A Skeleton from the Lapita Site at Koné, Foué Peninsula, New Caledonia

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ABSTRACT

A relatively complete and reasonably well preserved skeleton, including a partially reconstructed cranium and mandible, of an approximately 35–45 year old female, found at the Lapita site, WKO-013B, near Koné, Foué Peninsula, New Caledonia, is described. Although not without problems, radiocarbon dating of the skeleton and other archaeological considerations place the burial around the middle of the first millennium BC (*c.* 500 BC). Chemical analysis of the bone gives no clear picture about diet, although direct or indirect consumption of C4 plants is hypothesised. Nitrogen isotope values imply average contribution from both land and marine environments. The reconstructed skull is long and resembles crania from eastern island Melanesia. The teeth are small and the incisors exhibit moderate shovelling. A single dental caries, an apical abscess, moderate dental attrition, enamel hypoplasias, and evidence of periodontal disease were observed in the teeth. The stature is estimated to be 161.4 cm, or 5 feet 3.5 inches. There is osteological evidence that this individual experienced childbirth. The cranial vault bones are thickened. There is little or no osteoarthritis in these remains. Limited comparisons of certain cranial, dental and skeletal morphological features of this new skeleton suggest affinities with other Lapita-associated skeletons and skeletal series from eastern island Melanesia.

Keywords: PHYSICAL ANTHROPOLOGY, OSTEOLOGY, LAPITA, NEW CALEDONIA, PREHISTORY, RADIOCARBON DATES, ISOTOPE ANALYSIS.

INTRODUCTION

In 1988, part of a human skeleton was discovered by Galipaud in a beach section exposed by strong wave action at an area of land in New Caledonia known as Foué, near the European village of Koné. Additional remains of the skeleton were retrieved during salvage excavations shortly afterwards. The 'type site' for Lapita pottery is located at Foué. The site is known as Site 13, and was first excavated by Gifford and Shutler in 1952 (Gifford and Shutler 1956). Very little is known about Lapita people, and the recovery of human remains at Site 13 is therefore potentially of great importance. This paper describes the physical

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attributes of the skeleton. First, however, the circumstances of the discovery of the skeleton and its context are described; previous archaeological work in the area is reviewed; and the dating of the skeleton itself is discussed. This is undertaken in order to establish the probable Lapita affiliations of the skeleton.

The Foué area consists of a peninsula and an adjacent bay (see Figs 1, 2). The site is designated WKO-13 in the site recording scheme of New Caledonia (Frimigacci and Maitre 1980). The bay is also known as Lapita, a name collected by Gifford and Shutler from one of their local workmen. Galipaud attempted to ascertain the meaning of this term from local villagers, including the only living member of the original excavation team. However, the term Lapita now means nothing to these people, and does not relate to any land district or locality in the area. This suggests that Gifford and Shutler misunderstood something told to them in French by a workman. There are a number of possibilities, for example: 'la petite là' = the small one (with emphasis on feminine objects); or 'l'habitat' (pronounced labita) = the place where people live. Whatever its origin, the term Lapita is firmly embedded in world literature on Pacific archaeology, and it would now be pointless to suggest changing it to Foué.

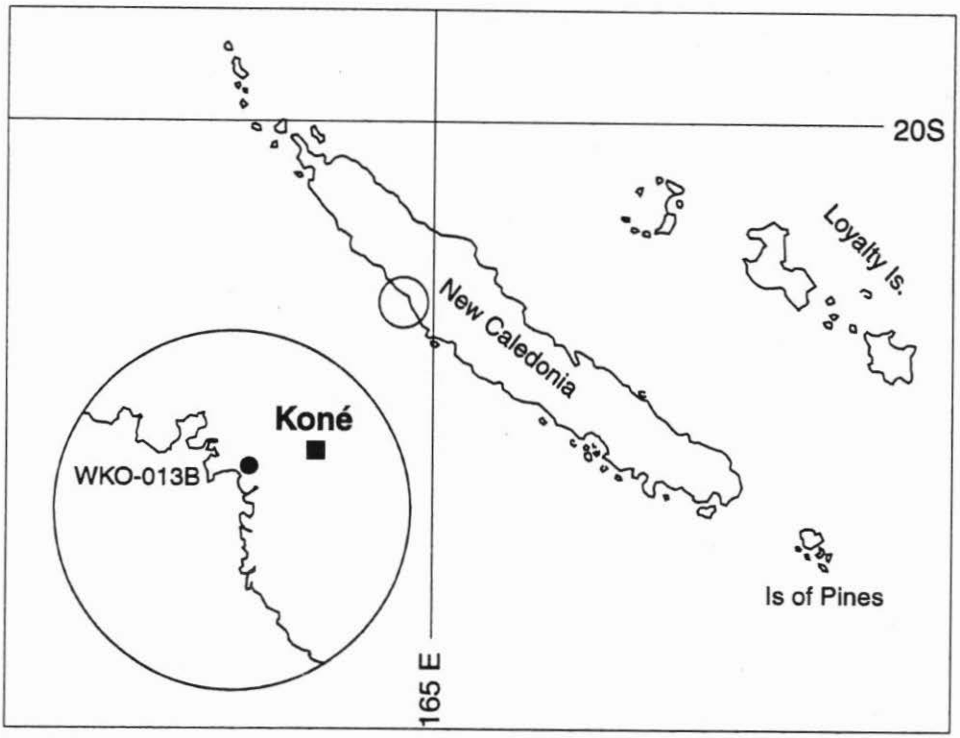

Figure 1: Map of New Caledonia showing the location of the Lapita site (WKO-013B) at Koné.

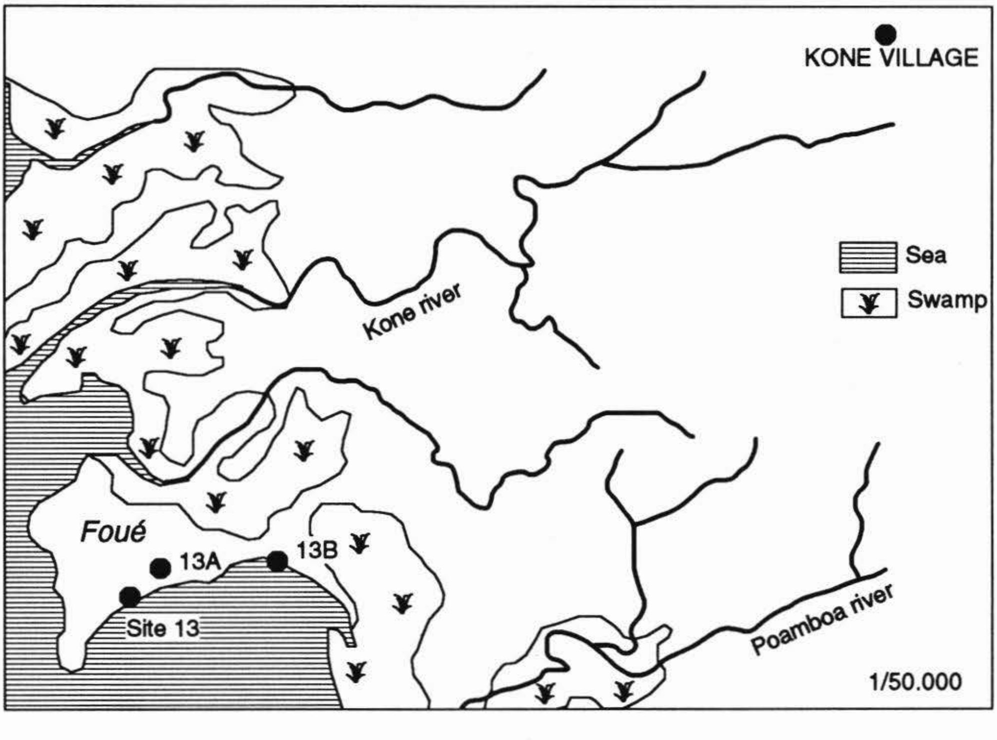

Figure 2: The Foué Peninsula and the adjacent bay where the WKO-013 sites are located.

Cyclone Anne caused severe damage on much of the west coast of New Caledonia in January 1988. It is rare for the west coast to be affected in this way, since cyclones normally approach New Caledonia along a corridor between the Loyalty Islands and the north-east coast of the main island. Galipaud visited Foué Bay the day after the cyclone to check for any damage to the Lapita site. Approximately 2 m of the sandy scarp behind the beach had been eroded away, revealing archaeological deposits at several locations. The human burial was provisionally named Anne after the cyclone which exposed it.

Galipaud found parts of a cranium and several teeth which had eroded out from a sandy layer in the section. A salvage excavation was carried out by Kasarhérou from the Service des Musées et du Patrimoine de Nouvelle-Calédonie a short while after this discovery. The results of the excavation have been published elsewhere (Dédane and Kasarhérou 1988: 2–5).

ARCHAEOLOGY OF SITE 13

The Lapita site extends along more than half of Foué Bay and disappears on the inland side in a marine-induced brackish swampy area. Wind and wave action repeatedly wash away remnants of the archaeological deposits.

The site was first described early this century by two French scientists, Sarasin and Piroutet. They noted the distinctiveness of the pottery compared to the better known traditional Kanak ware (Piroutet 1917; Sarasin 1920: 119).

In 1952, as part of their extensive archaeological survey of New Caledonia, Gifford and Shutler (1956: 7) carried out excavations at two locations in the bay, which they named Site 13 and Site 13A. Site 13 (here referred to as Locality 1) is at the western end of the bay, on a sloping area, while Site 13A is on the flat isthmus which connects the western part of the bay to the mud flats of the dry lagoon behind, 400 m east of Locality 1.

Gifford and Shutler dated the occurrence of Lapita pottery to 2800 ± 350 BP (M-341) and 2435 ± 400 BP (M-336) (Gifford and Shutler 1956: 89). This first attempt at dating a Lapita-bearing horizon was not without problems, perhaps partly because of the lack of accuracy of the newly invented radiocarbon dating method. The relative ages of the two dates are in reverse order to the stratigraphy, something which Gifford and Shutler were embarrassed about, and attributed to yam cultivation in the area (1956: 89). However, the two dates are not significantly different and apparently derive from the same cultural layer, although at different depths (Green and Mitchell 1983: 33).

In 1967, Shutler carried out further excavations in the vicinity of Site 13A and unearthed an intrusive human burial (Site 13C). The skeleton was in an upright crouched position in a small pit which was sealed by a complete open pottery bowl of a type similar to specimens of Polynesian Plain Ware from Western Polynesia. The exterior of this pot was decorated with fine parallel marks of paddle impressions. The skeleton was neither studied nor dated, and the excavation was never published apart from an item of correspondence prepared for the Nouméa Museum. Unfortunately, neither the pottery nor the skeleton was catalogued when they were deposited in the Museum. The pottery was later recognised by its distinctive characteristics.

Frimigacci visited the site in 1971 with a geologist. They reconsidered the stratigraphy (Frimigacci, 1975: Fig. 105, cf. Green and Mitchell 1983: 35) and dated some shell beneath Layer A (Fig. 3) to 2250 ± 100 BP (GIF-1983, Coudray and Delibrias 1972).

In 1987, Galipaud organised a detailed survey of Foué Peninsula and the adjacent bay, in order to define the general stratigraphy of Site 13 and assess the possibility that remains of an undisturbed Lapita occupation still existed (Galipaud 1988). The results showed that a horizon with Lapita pottery was still preserved *in situ* in the central part of the bay. Galipaud named this area Site 13B, following Gifford and Shutler's earlier use of letters to distinguish sections of the larger site. The burial which is the subject of this paper was found at Site 13B; a nearly complete Lapita dentate stamped vessel was found in the same location nearly a year later.

In 1991, following the discovery of further scattered finds, including parts of a second Lapita vessel (also at Site 13B), an archaeological salvage excavation was organised jointly by ORSTOM and the Archaeology Department of the Nouméa Museum (Sand *et al.* 1992). This work has allowed a fresh appraisal of the radiocarbon age of the site, and enhanced our knowledge of the geomorphological history of the area and the associated cultural deposits.

STRATIGRAPHY OF THE LAPITA SITE, FOUÉ PENINSULA

Prehistoric coastal settlements on the west coast of New Caledonia seem to have undergone several major disturbances during the course of their history and it is very difficult to find undisturbed deposits. Site 13 is no exception and, although Lapita pottery is abundant throughout the site, it now seems clear that most of it is in redeposited layers (Galipaud 1988; Sand *et al.* 1992).

Recent work (Galipaud 1987; Sand *et al.* 1992: 24–26) has provided a far better understanding of the stratigraphic history of the site. This work has shown that sandy layers of marine origin (Layers B, C and D) are covered by a clay-rich deposit from the nearby swamp area (Layer A, Gifford and Shutler's adobe layer). The thickness of Layer A varies from 30 to 80 cm (Fig. 3) and contains most of the archaeological material recovered during the early phase of research (Gifford and Shutler 1956; Frimigacci 1975). This is the layer which is known to have been disturbed by recent cultivation. The mean grain size of Layer B increases with depth. It has a maximum thickness of 1.3 m. Coarse layers of sand and shell (Layers D–F) underlie this and rest on consolidated sand (beach-rock). Layers C and E contain scattered cultural material. Layer E is certainly *in situ*, and parts of Layer C also.

Excavations conducted by Gifford and Shutler (1956: 7–9) at Site 13A did not reach deeper than the upper part of Layer B (1.06 m) and then in only a few squares with little pottery. Pottery does not appear below 0.76 m in their test pits near the coastal scarp. These depths coincide with the part of the deposit which is disturbed by cultivation. Moreover, almost all of the pottery found in Layer A occurs in the upper 46 cm (88% of all plain sherds found and 83% of all decorated sherds) (Green and Mitchell 1983: 35). This supports the idea that the pottery in Layer A has been redeposited.

The stratigraphic history can be summarised as follows. When the Lapita people first settled in this area the surface consisted of coarse sand (Layer F). Cultural material was deposited on this layer over a period of time during which there was progressive deposition of finer wind-blown sands (Layer E). The immediate area was abandoned by the Lapita people, and wind-blown sands continued to form a sand layer (Layer B) over the cultural deposit. This was followed by a period when the river delta system silted up, extending the swampy land over the sandy coastal fringe. This process was responsible for the re-deposition of Lapita pottery sherds from further inland on the sandy layer on the coast (Layer B). This redeposited pottery occurs in Layer B as well as in Layer A. Finally, the beach encroached on the dune formation, eroding the scarp inland until only a small part of the initial settlement horizon remained, sealed in by the later deposited clays.

The stratigraphic sequence described here suggests that the original Lapita settlement was associated with an active dune complex and consisted of a single discrete cultural horizon, and that this was partly destroyed during the process of encroachment by the sea. Much of the pottery higher up in the sequence shows evidence of erosion, while that in the deeper *in situ* layers consists of uneroded pieces of larger size. This suggests that there has been a complex history of several phases of sand erosion and re-deposition after the abandonment of the Lapita site.

The skeleton at Site 13B was found in the sandy deposit and a year later a complete Lapita vessel was found in the same stratigraphic context. A short period later, a second Lapita vessel was found. All these remains were in the undisturbed sandy layer, associated with the initial period of occupation of the bay. Artefacts associated with the sandy Layers B and C in all excavated pits confirm that the site was occupied by people with pottery of the Lapita and Podtanéan traditions during the first millennium BC (the Koné period of New Caledonian prehistory). Scattered remains of more recent ceramic types were also found in the clay-rich Layer A. In addition, there is evidence of taro cultivation on the surface, indicating that the site was re-occupied for some time during the later phase of New Caledonian prehistory.

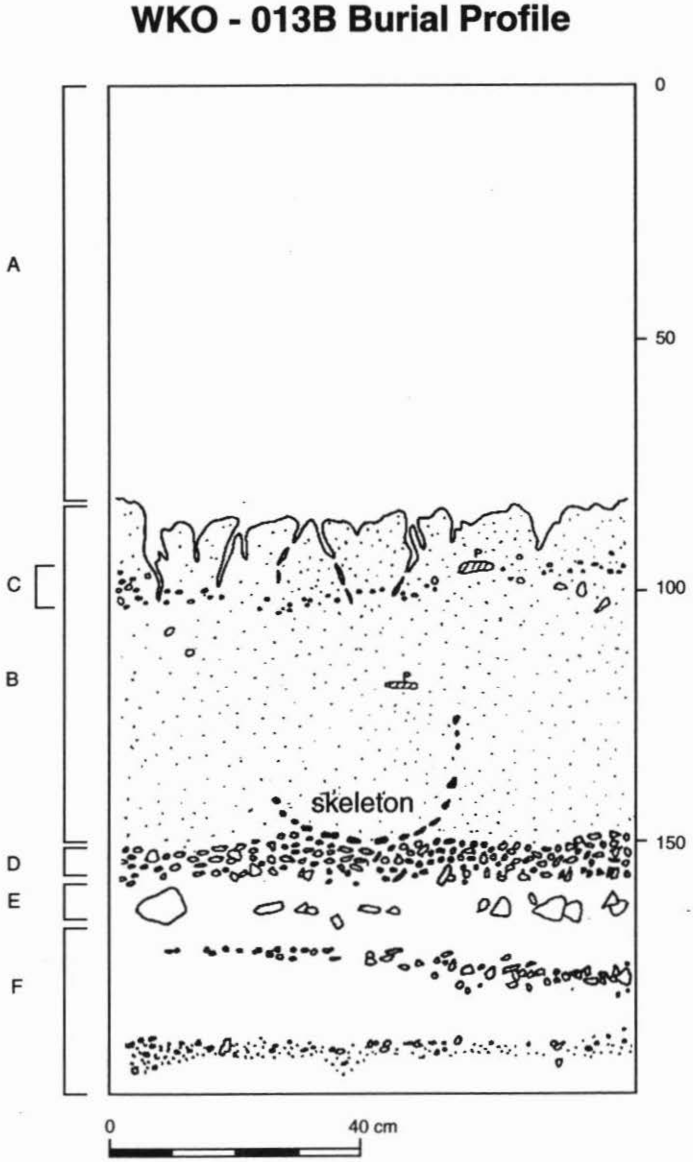

Figure 3: The position of the WKO-013B skeleton in the profile. See text for details of stratigraphy.

The skeleton lay in the lower part of the sandy Layer B, above some coarse sand layers of marine origin. There is no visible grave feature around the skeleton, apart from a slight coloration of the sand around the body. The skeleton was lying in a somewhat unnatural posture—the upper body lay flat on the back with the arms folded across the stomach. The lower body area appeared in the excavation section first, and the feet were higher than the head. Both legs were twisted across the body, with the left foot touching the pelvis. This unnatural posture suggests post mortem movement of the skeleton. It is possible that the original burial position was in a crouched-upright position.

Artefacts found during the excavation of the skeleton mainly consist of pot sherds associated with the Lapita complex (Lapita and Podtanéan in style). They were found in the bottom part of Layer A, except for several larger sherds which were found in the upper part of Layer B. Among these latter sherds is one with paddle impressed decoration (Podtanéan), and part of a pottery handle. According to Kasarhérou and Dédane, none of these artefacts was in close association with the skeleton, most of them being well above it in the stratigraphy.

RADIOCARBON DATING AND CHEMICAL ANALYSIS OF BONE

This Lapita site has been dated several times in the past. The earliest date of 2800 ± 350 BP (M341) was obtained on charcoal in 1953. More recent dates confirm this approximate age. These are listed in Table 1 and graphed in Figure 4.

With one exception (discussed below) these dates form a very consistent series for this Lapita occupation, and fall within the range of dated occupations for the nearby Lapita sites of Koumac and Bourail. This set of dates gives a general indication of the period of settlement of Site 13. The close correspondence of the different sets of dates, obtained at different times by different methods, allows us to place this occupation with some confidence between 500 and 1000 BC.

The question arises as to how good the association is between the skeleton and the nearby Lapita occupation—that is, can we be fully confident that Anne is a "Lapita woman" ?

As is often the case with skeletal material in the Pacific there are no structural remains or grave goods to help correlate the skeleton with its archaeological environment. Moreover, in New Caledonia there have been very few skeletons found in secure stratigraphy which would permit comparison with this specimen.

The position of the skeleton, deeply buried in this section, might seem clear evidence of antiquity; however, there was no sign of a burial pit, so in theory the skeleton could have been buried at a later time than the earliest horizon. Nonetheless, the close proximity of two complete Lapita pots to the skeleton, although not in intimate association, does suggest an old date for the skeleton.

The only way to be certain was to date the bone material directly. Bone dating is not without its hazards and has had mixed fortunes in the Pacific region. It is well known that under some conditions, carbon in the inorganic fraction of bone can exchange with carbon from the surrounding environment. For this reason it is customary to extract the organic fraction from bone and date it. The organic fraction of bone is composed of collagen, and different laboratories adopt quite different procedures in their extraction, purification, and dating of collagen. Some laboratories date individual amino acids.

We decided to extract collagen from a small sub-sample of the remains using a phosphoric acid digestion technique (Quinn 1990), so that we had some basis for assessing the integrity or otherwise of the bone before dating it. A sample of 50.5 g of bone was split into two: AA726 was part of the right femur, and AA727 consisted of mixed fragments including rib bone. The samples were carefully cleaned first by scrubbing and then washed in an ultrasonic bath containing deionised water. A sample of 35.03 g of bone was used for extracting collagen. The collagen extract was freeze dried after washing to neutral pH. The yield of dry collagen was 1.85 g, or 5.28% by weight of the original bone. Sub-samples of

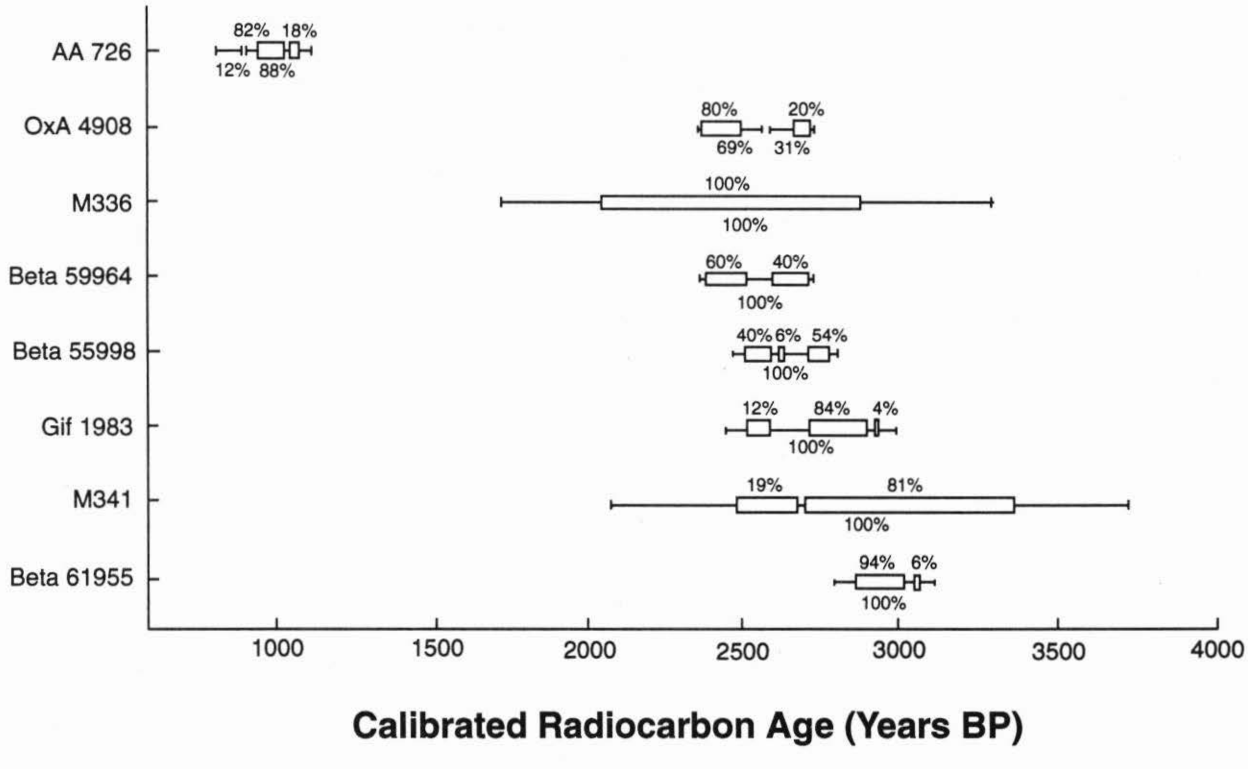

Figure 4: Calibrated radiocarbon dates for the Lapita (WKO-013) site.

the extract were examined with a mass spectrometer at Waikato University, interleaved with tests on a special bone standard to check for consistency. The results were:

Sample	**% Carbon**	**$\delta^{13}C$**	**% Nitrogen**	**$\delta^{15}N$**	**C/N**
AA727/1	31.03	-11.73	10.52	10.98	3.44
AA727/2	30.82	-12.06	10.86	11.52	3.31
AA727/3	30.46	-12.31	10.55	11.12	3.37
AA727/4	31.74	-12.78	10.56	10.71	3.51
Mean	**31.01**	**-12.22**	**10.62**	**11.08**	**3.41**

The C/N atomic ratio of bone samples is a particularly useful way of identifying whether diagenic change has taken place in an archaeological site. Such changes can render isotope results meaningless and cast doubt on whether radiocarbon results reflect the original chemical composition of the bone. DeNiro (1985: 808) suggests that the acceptable range for this atomic ratio is between 2.9 and 3.6. The values for the WKO-013B skeleton are within this range, and postmortem diagenesis is therefore not indicated.

A sample of 1.22 g of the piece of the cortical part of the right femur was submitted to the then Institute of Nuclear Sciences Lower Hutt (INS) for dating using their accelerator, because of the small sample size. The conventional radiocarbon age (Stuiver and Polach 1977) reported was:

NZA-3013 $\quad$ 1061 ± 65 years BP

The $\delta^{13}C$ value obtained was -14.35‰. These results were quite unexpected, given the earlier series of dates, centering on about 2800 years BP. The date appeared to be too young by about 1800 years. Dr Rodger Sparks, head of the radiocarbon laboratory, was consulted about this problem for any further information which might be relevant. He reported that this was a "tricky sample of very degraded bone producing only 2% of impure collagen, although the graphite target of 2.1 mg was quite reasonable". He also said that "the yield was unusually low and had an unusual brown coloration, suggesting a residual contaminant. Some collagen was set aside for separation of acid soluble and insoluble portions for further research" (Sparks, pers. comm. to Leach 16.3.93). No results have been reported to us from the two portions set aside.

There are a number of things about the INS evaluation of this sample which are contrary to expectation. Not only is the date far too young, but both the collagen yield and the $\delta^{13}C$ values are very different to our earlier evaluation. The INS obtained only 2% collagen from the bone powder, whereas our earlier study produced 5.28% by weight. The Quinn digestion method was developed under rigorous conditions to check when all inorganic material had been removed, using a combination of X-ray diffraction analysis and X-ray fluorescence analysis. The amount of collagen obtained using this method represents something close to the maximum yield for organic matter in human bone. The INS method involved HCl acid digestion, followed by alkali wash. The difference in yield is dramatic.

The $\delta^{13}C$ discrepancy also gives cause for concern. Our earlier research produced a mean value of -12.22, whereas the INS obtained a value of -14.35. The comment made by Sparks that this sample appeared to be very degraded bone is not confirmed by our study; the sample was certainly not exceptional in any respect compared with numerous other human bone samples we have studied during the course of isotope and trace element analysis in the last decade. This also applies to the brown coloration observed at the INS. In our experience, this is typical of human bone collagen from the western Pacific region.

Given this very unsatisfactory result from the INS, we decided that it would be desirable to have the bone sample analysed independently by the accelerator facility at the Research Laboratory for Archaeology and the History of Art at Oxford University. With this in mind we obtained a further 60 g from the right femur of WKO-013B (AB705), and extracted a piece weighing 1.1 g for dating.

The Oxford technique involves extraction of the collagen using HCl, gelatinisation, and then purification by ion exchange. They obtained 20 mg of "good" collagen from the 1.1 g sample of bone (1.82% by weight). They obtained a satisfactory C/N ratio (value not specified), and a $\delta^{15}N$ value of +13.5. This compares with our earlier mean value of +11.08. Their $\delta^{13}C$ value was -9.6, which can be compared with the our mean value of -12.22, and the INS value of -14.35. These comparative figures were reported to the Oxford group for comment and the response was "I am confident that the collagen extracted and measured was not seriously diagenetically altered" (Hedges pers. comm. to Leach 16.9.94). The conventional radiocarbon age obtained was: OxA-4908, 2410 ± 55 years BP.

When this date is corrected for secular effects (Fig. 5), there are two nodes centering on 460 and 720 B.C. This is far more satisfactory when compared with other dates for the Lapita horizon at Site 13.

The two dates obtained by different laboratories are so far apart that one of them has to be wrong. However, it is not a simple matter to decide which is correct. On archaeological grounds, the Oxford date is far more satisfactory. If the more recent INS date for this burial was correct the skeleton would have to have been buried by digging a pit through the black Layer A. This would surely have left a clear pit outline in the much whiter sand of Layer B. It is conceivable that the proximity of the sea may have influenced the sediment deposition of Layer A in this part of the site; however, there is no evidence of this.

The isotope values for $\delta^{13}C$ and $\delta^{15}N$ are of special interest because they shed light on the diet of the person during life. Unfortunately, we have been unable to obtain a value for $\delta^{34}S$ for this individual which would have enabled a much more satisfactory assessment of diet (Leach *et al.* 1996). In the absence of results for $\delta^{34}S$ only preliminary comments can be made. Figure 6 shows the nitrogen isotope value for WKO-013B (Anne) plotted out along with results for other Oceanic peoples (from Leach and Quinn unpublished results). On the basis of this one isotope, WKO-013B would appear to have had a diet with average contributions from both land and marine environments. When a similar graph is prepared for the carbon isotope (Fig. 7), a quite different picture emerges. Here the signature is on the extreme heavy side of the range, extending beyond the range of even the Moriori of the Chatham Islands, a group of people for whom it is estimated that 90% of their food energy came from the sea (Leach 1995). It seems most unlikely that the diet of WKO-013B could have been anything like that of the Moriori people. One characteristic of such a heavy reliance on marine foods is mercury accumulation, which for Moriori ranges from 2.64–12.65 μg.g for whole bone powder. Total mercury analysis was carried out on sub-sample AA726 from the WKO-013B skeleton, which was found to have 0.041 μg.g, or less than 2% of the Moriori values, and to be much more typical of Oceanic peoples (Leach 1995).

There are two possible explanations for this unusual $\delta^{13}C$ value. One possibility is post mortem contamination by diagenic change. The C/N ratios discussed above have more or less ruled this out, but to be absolutely certain, we carried out full amino acid analysis on sub-sample AB705 (Table 2). The results were very close to our special human bone

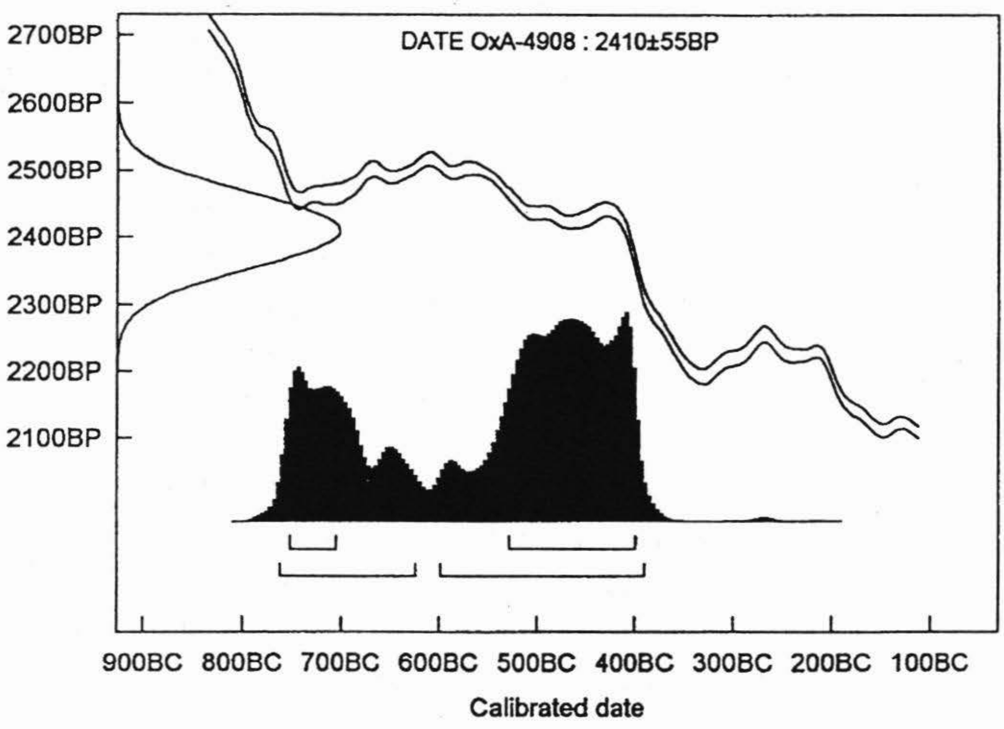

Figure 5: Calibration of the date obtained from a sample of bone from the WKO-013B skeleton using the Oxford University technique.

standard which we use for isotope and trace element research on human bone. We conclude that there has been no significant chemical alteration of the organic portion of these bones.

The second possibility is that C4 plants made a significant contribution to the diet of the WKO-013B skeleton. This is not without precedent in the Pacific region. A study of human remains of the Lapita community on Watom showed that about 3% of the diet of these people came from C4 plants (Leach *et al.* n.d.). Several sources are implicated—sugar cane, *Saccharum officinarum*, and/or a herbivore which browsed on the extensive C4 grasslands of Papua New Guinea, such as *Saccharum spontaneum* (pit-pit) and *Imperata cylindrica* (kunai sword grass). Our study of wallaby has yielded a $\delta^{13}C$ value of -9.3‰, clearly indicating that this animal fed on C4 plants. Consuming the meat of such a browsing animal would certainly lead to a very heavy $\delta^{13}C$ value in human bone.

There are several possible sources of food in New Caledonia which might have led to a heavy $\delta^{13}C$ value for WKO-013B. The sword grass (kunai), *Imperata cylindrica*, is one of the main indigenous grasses on the alluvial plains (Jaffre *et al.* 1977), and it is likely that sugar cane, *Saccharum officinarum*, was present during the earliest human habitation too. Another possible source is the megapodes and other flightless birds of New Caledonia. Although knowledge of the relationship between people and these birds is at present fragmentary, it appears that humans were involved in their extinction (Poplin and Mourer-Chauvire 1983, 1985). Judging from modern studies of the diet of megapodes in Australia,

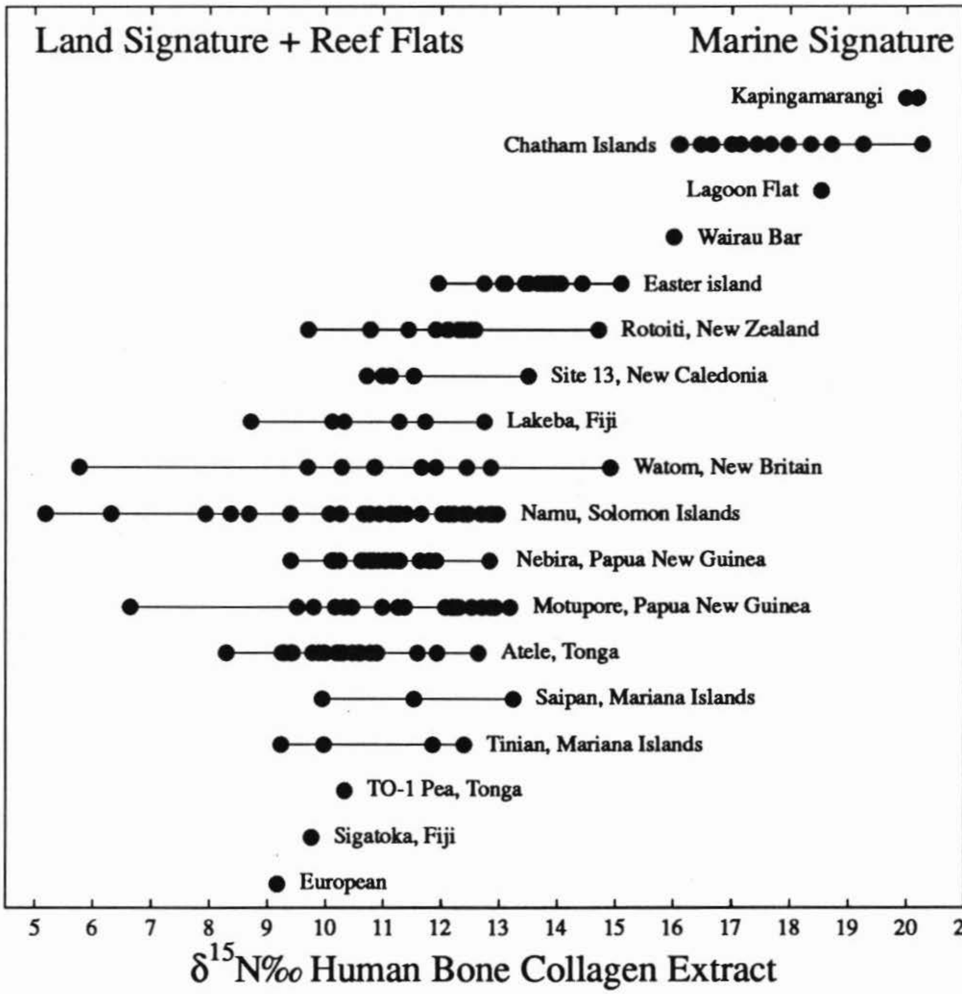

Figure 6: Graph showing Nitrogen isotope values for the WKO-013B skeleton (Anne) and other Oceanic people.

these birds are omnivorous, eating seeds, flowers, fruit, insects and small vertebrates. The large eggs of these birds are great favourites of people on Pacific Islands where they are found (Marchant and Higgens 1993: 322–323). It would be useful to carry out isotope analysis on some megapode bones to ascertain the extent to which they may have relied on C4 grasses, and thereby passed on this unusual $\delta^{13}C$ signature to humans. The specimens would, however, have to come from this district of New Caledonia, because it is clear from modern studies of these birds that their diet varies from place to place.

At this stage we can only hypothesise that the unusual isotope signature of WKO-013B is due to direct or indirect consumption of C4 plants.

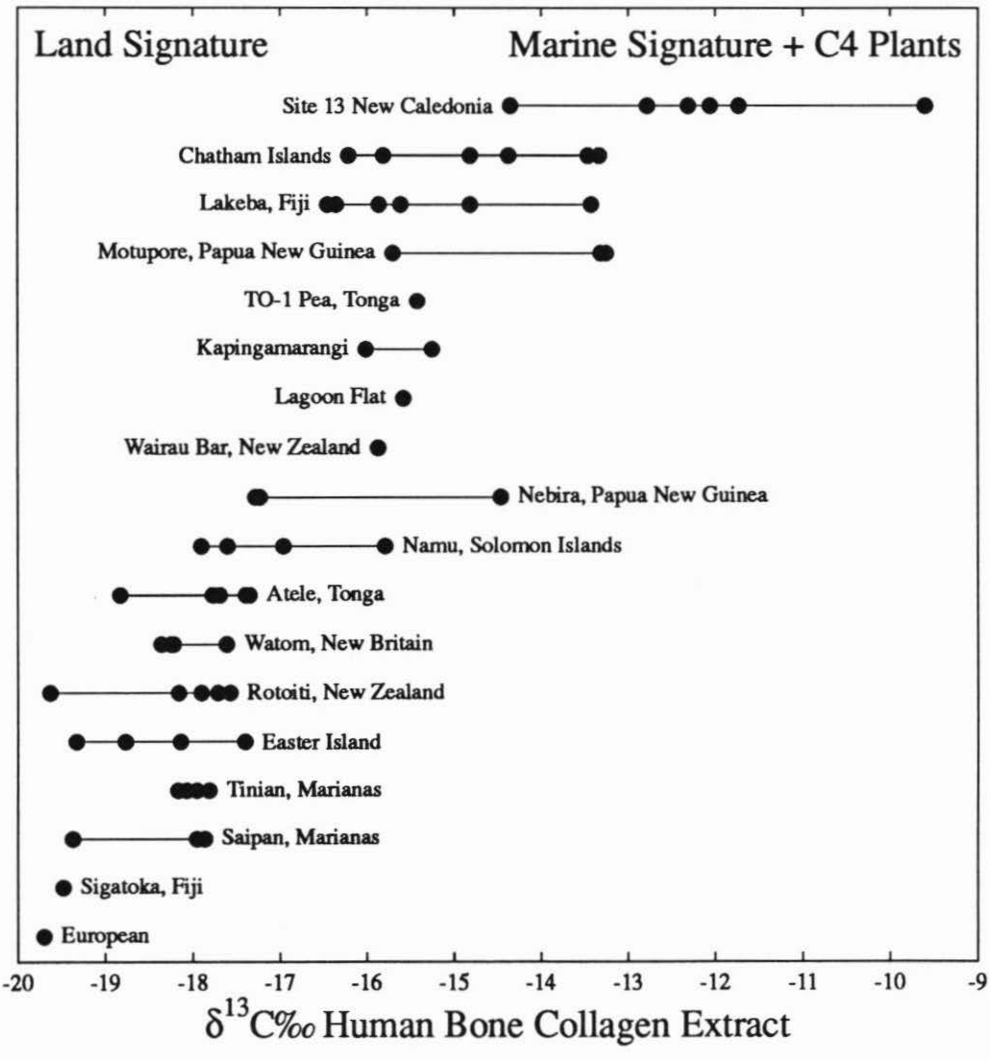

Figure 7: Graph showing Carbon isotope values for the WKO-013B skeleton and other Oceanic groups.

OSTEOLOGICAL METHODS AND RESTORATION WORK

The WKO-013B skeleton was analysed by Michael Pietrusewsky and students at the University of Hawai'i. The remains arrived in excellent condition. Each bone, or group of bones, had been individually wrapped to ensure safe transport to the laboratory. Furthermore, to minimise destruction of the bone, much of the surrounding matrix adhering to the bone had been left intact. All human material was cleaned, in the laboratory, using brushes and dental picks. Because most of the bones were impregnated with beach soil and debris, moderate mechanical brushing was necessary to remove this foreign material. Where possible postmortem breaks were mended using an epoxy glue. The bones and bone fragments were labelled with the designation, "WKO-013". Much of the preliminary laboratory analysis of these remains, including the restoration of the cranium, was undertaken by Ms Claire Arakaki.

After the remains had been cleaned, restored, and inventoried, metric and non-metric morphological observations of the skull, teeth, and infracranial skeleton were recorded. Definitions of the measurements and non-metric observations used to describe the WKO-013B skeleton are given in Pietrusewsky (1969a, 1969b, 1984, 1989a, 1989b). Following standard osteological methods, determination of age at death, sex, stature, observations of dental and skeletal palaeopathology, and other traits of individuation were made. A photographic record was made to document these osteological remains.

Two samples of bone, each weighing approximately 50 grams, were sent to Dr Foss Leach of the Museum of New Zealand Te Papa Tongarewa, in Wellington, New Zealand, for radiocarbon dating and isotopic work. Two addition samples of solid cortical bone, one weighing approximately 6 g and the other 7 g, were sent to Dr Erika Hagelberg, Cambridge University, United Kingdom, for mtDNA research. Attempts to extract mtDNA from these samples for analysis were unsuccessful and therefore no results can be reported.

PRESERVATION AND COMPLETENESS OF THE SKELETON

A partially complete skull and infracranial skeleton representing a single individual are represented in the remains from WKO-013B. The colour of the bones is dark to light grey brown. A portion of the remains display differential coloration and preservation which is consistent with some being exposed to wave action while others remained buried and relatively protected from wave action. Those portions of the skeleton that remained buried until the time of their excavation were encrusted with dark gritty beach soil and debris. The teeth, cranial and mandibular fragments, on the other hand, which had been disturbed and exposed by wave action, had much cleaner surfaces and required little preparation. The bones are light in weight, suggesting that a great deal of the organic matrix has been lost. The bones do not appear to be fossilised. The bones represented in the WKO-013 skeleton are shown in Figure 8.

The skull was completely disarticulated when the remains were sent to the laboratory for osteological analysis. Extensive reconstruction efforts resulted in restoration of a substantial portion of the cranium and mandible (Fig. 9). The anterior temporal regions (pterion) and glabella portion of the frontal bone are missing, as is most of the face with the exception of the left zygomatic bone and the adjoining portion of the left maxilla. Most of the parietal, frontal (missing glabella) and superior portions of the occipital bones are represented and relatively well preserved. The posterior temporal bones (regions containing the mastoid processes and petrous portions of the temporal bones) are intact and can be attached to the cranium. Fragments representing the right and left maxillae (Fig. 10), containing a total of 11 teeth, are also present.

The mandible was reconstructed from four major fragments (Fig. 11). The left ramus is fragmented and cannot be fully restored but enough exists to allow an approximation of this part of the mandible. Thirteen mandibular teeth could be returned to their alveolar sockets.

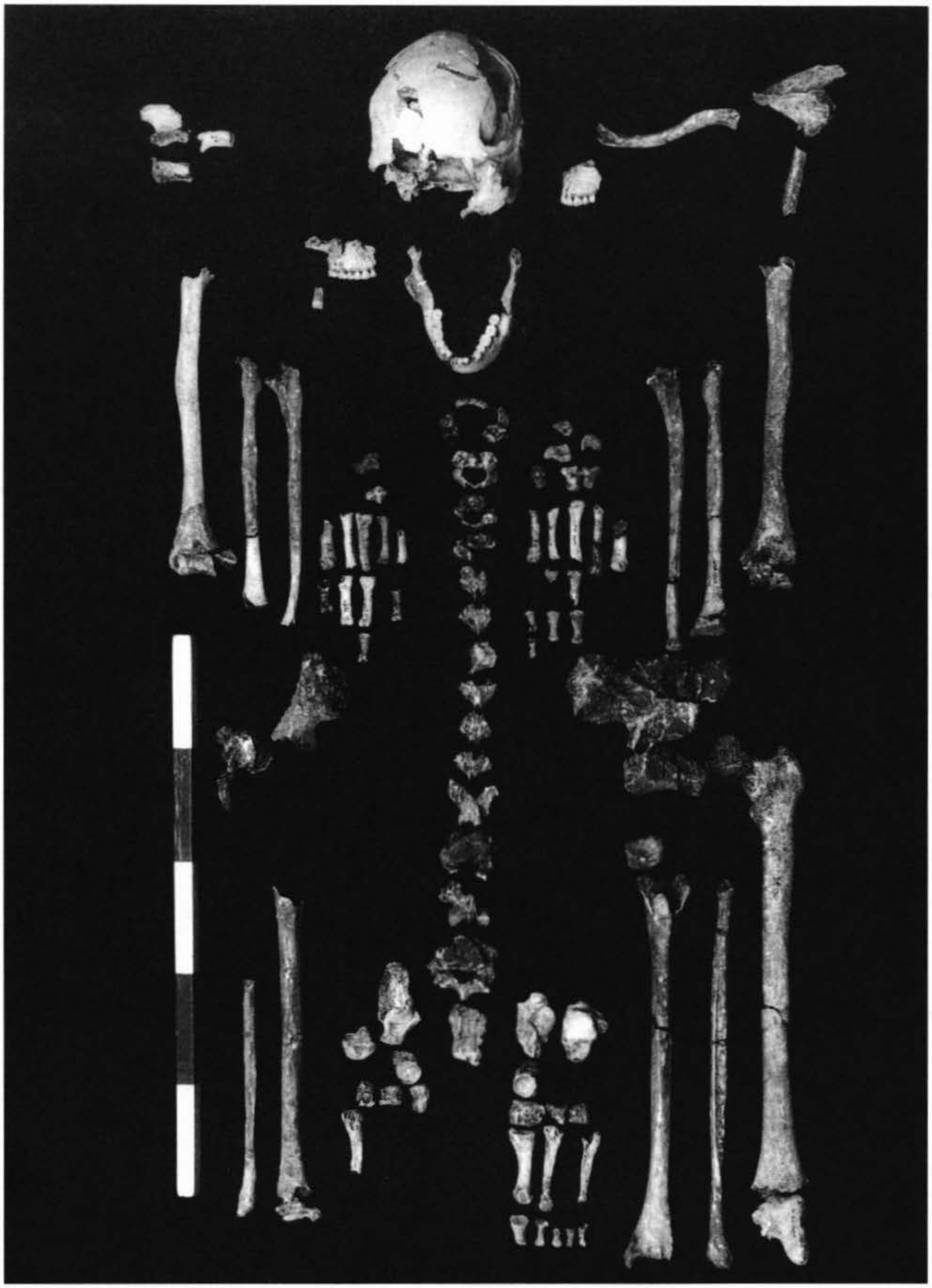

Figure 8: Overview of the WKO-013B skeleton showing the major bones represented.

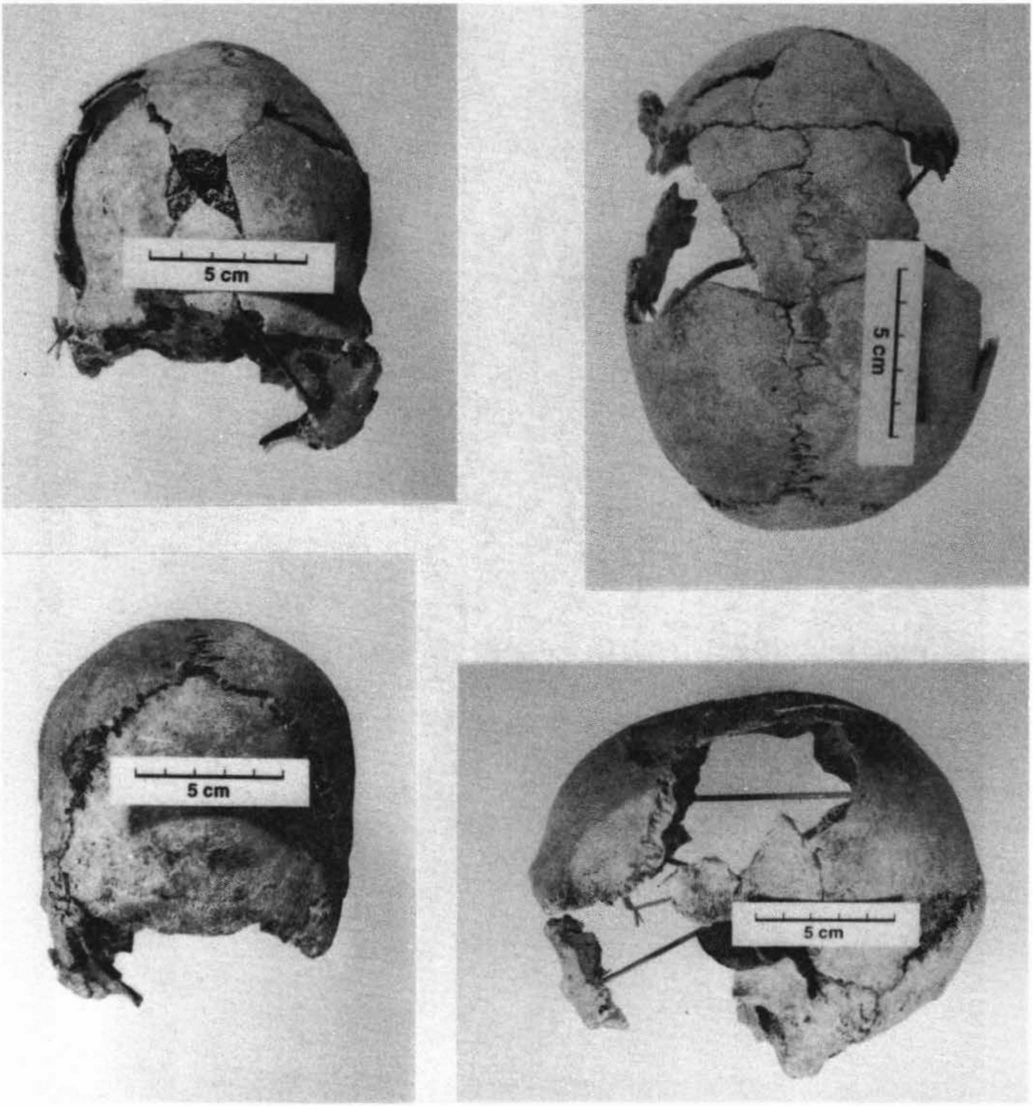

Figure 9: Four views of the WKO-013B cranium: frontal (upper left), superior (upper right), posterior (lower left), and lateral (lower right).

Approximately 70 smaller bone fragments, presumably representing most of the missing areas of the skull, were identified in these remains. Although not completely restored, the cranium of WKO-013B is one of the most complete Lapita-associated female crania thus far described.

The overall preservation of the skull is fair to good. The bones are uniformly weathered and bleached. The colour of the bones is light tan to grey. A black dirt has penetrated the inner trabecular structure of most of the bones. The external cortex is generally smooth (polished) and water worn. Some postmortem pitting is visible on the external surfaces. The tooth roots are stained a reddish-brown colour and the tooth enamel is grey/white.

The infracranial skeleton is substantially complete. The upper and lower limb bones are the best preserved parts of the skeleton. Many of the long limb bone shafts have been reconstructed from fragments but the ends are either missing or damaged. Only a few long limb bones, such as the left ulna, are intact and complete. The carpals, a single metacarpal, two metatarsals, and a few hand and foot phalanges are some of the best preserved bones. The sternum, left clavicle, and patellae are missing. The vertebral column and ribs are represented by a few fragments only, the majority having been damaged or destroyed by postmortem disturbances. Five metatarsal bones, nearly half of the carpals and many of the hand and toe phalanges are also missing.

Preservation in the infracranial skeleton ranges from poor to fair. The bone is more or less uniformly weathered and breaks easily. There is postmortem damage throughout. The external surfaces of many of the bones are chalky and rough to the touch. Natural disturbances and mechanical removal of the adhering beach matrix is undoubtedly responsible for much of the coarseness. The bone extremities are especially friable. Much of the cancellous bone is missing or damaged as a result of natural bone erosion and weathering.

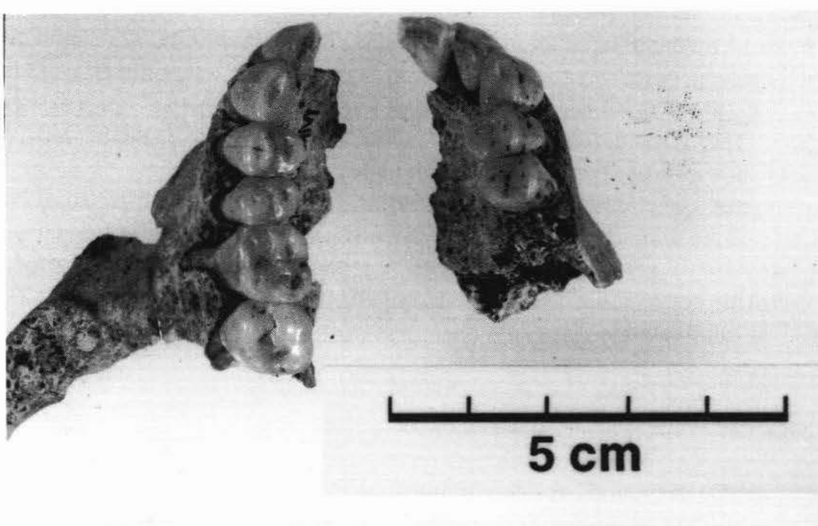

Figure 10: Occlusal view of the WKO-013B maxillary fragments and teeth.

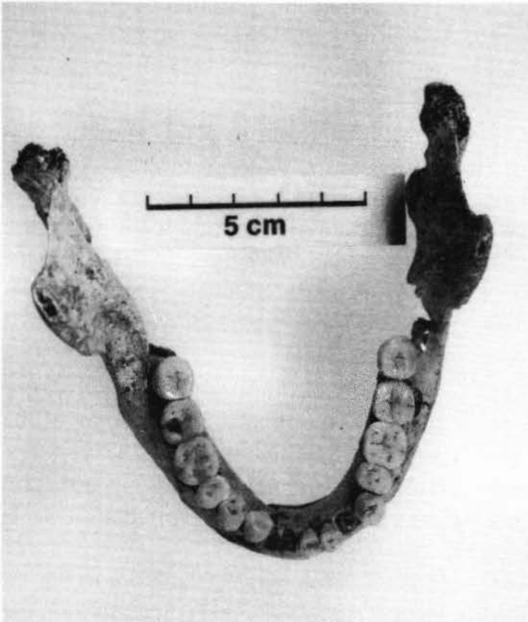

Figure 11: Occlusal view of the WKO-013B mandible.

SEX AND AGE DETERMINATION

Morphological features of the skull, pelvis and infracranial skeleton were assessed in an attempt to determine the sex of this individual. Although the pelvic remains are limited, several features (e.g., wide sciatic notch, presence of a large preauricular sulcus) and a raised auricular surface indicate that the sex is female. Several characteristics of the skull (e.g., small to medium-sized mastoid processes, slight supraorbital development, presence of frontal bossing, gracile zygomatic bones, small palate size) support this assignment. Other features (e.g., the over-all size of the cranium and the blunt supraorbital margins) are more masculine. The femoral head diameter, clavicle length, and general lack of skeletal robusticity also indicate the individual is female.

The estimated age at death of this individual is 35–45 years. This estimate is based on the appearance of the auricular surface (Lovejoy *et al.* 1985), ectocranial suture closure (Meindl and Lovejoy 1985), general tooth wear, and degenerative joint disease. Unfortunately, other areas useful in determining age, e.g., sternal rib ends, symphysis pubis, etc., were either damaged or not available for study.

THE SKULL

The sex-associated features observed in the cranium have already been discussed. Eighteen measurements and one index were recorded in the skull (Table 3). Because of its incomplete nature, additional measurements and indices could not be recorded. The cranial vault is long, or hyperdolichocranic (cranial index = 69.4). The mandibular measurements and indices are presented in Table 4. The ramus index (59.7) is high, indicating that the ramus is somewhat broad relative to its height. The mandibular robusticity index is 35.5. The gonio-condylar index, which reflects the degree of divergence of the ascending ramus from the mandibular angle, is 87. The relatively high value (106) obtained for the mandibular index indicates that the mandible is long. Comparisons with other Pacific skeletal series are discussed separately.

Pacchionian pits are present adjacent to the anterior sagittal suture on the interior of the parietal bones. The lacrimal depressions in both eye sockets are deep and well formed. A record of the non-metric observations recorded in the skull is given in Table 5. The mandible lacks the rocker jaw morphology characteristic of Polynesians and other Pacific Islanders.

CRANIAL PALAEOPATHOLOGY

The cranial vault bones appear to be thickened. The thickness was measured at several locations, following the method of Ishida and Dodo (1990) and Webb (1989). The measurements (in mm) follow.

	Right		Left
Frontal eminence	6		6
Midfrontal		6	
Bregma		5	
Obelion		8	
Parietal Eminence	6		6
Asterion	7		7
Lambda		10	

These measurements indicate that the vault is moderately thickened, although published comparative data for Pacific crania are generally unavailable. The cause of this observed thickening is not known.

Cribra orbitalia (a porosis of the orbital roofs), a condition which is frequently attributed to iron deficiency anaemia (Stuart-Macadam 1989), is not observed in this specimen.

DENTAL REMAINS

Three of the mandibular teeth were lost after death and are missing. The remaining mandibular teeth are *in situ*, or could be returned to their sockets (Fig. 11). The left maxillary fragment contains five teeth (I1–P4) and the right contains six (I2–M2) (Fig. 10). The molar teeth and that region of the left maxilla are missing. The right maxillary third molar is loose. The right maxillary central incisor is missing. None of the teeth appear to have been lost before death. The teeth are generally well preserved, although the enamel crowns of a few of the teeth exhibit cracking. The enamel is grey/white in appearance. The exposed tooth roots (i.e., areas not previously covered by alveolar bone) are uniformly brown in colour. The cause of this discoloration is unknown but natural geological processes cannot be ruled out. A complete record of dental attrition observed in these remains is given in Table 6.

The maxillary incisors, although worn, exhibit moderate shovelling. Extensions of the enamel into the neck region of the premolars and molars were not observed. None of the mandibular molars have protostylid cusps. The first and second mandibular molars have the

"+4" cusp pattern. The mandibular left third molar exhibits the "+4 and wrinkled" cusp pattern, while the cusp pattern in the right third molar is "Y4". Carabelli's cusps were not observed in any of the right maxillary molars present. The right maxillary first molar has four ("4") well developed cusps. The size of the hypocone is reduced in the second molar ("4-"). The hypocone is completely absent in the third molar ("3") on the same side. The method of scoring maxillary molar cusp patterns follows that of Dahlberg (1951). A record of these dental non-metric observations is presented in Table 7.

The teeth are small and of normal construction. None are peg-shaped. Tooth crown diameters and cross-sectional areas are presented in Table 8.

ORAL-DENTAL PALAEOPATHOLOGY

Degenerative dental disease (dental attrition) was scored on a none, slight, moderate, and marked basis. Attrition, to some degree, is observed in all the teeth. The dentine (moderate wear) is exposed in all the teeth from the first molars to the incisors. The second and third molars, when present, have less (slight) attrition affecting only the enamel. The anterior teeth (upper and lower) exhibit the greatest wear, suggesting edge-to-edge bite. An apical abscess is visible at the base of the left mandibular second molar. Although there has been postmortem bone loss, the abscess is likely to have exposed the roots of this tooth. The alveolar margins of this abscess are sharp. A single dental caries is observed in the occlusal (mesial-buccal quadrant) surface of the mandibular right second molar. This carious infection has destroyed much of the enamel in this quadrant of the tooth and has reached the pulp chamber. There is little or no evidence of periodontal disease. No calculus, or calcified tartar build-up, is observed in any of the teeth. Some alveolar resorption or exposure of the tooth root is observed, but systematic assessment of this condition is limited because of the postmortem destruction of the alveolar margins. A sharpened build up of alveolar bone around the tooth roots (rolled rim), another indicator of periodontal disease, is observed in the mandibular third molars. Dental enamel hypoplasia, attributable to a variety of stresses (nutritional, emotional, disease) (Goodman *et al.* 1980) is observed in three of the teeth of WKO-013B. Hypoplastic defects, visible as a distinct grey linear band, are observed in the maxillary left central and lateral incisors and in the left maxillary third premolar.

In summary, the dental health of the WKO-013B individual is reasonably good but examples of dental caries, abscessing, attrition, and developmental dental pathology are observed.

INFRACRANIAL SKELETON

A record of the measurements and indices recorded in the WKO-013B infracranial skeleton is presented in Table 9. Because of the poor and imperfect preservation of these remains, most of the maximum lengths presented in this table are estimates of the true lengths.

Stature was estimated using regression formulae for Polynesian (Houghton *et al.* 1975) and White (Trotter 1970) ethnic groups. Using Polynesian formulae and the length of the left femur, the estimated stature of the WKO-013B skeleton is 161.4 cm, or 5 feet 3.5 inches. A slightly shorter stature (157.6 cm, or 5 feet 2 inches) is obtained when the left femur and tibia and White formulae are used. The infracranial indices are presented in Table 10 and the non-metric observations recorded in the infracranial skeleton in Table 11.

A very large preauricular sulcus, or groove of pregnancy, is observed in the right *os coxae*, suggesting this individual had experienced childbirth.

With the exception of the fifth lumbar vertebra, very little of the vertebral column remains intact, thus precluding the scoring of non-metric observations in this part of the skeleton. Laminal spurring, spina bifida, spondylolysis and mammillary foramina were not observed in the fifth lumbar vertebra.

There is little or no degenerative osteoarthritis in the appendicular skeleton and vertebral column, although few articular surfaces could be observed.

COMPARISONS

In this section, we make limited comparisons of the new skeleton from Koné with previously described Lapita-associated skeletons and with other prehistoric skeletal series from the Pacific.

Before the discovery of the present skeleton, human skeletal remains associated with the Lapita Cultural Complex were limited to five locations (Table 12)[4]. Two are located in the Bismarck Archipelago (Reber-Rakival on Watom Island and the Mussau Islands in New Ireland), two are in Fiji (Natunuku and Lakeba) and one is in Tonga. The skeletal remains from the Mussau Group are from several sites; the material is extremely fragmentary and incomplete. Disregarding this material, for which estimates cannot be obtained, the minimum number of individuals represented by Lapita-associated culture, thus far described, is thirteen. The only females in this previously described material are two partial skeletons from Watom Island in New Britain. None of the Lapita-associated skeletons are represented by complete crania. The two female skeletons from Watom Island lack cranial remains. The lack of Lapita female crania and female skeletons, in general, seriously restricts comparisons. Where possible, information recorded in other prehistoric skeletal samples from the Pacific is used in the following discussion.

CRANIAL COMPARISONS

Published data recorded on female crania and skeletons from the Pacific region are extremely rare. Currently, there are no female Lapita-associated cranial remains available for comparison with the Koné cranium. A recent analysis (Pietrusewsky 1997), although limited to Polynesia and Fiji, provides some comparative female craniometric data (Table 13). Of the groups represented, the measurements recorded in the WKO-013B cranium are closest to crania from Easter Island and Fiji. The crania in these latter series are typically long (dolichocranic) and possess smaller breadth dimensions. The Marquesas, Society, Tuamotu, and Easter Islands series are similar to WKO-013B when the minimum frontal breadth, bifrontal breadth, and mastoid height variables are compared. There is significant overlap between WKO-013B and some of the other cranial series when other variables are compared. Broader comparisons of the WKO-013B crania with other Pacific cranial series are limited to three measurements (maximum cranial length, maximum cranial breadth, and minimum frontal breadth) and the cranial index (Table 14). Once again, the unusually long,

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[4]Since this paper was accepted for publication, another Lapita-associated skeleton from Waya Island, Fiji, has been described by Pietrusewsky *et al.* (1997a, 1997b).

or hyper-dolichocranic, vault shape in the WKO-013B specimen is evident in these comparisons. Cranial series whose cranial vault shapes are classified as hyper-dolichocranic (65–69.9) included the WKO-013B specimen, Fiji, and Easter Island. All of the cranial series from eastern island Melanesia, including New Caledonia, are characterised as possessing long, or dolichocranic skulls, while within Polynesia, skull shapes generally range from dolichocranic to mesocranic proportions. The minimum width of the frontal bone in the WKO-013B specimen is closest to Vanuatu, Marquesas, Easter Island and the Trobriand Islands. The minimum frontal bone widths for New Caledonia and Loyalty are 1 or 2 mm greater than the WKO-013B specimen. In general, however, frontal bone breadth is not remarkably different in these series. Fiji, Tonga-Samoa, and Guam have some of the widest frontal bones.

These limited univariate observations, using cranial measurements, indicate that WKO-013B is closest to eastern island Melanesian groups and Easter Island. Because only a single female specimen is available, and because only a few measurements could be recorded on the WKO-013B specimen, application of multivariate statistical procedures and statistical packages such as CRANID2 (Wright 1992) and FORDISC (Jantz and Ousley 1993) were not feasible.

Comparisons of the measurements recorded on the WKO-013B mandible (Table 15) are limited to several Polynesian and one Fijian group provided by Pietrusewsky (1969a). Several of the measurements recorded on the WKO-013B mandible (e.g., bigonial diameter and bicondylar breadth) may have been affected by the less than perfect reconstruction of the left ramus portion. Discounting these two measurements, the length of the mandible, symphysis height, and ramus dimensions are closest to those reported for Fiji and Tonga. The WKO-013B mandible is relatively long and has a broad ascending ramus. Previously described Lapita-associated mandibles have been characterised as short with broad rami (Pietrusewsky 1989a).

Non-metric traits recorded in the WKO-013B cranium are compared with several Pacific Island cranial series in Table 16. A metopic suture and frontal grooves, absent in the WKO-013B cranium, are relatively rare in most Pacific cranial series. One of the Lapita-associated crania from Watom Island possesses a metopic suture. A single supraorbital notch, single zygo-facial foramen, blurred subnasal region, and the presence of a parietal foramen are common in the Lapita-associated and most Pacific Island crania. Coronal wormian bones, bregmatic and lambdic bones, are absent or rare in most of these series. Parietal notches and asterionic bones, which are relatively common in Polynesian crania, are not observed in the WKO-013B specimen. Auditory exostoses, which are relatively common in Tongan and Hawaiian crania, were not observed in the WKO-013B specimen.

Three non-metric mandibular traits recorded in the Lapita and Pacific Island series are presented in Table 17. Bridging of the mylo-hyoid groove, a groove on the inner surface of the ramus, is never observed in the Lapita mandibles, including the WKO-013B specimen. The highest frequency of occurrence of mylo-hyoid bridging occurs in the Bismarck Archipelago extending into eastern Melanesia and Tonga. Multiple mental foramina, recorded in the WKO-013B mandible, are slightly more common in eastern Melanesia and in the Bismarck Archipelago region. Multiple mental foramina are also recorded in the Natunuku mandible. The WKO-013B mandible does not possess the rocker jaw morphology observed in the majority of the other Lapita and Pacific mandibles.

Given the spareness of these data, very little can be concluded at this time using cranial non-metric data. The cranial non-metric traits observed in the WKO-013B cranium are broadly comparable to other Pacific Island series. With the exception of the absence of a rocker jaw, the non-metric traits recorded in the WKO-013B mandible are consistent with other Pacific Island series. The presence of multiple mental foramina in two of the Lapita-associated mandibles is noteworthy and hints at a connection with samples from eastern Melanesia and from the Bismarck Archipelago region.

DENTAL COMPARISONS

Some comparative data on tooth size in the WKO-013B and other Pacific-Asian dental series are presented in Table 18. The WKO-013B teeth are among the smallest of the dental series compared in this table. It should be cautioned, however, that there are limits to comparing a single individual specimen such as WKO-013B and many of the tooth summary figures presented in this table are based on samples which combine male and female specimens. The fact that the WKO-013B specimen is female may also explain the observed smaller tooth size. However, small tooth sizes have been reported for previously described Lapita-associated skeletal series, tooth sizes which approach those of the Ainu of northern Japan (Pietrusewksy 1997).

A number of non-metric dental traits are compared in Table 19. Enamel extensions, Carabelli's cusps, and peg-shaped teeth are not common in the WKO-013B and other Lapita series or, for that matter, in the other Pacific dental series. Furthermore, the presence of moderately shovel-shaped incisors, the +4 cusp pattern in the lower second molars and the absence of protostylid cusps, observed in WKO-013B, are common in many Pacific and Asian populations (Turner 1989; 1992). Overall, there is little to differentiate these Pacific Island groups using dental variation.

Several aspects of oral-dental health are compared in Table 20. With the exception of the WKO-013B specimen, hypoplastic defects of the incisor and canine enamel are of low occurrence in the Lapita-associated teeth. Similarly, low occurrences of hypoplasia are recorded in the series from Fiji, Tonga, and Hawai'i. Only Apurguan (Guam) has a relatively high frequency of hypoplastic defects. A generally low caries rate is observed in the WKO-013B teeth and in the teeth of prehistoric Fijians, Tongans, Chamorro, and Hawaiians. Dental abscessing is equally low in these series. The WKO-013B, Watom, Natunuku, and Sigatoka specimens have the highest levels of advanced attrition of all the series compared. Premortem tooth loss is of low occurrence for most of the comparative series. No premortem tooth loss was observed in the WKO-013B specimen. The overall dental health of the WKO-013B and other Lapita specimens includes relatively low rates of caries infections, dental abscessing and enamel hypoplastic defects in the presence of extreme dental wear, a combination of dental features which may be associated with diet and/or habitual use of the teeth and jaws in some occupational activity.

INFRACRANIAL COMPARISONS

Some comparative data on female infracranial measurements and indices are presented in Tables 21 and 22. The usual caveats, small sample sizes and comparisons involving a single individual, are in order. In general, the limb bone lengths in the WKO-013B skeleton are most similar to those recorded in the Hane Dune (Marquesas) and Hawaiian skeletal series. With the exception of the humerus and ulna, the limb bone lengths and diameters recorded for the Sigatoka series from Fiji tend to be greater than those recorded in the WKO-013B skeleton. Examination of the indices in Table 22 demonstrates that there is some correspondence between the WKO-013B specimen and the averages reported from Guam for the first five indices. Inspection of the platymeric index indicates that the shape of the upper femoral shaft is greatly flattened (hyper-platymeric) in the WKO-013B and Hane Dune series. With the exception of Guam, most of the femora in these series are classified as platymeric. In addition, there is medium pilastric development in the majority of Pacific femora, including the WKO-013B specimen. The value of the platycnemic index, which expresses the shape of the upper tibial shaft, for the WKO-013B specimen is closest to Hane Dune and Sigatoka. In summary, there is very little to differentiate these skeletal series based on limb bone dimensions and indices.

The estimated stature (161.4 cm) for the WKO-013B skeleton falls within the range defined by two female skeletons from Watom Island (Table 23) and is within a few centimetres of the average statures for Sigatoka (163.4 cm), Hawai'i (163.1 cm), and Guam (162 cm). The average stature (162 cm) recorded in three female skeletons from Fiji by Weber (1934) is very close to that reported for the WKO-013B skeleton.

Some infracranial non-metric traits recorded in the WKO-013B skeleton are compared with two other Lapita-associated series in Table 24. The frequency of occurrence of supraclavicular foramen and septal aperture are uniformly low in the Pacific series. Oval *fovea capitis* and tibial squatting facets are almost universally present in these series.

CONCLUSIONS

A moderately well preserved skeleton, including a partially complete skull, of a 35–45 year old female from the WKO-013B Lapita site, near Koné, New Caledonia has been described. Although very few of the bones are complete, the WKO-013B specimen is the most complete female skeleton from a Lapita site thus far described. Radiocarbon dating of the site and skeleton suggest an age of approximately 500 BC. The nitrogen isotope value for the WKO-013B skeleton suggests a diet with average contribution from marine and land environments. The unusual carbon isotope value obtained suggests a direct or indirect consumption of C4 plants.

The skull is unusually long and, when viewed posteriorly, is pentagonal in shape. The cranial vault bones appear thickened. Multiple mental foramina are present and the mandible lacks the rocker jaw condition. Although the teeth are not all present, none appear to have been lost prior to death. The maxillary incisors exhibit moderate shovelling and the size of the teeth is small. The oral-dental health of WKO-013B is generally good but caries, abscessing, degeneration, and developmental defects (e.g., dental enamel hypoplasias) are observed.

Stature is estimated to be 161.4 cm, or 5 feet 3.5 inches. The femoral and tibial shafts exhibit flattening. Oval-shaped *fovea capiti* and a tibial squatting facet are present. There is evidence that this individual experienced childbirth. There is little or no degenerative osteoarthritis.

Unlike the majority of previously examined Lapita-associated skeletons, the present specimen is female, which limits comparisons. Comparisons of the metric and non-metric morphological features observed in the WKO-013B skeleton and teeth with (mostly male) Lapita-associated and other female Pacific skeletal series, however, allows some tentative conclusions regarding biological relationships. The exceptionally long cranial vault and relatively small frontal breadth observed in the WKO-013B specimen are closest to the mean values reported for several female eastern Melanesian groups (e.g., Vanuatu, Loyalty, Fiji) and Easter Island. Polynesian (male and female) crania are predominantly brachycranic, or broad. The relatively long mandible with broad ascending ramus observed in the WKO-013B specimen resembles female mandibles from Fiji and Tonga. Broad ascending mandibular rami have been observed in previously described Lapita-associated mandibles. Although cranial non-metric traits generally do not differentiate the WKO-013B specimen from other Pacific Island crania, the presence of multiple mental foramina suggests biological connections with eastern island Melanesia. Dentally, the WKO-013B specimen has small teeth, a feature observed in some of the previously examined Lapita-associated remains. The non-metric dental features observed in the WKO-013B teeth, including moderate incisor shovelling, conform to the Sundadont dental pattern (Turner 1992) which characterises most Pacific Islanders. The dental health of the WKO-013B specimen is similar to other Lapita-associated skeletons and to those from the Sigatoka cemetery in Fiji. The extreme flattening of the upper femoral shaft, oval *fovea*, and tibial squatting facets observed in WKO-013B specimen are reminiscent of other Lapita-associated and Pacific Island skeletons. The estimated stature of WKO-013B is similar to that estimated for Fijian females and two Lapita-associated female specimens from Watom Island, New Britain.

In conclusion, the new skeleton from New Caledonia is a welcome addition to the Lapita-associated skeletal record and, for the first time, allows extensive observations of a female skeleton, as well as a partially complete cranium. Two morphological features, small teeth and broad ascending rami, present in the WKO-013B specimen, have been described in previous Lapita-associated skeletons. Although similarities with Polynesians were noted, the great majority of the skeletal and dental features observed in the WKO-013B specimen, and in other Lapita skeletons, suggest affinities with skeletal series from Fiji and eastern Melanesia. As such, the extant Lapita-associated skeletal record, including this new specimen from New Caledonia, may say more about the contemporary indigenous inhabitants of eastern Melanesia than it does about the ancestors of the Polynesians.

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TABLE 1

Radiocarbon Dates Obtained for the WKO-013 Site

CRA = Conventional Radiocarbon Age as defined by Stuiver and Polach (1977). An item which has an asterisk (*) indicates that the CRA status is uncertain.

Lab Number	**CRA**	**Material**	**ProvenanceSource**
M341	2800* ± 350	charcoal	Loc. 1, 24"-30"[1]
M336	2435* ± 350	charcoal	Loc. 1, 30"-36"[1]
Gif-1983	2662* ± 10	shell	Loc. A[2]
NZA-3013	1061 ± 65	bone AMS	Skeleton WKO-013B[3]
OxA-4908	2410 ± 55	bone AMS	Skeleton WKO-013B[3]
Beta-59964	2450 ± 70	shell	Loc.B Layer B[4]
Beta-61955	2850 ± 60	Charcoal AMS	Loc.B Layer D[4]
Beta-55998	2590 ± 60	shell	Loc A Layer B[4]

Sources:

[1] Gifford and Shulter (1956)

[2] Coudray and Delibrias (1972)

[3] This paper

[4] Sand (1994)

TABLE 2

Amino Acid Analysis of Bone Collagen Sample from Site 13,
Compared with Human Bone Collagen Standard at
Archaeozoology Laboratory, Musuem of New Zealand
(Results are residues in pmol units)

Symbol	**Amino Acid**	**Collagen Standard**	**Site 13**
D/N	Aspartic acid	58.122	48.660
HPro	Hydroxyproline	65.024	77.680
E/Q	Glutamic acid	87.018	88.973
S	Serine	30.224	29.712
G	Glycine	306.194	355.217
H	Histidine	5.970	4.012
R	Arginine	48.398	53.093
T	Threonine	16.526	16.727
A	Alanine	98.927	107.763
P	Proline	111.959	127.629
Y	Tyrosine	3.925	1.618
V	Valine	27.220	28.885
M	Methionine	7.121	7.860
I	Isoleucine	11.708	11.811
L	Leucine	23.501	23.671
F	Phenylalanine	14.901	13.421
K	Lysine	29.683	29.707
Totals		**946.420**	**1026.438**

TABLE 3
Measurements and Indices[1] Recorded in the WKO-013B Cranium

Measurement	mm	
Maximum cranial length	180	*
Maximum cranial breadth	125	*
Cranial Index	69.4	
Maximum frontal breadth	105	
Minimum frontal breadth	91	
Bistephanic breadth	101	
Biauricular breadth	110	
Biasterionic breadth	101	
Mastoid height	26	
Mastoid breadth	19	
Bifrontal breadth	100	
Biorbital breadth	87	
Cheek height	23	
Nasion-bregma chord	101	*
Bregma-lambda chord	114	
Lambda-opisthion chord	93	
Frontal subtense	20	*
Parietal subtense	23	
Occipital subtense	21	

[1] References to these measurements and indices are given in Pietrusewsky (1969, 1984).
* estimates

TABLE 4

Measurements and Indices[1] Recorded in the WKO-013B Mandible

Measurement/Index	**in mm.**	
Mandibular length	106	*
Inferior length	62	
Alveolar length	53	
Bicondylar width	100	*
Mandibular index	106.0	
Bicondylar articular breadth	86	
Bicoronoid breadth	95	
Bigonial breadth	87	*
Gonio-condylar index	87.0	
Bicanine breadth	26	
Bimolar-1 breadth	52	
Bimolar-3 breadth	59	
Symphyseal height	33	
Mental foramen height	31	
Canine height	29	
Molar height	28	
Symphyseal breadth	13	
Mental foramen breadth (maximum body breadth)	11	
Canine breadth	12	
Molar breadth	15	
Ramus height	62	*
Ramus breadth	37	
Ramus index	59.7	
Mandibular notch breadth	30	
P3 to M1 length	22	
M1 to M2 length	18	
M1 to M3 length	28	
Mandibular robusticity index (at *mental foramen*)	35.5	

1 References to these measurements and indices are given in Pietrusewsky (1989b: 315).

* estimates

TABLE 5
Non-metric Traits Recorded in the WKO-013B Skull

Trait	Observation
Metopic suture	absent
Frontal grooves	R-absent, L-absent
Supraorbital structure	L-notch
Zygo-facial foramen	R-single, L-double
Subnasal	blurred
Marginal tubercles	R & L-slight
Os japonicum	L-absent
Maxillary torus	R-absent, L-absent
Mastoid suture	R-absent, L-absent
Mastoid suture exsutural	R-temporal, L-temporal
Parietal foramen	R-single, L-single
Coronal wormians	R-none, L-none
Bregmatic bone	none
Sagittal wormians	none
Lambdic bone	absent
Vault form	haus-form
Sagittal keeling	anterior ridge, posterior depressed
Occipital form	mound & ridge
Sagittal-bregma deflection	to left
Parietal notch	R-absent, L-absent
Asterionic bone	R-absent, L-absent
Auditory exostoses	R-absent, L-absent
Mandibular torus	R-absent, L-absent
Mylohyoid bridge	R-absent
Multiple mental foramen	R-none, L-present
Rocker jaw	absent
Chin form	median-angled
Ramus shape	R-coronoid>condyle

TABLE 6
A Record of WKO-013B Dentition and Observations of Oral-Dental Pathology

				Right				
	M3	M2	M1	P4	P3	C	I2	I1
Attrition	+	+	++	+	+	+	++	-
Maxillary	**1**	**2**	**3**	**4**	**5**	**6**	**7**	8
Mandibular	**32**	**31C**	**30**	**29**	**28**	**27**	~~26~~	~~25~~
Attrition	+	+	+	+	+	++	-	-
				Left				
	M3	M2	M1	P4	P3	C	I2	I1
Attrition	-	-	-	+	+	+	++	++
Maxillary	16	15	14	**13**	**12H**	**11**	**10H**	**9H**
Mandibular	**17**	**18A**	**19**	**20**	**21**	~~22~~	**23**	**24**
Attrition	+	+	++	+	+	-	++	++

Teeth in **bold** are present
Teeth in ~~strikeout~~ were lost postmortem
Teeth underlined were either not available or the region was damaged or missing
C = caries present
A = abscess
H = hypoplastic defect
+ = slight (enamel) attrition
++ = moderate (dentin) attrition
- = no observation

TABLE 7
Non-metric Dental Variation Recorded in the WKO-013B Teeth

					Mandibular Teeth					
	LP4	LP3	LM3	LM2	LM1	RM1	RM2	RM3	RP3	RP4
Protostylid	-	-	0	0	0	0	0	0	-	-
Cusp pattern	-	-	+4	+4	+4	+4	+4	Y4	-	-
Enamel extension	0	0	0	0	0	0	0	0	0	0
					Maxillary Teeth					
	LP4	LP3	RP3	RP4	RM1	RM2	RM3			
Enamel extension	0	0	0	0	0	0	0			
Carabelli's cusp	-	-	-	-	0	0	0			
Cusp pattern	-	-	-	-	4	4-	3			
					Incisors					
		LI2	LI1		RI1	RI2				
Shovel-shaped incisors		++	++		-	++				

0 = absent
++ = moderately expressed
- = no observation

TABLE 8
Measurements and Cross-sectional Areas Recorded in WKO-013B Teeth

	MD[1]	BL[2]	Cross-sectional Area
Right Maxillary			
M3	8.2	9.8	80.4
M2	7.9	11.0	86.9
M1	8.9	11.3	100.6
P4	4.6	9.2	42.3
P3	5.3	9.5	50.4
C	6.6	8.0	52.8
I2	4.8	6.7	32.2
I1	-	-	-
Left Maxillary			
M3	-	-	-
M2	-	-	-
M1	-	-	-
P4	5.3	9.0	47.7
P3	5.7	9.4	53.6
C	7.2	8.3	59.8
I2	5.4	6.8	36.7
I1	6.6	7.1	46.9
Right Mandibular			
M3	9.2	9.6	88.3
M2	8.4	9.8	82.3
M1	9.0	9.9	89.1
P4	5.7	8.6	49.0
P3	5.8	8.4	48.7
C	5.8	7.2	41.8
I2	-	-	-
I1	-	-	-
Left Mandibular			
M3	9.2	9.3	85.6
M2	9.0	9.6	86.4
M1	8.9	10.1	89.9
P4	5.4	8.2	44.3
P3	6.1	8.0	48.8
C	-	-	-
I2	4.5	6.5	29.3
I1	3.8	6.0	22.8

[1]MD = mesial-distal diameter
[2]BL = buccal-lingual diameter

TABLE 9
Measurements Recorded in the WKO-013B Skeleton

Bone	Measurement	Left	Right
Clavicle	Maximum length	-	130*
	Sagittal diameter, midshaft	-	11
	Vertical diameter, midshaft	-	10
	Circumference, midshaft	-	35
Humerus	Maximum length	300*	310*
	Epicondylar breadth	48*	45*
	Circumference, midshaft	56*	56*
	Maximum diameter, midshaft	18	18
	Minimum diameter, midshaft	15	14
	Least circumference	55*	53
Radius	Maximum length	236*	239*
	Head diameter	18*	-
	Sagittal diameter, midshaft	14	13
	Transverse diameter, midshaft	10	10
Ulna	Maximum length (minus styloid process)	260	-
	Dorso-volar diameter (max.)	12	13
	Transverse diameter	11	12
	Physiological length	234	-
	Minimum circumference	32	30
Femur	Maximum length	417*	-
	Physiological length	412	-
	Maximum head diameter	40	36
	Subtrochanteric a-p diameter	21	-
	Subtrochanteric trans. diameter	29	-
	Midshaft a-p diameter	25	-
	Midshaft transverse diameter	22	
	Circumference, midshaft	74	
Tibia	Maximum length	335*	-
	Max. epip. breadth, distal	40	43*
	Max. diameter, nut. foramen	33	29
	Transverse diam., nut. foramen	18	18
	Circumference, nut. foramen	86	78
	Midshaft a-p diameter	28	26
	Midshaft transverse diameter	18	18
	Circumference, midshaft	75	70
Fibula	Maximum length	326*	-
	Maximum diameter, midshaft	13	13
Calcaneus	Maximum length	-	75
	Maximum breadth	-	37*
Talus	Maximum length	51	-
	Maximum breadth	38	-

* estimated measurements

TABLE 10
Infracranial Indices for the WKO-013B Skeleton

Index	Right	Left
Humerus robusticity	17.1	18.3
Humeral diaphyseal	77.8	83.3
Radio-humeral	77.1	78.7
Intermembral	-	71.3
Femur robusticity	-	11.3
Femur-humeral	-	71.9
Tibia-radial	-	70.4
Crural	-	80.3
Tibia thickness	69.2	64.3
Platymeric	-	72.4
Pilastric	-	113.6
Platycnemic	62.1	54.5

TABLE 11
Non-Metric Observations Recorded in the WKO-013 Skeleton

Trait	Observation
Supraclavicular foramen (clavicle)	R-absent
Supratrochlear spur (humerus)	R-absent, L-absent
Septal aperture (humerus)	R-absent
Preauricular sulcus (*os coxae*)	R-present
Fossa of Allen (femur)	L-absent
Third trochanter (femur)	L-ridge
Fovea capitis (femur)	R-oval, L-oval
Femur anterior neck torsion	L- 10-15°
Tibia distal squatting facet	L-present
Calcaneus facet	R-hourglass, L-hourglass

TABLE 12
The Extant Lapita-Associated Skeletons from Near and Remote Oceania

Site/Location		Description of Remains	Dating of Remains	References
1.	Reber-Rakival, Watom, East New Britain	Eight adult (6 male, 2 female) skeletons of varying completeness, no complete crania. Age range of these individuals is 18-40 years. MNI=8	c.500 B.C. – 100 B.C.	Specht (1968), Green and Anson (1987), Pietrusewsky (1989a).
2.	Mussau or St. Mathias Group, New Ireland	Fragmentary and incomplete skeletal and dental remains from four sites on Eloaua, Emananus and Mussau Islands. MNI=?	c.1600 B.C. – 500 B.C. (occupation dates of sites)	Kirch *et al.* (1989).
3.	Natunuku (VL1/1), Viti Levu, Fiji Is.	A partially complete skeleton of an adult male, approx. 50 years old. MNI=1	0–500 B.C.	Shaw (1975), Pietrusewsky (1985, 1989b), Davidson *et al.* (1990).
4.	Lakeba, Lau Group, Fiji Is.	Incomplete remains of at least two individuals. The primary burial is a 30-40 year old male. MNI=2	Middle of early part of first millennium B.C. (c. 500 B.C.	Best (1977), Houghton (1989a).
5.	Burial AK, Tongatapu, Tongan Is.	A partially complete skeleton and portions of a second individual. The primary burial is a middle-aged male. MNI=2	Late Eastern Lapita Age	Poulsen (1987), Spennemann (1987), Houghton (1989b).
6.	WKO-013B, Koné, New Caledonia	A substantially complete skeleton of a 35-45 year old female, including a partially restored cranium. MNI=1	Second half of the first millennium B.C.	present study

TABLE 13
Female Cranial Measurements for Polynesians and Fijians[1]

Measurement[2]	WKO-013 (1)	Tonga-Samoa (11)	Easter Is. (39)	Marquesas (26)	New Zealand (41)	Hawai'i (40)	Society (23)	Tuamotu (14)	Chatham Is. (36)	Fiji (41)
Maximum cranial length (M-1)	180	174.8	179.8	174.5	179.0	175.5	171.1	172.3	179.4	181.6
Maximum cranial breadth (M-8)	125	140.0	126.1	130.3	131.7	138.7	128.1	129.0	137.6	127.6
Maximum frontal breadth (M-10)	105	118.5	108.2	110.2	110.3	112.3	110.5	111.7	113.1	110.7
Minimum frontal breadth (M-9)	91	95.6	90.7	90.5	92.2	92.0	91.4	90.7	94.4	94.6
Bistephanic breadth (H-STB)	101	113.4	102.9	105.4	103.5	106.0	106.3	106.5	105.3	105.8
Biauricular breadth (M-11b)	110	120.3	115.4	119.1	119.8	120.0	118.1	117.7	122.5	114.1
Biasterionic breadth (M-12)	101	106.4	100.8	103.1	103.7	103.5	105.0	102.3	105.6	103.3
Mastoid height (H-MDL)	26	21.6	23.1	25.5	24.0	26.4	24.8	25.9	25.9	24.2
Mastoid width (H-MDB)	19	17.5	17.7	18.2	18.5	17.7	18.1	19.0	19.6	18.1
Bifrontal breadth (M-43)	100	103.5	99.5	99.0	100.9	102.3	100.1	99.5	103.9	102.8
Biorbital breadth (H-EKB)	87	93.6	92.8	92.6	93.9	93.4	92.4	92.8	94.8	94.7
Cheek height [M-48(4)]	23	23.5	21.7	22.9	21.5	22.8	22.4	22.9	22.1	21.3
Nasion-bregma chord (M-29)	101	110.1	109.8	111.0	109.4	111.3	109.8	111.4	109.7	109.9
Bregma-lambda chord (M-30)	114	110.2	109.9	106.4	108.6	107.6	108.9	108.8	107.6	117.0
Lambda-opisthion chord (M-31)	93	98.5	96.1	98.1	96.6	97.8	96.9	98.1	98.3	96.0

[1] All comparative data are taken from Pietrusewsky (1997)
[2] M = Martin (1957); H = Howells (1973)

TABLE 14
Comparative Female Cranial Measurements

Series/Measurement	Max. Cranial length	Max. Cranial breadth	Cranial index	Min. front. breadth
WKO-013B	180	125	69.4	91
New Caledonia (81)[1,2]	177.3	127.5	71.9	93
Vanuatu (49)	176.3	125.3	71.1	91.2
Loyalty (27)	180.4	126.8	70.3	92
Fiji (24)	182.5	125.9	68.9	95.6
Tonga-Samoa (10)	171.9	134.2	78.1	99.1
Marquesas (61)	175.9	130.4	74.1	91.5
Society (28)	173.8	127.6	73.4	92.6
Easter Island (34)	181.2	125.7	69.4	91.6
Chatham Island (8)	180.5	134.9	74.7	94.0
New Zealand (38)	178.5	129.0	72.3	92.6
Hawaii (159)	173.9	140.3	80.7	92.5
Tuamotu (22)	171.4	128.4	74.9	90.9
Guam (43)	174.9	134.4	76.8	95.9
N. Marianas (19)	177.3	131.6	74.2	91.9
Markham, PNG (33)	176.9	127.0	71.8	92.5
Trobriand, PNG (32)	176.4	130.3	73.8	91.3
Gulf, PNG (58)	168	132.4	78.8	92.2
Murray R. (67)[3]	179.9	127.3	70.8	92.8
Tasmania (36)	178.0	133.2	74.8	92.4

[1] numbers in parentheses represent sample sizes
[2] all data, except where indicated, are taken from Pietrusewsky (1977)
[3] Murray R. and Tasmania data are taken from Pietrusewsky (1984)

TABLE 15
Comparative Female Mandibular Measurements[1]

Measurement/ Series	WKO-013B	Fiji	Tonga	Society	Tuamotu	Marquesas	Hawaii	Easter Island	New Zealand
Bigonial diameter	87	94.5	93.5	91.8	93.2	93.1	94.8	92.4	97.3
Symphysis height	33	31.5	29.9	30.9	30.0	29.9	29.7	29.2	30.4
Ramus height	62	58.4	60.5	52.7	58.8	60.3	55.6	54.3	62.2
Ramus breadth	37	34.8	36.7	33.4	35.2	34.4	34.0	35.9	33.1
Ramus index	59.7	59.6	60.7	63.4	59.9	57.0	61.2	66.1	53.2
Mandibular length	106	107	108.9	104.3	97.0	105.8	104.2	100.3	102.9
Bicondylar width	100	114.3	123.1	112.5	117.3	118.0	118.1	113.8	117.3
Gonio-condylar index	87	82.7	75.9	81.6	79.5	78.9	80.2	81.2	82.9
Mandibular index	106	93.6	88.5	92.7	82.7	89.7	88.2	88.1	87.7

[1] all comparative data are from Pietrusewsky (1969a).

TABLE 16
Cranial Non-metric variation in Lapita and Pacific Island Skeletal Series

Trait/Series	-	WKO-013B[1]	Watom[2]	Sigatoka[3]	To-At-1,2[4]	Hane[5]	Hawaii[6]	Apurguan[7]	Nebira[8]
Metopic	n/N	0/1	1/1	0/23	0/24	0/21	7/320	0/25	2/22
suture	%	0.0	100.0	0.0	0.0	0.0	2.2	0.0	9.1
Frontal	n/N	0/2	0/2	0/49	2/46	3/42	97/631	0/53	4/44
grooves	%	0.0	0.0	0.0	4.3	7.1	15.4	0.0	9.1
Supraorb. for.	n/N	1/1	1/1	16/35	5/46	22/39	106/652	24/46	12/35
single notch	%	100.0	100.0	45.7	10.9	56.4	16.3	52.2	34.3
Zygo-facial	n/N	1/2	3/3	23/37	23/31	19/39	218/609	30/68	21/31
for. (single)	%	50.0	100.0	62.2	74.2	48.7	35.8	44.1	67.7
Subnasal	n/N	1/1	1/1	4/13	-	10/15	137/304	21/27	15/18
blurred	%	100.0	100.0	30.8	-	66.7	45.1	77.8	83.3
Mastoid	n/N	0/2	-	2/44	33/49	-	234/620	28/76	-
suture	%	0.0	-	4.5	67.3	-	37.7	36.8	-
Parietal	n/N	2/2	1/1	11/30	-	15/38	314/610	25/55	13/41
foramen	%	100.0	100.0	36.7	-	39.5	51.5	45.5	31.7
Coronal	n/N	0/2	-	0/26	0/22	0/36	66/447	0/47	0/46
wormians	%	0.0	-	0.0	0.0	0.0	14.8	0.0	0.0
Bregmatic	n/N	0/1	-	0/14	0/21	0/17	3/281	0/28	0/23
bone	%	0.0	-	0.0	0.0	0.0	1.1	0.0	0.0
Lambdic	n/N	0/1	-	0/23	1/23	1/19	6/296	0/28	1/19
bone	%	0.0	-	0.0	4.3	5.3	2.0	0.0	5.3
Parietal	n/N	0/2	1/1	4/40	21/34	9/25	194/598	11/53	6/26
notch	%	0.0	100.0	10.0	61.8	36.0	32.4	20.8	23.1
Asterionic	n/N	0/2	-	2/49	7/28	11/32	156/604	3/62	2/30
bone	%	0.0	-	4.1	25.0	34.4	25.8	4.8	6.7
Auditory	n/N	0/2	1/1	1/45	19/51	0/39	71/632	0/78	3/43
exostoses	%	0.0	100.0	2.2	37.3	0.0	11.2	0.0	7.0

[1] present study; [2] Pietrusewsky 1989a; [3] Pietrusewsky *et al.* 1994; [4] Pietrusewsky 1969a; [5] Pietrusewsky 1976b; [6] Pietrusewsky *et al.* 1991;
[7] Pietrusewsky *et al.* 1992; [8] Pietrusewsky 1976a

TABLE 17
Non-metric Variation in Lapita and Pacific Asian Mandibles

Series/Trait	Mylo-hyoid Bridge		Multiple Mental For.		Rocker Jaw	
	n/N	%	n/N	%	n/N	%
WKO-013B[1]	0/1	0.0	1/2	50.0	0/1	0.0
Watom[2]	0/4	0.0	0/5	0.0	3/4	75.0
Natunuku[3]	0/1	0.0	1/1	100.0	1/1	100.0
Lakeba[2]	0/1	0.0	0/1	0.0	2/2	100.0
Burial AK[2]	0/1	0.0	0/2	0.0	1/1	100.0
Sigatoka[4]	2/62	3.2	4/66	6.1	25/37	67.6
To-At-1,2[5]	6/64	9.4	6/67	9.0	26/34	76.5
Honokahua[6]	29/618	4.7	38/620	6.1	215/307	70.0
E. Melanesia[2]	9/173	5.2	22/191	11.5	52/94	55.3
Bismarck[2]	19/201	9.4	34/204	16.7	58/96	60.4
Papua New Guinea[2]	1/165	0.6	13/160	8.1	74/78	94.9
Apurguan[7]	2/82	2.4	9/102	8.8	4/46	8.7
Nebira[8]	0/42	0.0	0/45	0.0	21/22	95.5
E. Asia[2]	2/141	1.4	17/178	9.6	62/89	69.7
S.E. Asia[2]	4/112	3.6	9/114	7.9	35/52	67.3
Is. S.E. Asia[2]	19/350	5.4	31/358	8.7	138/177	78.0

[1]present study, [2]Pietrusewsky (1989a), [3]Pietrusewsky (1989b), [4]Pietrusewsky *et al.* (1994) [5]Pietrusewsky (1969a), [6]Pietrusewsky *et al.* (1991), [7]Pietrusewsky *et al.* (1992), [8]Pietrusewsky (1976a)

TABLE 18
A Comparison of Tooth Size for WKO-013B and Other Pacific and Circum-Pacific Groups

Series	**TS**[1]
WKO-013B	952.6[2]
Watom Island, New Britain	1140
Ainu[3]	1141
China[4]	1157
Moriori	1181
Borneo	1190
Hawaii	1200
Japan	1200
Marquesas	1204
Thailand	1233
Northern Mariana Islands	1238
Java	1240
New Caledonia	1256
New Ireland	1266
North Coast Papua New Guinea	1286
Philippines	1288
Vanuatu	1295
Guam	1309
Samoa	1311
Sepik R.	1321
New Britain	1334
Fiji	1338
Bougainville	1359
Tonga	1371
Eastern Highlands, Papua New Guinea	1395
Tasmania	1429
Murray River, Australia	1486

1 TS = Tooth Summary Figure = sum of mean cross-sectional area (MD x BL) for each tooth category, upper and lower (right and left sides combined)

2 The cross-sectional area of the antimere was used if a tooth was missing to calculate TS for the WKO-013B specimen

3 Brace *et al.* (1989)

4 The remaining comparative data in this table are taken from Brace & Hinton (1981).

TABLE 19

Some Dental Non-metric Traits Recorded in Adult Teeth (Sexes and Sides Combined)

Series/Trait	Molar Extensions (Molar + Premolar)		Carabelli's Cusp		Peg-shaped Teeth	
	n/N	%	n/N	%	n/N	%
WKO-013B[1]	0/17	0.0	0/3	0.0	0/28	0.0
Watom[2]	0/31	0.0	0/10	0.0	0/53	0.0
Natunuku[3]	0/5	0.0	0/1	0.0	0/1	0.0
Burial AK[2]	0/9	0.0	1/5	20.0	---	---
Mussau[4]	0/3	0.0	---	---	---	---
Sigatoka[5]	32/521	6.1	0/154	0.0	1/930	0.1
To-At-1,2[6]	15/375	4.0	0/112	0.0	0/597	0.0
Hane Dune[7]	0/18*	0.0	0/17	0.0	1/599	0.2
Honokahua[8]	513/4615	11.1	42/1349	3.1	28/8298	0.3
Apurguan[9]	24/876	2.7	43/298	14.4	2/1757	0.1
Nebira[10]	0/24*	0.0	1/23	4.3	2/706	0.3

* premolars not included, [1] present study, [2] Pietrusewsky (1989a)
[3] Pietrusewsky (1989b), [4] Kirch *et al.* (1989), [5] Pietrusewsky *et al.* (1994), [6] Pietrusewsky (1969a), [7] Pietrusewsky (1976b), [8] Pietrusewsky *et al.* (1991), [9] Pietrusewsky *et al.* (1992), [10] Pietrusewsky (1976a)

TABLE 20

Oral-Dental Pathology in Lapita and Pacific Island Dental Remains

		WKO-013B[1]	Watom[2]	Natunuku[3]	Sigatoka[4]	To-At-1,2[5]	Hane[6]	Hawaii[7]	Apurguan[8]	Nebira[9]
Enamel	n/N	2/8	0/17	0/4	12/340	17/184	---	102/1718	110/342	---
Hypoplasia[10]	%	25.0	0.0	0.0	3.5	9.2		5.9	32.2	
Caries	n/N	1/25	0/52	3/5	57/944	43/587	9/43	985/7309	39/1491	5/56
	%	4.0	0.0	60.0	6.0	7.3	20.9	13.5	2.6	8.9
Abscessing	n/N	1/28	0/42	---	14/893	14/590	5/43	381/7629	59/1278	1/56
	%	3.6	0.0		1.6	2.4	11.6	5.0	4.6	1.8
Attrition[11]	n/N	8/25	21/52	4/5	700/935	36/237	20/43	3456/7365	328/1457	27/56
	%	32.0	40.4	80.0	74.9	15.2	46.5	46.9	22.5	48.2
Premortem	n/N	0/25	1/26	extensive	114/1128	37/793	20/619	852/8892	115/1996	7/706
Tooth Loss	%	0.0	3.8		10.1	4.7	3.2	9.6	5.8	1.0

[1] present study, [2] Pietrusewsky (1989a), [3] Pietrusewsky (1989b), [4] Pietrusewsky *et al.* (1994), [5] Data collected by M. Pietrusewsky and M. Douglas at the Auckland Institute and Museum, Auckland, New Zealand in 1992, [6] Pietrusewsky (1976b), [7] Pietrusewsky *et al.* (1991), [8] Pietrusewsky *et al.* (1992), [9] Pietrusewsky (1976a), [10] Any expression of hypoplastic defects in incisors and canines, [11] Includes wear scored as reaching the dentine (moderate), pulp, and roots only.

TABLE 21
Comparative[1] Female Infracranial Measurements [Left Side if Available]

Bone Measurement	WKO-013B[1]	Watom[2]	'Atele Tonga[3]	Hane Marquesas[4]	Hawaii[5]	Guam[6]	Sigato-ka[7]	Nebira, PNG[8]
Clavicle								
Max. length	130(R)	—	141	127	134.3	137.5	135	—
Humerus								
Max. length	300	—	323	284	292.3	298.0	298.8	269
Max. mid. diam.	18	—	24.4	—	20.6	—	21.7	—
Radius								
Max. length	236	245	244	215	222	232.0	231	211
Hd. diam.	18	21	24	19	20.6	20.9	18.5	18.7
Ulna								
Max. length	260	—	269	234	239.5	247.3	—	—
Femur								
Max. length	417	—	463	405	416.5	423.0	437.8	405
Max. hd. diam.	40	39	46	37	40.7	40.8	42.0	39.5
Sub. A-P	21	24	25	21	22.6	24.0	23.8	23
Sub. Trans.	29	29	33	29	29.5	28.2	29.7	28.1
Mid. A-P	25	30	29	27	26.3	26.9	28.6	25.8
Mid. Trans.	22	26	26	22	22.3	24.1	25.1	22.5
Tibia								
Max. length	335	—	385	332	346.3	340.0	364.5	340
A-P diam.	33	33	35	31	31.1	33.0	34.2	30.3
Trans. diam.	18	24	25	20	21.2	24.0	21.6	19.8
Fibula								
Max. length	326	—	399	335	335	333.0	341	—

[1] present study, [2] Burial No. 1 (♀) from Watom Is. (Pietrusewsky, 1989a) [data on file], [3] Pietrusewsky (1969a), [4] Pietrusewsky (1976b), [5] Pietrusewsky *et al.* (1991), [6] Pietrusewsky *et al.* (1992), [7] Pietrusewsky *et al.* (1994), [8] Pietrusewsky (1976a)

TABLE 22

Comparative Female Infracranial Indices [Left Side When Available]

Index	WKO-013B[1]	Watom[2]	'Atele[3]	Hane[4]	Hawaii[5]	Guam[6]	Sigatoka[7]	Nebira[8]
Radio-humeral	78.7	—	70.9	76.8	75.9	77.9	75.1	77
Intermembral	71.3	—	65.1	—	67.4	69.5	68.6	64
Femur-humeral	71.9	—	69.8	70.1	70.2	70.4	68.2	67
Tibia-Radial	70.4	—	59.5	64.7	64.1	68.2	66.1	61
Crural	80.3	—	83.2	82.0	83.2	80.4	83.3	85
Platymeric	72.4	80.6	76.7	72.4	76.6	85.1	80.0	82
Pilastric	113.6	121.7	113.7	103.8	118.3	111.4	113.7	113
Platycnemic	62.1(R)	67.7	70.6	64.5	68.2	72.7	63.0	67

[1] this study, [2] Watom Burial # 2, female, left side [data on file], [3] female data, Pietrusewsky (1969a), [4] female data, Pietrusewsky (1976b), [5] female data, Pietrusewsky *et al.* (1991), [6] female data, Pietrusewsky *et al.* (1992), [7] female data, Pietrusewsky *et al.* (1994), [8] female data, Pietrusewsky (1976a)

TABLE 23

Female Stature in Selected Pacific Island Series

Skeletal Series	N	Stature (cm)	Reference
WKO-013B	1	161.4	present study
Watom 1	1	164.0	Pietrusewsky (1989a)
Watom 2	1	154.7	Pietrusewsky (1989a)
Sigatoka, Fiji	8	163.4	Pietrusewsky *et al.* (1994)
Fiji	3	162.0	Weber (1934)
To-At-1,2, Tonga	9	165.3	Pietrusewsky (1969b)
Hane Dune, Marquesas	6	155.0	Pietrusewsky (1976b)
Honokahua, Hawai'i	234	163.1	Pietrusewsky *et al.* (1991)
Easter Island	8	153.6	Murrill (1968)
Nebira, Papua New Guinea	7	155.5	Pietrusewsky (1976a)
Apurguan, Guam	21	162.0	Pietrusewsky *et al.* (1992)

TABLE 24
Non-metric Infracranial Traits in Lapita and Pacific Skeletal Series

Trait/Series	WKO-013B[1]	Watom[2]	Burial AK, Tonga[3]	Sigatoka[4]	To-At-1,2[5]	Hane Dune[6]	Hawai'i[7]	Apurguan[8]	Nebira[9]
Supra-clavicular	0/1	2/7	—	10/34	—	—	94/586	23/82	0/1
foramen	0.0	28.6		29.4			16.0	28.0	0.0
Septal aperture	0/1	1/3	0/3	5/34	6/39	3/30	169/580	8/65	8/46
	0.0	33.3	0.0	14.7	15.4	10.0	29.1	12.3	17.4
Third trochanter	1/1	3/3	1/1	50/57	30/31	25/28	275/519	20/44	16/38
(ridge)	100.0	100.0	100.0	87.7	96.8	89.3	53.0	45.5	42.1
Oval *fovea capitis*	2/2	3/5	—	15/18	—	—	275/511	8/17	—
	100.0	60.0		83.3			53.8	47.1	
Tibial squatting	2/2	2/2	1/1	17/17	9/12	23/27	537/559	29/32	24/25
facet	100.0	100.0	100.0	100.0	75.0	85.2	96.1	90.6	96.0

[1] present study, [2] Pietrusewsky (1989a), [3] Data recorded by Pietrusewsky in 1984, [4] Pietrusewsky *et al.* (1994), [5] Pietrusewsky (1969b), [6] Pietrusewsky (1976b), [7] Pietrusewsky *et al.* (1991), [8] Pietrusewsky *et al.* (1992), [9] Pietrusewsky (1976a)