Basilius, Umai and Julita Tellei. 1996. Oral History Documentation, Appendix A. In F.R. Beardsley *Fragments of Paradise: Archaeological Investigations in the Republic of Palau, Palau Rural Water System Survey and Testing.* Prepared for Winzler and Kelly, Koror, Palau. Honolulu: International Archaeological Research Institute, Inc.

Beardsley, Felicia R. 1996. *Fragments of Paradise: Archaeological Investigations in the Republic of Palau, Palau Rural Water System Survey and Testing.* Prepared for Winzler and Kelly, Koror, Palau. Honolulu: International Archaeological Research Institute, Inc.

Beardsley, Felicia R. 1997. *Fishponds, Taro Patches and Shell Middens: Archaeological Investigations on Peleliu, Republic of Palau, Data Recovery and Monitoring for the Palau Rural Water System Program*. Prepared for Winzler and Kelly, Koror, Palau. Honolulu: International Archaeological Research Institute, Inc.

Beardsley, Felicia R. and Umai Basilius. 2002. Sengall Ridge, Belau: burials, spirit walks, and painted pottery. *BIPPA* 22(6):147-51.

Hunter-Anderson, Rosalind L. 1998. Human vs. climatic impacts at Rapa Nui, or did the people really cut down all those trees? In C.M. Stevenson, G. Lee and F.J. Morin, (eds), *Easter Island in Pacific Context*, pp.85-99. South Seas Symposium. Proceedings of the 4th International Conference on Easter Island and East Polynesia.

Kaschko, Michael W. 1997. Survey Area D Report, Part V. *Intensive Archaeological Survey for the Palau Compact Road, Babeldaob Island, Palau, Volume II: Area Survey Reports*, pp. 435-98. Draft report prepared for the U.S. Army Corps of Engineers, Pacific Ocean Division, Ft. Shafter, Hawai'i. Honolulu: International Archaeological Research Institute, Inc.

Kaschko, Michael W. 1998. Fortified Hilltops, Black Pottery, and Early Settlement in Palau.Paper presented at Society for American Archaeology 1998 Annual Meeting, March, Seattle, Washington.

Liston, Jolie. 1999. Appendices. *Archaeological Data Recovery for the Compact Road, Babeldaob Island, Republic of Palau, Volume VI.* Draft report prepared for the U.S. Army Cores of Engineers, Pacific Ocean Division, Ft. Shafter, Hawai'i. Honolulu: Internation Archaeological Research Institute, Inc.

Liston, Jolie and H. David Tuggle. 1998. The Terraces of Palau: New Information on Function and Age. Paper presented at Society for American Archaeology 1998 Annual Meeting, March, Seattle, Washington.

Liston, Jolie., Michael W. Kaschko and David W. Welch. 1998a. *Archaeological Inventory Survey of the Capital Relocation Site, Melekeok, Republic of Palau*. Report prepared for Architects Hawaii, Inc. Honolulu: International Archaeological Research Institute, Inc.

Liston, Jolie., H. David Tuggle, Tina M. Mangieri, Michael W. Kaschko and Michael Desilets. 1998b. Fieldwork Reports. *Archaeological Data Recovery for the Compact Road, Babeldaob Island,Republic of Palau, Volume I.* Draft report prepared for the U.S. Army Corps of Engineers, Pacific Ocean Division, Ft. Shafter, Hawai'i. Honolulu: International Archaeological Research Institute, Inc.

Liston, Jolie., Tina M. Mangieri, David Grant, Michael W. Kaschko and H. David Tuggle. 1998c. Fieldwork Reports. *Archaeological Data Recovery for the Compact Road, Babeldaob Island, Republic of Palau, Volume II.* Draft report prepared for the U.S. Army Corps of Engineers, Pacific Ocean Division, Ft. Shafter, Hawai'i. Honolulu: International Archaeological Research Institute, Inc.

Masse, W. Bruce. 1989. The Archaeology and Ecology of Fishing in the Belau Islands, Micronesia. Ph.D. Dissertation, Southern Illinois University, Carbondale.

Masse, W. Bruce. 1990. Radiocarbon Dating, Sea-Level Change and the Peopling of Belau. *Micronesica* Supplement 2:213-30.

Tellei, Julita., Umai Basilius and Faustina K. Rehuher. 1998. Oral History Documentation. *Archaeological Data Recovery for the Compact Road, Babeldaob Island, Republic of Palau, Volume III.* Draft report prepared for the U.S. Army Corps of Engineers, Pacific Ocean Division, Ft. Shafter, Hawai'i. Honolulu: International Archaeological Research Institute, Inc.

Ward, Jerome V. 1994. A Holocene Pollen Record from the Pago River Valley, Guam.In R.L Hunter-Anderson (ed.), *Archaeology in Manenggon Hills, Yona, Guam, Vol. III*, pp. 9-34, 9-51. Guam: Micronesian Archaeological Research Services.

Ward, Jerome V. 1995. Pollen Analysis of Laguna de Bay, Luzon. Unpublished report.

Ward, Jerome V., J. Stephen Athens and Carol Hotton. 1998. Holo-cene Pollen Records from Babeldaob Island, Palau, Western Caroline Islands. Paper presented at Society for American Archaeology 1998 Annual Meeting, March, Seattle, Washington.

Welch, David J. and Stephen Wickler. 1998. The Formation of Late Prehistoric Traditional Palauan Villages. Paper presented at Society for American Archaeology 1998 Annual Meeting, March, Seattle, Washington.

Wickler, Stephen K., David J. Addison, Michael W. Kaschko and Thomas S. Dye. 1997. Area Survey Reports. *Intensive Archaeological Survey for the Palau Compact Road, Babeldaob Island, Palau, Volume I.* Draft report prepared for the U.S. Army Corps of Engineers, Pacific Ocean Division, Ft. Shafter, Hawai'i. Honolulu: International Archaeological Research Institute, Inc.

Wickler, Stephen K., David J. Welch, M. J. Tomonari-Tuggle, Jolie Liston and H. David Tuggle. 1998. Scope, Background, Results, Evaluation, and Recommendations. *Intensive Archaeological Survey for the Palau Compact Road, Babeldaob Island, Palau, Volume I.* Draft report prepared for the U.S. Army Corps of Engineers, Pacific Ocean Division, Ft. Shafter, Hawai'i. Honolulu: International Archaeological Research Institute, Inc.