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On The Periphery? Archaeological Investigations At Ngelong, Angaur Island, Palau

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Abstract—Ngelong is an extensive late-prehistoric site situated within the rugged limestone terrain of Angaur Island. Earlier research documented extensive midden and artefact deposits, but only a few stone structures. Recent archaeological work has confirmed the relative absence of built stone features, and obtained new data—including radiocarbon dates and X-Ray Fluorescence results—to evaluate the Ngelong occupation. These indicate the site dates to 450–250 cal. B.P., and overlaps in time with Rock Island villages containing abundant stone work. Compared to several other prehistoric sites in southern Palau, Ngelong is atypical, and appears to represent community occupation of a peripheral socio-economic landscape as a result of warfare, a possibility also found in traditional accounts. While constructed defences indicate the existence of inter-group hostility in the past, it is suggested the outcome of warfare resulted in significant differences between late-prehistoric Palauan communities, which can be identified in the archaeological settlement record.

Introduction

Archaeological research in the Palau Islands has focused on large, numerous and highly visible sites such as crown and terrace earthworks and nucleated settlements containing stone structures often termed 'Traditional' or 'Stonework' villages (Gumerman et al. 1981, Liston 1999: 333, Masse et al. 1984, Osborne 1966, 1979, Snyder 1989). Recent investigations have broadened into different landscape zones resulting in the discovery of new site types and improved understanding of previously known prehistoric remains. In the former category are 'Upland' occupation sites on the main island of Babeldaob dated to ca. 2400 BP, hilltop ring-ditch fortifications (Welch 2001, Wickler 2001) and early human burials interred in Palau's southern limestone 'Rock Islands' (Beardsley and Basilius 2002, Fitzpatrick 2003, Reith and Liston 2001).

At the same time investigation of monumental earthworks and late-prehistoric Stonework villages, particularly during CRM investigations by the International Archaeological Research Institute, Inc. (IARII), has resulted in new frameworks for examining the genesis and development of the two most spectacular types of prehistoric site in Palau's landscape (Phear et al. 2003, Wickler 2001, 2002). In the case of Stonework village sites, which have sometimes been characterised as a short-lived phenomena dating to the late-prehistoric/historic era (Masse et al. 1984: 110, Masse 1990), recent work suggests development as early as AD 1250 (Liston 1999). Further, at some sites there is stratigraphic evidence for several phases of prehistoric occupation (Wickler 2002) indicating that nucleated settlements might have a complex settlement history (see Masse 1990, Osborne 1966, Wickler 2002), incorporating occupation deposits that pre-date the development of stonework (Liston 1999: 333).

This paper reports the results of test excavations at the Ngelong site on Angaur Island (Figure 1), which appears to represent an unusual expression of a late-prehistoric village occupation. This is manifested by the paucity of stone structures—the generally agreed criterion for identifying late-prehistoric village sites (Liston 1998: 18, 1999: 408, Masse 1989: 72, Osborne 1966)—which contrasts with the areal extent and abundance of the material culture and midden remains. In addition, Ngelong is located, unusually, entirely within a section of rugged and pinnacled limestone. Traditional and ethno-historical sources concur that inter-group aggression in Palau was frequent, and as a result community mobility and relocation was relatively common. If so, then some of the variability among late-prehistoric sites, like Ngelong, might well reflect refuge or defensive placement or the forced settlement of a community in peripheral economic and social landscapes due to warfare, a possibility also found in Palauan oral traditions.

Location and Previous Work

Angaur is composed of Miocene limestone in the north around which lie eroded raised reef complexes of Pleistocene age, while the southern part consists of low lying calcareous deposits of probable late-Holocene age. The island has an area of 8.4 sq. km, a maximum altitude of 61 m above sea level, and lies 11 km beyond the barrier reef system surrounding the archipelago (Corwin et al. 1956). The landscape and vegetation have been severely affected by phosphate mining and World War II activity, which have also negatively impacted archaeological and palaeoenvironmental sites elsewhere in Palau (Beardsley 1996, Osborne 1966, Pregill & Steadman 2000).

Archaeological survey and excavation on Angaur Island was begun by Douglas Osborne (1966: 311–356), who recorded 26 sites comprising open sites, paths, caves and rock shelters. The majority of sites were located in the north of Angaur, with a few on the east coast and in the south of the island. Removal of prehistoric sites from these areas is likely due to the construction of a large air strip on the eastern side, and bulldozing of the sand plain in the southwest. Osborne (1966) analysed ceramics from surface collections and test excavations, and targeted three sites (Angaur 12,19, 25) for future archaeological work. One of these, Angaur 19 (also known as Ngelong) was subsequently excavated by a team supervised by Osborne (1979, see below). In 1978 Takayama et al. (1980) visited Angaur for four days, surface collecting ceramics and shell adzes from Ngelong, designating the site PAAG-19, and recording a possible lookout site 750 m north of Ngelong called Olsechall ra Ruchell (PAAG-27). Beardsley (1996) made 33 shovel probes along an 830 m stretch of proposed water alignment in the south of the island and recorded a shallow stratigraphy of silty loam over coral cobbles and boulders, below which lay limestone substrate, but no intact prehistoric deposits were found. The cultural resources of Angaur were inventoried by Olsudong & Blaiyok (1996) with 60 sites recorded. Most were historic sites from phosphate mining (10), World War II (19) or colonial enterprises (17), with only 14 archaeological and traditional sites. The small number reflects site destruction and the difficulty of locating sites due to vegetation growth following the demise of phosphate mining in 1955, in addition to different site recording methods used by Osborne (1966) and Olsudong & Blaiyok (1996). Recently, Clark & Wright (2003) excavated a Japanese defensive position in a rock shelter containing prehistoric remains on the north coast of Angaur (Elechol ra Uchal a Kerekar), test pitted the limestone-sand plain boundary at Garangool Cove, and conducted the excavation at Ngelong reported here.

Ngelong is located in the northwest of the island where ceramics and shell fish remains are spread over an area of rugged limestone pinnacles and ridges of c.5000 sq. m. (Figure 1). The site was first excavated over 12 days in 1969 with five test pits in an open area surrounded by limestone called the 'Second Flat' and nine test pits in the adjacent 'First Flat' (see Osborne 1979: Fig. 3). The deposit was removed in 15 cm spits down to 60 cm depth with pottery attributes recorded from three test pits (Osborne 1979: 244). There were 66 shell artefacts surface collected (five shell adzes had been collected by Osborne (1966) previously). Material culture included shell knives, beads, a trumpet, food pounders and shell and stone adzes. Seven primary burials were found in the 'Second Flat' with individuals interred in small shallow pits 55–92 cm below ground surface. Osteological examination of the poorly preserved remains suggested that all were adults (age range 15+ to 45+). Two individuals were male, but the sex of the remainder could not be determined (Anderson 1979).

Osborne (1966: 344–345) first considered Ngelong as a multi-component settlement incorporating village, defense and lookout areas that had been used up until the late-nineteenth century as a place of refuge. After further work and excavation the site was thought to be a late-prehistoric temporary settlement for refuge or defensive purposes, despite the extensive nature of the cultural deposit and the

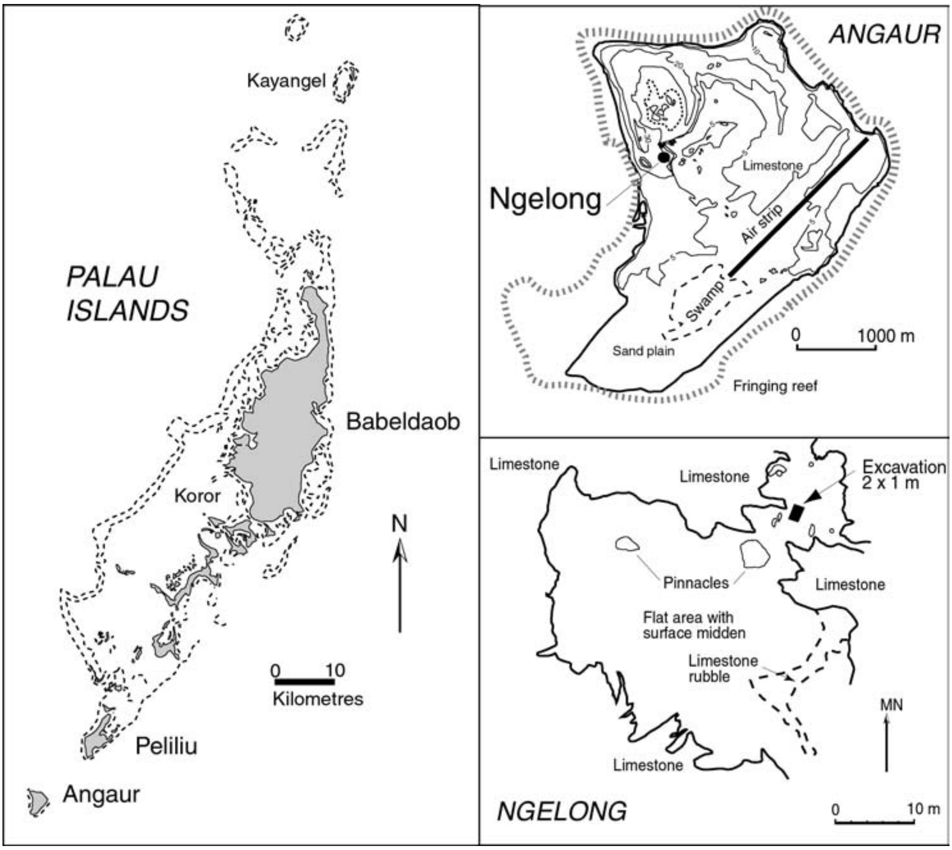

Figure 1. Palau, Angaur Island and plan view of Ngelong excavation.

presence of clustered burials in the Second Flat, that might represent a community cemetery (Osborne 1979). Traditional accounts collected by Osborne (1979) and Takayama et al. (1980) agree that warfare caused Ngelong to be abandoned, but do not mention why occupation was established entirely in such rugged terrain. Angaur is a relatively small island and while the linear distance to resource zones such as the main taro swamp in the south and oceanic environments are not large, the rough terrain imposes significant transport costs on a settlement based on marine and horticultural foods. Field work at Ngelong was undertaken to recover cultural remains that would establish the age and duration of occupation, and whether the site was in fact a Stonework village, a fortified refuge or other recognizable Palauan site type.

Excavation and Survey

Ngelong was visited in March 2002 by a team of five, and after a walk-over survey a 1 m x 2 m trench was placed northeast of a pinnacle in a narrow limestone corridor between two oval chambers with abundant surface deposits of pottery and shell fish (Figure 1). Osborne (1979: Fig 3) was not able to map Ngelong because of the thick vegetation and located his excavations on a sketch map. From his description and map we tentatively conclude that our excavation was placed in a corridor north of the 'Second Flat' area where seven burials where found (Osborne 1979). The trench was excavated as two 1 m^2 squares in 20 cm spits with matrix material sieved through 3 mm mesh. Cultural material from a 1 m^2 excavation square were retained and transferred to the Australian National University for analysis. Excavation continued to 140 cm depth and a sand auger was used down to 240 cm below surface. Shell and stone artefacts were surface collected from the large flat area south of the excavation shown in Figure 1. Most artefacts were found close to the indented limestone walls as a result of land crab burrowing. Surface collections had been made previously by Osborne (1966, 1979), Takayama et al. (1980), and a local collector who occasionally sells artefacts to tourists. The distribution of surface artefacts is unlikely to reveal activity differences within the site.

The presence and absence of artificial stone features was noted over approximately 70% of the estimated site area in three walk-over surveys. Plan mapping of Ngelong was not feasible due to labour and time constraints as the large site area was covered in thick secondary vegetation, particularly abundant stands of wild yam *(belbi, Dioscorea* sp.). The vegetation cover might have covered a few stone structures, but the relative absence of stone platforms and stone work recorded during site survey and limited mapping parallels previous field work (Olsudong & Blaiyok 1996, Osborne 1966, 1979, Takayama et al. 1980), which also recorded only a few small platforms and low walls.

Stratigraphy

The stratigraphy at Ngelong was simple and consisted of three layer. The upper two layers contained abundant marine shell and ceramic remains to a depth of 60 cm. Small quantities of cultural material were found in Layer 3 down to 100 cm depth, and appear to derive from the downward movement of midden from the main occupation deposit. The volume of excavated deposit for the test pit was 0.91 m^3. No subsurface features were identified in excavation.

Layer 1: 0–10 cm. Dark brown (10YR 4/1) silty organic soil (pH=8.0). Abundant cultural material (ceramics, marine shell and fish bone), except for charcoal, which existed as small dispersed fragments.

Layer 2: 10–60 cm. Dark grey (10YR 5/1) silty organic soil at layer top (pH=8.0–8.5) grading to a dark silt at base (pH=9.0). Midden material declines in quantity toward layer base with small flecks of charcoal.

Layer 3: 60–240 cm. Yellow-brown (10YR 5/4) coarse granular deposit of phosphate oolite (pH=9.5–10.0). Minor amounts of ceramics, shell and fish bone were found from 60 cm to 100 cm. The basal limestone was heavily eroded with a peak top at 65 cm depth.

Radiocarbon Dates

Charcoal is the preferred material to radiocarbon date Pacific archaeological sites when the value of the local marine reservoir (deltaR) is not known. The Ngelong cultural deposit contained charcoal fragments, but no single piece was large enough for conventional dating. Small flecks and fragments of charcoal are susceptible to bioturbation and radiocarbon dates on combined charcoal samples of potentially mixed provenience may not provide accurate age determinations (Spriggs and Anderson 1993). Two marine shells were dated at the Australian National University Radiocarbon Dating Laboratory with the benzene synthesis/liquid scintillation method. Samples were intact valves from *Hippopus* sp. and *Anadara* sp. The shells were free from predator bore holes and could not have been transported to the site by hermit crabs, which are common on Angaur. The incorporation of shell fish that date earlier than the archaeological levels they are found in can occur when shells selected for artefact manufacture derive from subfossil sources or older midden shell deposits. Neither of the samples selected for dating had evidence of deliberate or natural modification, and their likely status is occupation midden shell. Pre-treatment consisted of surface cleaning samples with a dental drill and washing in an ultrasound bath.

Calibration of marine shell determinations in Western Micronesia is hampered by uncertainty about the magnitude and direction of the local marine reservoir (deltaR). Recent dating of paired charcoal and marine shell samples from an archaeological site on Ulong Island indicates that a low deltaR might not be inappropriate for Palau's limestone islands (Clark in press), and potentially more widely given a recent deltaR result of 5 ± 50 BP from Guam and evidence that the water masses from the western Pacific are well-equilibrated (Southon et al. 2002). This suggestion, of course, needs to be established more securely in future research, but available data, although scanty, does not yet point to a deltaR value that would significantly alter marine shell dates from Palau's southern islands. Conventional radiocarbon ages were calculated with the CALIB rev.4.3 software using method A at two standard deviations (Stuiver & Braziunas 1993) with deltaR set, therefore, at 0.

Radiocarbon ages are in stratigraphic order (Table 1) with the oldest result on *Anadara* sp. from near the base of cultural deposit (50–60 cm) indicating site use at 560–330 cal. BP (ANU-12025). The result on *Anadara* sp. from (0–10 cm) does not overlap at two standard deviations with the determination on *Hippopus* sp., which has a range of 300–0 cal. BP (ANU-12095). Median calibrated ages, if accurate, suggest that occupation at Ngelong spanned 200–300 years from about the early-16th to the mid-18th century; an important period which saw increasing

Table 1. Radiocarbon dates from Ngelong. ^{13}C value estimated.

Sample	Depth	Material	CRA	^{13}C*	cal. BP
ANU-12095	0–10 cm	*Hippopus* sp.	560 ± 60 BP	0.0 ± 2.0E	300 (240) 0
ANU-12025	40–50 cm	*Anadara* sp.	850 ± 80 BP	0.0 ± 2.0E	560 (480) 330

interaction between Palauan and European cultures, and the apparent relocation of populations from the Rock Islands to Babeldaob (Masse et al. 1984, Phear et al. 2003).

Ceramic Analysis

A total of 560 ceramic sherds weighing 11.0 kg was recovered from a 1 m^2 excavation. The majority of sherds (97%) came from the upper 60 cm of deposit. This suggests fragmentation and incorporation of small sherds in the natural Layer 3 deposit by rat and crab burrowing, or from stake holes, pits and other types of subsurface features made during prehistoric occupation.

Rim and body sherds were examined using standard methods to examine vessel size and shape (Clark 1999, Osborne 1979). The dominant vessel form was a large bowl with an inverted rim and medium-to-thick body walls (Figure 2), similar to the results of Osborne (1979) who recorded direct and inverted rims with flat, rounded and thickened lips typical of late-prehistoric sites. Osborne (1979: 27) also recorded a few 'backcurve' rims he considered to be an early form in Palau's ceramic sequence. This type of rim form has recently been dated to c.2400 BP on Ulong Island (Clark in press). Thus, use of the Ngelong area has a significant antiquity, although no evidence for an intact early occupation has been found. Mean body-sherd thickness was 9.6 ± 2.1 mm, with the thinnest sherds (mean=8.3 mm) at 60–80 cm depth. In Osborne's (1979: 244) excavation body-sherd thickness ranged from 8.8 mm to 9.8 mm with the smallest sherds from the base of the excavation at 45–60 cm depth. Vessel orifice diameter was large with a mean of 39 cm, but estimates are complicated by the existence of oval vessels (Desilets et al. 1999). The average rim inversion angle is 17.9 degrees with the inversion angle increasing slightly with depth. Both rim and body attributes vary slightly with depth indicating that a small amount of vessel change occurred during occupation. On Ulong Island vessels with inverted flange rims are the main ceramic type from about 1000 years ago until the island was abandoned at c.450–500 BP. The Ngelong assemblage includes some small flange rims, but radiocarbon dates indicate the site dates later than 500 BP, suggesting that flange rim ceramics were being replaced by vessels with direct or slightly inverted rims. Rim form analysis by Desilets et al. (1999) on ceramics from 15 Babeldaob sites identified that flange rims (Types 4 and 5) were the main rim type from A.D. 1100 to the present. It is unclear whether flange rims existed for longer in parts of Babeldaob than on Angaur, or, if there were regional differences in pottery styles; a hypothesis that has yet to be investigated in detail.

All rim sherds were sectioned with a gem saw and examined under low-power magnification. Light inclusions were tested with 10% HCl. Our results were similar to those of Osborne who had recorded that grog (dried or prefired clay) was the dominant temper at Ngelong as was the case elsewhere in Palau (Fitzpatrick et al. 2003), with a few sherds containing a mixture of volcanic and grog temper grains. A few light grains reacted with HCl, but it is unclear if these were limestone or were of calcareous beach origin.

Osborne (1979) recorded both red-slipped and incised pottery at Ngelong, but neither decoration type was found in the excavated collection. One sherd (0–20 cm) had a *Pandanus* sp. mat impression on the exterior vessel surface that might have been made incidentally during vessel construction and drying. A carbonised residue adhering to the interior surface of a body sherd was processed and

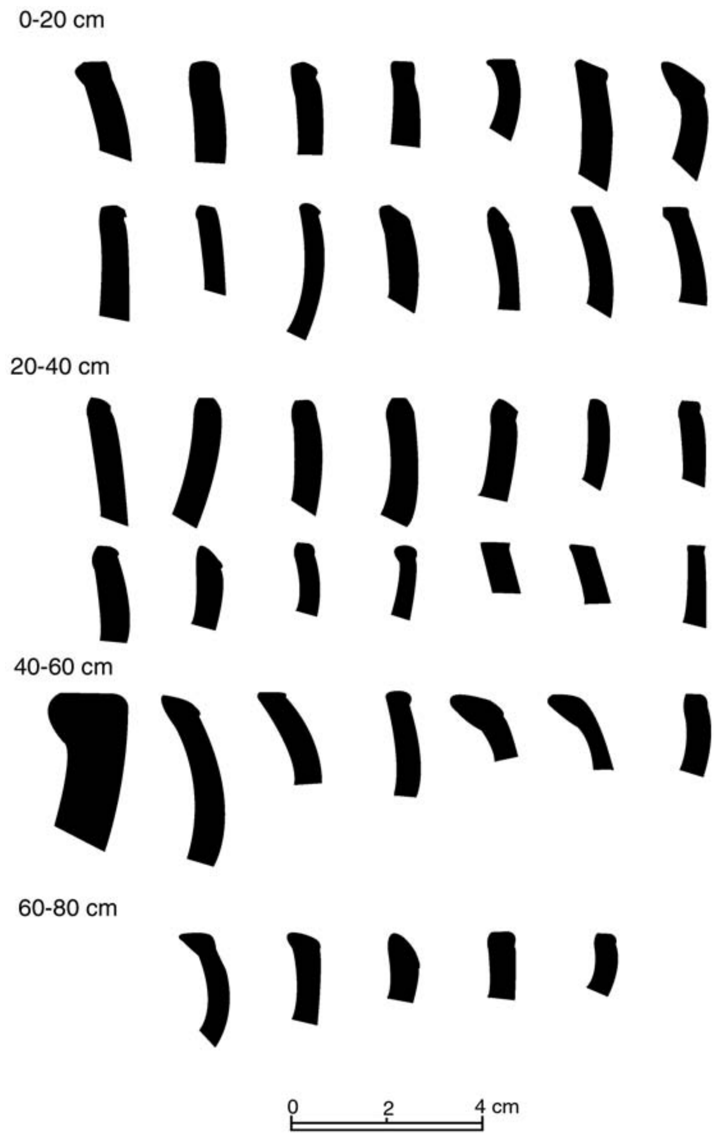

Figure 2. Ngelong rim profiles.

examined under high-power magnification for pollen, phytolith, raphides and starch grains. However, no plant or animal structures, such as fish scales, were identified (G. Atkin, Australian National University, pers. comm.).

All prehistoric pottery found in Palau's limestone islands is thought to be made in clay from volcanic islands, representing, if the assumption is accurate, substantial intra-archipelagic transfer of ceramics to sites like Ngelong.

Artefacts of Shell, Stone and Bone

There were 12 artefacts recovered from the 1 m x 2 m excavation and another 33 were surface collected. They comprise shell and stone adzes, shell knives, possible limestone 'cores', a stone pounder, shell awls and other worked shell. Most artefacts were shell (34/76%) from species of *Terebra/Mitra, Tridacna* and *Conus.* The range of artefacts recovered is similar to that reported from the site previously by Osborne (1979) and Takayama et al. (1980), except that no tools made in *Cassis* sp. were identified (cf. Osborne 1979, Takayama et al. 1980: 24).

Shell Adzes

Adzes were the most common artefact at Ngelong, with 19 specimens made in *Tridacna* sp. or *Terebra/Mitra*. The majority (n=14) were complete or had suffered minimal damage, while five were fragments. The small size of many shell adzes suggests they had been extensively used and discarded once the cutting edge could not be refurbished. The Ngelong shell adzes were characterised using Kirch and Yen's (1982: 206–232) Tikopia shell-adze typology, which has been used to describe Palauan shell adzes (Beardsley 1996, 1997). [Craib (1977) has also produced a shell adze typology for Micronesia, but his unpublished MA thesis was not available at the time of study. See also shell adze classifications by Davidson (1971: 51–69) and Sinoto (1978)].

Table 2. Attributes of *Tridacna* sp. adzes from Ngelong. Terminology and dimensions after Kirch and Yen (1982).

Butt Form	Cross section	Max. Length (mm)	Cutting Edge Width (mm)	Midpoint Width (mm)	Poll Width (mm)	Angle of Bevel (^{0})	Weight (g)	Location
Blunt	Elliptical/oval	95	45	30	14	25	218	Surface
Beveled	Elliptical/oval	85	40	25	10	20	161	Surface
Beveled	Elliptical/oval	90	35	30	10	40	120	Surface
Beveled	Elliptical/oval	75	35	25	15	35	97	Surface
Pointed	Elliptical/oval	75	30	15	20	25	56	Surface
Rounded	Elliptical-oval	60	25	35	14	15	30	Surface
Damaged	Elliptical/oval	70	na	?	15	?	82	Surface
Beveled	Plano-convex	95	45	25	15	20	176	Surface
Blunt	Plano-convex	70	25	20	5	35	81	0–20 cm
Blunt	Plano-convex	105	40	40	16	20	230	60–80 cm
Damaged	Quadrangular	80	20	20	15	30	72	40–60 cm

In Kirch and Yen's shell adze typology Types 2–5 are made from the thinner dorsal region and Types 6–8 are from the thicker hinge section of *Tridacna* sp. The 11 *Tridacna* adzes from Ngelong (Table 2) were all from the hinge region with Type 7 (elliptical/oval cross-section) the most common and a few examples of Type 6 (plano-convex cross-section) and Type 8 (quadrangular cross-section). One *Tridacna* sp. adze fragment had a triangular cross-section. Adze butts were bevelled (n=4) or blunt (n=3), whereas on Tikopia blunt and rounded butts were common (Kirch and Yen 1982: Table 22), possibly indicating different methods of adze hafting.

There were eight *Terebra/Mitra* adzes of which five were highly worn. Osborne (1979) suggested that *Terebra/Mitra* adzes were a rapidly exhausted tool type as they have a relatively light shell compared to *Tridacna* sp. The butt of *Terebra/Mitra* adzes was often damaged, possibly the result of using the naturally sharp point of the shell as a gouge or awl, or reducing it to aid hafting.

Shell Knives/Scrapers

Knives/scrapers made in *Conus* sp. were found in surface (n=5) and excavated (n=2) collections (0–20 cm, 20–40 cm). They have a single bevelled cutting edge 40–55 mm long, made by removing and grinding a section of the aperture. Five specimens were broken and had extensively worn and chipped working edges. Informants told Takayama et al. (1980: 14) that these artefacts were a woman's knife *(ongort)* used to process breadfruit. Osborne (1966, 1979) and Beardsley (1996) report *Tridacna* sp. knives/scrapers on Angaur, but these did not occur in our collections.

Other Shell Artefacts

A piece of a small shell ring made in *Trochus* sp. was found in the 0–20 cm level. The piece was too small to determine a diameter. A Tridacna artefact has a sub-diamond shape and has been drilled (hole diameter 3–4 mm) from the ventral side of the shell. A similar item is figured by Osborne (1979: Fig. 201). Other items made in Tridacna sp. include a possible awl and five worked tabs, that might be adze blanks.

Stone Tools

Four incomplete stone adzes and one complete pounder were surface collected. Adzes have rectangular, sub-rectangular and plano-convex cross-sections with cutting edge narrower, equal or wider than adze sides. The mostly complete adze (PL03) has been refurbished by grinding, which has changed the original cross-section from a plano-convex/rectangular form to a low sub-rectangular form (Figure 3). This specimen might have been discarded when the size of the adze made hafting difficult. Two fragments are bevel sections from broken adzes which have subsequently been reused as hammer stones/pounders (PL05, PL06). A broken bevel section has not been reused possibly due to its small size. The composition of the tools was examined in thin-section and under

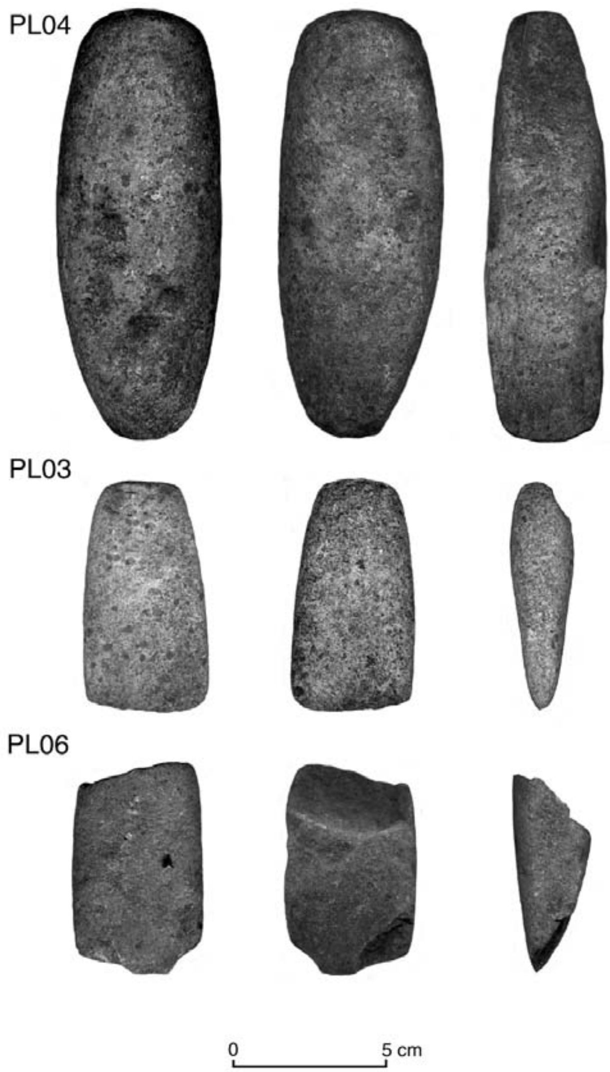

Figure 3. Ngelong stone artefacts (PL03, PL04, PL06).

low power magnification. The material was an olivine-augite basalt containing volcanic rock fragments and glassy olivine indicating an origin from Palau's volcanic islands.

The pounder (PL04) has an oval cross-section and was smoothed by grinding (Figure 3). There is evidence of pecking on one side suggesting that the basaltic-andesitic breccias of Palau were worked by pecking and grinding rather than flaking. The 'butt' of the pounder has a flat tapering surface on one side and a median ridge on the other which might indicate it was hafted.

LIMESTONE 'CORES'

Six pieces of crypto-crystalline limestone, have had a few small flakes struck from them and might be cores. It is feasible that the 'cores' are hammer stones, however, since no limestone flakes were recovered at the site.

BONE ARTEFACT

A complete bone artefact was found at 60–80 cm depth. The bone is curved and is probably from a sea-mammal or possibly a large turtle. Small holes have been drilled diagonally from the sides to the end surfaces and small channels placed to recess attachment cords. This suggests that the artefact, almost certainly an ornament, was worn with the outer curvature surface exposed, as a wrist bracelet or perhaps round the neck. Three similar items were found by a local collector on Angaur at an old *bai* platform in the south of the island. Keate reported that three kinds of bone artefact denoted status, One of these, the atlas vertebra of the dugong, was worn on the wrist and was the premier symbol of power, while smaller bone ornaments expressed lower rank (Keate 2000 [1789]: 234–236).

XRF Analysis of Stone Artefacts

Major element (n=11) and trace element (n=29) analysis of four stone artefacts (PL03, PL04, PL05, PL06) was made at the Australian National University using X-Ray Fluorescence (Table 3). Cores or sawn slices 0.7–1.0 g were milled to a fine powder in a tungsten carbide ring mill and fused with lithium borate flux to make homogeneous glass discs (0.27 g sample fused with 1.72 g flux to make a disc 30 mm diameter and 1 mm thick). Disk composition was analysed with a Philips PW2400 X-ray fluorescence spectrometer with a Rh tube operating at 2.4 kW. The method was calibrated against a suite of 28 standard rocks for Na, Mg, Al, Si, P, S, K, Ca, Ti, Mn and Fe. Loss of ignition values of 3–5% are attributed to vaporization of H_2O and CO_2, with similar values reported by Corwin et al. (1956: 51). Detection limits were single ppm for most elements and somewhat higher for Na and Si.

Trace elements for the Ngelong artefacts were compared to those from eight stone artefacts collected from Ulong Island and Oikull (southeast Babeldaop), and a piece of basaltic-andesitic volcanic breccia collected from the roadside overlooking the traditional village at Oikull. The compositional results are the first from Palau where stone artefacts comprise a small and rare segment of the archaeological record (Liston 1999: 99, Osborne 1979). Consequently, knowledge of the stone sources utilised by prehistoric Palauans and the compositional variability within and between locations is not yet available. In contrast the stone resources of Polynesia are known from a vast database of chemical results on artefacts, and both potential and known sources of artefact stone, particularly quarries (Best et al. 1992, Weisler 1997).

In the absence of sufficient comparative data the statistical interpretation of XRF results must be seen as tentative and requiring a structured and comprehen-

Table 3. Major and trace element analysis of Ngelong stone artefacts.

Artefact Identifier	PL03	PL04	PL05	PL06
SiO2	51.4	51.8	49.2	49.0
Al2O3	17.5	17.3	14.6	15.2
CaO	8.8	9.3	10.1	9.7
MgO	4.1	6.7	9.7	9.3
MnO	0.1	0.1	0.2	0.1
Na_2O	1.8	2.1	2.0	2.5
K_2O	0.1	0.1	0.2	0.1
TiO_2	0.7	0.5	0.4	0.5
P_2O_5	0.1	0.1	0.4	0.1
SO_3	0.1	2.2	0.1	0.0
Fe_2O_3	10.5	7.1	7.9	9.3
Sc	37.5	37.8	45.0	53.5
V	249.4	230.1	194.0	206.2
Cr	60.9	287.8	357.6	364.1
Ni	30.2	72.4	81.9	64.6
Cu	27.4	395.0	141.3	21.6
Zn	39.5	23.0	90.9	31.9
Ga	13.8	14.6	12.0	12.8
Rb	1.8	0.9	1.7	0.5
Sr	192.6	146.1	197.1	88.6
Y	20.5	16.0	18.1	13.3
Zr	43.1	25.1	21.7	23.9
Nb	0.8	0.5	0.4	0.3
Cs	1.0	0.8	4.7	2.1
Ba	11.0	7.0	14.1	8.6
La	1.1	1.5	2.6	0.4
Ce	2.7	3.9	5.8	1.3
Nd	3.1	3.8	5.3	2.2
Sm	1.8	1.9	2.6	1.5
Eu	1.1	1.0	1.9	1.3
Gd	2.9	2.6	3.6	2.5
Dy	4.1	3.6	4.3	3.4
Er	4.1	4.0	5.0	4.8
Yb	4.7	4.9	5.6	6.3
Lu	3.7	4.5	5.3	6.5
Hf	5.7	3.4	4.9	3.8
Ta	2.5	1.7	3.0	2.0
Pb	5.0	6.6	6.7	5.9
Th	0.4	0.3	0.3	0.3
U	0.6	0.4	1.5	1.2

sive study of prehistoric stone tools in tandem with an archipelago-wide program of geological sampling. With these cautions outlined a multidimensional scaling (MDS) and hierarchical cluster analysis of the trace element data was carried out using SPSS 11.0 with the basic aim of investigating variability among samples. Despite considerable elemental variation all artefacts have a composition compatible with a Palauan origin, as suggested by petrographic and hand specimen observation. The MDS and cluster analysis gave similar results. Figure 4 shows that some of the Ngelong artefacts (PL05, PL06) have a composition similar to those found at Oikull (PL01, PL07, PL10, PL11), although the fine-grained volcanic breccia collected from above Oikull (PL12) does not appear to be a particularly close match for the majority of prehistoric artefacts. The outliers in the cluster plot include a pounder from Ngelong (PL03) and a possible pounder found at Oikull (PL08). Whether these indicate utilisation of several distinct stone sources or variation within a single procurement zone requires further investigation.

Faunal Remains

There were 1598 bone fragments weighing 573 g from a 1 m^2 excavation sample, which were identified using the Australian National University faunal reference collections. A total of 119 bones (7.5%) were identified to family/species. Bone was found down to 100 cm depth, but most (96%) came from 0–60 cm depth paralleling the stratigraphic distribution of pottery.

Fish

There were 12 fish taxa identified with Lutjanidae, Scaridae and Nemipteridae making up 58% of MNI (Table 4), similar to several other analysed collections of archaeological fish bone from Palau (Masse 1989, Osborne 1979, Snyder 1989). The two most common families recorded at Stonework villages on Babeldaob were Scarids (parrotfish) and Sparids (bigeye emperor) (O'Day 1999a: 106), although differential bone preservation in acidic soils favours the survival of species with large and robust elements like the pharyngeal plate, premaxilla and dentary bones of Scarids. The proportion of reef-browsing species at Ngelong indicate capture by shallow-water hook and line fishing (5–25 m depth) and netting and spearing along the fringing reef (Masse 1989). The shark tooth was identified to the reef-dwelling Oceanic white-tip shark *(Carcharhinus longimanus).* Keate (2000 [1789]: 302) records that the flesh of sharks was much esteemed, and they were speared when they came within the reef. There was substantial size variation in fish head bones with relatively few bones from large-sized individuals (>60 cm in length).

Mammal, Turtle, Bird

There were 29 non-fish bones identified (Table 4). Rat bone was present in the 40–60 cm level, but could have been introduced by burrowing from upper

Table 4. Ngelong identified vertebrate remains by depth (1 m^2 excavation).

Depth	0–20 cm	20–40 cm	40–60 cm	60–80 cm	80–100 cm	NISP	MNI
Balistidae	4					4	2
Diodontidae	4	3	2	2		11	1
Holocentridae	2					2	1
Lethrinidae		1	3			4	2
Scaridae	5	3	2	1	2	13	8
Mullidae			2	1		3	2
Nemipteridae	1	2	3	1	1	8	7
Elasmobranchii		1			1	2	1
Seranidae	2	2	1		3	8	5
Lutjanidae	4	2	7	2	1	16	12
Labridae	1					1	1
Sparidae		3				3	1
?Family	7	3	2		2	14	
Total	30	20	22	7	10	89	43
Turtle	6		8	3		17	1
Bird/Fruit bat	1	1	2	1	1	6	2
Rattus sp.			6			6	1
Total	7	1	16	4	1	29	4

levels as rats are numerous at the site today. While the sub-species of the rat is uncertain, it is larger than the widespread Pacific Rat *(Rattus exulans)* and appears to be smaller than the Large Spiny Rat *(Rattus praetor);* the other rat species introduced to the Pacific in prehistory (White et al. 2000). Fragments of bird bone and turtle occurred in the main cultural levels and one drilled bone artefact made in sea mammal bone, probably dugong *(Dugong dugon),* was found at 40–60 cm depth. Bone fragments from the indigenous fruit bat *(Pteropus pilosus)* might also be present, but could not be reliably identified from bird bone due to articular surface damage. A shrew cranium from the upper 10 cm of deposit was identified as the Asian house shrew *(Suncus murinus).* The Asian house shrew has previously been reported from Angaur where introduction may be due to adventitious arrival on phosphate ships (Pregill & Steadman 2000).

Shellfish

There were 187 fragments of marine shell weighing 2.8 kg from a 1 m^2 excavation (Table 5). Shell fish were identified using a Palau shell reference collection made by C. Szabo (ANU). The greatest number of shell fish remains was in the first 0–20 cm with numbers declining with depth. Although, shell fish occur at 60–80 cm depth they make up only 4.3% of the NISP total. As with pottery the mean weight of shell fish fragments declines from 11.7 g/specimen at 0–40 cm to only 1.7 g/specimen at 60–80 cm, consistent with downward movement of small pieces of broken shell rather than primary deposition of midden remains.

There were 22 species of shell fish with *Atactodea striata* and *Nerita* sp. making up 63% of MNI. The small size of these species means that they were likely of relatively minor dietary importance. Of the species returning higher meat weights the bivalve *Hippopus hippopus* (MNI=12) is clearly significant, with smaller quantities of *Strombus, Turbo* and *Anadara.* Carruci (1992: 135–137) found that these species, along with *Tridacna* sp., were a common component of Rock Island shell fish assemblages. On Babeldaob the Ngimis village midden dated to A.D. 1290–1621 was dominated by *Anadara* (54.6% by weight) and *Strombus* sp., with another 15 species making up the remainder (O'Day 1999b). Similarly, in a shell midden deposit in Ngerdubech *Anadara* sp. composed 41% of the assemblage by weight with contributions from other species such as *Hippopus hippopus* (16%) and *Strombus luhuanus* (4.6%).

The ecological preference of the Ngelong shell fish species indicates collection from intertidal and fringing reef zones. Collection of some species for food is suggested by consistent breakage patterns with smashed dorsal surfaces on *Strombus* sp. and *Lambis lambis,* for meat extraction. Several of the large

Table 5. Ngelong identified shell fish remains by depth (1 m^2 excavation). **Pythia* sp. is a common land snail. MNI=Minimum Number of Individuals, NISP=Number of Identified Specimens.

Depth	0–20 cm	20–40 cm	40–60 cm	60–80 cm	NISP	MNI
Anadara antiquata	2		3	1	6	6
Anodontia edentula	2				2	2
Atactodea striata	25	20	11	2	58	50
Cerithium nodulosum	1	3	2		6	
Conus sp.		1			1	1
Cypraea sp.		1			1	1
Fimbria fimbriata	1				1	
Fragum unedo			1		1	1
Lambis lambis	1	1			2	1
Nerita albicilla	3				3	3
Nerita plicata	7	3	10	1	21	18
Nerita polita	1	3	1		5	5
**Pythia sp.*		1			1	1
Strombus gibberulus	1				1	1
Strombus lentiginosus	5	2			7	4
Strombus luhuanus	4		1		5	5
Hippopus hippopus	7	7	4		18	12
Tridacna sp.	2	1			3	1
Trochus maculatus			3		3	2
Trochus niloticus		1			1	1
Turbo argyrostoma	1	1	2	2	6	4
Turbo opercula	16	8	6	2	32	
Vasum ceramicum	3				3	1
Total	82	53	44	8	187	120

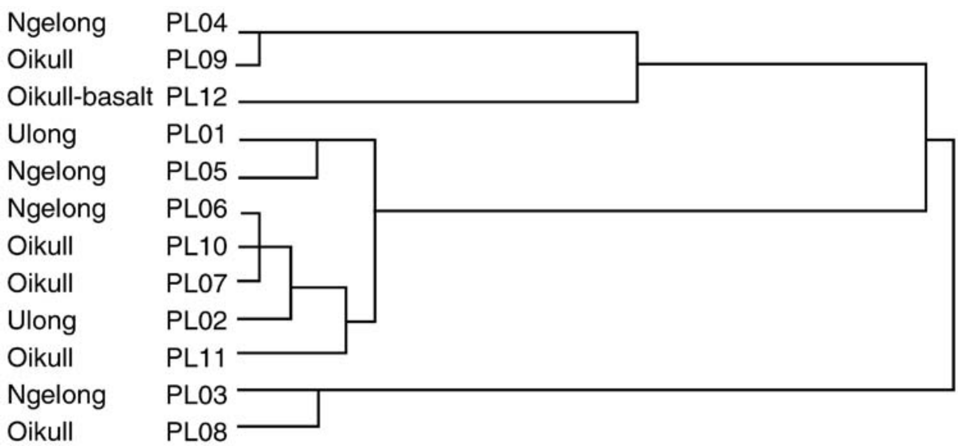

Figure 4. Hierarchical cluster analysis of Ngelong and other Palauan stone artefacts using 29 trace elements.

bivalves, such as *Anadara* sp., had jagged perforations near their dorsal margins, perhaps from severing hinge muscle attachments to extract the meat, a type of damage also recorded by Takayama et al. (1980: Pl. 11). Carucci (1992: 226) has concluded, however, that shell burning and breakage were not due to meat extraction and occurred, unintentionally, when refuse shell was damaged by human activity. Ethnoarchaeological studies demonstrate, however, that shell breakage and heating are often used to process and cook shell fish (e.g. Meehan 1982).

Discussion and Conclusion

The Ngelong site is defined largely by concentrations of ceramics, marine shell and non-pottery artefacts similar to those recorded from other Stonework villages in southern Palau (Masse 1989: 288). Median radiocarbon ages indicate the site was probably utilised 450–250 cal. BP. Stone tools and abundant ceramics show that the people inhabiting Ngelong had access to volcanic island products, as did other late-prehistoric communities in southern Palau.

Ngelong differs, however, in two important respects from other village sites reported in the Rock Islands. First, Ngelong is located exclusively within karstic terrain and lacks easy access to either the coast or to the large southern beach flat, where the main taro gardening area of Angaur is located (Osborne 1966: 312). Elsewhere in the Rock Islands village sites examined by Masse (1989) typically contain evidence of prehistoric settlement extending from limestone ridges and peaks down to beach flats, reflecting the cultivation of giant swamp taro *(Cyrtosperma chamissonis)* in swampy back-beach areas and the importance of marine resources, particularly fish and shell fish to island populations (Carucci 1992, Masse 1989, Parmentier 1987: 59). Interestingly, informants told Osborne (1966: 312) that Angaur was once divided into eight clan areas all of which contained substantial areas of coastline in their territory except for Ee (also Eche or E'e) in which Ngelong is located. Due to its extreme ruggedness, poor soils and lack of coastal access Osborne (1966: 315) thought that Ee could not have supported a permanent population, although he noted that according to oral traditions there was continual strife when the people of Ee sought to use the west seacoast that was controlled by Ngcheanged and Rois villages.

Second, the relative absence of stone structures at Ngelong is unusual given the presence of numerous built stone features elsewhere in southern Palau. The absence is unlikely to be due to colonial activities such as World War II bombing and phosphate mining. For example, Krämer (1917: 286) recorded stone platforms and paths along a ridge top in the northeast of Angaur that were later destroyed by extensive phosphate mining under German (1899–1914) Japanese (1914–1944) and American administrations, but such activity would have also removed or displaced midden deposits. Olsudong & Blaiyok (1996) note that the impact of phosphate mining at several sites with stone platforms and structures recorded in the early 20th century could be identified in their archaeological survey. The assertion that Ngelong is depauperate in constructed stone features, and represents, therefore, an atypical prehistoric occupation is further illustrated by a comparison of the stone features found at Ngelong with those from Stonework settlements reported by Masse (1989). These settlements appear to have been contemporaneous with Ngelong based on selected radiocarbon results (Table 6). On Babeldaob the number of stone features in three villages ranged from 23 to 87 (Liston 1999: 378).

The stonework features characteristic of prehistoric Palauan villages are platforms *(odesongel, cheldeklel a bai, iliud),* with a variety of functions (Liston 1998: 19). Other stone-built structures include graves *(bluks),* paths, defensive locations *(euatel),* monoliths *(btangch),* wells *(ollúmel),* walls and canoe docks

Table 6. Stone features recorded from Rock Island villages and Ngelong. 'Other'=dock, low wall associated with platform, stone-lined well, standing/corner stones. Selected radiocarbon dates on marine shell from Masse et al. (1984) and Masse (1989) calibrated using conventions in text.

Island	Ngeruktabel	Ngeanges	Ngemelis	Uchularois	Ngelong
Platform	34+	21+	24+	12+	2?
Large platform	2	1	2	1	–
High wall	2	–	5	–	–
Low wall	9	6	2	3	2
Path	4	–	1	1	–
Breakwater	–	–	2	2	–
Other	4	1	3	2	2
Laboratory No.	(1) DIC 2532 (2) NZ 6296	(1) DIC 2531 (2) NZ 6313	(1) DIC 2530 (2) NZ 6345	DIC 2529	(1) ANU-12095 (2) ANU-12025
^{14}C Age BP	(1) 600 ± 40 (2) 870 ± 40	(1) 550 ± 40 (2) 820 ± 40	(1) 600 ± 50 (2) 770 ± 40	650 ± 50	(1) 560 ± 60 (2) 850 ± 70

(Liston 1998, 1999: 378, Masse 1989, Osborne 1966, Parmentier 1987). Stonework features are listed differently in Table 6 as the indigenous function of structures cannot always be identified at prehistoric sites. Platforms, for instance, are divided into two groups comprising 'small-medium' and 'large', relative to their size in each settlement complex (Masse 1989). Smaller stone features including stone-lined wells, pits and low walls attached to platforms are included in the 'Other' category.

Ngelong has some low walls and small platforms (Olsudong & Blaiyok 1996, Osborne 1966), and Takayama et al. (1980) note the possibility that Ngelong might be associated with stone platforms on a high ridge 750 m from the site. However, there are no paths or midden deposits that appear to link the sites. Walk-over surveys recorded two small platforms less than 30 cm high and a few low walls and piles of limestone that could represent former platforms or boulder clearance. At the Stonework village sites recorded by Masse (1989) occupation platforms were located on limestone ridges and slopes, presumably reflecting the placement of habitation sites in easily defended locations. Concentrated midden material was deposited near to platforms, on beach flats and in rock shelters, What is unusual about Ngelong is the quantity of midden debris within karstic terrain and the presence of only few stone features within the site, which contrasts with the nucleated settlement pattern and abundant stonework of Rock Island villages and more broadly with numerous stonework features reported from Babeldaob (Liston 1999: Table 67).

Prior to the colonial era Angaur was divided into seven or eight villages (Osborne 1966: 314–316, Olsudong & Blaiyok 1996: 12). By the early 1900s Krämer recorded only four villages (Ngermasech, Rois, Ngebeanged, Ngerabelau), and since 1910 the spatial divisions between the four villages have reduced with occupation today concentrated in the west-central area of Angaur that associated with Rois and Ngermasech villages. Angaur people continue to identify themselves with a particular clan *(kebliil),* house *(blai)* and community even if they no longer live in a nucleated village. The fluidity of village settlement in Angaur over the last 100 years is, in part, related to colonial activity and economic development (Parmentier 1987: 58), but Olsudong & Blaiyok (1996: 12) note that oral traditions, while non-specific to detail, attribute the formation of several Angaur settlements, including those reported by Krämer, to inter-group hostility.

Parmentier (1987: 79–90) identifies two kinds of inter-village warfare in the late prehistoric and proto-historic period in Palau. The first consisted of swiftly executed head-hunting raids by a small party of warriors to obtain a human head, which was required for a village to gain the chiefly valuables *(chelebucheb)* used to meet political obligations. This form of warfare did not disrupt village occupation, while warfare aimed at the destruction of a village, the acquisition of new territory or the establishment of a slave relationship with a defeated group, clearly did. Such 'sieges' or 'pitched battles' constitute the second type of warfare and resulted in the destruction of residential houses and public buildings, the killing of inhabitants and uprooting of gardens and taro patches. Not only did warfare destroy the economic infrastructure of a village, but also the broader set of social relations expressed in its spatial organisation and architecture (e.g. Parmentier 1987: 208). Butler (1986), for instance, found a correlation between village rank and the number and size of its architectural features (see also Olsudong 1995).

Thus, warfare whose aim was community dismemberment was a dramatic and symbolic act of political change, in which village and district rank was reassessed. It is not surprising, then, that the stonework of a defeated village could be systematically removed and incorporated into the structures of a conquering village as a tangible expression of socio-political change (Keate 2000 [1789]: 170, Liston 1999: 378). Stonework contains, therefore, the history of a village, and structurally expresses social relations within and between settlements (Cordy 1985: 171, Liston 1999: 377, Parmentier 1987: 59). The relative absence of stone remains at Ngelong could result from a community occupation that was dislocated by warfare. Alternatives include the possibility that dislocation might have been caused by a severe ENSO event like those recorded in historic records in A.D. 1396 and A.D. 1685–1688 (Grove 1998), or that stonework was systematically removed from Ngelong after warfare. However, neither of these provide a particularly convincing explanation as an ENSO induced drought would likely result in population movement from the ecologically precarious limestone islands to Babeldaob (as oral traditions, in fact, suggest, see Liston et al. 1998), and the complete removal of stone structures at Ngelong would have been hampered by the extreme ruggedness of the terrain.

Archaeological sites and features associated with warfare include crowns and ditches, modified and unmodified hill tops, transverse ridge ditches, *bai* set aside for warriors at points of village access and stone walls (Liston 1999: 414). The majority are defensive fortifications designed to defend a permanent settlement or are refuges. Keeley's (1996: 57–58) analysis of pre-state warfare identified two kinds of fortified refuge. The first gave temporary protection to an entire community, while outpost or lookout refuges were smaller and strategically and often located along borders and community access points. The absence of defensive fortifications at Ngelong and evidence for long-term occupation in the quantity of midden debris, the radiocarbon ages and clustering of burials does not accord with either type of refuge site, nor with Rock Island village settlements of a similar antiquity.

In late-prehistory inter-group conflict in Palau is described as endemic (Parmentier 1987, Liston 1999), and oral records suggest that warfare could result in relocation of an entire settlement as appears to be the case with defeated groups, like those from Ulong Island and the Mdorm people from Angaur (Osborne 1966: 316, 401). Community fissioning following defeat is mentioned in the story about the destruction of Uluang Village, which also notes that temporary or short term occupation preceded community re-establishment (Parmentier 1987: 263–266). Members of a defeated group could be absorbed into the conquering group as kin *(kauchad),* but had limited property rights (Reed Smith

1997: 9), while settlement by immigrant groups was often restricted to the outer limits of high-ranked villages (Parmentier 1987: 60). Warfare to initiate or reinforce a relationship of village 'enslavement' *(ker el beluu)* is a motive given in oral accounts, and several refer to forced community relocation as a result of warfare and community occupation of peripheral social and economic landscapes. In a story about the expulsion of the Ngerdmau people by the men of Koror, the Ngerdmau leaders were "faced with the insulting prospect of finding living space beyond earshot of the centre of Ngiual" (Parmentier 1987: 84). Another tradition records how the people of Ngchesar, migrated to Ngerechelong, and were then forced from the area. The Ngchesar people then went to Ngetbang and petitioned the chief for land in which to settle. Land was eventually given, but the Ngchesar community was considered socially inferior to Ngetbang and was required to pay tribute (Parmentier 1987: 86).

Traditional accounts suggest that warfare led to patterns of community mobility and social restructuring that should be identifiable in Palau's archaeological record. Current work takes the presence of defensive structures, designed to protect or mitigate the effects of conflict on a social group, as evidence that a state of warfare existed in the past. However, such an approach tends to neglect the sites and features that represent the outcome of warfare on a group (see Burley and J. Clark 2003, Field 2002). For example, success in warfare could lead to elaboration of community structures to demonstrate increased village rank (funded by the labour and valuables of the defeated group, including its stonework), while failure might result in settlement destruction, abandonment and community movement and reconfiguration. The peripheral position of Ngelong, seen in the absence of stonework, suggesting loss of community identity, low rank and its location in ecologically impoverished karst, is consistent with a community that was subjugated in warfare and relocated subsequently to a marginal environment.

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