

Stratigraphy, Chronology, and Cultural Context of an Early Faunal Assemblage from Easter Island



DAVID W. STEADMAN, PATRICIA VARGAS CASANOVA,
AND CLAUDIO CRISTINO FERRANDO

THE ABUNDANT AND DIVERSE archaeological research undertaken on Easter Island has focused on such topics as architecture and material culture (Heyerdahl and Ferdon 1961, 1965), settlement patterns (McCoy 1976; Stevenson and Cristino 1986), site surveys (Cristino and Vargas 1980; Cristino et al. 1981; Vargas et al. 1990), the large stone statues or *moai* (Van Tilburg 1987, 1992), petroglyphs (Lee 1986, 1993), restoration (Mulloy 1975), or the ethnographic context of prehistoric and protohistoric materials (McCall 1980; Metraux 1940). The first research designed to describe past environmental conditions on Easter Island has been summarized by Flenley et al. (1991) and Bahn and Flenley (1992), who show mainly through palynological studies that much of the island was covered by indigenous forest at first human contact.

The purpose of our brief pilot project on Easter Island in July 1991 was to develop a vertebrate faunal record that could be correlated chronologically with the cultural and palaeobotanical sequences. On Polynesian islands with relatively well-studied archaeofaunas, marine fish generally were the most heavily exploited vertebrate category at all times. There was, however, much exploitation of indigenous birds early in the prehistoric sequence, followed later in prehistory by a greater dependence on nonindigenous terrestrial species such as chickens, rats, dogs, and pigs (Dye and Steadman 1990). A consequence of this trend was the prehistoric reduction in the number of indigenous species of Polynesian seabirds and landbirds (James and Olson 1991; Olson and James 1991; Steadman 1989, 1993; Steadman and Kirch 1990). We expected the same to be true on Easter Island, although reliable information (in the form of accurately identified bird bones from dated contexts) was lacking before our fieldwork.

Thus our goal was to obtain a chronostratigraphically controlled faunal sample from an early interval of Easter Island prehistory, at least before 500 B.P. (radio-

David W. Steadman is a curator in Biological Survey, New York State Museum, The State Education Department, Albany, New York. Patricia Vargas Casanova is a professor in the Instituto de Estudios Isla de Pascua, Universidad de Chile, Santiago. Claudio Cristino Ferrando is the director of the Museo de la Isla de Pascua, Isla de Pascua, Chile.

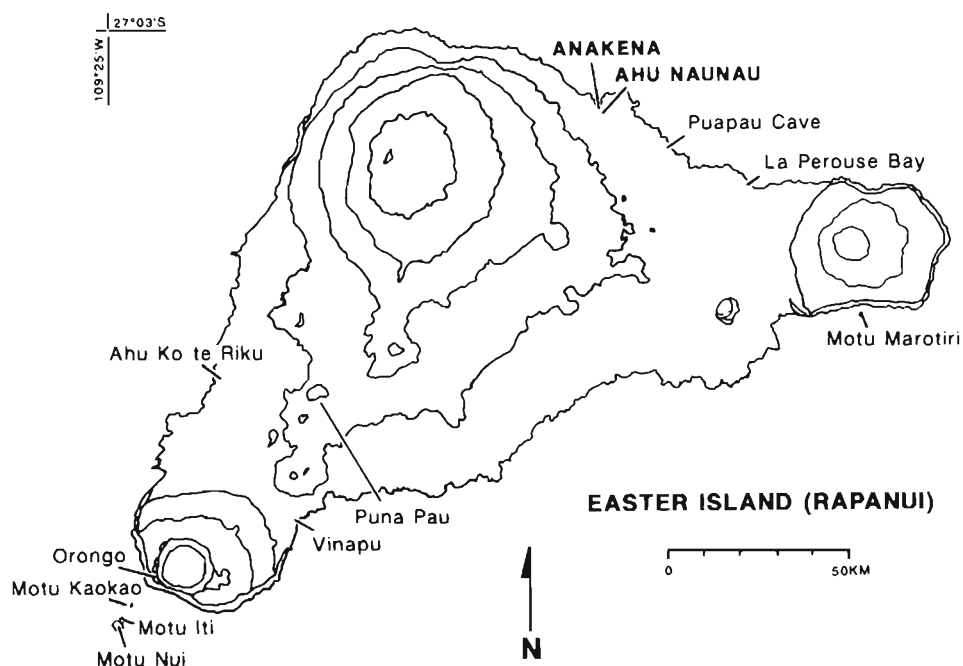


Fig. 1. Map of Easter Island (Rapanui), showing localities mentioned in the text. Courtesy of J. A. Van Tilburg, UCLA Institute of Archaeology.

carbon years before the present). We chose the calcareous sand deposits at Ahu Naunau, Anakena (Fig. 1) because we believed that this site was the most likely to yield such a sample. The geochemistry of calcareous sand often is favorable for preservation of bone, shell, and charcoal. And, although cultural deposits that include midden occur in various caves on Easter Island, these sites date mainly to 500 B.P. or younger (Ayres 1985, n.d.). The earliest radiocarbon dates on cultural deposits from Easter Island are associated with early phases of *ahu* construction rather than midden contexts (Ayres 1971, n.d.; McCoy 1979).

METHODS

Ahu Naunau lies c. 100 m inland from Anakena Bay, which is one of Easter Island's most protected sections of coastline. The *ahu* itself is well preserved and partially restored. Smith (1961a:207–209) provided a good description of the site.

Our 1 by 4 m excavation trends N34°W, perpendicular to and 10 m north of the north wall of Ahu Naunau. We excavated in an area where a team headed by Sergio Rapu had removed the upper 2 to 3 m of sand in 1978–1979. Thus, the uppermost part of our excavation sampled deposits that would have been 2 to 3 m below the natural surface of the calcareous sands.

We excavated the sediments at Ahu Naunau following natural stratigraphic layers, within which we designated arbitrary levels of ≤ 10 cm (square 1) or ≤ 20 cm (squares 2–4). All excavated sediment from square 1 was sieved

through screens of $\frac{1}{2}$ in. (12.70 mm), $\frac{1}{4}$ in. (6.35 mm), and $\frac{1}{8}$ in. (3.18 mm) mesh, with subsamples from each level sieved with $\frac{1}{16}$ in. (1.59 mm) mesh. Sediment from squares 2–4 was sieved through $\frac{1}{2}$ in. and $\frac{1}{4}$ in. mesh only. For all squares, obsidian and basalt flakes were saved from the $\frac{1}{2}$ in. and $\frac{1}{4}$ in. mesh screens, but not the $\frac{1}{8}$ in. or $\frac{1}{16}$ in. Because the $\frac{1}{8}$ in. and $\frac{1}{16}$ in. bone fractions were sampled only from square 1, we initially tabulated the faunal assemblage from square 1 independently from that of other squares, following the concepts of screen size biases put forth by Butler (1988) and Nagaoka (1988). Although the use of fine-mesh screens resulted in the retrieval from square 1 of many more bones per unit volume of excavated sediment, the percentages of major taxa were similar in square 1 to those from squares 2–3. Therefore, for the purposes of this preliminary report, we have combined the faunal data from square 1 with those from squares 2 and 3. Because we were unable to finish excavating square 4, we tabulated the artifacts and bones from that square separately from those of squares 1–3.

RESULTS

Stratigraphy

Except as noted below, the generalized stratigraphy of square 1 (Table 1) is similar to that of squares 2–4. Figure 2 depicts a south to north profile along the western wall from square 4 (closest to Ahu Naunau) through square 1 (closest to the sea). We designated the three primary, natural stratigraphic units as layers I, II, and III. Layer I is a rather featureless, medium calcareous sand. Layer Ia forms the bulk of layer I. Layer Ib includes a minor component of sediment reworked from layer IIa. Layer I is separated from the underlying layer II by a usually thin (< 2 cm) but distinct band of charcoal-stained sand.

TABLE 1. GENERALIZED SEDIMENT DESCRIPTION FOR SQUARE 1 OF THE 1991 TEST EXCAVATION AT AHU NAUNAU, ANAKENA, EASTER ISLAND

LAYER	LEVEL(S)	DEPTH (CM)	SEDIMENT TYPE ^a	COLOR (DRY) ^b
I	1,2	5–15	Med. calc. sand	10YR 7/4 very pale brown
IIa	2,3	15–30	Med. calc. sand	10YR 7/3 very pale brown
IIa	4	30–40	Fine-med. calc. sand	10YR 7/3 very pale brown
IIa	5–10	40–102/104	Fine-med. calc. sand	10YR 8/3 very pale brown
IIa	11,12	102/104–121/124	Sl. clayey fine-med. calc. sand	10YR 8/3 very pale brown
IIb	13	121/124–124/133	Clayey, sl. pebbly fine-med. calc. sand	10YR 7/2 light gray
IIb/III	13	126	Sandy silty clay	10YR 7/1–7/2 light gray
IIb	13	130–133	Clayey, silty fine-med. calc. sand	10YR 7/4 very pale brown
IIb	14	124/133–127/134	Clayey, silty fine-med. calc. sand	10YR 7/4 very pale brown
III	15	127/134–136/144	Sl. sandy, sl. pebbly silty clay	7.5YR 3/3 very pale brown

^a Calc., calcareous; med., medium; sl., slightly.

^b Colors are from Munsell Soil Color Charts, recorded dry in the laboratory from sediment samples ranging in volume from 45 to 710 cm³.

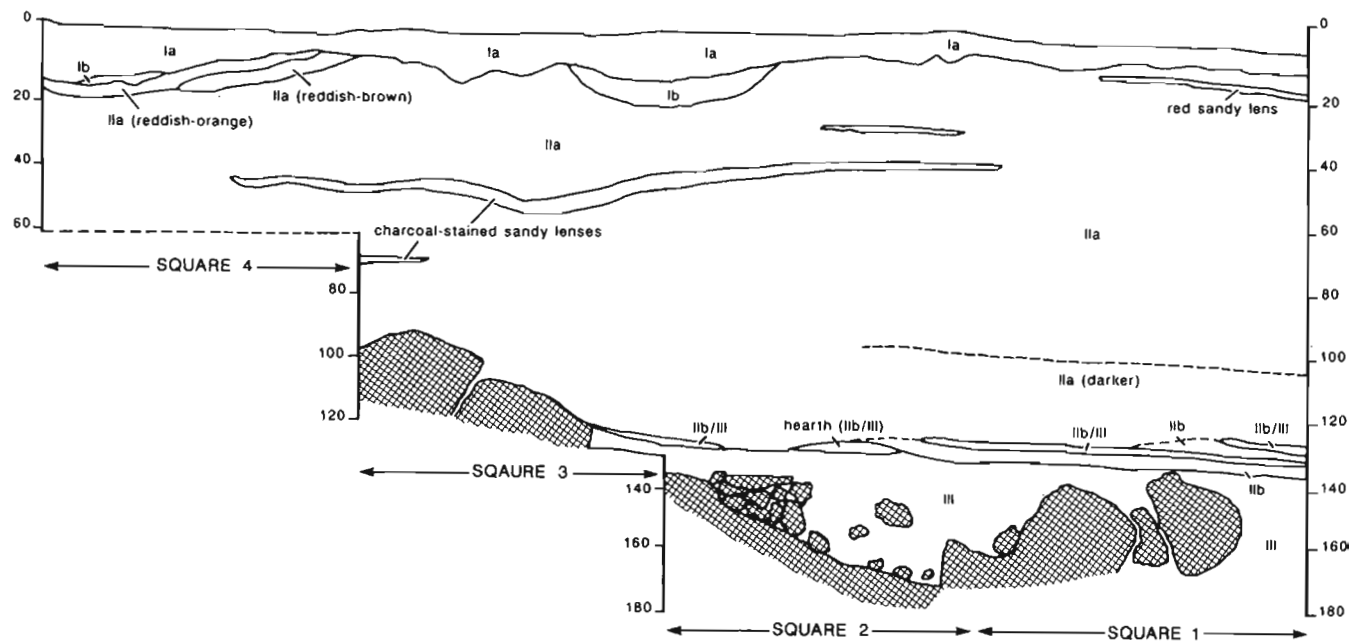


Fig. 2. 1991 excavations, Ahu Naunau, Anakena, Easter Island. Stratigraphic profile of the west wall of squares 1-4.

Layer II also consists of two subunits. Layer IIa is a relatively homogeneous calcareous sand. In square 1 and the northern third of square 2, the lowermost 20 cm of layer IIa is slightly darker (as observed *in situ*, but not in dried sediment samples) than the overlying portion of layer IIa. This is because of a small amount of clay and charcoal flecking, which results in greater water retention (Figs. 2, 3).

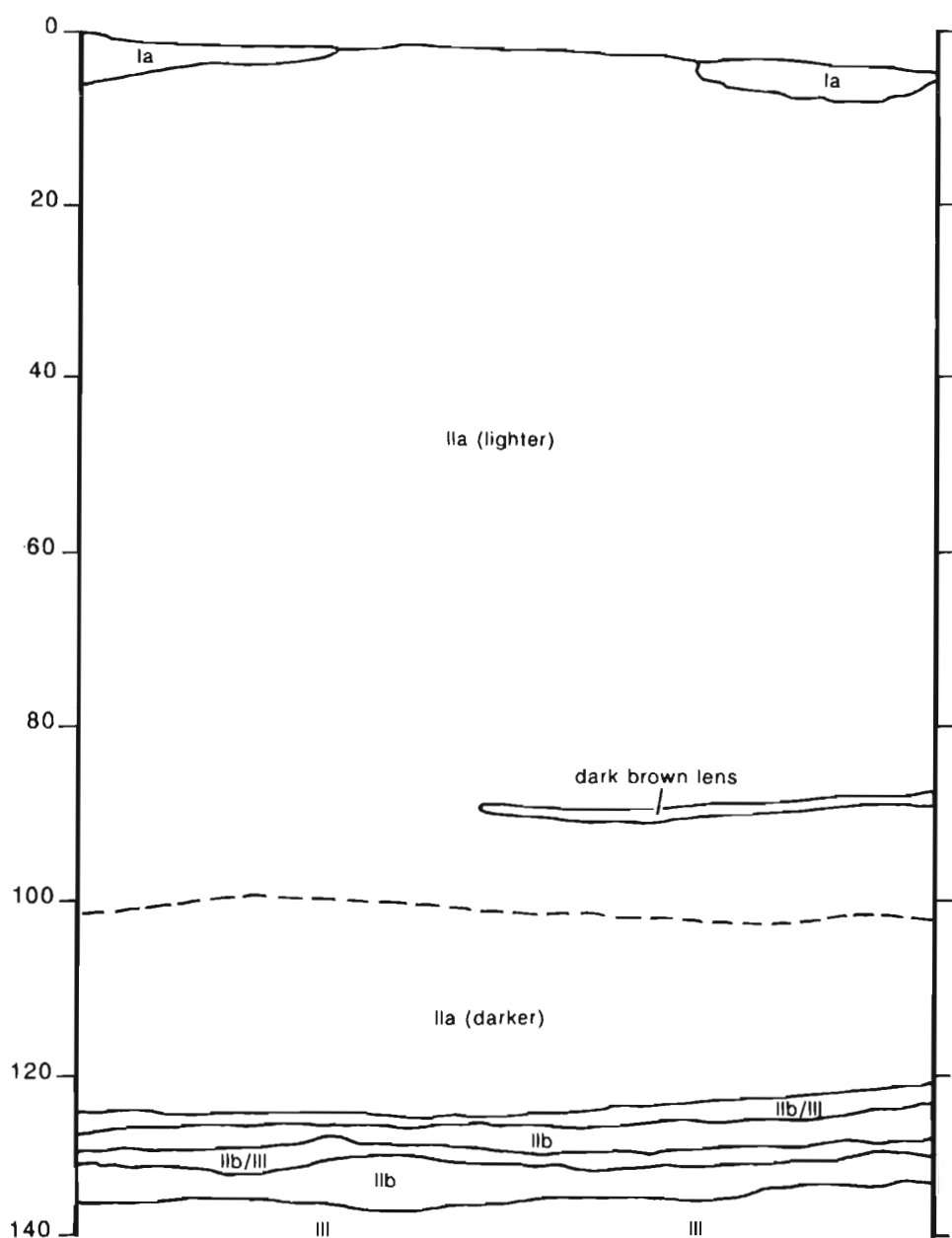


Fig. 3. 1991 excavations, Ahu Naunau, Anakena, Easter Island. Stratigraphic profile of the north wall of square 1.

Layer IIb is where the lowermost calcareous sands are mixed with silty clay derived from underlying weathered volcanic rocks and soils. The thin beds of layer IIb that have an especially strong component of volcanic silty clay are designated as layer IIb/III. A charcoal-rich hearth occurs *in situ* at the contact of layers IIb and III in square 2 (Fig. 2).

Layer III is a dark reddish brown bouldery, pebbly, silty clay derived from basaltic and scoriaceous colluvium and perhaps alluvium. It becomes more bouldery with depth. The subangular to subrounded boulders all exhibit weathering rinds, some of which are oxidized (orange) and others are bluish green to black (reduced). Layer III has the overall appearance of a subsoil. Within layer III, arti-

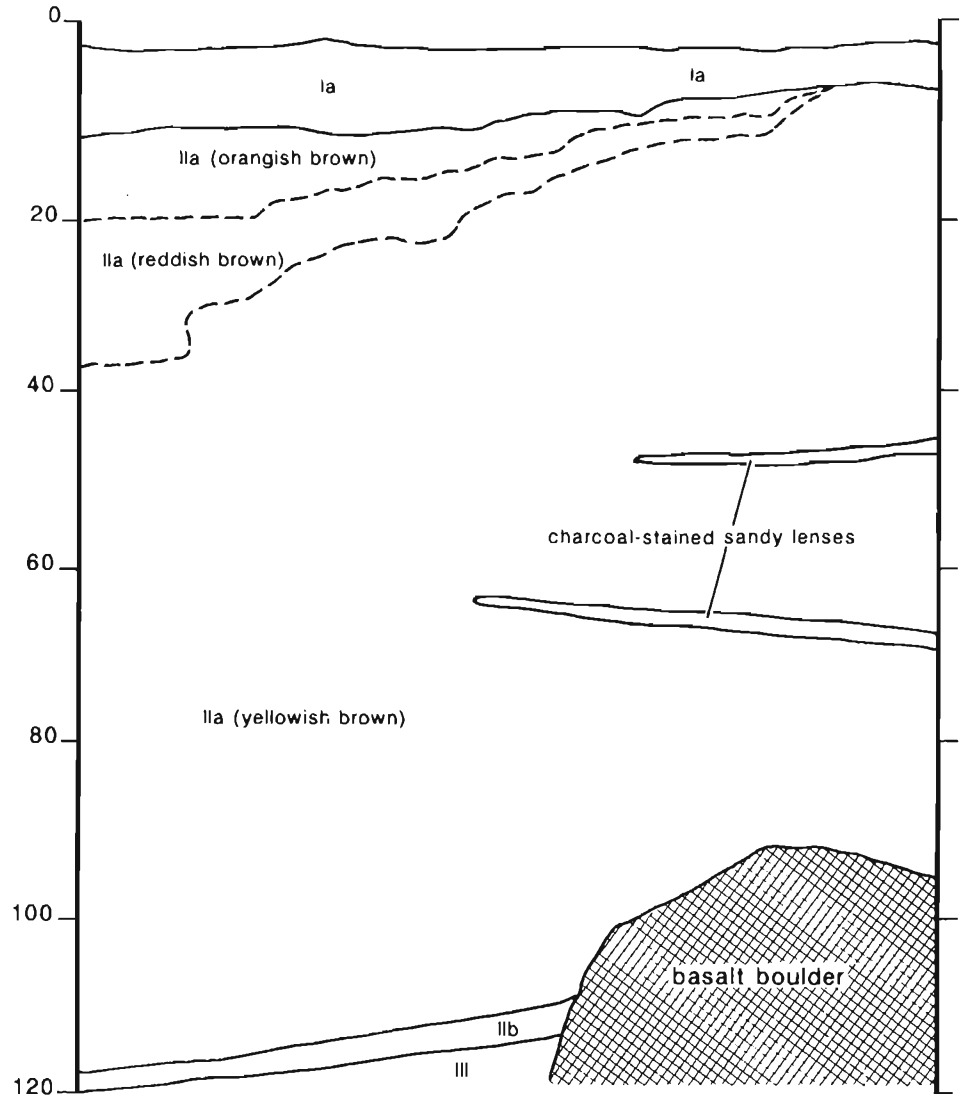


Fig. 4. 1991 excavations, Ahu Naunau, Anakena, Easter Island. Stratigraphic profile of the south wall of square 4.

facts and bones become scarcer with depth. The contact of layers IIb and III appears to be the original living surface of this archaeological site, with the qualification that a topsoil that once may have overlain layer III has been eroded away.

The full vertical extent of layer I could not be determined because much of it had been removed during the large-scale excavations in 1978–1979, the results of which have not been published. Although layer I is just barely evident at the north end of our excavation (Fig. 3), it is represented more fully across the entire western wall of squares 1–4 (Fig. 2).

A deposit of sand- to pebble-sized, angular scoria occurs in the eastern half of upper layer IIa in square 4 (Fig. 4). This deposit is poorly developed in square 3 (Fig. 5). Based on its color (orangish red rather than reddish black) and its high porosity, this scoria is the type quarried at Puna Pau rather than at Maunga o Tu'u or some other source (see Van Tilburg 1986:4). If the red scoria deposit in square 4 represents debitage from the final preparation of topknots (*pukao*) for *moai*, the association of the scoria with a radiocarbon date of A.D. 1220–1420 (see *Chronology*) would help to determine when the *moai* were placed on Ahu Naunau. Similar red scoria deposits have been reported from Ahu Ko te Riku and Ahu 2 of Vinapu, as well as elsewhere at Ahu Naunau (Van Tilburg 1986:17 and references therein).

Chronology

The chronology of our excavation is based mainly on four of five conventional radiocarbon (^{14}C) age determinations on wood charcoal (Table 2). The anomalously young age for Beta-47172 probably is related to the small size of this sam-

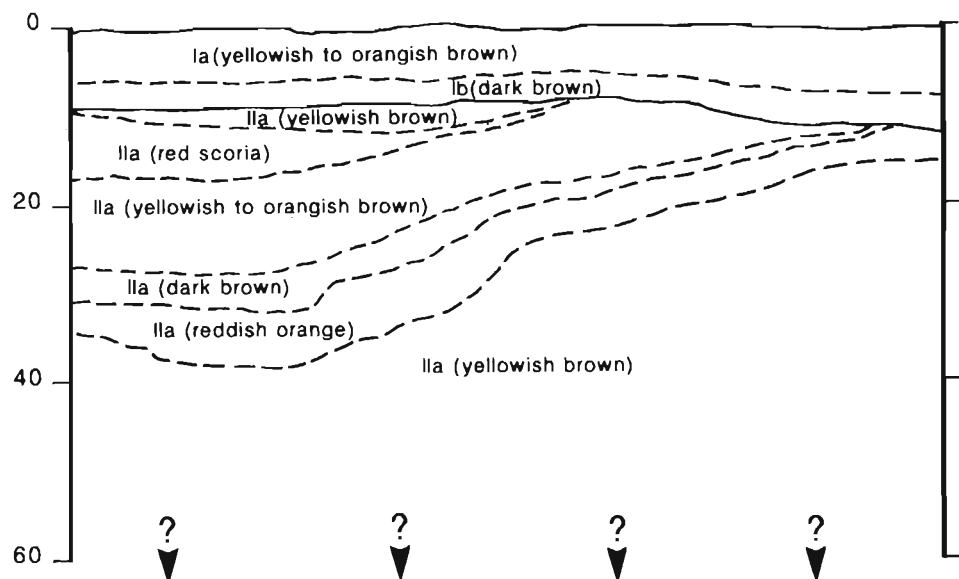


Fig. 5. 1991 excavations, Ahu Naunau, Anakena, Easter Island. Stratigraphic profile of the south wall of square 3.

TABLE 2. RADIOCARBON DATES FROM THE 1991 TEST EXCAVATION AT AHU NAUNAU, ANAKENA, EASTER ISLAND

LAB NO.	g C ^a	SQUARE: LAYER:		¹⁴ C AGE ^b	¹³ C/ ¹² C	¹³ C/ ¹² C	CAL.
		LEVEL	DEPTH (cm)			ADJUSTED AGE	A.D. (2σ)
Beta-47171	0.6	1:2	I/IIa:10-20	650 ± 80	-24.7	660 ± 80	1120-1420
Beta-47172	0.2	3:2	IIa:20-28	210 ± 110	-27.5	170 ± 110	1450-1950
Beta-47173	0.3	4:3	IIa:37/40-57/60	880 ± 100	-26.7	860 ± 100	980-1280
Beta-47169	1.7	2:8	IIb/III:129-130	910 ± 80	-25.5	900 ± 80	980-1280
Beta-47170	0.7	2:8	IIb/III:128-132	920 ± 60	-26.7	900 ± 60	1000-1260
CAMS-5336 ^c	—	2:1	I/IIa:0-20	1040 ± 80	—	—	780-1185
CAMS-5337	—	1:14	IIb/III:124/133-127/134	1310 ± 60	—	—	615-864
CAMS-5335	—	1:15	III:127/134-136/144	1090 ± 60	—	—	778-1020

^a g C = grams of purified carbon (c. 50% of the weight of the uncontaminated wood charcoal).

^b ¹⁴C ages and ¹³C/¹²C-adjusted ages are reported in years before present (yr B.P.).

^c Accelerator-mass spectrometer dates are based on purified collagen from periotic bones (CAMS-5336, 5337) and a tooth (CAMS-5335) of the Common Dolphin *Delphinus delphis*, submitted by T. W. Stafford, Jr. (INSTAAR, University of Colorado) to the Center for Accelerator Mass Spectrometry, Lawrence Livermore National Laboratories, Berkeley, California.

Note: Conventional dates (Beta Analytic Inc., Coral Gables, Florida; Beta = 471xx) are based on wood charcoal.

ple, in which all individual uncleaned charcoal pieces were <2 cm in greatest diameter, and the total yield of purified carbon was only 0.2 g. Certain other small charcoal samples have yielded anomalously young ^{14}C ages elsewhere in Polynesia (Allen and Steadman 1990; James et al. 1987; Kirch et al. 1991; Steadman and Kirch 1990), probably because small pieces of charcoal are more likely to become displaced down-section with time.

The four other conventional ^{14}C ages are concordant stratigraphically. The two oldest (900 ± 80 and 900 ± 60 B.P.) are from the hearth at the base of layer IIb in square 2. Beta-47169 was determined on relatively large (>4 cm) chunks of wood charcoal from the center of the hearth, and Beta-47170 was determined on smaller (2–4 cm) pieces of wood charcoal from the edge of the hearth. Taxonomic identification of the wood charcoal is under way by Jonathan Hather (Institute of Archaeology, University College, London).

Three accelerator-mass spectrometer (AMS) ^{14}C dates were determined on purified collagen from two periotic bones and a tooth of the Common Dolphin (Table 2). Methodology of collagen extraction and purification followed Stafford et al. (1987, 1988). The AMS dates have not been corrected for the marine reservoir effect, the magnitude of which has not been determined for Easter Island (Stuiver et al. 1986), although it is likely to be on the order of one to several centuries. The "marine reservoir effect" reflects the fact that marine organisms and ocean surface waters are variously depleted in ^{14}C and therefore may yield ages older than contemporary terrestrial organic materials (Goodwin 1993). All three AMS dates overlap each other at 2σ . Two of the three AMS dates overlap the oldest conventional dates at 2σ . If a marine reservoir correction were made, it might be that all three AMS dates would be fairly similar to the two oldest conventional dates.

The ^{14}C data suggest a rather rapid accumulation of beach sand at Ahu Nau-nau. Note that Beta-47173 (layer IIa, depth 37/40 to 57/60 cm) has considerable overlap at only 1σ with the two oldest conventional age determinations (Beta-47169, 47170; depths from 128 to 132 cm, the base of layer IIb). Even Beta-47171 (from the contact of layers I and IIa) overlaps the two oldest conventional age determinations at 2σ . Furthermore, CAMS-5336 and CAMS-5335 are very similar in age, in spite of the former being from layer I/IIa and the latter being from layer III.

Artifacts

The artifact assemblage is summarized in Tables 3 and 4. Objects of obsidian constitute 1281 of 1435 artifacts, with 1142 of these being unretouched obsidian flakes. The six bifacially flaked obsidian drills are similar in size and shape to those illustrated and described by Metraux (1940:281) and Heyerdahl (1961:400, plate 74m,n). The drills range from the top of the deposit to the contact of layers IIb and III, establishing their occurrence at least as early as A.D. 980–1280. Two obsidian spearpoints or *mata'a* were recovered *in situ* in layer I. *Mata'a* have been regarded as characteristic of late prehistoric times on Easter Island (Heyerdahl 1961:398–400). The *mata'a* at Ahu Nau-nau are associated with a conventional radiocarbon date of A.D. 1220–1420, the earliest reported occurrence of this artifact type.

TABLE 3. NUMBERS OF ARTIFACTS FROM SQUARES 1-3 OF THE 1991 TEST EXCAVATIONS AT AHU NAUNAU, ANAKENA, EASTER ISLAND

ARTIFACT	DEPTH (cm)							TOTALS
	0-20	20-40	40-60	60-80	80-100	100-120	>120	
Obsidian core	5	2	—	—	—	—	4	11
Obsidian flake <20 mm	318	137	80	57	11	7	38	648
Obsidian flake 20-40 mm	130	50	20	5	4	5	27	241
Obsidian flake >40 mm	12	3	2	1	2	—	11	31
Obsidian flake retouched/use wear	23	29	10	4	2	2	20	90
Obsidian <i>mata'a</i>	2	—	—	—	—	—	—	2
Obsidian drill	1	—	1	—	—	—	3	5
Basalt flake <20 mm	1	1	5	3	—	21	2	33
Basalt flake 20-40 mm	3	1	3	—	—	6	—	13
Basalt flake >40 mm	9	1	2	—	—	2	2	16
Basalt adze preform or scraper	2	3	—	—	—	—	—	5
Polished basalt adze flake	—	—	—	—	—	1	2	3
Polished, flat basalt grinding stone	—	—	—	—	—	—	1	1
Basalt pounder	5	—	1	—	—	—	—	6
Red scoria disk	1	—	—	—	—	—	—	1
Bird bone needle	1	1	—	—	—	—	—	2
Totals	513	228	124	70	19	44	110	1108

Objects of basalt are about as varied as those of obsidian, but not nearly so numerous. Flakes make up 129 of the 151 basalt artifacts. The nine unpolished basalt adze preforms or scrapers are confined to the upper 40 cm of sediment, and the four polished basalt adze flakes (none complete enough for typological determination) occur either in the upper 20 cm or at depths >100 cm. The eight rounded basalt pounders are confined to the upper 60 cm, and the single polished grinding stone (roughly similar to those described by Heyerdahl 1961:411) occurs below 100 cm.

A circular disk of red scoria (Puna Pau type; 58 mm diameter) is from the upper 20 cm of square 3, not directly associated with the red scoria deposit described from square 4. This disk may have been used as an iris from within the white, coralline eye of a *moai* even though it is smaller than other reported irides (Bahn and Flenley 1992:118).

Only three nonlithic artifacts were recovered. Two are bird bone needles made from the radius of Murphy's Petrel (*Pterodroma ultima*), a tropical seabird that no longer occurs on Easter Island (Steadman, pers. obs.). These two needles (a complete one 78 mm long, a broken one 31 mm long) are similar to some of those described by Heyerdahl (1961:412, 413). As with the *mata'a* just mentioned, the bird bone needles are particularly significant for being recovered from a relatively early, dated, stratigraphic context. The third nonlithic artifact is a cut and polished piece of dolphin bone (13 by 15 by 3.4 mm) from layer IIb. We interpret this as the broken end of a probable net gauge. This particular bone is not sufficiently hard or dense to have been a fishhook tab.

TABLE 4. NUMBERS OF ARTIFACTS FROM SQUARE 4 OF THE 1991 TEST EXCAVATIONS AT AHU NAUNAU, ANAKENA, EASTER ISLAND

ARTIFACT	DEPTH (CM)			TOTALS
	0/3-18/22	18/22-37/40	37/40-57/60	
Obsidian core	—	2	1	3
Obsidian flake <20 mm	79	41	29	149
Obsidian flake 20-40 mm	35	16	19	70
Obsidian flake >40 mm	—	2	1	3
Obsidian flake retouched/use wear	13	7	7	27
Obsidian drill	1	—	—	1
Basalt flake <20 mm	19	1	5	25
Basalt flake 20-40 mm	28	2	2	32
Basalt flake >40 mm	8	1	1	10
Basalt adze preform or scraper	3	1	—	4
Polished basalt adze flake	1	—	—	1
Basalt pounder	2	—	—	2
Totals	189	73	65	327

Fauna

Compared with those from prehistoric midden sites elsewhere in Polynesia, marine molluscs are rare at Ahu Naunau. We seldom found even the historically popular shells of the *pipi* (*Planaxis akuana*) or *pure* (*Cypraea caputdraconis*) shells, uses of which are described by Seaver (1986). Only near the contact of layers IIb and III are marine molluscs encountered in quantities that exceeded 25 shells per square level. The remains (tests, spines) of sea urchins are scarce throughout the sequence. Coral is absent except for being the primary raw material of the calcareous sand.

Terrestrial molluscs (land snails) occur in the deposit (P. V. Kirch, C. C. Christensen, and D. W. Steadman, pers. obs. 1993). They feature the first indigenous land snail ever recorded from Easter Island, an undescribed genus and species of Achatinellidae.

The vertebrate fauna from Ahu Naunau is summarized in Tables 5-7. Much as

TABLE 5. NUMBERS OF IDENTIFIED BONES (NISP) FROM SQUARES 1-3 OF THE 1991 TEST EXCAVATIONS AT AHU NAUNAU, ANAKENA, EASTER ISLAND

BONE	DEPTH (cm)								TOTALS
	SURFACE	0-20	20-40	40-60	60-80	80-100	100-120	>120	
Fish	—	100	248	168	87	98	205	689	1595
Rat	—	252	480	616	196	44	19	536	2143
Dolphin	6	530	563	337	285	26	28	537	2312
Pinniped	1	—	1	—	—	1	—	—	3
Chicken	3	11	12	1	—	—	—	2	29
Native bird	10	19	78	41	15	5	21	162	351
Total NISP	20	912	1382	1163	583	174	273	1926	6433

TABLE 6. NUMBERS OF IDENTIFIED BONES (NISP) FROM SQUARE 4 OF THE 1991 TEST EXCAVATIONS AT AHU NAUNAU, ANAKENA, EASTER ISLAND

BONE	DEPTH (cm)			TOTALS
	0/3-18/22	18/22-37/40	37/40-57/60	
Fish	9	27	51	87
Rat	20	60	116	196
Dolphin	133	200	238	571
Human	1	—	—	1
Chicken	1	—	2	3
Native bird	2	5	13	20
Total NISP	166	292	420	878

with the artifacts, bones become less frequent downsection, reaching a low at 80–100 cm and then increasing again. This relative scarcity of bones and artifacts from depths of 60 to 120 cm may be caused by a rapid rate of sand deposition (see *Chronology*).

The fish bones, currently under study by Virginia Butler (University of Colorado Museum), are remarkable for their relative scarcity, being only 23 percent (1682 of 7311) of all vertebrate remains. In a more tropical region of East Polynesia, fish made up 90% (9362 of 10,366 NISP [number of identified specimens]) of all bones from the 1989 excavations at Tangatatau Rockshelter, Mangaia, Cook Islands (Steadman and Kirch 1990). This large difference in relative abundance of fish is not due to possible sedimentary biases. At the Ureia site (Aitutaki, Cook Islands), a calcareous sand deposit like that at Ahu Naunau, the bone assemblage was 86 percent fish by weight (Allen and Steadman 1990). Fish are the highest ranking faunal category at depths >80 cm but are exceeded by both rats and dolphins from 0 to 80 cm depth (Table 7). Even when they rank first, the fish bones at Ahu Naunau make up a much lower portion of the prehistoric assemblage than elsewhere in Polynesia, regardless of the age of the site.

TABLE 7. NUMERICAL RANK OF NISP FROM SQUARES 1-4 OF THE 1991 TEST EXCAVATIONS AT AHU NAUNAU, ANAKENA, EASTER ISLAND

BONE	DEPTH (cm) ^a								OVERALL
	SURFACE	0-20	20-40	40-60	60-80	80-100	100-120	>120 ^a	
Dolphin	2	1	1	2	1	3	3	2	1
Rat	—	2	2	1	2	2	4	2	2
Fish	—	3	3	3	3	1	1	1	3
Native bird	1	4	4	4	4	4	3	4	4
Chicken	3	5	5	5	—	—	—	5	5
Pinniped	4	—	6	—	—	5	—	—	6
Human	—	5	—	—	—	—	—	—	7
Total NISP	20	1078	1674	1583	583	174	273	1926	7311

^aSquare 4 extends only from 0 to 60 cm depth. Surface bone sample is unscreened, unsystematically collected, and thus not directly comparable with values from other strata.

One or more small species of dolphin/porpoise (Delphinidae) is represented by 2583 bones, more than for any other taxon in the Ahu Naunau fauna. Because each of the many diagnostic periotic bones in the assemblage is from the Common Dolphin, *Delphinus delphis*, we assume that this widespread species is the only delphinid represented. Periotics of *D. delphis* were reported from ocean-floor sediments dredged by the *Albatross* expedition in the eastern Pacific (Eastman 1906), presumably (but not explicitly) from some of the collecting stations near Easter Island.

Bones of delphinids are rare, in many cases nearly absent, from Easter Island faunal assemblages younger than c. 500 B.P. (Ayres 1979, 1985). Polynesians hunted delphinids primarily with harpoons from seaworthy canoes (Dye 1990). A supply of large trees is needed to manufacture canoes that are capable of sailing rapidly and, at least occasionally, far offshore, in pursuit of marine mammals. The prehistoric deforestation of Easter Island is believed to have been virtually complete by about 550 B.P. (Bahn and Flenley 1992; Flenley et al. 1991), after which large, seaworthy canoes would have been difficult or impossible to make. Eighteenth-century ethnographic accounts verify the lack of such canoes on Easter Island at European contact (Beaglehole 1961:352–353). Thus layer I and uppermost layer IIa of our excavation may have been deposited only a century or two before the near elimination of marine mammals from the diet of prehistoric Easter Islanders. The decline in exploitation of marine mammals must have been precipitous, because even in the upper 20 cm of our excavation delphinids remain the highest ranked vertebrate category (Table 7).

The three pinniped bones were studied by Clayton Ray (Department of Paleobiology, Smithsonian Institution). One of these bones, a left upper canine, is from the Leopard Seal (*Hydrurga leptonyx*), a rather large pinniped that annually disperses northward (in variable numbers) from its Antarctic breeding grounds (Rounsevell and Eberhard 1980). In the Pacific, the Leopard Seal has been recorded as far north as 20°S at Rarotonga, Cook Islands (King 1983:116). The Rapanui word *pakia* translates as seal or sea lion ("*foca, lobo del mar*"; Engler 1978:218), so pinnipeds presumably still are found occasionally on Easter Island. Smith (1961b:263) reported a tooth of the Leopard Seal from late prehistoric cultural deposits in Puapau Cave, near La Pérouse Bay. The other two pinniped bones from Ahu Naunau are too fragmentary for identification.

Contrary to Bahn and Flenley (1992:79, 91), we found no bones of dogs at Ahu Naunau in 1991. Although such a discovery would not be wholly unexpected, there still is no skeletal evidence for prehistoric dogs or pigs on Easter Island.

Bones of the Pacific or Polynesian Rat (*Rattus exulans*) rank second in abundance to those of the Common Dolphin, both collectively and in most levels (Table 7). This commensal rodent was transported across Oceania prehistorically, including to the most remote corners of the Polynesian triangle. As at certain other Polynesian sites (Steadman and Kirch 1990), the rat bones from Ahu Naunau probably represent animals that were eaten as well as others that merely had been attracted prehistorically to the accumulating midden. As with the dolphin, we are aware of no other Polynesian sites where bones of rats outnumber those of fish.

The only human (*Homo sapiens*) bone in the entire assemblage is an adult distal

right radius from level 1 of square 4. Human bones typically are much more common than this in late prehistoric faunal assemblages from Easter Island. Sea turtle bones, also found rather commonly in late prehistoric sites, do not occur in our sample.

Bones of the chicken (*Gallus gallus*) are poorly represented throughout the sequence and always are outnumbered by bones of native birds. This contrasts markedly with late prehistoric and protohistoric sites on Easter Island, where chicken bones are abundant and far outnumber those of native birds (Steadman, pers. obs.). Chickens were introduced prehistorically virtually throughout tropical Polynesia, with the probable exception of Henderson Island (Schubel and Steadman 1989; Steadman and Olson 1985).

The nonchicken (native) bird bones from our excavations will be described in detail in a future publication. They fairly consistently rank fourth among major vertebrate categories. This consistency contrasts with various other East Polynesian sites, where birds decline in rank from early to late prehistory (Dye and Steadman 1990; Steadman and Kirch 1990). The short time interval represented by our sample would account for at least some of this difference, although the evidence in hand suggests that the process of avian extinction may have been relatively gradual on Easter Island.

Represented at Ahu Naunau are 14 species of seabirds and six undescribed taxa of landbirds. The seabirds include nine species that no longer breed on Easter Island itself and 13 species that no longer breed on Easter Island or any of its offshore islets (Motu Marotiri, Motu Kaokao, and especially Motu Nui and Motu Iti). Combined with data from previous excavations (Steadman, pers. obs. 1993), the seabird fauna of Easter Island stands at a remarkable 25 species, only one of which (the Red-tailed Tropic bird, *Phaethon rubricauda*) still nests on Easter Island itself.

The few landbird bones from Ahu Naunau are of great biogeographic interest in providing the first evidence that nonmarine birds once inhabited this remote locality. Except for two bones of an undescribed species of rail (*Porzana* sp.), the landbird bones recovered thus far are too fragmentary for identification beyond the family level. Documenting the extinct avifauna of Easter Island is of considerable interest to biogeographers and systematic biologists. It also helps in interpreting the prehistoric concepts of avian imagery on Easter Island (see Lee 1986, 1993), as well as other aspects of avian ethnography, such as the celebrated "bird-man" activities at Orongo (Routledge 1917).

DISCUSSION

Our small test excavation establishes that the calcareous sands and underlying silty clays in the Ahu Naunau region of Anakena are a rich source of intertwined cultural and palaeoenvironmental data for Easter Island. Such data are particularly important because they come from the early part of the "expansion phase" (following Stevenson and Cristino 1986:38), a relatively poorly documented period in Easter Island prehistory.

The stratigraphy of our 1 by 4 m test trench has some interesting implications for the late Holocene geomorphological evolution of the Anakena region. Prehistoric deforestation of Easter Island began at least 1200 years ago and essen-

tially was completed by about 550 B.P. (Bahn and Flenley 1992; Dransfield et al. 1984; Flenley and King 1984; Flenley et al. 1991). Our excavation shows a major sedimentary change at c. 900 B.P., when prograding calcareous beach sands first mixed with (layer IIb), and then covered (layer IIa), the volcanic soils and subsoils (layer III) derived from colluvium and alluvium from the surrounding hills. A change in relative sea level, such as that caused by a local subsidence of land, might have been a factor. Although changes in eustatic sea level have been minor over the past 1000 years, there is evidence from French Polynesia for a high sea level stand until about 1500 B.P. (Pirazzoli and Montaggioni 1988). Furthermore, deforestation may have led to the drying up of a formerly perennial stream that entered the sea at Anakena Bay. When Easter Island was forested, Anakena Bay probably was an estuary where regularly flowing fresh water and its sediment load mixed with seawater. With deforestation, the lack of regular stream flow, and a possibly lowered freshwater table, may have allowed the beach to develop and prograde as local marine sedimentation became greater than that derived from freshwater flow.

Compared with late prehistoric faunal assemblages from Easter Island (Ayres 1979, 1985), the early assemblage from Ahu Naunau differs in that bones of marine mammals, seabirds, and native landbirds are much more common, and bones of fish, humans, and chickens are much rarer. In addition, the bones of fish are much rarer, and those of marine mammals much more common, than in typical prehistoric midden assemblages from more tropical parts of East Polynesia. Our faunal assemblage from Ahu Naunau includes no bones of sea turtles, lizards, pigs, or dogs, and only a single human bone. Bones of extinct or extirpated native seabirds and landbirds occur throughout the deposit.

We hope to expand the excavations at Ahu Naunau in the near future, with the following goals: (1) to locate *in situ* cultural deposits older than 1000 B.P. and younger than 600 B.P.; (2) to enlarge the faunal assemblage so that additional rare species of birds are sampled; (3) to obtain long chronostratigraphic sequences of plant macrofossils, snails, and artifacts; and (4) to test systematically all areas of calcareous sand on a N-S/E-W grid, thereby reconstructing the prehistoric landscape changes at Anakena, which we believe was the mouth of a perennial stream until about 900 B.P.

Anakena has been one of Easter Island's most important ceremonial and habitation sites for at least a millennium. Through a carefully planned research program, we can learn much more about this beautiful, unusually sheltered bay in the southeastern corner of Polynesia.

ACKNOWLEDGMENTS

For research permits and valuable cooperation, we thank the staffs of the Consejo de Monumentos Nacionales (Santiago, Chile), Parque Nacional de Isla de Pascua, and the Museo de la Isla de Pascua. Steadman's travel was funded in part by National Science Foundation grant BNS-9020750. The AMS radiocarbon dates were provided by T. W. Stafford, Jr., with partial funding from National Science Foundation grant EAR-9118683. L. Gonzalez, P. Rapu, M. Rausch, V. C. Steadman, and F. Teao assisted in the field. E. L. Shupe and D. Brasmeister helped to prepare the manuscript. P. Kernan drafted Figures 2-5 and modified Figure 1. For comments on the manuscript, we thank W.S. Ayres, V. Butler, J. M. Diamond, P. V. Kirch, P. S. Martin, L. Nagaoka, T. W. Stafford, Jr., and J. A. Van Tilburg.

REFERENCES

- ALLEN, M. S., AND D. W. STEADMAN
 1990 Excavations at the Ureia site, Aitutaki, Cook Islands: Preliminary results. *Archaeology in Oceania* 25:24–37.
- AYRES, W. S.
 1971 Radiocarbon dates from Easter Island. *Journal of the Polynesian Society* 80:497–504.
 1979 Easter Island fishing. *Asian Perspectives* 22:61–92.
 1985 Easter Island subsistence. *Journal de la Société des Océanistes* 80:103–124.
 n.d. Calibrated radiocarbon dates from Easter Island. Unpublished manuscript on file with the author.
- BAHN, P., AND J. R. FLENLEY
 1992 *Easter Island, Earth Island*. London: Thames and Hudson.
- BEAGLEHOLE, J. C., ED.
 1961 *The Journals of Captain James Cook on His Voyages of Discovery: The Voyage of the Resolution and Endeavor*. Cambridge: The Hakluyt Society.
- BUTLER, V. L.
 1988 Lapita fishing strategies: The faunal evidence, in *Archaeology of the Lapita Cultural Complex: A Critical Review*: 99–115, ed. P. V. Kirch and T. L. Hunt. Thomas Burke Memorial Washington State Museum Research Report No. 5.
- CRISTINO F., C., AND P. VARGAS C.
 1980 Prospección arqueológica de Isla de Pascua. *Anales de la Universidad de Chile* 161–162:191–215.
- CRISTINO F., C., P. VARGAS C., AND R. IZAURIETA S.
 1981 *Atlas Arqueológica de Isla de Pascua*. Santiago: Facultad de Arquitectura y Urbanismo, Instituto de Estudios, Universidad de Chile.
- DRANSFIELD, J., J. R. FLENLEY, S. M. KING, D. D. HARKNESS, AND S. RAPU
 1984 A recently extinct palm from Easter Island. *Nature* 312:750–752.
- DYE, T.
 1990 The causes and consequences of a decline in the prehistoric Marquesan fishing industry, in *Pacific Production Systems: Approaches to Economic Prehistory*: 70–84, ed. D. E. Yen and J. M. J. Mummery. Australian National University Occasional Papers in Prehistory 18.
- DYE, T., AND D. W. STEADMAN
 1990 Polynesian ancestors and their animal world. *American Scientist* 78:207–215.
- EASTMAN, C. R.
 1906 Reports on the scientific results of the . . . “Albatross” . . . VII. Sharks’ teeth and cetacean bones. *Bulletin of the Museum of Comparative Zoology, Harvard University* 50:75–98.
- ENGLERT, P. S.
 1978 *Idioma Rapanui*. Santiago: Ediciones de la Universidad de Chile.
- FLENLEY, J., AND S. M. KING.
 1984 Late Quaternary pollen records from Easter Island. *Nature* 307:47–50.
- FLENLEY, J. R., A. S. KING, J. JACKSON, C. CHEW, J. T. TELLER, AND M. E. PRENTICE
 1991 The Late Quaternary vegetational and climatic history of Easter Island. *Journal of Quaternary Science* 6:85–115.
- GOODWIN, I. D.
 1993 Holocene deglaciation, sea-level change, and the emergence of the Windmill Islands, Budd Coast, Antarctica. *Quaternary Research* 40:70–80.
- HEYERDAHL, T.
 1961 Surface artifacts, in *Archaeology of Easter Island*, vol. 1:397–489, ed. T. Heyerdahl and E. N. Ferdon, Jr. Monograph of the School of American Research and the Museum of New Mexico 24, Part 1.
- HEYERDAHL, T., AND E. N. FERDON, JR., EDS.
 1961, *Archaeology of Easter Island*, Vol. 1 and 2. Monograph of the School of American Research and the Museum of New Mexico 24, Parts 1 and 2.

- JAMES, H. F., AND S. L. OLSON
1991 Descriptions of thirty-two new species of birds from the Hawaiian Islands: Part II. Passeriformes. *Ornithological Monographs* 46.
- JAMES, H. F., T. W. STAFFORD, JR., D. W. STEADMAN, S. L. OLSON, P. S. MARTIN, A. J. T. JULL, AND P. C. MCCOY
1987 Radiocarbon dates on bones of extinct birds from Hawaii. *Proceedings of the National Academy of Sciences USA* 84:2350-2354.
- KING, J. E.
1983 *Seals of the World*. Ithaca, N. Y.: Cornell University Press.
- KIRCH, P. V., J. R. FLENLEY, AND D. W. STEADMAN
1991 A radiocarbon chronology for human-induced environmental change on Mangaia, Southern Cook Islands, Polynesia. *Radiocarbon* 33:317-328.
- LEE, G.
1986 The birdman motif of Easter Island. *Journal of New World Archaeology* 7:39-49.
1993 The Rock Art of Easter Island. *Monumenta Archaeologica* 17.
- MCCALL, G.
1980 *Rapanui: Tradition and Survival on Easter Island*. Honolulu: University of Hawaii Press.
- MCCOY, P. C.
1976 *Easter Island Settlement Patterns in the Late Prehistoric and Protohistoric Periods*. Bulletin 5, Easter Island Committee, International Fund for Monuments, New York.
1979 Easter Island, in *The Prehistory of Polynesia*: 135-166, ed. J. D. Jennings. Cambridge, Mass.: Harvard University Press.
- METRAUX, A.
1940 *Ethnology of Easter Island*. B. P. Bishop Museum Bulletin 160.
- MULLOY, W.
1975 *Investigation and Restoration of the Ceremonial Center of Orongo, Easter Island*. Bulletin 4, Easter Island Committee, International Fund for Monuments, New York.
- NAGAOKA, L.
1988 Lapita subsistence: The evidence of non-fish archaeofaunal remains, in *Archaeology of the Lapita Cultural Complex: A Critical Review*: 117-133, ed. P. V. Kirch and T. L. Hunt. Thomas Burke Memorial Washington State Museum Research Report No. 5.
- OLSON, S. L., AND H. F. JAMES
1991 Descriptions of thirty-two new species of birds from the Hawaiian Islands: Part I. Non-Passeriformes. *Ornithological Monographs* 45.
- PIRAZZOLI, P. A., AND L. F. MONTAGGIONI
1988 Holocene sea-level changes in French Polynesia. *Palaeogeography, Palaeoclimatology, Palaeoecology* 68:153-175.
- ROUNSEVELL, D., AND I. EBERHARD
1980 Leopard seals, *Hydrurga leptonyx* (Pinnipedia), at Macquarie Island from 1949 to 1979. *Australian Wildlife Research* 7:403-415.
- ROUTLEDGE, K. S.
1917 The bird cult of Easter Island. *Folk-Lore* 28:337-355.
- SCHUBEL, S. E., AND D. W. STEADMAN
1989 More bird bones from Polynesian archeological sites on Henderson Island, Pitcairn Group, South Pacific. *Atoll Research Bulletin* 325.
- SEAVER, J. T.
1986 Pipi and pure: Ethnoarchaeology of the Rapa Nui shell industry. *Journal of New World Archaeology* 7:51-62.
- SMITH, C.
1961a A temporal sequence derived from certain *ahu*, in *Archaeology of Easter Island*, Vol. 1: 181-219., ed. T. Heyerdahl and E. N. Ferdon, Jr. Monograph of the School of American Research and the Museum of New Mexico 24, Part 1.
1961b Two habitation caves, in *Archaeology of Easter Island*, Vol. 1: 257-271, ed. T. Heyerdahl and E. N. Ferdon, Jr. Monograph of the School of American Research and the Museum of New Mexico 24, Part 1.

- STAFFORD, T. W., JR., K. BRENDDEL, AND R. C. DUHAMEL
 1988 Radiocarbon, ^{13}C and ^{15}N analysis of fossil bone: Removal of humates with XAD-2 resin. *Geochimica et Cosmochimica Acta* 52:2257-2267.
- STAFFORD, T. W., JR., A. J. T. JULL, K. BRENDDEL, R. C. DUHAMEL, AND D. DONAHUE
 1987 Study of bone radiocarbon dating accuracy at the University of Arizona NSF accelerator facility for radioisotope analysis. *Radiocarbon* 29:24-44.
- STEADMAN, D. W.
 1989 Extinction of birds in Eastern Polynesia: A review of the record, and comparisons with other Pacific island groups. *Journal of Archaeological Science* 16:177-205.
 1993 Biogeography of Tongan birds before and after human impact. *Proceedings of the National Academy of Sciences USA* 90:818-822.
- STEADMAN, D. W., AND P. V. KIRCH
 1990 Prehistoric extinction of birds on Mangaia, Cook Islands, Polynesia. *Proceedings of the National Academy of Sciences USA* 87:9605-9609.
- STEADMAN, D. W., AND S. L. OLSON
 1985 Bird remains from an archaeological site on Henderson Island, South Pacific: Man-caused extinctions on an "uninhabited" island. *Proceedings of the National Academy of Sciences USA* 82:6191-6195.
- STEVENSON, C. M., AND C. CRISTINO F.
 1986 Residential settlement history of the Rapa Nui south coastal plain. *Journal of New World Archaeology* 7:29-38.
- STUIVER, M., G. W. PEARSON, AND T. BRAZIUNAS
 1986 Radiocarbon age calibration of marine samples back to 9000 CAL YR B. P. *Radiocarbon* 28 (2B):980-1021.
- VAN TILBURG, J. A.
 1986 Red scoria of Easter Island: Sculpture, artifacts and architecture. *Journal of New World Archaeology* 7:1-27.
 1987 Larger than life: The form and function of Easter Island monolithic sculpture. *Musées Royaux d'Art de d'Histoire Bulletin* 58:111-130.
 1992 *HMS Topaze on Easter Island: Hoa Hakananai'a and Five Other Museum Sculptures in Archaeological Context*. British Museum Occasional Paper 73.
- VARGAS C., P., L. GONZALEZ N., R. BUDD P., AND R. IZAURIETA S.
 1990 *Estudios del Asentamiento de Isla de Pascua: Prospección Arqueológica de la Península del Poike y Sector de Mahatua*. Santiago: Universidad de Chile.

ABSTRACT

We report on the text excavation of a small trench at the coastal site of Ahu Nau-nau, Anakena, Easter Island (Rapanui), Chile. The cultural deposits are a basal silty clay overlain by up to 1.3 m of calcareous sand. Conventional ^{14}C dates on wood charcoal range from 660 ± 80 B.P. to 900 ± 80 B.P. Most lithic artifacts are of obsidian, with the remainder of basalt or red scoria. The nonlithic artifacts include two bird-bone needles and a dolphin-bone tab. The vertebrate fauna differs from later prehistoric Easter Island assemblages in that bones of marine mammals, sea-birds, and native landbirds are much more common, and bones of fish, humans, and chickens are rarer. The fauna is dominated by the Common Dolphin, Pacific Rat, and fish. Bones of fish are much rarer, and those of dolphins much more common, than in prehistoric midden assemblages from more tropical parts of Polynesia. The abundance of dolphin bones suggests that the prehistoric Rapanui had seaworthy sailing canoes for hunting dolphins offshore until c. A.D. 1300-1400, after which deforestation eliminated the raw material (trees) needed to make the canoes. Bones of extinct and extirpated native seabirds and landbirds occur throughout the deposit. KEYWORDS: Polynesia, Easter Island, prehistoric extinctions, fauna.