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Fossil Vertebrates From Palau, Micronesia: A Resource Assessment

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Abstract—During 60 days of field work from 1993 to 1997, we located and sampled 10 small, late Holocene bone deposits in caves and rockshelters on four islands in Palau (Republic of Belau). None of these sites was deeply stratified, nor did they yield bones of extirpated species. These attributes distinguish Palau from other groups of raised limestone islands in Oceania, such as the Mariana Islands, Tonga, and Cook Islands. Activities associated with World War II destroyed the natural integrity of most of Palau's caves and rockshelters and therefore, by inference, most of Palau's fossil vertebrate record. Other factors that challenge our ability to discover rich prehistoric bone deposits in Palau are the non-horizontal floors of most caves and rockshelters, their damp microclimates, and the apparent remoteness of any remaining undisturbed sites.

Introduction

The Palau Islands (Republic of Belau) comprise the most physiographically varied archipelago in Micronesia. Moreover, proximity of Palau to the Philippines and Greater Papuan region makes these islands highly significant zoogeographically. In many aspects of biology, however, Palau is one of the most poorly known archipelagos in Oceania. Beginning in 1993, we explored these islands for late Quaternary vertebrate fossil sites in conjunction with a broader field project on Palau's terrestrial vertebrates, especially amphibians and reptiles. Paleontological and archaeological research in the Pacific over the past two decades demonstrates that fossils (prehistoric bones) are indispensable for assessing the natural distributions of species and the effects of human colonization on native plants and animals. In Micronesia, the published fossil record of indigenous terrestrial vertebrates is limited to the northern Mariana Islands of Rota, Tinian, and Aguiguan (Pregill 1998, Steadman 1992, 1999), Fais in Yap State (Steadman & Intoh 1994), and Pohnpei (Steadman 1999).

To interpret a fossil record, an island's extant fauna must be reasonably well documented. The resident freshwater and land birds of Palau have been surveyed by Marshall (1949), Baker (1951), Engbring (1983, 1988), Engbring & Pratt (1985), Pratt et al. (1980, 1987), Wiles & Conry (1990), but the herpetofauna had never been comprehensively surveyed (Owen 1977) prior to our project. We more than doubled the number of known species (Crombie & Pregill 1999). The endemic land mammals known from Palau are the Palau Sheath-tailed Bat, *Emballonura semicaudata*, the "Marianas" Fruit Bat, *Pteropus marianus pelewensis*, and the larger Palau Fruit Bat *Pteropus pilosus*. The Palau Fruit Bat has not been seen since the 19th century and is presumed to be extinct (Wiles et al. 1997). Introduced mammals include rodents *Rattus* spp. and *Mus musculus*, as well as the Asiatic musk shrew *Suncus murinus*, confined to Ngeaur (Angaur). The introduced Crab-eating Macaque, *Macaca fascicularis*, is most common on Ngeaur. Archaeological sites have been identified in Palau (Osborne 1966, 1979), but no vertebrate bone record exists in either a cultural or noncultural context. Paleontologically, Palau proved to be frustrating for reasons that we will explain here. In fact, the scarcity of rich, fossiliferous sediment in Palau is thus far unequalled for tropical Pacific islands.

The Palau archipelago encompasses some 350 islands of volcanic and coralline origin centered near 7º20' N lat. and 134º E long (Fig. 1). All but the outlying Southwest Islands are scattered over a 160-km chain ranging in size from Babeldaob at 333 km^2 (about 80% of Palau's total land area) to unnamed islands of less than one hectare. A barrier reef encircles much of the archipelago to create a lagoon up to 20 km wide. Most of the islands are uninhabited, accessible with difficulty only by boat at high tide, and are densely vegetated over steep, rocky terrain. Babeldaob is primarily an eroded volcanic island with some patches of raised limestone on its northern and southern coasts (Mason et al. 1956). Ngcheangel (Kayangel), Ngaruangel, and the Southwest Islands are atolls or very low coral islands (Nicholson 1969:396, 398). All of the remaining islands in Palau are raised limestone, most of which are inside the lagoon and are referred to locally as the Rock Islands (Fig. 2). Cartographically, Palau is often included in the Caroline islands, but Palau, as well as the Marianas, are exposed peaks of undersea ridges stretching between Japan and New Guinea and are not located on the Pacific Plate.

Methods

Our field team in Palau consisted of R.I. Crombie, GKP, and DWS, assisted at various times by others (see Acknowledgements). Paleontological field work took place from 5 Jan–15 Feb 1993 (RIC, GKP), 1 June–7 July 1994 (RIC, GKP), 3–23 Jan 1995 (RIC, GKP, DWS), and 29 Dec–23 Jan 1997 (RIC, GKP, DWS). For all place names we follow the spelling found on the USGS Topographic Maps of the Palau Islands (1983–1984).

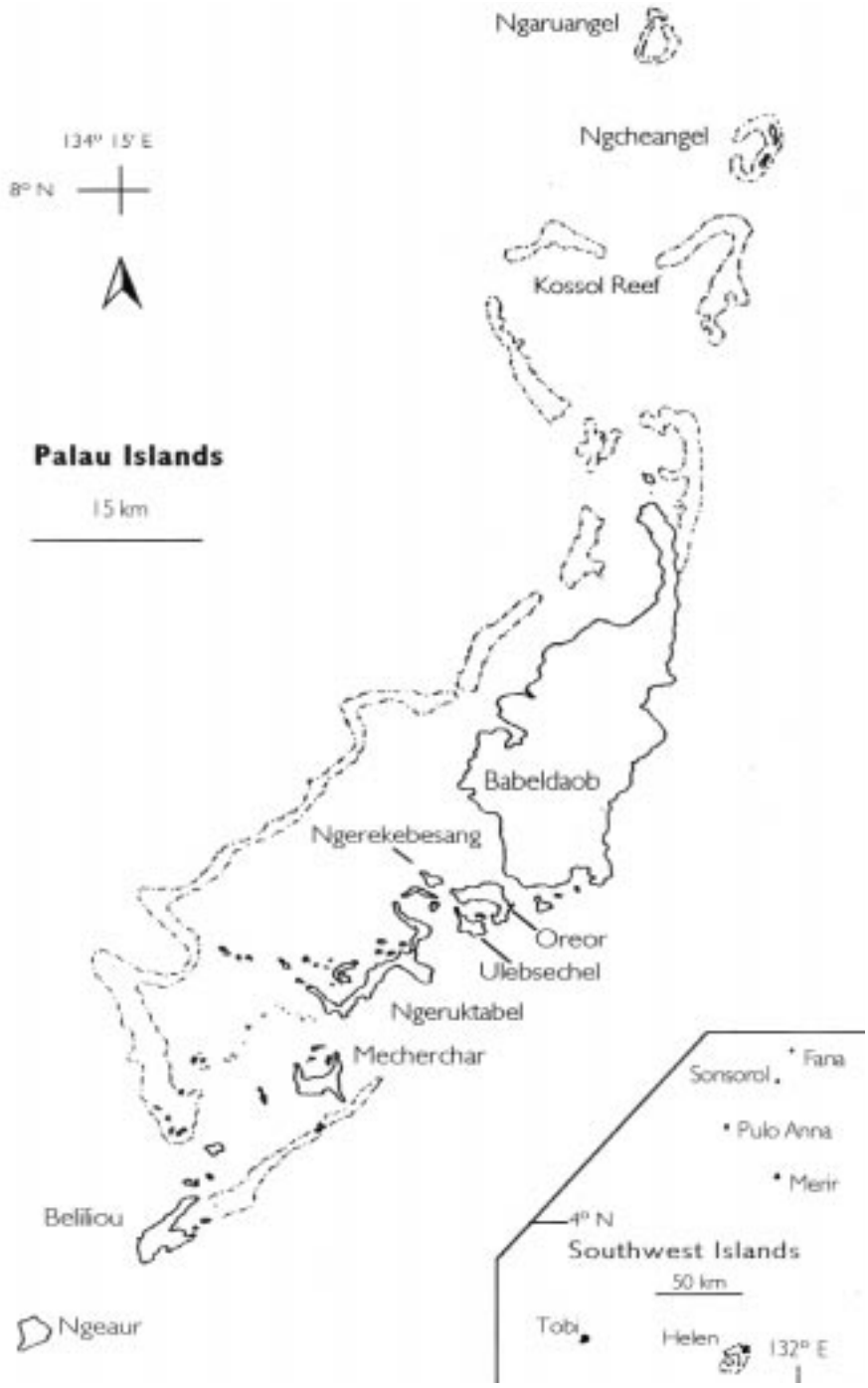

Figure 1. Palau (Republic of Belau). From Crombie & Pregill (1999)

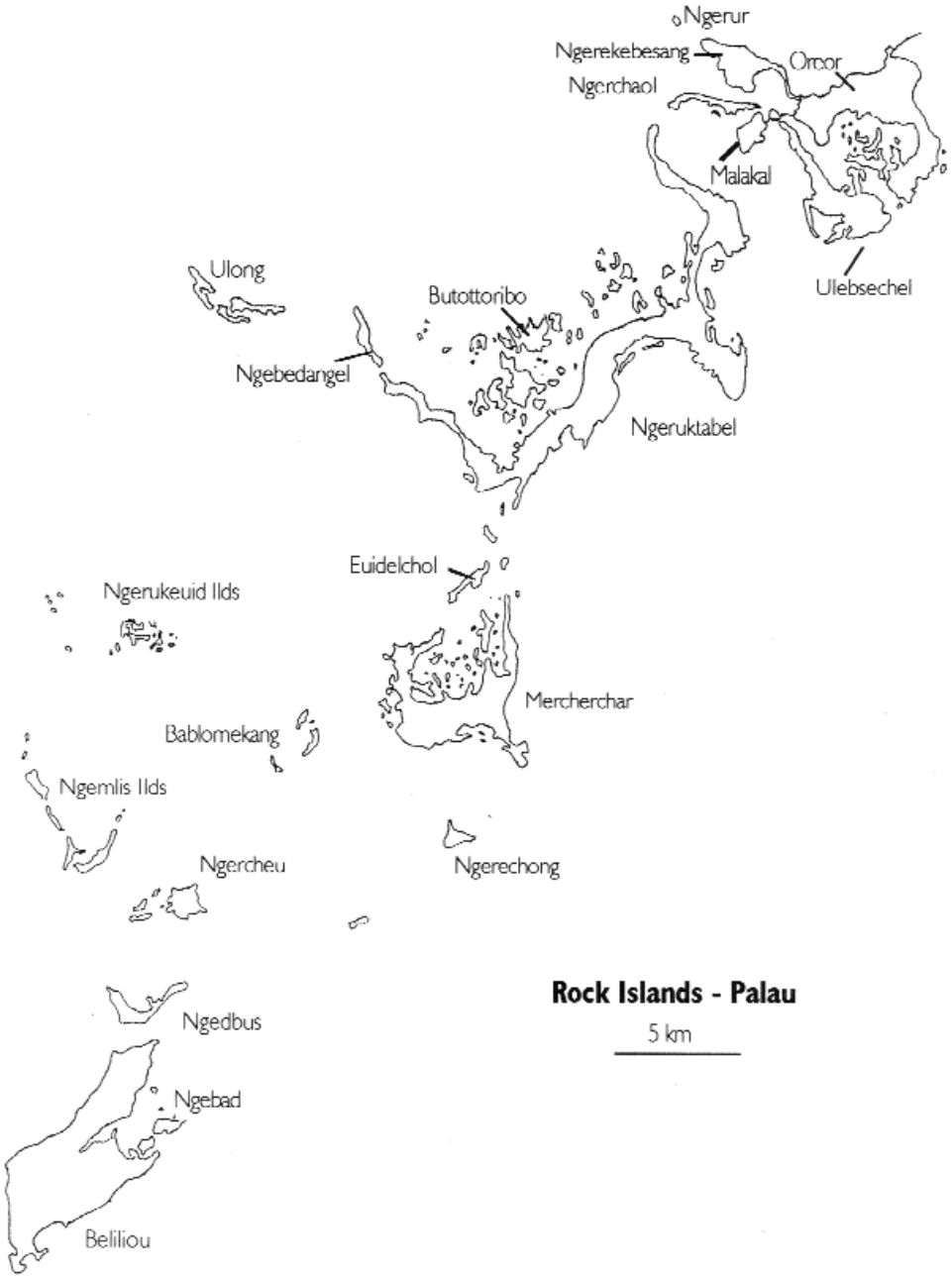

Figure 2. The Rock Islands of Palau (Belau). From Crombie & Pregill (1999)

Caves, sinkholes, overhangs, lava tubes and old beach ridges are the primary sources of vertebrate fossils on tropical islands in both cultural (archaeological) and non-cultural (paleontological; usually via avian predators) contexts (Pregill et al. 1994, Steadman 1995). Concentrating on the abundant limestone caves and solution features in Palau (surveyed by Rogers & Legge 1992), we investigated several hundred potential fossil sites throughout the islands. On each island we systematically searched for caves and rockshelters that might contain prehistoric bone deposits. Typically this involved hiking along the bases of cliffs, or at various levels across steep slopes. Much reconnaissance was done as well from boats, usually at a distance of only 10–40 m from an island. Each cave or rockshelter that we could access was inspected for sediments that might yield bones in a paleontological or archaeological context. In the few places where possibly suitable sediments were found, a small (0.5 x 0.5 to 1 x 1 m) test unit was excavated by trowel. Vertical control (measured as centimeter below surface, or cmbs) was maintained during these small excavations. All sediments were sieved through nested screens of 1/2", 1/4" and 1/16" to maximize retrieval of bones and artifacts. Upon completion, each test unit was marked and backfilled. Prehistoric pottery, recovered from three of the sites (Uleb-1, Uleb-7, Uleb-9), was deposited in the Palauan Department of Cultural Affairs. We did not test open archaeological sites near beaches. These sites are usually much larger in areal extent than those in caves and rockshelters, and require a larger field crew for proper testing.

Results

We discovered that most of the caves in Palau are too small to hold appreciable sediment, horizontal surfaces may be few or lacking, or dampness may render the sediments too organic, such that bone decays rather than being preserved. Undisturbed, dry cave sediment is the ideal environment for the preservation of vertebrate fossils, but it is extremely scarce in Palau. We encountered such conditions in less than five percent of the caves we investigated. We further discovered that Palau's paleontological potential had been seriously diminished by events of World War II. The best and most likely caves with potentially fossiliferous sediment were used by the Japanese military for more than a decade prior to the invasion of American forces in 1944 (Hough 1990, Ross 1991). Caves were used as storage facilities, communication stations, gun emplacements, command posts, and troop quarters. To make then functional for military occupation, the caves were excavated, their walls scraped and tunneled, and the floors were compacted or covered over. On the islands of Ngeaur and Beliliou (Peleliu) we frequently encountered the sad and disheartening evidence of wartime activities: rusted canteens and shell casings, gerry cans, broken saki bottles, melted glass, and occasionally human bone. Even caves on remote islands with no apparent strategic value were occupied and disturbed, such as on the steep, rugged and currently uninhabited island of Ngeruktabel.

Table 1. Stratigraphic bone summary from sites on Ngerduais Island (**Nger-**), Ulebsechel Island (**Uleb-**), and Ulong Island (**Ulon-**).

Nger-1 (small cave)

SURFACE	Total
Fish	12
Rattus sp.	10
Phaethon lepturus	1

Uleb-1 (cave at Lee Marvin Beach; 11m wide, 3m high, 4 m deep; elev. 10m)

UNIT 1 (50 X 70 cm)

	Level 1 (0–15 cmbs)	Level 2 (16–30 cmbs)	Level 3 (31–45 cmbs)	Total
Platymantis pelewensis	20	–	–	20
cf. *Candoia* sp.	1	–	–	1
Pteropus sp.	1	–	–	1
Rattus sp.	35	–	–	35
Phaethon lepturus	1	–	–	1
Anous stolidus	4	1	–	5
Gygis candida	1	–	–	1

UNIT 2 (55 X 80 cm)

Platymantis pelewensis	26	3	–	29
cf. *Gehyra* sp.	3	–	–	3
cf. *Candoia* sp.	2	–	–	2
Rattus sp.	26	2	–	28
Puffinus lherminieri	1	–	–	1

Uleb-2 (seaside cave 13m wide, 4m high, 2m deep; elev. 2m)

UNIT 1 (50 X 50 cm)

	Level 1 (0–12 cmbs)	Total
Fish	1	1
Rattus sp.	2	2
Puffinus lherminieri	1	1

Uleb-3 (seaside cave 5m wide, 3m high, 2m deep; elev. 3m)

UNIT 1 (70 X 70 cm)

	Level 1 (0–15 cmbs)	Level 2 (16–28 cmbs)	Total
Platymantis pelewensis	9	–	9
Scincidae	1	–	1
Dendrelaphis sp.	3	–	3
Candoia sp.	2	–	2
Rattus sp.	14	–	14
Puffinus lherminieri	3	–	3

Uleb-4 (seaside crevice 3m wide, 10m high, 15m deep; elev. 2m)
UNIT 1 (70 X 70 cm)

	Level 1 (0–15 cmbs)	Level 2 (16–30 cmbs)	Total
Fish	1	–	1
Platymantis pelewensis	3	–	3
cf. *Sterna sumatrana*	1	–	1

Uleb-5 (cave 60m inland, E of Uleb-2; 2m wide, 0.8m high, 20m deep; elev. 20m)
UNIT 1 (60 X 70 cm)

	Level 1 (0–15 cmbs)	Level 2 (16–22 cmbs)	Total
Dendrelaphis sp.	2	–	2
Rattus sp.	6	–	6

Uleb-6 (seaside cave 6m wide, 3m high, 2m deep; elev. 4m)
UNIT 1 (60 X 60 cm)

	Level 1 (0–15 cmbs)	Level 2 (16–26 cmbs)	Total
Platymantis pelewensis	4	–	4
Scincidae (*Eugongylus, Lamprolepis*)	1	–	1
Rattus sp.	11	–	11
Puffinus lherminieri	1	–	1
Phaethon lepturus	1	–	1

Uleb-7 (seaside crevice 7m wide, 5m high, 14m deep; elev. 5m)
UNITS 1, 2 (1.5 X 1 m)

	Level 1 (0–12/15 cmbs)	Level 2 (12/15–27/29 cmbs)	Level 3 (27/29–35/43cmbs)	Total
Fish	292	218	136	646
Platymantis pelewensis	3	–	–	3
cf. *Eugongylus*	–	–	1	1
Pteropus sp.	–	1	1	2
Rattus sp.	1	3	–	4
Puffinus lherminieri	28	8	1	37
Phaethon lepturus	4	1	2	7
Gygis candida	–	1	–	1

Uleb-8 (seaside cave 6m wide, 3m high, 5m deep; elev. 3m)
UNIT 1 (60 X 70 cm)

	Level 1 (0–15 cmbs)	Level 2 (16–23 cmbs)	Total
Fish	198	–	198
Rattus sp.	1	–	1
Phaethon lepturus	2	–	2

Uleb-9 (inland cave behind Lee Marvin Beach 6m wide, 5m high, 5m deep; elev. 4m)
UNIT 1 (60 X 70 m)

	Level 1 (0–15 cmbs)	Level 2 (16–30 cmbs)	Level 3 (31–38)	Total
Fish	153	87	–	240
Platymantis pelewensis	1	3	–	4
cf. *Suncus*	–	1	–	1
Rattus sp.	58	20	–	78
Phaethon lepturus	–	1	–	1

Ulon-1 (inland rock shelter 6m wide, 2m high, 0.8 deep; elev. 30 m)
UNIT 1 (80 X 20 cm)

	Level 1 (0–5 cmbs)	Total
Fish	4	4
Pteropus sp.	8	8
Rattus sp.	49	49
Phaethon lepturus	4	4
Anous stolidus	1	1
Megapodius laperouse	4	4
Gallicolumba canifrons	1	1

Brief classification for vertebrates listed in Table 1.

FISH
- Osteichthyes sp. – Boney fish

FROGS
- Bufonidae
  - *Bufo marinus*–Cane Toad
- Ranidae
  - *Platymantis pelewensis*–Palau frog

LIZARDS
- Gekkonidae
  - *Gehyra* sp.–unidentified Gecko
- Scincidae
  - *Eugongylus* sp.–Ground skink
  - *Lamprolepis (smaragdina)*–Green tree skink

SNAKES
- Boidae
  - *Candoia* cf. *C. carinata*–Pacific Boa
- Colubridae
  - *Dendrelaphis* sp.–Ground snake

MAMMALS
- Chiroptera–Bats
  - Pteropodidae
    - *Pteropus* sp.–Flying fox
- Insectivora
  - Soricidae
    - cf. *Suncus* sp.–Shrew
- Rodentia
  - Muridae
    - *Rattus* sp.–Rat

BIRDS
- Procellariiformes
  - Procellariidae
    - *Puffinus lherminieri*–Audubon's Shearwater
- Pelicaniformes
  - Phaethontidae
  - *Phaethon lepturus*–White-tailed Tropicbird
- Charadriiformes
  - Sterninae
    - cf. *Sterna sumatrana*–Black-naped Tern
    - *Anous stolidus*–Brown Noddy
    - *Gygis candida*–Common Fairy Tern
- Galliformes
  - Megapodiidae
    - *Megapodius laperouse*–Micronesian Megapode
- Columbiformes
  - Columbidae
    - *Gallicolumba canifrons*–Palau Ground-Dove

Despite the destruction of most potential paleontological sites in Palau, we did locate several minor bone deposits. None of these sites is stratified. The sediments consist of brownish-orange to orange-yellow uncompacted silts and clayey silts. Based on our experience with well-dated archaeological and paleontological sites in caves and rockshelters elsewhere in Oceania (e.g., Steadman 1993, 1999), we believe that the ages of bones recovered are most likely measured in decades or centuries rather than millennia. These limited faunal assemblages (Table 1) include no vertebrate taxa that do not still occur in Palau today.

The following is a summary of the principle cave localities that we identified, by island, north to south. We use the term "rocky" to mean that the floor of the cave or rockshelter was dominated by boulders and cobbles rather than sand, silt, or clay. The few sites that yielded bones are indicated with an asterisk (*).

BABELDAOB

This populated island is the largest in Palau. It is almost entirely volcanic, and limestone is limited to a narrow section of the northeast coast, and to small islands around the south coast. One of these, Ngerduais*, is a small (144 ha) limestone island connected to Babeldaob by extensive mangrove swamps. Numerous small caves and overhangs surround a large, overgrown cultural site in the middle of the island. The sediment is damp, organic and rocky. Some surface bone was recovered at a single site, Nger-1. (14 Jan 1997)

KOROR (OREOR)

This heavily populated island is the center of Palau's commercial activity. Koror's high limestone outcrops consist of 1) a 1.5 km, N-S trending ridge that defines the northeast margin of the island, identified as Sngall on USGS Topographic maps; 2) a wide, 3-4 km arc, Ngermeuangel Ridge, that sweeps SSE from Sngall and is accessible only by boat.

Sngall:

1. Three vertical fissures are formed in a ridge on the side of the main road, 1 km N of Etpison Mansion. The fissures are narrow, about 3–4 m deep, and the bottoms are littered with tin sheeting and trash. There is no appreciable sediment. (23 Jun 1994)
2. Six overhangs and bunkers on Etpison Mansion road; all are rocky with no sediment. (13 Jun 1994)
3. One overhang, one fissure, three Japanese caves located approximately .25–.5 km E of Etpison Mansion; none had workable sediment. (13 Jun 1994)

Ngermeuangel Ridge:

1. Extreme W end at *Mother and Child Turned to Stone* (a natural rock feature): one overhang, two A-frame caves (Japanese occupied); none with workable sediment. (11 Jan 1997)
2. S end at Gobi Lake, one cave; sediment tested (60 x 60 x 20 cm) with trowel and screens but no bone was found. (17 Jun 1994)

3. S end at Flatworm Lake (1 km NE Gobi Lake), one sinkhole; no sediment. (18 Jun 1994)

MALAKAL

This small, inhabited island adjacent to Koror supports the Port of Palau and other commercial activity. It is heavily disturbed and connected to Koror by a causeway.

1. One roadside bunker reinforced by concrete, 100 m N of turn-off to Radio Tower Rd.; no sediment. (25 Jun 1994)
2. Tunnels and bunkers on hillside above the Coral Reef Research Foundation; no sediment.

NGERMALK

This is a small, uninhabited island opposite Malakal, facing the Palau docks.

1. A large cave inset on the cliff about 15 m above sea level faces the harbor. This cave consists of four levels, the lower two reinforced with concrete and modified for artillery mounts. A bat colony (*Emballonura* sp.) occupies the upper level. Sediment from the lower level was tested (70 x 70 x 25 cm) with trowel and screens but unfossiliferous. (23 Jun 1994)
2. A smaller cave ca. 200 m E of the above; no sediment. (23 Jun 1994)

NGEREKEBESANG

This densely populated volcanic island is connected to Koror by a causeway.

1. Three low, tubular caves along the driveway leading to the Carolines Resort; standing water in one; all modified as bunkers by Japanese. (12 Jun 1994)
2. Hillside cave formed by large boulders above concrete cistern; located near the end of main road, 0.5 km E of the Palau Pacific Resort; no appreciable sediment. (19 Jan 1993)
3. Roadside bunker on road to hamlet of Echang; damp, no sediment. (Jun 1994)

ULEBSECHEL

This large, uninhabited Rock Island, like practically all of the limestone islands of the Palau lagoon, is undercut by solution notches that form overhangs from1–5 m deep. We surveyed parts of this island intensively in January 1995.

*1. Numerous small caves and overhangs (sites Uleb-2 to Uleb-8) were located in the cliffs defining the large bay (Risong) on the SW coast. These features were found by cruising along the cliff edges by boat. Most caves and overhangs are located 2–4 m above high tide with openings facing the water. Nine caves were tested, including one cathedral-like cave (Uleb-7) from which we excavated and screened ca. 0.75 m^3 (1.5 x 1 x 0.5 m) of relatively dry sediment.

*2. Three sinkholes (one screened), two caves with prehistoric pottery (Uleb-1, Uleb-9; screened) at Lee Marvin Beach located on the S shore of Ulebsechel.
3. A large, open cultural site with prehistoric pottery on the surface occupies the landward portion of Lee Marvin Beach; not tested.
4. Five overhangs at Hemipene Point; no sediment.

NGERUKTABEL

This is the largest and highest of the Rock Islands. It is uninhabited now, but was extensively occupied by the Japanese during WWII.

1. Three sites at Tee Lake at the NW end of Ngeruktabel; an overhang in the saddle NW of the lake; two sinkholes 150 m N of saddle. All are rocky and no appreciable sediment was found. (28 Jun 1994)
2. Two sites at the end of the southern peninsula at a small cove along the E coast. 1) a shallow, ground level cave indicated on USGS Topo map; 2) a small cave at NW side of Mekald Lake; both were rocky and without sediment. (21 Jun 1994)
3. Southern peninsula, above landing on stone road to German lighthouse: a large overhang, Japanese occupied, and with no sediment; large cave W of garrison ruins near ridge top, Japanese occupied, no sediment. (14 Jan 1997)

ULONG

Layered rather than massive limestone characterizes this small, uninhabited island in the central lagoon. No large caves were located other than burial caves at the west end, which we left undisturbed. * Ca. 8 liters of sediment (80 x 20 x 5 cm) were excavated and seived from the ledge of a shallow overhang, known as Ulon-1. (16 Jan 1995)

NGEMELIS ISLANDS

We explored four (Ngis, Dmasech, Iilblau, Bailechesengel) of these uninhabited, relatively small Rock Islands, which are too low to have major cave systems.

1. Two large, open cultural sites with prehistoric pottery on the surface were identified on sandy, inland soil on Dmasech and Iilblau, but were not tested. (12 Jan 1997)

BELILIOU

The inhabited island of Beliliou (Peleliu) received more damage from World War II than any other island in Palau. It was the site of one of the war's bloodiest battles in the Pacific (Hough 1990, Ross 1991). When American military assaulted Beliliou in September 1944, Japanese forces were well-entrenched in the vast network of caves in the Umurbrogol Mountains, the spine of limestone ridges trending NE to SW in the central part of the island. Over the next six months U.S. forces systematically burned the island to expose cave entrances.

Artillery hits were followed by mechanized equipment to demolish and seal off entrances, entombing any Japanese soldiers who did not surrender (very few did). To illustrate, the following quote is excerpted from an undated, declassified report by the U.S. military that we obtained from a Beliliou resident:

> "In order to take these caves we were first required to fight to their entrances. Portable flame-throwers cleared "A" and "B", demolitions sealed both entrances to "B" and the entrance to "C". Later, a few Japs dug out of them and gasoline was poured into "A" and into both tunnels, with good effect."

Because Beliliou contains some of the most extensive caves systems in all of Palau, we explored the island in 1993 and in 1995 hoping to find fossil sites that had been unsuitable for military purposes, and thus may have been spared the war's devastation. We found none. This is particularly unfortunate because Beliliou is by far the most cave-rich island in Palau and, if not for wartime activities, almost certainly would have yielded an important record of prehistoric vertebrates.

NGEAUR (ANGUAR)

The raised limestone of Ngeaur is located in the central and NW sections of this inhabited island. We searched for sites during February 1993.

1. Six caves and sinkholes were explored in the vicinity of the old mining machinery, ca. 2 kms N of Saipan Jetty; all were damp and rocky.
2. One cave 25 m E of the Japanese Memorial, NW Ngeaur; filled with rock and rubble.
3. Three sinkholes 100 m S of the Japanese Memorial, the southernmost being the largest; damp, rocky floor.
4. Seven caves and overhangs in a large, circular escarpment N of interior lake; heavily bombed and with considerable WWII litter.
5. Cultural site SW of interior lake, ca. 1 km S of Japanese Memorial; fish bones.
6. Bat cave in central part of the island; this is a very large *Emballonura* roost but damp, rocky and organic.

Discussion

None of the sites listed in Table 1 is likely to be more than late prehistoric in age, i.e., less than 1000 years old. The fauna recovered from these sites does not include any taxa not now present in Palau, nor is there any evidence of local extinction. *Rattus* spp. (*exulans, norvegicus, rattus*–all introduced by humans) was present in several sites. The discovery phase for Palau's prehistoric vertebrates is not over, and we note as well that the published prehistoric archaeology of Palau is also in the beginning stages of exploration. Most archaeological sur-

vey and excavation in Palau has been conducted on Babeldaob (Osborne 1966, 1979, Gumerman et. al. 1981) and Koror (Snyder 1985). These pioneering efforts have yielded very little information on terrestrial vertebrates.

Palau is an important zoogeographic crossroads, with faunal influences from the Philippines, New Guinea, the Moluccas, and Borneo. The Greater Papuan influence appears to be especially strong among the herpetofauna (Crombie & Pregill 1999). Nevertheless, Palau remains enigmatic in numerous ways, as much for the taxa that do not occur there as those that do. Holocene extinction might explain some of the absences, as it has on other Pacific islands (Steadman 1995). Likewise several peculiar disjunct and restricted distributions within Palau might also be a result of Holocene extinction in intervening areas, as is the case for a number of lizards and birds in the nearby Mariana Islands (Pregill 1998, Steadman 1999) or in Polynesia (Olson & James 1991, Steadman 1995).

It will be a challenge to develop a rich record of prehistoric vertebrates in Palau for at least four reasons: 1) the destruction of most caves and rockshelters associated with World War II; 2) the very rocky, non-horizontal floors of most caves and rockshelters that render them nonconducive to deposition of fine-grained sediments; 3) the very damp microclimates within the caves that promote decay rather than preservation of bones; and 4) the probability that any productive sites would be located only in areas of extremely difficult access, given our intensive reconnaissance (by boat and on foot) and the much more extensive search for caves during World War II. Palau's most promising potential source of high-quality data on prehistoric terrestrial vertebrates are archaeological sites in calcarious sands behind beaches. These sites, such as the ones we noted on Ulebsechel and Ngemelis, deserve protection and eventually should be sampled archaeologically.

Despite our failure to locate rich fossil sites in Palau, this result itself deserves emphasis. Just as human settlement on Pacific islands contributed significantly to habitat and faunal losses (Kirch & Hunt 1997), paleontological and archaeological resources also are not immune to destruction through human agency, as the situation on Beliliou dramatically testifies. The difference is that destruction of prehistoric sites has occurred primarily late in the historic period, and we believe that it will only continue. For Palau, time is of the essence. Growing economic interests may damage or destroy prehistoric sites through construction projects, and probably will adversely affect the native fauna as well. The human population is projected to double in 5-10 years (Cassell et. al. 1992), and at least one major road is being built to the northern end of Babeldaob where none presently exists. Run-off and siltation of some Babeldaob water courses is already evident, and mature forest is being cleared. Tourism is burgeoning, and numerous hotels are planned or being built in Koror, southern and eastern Babeldaob, Malakal, and on the Rock Islands. The government of Palau has proudly and justifiably promoted its marine resources as a tourist attraction. We hope that this does not come to the detriment of its terrestrial ecosystems and what little may be left of its paleontological resources.

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