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MORTUARY PATTERNS AND TAPHONOMIC PROCESSES IN THE PALAU ARCHIPELAGO

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Abstract. The discovery of human burials in Palau, Micronesia have often centered on traditional village sites with stone architecture dating post - AD 1200. Although the placing of the deceased in caves has been noted in the past, especially within the limestone Rock Islands, only recently have these sites been investigated in any detail. We present new data from a cemetery on Orrak Island, one of the largest and earliest burial sites in the Pacific Islands dating to ~ 900 BC. Surface reconnaissance in the smaller limestone islands suggests that cave burials were probably a frequent cultural practice in early Palauan prehistory.

Introduction

The placing of the deceased in cemetaries over long periods of time provides important comparative evidence with which to reconstruct cultural behavior. Differences in the spatial and temporal configuration of graves and grave goods can be extremely significant as indicators of changing societal practices (Koji 2002:174). Unfortunately, there is a paucity of burial sites in the Pacific Islands dating to the era of early colonization which have a sample size large enough to allow insight into ancestral origins. Large sites of this type can provide a critical "snapshot" of society's first mark on the landscape, and eventually a view of how it evolved through time. Furthermore, a large skeletal collection from a site or group of similar site types with representatives from both sexes and different age-grades affords great potential for better understanding spatio-temporal perspectives on mortuary arrangements and sociocultural change.

One site that has the potential to fulfill all of the above requirements is the Chelechol ra Orrak site in Palau, western Micronesia. During summer 2000, a cemetery was discovered in deposits over a meter deep at Chelechol ra Orrak from which, to date, skeletal remains representing 26 individuals have been recovered. A suite of 17 radiocarbon dates from the site provides archaeological evidence of a diverse and much earlier human presence than previously thought (Fitzpatrick 2002). Accelerator Mass Spectrometry (AMS) radiocarbon dating of human bone, charcoal, and shell indicate that human occupation at Chelechol ra Orrak took place as early as 3,000 years ago, and perhaps even earlier. This makes these burials the oldest in Palau, the earliest evidence of a human presence in the limestone islands of the archipelago, and the oldest skeletal assemblage known thus far in the Pacific Islands outside of Melanesia.

In this paper, we report on the radiocarbon dates and osteoarchaeological data recovered from Chelechol ra Orrak. We begin by providing a brief background of research concerning archaeological investigation at the site and then contextualize these findings into what is presently known about other Palauan and early Pacific Island burials. The goal here is to describe the skeletal material and place burial activity and subsequent human use of the site into a temporal perspective. These data have strong implications for revising orthodox models of settlement to the region and in developing new theories of how and why the colonization of Micronesia took place.

Geographical Background

Palau is located roughly 7 north of the equator along the western edge of the Caroline Islands in Micronesia (Figure 1). The Palauan archipelago is comprised of over 300 islands that range from volcanic (e.g., Arakebesang, Babeldaob, and much of Koror and Malakal) to raised limestone (e.g., Pelelieu, Angaur, Chelebacheb), and atolls (e.g., Kayangel). Most of the islands are coralline and locally referred to as the "Rock Islands." These islands are geologically distinct from ones that lie along the southern and western reefs (e.g., Pelelieu, Ngemelis) which tend to have less dramatic karst topography and less consolidated reef formations.

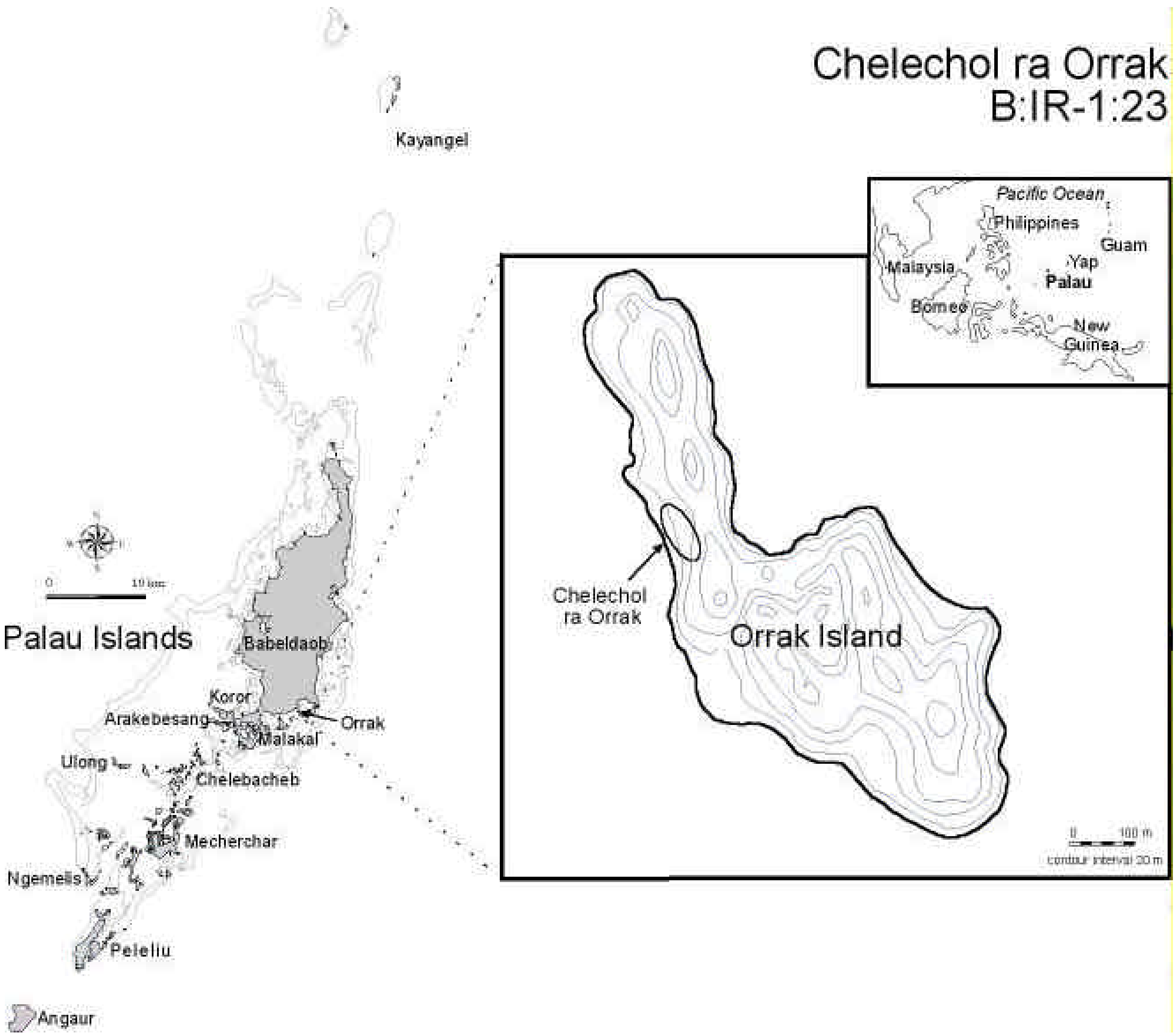

FIGURE 1. Map of the Palauan archipelago with inset of Orrak Island.

The Chelechol ra Orrak ("beach of Orrak") site is located along the southern edge of Orrak Island among a small cluster of Rock Islands 1 km east of Babeldaob's southeastern tip (Figure 2). The island is connected to Babeldaob by a prehistoric causeway constructed of coral rubble now covered in mangrove vegetation. The site was originally identified as a Yapese stone money quarry by Blaiyok (1993) and consists of several caves and small overhangs that stretch for about 200 meters just behind the shoreline.

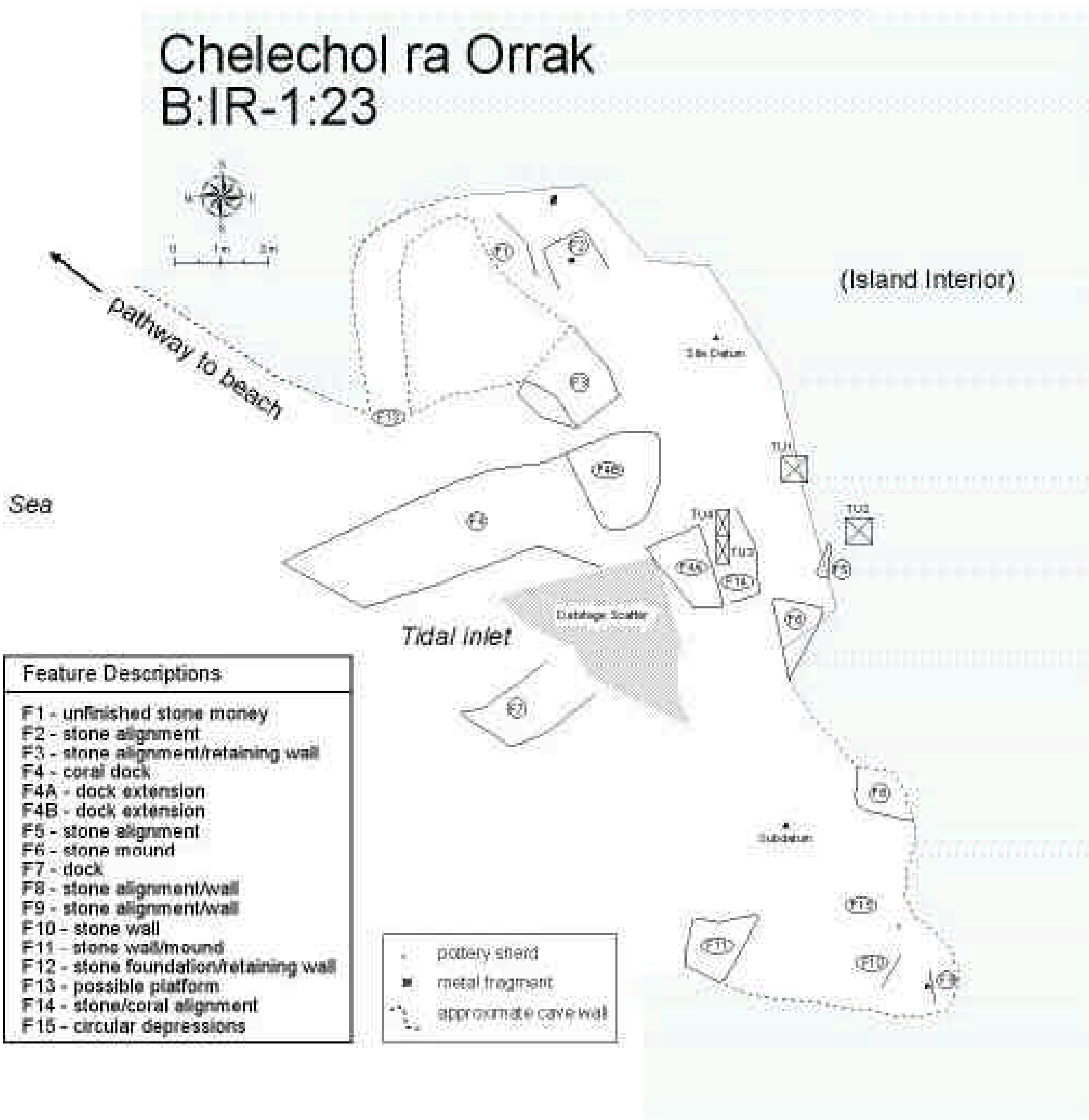

FIGURE 2. Chelechol ra Orrak site map.

Archaeological Methods

Four test units were opened (two – 1.0 x 1.0 m [units 1 and 2]; two – 0.5 x 1.0 m [units 3 and 4 lie adjacent to each other]), three of which were excavated to 90 cmbs or more (units 1, 3, and 4). Soils in the upper 50 cm were typically a mixture of calcareous sand and silty loam with large quantities of shellfish and fish bone. Soils below 50 cm were mostly calcareous sand deposits intermixed with spotty loam inclusions and a dramatic decrease in faunal remains. Sediments were water screened through 1/8-inch mesh to ensure the recovery of smaller site constituents. A diverse faunal assemblage was recovered including crustacea, echinoderms, elasmobranchs, turtle, nearly a hundred different shellfish taxa, and at least 25 fish taxa. Artifacts recovered include pottery, glass beads, pearl shell tools, *Tridacna* adzes, a stone adze, shell ornaments (including *Trochus* sp. rings and *Conus* shell beads and pendants), pottery, a drilled turtle plastron fragment, and a bone needle, to name a few. Human remains, most of which were found in Test Units 1 and 4, were also discovered in each of the test units, usually below 50 cmbs in Layers 7-10. The human remains recovered from Chelechol ra Orrak were extremely disarticulated and consisted of over 400 skeletal fragments and teeth in both primary and secondary burial contexts. Determination of the minimum number of individuals (MNI) was made through analysis and correlation of dental and skeletal element count, dental wear, skeletal and dental age, and element size. These results are discussed below.

Most human remains in Palau have been discovered in either stone platforms within traditional village sites, terrace complexes, or caves (Liston et al. 1998c; Rieth and Liston 2001). Palauan burials found in caves are located exclusively in the Rock Islands or limestone outcrops within Koror and Babeldaob (Beardsley 1998; Rieth and Liston 2001). However, no burials have been located in deep stratified deposits, found in good preservation, and radiocarbon dated. So, numerous samples were selected to determine the antiquity of the burials and dates of subsequent occupation.

Radiocarbon Dating of Burials

The 17 radiocarbon dates presented here are from each of the four test units with a majority of the dates (11 of 17; 65%) coming from Test Unit 1. This unit had deep stratified deposits, contained the majority of skeletal fragments (n=350+), and had the highest number of individuals. Specimens were collected from nearly all stratigraphic layers down to a depth of 110 cmbs.

At the request of the Palau Bureau of Arts and Culture, a human cranial fragment from layer 9 (AA-40957) was submitted for AMS radiocarbon dating as a preliminary test to determine the age of burials found within the lower deposits of Test Unit 1. A calibrated date of 2800 cal BP (Fitzpatrick 2002) made this the oldest date for any Rock Island site (see Masse 1989, 1990; Carucci 1993 for previous research in the Rock Islands). Although this date was within the range predicted by other researchers (Osborne 1979; Athens and Ward 1999; Wickler 2001), 16 additional samples representing all test units were submitted to test the validity of this date and to place burials at the site within a more detailed chronological sequence. AMS Radiocarbon dating was conducted on eight bone (seven human and one burned pelagic fish[2]), five charcoal, and four shell samples (Table 1).

Additional samples were selected from burial deposits in other test units to determine whether burial activity differed temporally or spatially at the site. Samples of bone, charcoal, and shell were submitted to two different labs for AMS radiocarbon dating – the University of Arizona AMS facility and the National Ocean Sciences Accelerator Mass Spectrometery (NOSAMS) Facility at Woods Hole in Massachusetts. All samples were calibrated using CALIB 4.3 after Stuiver and Reimer (1993)[1].

One of the difficulties in dating human skeletal remains is that porous bone can absorb calcium carbonate from a surrounding limestone environment and skew the resulting age if standard radiocarbon techniques are used. Pretreatment procedures must therefore be employed to ensure an accurate age assessment of bone specimens (see Taylor 1987:54-61). Pretreatments are generally used to isolate protein or a specific amino acid such as hydroxyproline known to occur almost exclusively in bone collagen (Van

Klinken and Mook 1990). For this research, AMS radiocarbon analysis was used so pretreatment procedures could isolate one or more of the organic constituents indigenous to the original sample.

Lab No.	Material	species	Unit	Stratum	Level	$^{13}C/^{12}C$ ratio	measured ^{14}C age	cal. BP
AA-43047	charcoal	---	1	2	0-20	-26.5	96+-33	historic
AA-43051	shell	*Anadara* sp.	1	4	20-30	1.57	1245+-54	720 (780) 870
AA-43048	charcoal	---	1	4	30-40	-25.4	1306+-36	1180 (1260) 1290
AA-43049	charcoal	---	1	6	40-50	-25.8	1253+-36	1150 (1210) 1260
AA-43052	shell	*Conus litteratus*	1	7	60-70	3.02	2881+-43	2650 (2700) 2720
AA-43053	bone	human (distal phalange)	1	8	80-90	-17.1	3860+-360	3570 (4030) 4530
OS-33568	charcoal	---	1	8	100-110	-25.9	2770+-30	2790 (2850) 2920
AA-43054	bone	human (L. navicular)	1	9	80-90	-15.4	2028+-44	1720 (1810) 1860
AA-40957	bone	human (cranial)	1	9	90-100	-15.7	2678+-41	2500 (2700) 2720
AA-43050	bone	indet. pelagic fish	1	9	100-110	-12.6	2220+-43	1950 (2000) 2060
OS-33447	shell	*Pinctada* sp.	1	9	---	0.36	2140+-50	1680 (1720) 1800
AA-43058	bone (humeral head frag.)	human	2	4	30-40	-15.3	2735±48	2740 (2720) 2700
AA-43060	shell	*Mactra* sp.	3	10	60-70	2.11	2737±46	2490 (2420) 2340
AA-43063	bone (L. Iliac crest frag.)	human	4	10	60-70	-15.7	2607±46	2680 (2420) 2360
AA-43062	bone (L. 3rd cuneiform)	human	4	10	70-80	-16.5	3164±51	3260 (3200) 3090
AA-43061	bone (L. vert. - C7 frag.)	human	4	10	80-90	-16.5	3658±65	3840 (3760) 3680
OS-34566	charcoal	---	4	10	80-90	-25.9	2650±35	2780 (2760) 2750

TABLE 1. Radiocarbon dates from Chelechol ra Orrak. Human bone calibrated as 50% marine and 50% terrestrial to better reflect a mixed diet of fish, shellfish, and aroids common in the region (see Hunter-Anderson 1991; Weisler 1999, 2000). Ambrose et al. (1997) suggest that marine protein may have comprised 20-50% of the diet in ancient Chamorro populations (Marianas); recalibrating the Palau human bone dates using these figures would make them slightly older.

The bone samples were first demineralized in 0.6M HCl with heat, rinsed to a neutral pH, and the remaining liquid evaporated. The sample was then put back into solution with dilute ammonium hydroxide, run through a cation exchange resin, and freeze-dried to recover bone collagen. The collagen was then combusted under vacuum and the resulting gas converted to graphite for AMS analysis. Charcoal and shell specimens were prepared using standard methods that will not be repeated here, but are described on the NOSAMS web site <www.nosams.whoi.edu>.

Skeletal Analysis

The skeletal remains from Orrak were analyzed by excavation unit and for the site as a whole. Analysis by unit was initiated in light of the differences found between them in element distribution and apparent burial context as well as the fact that the two units that are contiguous (TU=s 3 and 4), and quite different in the amount and type of material recovered from them. Table 2 reports the minimum number of individuals and the estimated breakdown by age and sex. Due to the fragmentary nature of the remains all numbers should be considered a conservative estimate of the number of individuals represented. Preservation of the bone spans the continuum from excellent to very poor and fragile and, in general, material from the rear of the rock shelter, Test Units 1 and 2, is in better condition.

Unit	MNI	Age	Sex
TU 1	13	5 Sub-adult 8Adult	3 Female 1 Male
TU 2	2	1 Sub-adult 1 Adult	1 Female (?)
TU 3	4	1 Sub-adult 3 Adult	?
TU 4	7	2 sub-adult 5 Adult	4 Female 1 Male
Site total	26	9 Sub-adult 17 Adult	8 Female 2 Male

TABLE 2. Minimum Number of Individuals, age, and sex data by excavation unit at Chelechol ra Orrak.

Test Unit 1

Human skeletal remains found in TU-1 represent an MNI of 14 ranging in age from prenatal to adult. There are approximately 350 identifiable (as human) bone fragments attributed to this unit which can be separated into two basic groupings. The first, comprising the majority of the bone, consists of unassociated fragments representing most skeletal elements with the largest being the distal two-thirds of a humerus. The second comprises portions of two sets of legs found in anatomical position which probably represent portions of two internments (Figure 3).

FIGURE 3. Undisturbed burials in Test Unit 1 (100-110 cmbs, facing east; photo by Brian Diveley). Arrows point to the lower leg bones of two individuals. The burial on the right (dark sand) truncates the burial deposit on the left (light sand).

Among the fragments belonging to the first group are elements representing five juveniles; prenatal, neonate, 2-3 years, 5 years and 10 years old (Figure 4). The majority of skeletal elements recovered from TU-1 belong to adult individuals. The MNI of eight adults is based on the presence of at least two individuals in Layer 7 and three individuals in each of layers 8, and 9 (isolated teeth from layers 1 and 6 were not considered) broken down in the following manner. Layer 7, MNI is based on the differential staining of teeth, as a result of betel nut chewing; layer 8, cranial, long bone, and carpal elements each indicate minimum of three individuals; layer 9, articulated legs plus post cranial remains of two other individuals.

Test Unit 2

The human skeletal remains recovered from TU-2 consist of 14 post-cranial fragments and three teeth. Overall, the preservation is moderate with the only complete element being a permanent upper left third molar. The MNI is two based on the dental identification of one child (rd^c) and at least one adult (LM^3, fragmentary upper canine). There is no duplication of elements within the post-cranial assemblage.

Test Unit 3

Four teeth and 22 skeletal fragments including 11 adult cranial fragments, three juvenile cranial fragments, the body of a hyoid, one complete carpal navicular and the body of one thoracic vertebra (T-11 or T-12) were recovered from TU-3. By element count the MNI is two, one adult and one juvenile. However, although there is no duplication among the teeth (RI_1, LM_2, RM^2, and RM^3) the upper molars are from different individuals as there is no distal interproximal wear facet on the RM^2 while there is a mesial facet on the RM^3. In addition the incisor has relatively dark betel staining whereas the molars do not exhibit any staining, indicating that the incisor and each of the molars probably derive from different people.

Test Unit 4

The human skeletal remains from TU-4 consist of cranial and post-cranial elements representing at least five individuals. Preservation is quite poor overall and the post-cranial bones in particular are very fragile and fragmentary. In this unit four skulls were found grouped together and not in anatomical association with any of the post-cranial elements. For TU-4 the MNI was calculated on the basis of these skulls and the four female and one male innominate recovered. When discovered the crania were largely complete (Figure 4). However, as waterlogged bone can be very soft, pliable and highly susceptible to breakage, their condition soon deteriorated. The fragments were carefully packaged for transport but were in need of extensive reconstruction after reaching the lab.

FIGURE 4. *In situ* crania in Test Unit 4 (80-90 cmbs; photo by Brian Diveley).

Skull number 1 is a fragmentary calotte consisting primarily of the right and left parietals with an attached fragment of the left zygomatic. Upon reconstruction Skull 2 presents most of the calvaria minus the foramen magnum (occipital condyles present but detached) and the bodies of the ethmoid and sphenoid. The parietals are complete except for an approximately 1cm^2 area on the left at the squamosal suture and a similarly sized gap in the central portion of the right. On the frontal the area around glabella is broken away exposing the sinuses, approximately 1/4 of the outer table has spalled off, and several small pieces are missing throughout the main body of the bone. Portions of both greater wings of the sphenoid remain attached to the temporals, each of which is missing the superior portions of the squama. The mastoids are relatively small and the neurocranium lightly built, possibly indicating that Skull 2 is that of a female. As mentioned, most of the base of the occipital is missing.

The most complete of the skulls is Skull 4. The only elements absent are the ethmoid, body of the sphenoid, lacrimals, vomer, and conchae. Although most of the maxilla is present it is too fragmentary and fragile to reconstruct. The mandible has been partially reconstructed. The frontal is broken in the area of glabella (glabella is present but detached) exposing the sinuses. Although the zygomatics are present the fragmentary nature of the anterior portion of the frontal precludes reconstruction of the orbits. All teeth except for the RM^3 are present and in good condition. That all teeth had erupted, but are in a relatively unworn condition, indicates that this individual was in their early 20's at death. Due to the general robusticity of the skull, the relatively large size of the mastoid processes, and the robusticity of the mandible the sex is estimated to be male. The majority of the remaining cranial bones are fragile but complete except for the mastoid and petrous portion areas of the left temporal. In the posterior region around the area of the left occipitomastoid and superior into the lambdoidal suture there is very slight plastic deformation. There appears to be no pathology. However, there is a large intrasutural bone located along the lambdoidal suture that, in effect, comprises the superior third of the occipital bone.

Overall, Skulls 2 and 4 are complete enough when reconstructed that some craniometrics can be recorded for each. However, the bone is relatively fragile and susceptible to continued breakage, particularly the outer table of the bone which is prone to spalling off, exposing the white, chalky inner table.

Other human skeletal remains from TU-4 include six isolated teeth, five adult and one child, representing an MNI of three. Post-cranial bones include fragments of all elements although no whole bones remain except a few carpals, metacarpals, and phalanges.

Pathology

The fragmentary nature of most of the remains makes it difficult to build a profile of the skeletal pathology for the Orrak sample. However, isolated elements from all test units and one individual from TU-4 hint at some of the problems encountered by the earliest inhabitants of Palau. The individual from TU-4 is represented by the lumbar and sacral regions (L-1 through S-1) which exhibit extensive remodeling, porosity, and osteophytic lipping. In addition there is a compression fracture of the body of L-5 with a corresponding spondylolytic separation through the *pars interarticularis* of the arch of L-4 (Figure 7). Although generally occurring in low frequencies in most populations (Merbs 1989) spondylolysis has been found in relatively high rates in prehistoric inhabitants of the Marianas (Arriaza 1997).

Examples of noted pathology from TU-1 include: the ankles of burial 2 which show early stages of degenerative joint disease impacting the talar-calcaneal articulation, periosteal reactions on the shaft of a fibula, osteophytic lipping on the superior aspect of a 5th lumbar vertebra, and a right patella exhibiting extensive porosity on the articular surface and moderate lipping along the margins. Besides the vertebral sequence, pathological manifestations in specimens derived from TU-4 consist of both hands and wrists of one individual which contain numerous examples of bony changes possibly associated with osteoarthritis (involvement extends to all articular areas; carpal, metacarpal, and phalangeal), two of five preserved patellae exhibit some level of bony reaction, and the parietal regions of Skull 2 exhibit possible porotic hyperostosis as manifested by pin-prick sized porosity over a wide area of the posterior region of both parietals and the superior portion of the occipital and apparent inflation of portions of the parietals extending postero-laterally from near the mid-point of the sagittal suture.

Chronology of Early Human Burials

Test Unit 1

Of samples selected from Test Unit 1, two were from Layer 8, the earliest deposit recorded, three from Layer 9, and five from Layers 7 or above (Figure 5). A distal phalange from Layer 8 (AA-43053) dated to 4030 cal BP, but had a large standard error and may represent a statistical outlier. Charcoal from the same layer dated to 2850 cal BP (OS-33568), suggesting this older date may be in error.

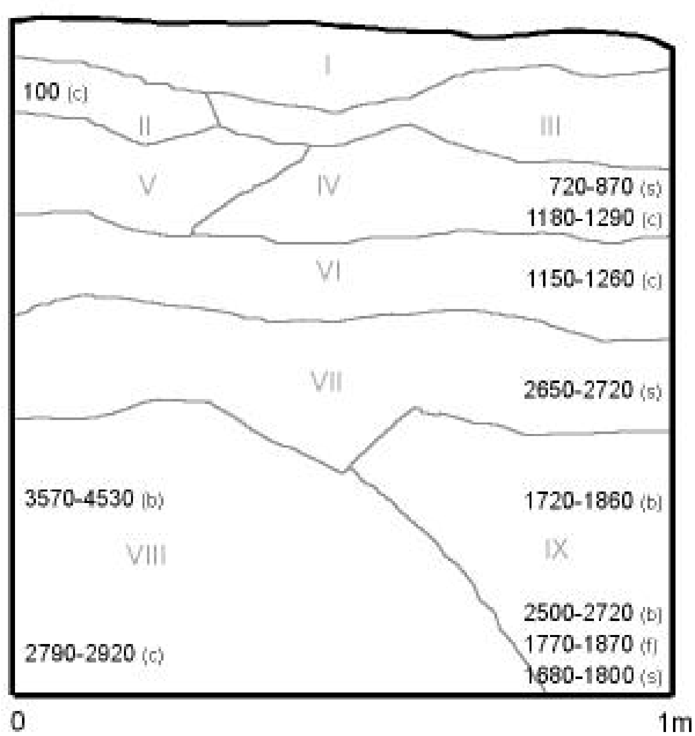

FIGURE 5. Stratigraphic profile of Test Unit 1, east wall (all dates are listed in cal BP according to strata and depth; b = bone; c = charcoal; f = fishbone; s = shell).

A fragment from a pearl shell (*P. margaretifera*) scraper/grater, three of which were found above the proximal end of the left femur from burial 2 (Layer 9) and which represent the only grave goods found, dated to 1720 cal BP (Fitzpatrick and Boyle in press; Figure 6). Similar tools were associated with burials at Ngermereues Ridge dating to roughly the same age (1720 ± 40 BP [CAMS-65958]; 2480 ± 40 BP [CAMS-65957]; Rieth and Liston 2001:44). Three other dates of both human and fish bone, dated from 1810 – 2700 cal BP. Although one of these dates (AA-40957) is slightly older than the adjacent deposit (Layer 8), it seems curious that in situ burials from Layers 8 and 9 are closely arranged, but separated from Layer 6 by over a thousand years, especially if the *Pinctada* sp. tool date is directly associated with the burial in Layer 9. Part of this problem may stem from lack of a local reservoir effect for dating shell and problems with bone contamination. Given the heavy carbonate content of site deposits within a limestone environment, this is certainly a concern. Even if the four dates from Layer 9 are averaged, the burial deposit becomes only slightly older at 2060 cal BP, still separated by almost a thousand years.

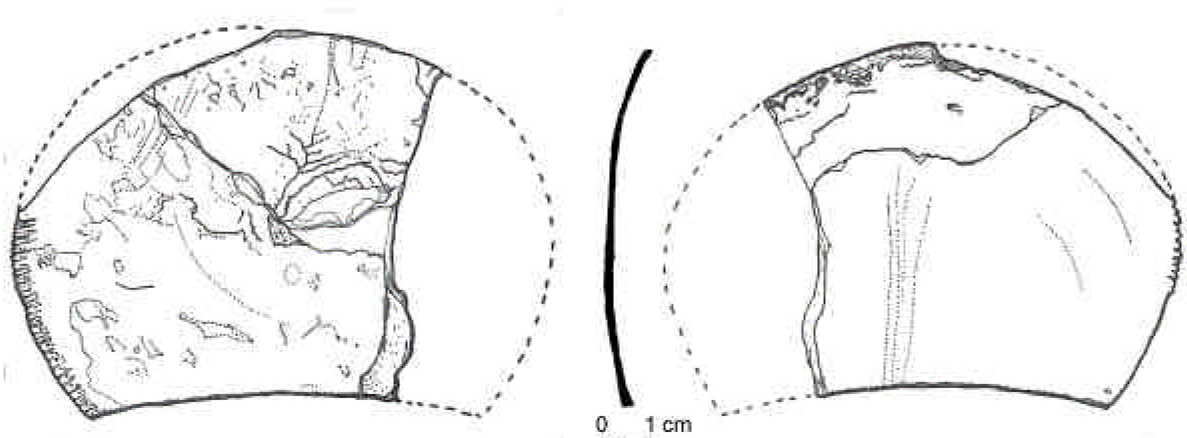

FIGURE 6. Pearl shell scraper/grater (drafted by Jenna Boyle).

Other dates from later deposits (Layers 7 and above) indicate subsequent periods of occupation over the next 2,000 years or so including Yapese quarrying of stone money at the site (see Fitzpatrick 2001;

Fitzpatrick 2002). Except for a shell date from Layer 7 (AA-43052), all of the later dates are stratigraphically correct. Several date reversals in the lower deposits (Layer 7-9) are not surprising given that these soils are predominantly sandy in nature. Smaller site constituents could move within and between sedimentary deposits in these deeper layers due to human reburial episodes. A human tooth in Layer 7 from a mandible in Layer 8 suggests this is occurring on at least a limited basis (Nelson and Fitzpatrick n.d.). It is also possible that these dates are not an artifact of contamination, but actually represent two different burial episodes. Except for the apparently undisturbed burials, the skeletal assemblage overall is very fragmentary. Given the stratigraphic relationships, radiocarbon dates, and burial assemblages, we would argue that the skeletal fragments in Layers 8 and 9 represent early burials that became highly mixed due to soil liquefaction and subsequent burial events over a long period of time.

Test Units 2-4

Six specimens were selected for radiocarbon dating from Test Units 2-4. These samples were collected from known burials or burial deposits (Layer 10) and included human bone (four), charcoal (one) and shell (two). The dates ranged from 2340 to 3840 cal BP. Two of the oldest dates (AA-43062; AA-43061) were from bone in secondary burials in Test Unit 4. A third associated bone date (AA-43063) from Test Unit 4 dated to 2420 cal BP, but statistically overlapped with a charcoal (OS-34566) date from the unit and bone (AA-43058) from Test Unit 2. These dates ranged in age from 2340 to 2780 cal BP. In addition, a shell date (AA-43060) from Test Unit 3 (Layer 10) fell within this range and dated to 2420 cal BP.

Radiocarbon dates from Test Units 2-4 indicate that burial activity at Chelechol ra Orrak took place from approximately 1800 to 3000 cal BP, and possibly earlier. This is similar to what was found in the sequence of dates recovered from Test Unit 1. All of the dates suggest that early burial activity was not restricted to a small area, but was fairly widespread throughout the cave. The island-wide reconnaissance survey on Orrak that continued in 2002 revealed additional human remains tucked away in crevices near the site and in deep caves within the island, some of which were absorbed into the still growing flowstone formations (observations of the authors). Although undated, these newly discovered burials support the notion that the site, and the island as a whole, was used extensively for burying the deceased for hundreds and perhaps thousands of years.

Summary of Dates from Chelechol ra Orrak

Several specimens pre-date 3000 cal BP and range in age from 3090 to 4530 cal BP. Although these dates fit within the palaeoenvironmental chronology proposed by Athens and Ward (1999), the question remains as to whether the Chelechol ra Orrak dates are reliable considering that they are derived from human bone in a limestone environment where contamination can occur. Although pretreatment procedures were employed, three of the four specimens dating prior to 3000 BP are outside the range of other charcoal and shell dates from the same contexts. This implies that contamination may be occurring at some unknown level.

However, given the nature of the burials which are predominantly fragmentary and secondary in sandy deposits, it is difficult to automatically assume that these dates are unreliable based on their age, especially since rigorous pretreatment procedures were enacted using AMS radiocarbon dating. It is equally plausible that these specimens do in fact represent even earlier burials, but were disarticulated over time due to continued burial activity at the site and natural soil movement. This, however, has not yet been tested. Additional radiocarbon dating of paired samples and systematic excavation of the burial layers should help to resolve this question. Despite these issues, the radiocarbon suite suggests that the antiquity of burials at Chelechol ra Orrak extends back at least three millenia. This conclusion is supported by multiple dates on a variety of different materials (bone, charcoal, and shell).

Palauan Burials in a Pacific Island Context

Burials in Palau have been documented from a variety of contexts and locations including stone platforms (*odesangel*), terrace formations, and limestone caves. The placing of the deceased in stone platforms occurred prior to European contact and postdates other burial practices (Rieth and Liston 2001:66). Burials have also been discovered in earthwork terraces in the Roi and Roisingang terrace complexes (Liston et al. 1998c). Despite the sheer number of stone platforms and terrace sites in Babeldaob, the ability to discover intact and well preserved burials is hampered by the island's acidic volcanic soil making discovery and interpretation of skeletal assemblages difficult.

Archaeological surveys in the limestone Rock Islands of Palau prior to this research identified at least ten cave burials throughout the archipelago. Several of these were recorded by Osborne (1979) and Blaiyok (1993), nearly all of which are located in and around Airai (southern Babeldaob) and Koror (see Rieth and Liston 2001:63-64 for a list of previously discovered burial cave sites). It should be noted that uncertainties remain about whether some of these burials are Japanese or Palauan (Beardsley 1998) and the actual minimum number of individuals (MNI) present.

Only two of these burial sites, Sngall Ridge (Beardsley 1998) and Ngermereues Ridge (Rieth and Liston 2001) have been dated. A sherd temper AMS date from pottery associated with burials at Sngall Ridge dated to 2630 BP. Because it is unknown whether the sample was actually organic temper or some other type of organic material that penetrated the sherd, this date should be considered questionable (Beardsley 1998; Rieth and Liston 2001:69). Rieth and Liston (2001:53) dated three bone samples from Ngermereues Ridge with AMS, the earliest of which was from a left tibia (Feature 2; CAMS-65957) dating to 2480 BP.

The Chelechol ra Orrak burials greatly contrast with most other human remains found in Palau in terms of the number of individuals present, stratigraphic position and depth, and temporal range. As noted previously, the skeletal assemblage includes the remains from at least 26 individuals comprised of prenates, neonates, adolescents, and adults of both sexes which are predominantly female (Nelson and Fitzpatrick n.d.). This is the second largest MNI from any burial site in Palau (Ngermereues Ridge has 32; Rieth and Liston 2001), and is the only assemblage to include pre-adolescents. The dates also show a sequence of occupation spanning at least 3000 years. Excluding the extremely old dates (those prior to 3000 cal BP), seven are anywhere from 300-1500 years older than radiocarbon dates collected from Ngermereues Ridge, the next oldest burial site in Palau.

The earliest dates from burial deposits at Chelechol ra Orrak are also older than any known Pacific Island skeletal assemblages. Pietrusewsky (1996:344) noted that "[v]ery few human remains have been found directly associated with the Lapita cultural complex, the culture believed to represent ancestral Polynesians. The Lapita-associated remains are often incomplete and poorly preserved, and rarely represent more than a single individual." He also goes on to say that "[a]lthough the dates for the Lapita cultural complex fall between 3600 and 2500 years BP, most of the Lapita-associated skeletons are from the terminal phases (ca. 2500 years BP) of this cultural complex, while others post-date it" (Pietrusewsky 1996:344). A list of known Lapita-associated skeletons from Near and Remote Oceania (Pietrusewsky 1996:345) reveal only one fragmentary and incomplete skeleton from the St Mathias Group, New Ireland, dating to the mid first millennium BC (see Kirch et al. 1989). This date is roughly contemporaneous with the Orrak burial assemblage.

The placement of the deceased in caves is fairly unique in Micronesia outside of Palau, with only a few documented from Saipan and Rota in the Marianas (Hunter-Anderson and Butler 1995). Of these, only Laulau rockshelter on Saipan may be as old as the youngest dates from Orrak (Spoehr 1957). However, the plethora of limestone islands in Palau with caves and rockshelters would have provided ample opportunities for people to bury their deceased in enclosed, and perhaps secret locations. This suggests that many more examples of cave burials exist within the archipelago.

In Micronesia, the only other well documented, large cemetery sites are found in the Marianas, particularly on Guam (Hanson and Butler 1997; Douglas et al. 1997). Generally associated with late prehistoric Latte structures, similarities to the Orrak cemetery seem to be in how the skeletal material is distributed within the cemetery. As in Guam (Hunter-Anderson and Butler 1995) the two currently known extended primary burials appear to have been placed perpendicular to the shoreline. In addition, the disarticulated nature of the crania from Test Unit 4 may be indicative of cultural practices similar to those recorded in the Marianas in which crania of relatives are retained for a period of time in concert with ancestor worship (Butler 1995). This cemetery varies from those in the Marianas in that it appears to have been used only as a burial ground and does not seem to be associated with structures or other significant cultural artifacts.

Cave/rockshelter burials in Palau seem to belong to two types; the large, more open, stratified context of large rockshelterrs where the remains are buried relatively deep, and that of seemingly single individuals placed on the surface or in crevices of small caves. In the case of Chelechol ra Orrak and Ngermereues Ridge, both types are found at the same locality. Whether these two different burial contexts represent different time periods or cultural practices is unknown. No skeletal remains from the numerous small caves surveyed on Orrak in 2002 have been collected or dated, although it is clear that these deserve further attention.

Conclusions

Radiocarbon dates of bone, charcoal, and shell collected from the Chelechol ra Orrak site in Palau provide a chronology of human presence spanning 3,000 years or more. These are some of the earliest dates recovered from the Palauan archipelago and represent the earliest burial activity known thus far in the Pacific Islands outside of Melanesia. Although some of the radiocarbon dates presented here are quite early for Palau (c. 3200 – 4000 BP), they do fall within the range of settlement predicted by Irwin's (1992) safe strategy voyaging against the wind, dentochronology (Turner 1990:412), and paleoenvironmental evidence from Palau (Athens and Ward 1999) and the Marianas (Athens and Ward 1995).

This research supports a settlement pattern of western Micronesia that took place much earlier than archaeological evidence had previously indicated. The question remains as to where similar sites are located in which to test hypotheses regarding early settlement to Palau. Wickler (2001:190) states that "[i]t is likely that initial settlement was focused along the coastal margins of the large volcanic island of Babeldaob where resources would have been more abundant than on the raised limestone islands to the south or the small atolls." But, he also cautions that with possible tectonic uplift, "a majority of the early coastal sites may have been eroded away leaving minimal evidence of human occupation prior to the first millennium BC" (Wickler 2001:190). Wickler's predictive model holds that early sites will be found in the coastal and lowland zones and that "there is much to be gained by focusing investigations on larger islands rather than concentrating excessively on smaller limestone islands and atolls. While site deposits may be richer on these islands, early human occupation was arguably of a more sporadic and peripheral nature, as exemplified by the rock islands in Palau" (Wickler 2001:194).

Given the nature of recently conducted archaeological and paleoenvironmental data on Babeldaob (Liston 1998; Wickler 1998; Athens and Ward 1999), this would certainly appear to be the case. However, we argue that the limestone islands adjacent to Babeldaob also hold great promise for finding deep stratified deposits with evidence of early human occupation and exploitation of abundant marine resources. Archaeological sites on these islands are well preserved and are close to the bigger island for easy access to subsistence farming and non-marine resources.

The results from Chelechol ra Orrak indicate that deep, stratified deposits with evidence for early settlement in Palau will be found in coastal areas, but not necessarily on Babeldaob as predicted by Wickler (2001). Pregill and Steadman (2000) note that the best sources of data on prehistoric terrestrial vertebrates (and probably other faunal and archaeological assemblages), are sites in calcareous sands behind beaches. The same could be said for remnants of early human settlement.

It is now clear that both the volcanic and limestone islands in Palau will provide new and important information about the antiquity and lifeways of early Micronesian settlers. Continued research at Chelechol ra Orrak and similar sites in the archipelago, especially those in the Rock Islands fringing Babeldaob, should help refine the settlement chronology of Palau and establish a stronger framework for understanding the widespread colonization of peoples into the western Pacific. Additional radiocarbon dates from Chelechol ra Orrak and investigation of other similar sites on Orrak Island should also help determine what the relationship is between these and other human remains, whether they represent periods of prolonged or sporadic human burial activity, and if newly discovered burial sites show evidence for gender, status or other culturally related interment patterns. Continued survey on Orrak Island in summer 2002 revealed numerous other burial sites in crevices and caves, some of which extend 20-30m below the surface. This suggests that the island held great social and perhaps spiritual significance to early Palauans and continued over a thousand years or more.

Although osteological analysis and radiocarbon dating of the skeletal assemblage from Chelechol ra Orrak are critical components of the research, a rich collection of artifacts and faunal remains should also provide important information regarding prehistoric Palauan lifeways. Shellfish and fishbone identification currently in progress will be useful for comparing with other faunal remains recovered from sites in the Rock Islands, only a handful of which have been described in detail (see Osborne 1979; Carucci 1992; Fitzpatrick in press). These will help to answer questions regarding subsistence strategies and site taphonomy over time. Ceramic petrography of sherds has already proven to be a valuable tool for identifying the transfer of Palauan pottery to clay-impoverished coralline islands within and outside of the archipelago (Fitzpatrick et al. in press) but, it is unclear what role these and other artifacts played in the daily rituals of early Palauans or in systems of exchange. The tools, ornaments, and other objects found on

Orrak Island, many of which appear to be unique to Palau, hold vital clues to the settlement and cultural evolution of peoples in western Micronesia. Ultimately, DNA and isotopic analysis should provide further data on the origins of early Palauans.

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Footnotes

[1]A local ÄR for Palau has not yet been determined so the mean global reservoir correction was used (Stuiver et al. 1998). See Kennett et al. (1997), Phelan (1999), Guilderson et al. (2000), Kuzmin et al. (2001), Yoneda et al. (2001), and Hideshima et al. (2001) for recent attempts to determine ÄR correction values in other parts of the Pacific.

[2] Petchey and Higham (2000) suggest that fish bone (barracouta – *Thyrsites atun*) may be reliably radiocarbon dated if the reservoir conditions of fish are similar to those of locally collected shellfish. However, this has not yet been tested in Palau.