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Extinct and Extirpated Birds from Rota, Mariana Islands

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Abstract—Twenty-one species of birds were recovered from preliminary excavations in 1990 at a late Holocene bone deposit in Payapai Cave, Rota, Commonwealth of the Northern Mariana Islands. Twelve of these species are extinct or extirpated on Rota. Three of these (Audubon's Shearwater, *Puffinus lherminieri*; Micronesian Megapode, *Megapodius laperouse*; Island Swiftlet, *Collocalia vanikorensis*) are known from Rota in the 19th or 20th century. Two others (White-browed Crake, *Poliolimnas cinereus*; Guam Flycatcher, *Myiagra* cf. *freycineti*) are previously unknown on Rota but have been recorded on Guam. Three species (Blue-gray Noddy, *Procelsterna cerulea*; swamphen?, *Porphyrio*? sp.; Micronesian Pigeon, *Ducula oceanica*) have not been recorded previously from the Mariana Islands but still occur elsewhere in Micronesia. Four species are extinct and undescribed (a small, perhaps flightless duck, Anatidae new sp.; giant ground-dove, *Gallicolumba* new sp.; large parrot, Psittacidae new sp.; large parrotfinch, *Erythrura* new sp.). An unnamed cave on Rota yielded a single bone of the Common Moorhen, *Gallinula chloropus*, also extirpated on Rota. Although more bones are needed to refine certain identifications and describe new species, the preliminary results from Rota indicate that great losses of birds occurred in the Mariana Islands during the past few millennia. Probably the same is true throughout Micronesia, where the prehistoric record of birds, confined thus far to Rota, is much more limited than in Polynesia.

Introduction

Many individual populations and entire species of Micronesian and Polynesian birds have been lost because of human impact during the past century (Engbring & Pratt 1985, King 1985, Pratt et al. 1987, Collar & Andrew 1988, Reichel & Glass 1991). Recent studies have shown that the Polynesian islands experienced numerous extinctions in prehistoric times as well (Steadman 1989). Thus, significant pre-European losses of birds also might have occurred in Micronesia. However, the only evidence of such is a report of the Common Moorhen, *Gallinula chloropus*, from the Unginao-Uyulan archaeological site on the northern coast of Rota, CNMI, where the species now is absent (Becker & Butler 1988). The three bones of *G. chloropus* from Unginao-Uyulan were bracketed by strata

radiocarbon dated (on wood charcoal) at 1,350 ± 50 yr BP and 1,920 ± 100 yr BP, respectively.

To develop a prehistoric record of Micronesian birds, I surveyed caves for bone deposits on the island of Rota from 27 January to 6 February 1990. This paper summarizes the results of my preliminary survey, which was done in part to provide biogeographic justification for translocation of the Guam Rail (*Gallirallus owstoni*) to Rota, where rails are unknown historically (see Witteman et al. 1991). Additional details of the osteology, systematics, biogeography, and paleoecology of Rota's prehistoric birds await further field work. Here I will document the numerous new records of birds uncovered during the initial excavation.

Study Area & Methods

Most of Rota's many caves were damaged heavily during the World War II Japanese occupation of the island. The caves, most of which face the sea, were fortified as gun implacements and human shelters. As a result, potentially fossiliferous sediments were either removed, mixed, or crushed, eliminating their scientific value. An exception was Payapai Cave (sometimes called Alaguan Cave), which contained by far the largest prehistoric bone deposit that I found on Rota. Payapai Cave is located in a coralline limestone cliff (uplifted marine terrace) about 150 m from the island's southern shore, at 14°8′N, 145°13′E. It is much larger than most caves on Rota, with an entrance about 25 m high and 25 m wide. Aside from Payapai Cave, I located three smaller, unnamed caves that yielded much less significant vertebrate faunas.

Unless stated otherwise, the modern distribution and status of Micronesian birds were taken from Baker (1951), Engbring & Pratt (1985), Pyle & Engbring (1985), Pratt et al. (1987), Engbring (1988), Glass et al. (1990), Reichel (1991), and Reichel & Glass (1991). The current status of extant species on Rota was taken from Engbring et al. (1986), supplemented by my observations in 1990. Nomenclature is that of Pratt et al. (1987) and Reichel & Glass (1991) except for three generic names: following Olson (1973) and Steadman (1987), I recognize *Gallirallus* rather than *Rallus* for *G. owstoni*, and *Poliolimnas* rather than *Porzana* for *P. cinereus*; I use *Collocalia* rather than *Aerodramus* for *C. vanikorensis* because of simple priority (*Collocalia* G. R. Gray 1840 versus *Aerodramus* Oberholser 1906; see Peters 1940:220). The bones from Rota have been catalogued in the Department of Paleobiology, National Museum of Natural History, Smithsonian Institution (USNM). Identifications were based upon comparisons with modern skeletons from USNM, American Museum of Natural History, New York State Museum, and University of Washington Burke Museum. All excavated sediment was sieved through screens of ½″, ¼″, and 1/16″ mesh.

Results

STRATIGRAPHY AND CHRONOLOGY

Caves 1–3 are near Rota's southernmost point, just inland from the main road through Puntan Poña. Cave 1, visited on 31 January 1990, is a shallow (up

to 4 m inside the dripline) shelter where a 0.5 × 1.0 m test pit in poorly stratified, dark, organic sediment reached bedrock at depths of 38–45 cm. Caves 2 and 3, visited on 2 February 1990, are also shallow (up to 2 m inside the dripline). A 0.5 × 1.0 m test pit in each revealed poorly stratified, dark, organic sediment up to 25 cm in depth.

On 3–6 February 1991, I excavated two small, adjoining test pits (TP1, TP2, Figure 1) in the very dry, powdery sediment about 30 m within Payapai Cave. The stratigraphic sequences of TP1 and TP2 are similar, each consisting of three distinct strata designated as Layers I, II, and III (Figure 2). Layer I (4–12 cm thick in TP1, 8–13 cm thick in TP2) is a light grayish brown sandy, slightly

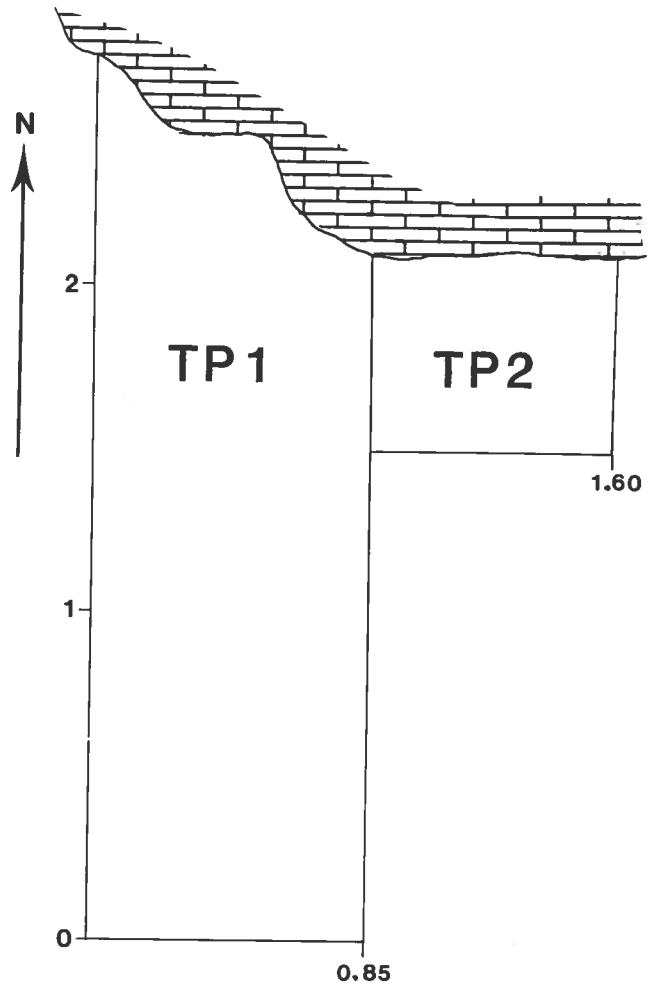

Figure 1. Plan view of the two test pits (TP1, TP2) excavated along the north wall, Payapai Cave, Rota. See Figure 2 for stratigraphic profile of west wall of TP1. All measurements are in meters.

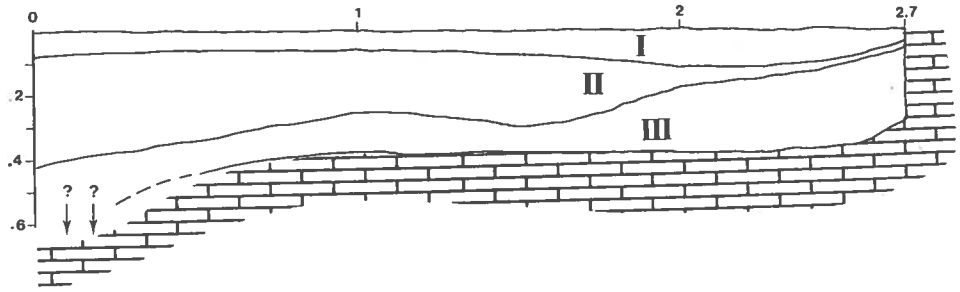

Figure 2. Stratigraphic profile of west wall of TP1, Payapai Cave, Rota. See text for description of Layers I–III. All measurements are in meters.

pebbly, slightly cobbly silt. Layer II (2–35 cm thick in TP1, 6–20 cm thick in TP2) is a very dense concentration of wood charcoal, ash, and silt, with few pebbles and no cobbles. Layer III (18–50+ cm thick in TP1, 4–24 cm thick in TP2) is a yellowish orange slightly sandy, very pebbly, very cobbly silt. The calcite and gypsum clasts are more angular in Layer III than in Layer I.

From the base of Layer II in TP2, 12 grams of wood charcoal yielded a single radiocarbon date of 930 ± 70 yr BP (Beta-36074; corrected for C^{13}/C^{12} of −27.3 ‰). Charcoal was extremely scarce in Layers I and III, and in both cases may have been intrusive from Layer II. The only other potentially datable organic remains were bones and small fragments of plants in Layer I, and bones only in Layer III.

FAUNA

Bones of the following species were recovered from unnamed caves 1–3. Cave 1: fish, Osteichthyes sp. (2 bones); introduced marine toad, *Bufo marinus* (9); introduced undetermined rat, *Rattus* sp. (10); Common Moorhen, *Gallinula chloropus* (1). Cave 2: gecko, Gekkonidae sp. (1); Micronesian Starling, *Aplonis opaca* (2). Cave 3: fish, Osteichthyes sp. (1); introduced marine toad, *Bufo marinus* (1); gecko, Gekkonidae sp. (1); introduced undetermined rat, *Rattus* sp. (2); undetermined fruit bat, *Pteropus* sp. (1); Micronesian Starling, *Aplonis opaca* (1).

Payapai Cave yielded bones of fish, reptiles, mammals and, primarily, birds (Table 1). The fish bones consist only of a few specimens from very small species, most likely deposited in the cave by piscivorous birds, such as shearwaters, tropicbirds, terns, or herons, all of which occur commonly in the bone deposit. The bones of reptiles represent at least two species of lizards (a gecko, Gekkonidae sp.; and a small skink, Scincidae sp.). The most common mammal is the sheath-tailed bat, *Emballonura semicaudata*, a species lost from Rota, probably in the late 1960s (Lemke 1986). The second most abundant mammal is an undetermined fruit bat or flying fox, *Pteropus* sp. Although the specimens likely represent the Marianas Fruit Bat, *P. mariannus*, which still survives on Rota (Wiles et al. 1989), I have not confirmed this by direct comparison. Thus I cannot rule out that some or all of the bones may not be from *P. tokudae*, a smaller species extinct

Table 1. Vertebrates other than birds recovered from preliminary excavations at Payapai Cave, Rota, Commonwealth of the Northern Mariana Islands, February 1990.

Species	Status	Level					Total
		Surface	I	II	III	Mixed	
Osteichthyes sp. Unknown small fish	X?	—	7	—	3	—	10
Gekkonidae sp. Unknown gecko	X?	—	11	1	34	17	63
Scincidae sp. Unknown small skink	X?	—	1	—	—	3	4
Emballonura semicaudata Sheath-tailed Bat	E	2	4	1	25	11	43
Pteropus sp. Unknown fruit bat	X?	—	3	3	10	3	19
Rattus sp. Unknown rat	X	—	4	1	—	1	6
Totals		2	30	6	72	35	145

Numbers represent identified bones. E = extirpated on Rota. X = still occurs on Rota. Levels: Surface = surface of cave floor; I, II, III, Mixed = stratigraphic layers (see text for details).

on Guam, the only island where it ever was recorded (Wiles 1987). From 1975 to 1981, 400 to 1,900 individuals of *P. mariannus* were exported each year from Rota to Guam for human consumption (Wiles & Payne 1986), contributing to its current scarcity. The few bones of *Rattus* sp. have not been compared to skeletons of the Pacific rat, *R. exulans*, or the black rat, *R. rattus*, which is abundant on Rota today. Rats (species undetermined) were common on Rota as early as AD 1602 (Driver 1989:12).

The 316 identifiable bird bones recovered from Payapai Cave represent 21 species (Table 2), of which five are seabirds and 16 are landbirds. By far the most common species throughout the deposit is the extant Micronesian Starling, *Aplonis opaca*, which still nests on small ledges in well lighted parts of the cave's roof. Other species that currently nest or roost in the cave are the White-tailed Tropicbird *Phaethon lepturus*, White Tern or Common Fairy-Tern *Gygis alba*, and Pacific Reef-Heron *Egretta sacra*, each of which also is well represented in the deposit (including bones of juveniles), particularly on the surface and in Layer I. As indicated by both bones and guano, Payapai Cave also had been occupied formerly by Island Swiftlets (*Collocalia vanikorensis*) and Sheath-tailed Bats (*Emballonura semicaudata*), both of which died out on Rota in recent decades (Pratt et al. 1979, Engbring et al. 1986, Lemke 1986, E. Taisacan, pers. comm.).

Twelve of the 21 species of birds recorded from Payapai Cave no longer occur on Rota. One bone of an additional extirpated species, *Gallinula chloropus* (Common Moorhen), was recovered elsewhere (Cave 1). The 13 species of birds no longer on Rota fall into four categories, as follows.

Table 2. Species of birds recovered from preliminary excavations at Payapai Cave, Rota, Commonwealth of the Northern Mariana Islands, February 1990.

		Level					
Seabirds	Status	Surface	I	II	III	Mixed	Total
Puffinus lherminieri Audubon's Shearwater	E	—	8	6	28	4	46
Phaethon rubricauda Red-tailed Tropicbird	X	1	—	—	—	—	1
Phaethon lepturus White-tailed Tropicbird	X	41	12	—	1	5	59
Procelsterna cerulea Blue-gray Noddy	E	—	—	1	13	2	16
Gygis alba Common Fairy-Tern	X	1	3	—	—	—	4
Landbirds							
Egretta sacra Pacific Reef-Heron	X	4	7	2	—	3	16
*Anatidae new sp. Rota Duck	E	—	—	1	—	—	1
Megapodius laperouse Micronesian Megapode	E	—	1	1	8	—	10
Poliolimnas cinereus White-browed Crake	E	—	—	1	1	—	2
cf. *Porphyrio*? sp. Swamphen?	E	—	—	—	—	1#	1
Gallicolumba xanthonura White-throated Ground-Dove	X	—	2	2	8	4	16
**Gallicolumba* new sp. Extinct Giant Ground-Dove	E	—	—	—	2	1	3
Ptilinopus roseicapilla Mariana Fruit-Dove	X	—	1	1	8	—	10
Ducula oceanica Micronesian Pigeon	E	—	1	—	—	—	1
*Psittacidae new sp. Extinct Parrot	E	—	—	1	—	—	1
Collocalia vanikorensis Island Swiftlet	E	—	1	—	1	—	2
Aplonis opaca Micronesian Starling	X	—	29	5	72	16	122
Zosterops conspicillatus Bridled White-Eye	X	—	1	—	—	—	1

Table 2. Continued.

Seabirds	Status	Level					Total
		Surface	I	II	III	Mixed	
Erythrura new sp. Extinct Parrot-Finch	E	—	—	—	1	—	1
Myiagra cf. *freycineti* Guam Flycatcher	E	—	—	—	2	—	2
Myzomela rubrata Micronesian Honeyeater	X	—	—	—	1	—	1
Totals: Bones		47	66	21	146	36	316
Species (E + X)		4	11	10	13	8	21
Species (E only)		0	4	6	8	4	12
% E		0	36	60	62	50	57

Numbers represent identified bones. E = extirpated or extinct on Rota. X = still occurs on Rota. Levels: Surface = surface of cave floor. Mix = mixed layers. I, II, III = stratigraphic layers (see text for details). * = extinct species. # = specimen cemented on wall. Total species (all layers combined): Seabirds (E + X) 5; Seabirds (E) 2; Landbirds (E + X) 16; Landbirds (E) 10; All birds (E + X) 21; All birds (E) 12.

1. Known historically on Rota: Audubon's Shearwater, *Puffinus lherminieri*; Micronesian Megapode, *Megapodius laperouse*; and Island Swiftlet, *Collocalia vanikorensis*. The shearwater had been known on Rota only from a specimen taken in July 1888 by A. Marche (Oustalet 1896:56; Baker 1951:68; Reichel & Glass 1991:4). No populations of *P. lherminieri* are known to survive in the Marianas. The megapode apparently died out on Rota early this century (Pratt & Bruner 1978), the only certain record being a specimen collected by Marche in 1888 (Oustalet 1896:27; Baker 1951:111). A single juvenile megapode may have been seen on Rota in 1985 (Wiles et al. 1987), although indigenous people are known to transport megapode eggs between islands (Engbring et al. 1986). Megapodes once occurred throughout the Marianas. They have been extirpated on Guam, Rota, and perhaps Tinian. The swiftlet was last observed on Rota in 1976, at Payapai Cave and other localities (Pratt et al. 1979, Engbring et al. 1986). Within the Marianas, swiftlets survive in small to moderate numbers on Guam, Aguijan, and Saipan.

2. Previously unknown on Rota but recorded elsewhere in the Mariana Islands: White-browed Crake, *Poliolimnas cinereus*; Common Moorhen, *Gallinula chloropus*; and Guam Flycatcher, *Myiagra* cf. *freycineti*. Recorded in the Marianas only on Guam (Baker 1951), the crake probably was gone from Guam by the 1950s or early 1960s. The moorhen has been recorded from Guam, Saipan, Tinian, and Pagan, surviving on all except Pagan (Stinson et al. 1991). Both the crake and moorhen prefer freshwater wetlands, which no longer are present on Rota.

The flycatcher is represented by a humerus (USNM 453471) and ulna (USNM 436625). USNM 453471 agrees with the humerus in *Myiagra* rather than in *Monarcha*, *Rhipidura*, or any other regional monarchine in the distinctive shapes of the caput humeri and both fossae pneumotricitalis, as well as in the slender shaft. USNM 453471 is qualitatively inseparable from the humerus in *Myiagra oceanica pluto* from Pohnpei, but is smaller (total length 16.0 mm compared to 17.3 mm in *M. pluto*). This size difference in bones is roughly proportional to that in wing measurements (65–73 mm in *M. freycineti*, 78–84 mm in *M. pluto*; Baker 1951:276). Humeral lengths of other *Myiagra* are 14.3–15.0 mm (n = 10) in *M. caledonica caledonica* from New Caledonia and 15.2–16.0 mm (n = 5) in *M. galeata* from Halmahera, Northern Moluccas. Skeletons are not available for populations of *Myiagra* from Belau, Chuuk, or Guam. Like the humerus, the ulna from Payapai Cave is inseparable from that in *M. pluto* except for being slightly smaller. *Myiagra freycineti* became extinct in about 1985. Classified as a subspecies of *M. oceanica* by Baker (1951:277) but generally recognized as a full species today (Pratt et al. 1987), *M. freycineti* was known only from Guam, where it had been regarded as endemic.

3. Not recorded previously from the Mariana Islands but still occurring elsewhere in Micronesia: Blue-gray Noddy, *Procelsterna cerulea*; swamphen?, *Porphyrio*? sp.; and Micronesian Pigeon, *Ducula oceanica*. The nearest population of Blue-gray Noddies is on Bikar in the Marshall Islands, 2,700 km east of Rota. The record from Rota, and an unconfirmed sight record from the Andaman Sea off Thailand (Taylor 1989), suggest a much greater range for *Procelsterna* in the past. The probable swamphen from Payapai Cave is based only on a single proximal end of a radius (USNM 453552), and thus its identification must be regarded as tentative. The nearest and only other Micronesian record of a swamphen is the small Palauan population of Purple Swamphen, *Porphyrio porphyrio pelewensis* (Engbring & Pratt 1985). The Micronesian Pigeon occurs through much of Micronesia (Belau, Yap, Chuuk, Pohnpei, Kosrae, Marshalls), although certain populations are candidates for endangered status (Engbring & Pratt 1985). Baker (1951:198) noted the conspicuous absence of large pigeons in the Marianas. The bones of *Ducula oceanica* and *Gallicolumba* new sp. from Payapai Cave indicate that this absence is a recent event.

4. Extinct and undescribed species (a small, perhaps flightless duck, Anatidae new sp.; giant ground-dove, *Gallicolumba* new sp.; large parrot, Psittacidae new sp.; and large parrotfinch, *Erythrura* new sp.). Additional material is desired for each of these species before they can be named and described properly. Nevertheless, some preliminary remarks are warranted.

The undescribed duck is represented by a single juvenile coracoid (USNM 436620). This unusual specimen agrees with the coracoid of flightless Hawaiian anatids (the "moa-nalo's"; see Olson & James 1991) and very juvenile volant anatids, rather than those of flightless rails, in the extent of concavity of dorsal surface, extent of convexity of ventral surface, great amount of widening toward sternal end, reduced development of the procoracoid region, great reduction in size of entire humeral end, and orientation of cotyla scapularis (facing nearly

perpendicular to, rather than nearly parallel to, the long axis of the bone). USNM 436620 is much smaller than the coracoid in any of the Hawaiian species. Although generic relationships are difficult to discern in this single specimen, dabbling ducks (*Anas* spp.) should be examined closely when more material is available. During the 20th century, at least 11 species of *Anas* have been recorded in the Mariana Islands, mainly as migrants (Reichel & Glass 1991). Outside of the New Zealand region (Worthy 1988, Livezey 1989) and Hawaii (Olson & James 1991), flightless or nearly flightless ducks are unknown in the Pacific. The flying abilities of the extinct whistling duck (cf. *Dendrocygna* new sp.) from Aitutaki, Cook Islands is undetermined (Steadman 1991).

The giant ground-dove, *Gallicolumba* new sp., is represented by a mandible, tarsometatarsus, and pedal phalanx (USNM 436623, 436660, 436588). It is most similar in size and other features to the largest species in the genus, *Gallicolumba* new sp. from East Polynesia (Steadman in press).

The large parrot, Psittacidae new sp., is represented by a tibiotarsus (USNM 436602) roughly the size and shape of that in the Palm Cockatoo *Probosciger aterrimus* (New Guinea, Australia), Pink Cockatoo *Cacatua leadbeateri* (Australia), or Eclectus Parrot *Eclectus roratus* (Lesser Sundas, Moluccas, Bismarcks, Solomons, New Guinea, Australia; introduced to Belau this century). USNM 436602 agrees with *Eclectus* and disagrees with *Probosciger* and *Cacatua* in having a more distinct impressio ligamentum collateralis medialis and a more distinct diagonal muscle scar running distad from crista fibularis on the caudal surface of the shaft. More specimens of this large parrot are needed to determine unequivocally if it is referable to *Eclectus*. If so, it is unlikely to represent *E. roratus* (the only extant species in the genus) because of its slightly larger size and the different angle of the diagonal muscle scar on the caudal surface of the shaft.

The extinct parrotfinch, *Erythrura* new sp., is represented by a single complete humerus (USNM 436622) that is referred to *Erythrura* rather than other passerine genera of the region (*Cleptornis*, *Rukia*, *Zosterops*, *Coracina*, *Lalage*, *Acrocephalus*, *Myiagra*, *Monarcha*, *Rhipidura*, *Myzomela*, *Foulehaio*, *Aplonis*, *Artamus*, *Hirundo*) because of these characters: unique width, depth, and overall shape and position of both fossae pneumotricipitalis; stout shaft; size and shape of margo caudalis; in cranio-ventral aspect, concave silhouette of area between caput humeri and tuberculum dorsale; and more bilaterally symmetrical distal surface of condylus ventralis. USNM 436622 is larger than in any congeners, with a total length of 16.3 mm compared to 12.9–13.8 mm (n = 2) in *E. trichroa*, 14.2 mm (n = 1) in *E. cyaneovirens pealei*, 13.8–14.5 mm (n = 4) in *E. psittacea*, from New Caledonia, 13.0–13.8 mm (n = 4) in captive *E. psittacea*, and 14.9–15.3 mm (n = 6) in *E. prasina*. The nearest occurrence of *Erythrura* is *E. trichroa* in Belau, Chuuk, Pohnpei, and Kosrae.

Aside from the taxa listed in Table 2, there are two bones from Payapai Cave that probably represent additional extinct or extirpated species but are too fragmentary to identify even to family. A partial rostrum (USNM 453427) is reminiscent perhaps of a medium to large-sized meliphagid (honeyeater) with a relatively long bill, whereas a complete pedal claw (USNM 436641) seems to

represent a non-meliphagid passerine larger than *Aplonis opaca* but smaller than *Corvus kubaryi*.

Discussion

TAPHONOMY

I interpret the vertebrate fauna of Payapai Cave as being accumulated primarily or solely by two non-human agents: 1), natural deaths of species nesting or roosting within the cave; and 2), avian predators. That this paleofauna is not archaeological in origin is indicated by its composition, particularly the absence of bones of humans, pigs, and dogs, the scarcity of bones of fish and rats, and the dominance of bones of small species of minimal interest to humans, such as lizards, sheath-tailed bats, swiftlets, and passerines. Four archaeological sites on the northern coast of Rota, for example, produced 261 identifiable fish bones (Davidson & Leach 1988) and only three identifiable bird bones (Becker & Butler 1988), while Payapai Cave yielded 10 fish bones (none identifiable to genus) and 316 bird bones (Table 2). The complete lack of marine invertebrate remains (mollusks, urchins, etc.) is another indication that the Payapai Cave deposit, which lacks cultural features other than the thick band of wood charcoal that comprises Layer II, is not anthropogenic.

The great variety of small vertebrates (lizards, bats, birds) in the Payapai Cave deposit suggests that a predatory bird was involved in accumulating the bones. Even though no bones of hawks, falcons, or owls were recovered, this is of little consequence in a sample as small as 316 bones because birds of prey often are very poorly represented in cave sites, even in bone deposits that they created themselves (Steadman 1986).

There are no resident avian predators on Rota or anywhere in the Mariana Islands today, although *Milvus migrans* (Black Kite), *Accipiter gularis* (Japanese Sparrowhawk), *A. soloensis* (Chinese Goshawk), *Buteo buteo* (Common Buzzard), *Falco tinnunculus* (Eurasian Kestrel), *F. amurensis* (Amur Red-footed Falcon), *F. subbuteo* (Northern Hobby; hypothetical record), *F. peregrinus* (Peregrine Falcon), and *Asio flammeus* (Short-eared Owl) have been recorded as migrants at various places in the Marianas. The nearest resident owl is the Belau Owl, *Pyrrhoglaux podargina*. Endemic to Belau, this owl is small and feeds primarily on invertebrates (Pratt et al. 1987:215). The next nearest resident owl is *Asio flammeus* on Pohnpei. The scarcity of rat bones in Payapai Cave argues against the Common Barn-Owl, *Tyto alba* (unrecorded in Micronesia but widespread and often common in Polynesia and Melanesia), as a candidate for the extinct/extirpated avian predator postulated to have existed on Rota. Considering how abundant and conspicuous rats are on Rota today, and how nearly all caves lack bones of rats or anything else on the floors, I am confident that no cave-dwelling predator exists on Rota today.

Species of *Accipiter* and *Falco* typically are ornithophagous. There are no resident populations of *Accipiter* in either Micronesia or Polynesia today. Various species of *Accipiter*, all poorly studied, occur in Melanesia. Concerning *Falco*,

the resident Peregrine Falcons in Fiji (*F. peregrinus nesiotes*) feed heavily on birds, including a variety of both seabirds and landbirds as well as bats and geckos (White et al. 1988). The Peregrine Falcons in Fiji also prefer to roost and nest on cliffs that provide easy access to shorelines, a setting like that of Payapai Cave. The resident population of *F. peregrinus* nearest to Rota is *F. p. fruitii* in the Volcano Islands (800 km NNW of Rota, 400 km NW of the northernmost Mariana Islands). Perhaps *F. peregrinus* once resided in the Mariana Islands. Of all birds of prey, I believe that *F. peregrinus* is the most likely to have been responsible for much of the paleofauna from Payapai Cave.

EXTINCTION AND BIOGEOGRAPHY

By brief survey of Rota did not yield any bones of a rail similar to the Guam Rail (*Gallirallus owstoni*), which recently was extirpated on Guam but is being translocated to Rota (Witteman et al. 1991). The current sample of bones is too small for this absence to be significant. Rota's caves did produce evidence that three other rails (*Poliolimnas cinereus*, *Gallinula chloropus*, *Porphyrio*? sp.) once lived on the island. Human-related losses of wetlands probably was a factor in the disappearance of at least the first two species. Rats and perhaps cats also may have been involved in the loss of Rota's rails.

The limited prehistoric record from Rota has added *Erythrura* and *Myriagra* to the island's passerine community. Based upon modern distributions, an improved prehistoric record of birds from Rota might also reveal the past occurrence there of species of *Monarcha*, *Acrocephalus*, and *Cleptornis*, each of which is represented elsewhere in the Mariana Islands today. Craig (1989, 1990) has studied the foraging ecology, microhabitat use, and social behavior of small passerines on Saipan and Tinian. When similar studies are conducted for other Micronesian passerines, we may have adequate information to interpret the paleoecology of the expanded passerine communities that existed in the past. This information also will be important to evaluate the feasibility of translocating species to islands that once were part of their natural distribution, as Franklin and Steadman (1991) have suggested in Polynesia.

As the prehistoric data base for Micronesian birds improves, I predict that, as in East Polynesia (Steadman 1989), many volant species supposedly endemic to a single island will be found to have had much larger ranges hundreds or thousands of years ago. The first example of a Micronesian "pseudoendemic" is the "Guam" Flycatcher, *Myiagra freycineti*, now known from Rota.

Four species of extant, indigenous landbirds from Rota were not recorded from the bone deposit in Payapai Cave: Yellow Bittern (*Ixobrychus sinensis*), Collared Kingfisher (*Halcyon chloris*), Mariana Crow (*Corvus kubaryi*), and Rufous Fantail (*Rhipidura rufifrons*). Their absence probably is an artifact of small sample size of bones. Of the total 21 species of landbirds now known to have resided on Rota, 13 (62%) are gone. For now I assume that human impact was responsible for these losses (see discussion of human impact on island birds in Engbring & Pratt 1985, King 1985, and Steadman 1989). The number of lost

species on Rota almost surely will increase when excavations at Payapai Cave are expanded.

Our first glimpse of a prehistoric Micronesian avifauna indicates that great losses of birds occurred in the Mariana Islands since the arrival of humans. Probably the same is true elsewhere in Micronesia, where the prehistoric record of birds remains to be explored.

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