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CONTENTS

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RECORDS OF THE AUSTRALIAN MUSEUM 2004 Supplement 29

RECORDS OF THE AUSTRALIAN MUSEUM

A Pacific Odyssey:

Archaeology and Anthropology in the Western Pacific. Papers in Honour of Jim Specht

edited by

Val Attenbrow and Richard Fullagar

SUPPLEMENT 29

19 May 2004

RECORDS OF THE AUSTRALIAN MUSEUM

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The **cover** design is the enlarged detail of design on the *baru* from Maewo island which was repatriated from the Australian Museum to the Vanuatu Cultural Centre in 1995. The complete textile is shown in Figure 1 of Lissant Bolton's paper in this volume. Photograph by Australian Museum, reproduced with permission of the Vanuatu Cultural Centre.

The title-page portrait photo of Jim Specht is by Australian Museum photographer Carl Bento.

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http://dx.doi.org/10.3853/j.0812-7387.29.2004.1400

Denham, 2004, *Rec. Aust. Mus., Suppl.* 29: 47–57
http://dx.doi.org/10.3853/j.0812-7387.29.2004.1401

Galipaud, 2004, *Rec. Aust. Mus., Suppl.* 29: 59–64
http://dx.doi.org/10.3853/j.0812-7387.29.2004.1402

Knowles, 2004, *Rec. Aust. Mus., Suppl.* 29: 65–74
http://dx.doi.org/10.3853/j.0812-7387.29.2004.1403

Lentfer, 2004, *Rec. Aust. Mus., Suppl.* 29: 75–88
http://dx.doi.org/10.3853/j.0812-7387.29.2004.1404

Lilley, 2004, *Rec. Aust. Mus., Suppl.* 29: 89–96
http://dx.doi.org/10.3853/j.0812-7387.29.2004.1405

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Sand, 2004, *Rec. Aust. Mus., Suppl.* 29: 109–122
http://dx.doi.org/10.3853/j.0812-7387.29.2004.1407

Sheppard, 2004, *Rec. Aust. Mus., Suppl.* 29: 123–132
http://dx.doi.org/10.3853/j.0812-7387.29.2004.1408

Smith, 2004, *Rec. Aust. Mus., Suppl.* 29: 133–138
http://dx.doi.org/10.3853/j.0812-7387.29.2004.1409

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http://dx.doi.org/10.3853/j.0812-7387.29.2004.1410

Summerhayes, 2004, *Rec. Aust. Mus., Suppl.* 29: 145–156
http://dx.doi.org/10.3853/j.0812-7387.29.2004.1411

Swadling, 2004, *Rec. Aust. Mus., Suppl.* 29: 157–161
http://dx.doi.org/10.3853/j.0812-7387.29.2004.1412

Torrence, 2004, *Rec. Aust. Mus., Suppl.* 29: 163–172
http://dx.doi.org/10.3853/j.0812-7387.29.2004.1413

Wilson, 2004, *Rec. Aust. Mus., Suppl.* 29: 173–186
http://dx.doi.org/10.3853/j.0812-7387.29.2004.1414

A Pacific Odyssey:

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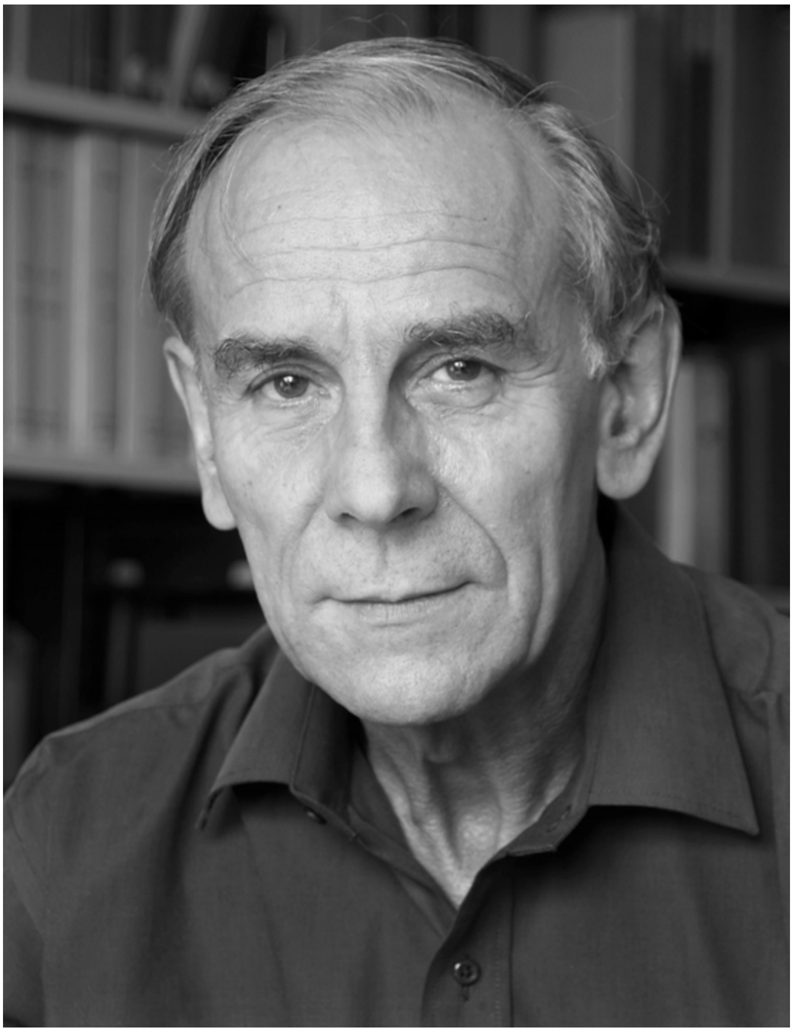

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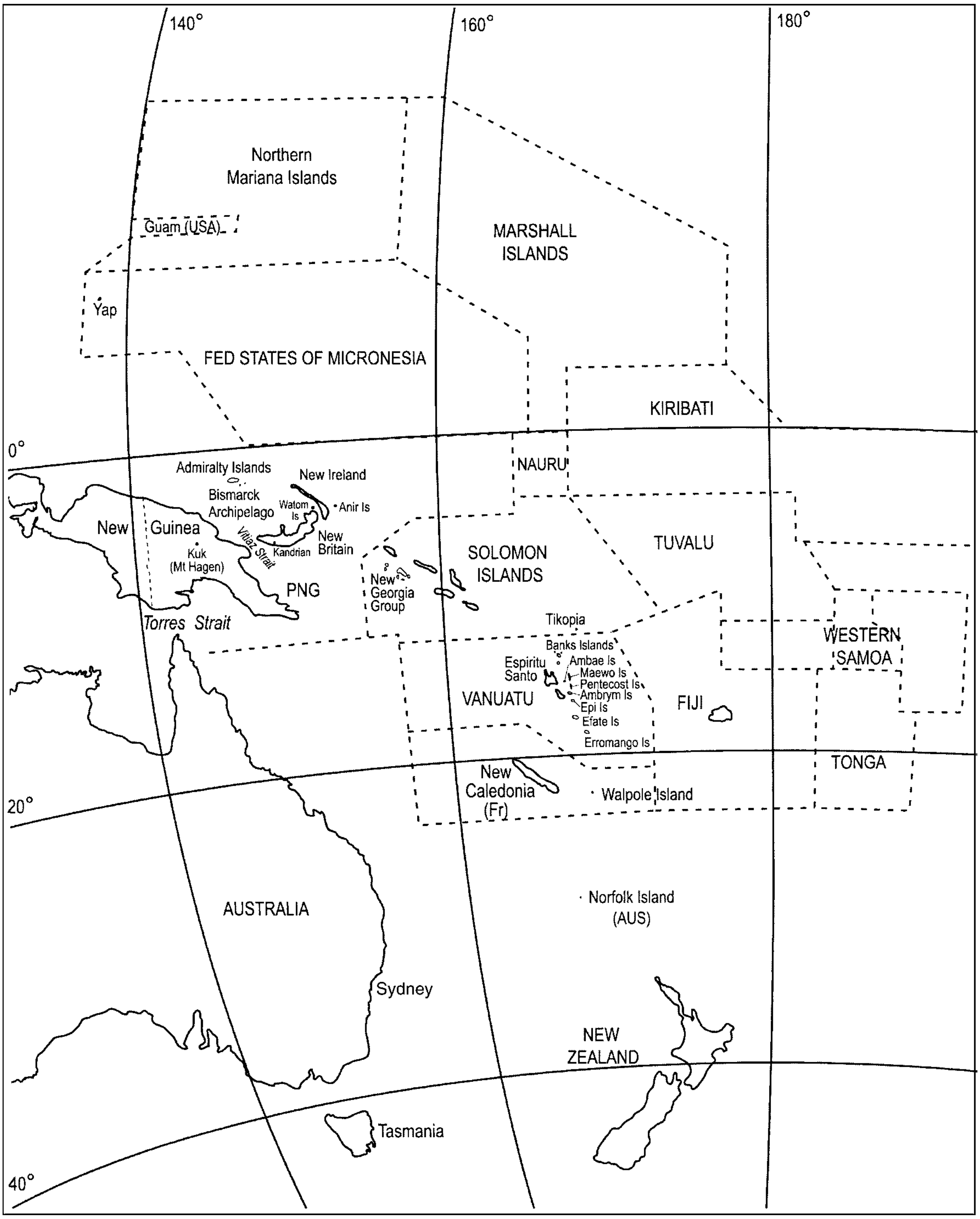
Contents



Countries and key places referred to in this volume
indicating the geographical extent of Jim's research and influence.

Preface

A core of papers in this volume was first presented at a one-day conference held at the Australian Museum on the 11th November 2000, titled "A Pacific Odyssey: Recent Archaeological Discoveries, on the occasion of Jim Specht's retirement". It was Robin Torrence's idea that the conference present and discuss the results of important recent discoveries in Pacific archaeology with case studies from Micronesia, Polynesia and Melanesia. The idea was embraced by the Museum, and the program, introduced by the Australian Museum's director Mike Archer, included presentations by scholars from around the world: Steve Athens (USA), Chris Gosden (UK), Christophe Sand (New Caledonia), Peter Sheppard and Richard Walter (NZ), and Australia: Tim Denham, Anita Smith, Matthew Spriggs, Glenn Summerhayes and Meredith Wilson.

Although the number of speakers was limited to ten, the audience numbered over one hundred. The day of stimulating papers was followed by a celebratory dinner at the Museum. Highlights of the evening included addresses by Phil Gordon (Head, AM Aboriginal Heritage Unit), Des Griffin (past AM Director), John Namuno from the West New Britain Cultural Centre, the late Mrs Grace Molissa from the Vanuatu Cultural Centre, and Kirk Huffman (past Director of the Vanuatu Cultural Centre), and many of Jim's colleagues at the Museum and other institutions.

In addition to papers presented at the Symposium, contributions to this volume come from others working in Jim's areas of interest. The volume includes 19 papers by 26 authors. All of the authors and the editors have in some way been influenced by Jim's work, and this is brought out by many of the authors in their papers. His archaeological work also extended to eastern Australia where in 1975 he was involved in excavating a number of Aboriginal middens at Bantry Bay in Sydney Harbour—the current research area of one of the volume editors. The papers acknowledge Jim's achievements and the contributions that he has made to the development of archaeology and anthropology of the western Pacific. Excluding the introductory tribute and bibliography, the papers are presented in alphabetical order by first author's name. This is because there was no obvious grouping of themes according to geography, subject or object—from front to back the volume presents a wide-ranging set of papers addressing issues relating to environment, repatriation, agriculture, settlement history, historical collectors, trade, pottery, obsidian and rock art. This ordering, however, perhaps reinforces the breadth and diversity of Jim's contributions to a variety of disciplines and organizations with which he worked.

Although the conference and this volume were organized to celebrate Jim's retirement from the Australian Museum, he has maintained his interest in and still contributes to the discipline. He continues to work in West New Britain and to publish his research. He has also been chair of the Archaeology and Prehistory Committee at the Academy of the Humanities and an Expert Advisory Committee member with the Australian Research Council. Will he ever really retire?

There are many people to thank for bringing this volume to publication; these include not only the contributors, but also many anonymous referees, staff at the Australian Museum, and Fiona Roberts for producing the map opposite. Needless to say we are both indebted to Jim Specht for his wonderful generosity of spirit as much as his academic acuity and leadership.

Richard Fullagar, Senior Research Fellow, Department of Archaeology, University of Sydney.

Val Attenbrow, Senior Research Scientist, Anthropology, Australian Museum.

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Jim Specht's Brilliant Career—A Tribute

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ABSTRACT. Jim Specht's career at the Australian Museum spanned almost thirty years, over half as Head of Anthropology. In his capacity as Division Head, field expedition leader, museum curator, scholar and friend he had an enormous impact on both the anthropological and museum worlds. Although much of his work focuses on the western Pacific, its ramifications have been felt across the world. In this brief overview we highlight some of his more outstanding achievements.

TAÇON, PAUL S.C., JACK GOLSON, KIRK HUFFMAN & DES GRIFFIN, 2004. Jim Specht's brilliant career—a tribute. In *A Pacific Odyssey: Archaeology and Anthropology in the Western Pacific. Papers in Honour of Jim Specht*, ed. Val Attenbrow and Richard Fullagar, pp. 1–8. *Records of the Australian Museum, Supplement* 29. Sydney: Australian Museum.

James Richard Specht (Fig. 1) has had a rich, rewarding, long and varied career that has positively impacted on an untold number of people across the globe. The four of us have felt the "Specht effect" in different ways but for each it was an enriching experience. As co-researchers, close colleagues, teachers, students and long time friends, in different times and places, we have embraced the breadth of Jim's knowledge, leadership, experience and zest for life. Jim's tenure at the Australian Museum began in June 1971. He retired in November 2000. In this tribute a small sample of Jim's contributions to archaeology, museums, indigenous peoples, friends and colleagues is highlighted.

Jim Specht and New Britain Archaeology

Jim Specht paid his first visit to New Britain in 1965 as a Ph.D. scholar of the Australian National University, continuing to visit until and beyond his retirement from the Australian Museum. The advances of the intervening years in our knowledge of the prehistory of the island and its place in that of the wider region are testimony to the value of a long-term commitment. His own research, and that of many others, came to benefit from his ever-increasing familiarity with the archaeological resources of his chosen study areas and his constantly renewed association with the local

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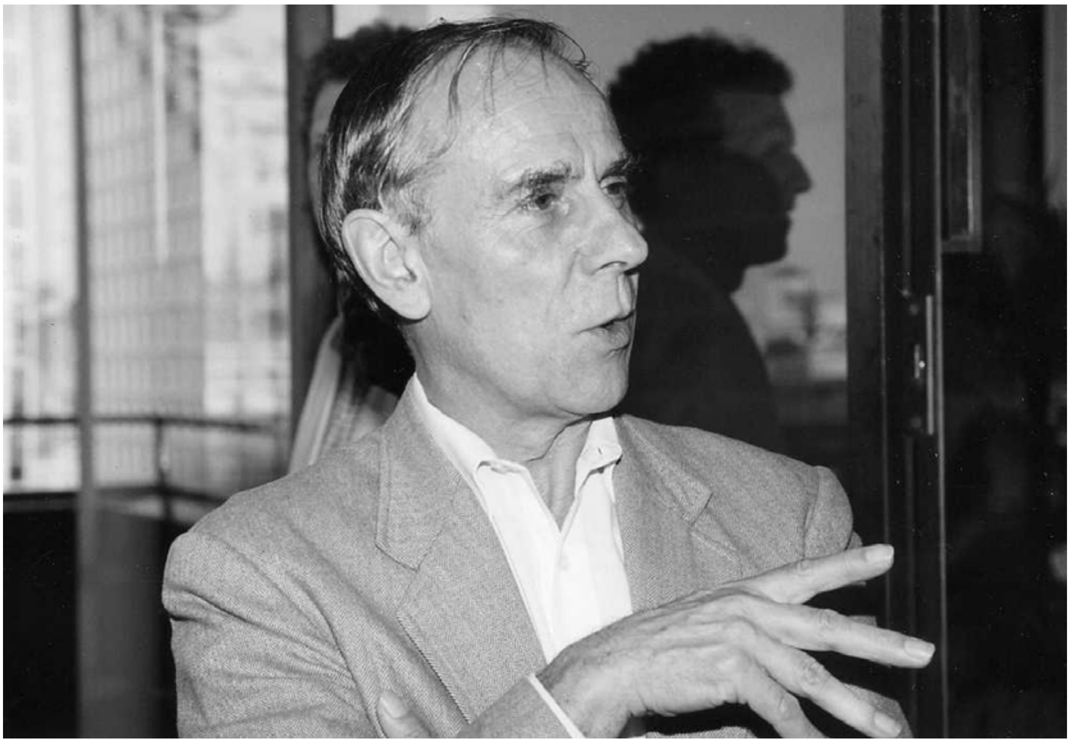

Fig. 1. Jim Specht, early 2000.

communities with whom he carried out his work of reconnaissance and excavation. The close relationship that he developed with the provincial officials whose support was important at all stages also opened the door to further research. As we shall see, he became a point of reference for scholars of many kinds and a stimulator and facilitator of research in the area by other people.

First steps. The archaeological group that Jim Specht joined in the Department of Anthropology in the Research School of Pacific Studies at ANU in 1965 was small and new, and most of the designated region of its operations archaeologically virgin territory. In these circumstances he became the first archaeologist of the Bismarck Archipelago. He was despatched to the small island of Watom near Rabaul. There he was charged with following up the discovery, put on record more than 50 years previously by the missionary Father Otto Meyer, of what we now know as Lapita pottery. Until then, the study of Lapita pottery had been limited to sites in the remoter Pacific, in Tonga, Fiji and New Caledonia.

However, because the archaeological remains at Watom were blanketed by a thick volcanic ash that made sampling them a haphazard exercise from the viewpoint of a limited-term Ph.D. undertaking, he only had a single season there (Specht, 1968) before transferring his attention to sites in the northern Solomon Islands (Specht, 1969). Before he left for Australia at the end of his Watom fieldwork, however, he made an important visit to Talasea, at the base of the Willaumez Peninsula on the mid-north coast of New Britain.

Talasea was the source of the obsidian that Specht observed in the possession of inhabitants of Watom Island some 270 km away. Obsidian artefacts that he excavated with Lapita pottery on Watom were shown by subsequent spectrographic analysis to have also come from Talasea more than 2,000 years before (Key, 1969). In light of the results of contemporary ethnographic work by Harding (1967) with the Siassi Islanders of the Vitiaz Strait, Specht saw the evidence emerging for the Talasea area as a centre for the extraction and distribution of a raw material widely valued over time as well as space and thus as a fruitful location for research. This was strikingly confirmed a few years later with Wal Ambrose's demonstration that the obsidian found by Roger Green in association with Lapita pottery in the Reef Islands of the southeast Solomons also came from the Talasea source some 2,000 km away (Ambrose & Green, 1972).

There was a second long-term outcome of Specht's involvement as a Ph.D. student with New Britain. A co-resident of University House, the ANU's graduate hall of residence at the time, was an American anthropologist, Ann Chowning, who had recently joined the University's Department of Anthropology. Chowning had carried out ethnographic fieldwork in the early 1960s with fellow American Jane Goodale in the sparsely settled Passismanua district of lowland tropical rainforest inland of Kandrian on the New Britain south coast. Here they found sites with chert implements that were unrecognized as artefacts by the inhabitants and made a large collection (Chowning & Goodale, 1966; Goodale, 1966). Chowning brought some of this collection with her when she came to ANU. In early 1967, Specht found himself briefly at the Kandrian airstrip en route from Kilenge, at the western end of New Britain, via Rabaul to Buka, for the next stage of his doctoral fieldwork. With the Passismanua collection in mind, he made some enquiries and discovered that chert tools had been found during recent work at the airstrip. Kandrian and district developed as a focus of interest for him when he joined the Australian Museum in 1971.

Specht was at Kilenge in 1967 because he had met Philip Dark of Southern Illinois University, Carbondale, at

University House in 1966. Dark was researching the context of art in culture at Kilenge and he invited Specht to record an engraved rock art site there. Specht did so, being hosted in the field by Adrian Gerbrands of the University of Leiden, who was Dark's colleague in the project. This led to what has been called "Specht's (1979*b*) seminal review" of rock art in the western Pacific (Ballard, 1992: 94).

Defining the field. Specht's fieldwork opportunities were limited for most of the 1970s, when his activities outside the museum were concerned with the development of programs of cultural assistance in the Pacific through the Australian Department of Foreign Affairs and UNESCO. He did some work in the Talasea area in 1973 and 1974, initially following up the discovery of obsidian stemmed tools by Johan Kamminga in 1972. Given the association of Lapita pottery with transported obsidian from Talasea at Watom and elsewhere, Specht's main aim was to discover Lapita sites in the source area and investigate their relationship with obsidian quarries (Specht, 1974*c*). In 1974, he collected oral traditional information about obsidian sources ahead of a visit from Wal Ambrose to sample them for geochemical characterization (Specht, 1980*a,d*, 1981*c*) and initiated (with Lin Sutherland, geologist at the Australian Museum) an investigation into the tephrostratigraphy of the region that was more fully developed in later years. That same year Jim Rhoads, a graduate student of the University of Minnesota, joined him for fieldwork. Rhoads told us (pers. comm., 2000) that Specht was instrumental in developing his doctoral research proposal for ANU, which involved fieldwork among sago users in Gulf Province on mainland P.N.G. (Rhoads, 1980).

Shortly afterwards, Sydney University student Dimitri Anson began work on Lapita pottery from the Bismarck Archipelago, with Specht's encouragement and support. By this time, two of the four sites in the region that had produced such pottery, Watom and Talasea in New Britain were known as a result of Specht's own work.

Towards the end of the 1970s Specht's program really took shape. Described as a study of settlement history and exchange network development in the region of West New Britain (Talasea and Passismanua) and the Huon Peninsula (Specht *et al*., 1981: 13) it comprised three main seasons of fieldwork over the years 1979 to 1982. There was close association with the newly established West New Britain Cultural Centre at Kimbe in the planning and execution of the fieldwork at the local level and John Normu of the Centre was a member of the field team. In the third season, Specht and Julian Hollis, a consultant geologist, extended the work of the tephrostratigraphic survey in the Talasea area begun some years before. In the course of this, they were taken to a new obsidian source at Mopir, which proved to be the "unknown" in the source determinations of archaeological obsidians being produced by Atomic Energy Commission research scientists at Lucas Heights in a collaborative program with Wal Ambrose. During the second and third seasons of the project, a member of the archaeological team was Ian Lilley, an M.A. student from the University of Queensland. He went on to do his Ph.D. at the ANU on the archaeology of the Siassi Islands of the Vitiaz Strait between New Britain and the New Guinea mainland (Lilley this volume).

There was fieldwork in the Passismanua district in each of the three seasons of the project. Excavations took place in Yombon village territory, at Misisil cave. This work produced the then-oldest archaeological date for the islands east of the New Guinea mainland, one from the terminal Pleistocene, as well as dates back to 4,000 B.P. for activity at an open hill-top site with 1 m deep deposits (Specht *et al*., 1981, 1983: 92). In addition, there was survey and excavation at the coast in the vicinity of Kandrian (Specht *et al*., 1983: 92, 94).

In conjunction with this extensive program of archaeological research, Specht conducted complementary ethnographic investigations, focusing on oral traditions, early written history and material culture. His extensive knowledge in these areas led to a range of exhibitions (e.g., most recently Sospen Graun in 2000) and publications, including a lengthy and scholarly account of Richard Parkinson and his artefact collecting (Specht, 2000*c*).

The Lapita Homeland Project. Jim Allen (1991: 1) reports that the idea for the highly productive Lapita Homeland Project, which he organized for the Bismarck Archipelago in the mid-1980s, arose out of a conversation with Jim Specht at a conference in Sydney in 1982 (see the subtitle of Specht, 1967*c*). It is no surprise that Specht was one of three people, the others being Wal Ambrose and Doug Yen, who Allen (1991: 2–3) invited to join him on the 1984 reconnaissance that set up the fieldwork schedule for the project in 1985.

During the project itself, because of his official and local connections, Specht had a wandering brief. He was in touch with the authorities in Kandrian and on the spot in the Arawe Islands ahead of the arrival of the project vessel, the *Dick Smith Explorer*, with Chris Gosden for the opening stage of fieldwork. The few days of survey that Specht could spend with Gosden were sufficient to demonstrate the archaeological potential of the island group, which Gosden (1991) explored to good effect in 1985 and subsequent years. From the Arawe Islands, Specht went to Rabaul to meet Roger Green and Dimitri Anson, settle them on Watom Island and relocate his excavation trenches of 1966 in preparation for their work. After Watom he was off to Kimbe to talk to the provincial authorities about his own plans, pick up John Normu at the Cultural Centre and move to Kandrian for survey and test excavation at the south coast. This was the occasion of the discovery of the Kreslo site as a result of local information (Specht, 1991*b*).

Bringing it all together. Regarding the obsidian province around Talasea, there were major questions outstanding from previous work, related to obsidian exploitation and use, the role of Lapita and the place of the stemmed obsidian tools. These questions were addressed in 1988 and subsequent seasons, when Specht was accompanied into the field by Robin Torrence and Richard Fullagar. Torrence, then of the University of Sheffield, had interests in the organization of stone tool production and Fullagar, a postdoctoral fellow under the Specht/Gosden ARC grant, was analysing use-wear and residues on tools.

According to Torrence (pers. comm., 2000), the major achievement of this period of fieldwork was Specht's trench at Bitokara Mission, which passed through 3 m of interbedded deposits of volcanic ash and the debris of obsidian working (Specht *et al*., 1988: 8–9). This constituted a type section, which, expanded and refined by work elsewhere, established a tephrostratigraphic framework for the archaeological evidence of the region (Specht *et al*., 1991: 282–284).

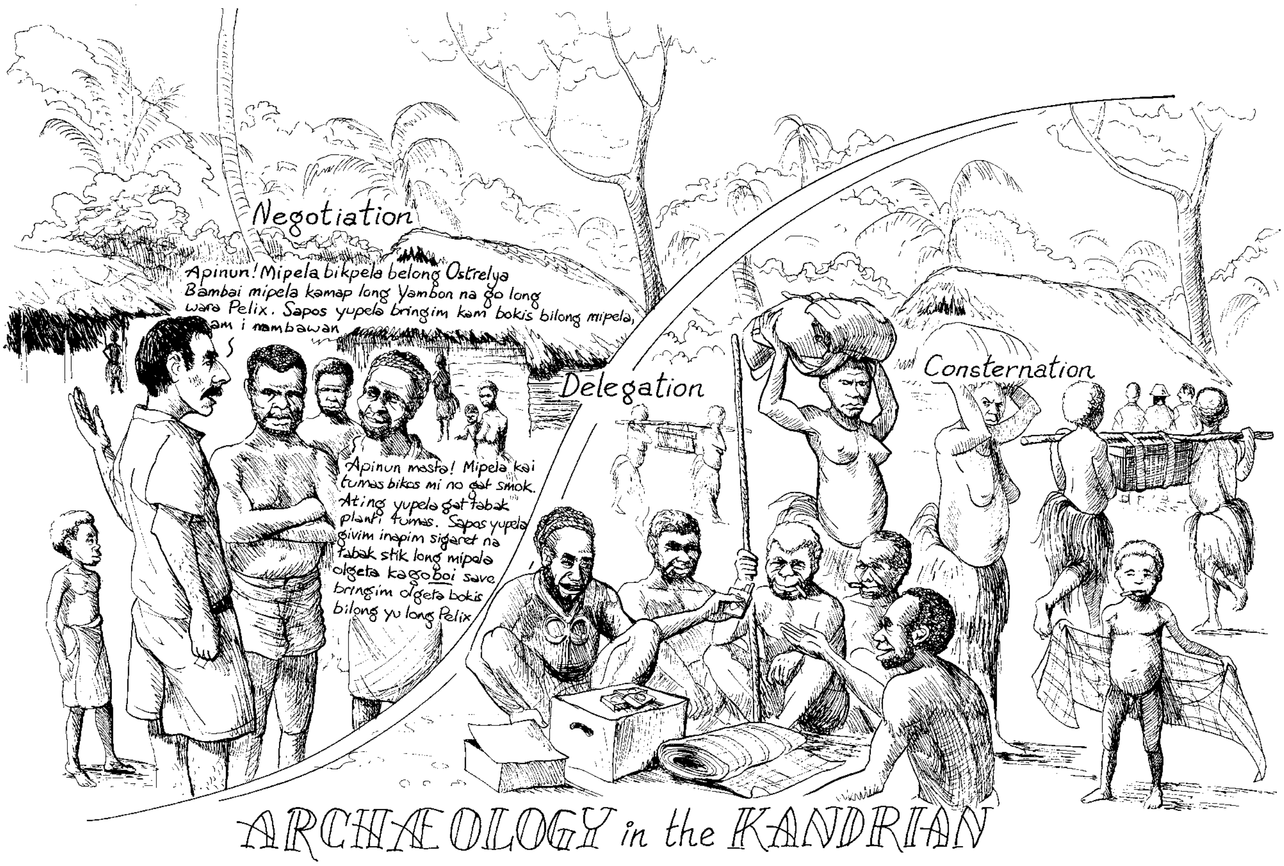

Fig. 2. Cartoon depicting Jim Specht negotiating the portage of equipment in the Kandrian area, Papua New Guinea. Designed by Foss Leach, drawn by Linden Cowell.

At this time, Russell Blong, of the School of Earth Sciences at Macquarie University, became involved with Specht's tephrostratigraphic program in the Talasea region, although it was Blong's Japanese colleague, Hiroshi Machida of Tokyo Metropolitan University, who took the leading role. Machida became closely associated with Specht's work and was appointed to a Visiting Fellowship at the Australian Museum. The program (Machida *et al*., 1996) included not only sustained investigations in the north, but also the identification of the same tephra sequence at sites in the Passismanua district in the south that were shortly to be excavated.

Meanwhile, Specht and his team expanded and systematized the sampling of obsidian flows within source areas that Wal Ambrose had initiated earlier in the decade (cf. Torrence *et al*., 1992). Glenn Summerhayes, a Ph.D. student at La Trobe, who was in the field with Specht in 1989, analysed source and archaeological samples of obsidian at Lucas Heights (Summerhayes *et al*., 1993).

The interrelated operations described above provided the opportunity for detailed work on changing patterns of settlement and resource use in the region. Whilst Torrence undertook investigations on Garua Island, Specht followed up other aspects of the coordinated program of research in West New Britain for which he and Chris Gosden obtained joint funding for the period 1989 to 1993—Gosden in the Arawe Islands and Specht on the mainland.

As a result, Specht went south in 1991 to re-establish his contacts in the Kandrian coastal area and consider options for Yombon, in the interior rainforest. Ten years before, when he had worked at Yombon, it was a remote area, six or seven hours walk from Kandrian on each of two days, requiring a cargo line of up to 30 men to carry everything in (Fig. 2). Now, in early 1991, there was a mission, radio and an airstrip, but Specht still walked in with Chris Gosden, then at La Trobe University, and his Ph.D. student, Christina Pavlides, to obtain support from the people and the mission for Pavlides to undertake archaeological research (see this volume).

The early 1990s saw major pieces of the West New Britain jigsaw that Specht had acquired 20 years before firmly in place. However, Specht conducted further work with a range of colleagues, especially Robin Torrence. Subsequent research programs recently received funding for fieldwork beyond 2003.

Jim—The Museum Man

Over the course of 29 years, Jim Specht had a profound impact on the Australian Museum. He was a pillar of strength and continuity through three decades of almost constant change. He saw many Anthropology staff members come and go but also was instrumental in building up the Anthropology section, as well as defending it from budgetary and other attacks. Specht acted as Head of Anthropology for over half his time at the Museum and on many occasions acted as the Museum's Deputy Director (including one stretch of almost a year). When Jim retired in late 2000 he was one of only two Museum Chief Scientists, a position bestowed upon him in recognition of the museum science wisdom he had accumulated.

Specht was very successful at obtaining grants, including various large ARC grants. He attracted a range of postdoctoral fellows, with Richard Fullagar and Robin Torrence staying the longest. Infrastructure grants obtained by Specht, sometimes in association with colleagues at the University of Sydney, enabled the Museum's Archaeology Laboratory to be refurbished. The well-equipped laboratory, used regularly by staff, students and visiting fellows, stimulates innovative projects at the Museum.

Besides being extremely active in Museum research and politics, Specht threw himself wholeheartedly into many exhibitions. One of the more exceptional and successful exhibitions was the award winning *Pieces of Paradise*, which opened in March 1988. Specht was also instrumental in establishing the Australian Museum's djamu Gallery, which had anthropology, art and material culture exhibitions at Old Customs House, Circular Quay from late 1998 to late 2000. As can be seen from his publication list (Khan, this volume), Specht also wrote many exhibition catalogue essays and, in some cases, most label and exhibition display text as well. However, Specht's publications were not limited to museum exhibitions and New Britain archaeology. While at the Australian Museum, Specht published in both scholarly and popular venues on a vast range of topics, including rock-art and many aspects of material culture such as the nature of ethnographic collecting, as Khan notes in more detail (this volume).

As a museum man dealing with the tangible results of more than a century of ethnographic collecting, Specht (1991*c*) was caught up early in questions about a proper role for museums in the post-colonial era. During the 1970s, as already noted, he was a member of various committees concerned with programs of cultural assistance to Pacific Island countries through the Australian Government or UNESCO and this continued through the 1980s. Inevitably, this work came to involve questions about the return of objects to new or remodelled museums and cultural centres in previously dependent territories, and about the provision of technical facilities and training for the proper curation of collections. As a result, Specht built up special relationships with cultural officials and workers in Pacific Island countries, especially Vanuatu and Papua New Guinea. It is in this context that we can appreciate Specht's long and supportive association with the West New Britain Provincial Cultural Centre at Kimbe.

This was formally set up in 1978 after discussions between the West New Britain Provincial Government, the West New Britain Division of Education and the National Cultural Council, which was established in 1973 to coordinate cultural activities throughout Papua New Guinea and provide financial assistance for the purpose (see Namuno, 1991: 92 for the Cultural Centre; Crawford, 1977: 29 for the Cultural Council).

The regular field visits of Specht and his team, and those of others developing his work, have been of great help to the Centre in its work. Officers of the Centre took part in the fieldwork activities of the visitors. Namuno (1991: 98–99) points out that this gave Centre staff the opportunity to carry out cultural patrols that otherwise might not have taken place. There was also a direct contribution to the Centre through the provision of fieldwork reports, items collected in the course of fieldwork and photographs. As John Namuno (pers. comm., 2000) notes:

> The Provincial Cultural Centre and especially the Provincial Museum owe Jim a great deal. A good volume of the collection held in the Museum had been supplied by Jim in his field trips around the province. He has provided the Museum with good quality photographs and slides which are very useful to the Museum. And not only that but the compiled notes on all the research conducted since 1978. He assisted John Normu in the Museum records and other necessary requirements. The West New Britain Provincial Museum will really miss him, but will remember his great work for a long time. Being a small set up, we are really going to miss someone who is a friend and like a father to us.

South Pacific Cultures Fund. As is evident above, most academics know of Specht through his important archaeological work in New Britain, his numerous scientific articles and from interacting with him through the Anthropology Department/Division of the Australian Museum since 1971 or at numerous international conferences. Fewer people, though, know much about his long-term commitment and assistance to living Pacific cultures, Pacific nations, Pacific Island Museums and Cultural Centres. Specht's support was given not only through his Anthropology staff and with the assistance of the recently retired Australian Museum Director, Dr Des Griffin, but also through Specht's involvement in the setting up of the Australian Government's South Pacific Cultures Fund (SPCF) in the mid-1970s. Specht was on the committee of this "low budget" but incredibly useful "grass roots" cultural aid fund until 1983.

For nearly 20 years, the SPCF distributed approximately AU$100,000–200,000 annually to many cultural projects throughout a dozen Pacific nations (Fig. 3). Specht and Robert Langdon of the SPCF advised the Australian Government on aspects of the setting up of the fund. Together they travelled widely throughout the Pacific in the mid-1970s through to the early 1980s, looking into the possible "cultural aid" desires, needs and aspirations of certain island societies and local and national governments. By the time the Australian Government shut down the SPCF in 1996, it had funded hundreds of cultural projects. With its disappearance, the Australian Government lost its least expensive but most effective, sympathetic and widespread form of useful profile in this vast area.

From the late 1970s until 1995 Pacific Island individuals, groups, local governments and cultural institutions made their SPCF requests through their own governments to the Australian High Commission in their respective capitals. The vast scope of the SPCF-supported projects reflected to a large extent Specht's heart-felt concern to assist indigenous peoples and developing nations in the Pacific to use whatever means were available to retain and develop their cultural identities. Specht's view of the practical ways that a large and respected museum (with the world's largest ethnographic collections from the western Pacific) and a government cultural fund could assist Pacific nations to fulfil their cultural visions has been immensely successful. It has left an enduring and permanent legacy in many areas of the Pacific.

Returning cultural property. Over the last twenty years the Australian Museum has come to be recognized internationally as a world leader in the return of cultural property to its country of origin. Important items have been returned to Papua New Guinea, the Solomon Islands, Vanuatu, New Zealand, Canada and India. The Australian Museum Trust

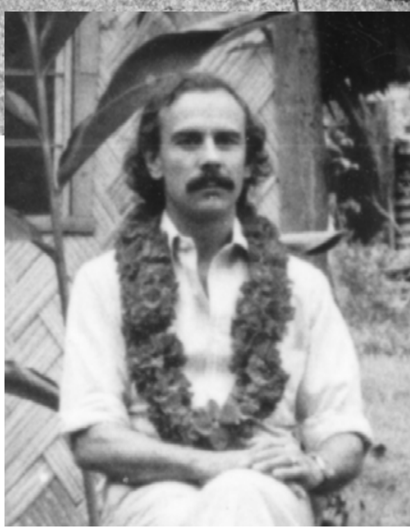

Fig. 3. Official delegation at the opening of the South Pentecost Cultural Centre office (sub-office in southern Pentecost island of the Vanuatu Cultural Centre)—the hut in the background—at Pangi, south Pentecost, Vanuatu, early September 1982. The building was funded by the SPCF. Seated from left to right: Michael Ovington (Australian High Commissioner), Robert Langdon (SPCF), Jim Specht (SPCF and Australian Museum), Frederic Tau (Vanuatu Ministry of Home Affairs, representing the Minister responsible for Culture and the Vanuatu Cultural Centre). Photo courtesy *Vanuatu Tam Tam* (national newspaper).

has adopted appropriately sensitive policies concerning return of material consistent with UNESCO Conventions.

The leadership of Specht, Head of the Department of Anthropology, made the difference to the Australian Museum's role in returning cultural property. His involvement in UNESCO committees in the 1980s, which drew up guidelines that refined our approach to issues of return, and his longer involvement with cultural centres in the Pacific, led to trusting relationships being developed. These relationships gave the Museum greater confidence in their dealings on this matter, a contribution which, among others, the late Grace Molissa, of the Vanuatu Cultural Centre, recognized. Speaking at the opening of the magnificent exhibition, "Pieces of Paradise" (the project team of which was chaired by Specht), Grace Molissa said:

> We Melanesians, particularly ni Vanuatu, welcome Australia's review and reorientation of approach and direction from Europe to the Pacific where we all live. Greetings from Vanuatu, from the smallest museum in the Pacific to the biggest museum in the southern hemisphere. I take this opportunity to thank the Australian Museum Trust and staff for the numerous good deeds rendered to the Vanuatu Cultural Centre… We're glad that overseas museums have collected Vanuatu material and looked after them so well.

Mrs Molissa also acknowledged that it was during Jim's term on the Committee of the Australian Government's South Pacific Cultures Fund that funding was initially provided for the salary of the first museum curator in the Vanuatu Cultural Centre, as well as a subsequent trainee curator.

Specht's credibility, his care and his unrivalled knowledge of all the relevant issues, together with his commitment to the rights of peoples in respect of their culture, made the difference.

An appreciation

This tribute to Jim Specht illustrates the value of his long-term commitment to the West New Britain region, not only to the research problems that he addressed but also to the local communities he consulted, and who contributed and benefited in the process. Specht has attracted a large number and wide range of Australian scholars, at different stages of their careers, to take part in the projects that he has formulated. He has always carried these projects out in close association with the scholarly institutions of the host country and their personnel, officials at the national and local levels and the cultural establishments on the spot, in particular the West New Britain Provincial Cultural Centre.

His legacy also continues across Australia, particularly at the Australian Museum, as well as in Vanuatu and in many other parts of the world, as comments from colleagues, friends, former students and indigenous peoples attest. For instance, Anthropology curator at the South Australian Museum, Barry Craig notes:

> Jim's professional opinion is widely sought and respected; his Forewords and Introductions to books and republications of classic works are eagerly sought and read. I arranged for him to be an official external supervisor for my Ph.D. thesis, not only because there was hardly anyone else in this country who had the broad range of knowledge and experience to do it, but also because I wanted to have his criticism before I handed in the thesis rather than afterwards.

Former student Paul Rainbird, now teaching in the Department of Archaeology, University of Wales, Lampeter, goes further:

> My association with Jim does not go back a long way—less than 10 years in fact, but this time has been a significant one for me as … Jim was able to nurture my new found interest in Pacific archaeology. In February 1992 I enrolled as a doctoral candidate at the University of Sydney studying Micronesian archaeology and due to my growing admiration for Jim I asked him to be my co-supervisor along with Roland Fletcher at the university. Our friendship grew and the supervisory relationship became steadily more informal with the majority of advice and much discussion or debate occurring over dinner or a few schooners in the New Zealand Hotel or Lord Wolseley amongst others. Following the completion of my Ph.D. in 1995 and over the next three years up until the end of 1998 we saw each other fairly regularly either in Sydney or at conferences and special events. Since my return to the UK contact has been limited to irregular email communication. However, in my research and teaching Jim's name often comes to the fore whether it be in regard to shell artefacts from Nauru or the politics of museum collections, such is the wide range of his intellectual legacy.
>
> Jim never shirks from criticism where it is deserved, but his humour and humanity along with his maintenance of high personal standards of behaviour are indelible memories and these, along with his knowledge of the Pacific and academic integrity, are the things from Jim that I continue to strive to attain.

Specht has also made an impact on members of the art world, for instance speaking at exhibition openings and giving many lectures to the Oceanic Arts Society. He developed many close friendships with contemporary artists, including the late Tony Tuckson and his curator/author wife, Margaret. Margaret provides an example of the sort of inspiration Specht gave to others with shared interests:

> Jim is a very special part of my life. But for him I doubt if I would have battled on with my research into the pottery of PNG. He allowed me free access to the pot collection at the Museum and gave endless encouragement and helpful advice. In 1971 I started to work with Patricia May to do the research and put together our book on PNG pottery. Jim gave a lot of help and did invaluable reading and correcting for the revised, re-published version in 1999. Recently, we worked together and with Patricia, as three curators of the exhibition *Sospen Graun* for djamu Gallery. It was a joy to work with Jim again for both Patricia and myself. I treasure his friendship.

For former Australian Museum anthropologist Betty Meehan, it was Specht's negotiation skills that were particularly impressive:

> As you probably all know, Jim lives in a small, charming and somewhat run down terrace house in Ultimo. No matter what time he finished work or socialising he always walked home a distance of several kilometres on a route which took him through Hyde Park. Some of us at the Museum worried about these late night journeys. In fact, one night he was accosted while walking through the park by two large "lads". They wanted money. Unfortunately for them, they could not have chosen a less likely candidate, for Jim was well-known for never carrying much cash on his person. On this night he had, from memory, two ten cent coins in his pocket. Amazingly, even in this dangerous and threatening situation, he negotiated with his assailants about the cash and they agreed to split it 50/50 with him! Apparently, Jim continued on his way home without further mishap. Perhaps it is these exceptional negotiating skills that made him such an excellent colleague and leader in a large and at times unwieldy institution.

Besides former students, museum curators and academics, Specht has many close indigenous friends, as can be seen from comments such as the following by John Namuno, Provincial Cultural Officer of the Kimbe Provincial Cultural Centre, Papua New Guinea:

> I would like to make my personal comments on Dr Jim Specht's attitudes and general everyday manners and lifestyle as I saw over almost twenty years when conducting researches in the West New Britain Province. On many occasions I went with Jim into the Villages to discuss visiting sites and so on and I really admired his approach to the Village Elders. You would see him sitting on a piece of log offered, as sitting stool, and calmly conversing in Pidgin English with the Villagers. After everything is done Jim would give them packets of cigarettes or tinned food as rewards. Because of his doings, Jim was well known in the areas where he visited and worked…
>
> One very remarkable thing I would like to say about Jim too, is his good and long memory. To all the Elders, Jim made contact with them in their little remote villages, Jim never ever forgot their names and their faces. Sometimes he would enquire about a face he did not see and was told that the person had died.
>
> That is the same for the names of places or sites where some research activities had been conducted. The names and geographical setting never left Jim's brain. He would correctly describe a place he visited some three to four years ago as if he had just visited it yesterday. And that is Jim as I know him…

We would like to conclude with a few comments by Ralph Regenvanu, Director of the Vanuatu National Cultural Council and Vanuatu Cultural Centre. They are an extract of a speech read at Specht's retirement dinner at the Australian Museum on 11 November 2000:

> On behalf of all of us in Vanuatu, I would like to take this opportunity to express our most profound appreciation to you, Jim, for the work you have done over many years in support of the preservation and promotion of culture in Vanuatu… May I make the point here that the Australian Museum is the institution singularly responsible for over 90% of the items of our ancient cultural heritage that have been repatriated and now are part of our national collections. This is due significantly to Jim's vision of the meaning of cultural heritage and the role of our institutions in facilitating this meaning…
>
> Dr Specht, through your work at the Australian Museum and with the South Pacific Cultures Fund you have left a permanent cultural legacy not just in Vanuatu but throughout the Pacific and we, our peoples, thank you.
>
> We wish you well in your retirement and hope you will use this opportunity to visit us again—soon and frequently…

ACKNOWLEDGMENTS. Jim Specht's close colleagues, Robin Torrence and Glenn Summerhayes, and Pamela Swadling, for many years his counterpart at the Papua New Guinea National Museum, provided information, read drafts and saved us from some errors of fact and interpretation. We thank them for their help. We also thank Barry Craig, Betty Meehan, John Namuno, Paul Rainbird, Ralph Regenvanu, Jim Rhoads and Margaret Tuckson for tributes and comments they allowed us to include. Most of all, we thank Jim himself for his willingness to be interviewed and his patience in the face of the plethora of enquiries that ensued from each of us.

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Jim Specht: A Bibliography

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KHAN, KATE, 2004. Jim Specht: a bibliography. In *A Pacific Odyssey: Archaeology and Anthropology in the Western Pacific. Papers in Honour of Jim Specht*, ed. Val Attenbrow and Richard Fullagar, pp. 9–14. *Records of the Australian Museum, Supplement* 29. Sydney: Australian Museum.

Jim Specht follows a long and illustrious line of heads of Anthropology who put pen to paper since Anthropology, or Ethnography as it was initially known, first existed at the Australian Museum in 1872.

The first to publish on anthropological matters at the Museum was Robert Etheridge Jnr. In 1887 he was an Assistant in Palaeontology, eight years later a Curator, and in 1917, Director of the Museum. However, he always had an abiding and broad interest in ethnography, writing on such topics as "An Aboriginal knife", *Records of Australian Museum*, 1902, 4: 207–208 and "A remarkable rock shelter in the Milton district, N.S.W.", *Records of Australian Museum*, 1904, 5: 80–85. In 1900 W.W. Thorpe, labourer, watchman and gallery attendant, became assistant to Etheridge, and in 1906 a separate department of Ethnology was created with Thorpe, then 26 years old, as head. He received all his training from Etheridge (himself not an anthropologist or archaeologist) and stayed until 1932, eight years before Jim was born.

Thorpe wrote on everything from "The Palolo Worm", *Australian Museum Magazine*, 1923, 1(7): 220, "Bronze and ivory figures from Burmah", *Australian Museum Magazine*, 1924, 2(3): 99, to "Stencilled handmarks", *Australian Museum Magazine*, 1925, 2(7): 253–254.

With the appointment of Miss Elsie Bramell (later to become Mrs McCarthy) in 1933 and Fred McCarthy in 1935, the first anthropologically-trained staff had arrived, but the broad sweep of Anthropology and Archaeology still had to be catered for. McCarthy wrote prolifically on everything from "The geographical distribution theory and Australian material culture", *Mankind*, 1936, 2(1): 12–16, to "Sepik face masks" *Australian Museum Magazine*, 1949, 10(1): 1–8, to "Bali: emerald gem of the Indies", *Australian Museum Magazine*, 1954, 11(6): 189–193.

Following McCarthy's departure in 1963 to become founding Principal of the then Australian Institute of Aboriginal Studies in Canberra, Doug Miles came and went after a short stay (1963–1964). David Moore became Curator of Anthropology in 1965 and in 1967 Dr Peter White joined the department as Assistant Curator. Then,

> Following the resignation of White in 1970 to take up a lectureship in the University of Sydney, an Englishman, Dr James Specht, was appointed Assistant Curator of Anthropology. (*Rare and Curious Specimens*, ed. R. Strahan, Australian Museum, Sydney, 1979: 94).

Thus began the life and times of Jim Specht at the Australian Museum, 64 years after the Department of Ethnology was first established. His bibliography reflects the level of specialization now expected of the Head of Anthropology—no ranging from "The toilet vehicles of Ancient Egypt" (W.W. Thorpe, *Australian Museum Magazine*, 1922, 1(4): 119–120) to "A mirror from the Temple of a Thousand Ages, Peiping, China" (F.D. McCarthy, *Australian Museum Magazine*, 1934, 5(8): 255–256).

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Holocene Vegetation, Savanna Origins and Human Settlement of Guam

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ABSTRACT. Palaeoenvironmental investigations not only provide information about past climate, geomorphological changes, and vegetation, but also can give a unique and complementary perspective to archaeological studies relating to the history of human settlement. The IARII Laguas core on the west coast of Guam yielded 28 meters of sedimentary deposition dating back 9,300 years from the present. Pollen analysis indicates that forested conditions dominated the upland and coastal landscape of southern Guam during the early part of the Holocene. At 4,300 cal. B.P. the earliest charcoal particles appear, suggesting human colonization. By about 3,900 cal. B.P. *Lycopodium* and *Gleichenia* ferns first become noticeable in the core record, probably indicative of gardening and resource collecting activities by small human populations. At 2,900 cal. B.P. these and other disturbance indicators (e.g., grasses, charcoal particles) become continuously present in quantity, signalling the demise of the upland forests in southern Guam and development of the degraded savanna landscape seen today. By 2,300 cal. B.P. there are only remnant patches of native forest in evidence. The sedimentary record of the Laguas core and another nearby sampling location suggest increased hillslope erosion along the coastal margins after about 1,700 cal. B.P., which is accompanied by higher charcoal particle concentrations. Although the exact date of major coastal deposition remains unresolved by the Laguas evidence—it could have been much later than 1,700 cal. B.P.—other studies of erosion and coastal deposition on Guam suggest a time frame sometime between the early first millennium B.P. and late second millennium B.P.

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Three related issues common in Oceanic archaeology studies are examined in a palaeoenvironmental study conducted on Guam, the southern-most island of the Mariana archipelago (Fig. 1). The first is the date of the earliest human colonizers, the second concerns the nature and intensity of prehistoric human impact on the natural environment, and the third, actually one aspect of the second issue, concerns the origin of the interior savannas of southern Guam, whether human or natural.

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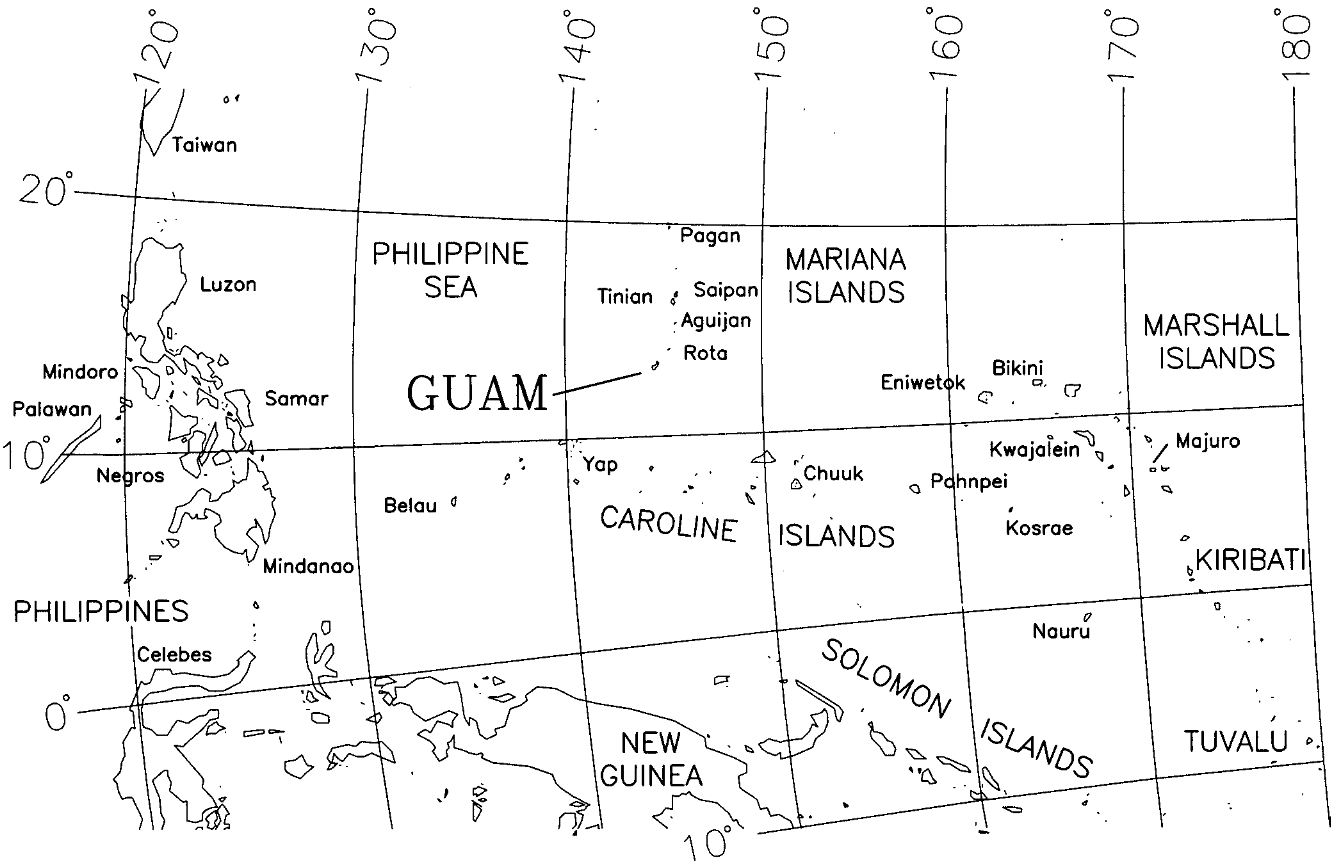


Fig. 1. Location of Guam and the Mariana Islands in western Micronesia.

These issues tend to be contentious in Pacific archaeology, with the amount of debate concerning particular islands more or less related to the amount of work conducted by different archaeologists. Witness the range of dates archaeologists have offered (and continue to offer) for the timing of initial human settlement in New Zealand and Hawai'i. The issue of human-induced changes versus climate induced changes of island landscapes, including the formation of savannas, also inspires heated debate (e.g., Nunn, 1997). Palaeoenvironmental methods potentially offer a highly sensitive approach that can provide relatively unambiguous results—or at least valuable insights—concerning all three issues.

With respect to the first issue, Kirch & Ellison (1994: 318) have noted:

> …carefully designed palaeoenvironmental research may be a more productive approach to dating the colonization of remote Pacific Islands than an elusive search for the "first colonization site," which becomes something of a Holy Grail.

Even in the best of circumstances, archaeologists can never be certain that they have found the earliest sites, or that the earliest traces of human settlement have not eroded away due to sea level changes or any number of other factors. Palaeoenvironmental studies can avoid this problem entirely, relying on wetland sedimentary cores that provide a continuous and highly sensitive record of environmental changes and perturbations of the island landscape. We feel that our work in Hawai'i, in particular, demonstrates this point (Athens, 1997; Athens & Ward, 1993*a*, 2000; Athens *et al*., 2002), though work by Flenley *et al*. (1991) on Rapa Nui is certainly illustrative (see especially Flenley, 1998, Butler & Flenley, 2000), and there are other examples as well (e.g., Newnham *et al*., 1998; McGlone & Wilmshurst, 1999 for New Zealand).

In terms of landscape change—particularly that concerning vegetation—palaeoenvironmental techniques are especially valuable for addressing this issue: (*a*) they provide a source of information independent of archaeology (i.e., the data are unbiased by human selection processes inherent in the formation of archaeological sites), and (*b*), as with the issue of earliest colonization, palaeoenvironmental studies on most Pacific islands provide an often continuous record of data from before and following the initial period of prehistoric human settlement.

While the palaeoenvironmental approach has been criticized by some investigators (e.g., Anderson, 1994; Spriggs & Anderson, 1993; Hunter-Anderson, 1998), the cited problems are really practitioner deficiencies rather than some inherent flaw in the methodology. Thus, interpretive errors arise as a result of an investigator's (*a*) failure to recognize sedimentary unconformities, (*b*) failure to obtain a sufficient number of radiocarbon dates, (*c*) use of inappropriate materials for radiocarbon dating, especially when working in ^{14}C-depleted water, (*d*) failure to understand possible source areas for pollen and charcoal influx, (*e*) failure to have an adequate reference base for pollen identifications, and (*f*) failure to achieve sufficiently high pollen counts. Our experience (e.g., Athens, 1997, Athens *et al*., 2002) like that of many others (e.g., Haberle, 1994; Flenley, 1994) has demonstrated that palaeoenvironmental data such as the appearance of microscopic charcoal particles and the rise of various floral indicators of disturbance in the pollen record are often highly sensitive markers of human presence. Disturbance indicators include pollen from a number of pioneering weedy plants that grow rapidly such as grasses, the Chenopodiaceae and Amaranthaceae (cheno-ams), *Pandanus*, and spores from ferns such as *Lycopodium cernuum* and *Gleichenia linearis*. With respect to the issue of initial human settlement, the propitious appearance of pollen from non-native plants and cultigens (i.e., plants introduced to the island by human colonizers) can provide the most unambiguous evidence, even before various archaeological manifestations become evident on the landscape (e.g., midden sites and artifacts). Pacific examples of plant introductions are provided in various palaeoenvironmental studies (Athens *et al*., 1996, 2002; Athens & Ward, 2002).

Nevertheless, we do not take issue with the cry of some investigators that the appearance of charcoal particles and disturbance indicators in a sediment column are not inherently indicative of human presence. Logically, they could also be associated with climatic drying. Our experience, however, supports Haberle's (1994) optimism that such ambiguities can be avoided by using what he calls an "integrated methodology" (i.e., refined identification of pollen types with palaeoecological techniques). We would add, furthermore, that it is also important (*a*) to analyse the palaeoenvironmental data in light of the particular interpretive problems inherent to the study location; (*b*) to be particularly cautious of sources of radiocarbon dating errors; (*c*) to be mindful of the importance of the assumption of a continuous sediment column (i.e., no unsuspected unconformities to invalidate chronologies); and (*d*) to undertake close-interval radiocarbon and pollen sampling in portions of the core record that are particularly important for interpretive purposes (see also Hope *et al*., 1999).

Aim

The aim of this paper is to present new data which will inform us about three archaeological problems relevant to human colonization and land use in the Mariana Islands.

1. Early human settlement in the Mariana Islands. It has been almost axiomatic among Micronesian archaeologists that human settlement first began about 3,500 years ago in the Mariana Islands. This date was assigned over four decades ago by Alexander Spoehr to the distinctive Pre-Latte pottery he documented (Spoehr, 1957: 168).

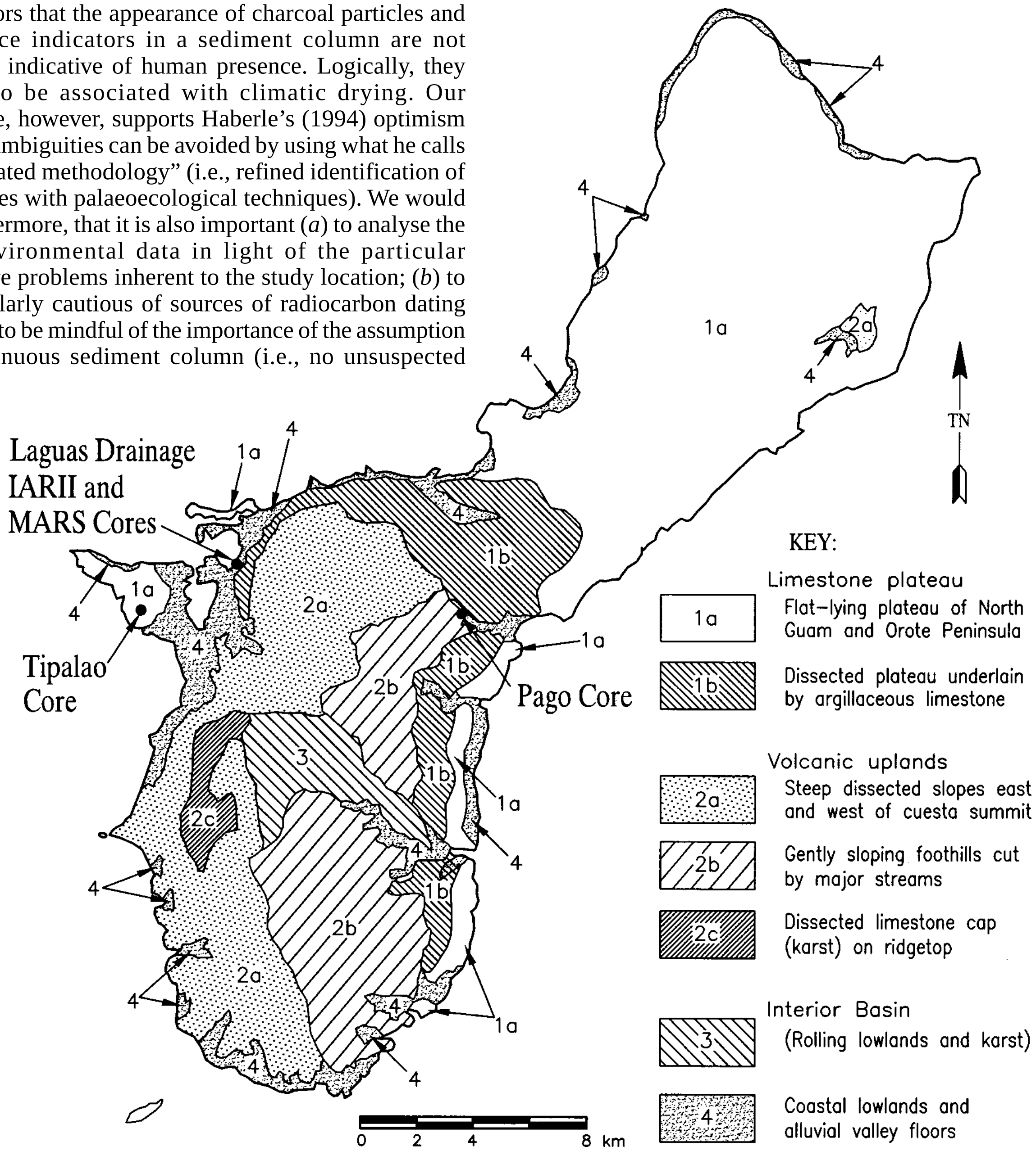


Fig. 2. Map of Guam showing major physiographic divisions (redrafted from Tracey *et al*., 1964: A63) and locations of IARII Laguas, MARS Laguas, Pago, and Tipalao cores.

Archaeologists working in the Mariana Islands have not seriously challenged or modified this date since it was originally proposed. In this paper we will suggest that there is now good reason to challenge Spoehr's date. Based on recently obtained palaeoenvironmental evidence, we believe that human colonization occurred about 4,300 years ago, 800 years earlier than Spoehr's date.

2. The formation of savannas on Guam. The general location of the current savanna areas on Guam as delimited by the symbols for volcanic uplands is shown on Fig. 2 (2a, 2b, and 2c—compare to general vegetation map in Key, 1968: 23). The idea that the Guam savannas are anthropogenic in origin has been vigorously opposed by several investigators (Zan & Hunter-Anderson, 1987; Hunter-Anderson & Moore, 2000: 100). New palaeoenvironmental data, however, make this position untenable, indicating that prior to the arrival of humans, the uplands in southern Guam would have been entirely forested with a diversity of tree taxa. It was only as a result of human activities, probably due to the repeated burning of forest patches (for reasons that remain uncertain) in the highly weathered and impoverished upland soils, that the forest failed to regenerate and was replaced by savannas/grasslands.

3. Landscape change: vegetation history of Guam. Several investigators have identified significant landscape change around 780 to 1,780 cal. B.P. (Dye & Cleghorn, 1990: 271) and about 1,270 cal. B.P. (Hunter-Anderson, 1989: 61–62), including soil erosion in the interior areas of southern Guam with accompanying alluvial coastal build-up. Interestingly, the transformation from the earlier Pre-Latte Period to the later Latte Period in the Mariana Islands also occurred within this time frame, suggesting a possible causal connection.

The Latte Period takes its name from the upright pillars of stone with capstones in parallel rows, called *latte*, that began to appear around 850 to 950 cal. B.P. in the Mariana Islands (Graves, 1986: 141). This period is also identified by a distinctive pottery complex and other associated changes (Butler, 1990: 35, 42).

As noted by Butler (1990: 42), a substantial increase in population from Pre-Latte times is apparent from the fact that Latte Period sites are far more common than Pre-Latte sites. Latte sites are commonly found in interior areas while Pre-Latte sites are only rarely found in these areas, and those that have been found date to the late part of the Pre-Latte period (e.g., Moore & Hunter-Anderson, 1994: 37). Thus, an increase in the intensity of landscape use on Guam seems

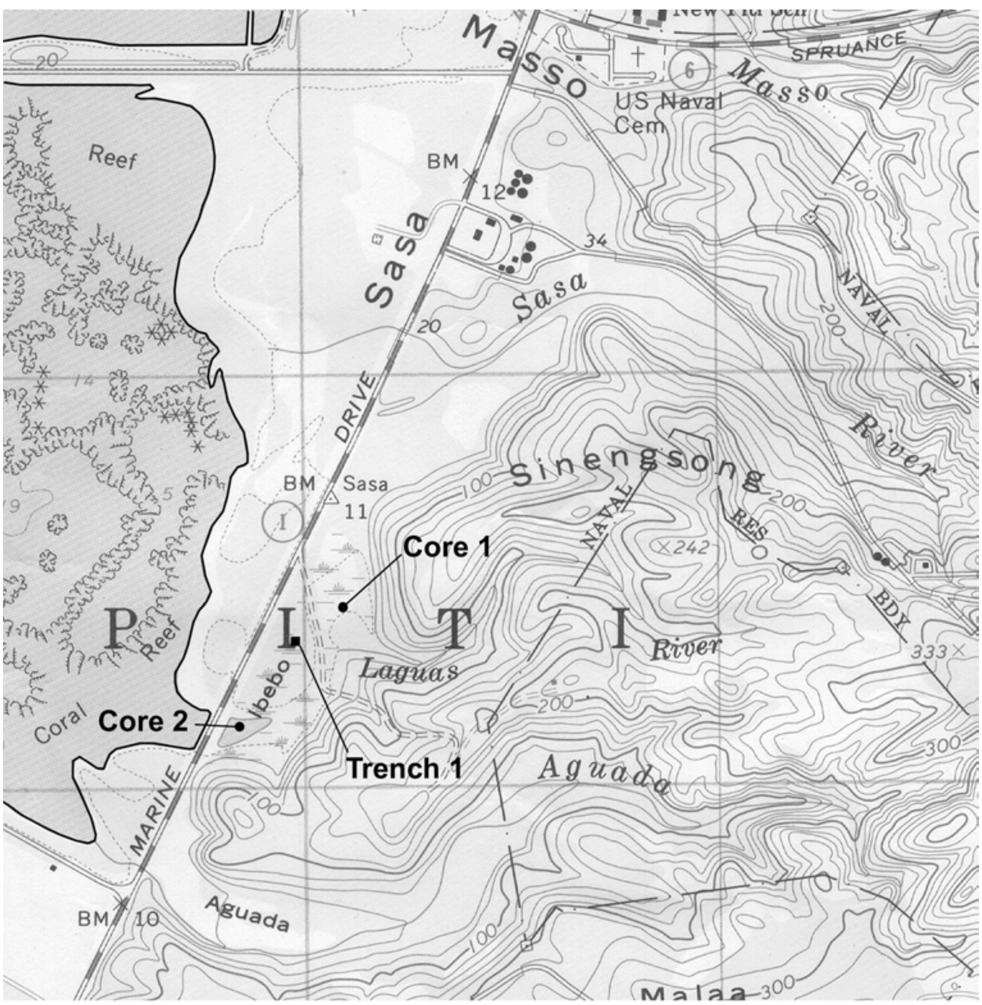


Fig. 3. Portion of USGS Topographic map showing location of the Laguas drainage basin and stream channel with Cores 1 and 2, and Trench 1 (map slightly modified from original). Note that Core 2 location is entirely a marsh and not open water as shown on map.

to have occurred starting just prior to the onset of the Latte Period. That this would have had some effect on slope erosion and coastal sedimentation does not seem surprising. It would nevertheless be of interest to further document the expected sedimentary changes with palaeoenvironmental coring studies, besides also addressing the question as to whether distinctive changes in the island's flora appeared concurrently. Further, little is known about prehistoric agriculture and possible plant introductions, which are also subjects potentially amenable to coring investigations.

To address these research aims, we present an analysis of the 28 m deep IARII Laguas core. It is the most detailed and complete palaeoenvironmental record from Guam in the Mariana Islands. The core was recovered in 1998 by the International Archaeological Research Institute, Inc., of Honolulu (the lead organization for the study) using standard palaeoenvironmental coring techniques as described in Athens & Ward (1999). This site is a wetland coastal location near the mouth of a small drainage basin that descends from the dissected and weathered volcanic uplands of southern Guam on the west side of the island (Figs. 2 and 3). It is roughly 125 m inland from the Apra Harbor shoreline.

Palaeoenvironmental data derived from four other cores have been previously reported for the Mariana Islands: the MARS Laguas core which was recovered by Micronesian Archaeological Research Services of Guam (Ward, 1995); the Pago core deep within an eastern valley in southern Guam (Ward, 1994); and a core from Tipalao Marsh at the Orote Peninsula on the west side of Guam (see Fig. 2; Athens & Ward, 1993*b*, 1995). Additionally, a core record was analysed from Lake Hagoi on Tinian (Athens & Ward, 1998). All of these records provide data for much of the Holocene; relevant information for the present discussion is summarized in Table 1.

While these previous records are instructive and provide useful and complementary information for the present study, they all suffer to some extent from either limited analysis and dating (MARS Laguas and Pago cores), or generally poor pollen preservation in the earlier intervals of interest regarding initial human settlement (Orote and Lake Hagoi). Another concern with the MARS Laguas and Pago records is that they were recovered by means of mechanized drilling equipment for engineering studies and it was uncertain whether such a recovery procedure could have compromised the palaeoenvironmental data. Furthermore, the sedimentary records of both of these cores were incompletely described. Finally, the Tipalao core, by virtue of its relatively isolated position on the Orote Peninsula with its correspondingly small catchment area, conceivably would not be representative of landscape changes on the main land mass of southern Guam.

IARII Laguas record

The stratigraphy of the IARII Laguas record is shown in Fig. 4. Twelve sedimentary layers were identified, and these fall into seven major depositional units (or DU) (Athens & Ward, 1999). Describing the latter from bottom to top, DU-7 consists primarily of terrestrial colluvium; the calcareous material that is present may derive from argillaceous limestone in the uplands. DU-6 is a black humic loam with abundant wood. It likely formed from a wetland that perhaps existed on a bench or terrace above the then lowered ocean. DU-5 is a transitional unit that contains a mixture of both terrestrial sediments from DU-6 and coarse marine sediments from DU-4. DU-4 consists of a light grey silty loam with abundant coral fragments and marine bioclastics. Deposition must have occurred in a relatively exposed or high energy (and presumably shallow water) environment. DU-3 is a greenish grey to grey clay loam with very fine calcareous sand and a very small amount of dispersed fragmentary shell. It was deposited in relatively shallow but protected marine waters (perhaps protected by a barrier reef). DU-2 consists of grey, dark grey, and black loam with fine calcareous sand. It has some fine fibrous macrobotanical remains and some finely fragmented shell. Humic content appears fairly high in this unit, though deposition was definitely in a protected, quiescent, and perhaps estuarine environment. Much of the sediment load of this depositional unit was probably derived directly from the Laguas River discharge. DU-1, a silty loam, is entirely of terrestrial origin, having no marine materials.

Table 1. Summary information for previous palaeoenvironmental cores on Guam and Tinian.

characteristics	**Tipalao**[a]	**Pago**[b]	**MARS Laguas**[c]	**Lake Hagoi (Tinian)**[d]
depth, m	4.98	33.8	41.8	6.58
age, base of core, cal. B.P.[e]	7,924	10,453	>9,100[f]	>7,632[g]
no. ^{14}C dates	5	4	6	10
no. pollen samples	26	17	14	46
earliest charcoal particles, cal. B.P.	3,561	4,857	3,602	3,444
earliest *Cocos*, cal. B.P.	4,600	4,328	>9,100[f]	3,444
earliest *Areca* (betel), cal. B.P.	5,638	4,857	9,080	—
earliest significant grass, cal. B.P.	1,399	3,222	2,225	3,289
earliest significant *Gleichenia*, cal. B.P.	—	3,222	2,761	—
earliest significant *Lycopodium*, cal. B.P.	—	4,857	2,761	—
earliest significant decline of *Pandanus*, cal. B.P.	2,145	4,328	1,957	not determinable
earliest significant decline in forest types, cal. B.P.	2,450	4,857–4,328	2,225	not determinable

[a] Athens & Ward, 1993*b*
[b] Ward, 1994
[c] Ward, 1995
[d] Athens & Ward, 1998
[e] Dates are based on age/depth interpolations derived from calibrated radiocarbon determinations.
[f] Dates extrapolated below the lowest radiocarbon determination at 27.4 m cannot be regarded as reliable without further radiocarbon determinations; dates below this depth, therefore, are designated as >9,100 cal. B.P.
[g] Dates extrapolated below the lowest radiocarbon determination at 4.65 m cannot be regarded as reliable without further radiocarbon determinations; dates below this depth, therefore, are designated as >7,632 cal. B.P.

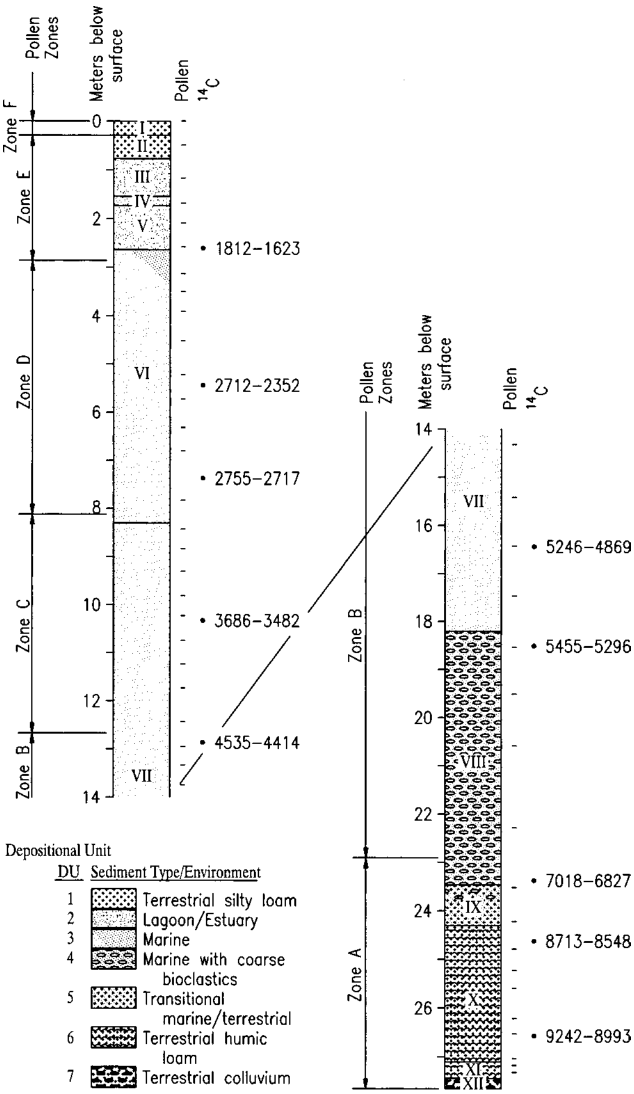


Fig. 4. Profile of IARII Laguas core. Note depositional units, calibrated radiocarbon determinations (1σ range), pollen samples, and pollen zones.

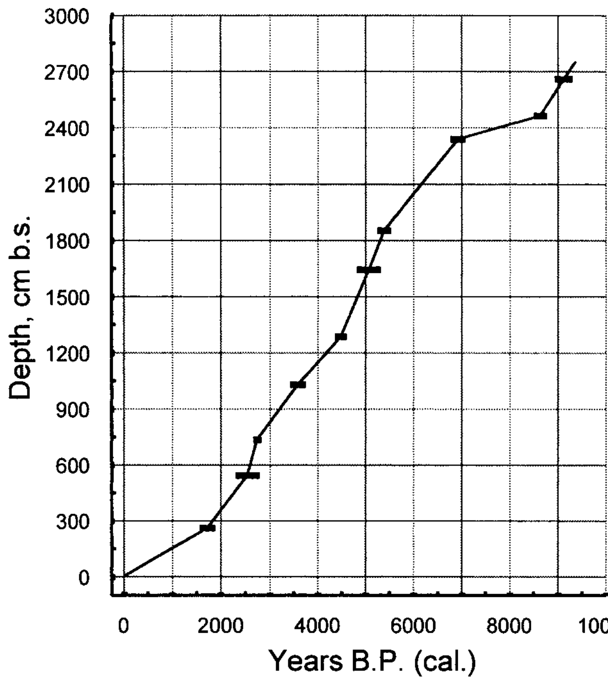


Fig. 5. Depth-age distribution of calibrated radiocarbon determinations (1σ range), IARII Laguas core.

The chronology of the IARII Laguas record is defined by 10 radiocarbon determinations (Table 2). As indicated by the depth-age graph (Fig. 5), all determinations are in proper chrono-stratigraphic order, suggesting continuous deposition for about 9,300 years, virtually the entire Holocene.

It appears that DU-1 (to the base of layer II) corresponds to the very late prehistoric and historical periods in Guam (i.e., the last 505 years), and that the base of DU-2 may represent the onset of estuarine deposition following marine regression after the mid-Holocene highstand (Dickinson, 2000). The date for the onset of DU-3 at 5,328 cal. B.P. could represent the onset of the Holocene highstand or transgression, creating slightly deeper inshore waters and promoting the growth of an offshore barrier reef. The base of DU-4, dating to 7,018 cal. B.P., represents the post-glacial

Table 2. Radiocarbon determinations, Laguas Core 2.

catalogue number	lab. number	provenance, depth below surface (cm)	submitted weight (g) and material	$^{13}C/^{12}C$ ‰	conventional age B.P.	calibrated age B.P.[b]
Lag-2,260–261	Wk-6995[a]	Layer V, 260–261	4.98 sediment	-26.0±0.2	1,804±59	1,812–1,623
Lag-2,541–543	Wk-6996[a]	Layer VI, 541–543	10.49 sediment	-24.1±0.2	2,441±63	2,712–2,352
Lag-2,734–736	Wk-6997[a]	Layer VI, 734–736	15.58 sediment	-23.2±0.2	2,583±56	2,755–2,717
Lag-2,1030–1032	Wk-6998[a]	Layer VII, 1030–1032	15.27 sediment	-24.5±0.2	3,372±56	3,686–3,482
Lag-2,1284–1286	Wk-6999[a]	Layer VII, 1284–1286	14.71 sediment	-23.3±0.2	4,020±56	4,535–4,414
Lag-2,1644–1646	Wk-7000[a]	Layer VII, 1644–1646	16.17 sediment	-22.5±0.2	4,424±73	5,246–4,869
Lag-2,1850–1852	Wk-7001[a]	Layer VIII, 1850–1852	11.76 sediment	-21.9±0.2	4,639±68	5,455–5,296
Lag-2,2337–2339	Wk-7002[a]	Layer VIII, 2337–2339	coral[d]	-0.7±0.2	6,574±73	7,018–6,827[c]
Lag-2,2463–2464	Wk-7003[a]	Layer X, 2463–2464	2.37 wood (probably bark)	-28.6±0.2	7,878±58	8,713–8,548
Lag-2,2655–2662	Wk-7004	Layer X, 2655–2662	15.81 wood (unidentified)	-28.6±0.2	8,190±60	9,242–8,993

[a] AMS procedure used to date sample; AMS determinations made by Nuclear Sciences Group, Institute of Geological and Nuclear Sciences, Ltd., Lower Hutt, New Zealand (sample preparation by Waikato Radiocarbon Dating Laboratory).
[b] Calibration from Calib 3.0.3 computer program of Stuiver & Reimer (1993); all dates have a 1σ age range. Data set 1 was used: bidecadal tree-ring data set to 9,440 cal. B.C. (c. 10,000 ^{14}C B.P.).
[c] Calib marine model used for calibration; ΔR of 115±50 from Athens (1986: 113) and Swift *et al*. (1991: 85).
[d] *Pavona* cf. *cactus* or *decussata*.

Table 3. Pollen Samples, IARII Laguas core.

catalogue no.	depth (cm)	layer	interpolated date cal. B.P.[a]	sediment acumulation (cm/yr)[b]
Lag-2,surf	surface	I	—	—
Lag-2,50–52	50–52	II	334	0.1513
Lag-2,117–119	117–119	III	776	0.1513
Lag-2,167–169	167–169	IV	1,107	0.1513
Lag-2,210–212	210–212	V	1,391	0.1513
Lag-2,258–260	258–260	V	1,708	0.1513
Lag-2,312–314	312–314	VI	1,870	0.3458
Lag-2,350–352	350–352	VI	1,980	0.3458
Lag-2,390–392	390–392	VI	2,095	0.3458
Lag-2,451–453	451–453	VI	2,272	0.3458
Lag-2,521–523	521–523	VI	2,474	0.3458
Lag-2,571–573	571–573	VI	2,564	0.9462
Lag-2,631–633	631–633	VI	2,627	0.9462
Lag-2,680–682	680–682	VI	2,679	0.9460
Lag-2,781–783	781–783	VI	2,871	0.3491
Lag-2,840–843	840–843	VII	3,041	0.3491
Lag-2,881–883	881–883	VII	3,157	0.3490
Lag-2,936–938	936–938	VII	3,315	0.3490
Lag-2,981–983	981–983	VII	3,444	0.3490
Lag-2,1021–1023	1021–1023	VII	3,558	0.3491
Lag-2,1071–1073	1071–1073	VII	3,728	0.2851
Lag-2,1121–1123	1121–1123	VII	3,903	0.2851
Lag-2,1171–1173	1171–1173	VII	4,079	0.2851
Lag-2,1241–1243	1241–1243	VII	4,324	0.2851
Lag-2,1291–1293	1291–1293	VII	4,486	0.6174
Lag-2,1331–1333	1331–1333	VII	4,551	0.6174
Lag-2,1371–1373	1371–1373	VII	4,616	0.6176
Lag-2,1431–1433	1431–1433	VII	4,713	0.6174
Lag-2,1541–1543	1541–1543	VII	4,891	0.6174
Lag-2,1641–1643	1641–1643	VII	5,053	0.6176
Lag-2,1747–1749	1747–1749	VII	5,217	0.6477
Lag-2,1852–1855	1852–1855	VIII	5,384	0.3148
Lag-2,1950–1954	1950–1954	VIII	5,697	0.3148
Lag-2,2057–2060	2057–2060	VIII	6,035	0.3148
Lag-2,2227–2229	2227–2229	VIII	6,574	0.3148
Lag-2,2352–2355	2352–2355	IX	7,134	0.0735
Lag-2,2422–2425	2422–2425	IX	8,087	0.0735
Lag-2,2479–2481	2479–2481	X	8,672	0.4005
Lag-2,2522–2525	2522–2525	X	8,781	0.4005
Lag-2,2560–2562	2560–2562	X	8,875	0.4005
Lag-2,2622–2624	2622–2624	X	9,029	0.4005
Lag-2,2654–2656	2654–2656	X	9,109	0.4005
Lag-2,2704–2706	2704–2706	X	9,234	0.4003
Lag-2,2718–2720	2718–2720	XI	9,269	0.4003
Lag-2,2732–2734	2732–2734	XI	9,304	0.4005

[a] Note that dates obtained for selected intervals by mean of linear interpolation have an undefined error range roughly similar to the radiocarbon determinations on which they are based.
[b] Sediment accumulation rate determined using computer program of Maher (1992).

marine transgression at a depth of 23.45 m below the surface. By this time sea level had already risen roughly three-quarters of the way to its modern level and the rate of rise had begun to slow (Fairbanks, 1989). DU-5 and 6 are unusual because they indicate the formation of a terrestrial wetland early in the Holocene, presumably on some sort of bench, terrace, or small basin on the seaward slope of Guam during the immediately post-glacial lowstand. It is possible that this wetland formed as a result of the deposition of coarse colluvial sediments during DU-7. Such sediments were carried down the Laguas drainage early in the Holocene presumably as a result of greatly increased rainfall that commenced in the immediately post-glacial period. These sediments apparently formed a barrier on an existing terrace or bench, which then trapped sediments and moisture that enabled the formation of a wetland.

A total of 45 pollen samples were analysed with all sample intervals yielding good results. Details of the pollen processing methodology are provided in Athens & Ward (1999). An age was assigned to each sampled interval based on linear interpolation using the depth-age model; a listing of the samples and their respective ages, layer derivations, and sediment accumulation rates are provided in Table 3. Palynomorph counts are compiled in Athens & Ward (1999); Fig. 6 provides a graphical presentation of the pollen data.

Pollen zones. The IARII Laguas core was divided into six pollen assemblage zones based on shifts in the frequencies of pollen and spore types, and in charcoal particle concentrations. The location of these zones with respect to the sedimentary units is illustrated in Fig. 4. The pollen zones may be summarized as follows.

Zone A: 9,304–6,854 cal. B.P. Zone A includes a number of well-known pollen types, and also an abundance of unknowns. The basal portion of the profile is represented by *Aglaia*, Arecaceae indet. (indeterminate palm pollen), and Araliaceae types. Curves for *Colubrina*, *Cycas*, and *Freycinetia* show slightly higher abundances than the former group while *Pandanus* and Myrtaceae display the strongest signals among the Trees and Shrubs. The Swamp/Mangrove group is dominated by *Bruguiera*, *Rhizophora apiculata*, and *R. mucronata* pollen, which are indicative of the minor influence of mangrove conditions. The unknown pollen types include the monosulcate, granulate and reticulate types with conspicuous occurrence of the following tricolporate types: microreticulate (small and with ear-like ora), reticulate and psilate.

The Pteridophyte presence is relatively weak with monolete, psilate type dominant at c. 25 percent of total followed by *Polypodium pellucidum*-type, *Adiantum*, psilate type and *Angiopteris*. *Lycopodium phlegmaria* spores are present, and these are joined by a stronger contribution from *Pteris* in the upper part of Zone A.

Zone A records the early Holocene at Laguas with dominance by a diverse pristine forest. The large number of unknown pollen types in this zone can be reasonably assumed to pertain primarily to forest taxa in the absence of disturbance indicators. Grassland and savanna pollen types are virtually absent in Zone A.

Zone B: 6,854–4,405 cal. B.P. In Zone B there is a decline in *Aglaia*, Arecaceae indet., and Araliaceae comp. *Colubrina* pollen also drops off significantly from the Zone A abundance. Both *Cycas* and *Freycinetia* persist at levels established in Zone A. *Guettardia* and *Ixora* display low levels of abundance in this and the following zone. *Cocos* appears at the base of Zone B intermittently and always in low numbers. *Metroxylon* displays a minor abundance in Zone A, increasing gradually to a position of co-dominance with *Pandanus* by mid-Zone B. *Pandanus* shows an early decline in this zone but begins to increase especially after

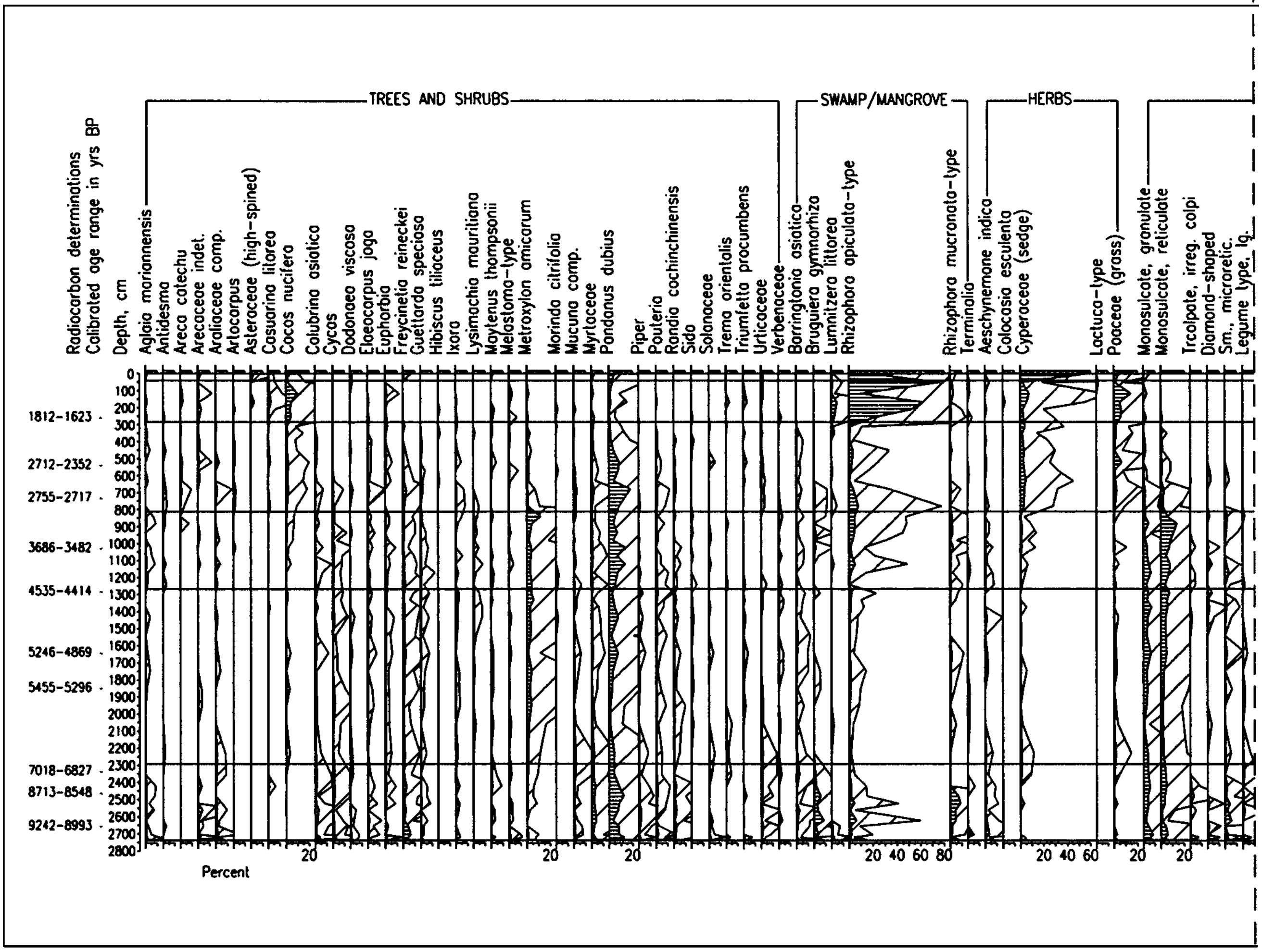


Fig. 6 [above and facing page]. Pollen diagram from IARII Laguas core plotted in silhouette style (tenfold exaggeration indicated by diagonal hatching). Palynomorph and charcoal concentration as well as pollen sum graphs are plotted in histogram style. Two pollen sums were used in calculating percentages: One sum was based on total pollen (Trees and Shrubs, Swamp/Mangrove, Herbs, Unknowns) and Pteridophytes, excluding monolete, psilate spores and the aquatic spore, *Pseudoschizaea*. For the monolete, psilate and *Pseudoschizaea* curves the sum was based on total pollen and spores.

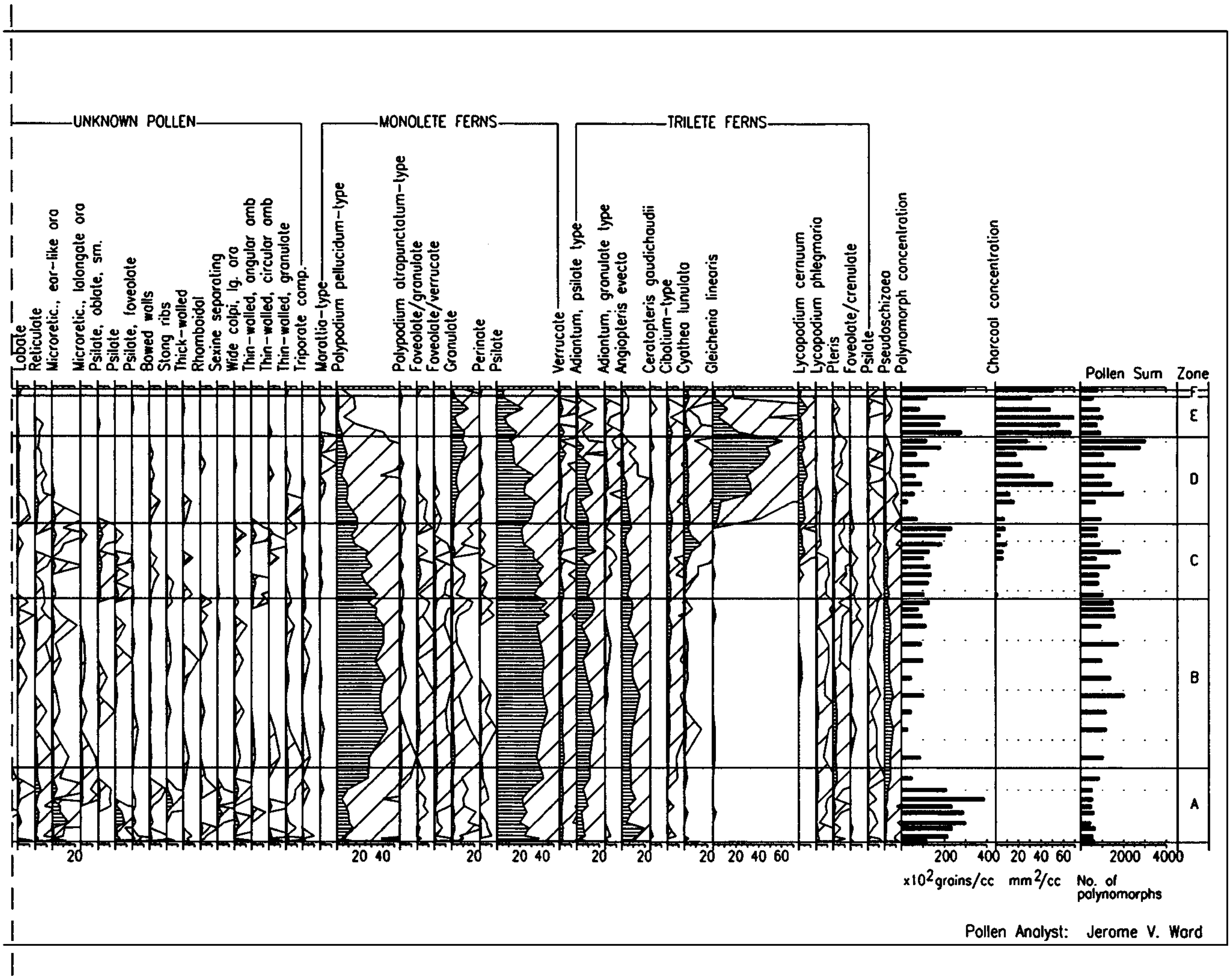
the 1852–1855 cm interval. Pollen of *Piper, Pouteria,* and *Randia* have fallen to half their values in the basal zone. *Barringtonia, Bruguiera*, and *Rhizophora* pollen begin at low amounts at the base of Zone B and regain less than half values seen in Zone A. Among the unknown pollen types, the monosulcates (granulate and reticulate) hold to levels established in Zone A. Most of the other unknown types have declined perhaps by half the levels seen in Zone A.

Among Pteridophytes, *Polypodium pellucidum* is the strongest contributor in the diagram at c. 35 percent of the total, while the monolete, psilate type is at 30 percent of the total spectrum. The foveolate/granulate and foveolate/verrucate spore types increase in this zone. *Adiantum*, psilate type, and *Angiopteris evecta* increase slightly from Zone A. The *Cibotium*-type begins to show some prominence in this zone although the values are still low. *Lycopodium phlegmaria* and *Pteris* are slightly more abundant in this zone but are still of minor importance.

Pseudoschizaea spores peak in this zone, essentially doubling in importance from the previous zone. This suggests a greater influx of freshwater into the catchment and possibly the accumulation of this water in a protected lagoon.

No grassland or savanna indicators are present in Zone B.

***Zone C: 4,405–2,956 cal.* B.P.** In Zone C there is a slight increase in *Aglaia*. About midway through the zone in the 981–983 cm interval, *Cocos* begins a gradual rise in importance, which continues into the next zone. This probably marks the rising importance in agroforestry by recently arrived human colonizers (as suggested by the advent of fires—see below). *Cycas* pollen continues at levels displayed in Zone B, but starts to decline near the top. *Areca catechu* pollen appears late in Zone C, and continues to manifest itself in low numbers in most intervals thereafter. With *Cocos*, it is probably also a part of what may be a developing agroforest. Pollen of *Freycinetia, Guettardia*, and *Ixora* hold to abundance levels seen in Zone B, but decline in Zone C. Similarly, *Metroxylon* displays a frequency seen in Zone B, then peaks at the top of Zone C before almost disappearing from the profile. Both Myrtaceae and *Pandanus* show slight increases in importance from the previous zone. Other forest elements are in decline here, including *Piper, Pouteria*, and *Randia*. Also, Urticaceae continues to decline in comparison to Zone A where it was more common. Among the Swamp/Mangrove types, *Barringtonia* follows a declining trend similar to the previous pollen types. At the same time *Bruguiera*, and both



species of *Rhizophora* gradually increase toward the top of this zone. Sedge and grass pollen begin to show slight increases from their very minor presence in Zone B. Both the unknown monosulcate pollen types (granulate and reticulate) remain steady throughout this zone. Other unknowns show increases, especially the microreticulates (small and ear-like ora types), reticulate, psilate/oblate, psilate, and the thin-walled angular amb type.

Polypodium pellucidum-type spores decline throughout this zone from about 35 percent to around 20 percent, a trend mirrored by the monolete, psilate type. Other monolete types hold to previous levels while the granulate type increases in the upper part, and the perinate type almost disappears after the top of this zone. Trilete type fern spores persist and maintain previous levels, including *Adiantum*, psilate type and *Cibotium*-type, while spores of *Angiopteris evecta* register at lower levels than in Zone B. In the 981–983 cm sample *Cyathea lunulata* spores increase and peak in the upper part of the zone. This pattern is duplicated in the *Lycopodium cernuum* curve. Of interest is that the *Lycopodium phlegmaria* curve drops from importance at the same interval that *L. cernuum* begins to rise, suggesting an ecological shift to a more open habitat at this time.

Charcoal particles first appear at the base of Zone C in minor amounts. In the first four samples of the zone the charcoal concentration values average 0.9 mm^2/cc, while in the upper half the values average 6.8 mm^2/cc. The entire zone averages 4.2 mm^2/cc. These values suggest low levels of fire but with an increase in the upper part of the zone. The consequent rise in *Cocos* pollen and *L. cernuum* spores points to both a more open and a fire-managed landscape during this zone.

Zone D: 2,956–1,789 cal. B.P. In Zone D, *Cocos* and *Pandanus* are the dominant contributors to the dryland pollen sum. These are joined by minor signals from *Aglaia, Areca*, and *Colubrina*. Several types appear to decline by mid-zone, including *Freycinetia* and Myrtaceae, while *Pandanus* declines throughout the zone. The Swamp/Mangrove pollen types are less conspicuous here than in Zone C. Of importance are the signals from sedge and grass, which begin their rise in importance in the plant community. Marsh conditions in the Laguas drainage were beginning to expand, and more of the forest was converted to open areas with grass cover. The unknown monosulcate (granulate and reticulate) types decline especially after the 571–573 cm interval. Most of the unknown pollen types disappear from the profile after this interval or are in steep decline. The exceptions are triporate pollen types, which increase in abundance slightly towards the top of this zone.

Polypodium pellucidum-type and psilate monolete spores steadily decline throughout this zone inversely to the monolete, granulate group. *Angiopteris evecta* and *Adiantum*, psilate both decline in this zone while *Adiantum*, granulate peaks in this zone. Similarly, *Gleichenia* surges to the highest level of any spore type in the profile, here exceeding 50 percent of the total sum. *Lycopodium cernuum*, *Pteris*, and trilete, psilate spores display modest gains in this zone. *Pseudoschizaea* levels decline through this zone.

Charcoal particle concentrations average 26 mm^2/cc in Zone D, which represents a sixfold increase in abundance from Zone C. They are especially abundant after the 571–573 cm interval, after which they average 33 mm^2/cc. These data suggest continued and increased fire use in the Laguas watershed area.

Zone E: 1,789–est. 200 cal. B.P. In Zone E *Casuarina*, *Cocos*, and *Euphorbia* are present but only in minor quantities. *Pandanus* registers about half of the level seen in the previous zone. Mangrove types including *Lumnitzera*, *Rhizophora apiculata*, and *R. mucronata* are dominant in this zone, comprising almost 70–80 percent of the total pollen spectrum. They clearly indicate the presence of a mangrove plant community at the Laguas coring site. Sedge pollen rises in importance while grass pollen peaks in this zone. Almost all of the unknown pollen types have disappeared from the profile in Zone E, and those that remain are represented by single grain occurrences. In general, the types and abundances of all pollen except mangrove, sedge and grass have fallen steeply, especially in comparison to Zone C

Among the Pteridophytes, the monolete (granulate and psilate) spore types are most prevalent. Trilete fern spores are markedly reduced from Zone D with only *Cyathea*, *Cibotium*-type, and *Gleichenia* present. *Gleichenia* spores decline abruptly throughout this zone.

The charcoal particle concentration values suggest further increases of burning frequency. The mean value for this zone is 54.5 mm^2/cc which is twice that estimated for Zone D. Clearly, there was continued and possibly intensified burning activity during the period represented by Zone E.

Zone F: Modern. Zone F comprises a single surface pinch sample (with multiple pinches) recovered from the immediate vicinity of the core. This sample therefore records modern conditions at the Laguas site. The main contributors to the arboreal dryland pollen spectrum include *Artocarpus*, *Casuarina*, *Cocos*, and *Pandanus*. Among the Swamp/ Mangrove types, *Rhizophora apiculata* is dominant. In the Herb group, sedge pollen reaches almost 60 percent and dominates the pollen spectrum, attesting to continued marsh habitat at the coring site.

Most of the pteridophyte spore types have disappeared from the profile in Zone F. Minor signals are seen from monolete (granulate and psilate), *Cyathea* and *Gleichenia* spores.

The estimated charcoal particle concentration from this zone is 51.5 mm^2/cc, which compares favourably to the mean of Zone E. Thus, the modern pattern of fire use in the Laguas watershed apparently was similar to that of Zone E based on this evidence alone.

Discussion

Early human settlement. Analysis of the IARII Laguas core shows that microscopic charcoal particles are entirely absent between 9,300 and 4,300 cal. B.P., and at 4,300 cal. B.P. they first appear in low concentrations. Because charcoal particles are entirely absent from this and other palaeo-environmental records for the preceding 5,000 years in Guam, we believe their appearance is likely the result of anthropogenic activities.

Interestingly, other disturbance indicators—pollen and spores—are not in evidence at this earliest time, and only

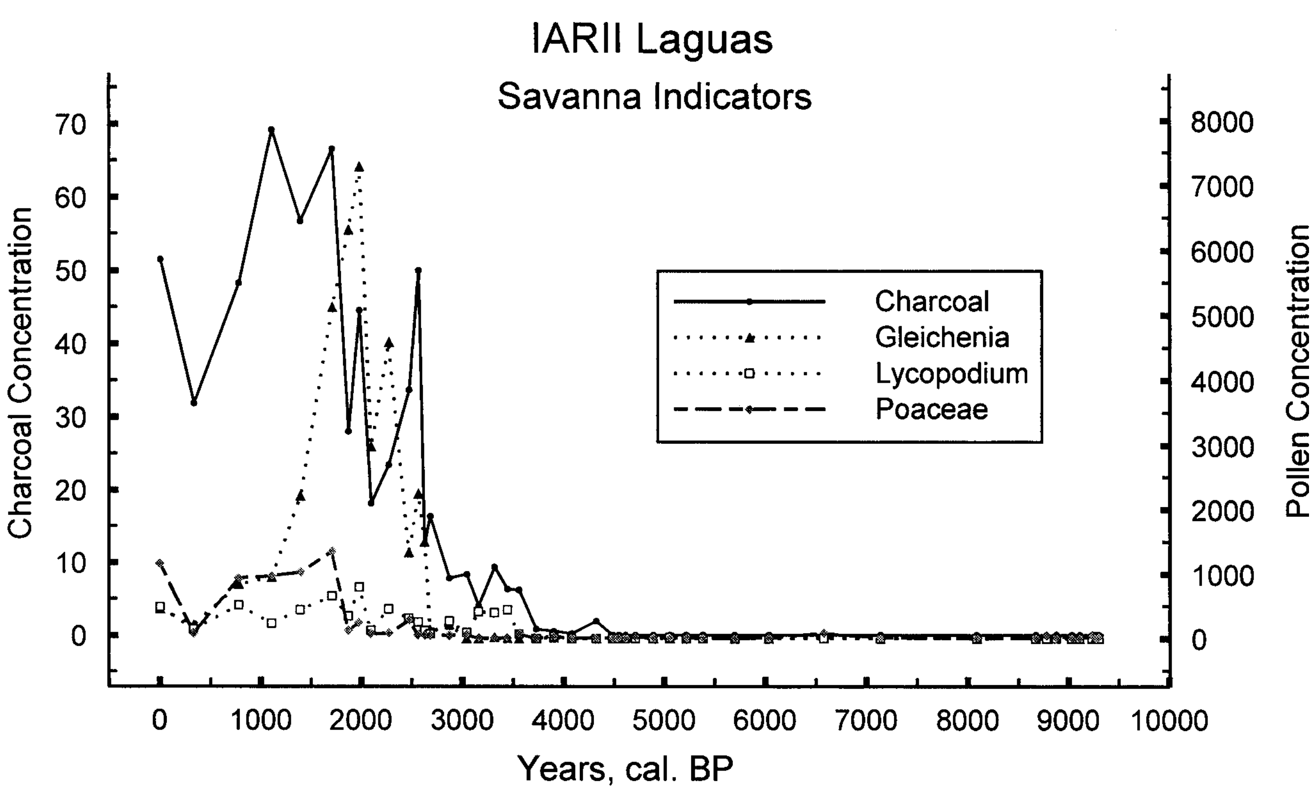


Fig. 7. Graph of charcoal particle concentrations and pollen concentrations of main savanna indicators for IARII Laguas core.

first become noticeable, albeit in low densities, in the core record about 3,900 cal. B.P. We believe this speaks of the sensitivity of charcoal particles for detecting human settlement, which is likely due to their wider dispersion as a result of atmospheric transport (Clark, 1988; Morrison, 1994). The absence of detectable signs of disturbance indicated by pollen and spores before 3,900 cal. B.P. may have to do with the small scale of human settlement and gardens located on the coastal fringes. These activities would not have produced a pollen signal indicative of disturbance in the more interior locations, where much of the pollen in the core presumably originated.

It might be argued that charcoal particles were derived from natural burning during drier conditions. However, any climatic change towards more arid conditions should show a broader scale impact, such as an increase in firing in the interior. No such increase is visible, nor is any evidence of increased long-term drought seen elsewhere in the global palaeoclimatic record. We therefore believe that the earliest appearance of charcoal particles results from human activities.

In view of the palaeoenvironmental evidence for a 4,300 cal. B.P. date for the initial settlement of Guam, it is very interesting to reconsider an often dismissed or ignored archaeological radiocarbon determination obtained by Joyce Bath in the 1980s for the San Vitores Road project. The charcoal date has a calibrated range of 4,419–4,150 cal. B.P. (1σ), which was derived from "…a dense firepit deposit, and thus of cultural origin" (Bath, 1986: 41). This date seems to be telling us exactly what the palaeoenvironmental evidence is telling us: people arrived on Guam well prior to the 3,500 year old time frame indicated by Spoehr and other archaeologists. The only other pre-3,500 cal. B.P. date for the Mariana Islands that appears reasonably secure is a determination of 3,866–3,576 cal. B.P. (1σ) from the Achugao site on Saipan (Butler, 1994). Unfortunately, the woods of both the Achugao and the San Vitores samples were not identified, which would have allowed only the short-lived plant parts or taxa to have been selected for dating. Thus, because of the potential problem for "in-built" ages in these dating results (Anderson, 1991: 779–782, McFadgen, 1982: 384), it cannot be known with certainty if the archaeological materials are actually as old as the samples seem to indicate.

Origin of interior savannas. With respect to the development of a savanna landscape in the interior upland areas of southern Guam, the data are about as unambiguous as it is possible for palaeoenvironmental data to be. As may be seen from the graph of the savanna (or disturbance) indicators (charcoal, *Gleichenia linearis* and *Lycopodium cernuum* ferns, grasses—see Fig. 7), there were none whatsoever prior to 4,300 cal. B.P., the date when the first evidence for burning began to appear. It is very unlikely that a major environmental zone of savanna or grasslands was present above the Laguas watershed and did not leave evidence in the palaeoenvironmental record. At 3,900 cal. B.P. two ferns suggestive of savanna formation and landscape disturbance began to appear, *Lycopodium* and *Gleichenia*. As already mentioned, their appearance probably denotes small-scale gardening activities within the Laguas watershed, and perhaps even the formation of small patches of savannas or grasslands. Limited environmental disturbance persisted until about 2,900 cal. B.P., when *Lycopodium*, *Gleichenia*, and other disturbance indicators became a conspicuous part of the palaeoenvironmental record. At this time the extent of the savanna/grasslands clearly underwent a substantial increase. Concurrently, pollen types representing different species of Guam's native

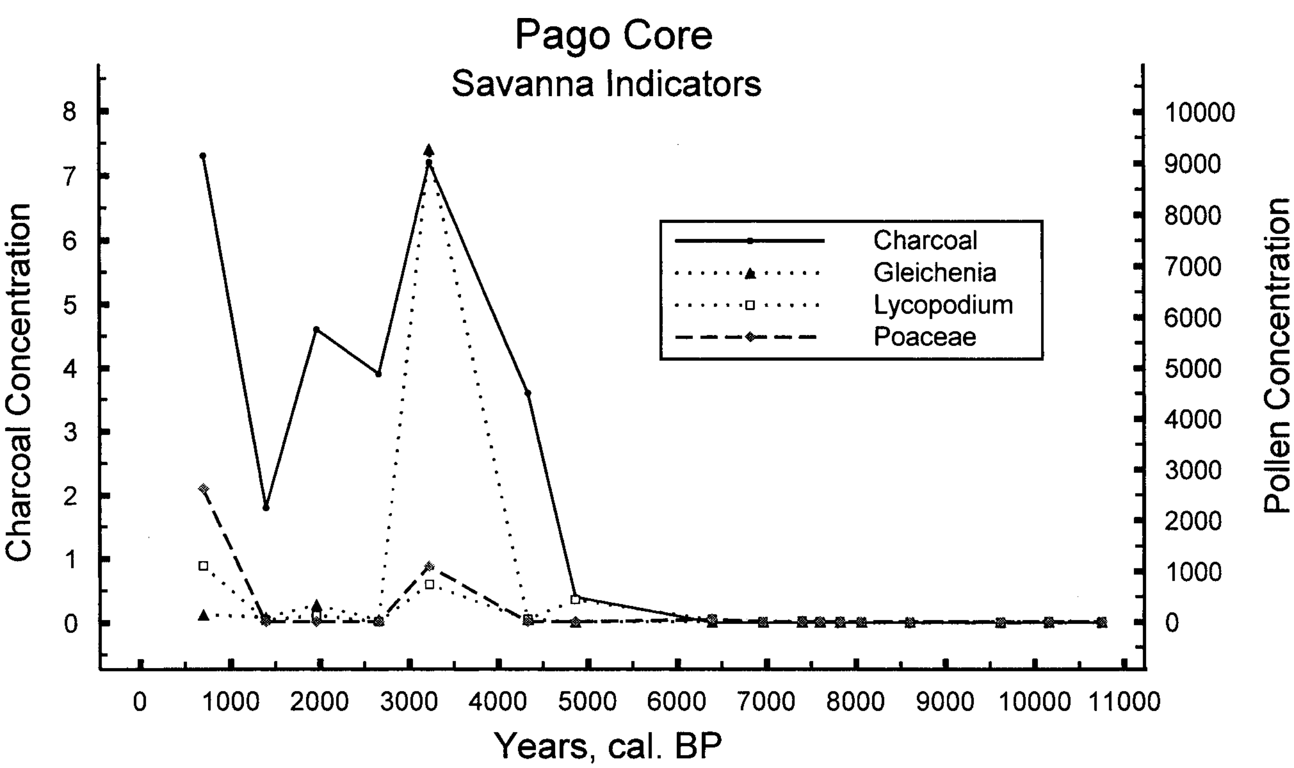


Fig. 8. Graph of charcoal particle concentrations and pollen concentrations of main savanna indicators for the Pago core (data from Ward, 1994).

forests declined steeply. By about 2,300 cal. B.P. it appears only remnant patches of the native forest remained. Presumably the savanna/grasslands of the interior uplands also began to assume their present appearance and extent by this time.

By way of comparison, the Pago core, despite the coarseness of its sampling record, mirrors the IARII Laguas findings (Fig. 8).

Landscape change and prehistoric agriculture. The pollen record shows that around 2,900 cal B.P. there was a steep decline in native forest about the time savannas became a significant landscape feature, and by c. 2,300 cal. B.P. only remnant patches of native forest were left.

Thus, in scarcely 2,000 years the entire appearance and natural history of Guam were transformed as a result of human settlement.

Direct pollen evidence for prehistoric agriculture is limited. One important finding (corroborating findings in the MARS Laguas and Tipalao cores—Ward, 1995; Athens & Ward, 1995) is that *Cocos* is not an introduced tree, but was among the native plants already existing on Guam when the first human colonists arrived. The IARII Laguas data show that this economically important tree increased gradually in the record after about 3,444 cal. B.P. from its pre-human sporadic occurrences, and did not decline until the start of the historical period.

Another cultigen, *Areca catechu*, the betel palm, also appears to be a native plant on Guam rather than an introduction. While in the IARII Laguas core its earliest appearance is at 3,157 cal. B.P., which is well after initial human colonization, it is present in the earlier prehuman Holocene intervals in the Tipalao and MARS Laguas cores (Table 1; Athens & Ward, 1993*b*; Ward, 1995). The IARII Laguas record suggests that *Areca catechu* became more common on the landscape beginning about 3,157 cal. B.P., possibly implying a long history of use by Guam's prehistoric population.

The only other definite cultigen to appear in the Laguas record is that of taro, *Colocasia esculenta*. Two grains of its pollen are present in the 167–169 cm interval, which dates to 1,107 cal. B.P. This appears to be the first time prehistoric *Colocasia esculenta* pollen has been documented in the Mariana Islands. Loy (2001, 2002) also recently identified *Colocasia esculenta* starch grains from the interior residues of Pre-Latte and Latte Period pottery sherds recovered from Guam sites (see also archaeological discussions in Moore & Hunter-Anderson, 2001: 102–112, 213, 230; Moore 2002: 43–47). *Colocasia esculenta* is a shy pollen producer and tends to be only infrequently observed in coring records. Its presence in the Laguas core suggests that taro was likely grown in the vicinity of Core 2 c. 1,100 years ago (i.e., the coastal wetlands were used at this time for growing taro).

An indefinite cultigen appearing in the Laguas coring record is that of *Artocarpus*, or breadfruit. Its occurrence as a cultigen is regarded as indefinite because there are four species on Guam, one of which (*A. mariannensis*) is considered to be native and wild (Stone, 1970: 247). All have edible fruits or seeds. Only *A. altilis* and *A. mariannensis* are common in Guam, and the latter has extensively hybridized with the former. The cooked seeds of the *A. mariannensis* are said to be "particularly tasty" (Stone, 1970: 249). Of interest for the present discussion is that *Artocarpus* first appears in the IARII Laguas record only sporadically as one or two grains just after 3,558 cal. B.P. Its regular appearance in the record at all after 3,558 cal. B.P. may indicate that either the native species or an introduced domesticated type (*A. altilis*) became more common on the landscape due to their incorporation into a human-managed coastal agroforest (with *Cocos* and *Areca catechu*).

Several important grasses were likely used by the prehistoric people of Guam, including rice (confirmed archaeologically, Hunter-Anderson *et al*., 1995), sugarcane, and bamboo. These plants are all regarded as introduced. The IARII Laguas pollen counts do indicate that grass pollen rose substantially after human arrival, particularly in Zones D and E. It is reasonable to suppose that possibly a small portion of the pollen sum was comprised of these introductions. However, because pollen in the grass family is not easily differentiated due to similar morphology (monoporate, granular), separation of these ethnobotanically-important species is not feasible using pollen analysis.

As for evidence of infilling or coastal progradation, the sedimentary evidence of the IARII Laguas core indicates that with the onset of Depositional Unit 2 around 1,700 B.P., the sedimentary regime changed from being primarily marine to terrigenous. Unfortunately, there is no basis for relating this change to human activities in the watershed as opposed to primarily natural processes. In fact, rather than an increase in the sedimentation rate, as would be expected from anthropogenic disturbances, it substantially decreased (Table 3).

Nevertheless, two nearby sampling areas (Core 1 and Trench 1) on the coastal plain c. 0.5 km north of the IARII Laguas core (Fig. 3) do point to significant terrigenous deposition along the coast during late prehistoric times. Neither of these sampling areas receives direct discharge from the Laguas River or any other stream. An initial auger/core effort (Core 1) roughly 100 m west of the point where the foothills begin their rise toward the interior revealed a brown clay loam to a depth of 145 cm below the surface, and bioclastic materials (sand with silt) to a depth of 207 cm below the surface; at 207 cm solid limestone rock was encountered. A sample of *Porites* sp. coral from the top of this limestone reef rock, located 85 cm below the surface in an excavation unit at a slightly more seaward location (Trench 1, about 50 m west of the auger/core unit) was dated to 2,455–2,298 cal. B.P. (1σ) (Athens & Ward, 1999: 126, 133, 142). This evidence confirms the identification of this slightly raised reef as Merizo Limestone (Easton *et al*., 1978), and provides a terminal date for its formation. Clearly, the heavy clayey sediments on top of this reef post-date the age of the reef. However, the date for the onset of deposition cannot be determined with more precision since deposition may not have begun immediately upon cessation of coral growth. Nevertheless, these results suggest that considerable coastal infilling occurred during the past roughly 2,000 years. Future investigations will be required to determine more precisely the time when major coastal deposition occurred in the Laguas area, but in general our data do not contradict the previous findings of Dye & Cleghorn (1990) and Hunter-Anderson (1989).

Conclusion

The palaeoenvironmental data are provocative for their implications about early human settlement in Guam (and presumably the other major Mariana Islands). Interestingly, the changes in the IARII Laguas record mirror changes in our cores from Palau concerning the dating of initial human settlement (Athens & Ward, 2002). This strengthens our belief that these changes are real and that enough work has been accomplished to seriously consider that human colonization of western Micronesia (including Palau) occurred by the mid-fifth millennium B.P. (Yap may also fit this pattern, but the palaeoenvironmental evidence is not conclusive—see Dodson & Intoh, 1999). Such evidence is consistent with the chronology postulated by the various models for Austronesian ethno-linguistic expansion in island southeast Asia (see Oppenheimer & Richards, 2001 for an informative diagram and discussion of the three main models—see also Terrell *et al*., 2001 for recent arguments). The significance here is, first, that the initial settlement of western Micronesia, presumably by Austronesians, occurred about 1,000 years before the advent of the Lapita cultural complex in Melanesia (around 3,500–3,400 cal. B.P.—see Bellwood, 1991, Kirch, 2000: 91–93). Second, it was apparently tied to the early, possibly initial, period of Austronesian ethno-linguistic expansion in island southeast Asia.

The Philippines and Sulawesi often have been referred to as likely points of origin for the initial Austronesian settlers of the Mariana Islands (e.g., Bellwood, 1979: 282–286, Kirch, 2000: 171–173). Although both the Mariana and Palau archipelagos seem to have been first settled at approximately the same time (by the mid-fifth millennium B.P.), we do not wish to imply similar origins for the settlers. Present evidence, in fact, suggests very different origins and complex histories for the various western Pacific archipelagos, as others also have argued.

As to the Laguas palaeoenvironmental data, the finding that humans are responsible for the creation of the savannas that presently extend over broad areas of the interior uplands of southern Guam appears indisputable. This finding, while presumably solving one important research problem, opens up another. This concerns why people were burning the interior of Guam? We agree with Hunter-Anderson (1998) that it is probably not because the earliest prehistoric inhabitants sought out these areas as the most favourable locations for slash-and-burn agriculture as some models of oceanic agriculture suggest (e.g., Barrau, 1961).

Although the ancient volcanic and highly weathered interior soils of Guam tend to be very poor for agriculture, there are patchy areas with better soils as indicated on soil maps (see Young, 1988). Presumably these patches were the focal interior areas sought out and settled by at least a few people in late Pre-Latte times, and then much more extensively during the Latte Period. While recent studies have shown that archaeological sites are not rare in interior savanna areas during the Latte Period (e.g., Moore & Hunter-Anderson, 1994), they were obviously not the most desirable places to live. The truth, it seems, is that prehistoric populations preferred living near the coast and tending gardens in nearby alluvial and wetland areas if at all possible (especially as these areas increased as a result of coastal sedimentary deposition after c. 2,000 cal. B.P.). Some movement to the interior likely occurred as a result of population growth beginning as early as late Pre-Latte times, but presumably these interior settlements were located in alluvial valleys and patchy upland areas where edaphic conditions for agriculture were relatively more favourable than the older weathered soils that typify much of the area.

To account for the formation of the savannas, it appears that dry season fires must have been intentionally set on occasion, perhaps by individuals making forays into the interior for wild tubers or other wild food resources. These fires might have been set with the intention of increasing the production of certain wild forest products, to facilitate travel through these areas, or for pure entertainment. The actual reason is probably not determinable. The result, however, was that with exposure to the sun and tropical rains, and continued firing at irregular intervals during dry seasons, the fragile soils of the upland landscape quickly became degraded and could no longer support forest vegetation.

With respect to the issue of landscape change, the palaeoenvironmental record suggests that coincident with the rise of savannas beginning about 2,900 cal. B.P., there was a steep decline in the native forest, and that by about 2,300 cal. B.P. there were only remnant patches of native forest left. With the onset of pollen Zone E c. 1,800 cal. B.P., charcoal concentration values increased markedly, possibly suggesting greater land use intensification and/or population increase.

Unfortunately, the pollen data in regard to prehistoric agriculture are very limited and cannot provide much useful information. Apparently arboriculture with coconut, breadfruit, and betel nut was an aspect of the cropping system. *Colocasia* taro was present at least by 1,100 cal. B.P., though it is such a poor pollen producer that it may have been cultivated for a long time prior to this date (as suggested by the pottery residue analyses of Loy). There were undoubtedly other cultigens, such as tubers and grasses, but thus far these are not visible palynologically.

The Laguas sedimentary evidence (from Merizo limestone sampling areas north of the IARII Laguas core) makes it clear that sometime after about 2,400 cal. B.P. there was an increase in coastal deposition as a result of erosion from the surrounding hillslopes. This implies that the landscape came under more intensive utilization, presumably for agriculture, though exactly when this happened in the Laguas area is not clear from either the coring data or the Merizo limestone excavation. As noted, the charcoal particle evidence suggests increasing intensification of land use beginning c. 1,800 cal. B.P., but there is no corresponding increase in the rate of deposition in the IARII Laguas core. Investigations elsewhere in Guam (e.g., Dye & Cleghorn, 1990, Hunter-Anderson, 1989) indicate that coastal deposition of inland sediments occurred sometime between the early first millennium B.P. and late second millennium B.P., suggesting a later date for a quantum increase in land use of the coastal hill slopes and interior valleys. As this seems to occur immediately prior to the change from the Pre-Latte to the Latte Period, there may have been a causal connection. Though this may well also be the case in the Laguas area (more studies are needed to pin down the timing of coastal deposition), it is nevertheless clear from the IARII Laguas record that land use intensification was an ongoing process on Guam and not an event that suddenly occurred.

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The Effect of Objects: The Return of a North Vanuatu Textile from the Australian Museum to the Vanuatu Cultural Centre

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ABSTRACT. In 1995 a plaited pandanus textile was repatriated from the Australian Museum to the Vanuatu Cultural Centre. During the process questions about the textile's specific place of manufacture arose. The Australian Museum records indicated that it was a girl's dress collected from the northern part of Pentecost Island. However, through discussions with women fieldworkers from the Vanuatu Cultural Centre about variations in methods of manufacture and designs in different parts of Vanuatu it became clear it was a special type of textile called *baru* from Maewo which was no longer made. The return of the *baru* stimulated redefinition of what was known about such objects. For the Cultural Centre fieldworkers it drew attention to items in danger of being no longer made, of loss of skills and knowledge. Accounts of transactions such as this demonstrate both the complexity and the importance of the relationships that can flow through and around museums.

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The return of objects from museums to their communities of origin has often been controversial, with focus usually on issues about ownership: about the rights of museums to own objects, and the rights of communities to demand them back. Such controversies have tended to obscure one of the most crucial features of the return of objects to their communities of origin, that is, that this movement is above all about relationships. Return can be about relationships between nations, between institutions, between individuals, or, more usually, some complex combination of them all. The return of an object is always a kind of exchange: exchange as compensation, exchange as debt repayment, exchange to mark changes in comparative status, to affirm an existing relationship, or to open a new relationship. The degree to which the return of objects is a matter of the making and remaking of relationships has begun to be recognized, as indicated in the title: "we deal with relationships: not just objects" (Kelly *et al*., 2001).

In this paper I tell the story of an object returned—from the Australian Museum, Sydney, to the Vanuatu Cultural Centre. This is a small story, not one of great moment. However, in tracing the return of this object and the consequences that flowed around it, it is possible to demonstrate both the complexity and the importance of the relationships that can flow through and around museums, and the way that key individuals in museums can act in ways that have far-reaching effects. As such, this paper is a tribute to Jim Specht. Jim's investment in relationships with

Fig. 1. Plaited pandanus textile from the collections of the Australian Museum, Sydney, returned to Vanuatu in 1995. The textile was collected by A.R. McCulloch in 1910 on Pentecost Island. Research in Vanuatu after 1995 demonstrated its stylistic origins in the central area of Maewo island. AM registration E.18864. Photograph by Australian Museum, reproduced with permission of the Vanuatu Cultural Centre.

indigenous communities in Australia and in Melanesia, and his willingness to bring about the return of objects to them, has been of very considerable importance for cultural programs in the region. James Clifford has suggested that museums can be viewed as "contact zones", arguing that museums can and perhaps should see themselves as "specific places of transit, intercultural borders, contexts of struggle and communication between discrepant communities" (Clifford, 1997: 213). Jim's gift to the Australian Museum has been to make that suggestion real, long before it was proposed, and to teach those of us who worked with him to be open to the possibilities of such permeabilities.

The object which is the subject of my small story is a plaited pandanus textile. It was returned from the Australian Museum to the Vanuatu Cultural Centre in 1995, to mark the opening of a new Cultural Centre building. Appropriately enough, this story has several distinct strands, which I discuss in turn, showing how they gradually join together. I first provide some background on textiles in Vanuatu, discussing next the Vanuatu Cultural Centre and its relationship with the Australian Museum, then move on to consider the return itself, and the consequences which flowed from it.

Strand one: North Vanuatu textiles

To begin with, there is the textile itself. It was collected in 1910 on the island of Pentecost in north Vanuatu (then the New Hebrides) by an Australian Museum biologist, A.R. McCulloch. It was registered the same year as a "Girl's Dress" and given the number E.18864 (Fig. 1). McCulloch was not an ethnologist, and he was not in the New Hebrides for long. I hope I do him no disservice if I suggest that, probably, he collected the textile rather as he might have collected a biological specimen, with interest, but not expecting to need to know much more about it than what it was and where it came from. He must have engaged in a transient relationship of some kind with the person from whom he acquired the textile, but he didn't document that relationship for posterity. McCulloch recorded the textile as coming from Raga (the local name for the northern part of Pentecost), but with no more specific provenance. The textile is a small (L: 84 cm, W: 24 cm), with a raised design of five large diamonds plaited into the fabric, and highlighted with red dye.

North Pentecost is one of three places in Vanuatu where women produce a distinctive style of pandanus textile, dyed red using the stencilling technique unique to north Vanuatu (log-wrap stencil dyeing). Although Speiser illustrated a number of textiles in his survey of the material culture of the then New Hebrides (Speiser, 1923), and although quite a few exist in museum collections internationally, until recent decades very little has been known about them. Research by Annie Walter (1996) and myself (Bolton, 2001, 2003) has begun to disentangle their complexities.

The three places which produce these distinctive textiles are north Pentecost, Ambae, and Maewo. These islands are geographically close in the Vanuatu archipelago, meeting together like the petals on a three-leaf clover. In the past, there was extensive trade between them, so that although each place produced its own textiles, men often sought to acquire textiles (especially certain clothing textiles) from other areas in order to enhance their status in rituals in their own places. Since the early 1990s, these three islands have linked administratively as a province of Vanuatu, known as

Penama. Other styles of red-dyed textiles are produced elsewhere in the archipelago, in Malakula, Ambrym, and also in the Banks Islands, but they are different again (Deacon, 1934; articles in Bonnemaison *et al*., 1996), and do not have the similarities in appearance and use which characterize Pentecost, Ambae and Maewo textiles. Borrowing the recent administrative terminology, the Pentecost, Ambae, Maewo textile complex can thus be termed the Penama textile complex.

Penama textiles are most usually described as “mats” in museum catalogues, in publications, and also in Bislama, Vanuatu’s lingua franca. However, “mat” in the English sense is hardly an adequate term for them, for there are many different kinds of textile, and they are used for diverse purposes. There are textiles used as exchange valuables, textiles that are domestic furnishings, and others used in specific ritual contexts. In the past there were also textiles worn as everyday clothing. To the uninitiated, all these textiles are similar in appearance, but in fact each different type has its own characteristics, name, use and meaning, and each is subject to a number of rules about who can make and use it. These different types of textile are so distinct that they are treated as fundamentally different kinds of objects, in the way that, for example, Australians would generally regard a cotton tea towel and a cotton bed sheet as quite distinct kinds of thing (Bolton, 2001). The textiles are physically distinguished from each other by size, by the kinds of selvages, fringes and tassels appropriate to each, by the decorative features plaited into them, by whether or not they are dyed, and often by the appearance and the name of designs stencilled onto them.

The differences in north Ambaean pandanus textiles are not just a matter of the variety of types, but also of the places where they are made. In north and central Pentecost, three kinds of textile are made. Annie Walter has recorded the language terms for them in the Apma language of central Pentecost. There they are known as *sese, tsip*, and *butsuban* (Walter, 1996). *Sese* are up to 4 m long, and are stencilled along their whole length. *Butsuban* are undyed sleeping textiles. *Tsip* are small (only about 120 cm long) and are also stencilled. The Raga language term for the smallest mat is also *tsip*, and McCulloch’s textile would thus appear to be a *tsip*. The system on Ambae is more complex than on Pentecost: there women make many distinctively named types of textile, which are grouped together into four categories, three of which are named. In east Ambae these categories are: *maraha*, large exchange valuables (the most valuable of which can be up to 100 m long); *qana*, which are smaller exchange valuables also used as domestic furnishings and which are similar to the Pentecost *sese*; clothing textiles, which today have no category name; and *singo*, textiles used mostly in ritual contexts (Bolton, 2003). One type of *singo, singo tavalu*, is quite similar in size and appearance to the Pentecost *tsip*, although a well-trained eye can readily tell them apart. On Maewo, women make nine different types of textile, which are not grouped into categories, but each of which has specific contexts use. Their names are: *qan seresere, qan melomelo, tavalu, qan rururu, qan somsombei, qan qanariringi, malo, ban tavalu, qana tutuhu* and *baru*. Of these only one type is dyed. These are the small textiles known as *baru*, which are particularly close in appearance to the Ambae *singo*, and to a lesser extent to the Pentecost *tsip*.

Strand two: the Vanuatu Cultural Centre and the Australian Museum

In total, Vanuatu comprises about eighty islands, with a population at the turn of the twenty-first century of about 200,000 people. There is immense cultural diversity in the archipelago; in every small area people speak a different language (113 in total), and have different knowledge, beliefs and practices. The Vanuatu Cultural Centre, which was founded in 1956, attempts to both document and promote this cultural diversity. It is renowned, in the Pacific at least, for the programs which it operates throughout the archipelago, programs designed to enable local people to document and revive their own practices, and to negotiate local belief and practice in the face of ongoing changes to their lives. These Cultural Centre programs rely on a network of extension workers, known as fieldworkers, who are volunteers, and who work in their own villages and regions to document and sustain local practice (Tryon, 1999). The fieldworker program was initially developed in the late 1970s, becoming established with the introduction of annual fieldworker workshops in 1981. Until the early 1990s, the project was directed solely at men, and there were only male fieldworkers. In 1994 a women’s group was founded.

At the annual fieldworker workshops, fieldworkers present the results of research on a nominated topic, which they have been preparing through the preceding year. They share knowledge—about architectural styles, about pigs, about ritual cycles—and at the same time document it, exchanging ideas and encouraging each other in their common goal of keeping their distinctive local knowledge and practices alive through the massive social changes that have followed the achievement of independence in 1980. Individual fieldworkers are thus both knowledgeable about the cultural practices of their own areas, and are often deeply committed to the documentation and revival of those practices.

The curator of the Vanuatu Cultural Centre from 1977 until 1989 was an Anglo-American ethnologist, Kirk Huffman. Kirk had been good friends with Jim Specht for many years, their friendship dating back to before Kirk became the Cultural Centre curator. This friendship created strong links between the Australian Museum and the Vanuatu Cultural Centre, and has generated a number of joint programs and other connections between the two institutions. One of these was a cataloguing and staff training project at the Cultural Centre, which began in 1989, and in which a number of Anthropology staff, myself included, were involved. An outcome of this was an invitation made to me by the Board of the Cultural Centre to assist in developing the women’s fieldworker program at the Cultural Centre. I spent 14 months in Vanuatu in 1991 and 1992, training Jean Tarisesei, who now co-ordinates the women fieldworker program.[1] During that period, Jean and I undertook a documentation and research program on Ambae, which focussed on women’s production of plaited pandanus textiles.

The Ambae program is a good example both of the collaboration between the Australian Museum and the Cultural Centre, and of the degree of local commitment to cultural revival which the fieldworker program generates.

When I was planning the Ambae program, Jim Specht suggested that the project should include a workshop held on Ambae for women from across the island, at which they could share and discuss their knowledge about textiles. At Jim's suggestion, the Cultural Centre and I obtained funding for the workshop from the Australian National Commission for Unesco. The workshop was held in June 1992, and was attended not only by women from Ambae, but by observers from adjacent islands, from Pentecost, Maewo, Santo and Malo.

At this workshop delegates shared public knowledge about textile types and uses, learned with interest about differences in textile use and classification from district to district around the island, and in adjacent islands, and thus recognized that their knowledge about textiles was not just a matter of everyday ordinariness, but something distinctive and special to their places. This recognition of difference was actually quite important. Trade in textiles, as in other resources, was almost completely eradicated in the archipelago as a result of various expatriate pressures from the late 1920s (Huffman, 1996: 187). Moreover, trade had been generally conducted by men, so that women never had as much opportunity to see different textile forms. In the early 1990s neither men nor women on Ambae were able to identify textiles as coming from Maewo or Pentecost.

By 1995 quite a number of other Australian Museum staff had developed personal connections with the Cultural Centre, through running training and other assistance programs both in Sydney and in Vanuatu, so that, early that year, matching the temper of the times, the two institutions formalized their relationship by signing a Memorandum of Understanding.

Strand three: the return of the textile

Later in 1995, when the Vanuatu Cultural Centre opened a new building, Jim suggested to the Australian Museum Trustees that, especially given the Memorandum of Understanding, it would be appropriate for the Australian Museum to mark the occasion by returning an object to Vanuatu. This was not the first return of an object to Vanuatu by the Australian Museum, but the fourth. The museum had returned a drum from Mele village in 1981, a bark cloth from Erromango in 1985 and a bark cloth from Ifira island in 1988. Given my ongoing involvement with the women fieldworkers program and with the Ambae textile project, Jim suggested that I act on behalf of the Cultural Centre in choosing a textile to be returned.

I had already established that all the Ambaean textiles in the Australian Museum were types which were still being made. I chose what I thought was a rare but well-documented textile produced within the north Vanuatu red textile complex, of a type not represented in the Cultural Centre collections. I chose the McCulloch textile from Pentecost.

The new Cultural Centre building was opened in November 1995. Jim Specht attended the opening and announced the presentation of the textile to the Cultural Centre. Several weeks later it was formally received for the Cultural Centre by two male fieldworkers from northern Pentecost, Richard Leona and Columbas Toa. Carefully mounted in an insect resistant box, the textile was put on display in the new Cultural Centre exhibitions.

Strand four: the effects of the return

When Richard Leona and Columbas Toa received the textile, they were a little bewildered by it. They didn't recognize it. Annie Walter, the Pentecost textile specialist, was also puzzled. She also saw the McCulloch textile when it was presented, and later said to me she didn't think it was from Pentecost at all. I, naively secure in the certainty that McCulloch had collected the textile there, was not too worried by these doubts. It seemed to me that the diversity of the red textile complex and the probability of changes in it over the years since 1910 might explain why neither Richard, Columbas, nor Annie especially recognized McCulloch's textile.

In 1994, following the completion of the Ambae project, the Cultural Centre had inaugurated annual workshops for women fieldworkers, following the model of the men's workshops. In 1996 Irene Lini and Rachel Ngotiboe, who are the two Cultural Centre women fieldworkers from Maewo, the third island in the red textile complex, saw the McCulloch textile when they came to Vila for the third women's workshop. (They had not been present when the textile was presented the year before). Irene immediately identified the textile as coming not from Pentecost, but from central Maewo.

In 1999, Jean Tarisesei and I travelled to Maewo specifically to study textiles. We took with us photos of textiles from north Vanuatu in various museum collections, including the McCulloch textile. Irene Lini, on her own initiative, organized about sixteen women from a number of villages in central Maewo to meet with us for an informal five-day workshop in Kerebei, central Maewo (the home of the male Maewo fieldworker, Jeffrey Uliboe). From Irene's point of view, the workshop was all about sharing knowledge to encourage the maintenance and revival of textile skills. For Jean and myself, it was an invaluable opportunity to learn about Maewo textiles, which had never been previously documented.

It was at this workshop that I learned that only one of the Maewo textile types is dyed. All the other textiles made on Maewo are left undyed. (This doesn't mean that they are completely plain: some Maewo textile types are decorated with beautiful openwork designs). The dyed textiles are a special type known as *baru*, and are associated with descent groups; or rather, the designs worked into and stencilled onto them are descent group designs, which are used on other media. The workshop delegates were no longer confident in naming all the descent group designs as they appeared on the *baru* or in identifying which design belonged to which descent group, but they recognized the McCulloch textile (of which we had a photograph) as one of them.

The kinship system in central Maewo is organized on the basis of matrilineal moieties, Liu and Asu. Lynne Hume, who undertook research on Maewo in 1981, reports that each moiety contains four main descent groups (which she describes as clans), and that sub-groups to these also exist (Hume, 1982: 34). In my visits to Maewo, I found the situation somewhat less clear. However, I did establish that there are descent groups (*laen* in Bislama), and these descent groups have exclusive rights to certain designs. Descent group membership is not exclusive. By tracing links back through a family, individuals can claim the right to use different descent group designs. These designs are used on specified media in specified contexts. They are used on *baru*. They are used as face painting designs at a certain stage in *lengwasa* (a Maewo women's status-alteration ritual). The same designs are also used on men's head-dresses in the linked male status-alteration rituals, *kwatu*. (There are four *kwatu* rituals: *kwelu*, *kwatbarungu*, *kwatu takombio* and *kwatasmori*). The designs also appear in rock art: the male Maewo fieldworker, Jeffrey Uliboe, regards some rock engravings in central Maewo as descent group designs. The importance of these designs, and the way in which they can shift from medium to medium, is characteristic of north Vanuatu. On Ambae, for example, certain important designs are used on specified textiles, were used as women's tattoo designs, appear as rock engravings, and are worked into armbands and belts worn by men in the *huqe*, the principal Ambae male status-enhancement system.

Baru utilize a special plaiting technique which marks out a design in the weave is subsequently highlighted through the stencilling process. In this technique designs are plaited into the body of the textile using a mixture of float weaves and tied loops, producing a raised surface, like a kind of bas-relief. I call this technique "overweave", for want of a better term. This technique is also used on Ambae *singo*, but it is not used on Pentecost *tsip*. Thus the McCulloch textile, which incorporates an overweave design, could not have been produced on Pentecost. On Ambae there is a strictly limited range of named designs which can be worked using overweave. The McCulloch textile design, with its five large diamonds, while structurally similar to the Ambae *singo* designs, is nevertheless not one of these. It is, as it was to Irene and to Rachel, recognizably a Maewo descent group design.

Kirk Huffman has published a map of exchange routes in north Vanuatu which notes a trade in pigs and textiles between Maewo and Raga (north Pentecost) (Huffman, 1996: 184). It seems likely that McCulloch, thinking he was collecting a girl's dress from Pentecost, had actually collected a Maewo *baru* which had been exchanged in this trade between Maewo and north Pentecost.

As the Maewo textile workshop progressed, women began to produce carefully preserved examples of *baru* from the rafters of their houses and other safe storage places. These textiles were kept to be worn occasionally to mark achieved status and descent group membership at rituals and other special times. Beautifully and finely made, these *baru* were nevertheless old, and sometimes rotting. The very fine plaiting technique necessary to making them was a skill no longer practised, although several older women, notably Rachel Ngotiboe, still remembered the highly restricted and ritualized techniques for dyeing them. When people needed to wear *baru* they would use these old ones, but increasingly people had been no longer made the effort to wear them for rituals. Thus, for example, women would perform *lengwasa* (the women's status-alteration ritual) without attempting to wear the correct textiles.

My assumption that the textile might not have been recognized by either Richard Leona, Columbas Toa or Annie Walter, because of changes in textile production over time, was thus proved entirely wrong. Instead, the consistency of the Penama textile traditions, and the maintenance of knowledge about them, was more than amply demonstrated. If I was amazed to find that there were many *baru* still on Maewo, the point for Irene Lini, who had organized the 1999 Maewo workshop, was that the skills and knowledge necessary to make them were nearly forgotten.

One of Irene's objectives for the Maewo workshop was to revive the necessary plaiting and dyeing skills, and to make *baru* again. Here the threads of this story begin to form a yet more complex pattern. When Jean and I organized the Ambae textile workshop in 1992, Irene had not yet become involved with the Cultural Centre. The delegate sent from Maewo to the Ambae workshop was a woman called Perpetua Lini. The Ambae workshop made a deep impression on Perpetua, and when she returned to Maewo she talked about it to other women. She had concluded that it was very important to keep the practice of making *baru* alive, and she had spoken so persuasively about it that one of Irene's daughters, Doreen, a notable plaiter of textiles, had been persuaded to make an attempt. Doreen had copied one of the *baru* on Maewo, and after much trial and error, had succeeded in making one. Rachel Ngotiboe had dyed it.

Irene was thus speaking about a revival that had already started when she urged women at the 1999 Maewo textile workshop to try to make *baru* again. Doreen brought her *baru* to the workshop; the comparison between it and the older ones was very clear. Despite her very considerable achievement in making it, Doreen's *baru* was neither as finely-plaited nor as well-dyed as the ones still kept in the rafters. There was a feeling among the women at the workshop that more effort needed to be made. More women needed to try to make *baru* and they needed to try to achieve the fineness of the older textiles. It was also well-understood that it would have to be young girls, whose eyesight is still sharp, who took up the challenge. Irene hoped that the discussions of the workshop would stimulate some of the participants to follow Doreen's lead.

Conclusion

On the day the new Cultural Centre building opened in 1995, many thousands of people visited it, and when a section of the Swiss French touring exhibition, *Arts of Vanuatu*, came to the Cultural Centre the next year, over a third of the population of Port Vila, the capital, came to see it. In general, however, the new Cultural Centre building, which is opposite the Parliament House on a hill above the town, not in the main street, is not much visited by ni-Vanuatu. Probably, especially for the many young people living in poor settlements around the town, the building seems intimidatingly smart. It could not be said that the McCulloch textile is, or ever was, the focus of visitor interest. The effects of the return were brought about as news of, and ideas about, the textile were communicated to the people in Vanuatu who could bring their own knowledge to bear upon it.

The controversies surrounding the return of objects to their countries of origin often involve a discourse of rights—the right of the originating community to take possession of, or to exercise authority over, objects identified as part of their cultural heritage, and the rights of museums to continue to hold objects. Thus in this discourse, rights are often opposed to rights, and an analysis of the return of objects framed in terms of rights is thus generally oppositional, pitting the one against the other. The effect of this kind of discussion is to focus particularly on the object and on its physical ownership. Objects, however, exist in, and have effects upon, relationships between people, and these effects are often as dependent upon knowledge or information associated with the object as with the object itself.

In the case of the McCulloch *baru* there was no debate about rights; the Australian Museum initiated the textile's return to Vanuatu. Ownership was not the issue. It was rather knowledge about the textile, and the knowledge-sharing stimulated by it, around which the story of the McCulloch *baru* turned. The physical return of the textile to the Cultural Centre was a stimulus for a redefinition of what was known about it: no longer a Girl's Dress from Raga, it was recognized as a central Maewo *baru*. And for fieldworkers such as Irene Lini, the return of the actual textile was all about Cultural Centre goals of documentation and revival, drawing attention to something in danger of being no longer made, of the loss of skills and knowledge.

An analysis of return in terms of relationships thus opens up a wider series of interconnections and consequences. The return of the McCulloch textile is part of the ongoing relationship between the Australian Museum and the Vanuatu Cultural Centre. In presenting it at a key moment in the Cultural Centre's development, the Australian Museum gave substance to the Memorandum of Understanding which had been signed the year before, demonstrating the ongoing relationship between the two institutions. It was not just the relationship between the Australian Museum and the Cultural Centre which was important, however, but the relationships between Kirk Huffman and Jim Specht, between Perpetua and Doreen, between Irene, Jean Tarisesei and myself, and between Irene and other people on Maewo. All of these relationships were woven partially around the McCulloch *baru* and knowledge about it. And all these relationships, as well as the object, made the difference to Maewo women, and developed what is, I hope, now an ongoing project to make *baru* again on Maewo.

Notes

[1] During this period I was on unpaid leave from the Australian Museum, doing research for my doctoral thesis, and simultaneously working as a volunteer for the Cultural Centre.

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Ownership and a Peripatetic Collection: Raymond Firth's Collection from Tikopia, Solomon Islands

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ABSTRACT. The ethnographic collection made by Sir Raymond Firth in Tikopia, Solomon Islands, in 1928 and 1929 is used as a case study for the examination of the different meanings and interpretations attributed to museum collections. This collection is now housed at the Australian Museum in Sydney. In the 1970s the collection was subject to a repatriation request by the National Museum of the Solomon Islands, but the collection was not returned. In examining the progress of this request the history of the collection is traced, including acquisition in the field and subsequent re-locations between university, state and national bodies in Australia. I suggest that the reasons for the failure of the National Museum of the Solomon Islands to successfully negotiate the return of this collection lie in the nature of the repatriation request as an expression of political difference at a national level rather than cultural difference at the local level, and in the specific social relationships, past and present, surrounding the collection. However, the contemporary attitudes to the collection identified in this study should not be assumed to remain constant, as future generations of Tikopia may well reassess the cultural value of this collection. I conclude that museums are sites which mediate specific social relationships, at specific times in history.

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In the 1970s, twenty years prior to its transfer to the Australian Museum from the National Museum of Australia, the Firth Collection was earmarked for repatriation to the Solomon Islands. However, despite being partially funded for return, the collection remained in Australia. In this paper I examine some of the meanings of this collection in its Australian contexts by drawing upon documents and correspondence transferred to the Australian Museum along with the objects. In doing so I seek to shed light on why the return was not completed. In addition, I draw upon information gathered by Leonie Oakes (1988) in her survey and summary of papers relating to the University of Sydney Collection. In presenting a brief and necessarily partial history of the Firth Collection in Australia, I argue that it is people who attribute potency to objects and without a social context for repatriation, objects in museum collections remain simply "things".

Throughout this paper I refer to a number of different collections. For the purposes of clarity I will identify these now before embarking upon the main body of the paper. The Tikopia material forms one component of the University of Sydney Collection, which was made by anthropologists working at the newly founded Anthropology Department from 1926. This collection includes materials from both Aboriginal Australia and the Pacific Region. One of the first researchers in the Anthropology Department was Raymond Firth who collected 641 objects during his first field trip to the tiny island of Tikopia in the Solomon Islands in 1928 and 1929. It is this collection which I henceforth refer to as "the 1928–1929 Firth Collection" although it falls within the umbrella of the University of Sydney Collection. Firth did in fact make a second collection in 1956 while working in Tikopia with his colleague James Spillius. I refer to this collection as "the Firth-Spillius Collection". This collection forms one component of the Australian National University Collection, which is now housed on campus in Canberra. For a considerable number of years, both the University of Sydney Collection and the Australian National University Collection were housed, as part of the National Ethnographic Collection, in the basement of the Institute of Anatomy in Canberra, home to what is now ScreenSound Australia. In the documentation used in this paper, this institution is referred to by its previous name, the Australian Film and Sound Archive. During this period the ownership of the University of Sydney Collection was ambiguous. However, in 1989 the National Museum of Australia transferred ownership of the Pacific Island components of this collection to the Australian Museum. Notwithstanding the complexities of these interactions, and the large number of objects involved in addition to the Tikopia collections, it is the 1928–1929 Firth Collection that is the central focus of this paper.

As a staff member of the Anthropology Division at the Australian Museum, my interest in this material has developed within the Museum's positive stance on repatriation. This position has been fostered by Jim Specht who, since his career at the Australian Museum began in 1970, has worked tirelessly to build relationships between indigenous people and the Australian Museum. He has overseen the repatriation of many ethnographic objects, most of these returning to the national museums of Papua New Guinea, Vanuatu and the Solomon Islands, and has contributed to the literature on cultural heritage issues, collections and museums through 29 publications (Khan this volume). I am indebted to Jim for his knowledge and insights concerning issues relating to museums and cultural heritage.

This paper is divided into four sections. In the first, I recount the sequence of events surrounding the request for repatriation, how the request was handled and by whom. This information is drawn from correspondence held by the National Museum of Australia, copies of which were transferred to the Australian Museum along with the collection. The second section describes the movement of the collection between Sydney and Canberra to become part of the National Ethnographic Collection. The third section examines the relocation of the collection to the Australian Museum and considers the status of the collection as "cultural heritage". The last section examines the social relationships mediated by the objects in the collection both in the past and in the present.

A brief chronology of an unsuccessful repatriation request

In the 1960s the Honiara Museum Association was formed to find funding to build a museum and to unify the various collections scattered in colonial government buildings. This association, where members were for the most part expatriate government officials, obtained funds from the Gulbenkian Foundation, England, for a building and exhibition space (Foanaóta, 1994: 96), and the first gallery opened in 1969. Further funds were acquired through annual contributions from local councils in addition to international and local donations. In 1972 the Honiara Museum became the Solomon Islands National Museum and Cultural Centre and came under central government control. The institution's aims were to collect cultural materials and information, carry out research, disseminate information through exhibitions and educational programs, and to entertain the general public. The collections comprised ethnographic and archaeological material, as well as natural history, geology and social history collections, including war relics (Foanaóta, 1994: 96).

In the early 1970s Anna Craven, curator at the Solomon Islands National Museum, wrote to several museums in Australia and requested the repatriation of Solomon Islands cultural heritage materials. At this time the Firth 1928–1929 Collection was stored as part of the National Ethnographic Collection in the basement of the Institute of Anatomy. Professor Firth supported Craven's request arguing that the people of the Solomon Islands "have a right to be educated in their cultural heritage" (Firth, 1973*a*). Both focused on the importance of the collection as the national heritage of the Solomon Islands, but while Craven wanted all material returned, Firth suggested that some of his collection remain to represent Tikopia people in Australia. The National Museum of Australia undertook to investigate the legal status of the collection (Keith, 1973). In 1977 Craven, frustrated by the lack of progress, wrote again to the National Museum of Australia (Craven, 1977). Firth also wrote to the Public Affairs and Cultural Relations Division of the Department of Foreign Affairs in 1978 pointing out that the Solomon Islands now had a museum where these objects could be preserved. Against the background of independence, Solomon Islanders were interested in their cultural heritage and he felt that Solomon Islanders should have access to items of their cultural heritage (Firth, 1978*a*). Letters were also written to Dr Jim Specht calling upon his assistance in the return (Firth, 1978*a*; Specht, 1978).

In January 1979, the Firth-Spillius Collection from Tikopia, made in 1956, was brought into discussion for repatriation too. This collection was owned by the Anthropology Department at the Australian National University, and was also held in the basement of the Institute of Anatomy. While Firth supported the return of the Firth-Spillius Collection, Spillius requested that twelve items be retained for himself (Spillius, 1979*a*). Both Firth and Spillius thought some of the 1956 collection should be put on display at the Australian National University for teaching purposes (Spillius, 1979*b*). Conservators assessed the 1928–1929 and 1956 collections—some 980 objects—and made preparations for their return (Preiss, 1980). The proposed return was approved by the Department of Home Affairs in March 1980 (Ryan, 1980).

However, in April of that year, in a letter from Foreign Affairs to the Department of Health, it was suggested that "in the spirit of the UNESCO Director-General's call for the restitution of cultural property" the museum in Honiara should be consulted about which objects might stay in Australia (McPherson, 1980). The letter was addressed to the Department of Health, as the collections were in that department's area of authority through their presence in the basement of the Institute of Anatomy. Despite the labour attendant upon the conservation report of the objects, the two Tikopia collections did not go back to the Solomon Islands. The Tikopia materials remained in Canberra until 1989 when the 1928–1929 Firth Collection was relocated to the Australian Museum. At this time legal title to the Pacific components of the University of Sydney collection were transferred from the National Museum of Australia to the Australian Museum. The Firth-Spillius collection remained in Canberra, but was relocated to the Australian National University, which held title to it.

From the correspondence it is clear that both Craven and Firth believed that the objects in the Tikopia Collection were an important part of the Solomon Islands national heritage. Firth felt that the objects also had value as a teaching collection for anthropology students in Australia, and that some objects could be regarded as "duplicates". As the collector, Firth supported the return. As a representative of the new National Museum of the Solomon Islands, Anna Craven requested that all the material be returned because of its national value. The National Museum of Australia did not object to the return of the collections, or at least no readily visible obstacles, such as ethical or scientific objections to repatriation, were recorded in the files to argue against a return.

The Tikopia Collection as part of the Australian National Estate

The Anthropology Department at the University of Sydney was the first home of the 1928–1929 Firth Collection. While the School was established in 1926, as early as 1928 storage of the university's collections had become a problem. Radcliffe-Brown, Chair of the Department, wrote to A.J. Gibson of the Royal Society to inform him that he had raised this problem with the Prime Minister, Mr Bruce, as well as the Minister for Home and Territories, Mr Marr. Radcliffe-Brown had suggested that there should be a National Museum of Ethnography in Canberra, to which these collections, which he referred to as the Australian National Research Council Collections, could be added. This would ensure the proper storage of the collection (Radcliffe-Brown, 1928; also Stone, 1960, 1968). In the following December, Radcliffe-Brown received a positive reply from the Australian National Research Council which supported a proposal for a national collection and a suitable home to house it (Gibson, 1928). The Australian National Research Council was consulted because this body had funded the research carried out by the University of Sydney researchers who made the collections.

The 1928–1929 Firth Collection, as a part of the larger collection at the University of Sydney, was gaining national importance. In February 1929, Radcliffe-Brown was informed that the Executive Committee of the Australian National Research Council had discussed the concept of developing a Commonwealth Museum. The Council felt that the issue should be adopted as a matter of policy and that immediate action should be taken to set up an Anthropology section (Gibson, 1929*a*). In April 1929, a series of letters indicates that the matter was raised at the Department of Home Affairs (Gibson, 1929*b*) as well as funding sought for the preservation and storage of the collection of photographs and glass plate negatives being built up by University of Sydney researchers (Radcliffe-Brown, 1929).

However, Leonie Oakes (1988), who collated the correspondence relating to the University of Sydney Collection for the Australian Museum, noted that Radcliffe-Brown sought the relocation of the collection due to lack of interest. He suggested to G.B. Cook, Private Secretary of the Prime Minister, that the coal store at the Powerhouse in Canberra would be an alternative storage location for the objects (Tiger Wise cited in Oakes, 1988: 6). The research interests of Radcliffe-Brown and the British School of Social Anthropology did not lie with ethnographic collections but with non-material aspects of social behaviour, the identification of social institutions, social structure and social organization (Radcliffe-Brown, 1952; see also Stocking, 1984, 1985).

However, Radcliffe-Brown's successor Professor A.P. Elkin, who became a Trustee of the Australian Museum in October 1946, and President of the Board of Trustees in 1962, was much more interested in the collections and in museums. In contrast to Radcliffe-Brown, Elkin supported maintaining the collection at the University of Sydney and wanted to build a small museum, or a "fixed research laboratory" but he lacked funding to achieve this (Oakes, 1988: 7). After Elkin's retirement in 1957, his successor Professor Barnes, moved the collection to the Institute of Anatomy on a permanent loan, although a few pieces made their way to both the Macleay Museum at the University of Sydney and the Australian Museum (Oakes, 1988: 7, 13–14). Barnes' intention was that it should join other collections making up the National Ethnographic Collection (Oakes, 1988: 2) which had already been placed in the Institute building soon after it was erected as the National Museum of Australian Zoology in 1931 (Stone, 1968). However, according to E.H. Hipsley (1959), Medical Officer at the Institute of Anatomy, Barnes wanted to move the collection elsewhere because he urgently needed office space and remarked that the collection had never been put on display, catalogued or used for research. There was no document outlining the loan conditions associated with this "permanent loan". The Institute building provided a storage place for a number of ethnographic collections which had been presented to or purchased by the Government over preceding years and which had been stored in various parts of the country. The site was considered to be a temporary one until a national museum was erected (Stone, 1968).

However, in 1959, Hipsley wrote to the Deputy Crown Solicitor concerning the status of the collection because the new Head of the Anthropology School at the University of Sydney, Professor Geddes, had expressed interest in having the collection returned to the University. Hipsley was seeking clarification about who owned the material and was concerned about relocation costs. The Sydney to Canberra move had cost £400. Despite Geddes request, the collections remained in the Institute of Anatomy basement for 23 years until 1989, when the National Museum of Australia transferred title of the Pacific Region collections of the University of Sydney to the Australian Museum, while maintaining ownership of the indigenous Australian collections. This second massive relocation of objects occurred when ScreenSound Australia, then the National Film and Sound Archive, took over the Institute of Anatomy buildings, which required storage area for its own collections.

Within the 60 years between collection and transfer to the Australian Museum, the 1928–1929 Firth Collection had become in turn a teaching collection, a national collection, and an impediment to the efficient use of space. When the National Museum of Australia established its area of interest as indigenous Australia, the subsequent division of the National Ethnographic Collection between Australian and non-Australian regions effectively demoted the Firth Collection's significance. At this point, all the objects collected by University of Sydney researchers working in the Pacific Region ceased to be of "national importance".[1] Yet the transfer to and acceptance of the Pacific Islands material by the Australian Museum signalled an interpretation of the collection as having both ethnographic and cultural heritage significance (Bolton, 1985).

Tikopia cultural heritage at the Australian Museum

During negotiations for the removal of the Pacific component of the University of Sydney Collection to the Australian Museum, Jim Specht, Head of the Division of Anthropology, and Lissant Bolton, the Collection Manager, met with Lawrence Foanaóta, Director of the Solomon Islands National Museum in Sydney on 6 May, 1988.[2] They met to discuss the future of the Solomon Islands objects held within that collection. While a number of objects from the Australian Museum's Solomon Islands collection had already been repatriated to the Solomon Islands National Museum to celebrate their Independence, Foanaóta had concerns about the relocation of larger numbers of objects. He was concerned that the Solomon Islands was not a signatory to the UNESCO 1970 Convention on Export of Cultural Heritage and felt there were issues regarding reciprocal relationships between Melanesian countries concerning illegally exported items. He indicated that the National Museum of the Solomon Islands was working towards national legislation to protect cultural property and to counter black market activity. Such issues have formed the basis for cultural heritage workshops for Pacific Island museums and cultural centres in subsequent years (Eoe & Swadling, 1991; Foanaóta, 1991, 1994; Lindstrom & White, 1994*b*). In conclusion, Foanaóta considered that it was not possible for the Solomon Islands National Museum to receive large numbers of objects from Australia at that time, adding that their storage facilities were inadequate and that the museum lacked trained collections staff. Foanaóta also felt it was important for consideration to be given to what the researchers who had made the collections might have wanted for these objects. As a result, there was minimal effort to move towards a repatriation of the Solomon Islands material, which of course, included the Tikopia material.

Foanaóta's incorporation of the collectors' opinions about the disposal of their collections is interesting. While the comment is somewhat ambiguous, it appears not to be a reference to ownership. By this stage in the proceedings the legal status of the University of Sydney Collection, and therefore the 1928–1929 Firth Collection which is a part of it, was no longer the topic of discussion. However, the inclusion of the collectors' sentiments about the objects introduced social interaction and attachment to objects. Earlier references to collectors had been made in terms of seeking permission or advice to disperse collections.

If we recall the stated reasons for the initial request for the repatriation of the Solomon Islands collections, this revolved around the concepts of cultural heritage at a national level. An expatriate worker of the Solomon Islands National Museum, supported by Firth, initiated the original request. Some twenty years later, Foanaóta, an indigenous Solomon Islander, but not a Tikopia man, raised concern for the social relationships surrounding objects although aspects relating to cultural heritage were not insignificant. For the first time in these proceedings concern was raised about objects as the foci of social relationships and what effect this might have on how a repatriation request would be made. The issue of whether the objects were of national importance to the Solomon Islands was not prominent at this time. Was this partly because the Solomon Islands National Museum had already received objects from the Australian Museum? If someone from Tikopia had been present in these discussions, would the outcome have been different?

In recent years the interpretation of objects as material culture has been subject to re-evaluation that has particular relevance to museum collections. These new interpretations, such as contained in the book *The Scramble for Art in Central Africa* (Shildkrout & Keim, 1998), have focused on the historical complexities of interactions between people in the exchange of objects. Such studies have investigated the nature of these relationships giving consideration to the processes which may have been unfolding during these interactions. Nicholas Thomas' (1991) *Entangled Objects* is of especial interest for the Pacific Region. Also, while not concerned with museum objects per se, but with the meanings attached to objects, Gell's (1998) work on objects and agency also raises a questioning of assumptions about how objects are made, used and viewed by both the maker and the viewer. Such works raise questions about the nature of indigenous "social agency" in past transactions. In regards to this collection, what did Firth, as the collector, think of his collecting process, and what did the Tikopia think of interaction surrounding the giving and receiving of objects? I believe these two things need to be contemplated before the contemporary status of a collection as cultural heritage can be adequately assessed. It is the comparison between former interpretations of objects and those made in the contemporary setting which may reveal significant shifts in social practice.

What then was the nature of the social relationship initiated and developed between Firth and Tikopia people at the time the collection was made?

Objects mediating relationships

Firth's initial training was in economics, but in 1924 he moved from New Zealand to London and trained in anthropology under Bronislaw Malinowski. As a "British Social Anthropologist", not an ethnologist, Firth made a clear distinction between technology (objects) and the study of the organization of economic systems (social behaviour) (1939: 11–12). It is a distinction that rejected the concept (common at the time, see Stocking, 1985) that objects were associated with levels of technological development, and therefore stages of human development.

Rather, Firth concentrated on an analysis of the relationships between groups in the operation of a society, for example, collective rights in property, the distribution of these rights, and their effect on production. This approach tended to neglect symbolic interpretations of objects (Firth, 1939: 12). Firth separated objects from the bodies of knowledge relating to magic, ritual, kinship and social organization in which objects were used. In his view, the social anthropologist had to make this theoretical separation even though Tikopia people themselves may not have made the same distinction.

However, Firth was a thorough recorder of detail in his descriptions of Tikopia "ritual" and "economy" and in this sense he could not ignore symbolic interpretations of objects because the Tikopia incorporated these into their daily lives. Further, Firth gave priority to recording observed actions, that is, what people do, not what they say they do (however, see Firth, 1970*a* some years later, and Parkin, 1988 for comments by Firth on the distinction between psychology and social anthropology).

In acquiring objects, I suggest that Firth saw himself primarily as collecting scientific data in three-dimensional form. This approach can be seen in Firth's publications in which he addressed issues relating to material culture, for example, the manufacture and use of bark cloth (Firth, 1947), body ornaments (Firth, 1951), ritual adzes (Firth, 1959), woodworking (Firth, 1960), string figures (Firth, 1970*b*) and art (Firth, 1973*b*). These articles on material culture form a small proportion of Firth's publications, and concentrated on describing manufacture rather than symbolic meaning. Despite this there is, however, much to be learnt about material culture from Firth's detailed descriptions of objects as "wants", items of technology, capital or possessions in discussion of Western economic terminology and non-Western economic settings. Bark cloth, for example, was "…one of the most important of consumer's goods in the Tikopia economy…" (Firth, 1947: 71). Bundles of bark cloth were incorporated into important gifts to the *atua*, the gods of the Tikopia pantheon (Firth, 1947: 71). However, while Firth noted that women were valued as bark cloth makers because their cloth was used for ceremonial purposes[3] (Firth, 1947: 71), he provided little comment on the economic status of women.[4]

In 1939, ten years after his first field work, Firth played with the idea of nascent money in a non-market economy through his "purchase" of native craft items (Firth, 1965: 377–380). Firth "sold", gave away or exchanged various European items while on Tikopia (Firth, 1928; Wedgwood, 1930). These included fish-hooks, clay pipes, calico, cotton prints, cotton belts, iron blades from smoothing planes, tobacco, razors, strings of beads, axes, tomahawks, and various sized knives including sheath knives. He identified 184 items in his collection as "purchases", which represent 29% of his collection (641 objects). Over a quarter of the collection was made in the first three months of fieldwork, with events such as "bartering" evenings providing an arena in which to acquire "specimens".

In describing these acquisitions Firth suggested that the Tikopia had no concept of comparative value as mediated by a common denominator (i.e., money) but they did have an internal valuation of items in terms of a "rough scale of comparative utility of things" (Firth, 1965: 277). For example, clamshell adzes were considered more valuable than net gauges, which in turn were more valuable than sinnet beaters.

Firth suggested that his presence gave the Tikopia people the opportunity to increase their wealth and the opportunity to negotiate their "sale" price, to discuss their wants, the quality of items, as well as the opportunity to come back and complain if they were unhappy. Firth saw his position as having been a benevolent monopolist "…controlling a limited supply of goods…of great utility". Firth's "wants", the "specimens", were evaluated by him in terms of the quality of workmanship whereas the Tikopia people, he suggested, wanted the most they could get. "The Tikopia hazarded a request which he hoped I might be gullible or polite enough to fulfil" (Firth, 1965: 379–380).

Firth did not investigate Tikopia views on these transactions. His own interpretation rested on his assumption of an innate drive for "goods", rather than an indigenous pattern of inclusion or exclusion. Firth imposed an economic imperative that assumed market forces. In doing so I suggest that he ignored factors such as the documented lack of concern for the "diminishing" but "valuable" objects that Firth had to offer. For example, when Firth was running low on supplies for barter, the Tikopia stopped coming to "exchange" items with him. The scarcity of "goods" did not affect a price rise, nor were European items re-circulated amongst the Tikopia. Nor were the objects considered significant enough to incorporate into the indigenous exchange system. There was one substitution of cotton cloth for *maro*, barkcloth, in an offering in which Firth participated (1983: 424), though the items concerned were not "purchased". Also, fish-hooks formed part of a payment of mortuary obligations but "On the whole they [Firth's goods] did not feature in the elaborate native exchanges" (Firth, 1965: 380).

While Firth stated that he dictated the initial rates of exchange, "Tikopia etiquette" regarding gift and counter gift affected the final outcome of the transaction and he discovered the "price" below which Tikopia people would not enter into exchanges. (This "price" was independent of the cost incurred by Firth in acquiring and bringing the items to Tikopia.) He therefore suggested that he acquired his "specimens" and the Tikopia got very useful things they needed, at a negotiated price (Firth, 1965: 379). After a time standard rates developed, although these were never openly discussed or agreed upon. Firth acknowledged an indigenous scale of importance that dictated the exchange-ability of the objects (Firth, 1965: 379–380). Some categories of items were never exchanged for others. For example, clubs, pandanus mats and bonito hooks were offered in return for calico, beads and knives. Clubs, pandanus mats and bonito hooks were never traded for metal fish-hooks.

The objects Firth took with him to Tikopia for purposes of exchange do not appear to have been included in indigenous exchange networks but were kept by Tikopia people for personal or family use (Firth, 1965: 380). This suggests that whatever items the Tikopia traded for, while

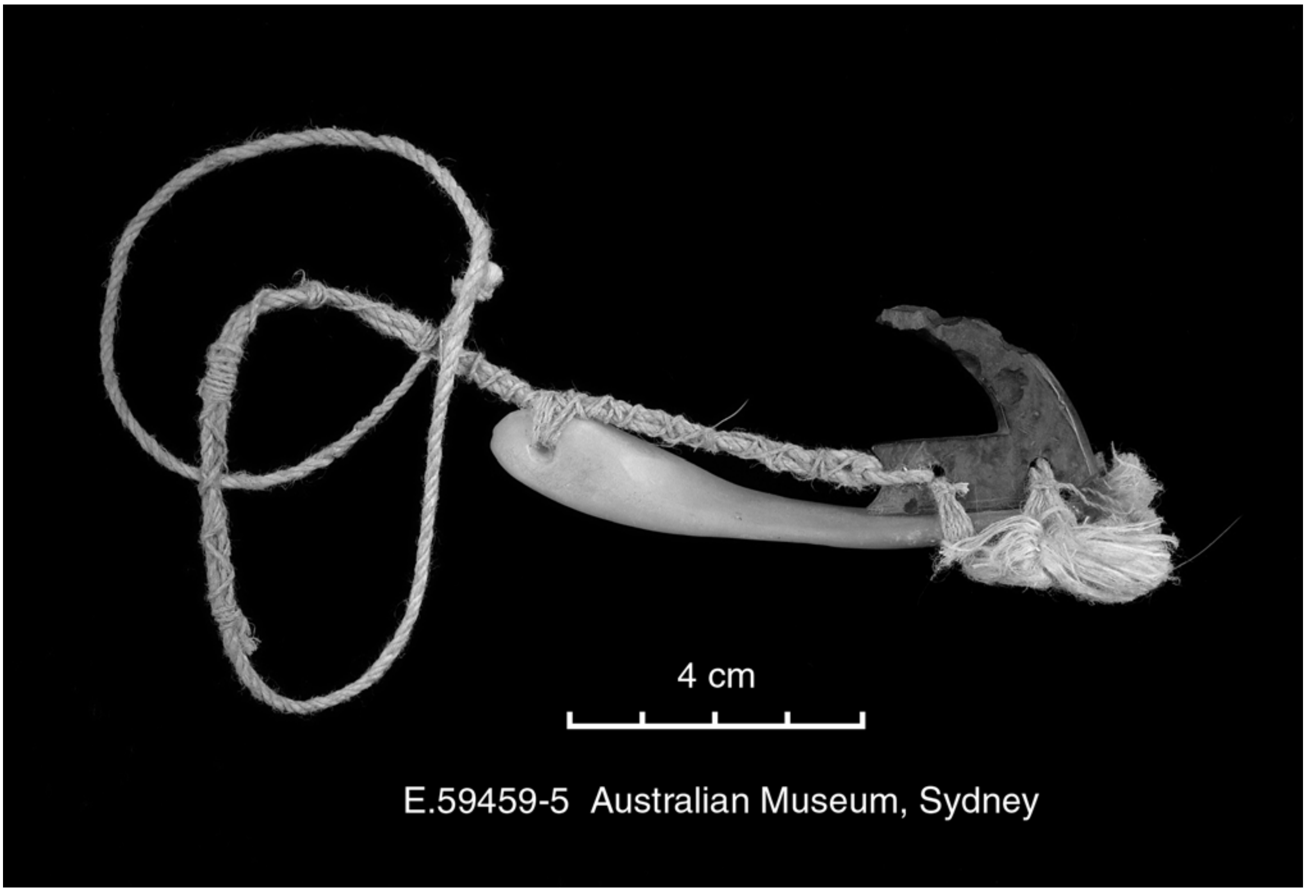

Fig. 1. Bonito hook, given to Firth by Ariki Kafika, one of the chiefs of Tikopia.

they could well have been "useful", they remained of either peripheral cultural significance or became objects associated with Firth himself.

Firth's attempt to determine the exact, or as near possible to exact, values of the objects he purchased, ignored qualities attributed to objects by Tikopia people which Firth himself described in his accounts of traditional life at the time (Firth, 1965: 377–380 discussed below). From Firth's accounts I consider that many of the objects present in the 1928–1929 collection were acquired either through customary use to acknowledge the person's status vis-à-vis the ancestral spirits, and/or to indicate the person's social and personal associations. I propose that Firth underestimated the power of Tikopia people in determining an outcome in participating in these exchanges. After all, Firth states that Tikopia "etiquette" won out on exchange rates, despite Firth's own position as "benevolent monopolist".

Examination of the 1928–1929 collection using Firth's purchase list (Firth, 1928) reveals that 29% of the collection was acquired by "purchase", leaving a much greater percentage 71% to be acquired some other way. He does tell us that he gave seven metal adzes as gifts to the chiefs and other men of rank for "religious" and "traditional information". He also used a supply of cotton prints as ritual offerings to canoe and temple deities while other European-made items were used to acquire "specimens of the native craft" (Firth, 1965: 377).

If we move away from what Firth says about his collecting and his "purchase price" for specific objects, and consider the types of objects Firth acquired and the people from whom Firth acquired objects, it is apparent that high ranking "donors" are represented in the collection (Bonshek, 1999: 102–129). How these men (all named donors except one are men) interpreted the transactions being undertaken is a matter for speculation. However, Firth recorded that objects such as mats and barkcloth, sinnet rope, wooden bowls, and pearl shell fish-hooks all had specific social relationships attached to them when transacted. Some of these, such as the fish-hooks called *pa tu manga*, were associated with only the highest ranking chiefs and elders of Tikopia (Fig. 1). Such objects were not casually given away. Many of these same objects would have represented specific family relationships, mementos of their owners and makers. Still other objects, such as sacred shell adzes, were associated with the spirit world of Tikopia cosmology. To obtain such objects Firth must have been taken into a community in a manner which respected and valued his inclusion in day to day as well as ritual life (Bonshek, 1999: 70–124). While Firth saw himself as making scientific collections, I believe the Tikopia were incorporating Firth into their lives, mediating social interactions with Firth through the transfer of objects using already established patterns of exchange and reciprocity.

So, what do Tikopia people think of the collection today? Whose cultural heritage does the collection represent? The absence of Tikopia opinion about the return of this collection is noticeable throughout the correspondence concerning a return. In the history of the request as represented in the Australian Museum archives, the negotiation for the return of all Solomon Islands collections held in the basement of the Institute of Anatomy buildings, reflected sentiments of nationhood rather than the expressed desires of the specific groups within the Solomon Islands. The Tikopia people, whose "cultural heritage" comprises a significant number of objects, are a strong minority in the Solomon Islands (Bonshek, 1999), but they were not players in the original negotiations between the National Museum of Australia and the National Museum of the Solomon Islands. The collection had been used to mediate expressions of Solomon Islands' nationhood, not Tikopia cultural identity at a local level.

In 1996, I met a number of migrant Tikopia living away from the home island in an attempt to establish the significance of the collection to them. These interviews took place in Honiara, in Kira Kira on Makira Island and in Lata in Santa Cruz. Interest in the objects was sparked off by the knowledge that family members had given objects to Firth so long ago. Also, some people were excited about the objects because they had been given to Firth. Many people did not have a detailed knowledge of designs and patterns on objects, but referred to others who did. Interestingly, most made particular reference to Firth, who was seen as the authority on traditional (that is pre-Christian) Tikopia belief. Some referred to his texts when questioned about particular aspects of Tikopia life in relation to the objects. Knowledge of the 1928–1929 collection and its existence in an overseas institution did not generate worry or anxiety about access to the objects, but people were very interested in the collection because Firth had made it.

In 1980 Judith MacDonald (1991) carried out anthropological fieldwork in Tikopia. She noted that Tikopia's history has been played out somewhat separately to the remainder of the Solomon Islands. To a large extent, the lack of exploitable resources that could become exportable products has affected this. There has been no cash cropping, no foreign trade stores and Tikopia people have not needed to "re-invent themselves culturally" to cope with European influences (MacDonald, 1991: 72–73). The Tikopia people have a strong sense of their cultural identity and it was not necessary to express this through association with the objects in Firth's collection. Some objects in the 1928–1929 collection are still made today, and were not noted by the Tikopia as remarkable. However, this opinion changed when the social relationships surrounding a particular object became known, that is, when specific family members were discovered to have made an object, or have given an object to Firth (Bonshek, 1999).

At the same time, objects remained emblematic of what it is to be a Tikopia. That is, the objects were visibly distinguishable in their form and manufacture, as having been made by a Tikopia person. In 1996 the collection was not considered vital to the continued existence of the cultural identity of the Tikopia people I met, nor was it an emblem of a nostalgic past. The people I talked to did not interpret the 1928–1929 Firth Collection held in a museum as objects severed from their cultural origins or as objects through with they could or should revive pre-Christian practices.

Conclusion

The creation of the 1928–1929 Firth Collection under the auspices of the University of Sydney, along with the many other collections made by researchers in the Pacific region, was made in parallel with the establishment of the first school of Anthropology in Australia. At one level these collections are intimately connected to the development of a broad "scientific" research program in Australia and the Pacific. Clearly the concept of "cultural heritage" as we use it today was not one which had any currency at the time. "Science" was the engine that drove the collection process. In particular, Firth's collecting fell into this framework. However, Firth was at the forefront of his discipline, and his 1928–1929 collection mediated a complex change within anthropological theory. Objects that had previously been associated with evolutionary stages of progression were, in the School of British Social Anthropology to which Firth belonged, stripped of this interpretation. Firth did, however, maintain a descriptive functional explanation of objects. Firth's efforts to inject a more complex understanding, first of economic practices, and subsequently of social and religious practices, have added greatly to an understanding of the objects in the collection. This occurred despite his emphasis on functionalism, which downplayed an interpretation of the symbolic associations placed on objects.

The request for the repatriation of the Tikopia collections reflected the use of objects to mediate relationships between nation states, not relationships between Tikopia people and the National Museum of the Solomon Islands, nor between the Tikopia people and the National Museum of Australia through the National Museum of the Solomon Islands. The repatriation process was not completed and the files do not record any explanation for this, despite the relevant preparations for a return having been made. I suggest that the repatriation was not completed because the request lacked a social context. It was initiated by an expatriate museum worker, and not negotiated within the context of Tikopia interest in the objects. The subsequent inclusion by the National Museum of the Solomon Islands of the wishes of the collectors, in addition to the practical difficulties associated with the return, further mitigated against the completion of the repatriation process. The proposed return was not located within an indigenous Tikopia social context.

In making this last point however, I do not suggest that the inclusion of a Tikopia social context in the 1970s would necessarily have resulted in the repatriation requests being successfully completed. In using this example, I highlight the implication for museums, that not all collections are contested sites in which ethnographic and political authority is challenged. On the contrary I suggest that, with regard to the 1928–1929 Firth collection, the museum is a site holding objects which mediate specific social relationships. This collection is important because it embodies the relationships of Tikopia people with Raymond Firth. For many Tikopia people, the ethnographer's work has become authoritative and Firth has inscribed into text what it means to be "traditionally" Tikopia. His work has become canon, as yet largely unquestioned, and Firth himself is warmly embraced.

This is in marked contrast to the arena in which many museums operate, in which issues concerning ownership and access to objects of "cultural heritage" or "cultural property", and the nature of authenticity and tradition, challenge the authority of the curator, the museum worker and the institution of the museum as a whole (for example see Jones, 1993). Clearly the history of interactions and experiences of Tikopia with Europeans under colonial rule and with Solomon Island national government since independence, has taken a different path to that experienced, for example, by indigenous Australians in the unfolding of black-white relationships since colonization.

I am not suggesting here that the Solomon Islands National Museum is disinterested in issues concerning cultural heritage (on the contrary see Edwards & Stewart, 1980; Foanaóta, 1991, 1994; Roe & Totu, 1991; Totu & Roe, 1991; Lindstrom & White, 1994*a,b*). However, in this specific case, I believe that the original repatriation request reflected statements about political difference, rather than cultural difference. On the international scene, therefore, collections are incorporated into statements of nationalism, and not used as cultural markers but as political markers. In the future the relationship between Tikopia on the home island and Tikopia living in other parts of the Solomon Islands may play out a different story, and introduce another social context for the collection.

Notes

1. For the purposes of clarity, I have purposefully omitted mention of the Official Papuan Collection which was also housed in the basement of the Institute of Anatomy. This collection is currently housed at the National Museum of Australia.
2. As the Sydney University Collection included material from Papua New Guinea and Vanuatu, the meeting was also attended by Grace Molissa and Godwin Ligo representing the Vanuatu Cultural Centre and Soroi Eoe, Director of the Papua New Guinea Museum.
3. It is not until "Rank and Religion" (Firth, 1970*a*) that objects were dealt with more attention to emic understanding, although Firth's interest remained in transactional modes rather than in symbolic contexts.
4. Firth noted his lack of "access to the more intimate aspects of women's lives" in "Encounters with Tikopia over sixty years" (1990: 242) as well as earlier in "Sex roles and sex symbols in Tikopia society" (Firth, 1978*b*, see also Firth, 1965: 105).

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Early Agriculture in the Highlands of New Guinea: An Assessment of Phase 1 at Kuk Swamp

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ABSTRACT. The wetland archaeological evidence for Phase 1 at Kuk Swamp, Wahgi Valley, Papua New Guinea, is evaluated in terms of previous interpretations of the artificiality and agricultural function of the palaeochannel and palaeosurface. The evaluation concludes that the current evidence is insufficient to warrant claims of artificiality for the palaeochannel and some palaeosurface elements. Drawing on previous multi-stranded arguments proposed by Jack Golson and Philip Hughes, new lines of multi-disciplinary evidence suggest a revised interpretation of the wetland archaeological evidence for Phase 1 at Kuk does not negate a long-term trajectory towards agriculture in the highlands of New Guinea from the Early Holocene.

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Agriculture in the highlands: an old concern

The development and antiquity of agriculture in the highlands of New Guinea, particularly its antiquity, have been continual concerns since the first archaeological excavations in the region. Bulmer sought to elicit signatures of a transition to agriculture from the lithic assemblages collected during her excavations at Yuku and Kiowa rock shelters in 1959–1960 (Bulmer, 1964, 1966). She suggested that "the direct proof of agriculture must depend on pollen analysis, on the future fortunes of archaeology in obtaining organic remains, and on the analysis and dating of ditches and drains of agricultural derivation" (Bulmer, 1966: 152).

In this paper, multiple forms of evidence claimed to indicate the presence of agriculture in the highlands of New Guinea at approximately 9,000 radiocarbon years before present (B.P.) are assessed. The main focus of the paper is a presentation of the wetland archaeological evidence for Phase 1 at Kuk Swamp, the only site for which agriculture at 9,000 B.P. has been claimed (Golson, 1977, 1989, 1991; Golson & Hughes, 1980; Hope & Golson, 1995: 824). Although the specific interpretations have changed through time, it has been consistently argued that wetland agricultural practices were conducted as part of a broader land use strategy that included dryland environments within the catchment (Bayliss-Smith, 1996: 509). The evolution of these interpretations will not be reviewed here because the aim of this paper is to interrogate the evidence upon which they have been based.

The interpretation of agricultural activities at Kuk at 9,000 B.P. has always been controversial. Golson originally viewed the artificiality of the evidence for Phase 1 with scepticism and uncertainty (Golson, 1977: 613–614). Since then, he has referred to the agricultural interpretation of Phase 1 as "indirect and unusual" (Golson, 1982: 56), "possible" (Golson, 1991: 484) and as being based on analogies with more recent prehistoric evidence (Golson, 1991: 485; Hope & Golson, 1995: 824). In recent years, the nature and significance of the early phases at Kuk, particularly Phase 1, have been called into question within the broader archaeological community (e.g., Spriggs, 1996: 528). Indeed, some reviews of the global origins of agriculture question whether New Guinea was an independent centre due to the equivocal nature of the early evidence at Kuk (e.g., Smith, 1998: 142–143).

The wetland archaeological evidence for Phase 1 at Kuk, together with evaluations of its artificiality and agricultural function are presented in the first half of the paper. However, Golson, both individually and with Hughes, has drawn on a wide range of evidence to support a claim of agriculture at 9,000 B.P. (Golson, 1977, 1991; Golson & Hughes, 1980). In the second half of this paper, and in accordance with Golson's multi-stranded approach, a range of new evidence and ideas with a bearing on agricultural origins in New Guinea is briefly reviewed. This review concludes with a re-evaluation of the idea of agricultural origins at 9,000 B.P. in the New Guinea highlands.

Phase 1 at Kuk: the evidence

Golson and co-workers intensively investigated Kuk Swamp in the 1970s and 1980s, with additional fieldwork being undertaken in 1998 and 1999 by Denham and Golson. In total, over 200 trenches were excavated, and archaeological and stratigraphic recording occurred along approximately 10 km of modern plantation drain (Fig. 1). From the thousands of features, mostly prehistoric field drains and house sites, Golson identified six major periods of prehistoric agricultural drainage (Table 1).

The archaeological evidence for Phase 1 was exposed in relatively few trenches and plantation drains (Fig. 2). The majority of trenches were designed to investigate more recent drainage phases, and did not penetrate down sufficiently to expose the older stratigraphy. The evidence for Phase 1 was located in the southeastern portion of the plantation, close to a former margin of the wetland. Test excavations located to the north did not detect any artificial features beneath the grey clay or equivalent stratigraphic unit.

Table 1. Prehistoric agricultural phases at Kuk Swamp (Golson, 1982). All ages given in uncalibrated radiocarbon years.

phase	age (B.P.)
6	250–100
5	400–250
4	2,000–1,200
3	4,000–2,500
2	6,000–5,500
1	c. 9,000

Fig. 1. Location map depicting excavations at Kuk.

The evidence for Phase 1 at Kuk Swamp has two main inter-related components, a major palaeochannel and a palaeosurface comprised of inter-cut features. The pre-grey clay palaeosurface was inferred to be "chronologically and perhaps functionally associated" (Golson, 1982: 56) with the palaeochannel. The evidence and possible interpretations of each major component are described below.

Stratigraphically, the palaeochannel and palaeosurface were filled and sealed by a massively structured grey clay. The grey clay was a component of a fan emerging from the low-lying hills and drainage basin to the south of the wetland. Similar deposits, superimposed on Pleistocene fans, extended south onto the northern margins of the wetland from a ridge to the north (Ep Ridge). The grey clay has been interpreted to represent accelerated erosion (Hughes, 1985; Hughes *et al*., 1991), which was a product of agricultural clearing for swidden-type, dryland cultivation (Golson, 1991: 485). It has been presumed that deposition of this fan commenced with the abandonment of the short-lived Phase 1 palaeochannel, which occurred at c. 9,000 B.P.; formerly the palaeochannel had transported sediments away from the swamp margin.

The palaeochannel

The major palaeochannel was traced in excavation trenches and plantation drain walls across the southeast portion of the plantation (Fig. 2). The field evidence suggested that it flowed northeast across the wetland margin, that it was relatively wide and shallow and that it dated to approximately 9,000 B.P. (Golson & Hughes, 1980). The palaeochannel was presumed to have been dug in order to divert drainage waters from the southern catchment away from the swamp margin, thereby enabling cultivation of adjacent surfaces (Golson, 1977: 614; Golson & Hughes, 1980: 298). Four aspects of the palaeochannel have been proposed as indicators of its artificiality: straightness of course, passage through elevated areas, morphology, and its temporal occurrence and duration (Golson, 1991: 484; J. Golson & P.J. Hughes, pers. comm.). Each aspect is discussed in detail below.

Firstly, the straightness of the palaeochannel's course between marked curvatures was suggested as an indicator of its artificiality through analogy with the major palaeochannels of later phases (Golson, 1991: 484). In a

Fig. 2. Map of palaeochannel course relative to Phase 1 excavations (e.g., T-A12b/75–77) and plantation drains (e.g., drain A12a/b) with inset of previous course depiction (latter based on P.J. Hughes plan).

previous reconstruction, undertaken while fieldwork was ongoing, the course of the palaeochannel was not entirely straight and changed direction markedly in at least two locations (Golson, 1977: 615; Fig. 2 inset). The straight sections of the palaeochannel were considered unlikely to have formed naturally across this low gradient swamp margin.

Replotting of the palaeochannel's course, based on the excavation trenches and plantation drains in which it was exposed, clearly shows that straight sections are solely a product of interpolation between known points (Fig. 2). Those sections of the palaeochannel's course for which there are closely spaced records all exhibit slight sinuosity. Such sinuosity is expected across a low gradient slope. Furthermore, the one location in which there is a marked change in direction had higher constraining stratigraphy (see below). In general, the palaeochannel course was oriented to the northeast and perpendicular to the greatest angle of slope.

Secondly, the artificiality of the palaeochannel was inferred from its passage through slightly elevated mounds of underlying Pleistocene ash substrate in blocks A12b, A12c and A12d. If natural, the palaeochannel would be expected to follow the path of least resistance to lower ground, i.e., it would be expected to follow the slope. If artificial, the course of the palaeochannel need not have been determined solely by topography. The latter scenario was adopted by the original excavators based on the apparent passage of the palaeochannel through a locally elevated mound (implied in Golson, 1991: 484).

Based on a reconstruction of the Phase 1 palaeosurface topography and an examination of associated stratigraphic sections, the palaeochannel did not cut through significantly elevated ground. The area of greatest interest includes blocks A12b, A12c and A12d (Fig. 3). Between drains A12a/b and A12b/c, the palaeochannel flowed down slope and undertook a gradual change in course from northeasterly to east-northeasterly. Between drains A12b/c and A12c/d only a slight rise in pre-grey clay palaeosurface topography of <20 cm can be inferred (Fig. 4). In this comparison of palaeosurface heights adjacent to palaeochannel banks, only the northern bank in drain A12c/d has been considered because the southern bank had evidence of slumping and had undercut higher ground on the outside of this bend (Fig. 4b). The palaeochannel underwent a marked change in course in block A12d from east-northeasterly to northerly. These micro-topographic variations are not significant for three reasons:

1 Micro-topographic variations of such magnitude occur along the banks of small streams and are not necessarily determinate for channel course.

2 The alluvial stratigraphy in the vicinity of the palaeochannel is likely to be compactional. The higher areas

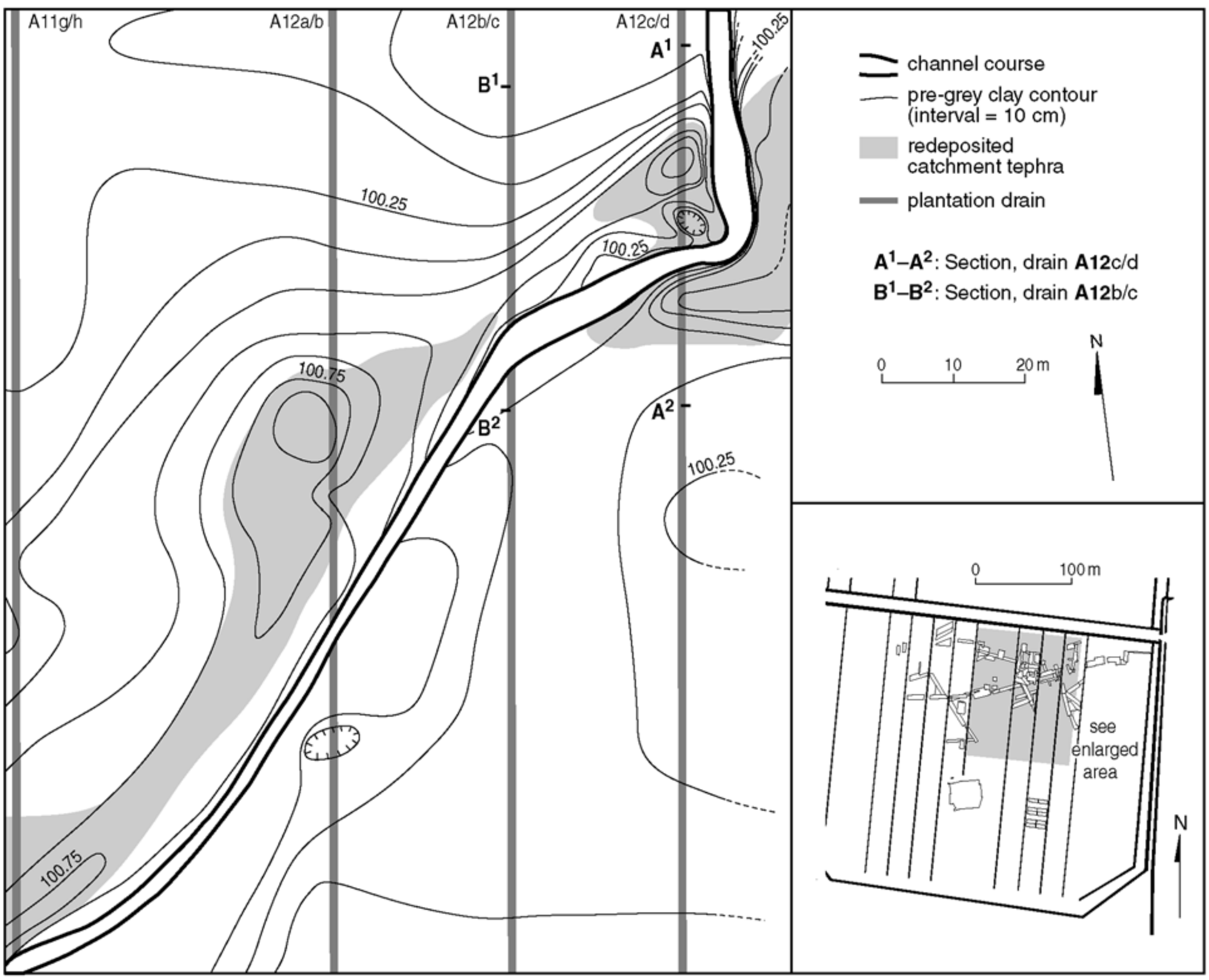

Fig. 3. Plan of palaeochannel course across pre-grey clay palaeosurface, with redeposited catchment tephra depicted (reconstructed by T. Denham from P.J. Hughes field notes).

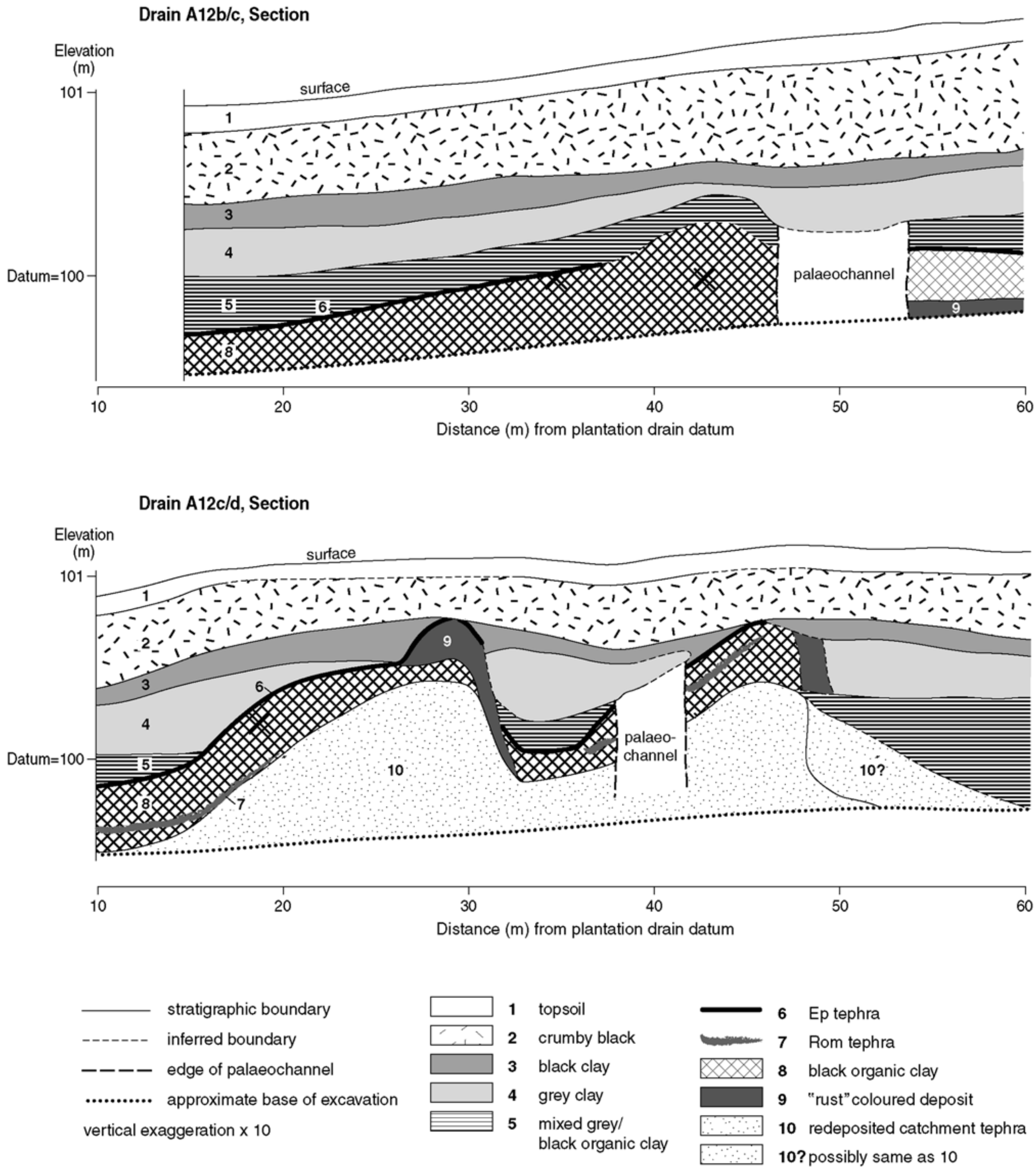

Fig. 4. Sections of drains A12b/c (Fig. 4a) and A12c/d (Fig. 4b), depicting palaeochannel course relative to stratigraphy (reconstructed by T. Denham from P.J. Hughes field notes).

of pre-grey clay palaeosurface are comprised of inorganic sediments, probably redeposited Tomba Tephra from the southern catchment. These areas appear to be higher than adjacent stratigraphy of the same age, but this is largely a product of post-depositional compaction associated with the differential ripening, shrinkage and wasting of more organic sediments away from the palaeochannel. Much, and potentially all, of the variation in relative height between more organic and inorganic sediments in the stratigraphy did not exist at the time of palaeochannel formation.

3 The redeposited catchment tephra forms a linear deposit that was subsequently followed by the palaeochannel (Fig. 3). In the drain A12c/d section, the relationship between the linear deposit and palaeochannel is clear (Fig. 4b). The palaeochannel cuts two Pleistocene tephras (Ep and Rom), which line an apparent depression between higher areas of redeposited tephra. Thus, and even if the "mounds" of redeposited tephra were apparent at the time of formation and were not a product of post-depositional compaction (which is unlikely), the palaeochannel followed

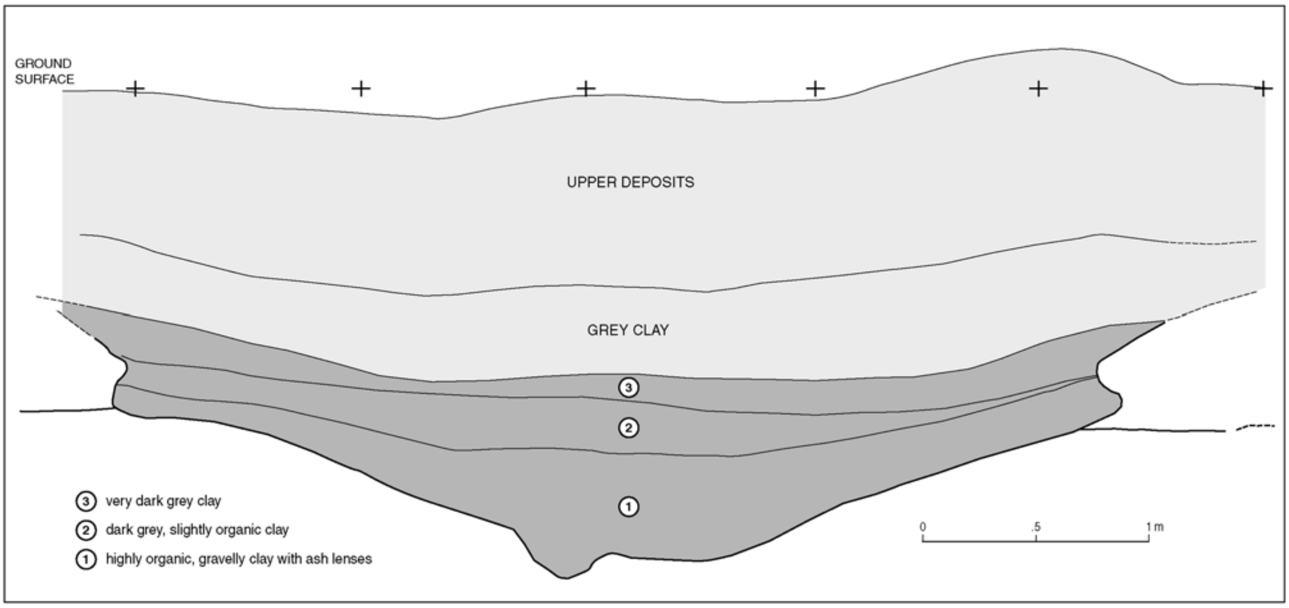

Fig. 5. Section of palaeochannel, S. face, N. drain, E-W Rd. No. 1. (reconstructed by T. Denham from P.J. Hughes field notes).

Fig. 6. Photograph along excavated palaeochannel bed, Trench A12d/C, view to south (taken by J. Golson).

an earlier Pleistocene depression that potentially constrained and deflected its course in block A12d. The most plausible explanation for the stratigraphy in this area is that the Early Holocene palaeochannel followed the course of an earlier, Pleistocene palaeochannel (see below).

Thirdly, the form of the palaeochannel in section and plan was investigated to determine if the morphology of the bed and banks could elicit its mode of formation. In section, the palaeochannel was wide and shallow, with gently sloping sides and a slightly rounded base (Figs. 5, 6). The upper portions of the banks appeared to be undercut, a product of fluvial erosion or mass movement processes during use or post-depositionally. The preserved form of the palaeochannel suggested that it was previously much narrower and had widened with time. Lateral erosion occurred along the banks, thereby making the interpretation of palaeochannel course based on adjacent palaeosurface elevations problematic (see above).

The recorded sections and trenches depict a wide and shallow palaeochannel with gently sloping sides (in section) and curved edges (in plan), respectively. These characteristics could have developed in an initially steep-sided (in section) and straight edged (in plan) channel, which had been subject to scouring and slumping. Evidence for these processes was widespread. Given that these processes would be characteristic of both natural and artificial palaeochannels, it is not possible to discern mode of formation from palaeochannel morphology.

Fourthly and from a broader perspective, the temporal occurrence and duration of the palaeochannel have been suggested to be significant indicators of its artificiality. The fill sequence consisted of a basal organic deposit sealed by a series of very dark grey clays. The basal organic deposit consisted of a well-preserved admixture of leaves, wood, seeds, ashes and soil crumbs. The overlying massive, very dark to dark-grey clays were variants of the major grey clay depositional unit. Based on the depositional sequence, Golson and Hughes inferred this palaeochannel to have been short-lived (1980: 298). There was no other evidence of palaeochannels draining the southern catchment during the preceding 10,000 years and the following 3,000 years. Thus, the presence of an apparently short-lived palaeochannel at 9,000 B.P. required explanation and suggested anthropogenesis.

In contrast to Golson and Hughes' previous interpretations, the Early Holocene palaeochannel followed the course of a Pleistocene predecessor. An extremely stable palaeochannel course through highly organic stratigraphy may have existed from the Pleistocene to Early Holocene, at which time it was abandoned due to changes in catchment hydrology and sediment input. Similar "stable-bed and aggrading-banks" models have been proposed to account for the stability of palaeochannel courses in lowland Britain during the Holocene (after Brown, 1997: 24–25). In such situations, there is a tendency to underestimate the age and duration of a palaeochannel based on the fills that correspond to its last phase of use, as opposed to its broader stratigraphic associations. A similar scenario may account for the apparent absence of a palaeochannel during grey clay deposition; a palaeochannel may have been present but it has been allocated to a later phase on the basis of radiocarbon dates of its fills.

In conclusion, no element of the palaeochannel's course or morphology suggests that it is "undeniably artificial" (Hope & Golson, 1995: 824). Rather, all elements are consistent with a palaeochannel flowing northeasterly in accordance with the general direction of slope. The slightly sinuous palaeochannel underwent a major variation in course in blocks A12d where it followed the course of an earlier palaeochannel.

The palaeosurface

The features exposed on the palaeosurface adjacent to the palaeochannel have been variously described (Golson, 1977, 1991; Golson & Hughes, 1980). Essentially they consisted of rounded and relatively shallow depressions occurring as either isolated features or inter-cut complexes. There were recurrent feature types, as some of the more defined and deeper depressions were associated with stake holes. Additionally, a number of stone artefacts were collected from feature fills or from the palaeosurface itself. Interpretations of these features as artificial and as evidence of agriculture have been largely based on their purported human origins (Golson & Hughes, 1980: 299) and the inferred chronological and functional associations between the palaeochannel and palaeosurface (Golson, 1982: 56, 1991: 484). Given that the artificiality of the palaeochannel has not been demonstrated, this may have major consequences for the interpretation of the palaeosurface.

Of the trenches excavated with the intention of exposing the palaeosurface, most contained only a few or no features. The only extensive palaeosurface was exposed in block A12b during successive investigations in 1975, 1976 and 1977 (Figs. 7, 8). For ease of description, the features have been grouped into complexes. These complexes each contain multiple micro-topographical, palaeosurface features. Across the exposed palaeosurface between these main complexes were numerous dispersed and discrete depressions.

Three composite, curvilinear or sinuous runnels (A, B and C) were exposed. These were multi-component complexes comprised of deeper basins connected by shallower depressions to form an irregular sinuous or curvilinear feature. Given their linear form, these features have been interpreted as surficial drainage ways. Two complexes comprised of upraised areas defined by surrounding inter-cut depressions (D and E) were exposed. These two complexes were interpreted to have functioned in a similar way to the Phase 2 palaeosurface, i.e., the upraised areas were used for planting water-intolerant crops. These two complexes, however, were neither as integrated nor as regular as their supposed Phase 2 equivalents (as indicated by Golson, 1977; Golson & Hughes, 1980).

The artificiality of the palaeosurface is not self-evident. Although some of the deeper and more defined features appear to have been dug, it is equally plausible on morphological grounds that some represent natural micro-relief. Regular and irregular micro-relief has been

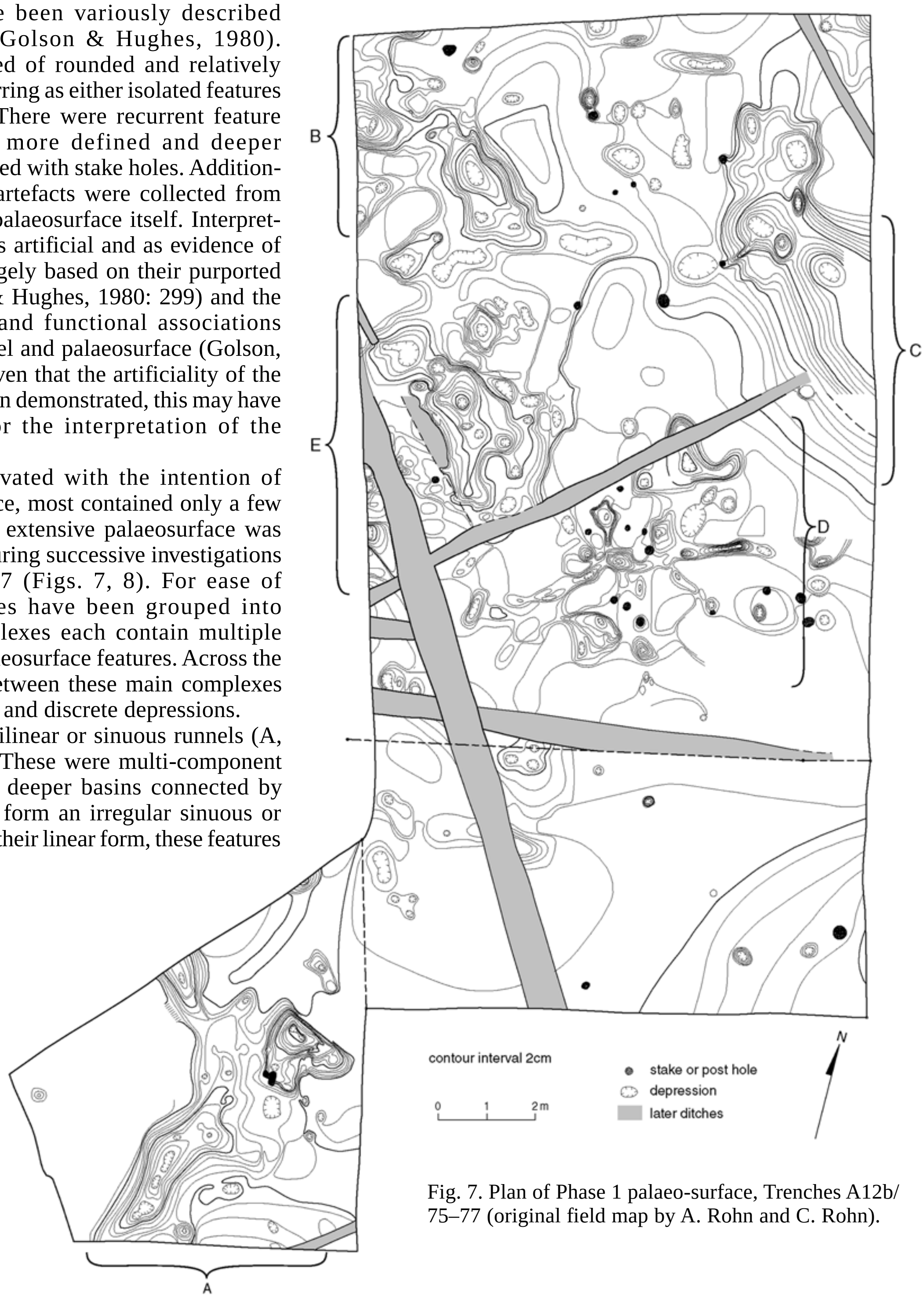

Fig. 7. Plan of Phase 1 palaeo-surface, Trenches A12b/75–77 (original field map by A. Rohn and C. Rohn).

Fig. 8. Photograph of Phase 1 palaeo-surface, Trenches A12b/75–77 (excluding 77–3) (taken by A. Rohn).

documented under grasslands in New Guinea (Bleeker, 1983: 248–258; Sullivan & Hughes, 1991). Even though the same processes may not apply at Kuk, it is plausible that some elements of the palaeosurface relief formed under grassland in wet conditions along a wetland margin. However, the stake holes and artefacts from palaeosurface contexts are definite evidence of a human presence at c. 9,000 B.P. The presence of *Musa* sp. phytoliths (of unknown section) from contemporaneous sediment samples may also represent human activity, although it is not at present known if the bananas were edible varieties or how they dispersed (Wilson, 1985). At present and on the existing evidence, it is not possible to differentiate the anthropogenic and non-anthropogenic components of the palaeosurface or to elicit the prehistoric practices of formation and use. Ongoing sedimentological and palaeo-ecological research by the author aims to enable more fine-grained reconstructions of the past environment and land use of this palaeosurface.

The original interpretation of the palaeosurface as agricultural was largely dependant on the artificiality of the palaeochannel. If the palaeochannel was artificial, then the most reasonable explanation would be for drainage of the wetland margin for the growing of crops. The palaeosurface provided the corroborating evidence for this interpretation, particularly given the analogies to the Phase 2 palaeosurface. However, the current evidence does not justify a claim of artificiality for the palaeochannel, and the mode of formation of some palaeosurface elements is unknown. Thus, it has to be concluded that there is currently insufficient evidence to warrant a claim that the palaeosurface represents former agricultural activities.

Broadening the context

The review of the archaeological evidence for Phase 1 at Kuk has concluded that there is insufficient evidence to determine the artificiality of the palaeochannel and palaeosurface. Consequently, the claims for Phase 1 representing wetland agricultural activities at 9,000 B.P. are not justifiable. However, Golson has relied on multiple lines of evidence to establish a claim for agriculture at c. 9,000 B.P. What do these other lines of evidence suggest regarding the onset of agricultural-type activities in the highlands?

Two types of evidence present themselves: chronological and contemporary. Chronological evidence indicates change through time and includes archaeology, geomorphology and palaeo-ecology. Some forms of contemporary evidence can be used to infer past processes, e.g., contemporary distributions of people, plants and languages. Given limitations of space, it is possible to only draw out the main themes.

Chronological evidence: change through time

There is limited archaeological evidence from the highlands to indicate agriculture at around 9,000 B.P. No other wetland sites contain evidence of such antiquity and the lithic and faunal collections at rock shelters and caves have not provided any clear and well-dated diagnostics of a transition to agriculture (Aplin, 1981; Bulmer, 1966; Christensen, 1975; Mountain, 1991; White, 1972). Potentially, the most significant finds in the highlands have been uncovered at the open sites of NFX (Watson & Cole, 1977) and Wañelek (Bulmer, 1977, 1991), which date to c. 18,000 B.P. and c. 15,000 B.P. respectively. The presence of Late Pleistocene settlements in the highlands may be significant in terms of general assumptions about the association of sedentism and agriculture. However, even if these assumptions are tenable, it is not clear if the structures at these sites represent permanent as opposed to temporary habitation.

Table 2. Selected sites at which palaeo-environmental evidence of major anthropogenic disturbance in New Guinea has been identified. All ages given in uncalibrated radiocarbon years.

site	altitude (m)	commencement (age B.P.)	references
Kelela Swamp, Baliem Valley	1420	pre-7,000	Haberle *et al.*, 1991
Telefomin, Ifitaman Valley	1500	18,000–15,500	
		11,500–8,200	Hope, 1983
Kuk Swamp, Wahgi Valley	1580	pre-9,000	Powell, 1984; Haberle, pers. comm. research in progress
Lake Haeapugua, Tari Basin	1650	21,000	Haberle, 1998
Lake Wanum	35	8,500	Garrett-Jones, 1979
Lake Hordorli	780	11,000	Hope & Tulip, 1994
Kosipe Swamp	1960	c. 30,000	Hope & Golson, 1995
Lake Ijomba	3720	c. 11,000	Hope, 1996

The palaeo-ecological record, largely palynological, is more comprehensive. Several locations across New Guinea show periods of disturbance and firing in the Late Pleistocene and Early Holocene. Major clearance events have been documented for several large, inter-montane valleys along the highland spine of New Guinea, as well as for some higher and lower altitude sites (Table 2). The human origin of these disturbances can be inferred from the long-term decline in primary forest and concordant rises in secondary forest, grassland and charcoal frequencies (Haberle, 1994).

The most significant records are from Kuk. Powell's pollen diagram shows gradual increases in charcoal with minor disturbance of the primary forest from the Late Pleistocene until the beginning of the Holocene (Powell, 1980, 1984). Haberle's work on an early Holocene sediment sequence documents a change at c. 9,000 B.P. (Haberle, in progress). The change constitutes a decline in primary forest species and their replacement by a mosaic of secondary forest, swamp forest and open grassland. A peak in burning at this time suggests that the vegetation change was anthropogenic and driven by fire. At this time of increasing temperatures and wetter conditions, forests would be expected to be expanding at the expense of grasslands (Hope, 1989). These anthropogenic transformations are regional and can be traced in the pollen diagrams from Ambra Lake and Draepi, which register dramatic changes in the vegetation between the Late Pleistocene and mid-Holocene (Powell, 1970, 1981).

Palynological research provides corroborating evidence for previous interpretations that grey clay deposition represents sustained forest clearance for dryland agriculture at 9,000 B.P. (Golson, 1991; Golson & Hughes, 1980; Hughes, 1985). The deposition of grey clay marked a dramatic increase in erosion rates within the catchment (Hughes *et al*., 1991). Taken together, the palynological and geomorphological records are clear evidence of major transformations of the dryland environment within the Kuk catchment from c. 9,000 B.P.

The presence of Late Pleistocene settlements and the widespread anthropogenic alteration of dryland environments in the highlands from this time suggest a major prehistoric trajectory in the interaction between people and their environment. Given the inference that people were oriented more towards plants than towards animals at this time (White, 1996), and possibly from initial settlement (Groube, 1989), these major environmental transformations were probably associated with crop production. With time and continued disturbance, people became more and more dependent on an anthropogenic landscape for their subsistence. Within this context, a scenario can be envisaged from which an "agricultural" relationship between people and their environment emerged.

Contemporary evidence: inferring the past from the present

Recent research in plant genetics has opened up new possibilities for the interpretation of plant, domesticate and agricultural origins in the Pacific. Approximately 25 years ago, at the time that the major archaeological and palaeo-ecological investigations were being undertaken in the Wahgi Valley, it was believed that many of the potential staples for prehistoric agriculture were imported domesticates from Southeast Asia (Yen, 1973). In the light of new biomolecular evidence, and occasional archaeological verification, a number of these crops are now interpreted as having been either first or independently domesticated in Melanesia (Haberle, 1995; Lebot *et al*., 1994; Lebot, 1999; Matthews, 1991). Plants relevant to an understanding of agriculture at c. 1500 m altitude include taro (*Colocasia esculenta*), the greater yam (*Dioscorea alata*) and Eumusa bananas (*Musa* spp.). Although the timing of domestication is unknown, the potential availability of these major staples to food producers in New Guinea makes the possibility of highland agriculture more plausible.

The potential domestication of these crop plants in Melanesia makes Bellwood's edge-of-the-range hypothesis more applicable to the New Guinean context (e.g., Bellwood, 1996). Bellwood has proposed that agriculture may have developed in regions at the end of the last glacial cycle that were at or close to the ecological limits of utilizable plants. Given colder temperatures in the highlands at the end of the Pleistocene, a range of potential crops including taro, bananas and sugarcane (*Saccharum officinarum*) would have been at their altitudinal limits during this period (Haberle, 1993: 299–306; after Bourke, n.d.). The stresses upon these plants during any climatic fluctuations during this period necessitated increased human intervention to maintain yields. The increased levels of intervention potentially led to the development of agricultural practices. Such environmental forcing may well explain the documented, increased intensity of human disturbance within the Baliem and Wahgi valleys in the Early Holocene (Haberle, *et al*., 1991; Haberle, pers. comm. and research in progress). Haberle's position, however, contrasts with Yen's conclusion that the majority of utilizable plants were originally found in the lowlands (Yen, 1995). According to Yen, crop plants adapted to higher altitudes as a result of agronomic selection. Irrespective of the ultimate location of domestication, either lowland or highland, the likely presence of these potential crops frees an indigenist perspective on agricultural development in New Guinea from a dependence on introduced Southeast Asian crops and techniques.

Drawing on the association between agriculture and large linguistic groupings, Pawley has proposed that the distribution of Trans New Guinea Phylum (TNG) languages, which cover most of New Guinea today and include the majority of its languages, was driven by agriculture (Pawley, 1998: 684). According to his speculative model, groups with agriculture were able to expand and displace or assimilate other non-agricultural language groups. With time this led to the demic diffusion of proto-TNG agriculturalists at the expense of non-pTNG and non-agricultural populations. These latter populations were marginalized into the least favourable, lowland locations. This model appears to fit recent language maps for New Guinea, although there is insufficient published human biological evidence to corroborate the linguistic evidence. Although there may be many problems with the details of Pawley's general model, it is a plausible working hypothesis worthy of future investigation.

In summary, multiple lines of evidence seem to enable a proposition of independent agricultural origins in New Guinea. Geomorphological and palaeo-ecological evidence suggest that this may have occurred as early as the Late Pleistocene/Early Holocene. At present, however, there is no archaeological evidence for such an early presence of agriculture in the highlands or the lowlands.

Long-term agricultural trajectories: an open possibility

The archaeological evidence does not support claims of an agricultural origin for the palaeochannel and palaeosurface dating to c. 9,000 B.P. at Kuk. Rather than thereby dismiss such an antiquity for agriculture in New Guinea, it is proposed, following the line of argument of Golson and Hughes, that the palaeo-ecological and geomorphological changes witnessed at Kuk at this time mark the widespread clearance and utilization of the dryland landscape for productive purposes. Removing the ambiguous wetland archaeological evidence for Phase 1 at Kuk from the debate of agricultural origins in New Guinea shifts the focus of research to an explication of the productive practices occurring within the catchment and at the wetland margin during and after this period.

In recent years, the definition of agriculture has been decoupled from plant domestication (Harris, 1996; Hather, 1996; Ingold, 1996; Spriggs, 1996), and has been grounded according to scale, level of dependence or relative scope of human involvement. If such a decoupling is valid, then disturbance of inter-montane environments in New Guinea in the Late Pleistocene/Early Holocene, almost certainly to enhance food production from plants, is akin to "agriculture". At present the direct archaeological, sedimentological and archaeobotanical remains of these past practices and past crops have not been identified.

Over forty years after Bulmer excavated at Yuku and Kiowa rock shelters, the origins of agriculture in New Guinea remain elusive. This is not surprising, as the emergence of something "agricultural" from preceding crop production strategies, using Harris' (1996) terminology, may be difficult to trace in the New Guinean context. Certainly later agricultural practices do leave clearer traces in the wetlands, but those of earlier and emergent practices are not likely to be so definitive. The transformations of the inter-montane valleys in the Late Pleistocene and Early Holocene require explanation and are likely to signify the emergence of practices akin to agriculture, both in terms of their effects on the landscape and the dependence of people upon them for their subsistence.

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Settlement History and Landscape Use in Santo, Vanuatu

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ABSTRACT. Preliminary results of an archaeological investigation of the northwest coast of Santo Island in Vanuatu are presented. They indicate the possibility that wet taro gardening correlated with the use of oven stone cooking technology in some coastal rockshelters extends back some 1,000 years.

GALIPAUD, JEAN-CHRISTOPHE, 2004. Settlement history and landscape use in Santo, Vanuatu. In *A Pacific Odyssey: Archaeology and Anthropology in the Western Pacific. Papers in Honour of Jim Specht*, ed. Val Attenbrow and Richard Fullagar, pp. 59–64. *Records of the Australian Museum, Supplement* 29. Sydney: Australian Museum.

In 1996 I started a research project on the prehistory of Santo, the largest island of Vanuatu, which began with field survey and test excavations in two rock shelters (Malsosoba 1 and 2). This project focused on subsistence strategies on the western, mainly mountainous part, of the island. The settlement chronology of the high northern islands of Vanuatu is very little known apart from the recent work done by Bedford in Malekula (Bedford, 2000). It was anticipated that in a rugged and hardly accessible part of the countryside any evidence of human presence would not only reflect the final expansion of ancient populations, but also indicate the introduction of important activities such as irrigated gardening, pig husbandry or stone oven technology.

Preliminary results showed that an important part of the archaeological material found on surface sites along the coast of Santo (Galipaud & Walter, 1997) was a pottery with stylistic similarities to Sinapupu ware of Tikopia in the Solomon Islands, which is around 2,000 years old (Kirch & Yen, 1982). This pottery, however, could not be dated in Santo. The general survey was completed in 1997 with further excavation in Malsosoba 1 rockshelter at the northern end of Cape Cumberland. This shelter is located at the edge of a large irrigated taro pondfield and the results of the excavation are used to discuss the chronology of irrigated taro gardening in this area.

Location

The rockshelters Malsosoba 1 and 2 are on the north end of Cape Cumberland, the northern-most part of the west Santo coast (Fig. 1). This area, surrounded by open sea, is an old coralline uplifted structure, which was once a reef at the base of the high volcanic chain of west Santo. Several flat terraces reveal the uplift history of the region. The maximum altitude is about 300 m. The only village in this area is Hokua, about 3 km northwest of the shelter. Irrigated gardens extend over several hectares in the vicinity of the two rockshelters and remnant garden systems are witness to irrigated taro gardening which once extended up to a few meters away from the shelters' entrances.

The shelters are close to the coast, about 10 m above the Naturtur River. Fossil terraces near the shelters are now too high for irrigation as a result of recent uplifting. The rate of uplift (determined from the dating of uplifted coral reefs, Jouannic *et al*., 1980; Gaven *et al*., 1980) is between 2.2 and 4.6 mm/year in this area.

Fig. 1. Location of archaeological sites on Santo, Vanuatu.

The main shelter (Malsosoba 1) is formed by an overhanging large coral block that broke loose from the main uplifted coral terrace. It provides a sheltered area, open to the west, about 20 m long by not more than 2 to 4 m wide, of which two-thirds is high enough for human habitation. The shelter floor is a flat, black, sandy soil that shows evidence of a casual use in the form of ashes from fireplaces, piles of cooking stones, and scatters of coconut palms (Fig. 2).

Another small shelter, Malsosoba 2 (about 30 m to the south of Malsosoba 1) is a round cavity about 6 m in diameter. The shelter floor is a dark rich humic deposit which has been levelled and is retained by a surrounding stone wall. The area immediately beneath the entrance is covered with fossil irrigated gardening terraces and the nature of the sediment inside the shelter suggests that terraces once extended inside it. The stone wall surrounding the shelter is of the same type as the retaining stone terrace

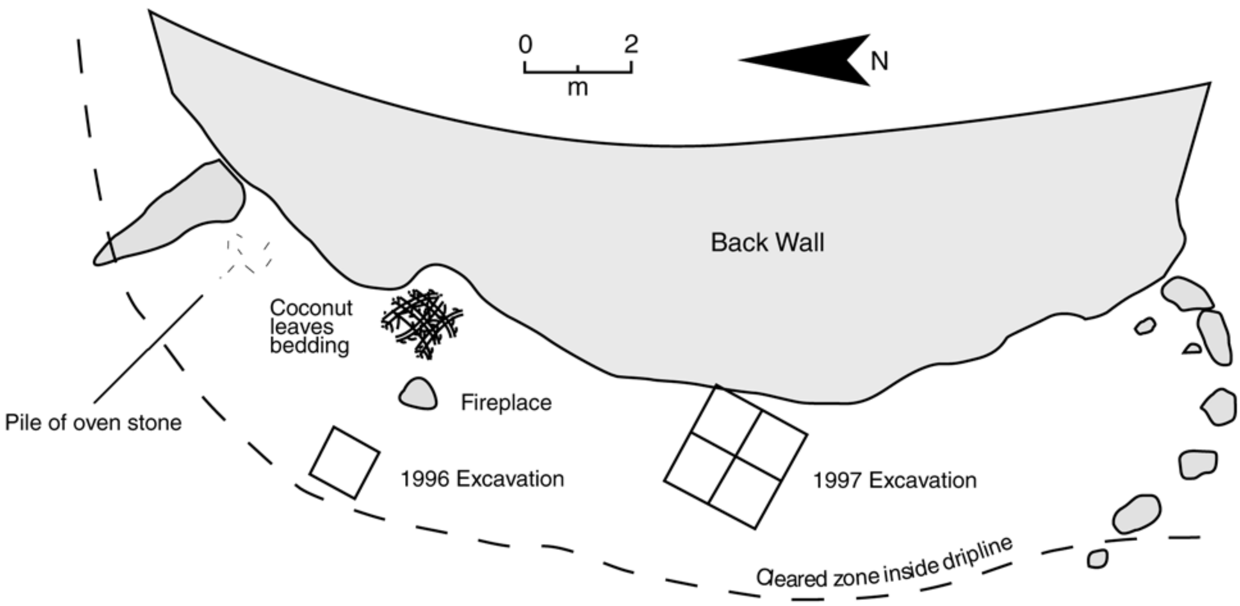

Fig. 2. Plan of Malsosoba 1 showing surface organization with location of excavated areas.

walls in the pondfields. A heap of volcanic stones from a stone oven as well as coconut palm bedding indicates that this place has been used recently. The ground in front of both shelters slopes down rapidly towards the mouth of the Naturtur River 10 m below. The entire slope is terraced.

Vegetation is typical of a low coralline environment (*Pandanus* sp., *Ficus* sp.) with an important component of introduced coconut, orange and mango trees, as well as breadfruit trees.

Excavation methods and results

In 1996, one square meter test-pits were excavated in Malsosoba 1 and nearby Malsosoba 2. The stratigraphy in Malsosoba shelters 1 and 2 revealed about 0.6 m of archaeological deposits, mainly burned stones and ash lenses from oven activity with a few faunal and plant remains and pottery.

Radiocarbon ages for the basal layers in the 1996 test-pits (Table 1) show that Malsosoba 1 was first occupied at the end of the first millennium A.D., probably at a time when the shelter had not yet uplifted to its present altitude. The recent date associated with the basal layer in Malsosoba 2 probably provides an indication of the cessation of gardening activity in this area of terraced gardens due to uplift and the consequent difficulty of re-establishing a water source.

In April 1997, a 2 by 2 m area was excavated in the eastern end of Malsosoba 1, close to the back wall (Fig. 2). This area was chosen because there was no evidence of recent use on the surface and because the ceiling height allowed for comfortable habitation. Excavation of the deposit followed as much as possible the natural strata and the eight spits were later grouped into three layers reflecting the depositional history. All sediments were dry sieved using a fine mesh screen (2 mm). All cultural remains were retained (apart from large stones which were drawn on plan), sorted, identified, measured and counted.

Table 1. Radiocarbon ages.

site name	sample ID	^{14}C age B.P.	$^{13}C/^{12}C$ ‰	conventional age B.P.
Malsosoba 1	Beta-98570	1,150±80	–27.4	1,110±80
Malsosoba 2	Beta-97558	350±60	–25.3	340±60

Stratigraphy of Malsosoba 1. The stratigraphy of Malsosoba 1 (Fig. 3) has been largely influenced by past human activity in the shelter, mainly cooking.

The surface (layer 1) is a brown loose organic deposit a few centimetres thick due to recent deposition of organic matter in the shelter. Some pottery sherds, a pig tusk, and a few bones were found on or in this layer.

Beneath layer 1 are several grey to white compact ashy lenses (layer 2) which appear thicker and better preserved towards the back wall. The lenses might be associated with the scattered heap of cooking stones in the eastern end of the shelter.

A grey-brown humic sandy layer (layer 3), 20 to 40 cm thick, is the main deposit. This humic sediment is linked with a strong human gardening activity in the nearby surroundings or with a more important vegetation cover near the shelter. Large stone oven features were found in this layer. A radiocarbon age of 1,110±80 B.P. (Beta 98570) for the base of layer 3 was obtained from large charcoal chunks associated with a small oven in test pit 1 (Table 1).

Grey and white sandy natural deposits with rounded volcanic and coral pebbles attest to the time when this shelter was at sea level and adjacent to the river. These natural alluvial sediments do not contain any cultural remains, with the exception of a few pottery sherds which might have migrated from the upper layers (see below for discussion).

The stratigraphic sequence suggests that the initially marine and fluvial environment of the shelter was, following uplift, affected by intermittent human activity, the latter evidenced by ashy lenses and scatters of burnt stones and stone fragments within the shelter.

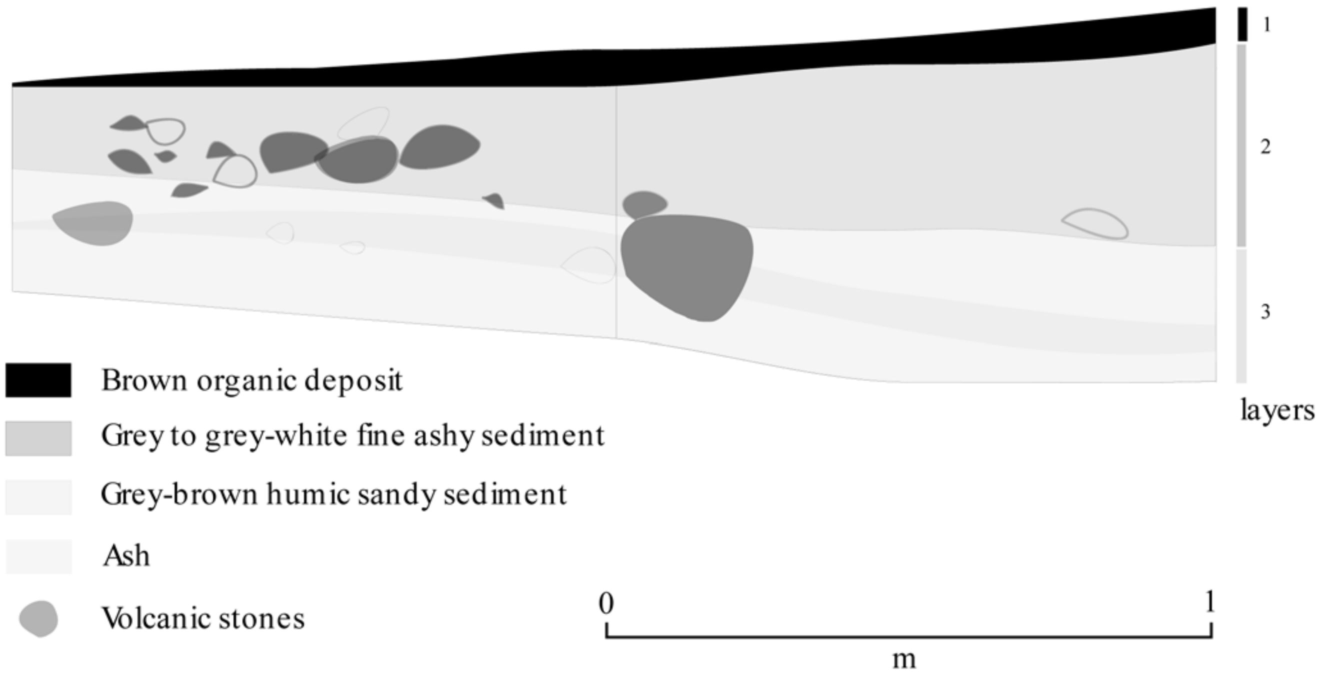

Fig. 3. Stratigraphy of west section of Squares L1 and L2 in Malsosoba 1.

Material from Malsosoba 1. Less than five pottery sherds were collected together with some shell beads which are probably from a necklace. The sherds are small and of a type made in a few villages along the coast up to the beginning of this century. Bone is also rare, and part of the collection may be of natural origin rather than brought into the shelter by humans (D. Steadman, pers. comm.). This is especially true for the rat bones and crab exoskeleton; the amount of fish bone and its recovery from all layers might be a result of the very fine mesh used for screening. The distribution of archaeological material in the excavated layers is shown in Table 2 (as most of the recovered bones weighs less than one gram, relative abundance in each square has been indicated by asterisks: one asterisk means present in one square only, four asterisks means present in all squares).

Plant remains are dominated by about nine woody species, four of which are common throughout the collection. The more common include mangrove (*Rhizophora, Bruguiera*) and among the less common species are *Pemphis acidula* and *Tespesia*. Non-woody species include one palm tree (*Metroxillon*?), a few endocarps which are probably from *Canarium* and *Barringtonia* and burnt food remains which include *Cordyline* or *Araceae* (taro) (Eric Pearthree, pers. comm.).

Table 2. Distribution of archaeological remains in Malsosoba 1. Increasing numbers of * indicate increasing levels of abundance.

archaeological remains	Spit 1 Layer 1	Spit 2	Spit 3 Layer 2	Spit 4	Spit 5 Layer 3	Spit 6
land fauna						
Sus sp.	**	*			*	
Pteropus sp.	*	***	**	*		
Rattus sp.	***	**	****	***	**	**
marine fauna						
fish	****	****	***	****	***	****
crab	***	****	****	****	****	***
oursin					*	*
birds						
land	**		**	****	*	
reptiles						
lizards	**	*	*	**	**	**
snakes		*	*	*	**	**
unidentified fauna				*		
artefacts						
pottery	**		**	*		
beads	*	**	****	***	*	*

Discussion

The initial date of the basal cultural layer in Malsosoba 1, the known rate of uplift, and present altitude of the shelter suggest a rapid human use of the area once it was beyond the influence of the Naturtur River. The numerous stone features, the appearance of burnt remains of *Cordyline* or *Araceae* (taro) together with the scarcity of other cultural material, suggest that Malsosoba 1 was occasionally used as a kitchen to cook tuberous foods in a stone oven, a practice that is still in use today in some nearby shelters close to taro gardens.

The most prominent features within the excavated area are the large numbers of burnt stones. The size of the stones (between 2 and 10 cm but occasionally up to 15 cm) and their distribution, as well as the occurrence of ash and charcoal, allow tentative identification of several large clusters and some smaller scatters (Fig. 4). Three large clusters of stones are located in squares K2 (feature 6), L2 (feature 7) and L1 (feature 1). One round depression without stones but with an abundance of charcoal and ash in the southern corner of square L1 (feature 5).

The stone structures identified during the excavation are either ovens or features associated with stone oven cooking.

In the four excavated squares, there are at least two stone ovens. One is composed of features 1, 2 and 5, which are features generally recognized as being associated with stone ovens (Green, 1979). This layout suggests that this oven was left with the intention of further use. The second structure consists of a well-arranged stone heap (feature 7) and probably a hollowed out area with stones and charcoal (feature 6). However, it is not possible in this case to be sure that both features belong to the same oven. Feature 6 has all the characteristics of a complete uncleaned oven, including the number of stones found in and around it. There is no direct evidence of a chronological sequence, and at the moment we could assume that these ovens were used during the same period. This may have been about one thousand years ago as indicated by the radiocarbon date from charcoal in another small oven in nearby Test Pit 1.

Today, there is a strong correlation between stone ovens found on the surface of several rockshelters and adjacent currently worked taro gardens in the vicinity of Malsosoba 1, but on the other side of the Naturtur River. These shelters are still used occasionally as places in which to rest and cook tubers while working in the taro pondfields and, as in Malsosoba 1, do not contain any other human traces than those occasioned by use of stone ovens. The presence of buried oven stones as well as burnt food remains in Malsosoba 1 thus suggests that irrigated taro gardening was already practised in the area a thousand years ago. It does not however preclude an earlier use of this practice further inland along the same river, where several ancient taro terrace systems have been located. They are, however, difficult to date. The dating of charcoal in a stone oven in Malsosoba 2 further indicates that irrigated taro gardening was still in use about 300 years ago when uplifting damaged the water channel.

The pottery found in Malsosoba 1 is of the type known ethnographically in the area. Several pottery production centres are known along this coast and pottery was probably made in the northwest area up to the beginning of this century. It is still made on the southwest coast in a village named Wusi (Speiser, 1990[1923]: 232).

Sherds of another pottery style were collected on the surface in many coastal and some inland areas during the initial survey (Galipaud & Walter, 1997). This pottery is characterized by a smooth red slip applied over the whole exterior of the pot with the exception of the incised-decorated surfaces. The incised decorated area thus comes out as a lighter spot on a darker background (the slip being applied like paint rather than a traditional slip). A similar type of decoration is described from Tikopia during the Sinapupu phase and has also been found in the Banks Islands and Ambae (Galipaud, 1996). This pottery is found in large quantities on the northwestern coastal area of Santo and, in a very few instances, on higher locations up to 1000 m a.s.l. on the main ridges of the west Santo volcanic chain. It has not been possible to date its appearance in Santo as no stratified site has been discovered yet. The only chronological evidence, from Tikopia, places the Sinapupu ware at the beginning of the first millennium A.D., that is, almost 2,000 years ago (Kirch & Yen, 1982). This could be an acceptable estimation for Vanuatu as this very specific red-slipped and incised pottery is not present in recent or traditional sites, but such an hypothesis will need to be confirmed by securely stratified finds in datable contexts.

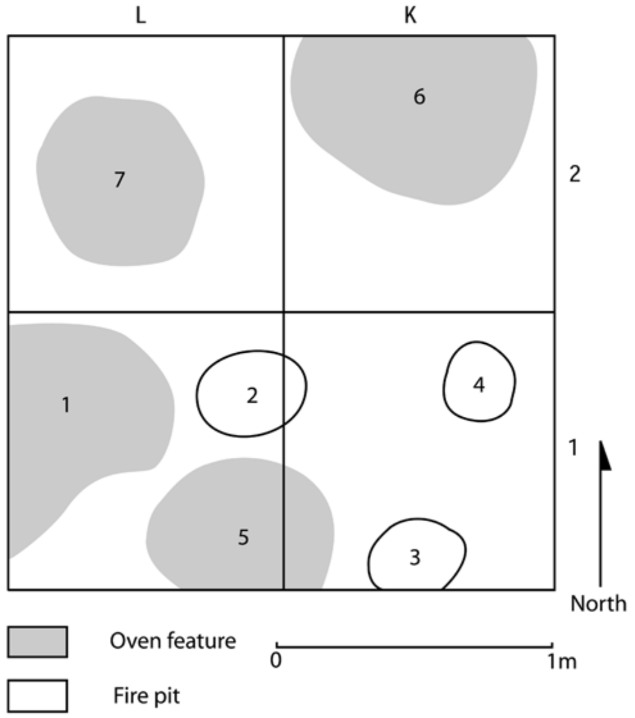

Fig. 4. Drawing of excavated stone features Squares L1 and L2 in Malsosoba 1.

There are very few archaeological sites dating from the first millennium A.D. in the high northern islands of Vanuatu and it is difficult to accept such an antiquity for predominantly surface deposits. The mineralogical composition of the Sinapupu ware from Tikopia points to its origin being a volcanic island in the Vanuatu chain (Dickinson, in Kirch & Yen, 1982). However a recent analysis of the mineralogy of the Santo red-slipped pottery demonstrates the local origin of this pottery (Dickinson, 1997, 2001) and rules out an identical origin for the Sinapupu ware from Tikopia which could have been imported from Vanikoro or the Banks Islands (Dickinson, 1995).

Conclusions

Remains of an early occupation along the west coast of Santo are very scarce probably because of the rugged and steep environment. The succession of tectonic uplifting in this area provides landmarks for understanding human adaptation and use of this coast.

Excavations in the Malsosoba rockshelters show that from the end of the first millennium A.D., i.e., just over one thousand years ago, large irrigated taro gardens may have been in use near the coast and most probably along the permanent water streams. There is no evidence at the moment for earlier pondfield gardening in the area. There is a strong correlation in present-day Santo between irrigated taro gardening and stone oven technology which may be in evidence archaeologically at Malsosoba. Our knowledge of ancient cooking practices in Vanuatu is still very limited, and the antiquity of the stone oven technology used today is hypothetical. Future study will try to date the appearance of stone ovens, discuss the possible evolution of the technology, and test the hypothesis of a correlation of its use with irrigated taro gardening activities.

Several years of surveys and recent excavations in the Hokua region on Santo have enhanced our understanding of the prehistory of the high islands of north Vanuatu. It is now established that initial settlement occurred early during the first millennium B.C. in most coral islands of Vanuatu. However, there is no evidence of permanent settlements on high volcanic islands prior to the beginning of the first millenium A.D. (Bedford, 2000; Bedford *et al*., 1998; Galipaud, 1996; Ward, 1975).

On stylistic grounds, the incised and partly red-slipped pottery of the west and northwest Santo area is similar to the Sinapupu pottery from Tikopia but this is not sufficient to infer that the Santo "Sinapupu" is as old as Tikopia Sinapupu seems to be. If the Santo ware is more recent there is no archaeological evidence for a settlement of the west coast prior to the first millennium A.D. when pottery production and irrigated taro gardening developed rapidly wherever the local environment allowed.

ACKNOWLEDGMENTS. The initial surveys of the west and northwest coasts of Santo were made between 1992 and 1996 with the Team of the Vanuatu Cultural and Historic Site Survey. Jim Specht's pioneering work in the Pacific in the early 1970s also took him to Vanuatu. During a short stay in Tanna, one of the most beautiful islands of Vanuatu, Jim again demonstrated his ability to find archaeologically important places—this time the first stone engravings ever found in the southern Vanuatu islands. The more archaeologically focused survey of the northwest area in 1996 was conducted with Paul Gorecki. Yoko Nojima, a student from the Anthropology Department of the University of Hawaii at Manoa, gave valuable help during the archaeological excavation of Malsosoba 1. Dave Steadman, Florida Museum of Natural History, kindly made the faunal identifications. Eric Pearthree, Centre de Recherche et d'Etudes Oceaniennes (CREDO), Marseilles, France, identified the plant remains. Mike Carson, International Archaeological Research Institute, Hawaii, corrected the initial draft.

During the archaeological fieldwork the whole community of Hokua made every effort to facilitate the work and make our stay as comfortable as possible. Thank you all, especially Mao, Runa, Ripaï, David, Wora, Emile, Matthias, Pala, Kevin and all those who shared the work in the shelters. Aldi Ezekiel, the Vanuatu Cultural Center fieldworker for the West Santo area has shared this work and guided me during all these years. Thank you Aldi.

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A Century of Collecting: Colonial Collectors in Southwest New Britain

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ABSTRACT. The study of material culture has waxed and waned in importance in anthropology, unlike archaeology where it has always been central. However, much of the anthropology carried out on the south coast of New Britain has concerned the collection of material culture. We survey a century of collecting on the coast ranging from the large, well-organized expeditions of the German period, through a number of individual collectors both amateur and professional from the German period to the Second World War, and we finish with the more minor forms of collecting taking place in the quite different political climate after the War. We show that the study of past collections can throw light on a number of histories: the biographies of individuals, both local and colonial, the histories of institutions and disciplines, and the history of change along the south coast of New Britain itself.

KNOWLES, CHANTAL, & CHRIS GOSDEN, 2004. A century of collecting: colonial collectors in southwest New Britain. In *A Pacific Odyssey: Archaeology and Anthropology in the Western Pacific. Papers in Honour of Jim Specht*, ed. Val Attenbrow and Richard Fullagar, pp. 65–74. *Records of the Australian Museum, Supplement* 29. Sydney: Australian Museum.

The first archaeologist to carry out systematic research on the south coast of New Britain was Jim Specht, but, as he was aware, he was part of a longer tradition of research and collecting. We review collection practices in this region by looking at collectors who visited between the 1880s and 1990s (Table 1). This is one area of Papua New Guinea where material culture has always been the focal point of study, linking anthropological and archaeological work. We focus on the south coast of West New Britain, between the Arawe Islands and Kandrian—often known as the Arawe region.

Objects in common use on Arawe today include women's ornaments (turtle-shell armbands and earrings, hair ornaments, necklaces, and grass skirts); men's ornaments (earrings, pig's-tusk, cassowary-quill belts and barkcloth belts), and bags once common attire but recently only used in ceremonies (Fig. 1). Spears and shields are now only used for ceremonies, and stone axes, adzes and obsidian all went out of use early in the twentieth century. Wooden items range from out-rigger canoes to bowls exchanged in bride-price which are used for making sago pudding (*sapela*); these are made or bought from Siassi Islanders at the western tip of New Britain. Other containers include coiled-cane baskets also from the western end of New Britain, clay pots from the north coast of New Guinea and local coconut-leaf baskets. Nets of various shapes are used for catching fish, birds or pigs and some people still make looped vine-string bags. Exchange items include shell money, *mokmok*

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Table 1. Collectors in southwest New Britain.

collector	post	collection dates	number of objects	museum(s)
Richard Parkinson (1844–1909)	German New Guinea Resident, employee of Forsayth & Co. and amateur ethnographer	1897	38	Museum für Völkerkunde, Dresden
		1899–1909	56	Field Museum of Natural History, Chicago
Phebe Parkinson (née Coe) (1863–1944)	Wife of Richard, employee of Forsayth & Co.	1913	19	Museum für Völkerkunde zu Leipzig
Bruno Mencke (1876–1901)	Leader and financier of "Erste Deutsche Südsee Expedition"	1900	?<100	Niedersächsiches Landesmuseum, Hannover
			117	Berlin Museum für Völkerkunde
		1900–1901	116	Linden-Museum, Stuttgart
Hamburger Südsee Expedition (1908–1910)	Multi-disciplinary expedition initiated by Hamburg Museum	1908–1909	450	Hamburg Museum für Völkerkunde
Ferdinand Hefele	Ship's 1st Officer *Peiho* HSE	1908–1909	40	Linden-Museum, Stuttgart
Wilhelm Wostrack	Government Officer German New Guinea	1909	8	Linden-Museum, Stuttgart
Hermann Schoede	German Curio Collector	1909	180	Berlin Museum für Völkerkunde
Albert Buell Lewis (1867–1940)	Curator and Anthropologist	1910	330	Field Museum of Nat. Hist., Chicago
Felix Speiser (1880–1949)	Curator and Anthropologist	1930	110	Museum der Kulturen, Basel
John Alexander Todd (1911–1971)	Anthropologist	1933	245	Australian Museum, Sydney
W.E. Guinness, Baron of Moyne (1880–1944)	Traveller and Curio Collector	1935	8	British Museum, London
			1	Pitt Rivers Museum, Oxford
Beatrice Blackwood (1889–1975)	Curator and Anthropologist	1937	275	Pitt Rivers Museum, Oxford
Jim Specht (1940– …)	Curator and Archaeologist	1979	11	Australian Museum, Sydney

(perforated stone discs) and the all-important gold-lip shells. Pandanus mats and capes are made and exchanged locally. These objects are created by and help create social relations, local and long-distance. Both objects and relations have changed considerably over the last century.

Although our focus begins with the inception of the formal colonial period, we are aware that objects were collected from New Britain and the Arawe region before this date, but none have come to our attention. Residents, such as the Reverend George Brown on the Duke of York Islands (from 1875 to 1880), must have had an impact as they participated in the trade of items from the region (Gardner, 2000).

The following chronological survey is divided into three sections: collections made during the German colonial period before World War I; those made in the inter-war years (1914–1939); and those made after World War II. Much of the detail of these collections has been discussed in earlier publications (Buschmann, 2000; Gosden & Knowles, 2001; Knowles *et al.*, 2000; O'Hanlon & Welsch, 2000; Specht, 2000). The purpose of such an overview in this context is not merely a "who was who" regarding collecting in the region but a means of exploring the actions and motivations of individual collectors in each of the three colonial government phases in the Territory. By summarizing collecting in each of the various phases of colonial rule, we show exactly how wider economic and political factors influenced the aims and work of individual collectors.

Most collectors undertook their fieldwork at Kandrian and the nearby islands, where one of the first plantations (Aliwa) was situated. In addition, the bay of Kandrian allowed good access to yachts and steamships. To the west, the Arawe Islands, also with a plantation (Arawe) founded in the early colonial period, proved a favourite port of call for visitors and traders.

German colonial period

The German Colonial period (1884–1914) was characterized by three types of collector: the long-term resident, the government resident, and the visitor, whether amateur or academic, who came to do research and make an ethnographic collection. We examine the collecting activities of thirteen individuals and show that this was truly a "golden age" of collecting.

The long-term residents. The first group to make collections included Richard and Phebe Parkinson, and Isokichi Komine. Only Richard Parkinson was of German nationality, Phebe was Samoan-American and Komine Japanese. They were in the colony because of commercial opportunities and not through any formal link with the German colonial government. They were "frontier" collectors and settled on the mainland of New Britain in 1884, prior to the German colony being well established.

Richard Parkinson became famous as an amateur ethnologist and collector through his authorship of *Dreizig Jahre in der Südsee* (1907) and other works (Meyer & Parkinson, 1894, 1900; Parkinson, 1887, 1889, 1895). With his wife Phebe, he had a major impact on the Arawe region (Specht, 1999, 2000). Richard Parkinson's initial collecting was linked to his commercial interests, but profit-making was secondary to his intellectual pursuits. He had intellectual aspirations and wished to become more than a supplier of items to institutions. As a keen amateur ethnographer, he documented the culture and people around him by photographing them, collecting objects and writing notes on various aspects of the culture. He gave objects and photographs to overseas institutions to create and maintain links with leading anthropologists and curators (Forward to Parkinson, 1907). At his home in Kuradai, Parkinson also amassed his own personal collection, which he eventually

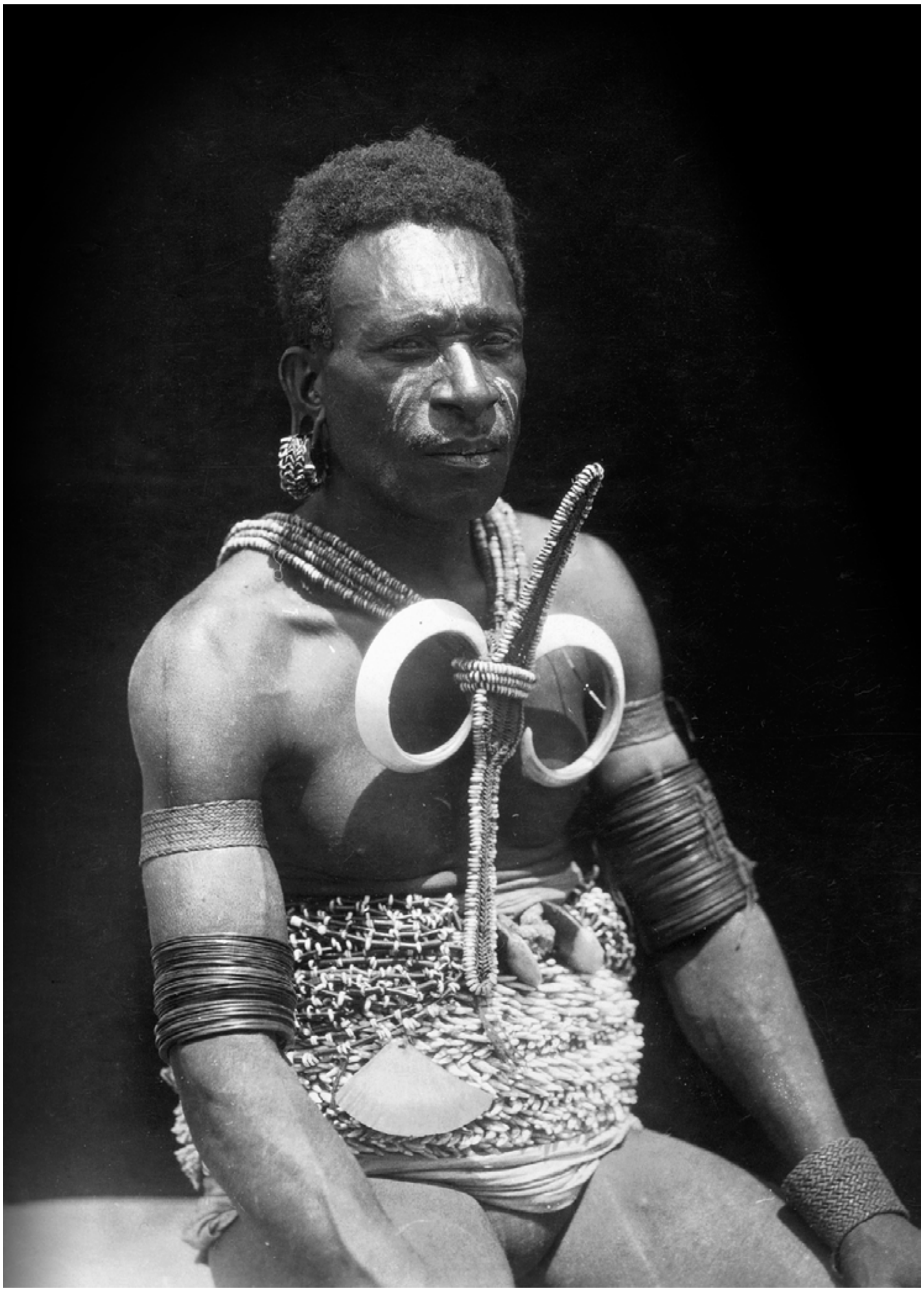

Fig. 1. "Big man" (Luluai Arulo of Kaleken village) wearing his wealth. Around his neck hangs a pig's-tusk ornament, the tusks are of high quality each forming a near complete circle. Around his waist, over the barkcloth belt, are many strands of dogs'-teeth belts and strings of cassowary quill and nassa-shell beads. Nestled amongst these strings are two *mokmok*. The man also wears turtle-shell earrings and armbands and several woven arm and wrist bands. Scarification on his face has been highlighted in white, a common device used when photographing a subject with scarification. Taken by H.L. Downing at Gasmata, sometime during his career as a patrol officer between 1922 and 1937. Photo PRM BB.P.14.13, courtesy of Pitt Rivers Museum, University of Oxford.

sold to the Field Museum of Natural History, Chicago, in 1909. Specht (1999) estimates that Parkinson must have sold or donated more than 10,000 artefacts. Only a few were from southwest New Britain, including 38 sold to the Museum für Völkerkunde, Dresden, in 1897, and 56 items in the Field Museum, Chicago.

Phebe Parkinson's role in her husband's collecting exploits is rarely acknowledged. However, two women, Lillian Overell (1923) and Margaret Mead (1960), afford us a glimpse. We know that Phebe was fluent in *tok pisin*, the lingua franca, and Tolai, and acted as both translator and secretary to Richard (Overell, 1923: 178). She took over much of the commercial work to give her husband the time to pursue his research. Phebe understood the wishes, desires and criteria of those requesting collections. After her husband's death in 1909, visitors and institutions continued to draw on her expertise. However, Phebe's assets were gradually depleted and her plantation was expropriated in 1922. During this period, Phebe sold 19 objects from southwest New Britain to Karl Safert at the Museum für Völkerkunde, Leipzig.

Isikochi Komine, a Japanese merchant, also spent most of his life in the colony. He lived in the Pacific from 1890 and in the Bismarck Archipelago from 1902. Komine collected approximately 3000 ethnographic artefacts including about 40 items from southwest New Britain. In 1911 A.B. Lewis (see below) negotiated the purchase of the collection and it was subsequently registered as part of the Lewis collection at the Field Museum. The collection contained many "duplicates" and Lewis set aside 402 objects for exchange with the Australian Museum, Sydney (Welsch, 1998, vol. 1: 425). It was said at the time that the collection held few fine pieces, but Komine obviously took pride in his personal collection on display around his home at Ponan, making it look like "a small ethnological museum" (Berghausen, 1910: 36 quoted and translated in Welsch, 1998, vol. 1: 425).

The government officials. Various colonial officials left collections to German museums documenting their own relations with the Territory. From 1889 to 1914 an imperial law required that all collections made by Germans in the colony on State business be offered to the Berlin Museum für Völkerkunde. Enraged by this draconian law, museum curators in other German cities tried to independently secure collections. A system of rewards was set up to attract individuals to collect for their museum, and it relied on patronage, medals and personal contacts (Penny, 1998).

The largest collection of Arawe items from a colonial officer was made by Wilhelm Wostrack. Born in Stuttgart, Wostrack arrived in the early 1900s and worked first in the Admiralties before being appointed District Officer at Namatanai Bay in New Ireland (Hahl, 1980 [1937]: 111–112). In 1904 Graf von Linden (later founder of the Linden-Museum, Stuttgart) asked Wostrack to support his home town by collecting objects from New Ireland, particularly "everyday" objects such as weapons, fishing gear, and musical instruments. In 1906 Wostrack's collections started arriving in Stuttgart. A collection of New Ireland material arrived in February 1908, and a second collection was received in February 1909 containing eight "valuables" (gold-lip shell, a cassowary quill belt, and pig's tusk ornaments) from the southwest coast of New Britain. Unlike the New Ireland material, the collection lacks "everyday" objects. One item gifted to the Linden-Museum by Albert Hahl, Governor of the Territory from 1901 to 1914—a goldlip shell from the Arawe—we consider wrongly provenanced as Admiralty Islands.

These two small collections exemplify the colonial officers' relationship with the local people, which was quite different from that formed between individuals who merely passed through the Territory. The fact that both Hahl and Wostrack were able to acquire valuables that other visitors had no access to indicates their relationship with the locals was based on their recognition of the power and authority of government officials and a desire on the part of local people to engage in long-term relationships through gift exchange (see Gosden & Knowles, 2001: 93–95 for a more detailed analysis).

The visitors: researchers and collectors. Once the colony of German New Guinea was well established and after the laws favoured the Berlin Museum, alternative means of obtaining large collections were sought and wealthy backers were encouraged to contribute. There was much public interest in the colonies, and visitors flocked to museums to see evidence of the people and the place. Newspapers wrote up activities in the colonies for a very interested audience. All the following collectors, with the exception of A.B. Lewis, were German and very much caught up in the process of providing collections for provincial museums.

The motivations of these visitors were similar. As well as promoting their own museum or city, they were all practising "salvage ethnography"—saving the material evidence of vanishing peoples. They were also promoting their own academic reputations. Bruno Mencke (1876–1901) was an independent collector keen to have a part in the colonies that were a focus of his Berlin social life (Buschmann, 1999: 157–160). Mencke arrived in 1900 as the head and financier of his self-styled *Erste Südsee Expedition* (First South Seas Expedition). He travelled with a research team aboard the *Eberhard*, named after his late father, and his inheritance financed the trip. Mencke hoped to make his own mark in life through the acquisition and donation of ethnographic objects to German museums. Three places were to become beneficiaries, his birth-town of Hanover, his hometown of Berlin, and Stuttgart (once again through the persuasive negotiations of Graf von Linden). Mencke recruited three researchers to study Natural History and chose to cover the ethnographic research himself.

The aims of the expedition were grand: it would last three years and would research the Bismarck Archipelago, including a proposed coast-to-coast crossing of New Britain. However, Mencke was young and inexperienced. He stayed at Ralum with the Parkinsons (famous for their hospitality), and bought the Arawe collection we discuss here. The collection could be better known as the Forsayth & Co. collection as it was made by the crew of their ship the *Mayflower* while on the south coast of New Britain prior to 1901. Having carried out no primary research, Mencke soon got a reputation for having a keener interest in pleasure than scientific achievement (Buschmann, 1999: 158; Parkinson, 1999: 139). The *Erste Südsee Expedition* ended sadly and suddenly when Mencke was fatally wounded on St Mathias Island. Mencke's Arawe collection was a commercial collection—it conforms to ideas of what objects were marketable, and contains several fine objects and many weapons. Although this collection of almost 300 objects is poorly documented, it is the earliest large collection from the Arawe so far identified.

After Mencke's death a new expedition, the Hamburger Südsee Expedition (HSE) (1908–1910), reached the Territory, with its own ship, the *Peiho*, and a team of researchers. The HSE was born out of civic and academic rivalry. Both Georg Thilenius, Director of the Hamburg Museum für Völkerkunde, and Felix von Luschan in Berlin (possibly inspired by Mencke) proposed expeditions to the national government. Much of the Godffroy collection had gone to Leipzig, and Thilenius persuaded wealthy citizens of Hamburg to back an expedition, using the promise of a collection that would rival Berlin's, and restore Hamburg's reputation (Thilenius, 1927 quoted in Buschmann, 1996: 322).

Thilenius recruited Professor Dr Friedrich Fülleborn, a specialist in tropical medicine, to lead the expedition. Dr Otto Reche was chosen as physical anthropologist but was also familiar with ethnography, geology and geography. Dr Wilhelm Müller was elected as the ethnologist and linguist, Herr Dr G. Duncker as zoologist, and Hans Vogel as official artist and photographer. Franz Hellwig, although not an academic, was principal purchaser of artefacts and responsible for the administration of collections. He was both trader and collector, with experience in Melanesia. The ship's crew included Captain Vahsel, who became a regular columnist in a Hamburg newspaper, and Hefele, the first officer, whom we discuss below (Fischer, 1981: 64–77; Reche, 1954: 44). The expedition's aim was to survey the whole region (Reche, 1954; Thilenius, 1927; Vogel, 1911). The expedition reached southwest New Britain in December 1908 and spent several weeks moving along the coast. They returned in January and again in February when the group split up with Hellwig and Müller in residence on one of the Arawe islands specifically to collect ethnographical data and specimens while the others explored the Pulie River.

The collections of Hellwig (190), Müller (160), Reche (40) and Fülleborn (40) total 430 items. Fülleborn and Reche were incidental collectors, who delegated much of the work to Hellwig. Hellwig drew on his knowledge of *tok pisin*, and was the ideal acquisitor. Müller, the anthropologist, compiled exemplary fieldnotes and detailed information on the objects.

Hefele was born in Stuttgart and was pressured by von Linden to collect for his museum. Hefele features in the expedition records due to his knowledge of meteorology and mapping (Thilenius, 1927). He collected around 550 objects in the first year, including about 40 items from southwest New Britain, but his collecting was in direct competition with the expedition, and he was transferred to another ship (Fischer, 1981). The range of objects that Hefele collected—including valuables, the everyday, and the "old" (stone tools)—suggests he was following the example of the professional collectors. The difference between his collection and that of the expedition is the level of documentation: Hefele's contains the bare minimum of detail.

Hermann Schoede, the next major collector was a wealthy German who travelled around German New Guinea from mid-1909 to 1910 (Welsch, 1998, vol. 2: 148). For six months he sailed the leased schooner *Harriet and Alice*, and spent several days visiting the south coast of New Britain. A.B. Lewis, spent Christmas 1909 at Arawe Plantation with Schoede, and Lewis's diary documents how Schoede worked (Welsch, 1998, vol. 1: 167–168). Schoede collected about 200 objects from the south coast, and approximately 180 are in the Berlin Museum (gifted in 1909). Part of his collection originally given to the Duke of Saxe-Meiningen is now in Leipzig, Museum für Völkerkunde, and four objects attributed to Schoede are in the Linden-Museum, Stuttgart. Although Schoede was an amateur, his documentation is impeccable. His collection was broad ranging like those of his professional contemporaries and for each item he recorded the provenance, drew the item and pasted all this information on the Berlin museum's catalogue cards. Schoede provided a much greater depth of information than many contemporaries and museum professionals.

Our final visitor was the American Albert Buell Lewis (1867–1940). Lewis was an assistant in the Anthropology Department of the Field Museum when George A. Dorsey, Curator of Anthropology, found a patron who could provide AU$5,000 per annum over three years to finance an expedition to Melanesia. Dorsey had previously visited German New Guinea, and had bought Parkinson's collection. He saw a large Melanesian collection as a means of putting Chicago's collections above those of the older American museums (Welsch, 1998, vol. 1: 3–9). In 1909 Lewis initially spent five months along the north coast of German New Guinea, but when he returned to Herbertshöhe (Kokopo) in December of that year, Governor Hahl offered him passage on a government expedition. He was taken to Arawe Plantation at Cape Merkus and spent eight weeks along the south coast collecting almost 330 items including masks and blowguns.

The contrast between Lewis and other visitors is marked. Lewis was dependent on the goodwill of locals for transport (Welsch, 1998, vol. 1: 226–228). Compared to subsequent collectors, he had a generous budget, but compared with Mencke, the HSE team and Schoede, Lewis was a relatively "poor man". However, he was still able to make a large collection which may have been due to the fact that, unlike his contemporaries, he was on foot. He used local transport which though unreliable meant he was unhindered with the overheads and restrictions associated with travel by yacht and was able to spend longer in the field and penetrate different areas (see Welsch, 1998, vol. 1: 175 for Lewis's "discovery" of the blowgun inland from Kandrian).

These visitors of the German colonial period share commonalities. All were propelled to the field, and were influenced by concerns at home. As individuals, collection was of paramount importance, and was the basis on which the wider public judged their efforts. Although many were researchers, it was the acquisition of objects that got them to the field. Müller's collecting and hence funding was restricted by the HSE research (Fischer, 1981) and Lewis's research was hampered by the museum questioning his judgement and requesting larger "showy" pieces (Welsch, 1998, vol. 1: 351). For the financiers back home publications and research were secondary concerns.

The German colonial period collections—overview. With the onset of war in 1914, the great "expedition period" of collecting (Welsch, 1998, vol. 1: 5) ended along with German Colonial rule. Civic rivalry in Germany and the USA turned to nationalism, and war put an end to publicly-funded research expeditions.

The number of items collected in this period is significant. In total, nearly 1300 objects were collected (1000 in just one year), a staggering 69% of all the collections we have researched. Partly this was due to the establishment of new or fledgling museums: and partly it was a result of the colonial expansion and coherent exploration of new territories and cultures. Finally, it reflected the academic approach at the time: foregrounding salvage ethnography and the paramount place of museums and objects in anthropology. "Salvage ethnography" and making "representative" collections were paramount in deciding what to collect. The earliest collection (by Richard Parkinson, now in Dresden) includes the oldest blowgun from the region. Blowguns from the southwest coast of New Britain are important because they are the only record of their occurrence east of Indonesia. Moreover, these items are fragile and frequently damaged, and the Parkinson example survives intact, complete with several darts.

Collecting was driven by academic concerns and civic rivalry at work in Germany and, to a lesser extent, the USA. Individual cities supported the academic research of artefacts but built up their ethnographic museum collections to enhance the status of their cities through the ownership and display of the material (Penny, 1998). For academics and privately funded individuals, it was an opportunity to immortalize their role in the colonies, perhaps even their role in "taming" the colonies, through providing object taxonomies and a material representation of the people to be brought under control.

The inter-war years 1914–1939

The second phase of collectors came in the inter-war period of Australian Administration, first under a military regime and then under the League of Nations from 1921 when New Guinea became a Territory Mandated to Australia. For local people, this was a period of massive change in settlement, subsistence, trade and ritual. Collectors of this period include museum curators with university links, an anthropologist and a tourist. We look first at the curators whose primary field objective was simply to collect objects.

Felix Speiser (1880–1949) was 49 years old when he arrived to carry out his second regional study of Melanesia. He had already spent time in Vanuatu from 1910 to 1912 and worked at the Basel Museum für Völkerkunde and in the anthropology department of the local university (Speiser, 1923). In 1929 he embarked on a regional survey of the Northern Solomons, south New Britain, northeast New Ireland and the Sepik region. His efforts swelled the collections of the museum, resulted in several publications (Speiser, 1936, 1938, 1941, 1945, 1945–1946, 1946), and an exhibition, but no major monograph.

In early 1930 Speiser was centred at three base camps: Gasmata government station, Kandrian, and the Arawe Islands. Speiser made short trips inland and along the coast, building up relations with local people. He interviewed both the whites and local people. At the end of his sojourn on the coast Speiser reported that he had collected approximately 350 artefacts of which 110 from the Arawe region remain in the collection. A significant number were from Umboi and Siassi, which suggests up to 100 further items may now be dispersed. These were classed as duplicates by Speiser who hoped to recoup costs through their sale and exchange with other museums. Speiser's research focussed on cultural traits and he wanted to delineate the cultural area and the external influences. He used material culture and ceremonial and ritual practices to define the Arawe region. In particular he concentrated on blowguns, head-binding, pig's tusk ornaments, art styles on shields, barkcloth and paddles, masking ceremonies and circumcision. He recorded a style of mask—*kuiunke*—that has never been recorded before or since.

The only other museum funded fieldwork during the inter-war period was carried out by Beatrice Blackwood (1889–1975) of the Pitt Rivers Museum, University of Oxford. Blackwood had met Speiser in Buka in 1929, and had acquired a blowgun from his "duplicates" collection for her museum. She returned to the Pacific in 1936 (Blackwood, 1950). The curator of the Pitt Rivers Museum, Henry Balfour, encouraged her to visit Kandrian and collect head-bound skulls, barkcloths and blowguns to complete various typological series (Knowles, 1998). She spent nearly four months on the south coast in 1937, mostly at Kandrian, but also at Gasmata and Lindenhafen. From these places she made daily trips to villages and offshore islands. From Kandrian, she travelled inland to record and photograph production processes of barkcloth (Fig. 2) and shields.

Blackwood collected 275 objects, similar in range to other collections, but due to the rainy season she found it hard to collect particular items. For example, ornaments in her collection have less variety, probably due to the lack of ceremonies, and she was unable to record any masks. However, Blackwood's collection and notes provide the best insights into the production of items and her methods of collection. Magnin, a local man, offered to work for her, and became her main informant, her means of accessing objects she wished to collect, and someone who could liaise with other locals. Magnin's influence was most significant in the acquisition of valuables otherwise hard to get. It was directly from Magnin that she bought several perforated stone discs (one *mokmok* and two *singa*), a pig's tusk ornament and goldlip shell.

Between Speiser and Blackwood's visits two others collected in the region. John Alexander Todd (1911–1971) was the first and stayed longest. Todd, only 22 years old, accepted an Australian National Research Council grant to carry out fieldwork on the south coast of New Britain, which he hoped would lead to a doctorate at the University of Sydney. Affiliated to a university and not a museum, Todd was required to collect for the university, and was given £30 to purchase specimens. During his twelve month trip from March 1933 to April 34 he collected 245 artefacts and took over 1000 photographs (Gosden, 2000; Gosden & Knowles, 2001). However, material culture was not what took him into the field and encouraged him to return in July 1935. He obviously saw himself as a social anthropologist, as his publications show (Todd, 1934*a,b*, 1935*a,b*, 1936).

Todd was based at Kandrian and his collection includes distinctive Arawe items (shields, blowguns and barkcloth), but it also has examples of coiled cane baskets, "Tami" bowls, drums, nets, cassowary-quill belts, vine-string bags, panpipes and skirts. Unique for this period, Todd also acquired valuable dogs'-teeth ornaments (four belts and one forehead ornament). Despite his lack of interest in material culture, Todd produced a 16–page catalogue indicating a good sense of how valuables were used, and an idea of their relative value. None of Todd's fieldnotes survive, but his collection shows that he had excellent local relations, linking into the activities of women who formed the basis of communities when men left the villages to work. The fact that Todd's collection exhibits so much women's material (bags, baskets and skirts) confounds any straightforward notion that collector's gender influenced collection practice—our only female collectors (Phebe Parkinson and Beatrice Blackwood) collected comparatively fewer items of female material culture.

Our final collector from the inter-war period was a tourist. Following the traditions of wealthy collectors such as Mencke and Schoede, Walter Edward Guinness, 1st Baron of Moyne (1880–1944) arrived in the region under his own sail. Moyne was head of the Guinness family and part of the wealthy aristocratic set that epitomized the swinging 1920s and 1930s. From November 1935 to February 1936, he sailed around the Pacific islands with his guests aboard the *Rosaura*. Moyne had an interest in anthropology, and while essentially on a pleasure cruise, he made collections that were divided between the British Museum in London, the Cambridge University Museum of Anthropology and Archaeology, and the Pitt Rivers Museum in Oxford. At the museum in Rabaul, he saw deformed skulls from the Arawe. To obtain similar specimens, he passed along the south coast of New Britain and stopped at Kandrian where he bought nine items, including barkcloth, shields and blowguns, but no skulls. Eight of these items were gifted to the British Museum, and one barkcloth went to the Pitt Rivers Museum. The Cambridge Museum did not profit

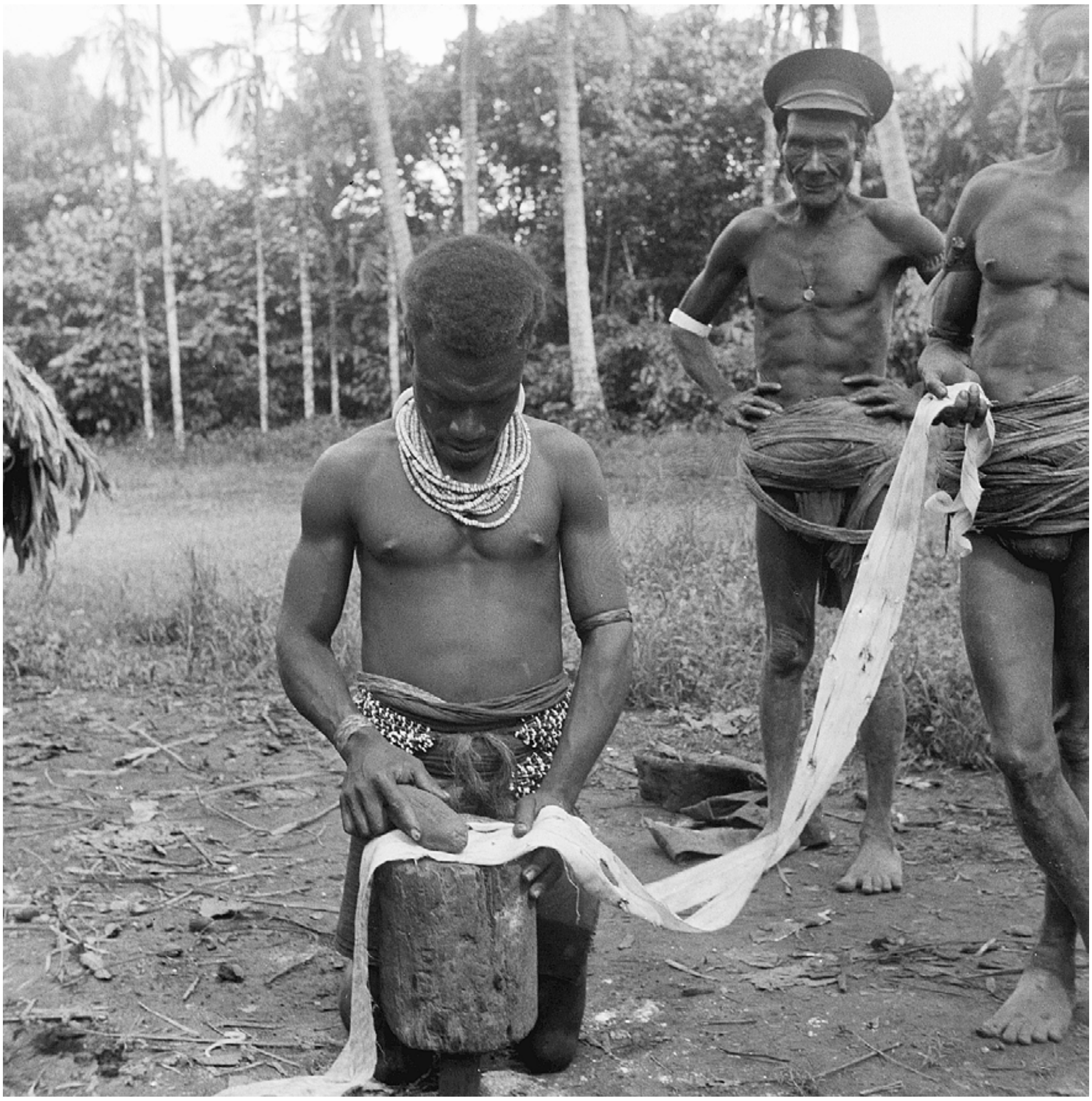

Fig. 2. Man (name not recorded) kneeling on ground beating barkcloth with stone barkcloth beater over wooden block. The man is wearing a trade-store *laplap* wound round with strings of cassowary quill and nassa shell beads. Around his neck hangs strings of nassa shells. Behind him stand two men (names not recorded) both wearing traditional barkcloth belts. One man wears a hat, the mark of a *luluai*. This activity would not usually take place out-of-doors but the men kindly moved their work outside the men's house to enable Blackwood to photograph it. Taken by Beatrice Blackwood in Alomos village, Kandrian district, 18 June 1937. Photo PRM BB.P.13.295, courtesy of Pitt Rivers Museum, University of Oxford.

from this part of the voyage. Back in Britain, Moyne wrote a popular account of his travels with a full chapter on the Arawe (Guinness, 1936: 78–84), and a barkcloth design as the decorative cover of his book.

The inter-war collections—overview. The four collectors and their collections span nine years (1929–1937). We know other individuals certainly acquired items in this period—Koch, a plantation manager, and Chinnery (1927), the Government Anthropologist, but we have not discovered any of their collections. The colonial and collecting landscape changed, as anthropology moved towards intensive, localized social study in Malinowski's wake (e.g., Todd). Collecting was not completely dismissed but it had become a by-product of research (Young, 2000). However, when straightforward links to a museum existed (as with Blackwood and Speiser), objects remained as central as before. A major change was that the naivety of "salvage ethnography" in its nineteenth century sense had dwindled.

The colonial landscape of the Arawe region changed radically in this period; by Speiser's arrival in 1929 the Gasmata District Office had been established for twelve years and could put a boat, police boys and carriers at his disposal. When Blackwood arrived in 1936 a *kiap* made regular patrols along the coast. In addition to the changing style of colonial rule, an important new element on the south coast of New Britain was the arrival of missions. There had been a mission station at the Arawe Islands for some years, but it was only in the mid-1930s, after accusations of neglect, that the missions established around Kandrian. Mission and government tried to ban practices like head-binding, the keeping of skulls and sorcery. This policy resulted in temporary devaluation of particular artefacts (skulls and *mokmok* stones) that became readily available to collectors (Gosden & Knowles, 2001: 151–153).

This period of colonial rule and collecting was driven by a desire to understand people with the long-term aim of control through education, the institution of colonial law and participation in the colonial economy (including taxation). While collectors may not have understood their work in these frames, they were certainly conforming to them, reinforcing them and benefiting from them. At this time, anthropology was taught to colonial officer cadets and Blackwood was teaching one of these courses at Oxford. Moyne as a British establishment figure and essentially on a pleasure cruise, was also gathering first hand experience of colonial rule (he became Secretary of State for the Colonies in 1941). Todd (1935*b*) even wrote an article on how European law could be better implemented in southwest New Britain. All the collectors, as they donned colonial whites and were facilitated by colonial officers, were framed by their dress code and contacts. They practised "salvage" ethnography only where legislation and missionary work were suppressing certain practices.

All but one of these collectors were in the field for months, time enough to develop local relationships quite distinct from the fleeting visits of earlier researchers. Again, we get a glut of visitors over eighteen months. Between them they removed over 500 items, and amongst them we can see items that were clearly made for sale, and the carefully negotiated acquisition of older items or valuables. Speiser and Blackwood even document the same informants—both refer to Luluai A. Rulo and Magnin in their notes. Speiser also engaged Aliwa, who worked with Müller, and by 1929 had become a Paramount Luluai, suggesting that an ability to broker trade and work with the whites did pay off.

Post World War II

After 1945 large-scale collecting was rare, but a steady trickle of researchers, tourists and dealers removed small collections from the region. Several researchers spent time in the region documenting contemporary material culture.

From 1962 to 1974 Anne Chowning and Jane Goodale worked inland from Kandrian among the Sengseng and Kaulong groups respectively (Chowning, 1974, 1978, 1980; Goodale, 1966, 1995; Goodale with Chowning, 1996). They were the first major researchers in the interior and were part-financed by National Geographic, which published their first article. The article, although using a "typical" Arawe object in the title (Blowgun hunters of the South Pacific), did not concentrate on material culture but gave an overview of social life. However, it refers to a collection of 300 stone tools and discussions with Australian National University archaeologists in Canberra. Goodale collected some representative objects that are now housed in the University of Pennsylvania's Museum. These items include a goldlip shell—the exchange of which became a focus of her research (Goodale, 1995: 87–108).

After Chowning and Goodale, Jim Specht visited the Arawe region in 1979 to carry out archaeological fieldwork. This work resulted in several subsequent visits and Specht was joined in the mid-1980s by Jim Allen and Chris Gosden, all participating in the Lapita Homeland Project.

In 1979, Specht collected 11 items of contemporary material culture which were deposited at the Australian Museum, Sydney. These items (collected only four years after Papua New Guinea independence) reflect a small range of well-known Arawe objects (e.g., vine string bags, blowpipe dart, barkcloth belts). There are no valuables, as Specht was reluctant to collect such items (pers. comm.). Those items he did acquire come from a disparate set of villages, and, as he was in the region to conduct archaeological research, he collected as a by-product of his main work in the region. In contrast to those collectors who had gone before him Specht deposited items in the National Museum in Port Moresby, which was often in response to a specific request made by the vendor (Specht, pers. comm.) Of course, if one extends the notion of collection to include archaeological excavation then Specht's collections (to be deposited in the PNG National Museum) number many thousands of objects ranging up to 12,000 years old.

From 1985 to 1992, Gosden and Pavlides carried out archaeological fieldwork in the Arawe Islands. They did not make a collection, stepping away from the traditional by-product of any material culture study. Instead, Pavlides (1988) collected information on Pililo and Kumbun Islands, her main interest being to document an extant trading system and outline links between the Arawe Islands, Siassi and Kandrian through objects, kinship and a network of trade friendships. Pavlides concentrated on household contents and noted two things: the absence of shields and blowguns (stored elsewhere); and the replacement of some items (e.g., stone tools, obsidian flakes and pottery vessels) with European equivalents. However, some items had survived in use because they functioned better than the European equivalent. For example, metal blades discolour taro, and therefore shell knives are still used.

Post World War II—overview. Although many tourists, dealers and other researchers, who passed through the region with different motivations, came away with objects or "souvenirs" from the region, very few collections from this most recent period have ended up in museums. Specht, our sole example of a museum curator in the region, is the only researcher who brought back a collection of objects for a museum. All the researchers probably acquired artefacts as mementoes of their work in the region, either through gift or trade. These items, like Hahl's goldlip shell, may yet end up in museums.

This period is characterized by the end of colonial rule and Papua New Guinea independence. Amongst researchers there is the recognition that salvage ethnography has been disproved as an agenda, and that to remove objects that are no longer made may be the actual cause of change. While all cultures do change there is no longer a "before" and "after" distinction, or pre-contact culture to be preserved through collections. Instead fieldworkers wish to understand cultures and work with communities, pursuing aims of interest to the communities as much as their own research agendas. In addition, the ethics of acquiring objects was questioned, new legislation passed, and new institutions such as the National Museum and Provincial Cultural Centres are now managing cultural preservation in Papua New Guinea.

Most collecting focussed on the "disappearing" archaeological heritage of the region, which is being preserved in Papua New Guinea (rather than elsewhere).

The lack of coherent collection exemplifies changes in collecting objectives, regional politics and the agency of Papua New Guineans (both nationally and along the south coast of New Britain).

Conclusions

Researchers and collectors were attracted to the Arawe region of New Britain as it was accessible and had interesting anthropological characteristics, such as the head-binding of infants to create the aesthetically pleasing "longhead", and the use of blowguns. All of the collectors had rather specific interests. Commercial traders concentrated on weapons, the curio collectors sought the obscure or the decorative, and the anthropologists looked for a representative selection of objects, including ordinary items in daily use.

None of the collectors felt that they were documenting themselves and their position in a colonial world. We are now using their collections as historical sources to throw light on them and the people they went to study. Only by comparing all the collectors can we can gain a full picture of colonial culture and its changes. However, the collectors' interests were not the only factors affecting collection composition. The locals developed an awareness of the structures and beliefs of a colonial culture in which the collectors played a key part. Blackwood's arrival hot on the heels of Todd and Moyne meant that her informant Magnin knew exactly what she wanted, how to offer himself as broker and how to use the transactions to his own advantage. Changes such as "pacification" were seen as vital parts of the colonial process that led to changes in the nature of material culture. Shields, once made for warfare but now almost exclusively for dance, were simplified so that later examples no longer had a protruding boss. The design on the inner face was less complex, no longer fully echoing barkcloth design. Wider intercommunity trade meant goldlip shells became more readily obtainable (though still expensive) and each collector gained at least one.

The south coast of New Britain has never been renowned as a great centre of anthropological research within Papua New Guinea as a whole. As can be seen from the amount of work and collecting in the last 100 years, such a reputation is not deserved, but is explicable in the lack of publication, and the diverse research traditions of Germany, Australia, Britain and the USA, which have inspired differing forms of work and the scattered nature of the collections. Specht's pioneering archaeological work on this coast has shown a rich prehistory. Specht was also a pioneer in taking material culture as his subject of study, in a manner that blurs the division between anthropology and archaeology. Following in his footsteps, we hope to have shown that there is rich historical material from the region that is relevant to the study of cultural change, and that allows insights into changing research traditions, and, more importantly, into the regional history of New Britain.

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Phytoliths and the Evidence for Banana Cultivation at the Lapita Reber-Rakival Site on Watom Island, Papua New Guinea

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ABSTRACT. Analysis of phytoliths in sediments from Kainapirina (SAC) locality in the Reber-Rakival Lapita site on Watom Island, East New Britain Province, Papua New Guinea, directly confirms and expands on the types of terrestrial plants, both domestic and natural, identified in the cultural and ashfall deposits of c. 400 cal. B.C. to A.D. cal. 650 found at the site. A significant new finding is that evidence for banana cultivation throughout that period can be associated with both former and additional confirmatory evidence for the growing of coconut and *Canarium* nut trees plus a range of new plants. Gardening activity alternating with fallow is also strongly suggested by the types of natural tree cover at the conclusion of that occupation sequence and the garden soils lying just below the primary seventh century A.D. Rabaul volcanic ashfall.

Taken with the hypothesized existence of pig husbandry, which is based on a previous analysis of faunal remains, as well as information about diet derived from the study of stable isotopes and trace elements present in the human bones from the burials, there is a strong case that arboriculture and horticulture formed a major component of the late-Lapita and immediately post-Lapita economy at this site.

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In 1965, some 56 years after Father Otto Meyer's early twentieth century investigations and report on the Reber-Rakival Lapita site on Watom Island (Anson, 2000*a*), Jim Specht began the long process of establishing its present-day credentials as an important site among those with Lapita style pottery. Despite the use of modern archaeological excavations and analytical methods (Specht, 1968, 1969), only recently has Reber-Rakival's true value as a late-Lapita site (Green & Anson, 2000*a*) within the widespread Lapita horizon (Kirch, 1997: 203–212) begun to be really appreciated. We offer this paper as a tribute to Specht who first identified the SAC locality of Kainapirina within the

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Reber-Rakival site as having highly intact stratigraphy. Its two basal layers, with evidence of cultural occupation, contain a very late style of Western Lapita ceramics; the lowest layer also yielded human remains indicating the location was used as a burial ground during the late-Lapita period.

While Specht's investigations provided information about the ceramic content of these occupation layers, he was unsuccessful in obtaining much additional economic evidence beyond that previously obtained by Meyer, particularly with respect to arboriculture and horticulture. At various localities within the site, both Specht and Meyer found direct evidence for the use of *Canarium*, *Terminalia*, and coconut (*Cocos nucifera*) in the form of nutshells. More recent excavations at the SAC locality in 1985 by one of the authors (Green) further confirmed the presence of charred coconut shell fragments in both cultural layers (Rod Wallace, pers. comm., 1999) which were subsequently used for AMS dating. In addition, burned pieces of coconut and *Canarium* shells were obtained from a charcoal lens just below the seventh century A.D. Rabaul ashfall at the nearby SDI locality (Anson, 2000*b*: 104; Yen, 1991: 84).

Although direct evidence from plant remains for horticultural activity at SAC remained elusive, some form of cultivation was inferred based on a number of indirect indicators which included the presence of domestic pig and chicken bones (Anson, 2000*a*: 17–18; Specht, 1968: 125–126). One of the strongest indicators from an analysis of the pig bones and their age at death implied a well-developed form of pig husbandry at SAC during the period of Lapita occupation rather than just hunting feral animals. As Smith (2000: 145) notes, "it seems unlikely that pig rearing could be sustained on a small island such as Watom unless food crops were also grown". The 1985 SAC excavations revealed a further five skeletons in addition to the three Specht had found (Green & Anson, 1987: 126). Coupled with the fairly recent developments in the analysis of isotopic and trace element signatures, the human remains provided another way to demonstrate that the diet of the people associated with the SAC Lapita occupation was dominated by a substantial edible terrestrial plant component (Green & Anson, 2000*b*: 49–50; Horwood, 1998; Leach *et al*., 2000: 158).

Another line of evidence for the inference of horticulture was development of a palaeosol on the late-Lapita occupation layer which was considered to have formed in part as a product of gardening activity. This interpretation was based, firstly, on the loamy texture of the sediment itself and the leaching of shell calcium from it; secondly, the repetitive mixing of the deposit leading to the obvious displacement of bones and artefactual material due to continued human disturbance; and thirdly, the abundance of small broken fragments of bone resulting from mechanical breakdown (Smith, 2000: 141–142). Some disturbance of the terrestrial plant cover inducing a heightened degree of erosion, probably from clearing for gardening on the slopes above the raised limestone cliff at the back of the SDI locality, is also attested in the increased loam content of its successive cultural layers C4 to C1 resting on a sand beach layer (Anson, 2000*b*: 98–99).

All of the above constitute supportive lines of evidence for an arboriculture and horticultural gardening component forming a major basis of the late-Lapita and immediately post-Lapita human diet at the Reber-Rakival site.[1] This is consistent with what is inferred more generally for sites of the Lapita horizon (Kirch, 1997: 203–212). Yet, empiricists among us would require additional direct evidence from plant remains themselves to more firmly establish the claim. If macro-remains could not be retrieved by basic excavation techniques, then an analysis based on plant micro-fossils was the most obvious alternative way of finding direct associations between people, plants and sediments.

Why phytolith analysis? It was the circumstance of one author (Green) hearing the other (Lentfer) reporting on the recovery of plant phytoliths (plant silica cells) from beneath volcanic ashfalls in the Talasea region of West New Britain Province at the Fourth Lapita Workshop Conference in Canberra in June 2000 that led to Green's recognition that the SAC locality offered a splendid context for applying that relatively new technique in this tephra covered region of the Pacific. Moreover, Green knew he had three appropriate sediment samples taken during the 1985 excavations at SAC and on his return to Auckland he quickly ascertained that they indeed contained phytoliths (Rod Wallace, pers. comm.). Here was yet another means for not only further confirming what was already claimed but also directly expanding the range of plants including possible cultivars associated with the SAC locality. He contracted Lentfer to analyse these three sediment samples. The primary aims of this analysis were to determine vegetation communities, disturbance patterns and change associated with Lapita settlement, and search for additional evidence of horticulture.

The SAC locality and sampling location

SAC, at the time of Lapita occupation, was located on a low lying, well-drained sand spit beach adjacent to the sea and bordered by raised limestone cliffs to the west and southwest (Figs. 1, 2 and 3). The beach emerged between 3,500 and 3,300 years ago as a result of a hydro-isostatically controlled lowering of the sea level (Green & Anson, 2000*b*: 39). Three distinct stratigraphic layers were sampled from the south section of Square I-15 in Rectangle III (Figs. 4 and 5). The uppermost of these three layers, B2, represents a zone of primary ashfall 5 to 10 cm thick comprising a plinian pumiceous tephra (Table 1). It was derived from one of the largest eruptions of the Rabaul volcano recorded for the Holocene at between A.D. cal. 650 and 850 (ANU 5338) (Anson, 2000*b*: 102; Nairn *et al*., 1995). The ash fallout from this catastrophic eruption effectively buried and sealed the underlying ground surface. Subsequently this layer itself was covered by an additional layer of re-deposited ash washed in from the surrounding area. The layers of interest to this analysis lie directly under the layer of tephra. These comprise an upper layer C1, a black sandy loam with an estimated age of 150 cal. B.C. to A.D. cal. 650 (ANU 5330), and a lower layer C2, midden with a grey coralline sand matrix with an age range estimated to be from 400 to 100 cal. B.C.[2] (ANU 5336, Beta 16835; see Green & Anson, 2000*b*: 38–39, 87). Beneath C2 lies a culturally sterile beach sand. Importantly, both C2 and C1 have been identified as late-Lapita occupation layers with shell, fish and pig bones, pottery sherds and stone artefacts. There is evidence for building construction and domestic habitation in the first phase of occupation in C2 (c. 400 to 300 cal. B.C.) which was followed by a period between 300 and 100 cal. B.C. when the site was used for burials. More recently,

Table 1. Summary of sediment characteristics at SAC.

sample	sediment zone	description	Munsell colour dry	Munsell colour wet	pH	Fig. 5 key field descriptions
B2	tephra	Plinian pumiceous tephra	2.5Y 6/2 light brownish grey	2.5Y 3/3 dark olive brown	7.65	ash
C1	palaeosol	sandy loam	7.5YR 2.5/2 very dark brown	10YR 2/2 very dark brown	7.65	black loam
C2	midden	coralline sand	10YR 4/1 dark grey	10YR 2/2 very dark brown	8.09	grey sand midden
	sterile sand	sterile beach sand				coral sand

during the initial development phase of C1, the land use reverted to something associated with domestic activity (between c. 150 cal. B.C. and A.D. cal. 50) which changed later to gardening between A.D. cal. 100 and 650 (Green & Anson, 2000*b*: 84).

Background information

Vegetation characteristics and patterns of plant colonization in relation to the sand spit environment at SAC. Studies documenting the vegetation of tropical Pacific Islands (Mueller-Dombois & Fosberg, 1998; Peekel, 1984) indicate that in the Bismarck region strand vegetation typically consists of an herbaceous cover of creeping plants (e.g., *Ipomoea pes-caprae, Canavalia rosea*) as well as grasses and sedges (e.g., *Ischaemum muticum, Lepturus repens, Thuarea involuta, Fimbristylis* spp. and *Cyperus pedunculatus*). The shrub and tree strata are often dominated by *Wollostonia biflora, Scaevola sericea, Hibiscus tiliaceus, Tournefortia argentea, Barringtonia asiatica, Terminalia catappa, Calophyllum inophyllum, Pandanus tectorius* and *Casuarina equisetifolia*. Botanical surveys in the Rabaul region and on islands in West New Britain (Lentfer, 1995; Lentfer & Boyd, 2001) support this description, and verify the predictability of colonization processes and composition of strand vegetation in the region. Furthermore, the Rabaul studies, in particular, reveal the rapid nature of strand colonization even after catastrophic volcanic eruptions, and provide a basis for determining the range of possible environments present on the sand spit at the time of the first Lapita occupation.

Indeed, on the basis of understanding the predictable nature of strand environments, especially colonization and successional processes, there are good grounds for assuming that the beach at SAC was colonized by plants within a reasonably short period of time following its formation—perhaps within a few years after it stabilised. Also, in view of the beach's close proximity to surrounding forests on the bordering cliffs, it is likely that the successional processes were relatively fast, with the introduction of a more complex array of species, predictably present in early secondary tropical vegetation in the region (Lentfer & Boyd, 2001; Thornton, 1996). Therefore, it seems reasonable to assume that at the time of the first Lapita occupation of the locality there was at least some vegetation cover on the sand spit with strand elements similar to that listed above. Furthermore, depending on beach stabilization processes, it is likely that additional early secondary growth and possibly elements of late secondary and primary forest vegetation were present, particularly in sheltered locations. While this cannot be substantiated within the framework of this analysis, at least some indication of environmental complexity on the recently formed ocean beach environment at approximately the time of first settlement, should be evident from the nature of the phytolith assemblage in the oldest occupation layer, C2.

Sediment characteristics. The characteristics of the three sediment samples vary significantly and are summarized in Table 1. Notably, C2 is more alkaline than the other sediments but is within the range suitable for phytolith preservation. The distinguishing features of the sediments are: the abundance of pumiceous tephra sherds in B2; the siliceous aggregates high in organic matter in C1; and, the presence of shell, coral and sponge spicules in C2.

Sampling and extraction methods

The three sediment samples were collected in 1985 from the SAC excavation pit. They were taken from the south section (Fig. 4), 30 cm from the west section where the stratigraphy was equivalent to that shown in the D-D' transect (Fig. 5). Layer B2, being of no greater thickness than 10 cm at the sampling location was sampled across its entirety avoiding the interface of adjacent layers. Samples from C2 and C1 with greater thickness (20 to 40 cm respectively) were taken from the middle of each layer. Each sample was of c. 10 cm vertical thickness. Five grams of each sediment sample were deflocculated in 5% Calgon solution and sieved through a 300 µm mesh. The fine fractions were used for phytolith analysis. Phytoliths were extracted using a rapid microwave digestion protocol adapted from Parr (2002).

Analytical procedure

Estimation of phytolith and charcoal concentration in sediment samples. Fine sediment fractions (<300 µm) were mounted in benzyl benzoate on microscope slides. The slides were viewed at 400× magnification. All particles were counted in 12 fields randomly selected across each slide. For every field the number of discrete diagnostic phytoliths and charcoal fragments were counted. Charcoal comprised black opaque particles (Piperno & Becker, 1996). Concentrations were measured as the total number of phytolith or charzcoal particles per total number of particles and converted to percentage values.

Phytolith classification and counting procedure. Slides were examined under polarized light with an optical microscope. Numbers of all siliceous particles, including

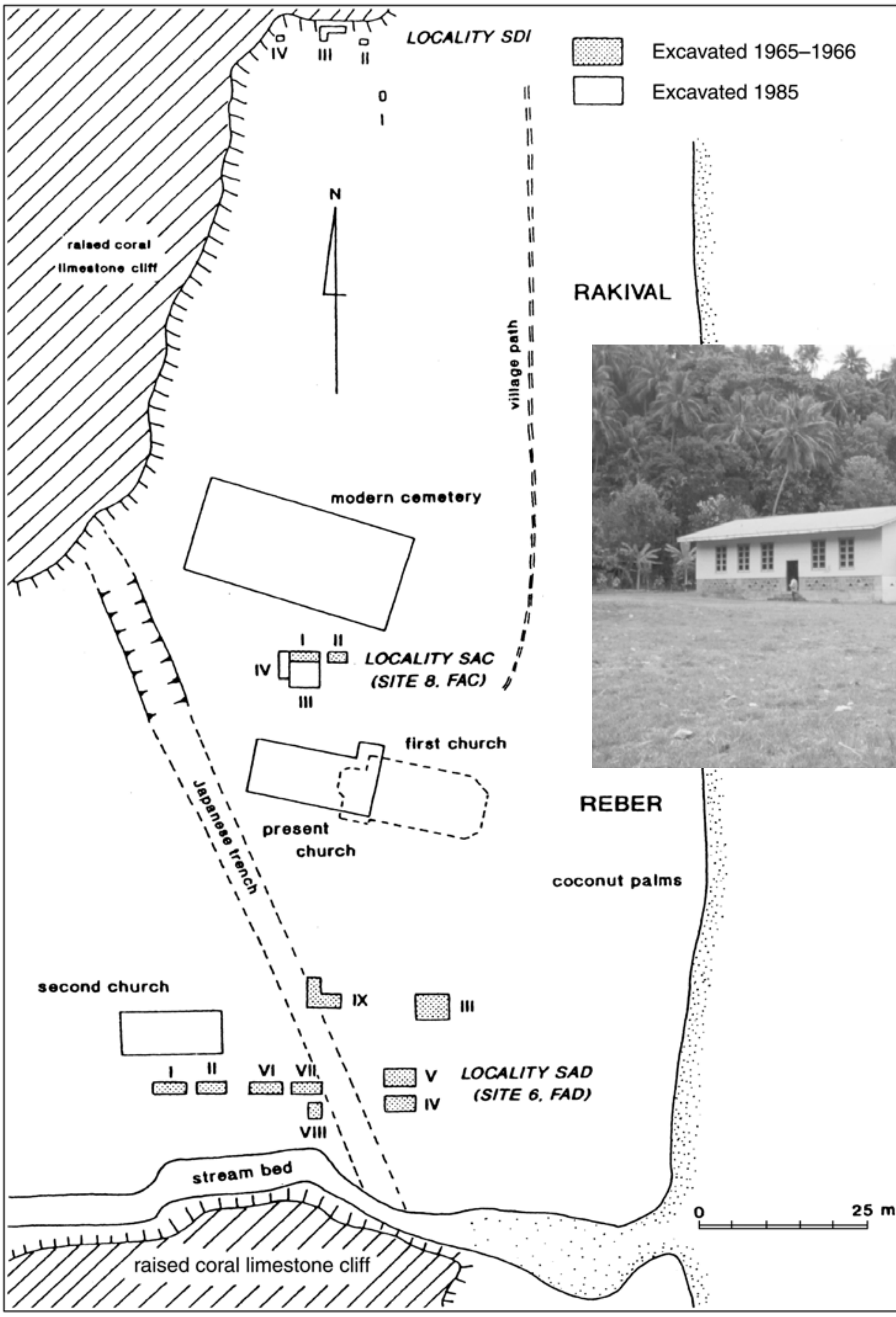


Fig. 2. View of the SAC locality at Reber village 2002. The SAC trench was dug to the right of the church. (Photograph Carol Lentfer).

Fig. 1. The Reber-Rakival Lapita site showing localities SAC, SAD and SDI and modern structures (from Green & Anson, 2000*b*: 32). Japanese tench dates to World War II.

particles considered to be (*a*) amorphous and/or non-diagnostic, and (*b*) diagnostic phytoliths, were counted in randomly selected fields at 400× magnification. All new morphotypes encountered were described using the terminology proposed by Bowdery *et al.* (2001). Photographs were taken of morphotypes considered to have cultural or environmental significance.

Counting and recording continued until the frequency of new morphotypes encountered approached zero. Following this, the slides were scanned for any new morphotypes not encountered previously. These types were drawn and their presence noted.

During and after the recording procedure morphotypes were compared with phytolith reference samples from plants collected in New Britain and elsewhere in Papua New Guinea (Lentfer, 2003). Where accurate taxonomic identification was possible, phytoliths were assigned to plant family groups, families, genera and species. Where morphotype redundancy (i.e., morphotypes common to several different species and/or genera) was considered to be a confounding factor for accurate identification, comparative taxonomic classifications were given. Other morphotypes, common to several different plant groups, were assigned to growth form categories.

Fig. 3. Village elders from Reber-Rakival standing on top of the SAC excavation site in 2002. Steven Lire (left) was 14 years old when he helped Jim Specht with the first excavations at the site (Photograph Carol Lentfer).

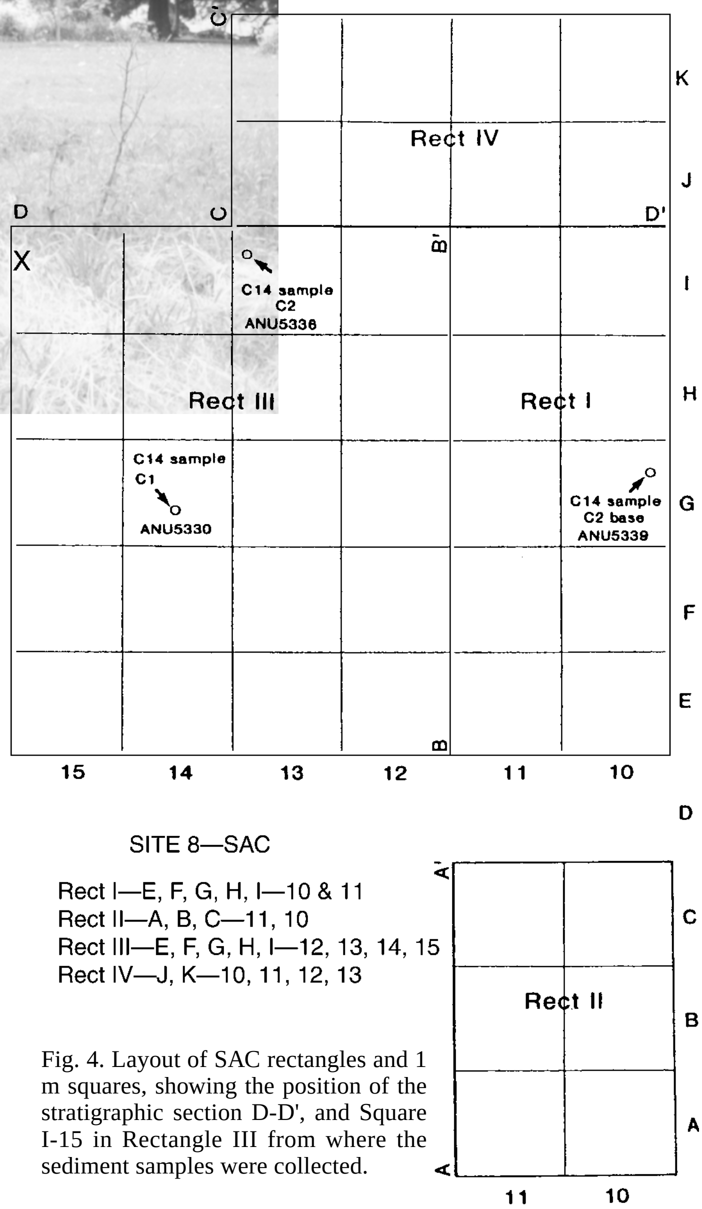


Fig. 4. Layout of SAC rectangles and 1 m squares, showing the position of the stratigraphic section D-D', and Square I-15 in Rectangle III from where the sediment samples were collected.

Results

Concentration of charcoal and phytoliths. The concentrations of charcoal and diagnostic phytoliths varied significantly between sediments. The tephra, B2, contained very small amounts of both charcoal (0.3%) and phytoliths (0.8%), contrasting with the palaeosol C1, with 14% charcoal and 7.8% phytoliths. Concentrations in C2 fell between the above with a moderate charcoal content of 4.6% but a much lower value of 1.9% for phytoliths.

The phytolith assemblages. *Categorization of morphotypes and assemblage variation*. Counts on slides varied according to the proportion of diagnostic phytoliths to non-diagnostic phytoliths and amorphous silica (this did not include obvious sherds of tephra). A total of 585 particles were counted for B2, 796 for C1 and 774 for C2. Of these total counts, between 300 to 400 were diagnostic phytoliths. Four amorphous/non-diagnostic groups and 59 separate diagnostic morphotypes were recognized. Following comparison with reference material the diagnostic morphotypes were grouped into 35 categories. Frequencies were then converted to percentage values (Table 2).

Thirty-five diagnostic morphotypes could be assigned to plant family groups, families, genera and species. The remainder consisted of types considered to be redundant. These were assigned to less well-defined groups based on growth form (Table 2). Within these major categories, B2 the tephra, contained the fewest diagnostic morphotypes (19), most were recorded in C1 the palaeosol (33), and 25 were recorded in the oldest cultural layer C2.

Of the diagnostic morphotypes the majority belonged to a suite of trichome bases, trichomes, epidermal and bulliform phytoliths derived mostly from pioneer and early secondary lowland tropical forest species within the Euphorbiaceae, Moraceae and Urticaceae families. Additionally, morphotypes belonging to tall herbs and palms, including bananas (Musaceae), gingers (Zingiberaceae), cordylines (*Cordyline* sp.), the fish-tail palm (*Caryota* sp.) and other palms (Arecaceae), were present in the assemblages. Grass (Poaceae) and sedge (Cyperaceae) morphotypes were also present albeit at low frequencies. Ten distinct grass morphotypes, including nine bilobate and similar short cell forms and one bulliform were recorded. Most of these were common to a number of grasses including a shade-tolerant forest grass, *Oplismenus compositus*, the pioneer species *Ischaemum muticum*, sugarcanes (*Saccharum* spp.), and a tall-growing grassland species, *Ophiuros tongcalingii*. The lobate/cross form, noted to occur in Job's tears *(Coix lachryma-jobi*), a native grass

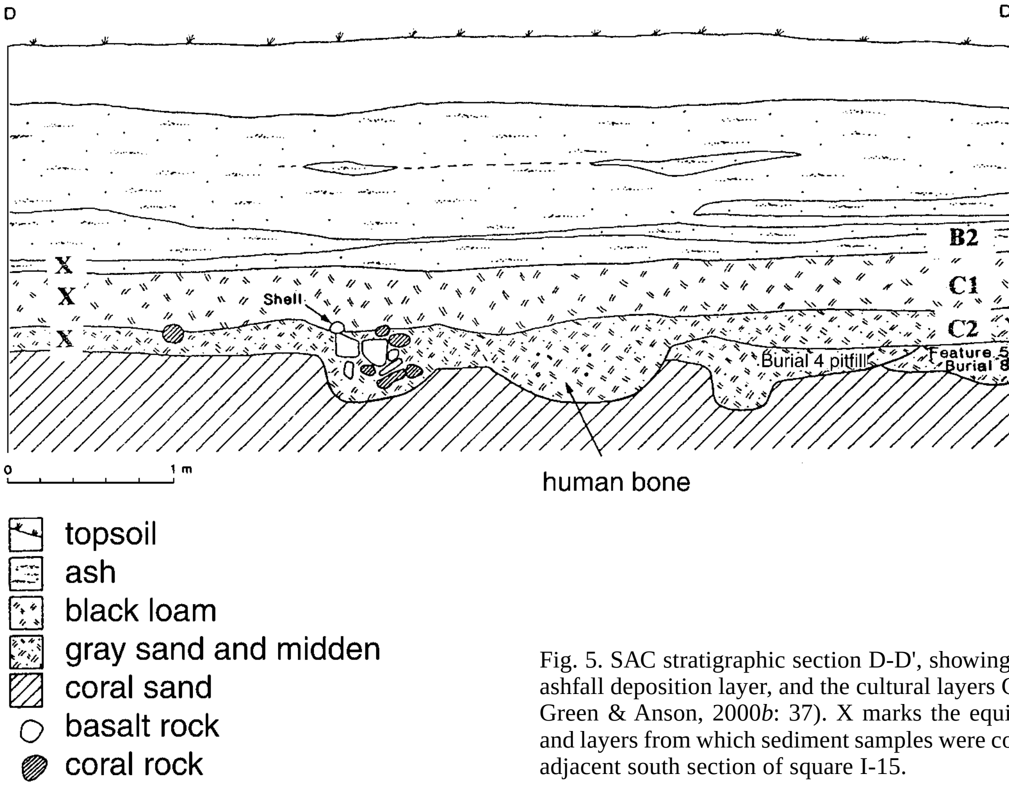


Fig. 5. SAC stratigraphic section D-D', showing the B2 primary ashfall deposition layer, and the cultural layers C1 and C2 (from Green & Anson, 2000*b*: 37). X marks the equivalent locations and layers from which sediment samples were collected from the adjacent south section of square I-15.

in the same tribe as maize, was the only morphotype identified that is possibly species-specific. There was only one morphotype possibly derived from a small sedge (*Cyperus sphacelatus*) commonly found growing in coastal strand environments.

Relative proportions of all morphotypes varied considerably between sediments, with χ^2 tests showing significant differences between B2 and C1, and C1 and C2 assemblages at $\alpha \leq 0.05$. High frequencies of secondary shrub and tree morphotypes occurred in all assemblages; nevertheless the relative proportion of these in the B2 assemblage was much higher than the other assemblages—almost double. Notably, although the C1 and C2 assemblages had similar morphotype presence (see the summary figures at the end of Table 2), there were relatively more vesiculate block and elongate 1 morphotypes in C1 than C2. By contrast, the relative frequency of the tuberculate spheroid 1 morphotype was higher in C2.

Morphotypes of cultural significance. Diagnostic banana (*Musa* spp.) morphotypes were present in all SAC assemblages. Similar relative frequencies were recorded in C1 and C2 assemblages (Table 2). However, only one was recorded in the quick scanning procedure used for the B2 tephra assemblage and thus only its presence was noted. Additionally, a second group was recorded. This consisted of a suite of variable spheroidal morphotypes marked by having troughs with weakly defined rims, as well as small trough apertures in comparison with the body dimensions. These occur in both Zingiberaceae and Musaceae and were given the classification of Zingiberaceae/Musaceae accordingly.

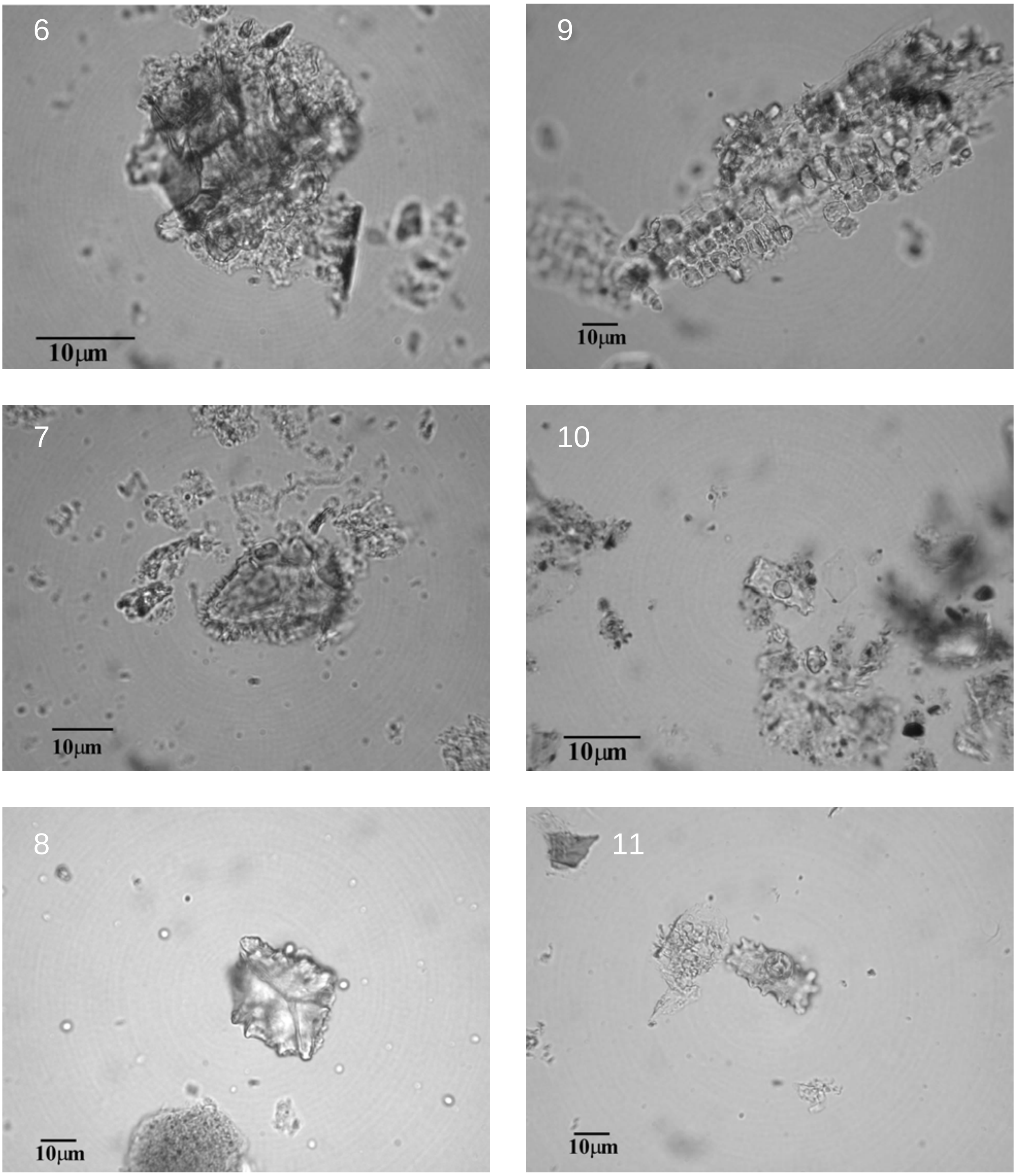
Due to the economic importance of the Musaceae and the relatively low frequency of diagnostic morphotypes recorded in the original assemblage counts, slides were rescanned in continuous transects to record all diagnostic Musaceae phytoliths present. This resulted in a total of 39 and 58 phytoliths being recorded from C1 and C2 samples respectively. Following comparison with modern plant material, this suite of morphotypes was divided into two major groups—seed and leaf/bract morphotypes (Table 3). Thirty-three percent (33%) and 25% of the seed morphotypes in the C1 and C2 assemblages respectively were identified as *Eumusa* (Figs. 6 to 9), while the remaining morphotypes in this group were common to both *Australimusa* and *Eumusa* bananas as well as *Ensete*. Notably, seed morphotypes specific to either *Australimusa* or *Ensete* alone were not recorded.

The leaf/bract morphotypes were more difficult to classify due to the high degree of variation within and between species. However, when compared to reference samples, 13.3% of the leaf/bract morphotypes in the C1 assemblage bore more similarity to the *Eumusa* complex, in particular *Musa acuminata* (Figs. 10, 11), than to either *Australimusa* or *Ensete* species, and 3.3% were more similar to the *Australimusa* species, in particular *M. maclayi*. The remaining morphotypes were less well-defined and were regarded as general types. None of the leaf/bract morphotypes in the C2 assemblage could be assigned to specific *Musa* sections or species, and likewise these were placed in the general categories. Notably, χ^2 tests showed that there was no significant difference between the C1 and C2 Musaceae assemblages at $\alpha = 0.05$.

Other morphotypes in the sediment assemblages with possible cultural significance include those derived from palms, gingers, the cordylines, Job's tears, possibly the sugarcanes and figs (*Ficus* cf. *copiosa*), and additionally some of the large granulate blocks possibly derived from *Canarium*, since these types are abundant in the wood of

Table 2. Concentrations of charcoal and phytoliths and percentage composition of phytolith morphotypes extracted from SAC sediments.

	sediment zone B2 tephra %	C1 loam %	C2 midden %
charcoal	0.3	14.0	4.6
phytoliths	0.8	7.8	1.85
NON-DIAGNOSTIC PHYTOLITHS			
aggregate/granulate	54.8	80.1	67.9
sherd/vesiculate	13.5	1.7	14.1
plate/psilate	31.6	18.2	18.0
spheroid <10µm	27.3	17.1	31.7
DIAGNOSTIC MORPHOTYPES			
SHRUBS/TREES			
Euphorbiaceae/Moraceae/Urticaceae			
prism/facetate	10.7	3.4	2.9
spheroid/prism complex	5.2	2.4	0.4
spheroid/vesiculate	53.4	26.9	26.1
block/perforate	0.0	0.7	1.1
block/vesiculate	2.9	6.3	0.7
Urticaceae			
point/verrucate … cf. *Dendrocnide cordata*	5.8	0.2	1.8
short point/echinate	0.3	0.0	0.0
Euphorbiaceae			
point/psilate … cf. *Macaranga* sp.	0.0	P	0.0
Moraceae			
long point/echinate … *Ficus* cf. *copiosa*	0.0	0.2	0.4
block/echinate … *Ficus* cf. *copiosa*	0.0	1.9	6.4
TALL HERBS/PALMS			
Zingiberaceae/Arecaceae			
spheroid 1/tuberculate	2.9	4.6	14.3
spheroid/psilate	0.3	1.9	2.5
spheroid/echinate <10µm	4.5	8.4	10.0
PALMS			
Arecaceae			
spheroid/echinate 10–25µm … cf. *Calamus* sp./*Cocos nucifera*	1.3	3.4	4.6
spheroid 2/tuberculate … *Caryota rumphiana*	0.0	0.0	P
Liliaceae			
spheroid 3/tuberculate … *Cordyline* sp.	0.0	P	0.0
Musaceae/Zingiberaceae			
spheroid/trough … cf. *Musa* spp./*Hornstedtia* spp./*Tapeinochilos* spp.	0.0	1.9	2.5
Musaceae			
block/tuberculate/trough … *Musa* spp.	P	3.6	4.3
GRASSES			
Poaceae			
bilobe 2 … cf. *Oplismenus compositus/Ischaemum muticum*	0.0	0.5	0.0
bilobe 5 … cf. *Oplismenus compositus*	0.0	P	0.0
bilobe 3 … cf. *Oplismenus* sp./*Saccharum* spp.	P	0.5	0.0
bilobe 6 … cf. *Oplismenus* sp./*Saccharum* spp.	0.0	0.2	0.4
prism 1 … cf. *Oplismenus* sp./*Saccharum* spp.	P	P	0.0
bilobe 4 … cf. *Saccharum* spp./*Ischaemum muticum*	0.0	P	0.0
bilobe 1 … cf. *Ophiuros tongcalingii*	0.3	0.2	0.0
prism 2 … cf. *Ophiuros tongcalingii/Ischaemum muticum*	P	P	0.4
lobate/cross … *Croix lachryma-jobi*	0.0	0.0	P
bulliform 1/psilate	0.0	1.2	1.1
SEDGES			
plate/ruminate/trough … *Cyperus* cf. *sphacelatus*	0.0	P	P
TREES/SHRUBS/HERBS			
elongates 1	9.7	24.5	9.6
block/granulate >25µm	0.0	1.0	2.5
bulliform 2/psilate/tuberculate	1.6	0.7	0.7
grass/herbs/trees/shrubs			
block/psilate/tuberculate <25µm	0.0	1.4	2.5
long Point/psilate	0.0	0.5	0.0
point/granulate	P	P	0.0
elongates 2	1.0	3.4	5.0
SUMMARY			
shrubs/trees	78.3	42.1	39.6
trees/shrubs/herbs	11.3	26.2	12.9
tall herbs/palms	9.1	23.8	38.2
grass/herbs/trees	1.0	5.3	7.5
grass	0.3	2.6	1.8



Figs. 6–11. (*6*) Sheet phytoliths from the midden sediment C2. The same articulated morphotypes are found in the seeds of *Musa acuminata banksii*, see Fig. 9. (*7*) Phytolith from C2. This morphotype is also found in seeds of wild *Eumusa* bananas. (*8*) Phytolith morphotype found in the palaeosol sample C1. The central ridge is a diagnostic feature of *Eumusa* seed phytoliths. (*9*) Sheet of seed phytoliths from *Musa acuminata banksii*. The plant material was obtained from the Queensland Herbarium, accession no. QH067962. (*10*) Phytolith from C1. This morphotype is commonly found in leaves of cultivars derived from *Musa acuminata*. (*11*) Leaf phytoliths from cultivated *Eumusa* banana from West New Britain, accession no. SCU WNB1024.

this genus. Of these, the cordyline morphotype in the C1 assemblage, and the fish-tail palm and one of the ginger morphotypes (*Tapeinochilos* sp.) in the C2 assemblage, were positively identified to the generic level. Most of the palm morphotypes, however, were more difficult to differentiate, having similar forms to spheroids, not only found in other palms, but also in a number of gingers. This suite of ginger/palm confounders includes the tuberculate spheroid morphotype, most common in the C2 assemblage, and the larger psilate and small echinate spheroids most common in both C1 and C2 assemblages. Likewise, the larger echinate spheroids with higher relative frequencies in C1

Table 3. Number and percentage frequencies of Musaceae phytolith morphotypes in C1 and C2 assemblages at SAC.

phytolith morphotypes	category	sediment zone			
		number of phytoliths		% frequency	
		C1 loam	C2 midden	C1 loam	C2 midden
seed forms					
block/tuberculate	Eumusa	3	3	33.3	10.7
block/trough 1	Eumusa	0	4	0.0	14.3
block/trough 2	General	6	21	66.7	75.0
leaf/bract forms					
tabular/trough/orn 1	Eumusa	4	0	13.3	0.0
tabular/trough/orn 2	Australimusa	1	0	3.3	0.0
tabular/trough/orn 3	General	15	14	50.0	46.7
spheroid	General	10	16	33.3	53.3

and C2 could not be assigned to a single palm species, being common to rattans (*Calamus* spp.) and the coconut (*Cocos nucifera*). Additionally, the echinate trichomes and blocks assigned to *Ficus* cf. *copiosa* are possibly doubtful given the small numbers present in the assemblages and the large variation of those morphotypes in the numerous fig species that occur in the region. Likewise, the large granulate blocks, common in the wood of *Canarium* species, have a broad distribution in many plant groups making taxonomic classification difficult. Finally, from the grass morphotypes it is highly probable that the lobate/cross form found in C2 was derived from Job's tears. However the status of the *Saccharum*-like morphotypes is less certain since these are not confined to cultivated species of sugarcanes (*Saccharum officinarum* and *S. edule*), also being present in *S. robustum* and *S. spontaneum* (pioneer grasses in the same genus), *Oplismenus compositus, Ischaemum muticum*, and possibly a suite of other grasses.

Discussion

The charcoal and phytolith concentrations, as well as the morphotype distribution in the phytolith assemblages from the three SAC sediments, were clearly differentiated. Layer C2, marking the earliest phase of settlement, had relatively low concentrations of phytoliths and some evidence of burning. The vegetation represented by the morphotypes comprised mostly arboreal vegetation as well as tall herbs and palms. Phytolith input from similar vegetation increased substantially in the following phase, C1, and there was a significant increase in levels of burning. The final phase in the sedimentary sequence marked by B2 was notable in having very low concentrations of both phytoliths and charcoal. The vegetation represented by the morphotypes in this layer also changed, and was largely dominated by trees. Thus, within this analysis, the patterns of change observed in the charcoal and phytolith record concur with changes in the archaeological record and provide strong support for taphonomical integrity. How the observed changes reflect the nature of the plant environment, patterns of human activity and land use specific to the SAC locality is discussed below.

General trends and vegetation change

Layer C2. The assemblage in layer C2, representing the earliest occupation phase, has a high relative frequency of morphotypes derived from secondary forest species comprising the Euphorbiaceae/Moraceae/Urticaceae complex, relatively low frequencies of grasses and sedges and an absence of peas and composites. This assemblage implies that either: (*a*) plants represented by the phytolith morphotypes were brought into the site specifically for building house structures and domestic purposes (this is considered to be unlikely since most of the morphotypes are leaf, not wood derivatives); (*b*) the strand vegetation in the vicinity of the SAC site had developed considerably beyond the pioneer strand forest stage at the time of occupation—this is also possibly indicated by the ginger/palm complex, the ginger component in particular; or (*c*) the beach vegetation was still undeveloped and phytoliths were derived from leaf litter and sediment washed into the site from the surrounding escarpment, possibly as a result of disturbance there. It is notable that the assemblage composition of C1 and C2 were significantly different. Therefore, there is no evidence for contamination of the C2 assemblage resulting from downwashing of phytoliths from C1.

The very low concentration of phytoliths in the sediment is significant, possibly due to SAC being situated on a mainly open sandy beach with minimal leaf litter, or rapid deposition of sediment relative to plant microfossil input. This accords with points (*a*) and (*c*) above. It is notable, however, that ethnographic and palaeoenvironmental studies have recorded low phytolith densities in swept village environments in both coastal and forested areas in other parts of New Britain (Boyd *et al*., 1998; Parr *et al*., 2001). Therefore, as there is good archaeological evidence for an initial phase of building activity indicating domestic habitation in this phase (Green & Anson, 2000*b*), ground sweeping to remove excessive litter from around habitation areas could also be a contributing factor here.

Layer C1. The dramatic increases in concentrations of phytoliths and charcoal in layer C1 (Table 2) mark a substantial change in land use at the SAC locality and possibly on the surrounding escarpment. Certainly, if ground sweeping was responsible for low concentrations of phytoliths in the first phase of occupation, there is very little evidence for this type of activity in the second phase wherein concentrations quadrupled. Rather, having considerably higher microfossil and charcoal concentrations and thus comparatively more grass and Musaceae morphotypes than C2,[3] there is strong evidence for gardening activity in C1. Additional support for this is given by the large component of morphotypes derived from secondary forest tree species and understorey gingers that commonly invade abandoned gardens (Lentfer, 1995; Mueller-Dombois & Fosberg, 1998; Paijmans, 1976). The likely presence of the shade tolerant grass *Oplismenus compositus* indicates that either: (*a*) the garden clearing was relatively small, certainly not of a scale large enough to encourage the prolific growth of sun tolerant grasses (Boyd *et al*., 1998); (*b*) bananas were planted in sufficient numbers to create shade over the ground cover; or finally, (*c*) the garden was planted under a canopy, possibly of coconuts. For any of the above, considering the high relative abundance of regrowth elements, it is likely that the garden environment was held in a state of flux throughout the entire occupation phase, alternating between fallow regeneration and cultivation.

Layer B2. After the ashfall, concentrations of charcoal and phytoliths again fell to extremely low levels. Since this layer was culturally sterile, it is of interest to consider the origin of the phytoliths present. Were they derived from leaves and wood and incorporated into the ash during and after the fall as the buried plant material decayed, or were they washed down into the primary tephra from the secondary ash burying it? Certainly, further investigation of phytolith distribution patterns throughout the primary and secondary ash deposits is necessary before this can be truly resolved. However, having said this, there is a degree of support from the B2 assemblage for in-situ derivation of phytoliths. For instance, the morphotypes mostly comprised secondary forest elements similar to the C1 layer, which accords with the expected bush fallow vegetation growing in an abandoned garden. Compared with the C1 assemblage, there was a higher relative frequency of Urticaceous morphotypes and a significant decline in frequencies of tall herbs and grasses. While the latter may have resulted from differential destruction of plants during the ashfall, whereby more flexible grasses and herbs were flattened and not incorporated into the ash layer, as much as below it, there is still strong evidence from the Urticaceous element showing the B2 assemblage to be representative of a successional environment with transitional forest elements typical of early secondary and late secondary vegetation (Mueller-Dombois & Fosberg, 1998). Therefore, this implies that before the ashfall the vegetation was comparatively well developed, most likely following a lengthy period of garden abandonment immediately prior to the Rabaul eruption and the resultant ashfall. This has also been suggested by Smith (2000) following an analysis of the weathering patterns of pig bones.

Evidence of banana cultivation. The most outstanding outcome of this analysis is the presence of Musaceae morphotypes in the assemblages. This constitutes the first direct evidence of bananas in association with Lapita settlement in the Bismarck Archipelago. Importantly, it raises questions about whether these were derived from cultivated bananas or wild bananas growing naturally in the SAC environment.

Watom Island is within the natural geographical range of *Ensete* and *Australimusa* and *Eumusa* wild bananas (Argent, 1976; De Langhe & De Maret, 1999; Simmonds, 1962), although a recent survey by Lentfer in August 2002 found no evidence for wild plants from either section growing on the island itself. Two wild *Australimusa* species (*Musa peekelii* and *M. maclayi*[4]) presently grow in close proximity to Watom Island. Both species occur on New Ireland and *M. peekelii* has been recorded growing wild on the Gazelle Peninsula (Argent, 1976; Daniells *et al*., 2001; Peekel, 1984; Qld. Herb. records, unpubl.). Their fruits are filled with hard seeds encased in yellow flesh (Stover & Simmonds, 1987). The male flower buds and pseudostems can be eaten (Arnaud & Horry, 1997) as well as the sweet yellow flesh of the fruit (Lentfer, pers. obs., 2002).

As well as the two *Australimusa* species noted above, *Ensete glaucum* and three wild species of *Eumusa* (*Musa acuminata banksii*, *M. schizocarpa* and *M. balbisiana*) occur in the general Papua New Guinea region. It is important to note, however, that various banana collecting missions (Argent, 1976; Sharrock, 1988; Simmonds, 1956) recorded only *M. balbisiana* and *Ensete glaucum* from East New Britain. *Musa schizocarpa* seems to be confined to the New Guinea mainland and has not been recorded from New Britain. *Musa acuminata banksii* has been found in West New Britain. Sharrock (1988) made a point of noting that *M. acuminata banksii* was not found in New Britain. However, a specimen was recently collected by Lentfer in the Talasea region in West New Britain.

It is of interest to this study, questioning the origins of the SAC bananas, that the endemic status of *Musa balbisiana* in the New Guinea region has not been resolved (Argent, 1976; De Langhe & De Maret, 1999). Possibly it was introduced to Papua New Guinea from regions further west (e.g., the Philippines) as a primitive diploid with a BB genotype and reverted to the wild non-parthenocarpic plant. The indigenous status of *Musa acuminata banksii*, however, is well recognized. It has a wide distribution ranging possibly from as far west as the Philippines to Papua New Guinea, Australia and Samoa (Argent, 1976). Its genome is present in banana cultivars, including diploid, triploid and polyploid varieties (De Langhe & De Maret, 1999; Lebot, 1999). Notably, it is thought to have been the source of banana phytoliths found in the Kuk assemblages from the New Guinea highlands, where current evidence suggests that there was early banana cultivation beginning c. 6,950 years ago and possibly earlier at c. 10,000 years ago (Denham *et al*., 2003; Wilson, 1985). Importantly, genetic evidence shows that at some stage, possibly prior to the Austronesian expansion into the Pacific region, *M. acuminata banksii* was crossed with *Musa balbisiana*, creating two important groups of AAB triploids, the plantains growing in Africa and India, and the *Maia-maoli/popoulu'* bananas growing in Polynesia (De Langhe & De Maret, 1999).

From current banana distributions and their genetic relationships, therefore, there are several possible sources of the SAC banana phytoliths, both natural and cultivated. In view of the present geographic distribution of wild bananas and close proximity of two wild species of *Australimusa* bananas to Watom, it would be expected that these would be represented in the phytolith assemblages. However, this is not the case. Although many of the morphotypes recorded in the SAC samples are common to

Australimusa and *Eumusa* bananas, as well as other members of the Musaceae family including *Ensete*, there is substantial evidence from the frequency of *Eumusa* seed types in the assemblages for a strong presence of *Eumusa* rather than *Australimusa* bananas, the most likely candidates being *M. acuminata banksii* and *M. balbisiana* or cultivars from both or either one of them. While the analysis cannot preclude *Australimusa*, it is notable that there were no *Australimusa* seed phytoliths recorded in the assemblages, although banana seeds more so than leaves are prolific phytolith producers. Furthermore, it is unlikely that *Ensete* was growing in the vicinity of SAC since none of its distinctive and abundantly produced seed phytoliths were recorded in the assemblages. All this constitutes strong support for anthropogenic introduction of bananas to Watom Island.

Several important implications for horticulture come from linking the results of this analysis with complementary lines of evidence. For instance, the extreme diversity of non-seeded, parthenocarpic banana cultivars the strong evidence of early banana cultivation at Kuk in the highlands of Papua New Guinea is indicative of the longevity of banana domestication and cultivation in the southeast Asian, New Guinean and Oceanic regions. This, coupled with the phytolith evidence, provides good grounds for inferring that bananas were being cultivated at SAC during the time of late-Lapita occupation.

Presently, the question of how the Lapita people acquired the practice of banana cultivation can only be surmised. Given the Kuk evidence for early banana cultivation on mainland New Guinea, it is possible that the original inhabitants who had occupied the Bismarck region for c. 30,000 years prior to Lapita occupation (Allen *et al.*, 1988, 1989; Wickler & Spriggs, 1988) had begun the process of domestication of bananas there. The Lapita peoples may have adopted banana cultivation from them when they settled in the region. Alternatively, if indeed the Lapita culture originated from the Southeast Asian region, the Austronesians could have brought bananas with them, and possibly at some stage used newly encountered cultivars in conjunction with their own, thereby merging two streams of domestication. While both models are equally plausible, the latter integration model, though more complex than the former, finds support not only from studies documenting geographical distribution and morphotaxonomy of bananas but also from a growing body of evidence arising from genetic and linguistic research (Arnaud & Horry, 1997; Daniells *et al*., 2001; De Langhe & De Maret, 1999; Lebot, 1999; Ross, 1996: 184–185). This integration scenario is canvassed in more detail by Green (2000: 377–378).

Certainly, given both the spatial and temporal context of SAC on Watom Island, it is likely that the late-Lapita settlers arrived on the newly formed sand spit with domesticates as part of their "cultural baggage"; the simultaneous presence of bananas and pigs in particular, gives credence to this. Furthermore, from the range of evidence presented here, it appears that banana cultivation occurred at SAC during the first period of occupation, possibly as small-scale, house-garden horticulture, and intensified during the second period.[5] Currently, given the evidence, there is no reason to assume that cultivation was limited to only one banana species or variety, and indeed, crop diversity would be expected given the likelihood of cultivation and prolonged agricultural activity. There is strong evidence from the phytolith analysis for presence of *Eumusa* but there is also some indication for *Australimusa* presence. Moreover, the presence of *Eumusa* seed phytoliths in the assemblages (Table 3) is significant, showing that sterility and parthenocarpy were not fully developed, and banana domestication processes were still *in operandum*.

Although no discernible difference between C2 and C1 banana phytolith assemblages could be detected, there is the possibility that ongoing trade may have influenced domestication and crop development processes on Watom and in the broader region. Indeed, the possible presence of *M. maclayi* in C1 may be linked with this type of activity. (*M. maclayi* is not found on Watom Island or the Gazelle Peninsula, though *M. maclayi maclayi* var. *erecta* grows on Bougainville in the Solomon Islands and *M. maclayi maclayi* var. *namatanai* grows in New Ireland.) Furthermore, since obsidian sourcing data confirms trade networks from the Talasea region in West New Britain and the Admiralty Islands, trade may have accounted for the introduction of new horticultural commodities from those regions. Certainly, the presence of *Canarium harveyi*, tentatively identified from the nearby SDI locality by Yen (1991: 84), is consistent with this.

Other cultivation. Evidence for other cultivars from the phytolith assemblages remains tentative. The cordylines, sugarcanes, Job's tears, *Ficus copiosa, Canarium*, coconut, betel nut (*Areca catechu*), the fish-tail palm and several types of gingers are known useful plants and may well have been cultivated. However, due to multiplicity and redundancy of phytoliths in plants, positive identification without rigorous size/shape analysis was possible only for the cordyline, the fish-tail palm, only one of the gingers, *Tapeinochilos* sp., and possibly Job's tears.

The grass Job's tears grows naturally in the region, mostly favouring swampy environments. Therefore, the areas bordering the stream to the south of the SAC locality would have provided a suitable natural growing environment for this grass. Alternatively, since it often occurs away from its favoured environments in association with gardening (Lentfer, 1995; Peekel, 1984) and the large shiny-grey seeds are edible and also used for beads, its cultivation on the dry sandy spit in the C2 occupation phase is plausible. Likewise cordyline species and several ginger species occur naturally in the region but, unlike Job's tears, this group of plants (the gingers in particular) commonly invade old gardens; hence, their cultivation cannot be assumed from the available data. Furthermore, although the natural distribution of the fish-tail palm is less well known (it is possibly endemic to Asia), it is too premature to assume anything other than a natural distribution (Yen, 1990). Of the remaining plants, coconut palms and *Canarium* nut trees are the most likely to have been cultivated at SAC, but since the *Canarium*-like morphotypes occur in multiple plants and since coconuts have a phytolith morphotype similar to gingers and other palms, this assertion is based primarily on the complementary evidence from macro-remains found at SAC and also a short distance away at SDI and SAD. Finally, from the phytolith analysis alone, the evidence for sugarcane cultivation is inherently weak. However, the possibility should not be dismissed, for again an integration scenario at the time of the spread of Lapita can be sketched involving both New Guinea and Southeast Asia (Green, 2000: 377).

Moreover, some circumstantial evidence from SAC, possibly supportive of sugarcane cultivation, comes from isotope studies. The mean daily consumption of C4 plants (commonly represented by tropical grasses) was calculated to be 2.7% from isotope analysis of human bones (Leach *et al*., 2000). *Saccharum officinarum* and *S. edule* are C4 plants and a proportion of the bilobate morphotypes recorded in the assemblages could indeed have been derived from one of these species, having been cultivated for both pig food and human consumption. A less likely possibility is that *Saccharum robustum*, a pioneer weed species often invading abandoned gardens, could have been consumed by pigs and possibly contributed to the C4 component of the human diet.

There may have been additional crops planted in the SAC gardens as evidenced by the high estimations of C3 plants in the human diet (Leach *et al*., 2000). However, two of the most important root crop complexes in Melanesia, Micronesia and Oceania, the taros and yams, being high in starch, but non-phytolith producers, would be invisible in the phytolith record. Starch analysis has been recognized as complementary to phytolith analysis (Fullagar *et al*., 1998; Lentfer *et al*., 2002; Piperno & Holst, 1998; Therin *et al*., 1999) and would be necessary to determine the presence of such crops at SAC. Examination of the sediments for starch grains would be useful, as obsidian tool residue studies have proven unrewarding (Green & Anson, 2000*b*: 65).

Conclusion

The SAC locality at the Reber-Rakival site on Watom Island has yielded a wide range of archaeological evidence for settlement and changing land use patterns by its late-Lapita inhabitants. This phytolith analysis complements the broad range of analyses previously applied to the site and has produced data that is supportive of former archaeological interpretations.

Evidence of banana cultivation constitutes the most significant outcome of this analysis, being the first direct evidence for its association with Lapita settlement in the Bismarck Archipelago. Diagnostic phytoliths from banana seeds indicate a strong presence of *Eumusa* banana species in the assemblages, whereas the evidence for *Australimusa* is much weaker. Given this evidence, together with genetic, morphotaxonomic and linguistic evidence, as well as the present geographical distribution of bananas, it is very likely that the first Lapita settlers at the SAC locality arrived with *Eumusa* bananas as part of their cultural baggage having inherited the horticultural "know-how" from generations of predecessors living in the Bismarck region and/or Southeast Asia. Further to this, the presence of seeds implies that development of domesticates was still *in operandum* in the region possibly implicating newly encountered banana species and varieties in ongoing domestication processes.

While further investigations are recommended to refine analyses for more definitive reconstruction of the SAC subsistence economy, the phytolith analysis presented here, in tandem with a range of previous analyses documenting evidence for pig husbandry and a variable human diet with high estimations of C3 and C4 plants, gives strong support for the late-Lapita economy having a well-developed agricultural base. In particular, the presence of bananas and pigs in the initial stage of occupation at SAC implies that the first Lapita settlers arrived with plant cultivars. It appears that pig husbandry and horticultural activities more or less continued, apparently successfully, for several hundred years until finally the Reber-Rakival site was abandoned when the area was buried under a substantial ashfall after the Rabaul volcano erupted.

Notes

1 A transitional style of pottery referred to as "post-Lapita" is found at the SDI locality in layers C2 and C1 (Anson, 2000*b*).

2 A newly calculated ΔR value makes shell dates at SAC c. 200 years younger than shown here (new dates and recalibration of older ones are to be published in a forthcoming paper by Roger Green and Fiona Petchey).

3 Although banana phytoliths have similar relative frequencies in C1 and C2, the concentration of phytoliths is more than four times higher in C1 than in C2. The absolute frequency of banana phytoliths in the C1 sediment is greater than in C2, and it would be expected that bananas were also more numerous in the area at the time of C1 deposition.

4 Genetic and morphotaxonomic evidence indicates that the early domestication of *M. maclayi*, possibly in the Solomon Islands where *M. maclayi maclayi* var. *erecta* is endemic, led to the development of the Fe'i banana cultivar, now grown in Papua New Guinea and the wider Pacific region (De Langhe & De Maret, 1999).

5 See Note 3 above.

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Trade and Culture History across the Vitiaz Strait, Papua New Guinea: The Emerging Post-Lapita Coastal Sequence

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ABSTRACT. This paper, focusing principally on post-Lapita times, outlines the course and outcomes of work undertaken over the last two decades in the West New Britain–Vitiaz Strait–north New Guinea coastal region. It presents two principal arguments. The first is that major periods of movement and abandonment documented in the archaeological sequences of this region from about 3,500 years ago coincide with the record of volcanism in the Talasea-Cape Hoskins area. The second is that the post-Lapita sequences of this region differ significantly from the post-Lapita sequences emerging in the island arc reaching from Manus via New Ireland to southern and eastern island Melanesia, which show continuous occupation and pottery production.

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Focusing principally on the post-Lapita period, this paper considers the results and culture-historical implications of research that Gosden, Summerhayes, Torrence and I have undertaken over the last 20 years in the West New Britain–Vitiaz Strait–north New Guinea coastal region (Fig. 1)—a region that Jim Specht (1967) began opening up some 35 years ago. Specht taught me how to do archaeology in New Guinea. I worked with him in West New Britain in 1980 and 1981 and literally and figuratively followed in his footsteps for many years afterwards. This places me in a good position to draw together aspects of the work undertaken on some archaeological issues close to his heart.

The aims of this paper are two-fold. The first is to demonstrate that major changes in the archaeological sequences in West New Britain and areas to the west across the Vitiaz Strait and along the north New Guinea coast from about 3,500 years ago align reasonably well with episodes of catastrophic volcanism in the Vitiaz Strait and the Talasea-Cape Hoskins area of north-central coastal New Britain. Linguistically this latter area is the proximal source of North New Guinea and Papuan Tip Austronesian languages (Ross, 1988). It is also well-known as the geological source of much of the archaeological obsidian found in island Melanesia. The broad correlation between archaeological and vulcanological sequences may help account for the ways in which the central social, linguistic and biological characteristics of the coastal and island peoples in the region developed during the late Holocene. The second aim is to show that this emerging post-Lapita sequence in the West New Britain–Vitiaz Strait–north New Guinea coast region differs significantly from the post-Lapita sequences emerging in the island arc stretching from Manus down through New Ireland into southern and eastern island Melanesia where, in general, there is no break in pottery manufacture and the deposition of cultural materials is evident following the Lapita period.

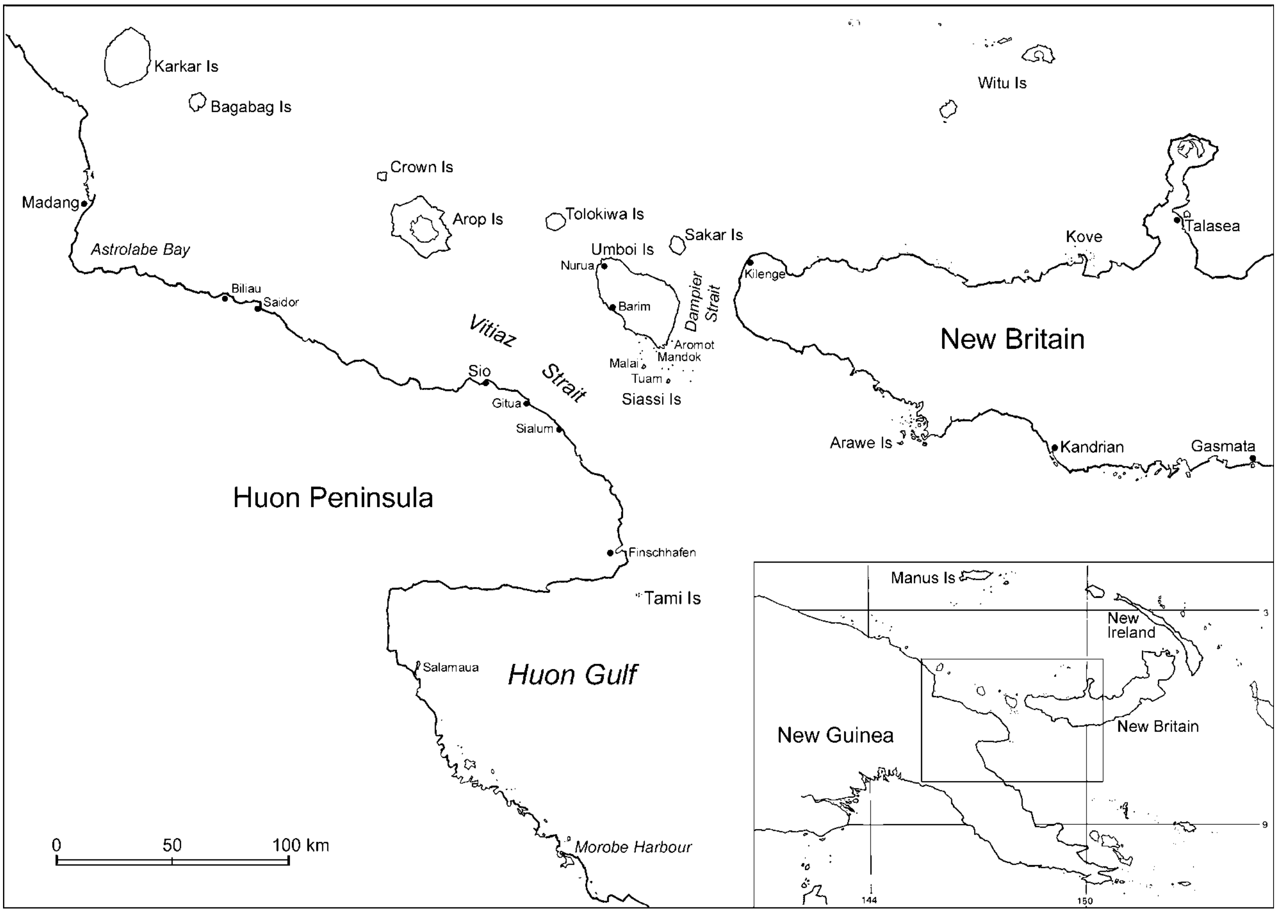

Fig. 1. Map showing places mentioned in the text.

Siassi and Sio

Specht (1973) completed an extensive survey of the Huon Peninsula in 1972 during the first field season of his long-running Trade and Culture History across the Vitiaz Strait Project (TACHAVS). He found 68 sites but only two, both in the Sio area, were considered worthy of further study: the large and highly disturbed shell middens of the KBP site on Sigawa (Sio Island), and the series of mounds forming the KBQ site on the adjacent mainland coast. I excavated these sites in 1984 immediately after finishing the first archaeological exploration of the nearby Siassi Islands and excavation of sites KLK on Tuam and KLJ on Malai (Lilley, 1986, 1986–1987, 1988*a*,*b*, 2002). My results are summarized at some length here, as they are pivotal to the arguments developed later in this paper. Age estimates (as elsewhere in this paper) are based on calibrated radiocarbon dates unless otherwise specified and are rounded up or down to the nearest 50 years. They differ slightly from the dates for these sites that I have published elsewhere owing to continual changes in calibration procedures.[1] Details of the dates in question, including laboratory numbers and standard deviations can be found in the site reports referred to above.

Although neither is continuous, the sequences in the Siassi Islands and Sio area can be amalgamated to suggest a culture-historical model of the development of regional exchange networks from about 3,150 years ago to the historical period (Fig. 2). As Harding (1967) anticipated in his *Voyagers of the Vitiaz Strait*, the earliest evidence for long-distance exchange in the Vitiaz region dates to the Lapita period, in this case a Lapita occupation some 3,150 to 2,750 years ago at the KLK site on Tuam in Siassi (Lilley, 1986–87: 57–61). Petrological analyses pointed to general compositional similarities between the Lapita and more recent pottery from the coastal Madang area (both contain coral-sand temper), but there is no evidence for cross-strait movement of commodities of any sort at this time, including pottery. Simply put, this means that the two-way cross-strait exchange which formed such a fundamental part of the historical trading system described by Harding cannot be derived from patterns of exchange during Lapita times. Moreover, in addition to being configured differently, the posited Lapita exchange system disappeared approximately 1,000 years before the emergence during what I call the Sau-Tambali Phase of an exchange system which can be considered ancestral to the ethnographic pottery-trading network.

The emergence of the "proto-system" of long-distance exchange some 1,700 years ago is signalled by the sudden appearance in the archaeological record of three, and somewhat later a fourth, distinct and distinctive styles of pottery, as well as the first evidence for cross-strait transfer of pottery, obsidian and probably chert. That the ethnographic trading network evolved from this proto-system is indicated by underlying continuities in most aspects of material culture and in the nature of local subsistence strategies. However, there are several noteworthy differences between the proto-system and the historical trade network. The most important here is that the configuration of pottery manufacture and movement differed markedly.

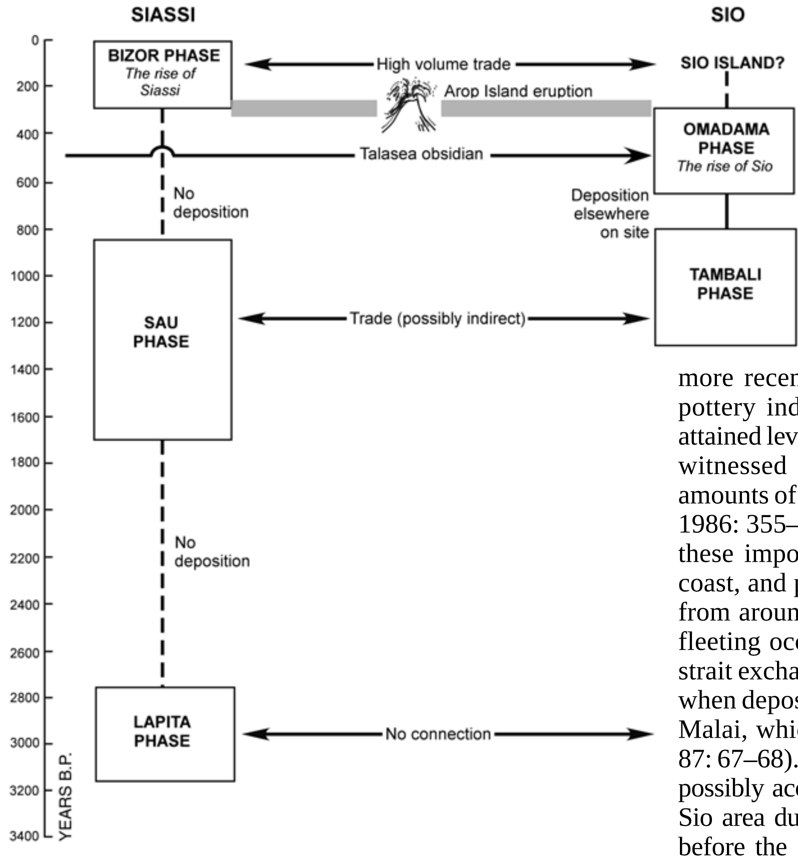

Fig. 2. Diagrammatic sequence of cultural change in Siassi and Sio.

Only one of the pottery industries that operated at the very beginning of the proto-system, Sio, survived into the ethnographic present. Another ware associated with the proto-system, Madang, also survives today, but it is present in the Sio area (and perhaps nearby Arop or Long Island)[2] only from about 1,300–1,000 years ago and may not have been made or at least traded very far before then. Of the two other early wares, I have already described Type X (Lilley, 1988*a*). I have little further information about the other, formally undescribed ware which I call Type Y (Lilley, 2000, 2002). It is very distinctive visually and petrologically, and on the latter basis may originate in West New Britain. Its dating remains uncertain. It may be associated with a radiocarbon determination of about 2,300 cal. B.P. (ANU 4619) from Siassi and thus may link with what might be late Lapita-early post-Lapita pottery from undated contexts in the nearby Arawe Islands (see below). At present, though, there is only this single determination of that age from my excavations on the Siassi Islands and in the Sio area (or Kove for that matter—see below), and it does not overlap with other dates from any of the sites. Moreover, nothing else was found that suggested an early post-Lapita presence. Thus, despite the ambiguous Arawe Islands material and the possibility of Type Y finds at Specht's Kreslo Lapita site (Lilley, 2002; Specht, 1991) and at Pililo in the Arawe Islands (Lilley, 2002; Summerhayes, pers. comm.), I hypothesize for now that Type Y is more likely to have appeared along with Type X and ancestral Sio pottery around 1,700 B.P.

The KLK site in Siassi was abandoned from about 850 to 500 B.P. (Lilley, 1986–87: 61), but at site KBQ on the mainland at Sio there are unambiguous indications that a number of important developments occurred at some stage between about 800 and 650 B.P., even though no deposits dating to this critical period have been excavated in the Sio area (Lilley, 1986–87: 71–72; Lilley, 1988*a*: 97–98). Most notably in the present context, excavated evidence from more recent deposits at KBP clearly shows that the Sio pottery industry of the Omadama Phase (650–300 B.P.) attained levels of intensity and specialization similar to those witnessed historically, at the same time that increasing amounts of Talasea obsidian began reaching the site (Lilley, 1986: 355–57). However, it should be stressed that despite these important developments on the north New Guinea coast, and patchy evidence for a human presence in Siassi from around 550 B.P., there is no indication of more than fleeting occupation of Siassi or of a resumption of cross-strait exchange until approximately 300 B.P. (Bizor Phase), when deposition accelerated at the KLJ site on the island of Malai, which is adjacent to Tuam in Siassi (Lilley, 1986–87: 67–68). In other words, a general intensification of activity, possibly accompanied by other major changes, began in the Sio area during the Omadama phase, almost four centuries before the emergence of an exchange system exhibiting a pattern of linkages like that recorded ethnographically.

There is no excavated evidence from the KBQ site on the mainland to cover the last 300 years, and the focus of local occupation seems to have shifted to the irretrievably disturbed KBP site on Sio Island during this period (Lilley, 1986–87: 68). However, there is a dramatic increase in the deposition of Sio pottery at the KLJ site on Malai at this time (Lilley, 1986: 297–301). This clearly indicates that there was a significant increase in the quantity of coastal New Guinea pottery transferred across the strait, which in turn suggests the possibility of further intensification of production in the Sio area. The Malai data also indicate that the bulk of the excavated Madang pottery was transported across the Vitiaz Strait during historical times. These developments are associated with increased deposition of a much expanded range of utilitarian artefacts and faunal remains and the first appearance of valuable manufactures in the Siassi Islands.

In short, while a shift to specialist pottery production had occurred in the Sio area by about 650 B.P., the excavated data suggest that the production of Sio pottery and cross-strait trading activity did not reach the levels of intensity recorded ethnographically until some time later—around the time that William Dampier first saw the Vitiaz Strait in 1700 A.D. (250 B.P.). I do not think Dampier or any other European who sailed through the region after him had anything to do with these developments. The changes may, however, be related to the fact that around the time of Dampier's visit, a cataclysmic eruption on nearby Arop Island caused the "time of darkness" that is discussed by Blong (1982) and perhaps implicated in Sio stories of a magically induced catastrophe that led people to move from the mainland to Sio Island. The volcanic event appears to have resulted in widespread disruption and population dispersal, which in turn may have necessitated a rearrangement of regional interaction patterns (Lilley, 1986: 476–478).

The Arawe Islands

After accompanying Specht on a visit to the area in 1985 (Specht, 1985), Gosden undertook detailed research in the Arawe Islands in southwest New Britain until 1992 (e.g., Gosden, 1985, 1991; Gosden & Webb, 1994; Specht *et al*., 1992). Work undertaken by Gosden and others associated with his projects (e.g., Summerhayes, 2000) has dealt almost entirely with Lapita, which I will not consider here, but post-Lapita deposits are present in some of these sites. Few detailed descriptions of the excavated post-Lapita material have been published or included in field reports. Working only from dated sites (and using the calibrated dates provided by Summerhayes [2000] rather than those Gosden has described elsewhere), it seems that the last vestigial traces of Lapita ceramics disappeared from the Arawe Islands by 2,300 years ago (Summerhayes, 2000: 27), and that ceramics did not reappear until about 800 cal. B.P., in the form of Type X, Sio and/or Madang wares from the New Guinea mainland. This material occurs in surface sites, as well as in sandy sediments above Lapita deposits, as at the Makekur (FOH) site on Adwe Island and at the Apalo (FOJ) site on Kumbun Island; or in shell middens stratified above a red-brown clay containing Lapita sherds, as at the Paligmete (FNY) site on Pililo Island (Gosden & Webb, 1994: 35–47, Summerhayes, 2000: 22–25).

It is this last site on Pililo Island that provides the date for the re-appearance of ceramics: 790 cal. B.P. from the base of the midden. (Summerhayes, 2000: 25). The picture changes somewhat if pottery in undated sites is considered. Incised and applied ceramics and sherds exhibiting "all-over [finger]nail impressions" were excavated in deposits of unknown antiquity at Winguru on Pililo Island (Gosden & Webb, 1994: 47 and fig. 15). Although the excavators presume them to be "late or post-Lapita", it remains uncertain how these ceramics articulate culturally and chronologically with the pottery recovered from the dated sites. It can be surmised that the finds are more than 1,000 years old owing to their stratigraphic position in the clayey deposits. However, from the information available it cannot be ascertained whether they were deposited without a significant break throughout the post-Lapita period, whether they were deposited only in the immediately post-Lapita times, before say 2,000 cal. B.P. at the latest, or whether they only appeared in the late post-Lapita period, from, say, 1,500 years ago.

The principal problem at Winguru is the dating of the various clay layers and the implications for continuity of occupation and deposition in the Arawe Islands. In their 1991 field report Gosden & Pavlides (1991: 1) note that their work at Makekur "confirmed the suspicion that… there is a period in the prehistory of this area of West New Britain during which pottery was not in use… it appears that this period will fall between 2,000–1,000 years ago". However, Gosden & Webb (1994: 47–49) argue for continuous occupation throughout the post-Lapita period on the grounds that the Lapita-bearing clay at Paligmete has a date of 2,682 cal. B.P. (Summerhayes, 2000: 25) from near the bottom, and dates of 1,048 cal. B.P. and 1,061 cal. B.P. from the top of the underlying clay, while the base of the overlying midden containing recent New Guinea ceramics has a date of about 790 cal. B.P.

There may in fact have been a substantial gap between the time the clay was deposited and the time the midden formed above it: a period of at least 1,000 years, perhaps more, coincident with the period mentioned by Gosden and Pavlides during which pottery was not deposited. This is because, despite the dates of c. 1,000 cal. B.P. at the top of the clay, it contains only Lapita ceramics, and in fact "proper" Lapita, as opposed to the cruder "terminal" Lapita from Winguru. A date of 1,000 cal. B.P. is far too recent for Lapita of any description, anywhere. Results from Siassi, Sio and Kove (Lilley, 1991) indicate that by that time, definitely post-Lapita ceramics such as the Type X found in the Paligmete midden and elsewhere in the Arawe Islands ought to have been present for upwards of 500 years. This suggests that, rather than indicating continuous deposition from 2,700 to 1,000 cal. B.P., the Lapita-bearing clay at Paligmete (and by extension, that in the other Arawes sites) may actually date only to the Lapita period, and that the 1,000 cal. B.P. determinations at the very top reflect downward migration of the dated material from the overlying, much younger midden owing to human scuffage and treadage and/or through natural processes. This in turn would imply that the material in the undated Winguru clay is in fact terminal or immediately post-Lapita rather than anything more recent. I return to this issue below.

Talasea

Building on work that Specht began many years ago (e.g., Specht, 1974; Specht & Sutherland, 1975), Torrence's studies in the Talasea area of West New Britain, especially on Garua Island and most recently on the mainland between Talasea and Kimbe, have been the subject of a series of valuable papers dealing with long-term variations in resource (especially obsidian) use and the disposition of human activity across the landscape (e.g., Torrence, 1992, 1994; Torrence *et al*., 1990, 2000). Her broader interpretations are discussed at some length as they bear directly on the relationship between the history of volcanism around Talasea and Cape Hoskins and the late Holocene archaeological record in the wider Vitiaz region that I want to highlight.

Although initially convinced that local events and processes were responsible for a continuous long-term sequence of gradual change which she detected in the Garua and wider Talasea sequence, Torrence has of late allowed for a more punctuated sequence of development and greater influence from non-local factors, especially during the Lapita period. Thus in her 1994 conference paper (p. 5), she noted that pottery appeared suddenly with Lapita, but then disappeared just as suddenly some time later (presumably immediately after production of classic Lapita ceased, as the only other ceramics known from the area are recent wares from the New Guinea mainland). She also noted that there was an abrupt shift in settlement pattern when Lapita appeared, and argued this was "the result of social changes unique to the Talasea region" (1994: 5–6). She went on to propose that there were underlying continuities bridging the pre-Lapita, Lapita and post-Lapita periods. She accepted, for example, that distinctive tanged obsidian tools, long known from work done in the TACHAVS Project (e.g., Specht, 1973) and recently described in detail by Araho (1996), were dated into as well as before the Lapita period (Torrence, 1994: 2, though cf. Torrence *et al*., 1990: 462). She also argued that other changes she observed in lithic behaviour represent "an accommodation" to gradual shifts in the subsistence and settlement system which unfolded over the last 6,000 years

(1994: 3). This perspective maintained the firm stance she took in 1992 when she argued that "changes…at Talasea can best be explained as the result of a long-term, slow, continuous change in subsistence and settlement patterns, rather than the sudden arrival of different people, ideas or material culture" (Torrence, 1992: 111–112).

In her most recent publications, Torrence continues to emphasize the benefits of a long-term view of change, and indeed maintains the same basic position that "a punctuated trend in lithic technology [can be] inferred to reflect a decrease in mobility and an increase in the intensification of subsistence practices" (Torrence *et al*., 2000: 225). It is fair to say, though, that she also acknowledges the elemental nature of shifts in the archaeological record and the likelihood of exogenous sources of change in the Lapita period in a way she did not do earlier. True, in 1990, with Specht and Fullagar, she argued that Lapita was somehow involved in the recolonization of Talasea following the cataclysmic W-K2 eruption about 3,600 B.P. They said, however, that "whether [these]…people bearing Lapita pottery were new to West New Britain or were previous residents returning with an adaptation to the new risks they would face, cannot yet be determined" (Torrence *et al*., 1990: 463). In 2000 she and other colleagues noted that after the W-K2 eruption:

> the character and speed of change is much more radical than before; for example, pottery is introduced, stone tool types [tanged forms] disappear, and the whole pattern of artefact discard is transformed…[it seems likely] that a major difference in human behaviour is required to explain the changes after the W-K2 event (Torrence *et al*., 2000: 241).

That difference is seen much less ambiguously as a result of migration or colonization dependent upon "processes taking place outside the study regions and probably beyond the island of New Britain itself" (Torrence *et al*., 2000: 241).

While three major eruptions occurred in Torrence's study area in the post-Lapita period, she and her colleagues note that two were much more limited in scale than W-K2, that unlike earlier events, the third, more violent eruption seemed to have affected only the Willaumez Peninsula, and that all three had significantly less impact on regional sequences of archaeological change than W-K2 (or the much earlier W-K1). They argue (Torrence *et al*., 2000: 242) that:

> in contrast to W-K2, W-K3 and W-K4 [which occurred in the period 1,400–1,700 B.P.] had very little impact on human occupation…Not only were the depths of tephra small…but it also seems likely that social strategies introduced after W-K2…created a large enough safety net such that the loss of resources could be coped with, perhaps through exchange networks or by seeking temporary refuge with people belonging to the same social network…social relations may also explain [rapid] reoccupation after the very severe Dk [Dakataua c. 1,000 B.P.] event…

This insight is central to the argument I develop below.

Discussion

The overall picture emerging from the foregoing research seems relatively straightforward. Following the catastrophic W-K2 eruption about 3,600 cal. B.P., people who made or used Lapita pottery colonized coastal areas of the Bismarck Archipelago from Siassi eastwards by about 3,300 cal. B.P. Lapita ceramics disappeared from the region between 2,500 and 2,000 cal. B.P. (Specht & Gosden, 1997).

In at least some areas, there was then an hiatus in the manufacture and deposition of pottery for a period in the order of 1,000 years. Aceramic activity seems to have continued around Talasea, but there appears to have been no archaeological deposition at all between 2,750 and 1,700 years ago in the Siassi Islands, in the Sio area, or the Kove area immediately west of Talasea. The situation in the Arawe Islands is unclear. Even though clays eroding from elevated parts of some of the islands contain only Lapita ceramics, they may have continued to be deposited from Lapita times until about 1,000 cal. B.P., well after the Lapita period. However, dated deposits less than 1,000 years old contain only recent New Guinea mainland pottery. Some undated ceramics recovered from clays below middens are thought to be late or post-Lapita, but exactly how "late or post-" is still unknown. I consider this material to be terminal Lapita, that the Lapita-bearing clays were deposited only during the Lapita period as conventionally dated (i.e., between 3,600–3,300 and 2,500–2,000 B.P.), and that there was a 1,000 year hiatus in deposition generally and not just of pottery at the sites, and thus perhaps a break in occupation of the Arawe area as a whole.

It is very important that this issue is resolved, as it has a significant bearing on the description and interpretation of regional patterns of post-Lapita change. This is because about 1,700 B.P., Sio, Type X and probably Type Y pottery appeared in the Vitiaz region, seemingly *de novo* after the postulated 1,000 year gap in deposition. Madang pottery may not have appeared until a somewhat later, as it is first found in the Sio area (and perhaps on Arop Island) in contexts only about 1,300–1,000 years old. Where Type Y fits chronologically is not clear, but whether it is immediately post-Lapita or only 1,700 years old does not affect the overall picture being developed here. Type X, on the other hand, disappeared between about 800 and 650 years ago. This is during the same period that Madang and Sio pottery acquired the distinctive characteristics of high-volume production for trade and began to appear in the Arawe Islands from about 800 B.P. and in the Kove area at the end of the period. Looking further afield, it was also the time that essentially modern Type A Adzera pottery probably replaced the earlier Type B in the Markham Valley (Specht & Holzknecht, 1971). Specht & Holzknecht (1971: 66) had no absolute dates of their own, but they noted White found "Markham Valley" sherds at Aibura in the Eastern Highlands above a level dated to about 680 cal. B.P. (GaK-622). Finally, the Vitiaz exchange network documented by Harding (1967) seems to have emerged only about 300 years ago.

In broad terms, this overall sequence seems to fit quite well with the sequence of volcanism around Talasea and Cape Hoskins described by Torrence *et al*. (2000). In addition to the broad coincidence of the appearance of Lapita and the W-K2 eruption in the period 3,600 to 3,300 B.P., it can be seen that the sudden appearance of the Vitiaz proto-system of exchange from about 1,700 B.P. broadly matches the timing of the W-K3 and W-K4 eruptions which occurred at some time during the period 1,700 B.P. to 1,400 B.P. Although Torrence sees little change occasioned by these more recent and less violent eruptions around Talasea, I propose that they had a flow-on or knock-on effect in areas to the west of the Willaumez Peninsula, prompting people from around the Kove area to move west into the Vitiaz Strait-north New Guinea region, as suggested by the aforementioned linguistic evidence for a relatively recent west-east movement of Austronesian speakers of precisely this sort (Ross, 1988; also Lilley, 1991).

The flow-on effect may not have stemmed from any single eruption, as neither W-K3 nor W-K4 seems to have been especially devastating. Rather, small-scale population movement may have emerged as a reaction or adaptation to a series of individually relatively minor but cumulatively damaging tectonic events, as suggested by the closeness of the dates for the two volcanic events in question. As has been hypothesized elsewhere (Lilley, 2000), Terrell & Welsch's (1997), findings on the Sepik coast and offshore islands near Aitape fit into this sequence at this time. Their Sumalo ware, initially hypothesized to be pre-Lapita, has now been dated to about 1,300–1,100 B.P. This is roughly 500 years younger than the first post-Lapita Vitiaz wares, and substantially overlaps the earliest current dates for Madang pottery. On that basis, it seems likely that Sumalo ware is further evidence for the east-west population movement in question. I am not sure in this connection what to make of Gorecki's (1992; Gorecki *et al*., 1991) and Swadling and colleagues' (1989, 1991) claims for pre-Lapita pottery in the Sepik-Ramu hinterland. In general I agree with Spriggs' (1996) assessment of the situation, and follow him in noting that Swadling *et al*. (1991) have a charcoal date of 1,800–1,300 B.P. from Akari, which, as they themselves note, contradicts an older shell date of about 6,300 B.P. from the same stratigraphic unit. This puts the pottery from Akari into the same general period as Sumalo ware and the first post-Lapita ceramics from the Vitiaz Strait, and thus may connect it in some way with the proposed westward expansion of Austronesian-speaking potters. I would add, too, that although there is no evidence for when coastal Huon Gulf pottery first appeared, Specht & Holzknecht (1971) consider that ancestral Type B Adzera pottery may have developed in the Markham Valley around this time as well. The notion that these processes of change were sparked by a volcanic event (or series of events in a short time) rather than the internal dynamics of regional cultural systems makes particular sense when it is recalled that prior to the W-K3 and W-K4 eruptions there appears to have been little or no post-Lapita activity in much, if not all, of the region in question.

While it was violent, it seems unlikely that the Dakataua eruption around 1,000 B.P. had the same impact on wider regional sequences, because it appears to have affected only the Willaumez Peninsula and not beyond (perhaps because of the location of the Dakataua crater at the very northern extremity of that landform). This means that while the appearance of the first post-Lapita proto-system of exchange across the Vitiaz Strait can be tentatively tied to the expansion of the North New Guinea cluster languages, and both linked to a period of tectonic instability manifested in the W-K3 and W-K4 eruptions, similar claims cannot be made for developments in the region between 800 and 500 years ago. These developments do not appear to be linked to any linguistic shifts of note and seem to be generated solely by the internal dynamics of regional trade networks. The final phase of development of the Vitiaz trading networks prior to European colonization may be a different story, however, which returns to the theme of volcanism and cultural change. As noted earlier, this is because Arop, just west of Siassi, exploded dramatically around the same time that the ethnographic configuration of trade emerged, with many of the communities with which the Siassi Islanders traded being composed of the dispersed speakers of Austronesian languages of Arop origin (Lilley, 1986; Ross, 1988).

This broad regional sequence is quite different from the one evident elsewhere in island Melanesia, where it appears there was no break in pottery manufacture and/or deposition following Lapita. Pottery certainly disappeared from some places in which it had been manufactured during the Lapita period. In regional terms, however, pottery persisted throughout the post-Lapita period. Moreover, it evolved in a manner which maintained quite clear continuities with Lapita even if it can no longer be claimed to represent a coherent, widespread and long-lived incised and applied relief tradition (Bedford & Clark, 2001; cf. Spriggs, 1992, 1997; Wahome, 1997, 1999).

The same applies to obsidian distribution. White's (1996) sequence of maps shows very clearly that the movement of obsidian continued in the northern and eastern Bismarck Archipelago throughout the post-Lapita period, albeit with changes in quantities moved and in the relative proportions of material from different sources. The evidence discussed in this paper as well as that considered by White indicates that the same situation did not obtain in areas to the west of Talasea, where there was a long gap between Lapita and what followed it (accepting the uncertainty about the hiatus in the Arawe Islands). In gross terms, the pre-Lapita, Lapita and post-Lapita periods seem to differ little in the Admiralty Islands and eastern Bismarck Archipelago whereas there are no connections to speak of to the west of West New Britain before about 1,500 years ago—the five pieces of terminal Lapita-period Talasea obsidian from Borneo notwithstanding (Bellwood & Koon, 1989). In terms of both pottery and obsidian distribution it thus seems that the post-Lapita sequence in the West New Britain–Vitiaz Strait–north New Guinea coastal region differs significantly from that which obtains through a very wide arc of islands stretching from the Admiralties in the north down through New Ireland and into southern and eastern Melanesia. This last region remained a hive of activity, whereas in the western region it appears that after Lapita, those coastal localities known to have been occupied during, and in some case prior to, the Lapita period were abandoned, or at least the scene of quite different and much less intensive activity, the remains of which are yet to be detected archaeologically.

How the West New Britain–Vitiaz Strait–north New Guinea sequence links with post-Lapita events and processes immediately to the south, in the Massim and along the Papuan south coast, is an interesting question in this context. On archaeological grounds there may be some connection (Lilley, 2000), and Ross (pers. comm.) has linguistic evidence for higher level ties between his north New Guinea and Papuan Tip clusters. This is not the place to pursue such matters, however.

In closing, I do not think that volcanism "caused" the scenario outlined above in any but the most proximal sense: geological phenomena have no inherent capacity to cause cultural changes of particular sorts. Rather, as stated elsewhere in relation to the connection between Lapita and the W-K2 cataclysm (Lilley, 2000: 189), eruptions can give "a coincidental fillip to processes already in train", an unanticipated random nudge delivered at a particular juncture in a local trajectory of change that reorients that trajectory to a greater or lesser extent. In the case of Lapita, W-K2 helped create the conditions for existing processes to produce a novel phenomenon out of long-standing social and economic connections reaching west from the Bismarck Archipelago along the north New Guinea coast towards Asia. In the case of the relationship between W-K3 and W-K4 and post-Lapita developments in the wider Vitiaz region, Torrence's insight about social strategies introduced after the W-K2 eruption, as quoted above (Torrence *et al*., 2000: 242), points to plausible cultural causes.

However, I propose that the reaction at that time to those particular eruptions produced a novel result—colonization to the west. This result can undoubtedly be accommodated by our knowledge of the societies concerned, given their inheritance from the people who overcame the devastation of W-K2. Yet it was certainly not an inevitable outcome of the longer-term processes of change evident in the period prior to the eruptions, a time during which there is little or no evidence for interest in the West New Britain–Vitiaz Strait–north New Guinea region rather than areas to the north, east and southeast of Talasea. In short, while acknowledging the undoubted inertia inherent in long-term trajectories of change, more weight should be placed on the relative influence of singular, random events than Torrence does, at least in her earlier formulations. I consider that chance is often as important as history in moulding the finer details of change in past human behaviour.

Conclusion

Clearly, a great deal remains to be done to test these still speculative hypotheses. In particular, much more fieldwork is required in the West New Britain–Vitiaz Strait–north New Guinea region, at least as far west as Madang and probably all the way to the Bird's Head in West Papua. Fieldwork is also required in the Huon Gulf and south along the coast of Morobe and Oro Provinces towards the Massim, as the former areas remain a complete archaeological blank and only very little has been done round the Papuan Tip. In addition to gaining a record of the archaeological sequences there, such studies would help determine what, if any, links joined developments in the Massim and Papuan Tip/south coast with those that occurred across the Vitiaz Strait. The post-Lapita sequence in the Arawe Islands urgently needs to be resolved as well, and all of the dates discussed in this paper need to be calibrated to the same standards to refine the chronological links (and gaps) under consideration. On a more conceptual level, further thought needs to be given to the interplay of one-off events and long-term processes in the patterning of past human behaviour, especially in a region with the tectonic volatility of island Melanesia, along the lines of the work being pursued by Torrence.

Notes

1 Conventional radiocarbon ages (CRAs) were converted to calendar years using the CALIB (v4.3) computer program (Stuiver & Reimer, 1993). Determinations based on charcoal and other terrestrially-derived samples (e.g., sediment) were calibrated using the atmospheric decadal dataset of Stuiver *et al*. (1998*a*) with no laboratory error multiplier (K=1.0). Charcoal determinations were not altered for a southern hemisphere offset (McCormac *et al*., in press) given the proximity of the study area to the equator. Dates on marine samples (e.g., marine shell) were calibrated using the marine calibration model dataset of Stuiver *et al*. (1998*b*) with a ΔR correction value of 0±0 with no laboratory error multiplier (K=1.0). This ΔR value was used as a default as no local values are available for the study area (see Reimer & Reimer, 2000).

2 Egloff (1975) got dates of only about 540 cal B.P. (GX-3561, GX-3633, GX-3632) for Madang pottery around Madang itself, but there is a date of 950 cal B.P. (ANU-1308) from Arop for a "clay B/style group IV" sherd that I think is probably Madang ware (Egloff & Specht, 1982).

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From Misisil Cave to Eliva Hamlet: Rediscovering the Pleistocene in Interior West New Britain

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ABSTRACT. The potential for archaeological evidence of Pleistocene activity to exist in West New Britain was first realized by Jim Specht. More recent work in Specht's research region of Yombon reveals intriguing archaeological data which demonstrate the organized utilization of rainforest resources as early as 35,500 years ago. The early colonists of the Bismarck Archipelago were versatile hunter-gatherers able to move beyond the coastal island fringes of Melanesia and harness important economic and lithic resources deep within the lowland rainforests.

PAVLIDES, CHRISTINA, 2004. From Misisil Cave to Eliva Hamlet: rediscovering the Pleistocene in interior West New Britain. In *A Pacific Odyssey: Archaeology and Anthropology in the Western Pacific. Papers in Honour of Jim Specht*, ed. Val Attenbrow and Richard Fullagar, pp. 97–108. *Records of the Australian Museum, Supplement* 29. Sydney: Australian Museum.

Twenty years ago Jim Specht published two short and modestly titled papers listing the then oldest archaeological site in the Bismarck Archipelago (Specht *et al*., 1981: 14, 1983: 92). The first paper relayed the facts that Misisil Cave, a site set deep in the lowland tropical rainforest of West New Britain, had evidence of terminal Pleistocene occupation. The realization that the Bismarck Archipelago might have been colonized during the Pleistocene was just dawning on scholars of Melanesian prehistory and this find in West New Britain put Jim Specht firmly in the middle of the most hotly pursued set of archaeological data. Since then many archaeological sites in the Bismarck Archipelago and the Solomon Islands have demonstrated the remarkable colonizing feats of Melanesia's first occupants. Several of these very early sites are from another area visited by Jim Specht in the early 1980s—the Yombon village area in the shadow of Misisil Cave. The Yombon sites are extremely important as they indicate that the rainforests of West New Britain were entered and occupied in excess of 35,500 years ago. In addition they indicate that the early colonists of the Bismarck Archipelago were not trapped along coastal island fringes, but rather were able to harness and utilize important inland resources and locales. This paper will evaluate current models of early habitation in Melanesia by examining the organization of flaked stone technologies found at Yombon and comparing this new information with data from other contemporary Melanesian sites.

"Strandlooper" models of sporadic, low intensity use of new environments by highly mobile coastal foragers are not consistent with new data from the Yombon area. For example, there is evidence to suggest that West New Britain's Pleistocene occupants were more structured in their approach to lithic resource acquisition and artefact production. In this case the targeting of specific high quality geological sources has organizational implications for technological planning and mobility strategies, as has the production of formal tools which could be maintained for extended periods of time. Models which argue for patterns of high mobility during the Pleistocene are therefore consistent with the pattern of technology observed at the

Yombon sites. A review of the available technological data from other sites of similar antiquity in Melanesia does not suggest this pattern of mobility. Significant differences may therefore have existed between these earliest colonists and those of the West New Britain interior forest.

Pleistocene models of settlement and subsistence in Melanesia and the Pacific

A number of models have been presented to explain the earliest occupation of Melanesia. For mainland Papua New Guinea these include the seasonal use of special local resources in cold, Highlands landscapes at sites such as Kosipe (White *et al*., 1970) and Nombe (Gillieson & Mountain, 1983; Mountain, 1983); and possible evidence of more permanent occupation and structural remains beginning at about 18,000 years ago at the site of NFX in the central Highlands (Watson & Cole, 1977: 35–40, 130–132, 194–195); and later at Wañelek in the Bismarck-Schrader Range (Bulmer, 1977: 65).

For the Melanesian islands a "strandlooper" model was proposed on the basis of early data from the coastal cave sites on New Ireland (Gosden, 1991, 1993; Gosden & Robertson, 1991; Spriggs, 1997: 35–39). These earliest colonists were seen as rapid explorers, taking advantage of local resources, wherever possible, within a system of low intensity foraging. This is in contrast to a model which sees the settlement of island Melanesia as characterized by more specialized and intensive solutions to resource acquisition (Allen, 1993: 146; Gosden, 1995: 815), including the movement of various goods, animals and raw materials after 20,000 B.P. (Gosden, 1993: 133; Enright & Gosden, 1992: 174). Such organization suggests reduced settlement mobility and a changed economy because it had the effect of equalising the distribution of key but scarce resources between regions.

The concentration on marine resources at many coastal sites and the total distance traversed by the early colonists are evidence for strong maritime capabilities (Irwin, 1991); however a totally marine adapted economy (Gosden & Robertson, 1991) at this early stage is unlikely. Evidence of Pleistocene activities occurs at numerous locations indicating the exploitation of an extremely diverse range of habitats on immediate arrival to the region (Table 1). In particular the findings reported here from the Yombon area of West New Britain (Pavlides, 1999; Pavlides & Gosden, 1994) clearly indicate that the model of earliest Pleistocene settlement must now include both coastal and inland adaptations as part of an extremely mobile and rapid process of colonization. Furthermore, the management of this range of environmental niches required a number of different technological and social approaches to resource acquisition and exploitation.

Evidence for the utilization of lowland, tropical rainforest resources comes in the form of plant residues, raphides and starch grains present on the Pleistocene tools from Kilu Cave, Buka Island (Loy, *et al*., 1992; Wickler, 1990) dating to 28,000 years ago and the earliest levels at Yombon (Pavlides, 1999). Other evidence of early plant manipulation comes in the form of special artefact types. Groube (1989: 298–302) has argued that the large waisted axes found at Pleistocene sites on the Huon Peninsula represent forest clearance activities. Environmental evidence from some sites in Papua New Guinea and Irian Jaya also point to early clearance activities, consistent with disturbance of the canopy (Groube, 1989; Haberle, 1993: 119; Haberle *et al*., 1991; Hope, 1982, 1983).

Pleistocene flaked stone assemblages have rarely been used to formulate or support models of settlement and subsistence in Melanesia. A review of these data indicates that patterns of high mobility encompassing long distances are not borne out in the organization of technology at most sites. For example, resource selection routinely involved relatively low cost solutions to raw material acquisition. In particular, secondary geological stone sources such as river and streams beds, often in the immediate vicinity of sites, were targeted and a wide variety of lithic material types selected. This pattern is observed at the New Ireland, Manus and Buka Island sites—Matenkupkum (Freslov, 1989: 35), Buang Merabak (Leavesley & Allen, 1998: 70–71; Rosenfeld, 1997), Pamwak (Fredericksen, 1994: 76) and Kilu (Wickler & Spriggs, 1988)—which contain a variety of local raw materials, extracted primarily from riverbed sources. The same is true of many mainland New Guinea sites: Kosipe (White *et al*., 1970: 163), Nombe (Mountain, 1983: 94; White, 1972: 132), Fortification Point on the Huon Peninsula (Groube *et al*., 1986: 454), Wañelek (Bulmer, 1991: 473) and Batari (White, 1972: 27). Only the Pleistocene assemblages from the sites around Yombon (Pavlides, 1999) indicate the selection of high quality stone from primary geological contexts. Flakeable stone material is locally available in riverbeds as cobbles and from *in situ* sedimentary rock sources around the Yombon area. The specific targeting of primary geological source material represents a much more costly solution to resource acquisition with organizational implications for planning, landscape use and mobility strategies.

Generally, the patterns of artefact production observed at most Melanesian Pleistocene sites indicate little specialization or standardization, and technological features from Matenkupkum, Balof and Pamwak do not suggest intensive reduction strategies (Freslov, 1989; Fredericksen, 1994: 74; White *et al*., 1991). During the Pleistocene the only formal tool, the stemmed and waisted axe, comes from mainland Papua New Guinea where it is a component of several assemblages, for example, at Kosipe (White *et al*., 1970: 165), Nombe (Mountain, 1983: 9) and the Huon Peninsula (Groube *et al*., 1986: 454). If highly mobile settlement patterns are to be predicted for the Pleistocene in Melanesia, then the production of formal tools which could be used and maintained for long stretches of time whilst on the move should be more prevalent. Within island Melanesia only the unifacial ovoid scraper from one of the Pleistocene sites at Yombon (Pavlides, 1999) and the ovoid tools from Pamwak, dating to the terminal Pleistocene (Fredericksen, 1994: 76; Fredericksen *et al*., 1993: 148), could indicate the production of formal tools.

On the surface, these Pleistocene data do not suggest a pattern of high residential mobility as part of either a rapid colonizing process or simple broad-based foraging, as there is little evidence to suggest a pattern of highly planned technological organization. Instead the organization of flaked stone technology at most Melanesian sites is primarily unspecialized and characterized by high variability in raw material selection and low levels of planning in terms of stone resource exploitation, tool design and use. In

Table 1. The earliest Pleistocene sites in mainland Papua New Guinea and island Melanesia and their geographic distribution.

geographic zone	site location	site name	reference
coastal	cave	Matenkupkum	Gosden, 1995; Gosden & Robertson, 1991
		Matenbek	Gosden, 1995; Gosden & Robertson, 1991
		Buang Merabak	Leavesley & Allen, 1998; Rosenfeld, 1997
		Kilu	Wickler, 1990; Wickler & Spriggs, 1988
		Lachitu	Gorecki, pers. comm., 1996; Gorecki *et al*., 1991
	open	Fortification Point	Groube, 1986; Groube *et al*., 1986
inland	cave	Panakiwuk	Marshall & Allen, 1991
		Pamwak	Fredericksen, 1994; Fredericksen *et al*., 1993: 149
		Nombe	Gillieson & Mountain, 1983; Mountain, 1983, 1991*a,b*
		Batari	White, 1972: 27
	open	Yombon	Pavlides & Gosden, 1994
		Kosipe	White, 1965, 1972; White *et al*., 1970
		Kuk Swamp	Golson & Hughes, 1977
		NFX	Watson & Cole, 1977: 35–40
		Wañelek	Bulmer, 1977: 62–65, 1991: 471

particular, lithic procurement activities appear to be non-intensive involving a least effort and largely unsystematic strategy of collection. Reduction activities are also generally non-intensive, as are tool production and use. These organizational and technological features suggest either low residential settlement mobility or extremely high stone resource availability (Andrefsky, 1994*a,b*; Bamforth, 1990, 1991; Nelson, 1991; Parry & Kelly, 1987).

The Pleistocene flaked stone assemblages from Yombon stand out from other Melanesian assemblages in several key respects regarding the organization of procurement activities, the effort involved in raw material extraction and the production, use and discard of flake stone artefacts. The pattern indicates a different picture of technological planning more consistent with the model of rapid colonization and high mobility proposed generally for the region.

The Pleistocene sites from Yombon

The Yombon area (which includes the historically documented Yombon village) is located approximately 35 km inland from Kandrian, the old administrative head-quarters of West New Britain's south coast (Fig. 1). The five trenches with evidence of Pleistocene occupation levels are in two areas of Yombon village itself, Eliva hamlet (PNG site code FYV) and the Yombon airstrip (PNG site code FIF). One further trench excavated at Asiu village (PNG site code FYW), 1 km southeast of Auwa hamlet, has evidence of a terminal Pleistocene occupation level dating to approximately 12,400 cal. B.P. above an as yet unidentified tephra layer. It is uncertain whether the unidentified tephra layer that forms the base of this 12,400 year old layer is the same as the material which seals the Pleistocene unit in the Eliva hamlet and Yombon airstrip trenches, although it is quite possible (Fig. 2). The poor preservation of the glass fraction within these Pleistocene volcanic deposits makes chemical characterization and comparison difficult. Further radiocarbon determinations may solve this problem. One flake tool was associated with this Pleistocene date at Asiu hamlet. This material is not, however, included in the analysis of Pleistocene technology presented here but rather has been grouped with assemblages deposited after the deposition of the unidentified Pleistocene tephra. A further nine trenches containing evidence of Holocene occupation levels were excavated in another three locations along a 4 km transect between the Yombon area and Dulago village (Pavlides, 1993, 1999). Discussion in this paper, however, confines itself to the site locations with evidence of Pleistocene activities prior to the deposition of the unidentified Pleistocene tephra (the Yombon airstrip and Eliva hamlet sites).

The local topography of the study area comprises flat, limestone ridge tops, lower rises, and valleys of varying depths and angles (Pain, 1981: 62). Coupled with high annual rainfall, the effects of swidden agriculture and the deposition of volcanic tephra material, these topographic features are most likely the main variables affecting the formation of archaeological sites (Pavlides, 1999). During Specht's, 1979 and 1981 field research around Auwa hamlet, he excavated trenches on only the high limestone ridge tops. Other features, such as the low rises below the highest ridge tops and the shallow valley bottoms, were excluded from Specht's sample. He did not find sites with well-preserved tephra layers or with deposits older than 4,200 years (Specht *et al*., 1981: 14). This is because the high ridges suffer more from erosion (due to human and natural processes) (Pain, 1981: 73; Specht, 1981: 57) than other parts of the landscape.

Site location and chronology

Eliva hamlet stands approximately 490 m above sea level on a low rise extending out of a shallow valley to the west below the main hamlet of Auwa. The Yombon airstrip is located 600 m west of Auwa hamlet. At its northern-most point the airstrip is 491 m a.s.l. The Pleistocene occupation levels were located within trenches FIF/2–3–4 in a shallow valley bottom on the airstrip's eastern side. This area is approximately 485 m a.s.l.

The two 1×1 m trenches excavated at Eliva hamlet, FYV/1 and FYV/2, were located approximately 15 m apart. Trenches FYV/1 and FYV/2 revealed a tephrostratigraphic sequence spanning the Holocene and Pleistocene and a

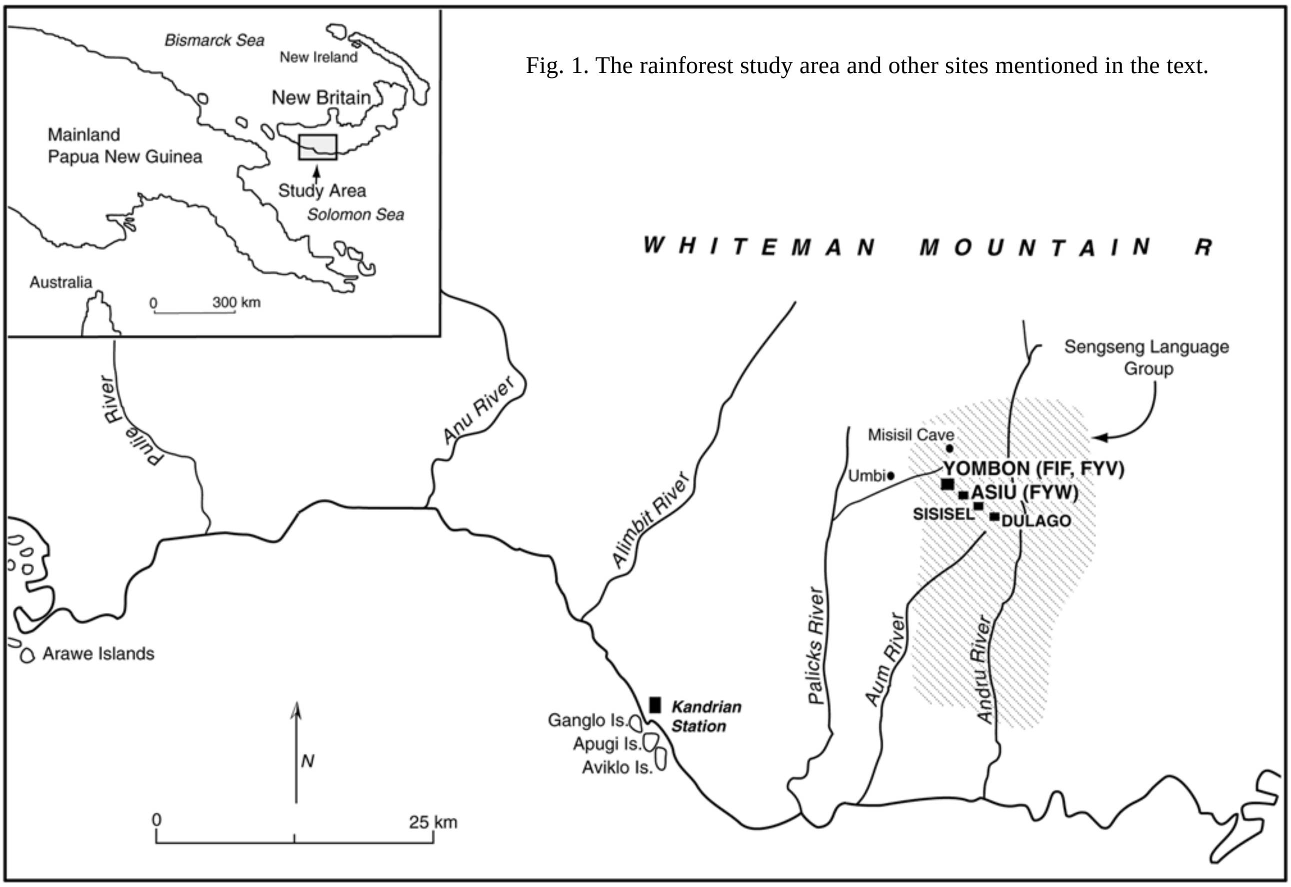

Fig. 1. The rainforest study area and other sites mentioned in the text.

chronology spanning over 35,500 years. The trenches have similar stratigraphies, and each contains three tephra beds. However, FYV/1 (Fig. 2 and Table 2) revealed the most complete stratigraphic sequence containing nine layers, while trench FYV/2 revealed a sequence of eight layers. The depth of FYV/1 is also greater than that of FYV/2 (2.2 m and 1.9 m respectively). Trench FIF/2–3–4 on the Yombon airstrip revealed a stratigraphic sequence comprising the maximum ten layers observed in the rainforest study area (see Pavlides, 1999 for details of the composite stratigraphic sequence). This 1×3 m trench revealed the full Pleistocene and Holocene tephrostratigraphic sequence. Like the trenches at Eliva hamlet, FIF/2–3–4 has a chronological span in excess of 34,000 years. The total depth of this trench is 2.76 m.

Flaked chert, limestone cortex, volcanic heat retainer cobbles and lumps of carbon were present within the Pleistocene levels. All sites were excavated until limestone bedrock was encountered.

Tephra layers and site formation processes

The preservation, structure and chronology of the rainforest sites of West New Britain are tied closely to the volcanic history of the island. In the past huge clouds of dense airfall tephras periodically showered this region. These ashes sealed entire landscapes and today act as stratigraphic marker beds which, through geochemical analyses, can be correlated directly with the volcanic sources from which they derive. Specht (1983: 4) suspected that Mt Witori, inland of Cape Hoskins, was the source of these volcanic ashes. Data collected as part of the current project (Pavlides, 1999) established this as fact and revealed that other later Holocene volcanoes have also showered the rainforest study area (see also Machida *et al*., 1996; Torrence *et al*., 2000).

All of the sediments in the study area are derived from either decomposing limestone, volcanic ash or soil development resulting from a combination of these two and

Table 2. Radiocarbon determinations from the Pleistocene layers at Yombon and Asiu Village.

chronological unit	trench locality	measured ^{14}C age	conventional age (^{13}C adjusted)	calibrated age b.p. (1σ)[a]	laboratory number
Unit 4	Asiu Village FYW/3	10,450±350	10,450±350	12,735 (12,360) 11,660	OZA179
Unit 5	Eliva Hamlet FYV/1	14,310±100	14,310±100	17,300 (17,155) 17,010	Beta 62318
	Yombon Airstrip FIF/4	29,100±750	29,100±750		OZA180
	Yombon Airstrip FIF/2	32,630±400	32,630±400		Beta 47046
	Yombon Airstrip FIF/3	33,600±670	33,570±670		Beta 62323
	Eliva Hamlet FYV/2	35,570±480	35,570±480		Beta 62319

[a] Radiocarbon dates calibrated using CALIB 3.0.3 (Stuiver & Reimer, 1993).

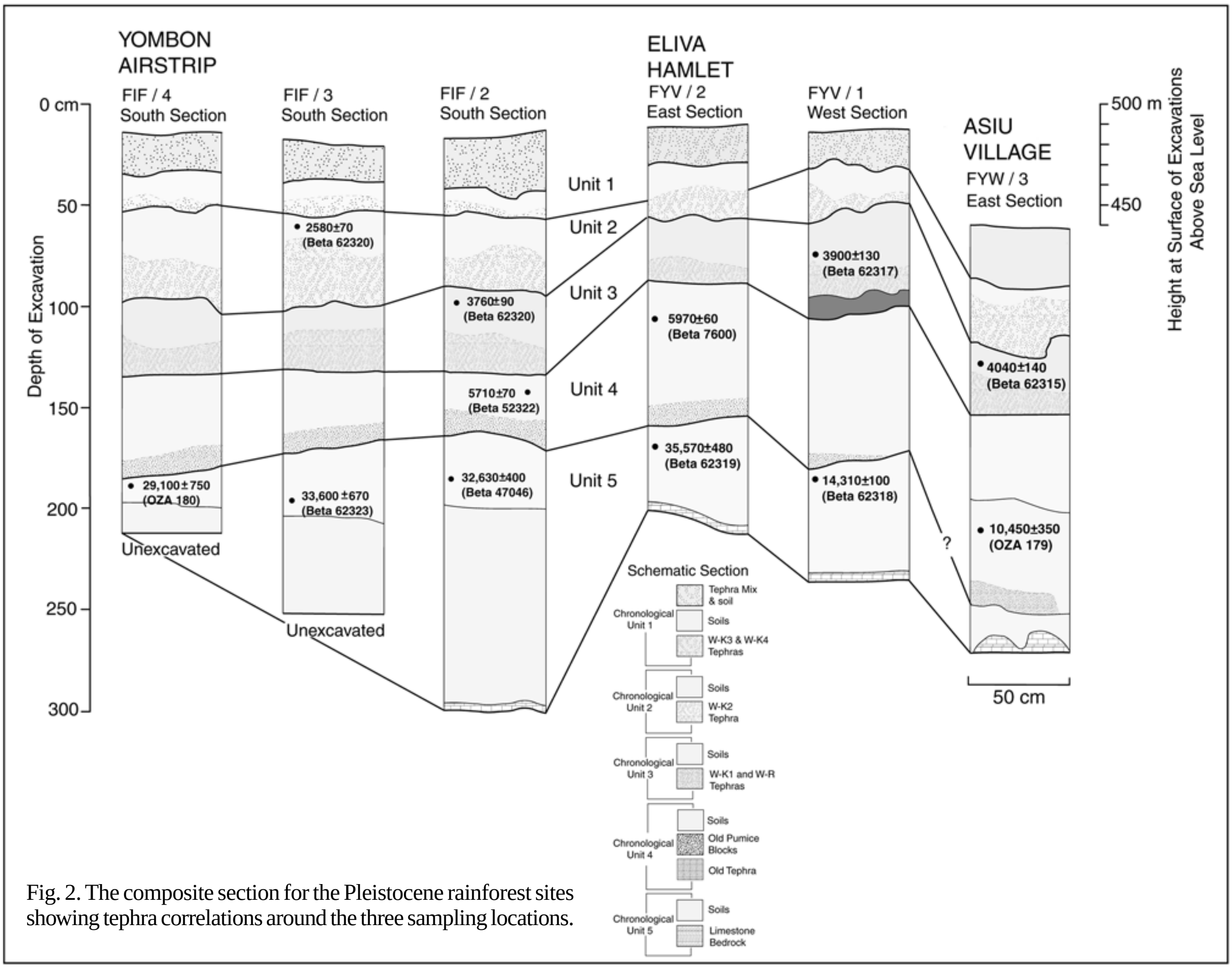

Fig. 2. The composite section for the Pleistocene rainforest sites showing tephra correlations around the three sampling locations.

organic matter (Pain, 1981: 70–74). The decomposition of the area's basal Miocene limestone and the deposition of airborne volcanic ash are thus the two primary sources and mode of sediment accumulation.

The Eliva hamlet and Yombon airstrip trenches contain Pleistocene deposits capped by a dense tephra which probably fell over southern West New Britain some time around 17,000 to 12,000 years ago.

The Pleistocene flaked stone assemblages from Yombon

The sample of flaked stone tools from the Pleistocene West New Britain sites is admittedly small, comprising only 29 artefacts. Nevertheless, several interesting points can be made regarding the structure and organization of technology during the Pleistocene in this region. As discussed above in relation to other Melanesian sites, stone material use during the Pleistocene suggests assemblages characterized by least effort procurement, reduction and tool use. This pattern of technological organization is not consistent with generally excepted views and models of highly mobile hunter-gatherers (Binford, 1979; Bleed, 1986; Kelly, 1992; Nelson, 1991; Shott, 1986; Torrence, 1989). At the Pleistocene rainforests sites around Yombon the pattern of stone resource procurement, production and use has some similarities with flaked stone assemblages from other Melanesian sites. However, several key elements in the organization of technologies suggest an alternative approach to lithic resource use.

Firstly, the pattern of raw material procurement at this time involved the location and quarrying of *in situ* primary geological source material. Secondly, the production of particular morphological types is indicated by the presence of one formal tool type, a unifacial ovoid scraper (Fig. 4). This artefact is the first of its kind to be discovered within the Bismarck Archipelago and is technologically and typologically unlike other contemporary Pleistocene tools found elsewhere in Melanesia in terms of its size, shape and production technology. This artefact may point to the development of a formal tool technology at this time. Finally, several of the retouched artefacts retain microscopic evidence of organic residues and usewear suggesting the utilization of local forest plant resources. All of these technological and organizational features suggest the development and use of a planned technological strategy functioning within a highly mobile settlement pattern.

Raw material procurement strategies

The only stone material selected for flaking during the Pleistocene phase was fine-grained chert. A total of 29 pieces, weighing 525.9 g, were recovered from the five excavated trenches at Eliva hamlet and the Yombon airstrip (Table 3).

Table 3. The frequency and weight of stone artefacts in Pleistocene layers at Eliva hamlet and Yombon airstrip.

locality	trench code	frequency number	%	weight g	%
Eliva Hamlet	FYV / 1	13	44.80	70.5	13.40
Eliva Hamlet	FYV / 2	4	13.80	372.2	70.80
Yombon Airstrip	FIF / 2	2	6.90	8.2	1.60
Yombon Airstrip	FIF / 3	9	31.00	74	14.10
Yombon Airstrip	FIF / 4	1	3.40	1	0.20
totals		29		525.9	

The exact quarry or source location of the Pleistocene chert material is unknown; however, chert is available as both nodules within *in situ* geological deposits of Miocene limestone, usually within deep sinkholes, and unconsolidated cobbles in secondary river gravel bed contexts within the immediate area. An inspection of the Eliva hamlet and the Yombon airstrip material indicates that only primary context material extracted from sedimentary bedrock contexts was utilized. The type of cortex and the unaltered condition of the flaked surfaces of the artefacts indicate the exclusive selection and quarrying of chert from *in situ* geological deposits. That is, the surface of the cortex and flaked surfaces are neither rolled nor stained with red oxides, two characteristics noted on material extracted from river bed and stream contexts. The cortex noted on the Pleistocene artefacts is chalky white limestone, indicative of primary source material.

Two artefacts from trench FYV/2 at Eliva hamlet reveal something of the type and size of quarried raw material at this time. One is a large angular fragment produced on a split limestone nodule with a centre of poor quality chert and another is a large *outrepassé* flake which is almost totally cortical on the dorsal surface (Fig. 3). These two artefacts may both indicate primary quarrying and nodule testing at the Eliva hamlet locality. The frequency of chert artefacts and limestone rubble discarded at Eliva hamlet is also greater than that present at the Yombon airstrip, suggesting a different set of activities at this location. This evidence from Eliva hamlet may represent production and discard activities close to a primary stone source during the Pleistocene.

While both *in situ* deposits of bedrock stone and river bed sources are locally available, the selection of primary source material from geological deposits of Miocene limestone has implications in terms of the development of extraction technologies (probably underground mining from sinkholes), extraction effort and processing technologies and effort. Clearly, the extraction of cobbles from river bed deposits would have been a less costly and more time efficient procurement strategy; however, this was not the choice made by the Pleistocene inhabitant of the West New Britain rainforest.

The composition of assemblages

The Pleistocene assemblages contain relatively little flaking debris (angular fragments or flaked pieces) compared to flakes and tools. The stone working debitage includes a single irregular flake (classed as *irregular* because of its cross section, size and general shape) and a core rejuvenation flake (*flake other form*) from Eliva hamlet as well as two angular fragments. The assemblages from the Eliva hamlet trenches also contain a range of fracture types (Table 4). Evidence suggesting *in situ* quarrying and flaking

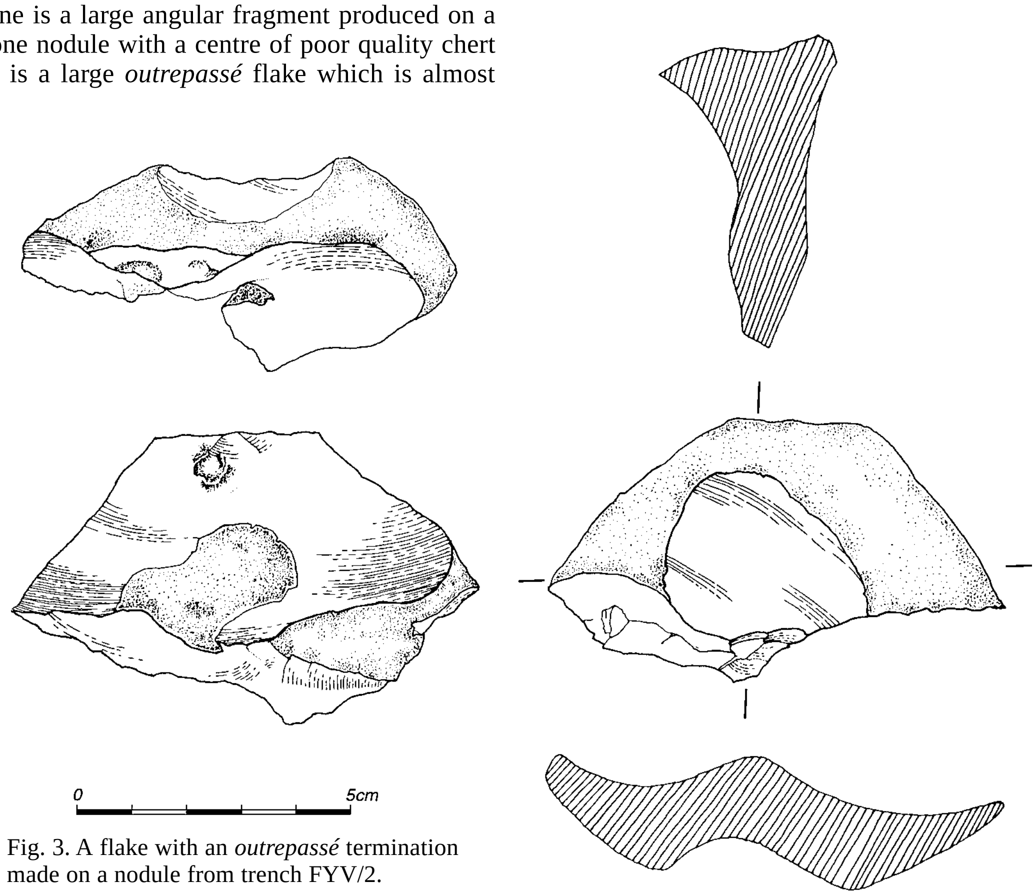

Fig. 3. A flake with an *outrepassé* termination made on a nodule from trench FYV/2.

Table 4. The frequency and weight (g) of artefact types in Pleistocene assemblages at Eliva hamlet and Yombon airstrip.

artefact type	FIF/2 n	FIF/2 (g)	FIF/3 n	FIF/3 (g)	FIF/4 n	FIF/4 (g)	FYV/1 n	FYV/1 (g)	FYV/2 n	FYV/2 (g)	total n	total (g)
flake—complete	—	—	—	—	1	1.0	1	15.9	—	—	2	16.9
flake—broken	1	6.2	1	0.8	—	—	4	13.6	—	—	6	20.6
tool—complete	—	—	1	71.7	—	—	4	32.9	2	147.7	7	252.3
tool—broken	—	—	—	—	—	—	2	1.3	—	—	2	1.3
flake—other form	—	—	—	—	—	—	1	6.4	—	—	1	6.4
flake—irregular form	—	—	—	—	—	—	—	—	1	83.9	1	83.9
angular fragment	—	—	1	0.6	—	—	1	0.4	1	140.6	3	141.6
fire-cracked stone	1	2	6	0.9	—	—	—	—	—	—	7	2.9
total	2	8.2	9	74	1	1.0	13	70.5	4	372.2	29	525.9

is not found at the other Pleistocene trenches, although a few very small angular fragments were recovered from trenches FYV/1 and FIF/3.

The presence of tools, including the formally shaped unifacial ovoid scraper (Fig. 4) indicates activities at the West New Britain rainforest sites beyond simple stone procurement and primary flaking. Tools are present at both locations with the highest number in the Eliva hamlet trenches. Burnt and fire-cracked chert artefacts are also present in assemblages from FIF/2 and 3. Inadvertently or deliberately burnt artefacts may signify that activities other than stone procurement took place at the Yombon airstrip.

Reduction strategies

As indicated above, the type and density of artefacts at Eliva hamlet may indicate that a slightly different set of activities was undertaken at this location during the Pleistocene compared to the Yombon airstrip. Although the numbers are small, the relative frequency of cortical artefacts is greatest at Eliva hamlet FYV/2. Cortex is, however, also present on artefacts from all other assemblages except FIF/4 (Table 5).

There are only two complete and six broken flakes in the Pleistocene assemblages. All of these artefacts lack dorsal cortex. These non-cortical flakes are present in three assemblages from both Eliva hamlet (FYV/1) and the Yombon airstrip (FIF/2, FIF/4). The two complete flakes have been struck downwards from one platform, that is, the core was not rotated prior to their removal, and only one of these flakes has more than three dorsal scars.

The platform surface treatments indicate both simple and more specialized core preparation. One flake, from trench FYV/1, has a highly worked platform, displaying several facets, while two others, from trenches FYV/1 and FIF/4, have only a single flake scar, or cortex and one flake scar. The flake with the faceted platform is interesting because it has microscopic evidence of residues along the platform, consistent with the use of this edge while the flake was still part of a larger tool (Fullagar, pers. comm.). Similar damage is also present along the platform of one of the flake tools (see below). This may indicate the resharpening of larger tools.

Regular or stepped overhang removal is present on three flakes. The dorsal platform angles measured on two flakes (60° and 80°) are quite acute indicating attention to core face morphology. One of the flakes ends in a feather and the other in a hinge termination.

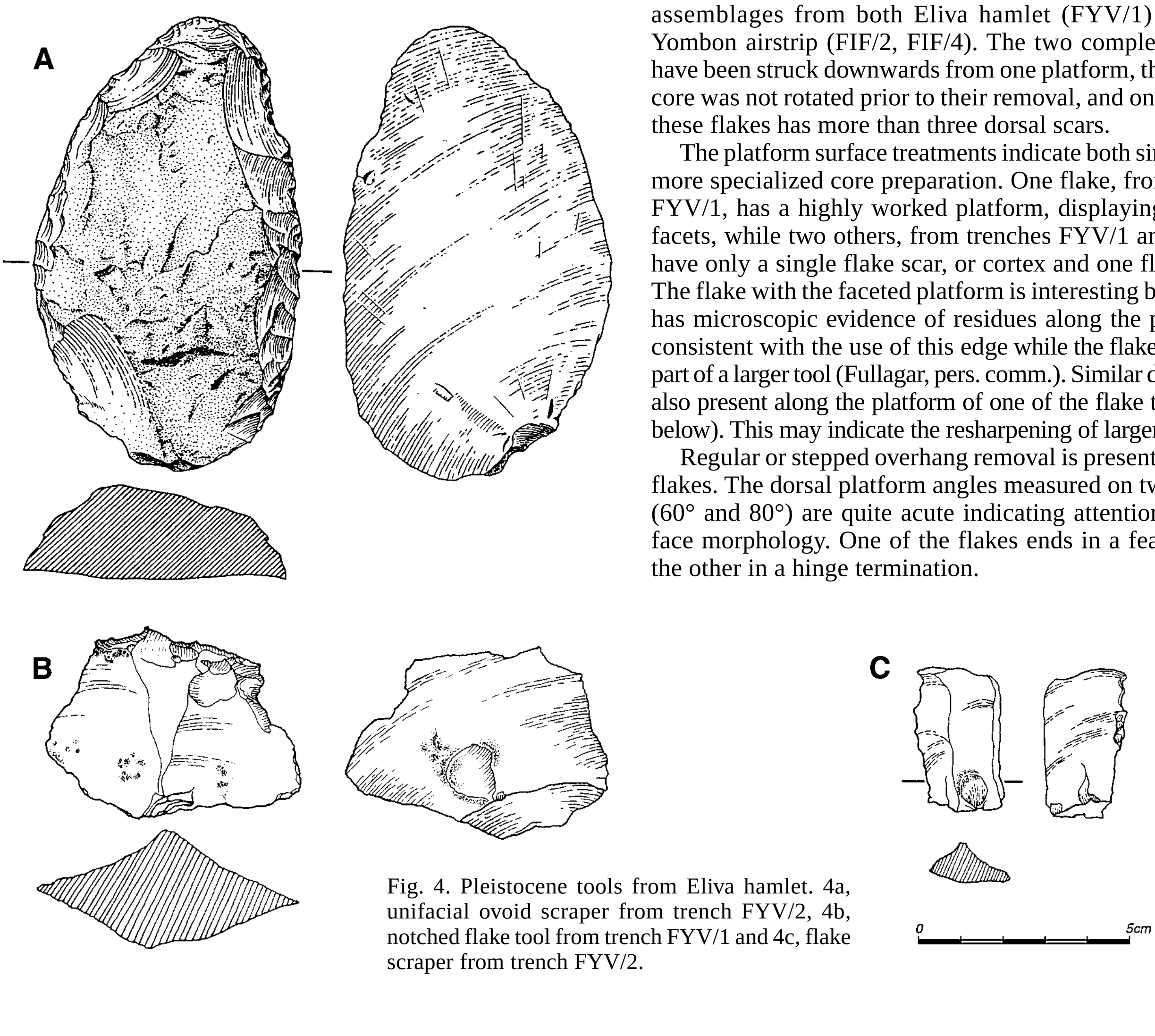

Fig. 4. Pleistocene tools from Eliva hamlet. 4a, unifacial ovoid scraper from trench FYV/2, 4b, notched flake tool from trench FYV/1 and 4c, flake scraper from trench FYV/2.

Table 5. The proportion of cortical to non-cortical chert artefacts within individual assemblages.

chert artefacts	FIF/2		FIF/3		FIF/4		FYV/1		FYV/2		total
	n	%	n	%	n	%	n	%	n	%	n
non-cortical	1	50	6	66.7	1	100	9	69.2	1	25	18
cortical	1	50	3	33.3	—	—	4	30.8	3	75	11
total number	2		9		1		13		4		29

While it is difficult to conclude much about either the organization of technology or the reduction strategies used during the Pleistocene, several patterns can be isolated. Firstly, chert extracted from *in situ* geological deposits was exclusively selected and quarried for flaking during the Pleistocene phase, and decortified material was reduced at both Eliva hamlet and the Yombon airstrip revealing a technological pattern of late and early stage reduction at the two locations. Some evidence of tool resharpening activities is indicated at Eliva hamlet, which also has the majority of discarded tools.

Tool blank technology and the spatial organization of reduction

Nine artefacts of the 29 flaked stones from the Pleistocene, are classified as tools (Table 4). These artefacts are all retouched flakes. The technology of tool blank production indicates evidence of both early and late stage flaking, and the type and intensity of retouch is consistent with low intensity tool modification and use.

Tools are present in assemblages from the two trenches at Eliva hamlet and trench FIF/3 at the Yombon airstrip (Table 6). The proportions of cortical (55.6%, n=5) and non-cortical (44.4%, n=4) retouched artefacts are similar, indicating almost equal early and late stage reduction and tool blank selection activities at both Eliva hamlet and the Yombon airstrip. Dorsal scars are directed predominantly from the platform down, indicating unidirectional flaking with little core rotation. Three of the six complete and proximal tools display complex platforms. One of these, from trench FYV/1, has a platform consisting of both multiple flake scars and faceting suggesting more intensive core platform preparation. Intensive overhang removal is present on two of the tools. Tools have more acute platform angles than the unmodified flakes with five of the six artefacts displaying platform angles less than 76°. The axial and maximum dimensions of the cortical and non-cortical tools indicate that cortical tools are generally larger (Table 6). The axial and maximum dimensions of the tools are larger than those of the cortical and non-cortical unmodified flakes, which is consistent with the selection of the largest blanks for further modification and use.

Tool types and the morphology of retouch

The Pleistocene retouched flakes were classified into three groups: flake tools, notched flake tool and the unifacial ovoid scraper (Table 7 and see Fig. 4). The flake tools and the notched flake tool are flakes with edge modification in the form of micro-flaking and larger retouch, while the large unifacial ovoid scraper is more formally shaped by intensive retouching and edge modification.

Microscopic usewear and residue analysis of the notched flake tool and one flake tool indicates generally non-invasive edge modification consistent with light woodworking and plant processing (Figs. 4B and 4C). The notched flake tool reveals heavy polishing around its notch with organic residues and unidentified cellular structures. A high density of starch grains is impacted into the notch and the surrounding step scars. Well-developed polishes, linear striations and dense concentrations of starch grains on the distal edge of this tool are also consistent with woodworking and the cutting of siliceous plant material (Fullagar, pers. comm.). A residue sample extracted from within the notch tested negative for different blood components using Ames Hemastix and immunoblot testing (Brass & Furby, 1999).

The flake tool displays light polish and edge rounding, in association with thick cracked residues along the right margin. Edge rounding, polish and residues are also noted on the platform indicating the use of this edge prior to the formation of the flake blank. Light plant processing is consistent with this pattern of edge modification (Barton, pers. comm.).

Table 6. The axial and maximum dimensions (mm) of cortical and non-cortical tools from Eliva hamlet and Yombon airstrip.

tool type	trench	axial dimensions (mm)			maximum dimensions (mm)		
		length	width	thickness	length	width	thickness
cortical tools							
unifacial ovoid scraper	FYV/2	100.8	60.9	21.6	105.8	63.1	23.3
flake tool	FIF/3	50.9	57.6	28.4	64	60.5	29.1
notched flake tool	FYV/1	38.3	47.6	18.2	49.2	36.3	20.8
flake tool	FYV/1	33.8	29.5	8	34.8	33.2	8.6
flake tool	FYV/1	—	—	—	28.4	11.9	4.1
non-cortical tools							
flake tool	FYV/2	32.8	18.9	8.1	36.7	21.3	7.9
flake tool	FYV/1	24.2	13.7	2.6	24.6	13.8	2.9
flake tool	FYV/1	16.4	9.2	1.6	17.4	11.9	1.7
flake tool	FYV/1	—	—	—	23.8	10.5	2.5

Table 7. The number of modified edges on Pleistocene tools from Eliva hamlet and Yombon airstrip.

tool type	1 edge	2 edges	3 edges	4 edges	number of tools	number of modified edges
flake tool	3	4	0	—	7	11
notched flake tool	—	1	0	—	1	2
unifacial ovoid scraper	—	—	0	1	1	4
total number	3	5	—	1	9	17
%	33.3	55.6	0.0	11.1		

The unifacial ovoid scraper (Fig. 4A) has been retouched around much of its circumference with the left margin more heavily retouched to produce a straight edge. Microscopic residues and edge damage on this tool indicate primarily soft plant processing and the linearity of striations present along the edges reveals use in a cutting action. A large quantity of starch grains is also present (Fullagar & Barton, pers. comm.).

In addition to the above data indicating the involvement of the unifacial ovoid scraper in plant processing, one residue sample taken from this tool gave a positive result to the Hemastix blood test. The Protein A Gold immunoblot produced a possible positive result and the Protein G Gold immunoblot produced a negative result, indicating a possible mammalian origin for this residue (Brass & Furby, 1999).

The number of modified edges (n=17) on the Pleistocene tools indicates a pattern of primarily low intensity retouching with a ratio of utilized edges per tool equalling 1.9 (Table 7). In this case, eight of the nine Pleistocene tools have one or two modified edges and only the unifacial ovoid scraper displays intensive retouch.

Retouch is most commonly present on the dorsal surface of tools (77%, n=13), followed by occasional instances of ventral (18%, n=3) and bifacial modification (6%, n=1) (Table 8). This pattern of retouch is consistent among the three Pleistocene tool types. The location of edge damage is most common in quadrant 4 (41%, n=7), 3 (29%, n=5) and 2 (24%, n=4), the left margin, termination and right margin, with only one instance of retouching along the platform edge, quadrant 1.

In summary, the data regarding tool types and the number, type and direction of edge modification reveals a pattern of relatively non-intensive retouching activities. What is striking about this small assemblage of Pleistocene tools is the presence of one highly worked formal tool, the unifacial ovoid scraper, unique to this region during the Pleistocene.

Discussion

During the Pleistocene phase in the West New Britain rainforests (approximately 35,500 to 17,000 cal. B.P.) stone material procurement involved the selection, extraction and use of local chert mined directly from *in situ* geological bedrock sources of Miocene limestone. No other stone material was utilized at this time, despite the importation and use of West New Britain obsidian at Matenbek (Allen, 1989: 151; Allen & Gosden, 1996: 188; Summerhayes & Allen, 1993) and Buang Merabak (Rosenfeld, 1997: 221) on New Ireland beginning approximately 20,000 years ago.

While the use of local stone is common in most Melanesian Pleistocene sites, the utilization and quarrying of local stone from *in situ* sedimentary deposits is not. Flaked stone assemblages from the New Ireland cave sites Matenkupkum, Matenbek (Freslov, 1989: 34), Panakiwuk (Marshall & Allen, 1991: 70) and Buang Merabak (Rosenfeld, 1997: 222; Leavesley & Allen, 1998: 73) all reveal a pattern of lithic source exploitation involving the collection of local river cobbles. This is also true for the more distant sites of Pamwak (Admiralty Islands) and Kilu (Solomon Islands), where water-rolled chert cobbles, along with other local stone, are used extensively in the early period of occupation (Fredericksen, 1994: 176; Fredericksen *et al*., 1993: 149; Loy *et al*., 1992: 901; Wickler, 1990: 140). Flaked stone assemblages from mainland New Guinea—Huon Peninsula (Groube *et al*., 1986: 454), Nombe (White, 1972; Mountain, 1983), Wañelek (Bulmer, 1991: 473) and Batari (White, 1972: 27)—also indicate the targeting of river cobbles along with very little material extracted from sedimentary contexts (see for example Kosipe, White *et al*., 1970: 167). This pattern of procurement is different to that witnessed at the Yombon airstrip and Eliva hamlet sites during the Pleistocene.

Table 8. The type and location of retouch on Pleistocene tools from Eliva Hamlet and Yombon Airstrip.

tool type	quadrant 1–platform edge	2–right margin	3–termination	4–left margin
flake tool	*n.a.*	1 dorsal edge damage 1 ventral edge damage 1 bifacial edge damage	3 dorsal edge damage	3 dorsal edge damage 2 ventral edge damage
number of edges	0	3	3	5
notched flake tool	*n.a.*	*n.a.*	1 steep dorsal scars	1 dorsal notch
number of edges	0	0	1	1
unifacial ovoid scraper	1 steep dorsal scar	1 steep dorsal scars	1 steep dorsal scars	1 steep dorsal scars
number of edges	1	1	1	1

The spatial distribution of reduction activities varies between the Eliva hamlet and Yombon airstrip localities, although cortical and non-cortical flake blanks were produced at both locations. The assemblage from trench FYV/2 at Eliva hamlet is the only exception in that it displays characteristics indicative of both extraction and the early stages of artefact production possibly taking place close to a raw material source in the vicinity of the Eliva hamlet trenches. Both cortical and non-cortical blanks were selected for further modification and use and these blanks are generally larger than the unmodified flakes.

Retouched artefacts are relatively frequent in the West New Britain Pleistocene assemblage and these exhibit a variety of residues and use-damage patterns. Obviously, other activities beyond stone procurement were undertaken at these sites. The presence of a formal tool may indicate a more organized technological strategy, incorporating the production and use of finished tools during this phase. A similar observation has been made regarding the assemblages of Pleistocene tools from Pamwak rockshelter (Fredericksen, 1994: 80).

Both the production technology and blank form of the unifacial ovoid scraper sets it apart from tools discovered in contemporary contexts around Melanesia and may signal a range of activities unlike those described for tools from mainland New Guinea (Groube, 1989). The tool is produced on a primary flake of locally quarried stone material rather than a river cobble. The discoid tools from Pamwak (Fredericksen, 1994: 80; Fredericksen *et al*., 1993: 148), and presumably the stemmed and waisted blades from Kosipe (White *et al*., 1970: 165) and Nombe (Mountain, 1983: 94; White, 1972: 132), are manufactured on large flake blanks; however, the form of the raw material and the reduction sequences involved remain sketchy. None of these Pleistocene tools appear to have been produced on primary (cortical) flakes, and all, except for the Pamwak discoids, have dimensions greater than the unifacial ovoid scraper from Yombon.

Conclusions

Based on the small data set presented here it is difficult to be definite about patterns of resource use and artefact production at the Pleistocene West New Britain rainforest sites. The behavioural model developed from other Melanesian sites occupied at this time indicates a picture of low density, sporadic occupation by small numbers of highly mobile people exploiting not only the locally available stone resources but also the available plant and animal resources of their habitats. Such a behavioural model of high residential mobility would suggest a pattern of highly planned technologies designed to be maintainable (Bleed, 1986), flexible (Nelson, 1991; Shott, 1986) and transportable (Binford, 1979). The organizational and technological features outlined above for most Pleistocene sites in Melanesia indicate an unsystematic, low intensity and spatially undifferentiated approach to procurement, production, tool maintenance and discard activities. This is coupled with high variability in raw material selection and use, and low levels of planning in terms of stone resource exploitation and tool design. In particular, lithic procurement activities appear to be non-intensive, involving a least effort and largely unsystematic strategy of collection.

On the surface, the small number of artefacts recovered from the Pleistocene deposits around Yombon appears consistent with assemblages from other Pleistocene sites. However, on closer inspection, the types of flaked stone artefacts recovered, the organization of procurement activities, the effort involved in raw material extraction and processing, and the associated residues and patterns of use-damage found on tools suggest an alternative picture of technological planning. For example, *in situ* sedimentary stone, probably from within deep sinkholes, was selected and exploited at all times despite the possibility of less costly extraction practices involving the collection of cobbles from loose river gravel deposits. The targeting of specific high quality geological sources in this way has organizational implications for technological planning and mobility strategies. Also, despite little evidence from other island Melanesian sites suggesting tool production and use beyond informal tools displaying little evidence of intensive retouch or distinctive morphology, there is some evidence for the production of more formally shaped and maintained tools in West New Britain. The unifacial ovoid scraper from Eliva hamlet indicates formal tool production during the Pleistocene and the microscopic use-damage on the platform of at least two other artefacts may indicate tool resharpening activities. The use of formal tools in the Papua New Guinea lowlands and islands during the Pleistocene is unknown.

Unlike the data outlined for other Melanesian sites, the evidence from Yombon is consistent with rapid colonization, high mobility, economic exploitation of important local resources and habitation of the rainforest niche during the Pleistocene, even if only for brief periods of time. A similar pattern of low artefact numbers is noted in the New Ireland cave sites and at Kilu Cave, where a model of high settlement mobility by small groups of people has been suggested (Gosden & Robertson, 1991: 43; Marshall & Allen, 1991: 89; Rosenfeld, 1997: 222; White *et al*., 1991: 56; Wickler, 1990: 139). Both short-term occupations, within a pattern of highly mobile settlement, or visits to the region for the purpose of raw material extraction and exploitation of local economic resources can explain the pattern of archaeological remains from the Yombon area of the West New Britain rainforest.

The pattern of stone procurement and tool production may also reflect the dispersed structure of resources within tropical forest environments. The new evidence from Yombon indicates that from the time of their earliest arrival in New Britain, people located and harnessed key rainforest resources. Contrary to current speculation (Bailey & Headland, 1991; Bailey *et al*., 1989; Hart & Hart, 1986; Headland, 1987; Headland & Reid, 1989), these new insights into the human utilization of the lowland rainforest zone challenge current theories about both the pre-agricultural utilization of this habitat, and the capability of Pleistocene humans to successfully harness and colonize the tropical rainforest zone (see also data presented by Endicott & Bellwood, 1991). In island Melanesia the lowland tropical rainforest zone has been one of the most important human habitats for at least 35,500 years.

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Walpole, A "Mystery Island" in Southeast New Caledonia?

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ABSTRACT. Walpole Island, the southernmost island of Melanesia, is a spectacular raised limestone formation 135 km south of the Loyalty Islands within the New Caledonian archipelago. Occupied by enormous numbers of seabirds when the first westerners landed, this rocky spot was mined for guano. Workers frequently reported archaeological finds that indicated prehistoric occupation and an early collection of artefacts was sent to the Australian Museum in Sydney. Over the last 30 years, research on the archaeological heritage of the island has been carried out through the study of museum collections and excavations. This paper reports the results of recent stratigraphic excavations, and synthesizes current archaeological knowledge about the human occupation of Walpole spanning at least 2,500 years.

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During the last two decades, Melanesian and Polynesian prehistory has come of age (Kirch, 2000). Jim Specht was a pioneer with an insatiable drive to explore new directions in Pacific prehistory. Amongst numerous other projects, he initiated modern archaeological studies of the pre-European settlement on Norfolk Island (Specht, 1984). Before discovering Norfolk on the 5th October 1774, James Cook put a new archipelago on the European map—New Caledonia (Beaglehole, 1961). One week previously he had passed just out of sight of a small uplifted coral island, at the southeastern tip of the Grande Terre. Its name, given a few decades later, is Walpole.

Very few people know of this island at the southernmost point of Melanesia. Although Walpole appeared as a "mystery" early in the literature (see Sand 2002: 14 for a review), it is not normally listed in studies of the Pacific "mystery islands", which focus only on Polynesia and eastern Micronesia (Bellwood, 1978: 352–353; Kirch, 1988; but see Di Piazza & Pearthree, 2001: 165). A historical connection links Walpole to the Australian Museum in Sydney, where the oldest archaeological collection from the island is stored. In this paper I summarize the historical and archaeological data of Walpole and propose a tentative chronology.

"Mystery Islands": a short review

When European navigators started to systematically explore the Pacific, they visited uninhabited islands with signs of former human occupation, like Pitcairn in East Polynesia, and Norfolk off eastern Australia. These abandoned islands were mostly in Polynesia (Kirch, 1984: table 9), although some east Micronesian islands were also identified (Terrell, 1986: fig. 28). The "mystery" of their pre-historic settlement and abandonment led to early research (e.g., Emory, 1928, 1934). As Kirch (1984: 89–92, 1988) pointed out, although all these "mystery islands" were grouped on the basis of isolation, resource scarcity and absence of occupation at

European contact (Bellwood, 1978: 352–353), there are huge differences in size, geographic location and natural environments.

First archaeological surveys in the early twentieth century showed a Micronesian-Polynesian cultural origin based on the presence of marae, ahu or diagnostic stone tools. Excavations dated these occupations to between 1,000 and 500 B.P., with most being abandoned soon after 500 B.P. More importantly, Kirch (1985: 89–98) showed that some, like the 23 ha Necker Island 500 km off Kauai in leeward Hawai'i, were occupied for a single generation (Kirch, 1988: 30), whereas the larger 77 ha neighbouring island of Nihoa, only 250 km from Kauai, probably had a longer human history. Although Necker and Nihoa were remembered in oral traditions (Kirch, 1985: 89) (as were other uninhabited islands) and showed a classic prehistoric Polynesian occupation, they were classified as "mystery islands".

More recent studies of the "mystery islands" concentrate on three regions:

- In the southwestern Pacific, research on sub-tropical Raoul and Norfolk Islands, has shown the existence of an inter-voyaging network between smaller and bigger islands during the first millennium B.P., in some cases over distances of more than 1000 km, before abandonment (e.g., Anderson, 2000; Anderson & McFadgen, 1990; Anderson *et al*., 1997).
- In sub-tropical eastern Polynesia, Weisler (1994, 1995, 1996*a,b*) conducted an extensive program on the Mangareva-Pitcairn group. Around 500 B.P. interaction ceased and consequently about 200 years later the Pitcairn group was abandoned by Polynesians (Weisler, 1998).
- Finally in the central Pacific, two teams (Anderson *et al*., 2000; Di Piazza & Pearthree, 2001) have conducted research on the windward Line Islands, concentrating on Kiritimati (Christmas Island) and Tabuaeran (Fanning Island). Interestingly, although both conducted excavations essentially on the same sites on Kiritimati, their proposed conclusions are very different. Anderson *et al*. (2000: 289) view settlement of the large atoll during the first half of the first millennium B.P. as occurring only once, being continuous, substantial, and not related to a wider inter-island interaction sphere, before "a combination of environmental hazard, tenuous horticultural productivity and unsustainable harvesting of the natural resources, produced, eventually, a subsistence environment that was no longer attractive to settlement, even one unable to sustain settlement". In contrast, Di Piazza & Pearthree (2001: 164) see Kiritimati as a staging post on long regional voyages, and as a regularly visited "satellite" island for bird and turtle hunting from a neighbouring "mother community" in Tabuaeran, but without permanent settlement.

This final example shows how much even the first step in interpreting "mystery islands" can vary immensely. Accordingly, reasons advanced for abandonment are numerous and certainly do not apply in the same way to each island. Weisler (1996*a*: 627) has listed five reasons to explain small population extinction: demographic and environmental stochasticity, natural catastrophes, inbreeding, and social dysfunction (like political threat and cessation of inter-island voyaging). On small, barren Necker Island, the whole history might have just involved a canoe castaway, with the survivors trapped. On large, fertile islands like Pitcairn, Raoul or Tabuaeran, the reasons for departure might relate to local environmental and social conditions. As Kirch (1984: 90) summarizes: "Why such larger and fertile islands should have ceased to be occupied is indeed a mystery, though either demographic instability, or the depredations of internal conflicts are conceivable causes for extinction". The Rapa Nui case shows how internal stress could lead to political uncertainty in Polynesian communities (Bahn & Flenley, 1992).

In island Melanesia, far less attention has been placed on unoccupied islands, and the small island of Anuta is at present the only one where a possible period of prehistoric abandonment, before resettlement, has been identified (Kirch, 1982). For southern Melanesia, only the remote uninhabited islands of Hunter and Walpole have received some attention, each showing very different types of remains. On Hunter Island, a small 1 km wide cone of volcanic origin located south of Vanuatu, three structures of human origin were partly studied by geologists (Lardy *et al*., 1988). The major site is a rectangular 11 m by 7 m structure with a 1.2 m high and 70–80 cm thick stone wall, and a possible pavement buried about 30 to 40 cm deep. A typical oceanic rounded net-sinker with a central groove was found in this undated structure. Nearby, a smaller 4 m by 4 m wall located in the only part of the island where cultivable soils are present was interpreted as a possible garden. Finally, a stone cairn about 1 m high was identified in the only cave where fresh water (rich in calcium sulphate) is present. No definitive origin for these remains can be given as they might be related to pre-historic short-term occupation, as well as recent historical whaling (Lardy *et al*., 1988: 46–48). In archaeological terms, Hunter Island (named *Fanuamanu*, the birds' island, by the people of nearby West-Futuna) has more in common with a "mystery island" like Necker than with closer examples like Raoul or Norfolk.

Walpole's environmental setting

Walpole Island is the southernmost outpost of the Loyalty Islands chain. Positioned 22°36'S 168°57'E, it lies 140 km east of the Isle of Pines and 135 km southeast of Maré (Fig. 1). The uplifted coral platform rises to a height of more than 80 m in some places and has a probable volcanic core.

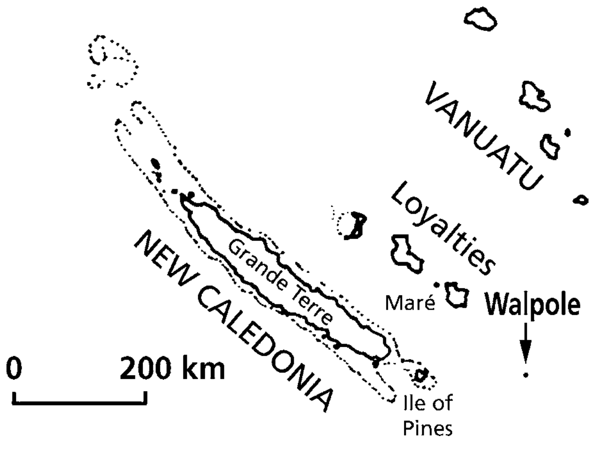


Fig. 1. Location of Walpole Island in the New Caledonian archipelago.

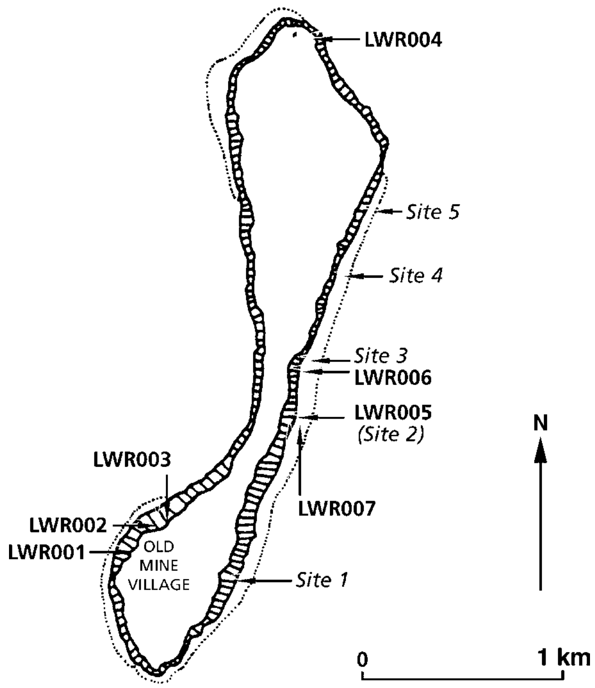


Fig. 2. Walpole Island, with the locations of the surveyed sites. The positions of the sites recorded by the treasure hunters are approximate only.

Successive uplifting and erosion during the last 400,000 years have created a long narrow island, about 3.5 km long and between 300 and 900 m wide (Fig. 2). The centre of Walpole is a flat plateau, surrounded by steep cliffs falling towards the sea (Fig. 3). On its southwestern and northwestern leeward sides, there is a narrow flat area that can be used for landing in calm weather. The heavy waves on the windward eastern side prevent landing by boat.

The island has no permanent streams, and the rainwater drains into the porous soil, sometimes accumulating in freshwater pools in deep caves. In a few areas a thin surface soil has been formed by decomposing leaves. The only other non-calcareous soil is guano from the nesting birds.

The remote position of Walpole and its extreme geology have led to a particular natural environment. Although there is an area of medium deep sea floor on the western side, the ocean around Walpole is not known for its richness in fishing grounds. The number of fish species is more limited than in the other parts of New Caledonia (Sand, 2002: 38–39). The former diversity of local flora has probably been much reduced by recent exploitation of guano soils (Renevier & Cherrier, 1991). On the southern and central parts of the central plateau, very degraded by mining, only a short scrubby vegetation is present, whereas pandanus and other coral-adapted trees grow on the lower plateaux. The only well-preserved remnant of forest occurs on the unexploited north of the plateau, where endemic species, hardwood species and symbolic oceanic trees like banana survive (Sand, 2002). Seabirds, the dominant fauna, nest on the low bushes, in trees, or in various natural holes in the uplifted coral. Endemic land birds, lizards, and insects are rare. Walpole was the first place in the archipelago where horned turtle (*Meiolania*) bones were found (Balouet, 1984).

History of Walpole

Walpole Island was first placed on a modern map on 17th November 1794, when the English captain Butler passed by and gave it the name of his ship. Surrounded by sea currents used by whales during winter migrations, Walpole was frequented by whalers early in the nineteenth century. Captain Herskine is the first European reported to have landed on the island in 1850 (Chevalier, 1976).

Fig. 3. Aerial view of the central and northern part of Walpole, showing the central plateau, the high cliffs and the narrow coastal zones.

At the beginning of the twentieth century, the high quality guano on Walpole led to the industrial exploitation of this natural fertilizer, the major player being the Austral Guano Company Limited. Between 1916 and 1941, up to 300 people lived on the island, with contact to the mainland only every three to four months. Over 100,000 tons of guano were extracted. Europeans, Kanaks and Asians worked in the extraction areas and the local factory. Meat was imported in tins, and very fertile gardens were cultivated (Chevalier, 1976). "One year was enough to have bananas, everything grew" (Sintès, 1988: 14). During their free time on Sundays, the workers explored the cliffs, looking especially for birds' eggs. However, they also discovered evidence of earlier occupation in the low shelters, confirming observations of human structures on the central plateau. Skeletons were found in caves, and various shell and stone artefacts were collected, all indicating the existence of a "mysterious civilization". In 1929, an anonymous writer published his discoveries in the *China Journal* of Shanghai. His testimony is worth reading in full, as the objects and structures he describes have mostly vanished, and it is reproduced in an appendix to this paper.

If the early Europeans had consulted the Kanaks, they would have heard stories about Walpole; to my knowledge, three have been recorded. The first two are from the nearest islands to Walpole—Isle of Pines and Maré—and were published by the ethnographer J. Guiart (1963: 207). One describes two canoes adrift between Maré and Isle of Pines. The first canoe was lost at sea. The second landed on empty Walpole, where its crew constructed a new canoe from two *Casuarina* trees, and set sail to the west. In the other story Tongan sailors stopped on uninhabited Walpole before settling on Isle of Pines and Lifou, probably in the 1820s or 1830s as the tradition is linked to the arrival of Christianity. The third story, recently recorded on Maré (Sand, 2002: 42), is more mythical and tells of two men setting sail to marry the queen of Walpole, an island possibly called *Ha colo* ("turn its back") in Nengone (Maré) language and where only women were living.

At the end of the Guano mining period new tales circulated about the Walpole discoveries. One was that a Kanak worker had found the remains of European sailors in a cave with pieces of cloth and a canoe. With them was a button that was supposed to bear a "fleur-de-lis" design, the emblem of the French king. In the early 1960s, Pognon, a local amateur historian, inferred from the button that Walpole was the place where Laperouse was shipwrecked after leaving Vanikoro. Another local historian wrote that the Peruvian captain Robertson had hidden his fabulous golden treasure (which he stole from the British in 1826) on Walpole. Others claimed that the human bones were the remains of convicts escaped from Tasmania (Sintès, 1987). Although amusing now, these stories were taken seriously by some people at the time.

Archaeological fieldwork and treasure hunting

The island was first archaeologically surveyed between the late 1960s to early 1970s by the former director of the New Caledonia Museum, Luc Chevalier. During five short stays, he found the remains of pre-European settlements with associated human remains, shell adzes and wooden objects. Working in southern Melanesia, R. Shutler Jr. started collecting information about Walpole, made the first study of the Australian Museum collection, and in the early 1980s submitted three samples from the Chevalier collection for radiocarbon dating (Sand, 2000*a*).

Unfortunately, each time Chevalier visited Walpole, the weather turned to rain and wind, necessitating departure after only two days (Nunn, 1967). However, worse was yet to come. In 1993, a team of "treasure hunters" spent one month on Walpole to find traces of Laperouse, collect prehistoric remains of the "mysterious civilization", and find hidden treasures (Letrosne, n.d.; Sand, 2002). They explored most of the rockshelters in the cliffs and systematically emptied those where stratified *in situ* deposits had been preserved, excavating five sites on the east coast (Fig. 2). Their activities resulted in huge destruction, although only some of the objects were brought back to Noumea. The available written reports suggest they collected all surface material, and mapped some surface "hearths" and "working floors". They also indicate stratigraphies up to 30–40 cm deep, with *in situ* materials like hearths, ornaments and shell artefacts. The richest site (No. 5, called "The Women's Cave"), located in a niche at the base of the cliff, contained worked bone points, shell artefacts and food remains.

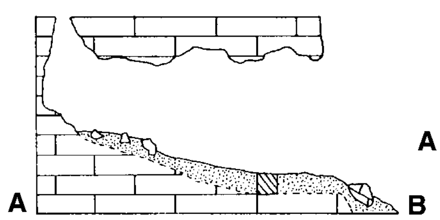
The New Caledonia Museum managed to recover some of the archaeological material from these unauthorized excavations only after a long battle. The most interesting objects were kept by the treasure hunters and so the collection, recently published (Lacroix, 1998; Sand, 2002), allows only a partial view of the island's archaeology. In the mid-1990s, I went to Walpole twice to evaluate the destruction caused by the treasure hunters, to make a preliminary survey (Fig. 2) and to conduct the first scientific excavations (Sand, 1995*a*; Sand, 2002). This recent visit showed a deplorable destruction of the deposits by the treasure hunters, particularly in Site No 5 where huge amounts of archaeological material were abandoned in the cave and scattered along the outside path. Some stratified deposit has hopefully survived, but this is yet to be confirmed.

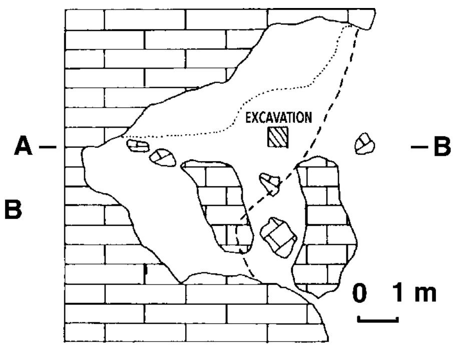
Most of the large rockshelters are at the base of cliffs, beyond wave action, and have archaeological deposits consisting of sediment and ashes, up to 60 cm deep. In some cases there are successive stratigraphic layers, indicating regular use of these sites over a relatively long period. Although no pollen samples have been studied to date, samples from some rockshelters could enable the reconstruction of local vegetation changes. During my first stay, I excavated 50 by 50 cm test pits in four locations. The sediments were not screened but soil samples were taken from each layer. A summary of the collected data follows:

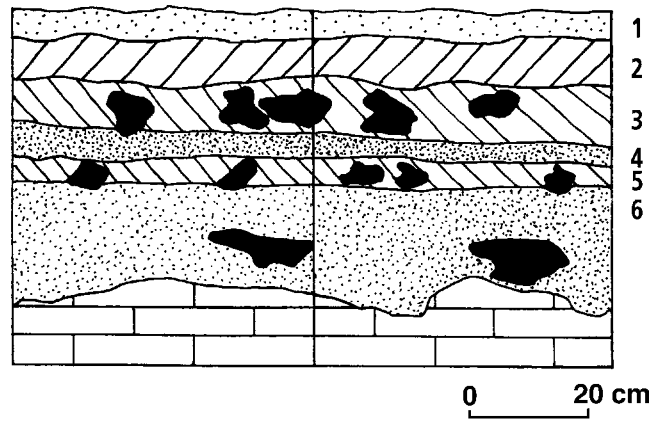
Site LWR003. A rockshelter with a 20 sq m floor, located about 30 m above sea-level on the southwest coast, the only accessible shore of Walpole. The 50 cm deep stratified deposit in the centre has six layers (Fig. 4). Under a sterile layer 1, layer 2, 10 cm thick, is mostly white ash with some charcoal forming the upper part of the anthropogenic occupation. Layers 3 and 5 are burnt soil and charcoal, with burnt oven stones, shells and broken bird bones. They are separated by a thin sterile yellow layer 4. The bottom layer 6, resting on the limestone floor, is of same texture as layer 4, and has some *Placostylus* land snail shells.

Site LWR004 is the only inland site excavated. It is at the northern tip of the central plateau, where a collapsed limestone cave has trapped sediments. Today, numerous rats

Fig. 4. Plan and cross-section of rockshelter LWR003 and stratigraphic profile.







and birds have dug deep holes. The excavation revealed 60 cm of stratified deposit with two layers which had accumulated on the limestone bedrock. The top layer, about 55 cm thick, is loose soil with very little cultural material. Some charcoal in the lower part of this layer was collected. The bottom layer, about 5 cm thick, is a brown sterile sediment.

Site LWR005, in the central part of the lower eastern plateau, is a 30 sq m rockshelter at the foot of the cliff, in front of an organized area with numerous flat floors made of shell debris, some alignments of fossil coral boulders, as well as coconut trees. Unfortunately, the excavation in the centre of the rockshelter revealed disturbed deposit about 35 cm deep, possibly linked to holes made by the treasure hunters (their site 2) or resulting from storms and wave action. Prehistoric *Tridacna* shell adzes and a cut Cowrie shell were recovered.

Site LWR006, in which the deepest test-pit was excavated, is a rockshelter in the northern part of the lower eastern plateau. It is about 35 m above sea-level, partly protected from the prevailing winds by large limestone blocks fallen from the cliff. The shelter has a flat floor of about 60 sq m, a roof over 4 m high and a large talus. A 1.3 m high wall is present on the northern side, and a broken stalactite about 1 m long was purposefully raised at the entrance of the site. The test pit, in the centre of the rockshelter, was excavated until 70 cm deep without reaching the limestone floor. Layer 1 is a thin sterile soil. Layer 2 is a 10 cm thick dark-grey sediment, with burnt soil at the base, containing some bird bones. Layer 3 is a 25 cm thick brown, loose sediment with burnt coral stones and charcoal. Broken bird bones, small sea shells (*Nerithae*, *Pinctada margarifera*, *Cypraea caputserpentis*), *Placostylus* shells and sea urchin spines were unearthed. Within layer 4, 20 cm thick, was a burnt white deposit surrounded by charcoal and heated coral stones. No bones were clearly identified in this layer, but the same types of sea shells as in layer 3, plus a *Turbo* sp. opercula, were noted, along with more *Placostylus* shells. Layer 5 is a sterile coarse yellow sand.

Archaeological finds

Although limited in size and scope, the test excavations confirmed the presence of stratified deposits on Walpole. Hearths and burnt coral blocks from ovens were identified. If some credit can be given to the treasure hunters' descriptions, working floors associated with the manufacture of shell adzes and shell ornaments were also observed in some layers. The sediments also contained bird and fish bones, as well as sea shells. Only in the lowest layers were land snails of the *Placostylus* family found. Artefacts include: stone items in surface collections, necessarily imported; shell artefacts, mostly from fossilized shell; as well as bone and wooden items (Lacroix, 1998; Sand, 2002).

Stone artefacts. Apart from one "basaltic" stone with no recognizable form, supposedly found by the treasure hunters, the stone items are all polished adzes/axes. Two artefacts, coming from early surface collections and housed in the Australian Museum, are certainly of Grande Terre origin. One is a classic Kanak adze probably of semi-nephrite (Fig. 5a). The other is a flat disc possibly of nephrite, with two holes made at one end (Sand, 2000*a*). These discs are used by the Kanaks to make the ceremonial *ostensoir* axe (Fig. 5b), which traditionally was manufactured on the Isle of Pines from stone quarried on nearby Ile Ouen, before being exchanged with people from Maré (Leenhardt, 1937; Sand, 1995*b*). A canoe lost at sea between the two islands may have resulted in these objects being on Walpole.

Two other black basaltic adzes, whose typology is clearly Fijian/West Polynesian, tell a different story. The first, a fully ground thin quadrangular adze (Fig. 5c), is from an unknown sub-alkaline basalt source west of the andesite line (Sheppard *et al*., 2001). The other, of longer and thicker section (Fig. 5d), was found by the treasure hunters and is in a private collection in New Zealand (Sand, 2002, fig. 5.22). Both objects indicate an eastern link.

Shell tools. The exposed and rugged nature of the Walpole coast does not allow for a large quantity of molluscs to grow near the surface or on the reef. The vast majority of the shell artefacts found in archaeological contexts were manufactured from fossilized shell which can be obtained easily on the island. The most spectacular are certainly the shell adzes/axes (Fig. 6). Probably made from the large ventral (hinge) and thinner dorsal parts of *Tridacna maxima*, some of these adzes are huge, weighing over 3 kg. Collected rounded hammer stones and waste flakes show that adzes/axes were made locally. Their size and the form are unique in New Caledonia—the archipelago is known for its near absence of shell tools. The Walpole shell tools also differ

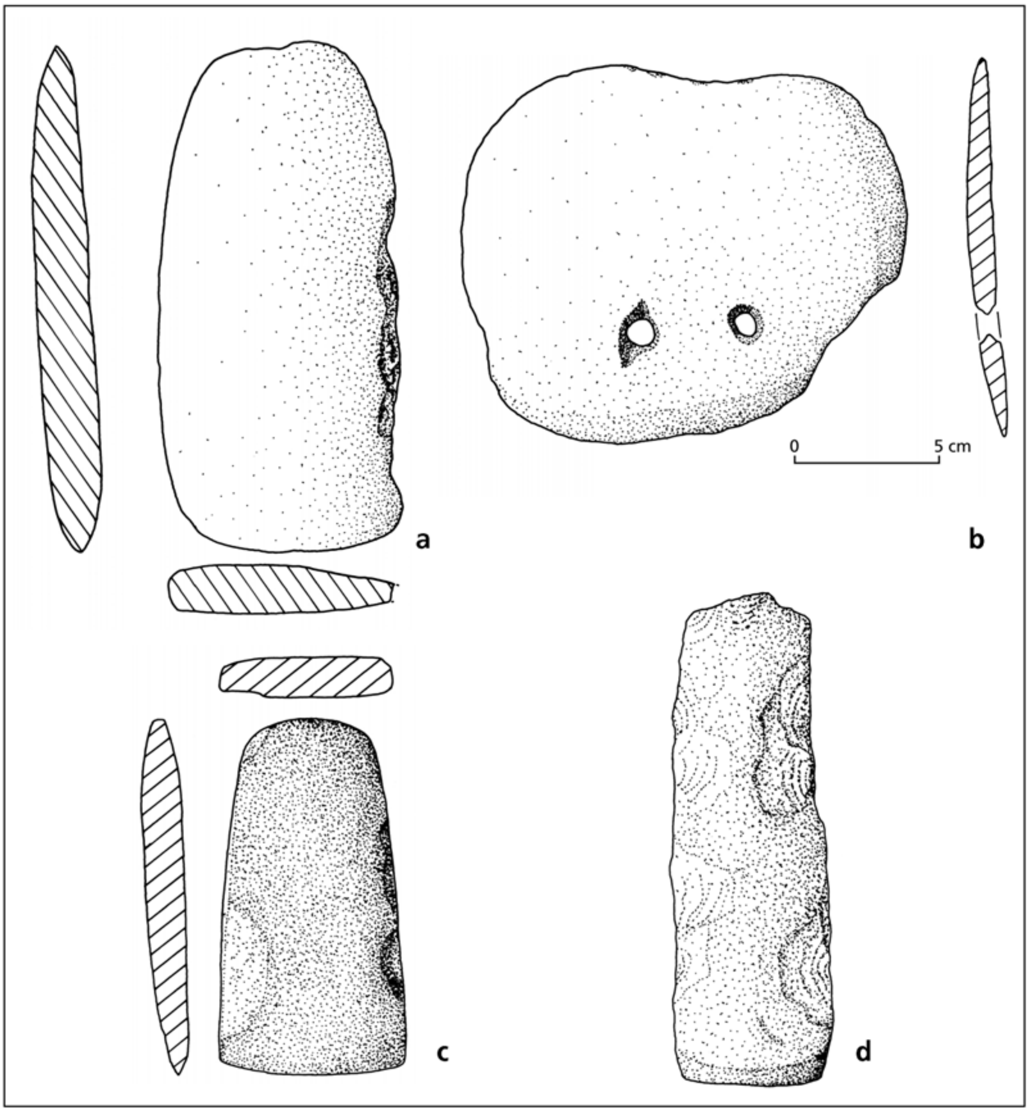


Fig. 5. Stone adzes/axes found in surface collection on Walpole Island. (a–b) New Caledonian origin; (c–d) probable Fiji/West Polynesian origin.

from those known in Vanuatu (Garanger, 1972), the southeast Solomon Islands (Kirch & Yen, 1982), elsewhere in Melanesia, and even East Polynesian islands like Henderson (Weisler, 1996*a*) which lack such large specimens.

Shell ornaments. Three different types of shell ornaments have been recovered. The first is made of the flat parts of bivalve and gastropod shells, smoothly rounded and polished, with a hole drilled at one end (Fig. 7a–b). Some are small, with an average length of about 10 cm, but others are more than 20 cm long and quite heavy. On some large specimens, two or three holes are present. All are made from fossilized shell, pointing to local manufacture. These artefacts were obviously used mostly as pendant necklaces with a string indicated by use wear on some specimens.

The second type of ornament is made from the upper part of a conus-like shell, whose spire has been removed and its lower part cut and polished (Fig. 7c). Diameters vary from less than 3 cm to over 10 cm. None of these discs could be used as arm bands and they were probably attached to a string and worn as necklaces.

The third type of shell ornament is made from gastropod shells (several species and mostly fossilized) with a hole at one end of the margin (Fig. 7d–e). This type of work is mostly associated with fastening shells on complex noded pendants, each shell being firmly tied and therefore unable to damage its neighbour.

Bone objects. The treasure hunters' excavation of site 5's deposit yielded a variety of bone points. All seem to be made from bird bones. Large and small, long bones were bevelled, probably for use in pointing, netting and matting activities (Fig. 8). The articular end is preserved on large specimens but was removed from the small needles, which had a hole on the upper side for string. The large number of these bone objects in some sites indicates a rather long prehistoric occupation. Other bones (such as shark vertebra) may have been used for ornaments.

Wooden objects. Guiart (1963: 207) reported that large paddles and gourds were found during the Guano period, in addition to a decaying canoe with skeletons. The only wooden items remaining in current collections are a wooden beater, possibly for cloth preparation, and a large curved hook, probably used for catching large fish. These objects are recent, as wood preserves poorly in salty environments.

Fig. 6. Shell adzes/axes of different sizes from Walpole Island. Scale length 5 cm.

Human remains. Written descriptions of the structural remains on the central plateau clearly indicate the former existence of complex burials with upright slabs, unknown elsewhere in New Caledonia. The added existence of bodies placed in rockshelters, a common tradition elsewhere in the archipelago, indicates two different ways of disposing of the dead, possibly linked to two cultural traditions or two chronological periods.

The only collection of human remains from Walpole that I have located was brought back after the 1967 expedition and is now housed in the New Caledonia Museum. This material, representing a minimum of eight individuals, was analysed by F. Valentin (Valentin & Sand, 2000). The bones represent young children, adolescents and mature males and females. The skulls are absent. The only jaw has characteristics more common in Polynesian than Melanesian populations. Adults height ranges from 152 cm to 170 cm. The bones have numerous signs of degenerative osteoarthritis on the spinal column, the hands and feet. One vertebra bears a rare exostosis of hooked form (Valentin & Sand, 2000: fig. 6.4).

Prehistory of Walpole: a first tentative chronology

With such complex and mixed material, derived largely from surface collections or illegal excavations, it is difficult to build an accurate chronology. One point is central: objects that are clearly associated with the "Traditional Kanak Cultural Complex" of the last thousand years (such as the stone adzes/axes) (Sand, 1995*b*) have all been found on the surface in the rockshelters. This is also true for the human remains. A second set of objects made of shell and bone has been found in surface collections and in stratigraphic layers up to 40 cm deep. Controlled excavations confirmed the existence of stratified deposits in some sites, suggesting successive occupations. The first set of objects can be related tentatively to the Kanak oral traditions, which record irregular landings on Walpole. The second set of remains and the stone constructions on the central plateau, are clearly quite different and may relate to an older occupation.

There are eleven radiocarbon dates (Table 1) from three series of measurements:

- The oldest, run in the 1980s by Rainer Berger of UCLA Lab for R. Shutler Jr., are from wood, charcoal and shell samples coming most probably from the Chevalier collection (letter from R.B. to R.S. dated 27 April 1982). The dates are calibrated to 660–460 B.P., 760–0 B.P. and 460–110 B.P. (UCLA-2333A, wood; 2333B, charcoal with adze; 2333C, shell; respectively, see Table 1 for other details).
- A human bone, collected by Chevalier in a rockshelter and processed by the Lyon Laboratory in France, returned a calibrated result of 540–460 B.P. (Ly-8308).
- Dates of 690–570 cal. B.P. (Beta-155197) and 660–540 cal. B.P. (Beta-155198) came from bird bone tools excavated by the treasure hunters in site 5.
- Finally, five charcoal samples from stratigraphic contexts excavated in 1995. The earliest date calibrated to 2,750–2,470 B.P. (Beta-155199) comes from layer 5 (25–30 cm deep) in site LWR003, near the only generally accessible part of the island. In the same test pit, and separated by the sterile layer 4, charcoal from layer 3 (20 cm deep) returned a calibrated date of 2,050–1,880 B.P. (Beta-155200). On the lower east coast, samples from site LWR006 returned comparable dates. The earliest from layer 4 (55 cm deep) calibrated to 2,710–1,905 B.P. (Beta-83786), and the most recent layer with continuous signs of occupation (layer 3 at 20 cm deep) calibrated to 2,120–1,900 B.P. (Beta-155202). Possibly related to the Guano period is a calibrated date of 270–0 B.P. (Beta-155201) from LWR004 at a depth of 40cm.

Table 1. Radiocarbon dates from Walpole Island. Shell date UCLA-2333C has been calibrated using a ΔR of 0.0.

sample no.	material	site	depth (cm)	measured ^{14}C (B.P.)	$^{13/12}C$	conventional ^{14}C (B.P.)	calibration (2σ) (B.C./A.D.)	calibration (2σ) (B.P.)
Beta-155199	charcoal	LWR003	25–30	2,530±40	-25.2	2,530±40	B.C. 800 (780) 520	2,750 (2,730) 2,470
Beta-83786	charcoal	LWR006	55	2,270±130	-24.7	2,280±130	B.C. 760–635/560 (360 280 255) A.D. 45	2,710–2,585/2,510 (2,310 2,230 2,205) 1,905
Beta-155202	charcoal	LWR006	25	2,070±40	-26.0	2,050±40	B.C. 170 (50) A.D. 40	2,120 (2,000) 1,900
Beta-155200	charcoal	LWR003	20	2,010±40	-24.8	2,010±40	B.C. 100 (10) A.D. 70	2,050 (1,960) 1,880
Beta-155187	bone	site 5	?	510±40	-12.5	710±40	A.D. 1,260 (1,290) 1,310/1,370–1,380	690 (660) 640/580–570
Beta-155188	bone	site 5	?	420±40	-13.7	610±40	A.D. 1,290 (1,320 1,350 1390) 1,420	660 (630 600 560) 54
UCLA-2333A	wood		surface	530±80	not rep.		A.D. 1,290 (1,410) 1,490	660 (540) 460
UCLA-2333B	charcoal		surface	460±200	not rep.		A.D. 1,190 (1,440) 1,952	760 (510) 0*
UCLA-2333C	shell		surface	650±80	not rep.		A.D. 1,490 (1,660) 1,840	460 (290) 110
Ly-8308	bone		surface	455±40	not rep.		A.D. 1,410 (1,440) 1,490	540 (510) 460
Beta-155201	charcoal	LWR004	40	100±40	-25.5	90±40	A.D. 1,680–1,770/1,800 (1,890–1,910) 1,940/1,950	270–180/150 (60–40) 10/0

The calibrated dates obtained for stratigraphic contexts in the bottom and middle levels of the excavations fall into the early part of the regional prehistoric chronology, mainly covering the second half of third millennium B.P. Significantly, the dates obtained from surface collections all fall in the first millennium B.P., mainly during its middle and second part. These results, although preliminary, enable a hypothesis of prehistoric occupation.

First discovery and permanent settlement. It appears that initial settlement of each Pacific region was characterized by a period of regular exploration to locate all the islands (Irwin, 1992). Walpole, although very rarely visible from Maré Island and Isle of Pines even in good weather, must have been discovered during Lapita times. The earliest date for a human presence on Walpole in front of the only viable landing place (LWR003) possibly places this exploratory phase at around 2,750–2,470 B.P. (800–520 B.C., Beta-155199).

Long-term settlement on the island was probably delayed until the expansion period of New Caledonian prehistory which occurred during the second half of the third millennium B.P. (Sand, 1999), partly as a consequence of rapid population growth (Sand, 1995*b*). Two radiocarbon dates place the major occupation of two strategically located rockshelters, LWR003 and LWR006, about 2,000 B.P. (Table 1). Significantly, the chronology of the nearby Loyalty Islands at that period shows the rapid reduction of exchange and relationships with the Grande Terre, leading to the disappearance of imported items in the excavated sites (Sand, 1995*b*, 1998). In this regard, one major difference between Walpole and the East Polynesian "mystery islands" (Weisler, 1994) is certainly the absence of foreign objects (e.g., potsherds, stone flakes, and stone adzes). Imported items have never been found in stratigraphic association with the shell artefacts on Walpole, contrary to what appears in the Loyalty Islands during the third millennium B.P. (Sand, 1998). Production of artefact types unknown in the rest of the archipelago included the heavy *Tridacna* axes, unusual shell ornaments, and numerous bone points—all rare or unknown in prehistoric contexts in New Caledonia where pottery, conus armbands and stone tools dominate. I consider that this is a sign of a rather isolated community on Walpole at a period characterized by little movement of objects between islands. In the Loyalty Islands, this occurred during the second millennium B.P., contemporaneous with the appearance of megalithic fortifications indicating regular episodes of war (Sand, 1996).

This first period of permanent settlement seems to have been characterized by a humanization of the landscape, with at least some environmental transformations. *Placostylus* land snails are present only in the bottom of the stratified deposits and unidentified bones of what might be extinct species have been found associated with the shell artefacts. If the settlement had been only intermittent, each time by a small group, these indigenous species would have managed to survive in one or the other part of the island. However, at this stage there is no way of linking the rockshelter chronology with architectural remains on the central plateau (i.e., the walls, plazas, coral columns and raised burials with cut coral slabs).

Some human bones found buried in rockshelters may be related to that major phase of occupation. As well as exploiting fish and birds, the people were probably

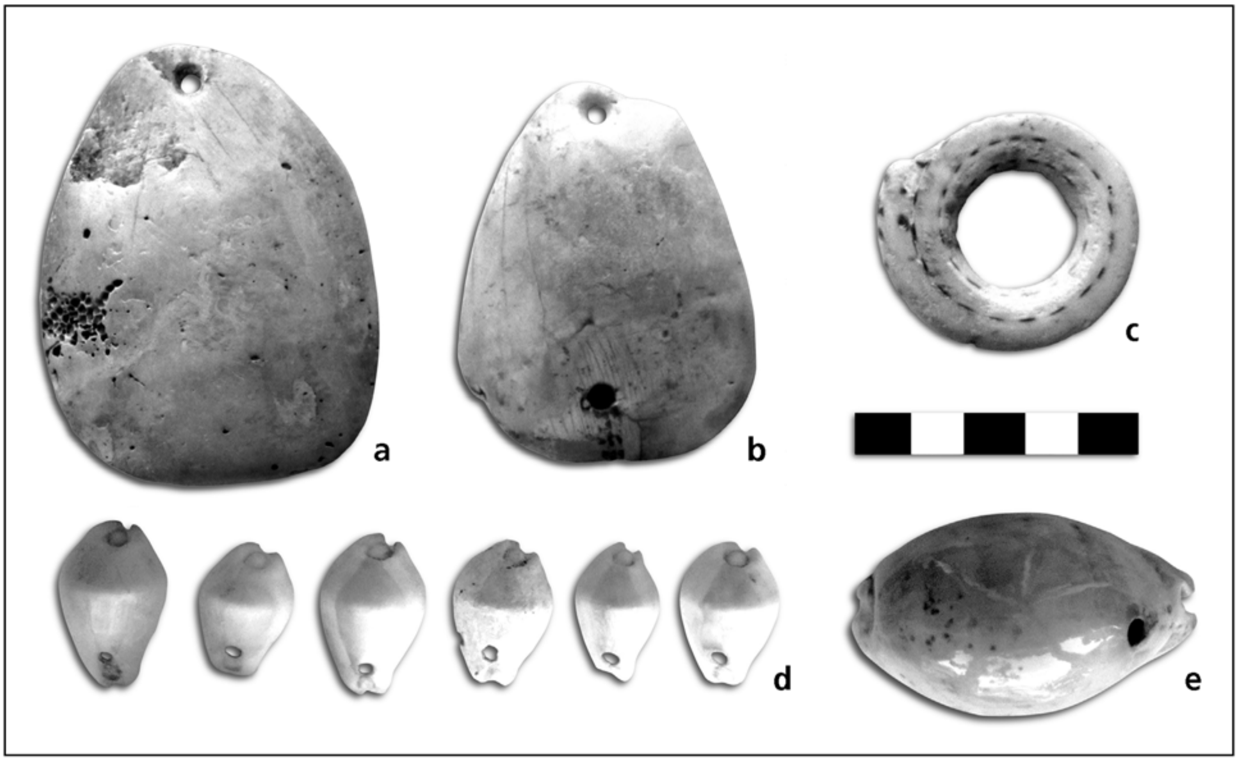


Fig. 7. Shell ornaments from stratigraphic contexts on Walpole Island. Scale length 5 cm.

Fig. 8. Bone points from Walpole Island. Scale length 5 cm.

cultivators. Historical records emphasize the high fertility of the soil, and taro plants still survive today. Some walls may have been garden enclosures protecting crops from the wind. The descriptions of "raised burial mounds" with cut coral slabs and rounded pebbles on the surface point to a West Polynesian or maybe Vanuatu tradition, but clearly not to New Caledonia. The coral columns described as laying on their side recall a coral pillar of Maré, raised on the seashore to mark the limit of a former chiefdom (Sand *et al.*, 1999). However, it is not possible to link the remains described on the central plateau to a specific culture or society, and even less to give them a date.

The duration of this possibly isolated settlement is impossible to evaluate at this stage. Similar results from the two rockshelters indicate that it may have lasted a few generations or a few centuries. Studies in other areas have shown that a simple explanation for the abandonment of small islands is unsatisfactory and that each case is probably unique (Kirch, 1988).

A stopover. After its abandonment, perhaps during the second part of the second millennium B.P., Walpole was used as a stopping point on regional voyages. The archaeological imported materials found in surface collections, significantly limited to a dozen items, is dated to the first millennium B.P., when new exchange routes were developing (Sand, 1995*b*, 1998). Six radiocarbon dates all fall in the last 600 years (Table 1), a period known for new movements of people (Spriggs, 1997: 187–222). The two dates from the bird bone tools excavated by the treasure hunters might correspond to one of these episodes of long duration by passing sea farers in search of new lands.

The stone artefacts, such as the nephrite *ostensoir* axe, indicate relationships with the rest of the New Caledonian archipelago, probably as a consequence of involuntary stops between the Isle of Pines and Maré as part of the jade exchange network. Interestingly, relations with the east, mainly Fiji/West Polynesia, are also represented, thereby giving credence to the oral tradition of an early historical "Tongan" stop on Walpole. Examination of the only collected human jaw shows affinities with Polynesians (Valentin & Sand, 2000: 95–96), possibly indicating the deaths of foreign visitors. Future surveys might even show that the few slab-faced burials of the central plateau are of West Polynesian cultural affinity, and bear no relation with the possibly older surrounding walls and cairns. Clearly, no objects collected on the surface indicate permanent settlement. Finally, the apparent absence of a widely known indigenous name for the island is another sign of the absence of a permanent local population immediately preceding European discovery, making the Walpole case no different to the "mystery island" of Nihoa for example, known in Hawaiian traditions (Kirch, 1985: 89).

Sometimes Kanaks came deliberately to Walpole for fish, bird eggs and feathers (Sand, 2002: 42). The large number of birds on Walpole, some with long or coloured feathers, may have attracted the producers of ornaments for dancing or display. No wide tradition of using indigenous bird feathers has survived in ethnographic accounts. Archaeological data, however, show that Kanak society was so transformed after first European contact (Sand, 2000*b*) that the scarcity of feather use during historical times and near absence of oral traditions about Walpole might not be a definitive sign that these traditions did not exist previously. The difficult access to Walpole's shores meant that the island may have experienced long periods without visits before the new settlement to exploit guano was established.

Analysis—Is Walpole a "Mystery Island"?

The archaeological data collected on Walpole Island show a complex human history. The destruction of most pre-European remains scattered on the central plateau prevents us from fully reconstructing the former landscape and occupation chronology. However, the main question arising from this work concerns the inclusion of Walpole into the group of "mystery islands", as traditionally described and summarized in the first part of this paper. Significantly, the term itself is getting outmoded, now that archaeology is taking "the mystery out of the … 'mystery islands'" (Weisler, 1994). Kirch, in his wide summary of Pacific prehistory, doesn't tackle the point of the "so-called 'mystery islands' of Polynesia" (2000: 265) in any detail. Interestingly, in his extensive work on southeast Polynesia, Weisler talked about "marginal islands" (1994: 84) when referring to the Pitcairn group. Di Piazza & Pearthree, expanding on work by Weisler (1996*a*), propose "three classes, defined by the role each island played in regional interaction. These classes might be characterized as mother communities, satellites and isolates" (Di Piazza & Pearthree, 2001: 165).

Applying this model to Walpole shows how unique the New Caledonian island is. The "mother community-satellite" model, with a distance not exceeding c. 250 km (Di Piazza & Pearthree, 2001: 150), can apply for the late part of the prehistoric chronology proposed for Walpole, with canoes using the spot as a waypoint, and Kanak navigators visiting irregularly to collect local products. Interestingly enough, Walpole is the only Melanesian Island appearing in Di Piazza & Pearthree's paper (2001: 165). In their model there is no "abandonment", as there is no resident populations. However, recent excavations now suggest an early permanent occupation, rendering the "mother community-satellite" model inapplicable for that period. Walpole may be unique in the Pacific, having two clearly differentiated historical episodes.

Moreover, Walpole remains a "real mystery island", as we do not know who made the unusual artefacts and structures, or for what purpose. Most likely Walpole represents an extreme situation of "local cultural adaptation and differentiation" widely recognized in the Melanesian region (Bedford, 2000) and possibly linked to some form of purposeful isolation.

In conclusion, Walpole is a "mystery island", not in Bellwood's (1978) sense, but because of its unique chronology, incorporating discovery and later long-term occupation(s), then abandonment, followed by irregular visits and short-term settlements. Although the start and endpoints of this chronology are fairly well identified, the unique phase of long-term occupation(s) characterized by unusual artefacts and raised structures, remains an enigma to be properly solved only by future archaeological research.

Fig. 9. The northern tip of Walpole Island, with its manta ray profile.

Conclusion

This very preliminary exploration into the prehistory of Walpole Island, the southernmost part of island Melanesia, has led to a voyage into a unique human experience in Remote Oceania. Using various sets of data collected on this coral fortress over nearly one century, I propose a hypothetical, preliminary and general chronology. To go further, a multi-disciplinary research program involving soil, pollen, bone and shell tool specialists is required. Recent studies prefer to replace Bellwood's concept of "mystery island" with terms like "marginal island" (Weisler, 1994: 84). For Walpole, the best term in the regional context is perhaps "extreme island", being one of the most inaccessible and inhospitable places in southern Melanesia.

Walpole is a fascinating place, one that you cannot forget once you have explored it. The permanent wind, the sea at the base of the huge cliffs, the noise of the millions of birds, and the profound loneliness of the place make it a unique experience, markedly different from the Pacific cliché. The whales and their young that can be seen from the cliffs around the island are a reminder of the Kanak traditions about the sign of first field preparation for planting during the winter season (Barrau, 1956) and of the Polynesian symbol of the *Tafola'a*, the chiefly representative. The northern point of Walpole has a long coral outcrop, that from one side looks like the giant head of a manta ray (Fig. 9). I am convinced that the first oceanic occupants of the island had seen this and perceived the rock as a protector of their *Fenua*.

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I would like to thank those who edited my text, and an anonymous reviewer whose very critical comments made me rework and detail the data for this paper. The final proposals published here still remain my own.

Finally, I would like to dedicate this paper to the memory of R. Sintès, Journalist in Noumea, who conducted bibliographical research on the Walpole case and would certainly be happy, wherever he is now, to see part of the "mystery" of the island solved.

Appendix

"… What was to me another interesting feature was the many traces of human habitation in the form of rough walls obviously built by man, columns of coral from two to nine feet high, large tombs or graves, clam shell bladed instruments and so on.

I knew from the walls and columns of coral, before I found anything else, that at one time the island was inhabited, but had not been so for nobody can say how long (the present people are only there to work the guano). What beat me was where did these early inhabitants get water, for although there is plenty of rain in the season, at times eight to nine inches in a night, it disappears nearly as quickly as it falls … .

The walls that I found in various parts of the island were of a very crude style, but still walls, up to about four feet high, one coming upon them here and there as the scrub was cut down. The columns of coral are as a rule in lots of fifty or so in and about one place. They appear in various parts of the island, but, strange to say, practically the whole of them are not great distances back from the edge of the cliff, some so close that part of them at the base project over the cliff, all going to show what a long time ago it must be since they were erected. The idea of them no one perhaps can say, certainly nothing to do with graves, as, where a lot of them are, there are no holes where a body could be placed, practically bare coral rock. Any body buried at the foot of one of them could only be covered with a heap of coral, and there are no signs of anything of that kind. Moreover, graves I found were built up or over with loose coral, with no sign of a columns [sic] near them. The most mysterious thing to me was how and where did they get those practically flat coral slabs. Anyone who knows anything about coral knows that you cannot split it, and of course, never get it in slabs that can be separated. There are all kinds of coral on this island, some so hard that it will cut glass, but most of it strongly gnarled. These columns are just wedged into crevasses, but are well fixed, very few having fallen. They have, of course, a good long base. At various times I have had boys from most of the islands in the western Pacific but these columns were new to them, so they told me.

I found several graves, all of which were formed by coral of various kind, built up like mounds the shape of a grave. One in particular was most interesting, being inside a walled enclosure, pear-shaped, about 50 feet long and 20 feet wide, with the entrance at the small end. The grave itself was extra large, about 12 feet long, piled up like the smaller ones, but on a better scale. Some of the coral was shaped a bit. On this grave only there were a lot of waterworn pebbles (coral, no stone of any kind on the island), also pumice, some very large pieces. I found no pumice anywhere else on the island. There was also a large piece of the hard cemented guano the shape of an egg, about 30 inches long, and of course, very heavy. How they got it into this shape which was perfect is another mystery. It certainly was not in its rough or natural state, nor was it waterworn.

Up to the time that I went there no one had been down on the lower reef on the weather side of the island. (I was most anxious to get down, thinking that perhaps I might find traces of water, so one Sunday the engineer, some Loyalty Island boys and myself made a bid for it. Getting down was not worrying us so very much, it was the getting up again that might be the trouble. However, we stuck a long crowbar into a hole in the coral, made a rope fast to it, also a small wire rope in case the other got cut on the sharp rough coral.) We got down all right. (The first 20 feet or so was the worst, as the cliff over hung there.) We found several caves at the foot of the cliffs, two of which contained good fresh water. These two caves were two of the outlets for the rain water, and one might call them small under ground creeks. Of course they only run during heavy rains. We crawled along one of them for a fair distance. The caves were pretty wide near the mouth with a smooth floor, each having a saucer shaped hole about eight feet across and about eighteen inches deep; both full of fresh water. The holes I am almost sure were formed by nature, although the ancients may have given them a start. The whole was of course of coral formation, and some kind of a sediment must have lodged in them to retain the water. The quantity of water we found would not go a long way towards keeping a lot of people supplied, but there are other caves which may be of the same nature, although since they are all in the face of the cliffs where the latter run sheer down into the sea, it was not possible to get near them. (But they were not always as they are now. Again, the island at one time may have been very much larger with some of the primitive rock showing, which would retain water.)

In some of the other caves we found numerous implements, such as axe heads and the like, made from fossilized clam shells. The axe heads were from six inches long and up, beautifully shaped and smooth at and near the cutting edges, the rest of the head being left pretty much in its natural stage, all very hard. (In breaking a piece off it glittered like a bit of broken quartz.) One of the axe heads was very large and heavy. I could not possibly lift it with one hand, and feel sure it could never have been used as an axe. We found also skulls and human bones in the caves, but I am pretty sure that they must be of a more recent date, and may have belonged to castaways from the Loyalty or other islands. I did not take away any of the skulls or bones, but the implements I took and gave to the Sydney Museum, where they told me that implements of that kind had not previously been found south of the Equator. They showed me some from, I think the Caroline Island. They had never seen or heard of anything of the kind so large as the large axe head."

Anonymous, 1929. This anonymous writer was most probably A.C. Mackay, who gave the Walpole collection to the Australian Museum.

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Oral Tradition and the Creation of Late Prehistory in Roviana Lagoon, Solomon Islands

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ABSTRACT. The use of oral tradition or oral history in archaeology is often a contentious issue. In this paper we briefly review methodological issues surrounding the use of such data and follow this with a case study using our research into the last 1,000 years of prehistory in Roviana Lagoon (New Georgia Group, Solomon Islands). We argue that it is not possible to generalize cross-culturally about the historicity of oral tradition/history. However, in the Roviana case, careful use of ethnohistory and archaeology together indicates that: (*a*) Roviana oral history is linear; (*b*) there is a close relationship between genealogical age and radiocarbon age; and (*c*) the modern uses of the oral tradition by Roviana provide a theory of their use in the past. We conclude that the model for the formation of the Roviana Chiefdom which emerges from the working back and forth between archaeology and ethnohistory has much more explanatory power than one based on either source of data by itself.

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Archaeologists generally acknowledge the importance of incorporating into our explanations or interpretations data that move beyond the economic and material to the ideological and symbolic, and which encompass notions of agency and structure. Even noted processual archaeologists (e.g., Flannery & Marcus, 1993; Renfrew & Zubrow, 1994) have turned to cognitive archaeology, cosmology and ideology. At the same time, post-processualists have pulled back from the relativist abyss and acknowledged that the material world studied by archaeologists is not totally malleable or arbitrary in interpretation (Hodder, 1994: 73). Today we see the potential in bringing together the large scale, long-term materialist arguments of the evolutionary models with the short-term variety generating processes of daily cultural behaviour that are foremost in idealist approaches (Preucel & Hodder, 1996: 311). However, as archaeology comes to adopt a realist philosophical position, it is left requiring standards of proof which, although they may not be as methodologically rigid as the positivism of the 1970s, nonetheless require explanation to be based on

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arguments whose strength can be evaluated by some non-arbitrary means. What this means in practice for archaeologists interested in ideology and symbolism is the existence of a body of reliable historical or ethnohistorical data (Flannery & Marcus, 1993; Trigger, 1995). But how can these data be evaluated?

Archaeologists have long been wary of the uncritical use of oral tradition. Many argue that there is no scientific way to test the "truth" of such data and often suggest that oral tradition or history is subject to political manipulation and is accordingly more about the present than the past. This, of course, is the fundamental philosophical position of the post-processualists, although they extended it to refute the processualists claims of doing objective science. In an attempt to move beyond the relativist impasse for archaeology in general, Wylie (1993) has proposed a realist philosophy where strength of argument is improved, in part, by the convergence of multiple lines of independent evidence. Upon reflection, this appears to be the way in which most effective archaeological explanation is done or attempted. We suggest that oral tradition/history, ethnology and linguistics can all be used as independent lines of argument in the critical "cables and tacking" methodology suggested by Wylie (1993, 2000). Of course, uncritical use of any lines of evidence by themselves in a simple direct reading of the past is unsound, but denying roles to large bodies of relevant data is, at the very least, unwise and unproductive. In the following we discuss our experiences with the use of oral tradition/history and ethnology while investigating the prehistory of the Roviana people as part of our larger project on the prehistory of the Western Solomon Islands (New Georgia Archaeological Survey).

Oral tradition/history and archaeology

Ethnohistory has often been a minor aspect of archaeological research, but has either existed as an add-on to the main archaeological database or as a parallel study with little archaeological cross-over, with notable exceptions (e.g., in the Pacific, Green & Davidson, 1969; Kirch, 1996; papers in Torrence & Clarke, 2000). In practice, however, much archaeological interpretation has made use of analogical arguments from ethnography, which in turn are often heavily reliant on oral tradition. In the Pacific region most ethnography attempting to describe "traditional" snapshots of cultural systems are describing entities, which changed dramatically in the last 100 to 150 years (Carrier, 1992). While processualists have been reluctant to incorporate direct oral history in their narratives, they have been much less reluctant to use the summary results of ethnographic research, if only in model formulation, although often it appears to be used in a simplified analogical fashion which masks both history and recorded variety (Feinman, 1997). Unfortunately, much of the debate over the use of oral history has become confused with the political debate over the "ownership of the past" and negotiations between indigenous peoples, archaeologists and historians. A recent example is the series of papers in *American Antiquity* that are clearly issues related to NAGPRA (the North American Graves Protection and Repatriation Act passed by the American Government in 1990) and other social currents loosely described as the "Science Wars" (Wylie, 2000). These papers reflect polarized positions around the use of oral history, with the positivist archaeologist Mason (2000: 264) recommending after reviewing the issue that it not be used. This is followed in the same issue with the Native American archaeologist Echo-Hawk (2000) arguing that some Native American oral history provides literal history back to the colonization of North America 13,000 years ago. He concludes his paper, by stating that oral history must be subject to critical scientific evaluation.

In his evaluation of the use of oral tradition/history, Mason (2000: 242) has presented the following as major problems:

1 Oral tradition is not trustworthy as it depends on memory and verbal transmission;
2 The genre by its nature is more an artifact of contemporary culture than a record of the past;
3 Oral traditions are closed belief systems, beholden to authority and impervious to external challenge;
4 Access to oral tradition may be limited by the keepers.

To these we would more specifically add:

5 Much oral tradition should not necessarily be conceived of as literal or lineal history;
6 Formulaic ways of relating to time or space may be characteristic of large culture areas and therefore not be reliable accounts of specific past events.

In response, we would argue that the data provided by oral tradition needs to be analysed and interrogated in much the same critical fashion (Vansina, 1985: 186) as any archaeological data, if the goal is the creation of a richer understanding of the past. When such data are available it is counter-productive to ignore it. Working back and forth between archaeology, ethnography and oral tradition/history provides a rich field of data and a product of greater use to an anthropological archaeology (c.f. Green, 2000 on holistic archaeology in the Pacific) and an indigenous community.

The problems noted by Mason (2000) are often present with the use of oral tradition, although it is equally not possible to generalize about the historicity of oral accounts. Societies vary greatly in the extent to which they consider the past important and attempt to remember or manipulate it. Similarly, the notion of history and its use in the present can vary widely. Evaluation of collected information is required to ascertain what kind of data can be created from it. Vansina (1985) has reviewed the methodology by which such evaluation should be carried out. He suggests the utility of the information is dependent on a variety of factors. These include the familiarity of the collector with the culture, his or her competence in the native language, and understanding of the context under which the information was collected. He also points out the importance of using multiple lines of evidence to cross-check the stories, both to determine how variable they are within the society and to assess, if possible from independent evidence, the historicity of the claims. Vansina also defines different classes of data, which may have different kinds of use in the construction of the past. These include specific descriptions of historical events or processes, myths or charters which can inform on cultural structure and/or power relationships and testimony to the function, use or name of things or places in the past. All of these have been used in our study of the last 1,000 years of Roviana development.

Fig. 1. General location map.

Roviana: oral tradition and archaeology

Speakers of the Austronesian Roviana language are today found living beside the Roviana and Vonavona lagoons that stretch 70 km along the southwest coast of New Georgia Island in the Western Solomon Islands (Fig. 1). Since 1850, European traders have been living in Roviana, but it wasn't until 1902 that Methodist missionaries established a mission at Munda in central Roviana. Early missionaries (Goldie, 1909) and the anthropologist Hocart (n.d.), who visited in 1908, recorded a society where political organization was dominated by chiefs, authority was based on genealogy, and power was achieved through effective head hunting and financed by an economy which revolved around an elaborate shell valuable exchange system. Warfare and disease contributed to significant depopulation in the late nineteenth and early twentieth centuries (McCracken, 2000), and by 1906 (Edge-Partington, 1907) the traditional cultural bases of head-hunting and ancestor worship were increasingly less central to cultural life and the organization of power in Roviana, although the associated symbols and material features (e.g., shrines, war canoes and shell valuables) remain a useful cultural currency up to today.

In 1996 Sheppard and Walter began, in co-operation with the National Museum of the Solomon Islands, the Ministry of Culture Western Province and the Roviana Area Council, a four-year research program designed to provide a baseline cultural and environmental history for the Roviana Lagoon and surrounding areas. Our greater goal was the investigation of the origins of cultural diversity in the region, but as only very limited archaeology had been carried out and published (Reeve, 1989), our immediate objectives required a baseline study. In 1998 we were joined by Aswani, who had just completed a degree in Social Anthropology (University of Hawaii) after two years fieldwork in Roviana, which involved collection of oral tradition. In 1998 and 1999, he continued to collect oral tradition, both checking on his original research and investigating issues arising from the ongoing archaeological survey and excavation. Preliminary results arising from the archaeological and ethnohistorical research have been appearing as Annual Reports to the Solomon Island Government and as academic papers (e.g., Sheppard *et al.*, 2000; Aswani, 2000; Walter & Sheppard, 2000; Thomas *et al.*, 2001) and theses (Nagaoka, 1999; McCracken, 2000).

In modern Roviana two chieftaincies are recognized, that of Kalikoqu in the western end of the Roviana Lagoon, and that of Saikile in the eastern end. Both Chiefs are nearing the end of their lives and the future of the chiefly titles and authority is under active debate. We have conducted archaeological and ethnohistorical research in Kalikoqu and Saikile, but because of land disputes in Saikile we have found access to Kalikoqu easier, and that is where most of our archaeological work has been carried out.

Chiefly authority in Roviana has been and is, albeit in a contested form, expressed through adjudication of land and sea use-rights. People have use-rights based, in the first instance, on ancestral ties to the area in question. In practice, chiefs are the keepers of the genealogy and arbiters of disputes. Their authority is based on their knowledge and this relates in large part to the cultural geography of Roviana and in particular to the genealogies and traditions associated with shrines constructed of stone, which are found throughout Roviana. The shrines where one's ancestors worshipped signify the material geographical references that divide the land and seascapes of Roviana. For most of the twentieth century land has been abundant in Roviana. It is probable that disputes over use-rights were limited and consequently the basis of communal use was not challenged. In the last 20 years, the development of logging by Malaysian and Australian companies has substantially increased the value of tree-covered land, some of which had not been used for many generations. During the initial period of logging, royalties were paid to Chiefs, or to landowner associations headed by the traditional chiefs. However, dissatisfaction with this system has grown and today many people want their traditional land rights to be transformed into title decided by government courts. Notwithstanding the fact that Roviana people have always had some claim to tenurial autonomy, this is a clear challenge to traditional chiefly authority and threatens to transform the very basis of land tenure in Roviana. At the same time the logging has both revealed shrines located in the deep bush which have been marked and protected by the local people, and made valuable the knowledge of any associated traditions and genealogies held by the chiefs. Throughout the Western Solomon Islands people are now interested in the recording of shrines and associated traditions. Such work helps make the shrines material in a legal sense and provides information of use in land court proceedings.

On the surface, the Roviana situation is a classic case of the past not being value free, but a subject of current politics and potentially highly "biased" in presentation and transmission. However we argue that it is the very fact that the past is important and contested that makes the Roviana data useful. First, the modern activity makes clear the relationships among chiefly power, land tenure and religion, and although it could with difficulty be argued that this is just a modern phenomenon, historical records and comparative Solomon Island ethnology (e.g., Keesing, 1982; Miller, 1980) support its antiquity. This provides a very useful basis for modelling relationships between the archaeologically visible shrines and power in Roviana. Second, all people have some idea of their own genealogy and in this comparatively small society where kinship is reckoned bilaterally, kinship networks are extensive. Given the stakes riding on correct genealogical affiliation and the large number of potential authorities, it would seem very difficult to alter a genealogical affiliation. Keeping accurate genealogies is important in this society, and although much could be gained by altering them, they cannot be arbitrarily changed (see also Valeri, 1990: 191 for Hawaii). This does not, however, stop people from continually arguing for "new wives" or descendants that have not been reckoned by the hegemonic chiefly lines.

The oral history and archaeology of shrines

Shrines or what Roviana people call *hope* (Lit. sacred place, Waterhouse, 1949) are found throughout Roviana in dense bush, gardens, coastal points, small islets, passages to the open sea and in modern and abandoned villages adjacent to houses. Although *hope* can be unmarked, or have minimally marked locations, large numbers of shrines are substantial constructions made of stone. On the barrier islands most are made from the coral limestone (Fig. 2) that makes up the outer islands of the Roviana Lagoon, although some barrier island shrines contain large amounts of columnar basalt from the mainland. Shrines today are not used in any formal religious or ritual way; however, they are considered *Tambu ples* and, as places of the ancestors, are respected and generally undisturbed. The start of archaeological surveys in these areas was often preceded by a visit from elders to bless the area and make it "safe". In some major chiefly skull shrines (e.g., Piraka and Kudu), twentieth century graves of chiefly people have been placed in very close proximity, demonstrating that continuity with the past has been maintained after the advent of Christianity.

When asked about shrines people clearly distinguish between shrines for which they have traditions and affiliation, and those for which they don't. On the island of Nusa Roviana, which was the nineteenth century centre of the Roviana polity, people have traditions about the

Fig. 2. Shrine (*hope*) in Roviana c. A.D. 1900 (Courtesy the Methodist Archives Auckland).

functions and ancestors associated with the shrines. These are found throughout the modern village, within the hillfort located above the village, and in abandoned villages that extend along the coastal flats west and east of the village. On the other hand, similar shrines located 5 km to the east in the village of Sasavele, where the present Chief of Kalikoqu lives, have no known traditions and people suggest they are associated with earlier inhabitants. Similarly, virtually all of the shrines located in the mainland bush have no associated tradition. They are recognized as shrines and were protected during logging operations, but are known, with a few exceptions, only to hunters and others who frequent the interior bush.

The recognized shrines are generally described as having certain functions. Large shrine complexes with numerous human skulls located inside skull "houses" and abundant offerings of shell valuables and occasional historical artefacts are described as ancestral skull shrines or chiefly skull shrines. It is these forms that are often associated with historical graves. Other shrines may have few or no human skulls but have artefacts and associated hearth structures, and are described as classes of shrines for specific rituals (e.g., fishing, curing, purification and warfare; Nagaoka, 1999). In the hillfort complex on Nusa Roviana (Sheppard *et al*., 2000), many of the shrines are traditionally associated with warfare and the *mateana* (lit. meteors) or angels, from which Roviana chiefs descend.

One shrine (Site 79) located to the east of the modern village on Nusa Roviana is traditionally associated with Ididuban̲ara (Nagaoka, 1999: 111), who is said to have been the Roviana chief who settled the island from the mainland, effectively founding the modern Roviana chiefdom. He is said to have established a shrine soon after settling on Roviana as a means of settling "80 protective spirits" in the new settlement. The current Chief of Kalikoqu provides the following account of this movement.

> Luturu Bangara, the chief of Bao [a Kazukuru inland settlement], got married and had a child named Ididu Bangara. Ididu Bangara grew at Bao and became the chief when his father died. Although Ididu Bangara lived at Bao he often descended to the coast and crossed over to Dokulu in the barrier island to search for *hio* (*Tridacna gigas*) shells and for fishing. Ididu Bangara got tired of travelling to the coast so he decided to move to the *toba* (barrier islands). So he spoke to his tribe and told them why he wanted to settle in the coast. He spoke, "I want to go down to the *toba* to find *hio* shells so that I can make myself *bakiha* (shell valuables). There are not too many shells at Bao nor do we have the material to manufacture the *bakiha*, so I want to move to the *toba*". The *butubutu* (tribe) gave its approval and got ready to move. Then Ididu Bangara set the day that they were going to leave Bao and then they left. After settling various areas they finally crossed the lagoon in a bamboo raft to settle the Island of Nusa Roviana. (Aswani & Sheppard, n.d.).

According to the genealogies collected recently by Aswani (1997, 2000), Schnieder (1997), Sheppard and Roga (Sheppard & Walter, 1998) and by Hocart (n.d.) in 1908, Roviana genealogies extend back 15 generations to the ancestor Roviana, and Ididuban̲ara is recorded at 12 generations from 1900. Allowing three generations per century would date Ididuban̲ara to c. A.D. 1500. Roviana oral history therefore would make Site 79, which is associated with Ididuban̲ara, one of the oldest shrines on Nusa Roviana pre-dating most of the shrines for which there is traditional knowledge.

The archaeology of shrines in Roviana has involved our recording details of location, morphology, construction, associated artefacts and facilities such as hearths, as well as limited excavation in associated hearths and under platform walls to secure dating materials. This work has resulted in our making a fundamental distinction between faced and unfaced shrine platforms. Faced platforms are generally constructed of basalt, which is used in its columnar form to create the outer walls of a platform that is then filled with earth or earth and rubble. On the barrier island, which has no naturally occurring basalt, some faced platforms are constructed of cut coral blocks or sheet coral slabs; however, most have a considerable amount of basalt used in their construction. These platforms are often found as complexes of several platforms and associated large basalt slabs set up on cobbles to form "table stones". In no case, however, have we found an associated hearth, and in most cases there are no associated artefacts or any cultural deposit or debris. The only clear exception is the presence at three sites (Nagaoka, 1999: 126) of single, rough shell rings called *bareke*, which are considered by Roviana to be early forms associated with priests and unlike the rings used in exchange or as symbols of chiefly authority. Oral traditions suggest that several generations before the regional power shift to the coast, Kazukuru inland dwellers utilized a sole shell valuable known as *ukeana* (in the now extinct Kazukuru vernacular) in their ceremonial and religious prestations (Waterhouse & Ray, 1931). However, accounts recollecting the ensuing amalgamation of inland non-Austronesian and Austronesian groups identify the emergence of a new set of shell valuables (Aswani & Sheppard, n.d.). None of these faced shrine forms are found near residential platforms and with the exception of Site 79, which has a main faced platform and is associated with Ididuban̲ara, none have reported oral tradition.

In contrast to the faced shrine platforms are the unfaced platforms (Fig. 2). These comprise roughly rectangular platforms of coral cobbles, associated skull houses made of sheet coral and stone lined hearths or ovens (*oputu*), numerous shell artefacts (particularly exchange valuables), human skulls, food debris (shell, pig jaws) and often historical artefacts. These shrine forms vary considerably in detail, most likely reflecting functional and temporal differences. They are found throughout the Roviana cultural landscape and are commonly found in close proximity to residential platforms, and as noted above, in modern villages. These shrines often have reported oral tradition and many were clearly in use in the early historical period, as is indicated by the historical artefacts (e.g., iron axes, pot fragments and pipes).

Oral tradition therefore clearly separates shrines with different physical features and artefact associations into early and late, or those with and without traditional associations. Faced shrines, with the occasional exception such as Site 79, have no traditional associations for Roviana people and if pressed, people suggest that they belong to older unrelated people. The radiocarbon chronology which we have developed (Table 1) for the shrine sequence supports the traditional sequence and in particular the posited age for Site 79. This shrine complex associated with Ididuban̲ara is distinctive for the large amount of basalt

Table 1. Radiocarbon dates associated with faced and unfaced platforms.

lab number	site	platform type	sample	^{14}C age B.P.	calibrated 1σ range (OxCal version 3.5)
WK-6761	Feature 111 Ex-B1, Oputu	un-faced	charcoal	modern	
WK-6156	Feature 1082 Ex-I2, Site 12, Oputu	un-faced	charcoal	300±45	1,517–1,650 A.D.
WK-6757	Feature 1058	hillfort wall	shell[a]	720±50	1,523–1,653 A.D.
WK-6760	Feature 122 Ex-M2, Oputu	un-faced	shell	810±50	1,459–1,530 A.D.
WK-6758	Feature 122 Ex-M2, Oputu	un-faced	charcoal	250±50	1,524–1,675 A.D.
WK-6756	Feature 773.6 Buni, Oputu #3	un-faced	shell	680±50	1,562–1,673 A.D.
NZA-9457	Site 79	faced	charcoal	556±57	1,300–1,360, 1,380–1,430 A.D.
WK-6155	Feature 118, Ex-J1	faced	shell[a]	1,060±45	1,290–1,365, 1,375–1,380 A.D.
WK-7916	Site 150 Kopo	faced	charcoal	610±50	1,305–1,395 A.D.
NZA-6235	Site 25	deposit near faced platform Site 24	charcoal	468±62	1,403–1,490, 1,608–1,612 A.D.
NZA-10856	Site 145 Bao-14	faced fill layer 2	charcoal	789±70	1,200–1,285 A.D.
NZA-10855	Site 145 Bao-14	faced fill layer 2	charcoal	830±60	1,164–1,270 A.D.

[a] All shell dates calibrated with a ΔR set to 0.

which has been transported from the mainland and used in its construction. The complex consists of a main stepped basalt faced platform (10.2×5.5 m) in association with two unfaced platforms within an enclosure defined by a low coral edging. Canarium nutshell recovered from the footing trench under the main platform wall suggests a construction date (NZA-9457) after the mid-fourteenth century. This compares very favourably with the date from genealogy of c. A.D. 1500, which was collected prior to the radiocarbon determination.

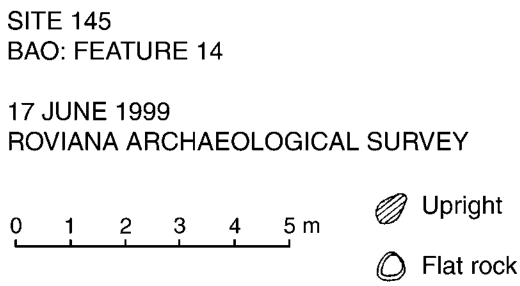
The oral history of Roviana origins and movement

Surveys of the New Georgia mainland ridges along the lagoon have revealed numerous isolated, faced shrine complexes with no associated settlement, and as we have shown above, these are old. In only one area have we found a concentration of shrines and other stone features. This is in the area called Bao, which is located in the centre of the island of New Georgia behind the coastal region of Munda. Oral tradition states that Bao is the origin point for the Roviana people. It was at Bao that various inland tribes aggregated with non-Austronesian speaking Kazukuru people (Aswani, 2000), and from Bao that Ididuba<u>n</u>ara came down via a series of settlements to settle on Nusa Roviana and establish coastal Roviana, naming the barrier island he settled on after his grandmother, Roviana.

In 1999 we conducted surveys in the Kazukuru region behind Munda in an effort to locate and record Bao. On a high central ridge that looks out towards the north New Georgia coast we found a series of 17 platforms extending 1 km along the ridge. The largest of these (Site 145) was a stepped faced platform (Fig. 3) with tall corner basalt uprights, an internal cyst arrangement, and a rectangular paved approach that extended 20 m east. Situated at a point 10 m along the paved area was a large flat basalt "table stone" (1.0×0.8 m) supported by cobbles. This shrine shared most of its attributes with other mainland faced platform shrines, although it is larger and more elaborate in construction than most. As with other faced platforms, there was no evidence of an oven or hearth arrangement, nor any associated artefacts or food debris. Excavation on the front of the platform (Excavation A) provided samples of charcoal from amongst the rock and earth fill. Dating of these samples (Table 1) indicates an age of c. A.D. 1200, which makes this the oldest shrine we have dated so far in Roviana. The presence of an atypical aggregation of faced shrines in this area and the associated radiocarbon date are clearly in keeping with the oral tradition relating to Bao, which is described as a large settlement. Informants in Munda state that a series of named shrines exist between Munda and Bao and these mark the movement of Ididuba<u>n</u>ara from Bao, although we have not been able to conduct a survey to record them. Linguistic data (Waterhouse & Ray, 1931) does, however, record that the non-Austronesian Kazukuru language did exist with three dialects recorded (Tyron & Hackman, 1983) at the turn of the century, just before it died out and was completely replaced by Roviana.

Context and evaluation. The Roviana origin story is told by all Roviana chiefs and is well known by elders. It is of particular importance for Chiefs as it is by affiliation to the genealogy, which goes back through Ididuba<u>n</u>ara to Bao and the original ancestor Roviana, that chiefs make their claim to chiefly status. Chiefs' legitimacy depends ultimately on how close to the *ngati* or "trunk" (Goldie, 1909) of the genealogy they can affiliate. Although the exact details of the genealogy may vary, all Chiefs of Kalikoqu and Saikile tell essentially the same story. There is obviously advantage to be gained by chiefs through modifying this genealogy. However, it seems that such modification, if it exists, is in the branch extending to the current Chief from the trunk. Chiefs jealously guard the right to tell the "correct" genealogy which they have preserved in written form as given to them by their fathers. Others may attempt to tell the story but people generally consider this to be inappropriate and warn of the possibility of receiving an "incorrect" story. People are especially worried that an incorrect version will be written down and published.

The importance of the Bao story is very high as the Kazukuru land around Bao has not yet been logged and people are competing for rights of access to this area from which they stand to derive income. Competition has essentially split the population of the Munda area (Schnieder, 1997). In 1998 a group of Munda elders, including one of the contenders for the Chieftainship,



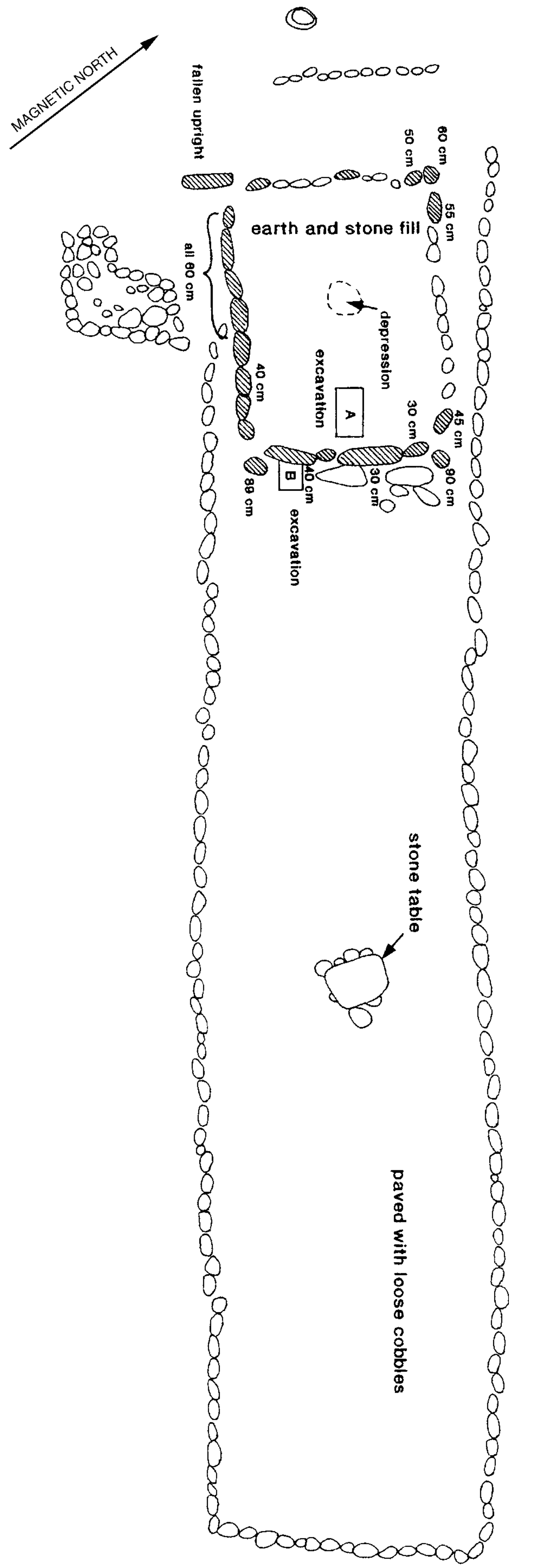


Fig. 3. Plan of the main shrine (Site 145) at Bao, Kazukuru, New Georgia.

attempted to have us meet with them to record their version of the Bao story and the names and locations of the shrines coming down from Bao to Munda. This meeting was repeatedly delayed and finally cancelled after word of it was carried to the Chief of Kalikoqu and he denied them permission to relate the story. Elders who had been pushing hard for us to record their version of the story suddenly became very hard to find even though they would routinely deny that the Chief of Kalikoqu in the inner lagoon had authority over them. This incident clearly illustrates the political nature of oral tradition in Roviana, as well as its role in validating the authority of chiefs and the relationship between shrines and land rights. It also shows that the "authorized" version of the past cannot be easily transformed. Change could be achieved but not without considerable struggle, even in the modern setting, although it should be noted that the presence of the researchers may have made this process more or less difficult. In the past a challenge to Chiefly authority could have had much more serious consequences.

Is the story "true"? It is true that there is an area in New Georgia behind Munda called Kazukuru and that people speaking a non-Austronesian language called Kazukuru lived in Munda at the turn of the nineteenth century. It is also true that a complex of shrines is located along a ridge in the centre of the Kazukuru area. A similar aggregation of shrines has only been recorded once before in Roviana and that is along the fortified ridge on the island of Nusa Roviana, which was the centre of the Roviana polity in the nineteenth century. Despite widespread surveys on New Georgia in the Kalikoqu area we have never found another concentration of shrines or other structures. Mainland shrines are isolated platforms or small complexes (2 to 3 small platforms) on ridge tops without any other closely associated features. It is also true that the largest platform and shrine complex is located at the eastern approach to the Bao ridge and, as predicted by oral tradition, it returns the oldest radiocarbon date recorded so far for shrine platforms in Roviana. There is then a "Bao" and it has many of the characteristics attributed to it. That it is the origin point of the Roviana people who came down to the coast and who, after fighting with local groups came to dominate and form the Roviana polity, can not be "proved" with the present data or perhaps with any possible data.

Stories of interior origins and subsequent coastal movement are common in Melanesia, and "topogenies" (Fox, 1997) or genealogies of place are generally common in the Austronesian world. Miller (1980) has specifically argued that this is a common pattern in the Western Solomon Islands and cannot be considered to be literally true, but simply reflects a "formal model" or cognitive structure where height and consequently ascent to interior heights on small islands is possibly associated with the sacred (Miller, 1980: 455). In Roviana we have not observed any correlation between height and the sacred, even though much of what we have recorded is very similar to the stories Miller recorded during brief fieldwork on Simbo and Isabel. These are areas with which Roviana has close historical connections. Does this then indicate that such traditions are lacking in any kind of historicity?

On islands, the primary geographical referents are coast and inland or sea and bush. People can, of course, move along the coast or come from other islands. In Roviana many people trace their own origins to other islands, in particular to Santa Isabel from whence they were brought as slaves or Simbo with which Roviana had a strong alliance. However, it is also literally true today that large numbers of coastal dwellers can trace their ancestry to people who came to the coast in the last 100 years. Archaeology attests to the presence of considerable numbers of people associated with interior taro irrigation systems and shrines. It is an historical fact that these people, when given the opportunity, moved to the coast leaving the interior of New Georgia completely uninhabited. Even today some groups of Roviana-speaking people living on the coast describe themselves, and are described by others, as Bush People. Why this last coastal movement occurred is undoubtedly related to a series of factors, which would include:

(*a*) the end of warfare making the coast safe;
(*b*) depopulation of New Georgia as a result of introduced disease and warfare (McCracken, 2000);
(*c*) the introduction of *kumara* (sweet potato, possibly as early as 1840 or earlier [Hviding & Bayliss-Smith, 2000: 123]) which would grow well in the poorer coastal and barrier island soils. Today *kumara* has replaced taro in the diet and is the subsistence mainstay of the large coastal villages; and
(*d*) the attraction of coastal marine and social resources.

This last factor has in the past 150 years included access to the western economy and mission facilities. Prior to 1850 the coast would nonetheless have been extremely resource rich. The large lagoon system is enormously productive (Aswani, 1997) and in the past, marine produce was likely commonly procured at the coast or traded inland by the coastal people. The Ididuba<u>n</u>ara story itself suggests that he came to the coast to have better access to the clamshell needed for the manufacture of shell valuables. The coast also provides easy communication and access to the resources of other islands, as well as potentially lower incidence of malaria on the small off-shore islands where breezes and less standing fresh water may have reduced the numbers of mosquitoes. Archaeology on the barrier islands reveals the presence of large village complexes similar in size to those seen today. The sociality of these places would have been attractive to people living in small interior transitory hamlets. The coast then would have always been a very strong attractor in the social geography of New Georgia, forming a fundamental social and economic tension. This tension is reflected today in the basic saltwater-bush people dichotomy found throughout the Solomon Islands. In this context it is also important to note that often the distance from the central interior to the coast along most of the long thin islands of the Solomon Islands can be covered in half a day's walk. Bao is less than a half day's walk from the coast, and for very fit people the distance would have been trivial. It seems probable that both the physical and social distance from Bao to the coast was short as kinship links would have covered broad areas, as is the case today. We need not interpret the Ididuba<u>n</u>ara story as literally reporting the movement of all the interior people to the coast c. A.D. 1600, as we know for a fact that Roviana people lived inland in the nineteenth and early twentieth century. However, it is likely that at that time the focus of what was becoming the Roviana polity shifted along a web of relationships from the interior to the coast, where it increasingly came into conflict with the pre-existing coastal populations. At this time we also see a fundamental shift in shrine forms and exchange media (Sheppard *et al*., 2000), suggesting a major shift in Roviana socio-political organization. It seems unlikely that all these changes are simply the result of one chief shifting residence but in Roviana history, as told by Roviana, this broader change is represented through a shift in residence, and in the establishment of new shrines on Nusa Roviana, initially in the old style, by a powerful leader.

Miller (1980) is likely correct in arguing that origin or descent stories in the Western Solomon Islands follow a similar cognitive structure, but we would argue that the structure itself is founded in a real and fundamental historical tension between coast and interior. Social movement from the interior to the coast and vice versa under changing circumstances is a basic historical process that has been played out over millennia in the Solomon Islands. In addition, as we see people moving back into the interior of New Georgia today, the result of population pressure and the opening of the bush by logging, we see the start of another cycle which will re-establish the old tension. People today say their ancestors came from the interior and for most people this is most definitely a recent historical fact that fits well within an ancient tradition and cognitive schema.

Discussion and conclusion

Our research has shown that oral tradition in Roviana does contain chronological information and that Roviana oral history is in large measure linear. We were able to show a fairly close relationship between features dated by genealogy and by radiocarbon methods: in general, those features that people felt were old because they lacked associated oral tradition turned out to be old. Without exception our radiocarbon dating followed collection of oral tradition regarding the dated features and in no sense did our chronological information lead our questioning of informants. However, once relationships between archaeological chronology and oral tradition were developed, we did feel we could extend the relationship to develop hypotheses about the age of shrines based on oral tradition (e.g., the age of undated faced shrines for which people have no traditions and we have no dates).

Traditions of origin which relate movement from the interior to the coast are to some extent formulaic in the Western Solomon Islands. However, in the Roviana case, we were able to confirm that cultural features, including unique concentrations of shrines and other platforms which in many respects mirror the historical features on Nusa Roviana, do exist in the nominated location in the interior of New Georgia. This, of course, cannot confirm the history of movement of Roviana populations but the fact that the largest shrine at Bao—stylistically very similar to coastal faced shrines—has provided the oldest date for a shrine in Roviana, is fully consistent with Bao as an origin or ancestral point. In conclusion, it does seem likely that Roviana was created as part of a struggle between bush and coastal peoples, and was personified by the story of the movement of Ididubanara, some time in the sixteenth century, when we see a radical change in the archaeology of coastal shrines and the building of fortifications (Sheppard *et al*., 2000) on Nusa Roviana.

Our research has proceeded (1996–2000) in an interactive manner, moving between lines of evidence in a tacking process much like that proposed by Wylie (1993). Roviana oral tradition and the current interests of the Roviana people have influenced our research, but as with ethnography the uses and interpretations of the data generated move beyond the direct "emic" perspective and naturally reflect the research perspectives of the archaeologists. We believe the final historical construction is a more powerful understanding of the Roviana past than could be provided by archaeology or oral tradition alone.

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Are the Earliest Field Monuments of the Pacific Landscape Serial Sites?

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ABSTRACT. Explanations of the origin and genesis of Pacific field monuments commonly assume they reflect local social change in islands or island groups which were increasingly isolated following colonization. A recent review of early West Polynesian archaeology suggests that the pene-contemporaneous appearance of various kinds of field monuments from eastern Melanesia to Polynesia may be better explained as evidence of interaction and the movement of people and/or ideas, possibly associated with the colonization of East Polynesia.

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The first appearance of field monuments in the landscapes of East and West Polynesia, Fiji and parts of eastern Melanesia (Fig. 1) have been argued to reflect social changes in relatively isolated islands or island groups, long after their initial colonization. This paper argues the need to rethink this interpretation in light of a recent review of the evidence for the early West Polynesian cultural chronology (Smith, 1999, 2002). The findings suggest that field monuments may first appear in the context of pene-contemporaneous regional social change indicating a movement of ideas and/or people and in East Polynesia, this may be associated with the initial colonization of the region in the late or recent model of Spriggs & Anderson (1993).

The origin and genesis of field monuments in the Pacific landscape has been given new emphasis at meetings of experts from Pacific nations under the auspices of UNESCO's World Heritage program. The aim of these meetings, held in 1997 and 1999, was to initiate a process redressing the current under-representation of Pacific cultural (and natural) heritage sites on the World Heritage list. In Fiji in 1997 representatives of Pacific nations met to discuss this issue and identified the kinds of sites that they consider will reflect the uniqueness of the Pacific region and should be the focus of tentative nominations.

> Potential world heritage sites in the Pacific Islands region are likely to be serial sites and multi-layered cultural landscapes…[S]erial sites attest to the history of voyaging, land and sea routes, and of trade, the first landings, activities, settlements and agriculture in the Pacific Islands region. Other series of sites reflect the different waves of migrations…As serial sites they form lines crossing boundaries between countries and are therefore transborder and transnational sites. (UNESCO, 1997)

This statement recognizes that many kinds of Pacific cultural sites are not limited to islands or even archipelagos, and reflect the interconnectedness and shared history of the Pacific peoples. Although Pacific heritage managers have not precisely defined the site types that would be included as serial sites, it can be argued that they would be sites that are common over large regions in the Pacific and reflect a similar activity, belief system, social system or event.

Although monuments of earth, stone or coral are found from New Caledonia to East Polynesia they are not usually

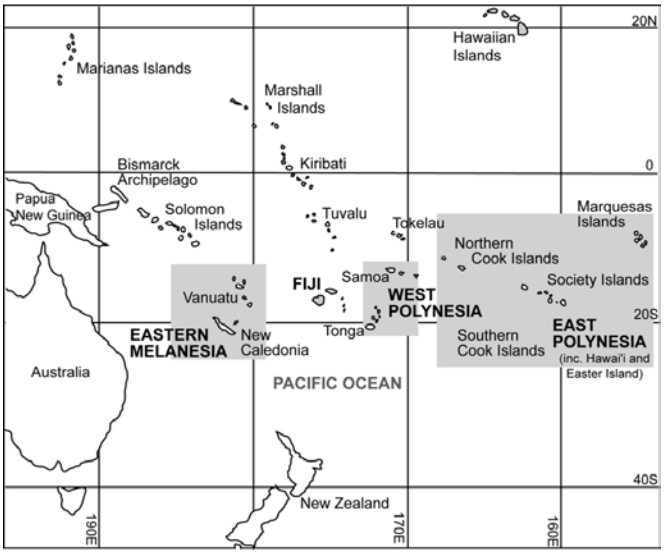

Fig. 1. Geo-cultural divisions and island groups in the Pacific.

considered serial sites that reflect the movement of ideas and people as Lapita pottery sites are thought to do. As the research discussed below indicates, it appears likely that early field monuments do offer potential for transnational, thematically linked serial nominations for World Heritage listing.

Field monuments in Pacific archaeology

Field monuments are structures in the landscape that would have taken a substantial and organized labour force to construct. They include fortifications (Fiji, West Polynesia, New Caledonia), mounds and platforms (Fiji, Tonga, Samoa, New Caledonia), ceremonial structures known as *Marae* in the Cook, Society and Tuamotu Islands and Hawaiian *Heiau* and Easter Island *Ahu*, as well as features associated with horticultural intensification such as large scale terracing and irrigation systems (New Caledonia, Fiji, East Polynesia).

At present, the chronology of the first appearance of the various kinds of field monuments is unclear. Although many radiocarbon dates associated with field monument construction may be questionable (see below), in Tonga and Samoa mound construction is dated to at least 900 B.P. (Davidson, 1974). Overall, relatively few field monuments have been radiocarbon dated but in all areas they are assumed to appear first by c. 1,500–1,200 B.P. The behavioural significance of this is unclear but it is commonly explained as tangible evidence of major social change.

Analyses of Pacific field monuments are too numerous to adequately review in this short paper but in almost all a combination of ethnohistorical data and archaeological evidence is used to interpret the function of monuments, especially in Fiji and Polynesia (Best, 1993; Burley, 1994; Davidson, 1974; Kirch, 1988, 1990*a*) and to provide a basis for regional comparisons (Best, 1993; Kirch, 1990*b*). The early field recordings of these structures provided typological classifications based on variation in the shapes and assumed functions of monuments (Emory, 1933; McKern, 1929). These were offered a theoretical context in the 1950s and 1960s by Pacific anthropologists wishing to understand the genesis of the Polynesian societies (Sahlins, 1958). It was, and is, generally accepted that the initial appearance of field monuments in Polynesia indicates change towards the kinds of social systems in place at European contact (Burley *et al*., 1995, 1999; Kirch, 1990*b*), that is, hierarchical chiefly polities the power of which is expressed through monuments on the landscape.

More recently, earlier typological analyses have been largely replaced by an emphasis on interpreting a range of evidence in the cultural landscapes in which monuments are found (Best, 1993; Field, 1998; Kuhlken & Crosby, 1999; Walter, 1998). However interpretations of cultural landscapes still rely heavily on ethnohistorical evidence, emphasizing the recent, immediate pre-contact construction of field monuments. Oral traditions and early observations by Europeans tell of local specificity in the function of the various types of field monuments in at least the last few hundred years, but we know very little about the earliest form and function of these sites or the societies in which they first appeared. In New Caledonia, where little ethnohistorical evidence exists, the function and the social structure reflected by field monuments such as terraces and fortifications remain enigmatic (Sand, 1996).

There is, however, a general acceptance that major social change took place in many parts of the Pacific during the first millennium A.D. and monumental structures in the landscape are associated with and indeed reflect these changes. This social change is not envisaged as a consequence of a flow of new ideas or technologies between interacting communities but as a local response to similar conditions in various islands or island groups. Populations rose, leading to pressure on indigenous resources and small-scale agricultural practices that in turn led to intensification in horticulture, perhaps warfare and concurrent social stratification (Kirch, 1984). In all areas, these changes, and the first appearance of field monuments, are considered to take place long after initial colonization and to be immediately preceded by a period of relative isolation and a period for which limited archaeological evidence is currently available.

A general model of increasing isolation following initial colonization in Polynesia and specifically the isolation of West from East Polynesia following East Polynesian colonization by c. 2,000 B.P. or earlier (Kirch, 1986) underlie comparative studies of field monuments, especially ceremonial mounds and platforms, in the two regions. In this model, colonization of East Polynesia takes place prior to the first appearance of field monuments (Irwin, 1992). Their occurrence in both regions is explained by a common cultural origin of all Polynesian societies in an Ancestral Polynesian Society which, in the established cultural chronology, developed in West Polynesia by c. 2,500 B.P. from the colonizing Lapita society, immediately prior to East Polynesian colonization (Kirch, 1997: 74; Kirch & Green, 1987). West Polynesian post-Lapita plainware ceramic assemblages have been considered the primary archaeological correlate of an Ancestral Polynesian Society and proto-Polynesian language, along with a suite of changes in existing artefact types and the appearance of new artefact forms. These "Polynesian" plainware assemblages have been argued to appear throughout the region by 2,500 B.P. (Kirch, 1984: 51; Kirch & Green, 1987; Kirch & Hunt, 1993).

In this phylogenetic model, similarities in Polynesian societies at European contact are argued to be evidence of their common Proto-Polynesian origin reflecting social evolutionary convergence in long isolated societies (Kirch, 1990*b*; Kirch & Green, 1987). The model also assumes a period of isolation of West Polynesia from communities further west, i.e., eastern Melanesia following the Lapita or colonization period during which the Ancestral Polynesian Society and associated Proto-Polynesian language developed. This assumption underlies claims for the distinctiveness of Polynesian field monuments and their local development separate from those features found to the west.

Evidence for cultural change in the early West Polynesian archaeological record

A recent assessment of early West Polynesian cultural assemblages (Smith, 1999, 2002) reviewed the archaeological evidence for cultural change in early West Polynesian prehistory, in particular the evidence for an Ancestral Polynesian Society. In the established cultural chronology, this is said to be archaeologically visible in plainware assemblages throughout the region by 2,500 B.P. Regional diversity becomes apparent by c. 1,700 B.P. and ceramic manufacture ceases around this time. Around 1,000 B.P., following several hundred years of an aceramic archaeological "dark age", monuments appear in the Tongan and Samoan landscapes.

Smith's assessment investigated published archaeological evidence from excavated West Polynesian sites with at least one uncalibrated radiocarbon date earlier than 1,000 B.P., that is, evidence from colonization until the generally accepted period for the appearance of field monuments. Because of the well-recognized unreliability of many Pacific radiocarbon dates (Spriggs, 1989; Spriggs & Anderson, 1993), they all were assessed according to a number of standard protocols before a date and its associated cultural assemblage were included in the analysis. All dates were recalibrated and corrections applied where appropriate. Following assessment, 55 of the initial 137 dates from 49 sites were rejected. This left evidence from a total of 23 sites. These included midden deposits, houses and field monuments excavated in all major field projects in West Polynesia including that of Green & Davidson (1974) and Jennings & Holmer (1980) in Western Samoa, Kirch & Hunt (1993) and Clark & Michlovic (1996) in American Samoa, Poulsen (1987), Shutler *et al*. (1994), Burley (n.d.), and Kirch (1988) in Tonga, Kirch (1981) and Sand (1990) in Futuna.

Assessment of the radiocarbon chronology appears to significantly alter the established West Polynesian cultural chronology. Re-calibrated dates associated with pottery indicate manufacture in some parts of the region continuing as recently as 1,000 B.P. This effectively wipes out the aceramic "dark age" argued for the period immediately prior to mound building. Early dates associated with some plainware ceramic assemblages are contemporary with Lapita deposits and like Lapita appear to reflect the chronology for colonization of the region (Kirch & Hunt, 1993; Burley *et al*., 1999). All dates associated with aceramic deposits including those associated with construction of field monuments were rejected under the assessment protocol (Smith, 1999: chap. 4, 2002). This is principally because the charcoal submitted for dating was taken from deposits beneath the structure itself and can provide an age for only the deposits beneath the mound and not the time the mound was constructed.

The site structure and stratigraphic evidence were used by Smith (1999, 2002) to establish intra-site analytical units, providing a relative chronology for cultural material. The associated radiocarbon determinations were used in combination with the analytical units to provide an absolute chronology for the dated deposits in the site. Unfortunately, in many instances the entire site has not been published, limiting usefulness of the published data. Commonly, the focus is deposits containing ceramics and especially those containing Lapita sherds. This makes comparison of stratigraphic units and assessment of change through time difficult. However, intra-site change through time in more than one of various classes of cultural material—ceramics, adzes, other artefacts, and faunal remains—could be investigated in 19 sites. A summary of Smith's (1999, 2002) findings for each class are described in Table 1.

Overall, Smith found that from initial colonization to c. 1,000 B.P. the only marked changes in the West Polynesian archaeological record appear to be the disappearance of dentate-stamped ceramics and complex vessel forms that identify assemblages as "Lapita". Associated with the loss of decorated and complex vessels, and also evident in the earliest plainware deposits, is a decline in the diversity and amount of indigenous terrestrial fauna. This is a common pattern in early Pacific sites and most likely explained by the targeting of these species during the colonization phase and their consequent extinction, extirpation or decline in local availability (Burley *et al*., 1995).

Given that early plainware and Lapita assemblages appear contemporary and can also be argued to be a part of the colonization phase, the continued association of plainware assemblages with an Ancestral Polynesian Society now seems implausible. Plainware assemblages are locally and regionally consistent throughout the sequence, although Smith found the number and distribution of dated plainware deposits is significantly less between 2,000 and 1,000 B.P. than for the previous 1,000 years. This may reflect an emphasis on radiocarbon dating basal ceramic deposits rather than an actual decline in ceramic manufacture.

The assessment of the West Polynesian evidence indicated that in many respects, the pre-1,000 B.P. cultural assemblages can be considered a regional archaeological signature characterized by plainware ceramics in both fully plainware assemblages and the undecorated component of Lapita assemblages. Except for certain adze types, most shell and other non-ceramic artefacts are consistently found in sites throughout the region. Variability in adze morphology can be explained at least partially in terms of raw material availability. Most other sources of variability in excavated assemblages can be accounted for through differential preservation of organic material (Smith, 1999: chap. 8, 2002). Change through time in faunal assemblages was limited to the early deposits in a decrease in indigenous, especially terrestrial, fauna. The small amount of evidence for domesticates—chicken, pig and dog—limited investigation of change through time in their abundance. Of the three, only chicken is present in earliest sites. There is no unequivocal evidence for pig prior to 2,000 B.P. and very limited evidence prior to c. 1,000 B.P. Pig is also absent from the early Fijian (Best, 1984: 544), New Caledonian and Southern Vanuatu (Spriggs, 1997: 146) deposits.

Smith's findings make it is difficult to see the archaeology of the West Polynesian plainware period as significantly different to that which went before. In general, there is a consistency in the West Polynesian archaeological record from shortly after colonization to around 1,000 years ago that does not indicate distinct cultural change over this period as is suggested in the phylogenetic model of Kirch & Green (1987). The major disjuncture in the West Polynesian archaeological record takes place c. 1,000 B.P.

with the appearance of monuments and the disappearance of ceramics. Along with other kinds of change (discussed below), this is suggestive of regional social change.

Spriggs (1997: 152) argues that there is a continuity similar to that seen in West Polynesian assemblages in many aspects of the Island Melanesian archaeological record from Lapita to post-Lapita indicating a cultural continuity until c. 2,000 B.P. The precise chronology is unclear, but sometime after this a suite of changes in the archaeological record indicates the appearance or origins of the diverse Melanesian societies evident at contact. Spriggs (1997: 152) considers evidence of cultural change to include the cessation or rearrangement of long-distance exchange networks, shifts in settlement pattern or general abandonment of previously occupied sites, loss of pottery and/or other significant changes in the material culture inventory, and changed subsistence practices or the use of the landscape.

This is precisely the kind of evidence seen in the West Polynesian record c. 1,000 B.P. There is little evidence for interaction between West Polynesia and communities to the west until c. 1,000 B.P. What evidence exists, is insufficient to infer any change through time in interaction during the colonization or plainware periods (for a review see Davidson, 1977; Green, 1996). After 1,000 B.P., at least in Samoa, increasing external interaction is evidenced by the movement of basalt sourced to American Samoa west to Fiji by 900 B.P. and to Taumako, north to Tokelau and Tuvalu and to the Southern Cooks c. 600 B.P. (Clark, 1996; Walter & Sheppard, 1996). In Fiji, Best (1984: 494) notes the re-establishment of long distance interaction with contact between Fiji and Vanuatu after 1,700 B.P., although contact with West Polynesia is unclear. In the late prehistoric period, Clark (1996: 454) describes Fiji, Tonga and Samoa as "linked in a network of social and economic interactions".

Changes in settlement pattern, in particular the spread of sites away from the coast and the appearance of new site types, have been cited as evidence for social change in West Polynesia and Melanesia (Best, 1984, 1993; Sand, 1996). In his review of the Western Samoan evidence, Clark (1996: 452) found no secure evidence for inland occupation earlier than 2,000 B.P., with a number of inland sites dating to c. 1,500 B.P. but most dating after 1,000 B.P. He considers that the pattern of continuous dispersed settlement evident in Western Samoa at European contact may date only to the last few centuries (Clark, 1996: 453). Clark (1996: 452) also suggests that large mounds appear c. 900–800 B.P. on the coast and in some valleys.

Evidence for the early Tongan settlement pattern is based almost exclusively on the distribution of surface scatters of ceramics. Lapita sites are located adjacent to, or on, a protected bay or lagoon and, according to Burley (1994: 382), are "middens in which habitation is both restricted and aggregated" and apparently village-based. Spennemann (1986: 10) described the distribution of plainware sites as "a dense but dispersed settlement" similar to that observed at European contact. Burley (1994: 389) contests such an interpretation, finding that the configuration of plainware sites, at least in the Ha'apai Group, differs little from Lapita. His view agrees with Kirch's (1988: 242) conclusions for Niuatoputapu that although the number of settlements increases, settlement pattern does not change during the ceramic period. The chronology for the development of the settlement pattern described at contact is unclear but falls within the last millennium.

Finally, it appears that it is not until after c. 1,000 B.P. that pig, usually associated with or a signifier of horticulture becomes prominent in West Polynesian assemblages. Kirch (1988: 253) has made a correlation between the social importance of pig and the rise of socio-political hierarchy in Fiji and West Polynesia in the last millennium.

Although a precise chronology is lacking, the apparent similarity of changes in the archaeological record of eastern Melanesia and Fiji after 2,000 B.P. and West Polynesia c. 1,000 B.P. suggests wide-spread social change indicative of interaction throughout the region.

"Late" colonization of East Polynesia

Spriggs & Anderson (1993) propose a model of "late" or recent East Polynesian colonization based primarily on an assessment of East Polynesian radiocarbon determinations. This suggests East Polynesian colonization was unlikely to have taken place until after c. 1,300 B.P. Subsequent research in East Polynesia (Anderson *et al.*, 1994; Rolett & Conte, 1995) and an absence of earlier, securely dated cultural deposits from the region have lent support to this model. If East Polynesian colonization did not take place until after c. 1,300 B.P., it was pene-contemporaneous with the appearance of field monuments in West and East Polynesia. In this model, is the colonization of East Polynesia associated with or even a consequence of social change evident in the archaeological record of the southwest Pacific between 2,000 and 1,000 B.P.? Rather than being an example of convergence in related but long isolated societies, the construction of field monuments in East Polynesia may have been a characteristic of the colonizing groups derived from West Polynesia or indeed further to the west. In this model, colonization of East Polynesia appears to take place suddenly and rapidly and is not unlike the pattern of Lapita colonization a millennium or more earlier.

Conclusions

There is currently insufficient archaeological evidence available to address the question of whether the first appearance of field monuments reflects social change in the context of interaction across the southwest Pacific and is associated with initial colonization of East Polynesia. We currently lack data from the crucial period between c. 2,000 and 1,000 B.P. to understand whether these regional changes are related in a behavioural sense, that is, reflecting a flow of ideas, people and social system from eastern Melanesia to West Polynesia or perhaps the reverse (Sand, 1996). In other words, whether the earliest field monuments, or at least some kinds of monuments such as mounds or fortifications or irrigations systems are truly serial sites. Current evidence cannot address this issue because: (*a*) the chronology for the first appearance of field monuments is unclear; (*b*) although field monuments are a regional phenomenon, individual research projects are commonly restricted to an island or island group. No detailed comparison of the field monuments throughout Remote Oceania, or of the cultural landscapes in which they exist, has yet been undertaken; and, (*c*) analyses commonly interpret field monuments according to the dominant paradigm of Pacific archaeology in which the development of Polynesian societies is seen as independent of social change to the west.

Table 1. Key findings from an assessment of change through time in West Polynesian cultural material by Smith (1999, 2002).

material evidence	the sample	evidence for change through time in excavated assemblages	references (see below)
CERAMICS	**Lapita** Dentate stamp sherds recovered from at least one stratigraphic unit in 7 sites, only 3 are fully published.	—Evidence for a decrease in sherd density equivocal due to reported disturbance of deposits. —No evidence for change through time in decorative technique or location of decoration on the vessel. —No evidence for change through time in vessel form.	1,2,3,4
	Lapita to Plainware Three sites or sequences of sites have Lapita and plainware. deposits. Only one is fully published.	—No site demonstrates a transition from Lapita to plainware through a decrease in decorated sherds, changes in decorative technique or location on the vessel. —Similarity in plainware assemblages from Lapita and non-Lapita contexts. —The only significant difference between Lapita and plainware ceramics is the absence of dentate stamp decoration and complex vessel forms.	5,6
	Plainware Seven sites have more than one stratigraphic unit containing plain-ware sherds. All are Samoan sites.	—An expected change through time from a thin fine to a thick coarse ware (Green & Davidson, 1974) is evident in two sites but over vastly different time spans. This pattern is contradicted in two other sites. —In two sites, sherd density decreases through time. The reverse is evident in two other sites. —Plainware assemblages span c. 2,000 years. —Assemblages throughout the region are characterized by globular pots.	7,8,9, 10, 11
ADZES	141 adzes excavated from 15 sites however 55 come from only two Western Samoan sites	—Small numbers of adzes per site or their concentration in a single stratigraphic unit did not permit assessment of intra-site change through time. —Change through time in adze morphology is evident in the introduction of several new forms after 2,500 B.P., all from Samoan contexts and likely to reflect the availability of different stone sources once people colonized Samoa, east of the Andesite line.	1,2,7,8, 9,10
OTHER ARTEFACTS	All sites contain some non-ceramic artefacts, including shell, coral and bone artefacts and flaked stone but often in small numbers. Intra-site change through time could be assessed in 9 sites	—Diversity in assemblage composition reflects differences in preservation of organic material and the availability of stone and shell as a raw material. —Comparison of Lapita and plainware middens suggest continuity in artefact forms. However, the range of shell ornaments from pre-2,500 B.P. deposits (Lapita and plainware) is slightly greater than post-2,500 B.P. —There is insufficient evidence to infer any change through time in fishhook manufacture.	1,2,3,5, 7,8,9,10
FAUNAL REMAINS	**Indigenous** 11 sites contain faunal material	—Indigenous fauna including turtle and terrestrial birds was concentrated in the pre-2,500 B.P. deposits in Lapita and plainware sites. —Some regional diversity and local change through time in shellfish assemblages likely to reflect exploitation patterns and environmental change.	1,2,8, 10,12
	Non-indigenous Seven sites contain limited evidence of domesticates (for 5 sites faunal evidence is not published)	—Chicken present in earliest sites across the region. —Very small amounts of pig bone found in 7 sites, all from disturbed and/or recent contexts. There is no unequivocal evidence for pig in pre-2,000 B.P. contexts. —Evidence for dog limited to a single tooth from a context dated c. 2,000 B.P. (Kirch, 1981)	1,2,5,8, 9,10,13

(*1*) Poulsen, 1987; (*2*) Dye, 1987; (*3*) Shutler *et al*., 1994; (*4*) Burley, n.d.; (*5*) Kirch, 1988; (*6*) Groube, 1971; (*7*) Green & Davidson, 1974; (*8*) Jennings & Holmer, 1980; (*9*) Clark & Michlovic, 1996; (*10*) Kirch & Hunt, 1993; Sand, 1990; (*12*) Burley *et al*., 1995; (*13*) Kirch, 1981.

The UNESCO aim of redressing the under-representation of Pacific sites on the World Heritage list will depend upon Pacific nations having the resources and expertise to put forward successful bids for nomination. To begin this process, participants at the meeting in Vanuatu in 1999 (UNESCO, 1999) recommended the urgent preparation of: (*a*) a desk-top review of all data relating to cultural places and cultural landscapes (including serial sites) which may warrant World Heritage status; (*b*) national comparative and Pacific-wide thematic reviews of potential World Heritage properties (including serial sites).

This will provide a basis for the nomination of field monuments for world Heritage listing. However, as this paper has sought to stress, knowing whether these sites, in their earliest manifestation can be considered truly serial, transnational sites requires field research specifically investigating their first appearance in the Pacific landscape.

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Is There Life After Lapita, and Do You Remember the 60s? The Post-Lapita Sequences of the Western Pacific

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ABSTRACT. Speculation on the relationships among pottery styles in the western Pacific started in the 1930s. Jim Specht's 1969 Ph.D. thesis brought this early period of speculation to an end by presenting a well-developed pottery sequence for Buka in the Northern Solomon Islands and relating it to emerging dated sequences from other parts of the Pacific. Following on from this research, and that of Kennedy and others, Spriggs in 1984 argued for cultural continuity between Lapita and post-Lapita pottery styles in Island Melanesia, and that post-Lapita stylistic changes continued in parallel over a large area until at least 1,500 B.P. Direct evidence of prehistoric contact between the various areas concerned seemed to support this idea. Wahome's 1998 thesis provided some statistical back-up to these ideas and presented a detailed pottery sequence for Manus which was then compared to other regional pottery sequences. The redating of the Mangaasi type-site in central Vanuatu by Spriggs and Bedford brought this important site into line with the dates for what was seen to be similar Incised & Applied relief pottery elsewhere. However, recent theses by Clark and Bedford on Fijian and Vanuatu pottery, respectively, have questioned the reality of the claimed stylistic similarities in post-Lapita pottery across the region. Thus, a debate has been opened up on the levels of similarity between pottery styles and the meaning of any similarity found between them. Basic culture-historical questions remain unanswered by the data so far presented and there is a need for further sequence construction and regional comparison.

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This paper is about what may be one of the next big debates in western Pacific archaeology. It concerns claimed connections between the post-Lapita pottery sequences in different parts of the region. The question is whether there are wide-ranging relationships among them and, if there are, to what social processes do these relationships point? Opening shots in this debate have already been fired at the start of this new millennium.

From "prehistoric" to "modern" views of the problem

Speculation on relationships based on perceived connections among pottery styles in the western Pacific started with Margarete Schurig's *Die Sudseetöpferei* (Schurig, 1930), and the "prehistory" of this speculation lasted nearly until the 1969 completion of Jim Specht's Ph.D thesis. Names such as MacLachlan (1939), Surridge (1944) and Avias (1950) need to be recalled. The "protohistoric" phase of this discussion consists of Golson's paper "Both Sides of the Wallace Line", originally written for a 1967 symposium and published in revised form (Golson, 1972). I call this "protohistory", as Golson was just starting to see the first results of archaeological study in the Pacific conducted by his students and staff at the Australian National University: Ron Lampert, Jens Poulsen, Jim Specht, Ron Vanderwal and J. Peter White. Golson (1972) talked of the three great traditions of Pacific pottery—Lapita, Paddle Impressed, and Incised & Applied Relief or Mangaasi ware. It is the last of these traditions we are interested in here.

In his 1969 thesis Jim Specht ushered in the "modern" discussion of the issue by addressing the external relationships of the more than 2,000 year old pottery sequence he had constructed for Buka in the northern Solomon Islands (in the Bougainville Autonomous Region of PNG as it is now styled). It is important to remember where archaeology and related disciplines were situated at the time in constructing the culture history of the region. For the then Territory of Papua and New Guinea (TPNG), Specht had only two other excavated and dated pottery assemblages with which to compare the Buka sequence. One of these he had excavated himself, at Watom Island near New Britain (Specht, 1968). The other was from White's Aibura site in the New Guinea Highlands, consisting of 16 sherds found above a date of 770 B.P. (White, 1968, 1972). Specht saw similarities between Watom and the earlier part of the Buka sequence, but none with Aibura. He also noted that there were dated sequences "under construction" from Lossu on New Ireland—Peter White's data later published as White & Downie (1980)—and from Wanigela in Milne Bay District of Papua—Brian Egloff's research published as Egloff (1979). Specht, however, had no detailed results available to him in 1968–1969 (Specht, 1969: 230).

Specht also compared his Buka pottery sequence to surface material collected by Con Key from the Moem site near Wewak on mainland New Guinea, and to material from the Kaup site in the same area collected by Ron Lampert. He concluded: "Both the Moem and Kaup sites show remarkable similarities with my Hangan style" (Specht, 1969: 233).

However, the comparison which really excited Specht was with the Mangaasi pottery from Garanger's work of the mid-1960s in Central Vanuatu, which at that time was only available in preliminary reports (Garanger, 1966*a,b*, 1969). The 1972 monograph was yet to come (Garanger, 1972, 1982). It was aspects of the Sohano and Hangan styles of Buka which he found closest to Mangaasi. As an aside, it is worth noting that the redating of the Mangaasi sequence by Bedford and myself (Bedford, 2000*a,b*; Spriggs & Bedford, 2001) would make somewhat more chronological sense of such comparisons than Garanger's original dates.

Specht (1969: 242, 247) noted that Garanger had also seen connections between Mangaasi pottery, Navatu pottery in Fiji and various pottery styles in New Caledonia as recorded by Gifford & Shutler (1956). By association, therefore, these could also be linked to the Buka sequence. Finally, Specht (1969: 253) saw some similarities with pottery from the Mariana Islands in Western Micronesia. His conclusion was: "The similarities between artefacts from Buka and the New Hebrides [now Vanuatu] and Micronesia, in similar chronological positions, can not be ignored, and some historical relationship must be considered. Assuming that they are evidence for population movements, the direction of these movements is uncertain…" (Specht, 1969: 318). He continued:

> "[Buka] lies at the junction of three possible routes for the entry of new peoples and ideas; to the north lies New Ireland, offering a link with Micronesia; to the south, Bougainville and the Solomon Islands provide a route to the New Hebrides; and to the west, New Britain links up with the New Guinea mainland" (Specht, 1969: 318–319).

Specht then dipped into a consideration of current linguistic models, though the dominant one at the time was the confused and confusing one of Dyen (1963). Dyen saw Malayo-Polynesian developing not in the northern Philippines as now generally believed (Pawley & Ross, 1993), but in central Melanesia, specifically Vanuatu. Thus an archaeological link between all the areas in question seemed quite plausible from a linguistic point of view.

Specht saw a cultural discontinuity between his Lapita-derived Buka style at the beginning of the Buka sequence and the subsequent Sohano style (1969: 229–230, 257). Similarly, Garanger (1972) saw his Mangaasi style as being distinct from the Lapita-derived Erueti style found at another site in Central Vanuatu. On Garanger's initial dates it seemed as if Mangaasi began earlier and continued later than the Erueti style. He thus postulated two separate populations, a "Polynesian" Lapita population and a "Melanesian" Mangaasi one (Garanger, 1972). This was an idea going back to O'Reilly's (2000[1940]) commentary on Meyer's original finds of both Incised & Applied relief and Lapita pottery at Watom. Specht (1969: 223) himself rejected O'Reilly's distinction as far as Watom was concerned as having no stratigraphic basis.

The dating of Lapita was extremely confused at this early stage of research and the two populations model was seemingly supported by a number of late, and now known to be erroneous, Lapita dates. Specht reported Garanger's 2,300 B.P. date from Erueti suggested as having a Lapita association, dates from a Lapita site on Malo Island in Vanuatu of 2,020 B.P., 1,200 B.P. and 940 B.P., and Poulsen's Tonga Lapita dates which extended over 2,000 years to European contact (Specht, 1969: 238, 247). Specht's own Watom dates were comparatively late as well. On the evidence available to him at the time there was certainly scope for seeing Lapita as overlapping in time with the various Incised & Applied relief and other pottery styles of the western Pacific, and potentially having a separate origin.

After Specht's 1969 thesis—incidentally still the most detailed pottery sequence from the western Pacific—others expressed their opinions on the issue of the similarities between the various Incised & Applied relief pottery assemblages of the region. Notable among these commentators was Jean Kennedy in the early 1980s, who added a Manus comparison to the Buka/Mangaasi ones and so extended the chain of possible links through to Micronesia beyond New Ireland (Kennedy, 1982, 1983). Kirch & Yen (1982: 329, 340, 341) also discussed these issues in relation to the Tikopia pottery sequence.

In 1984 I published a paper on "The Lapita cultural complex: origins, distribution, contemporaries and successors" (Spriggs, 1984). Building on the comparative research of Specht, Kennedy and others, I postulated that: immediately post-Lapita pottery styles in Island Melanesia, Fiji and (more uncontroversially) West Polynesia derived from Lapita, rather than representing a separate migration into the region by potters of a different tradition: i.e., that there was cultural continuity from Lapita; the post-Lapita ceramic sequences continued "in sync" or in parallel over a large area until at least 1,500 B.P. or so, betokening "a continuing communication network throughout the region" (Spriggs, 1984: 217); and there was direct evidence of some communication between different archipelagoes in the period around 2,000 B.P.: between New Caledonia and Vanuatu, Vanuatu and Fiji, Vanuatu and the southeast Solomons, the southeast Solomons and Fiji, the southeast Solomons and the main Solomons chain, the main Solomons and the Bismarcks, and so on.

After moving back from Hawaii to the Australian National University in 1987, I recruited a Ph.D. student, Ephraim Wahome from Kenya, to work on a seriation of the somewhat fragmentary Manus (Admiralty Islands) ceramic sequence and examine its external relations—particularly whether there really was a unified Incised & Applied Relief tradition. Within the limits of the then rather poorly defined post-Lapita chronologies of the western Pacific, Wahome (1998: 175–181, 187–189; see also Wahome, 1997) concluded that: the earlier Incised & Applied Relief styles were indeed related; changes in these styles did indeed occur in step over wide areas; and these post-Lapita connections were broken particularly after the period 1,500–1,000 B.P. as the number of pottery-making communities declined. After that time the distances between pottery production centres were such that contacts between them were broken and the potters would no longer have seen each other's products. There was thus an increasing "speciation" in pottery styles taking place on different islands after 1,000 B.P. as this isolation set in.

Interestingly, Wahome's Incised & Applied Relief tradition specifically excluded the north coast New Guinea pottery of Vanimo and Fitchin styles, which Gorecki (1992, 1996) suggested were potentially ancestral to the Mangaasi pottery of Vanuatu. However, Wahome held out the possibility of including other mainland New Guinea pottery styles. His grouping did include Fiji, but excluded western Polynesia where the same decorative techniques do not occur.

This was essentially the state of play when *Island Melanesians* was published (Spriggs, 1997, but essentially completed by 1995). From 1994 onwards, I have been examining the post-Lapita cultural sequences of Vanuatu, soon joined by Stuart Bedford whose recent Ph.D. thesis is the major overview of this work (Bedford, 2000*a*). We have worked on Erromango, Efate and Malakula Islands, thus covering the south, centre and north of the archipelago.

Our initial once-over-lightly look at the assemblage from Ponamla in northwest Erromango in 1995 assigned it as a variant of the Incised & Applied Relief or Mangaasi style of central Vanuatu (Bedford, 1999; Bedford *et al*., 1998). Bedford carried out further excavations on Erromango and on Malakula in 1996. In that same year we started the first of now-seven seasons at the Mangaasi site on northwest Efate in central Vanuatu, in cooperation with the Vanuatu National Museum as a training excavation for its staff.

Mangaasi, the type site for the Vanuatu Incised & Applied Relief pottery, had been excavated by José Garanger in the mid-1960s and fully published in 1972 (Garanger, 1972, 1982). As mentioned above, in the late 1960s both Golson and Specht, relying on Garanger's preliminary reports, had linked Mangaasi to the Buka sequence and other Incised & Applied Relief sites (Golson, 1972; Specht, 1969). In 1969 Specht had worried whether there were similarities between his Sohano style pottery at about 2,200/1,800 B.P. and the Early Mangaasi which began about 2,700 B.P. calibrated. He wondered if he should push back the beginnings of the Sohano style to reflect this connection (1969: 255). Our more recent research has led to a major revision of the Mangaasi sequence (Bedford, 2000*a,b*; Bedford & Spriggs, 2000; Spriggs & Bedford, 2001; and unpublished data), demonstrating a continuity from Lapita-derived Erueti style pottery through to the classic Mangaasi style ceramics. The latter began not at 2,700 B.P. as previously postulated, but on the latest dates about 2,300 B.P.

Recent research has also narrowed down the production of dentate-stamped Lapita pottery to the period from about 3,300 to 2,700 B.P., with the possible exception of the island of New Britain where it might have continued later (Anderson & Clark, 1999; Bedford *et al*., 1998; Burley *et al*., 1999; Sand, 1997; Specht & Gosden, 1997). The supposedly late dates for Lapita from Tonga were long ago refuted by Groube (1971). There was thus clearly no longer an overlap between Lapita pottery and Incised & Applied Relief assemblages, and the ultimate derivation of the latter from the former seemed supported.

By 1999 we could point to a whole series of contemporary Incised & Applied Relief styles which all seemed to be related. From north to south these included: Puian ware of Manus at c. 1,650 B.P. (Wahome, 1998), Sohano style of Buka from 2,200–1,800 to 1,400 B.P. (Specht, 1969, dating revised by Wickler, 1990, 1995, 2001), Sinapupu ware of Tikopia in the southeast Solomon Islands from 2,000 to c. 750 B.P. (Kirch & Yen, 1982), the Pakea material from the Banks Islands dating to around 2,000 B.P. (Ward, 1979), the Mangaasi style itself dating from 2,300 to 1,200 B.P., and the Plum tradition of New Caledonia dating to 1,800 B.P. (Sand, 1995, 1996). The Mussau sequence might also be included, but the dated sequence as published in preliminary form does not extend into the period under consideration (Kirch *et al*., 1991: 151–152,160). The purported links between Mangaasi and the Fijian Vunda Phase from c. 900 B.P. seemed indirect, but plausible on this chronology. Wahome's (1998) research thus seemed vindicated with better chronological control from subsequent research.

However, it was not to be. We can now look back on that period around 1999 as the peak of the "modern" period of study on this question; and so to the "post-modern" era.

The world turned upside down

For Fiji, Geoff Clark in his recent Ph.D. could see no links between Fijian post-Lapita pottery and any other pottery styles outside the Fijian archipelago (Clark, 2000). Stuart Bedford, working on a broader geographical canvas, concluded in his thesis (Bedford, 2000*a*) that that there were only rare examples of uniquely shared designs in the immediate post-Lapita period, until around 2,500 B.P. Apart from these, he concluded that the resemblances that others have seen between post-Lapita pottery styles such as Mangaasi and other Incised & Relief assemblages from Manus to New Caledonia are merely superficial. He believed they derive from shared inheritance from Lapita rather than continuing connections. The two "young turks" have combined their views for a seminal position paper (Bedford & Clark, 2001).

For Vanuatu, after a short period of post-Lapita plainwares, Bedford now sees significant divergence by 2,500 B.P. in elements such as rim form and decoration between the Erromango pottery and Erueti and later wares from Efate. He cautions against using decoration technique as a defining element, noting that Mangaasi has been a convenient term, indeed too convenient as it has masked a lot of post-Lapita variability. Bedford further points out that too often Mangaasi or Incised & Applied Relief are terms used as shorthand for any post-Lapita pottery (except for Paddle Impressed wares). Comparisons have been made using small sherds where the full design is unclear. We have not usually been comparing full motifs and complete vessel forms.

The work of Bedford and Clark is important for raising a series of significant questions: How similar is similar? Clearly there is a divergence of views. If there are similarities, are they because of shared ancestry or because of contemporary connection? And how can we tell the difference between the two? Their work suggests that the foundations for Island Melanesian cultural diversity were laid at the end of the production of dentate-stamped Lapita pottery 2,700 years ago, rather than largely in the last 1,500 to 1,000 years.

Discussion and conclusions

My own view is that both Clark and Bedford are overstating their case, but perhaps not by much. There remain some intriguing connections across wide areas revealed by Wahome's earlier analysis (Wahome, 1998), that they have not yet convincingly explained away. Also suggested by Bedford and my recent research in Vanuatu (referenced above) is the potential significance of northern Vanuatu for an understanding of interconnectedness within and between archipelagoes, particularly between Vanuatu and Fiji. Key islands in the north, such as Maewo, Pentecost and Ambae are archaeologically almost completely unknown.

Concrete connections such as Banks Islands obsidian being found in post-Lapita Fijian sites (Best, 1984, 1987) show that it is to northern Vanuatu we should turn when examining similarities between Fijian and Vanuatu ceramics of any period. Banks Islands obsidian does not occur in central and southern Vanuatu post-Lapita sites, excluding them from consideration. However, we do not yet know how long pottery production continued in various parts of the north. To European contact perhaps?

There is now no real point in comparing Vunda phase pottery of Fiji, which begins about 900 B.P., with central Vanuatu Mangaasi, as the latter seems to have gone out of use before that date. Any connection would have to be with the so far completely unstudied northern Vanuatu pottery of the period.

Pottery is often used as a proxy for other kinds of interconnections, or lack of them. It is interesting that on Bedford's (2000*a*) analysis, southern Vanuatu quickly diverges from central Vanuatu in pottery style before 2,500 B.P. This divergence is in fact paralleled in the major linguistic split in Vanuatu languages—that between the Central-North Vanuatu and South Vanuatu linguistic subgroups (Tryon, 1996). In addition, a humanly-introduced rat, *Rattus praetor*, is found in early central and northern Vanuatu sites, but is not in the south (White *et al*., 2000). Nor is it found in New Caledonia, as Sand (2001: 69) has recently discussed. He further points out that the early distribution of the domesticated narcotic kava (*Piper methysticum*) also excluded southern Vanuatu and New Caledonia. Both *Rattus praetor* and kava *are* found in Fiji, however, and Fijian languages go back to an immediate ancestor spoken in northern Vanuatu, perhaps on the island of Ambae according to Lynch (1999: 441–442). Anson's (1983, 1986) analysis of Lapita pottery decoration pointed up a particularly close connection between the Malo Island Lapita sites in northern Vanuatu and early Fijian Lapita assemblages.

There remains a major problem of culture history to be addressed. Many Fijians, Ni-Vanuatu, Kanaks of New Caledonia, and southeast Solomon Islanders do not look Polynesian in appearance. These areas, however, like Polynesia are part of Remote Oceania (Green, 1991). They all represent a region first settled by Lapita-using populations, the ancestors of all Polynesians. Either Lapita was not the first culture present in the eastern parts of Remote Oceania, as some have argued (Galipaud, 1996; Gorecki, 1996), or there must have been significant post-Lapita gene flow down the chain from the main Solomon Islands or from further north into Vanuatu, New Caledonia and Fiji. Pre-Lapita occupation is most unlikely for these areas on current archaeological, pollen and other evidence. Clearly a detailed comparison of post-Lapita northern Vanuatu assemblages with other Island Melanesian and Fijian pottery is needed. We are thus still left with an interconnectedness between these various areas which may in the end turn out to be tracked in part by similarities in post-Lapita pottery styles. That is, if we can agree on what it is we see when we look at them.

The way forward remains the same as when Jim Specht first considered these issues. We basically need better dated and described assemblages in each area under consideration. In the late 1960s, Specht for his immediate region had, you will recall, only two pottery assemblages for comparison with his Buka sequence. We now have several more, but they remain of variable completeness and as I suggested above they are not necessarily from the most crucial locations. Well may Jim say, "Plus ça change".

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The Nature of Prehistoric Obsidian Importation to Anir and the Development of a 3,000 Year Old Regional Picture of Obsidian Exchange within the Bismarck Archipelago, Papua New Guinea

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ABSTRACT. The results of obsidian sourcing studies from the Anir Island assemblages are presented and compared with other studies to develop a regional picture of obsidian distribution and use over a three and a half thousand year period for the Bismarck Archipelago, Papua New Guinea. Predicted changes in technology and mobility patterns are correlated with regional changes in the frequency and distribution of obsidian from particular sources in the region. Early Lapita assemblages in most parts of the archipelago were dominated by west New Britain obsidian. In the Middle Lapita period changes occurred in the northern and eastern Bismarck Archipelago and assemblages here became dominated by Admiralty Islands obsidian. In later periods, west New Britain obsidian re-gained dominance in some areas. Nevertheless, in the Lapita phases pottery assemblages suggest exchange was between culturally similar, socially related groups.

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Tracing the transport of obsidian in Melanesia's past has played an important role in identifying prehistoric exchange networks and understanding levels of interaction between communities (Ambrose, 1976, 1978; White, 1996). Obsidian has a naturally restricted occurrence. In the Bismarck Archipelago it is found in three regions: the Admiralty Islands, the Willaumez Peninsula and Mopir (Fig. 1). Within both the Admiralty Islands and the Willaumez Peninsula sources, chemically distinct sub-groups are identified. Because of their restricted natural distribution and distinct chemistry, obsidian found in archaeological sites can be matched (or traced) to their geological sources, thus providing archaeologists with important distribution information. By identifying the sources of obsidian from distant sites over select periods of time, the changing nature of distributions can be mapped and social and economic models to account for those changes can be developed and tested.

The earliest evidence for the movement of obsidian in this region comes from Matenbek, a cave in southern New Ireland. Obsidian flakes found in contexts dated to 20,000 B.P. were sourced to outcrops in west New Britain, a distance of 350 km in a straight line (Summerhayes & Allen, 1993). For the next sixteen and a half thousand years obsidian was transported from its source areas to a number of sites in New Britain and

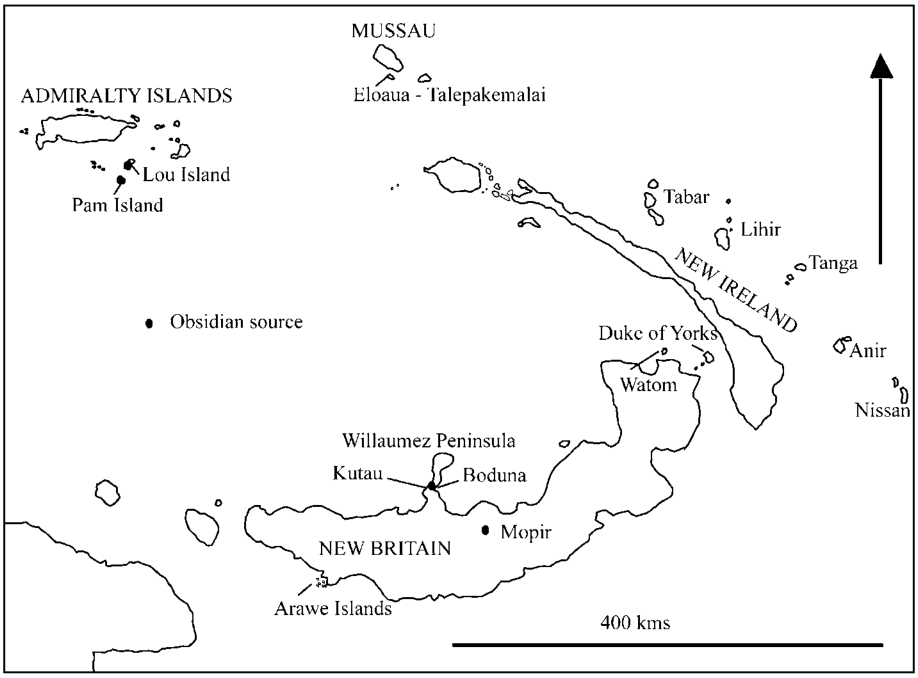


Fig. 1. The Bismarck Archipelago showing obsidian sources and archaeological sites.

New Ireland, within the Bismarck Archipelago. Obsidian was also transported within the Manus Islands from the terminal Pleistocene (Fredericksen, 1997). This restricted distribution of obsidian was to change in the latter part of the fourth millennium B.P. when people left the Bismarck Archipelago and colonized Remote Oceania for the first time.

The archaeological signature for the colonization of the islands east of the main Solomon chain is Lapita pottery, a highly ornate decorated ware with intricate dentate stamp impressed designs. Obsidian from sources in the Bismarck Archipelago is also found in these earliest settlements to the east, being found in the Reef/Santa Cruz Islands, Vanuatu, New Caledonia and Fiji. To the west, obsidian of a similar age has been found in sites in Sabah, Malaysia (Bellwood & Koon, 1989; Bellwood, pers. comm.). This extends the range of obsidian movements to over 6500 km. The identification of Bismarck Archipelago obsidian in Remote Oceanic sites was seen by Kirch (1988*a*) as an indicator of a formal exchange network that was an adaptive mechanism in the colonization process forming a "lifeline" back to a homeland (see also Green, 1976; 1979: 45; 1987: 246). In this context, exchange is an adaptive strategy for colonists moving east (Kirch, 1987) and a means of maintaining social ties (Green, 1987).

To further explore such models, however, the nature of the regional distribution of obsidian within the Bismarck Archipelago itself needs to be better understood. This paper aims to do this by first describing the way that importing obsidian to the Anir Islands in New Ireland Province changed in nature over time, and second, examining how the trends identified on Anir fit the regional picture of obsidian distribution. Excavation of the archaeological assemblages from Anir and characterization of the obsidian were undertaken by myself. The results of the characterization analysis are presented here. The Anir fieldwork is part of a larger project the aims of which are to assess the significance of exchange and the nature of interaction in the colonization of the western Pacific and its role in maintaining cohesion between far flung communities (Summerhayes, 2000*b*).

The Anir assemblages

Anir is composed of two islands, Ambitle and Babase, located 60 km off the southeast coast of New Ireland (Figs. 1 and 2). Fieldwork undertaken on Anir since 1995 has identified four Lapita sites where excavation found Lapita pottery in association with obsidian and shell artefacts (see Summerhayes, 2000*b* for further details of excavations; and Summerhayes, 2001*a* for a detailed listing of all radiocarbon determinations from Anir given in this paper).

Kamgot—ERA. On Babase Island, a major Lapita site was located near Kamgot village (site code ERA). The site is large, extending over 400 m in an east-west direction, and 60 m in a north-south direction. Twenty test pits were excavated over three field seasons with over 20,000 sherds and 1,000 pieces of obsidian retrieved. Other cultural material included chert and shell artefacts, bone and shell. On the basis of decoration, the pottery assemblage is "Early Lapita" (Summerhayes, 2000*b*). This fits well with the radiocarbon determinations which place the sequence between 3,300 and 3,000 B.P. (at 2σ range). The two AMS radiocarbon determinations on charcoal are consistent with a calibrated age of 3,360(3,250)3,080 cal. B.P. (WK7561) and 3,380(3,290)3,080 cal. B.P. (WK7563), while the conventional radiocarbon determinations on shell are calibrated at 3,330(3,210)3,070 cal. B.P. (WK7562) and 3,210(3,080)2,950 cal. B.P. (WK7560). Forty-eight obsidian artefacts from Test Pit 1 were selected for characterization analysis. This comprised a 42% sample of the obsidian from that test pit.

On Ambitle Island, three Lapita sites were excavated: Malekolon (EAQ), Balbalankin (ERC) and Feni Mission (ERG).

Malekolon—EAQ. The Malekolon site is located 0.5 km inland in a small valley (Fig. 2), although occupation would originally have been on the beach of an embayment when the Lapita material was discarded. A volcanic eruption on the island 2,300 years ago covered the embayment with ash, which was subsequently infilled by clays excavated from the top of the limestone escarpment (Licence *et al.*,

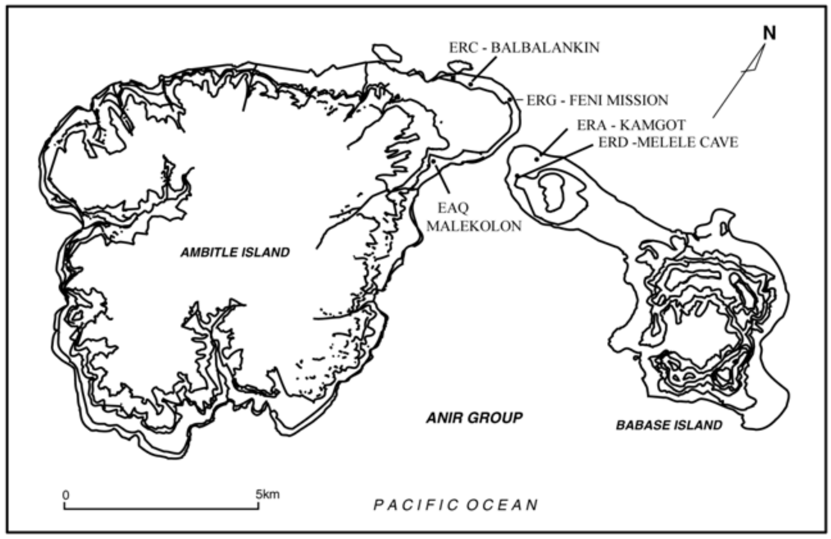


Fig. 2. The Anir Islands showing the location of excavated sites.

1987: 274). Pottery from the site was previously described by White & Specht (1971) and excavated by Ambrose in the early 1970s. The background to the geomorphological history of the site and a full description of the excavated test pits are published elsewhere (Summerhayes, 2000*b*). Five test pits were excavated along an east-west transect from the beach extending inland, with only one, Test Pit 4, having cultural material. Over 2,500 sherds and 200 pieces of obsidian were excavated from this single test pit. The bulk of the material was in the lower 40 cm of a brown ash sitting on top of black beach sand (25 cm deep) which in turn overlies a yellow and white beach sand. Decoration on the pottery includes dentate, linear incision, shell impressions, striations, and nubbins. Stone artefacts were also recovered. Only three conventional radiocarbon determinations are available from Malekolon. The first is on galip nut and comes from Ambrose's early 1970s excavation: 2,707(1,996)1,528 cal. B.P. (ANU 957) (Ambrose, pers. comm.). The next two are from Summerhayes' excavations and are on charcoal: 3,830 (3,430) 2,960 cal. B.P. (ANU 11193) and 2,750 (2,080) 1,530 cal. B.P. (ANU 11190). The first and last determinations could date the volcanic eruption. All determinations have large ranges exceeding 900 years at two standard deviations (see Spriggs, 1989 for a discussion on chronometric hygiene). A sample, consisting of 89 obsidian artefacts from Test Pit 4 (42% of the population) was selected.

Balbalankin—ERC. The Balbalankin site is located 140 to 200 m inland from the beach, extending towards the edge of the escarpment on an area of raised flat ground (Summerhayes, 2000*b*). Eight test pits were excavated at the site with over 1400 sherds retrieved. Pottery decoration includes dentate, linear incision, nubbins, appliqué and shell impressed ware. Other artefactual material included chert and shell artefacts, and midden material. The material was originally deposited in a low energy water environment, similar to that at the Arawe Islands and Talepakemalai (Kirch, 1988*b*; Gosden & Webb, 1994). On the basis of decoration, the pottery assemblage is "Middle Lapita" (Summerhayes, 2000*b*). This fits well with the single conventional radiocarbon determination on charcoal available from Test Pit 1—2,950(2,750)2,360 cal. B.P. (ANU 11188). Twenty-four obsidian artefacts were selected from Test Pit 1 for analysis; they comprised a 44% sample of that test pit's obsidian population.

Feni Mission—*ERG*. The Feni Mission site is located at the Catholic Mission on Ambitle (see Summerhayes, 2000*b* for details of excavations). Only one test pit was excavated from which 569 sherds and 113 pieces of obsidian were retrieved. The pottery sherds look eroded and re-deposited. Decoration includes dentate, linear incision, applied bands and flat knobs. From a cursory examination, the dentate decoration is open and loose. On the basis of decoration, the pottery assemblage is Middle to Late Lapita. Only a single conventional radiocarbon estimate (on charcoal) is available from the site: 3,690(3,280)2,850 cal. B.P. (ANU 11191). Again, this determination has a large range of 800 years at two standard deviations. A sample of 25 obsidian artefacts selected for analysis comprised 22% of the obsidian population from that test pit.

In summary, the Kamgot assemblage has four age determinations consistently around the late fourth millennium B.P., while Balbalankin is later in time dating to the early to late third millennium B.P. The other two sites have determinations which have large standard deviations. Summerhayes (2001*a*) gives details on the chronology of these sites. The number of obsidian specimens selected and their percentage of the total population for each test pit are listed in Table 1.

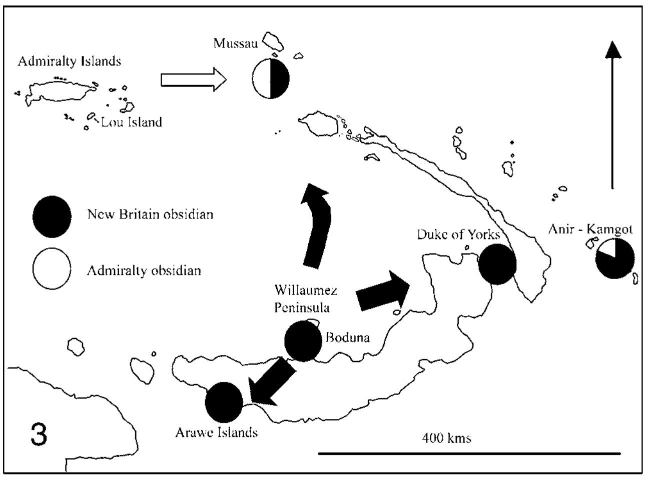
Results

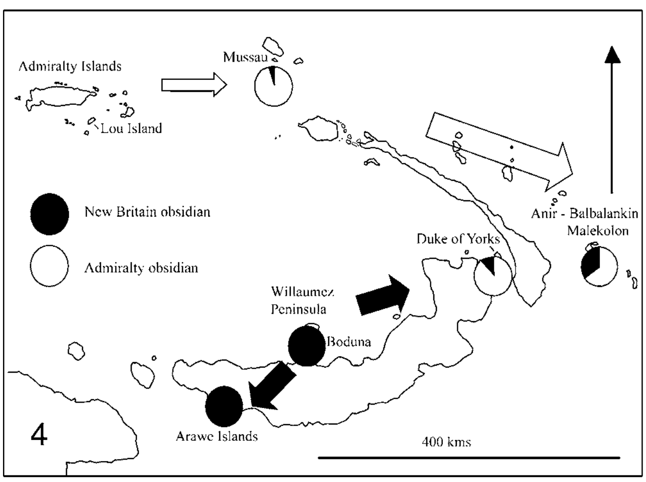
One hundred and eighty-six obsidian artefacts were chemically analysed using the established PIXE-PIGME (proton induced x-ray and proton induced gamma-ray emission) technique at the Australian Nuclear Science and Technology organization, Lucas Heights. A sample was randomly selected from each spit in each site. For a detailed outline of the technique and parameters used see Summerhayes, *et al*. (1998).

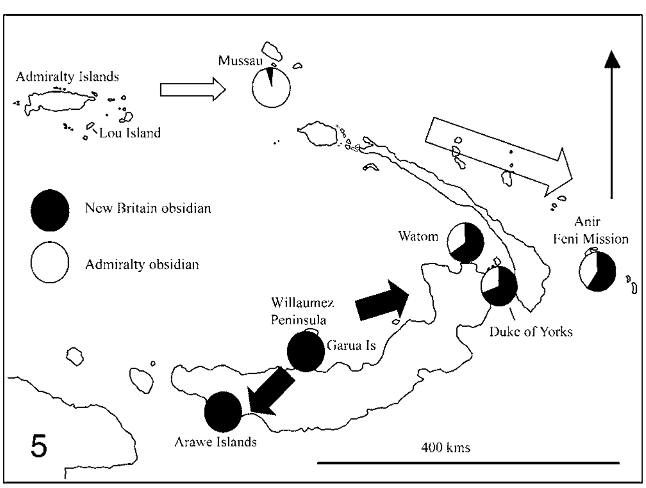
The results show that the proportion of obsidian from different sources varies at each site (Table 1). Obsidian from the Kamgot site is predominantly from the Willaumez Peninsula source of Kutau (80%) while the rest comes from the Admiralty sources. Malekolon and Balbalankin, on the other hand, have predominantly Admiralty obsidian at 64% and 67% respectively, with the rest from Kutau. In the Feni Mission assemblage the proportions are somewhere in between with 56% from the Willaumez Peninsula source of Kutau and 44% from the Admiralty Islands. It has been

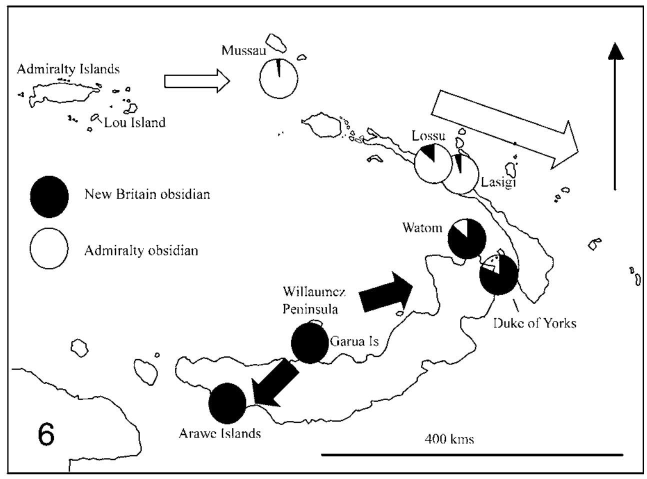
Table 1. Distribution of obsidian in each Anir site by source area.

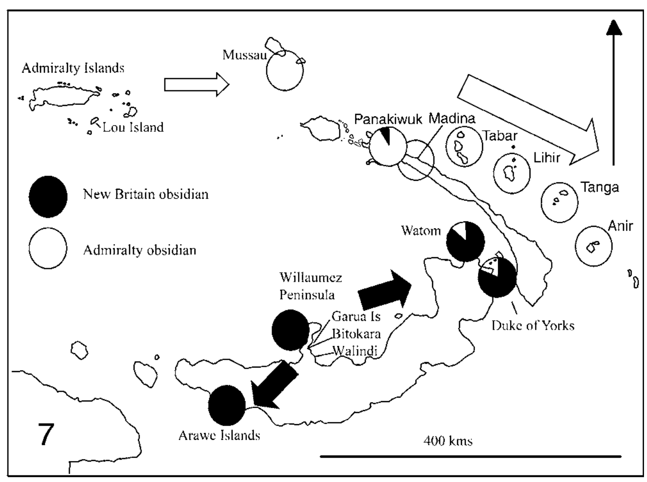
site	number of specimens analysed	% of population (%)	Willaumez Peninsula sources (%)	Admiralty Island sources (%)	Admiralty sub-source of Umrei (%)	Admiralty sub-source of Pam
ERA Kamgot—TP 1	48	47	80	20	67	25
EAQ Malekolon—TP 4	89	42	36	64	84	14
ERC Balbalankin—TP 1	24	44	33	67	88	13
ERG Feni Mission	25	22	56	44	55	45











Figs. 3–7. Regional distribution of obsidian from Early to Post Lapita and during the last 1600 years: (*3*) Early Lapita period; (*4*) Middle Lapita period; (*5*) Late Lapita period; (*6*) Post Lapita period; (*7*) the last 1600 years.

Table 2. Sites with obsidian assemblages.

time period B.P.	locality	sites	references
Early Lapita 3,500 to 3,000–2,900	Arawe Islands	Paligmete (FNY) Adwe sq. D/E/F (FOH)	Summerhayes *et al*., 1998 Gosden & Webb, 1994; Summerhayes, 2000*a*, 2001*a,b*
	Willaumez Peninsula	Boduna (FEA)	Summerhayes *et al*., 1998; Specht & Summerhayes, in prep.
	Duke of York Islands	Kabakan Island (SEE)	White & Harris, 1997
	Mussau Island	Talepakemalai (ECB) Area B Lower levels	Kirch, 1987, 1988*b*, 1990 Kirch *et al*., 1991; Kirch, 2001
	Anir Islands	Kamgot (ERA)	Summerhayes, 2000*b*, 2001*a*
Middle Lapita 2,900 to 2,700–2,600	Arawe Islands	Apalo (FOJ) Adwe sq. G (FOH) Amalut (FOL)	Summerhayes *et al*., 1998 Gosden & Webb, 1994 Summerhayes, 2000*a*, 2001*a,b*
	Willaumez Peninsula	Boduna (FEA)	Ambrose & Gosden, 1991
	Watom Island	Vunavaung (SDI) layer C4	Green & Anson, 1991; Anson, 2000
	Duke of York Islands	SDP layer III	White & Harris, 1997
	Mussau Island	Talepakemalai (ECA) Epakapaka shelter (EKQ) lower levels	Kirch *et al*., 1991 Kirch, 2001
	Anir Islands	Malekolon (EAQ), Balbalankin (ERC) Mission (ERG)?	Summerhayes, 2000*b*, 2001*a*
Late Lapita 2,700–2,600 to c.2200	Arawe Islands	Apalo (FOJ) upper units	Summerhayes *et al*., 1998; Summerhayes, 2001*a*
	Willaumez Peninsula	Garua Island (FSZ and FAO)	Summerhayes, 2000*a*; Torrence & Stevenson, 2000
	Watom Island	Vunavaung (SDI) layer C3 Kainapirina (SAC) layer C2 Maravot (SAD)	Green & Anson, 2000*a,b* Anson, 2000
	Duke of York Islands	SDP layer II	White & Harris, 1997
	Mussau Island	Epakapaka shelter (EKQ) middle levels Talepakemalai (ECA) upper levels	 Kirch *et al*., 1991
	Anir Islands	Mission (ERG)?	Summerhayes, 2000*c*, 2001*a*
Post Lapita Transition 2,200 to 1,600	Arawe Islands	Winguru (FNZ)	Gosden *et al*., 1989; Gosden & Webb, 1994
	Willaumez Peninsula	Garua Island (FSZ and FAO)	Torrence & Stevenson, 2000
	Watom Island	Vunavaung (SDI) layer C2 and C1 Kainapirina (SAC) layer C1	Green & Anson, 2000*a* Anson, 2000
	Duke of Yorks	SDP layer 1, SEO	White & Harris, 1997
	Mussau Island	Epakapaka shelter (EKQ) upper levels	
	New Ireland	Lossu (ECA) Lasigi (ELS and ELT)	White & Downie, 1980 Golson, 1991, 1992
	Lou Island	Sasi (GDY), Esmin (GEB), Pisik (GBC)	Ambrose, 1991
Last 1,600 years	Northern New Ireland	Panakiwuk (EAS) Madina	Marshall & Allen, 1991 Ambrose, 1976; Ambrose, 1978
	New Ireland's off-shore islands	Tabar, Lihir, Tanga, Anir	Ambrose, 1976; Ambrose, 1978
	Southern New Ireland west coast	 Lambon Island (EPG and EPK) Kamudru (EPQ/EPR)	 White, 1997
	east coast	EQA, EQH, EQB, EQD, EQE, EQF, EQZ	White, 1997
	Mussau Island	Sinakasae (EKU) Emussau Is Midden (EKS) Eloaua Cave (EHM) Rockshelter Mussau (EKP) Epakapaka (EKQ)	Kirch *et al*., 1991
	Willaumez Peninsula	Garua Island (FSZ and FAO)	Summerhayes *et al*., 1998
	WNB	Walindi (FRI), Bitokara (FRL)	Torrence & Stevenson, 2000
	Inland New Britain	Yombon (FGT), Misisil Cave (FHC)	Summerhayes *et al*., 1998
	Arawe Islands	Winkapiplo (FON) Adwe (FOH) surface, Apalo (FOJ) surface Lolmo Cave (FOF) upper levels Murien (FST)	Summerhayes *et al*., 1998
	Kandrian Area, WNB	Apugi (FFS, FFT), Yimlo (FLE) Alanglongromo (FLF), Alanglong	Summerhayes *et al*., 1998

argued elsewhere, on the basis not only of radiocarbon determinations but also regional trends in pottery form, decoration and production, that these changes are chronological (Summerhayes, 2001*a*). Kamgot is Early Lapita, Balbalankin and Malekolon are Middle Lapita, while Feni Mission is possibly Middle to Late Lapita.

A regional pattern

To identify wider regional trends over the past 3,500 years, obsidian assemblages from Anir and other excavated sites in the Bismarck Archipelago which have been chemically analysed by PIXE-PIGME have been placed into five chronological stages for comparative purposes (Figs. 3–7). Although there are four sources on the Willaumez Peninsula (Kutau, Gulu, Baki and Hamilton), only one was dominant in the export of obsidian—Kutau. Only minor amounts from the other three sources, if any at all, left the area. Where Kutau is known to be the source of the obsidian analysed, it will be referred to as such. However, some of the obsidian artefacts mentioned in this text were analysed before the finer discriminations between these sources could be made using updated PIXE-PIGME techniques (Summerhayes *et al*., 1998). Thus the generic source name of the Willaumez Peninsula is given when referring to these artefacts.

Where an assemblage's chronology is in doubt, such as those from the Duke of Yorks, it is placed into a temporal sequence according to decoration and dentate stamped motifs[1]. Assemblages are referred to here by both their site code (allocated by the Papua New Guinea National Museum and Art Gallery) and place name, if available.

Early Lapita. The regional distribution of obsidian from the Early Lapita period: 3,500–3,000/2,900 B.P. is shown in Fig. 3; Table 2 lists the sites from this period used in the distribution map.

Kutau obsidian dominates the New Britain assemblages whether they be next to the source such as Boduna (FEA) or on nearby archipelagoes such as the Arawe Islands (FOH, FNY) or Duke of York Islands (SEE) (White & Harris, 1997; Summerhayes, *et al*., 1998). Even assemblages further from New Britain and the Willaumez Peninsula sources have a preponderance of Kutau obsidian. Kutau provided half the obsidian found in the early Mussau Lapita assemblage of Talepakemalai (ECA) (Kirch *et al*., 1991), while in Kamgot (ERA) it provided 80%.

The above results from Kamgot confirm the earlier conclusions that Kutau obsidian is the dominant source in Early Lapita assemblages throughout the Bismarck Archipelago. They also confirm that Admiralty obsidian was never dominant in these early assemblages, although a higher proportion of it was found in sites furthest away from the New Britain sources. At sites closer to the Willaumez Peninsula sources, few if any pieces of Admiralty obsidian are found. Only two pieces were identified in the Arawe assemblages—one each in Adwe (FOH) and Paligmete (FNY). In Kamgot (ERA), which is almost equidistant to both sources, 20% of obsidian is from the Admiralty Islands. At sites closer to the Admiralty sources, such as Talepakemalai (ECA) about half the assemblage was Admiralty obsidian.

Of interest are those sites which have obsidian from both source areas, e.g., Talepakemalai (ECA) and Kamgot (ERA). Talepakemalai (ECA), for instance is much closer to the Admiralties than it is to the Willaumez Peninsula (Fig. 1). If nearness to the source were the only factor, then the Talepakemalai (ECA) assemblage would have contained 100% Admiralty obsidian. Yet this is not the case, which suggests that other factors were at play.

Middle Lapita. The earlier obsidian distribution pattern changes during the Middle Lapita period: 2,900–2,800 to 2,700–2,600 B.P. The regional distribution of obsidian in this period is shown in Fig. 4; the sites from this period used in the distribution map are listed in Table 2.

The results from Anir confirm the regional trend that Admiralty obsidian replaced Kutau as the major source in assemblages from sites to the east and north of the Willaumez Peninsula obsidian sources. Admiralty obsidian dramatically increases to 67% at Balbalankin (ERC) and 64% at Malekolon (EAQ). This is a major increase compared to the earlier assemblage at Kamgot (ERA). In contrast, Feni Mission (ERG) has a higher percentage of Kutau obsidian (56%) than Balbalankin and Malekolon with 33% and 36% respectively. This is closer to the Late Lapita phase pattern which is discussed next.

Changes identified at Balbalankin and Malekolon also occur in the Mussau Islands, and the Duke of Yorks off the eastern tip of New Britain. In the Mussau assemblages, which are close to the Admiralty sources, the change is more marked than elsewhere. While the earlier levels of Talepakemalai (ECA) and Epakapaka rockshelter (EKQ) had roughly equal amounts of Willaumez Peninsula and Admiralty obsidian, this changes in the later levels where Admiralty sources dominate (Kirch *et al*., 1991: 157). A similar trend is seen in the Duke of York assemblages, situated between New Britain and New Ireland, where 89% of the obsidian specimens (or artefacts) from SDP layer III analysed by PIXE-PIGME was from the Admiralties (White & Harris, 1997: 103). Unfortunately, from the sole Watom site of this period, SDI layer C4, only two pieces of obsidian were found: one came from Mopir and the other from the Admiralty source of Umrei (Anson, 2000: 108). Sites closer to the Willaumez Peninsula obsidian sources (Boduna, Arawe Islands) have Kutau obsidian with only one piece of Admiralty (Umrei) obsidian identified in the Apalo (FOJ) site.

Late Lapita. The regional distribution of obsidian in the late Lapita period: 2,700–2,600 to c. 2,200 B.P. is shown in Fig. 5; the sites from this period used in the distribution map are listed in Table 2.

The Feni Mission site, which on the basis of pottery decoration was classified as Middle/Late Lapita, shows an obsidian pattern similar to Late Lapita assemblages from the eastern tip of New Britain and the islands separating New Britain and New Ireland. Here, the distribution of obsidian reverts to a pattern similar to Early Lapita, where west New Britain sources dominate. This is seen in the Duke of Yorks (SDP) and at Watom (SAC, SDI). Unlike the previous Lapita periods, however, Mopir obsidian makes an increased appearance at this time in both the Duke of York and Watom assemblages (only one piece was found in Middle Lapita). Mopir obsidian is not found further east in New Ireland during this period.

In the Duke of York Islands site SDP layer II, 68% of the obsidian analysed by PIXE-PIGME came from west New Britain sources, while the rest came from Admiralty sources (White & Harris, 1997). Of the New Britain sources, 54% came from Mopir, and 46% from Kutau. Using density measurements on 53 artefacts, west New Britain sources

(Willaumez Peninsula and Mopir) account for 38% while the Admiralty sources account for 62%.

A similar pattern is seen in the Watom assemblages. From Kainapirina (SAC) layer C2, west New Britain sources dominate at 60%, of which 78% came from the Willaumez Peninsula and 22% from Mopir (Green & Anson, 2000*b*: 70). Unfortunately, only five pieces came from another late Lapita site on Watom: Vunavaung (SDI) layer C3. Two were sourced to Mopir, two to Admiralty sources (one each to Umrei and Pam), and one was not allocated (Anson, 2000: 108).

The pattern of obsidian distribution from the sites in western New Britain (Arawe FOJ, Garua Island FSZ, FAO) and Mussau remain mostly unchanged. Kutau obsidian is still found in the Mussau (ECA, EKQ) assemblages, albeit in small numbers (Kirch *et al.*, 1991).

Post-Lapita transition. The regional distribution of obsidian in the post-Lapita transition period from 2,200 to 1,600 B.P. is shown in Fig. 6. These assemblages are at the end of the Lapita period, where dentate stamped pottery sherds are rare, and the few that are found are probably mixed from earlier deposits with pottery where appliqué is found. Incised decoration is found on a restricted range of mostly incurving vessel forms. This is in stark contrast to the vessels of the preceding Lapita period where incurving forms are mostly absent (Summerhayes, 2000*c*). The sites from this period used in the distribution map are listed in Table 2. No sites from Anir have assemblages of this period. A volcanic eruption on Ambitle Island around 2,300 years ago devastated the island (Licence *et al.*, 1987: 274) and was of such a force that any inhabitants would have perished. The next evidence of human occupation occurs on Ambitle in the following period (see below).

There are three patterns in the obsidian distribution. First, continuity in obsidian exploitation can be seen in assemblages close to their source areas such as the west New Britain sites of FAO and FSZ on Garua Island and Winguru (FNZ) in the Arawe Islands; and those from the Lou Island sites of Sasi (GDY), Emsin (GEB) and Pisik (GBC) which have local obsidian (Ambrose, 1991).

Second, Admiralty Island obsidian dominates the assemblages from the Mussau Islands (EKQ) and North/Central New Ireland (Lossu [EAA] and Lasigi [ELS and ELT]). On Mussau Island (EKQ) a small amount of west New Britain obsidian was still being imported. From Lossu (EEA), 20 artefacts were analysed using PIGME. Eighty-five percent came from Umrei in the Admiralties, and 15% from the Willaumez Peninsula. None were allocated to sub-sources (White & Downie, 1980). From the Dori site (ELS) at Lasigi, 88 artefacts were analysed of which 94% came from the Admiralties, while 6% came from West New Britain (Golson, 1991,1992).

Third, changes are seen in assemblages at the tip of east New Britain where the proportion of west New Britain (Willaumez Peninsula and Mopir) obsidian continues to increase. This is seen in the Watom (SDI layer C2 and SAC layer C1) and Duke of York (SDP layer 1) assemblages where west New Britain obsidian accounts for over 80% of the obsidian analysed. In the Duke of Yorks site obsidian from Mopir equals that from Kutau, and forms between 18% and 25% in the Watom assemblages. Admiralty obsidian is still reaching this area; in the Duke of Yorks it makes up 20% (White & Harris, 1997: 103), while on Watom it is 16% and 19% from SDI layer C2 and SAC layer C1 respectively (Anson, 2000: 108; Green & Anson, 2000*b*: 70).

Last 1,600 years. The last 2,000 years are difficult to model due to limited archaeological investigation. The material from this last segment of time is patchy but some headway has been made and gross patterns are emerging (Fig. 7). The sites for this period used in the distribution map are listed in Table 2.

The obsidian pattern evident in the previous period continues. First, Admiralty obsidian dominates the assemblages of Mussau, northern New Ireland and the off-shore islands of New Ireland. Rather than having a secondary role, west New Britain obsidian begins to drop out completely in these later assemblages. That is, it is no longer being exchanged into these areas. From Mussau, the assemblage from Sinakasae (EKU), dated to the eighth century B.P. (thirteenth century A.D.) is mostly Lou with a minute amount from the Willaumez Peninsula (Kirch *et al.*, 1991: 157). According to Kirch *et al.* (1991), by the late prehistoric period no Willaumez Peninsula obsidian is found in the assemblages from EKS on Emussau Island, or from EKS, EHM and EKP on Mussau where only Admiralty obsidian has been found.

From the New Ireland cave site of Panakiwuk (EAS) nine of the 10 analysed pieces found in layer A dated to less than 2,000 B.P. Seven (78%) are from the Admiralty Islands (six from Lou, one from Pam Lin), and only two (22%) from the Willaumez Peninsula (Marshall & Allen, 1991: 71). From the offshore islands of New Ireland, isolated obsidian surface finds have been collected by Ambrose (1976, 1978) on Tabar, Lihir, and Tanga, and myself on Tabar, Tanga, and Anir. Those from Anir were found in association with Buka pottery which was traded from the south over the last 800 years. This is the first evidence for re-occupation of the island. Although only a handful of obsidian flakes has been analysed, all are from the Admiralty source of Umrei. Ambrose (1978: 331) records that a scatter of five flakes from Masahet Island, off Lihir, all came from the Willaumez Peninsula, however, the age of this site is unknown and is probably earlier than 1,600 B.P.

Second, the west New Britain obsidian sources are now the sole supplier of obsidian within this island. No Admiralty obsidian is reaching New Britain. This is the case for the many analysed assemblages from the Willaumez Peninsula, Arawe, and Kandrian regions of West New Britain listed above (Summerhayes *et al.*, 1998). The extensive ethnographic literature, which outlines the movement of Willaumez Peninsula obsidian to Watom and other parts of New Britain, also indicates the lack of Admiralty obsidian during this period (see Specht, 1981 for references).

Third, the assemblages in southern New Ireland have mostly west New Britain obsidian and a minor amount of Admiralty (Lou Island) obsidian. Of importance is Peter White's (1997) work in the southern part of New Ireland, where slight differences are seen between the east and west coast assemblages that he collected. Along the west coast (EPE, EPG and EPK on Lambon Island and EPQ/EPR and EPS at Kamudru), west New Britain obsidian dominates with little material from the Admiralty Islands sources present (White, 1997: 144). The east coast sites (EQA, EQH, EQB, EQC, EQD, EQE, EQF and EPZ), on the other hand, have a higher proportion of Admiralty obsidian, which on density analysis could comprise up to 22% of the assemblage (White, 1997: 144). Ambrose also made a surface collection of five flakes at Muliama on the east coast of New Ireland, with three sourced to the Willaumez Peninsula and two to the Admiralties (Ambrose, 1978: 331).

On the basis of obsidian distribution, New Ireland is thus separated into two regions: the north and east where Admiralty obsidian dominates, and the south where west New Britain sources dominate. There are two major spheres of obsidian distribution, a northern west to east network evident out of the Admiralty Islands across to central New Ireland, yet including all the northeastern offshore islands, and a southern network evident in the whole of New Britain and the southern third of New Ireland.

Discussion

The evidence presented above shows major changes over time in the distribution of obsidian from different sources and reinforces the prediction of Gosden *et al*. (1989) that "these differences may allow the tracking of discrete exchange networks in different parts of the Bismarcks when analyses are available from further sites" (Gosden *et al*., 1989: 575). There is a major change from the dominance of west New Britain (Kutau) obsidian in all Bismarck Archipelago Lapita assemblages during the Early Lapita phase, to one where Admiralty obsidian dominates in the eastern Bismarck Archipelago assemblages of New Ireland, Mussau and East New Britain during the Middle Lapita phase. Although this pattern continues from Late Lapita onwards for Mussau and northern New Ireland, it changes for the southern New Ireland and east New Britain assemblages in which west New Britain obsidian dominates. West New Britain continues to be dominated by its local sources throughout all the phases. Within the last 1,600 years a regional boundary, based on obsidian, is seen in southern New Ireland. What these changes in the distribution of obsidian can tell us about the past is best addressed by looking first at the nature of Lapita exchange, and second, at the nature of mobility and settlement patterns.

Nature of Lapita exchange. Indications about the nature of exchange can be gained from the limited analysis of obsidian technology undertaken to date where it is proposed that obsidian was not a "prestige good" valued for its scarcity with distance from the source region. This conclusion is based on analyses of both the Arawe Islands (Halsey, 1995) and Reef Islands and Santa Cruz (Sheppard, 1992, 1993) Lapita assemblages, from which it was argued that these assemblages showed an expedient technology and that proximity to the source was not an important factor in the reduction of obsidian. Other assemblages located away from the obsidian source areas which also showed an expedient technology or wasteful reduction of obsidian include the Duke of Yorks (White & Harris, 1997), southern New Ireland (White, 1997), Mussau ECA (Kirch *et al*., 1991: 157) and Watom (Green & Anson, 2000*b*: 64–66). Similar characteristics are seen in assemblages right next to the west New Britain sources such as Bitokara Mission (Torrence, 1992), as well as the Garua Island assemblages. Torrence *et al*. (1996) argue that users from Garua obtained obsidian from non-Garua sources to maintain social links with other groups. Whether an expedient use of obsidian lasted through all three Lapita phases in the Bismarck Archipelago is unknown. Further technological analyses of obsidian from the Middle to Late Lapita sites in this region are thus a priority in understanding the mechanisms of exchange.

However, the value of obsidian was argued to be social not utilitarian. Sheppard's (1992: 152) work is important here as he argues that models of trade and exchange based on formalist economic grounds do not explain the nature of the assemblages as the obsidian was not curated and economized. Of importance is Sheppard's suggestion that obsidian's commodity value "is maximized in social terms at points in its history where it may be a concrete symbol of exchange" (1993: 135). He goes on to suggest it is not at these points that the obsidian's value is seen in utilitarian terms, but "subsequent to these exchange events, consumption of some of the obsidian may then be carried out according to another set of commodity (utilitarian) values" (Sheppard, 1993: 135).

Torrence *et al*. (1996: 220) offer a model to explain the expedient use of obsidian. They argue that obsidian collected would have been the result of embedded procurement in which "materials are collected in the course of carrying out other activities". As such, "one would not expect the consumption of obsidian procured in this way to reflect distance from the raw material source" (Torrence *et al*., 1996: 220). Yet, as the authors note, embedded procurement would not explain the non-use of local obsidian on the Garua Island sites (see also Torrence & Summerhayes, 1997). The selection of non-local obsidian would be best explained, they argue, in terms of maintaining social ties with other groups (Torrence *et al*., 1996: 220), but as they point out, the data available are insufficient to reveal the nature of the social factors involved.

The nature of mobility and settlement patterns. If the value of obsidian was social, then what do changes over time in the obsidian distribution patterns within the Lapita periods suggest? The proportion of obsidian within an assemblage is dependent not only on closeness to the source, but also on what Green (1987) called the "social distance" between those communities within the exchange network. Change in the proportions of obsidian over time was argued to reflect the changing nature of the "social distance" between communities accessing the sources and those who are the recipients as part of an exchange transaction. The appearance of the two obsidian distribution networks where Admiralty obsidian dominates in the Mussau and New Ireland assemblages during the Middle and Late Lapita periods no doubt represents a re-alignment in the movement of obsidian and the changing relationships between those accessing the sources and those who are the recipients as part of an exchange transaction. However, what about the nature of Lapita society as a whole? Relations between Lapita communities are not expected to have remained stationary for half a millennium. So, do the changes in obsidian distribution patterns represent a greater regionalization or social break-up between these Austronesian communities within the Bismarck Archipelago? The pottery assemblages provide an important insight here.

Any regionalization evident from the pottery assemblages occurs at the end of the Lapita sequence, which is much later in time than changes occurring in the distribution of obsidian. There is no regionalization of Lapita pottery over time in the Bismarck Archipelago. Any changes in the decoration or style of Lapita pottery are seen in most Bismarck assemblages at the same time. For instance, for over nearly half a millennium similar changes occurred in the ceramics in three Lapita assemblages on the edges of the Bismarck

Archipelago (Anir Islands, Arawe Islands and Mussau Islands) which suggests a homogeneous society (Summerhayes, 2001*b*, see also Summerhayes, 2000*c*, for a discussion on the function of Lapita pottery). Social distance between these communities does not seem to have been lessened with the changes in obsidian distribution. Thus, changes in the distribution of obsidian did not equate with major divisions within Lapita society in the Bismarck Archipelago.

What does change over time and what may have affected the distribution of obsidian is the nature of settlement mobility. It is argued (Summerhayes, 2000*a*), for instance, that there is a change in settlement patterns from a mobile to more sedentary one. This argument is based on a change in pottery production strategies which occurs at the same time that pottery becomes more standardized in shape and size. Perhaps the changes in obsidian distribution and settlement mobility patterns are associated? A model involving the association of a mobile Lapita society with a dominance of west New Britain obsidian, and a more sedentary settlement strategy with the appearance of two obsidian distribution networks is one that needs to be explored further. Such a model needs to take into account wider regional processes occurring in the western Pacific.

The expanded distribution of west New Britain obsidian in the early Lapita period into areas of the Bismarck Archipelago where it was not previously found is no doubt related to the Austronesian expansion into this region. It co-occurs with the widespread distribution of Lapita pottery and other cultural elements not seen in the region previously (Green, 1997; Spriggs, 1996). The dominance of west New Britain obsidian in Early Lapita assemblages, including sites closer to the Admiralty sources, could be an expression of the direction of initial impetus for Austronesian expansion which on linguistic grounds came from the west New Britain region (Lilley, 1991; Ross, 1988). Unfortunately no sites earlier than the Mussau assemblages have been excavated from west New Britain to date. The dominance of west New Britain obsidian in areas beyond New Ireland such as Nissan (Spriggs, 1991) or in the earliest Remote Oceania sites of the Santa Cruz and Reef Islands (Green, 1987) indicates that the initial colonization of this region occurred during the phase when west New Britain and not Admiralty obsidian dominates.[2] Although the Santa Cruz and Reef Island assemblages are defined as Middle Lapita, the dominance of west New Britain obsidian indicates that the early movement out of the Bismarck Archipelago and into Remote Oceania occurred in the Early Lapita/Middle Lapita time span. Thus, the association of west New Britain obsidian with the initial spread of Lapita communities into and out of the Bismarck Archipelago occurred when these societies were the most mobile. Kirch's (1988*a*) model of exchange as a "lifeline" back to a homeland (see also Green, 1976; 1979: 45; 1987: 246) is applicable here.

It is only after Remote Oceania was colonized for the first time by peoples from the Bismarck Archipelago that what has been referred to as the "two major spheres of obsidian networks" developed. As noted earlier this may be no more than a result of a change from a mobile to a more sedentary settlement pattern. Obsidian was initially distributed with the initial impetus of expansion from west New Britain, followed by a more sedentary settlement pattern leading to a distribution pattern where closeness to the source accounts for the majority of obsidian found. Whether obsidian was obtained by direct procurement, traders or down-the-line exchange is unknown, although either (*a*) direct procurement or (*b*) procurement from the source then exchange between few socially related groups, has the advantage of explaining the expedient nature and social value of the obsidian assemblage. The social value of obsidian thus need not have changed over time within these societies. Furthermore, obsidian from the more distant source regions is still found in the later Lapita assemblages, for example, west New Britain obsidian found in Mussau Islands assemblages or Admiralty obsidian in the Arawe assemblages. The presence of a piece of Admiralty obsidian in the Arawe assemblage of Apalo does not demonstrate a specialized exchange network out of the Admiralty Islands. It does indicate that interactions and processes other than economic ones are at play.

Assemblages more distant from the source regions, such as Watom, the Duke of Yorks, and Anir Island, show similar changes in the proportions of Admiralty and New Britain obsidian over time which could indicate either changing exchange links with the source areas (Gosden *et al.*, 1989: 575; Green & Anson, 1991; White & Harris, 1997) or just changes in local exchange links with nearby communities. As noted earlier, more work is needed to refine the transition by technological analyses of Middle and Late Lapita assemblages.

The last 1600 years. In this period there are two major spheres of obsidian distribution: a "northern west-east" distribution out of the Admiralty Islands and across to central New Ireland including all the offshore islands; and a southern distribution including the whole of New Britain and the southern third of New Ireland. An understanding of the nature of these exchange configurations is hindered by a lack of detailed technological analyses of the post-Lapita and recent obsidian assemblages located away from the source areas. Such analyses are needed to identify the role of exchange in this time period in much the same way that Sheppard (1992, 1993) has done for the Lapita assemblages of Santa Cruz and the Reef Islands.

The limited evidence that is available suggests that, unlike the earlier periods, the obsidian in the Bismarck Archipelago was curated and economized. For instance, within the later southern New Ireland assemblages White (1997) argues that flakes from Admiralty obsidian were smaller, i.e. more reduced. He considers that "the more distant material is distinguished by users, perhaps pointing to a down-the-line exchange network" (White, 1997: 145). The small size of the pieces of Admiralty obsidian in these assemblages thus suggests that they passed through more hands, or nodes of exchange, before being used and discarded. If so, a simple down-the-line model for exchange, which was associated with an economical and curated use of obsidian, may be applicable for this late period for many parts of the Bismarck Archipelago.

Further technological analyses of assemblages from the last 1,600 years may thus show a non-expedient economizing behaviour different to that from the previous Lapita phases. Technological analyses could test the model that there was a change from either direct procurement or procurement from the source then exchange between few socially related groups as seen between settlements in the Lapita phases, to down-the-line exchange between socially unrelated groups seen in the ethnohistorical period. If proven, such studies could give time depth to the down-the-line exchange of obsidian seen in the ethnographic present (Chowning, 1978; Specht, 1981; Fullagar *et al.*, 1991; Parkinson, 1999). Until such technological analyses take place, however, interpretations are limited.

The development of the two major spheres of obsidian distribution within the last 1,600 years out of the preceding Lapita phases in association with a change from expedient to non-expedient technology would indicate changing mechanisms of exchange and micro-social configurations. The area where the two exchange networks meet in southern New Ireland coincides with a cultural boundary which was recorded by German observers in the late nineteenth and early twentieth centuries. Parkinson (1999: 117) records that the inhabitants of the southern part of New Ireland “are closely related to the inhabitants of the Duke of York Islands and of the northeastern Gazelle Peninsula”. This is also seen in the distribution of men’s societies and cultural practices such as the “duk duk” recorded in southern New Ireland, the Duke of Yorks and amongst the Tolai of the Gazelle Peninsula. It is in contrast to the cultural practices of the Mandok, Notsi, Nelik, and other speakers of central and northern New Ireland who participated in Malaggan ceremonies.

A clue to the formation of a cultural divide is provided by Specht, who in 1973 argued that the period from 1,000 to 750 years ago was one of change in the coastal regions. He (1973: 449) noted that “Watom was totally devastated about 1,000 years ago by volcanic eruptions that created the Rabaul caldera, and was reoccupied, perhaps by the antecedents of the present Tolai inhabitants, about 750 B.P.”. Could the boundary between the two major spheres of obsidian be reflecting the cultural divide between the antecedents of the Tolai and peoples to the north in New Ireland?

In this context Jim Allen’s comments on the relationships between territories are pertinent. Although referring to the Pleistocene, it equally applies to the Holocene post-Lapita phases. When comparing the obsidian distributions between north and south New Ireland, Allen argued that as more Bismarck sites were settled, “relationships between territories: around the archipelago presumably also evolved structurally” (Allen, 1996: 21). He noted that this developmental model “involving considerations like boundary formation and the regularising of across-boundary social relationships through trade, has many analogues in later Melanesian prehistory” (Allen, 1996: 21). Such a development in boundaries separating socially unrelated groups could be what was happening from the post-Lapita transition period onwards. Prior to that, the Lapita settlements would have formed one socially homogeneous group, which began to break up towards the end of the Late Lapita period. During the Lapita period, the non-Austronesian Lapita settlements whose ancestry went back over 35,000 years in the Bismarck Archipelago would have had other social boundaries and relationships which are not covered in this article, due mainly to the lack of excavated non-Lapita archaeological sites from this period.

Conclusion

The allocation of obsidian artefacts from Anir to their sources and their placement within the changing temporal configuration of obsidian distribution has added and further refined patterns identified by Ambrose (1976; 1978), White (1996) and Fredericksen (1997). It is now beyond doubt that west New Britain obsidian dominates the Early Lapita assemblages throughout the Bismarck Archipelago; and that while west New Britain obsidian continues to dominate assemblages close to those sources, Middle Lapita assemblages in the eastern Bismarck Archipelago region are dominated by Admiralty obsidian. Later assemblages indicate that regional obsidian distribution patterns changed yet again with west New Britain obsidian regaining dominance in east New Britain and southern New Ireland, particularly in the last 1,600 years. Yet, it is argued here that the development of these two obsidian distribution networks (one out of west New Britain and the other out of the Admiralty Islands) does not equate with major divisions within Lapita society in the Bismarck Archipelago. A model incorporating changing mobility strategies towards a more sedentary society after the initial colonization movement out of the Bismarck Archipelago could explain the beginning of these obsidian networks. Based on current limited technological studies it is proposed that the social value of obsidian did not diminish in the Middle and Late Lapita periods and the movement of obsidian took place between socially related groups. In contrast, in many parts of the Bismarck Archipelago, assemblages of the last 1,600 years are expected to indicate a non-expedient technology and that down-the-line exchange took place.

This paper highlights a number of concerns affecting modelling patterns in the distribution of obsidian. The first is the problem of relying solely on obsidian distribution patterns in modelling Lapita society. Only when changes in pottery assemblages from different parts of the Bismarck Archipelago were compared with changes in the obsidian assemblages could insights be made into the significance of the development of two obsidian distribution networks and their relationships to any change in Lapita society. The second is that the paper notes the limited number of technological analyses conducted on Lapita obsidian assemblages within the Bismarck Archipelago. Yet it is from these few technological analyses that the modelling of the social value of obsidian mostly depends. Further technological analyses on Lapita obsidian assemblages must be a priority for the future. Another issue, which was not addressed in this paper, concerns the non-Austronesian inhabitants of the Bismarck Archipelago, their use of obsidian and their changing relationship with the Austronesian settlers of the region over time. This is an area of study that is poorly understood and in urgent need of more research including fieldwork. Only when such fieldwork and technological analyses are undertaken can a more accurate model of obsidian distribution be formulated.

Notes

1 Site SEE, for instance, has dentate pottery with the form and decoration of Early Lapita. Most of this pottery, however, was found within 10 cm of the surface with the rest found spread out in the top three layers (White & Harris, 1997: 100). Although White and Harris entertain possible disturbance due to late nineteenth century European traders, the more likely cause of disturbance, given the island location opposite the volcanoes of northeast New Britain, is a tsunami. The radiocarbon date from SEE is 3,090±60 B.P. (SUA 3082) on shell which calibrates to 3,000(2,847)2,740 cal. B.P. (Summerhayes, 2001*a* has calibration details) and thus should not be associated with the deposition of this early pottery, in particular when details about the layer from which the sample was taken have not yet been published.

[2] East of the southeast Solomon sites obsidian is rare with only a handful of pieces found in Lapita contexts in New Caledonia (sourced to west New Britain—Sand & Sheppard, 2000), Malo (sourced to West New Britain, Admiralties and the Banks—Ambrose, 1976), Tikopia (sourced to the Admiralties—Spriggs, 1997) and Naigani in Fiji (sourced to west New Britain—Best, 1987). These few pieces are not part of the exchange system to the west that incorporated the Reef and Santa Cruz Islands sites (see Summerhayes, 2000*a*: 10–11 for details). Most of the obsidian is found in Middle Lapita assemblages, including Naigani (Summerhayes, 2000*a*). Tikopia on the other hand is Late Lapita. The presence of Admiralty obsidian in Late Lapita contexts suggests continued infrequent contact with the west.

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Stone Mortar and Pestle Distribution in New Britain Revisited

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ABSTRACT. This is the first of a series of regional studies on the distribution of stone mortars and pestles in Papua New Guinea (PNG). The pan distribution of these artefacts in New Britain, in conjunction with preliminary results from other parts of PNG, supports the view that there is a positive correlation in the distribution of stone mortars and pestles and taro cultivation. This result raises the possibility that these artefacts provide a signature of where people were growing taro in PNG from about 7,000 to 3,500 years ago.

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By using the distribution of stone mortars and pestles in Papua New Guinea, it may be possible to track the geographic extent of human settlement dependent on taro from about 7,000 to 3,500 years ago, the age range for dated mortar finds. This paper is the first of a series of regional studies that aims to test this hypothesis by examining the distribution of these artefacts and the subsistence potential of each study area.

The possibility that most mortars and pestles might be quite old was first proposed by White & O'Connell (1982: 192). Four mortars have been dated; they all come from the highlands. Two dated respectively at c. 4,560 B.P. and 7,000–7,500 B.P. are from Warrawau and Kuk, both swamp sites near Mount Hagen in the Western Highlands (Golson, 2000: 231–248). The third dating to <4,500 B.P. is from Nombe cave site in Simbu (Ambrose, 1996–1967: 1087; White, 1972: 134). The fourth dating to c. 3,500 B.P. is from NFB, an open site just south of Kainantu in the Eastern Highlands (Ambrose, 1991: 462; Watson & Cole, 1977: 193). What was initially identified as a mortar fragment from Wanelek is now confirmed as being a potsherd (S. Bulmer, pers. comm., 2000). No pestles have been dated. Some mortars may have been made in the recent past until the 1970s for use in ritual purposes in the Southern Highlands. Mortars were also made for pounding puddings in the 1960s at Mbiche village on Nggatokae Island in the Solomon Islands (Swadling, 1981: 52–53).

Pretty (1965) was the first to attempt a PNG wide distributional study but, apart from regional studies such as that by Specht (1966), there has been little attempt to update his work until now.

Results and discussion

Jim Specht's comprehensive article on stone mortars and pestles in New Britain was published in 1966 in the *Journal of the Polynesian Society*. After the passing of more than three decades it seems fitting to revisit this topic in a volume produced in his honour.

Specht (1966) listed 11 mortars and pestles for what is now West New Britain province, 15 for East New Britain (Tables 1 and 2), as well as large rocks with mortar-like

Table 1. Documentation history of mortars and pestles in West New Britain.

item	year	reported or acquired by	location	first published or illustrated
pestle*	<1899		Unea	Parkinson, 1899
pestle	1910–1912	Capt. Voogdt	French Islands	
mortar*	1926		SepSep†	Chinnery, 1926: 22
mortar*	<1933		SagSag	Sherwin & Haddon, 1933
mortar	1939	Louis Searle	Airagilgua area	
pestle	1939	Louis Searle	Airagilgua area	
pestle*	<1946–1949		Kandrian	Bühler, 1946–1949: fig. 3n–o
pestle*	<1946–1949		Gasmata	Bühler, 1946–1949: fig. 3i
pestles* (3)	<1952		Talasea	Goodenough, 1952
mortar*	1952		Talasea	Goodenough, 1952
mortars (2)	1959	J.K. McCarthy	Talasea	
mortar	1967	A. Gerbrands	Wankute, near Kilenge	
mortar*	<1955		Unea	Riesenfeld, 1955
mortar*	<1966	W.H. Goodenough	Hoskins Peninsula	Specht, 1966: 381
mortar	1970	A. Gerbrands	Kilenge	
pestle	1973	A. Gerbrands	Kilenge area	
mortar	1979	Joseph Goru	Dami, Talasea	
pestle	1979	O. Kaiku	Avalgin	
pestle	?1970s	Morris Young	?Gloucester	
pestle	1980a	John Namuno	Gilnit, (Gilinit) Gloucester	
pestle	1980b	John Namuno	Gilnit, (Gilinit) Gloucester	
pestle	1981	Jim Specht	Sangkiap, Passismanua	
pestle	1981	Mathias Baki	Ganeboku, (Ganemboku) Talasea	
mortar	1981	Marsha Berman	Pililo Island (Pileo)	
pestle	1981	Marsha Berman	Pililo Island	
pestle	1981	Elsie Marlissa	Valoka, Hoskins	
mortar	1982		Valoka, Hoskins	
pestle	1982		Igi	
mortar	1985	John Namuno	Dami, Talasea	
pestle	1980s	John Namuno	Gilnit, Gloucester	
pestle	n.d.	John Namuno	Asalmepua (Asilimapua)	
pestle	n.d.	John Namuno	SagSag	
pestle	n.d.	John Namuno	Umbili, Central Nakanai	
pestle	n.d.	John Namuno	Gilnit, Gloucester	
pestle	n.d.	John Namuno	Asalmapeo (?Asilimapua)	
mortar	1990s	John Namuno	Bitokara	
pestle	1990s	Robin Torrence	Ruango	
mortar	1999	Robin Torrence	Beremone (Talasea)	
mortar	2000	Peter Nuli	Morokea, (Morokia) Talasea	
mortar	2000	Robin Torrence	Garua	

* Listed by Specht (1966).
† Riesenfeld (1950: 276) wrongly attributes the SepSep mortar to neighbouring Bungi Island.

depressions and three pestles on Umboi Island in Morobe province. In 2000 my database[1] had expanded this list to 43 mortars and pestles in West New Britain and 29 in East New Britain. The located provenances for these finds are shown on Fig. 1. As the specific locations for both mortars and pestles are given in Tables 1 and 2 they are not discussed separately in this paper. None of the finds come from dated contexts in archaeological sites. Some were surface finds and others were unearthed by gardeners and bulldozers.

In 1966, Specht reported more finds from East New Britain than West New Britain. The opposite was the case in 2000. The difference reflects the efforts of John Namuno and other staff of the West New Britain Cultural Centre in Kimbe and the research interests of staff and associates of the Australian Museum in the Talasea and Kandrian areas. The main researchers involved have been Jim Specht in both areas and Robin Torrence in the Talasea area. It should be noted that no systematic field survey has been made of these artefacts in either province.

Jim Specht found he could not draw any conclusions from the distribution of recorded finds (Specht, 1966: 379). Working with a larger sample my paper examines how the current distribution of finds relates to the distribution of agricultural land and the main subsistence crops that were grown before 1870.

In 1993 John Saunders published the results of his agricultural land use survey of Papua New Guinea based on interpretation of aerial photographs (Saunders, 1993). His map of agriculturally used land provided a spatial basis for a national survey of agricultural systems which was carried out from 1990 to 1996 by staff from the Department of Human Geography, RSPAS, at the Australian National University, the PNG Department of Agriculture and Livestock, and the University of Papua New Guinea. The

Table 2. Documentation history of mortars and pestles in East New Britain.

item	year	reported or acquired by	location	first published or illustrated
mortar*	<1907		Varzin Plantation	Parkinson, 1907: fig. 99
pestle*	<1907		Watom	Parkinson, 1907: fig. 100
mortar*	<1909		Baining Mountains	Bley, 1909: 525
pestle*	<1909		Nambung river	Bley, 1909: 525
mortar*	<1913		Vunagalip	Burger, 1913: pl. 1
pestle*	<1913		Vunagalip	Burger, 1913: pl. 1
pestle*	<1913		Cape Lambert	Burger, 1913: pl. 1
pestle*	<1913		Bandarungum	Burger, 1913: pl. 1
pestles* (2)	<1949		Jacquinot Bay	Bühler, 1946–1949: fig. 3d–e
mortar*	<1950	Mr E.D. Clarke	Rabaul	Specht, 1966: 379
pestle*	1950	Mr E.D. Clarke	Rabaul	Specht, 1966: fig. 2
mortar	1960	S.G. Simpson	Livua, Bainings Mts	
pestle	1960	S.G. Simpson	Livua, Bainings Mts	
pestles (2)	1963	D. Maclean	Doilene Plantation	
mortar*	1965	Mr Garrett	Varzin Plantation	Specht, 1966: pl. 1
mortar*	1965	Mr Vale	Vunairoto	Specht, 1966: pl. 2
mortar*	1965	Jim Specht	Vunairoto	Specht, 1966: fig. 1
pestle	1966	Brother Dent	Vuvu near Kokopo	
mortars	1980		forest behind Kerevat	
pestles	1980		forest behind Kerevat	
pestle (7)	1987	L. van Bussel	Maso	

* Listed by Specht (1966).

two volumes on East and West New Britain were edited, respectively, by Bourke and colleagues (1996*a,b*).

Since about 1870 new subsistence crops have been introduced to New Britain. The new crops originated from South America and Asia. They are the sweet potato, cassava, Chinese taro (*Xanthosoma*) and triploid bananas. Some of these replaced traditional crops as the most important food grown in gardens. This commenced in the 1950s and in more isolated areas took place in the 1970s. Taro declined in significance on the Gazelle Peninsula in the 1950s (Bourke, 1976). A marked decline in taro production in West New Britain began in about 1960 when taro blight reached there (Chowning, n.d. cited in Bourke *et al*., 1996*b*). The main subsistence crops grown in both provinces before the post-1870 introduction of Asian and South American cultivars is shown on Fig. 2. With few exceptions, *Colocasia* taro was the main food grown throughout New Britain prior to 1870, with a varying complement of minor staples like banana, yam and *Alocasia* taro (M. Bourke, pers. comm., 2001).

To assess the relationship of the current mortar and pestle finds (Tables 1 and 2) with the distribution of agricultural land across New Britain, I have plotted the finds against the agricultural systems map produced by Bourke and colleagues (1996*a,b*) and included the plantation land plotted by Saunders (1993). Taking into account the serendipitous nature of the finds reported here, there is a pan New Britain distribution of mortars and pestles (Fig. 1). Taken alone this would not seem significant, but from a larger perspective this is an interesting finding as this pattern is not the case across Papua New Guinea. For instance, mortars and pestles are absent from the densely settled Wosera-Abelam area of the East Sepik and also the Markham valley of Morobe province. Unlike most areas of New Britain, the dominant subsistence crops grown in the Wosera-Abelam area and the Markham valley are, respectively, yam and banana.

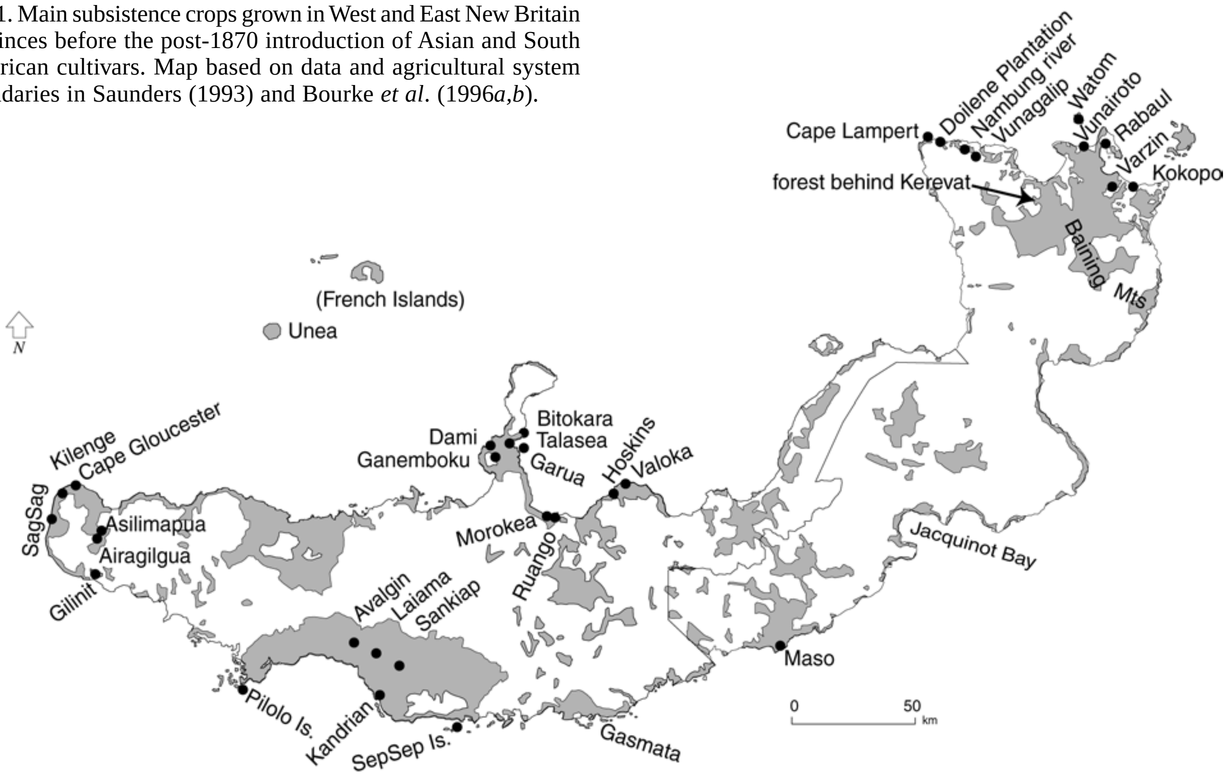

Fig. 1. Main subsistence crops grown in West and East New Britain provinces before the post-1870 introduction of Asian and South American cultivars. Map based on data and agricultural system boundaries in Saunders (1993) and Bourke *et al*. (1996*a*,*b*).

Conclusion

Initial results from this study and preliminary results from other parts of PNG give a positive correlation in terms of the distribution of mortars and pestles and the cultivation of taro. This raises the possibility that mortars and pestles provide a signature of where people were growing taro in PNG from about 7,000 to 3,500 years ago.

Studies are now required to see if taro starch residues, possibly along with nuts, are present on the work surfaces of mortars and pestles. Those from New Britain would make a good pilot study. If taro starch residues are present, these artefacts can then be associated with a particular subsistence crop and seen as a marker of a particular cuisine which, like the smoking of tobacco, crossed language and other cultural boundaries.

Notes

1 This database was started when I was working at the PNG National Museum. Filemaker Pro is used for catalogue data and images, and MapInfo for distributional data. Once the project is completed the data will be returned to the Museum on CD and copies also deposited at the Australian Museum and Australian National University. Anyone interested in contributing information to this database please contact the author.

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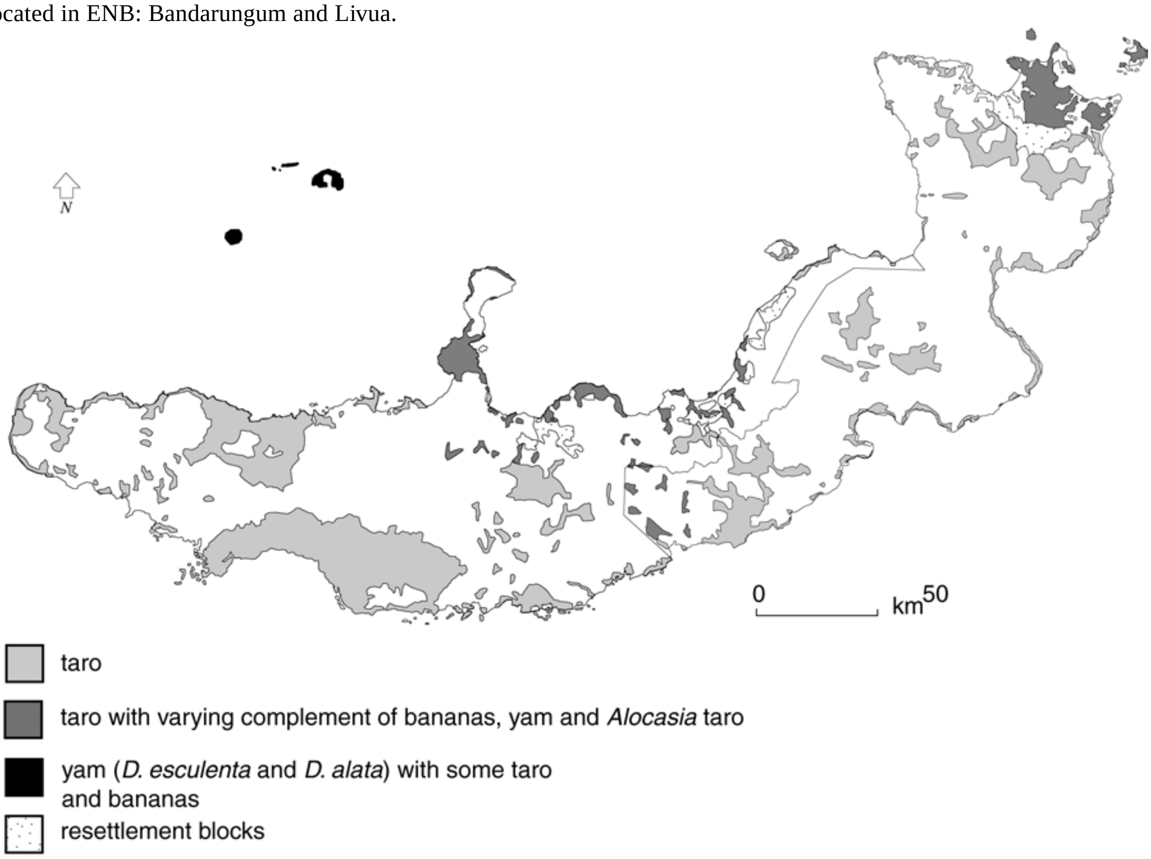
Fig. 2. Agricultural land in West and East New Britain provinces and mortar and pestle provenances (agricultural land based on Saunders, 1993 and Bourke *et al.*, 1996*a,b*). Provenances not located in WNBL: Igi and Umbili (central Nakanai); provenances not located in ENB: Bandarungum and Livua.



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Pre-Lapita Valuables in Island Melanesia

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ABSTRACT. An unusual obsidian stemmed tool found by Jim Specht at Boku Hill, West New Britain, Papua New Guinea, provides evidence for the existence of valuables in the pre-Lapita period. The large amount of skill, care, and effort invested in the manufacture of this large artefact combined with its symmetry and fragility imply that, unlike the other stemmed tools found at the site, Specht's find was not used in an utilitarian context. As in the case of axes in the Highlands of New Guinea, stemmed artefacts were therefore both useful tools and non-utilitarian objects which circulated in some form of ceremonial exchange system and for which control of the Kutau/Bao obsidian sources may have been important. The occurrence of valuables pre-dating Lapita pottery demonstrates that social systems based on ceremonial exchange and prestige goods were not imported, but developed *in situ*.

TORRENCE, ROBIN, 2004. Pre-Lapita valuables in island Melanesia. In *A Pacific Odyssey: Archaeology and Anthropology in the Western Pacific. Papers in Honour of Jim Specht*, ed. Val Attenbrow and Richard Fullagar, pp. 163–172. *Records of the Australian Museum, Supplement* 29. Sydney: Australian Museum.

It is well known among Melanesian archaeologists that Jim Specht has an uncanny ability to find important sites, often those with the early dates that are highly prized in this discipline. He excavated Misisil Cave, which for many years represented the earliest occupation of the Papua New Guinea islands (Specht *et al*., 1981; 1983); he began work in the Yombon area and found pottery (probably Lapita plainware) far inland of its normal distribution (Specht *et al*., 1981); he led Christina Pavlides to sites near Yombon mission where she found the earliest evidence for colonization of New Britain (Pavlides, 1999; Pavlides & Gosden, 1994); and he also began work at Kilu Cave on Buka, which later produced the earliest date for the Solomon Islands (Wickler & Spriggs, 1988). Although his achievements are perhaps not unexpected, since he has been exploring Melanesia for many years, I believe he has a gift. Not only did he, "by accident," find obsidian stemmed tools in the base of a new latrine at Bitokara Mission, an event which led to the excavation of the type site for the region and set the basis for the use of volcanic stratigraphy within landscape archaeology (cf. Specht *et al*., 1988; Specht *et al*., 1991; Torrence *et al*., 1999*a*, 2000), but recently he also made a find with much significance for Melanesian prehistory, as I hope to demonstrate in this paper.

A remarkable discovery

During the 1999 field season, Jim and I visited the newly developed Garu Plantation, part of the Numundo Group owned by New Britain Palm Oil Ltd (Torrence *et al*., 1999*a*) with a number of team members. The manager, Kefu Boromana took us to the top of Boku Hill where he had observed obsidian artefacts in an area recently levelled by bulldozer for a new house (Fig. 1). The hill is approximately 80 m a.s.l., overlooks an extensive peat swamp and has views stretching to the sea on the west side of the Willaumez Peninsula (about 10 km away). A small raised area on the north west side had been pushed over the edge of a steep cliff to provide the required level surface. As a result, most of the archaeological material dating to at least the past 6,000 years had been removed. Obsidian flakes were thinly

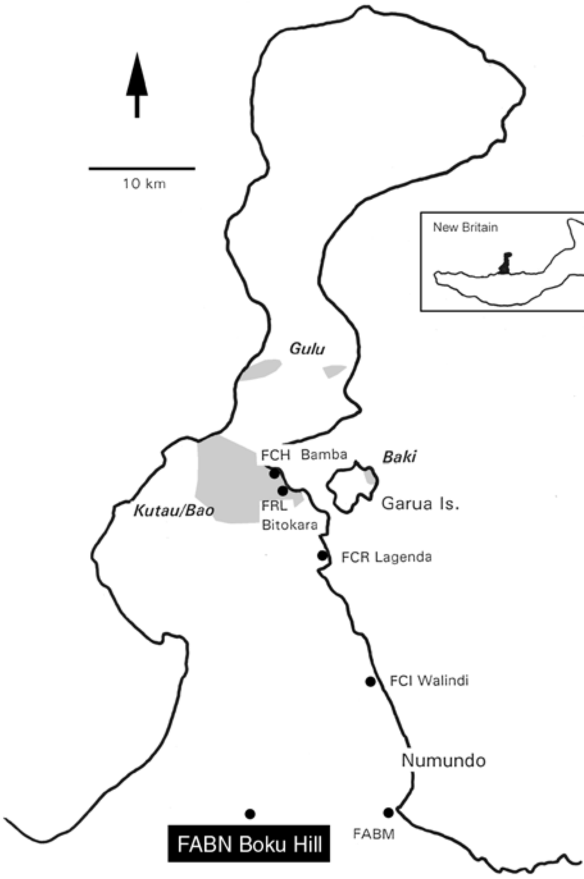


Fig. 1. Location of the Willaumez Peninsula and sites mentioned in the text. Obsidian sources are in italics. Shaded area shows distribution of obsidian outcrops.

scattered over the damaged area and careful survey also produced several pieces of Lapita pottery and a small stemmed tool (Fig. 2).

Jim found a patch where the bulldozer had removed the distinctive W-K2 tephra dated to c. 3,600 B.P. (Torrence *et al*., 2000) revealing the red-brown clay beneath. He targeted this area for his search and before long had recovered most of a second and very distinctive stemmed tool with a fresh break. The remainder was found by Leigh Jago a week later in spoil about 100 m away. The artefact has since been restored by the Materials Conservation Division at the Australian Museum and returned to the National Museum and Art Gallery, PNG (Fig. 3). About a month later, one of the workmen sold a third stemmed tool, supposedly found at the same location, to a local collector (Fig. 4). All in all, then, three stemmed tools with widely ranging shapes and sizes have been found in the disturbed area of Boku Hill.

Jim's discovery of a highly worked stemmed tool on Boku Hill (FABN) on Garu Plantation, West New Britain (Figs. 1 and 3) has opened up new possibilities for understanding the nature and evolution of prehistoric societies in Melanesia. In this paper I argue that the three stemmed tools provide significant new information about this enigmatic class of artefact and that these new data raise important questions about the nature of society in West New Britain prior to Lapita pottery. On the basis of this new find combined with recent research, I conclude that the concept of "special artefacts" or "valuables" was present in West New Britain in the period before 3,600 cal. B.P. (cf. Araho *et al*., 2002).

Boku Hill

The Boku Hill site represents an unusual environmental setting for both Lapita pottery and stemmed tools. Along with the three stemmed tools, eight potsherds (five plain and one each dentate-stamped, incised rim and notched rim) were found in the bulldozed area. We can only provide a dated archaeological context for these surface finds by correlation with similar material recovered in the local region. Using this approach, summarized below, it is clear that the stemmed tools derive from a context which precedes that of the Lapita pottery which is clearly separated from it at this site by the distinctive W-K2 tephra.

Three small test pits (a total of 2.5 sq m) were excavated on Boku Hill, but these produced disappointing results. Within the most successful test pit (XXV), a good sequence of Holocene tephras derived from the Witori volcano was preserved *in situ*, thereby providing an excellent source for relative dating using reference to the well-studied tephra stratigraphy of the region (e.g., Machida *et al*., 1996; Torrence *et al*., 1999*a*, 2000). Obsidian artefacts were recovered from soil underneath the W-K1 tephra as well as on soils developed on the following tephras: W-H4/5; W-K4; W-K2; W-K1. The relative age of the artefacts can be determined with reference to the dates for the tephras listed in Table 1. No stemmed artefacts or pottery were recovered from the test pits. The data nevertheless demonstrate that the site had been used periodically through much of the Holocene with a significant break between the W-K3 and W-K4 tephras.

Table 1. Approximate dates for Witori tephras (in calendar years) based on radiocarbon dates presented in Torrence *et al*. (2000) and Machida *et al*. (1996).

tephra	date (cal. B.P.)
W-K1	5,900
W-K2	3,600
W-K3	1,700
W-K4	1,400
W-H4/5	500

Obsidian from test pit XXV has been characterized using PIXE-PIGME with the machine conditions described in Summerhayes *et al*. (1998: 139). Thirty-five artefacts within soils on the W-K4 and W-K2 tephras and under the W-K1 tephra were assigned to the Kutau/Bao source group (Fig. 1). One piece from the earliest sample was sourced to Gulu and one from the most recent context to the Baki source. The dominance of the Kutau/Bao source during the Holocene fits what is known elsewhere in this region (Summerhayes *et al*., 1998; Torrence & Summerhayes, 1997).

It seems reasonable to suppose that the ceramics at Boku Hill were derived from the soil formed on the W-K2 tephra and sealed by the W-K3 tephra, as is the case in all known excavated cases in the region: e.g., at the nearby Numundo sites (Torrence *et al*., 1999*a*) and FRI at Walindi (Specht *et al*., 1991). This would place the pottery at between 3,600 and 1,700 cal. B.P., which seems reasonable given radiocarbon dates for the Willaumez Peninsula (Specht & Gosden, 1997; Torrence & Stevenson, 2000). The finding of Lapita pottery 10 km inland and adjacent to an extensive swamp raises interesting issues about the kind of subsistence patterns at this time and the nature of recolonization of inland regions following abandonment caused by the W-K2 volcanic event.

In contrast, the stemmed tools most likely derive from the preceding, pre-W-K2 contexts. It is therefore relevant that the stemmed tool which Jim found was lying on pre-W-K2 clay soils, whereas most potsherds were found in other parts of the disturbed area. Within the vicinity only one stemmed tool has been found *in situ*, at site FABM. It was found in a clay soil stratified underneath the W-K2 tephra, which means it would pre-date 3,600 cal. B.P. The absence of the W-K1 tephra at FABM, however, leaves us with only the youngest date for the artefact. Stemmed tools have been recovered at Bitokara Mission (FRL) from below both the W-K2 and W-K1 tephras and on Garua Island from below the W-K2 tephra (Specht *et al*., 1988; Torrence *et al*., 1990; Kealhofer *et al*., 1999; Torrence *et al*., 2000), but we lack radiocarbon dates for the oldest contexts. Only two fragments have been found in younger layers (Ambrose & Gosden, 1991; Torrence, 1993) and so these are now thought to have been scavenged from earlier sites rather than in original contexts.

Given the previous findings on the Willaumez Peninsula, we can confidently conclude that stemmed tools date to only the early to mid Holocene period, beginning sometime before the W-K1 eruption at 5,900 cal. B.P. and terminating with the W-K2 eruption at about 3,600 cal. B.P. Ceramics, however, belong to the period between the W-K2 and W-K3 tephras. We can safely conclude that the Lapita pottery and stemmed tools from Boku Hill were derived from different contexts and that the stemmed tools definitely pre-date the ceramics.

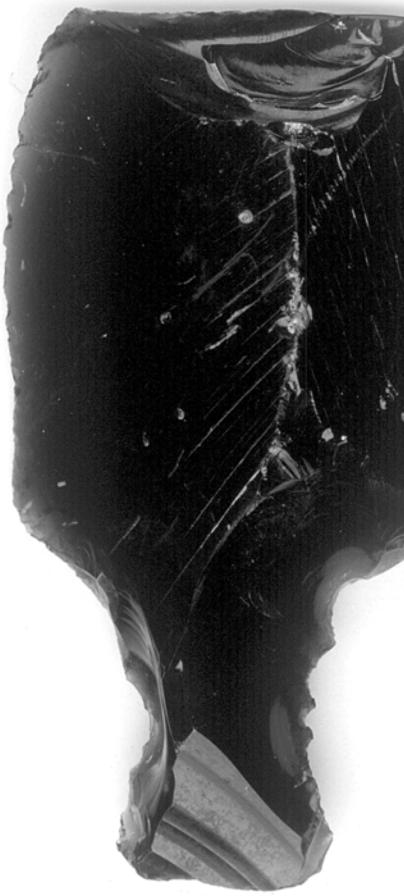


Fig. 2. Stemmed artefact FABN-M001. Original length is 5.6 cm. (Photo by Robin Torrence).

Stemmed tools

All three stemmed tools found on Boku Hill belong to Araho's (1996) type 2 which includes retouched flakes (Figs. 2–6). Within this general group many stemmed artefacts are made from kombewa type flakes (Inizan *et al*., 1992: figs. 18, 19). These are made by striking a blow across the ventral side of the flake to remove a portion of the bulb of percussion which was then retained as the dorsal side of the resulting flake. Consequently, the distinctive kombewa flake had smooth, rounded surfaces on both sides. Next, the flake blank was bifacially retouched to form the distinctive stem (Araho *et al*., 2002).

The Boku Hill stemmed tools are quite important because very little is known about these distinctive retouched forms from contexts outside the immediate periphery of the obsidian sources at Mopir (Fullagar *et al*., 1991) and the Willaumez Peninsula (e.g., Araho, 1996; Araho *et al*., 2002; Fullagar, 1992; 1993; Kealhofer *et al*., 1999; Rath, 2000; Specht, 1973; 1974; Specht *et al*., 1988; Swadling, 1981; Torrence *et al*., 1990). The stemmed tools found at the obsidian sources, production sites, and other sites assumed to represent tool use are extremely variable in shape and size with few clear cut distinctions that might indicate well-demarcated functional categories (e.g., Araho, 1996). The large variability is not surprising, however, given that many were probably rejected during manufacture and that standards of acceptability may have been higher at places where raw material was abundant.

What were stemmed tools used for? What was their role within society? Three hypotheses have been put forward to explain the function of stemmed tools in prehistoric societies in West New Britain (Araho *et al*., 2002). Firstly, I have proposed that they were utilitarian tools with an important role for a highly mobile society (Torrence, 1992; 1994). In this view, stemmed artefacts were portable, general purpose tools that were used and reworked so that they lasted a relatively long period of time. These curated tools would have enabled the users to carry out tasks without needing fresh supplies from the obsidian sources. Occasionally, people would return to the sources to replenish their obsidian tools, but in the meantime they could tolerate prolonged absences from the sources and did not have to make trips to obtain needed material. Support for this model has been provided by use-wear and residues studies (Fullagar, 1992; 1993; Kealhofer *et al*., 1999) which show that the stemmed tools were used in a wide range of tasks mostly involving plants, although some blood residues are also preserved on them. A second hypothesis was put forward by Araho (1996) who argued that the finished tools were highly distinctive trade goods. Araho was not explicit whether the trade was utilitarian or ceremonial. He also made the useful observation that since raw lumps of obsidian were the main source of trade in recent times (cf. Specht, 1981), the stemmed tools must have circulated in a different type of exchange system in which added value was invested into finished products.

Thirdly, Araho *et al*. (2002) have proposed that both hypotheses are correct, but incomplete. In their view, stemmed tools are a highly variable class of objects that incorporates both utilitarian objects and valuables. As with stone axes in recent New Guinea Highlands societies, which have been variously categorized as work, bride price, or

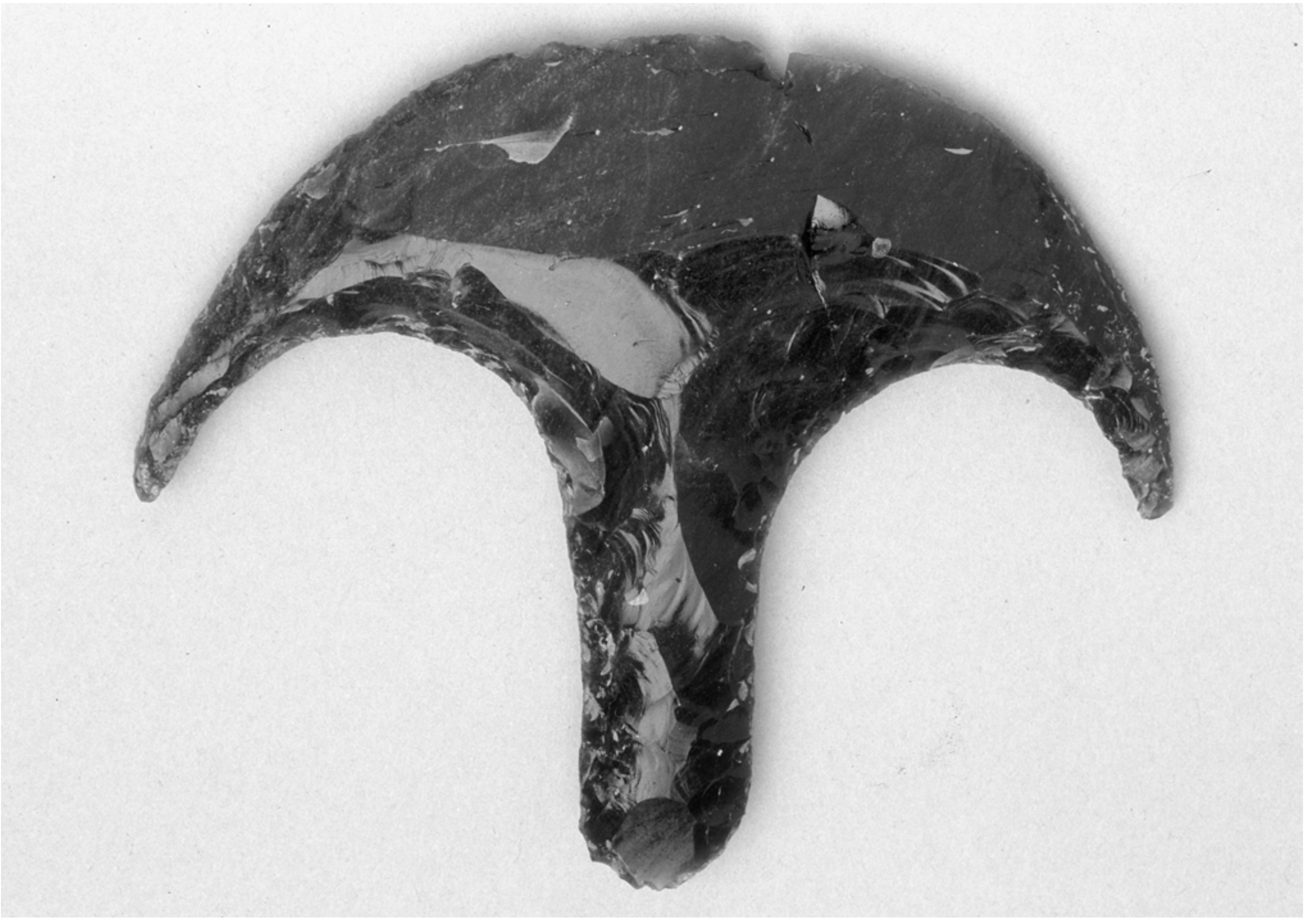


Fig. 3. Stemmed artefact FABN-M002. Original length is 10.7 cm. (Photo by Paul Ovenden).

ceremonial axes depending on their size and shape and/or the social context in which they were used (e.g., Burton, 1984, 1989; Strathern, 1969: 320–323; White & Modjeska, 1978), we suggested that the West New Britain obsidian stemmed tools were also multi-purpose. The implication of the hypothesis for stemmed tools as valuables is that ceremonial exchange or something like a prestige-goods economy, possibly one which revolved around the existence of differential status categories, operated in this area before the time of Lapita pottery.

Boku Hill artefacts

The three Boku Hill stemmed tools provide support for the Araho *et al*. (2002) hypothesis because both utilitarian and "special" kinds are represented at a single locality. It seems very unlikely that they were made at the site because the appropriate cores and debitage have not been found. From test pit XXII only a small number of flakes were recovered from under the W-K2 tephra (4) or beneath the W-K1 tephra (9). A summary of the dimensions of the three Boku Hill stemmed artefacts is provided in Table 2.

FABN-M001. The smallest of the three stemmed tools (Fig. 2) is not made on a kombewa flake. Although it resembles a blade, since it has long, parallel sides and a central straight dorsal arris, the ridge is an accidental product of irregular flaking on the core. The flake scars on both sides of the ridge show that the previous flakes had been struck almost perpendicular to the direction of this flake. In other words, the maker took advantage of the configuration of flake scars on the core to remove a flake with straight parallel sides. The flake terminates with a large hinge fracture which created a smooth dull edge that would not be very useful for cutting or scraping, but a few small patches of polish from indeterminate use are nevertheless preserved. The focus of use appears to have been the two sharp margins. A stem was formed at the proximal end of the flake with bifacial retouch made up of a combination of steep, abrupt, direct flaking (dorsal side); flat, invasive, inverse retouch (ventral side); and some steep, marginal retouch on the original flake platform. Direct percussion is the most likely method for flaking. Evidence for hafting is preserved on the tool in the form of microscopic polishes on the small ridges created by the retouch. Inserting the stem into a haft would have enabled the users to access both sharp, unretouched flake margins without damage to their hands. The tool was probably discarded when the edges were no longer sharp enough for the intended function. Both edges are now dulled and bear macroscopic edge damage, especially on the left dorsal side. Kononenko (pers. comm.) conducted a use-wear analysis of the tool. She found very bright patches of polish and parallel striations on both edges and perpendicular striations on the duller left side. She hypothesizes that the artefact was used in a limited range of light woodworking tasks, such as putting the finishing touches on a wooden tool by whittling and making small cuts or notches.

FABN-JR. The second stemmed tool was also probably a utilitarian implement (Fig. 4). It was made on a very large kombewa flake. Originally it would have had a flat smooth surface on the dorsal side, but as can be seen in Fig. 4, it has

Table 2. Comparison of dimensions for stemmed tools. Data for FCR and FCH are from Araho (1996: table 5.9).

	Boku Hill-FABN			Bamba	Lagenda
	M001	JR[a]	M002	FCH[b]	FCR
sample size	1	1	1	83	1
length maximum (cm)	5.6	18.0	10.7	5.3 (1.1)	14.2
width maximum (cm)	3.2	13.0	12.9	2.6 (0.8)	14.0
thickness maximum (cm)	1.2	—	1.8	—	—
length of stem (cm)	2.1	6.0	6.6	2.1 (0.7)	6.0
thickness of stem (cm)	0.9	3.6	1.3	1.1 (1.9)	3.0

[a] Measurements taken from photo only.
[b] Means for the sample and standard deviation in brackets.

been flaked subsequently. A stem was formed at the proximal end of the flake using steep, marginal, bifacial percussion flaking. The original platform of the flake is still intact at the end of the stem. Shallow, but well defined notches were also created on either side of the stem using invasive bifacial retouch. The thick points on either side of the notch are still intact.

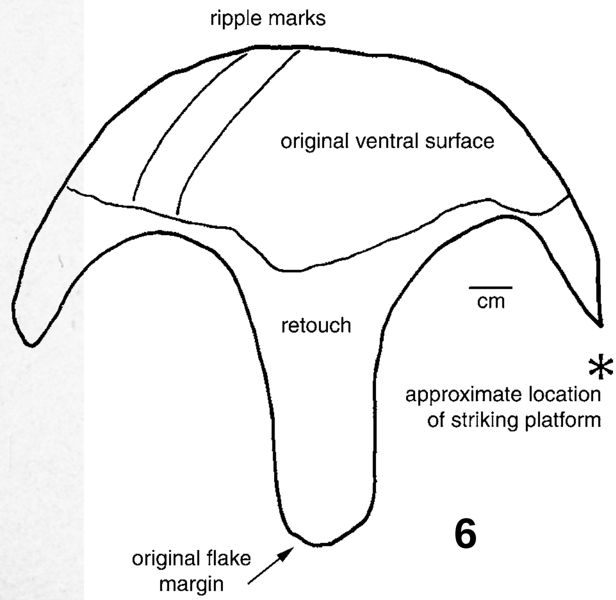
Since the periphery of the flake bears very heavy edge damage in the form of irregular, steep flake scars, mostly on the dorsal side of the flake, it was probably used. The scars are not fresh as would be expected with recent damage from the bulldozing. On one margin (right side in Fig. 4) use and retouch have combined to create a prominent notch in the edge. A large flake scar on the dorsal side was created by a blow to the distal end of the flake. It is possible that this flake was deliberately removed and so the JR tool was used both as a tool and as a core.

Artefacts M001 and JR support the original Torrence hypothesis that stemmed artefacts were multi-purpose tools and cores that fitted neatly into a highly mobile economy. The amount of edge damage on the JR artefact is much heavier than observed on most stemmed tools found in the vicinity of the obsidian sources, supporting its relatively heavy use at distance from the sources. The Boku Hill material is quite important because it represents a later stage in the use-life of these tools after they had been transported away from the place of production.

Were the utilitarian tools discarded because their useful lives had ended? This question cannot be answered sufficiently since their original use is unknown and their recently disturbed context means use-wear/residue analysis is not appropriate. M001 could easily have been thrown away because the unretouched edges were no longer sharp enough. Retouching the edge may not have been appropriate because it creates a thicker, much less uniform cutting surface than the original unretouched edges. The cutting edge of JR was also very battered and dulled, but it could have continued to serve as a core. Given the small number of obsidian flakes in the soils on top of W-K1 and W-K2 in test pit XXV, obsidian may have been in relatively short supply at this site. The quantities are far below those typically recovered on Garua Island or at Bitokara Mission (cf. Therin *et al*., 1999: fig. 23.3). Although some stemmed tools were probably made to be used, as I hypothesize was the case for M001 and JR, their role in conserving raw material for mobile users cannot be adequately tested merely on the basis of the Boku Hill finds.

FABN-M002. The third stemmed tool from Boku Hill, found by Jim Specht, is quite different from the other two (Figs. 3, 5 and 6). The high level of workmanship invested in its manufacture raises questions about the sole function of stemmed artefacts as utilitarian tools. Although slightly smaller than the JR artefact, M002 is still larger than the majority in the Araho (1996) sample of type 2 artefacts collected from the Bamba Beach site (FCH) (Fig. 1) (cf. Table 2). Although it resembles many stemmed tools made on circular kombewa flake blanks (e.g., FABN-JR, Fig. 4), this example has a much more symmetrical cross-section than most because the knapper removed the flake by striking quite close to the bulbar surface on the flake core. The direction of the blow was almost exactly parallel to the flake blank from which the M002 Kombewa flake was removed. This procedure resulted in the smooth, flat, unflaked surfaces on both the dorsal and ventral side of the finished artefact. The maker also took advantage of the original shape of the core face to create a perfectly flat, longitudinal cross-section. For the vertical cross-section there is a nearly 45 degree angle between the area of the flake that was subsequently transformed into the handle and the rest of the surface. Furthermore, the nature of the force exerted has resulted in a termination such that the intersection of the dorsal and ventral surfaces at the distal end of the flake ends in a

Fig. 4. Stemmed artefact FABN-JR. Original length is 18.0 cm. (Photo by J.Peter White).



Figs. 5 and 6. (*5*) Close up of the retouch on the notch of FABN-M002. Width of the stem is 2.2 cm (photo by Paul Ovenden). (*6*) An outline drawing of FABN-M002 showing the rings of force on the ventral side of the kombewa flake and the original position of the flake platform, which was removed to create a notch. Note that the unretouched distal end of the stem is part of the feather termination of the original flake. In contrast, the distal end of the FABN-M001 stem (cf. Fig. 2) is the original striking platform of the flake, which is much thicker and stronger than the FABN-M002 stem.

strong, sharp edge around the entire periphery, rather than a hinge or a feather-thin, fragile termination. The M002 artefact is much thinner than the JR tool or the majority of those found at FCH (Table 2).

The stem and notches of the M002 tool were formed by very regular, neatly aligned, steep, invasive bifacial flaking (Fig. 5). The stem is longer and more highly retouched than most artefacts of this type and the notches are also very deep. The ends of the notches have been carefully retouched into fragile points which are c. 0.8 cm in diameter and c. 2.5 cm long. The end of one tip is broken. As shown in Fig. 6, the original platform of the flake was located in an area which is now inside one of the notches and was removed to form the notches with their long points, leaving the central stem. Since the platform and much of the bulb has been flaked away, the stemmed tool is uniformly thin throughout. The base of the stem, where a small portion of the original ventral surface of the flake has been preserved, is extremely thin and sharp since it is the original margin of the flake. No attempt was made to strengthen the tip of the stem through retouch.

The extraordinary care and effort invested in its manufacture along with its symmetrical shape; large, flat shiny surfaces; and, most importantly, its fragility mean that M002 is highly unusual when compared to the many type 2 stemmed tools that have been found near the obsidian sources, as well as the other two examples from Boku Hill. Much careful and skilful flaking has gone into making the stem, deep notches and delicate points. I estimate that nearly half of the original flake was removed during this process. Not surprisingly, given it is so thin for its size and weight, it broke during the bulldozing, unlike the more robust JR tool which survived. Taking all these factors into consideration, it seems very unlikely that M002 was made to be used in utilitarian tasks.

Non-utilitarian artefacts

Only one other stemmed artefact known from the Willaumez Peninsula is as regular in shape and cross-section as M002, but it lacks the elaborately flaked points on the notches (illustrated in Swadling, 1981: 67, no. 4). It was found by Specht on the surface at the Lagenda site (FCR), which is located several kilometres south of the Kutau obsidian outcrops (Fig. 1). As with M002 the original flake platform of the FCR example has been removed and the stem is quite fragile. It is also larger than most of the FCH finds (Table 2).

These two extraordinary examples demonstrate that there was a distinctive class of non-utilitarian obsidian stemmed tools. Although the finding of immense skill in obsidian working within the Willaumez Peninsula prehistoric communities is not surprising given the great length of time over which obsidian has been utilized in this region (e.g., Torrence *et al*., 1999*b*) and the ease of knapping this glass, it seems unreasonable to think that so much effort would have been invested into objects that were mainly utilitarian. Within a stone-using society, people would have been well aware of the complex steps taken in stemmed tool production. They would have been able to distinguish between the more expedient manufacture of the stem in the JR tool, which took advantage of the thickest and strongest part of the flake (bulb and platform) to make the stem, as opposed to the more risky method which was used in creating the stem and notches for M002 in order to insure an overall even thickness of the tool and perfect symmetry. Furthermore, it is hard to imagine what tool-using function the long, thin points could have served (e.g., Fig. 5), other than to be aesthetically pleasing or to show off prowess in flaking. The same could be concluded for the long, thin stem with its very fragile base. If it had been incorporated within a binding or haft, the base would probably have shattered if much force was applied during use. I suspect that the tool was made for display and not meant to be hafted for use. Finally, unlike the other two stemmed tools found at Boku Hill, the quality of workmanship, the effort invested, and the fragility of the M002 tool is quite unusual: it sits far outside the normal variation for type 2 stemmed tools.

I therefore propose that the M002 stemmed tool from Boku Hill was made not as a work tool but instead had a non-utilitarian role within society. Perhaps it was made to display symmetry, perfection, fragility, shininess (cf. Taçon, 1991) and/or the skill and effort invested in its manufacture. As such, this stemmed tool could have served to symbolize status of some kind and may have circulated within a system of ceremonial exchange similar to what Dalton (1977) has termed a "primitive valuable". As a status item it might have represented a trait, such as an obsidian knapper, good hunter or taro grower; a gender; or a social position within the local group or wider community. As a valuable it could have had roles both within and between groups in one, or more likely, all of the following described by Dalton (1977: 202–203): settling feuds, making peace, establishing or cementing social links (e.g., between affines, allies and trading partners), or creating and affirming status.

The consequence of this hypothesis is that the broadly defined type 2 stemmed artefacts had multiple, overlapping roles within society, as both mundane and non-utilitarian objects. It may even be that some people (perhaps one gender or age class) chose to make and use tools in their daily lives which resembled the valuables in shape and mode of manufacture. In discussing axes in Highland New Guinea, Strathern (1969: 323) states that "one effect that the production of these ceremonial axes perhaps had was to enhance the value of the whole category of 'axe'." This may explain why care in the production of kombewa flakes and/or the retouching of stems was also invested into the manufacture of ordinary tools such as M001 and JR as well as for valuables such as M002. Another possibility is that the blurring of differences between artefacts with different roles was intentional because it enabled multiple readings of the artefacts. These in turn created status differences but also ensured a broad participation in social life and integrated daily activities with ceremonial life.

It is likely that, as with the New Guinea Highlands axes, there were no clear-cut boundaries between stemmed tools used in a utilitarian context and valuables. Instead, some artefacts held both roles simultaneously or shifted from one to the other depending on the social context. For example, a stemmed tool obtained as bride price might have been used later for social display to enhance status or in daily activities. It is also possible that there was a hierarchy of objects such that all people in a particular social category used the possession of a stemmed tool to symbolize membership in this group, but that some objects were ranked differentially, were related to higher status individuals, and circulated in different spheres.

Although archaeologists have often focused on "ornaments" as candidates for valuables, following ethnographic analogies to Melanesian exchange systems such as the *kula* (e.g., Kirch, 1988: 107; 1997: 236; Shackleton & Renfrew, 1970), ethnography provides us with cases in which utilitarian objects also played this role and where there was variation in the function of objects within a broad, general class. New Guinea Highlands axes are a well-known local example. Axes were exchanged in various contexts, including feasts, as bride price, or as work axes. The largest and most unique tended to be reserved for ceremonial exchange, whereas work axes were smaller and often bore evidence of heavy use and reworking (e.g., Burton, 1989; Strathern, 1969; White & Modjeska, 1978). Strathern (1969: 321) speaks of "axes which were deliberately fashioned as objects of beauty" and notes that among shells as with axes that the "value" of objects used in the exchange system was related to their individual excellence. Thus the most prized shells were those of a certain shape or sheen; size was a factor in assessing equivalences, but other aesthetic criteria might also be important. The same was true of the stone axe (Strathern, 1969: 321).

Archaeological studies of Neolithic stone axes in Great Britain also illustrate the many ways that axes were used and valued (e.g., Bradley & Edmonds, 1993; Edmonds, 1995). At great distances from the axe quarries some artefacts were used heavily and resharpened, whereas other axes imported from known quarries were deposited at ceremonial sites (e.g., causewayed enclosures) or in graves in a pristine condition.

Determination of the exact roles that stemmed tools played within prehistoric society in West New Britain demands much better data than currently available since the majority are surface finds found at a few places close to where they were manufactured. Stray finds of obsidian stemmed tools on mainland New Guinea, New Ireland and Manus suggest they circulated widely as valuables (Araho *et al*., 2002: table 1), but even within West New Britain, far too little is known about their distribution outside the immediate environs of the obsidian outcrops, at places such as Boku Hill. As argued by many archaeologists, an important test of how objects were valued and conceived of, particularly those that have been transported from a quarry source, is the context of deposition (e.g., general rubbish or "special" place) and association with other material, rather than simply their physical attributes (e.g., Hodder, 1982: 207; Edmonds, 1995: 68–73; Bradley & Edmonds, 1993). Sadly, these data are not available for the Boku Hill finds.

The three Boku Hill stemmed tools, especially when combined with what we know about stemmed tools found near the obsidian sources (e.g., Araho, 1996; Fullagar, 1993; Rath, 2000; Torrence, 1992), therefore provide a tantalising hint, rather than water-tight proof, that this type of artefact had multiple roles within society and that one of these functions was non-utilitarian and symbolic. Furthermore, without a great deal more excavation and analysis, we cannot yet describe with confidence their likely multiple functions. What the Boku Hill stemmed tools do indicate, however, is that in this region at this time (pre 5,900–3,600 cal. B.P.) highly distinctive and elaborate objects which might have circulated as valuables were being produced and transported. This finding has important implications for the evolution of society in island Melanesia.

Social evolutionary models

The early Holocene, pre-Lapita, period of Melanesian prehistory has been seriously neglected. The paucity of information about lifeways during the crucial time immediately before Lapita pottery has made it very difficult to differentiate between indigenous and foreign-induced change. As a consequence, the model based on migration of Austronesian speakers and the introduction of new forms of subsistence patterns, material culture, and social forms has been widely promoted (e.g., Kirch, 1997; Spriggs, 1997), although most authors suggest that some local practices (notably use of obsidian) were adopted by the immigrants on their way through to Remote Oceania. Green (1991) proposed a complex model in which local and foreign elements were integrated.

One aspect of Lapita culture often assumed to be totally novel in the region is social differentiation. For example, drawing on a combination of "linguistic clues, ethnographic analogy, general principle and common-sense" (Spriggs, 1997: 102), Kirch (1988: 112–113; 1997: 254–255) proposed that Lapita society was characterized by status differences supported by the exchange of prestige-goods or valuables (cf. Friedman & Rowlands, 1977; Friedman, 1981). In contrast, Hayden (1983) and Spriggs (1997: 103) see status differences arising from the need for leadership and direction in order to support long-distance voyages and new settlements. Since linguistic information has been at the forefront of these reconstructions, the implication has been that status differentiation arrived in the region with Austronesian languages and therefore that pre-Lapita societies lacked these characteristics.

On a slightly different subject, Kirch (1988: 103–104) proposed that a wide range of ethnographic trading systems in Near and Remote Oceania may have been derived from Lapita exchange as well:

> Perhaps the most provocative implication of these archaeological advances is that the historical roots of many of these diverse long-dthe JR tool was used both as a tool and as a core istance exchange networks may ultimately be traced to the Lapita Cultural Complex (3,600–2,500 B.P.)
>
> (Kirch, 1988: 104).

In particular, Kirch emphasises the exchange of obsidian from both the New Britain and Manus sources and trade of shell valuables which were manufactured at a limited number of sites and then widely dispersed. The relatively long-distance movement of obsidian does not begin at the time of Lapita pottery, but has a very long history within Near Oceania (Summerhayes *et al*., 1998). The presence of shell valuables, however, may support the proposal that a new form of social system was introduced by Austronesian speakers.

In contrast, the data from Boku Hill suggest that the use of valuables, like the practice of obsidian, played a role in the mid-Holocene societies on the north coast (and perhaps over a wider area) for at least 2,500 years before the arrival of Lapita pottery. It seems very likely that stemmed tool M002 (and the artefact from FCR) represent non-utilitarian objects which functioned as "valuables". The further implication is that social systems which used objects to create and cement social relationships and possibly status differences and which also exchanged obsidian within New Britain and beyond to New Ireland and the Papua New Guinea mainland (cf. White, 1996) developed *in situ* within West New Britain.

Were the users of stemmed tools primarily agriculturalists, low level forest managers, or hunter-gatherers? Although systems of exchange involving valuables are not unknown among hunter-gatherers (e.g., NW Coast of North America as well as a number of Californian groups), it is often assumed that prestige goods economies are only associated with hunter-gatherers living in resource rich areas or societies which depended on agriculture (e.g., Hayden, 1990, 1995). This does not fit what is generally assumed about the low intensity of subsistence patterns in the Willaumez Peninsula at this time (e.g., Therin *et al*., 1999; Torrence *et al*., 2000), although we have very little primary data.

Situations where there was an opportunity for monopoly of exchange items have also been proposed as contexts in which prestige goods circulate (e.g., Friedman, 1981; Friedman & Rowlands, 1977). One might therefore question whether ownership and control over the obsidian sources themselves, particularly the Kutau/Bao outcrops which dominate assemblages at this time, even near the Baki obsidian sources on Garua Island (Rath, 2000; Summerhayes, *et al*., 1998; Torrence & Summerhayes, 1997), had a role to play in the development of pre-Lapita societies in this region and particularly in the use of valuables. Along these lines, it is very interesting to compare the archaeological record of the major obsidian quarry site at Bitokara mission (FRL) for the periods before and during Lapita pottery. During the time when stemmed tools were manufactured, there is abundant evidence at Bitokara for quarrying of obsidian in the form of pits and production waste as well as spatial segregation in different stages of the process (Torrence, 1992). In contrast, following the W-K2 eruption there is no evidence for the extraction and manufacture of obsidian at the outcrops themselves and the site itself appears to have been abandoned from c. 3,600 cal. B.P. until long after Lapita pottery had ceased to be used in this region (Torrence & Stevenson, 2000). Furthermore, evidence from a number of sites locally and also in the Reef Santa Cruz islands show that during the time of Lapita pottery, nodules of obsidian rather than preforms were the major form of export and that many of the unworked pieces were gathered from beaches rather than quarried from the outcrops (Sheppard, 1993; Torrence, 1992). It therefore seems possible that not only was the utilitarian role of obsidian very different in the pre-Lapita period, but also that obsidian artefacts may have ceased to be valuables after the W-K2 eruption. Consequently, the nature of ceremonial exchange during the time of Lapita pottery, if present at all (cf. Sheppard, 1993), was much transformed.

The choice of one end of a continuum in the size, workmanship and fragility of the stemmed tools as a distinctive non-utilitarian item is also interesting because it allowed latitude in how objects were used and enabled people to shift meanings and roles depending on social context, as was the case with Highland New Guinea axes. This property is quite different from many other objects which have served as valuables, such as coppers on the NW Coast of North America or Trobriand *kula* necklaces and armbands. These had no counterparts among utilitarian objects. The stemmed tools highlight the need for a better understanding of the relationship between the physical properties of valuables and their social roles.

Conclusions

The presence of three different forms of stemmed tool at Boku Hill is a powerful indication that archaeological research within West New Britain has much potential for revealing new and unexpected information about societal forms that existed during the early Holocene period. The nature of society at this time seems to have differed from what has previously been expected of groups believed to lack full agriculture (e.g., Spriggs, 1997). These three artefacts, along with their counterparts found in the vicinity of the obsidian sources on the Willaumez Peninsula, encompass a range of forms that include both utilitarian tools (as determined by use-wear/residue analyses and by inference, e.g., FABN-M001, FABN-JR) and "special" artefacts that were too fragile to have been used in ordinary tasks (e.g., FABN-M002, FCR artefact). The presence of artefacts that might have circulated as valuables in the period from sometime before 5,900 cal. B.P. up to 3,600 cal. B.P. is surprising since it has been thought that the conditions under which prestige economies developed did not occur until some 200 or so years later during the time of Lapita pottery. These new finds raise doubts whether valuables and the particular form of society that used them were imported. It seems more likely that the social and ceremonial systems in which the stemmed tools circulated developed *in situ* within West New Britain and had been maintained over quite a long period of time prior to the putative introduction of domesticated plants and animals, sedentary patterns of settlement, and other characteristics of life that have been associated with Lapita pottery and/or Austronesian languages.

Clearly, a great deal more research is needed to reveal the history of stemmed tools and associated social forms and to understand the broader context in which they operated. The situation is also complicated because the kinds of stemmed tools found at Boku Hill are only one of Araho's (1996) types. Another contemporary form, called type 1, is made on large prismatic blades. In this case, the proximal end of the blade was retouched to create elaborate and fragile forms which also may have been used as valuables (cf. Araho, 1996; Rath, 2000). Characterization studies of type 1 artefacts from Garua Island suggest that the Kutau/Bao obsidian source was preferred (Araho *et al*., 2002). Control over access to the means of production of valuables may have been integral to their role as prestige goods, as suggested for the Boku Hill examples.

At this stage the social roles of these two types of valuable are purely hypothetical. Nevertheless, the possibility that there were several sets of objects potentially used in ceremonial exchange raises important questions about the nature of the society that made and used them as well as the relationships between local and long distance obsidian exchange and the low intensity subsistence system that has been proposed for the region at this time. We need to find stemmed tools in secure archaeological contexts and should also expand the search beyond the immediate environs of the obsidian sources.

The archaeology of the Willaumez Peninsula is producing a number of tantalizing facts and finds, as exemplified by magnificent stemmed tools found at Boku Hill and Lagenda by Jim Specht. The research on obsidian trade and Lapita sites which Jim initiated in this region is ongoing, fortunately with his continued participation, since we need more discoveries to help better understand the social systems that produced and used stemmed tools.

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Rethinking Regional Analyses of Western Pacific Rock-art

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ABSTRACT. Jim Specht has played a central role in the identification of two discrete bodies of rock-art in the western Pacific region, referred to in this paper as the “Austronesian engraving style” (AES) and the “Austronesian painting tradition” (APT). The aim of this paper is to explore the merits of the AES and the APT as analytical entities by determining how they articulate with one another across the region. This is achieved by conducting statistical analyses of western Pacific rock-art motifs. The results of these analyses are then compared with models founded on consideration of non-motif variables by previous authors, including Jim Specht.

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Several efforts have been made to document Pacific rock-art but these studies have tended to be restricted in their geographical focus and thus in their ability to enhance our understanding of Pacific prehistory on a broad-scale. This can be attributed largely to the fact that Pacific rock-art studies remain in a “data procurement and reporting” stage. Inter-regional collaboration is in its infancy, with most researchers adopting rock-art recording methodologies appropriate to their own area of study. Examples of these local studies include Röder’s (1956, 1959) analysis of the rock-art of the MacCluer Gulf (West Papua), Roe’s (1992) study of the rock-art of Guadalcanal (Solomon Islands), Spriggs & Mumford’s (1992) overview of sites in Southern Vanuatu, Frimigacci & Monnin’s (1980) inventory of rock-art motifs for New Caledonia, Lee’s (1992) analysis of the rock-art of Easter Island, Millerstrom’s (1990, 2001) Masters and doctoral research on the rock-art of the Marquesas, Lee & Stasack’s (1999) recent synthesis of the rock-art of Hawaii, and Trotter & McCulloch’s (1971) summary of the rock-art of New Zealand.

Only a handful of attempts has been made to understand how the rock-art of each of these regions articulates with one another. Comparative analyses of *western* Pacific rock-art, for instance, have been seriously undertaken by only four researchers—Hugo (1974), Specht (1979), Rosenfeld (1988) and Ballard (1992). The task for each of these researchers, however, was invariably inhibited by a lack of comprehensively recorded and inter-regionally comparable data. As a result, none of the rock-art models constructed by these authors derive from a systematic comparison of regional *motifs*. David Hugo (1974) embarked on a brief analysis of motifs but employed a relatively limited data set (a total of 77 different motifs from PNG compared to over 600 from an area extending from PNG to Tonga used in this study). The two most comprehensive studies of western Pacific rock-art, by Specht (1979) and by Ballard (1992), relied almost exclusively on the analysis of *non-motif* data. These authors paid attention to the relative distributions of rock-art techniques, colouring agents, and the locational contexts in which rock-art sites were found.

One of the most significant outcomes of these previous comparative studies was the widespread assertion that the rock-art of the western Pacific is divisible into two broadly defined *styles* or *traditions* of painting and engraving (Ballard, 1992; Specht, 1979; Rosenfeld, 1988). It is this distinction between the techniques of painting and engraving through space that provides the point of departure for this paper. My aim here is to develop a preliminary spatial framework for the rock-art of the western Pacific by comparing both *motif* and *non-motif* data and, in turn, to better define the similarities and differences between painted and engraved rock-art in the region. First, however, two previous studies which have been strongly influential in defining the characteristics of painted and engraved rock-art in the western Pacific are briefly outlined.

Previous models of western Pacific rock-art

Jim Specht (1979). In 1979, Jim Specht published a major paper on western Pacific rock-art in which he examined similarities and differences between 383 sites between Torres Strait and Tonga. This was the first study to synthesize existing rock-art data on a regional scale and to attempt a systematic analysis. Due to the essentially ad hoc way in which rock-art sites had been recorded in the past, Specht was unable to analyse traits such as site extent, the accessibility of the art (height above ground level), motif form, composition, chronology, and style. He was, however, able to examine the distribution of features such as rock-art techniques, geology, pigment colours and site topography.

Echoing an earlier finding by David Hugo (1974: 51), one of the major outcomes of Specht's study concerned the spatial patterning of artistic techniques. Painted rock-art was found to predominate in the west (Torres Strait, Indonesia and Papua New Guinea) and to occur in both coastal and highland regions (i.e., the New Guinea Highlands), while engravings were shown to occur mainly in the east (Island Melanesia, Fiji, Samoa and Tonga) and to have a predominantly coastal distribution. The New Britain and New Ireland areas, and perhaps also Milne Bay, appeared to be "intermediate between the two areas of technique dominance." (Specht, 1979: 63). Overall, the distribution indicated an eastward reduction in the incidence of painted art and a corresponding increase in engraving.

Specht also drew attention to the cohesiveness of the *engraved* rock-art of the western Pacific, tentatively proposing the presence of a rock-art "style" for the region. This style was said to be based on similarities between motifs and other characteristics at various engraved sites at Goodenough Bay (Milne Bay Province, PNG), on New Hanover (New Ireland Province), and in New Caledonia, New Britain and Vanuatu. Motifs were said to consist of "generally curvilinear geometric forms such as spirals, concentric circles, face-like forms, and various other concentric forms" (Specht, 1979: 74). In addition to sharing common motif forms, Specht (1979: 74) noted that:

> these sites share other features: they are all on [igneous] boulders or open rock faces, never in caves or shelters; they are all situated by water courses or the sea; and they are all in areas where Austronesian languages are spoken today … To this group could, perhaps, be added several painted sites which seem to share in common certain designs.

While Specht acknowledged the scope for an overlap between painted and engraved rock-art motifs, his study was not focused on the degree of comparability between the two media or the precise nature of the motifs involved.

Chris Ballard (1992). Ballard (1992) extended Specht's (1979) analysis by examining painted rock-art in the western Pacific and its relationship to certain locational characteristics and language areas. Inspired by similarities in painted motifs across the region (from Timor in the west to Bougainville in the east), Ballard sought to understand the rock-art of Western Melanesia within a broader historical framework. He examined 187 sites in relation to the following four variables:

1 distance from the nearest current coastline;
2 topographic or physical context (e.g., cliff-faces; boulders);
3 the maximum height (in metres) of the location of the art at each site;
4 whether the art was located in Austronesian or non-Austronesian-speaking areas at the time of European contact.

Ballard augmented Specht's original sample of painted sites with an additional 63 sites, which boosted the total number of documented rock-art sites (including engraving sites) in the western Pacific to 446. It is important to note, however, that Ballard decided to exclude sites from the New Guinea Highlands. His study yielded the following findings:

1 Most western Pacific sites with painted art were found to occur within 1 km of the current coastline and in "cliffed" contexts (cliff faces and caves within cliffs).
2 Of the 92 sites with known distances from the coast, 92% were found to be sea-cliffs.
3 Twenty-four of 31 sites were found to display rock-art located 5 m or more above the base of cliffs.
4 "High visibility" was found to co-occur with "inaccessibility". Painted rock-art was noted in highly visible locations, such as on exposed cliff faces or at or near cave entrances often visible from the sea.
5 A high degree of correlation was found between painted sites and current Austronesian-speaking communities.

Ballard (1992: 96) drew several conclusions from his results. First, that the lack of an oral tradition for the rock-art provides a *terminus ante quem* for its production (at least prior to contact in most places). Second, that the geographical correlation of the art with the distribution of Austronesian-speaking communities provides a *terminus post quem* of c. 4,000 B.P. (now considered to be 3,500–3,300 B.P.) for the painted art. Third, that people deliberately selected inaccessible locations to produce painted rock-art. And lastly, that the cohesiveness of the motif range suggests that a tradition of painted art developed in tandem with a migration of Austronesian-speakers. The regional uniformity among painted motifs suggested to Ballard that the tradition may have begun after the initial spread of Austronesians into the region—perhaps closer to 2,000 B.P.—and that it moved via existing networks of communication between Austronesian-speaking enclaves. In further support of the idea that the tradition coincided with a later Austronesian movement, Ballard noted the presence of formal similarities between rock-art motifs and those found on bronze artefacts dating after 2,100 B.P. Red painted designs on pottery from Eriama rock-shelter (Papuan south-coast) found in contexts dating after c. 1,930 B.P. were also thought to bear a close

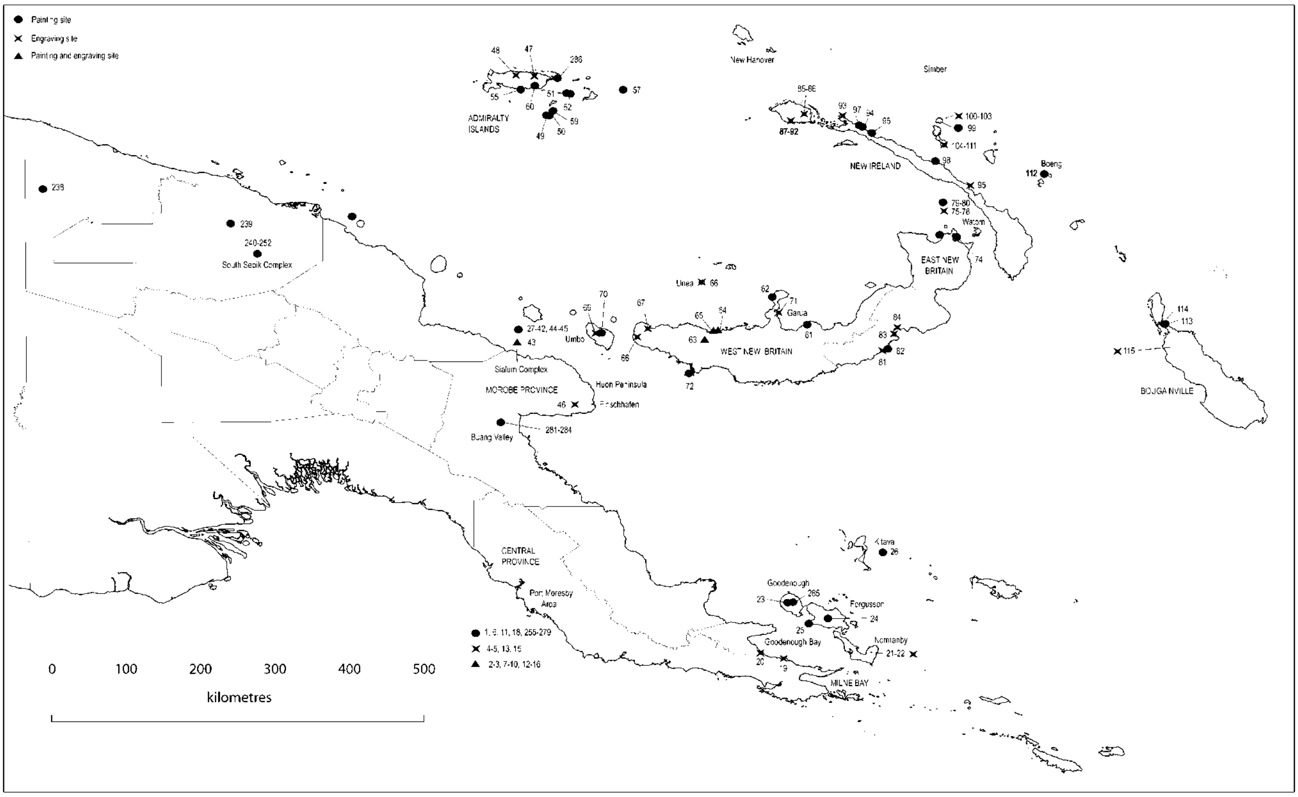

Fig. 1. The locations of rock-art sites in Papua New Guinea. Note: (*a*) Highland sites are not mapped; (*b*) symbols representing sites for which precise locations are unknown are located next to the numbered site code.

resemblance to red painted rock-art at the same site and elsewhere in the western Pacific (Ballard, 1992: 98).

Regional studies of western Pacific rock-art have relied primarily on non-motif variables to invoke the idea of two distinct spheres of rock-art, one defined by engravings and the other by paintings. A widespread engraving style referred to as the Austronesian engraving style (hereafter "AES") has been linked to Austronesian-speaking areas, and is described as being associated with boulders located in open locations, often within or beside water courses (Specht, 1979). The motif range affiliated with the AES is said to consist of curvilinear geometric forms, including spirals, concentric circles, face-like forms, and various other concentric forms (Specht, 1979: 74). Several painting assemblages bearing similar motifs are also regarded as possibly associated with the AES.

The "Austronesian painting tradition" (hereafter "APT") has been proposed as a collective description for a repertoire of painted sites found largely in Austronesian-speaking areas and associated with inaccessible coastal cliff locations often visible from the sea (Ballard, 1992). Red pigment has been noted as the primary colour represented at these sites, and inter-site homogeneity among the motifs has been observed—but not described (Ballard, 1992). The APT is thought to have emerged in conjunction with a late movement of Austronesian speakers around 2,000 B.P., although it may subsequently have influenced painting styles in non-Austronesian-speaking areas.

One of the problems that has emerged as a result of this dichotomized view of western Pacific rock-art is that it is unclear how these so-called traditions or styles of painting and engraving articulate with one another through time and space. This problem was exacerbated by Ballard's (1992) decision not to look at engravings, and because Specht (1979) had not identified Ballard's region-wide tradition of paintings—noting instead the occurrence of more localized painting styles.

As noted earlier in this paper, a further problem underlying this dichotomized view is the absence of an analysis of rock-art motifs. The AES is founded not only on a systematic study of locational variables but on an impressionistic link between motifs. The APT is also constructed on the basis of a systematic study of locational variables but an undemonstrated assertion that it is constrained by a cohesive set of motifs.

The second half of this paper offers a series of methods for systematically examining *motif* variability among sites within the western Pacific that might allow us to better explain Specht's (1979) finding that painted and engraved rock-art sites are essentially discrete "styles" geographically. This analysis forms a small part of a much larger and more complex study which examines the viability of the AES and the APT as analytical entities (Wilson, 2002).

Methods

Motifs. The analyses presented in this section compare rock-art motifs from a variety of different sources, including published and unpublished images, unpublished manuscripts and fieldnotes, and published papers in journals and books. Three analytical units have been used for the purposes of analysis: pictures, motif types, and motif categories. My definition of a "picture" corresponds with Clegg's (1978: 42, cited in Flood, 1997: 355) definition of a "mark" which, adopting his terminology, I take to refer to "any drawing, painting, engraving or other modification of nature which is probably a human artefact." The "picture"

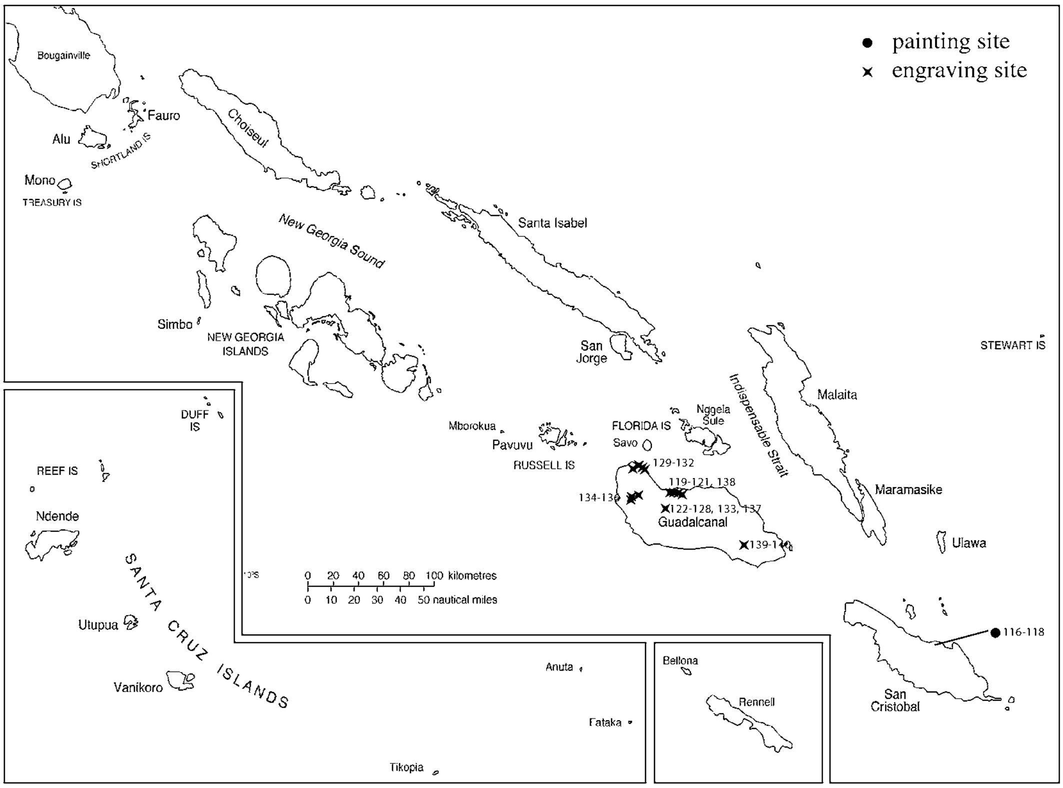

Fig. 2. The locations of rock-art sites in the Solomon Islands.

is the primary graphic unit. In defining a "motif" I follow Flood (1997: 355), who describes it as "a repeated form or recurrent type or class of [figure]". Thus, for example, a site may consist of two pictures (both circles with central crosses), but only one motif (a circle with a central cross). A picture cannot contain more than one motif. All motifs belong to a higher order "motif category". For instance, the motif described as a "circle with a central cross" belongs to the motif category "circles".

A total of 1232 individual pictures were available for analysis. These derived from 102 rock-art sites located in 16 different western Pacific regions (Table 1). The rock-art of Vanuatu is excluded from consideration as it forms part of a separate analysis that was undertaken after this paper was written. The selection of sites for analysis was contingent upon whether or not illustrations of motifs were available for classification. The geographic locations of each of these sites can be found in Figs. 1–4, each of which also indicates whether a site is represented by paintings, engravings, or a combination of both media.[1]

Each picture was assigned to one of 67 motif categories, and then to one of 614 individual motif types. Motif information was entered onto a spreadsheet as presence/absence (binary) data. The data were further subdivided into classes of non-figurative and figurative motifs (listed and illustrated in Wilson, 2002). One of the sites listed in Table 1 contains *both* paintings and engravings (site 7). All calculations are therefore based on a total of 103 analytical assemblages rather than 102 actual sites. There are 67 (65%) engraved assemblages and 36 (35%) painted assemblages. Of the 1232 motifs available for analysis, 894 (72.6%) derive from engraved assemblages and 338 (27.4%) from painted assemblages. The total for engravings is heavily weighted by New Caledonia which has a sample of 248 pictures (20.1%). The rock-art sites of New Caledonia were combined and treated as a single site due to site level data not being available at the time of the analysis.[2]

Before presenting the multivariate results, some comment on the way I interpret multivariate distributions is required. Archaeologists who use multivariate statistics often feel comfortable interpreting only those results which show clear statistical groupings, e.g., artefact *x* is always found in region *y*. The results which I present rarely show such discrete patterns, largely because the rock-art of the western Pacific manifests a high degree of homogeneity. However, within an essentially homogeneous pattern it is possible to discern more subtle variation by closely examining the relationships (statistical distances) between pairs of sites. The distance between two sites (or regions) on a multivariate graph provides a relative measure of the similarity between them. As I will show later in this paper, examining the graphs at this level of detail generates information which is useful in exploring a range of issues. The interpretation of each graph requires a continuous tacking between the observed patterns and my original data records. It is only by returning to the original data that it becomes possible to accurately assess which motifs cause sites to appear statistically similar.

Multivariate techniques. Two multivariate techniques were used to conduct the analyses: correspondence analysis (CA), and multi-dimensional scaling (MDS). All analyses were undertaken using the statistical program "S-Plus" (Venables & Ripley, 1999).

Correspondence analysis measures the chi-squared distance between variables (which in this case are regions and motifs). Unless otherwise specified, each of the data matrices examined using the CA method consists of the total counts of presence/absence data. Multi-dimensional

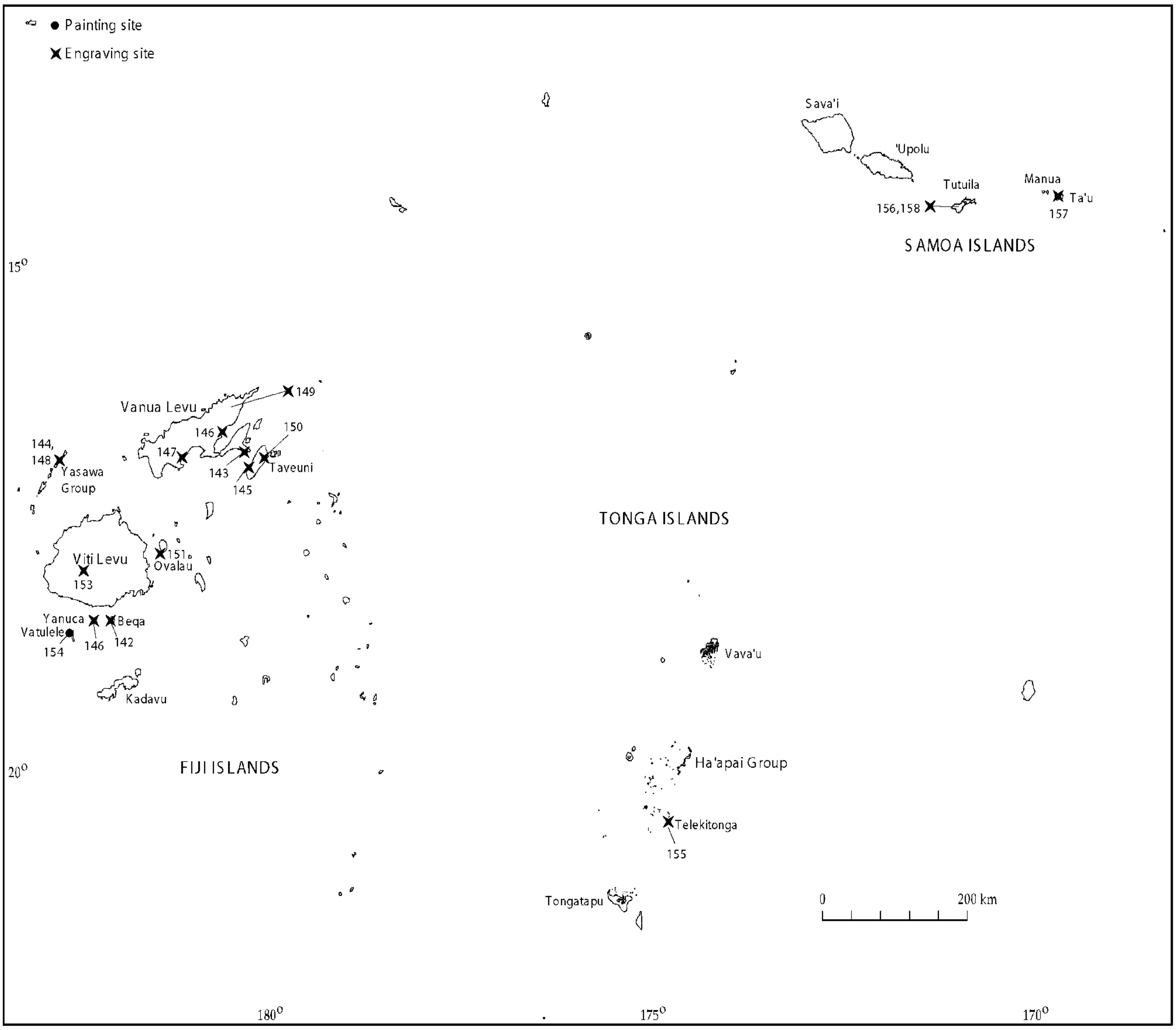

Fig. 3. The locations of rock-art sites in Fiji, Tonga and Samoa.

scaling (MDS) issues similar scores to sites with the same 1's in common and the same number of 1's in common. The MDS binary measure elicits similarities between pairs of sites, as shown in Fig. 5. The dissimilarity coefficient used for these analyses is often referred to as Jaccard's Coefficient.

Each of these techniques is potentially suited to the investigation of the types of data available for the analysis of motifs. The main reason for using more than one dissimilarity coefficient for examining variation within rock-art is to establish whether comparable patterns are produced by different methods, thus increasing the integrity of the result. Notably, dissimilarity coefficients differ in the weight that they accord to rare data (e.g., unique motifs). As demonstrated later in this paper, this has a significant bearing on the results and their interpretation.

Numerous statistical analyses have been performed on the dataset, each generating a comparable result (Wilson, 2002). For the purposes of this paper I have selected four analyses which most clearly illustrate the similarities and differences between painted and engraved rock-art at the motif level.

Results

Analysis 1: multi-dimensional scaling (MDS). In this first analysis I examine the body of non-figurative data only, which account for some 90% of the total number of rock-pictures (see Wilson [2002] for reasons for excluding figurative motifs). The result of a separate analysis in which figurative motifs were included was similar to that presented in this paper (Wilson, 2002: chapter 4, vol. 1, analysis 3).

One of the main problems with the data set analysed here is that it contains a high proportion of unique motifs. In earlier MV analyses this caused "outlier" responses and the graphed result displayed an inseparable cluster of points around the axes centroid (0,0) and one or two sites out on the margins of the graph. In an attempt to reduce the incidence of unique motifs, they have been aggregated into several large motif classes (Wilson, 2002: appendix 4.2). Omission of figurative motifs from the analysis required deletion of several sites (24, 28, 42, 47, 54, 63, 65, 66, 67, 85). Thus, an MDS binary metric analysis has been run on a matrix of 93 sites and 106 non-figurative motif classes. All motifs and motif classes are illustrated by Wilson (2002: appendix 4.2).

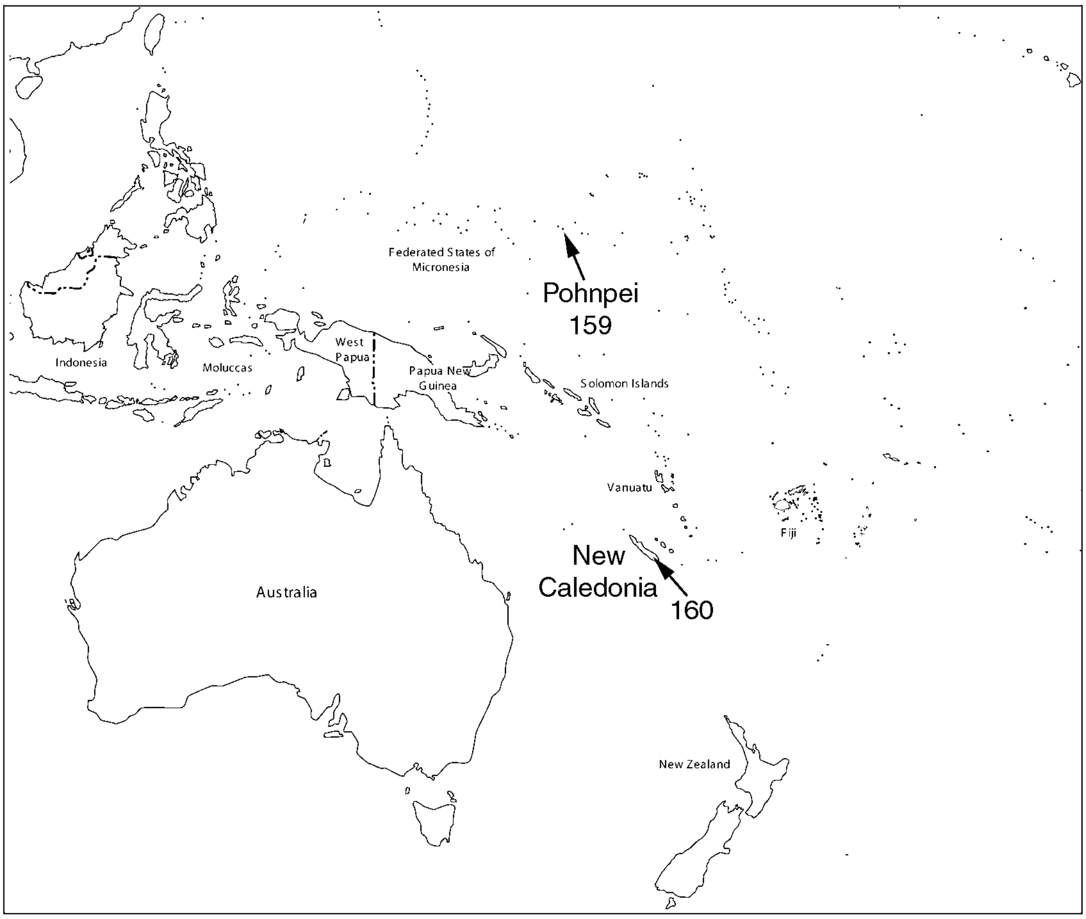

Fig. 4. Pacific Islands showing the locations of Pohnpei (159) and New Caledonia (160).

On first impression it would appear that the MDS analysis has generated a mass of points with no internal distinctions, suggesting that the rock-art regions of the western Pacific form a homogeneous group (Fig. 6). While "homogeneity" certainly is a feature of the rock-art of the region, closer inspection of the graph prompts a more complex interpretation. One of the most striking features of this distribution is that there is no perceptible overlap of points representing sites from Morobe and New Ireland, indicating that the rock-art of these two regions is very different from one another. The rock-art of New Ireland is largely engraved, and the rock-art of Morobe (with the exception of one site on the Gao River) consists entirely of paintings. Manus is most similar to Morobe, and Milne Bay has clustered with New Ireland. West and East New Britain, Fiji and Tonga share some similarities with New Ireland, while Central Province, Bougainville and Northwest Guadalcanal are more closely aligned with Morobe and Manus. The Sogeri area, New Caledonia and Micronesia are generally located in the centre of the graph, suggesting that each possesses motifs which are found throughout the western Pacific.

		Site *i*	
		+	–
Site *j*	+	a	c
	-	b	d

Fig. 5. Measures of similarity between pairs of sites using the MDS binary measure. Key: *a,b,c,d* = motifs; *a* = present at *i* and *j*; *b* = present at *i*; *c* = present at *j*; *d* = absent (the measure does not take account of absences).

Based on an assessment of the motifs seen to be causing this regional patterning, and for ease of analysis, I have divided the plot into four clusters (Fig. 6):

1 Cluster 1 includes three engraved boulder sites from West New Britain (Cao-go, Garua and Malapapua) located at the top of the distribution. The motifs which appear to be governing the close distances between these sites are circular forms, including circles with central cupules and contiguous circles. The only West New Britain (WNB) engraving site which falls just outside this cluster of the graph is Akono Sogo, which is also the only WNB assemblage associated with a limestone shelter instead of igneous boulders. On the graph margins but still within this cluster are three Fijian sites—Nacula, Dakuniba and Na Savusaru. Their location here is not easily explained in that the rock-art of two of these Fijian sites (Nacula and Dakuniba) is mainly rectilinear and quite unlike most engraved rock-art elsewhere in the western Pacific (which is mostly curvilinear). Na Savusaru possesses a few motifs which are more like those in the West New Britain assemblages (e.g., circles with central cupules) and has plotted closer to Cao-go than any other Fijian site. A couple of sites from the Sogeri area and Northwest Guadalcanal are also situated in this region of the graph. One of the sites from Northwest Guadalcanal (site 130) possesses several rectilinear motifs which are structurally similar to those seen at Nacula and Dakuniba in Fiji.

Table 1. The 103 assemblages at 102 sites included in the multivariate analyses (E and P in column 5 respectively indicate engraved and painted).

assemblage number	site number	region	number of motifs	technique
1	2	Sogeri	12	E
2	6	Sogeri	8	P
3	7	Sogeri	8	P
4	7	Sogeri	29	E
5	9	Sogeri	25	E
6	11	Sogeri	9	P
7	12	Sogeri	14	P
8	13	Sogeri	6	E
9	14	Sogeri	8	P
10	16	Sogeri	10	P
11	17	Sogeri	13	P
12	18	Central	5	P
13	19	Milne Bay	4	E
14	20	Milne Bay	9	E
15	21	Milne Bay	24	E
16	22	Milne Bay	5	E
17	26	Milne Bay	13	P
18	28	Sialum	5	P
19	29	Sialum	16	P
20	30	Sialum	18	P
21	31	Sialum	2	P
22	32	Sialum	8	P
23	33	Sialum	3	P
24	34	Sialum	1	P
25	35	Sialum	6	P
26	36	Sialum	1	P
27	37	Sialum	7	P
28	38	Sialum	1	P
29	39	Sialum	2	P
30	40	Sialum	7	P
31	42	Sialum	1	P
32	43	Sialum	12	P
33	45	Sialum	10	P
34	46	Morobe	26	E
35	49	Manus	32	P
36	50	Manus	1	P
37	51	Manus	48	P
38	52	Manus	13	P
39	65	West New Britain	41	E
40	66	West New Britain	21	E
41	67	West New Britain	46	E
42	68	West New Britain	1	E
43	71	West New Britain	27	E
44	75	East New Britain	1	E
45	76	East New Britain	1	E
46	77	East New Britain	2	E
47	78	East New Britain	1	E
48	85	New Hanover, NI	11	E
49	86	New Hanover, NI	15	E
50	87	New Hanover, NI	4	E
51	88	New Hanover, NI	1	E
52	89	New Hanover, NI	6	E
53	90	New Hanover, NI	10	E
54	91	New Hanover, NI	1	E
55	94	New Ireland	16	P
56	95	New Ireland	8	E
57	96	New Ireland	8	P
58	99	Tabar, NI	4	P
59	100	Tabar, NI	4	E
60	101	Tabar, NI	1	E
61	102	Tabar, NI	10	E
62	103	Tabar, NI	9	E
63	104	Tabar, NI	1	E
64	105	Tabar, NI	9	E
65	106	Tabar, NI	2	E
66	107	Tabar, NI	2	E
67	108	Tabar, NI	4	E
68	109	Tabar, NI	1	E
69	110	Tabar, NI	2	E
70	111	Tabar, NI	7	E
71	112	Boeng, NI	2	P
72	113	Bougainville	3	P
73	114	Bougainville	4	P
74	115	Bougainville	1	E
75	119	NW Guadalcanal	19	E
76	120	NW Guadalcanal	1	E
77	121	NW Guadalcanal	3	E
78	122	NW Guadalcanal	2	E
79	123	NW Guadalcanal	11	E
80	124	NW Guadalcanal	7	E
81	125	NW Guadalcanal	13	E
82	126	NW Guadalcanal	2	E
83	127	NW Guadalcanal	3	E
84	128	NW Guadalcanal	15	E
85	129	NW Guadalcanal	1	E
86	130	NW Guadalcanal	4	E
87	131	NW Guadalcanal	5	E
88	132	NW Guadalcanal	1	E
89	133	NW Guadalcanal	12	E
90	134	NW Guadalcanal	10	E
91	135	NW Guadalcanal	2	E
92	141	Fiji	1	E
93	143	Fiji	13	E
94	144	Fiji	7	E
95	146	Fiji	6	E
96	147	Fiji	5	E
97	148	Fiji	1	E
98	150	Fiji	8	E
99	153	Fiji	5	E
100	154	Fiji	19	P
101	155	Tonga	9	E
102	159	Micronesia	90	E
103	160	New Caledonia	248	E
Total number of motifs in sample:			1232	

2 Most of the rock-art in cluster 2 derives from Tabar and New Hanover (New Ireland Province), and Milne Bay. Sites from East New Britain and Northwest Guadalcanal are also found in this part of the graph. The motif category which appears to be governing the similarities between these regions is the spiral; a feature notably absent from the West New Britain engraved assemblages and most of the painted assemblages in the region. One exception is a painting site from New Ireland which includes a spiral among its corpus (site 96).

3 The third cluster is dominated by the painted rock-art sites of Morobe, Manus and Bougainville, with the painted sites of New Ireland also found in this area of the graph. The motifs which appear to be influencing this component of the distribution are simple "sun motifs", diamonds, triangles, motifs with central axes, chevrons, wavy lines, crosses and leaf-shaped forms—all broadly linked by their rectilinear structure. Most of these motif categories are found in Northwest Guadalcanal which is also represented in this part of the graph.

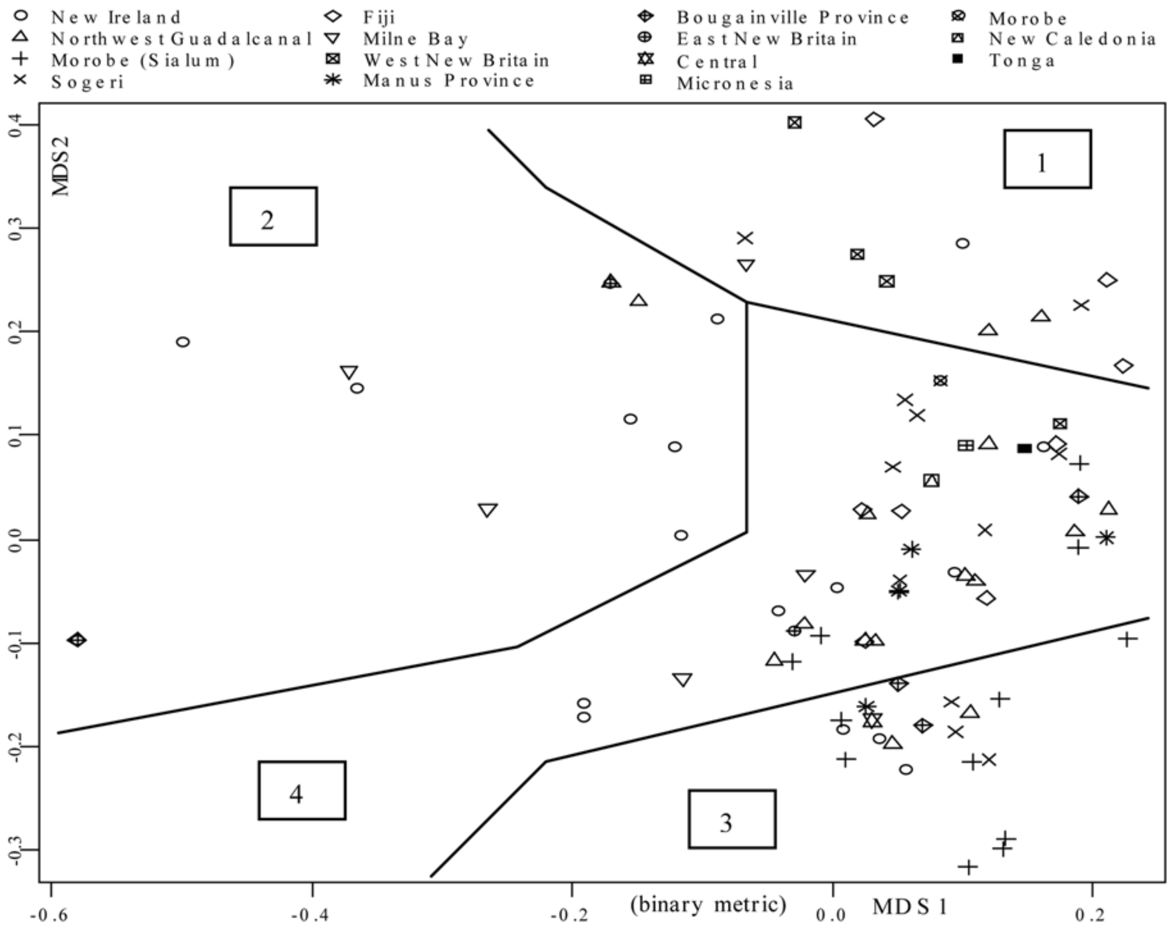

Fig. 6. Sammon binary measure result: Group 1 (106 non-figurative motif classes, 93 sites).

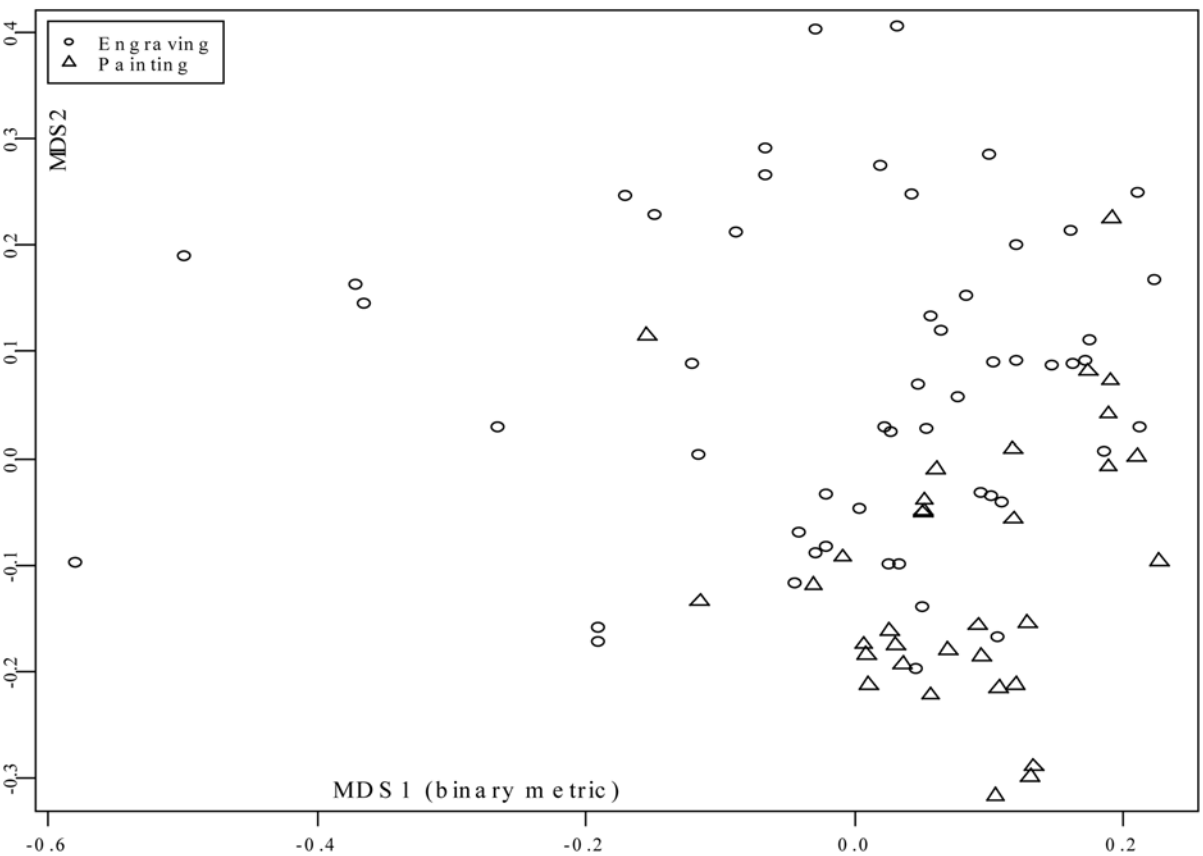

Fig. 7. Sammon binary metric result: Group 1 (paintings and engravings).

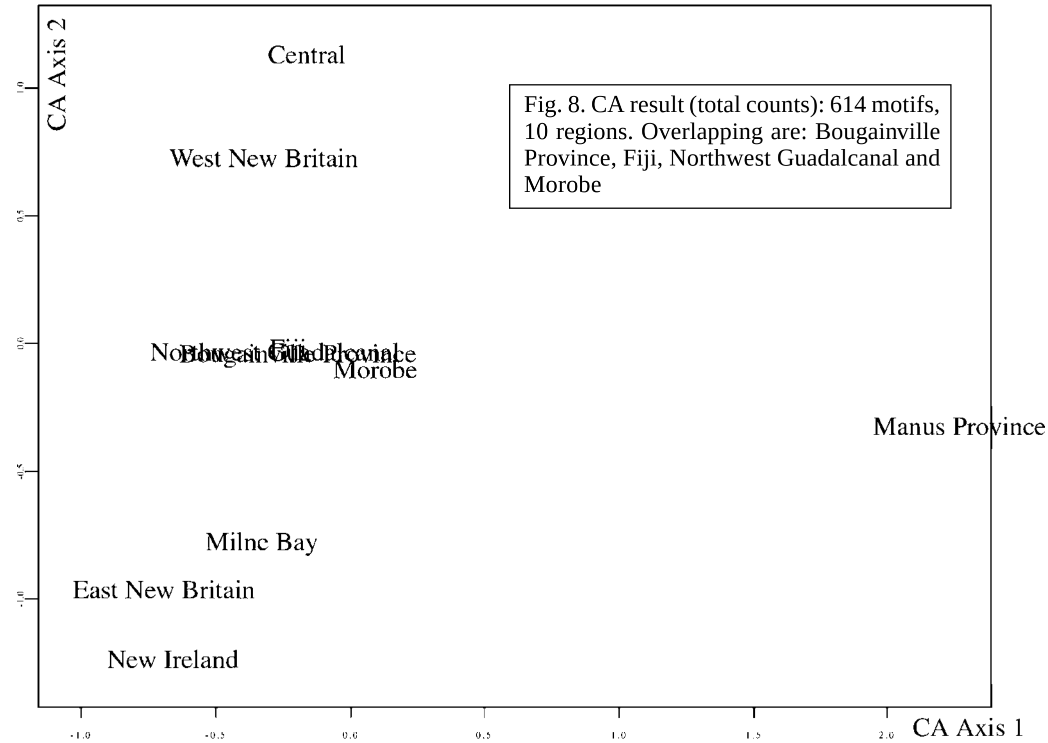

Fig. 8. CA result (total counts): 614 motifs, 10 regions. Overlapping are: Bougainville Province, Fiji, Northwest Guadalcanal and Morobe

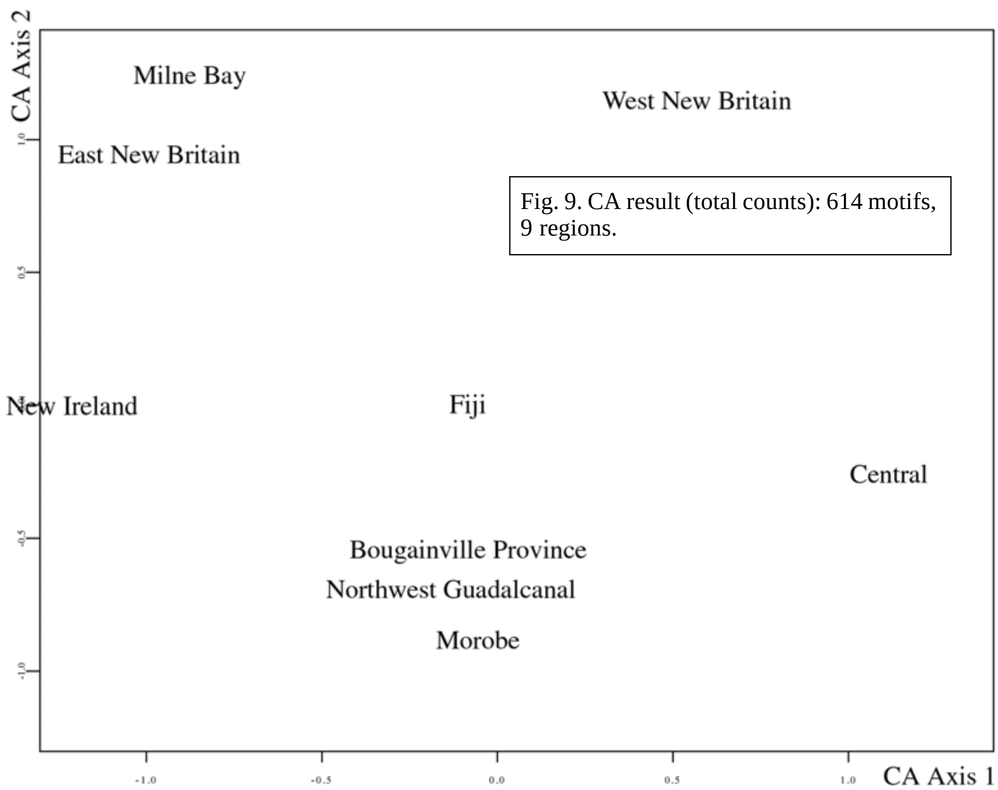

Fig. 9. CA result (total counts): 614 motifs, 9 regions.

4 The fourth cluster consists of sites located in the centre of the distribution. Most of the Remote Oceanic sites are found here, including those from Fiji, New Caledonia and Micronesia. Motifs common to these regions include enveloped crosses, scrolls, zigzags and circles with central spokes. Each of these motifs is also found in most other regions in the sample, consistent with the idea that motifs/sites located in the centre of a multivariate graph (close to 0,0) are least indicative of difference.

When the same distribution is re-coded according to the statistical relationships between painted and engraved assemblages, major differences can be observed between the two techniques (Fig. 7). Within a single regional group, such as New Ireland, painting sites share more in common with other painting sites in the western Pacific than they do with the engraving sites from New Ireland. There are two exceptions to this general pattern:

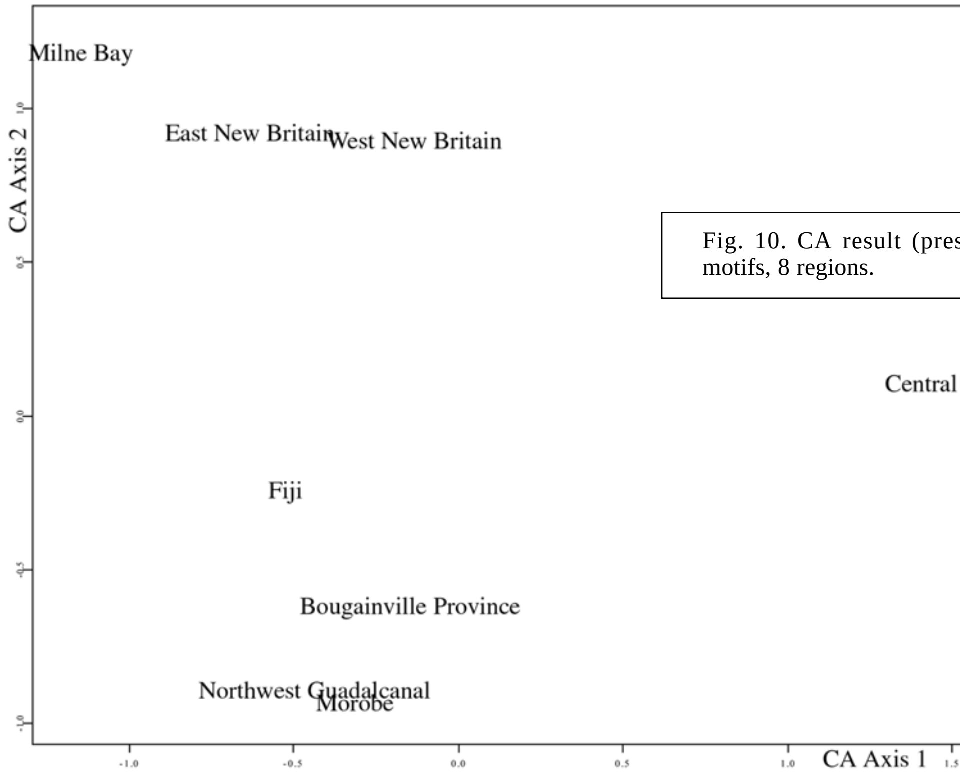

Fig. 10. CA result (presence/absence): 614 motifs, 8 regions.

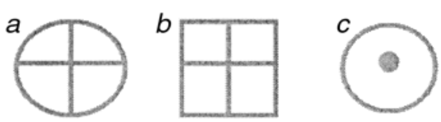

Fig. 11. An illustration of two ways in which motifs may be classified.

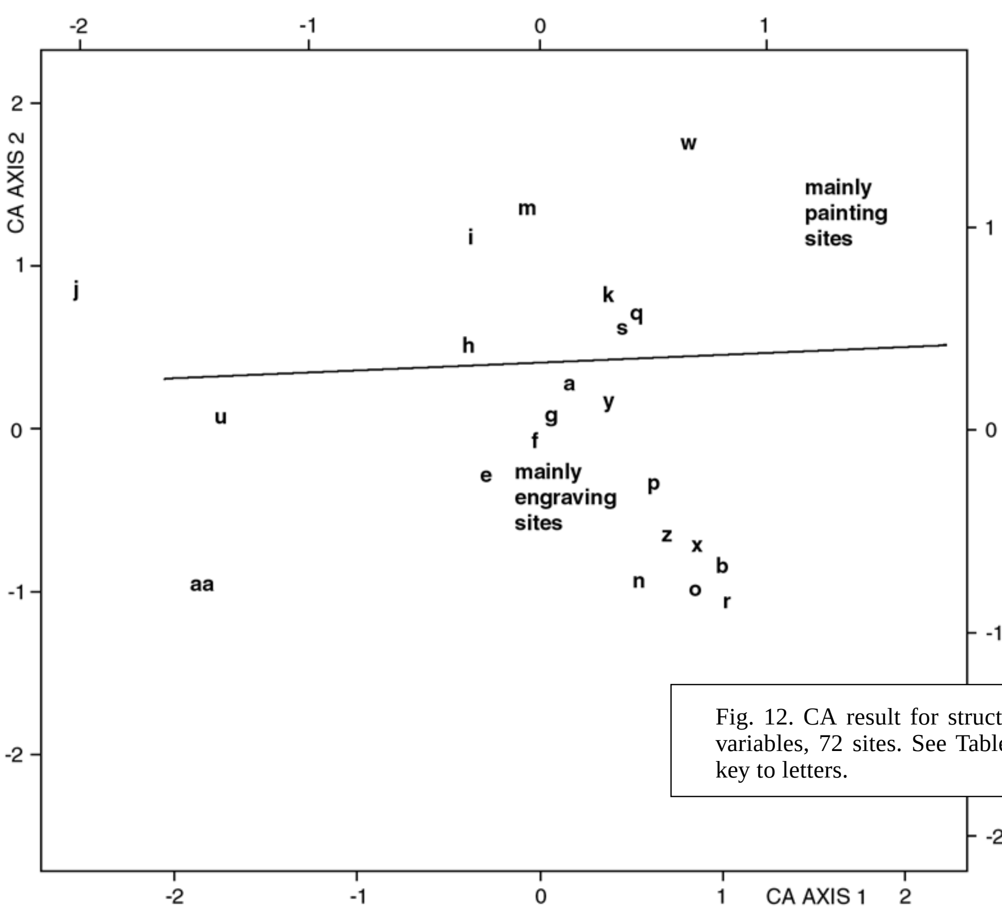

Fig. 12. CA result for structural elements: 25 variables, 72 sites. See Table 2 (opposite) for key to letters.

1 Several engraving sites from Northwest Guadalcanal are statistically similar to the main cluster of painting sites.

2 One engraving site from East New Britain (site 75) and another from New Hanover (site 85) are located within the main cluster of painting sites (these sites are not marked on Fig. 7). Site 75 contains only one motif; not a sufficient sample to allow it to be identified with the majority of engraved assemblages in the sample. Included among the motifs represented at Site 85 are enveloped crosses, a simple scroll motif, and some parallel lines—each of which have been recorded at a number of painting sites across the region.

Analysis 2: Correspondence Analysis (CA): total counts. This analysis uses CA to measure the chi-squared differences between regions (as opposed to sites). Calculations are based on "total counts"; that is, the total number of sites which possess a particular motif in a given region. The aim is to assess whether similar patterns to the MDS result described above are obtained when sites are combined into regional groups. A total of 12 regions and 614 figurative and non-figurative motifs have been defined for the analysis. The regions included in this analysis are: New Ireland, Northwest Guadalcanal, East New Britain, West New Britain, Morobe, Central, Fiji, Milne Bay, Manus, Bougainville, New Caledonia, and Micronesia. These regions differ slightly from those used in the MDS analysis. The Sogeri sites have been subsumed within the Central region, and Sialum has been combined with the rest of Morobe. Tonga is excluded from the analysis due to its small sample size.

An initial CA on the total counts produced a result which distinguished New Caledonia and Micronesia from other areas (the graph is not presented here). As with other CA analyses (described in Wilson, 2002), this outcome is probably due to the excessive number of unique motifs present in these two regions. When both regions were omitted, the results obtained from the remaining dataset show Central Province and West New Britain located close to one another at the top of the distribution (Fig. 8); Milne Bay, East New Britain and New Ireland form a second cluster at the base of the graph; Northwest Guadalcanal, Morobe, Fiji, and Bougainville form a third cluster in the centre of the graph; and Manus is located independently on the right hand side of the distribution.

When Manus was excluded from the analysis to allow for even greater separation between the remaining regions, similarities between Milne Bay and East New Britain, with distant links to New Ireland and West New Britain, are indicated (Fig. 9). Central Province, which includes material from the Sogeri area, is distinct from Milne Bay, East New Britain and New Ireland, but appears to share some similarities with Fiji, Bougainville, Northwest Guadalcanal and Morobe. Fiji, located in the centre of the graph, appears to manifest motifs common to all regions.

Analysis 3: CA: presence/absence. A second CA was conducted on presence/absence data producing a matrix which indicates whether a particular motif is present or absent in any given region. After running several initial analyses, New Caledonia, Micronesia, Manus and New Ireland were all deleted because they appeared as outliers. The result for the remaining data set (Fig. 10) resembles that obtained for total counts. Bougainville, Northwest Guadalcanal and Morobe are clustered together in the lower half of the graph. Milne Bay, East New Britain and West New Britain are grouped in the top left of the distribution. Central Province has distinguished itself from other regions on the right hand side of the graph. Fiji, once again, holds a relatively central position.

Together, the results of Analyses 2 and 3 suggest a broad similarity between the rock-art regions of New Britain and New Ireland and Milne Bay, with distant relationships to Central Province and Fiji. The result derived from the presence/absence data indicates a much closer relationship between the rock-art of East and West New Britain than the result from total counts. There is a relatively high degree of similarity between the painted assemblages of Bougainville and Morobe and the engravings of Northwest Guadalcanal.

Analysis 4: MDS: structural analysis. This analysis was designed to examine the internal structure of motifs. A common approach in rock-art research is to develop only *one* typology for classifying rock-art motifs. For instance, for each of the analyses presented so far I have grouped motifs initially according to motif categories (e.g., circles,

Table 2. Structural categories. In these definitions, the "main form" refers to the shape defined in the motif categories listed in Fig. 12 (e.g., circle).

a	main form with attached line
b	main form connected by a line
c	contiguous (touching)
d	main form (either single, in a sequence, or in a cluster; can be either a single line open, or a single line closed; occasionally has two or more lines attached to it)
e	line(s) (not touching the sides) within the main form
f	cupule or dot (or small circular gap) within the main form
g	line(s) (touching the sides) within the main form
h	internal cross (either touching or not touching the sides of the main form)
i	inner spokes
j	inner cluster of dots
k	contiguous main form with central linear axis
l	main form with outer inter-connected triangles
m	main form with outer rays or scalloping (may have a central cupule/dot or line)
n	concentricity: outer line of main form repeated twice or more
o	concentric (with inner spokes and/or cupule/dot)
p	concentric (with inner dots between lines of main form)
q	concentric with outer linear extensions [e.g., line(s) or rays, "scissor" or scroll shaped lines, other linear extensions] and inner cupule/dot or cross.
r	main form (concentric or not) with attached spiral(s)
s	concentric with spokes and rays
t	concentric with inner spiral, circle and dots and outer rays
u	inner bars
v	concentric with intersecting line(s)
w	mirror image of main form
x	main form surrounded by a circular or ovular shape (motif categories "C" and "O" excluded)
y	main form surrounded by a circle, oval, bean or heart-shape with inner cupule/dot and/or outer rays or other attachments
z	main form surrounded by a circle, oval, bean-shaped, or heart-shaped with attached spiral
aa	parallel

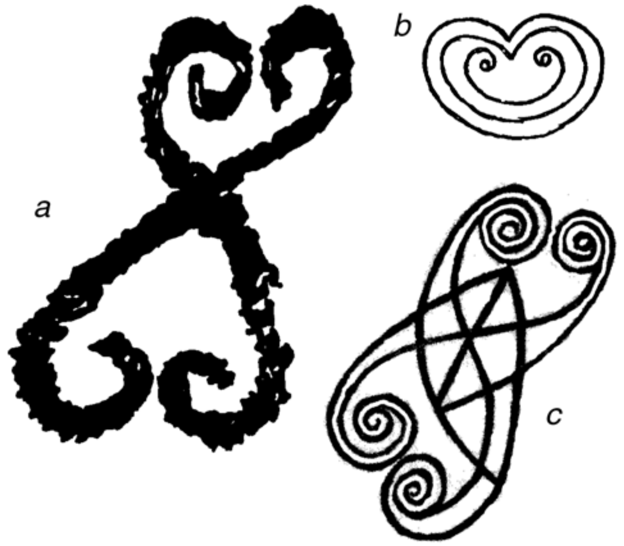

Fig. 13. Examples of scroll-like motifs. (*a*) Rock-painting from Timbinde Cliff (MSK), Jimi-Wahgi region, Western Highlands Province, PNG (after Gorecki & Dallas, 1989: 246, fig. 12.12). (*b*) Rock-engraving from Likding, New Hanover, New Ireland Povince (after Buhler, 1946–1949: 262, fig. 11). (*c*) Rock-painting from the MacCluer Gulf (after Roder, 1959: 124, fig. 2).

diamonds). In this analysis my aim is to reclassify all motifs according to their structural characteristics, such as the appendage lines and infill within the main form. Using the first typological approach (in Fig. 11), *a* would be grouped with *c*, as both are circles. In this analysis, *a* is grouped with *b*, as both share a central cross.

The objective is to test whether different typologies generate similar or different results. The data matrix includes all non-figurative motifs used for Analysis 1 which conform to one of the "structural categories" listed in Table 2. Category "d" has been disregarded because it does not include information about the structure of a motif. A matrix of 26 structural variables and 75 sites was analysed using CA. The most common variable is "n" (concentricity), and the least common variables are "y" and "z".

The first result showed a dense cluster of sites and three outliers (graph not presented). The outlier sites (and the corresponding variable "l") were deleted, and a CA was re-run on a matrix of 72 sites and 25 variables. The subsequent result—which shows a good separation of points—is extremely useful for identifying the structural properties which differentiate engraved and painted assemblages in the western Pacific (Fig. 12). Four main observations can be made in relation to this distribution:

1 Most of the painted sites of the western Pacific are distributed in the top half of the distribution and are characterized by rectilinear structural qualities, such as "outer rays", "inner spokes", "internal crosses" and "central axis lines". Compound motifs, which incorporate multiple triangles, diamonds and other geometric shapes within a single form, are also common.

2 In the centre of the distribution are most of the structural categories which define engraving assemblages from West New Britain, Sogeri, New Caledonia and Micronesia. The structural variables in this part of the graph (0,0) have very low scores and are therefore likely to be less indicative of regional or site differences than those located on the outskirts of the distribution. Included are central cupules or lines, contiguity, concentricity, and main forms surrounded by circles, ovals, bean-shaped and heart-shaped elements.

3 Motifs incorporating spirals and other relatively "complex" structural properties are located to the lower right of the distribution and are mostly associated with sites from New Ireland, East New Britain and Milne Bay. A few sites from Northwest Guadalcanal are located at the very base of this distribution and share the variable "o"; a concentric form with "inner spokes and/or a cupule/dot".

4 A few rare structural properties are associated with sites located on the left margin of the graph. These include "parallel" forms, "inner bars" and "inner dots". Most of these characteristics are associated with motifs from Northwest Guadalcanal.

This analysis has demonstrated that the differences between regions and between painted and engraved sites are replicated for both "motif types" and "structural categories". The structural categories which define the painted sites of the region include outer rays, inner spokes, internal crosses and other mostly rectilinear properties. Those which define the engraved sites of Milne Bay, East New Britain and New Ireland include spirals and several of the structural properties which have plotted in the centre of the distribution, such as concentricity. At the centre of the distribution are the more "simple" structural properties which define a number of engravings from West New Britain, Sogeri, New Caledonia and Micronesia. Each of these regions appears to contain elements which are common to both painted and engraved assemblages elsewhere. West New Britain is particularly interesting because, while it contains many of the elements characterizing sites elsewhere in the Bismarck Archipelago and in Milne Bay (spirals, scrolls, concentric circles), it is characterized by a prominent suite of motifs which incorporate cupules within their structure.

Discussion: centre or periphery?

Multivariate analyses have been employed in this paper to examine similarities and differences amongst rock-art motifs found throughout the western Pacific, excluding Vanuatu. One of the primary outcomes is the identification of a distinction between painted and engraved assemblages throughout the region, with some evidence of overlap between the two occurring in parts of Island Melanesia (e.g., Northwest Guadalcanal). Another important outcome is that, despite the use of different MV techniques (CA, MDS), the same overall patterns have emerged in each of the analyses. Both "motif-types" (figurative and non-figurative) and "structural categories" have been used to examine the relationships along two principal analytical axes: variation in rock-art techniques and between sites or regions. The regional analyses, particularly those derived from the use of MDS, generally demonstrated inter-regional *invariance*. That is, there are sufficient numbers of rock-art motifs shared by most regions to create a pattern of overall homogeneity. Most of the more subtle inter-regional differences are a by-product of distinctive differences between painted and engraved assemblages across the region. Thus, for instance, the painted rock-art of New Ireland is more similar to the painted rock-art of other western Pacific regions than it is to the engraved rock-art of New Ireland. This result does not sit easily with Specht's original observation that painted rock-art (dominant in the west of the study region) is geographically distinct from engraved rock-art (commonly found to the east, particularly in Island Melanesia).

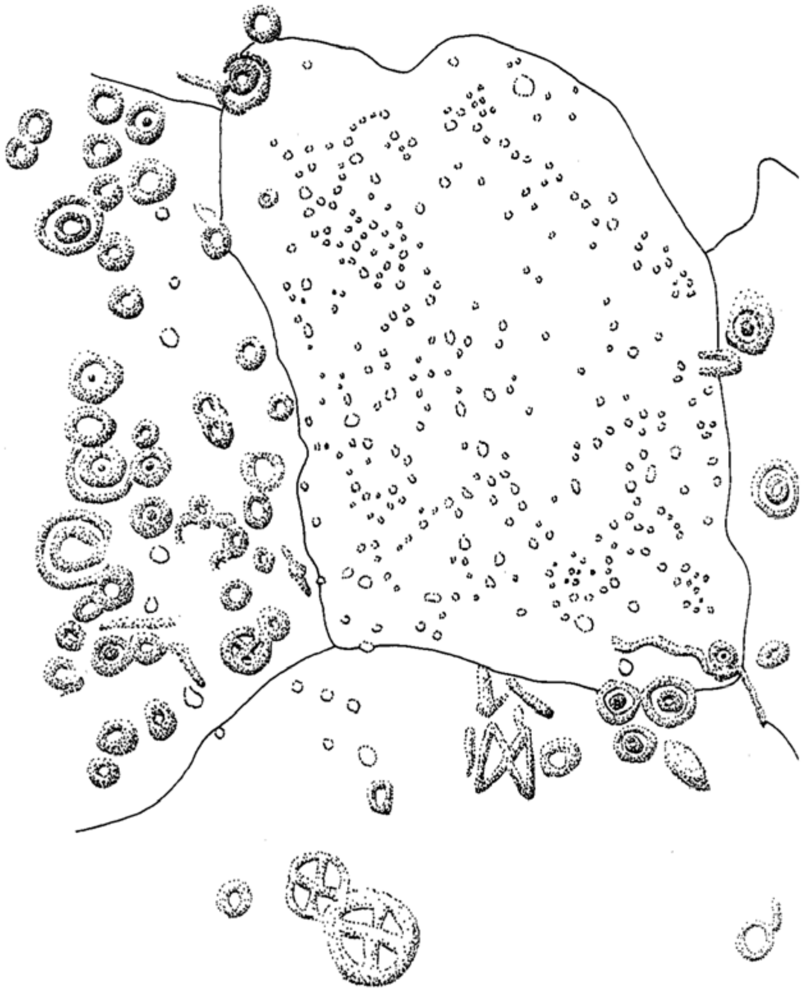

Fig. 14. Engravings at FAAS, Garua Island, West New Britain (Drawing courtesy of Robin Torrence).

Indeed, new data available since Specht's paper suggest that there are many more painted sites in Island Melanesia than originally supposed. In the Bismarck Archipelago, for example, the number of known painted sites has almost doubled. Matthew Spriggs (pers. comm., 2000) has also been informed of an unrecorded body of painted rock-art in northeast Bougainville (Teop language area), and Christophe Sand (pers. comm., 2000) has indicated the presence of several painting sites in New Caledonia which have not previously been published. In addition, my own data from Vanuatu raise Specht's (1979) figure of three painted sites for the archipelago to over 30. This more recent evidence indicates that the west/east division of painting and engraving sites may not be sustained by further intensive work, except perhaps in parts of Polynesia (e.g., the Marquesas, Hawaii, and Easter Island) where detailed recording has revealed relatively few painted sites.

On the basis of motif differences (both figurative and non-figurative) between painted and engraved assemblages in the western Pacific, the following inter-regional groups can be defined. Individual regions are linked together on the basis of specific combinations of motif and non-motif variables. Impressionistic comparisons are also made with rock-art regions located outside the area included in the MV analyses to demonstrate that interpretations vary quite substantially when different geographic scales are introduced.

1 Manus, Morobe (Sialum), Bougainville. These regions (as well as other painted assemblages elsewhere in the western Pacific) are defined by a primarily rectilinear painted rock-art associated with many of the non-motif variables that define the APT. A large number of these non-motif variables (such as "inaccessibility", "red pigment", "cliff-face locations") are also found immediately west of the region considered in this paper, such as in East Timor, the Moluccas (Eastern Indonesia) and the MacCluer Gulf in West Papua. There are also a few motif parallels found further west. For example, scrolls (which are found in small numbers in the painted rock-art of Sialum, Morobe Province, PNG) are present among *Manga* style rock-art in the painted assemblages of the MacCluer Gulf (Röder, 1956, 1959). The short distances between points representing painted sites on the MV graphs are suggestive of a high degree of graphic unity among painted assemblages across the region.

2 Milne Bay, East New Britain and New Ireland. These regions are defined primarily by curvilinear engraved rock-art assemblages which bear motif similarities to the painted Manga rock-art of the MacCluer Gulf, e.g., scrolls, and the painted rock-art of the New Guinea mainland (scrolls, enveloped crosses) (Fig. 13). One of the more distinctive motifs of Milne Bay, East New Britain and New Ireland is the spiral, or motifs which incorporate spirals in their overall structure. Faces and feet are also common. Notably, once the interpretation of the MV results extends beyond the regions included in the statistical analyses, overlaps between painted and engraved rock-art become more apparent.

3 West New Britain (with some links to Central Province, especially the Sogeri area). Many of the motifs characterizing West New Britain are also found in Milne Bay, East New Britain and New Ireland (e.g., the faces and scroll-like forms at Malapapua), but what differentiates this region from the former is the presence of motifs dominated by "cupules". Circles with central cupules, including unusual "contiguous circles" are particularly common. Two sites which are overwhelmingly dominated by these sorts of motifs are Akono Sogo (65) and Garua Island (71) (Fig. 14). These are distinctive sites because they are not characterized by any of the spiral, scroll or enveloped cross forms which feature in the Milne Bay, East New Britain and New Ireland assemblages. Cao-go is additionally characterized by a number of "cupule-based" motifs but it also contains a spiral form, linking it with the "Milne Bay" group. The similarities between West New Britain and the Sogeri area are based on the mutual occurrence of circles or ovals with either central cupules or a short central line (which does not touch the side). Circles with central cupules (often referred to as "cup and ring" in the literature) have also recently been found at a site in Mt Hagen in the New Guinea Highlands (Robin Torrence, pers. comm., 2001). These motifs, and the "non-motif" variables which define the contexts in which they are found, have a distribution which appears to be limited to mainland Papua New Guinea and Island Melanesia. Based on the density of their distribution, I would nominate West New Britain as the "centre" of this engraving group.

4 Northwest Guadalcanal, New Caledonia, Fiji, Tonga and Micronesia. On first impression it might seem difficult to assess the relationship between the rock-art of these regions and that found elsewhere because of the different ways they have been treated by the various MV algorithms. For example,

the CA algorithm often placed New Caledonia and Micronesia on the periphery of the distribution, whereas the MDS (Jaccard's coefficient) placed these regions in the centre of the distribution. The CA issued particularly high scores to the large numbers of unique motifs present in each of these regions, whereas the MDS algorithm preferenced those motifs which are held in common with other regions. What can be concluded from these seemingly different results is that, while a large number of the motifs in Northwest Guadalcanal, New Caledonia, Fiji, Tonga and Micronesia are probably the result of local innovation, a significant number are also found in all other regions in the sample. The motifs present in these regions are similar to both the curvilinear engraved rock-art of New Britain, New Ireland and Milne Bay, and the rectilinear painted rock-art of Manus, Sialum and Bougainville (i.e., all regions to the west). In other words, it is within the more easterly regions of the sample that we see a convergence of motifs associated with either engraved or painted assemblages in the west. This convergence can also be seen in relation to non-motif variables. For instance, painted motifs which are usually associated with the non-motif attributes of the APT (inaccessibility and cliff-faces) can be found as boulder engravings in Northwest Guadalcanal and regions in Remote Oceania.

Conclusion

This paper was written in response to Jim Specht's (1979) suggestion that painted and engraved rock-art in the western Pacific divides into two more or less geographically distinct groups. It was also designed to test the merits of Specht's (1979) "Austronesian engraving style" and Ballard's (1992) "Austronesian painting tradition" via a statistical analysis of motifs. While a more detailed appraisal of these two analytical entities has been undertaken (Wilson, 2002), the results presented above indicate that the relationships between painted and engraved rock-art, particularly through space, are more complex than previously thought. Painted and engraved rock-art does separate on the basis of motif differences but not according to the geographic distinction observed by Specht over 20 years ago. That is, the rock-art of the western Pacific can no longer be conceived in terms of "a western painting group" and an "eastern engraving group". Instead, the statistical comparisons between motifs demonstrate that painted and engraved rock-art sites in the western Pacific are associated with two distinct but homogeneous motif groups that overlap in the eastern parts of this wider region (e.g., Northwest Guadalcanal).

How might the differences between the motif ranges associated with painted and engraved rock-art be explained? Do these two media represent traces of two separate movements of people at different times? Or might they be indicative of function differences? Such questions, which cannot be critically assessed without some understanding of how painted and engraved rock-art articulate with one another through time and according to other social processes, are explored in a related but much larger study (Wilson, 2002).

Notes

1 Note that Figs. 1–4 display more rock-art sites than are included in the MV analyses.

2 Only after I completed my analyses did Matthew Spriggs draw my attention to the unpublished paper by Frimigacci & Monnin which contains site level information for New Caledonian rock-art.

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