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Renewed Excavations at Motu Paeao, Maupiti Island, French Polynesia: Preliminary Results

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ABSTRACT

Earlier research in the ancient burial ground at Motu Paeao, on Maupiti Island, French Polynesia, by Emory and Sinoto had produced a diverse range of material culture of Archaic East Polynesian type, similar to that known from Wairau Bar in New Zealand. Typological considerations suggested that the Motu Paeao burials dated to about the ninth century AD, the age of one radiocarbon determination from the site. In the light of recent radiocarbon determinations indicating a thirteenth century age for Wairau Bar, investigations were renewed at Motu Paeao. These uncovered four burial areas. Determinations on samples of human bone gelatin and marine shell indicate that the site dates to the thirteenth to fifteenth centuries AD, with a most probable use in the fifteenth century.

Keywords: MOTU PAEAO, MAUPITI, ARCHAIC EAST POLYNESIAN, RADIOCARBON DATING, FTIR ANALYSIS, POLYNESIAN PREHISTORY.

INTRODUCTION

The age at which the islands of East Polynesia were first settled has been debated according to different sources of evidence and nowhere more vigorously than in relation to New Zealand (Anderson 1991, 1995, 1996a; Conte 1992, 1997; Holdaway 1999; Kirch 1986; Spriggs and Anderson 1993; Sutton 1994). One of the basic difficulties lies in demonstrating and dating connections between archipelagos, and in this matter the evidence of archaeology is obviously crucial. Recent developments in lithic sourcing (e.g., Weisler 1997) offer one line of advance, but between New Zealand and tropical East Polynesia no suitable samples are known (Anderson n.d.). An alternative, less certain but still of value, is to explore the chronology of artefact types and assemblages held in common, adopting the assumption that typological similarity implies an historical connection. Sites which contain artefactual

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assemblages of early East Polynesian provenance have often been seen as the remains of a vicariant population of initial colonists, the implication of Golson's (1959) characterisation of the material as belonging to the Archaic phase of East Polynesian Culture (AEP). This idea has been challenged on various grounds by Kirch (1986), Sutton (1987), Green (1994) and Walter (1996), the fundamental arguments being that AEP is not the earliest assemblage in some areas and is absent in others, while its typological content and chronological span are so wide as to render doubtful the idea of a coherent assemblage. We think that the evidence for AEP is improving chronologically (below), but the points are well made and if comparisons are to be drawn then they had better be between assemblages which are specifically similar.

It has long been recognised that two prehistoric cemeteries have produced assemblages of considerable similarity: Wairau Bar in New Zealand (Duff 1956) and Motu Paeao on Maupiti Island in French Polynesia (Fig. 1). Emory and Sinoto (1964: 157) listed the similarities thus: burials placed in the same position and orientation, artefacts arranged around burials in a similar manner, identical forms of shaped whale-teeth pendants, identical forms of trolling lure hooks, and a similar range of adze types. Noting, however, that only 1 of the 15 adzes from Motu Paeao was clearly tanged, 8 had incipient tangs and 6 no tang, they concluded that this assemblage was earlier than that at Wairau Bar; since radiocarbon dates put Wairau Bar at about AD 1150 (Duff 1956: xii), and because colonisation of New Zealand might have occurred several centuries earlier, the age of the Motu Paeao assemblages should be older than AD 900, perhaps as early as AD 600. In later consideration, the distribution of adze-tanging was estimated differently (Emory 1968: 157) and similarities of adze typology with Wairau Bar downplayed (Duff 1968: 123). An inspection of the Maupiti adzes has led Leach (pers. comm.) to a similar conclusion — in the light of considerable adze research since the 1960s, they do not appear particularly close typologically to those at Wairau Bar. Nevertheless, the other similarities remain and on historical grounds, if no other, the question of chronological comparison needs to be pursued.

The Emory and Sinoto (1964) view seemed to be confirmed by the first radiocarbon date from the site of bone "collagen" (GXO-207) which had a conventional age of 1090 BP, commonly cited (uncalibrated) as AD 860 (Table 1). A second "collagen" sample (GXO-276) returned an uncalibrated age of AD 1190 (Krueger and Weeks 1966: 159). The former estimate has been preferred exclusively by Emory (1979: 202) and Sinoto (1983: 59), but others have cited the range AD 800–1200 for the age of the site (e.g., Garanger 1967: 381; Kirch 1986: 29; Bellwood 1987: 61), consistent as it was with the ages of similar assemblages in the Society Islands, such as Vaito'otia on Huahine (Sinoto and McCoy 1975).

Irrespective of which age range is preferred for Motu Paeao, some difficulties arise. Firstly, two dates are simply insufficient to establish the age of the site, especially since both are from the one cluster of burials (Ma-3 of Emory and Sinoto 1964). Secondly, the dates are very different from each other and the wide age range seems inconsistent with the similarity of artefacts between burials. Thirdly, bone "collagen" can be a difficult material for radiocarbon dating because of the potential uptake of contaminants of disparate age, and Spriggs and Anderson (1993) excluded bone "collagen" dates obtained up to that point from consideration in their review of the early East Polynesian chronology. Fourthly, more recent research on the chronology of sites in the New Zealand region with assemblages similar to Motu Paeao has put them consistently into a younger age range than hitherto, generally the thirteenth and fourteenth centuries AD (Anderson and Smith 1992; Anderson and Wallace

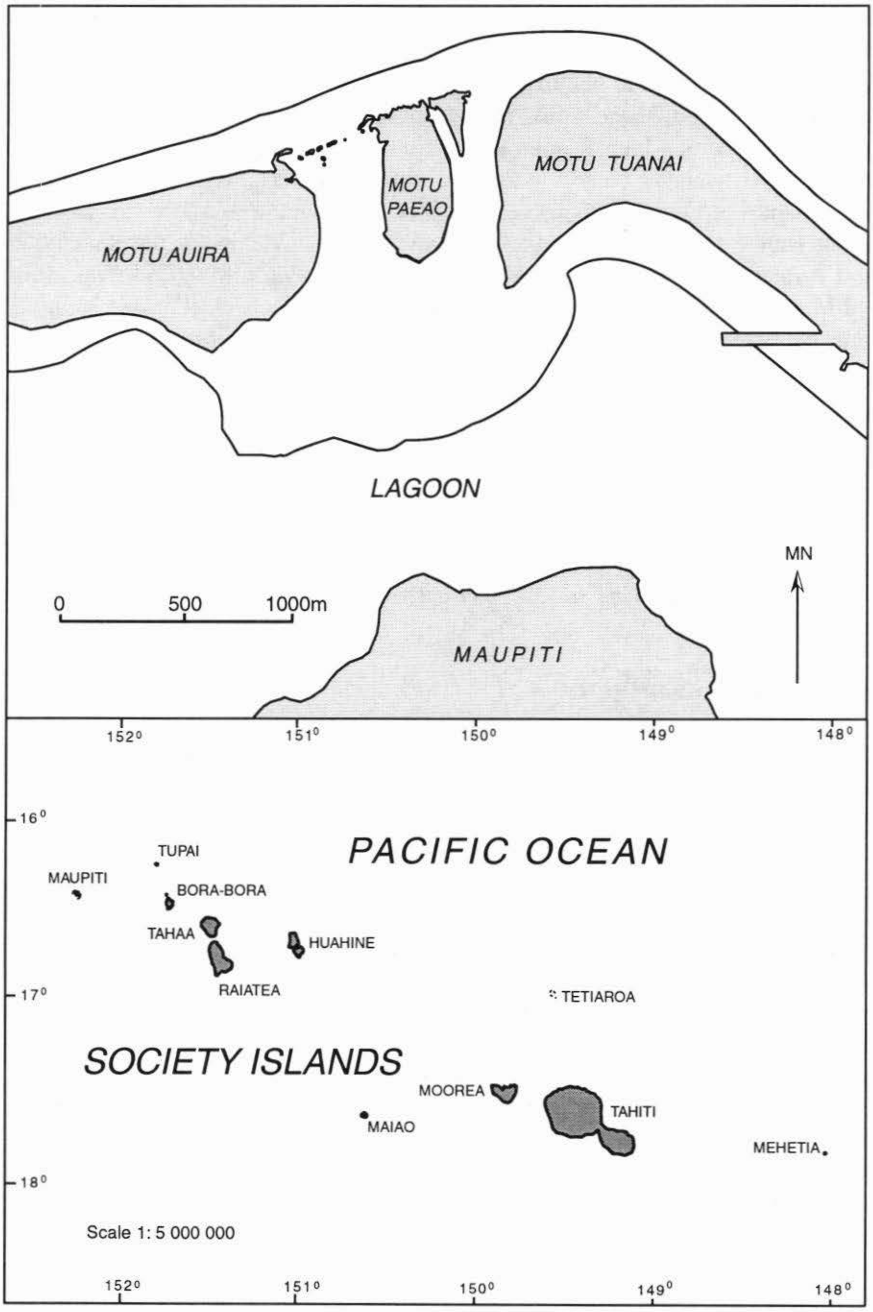

Figure 1: Location of Motu Paeao on Maupiti Island in French Polynesia.

1993; Anderson *et al.* 1996; Anderson 1996b; Higham and Johnston 1996). Most particularly, recent radiocarbon determinations on moa eggshell from Wairau Bar (Higham *et al.* 1999) showed that it was occupied for a brief period in the thirteenth century AD.

It was therefore important to obtain new samples upon which to clarify the chronology of interment at Motu Paeao. These would include, of necessity, human bone samples, but also samples of charcoal, non-human bone and marine shell, if they could be obtained from archaeological provenances clearly associated with the burials. With the approval of the Ministry of Culture, French Polynesia, and local land-owning and territorial authorities, excavations were conducted at Motu Paeao in June 1999. The fieldwork was directed jointly by Atholl Anderson and Eric Conte, assisted by Geoffrey Clark, Maui Tauvirai (Maupiti), and Jean-Marie Dubois (Papeete), a geomorphologist. Dr Sinoto was unable to attend the fieldwork, but provided invaluable background information. Our objectives were:

- to map the position of the Motu Paeao burial ground and tie it to a fixed datum,
- to expose at least one of the burials first excavated in the 1960s in order to obtain samples which could provide a reliable age for the associated material culture and,
- to relate the stratigraphic position of the Motu Paeao burials to the natural stratigraphy of the islet and to other archaeological remains.

FIELDWORK PROCEDURES

The southern end of Motu Paeao is scattered with coconut palms and thickly overgrown beneath them with small trees and shrubs. There are no fixed survey points on the island and it was difficult to establish the precise positions of land boundaries. Mr Tauvirai pointed out the approximate position of the division between Te Tiare and Paeao land and we also had a map which showed the layout of the 1962–1963 excavations (Sinoto unpub.). However, there was no indication of the precise position of the site upon the motu (islet), except that it lay more or less in the middle, about 30 m back from the southern point of the vegetation line. Around the southern end of the motu, at 30–50 m inland from the edge of the vegetation, a low rise, which to the east is marked by a bank, distinguishes the inland area. This low "plateau" has a deeper upper soil horizon than elsewhere and it is the only area which has produced archaeological remains (Fig. 2).

In order to locate the position of previous excavations, we initially probed for ground that was softer than elsewhere, because the excavation pits were filled with loose white sand at the end of the 1960s excavations. Upon locating one such area, we laid out a baseline and excavation grid, oriented magnetic north–south, within which all excavations were set out by metre square (Fig. 3). The excavation grid was eventually surveyed into a map of the southern part of the island, made by use of total station survey equipment. In the absence of a trig point or any other permanent fixture to provide a map datum, we buried a one-metre piece of iron reinforcing rod, bent into a u-shape with the points aligned north–south, along the eastern baulk of square ZG-9. The northern point of the rod marks the northeast corner of the excavation square. In future, this datum will be relocatable by our plans or with the use of a metal-detector.

The first excavation (E-8, E-9), exposed remains of two burials. While it was in progress, three squares at approximately equal intervals were excavated to the south, seeking to define

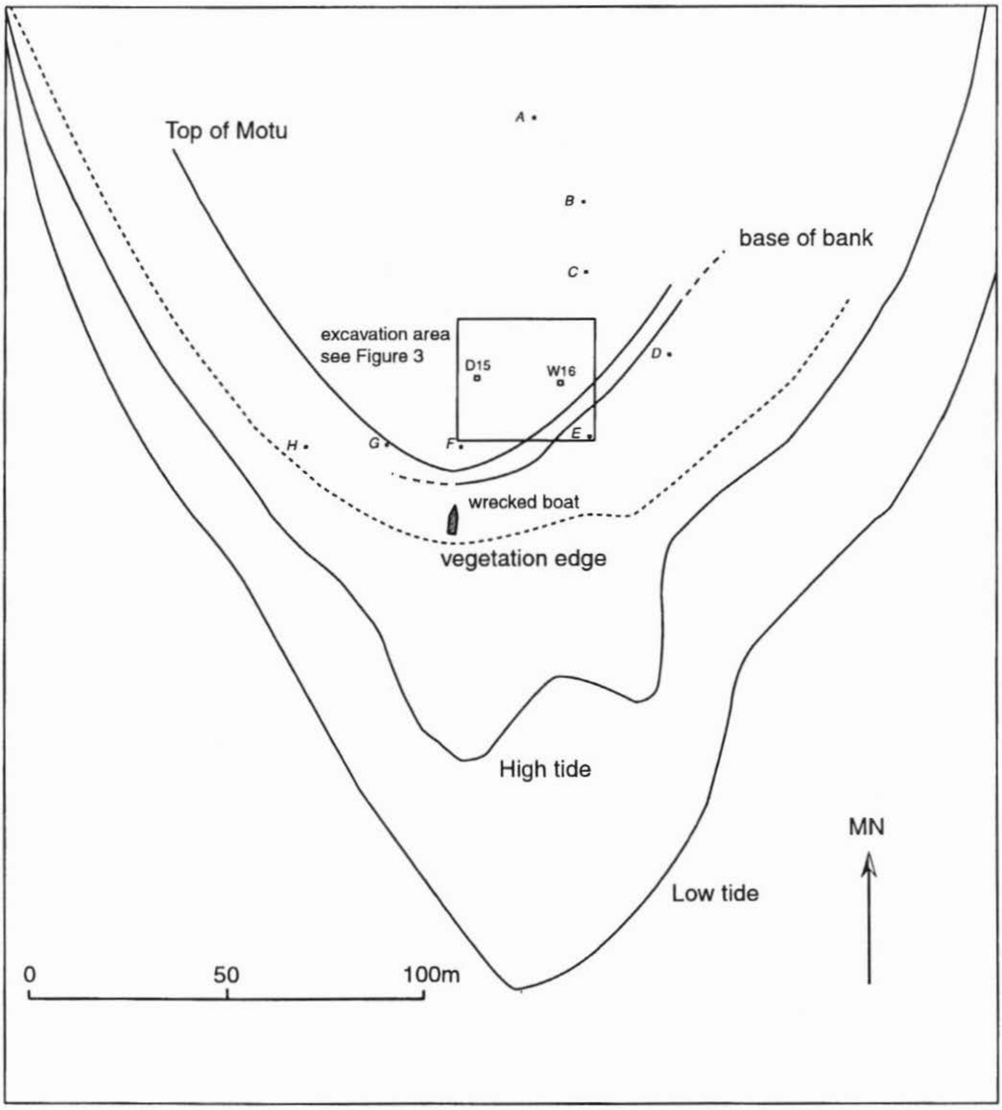

Figure 2: Surveyed map of the southern part of Motu Paeao, showing the location of the excavation grid in Figure 3.

the stratigraphy of the site in detail (D-15, C-21 and A-26). During excavation of D-15, it became apparent that there was evidence of a shallow trench running approximately north–south, and of a deeper disturbance which, in due course, turned out to be a burial, previously unexcavated. The excavation area was expanded (C-E 14-15) to expose this feature.

Once the burials in E-8, E-9 were fully exposed, it was proposed that they were the Ma-2 set of Emory and Sinoto (1964) as shown on the Sinoto (unpub.) plan (Fig. 4), in which

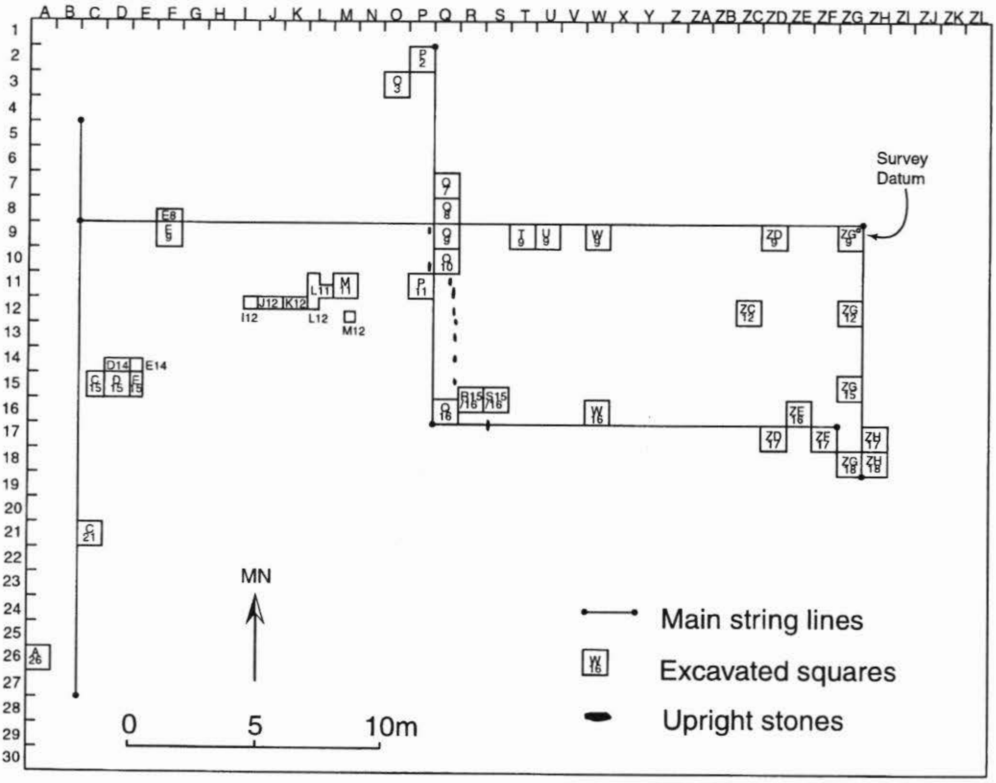

Figure 3: The 1999 excavation grid, showing the excavated squares.

case the main burial area lay further to the east. Clearance of an area 7–10 m to the east exposed some further patches of soft ground and a number of small slabs of coral set upright. Assuming Ma-2 to correspond to our squares E-8, E-9, then the slabs were set in the area of burial Ma-1 and the cluster of burials to the east of that.

Additional excavation areas were set out to expose the remains of Ma-1 (I-O 11-12), and to test the ground which, according to the Sinoto (unpub.) plan, remained unexcavated in the immediate vicinity of the main burial cluster. Most of our squares: N-3, P-2,11, Q-7,8,9,10,16, R-15/16 and S-15-16 (the latter two both offset 0.5 m to the north of the main grid to find the unexcavated ground between the Ma-1 and Ma-3 excavation areas), T-9, U-9 and W-9,16, proved successful in finding the unexcavated areas sought between the Emory and Sinoto trenches.

Attention was then focused on the eastern side of the low "plateau" with the intention of defining the stratigraphy of this area and seeking its relationship to anticipated ovens which were described by Emory and Sinoto (1964) as being exposed in the bank. The main area of excavation lay on the southeast edge of the bank and down it: squares ZD-17, ZE-16, ZF-17, ZG-18 and ZH-17,18. Excavation of square ZG-18 exposed a burial quite close to the surface, but no evidence of ovens or other archaeological remains. The bank excavations

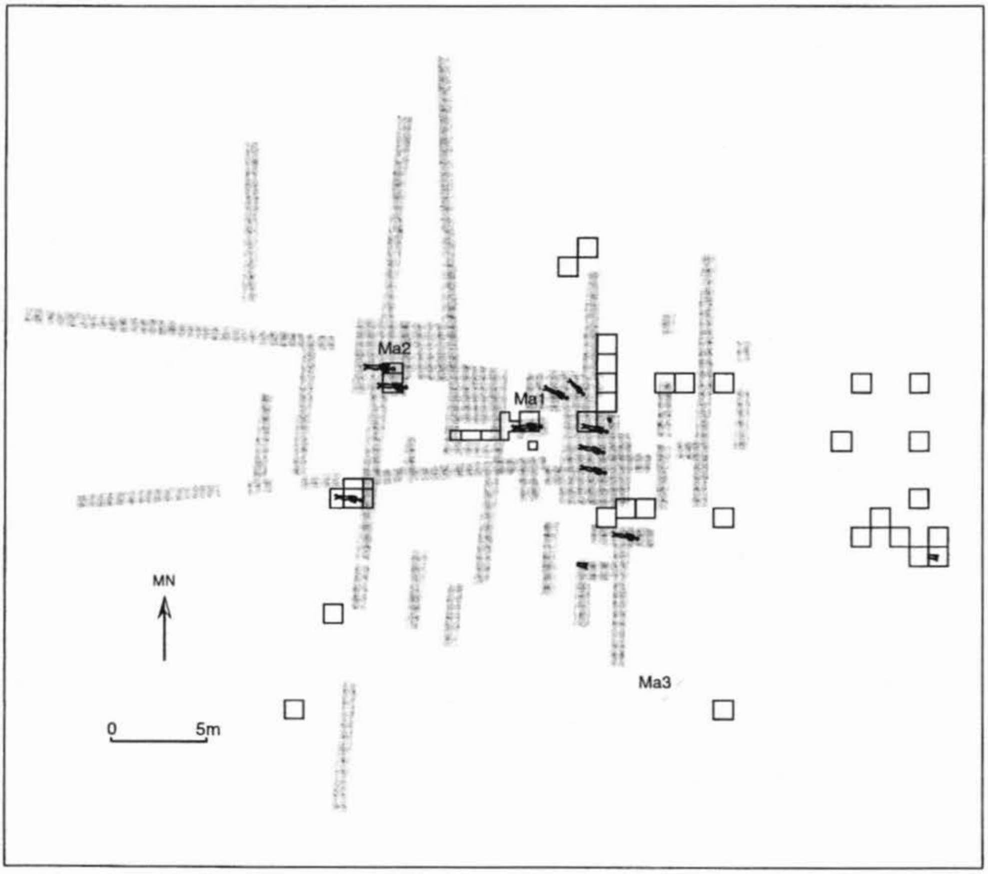

Figure 4: The 1999 excavations superimposed, as nearly as can be determined, upon the Sinoto (unpub.) plan which designates the burial areas Ma-1,2,3.

were then linked to the main east–west transect by excavations in ZC-12, ZD-9, and ZG-9,12,15. No ovens were located.

All excavations were conducted by trowel and brush, with features and samples being recorded by square, layer and depth. Excavated material from cultural layers was sieved through 2 mm or 4 mm mesh, or both, as appropriate. In addition to the excavations, a transect of spade holes at approximately 20 m intervals was dug north of the excavation grid and east–west across the motu to further amplify our understanding of the stratigraphy.

EXCAVATION RESULTS

STRATIGRAPHY

Most excavation squares disclosed the same stratigraphy and were bereft of cultural material except for probable midden remains enclosed within the upper soil horizon. The normal stratigraphy in the southern area of Motu Paeao is as follows.

Layer 1: 12–25 cm of a compacted, humus-enriched dark-brown to black topsoil in which are found sparse remains of marine molluscan shell, often broken and occasionally burnt, and small pieces of heavily-weathered fish bone, plus occasional small pieces of charcoal, set in a matrix of coarse coral sand and shell hash containing numerous pieces of coral from pebble- to cobble-sized. Towards the east in the excavation grid, and especially down the bank, layer 1 thinned to 5 cm in depth or less.

Layer 2: 20–30 cm of compacted, light-grey coarse coral sand and abundant coral pieces, often up to boulder-sized, especially at the base of the layer. In places it is almost as if there was a natural coral pavement formed at the interface between layers 2 and 3. Shell is less abundant in this layer than in layer 1 and much of it is water-rolled and probably of natural origin. However, there is also occasional shell of apparent midden origin and, rarely, some very small pieces of hard, black charcoal.

Layer 3: Beneath layer 2 was the natural white to light-yellow coarse coral sand and coral pieces of all sizes, heavily compacted and containing a high proportion of shell hash, distributed as thin drifts in some places. Excavation of this was taken to the water-table in square C-21 to establish the nature of the layer, and to depths ranging from 0.6 to 0.8 m elsewhere.

ARCHAEOLOGICAL FEATURES

Burials in E8, E9. In square E9, once the infilling sand was removed, there appeared a surface of grey sand upon which badly-preserved skeletal remains were lying. These comprised bones from the arms and the lower part of the trunk. The skeleton was oriented with the head to the east. An unworked piece of basalt lay beside the pelvis. In square E8 lay the fragmented remains of a skull, lying in right profile, upon the grey sand surface. Some other bone fragments nearby, to the west, suggest that this skeleton had also been oriented with the head to the east. A large coral slab separated this set of remains from those in square E9. In comparing the disposition of these skeletons with those shown on Sinoto's plan it can be deduced that these are the remains which he identified as Ma-2.

Burial in C-E, 14-15. During excavation of square D-15 a shallow trench was observed running north–south through layer 2. It is assumed that this marks the course of one of the 1960s excavation trenches. In the east and west baulks of square D-15, the grey sand and coral of layer 2 continued downward and was seen to form the outline of a deeper trench. Since layer 1 was of the same material and depth all around the square, except where the shallow trench crossed it, it was concluded that the deeper trench had been cut from no higher than the base of layer 1 and possibly from quite deep in layer 2. From 0.37 m to

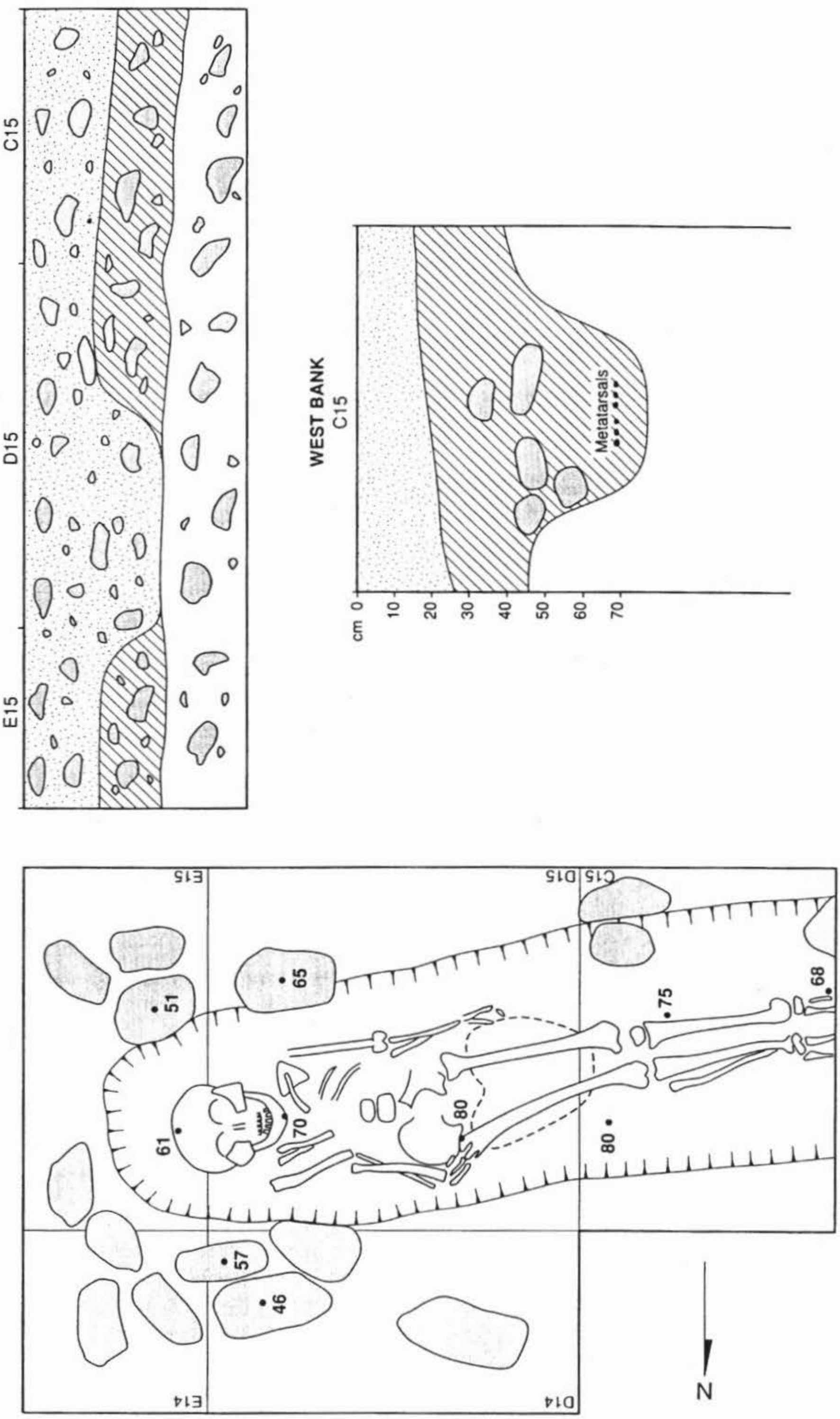

Figure 5: Stratigraphy and plan of the burial in C-E, 14-15.

0.65 m, layer 2 contained numerous coral boulders of 20–60 cm in maximum length. Immediately beneath these appeared the remains of a human burial.

The excavation was extended to take in an additional 0.5 m of squares D-14, E-14 and E-15, plus 0.7 m of square C-15. The exposed burial pit below the coral boulders was shallow and rounded, extending to a maximum depth of 80 cm into layer 3 (Fig. 5). The body had been laid out on its back, head to the east, with the hands folded over the pelvis. The bones were generally in poor condition, exhibiting fragility, deep weathering, flaking of the cortical surfaces and absence of the epiphyses of many of the long bones. Most of the vertebrae and ribs were gone and the upper arm bones were badly eroded.The skull had been severely broken across the frontal bones in antiquity with the face and jaw pushed back. The coronal and sagittal sutures were fully fused, the supraorbital ridge was quite prominent and blunt and the jugal bones broad. All the teeth were present, and generally in good condition, but the right lower first molar was worn down on a plane with the buccal side higher. The long bones were too eroded at the epiphyses to make taking any measurements worthwhile. Our conclusion is that the bones represent a robust adult of fairly short stature, and most likely a male.

Excavation continued around and under the bones. No grave goods were found. The position of a fallen coconut palm prevented excavation of the remaining part of square C-15 to expose the feet completely. However, we probed this area thoroughly from the west baulk of that square and we do not think that anything other than the bones exist there.

Burial in O-11. This area was chosen for excavation since, as nearly as we could determine, it is the site of the first discovery of ancient human remains on Motu Paeao, labelled Ma-1 by Emory and Sinoto (1964). At the eastern side of square O-11 a small coral slab had been set upright and its position, plus the position of others located nearby (Fig. 3), is consistent with the layout of the 1960s excavations (Sinoto unpub.).

Beneath a shallow deposit of humus and roots was 8–12 cm of clean white coral sand and pieces, the upper fill of the excavations placed by the 1960s workers. Beneath that layer was 15–20 cm of compacted grey sand and many blocks of coral, typical of layer 2 in the site generally, though evidently excavated and re-filled. At the base of this layer at the contact with layer 3, which in this square consisted of quite loose, white coral sand, were found some human bones. These were badly weathered and eroded but appeared to consist of the radius and ulna and parts of the upper arm bones of a burial which had lain with the head to the southeast. It is assumed that this is part of burial Ma-1 (Emory and Sinoto 1964). The skull had been reburied in another area by Mr Pofatu in 1961.

Extension of the excavation into adjacent squares (I-12 to O-12 and L-11), in order to expose areas left unexcavated in the 1960s, located the older excavation edge running north-south through square K-12. From the intact portion of that square a small piece of cut pearl shell was recovered at 5 cm depth in layer 1. This is probably part of the scatter of artefactual material which lay up to several metres from Ma-1 when it was excavated in 1962 (Emory and Sinoto 1964), the remainder of which was recovered at that time.

Burial in P-11. This square lay between the small coral slabs placed by the Emory and Sinoto team to mark their excavations. The upper part of the stratigraphy consisted of a thin humus layer (10–15 cm deep), lying upon white coral sand. At a depth of about 45 cm was a grey coral sand, darker with depth, containing numerous pieces of branch coral. This layer corresponds to layer 2 elsewhere in the excavations. Several fragments of bone and one tooth were located at a depth of 47–60 cm.

Burial in ZG-18, ZH-18. In this square, which lay across the top of the break of slope from the low "plateau" (Fig. 2), layer 1 was quite shallow, no more than 5 cm in most places and possibly fairly recent. There were also some drifts of recent sand and coral pieces extending from the lower ground to the south up to the lip of the slope. It seems probable that there has been some marine erosion of the slope and the adjacent area of the "plateau". Beneath the vestigial layer 1 is 20–25 cm of grey sand and coral pieces, typical of layer 2 generally, and at the base of this are some human remains lying on the surface of layer 3. No burial pit is evident in the stratigraphy. The burial is lying head to the east, but consists only of badly weathered and chalky remains of lower and upper limb and pelvic bones, together with several vertebrae. No grave goods were found.

Additional Remains. Fragments of human bone, which may be the remaining pieces *in situ* of former burials, or pieces transported out of context by land crabs, gardening, etc., were found in square W-9. In square R-15/16, pieces of human bone, probably from a previously undisturbed extension of the Ma-3 burial area, were encountered at 45 cm depth, at the contact with layer 3. A small piece of cut pearl shell was in association. Several other pieces of worked pearl shell were recovered from square ZG-12, but not in association with human bone.

RADIOCARBON DATING

Samples of bone, shell and charcoal for radiocarbon dating, and also samples of sediment associated with one of the burials (to assist in electron-spin resonance (ESR) dating of teeth) were collected. Other than to take small samples, the burials were neither unduly disturbed nor removed. Samples submitted to the Waikato Radiocarbon Laboratory are described in Table 1. Five samples are from the newly discovered burial in squares C-E, 14-15. The charcoal (MP13A) and *Turbo* shell (MP13B) samples came from within the grave fill, but near the top (25–40 cm depth). The *Turbo* consisted of two shells broken in a way characteristic of food refuse in this species on Maupiti (Mr Tauvirai collected modern *Turbo* and demonstrated the typical breakage pattern). Two other samples of shell came from lower down in the grave fill (MP15, MP28). They were of shell fragments of various species, but pieces which were not water-rolled and which were regarded as possible midden. The fifth sample (MP00) was of human bone.

The remaining three samples were of human bone from additional burials representing the full area of the site. MP21 is from one of the two burials designated Ma-2, with which were associated four adzes, two whale-tooth pendants, two trolling lures, polished pearl shells and other material (Emory and Sinoto 1964: 147). MP42 is from one of the burials in the area designated Ma-3 where Emory and Sinoto (1964: 148) uncovered 11 burials and substantial numbers of artefacts similar to those at Ma-2, including 14 whale tooth pendants. MP58 is from a newly-discovered burial on the eastern edge of the site. No artefacts were associated with these remains, or those of sample MP00.

The bones were washed, cleaned and ground to <1 mm. All bones were decalcified for two days in 2% HCl at room temperature, then gelatinised at pH 3, 90° C for four hours. They were not given a NaOH wash because of the small sample sizes and relatively clean appearance of the bone. The relevant pretreatment data (Table 1) show that %N values on whole bone place all samples in the Stafford *et al.* (1988) Class II (very well to well preserved; 3.5–0.6%N). Extractable protein yields for modern bone are above 20% (Hedges and van Klinken's (1992) "good preservation" category), and three of the samples clearly fall into that category. MP21, with 12% extractable protein, is transitional between Hedges and van Klinken's (1992) "good" and "poor preservation" (<10% extractable protein) categories.

TABLE 1
Samples submitted to Waikato Radiocarbon Laboratory

Code	*Material*	*Weight*	*Provenance*	*Pretreatment data* (1)	(2)	(3)	(4)
MP00	Human astragalus, cuneiforms metatarsals, phalanx	61.6 g	C-15: 70 cm	1.67	9.1	46	14.12
MP13A	Charcoal (unidentified fragments)	2.9 g	D-15: 25-40 cm				
MP13B	Two *Turbo* sp. shells	148.3 g	D-15: 25-40 cm				
MP15	*Anadara, Cypraea, Turbo* shells	79.6 g	D-15: 67 cm				
MP21	Human mandible fragment	16.0 g	E-8: 35 cm	1.03	2.4	12	15.11
MP28	*Cypraea, Turbo, Nerita, Strombus, Cerithium, Arca, Asaphis* shells	69.2 g	D-15: 45-60 cm				
MP42	Human patella, cranial fragment	43.1 g	Q-16: 45 cm	1.75	5.8	29	13.43
MP58	Human humerus and tibia shaft pieces	65.3 g	ZG-18: 25 cm	1.82	4.8	24	11.65

Note: Pretreatment data for bone samples: %N on whole bone (1); % gelatin yield (2), % extractable protein calculated on the basis that 20g of protein can be extracted per 100g of modern bone (3); $\delta^{15}N$ on bone (‰) (4).

In order to evaluate the preservation state of the bone protein, Fourier-Transform Infra-Red Spectrometry (FTIR) analysis was run on collagen and gelatin samples using a Biorad™ FTS-40 spectrometer at the School of Biological Sciences, University of Waikato (Fig. 6). Individual spectra were obtained using 8 acquisitions before Fourier transform, at a spectral resolution of 4 cm^{-1} using the empty chamber as the background reference spectrum. Absorbance spectra were plotted from 4000 to 500 cm^{-1}.

FTIR spectra of the "collagen" (acid insoluble) fractions of Wk-7580, 7581, and 7583 show, in addition to the typical collagen peaks (at ca. 1650 cm^{-1}, 1550 cm^{-1}, 1240 cm^{-1} and 1456 cm^{-1}), a pronounced peak at ca. 1200–1000 cm^{-1} which might be due to contaminants (humic acid-like materials), clay, or the result of diagenesis or pretreatment on poorly preserved collagen (cf. Weiner and Bar-Yosef 1990; Law *et al.* 1991). The typical collagen peaks are, however, relatively sharp, which is unlikely to be the case if they were overlapped by contaminants. The anomalous peak is still present in the gelatin fractions, but it is diminished except in A7582 gel.spc, where the small gelatin sample available for FTIR analysis is responsible for the less than perfect spectra.

It is difficult to be certain if these anomalous peaks are due to either contamination or degradation. The gelatinisation process should, however, remove better than 92% of any contamination that is present (van Klinken and Hedges 1995). In a sample dated to 600 BP, 8% contamination could result in an error of 42 years if contaminated by modern carbon, or 680 years too old if contaminated by ^{14}C free carbon (a result of 1280 BP). In practice, however, the majority of contaminants tend to be young and of varying age (cf. Higham 1993: 104–105). Moreover, comparison with DeNiro and Weiner's (1988) guidelines indicates that the Maupiti spectra are typical of "good prehistoric" samples, and should give acceptable isotopic results.

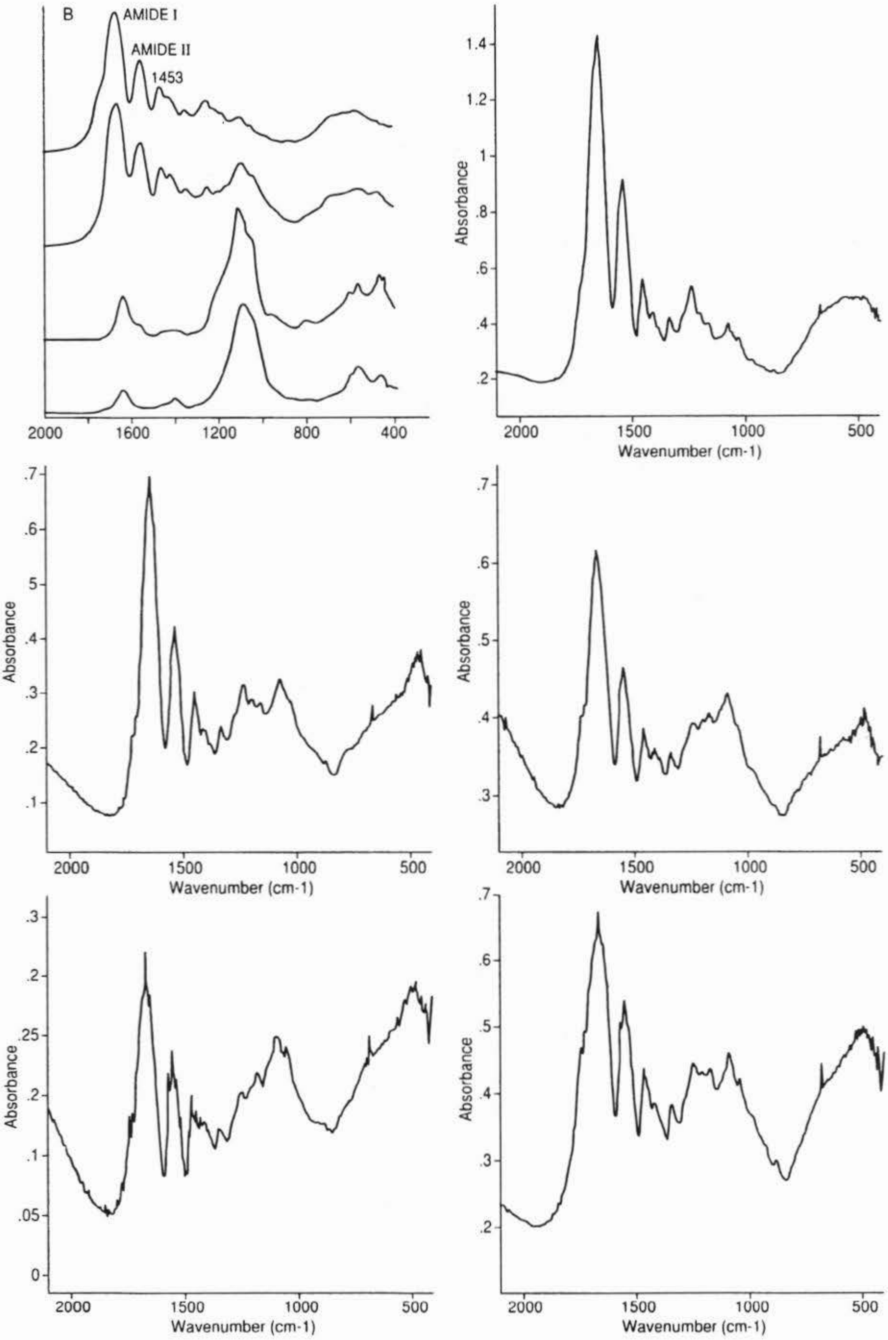

Figure 6: FTIR spectra in the wavenumber range 2000–500 cm^{-1} for Maupiti gelatin samples compared to reference spectra (top left) in DeNiro and Weiner (1988: figure 7) which show (from top) modern, good prehistoric and bad prehistoric (x2) examples, and a Waikato Radiocarbon Laboratory standard (top right). The archaeological samples are (centre) Wk-7580 (left) and Wk-7581; (bottom) Wk-7582 (left) and Wk-7583.

RESULTS

The results were evaluated using OxCal combined probabilities calculations (Bronk-Ramsey 1999). Using this method ^{14}C determinations were calibrated, combined, and then assessed in the light of the combined data. For an acceptable agreement between these two distributions, A (the "agreement index") should not fall below 60.0% (<A′c) (an unaltered index = 100%). This can be further tested by calculating an overall agreement index for combinations ($A_{overall}$), where An is the value (dependant on n) below which $A_{overall}$ should not fall. If $A_{overall}$ falls below 60.0%, the model should also be questioned.

Samples from the deep burial site in C-E 14-15 provided a wide range of results. The two dates on mixed shell (Wk-7577, Wk-7578) which might have been midden are almost certainly on natural shell, quite probably material dug from the grave and then used as fill. The ages are within the range of radiocarbon determinations on emerged coral conglomerates and microatolls from Motu Paeao (Pirazzoli n.d.). The remaining determinations from this burial do not, however, give statistically acceptable results ($A_{overall}$ =54.0% (An=40.8%, n=3)) with the charcoal result (Wk-7576) being in poor agreement (A=29.7% (<A′c=60.0%)). This charcoal sample was very small in size and sufficiently near the top of the fill to contain charcoal introduced by recent gardening. The bone gelatin ^{14}C result (Wk-7583), on the other hand, dates the burial directly and gives a calibrated age at one sigma of AD 1330–1480. This result overlaps at one sigma the remaining shell determination for this area (WK-7579), but does not overlap the associated charcoal result (Wk-7576) (Table 2). If Wk-7576 is excluded, the remaining two determinations from this area are in agreement ($A_{overall}$ =122.4% (An=50.0%, n=2)) and give a calibrated age at one sigma of AD 1401–1443.

All four burials are considered to be broadly contemporaneous as suggested by the overall uniformity of material culture between those interments which contained artefacts — although it must be conceded that burials with no grave goods could be significantly different in age. Our results show that radiocarbon determinations Wk-7582, Wk-7581 and Wk-7580 are not in close agreement with Wk-7579 and Wk-7583 from Area C-E ($A_{overall}$ = 22.3% (An=31.6%, n=5)). While contamination within the bone gelatin samples may be responsible for this discrepancy, especially in Wk-7582 which was noted to have low levels of extractable protein, moderately high $\delta^{15}N$ values obtained on all four bones prior to pretreatment indicate the possibility of a marine signature (Table 1). All human bone determinations should, therefore, be interpreted as being slightly too old, with Wk-7582 containing the largest amount of marine influence ($\delta^{15}N$ = 15.11‰) and the greatest deviation from expected age with a result of cal AD 890–1260 at 1σ. This would bring the calibrated ^{14}C ages more in line with the shell result, Wk-7579.

The detection of contamination within the acid insoluble fraction of the bone samples and the presence of a marine signature suggest that neither of the earlier obtained bone "collagen" determinations (GXO-276 and GXO-207) can be regarded as wholly reliable.

Considered as a group, and discarding the two oldest shell dates as being on non-cultural samples, there is broad agreement that the Motu Paeao burial ground was in use between the thirteenth and fifteenth centuries, with strong support for use in the fifteenth century. The new determinations are also close to two results (Gak-154, 660±80 b.p. and Gak-155, 480 b.p., but see Spriggs and Anderson (1993) on Gakushuin determinations) from eroding ovens at another probable early site on Maupiti Island (Kigoshi *et al.* 1962; Emory 1962). This is Motu Tiapaa on the edge of the main pass into the lagoon, from which came several one-piece hooks illustrated by Emory and Sinoto (1964: figure 6). These are insufficiently discriminated from the Motu Paeao material, and have been confused with it (e.g., Green 1975: figure 3a).

TABLE 2
Radiocarbon Determinations from Motu Paeao, Maupiti Island.

Lab. No.	*Provenance*	$\delta^{13}C$	*CRA*	*Cal AD (1SD)*
Geochron:				
GXO-207	Ma3-2	n.d.	1090 ± 85 BP	884–1021
GXO-276	Ma3-6	n.d.	760 ± 90 BP	1217–1300
Waikato:				
Wk-7576	MP13A	-26.6	260 ± 120 BP	1490–1950
Wk-7577	MP15	+4.0	3420 ± 50 BP	1380–1210 BC
Wk-7578	MP28	+3.4	2150 ± 50 BP	190–350
Wk-7579	MP13B	+3.3	950 ± 50 BP	1405–1470
Wk-7580	MP58	-20.3	640 ± 70 BP	1290–1410
Wk-7581	MP42	-19.5	740 ± 70 BP	1260–1390
Wk-7582	MP21	-18.5	990 ± 170 BP	890–1260
Wk-7583	MP00	-18.1	550 ± 60 BP	1330–1480

References: Emory and Sinoto (1964), Krueger and Weeks (1966). Calibrations: For charcoal and bone, Stuiver *et al.* (1998a), with southern hemisphere offset of 24±3 years; Stuiver *et al.* (1998b) for marine shell, using ΔR value of 45±30 years (Higham *pers. comm.*).

DISCUSSION AND CONCLUSIONS

The radiocarbon determinations reported here indicate that a significant change in our impression of the chronology of Motu Paeao is in order. With the exception of Wk-7582, the most problematic of the bone ages, there is nothing to suggest that interments occurred in the range AD 800–1200, much less began in or were confined to the early part of that range. A period of approximately AD 1400–1450 looks more probable. This is likely to be true of the site as a whole given the spatial distribution of the burials sampled and their variation in burial depth and association with artefactual assemblages. It is possible that there are burials of significantly different age at Motu Paeao but we have tried to cover all the main sources of potential variation. The result is that Motu Paeao appears very like Wairau Bar, where radiocarbon determinations on burials of different characteristics and widely distributed across the site returned very similar results (Higham *et al.* 1999).

Taken as a whole the Wairau Bar chronology suggests a period of use slightly earlier than at Motu Paeao, contrary to earlier typological considerations (Emory and Sinoto 1964). We do not draw the inference that AEP may have developed in New Zealand and been spread to central East Polynesia, since the absence in contemporary central East Polynesian sites of samples from New Zealand sources of desirable lithics (obsidian, nephrite, chert) is a compelling counter indication, but the suggestion appears more plausible chronologically than it has done until now (cf. Davidson 1994: 217). If the various elements of AEP were introduced to New Zealand, perhaps piecemeal in multiple voyages, by East Polynesian settlement in the period AD 1100–1200 (Anderson 1991), then there was time for its formation as an assemblage associated with burial practice 100–150 years later at Wairau Bar and, now, for initial introduction to the Society Islands soon after that. Putting such conjecture aside, we cannot emphasise too strongly the importance of establishing better chronologies for other important sites with AEP assemblages, of which Vaito'otia (Sinoto and McCoy 1975) is most outstanding in terms of a potential connection with New Zealand.

On the underlying question of whether AEP can be said to exist at all, we take a conservative view, and leave aside here the associated issue of whether it was part of the colonising culture of East Polynesia, wholly or in part. Our results suggest, however, that Walter's (1996: 525) conclusion about AEP in relation to Polynesian material culture, that "no assemblage, polythetic or otherwise, could be reasonably excised from this continuum and be claimed to hold other than trivial cultural meaning" is worth revisiting.

Several arguments that led to it are open to alternative opinion. For instance, it is not a crucial objection that some of the individual elements of AEP are also found elsewhere: after all, iron implements were widely distributed outside Polynesia in the eighteenth century but they are still distinctive markers of the Polynesian protohistoric. Nor, similarly, does it matter so critically that many other kinds of artefact types are found distributed erratically through sites which contain several or more of the types that have long been regarded as core elements of AEP. Collecting data from different types of sites, including villages, middens, rockshelters, caches and burials, will include a broad range of material culture, whereas AEP may have been a distinctive, restricted, subset manufactured for a non-utilitarian purpose such as status. Most of the known examples of ornamental forms such as shaped whale-tooth pendants, reels, and tanged pearlshell pendants come from known or suspected burial sites; finely-made trolling lure shanks, various adze types such as reverse trapezoidal and triangular adzes (often apparently new), one-piece hooks with acute recurved points or circular form, and harpoon heads are often associated with burial sites, though they are also found in settlement sites and caches. Indeed the argument for coherence of an AEP assemblage has been made largely from the burial sites, as it is made generally where status assemblages are recognised in prehistory.

The Motu Paeao determinations bear most particularly on Walter's (1996) objection to the notion of AEP as a cultural assemblage because of its 800 year chronological span. Since this point was made, very reasonably in terms of the existing evidence, the temporal range of AEP has begun to narrow with the radiocarbon determinations from Wairau Bar and Motu Paeao. Although it is too soon to say that Walter's objection has been met, a continuing trend towards a narrow chronological range for AEP (and considering the area over which it spread this is hardly likely to be less than a century or two) would increase the likelihood that it was distributed as an artefactual complex, rather than developed in various archipelagos as a superficial consequence of relatively high levels of interaction. More intensive interaction might indeed be true of Central East Polynesia, for geographical reasons if no other, but the same kind of evidence is found in the southern region of Polynesia (New Zealand, Chathams, Kermadecs, Norfolk), where the evidence suggests that the level of interaction between these islands was very low following initial colonisation (Anderson n.d.).

All of these and related issues will need to be worked through in detail as the chronological evidence takes clearer shape. We should emphasise in relation to Motu Paeao, that the present results do not exhaust our project for that site. We intend to test the radiocarbon determinations on bone with ^{14}CAMS determinations on teeth and pearl shell, and the radiocarbon chronology generally with ESR (Electron-Spin Resonance) dates on teeth. When those results are available it may be possible to discuss the chronology of the

Motu Paeao burials and the distribution of items of material culture amongst them in a more illuminating way.

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