Series Editors:

Glenn R. Summerhayes
Richard Walter
Les O'Neill

Department of Anthropology and Archaeology
University of Otago
Dunedin
New Zealand

This volume

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Excavations on Motupore Island
Central District, Papua New Guinea

Jim Allen

With contributions by

Pamela Swadling and Owen Rye
For Jill, for revving me up when I started to stall
PREFACE

In Western Motu oral tradition, Edai Siabo was a Motu man who lived at Davage, an ancestral Boera village about 25 km north-west of Port Moresby. One night while fishing, Edai fell asleep in his canoe and was dragged into an underwater cave by a giant eel who was a dirava, a spirit. While in the cave the dirava explained to Edai how to build a trading canoe or lagatoi, and taught him the rituals and requirements needed to undertake a hiri, a large-scale trading expedition to the Gulf of Papua that continued in the Port Moresby area up until the middle of the 20th century.

The following day, people from Davage searched for Edai and recovered his body. Although they believed him drowned, back on shore Edai revived and explained how the dirava had taught him to make the lagatoi and undertake the hiri, carrying pots to trade for sago that would carry them through the food shortages of the lahara, the time of the monsoon wind and wet season. While some of the men ridiculed him, Edai merely ignored them and followed the rituals he had been taught and built his lagatoi. His wife Oiooio made pots to trade and Edai instructed her in the rituals she had to observe in his absence, to ensure the success of the venture. Some of his fellow villagers, persuaded by Edai’s example, built their own lagatoi. Eventually the first hiri fleet departed for the west.

As instructed, Oiooio counted 50 days then began to watch for the return of the fleet from a coastal hill near Boera called Iduata, together with the other wives. But as weeks passed and the hiri fleet did not return, the women gradually abandoned their vigil until Oiooio waited alone. When eventually the fleet returned the men on the lagatoi discovered that their wives had abandoned them and remarried. Only Oiooio had maintained her ritual duties, and in so doing demonstrated that a successful hiri depended on the whole village maintaining the discipline and responsibility of the hiri rituals. In this way Oiooio was seen to be as symbolically important as Edai in the successful establishment of this trading expedition.

This is a bare-bones account from Western Motu oral tradition of the establishment of the annual hiri trading expedition, which by c. 1900 AD involved c. 600 men from villages centred on Port Moresby sailing c. 20 lagatoi carrying between them c. 30,000 clay pots and travelling c. 300 km to the Gulf of Papua, where the pots were exchanged for c. 600 tonnes of sago and perhaps 100 canoe hulls (Allen 1977a:437). Such a précis does not begin to account for the complexity of the hiri, its social and ritual requirements, its dangers, its social consequences, or its integration into the year-long round of the Motu trading economy.

There are many versions of the Edai Siabo story (see especially Oram 1991, also Moi 1979; Skelly 2014) and additionally several very different oral histories for the creation of the hiri. One of these (Tau 1976) tells of a fight between two brothers, Kiaura and Taurama that resulted in Kiaura moving west to the Kikori River Delta in the Gulf of Papua. Before leaving Kiaura threw soil into Bootless Bay forming the islands there, including Motupore Island. Taurama moved to one of the islands and became the original ancestor of all the Motu. Kiaura took with him a variety of foods including sago, betel nuts and yams, leaving behind armshells and beads and only wild yams and bananas. Subsequently, the hiri was developed to redress the imbalance between the resources of the two areas.
At first sight there appears to be nothing connecting these apparently competing stories that both set out to account for the origin of this famous trading expedition.

In the 1980s, post-processualists like Hodder, Ucko, Miller and Tilley decreed that undertaking archaeology in non-industrialised countries like Papua New Guinea was elitist, that it was designed to prolong colonial oppression, and that it precluded local historians from writing their own history. By this time I had worked in Papua New Guinea for 15 years and knew enough to dismiss such poorly-informed rhetoric and to by-pass the ensuing World Archaeological Congress.

But such ideas linger, at least in Australia, so I have deliberately begun this preface with these two Motu origin stories, to assert that both are carried by the thread of historical reality and that the proof is encapsulated in the archaeological record on Motupore.

Thus primarily, this report sets out to unite Motu oral history and Western archaeology by considering the origins of the *hiri* and its connections with Motupore Island and Bootless Bay.

**New Guinea**

I have half-remembered memories of stories about the World War II in Papua New Guinea from around 1944-1945 when I six or seven. Subsequently, as a teenager and voracious reader I stumbled on the small but seductive set of ‘adventure’ books set in Papua New Guinea. Two I recall were Frank Hurley’s *Pearls and Savages* and Ion Idriess’s *Gold Dust and Ashes*; I also recall documentary films, in retrospect likely also to have been shot by Hurley. On leaving high school I applied to the Australian School of Pacific Administration in Mosman in Sydney. This was an Australian Government tertiary institution set up to train administrators to work in Papua New Guinea. I wanted to become a *kiap*, a government patrol officer, but my application was rejected and thoughts of New Guinea faded.

Fast-forward ten years. I was by then a doctoral student in the Anthropology Department of the Australian National University in Canberra, taking a second or third detour in my extended education, this time investigating the application of archaeology to the short European history of Australia (Allen 2008). The archaeology was titillating but for me not intellectually compelling. However, my fellow students included Peter White, researching in the New Guineas Highlands, Jim Specht in New Britain, Colin Smart in New Caledonia and Jens Poulson in Tonga, overseen by Jack Golson, late of Cambridge and Auckland, doyen of Pacific archaeology. I listened in seminars, argued in the tea room, took vicarious pleasure in what wasn’t mine.

Then suddenly I was writing up, considering life beyond the thesis. From out of nowhere an advertisement appeared for a lectureship in the newly formed University of Papua New Guinea. With nothing to lose, I competed against better qualified colleagues. Against the odds, Ralph Bulmer offered me the job. I didn’t understand why. I didn’t ask.

**Port Moresby**

If one is lucky, on a few occasions in a life things fall perfectly into place. I arrived in Port Moresby in late 1968 and began teaching the following year. As various commentators (e.g. Inglis 1980; Pawley 1991; Griffin 1991) have remarked, this was the golden age of the University of Papua New Guinea. It had been established in 1965 and by 1969 was a fully
working entity. New staff were still arriving, and building on the Waigani campus continued, but suddenly there was a university where there had been scrub and red dirt a few years earlier. The staff were excited and optimistic about the future, a successful university being a step towards looming independence for Papua New Guinea. One lasting memory was the intellectual quality of the academics, a mix of New Guinea research experience and young enthusiasm. Anthropology was physically flanked by History and Geography, the former led by Ken Inglis, the latter by Gerry Ward. In between, Ralph Bulmer, who had arrived with his archaeologist wife Sue only the year before in 1968, had already built an eclectic department of social and cultural anthropologists, linguists, sociologists and now an archaeologist. The Bulmers’ campus house was renowned for parties and anthropological argument; it and the university were compulsory stops for foreign researchers moving in and out of the country, an apparently endless source of new conversation and ideas. The University’s ambition could be measured by the fact that in 1970 it hosted the multidisciplinary ANZAAS conference; I got the job of organising the Anthropology section, part of my steep learning curve.

Intellectual influences

Everyone who knew Ralph Bulmer during those Waigani days speaks of his wisdom, patience and generosity. I enjoyed those gifts, but have two other lasting memories. To fill yet another educational gap, in 1969 I sat in on Ralph’s first year lectures on New Guinea. When a lecture finished Ralph would be surrounded by students asking questions, but sometimes recounting personal experiences that augmented or questioned something Ralph had said in the lecture, following Mead or Malinowski. Ralph delighted in these ‘teaching rewards’ as he called them. ‘Where else’, he would ask, ’do your undergraduates correct your sources?’

My second memory is Ralph’s good-natured refereeing of my archaeological arguments with Sue Bulmer. These began early in our acquaintance and continued on over the decades. Sue’s data and ideas loom large in this report, together with my reactions to them, and will not be rehearsed here. In 1968 Sue was very kind to me, sharing her archaeological knowledge on New Guinea in general and the Port Moresby area in particular, where she was actively surveying with friends each weekend. On my second day in the country we climbed into the saddle between the twin peaks of Nebira Hill to visit her on-going excavation of Nebira 2 and within a few months my students and I were digging at Nebira 4, at the foot of Nebira on the Laloki River side.

By then I had met Nigel Oram. Nigel had begun working in the early 1960s in Port Moresby helping to develop the Australian National University’s New Guinea Research Unit, situated close by the Waigani campus. In 1969 he joined the UPNG History Department. Nigel wore many hats - anthropologist, administrator, historian and politician – but I knew him as an oral historian. At that time Nigel, a fluent Motu speaker, was reconstructing the history of the Western Motu from oral sources. I was, as my mother would have said, too young smart, too old wise and I was highly sceptical about the utility of studying what I thought of as mythology; but it was Nigel who introduced me to the Edai Siabo story and persuaded me that Motu oral traditions are carried by a thread of historical reality, if you can just tease it out. Nigel spent years teasing it out, but his and my conclusions frequently clashed.

And then, Murray Groves. Murray spent several years in the mid-1950s undertaking anthropological research for his doctorate among the Western Motu of Manumanu village
and had written several influential papers concerning aspects of their social and economic lives. Around 1970-71, I forget exactly, Murray was living in Port Moresby undertaking research in Hanuabada village and I got to know him at that time. Like Bulmer and Golson, Groves had been part of the legendary Auckland department, but unlike them Murray could be abrasive, impatient, rude and garrulous. He was also intellectually brilliant, and if you passed some unexplained test he ran, a kind and generous man. I recall during that time I chaired a seminar where Murray was relentlessly destroying the theoretical position of some anthropological luminary. Unable to contain himself any longer, the normally placid Bulmer jumped to his feet, shouting. A David between two Goliaths, I was still wondering how to manage this when Groves responded: ‘Sit down, Bulmer, you’ll get your chance at the end!’ And he did.

I learnt a huge amount about the Motu from Murray Groves’ articles and his conversation. For some reason we got on. I came to think that this was at least partly because the prehistory of the Motu was the only aspect of those people that Murray could not access himself. Time depth, origins and the processes of cultural evolution could not be effectively reached via social anthropology or oral traditions. This was archaeology’s great advantage, to be wielded like a sword.

Ethnography

In the same way that I began with only a superficial understanding of the nuances of Papuan oral traditions, I arrived in Port Moresby suspicious of both the accuracy and the utility of ethnography to enlighten the archaeological past. To some degree this reflected Australian experience, where at that time particularistic descriptions were frequently invoked to bolster explanation of a depleted archaeological record. My perception was that by employing this ethnographic strategy the past must almost invariably appear simpler than the present, but also necessarily similar to it, even when separated from it by tens of millennia and many unknown environmental, technological and social differences.

Here my perceptions were changed in particular by conversations again with Murray Groves, who had come from a history background, regarded himself as an empirical ethnographer and argued that both history and ethnography could offer systematic and precise evidence that could generate explanatory models of social behaviour for particular ‘universes of time and place’ as he later called them. Ethnography in this sense sat between the particularistic comparisons just mentioned and the uniformitarian principles of human behaviour that Jim O’Connell and I would later invoke in dealing with Pleistocene archaeology.

Groves allowed that such models might also be predictive, a somewhat elusive idea at the time that made me consider whether ethnographic models could be used to predict what the archaeology of Motupore should look like. Subsequently provoked by a paper by James Clifford (1986) suggesting that ethnography could not be objective and always produced ‘constructed truths’, Groves (1990, 1991) developed a detailed defence of his craft that clarified my thinking.

My conversations with Groves persuaded me of the validity of framing hypotheses from Western Motu ethnography for testing in the Motupore archaeological record and seeking comparisons between these two data sets whenever possible. My rationale for doing this depended particularly on the rare circumstance that even before excavation began, many oral
traditions identified Motupore as an ancestral Western Motu village. Given that the site’s archaeological sequence was unbroken, the island’s earliest inhabitants were also, by definition, ancestral Western Motu. Motupore had been occupied by only slightly older generations of the same social group. When the behaviour reflected in their archaeological record could be matched with the behaviour of their descendants reported in the ethnography, the linkage could be accepted with confidence and other aspects of that behaviour, ethnographically described, could be suggested for the archaeology, with similar confidence.

Similar arguments appear at various points in the text.

Archaeology

In 1966 Jack Golson gave a public lecture in the Hohola Community Hall entitled ‘Fifty Thousand Years of New Guinea History’. The hall could not accommodate all of the large audience, some of whom stood outside listening through the windows; Jack later wrote that it was the most enthusiastic audience he had ever talked to. Papuans and New Guineans were very interested in their history and sympathetic to the intellectual idea of seeking it in the debitage of past material culture. Plans were soon to be in train to re-invent the local Port Moresby museum as a national research institution alongside the University of Papua New Guinea. Golson and ANU colleagues were in the early stages of their epic exploration of early agriculture in the New Guinea Highlands, but took time out to visit and record local sites, including Taurama and Motupore Island (Golson 1968; Lampert 1968; Lampert and Golson 1967). Motupore was at that stage owned by an expatriate couple wanting to return to Australia. Lampert and Bulmer, supported by Golson, conceived the plan that the new university should buy the island and convert it into a university research station, initially as an archaeological field school and subsequently as a marine biology centre. My role, as the appointed archaeologist, was to combine a detailed assessment of the site with field school teaching. The purchase completed, I began excavations there in 1970 accompanied by Wallace Ambrose, who had been seconded from the Australian National University for six months to design and help fit out the new archaeology laboratory at UPNG.

As described in this report, the first two years of excavation on Motupore revealed the complexity and importance of the archaeological site and raised the problem for me of coming to terms with the archaeology of Motupore while meeting teaching and other obligations in the university. In 1972 I applied for and was appointed to the position of Research Fellow in the Prehistory Department at the Australian National University, enabling me to carry out the long Motupore field season of 1973, when I was on the site from April until September. My final season there was in 1975 when I accompanied Alan Thorne who went to excavate a number of burials that I had located but not excavated in 1973.

The latter part of the 1970s I spent analysing the vast array of excavated material from the site, while writing and participating in various departmental research activities in Tasmania and the Northern Territory. By the early 1980s, prompted by Roger Green’s Lapita research in the South-East Solomons, I developed plans for the Lapita Homeland Project. With colleagues, I was in the field in 1984 and 1985, an important time of change for me, helping to uncover Pleistocene archaeology in the Bismarcks and being appointed Foundation Professor of Archaeology at La Trobe University in Melbourne. La Trobe was also a busy time, writing lectures, appointing staff, overseeing the physical building of the new department and developing an active research project nearer to home than Papua New
Guinea, one that could involve La Trobe students. The Southern Forests project, investigating the Pleistocene occupation of south-west Tasmania with colleague Richard Cosgrove, consumed most spare moments of the years up to my retirement from La Trobe in 1998.

Thus by 1985 the completion of the Motupore project had largely stalled, mainly to do with analysis problems spelled out in Chapter 6, exacerbated by my other commitments at La Trobe and the switching of my principal research interest to the Pleistocene past. This Pleistocene interest followed me into retirement and a continuing academic partnership with Jim O’Connell and the Department of Anthropology in the University of Utah, where I was an Adjunct Professor.

But Papua New Guinea was never far away. I followed with interest archaeologists from Monash University beginning work in the Papuan Gulf around 2005 and later in Caution Bay just west of Port Moresby around 2008. In 2007 Glenn Summerhayes and I had published a review article of the ceramic colonisation of the Papuan south coast (Summerhayes and Allen 2007) and the same year Glenn invited me to accompany him, together with Matthew Leavesley and UPNG students, to re-date Ron Vanderwal’s Oposisi site on Yule Island (Allen et al. 2011). Shortly after that I undertook a revision of the Papuan sequence (Allen 2010). In 2008 I again worked with Otago colleagues excavating the Lapita site of Tamuarawai on Emirau Island in New Ireland Province (Summerhayes et al. 2010).

In retrospect, I see now that Papua New Guinea was not going to let me go. In 2012 I broke out the old Motupore notebooks and took a deep breath.

The result, for better or worse, follows this preface. I am pleased it has found a home in the University of Otago Working Papers in Anthropology. I thought it might for ever remain in manuscript form, for better than anyone I recognised that the manuscript is self-indulgent and prolix, a copy editor’s nightmare. But I persuaded myself to do it by granting myself the freedom to take it wherever my mind wandered, with no self-imposed regimen. The result is part history and part memoir, but always with a view to the central objective of explaining and interpreting Motupore’s archaeology. The late Roger Green once told me that among his 20 year-old papers the only ones cited after such a time were the data papers; along with many other archaeologists, his dictum was that if you dig it up, you write it up. While this sentiment is admirable and to be followed, archaeological data per se have little relevance beyond the context of their interpretation. The question is always, “What is the question?” What do you want to find out, and how do you pursue the data to get there? As a general rule here, I have tried to report the data as separately as possible from my contextualising interpretations. Hopefully they are presented sufficiently objectively for someone to use them to question what I think they say.

As Murray Groves noted for his Western Motu ethnography, any archaeological account must be partial and selective, and influenced by the sum of things that make up and define the archaeologist. No one else would likely excavate and report the Motupore site as I have done here. This does not mean that no other archaeologist could replicate my results, if they sought to do so. I have attempted to deal with the data systematically and carefully and in this sense, scientifically and objectively. But I believe that good archaeology also requires creativity, imagination and wit. As Groves (1990:8) observes, subjectivity is not only unavoidable but also desirable. In this respect I fell (and continue to fall) between the stools.
of processualism and post-processualism. But whether this report is oppressive, exploitative or elitist is for others to judge.

Mates

Most of the colleagues already mentioned above I count as friends and they have all contributed to my being able to complete this task. Below I list more fully those to whom I owe an intellectual debt; most are also my friends. Here I wish briefly to acknowledge in particular five people who in different ways made it a journey worth taking.

Jill Allen with Emirau women.

My wife Jill has been unstinting in her support, in Canberra, Melbourne, at Mossy Point and in the field where she has always worked like a navvy, cooked, and carried our social commitments with skills far beyond my own. At home, seemingly endless years of me at the computer have impinged on her life in retirement, something she has met with cheerful stoicism. Dedicating a dry-as-dust archaeological report to her is a poor reward, but one she will understand (together with my apologies to Meatloaf).

Guma Lumb
Guma Lumb was an Eastern Highlander who was the caretaker on Motupore when the university bought the island and he was kept on through the 1970s. He had left his village to join the army, where he trained as a cook. He kept the island and its buildings spotless and in good repair and maintained a garden on the mainland opposite Motupore. Sometimes Guma and I would sit in the early morning and watch dawn break across Bootless Bay; he would talk about his life before Motupore or ask me questions about the excavation. He was fascinated by the idea that history could be extracted from sherds, or as he described them ‘sospan bilong graun’. I tried endlessly to persuade him to call me Jim rather than ‘masta’, but it was a colonial step too far, although once in my hearing he described me to someone else as his ‘wantok’. I delight in the fact that Guma’s garden became a geographical location of archaeological significance as discussed in this report.

Saem Majnep

In 2012 the inaugural Saem Majnep Memorial Symposium on Traditional Environmental Knowledge was held in the University of Goroka to recognise the extraordinary contribution made to New Guinea ethnobiology by Ian Saem Majnep, who grew up as a Kalam speaker in the Upper Kaironk Valley in the Madang Province. One paper in the symposium, given by Andrew Pawley, describes Saem’s metamorphosis from stone age hunter to academic scholar (Pawley 2012; see also Pawley 1991; Majnep 1991). This note is drawn from these sources.

Saem was probably born around 1948 into a traditional hunter-horticulture social group living near the Simbai patrol post. In 1960 Ralph Bulmer began fieldwork in the area, within a decade of the first European patrols. Ralph was stranger to the Kalam than they were to him and his presence drew people from the surrounding country keen to see what this huge white man was about. Saem was one of them.

Even by Kalam standards, Saem endured a hard childhood. He was called Majnep, ‘just sweet potatoes’ because this was the only food available when he was born. When Saem was four years old his father died following an accident and his mother was left with minimal support from relatives to raise Saem and his younger foster sister. They lived in rock shelters and abandoned houses; at one point Saem described how his mother tried to waterproof a pig shelter for them to live in. A resourceful woman, Saem’s mother was an expert hunter of small game and at an age when European children are just starting school, Saem was already
familiar with the plant and animal resources of the forest. By the time he met Bulmer, at age 11, he was a skilled hunter, and by 1963 he was collecting bird species requested by Ralph, shooting them with bow and arrow. In turn Ralph recognised that Saem was not only a good hunter but that he could readily answer questions about the habits and behaviours of the species he shot, often when older men could not. An unlikely partnership was formed.

The subsequent history of the Majnep-Bulmer collaboration draws me far from my present purpose but is necessary to outline. It is remarkable by any measure, mostly because Bulmer did not merely use Saem as an informant, but deliberately made him into an ethnographer and author. For the first book, *Birds of my Kalam Country* (Majnep and Bulmer 1977) Bulmer interviewed Saem who made lengthy statements about the behaviour of more than 220 Kaironk Valley birds and their role in Kalam life. Bulmer translated these into English and they formed the core of the book, which was published to enthusiastic reviews. The second book, *Animals my Ancestors Hunted* (Majnep and Bulmer 2007) had a far more tortured genesis, initially to do with Bulmer wanting Saem to write the first draft in Kalam, a demanding request since few Kalam could write their language, although Saem had a working proficiency using the orthography devised by the linguists Andrew Pawley and Bruce Biggs. Pawley (2012) describes how Saem would first tape-record his ideas, sometimes interviewing other Kalam men to fill in gaps, then write these in Kalam, and lastly attempt a Pidgin translation. Bulmer would then re-transcribe the Kalam text. They would then work together to create a free translation into English that Bulmer would subsequently polish and annotate. Saem had completed the preliminary task for the *Animals* book by about 1980, but the second phase was extremely difficult because Kalam language structure and vocabulary were so different from English that totally accurate translation was not possible. By 1986 around 700 pages of bilingual text had been generated. The existing English translation closely approximated the unedited Kalam text and to be publishable required extensive editing. Partly because Saem wanted a Kalam version of the book to be available, Bulmer proceeded to draft a series of bilingual working papers in the Auckland Department of Anthropology, a task that was well advanced when Bulmer fell ill with lung cancer, dying in July 1988, just 60 years old.

To their lasting credit Andrew Pawley and Robin Hide stepped into the breach. Pawley edited all 12 volumes of the working papers, although only the first six were ever published, and then he and Hide reworked these papers into the volume submitted in 2003 and eventually published in 2007, again to enthusiastic reviews.

A third volume on plants, to be called *Kalam Plant Lore*, was foreshadowed, designed to follow a similar production and publication strategy to the *Animals* book, and a substantial early paper appeared (Majnep and Bulmer 1983). After Bulmer's death Saem continued with this work in collaboration with Andrew Pawley and botanist Rhys Gardner, and at his own sudden death in 2007 had largely completed the Kalam text. Like Ralph Bulmer, Saem was only about 60 years old.

In 1989 the University of Papua New Guinea awarded Saem an honorary doctorate for his contributions to New Guinea ethnobiology, a fitting tribute to a remarkable man.

Against this monumental academic achievement my own dealings with Saem might appear inconsequential, but were important to me. In 1968 Bulmer, newly arrived at UPNG, brought Saem to Port Moresby to facilitate the collaboration just described. Saem was found a job in
the university as my laboratory assistant. Saem also worked extensively in the field with both Sue Bulmer and me on our various Port Moresby excavations, and subsequently with other archaeologists working in the country. In particular Saem accompanied me on every period of fieldwork I undertook on Motupore, where, as might be anticipated, he became expert at stratigraphic excavation and faunal and shell species identification. On site and in the laboratory we discussed the archaeology as I would with any colleague; many insights in these pages can be attributed to Saem. During the recent 2016 Motupore field school season (see Chapter 16) I caught myself on several occasions turning around to look for him at the sieves or in the trench.

Mary-Jane Mountain

Mary-Jane Mountain came to UPNG in 1971 to excavate at Nombe in the New Guinea Highlands and after that filled in for me while I was on leave. We had met in Edinburgh in 1968 and I fear I subsequently led her astray with extravagant tales of the joys of New Guinea archaeology. Subsequently she was appointed to the UPNG Anthropology position made vacant by my move to the ANU. In 1972 she and Sandra Bowdler continued the excavations on Motupore and in 1973 she and her students were frequently on Motupore assisting me. Mary-Jane excavated on the island every year between 1972 and 1976, while also pursuing her own Highlands research and teaching, and along with Saem Majnep provided me with the support I needed to complete my fieldwork there. I have relied heavily on her opinion, memory and field notebooks while writing this report.

Geoff and Jill Irwin
In 1973 Geoff Irwin and I carried out a survey on the Papuan coast between Marshall Lagoon and Mailu, locating sites that would form the basis of Geoff’s doctoral research. Although ostensibly one of Geoff’s supervisors, over those years I learnt more from him than he did from me. We have remained friends and colleagues, united by our interest in Papuan prehistory which we still discuss regularly, and by the fact that he lets me fish from his yacht.

I have depended on Mary-Jane and Geoff to offer critical opinion as, between them, they have ploughed through drafts of most of my chapters. Both have found it hard work and I remain forever grateful for their sage advice. That I have sometimes chosen to ignore it does not mean that I have not always valued it.

Other acknowledgements

My primary thanks go to the generations of UPNG students who helped me excavate and process the Motupore material; I always enjoyed their knowledge, company and co-operation and was buoyed up by their interest in what we were doing.

Beyond them, there is a long list of people who variously contributed to this work. In particular I apologise to Pam Swadling for taking so long to bring her fine analysis of Motupore shellfish into view and to Owen Rye for not yet fully consummating his ground-breaking research into sourcing Motupore pottery.

I particularly thanks Hugh Davies Professor of Geology UPNG for his extensive correction of my original section on geology and geomorphology appearing on pages 28-30 of volume 1.

Greg McKay drew, enhanced, photo-shopped and changed illustrations for me, with great skill and patience. Many of these were from original drawings by Win Mumford and Betsy-Osborne and photographs by Mary-Jane Mountain.

Beyond these I remember and thank Bryant Allen, Wal Ambrose, Ken Aplin, Sandra Bowdler, Stella Bromilow, Peter Brown, John Chappell, Geoff Clark, Richard Cosgrove, Bruno David, Hugh Davies, Joshua Drew, Jocelyne Dudding, Stewart Fallon, Anne Ford, David Frankel, Klim Gollan, Jack Golson, Alu Guise, Peter Hiscock, Jenny Hope, Brenda Jacobs, Pat Kirch, Matt Leavesley, Ian Lilley, Dragi Markovic, Ian McNiven, Vincent Megaw, Monica Minnegal, Kylie Moloney, Jim O’Connell, Andrew Pawley, Yvonne Pittelkow, Ron Prior, Jim Rhoads, Prudence Rice, Georgia Roberts, Betty Ross, Rob Skelly, Glenn Summerhayes, Kat Szabó, Kym Thompson, Ron Vanderwal, Steve Webb, Ming Wei, Herb Weinand, Mike Worthing and Doug Yen.

Lastly, I also thank those whom I have possibly overlooked here. *Mea culpa*.

Jim Allen
Mossy Point
December 2016
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CHAPTER 1    INTRODUCTION

We are not yet in a position to say definitely where the Motu originally came from (Haddon 1901:250).

The recent history of Motupore Island

The archaeological importance of Motupore Island, situated in Bootless Bay, some 15 km east of Port Moresby, was first recognised in late 1967, when Ronald Lampert spent a day at the site at the northern end of the island (Figures 1.1 and 1.2). At that time Mr Peter Thorpe and his wife held a private lease on the island and had settled there some years previously. During their tenure they had constructed two dwellings and several smaller structures and had rotary-hoed a large area of the sand spit, thus disturbing the latest phase of prehistoric occupation on the site. This area had subsequently been planted to lawn, ornamental gardens and coconut trees.

![Figure 1.1. Map of Port Moresby area showing sites (unfilled circles) and villages (filled circles) mentioned in the text.](image)

Mr Thorpe reported having disturbed a number of human burials in the course of building. From the excavations now undertaken it seems likely that the construction of the larger house probably disturbed few, if any, burials, but burials were likely disturbed by other constructions and gardening. In mid-1967 Mr R.D. Mackay, then of the Public Museum and Art Gallery of Papua New Guinea, and Dr W. Wood, then of the Papuan Medical College, visited the site and excavated 'several' human skeletons which were closely spaced and uniformly oriented. Subsequent attempts failed to locate this skeletal material and any associated artefactual material in either institution.
Densest concentrations of archaeological deposits occur along the base of the hill.

During his visit Lampert examined surface features on the site and slightly enlarged a small test pit made by Wood. As far as can be determined, this pit may have subsequently become the location of the septic tank that serviced the smaller of the two original dwellings. An unpublished account of this visit (Lampert and Golson 1967) pursues two main themes. The first outlines the archaeological work carried out, and this was later published in large part (Lampert 1968). The second theme concerned the conservation of the site. Motupore was about to be sold and Lampert and Golson proposed that it be bought and used as a research station by the University of Papua New Guinea, primarily as an archaeological training site, but also as a field station for other disciplines at the University.

Early in 1969 I took up the position of lecturer in prehistory in the Department of Anthropology and Sociology in the University of Papua New Guinea. By this time negotiations to purchase the island along the lines suggested in the Lampert/Golson document were well advanced, led by Professor Ralph Bulmer. In 1970 ownership of the island passed to the University and I was invited to establish a combined field school for archaeology students and a personal research project there.

Nine periods of excavation were undertaken on Motupore every year between 1970 and 1975, as follows:

1970    July  J. Allen and W. Ambrose
1971    April  J. Allen and S. Bowdler
1971    June-July J. Allen
1972    April-May S. Bowdler and M-J. Mountain
1972    June-July S. Bowdler and M-J. Mountain
1973    April-September J. Allen (intermittently M-J. Mountain and P. Swadling)
1974    June-July M-J. Mountain
1975    May-June A. Thorne and J. Allen
The late Ian Saem Majnep, then a member of the Department of Anthropology and Sociology, was chief field assistant for all these seasons, and most seasons included UPNG students.

In 1978, Les Groube was appointed to the University of Papua New Guinea and re-opened the site in 1979 intermittently continuing excavating there through to 1983 (Cox 1989). John Burton subsequently also excavated there in 1986. This report covers most of the material recovered up to and including 1975 (exclusions are discussed in Chapter 3) and none of the subsequently excavated material, although several later chapters make reference to the Groube excavation and the pottery analysis by Cox (1989). With the exception of the 1975 season by Thorne and myself all of these earlier seasons involved student field training, the course for which was established in 1970 and which, after my departure from the University of Papua New Guinea, was carried on by Mary-Jane Mountain. I understand that field procedures remained the same, and that with the exception of the 1972 seasons, the strategies were formulated in accordance with the research design I had initiated and then continued after joining the Australian National University.

Altogether, the surface area of these excavations totalled 190 m$^2$, of which 170 m$^2$ was opened under my control.

**The archaeological importance of Motupore Island**

During his 1967 visit Lampert noted that most of the consolidated sand spit area had artefacts on its surface and that the site appeared to be confined to this area. Along the base of the hill flanking the southern edge Lampert noted three discrete middens, the largest of which he estimated to have a depth of about 3 m. From the surface indications these deposits were judged to be extremely rich in artefacts and faunal remains (Lampert and Golson 1967:2; Lampert 1968:74). Lampert also enlarged a small cutting made by Wood at the foot of the central and smallest of the middens. Here he reported a depth of cultural deposit of c. 80 cm.

Lampert reported pottery and shells throughout the sequence, noting in particular the presence of a flaked stone industry, which interested him because several earlier surveys along this coast had failed to locate a flaked stone industry of potential diagnostic value, which he considered this one to have. As well, two secondarily worked implements reminded him of Australian 'adze slugs' (Lampert and Golson 1967:2) although later he conceded that these might be drill points (Lampert 1968:74). The upper units contained more pottery than the earlier ones; there was also a change in decorative technique, where the earlier pottery was predominantly shell impressed while the more recent material was mainly incised.

Despite the brevity of his visit, Lampert had identified several archaeological themes elaborated in the subsequent excavations. In designating the site to be of ’considerable archaeological importance' Lampert (1968:74) stressed its rich artefactual remains for constructing culture-historical sequences and the potential of recovering human skeletal material for physical anthropological studies. While this monograph contributes to both these aims, process rather than sequence and human behaviour rather than material culture are the primary objectives of this analysis. These different theoretical perspectives will be elaborated in the later chapters.

**The historical importance of Motupore Island**

As well as its rich archaeological deposits, two independent disciplines had by 1969 pinpointed Motupore Island as a site of some historical importance. Early in the 20th century Murray (1912) had observed that Western Motu people traced their origin to and beyond the island of Motu Hanua in Bootless Bay and that they had vacated the island because of warfare with Eastern Motu people living on Loloata Island, less than a kilometre southeast of Motu Hanua (Murray...
Motu Hanua is an alternative name for Motupore and one that was still occasionally used in the 1970s. In 1969 Oram published independent confirmation of Motupore as an ancestral site of the Western Motu, gained from his study of the oral history of the area (Oram 1969). Motu oral history remained Oram's principal research and his work firmly placed Motupore Island as one of the ancestral sites of at least two patrilineal descent lines found in Pari and Hanuabada, modern day Western Motu villages of Port Moresby. As well, Oram documented 19th century historical sources that further corroborated the oral evidence (Oram 1981:210-12).

The second line of enquiry, while less precise, complemented the evidence of the oral histories. At the time Oram was researching oral traditions, Dutton (1969) produced a linguistic survey of central Papua written in historical terms. Although Dutton refrained from putting forward chronological dates for the arrival of Austronesian-speaking Motu in their present location, neither there nor subsequently have linguistic studies indicated that the Motu arrived in the Port Moresby region less than a few centuries ago. Other linguists, perhaps less cautious than Dutton, proposed some general dates. Capell (1943:276) suggested that the Austronesian speakers of the central coast around Port Moresby arrived no later than the beginning of the 13th century AD. Pawley suggested that a Proto Central District stage of the Austronesian languages in the region began to diverge into three dialect groups between 2500 and 3400 years ago. Of these, the central group separated from its neighbours between 1500 and 2000 years ago. These people were ancestral Motu (Pawley 1975:92-3). Both this chronological evidence (even allowing for imprecisions in the technique) and the lexical relationships between Motu and its neighbouring Austronesian languages (Pawley 1976:305, Table 1), where Motu is clearly intermediate between the western and eastern groups of Austronesian languages along the south coast, strongly discount the possibility that the Motu are immigrant intruders into the region in the last 300-400 years. Ross (1988) also argued for a long period of separation from other nearby Austronesian languages.

Bootless Bay is at the geographical centre of present-day Motu territory. Thus a circumstantial case can be made that its recent prehistoric occupants spoke Motu.

**Reconstructing Motu history**

By 1970, while Haddon's dictum remained essentially true, inroads had been made into the question by both linguists and oral historians. A brief résumé of current knowledge at that time helps set the scene.

The Motu occupy approximately 125 km of coastline from the village of Gabagaba in the southeast to Manumanu in the northwest. Motupore Island in Bootless Bay is 15 km east of Port Moresby and marks the approximate centre of this distribution and, as well, marks the point of division, which the Motu recognise for themselves, into two 'tribal' groupings, the Eastern and Western Motu (Figure 1.3). Within the latter group, three villages, Boera, Tatana and Vabukori consider themselves as originally distinct from the other Western Motu villages.

The separation of these three villages from Western Motu and the separation of Western and Eastern Motu seems to be based on culture-historical differences; Pawley (1975:14) found no sharp dialect boundaries between these groups and relatively little divergence between Motu communalects, nor has anyone pointed out significant differences in the village-level social organisation of these Motu groups. Earlier genetic studies (Groves et al. 1958; Price and Macintosh 1958) also failed to point out any distinctions between these groups. Instead the principal distinctions most often mentioned are that the Eastern Motu did not traditionally take part in the annual long-distance trading expedition, the hiri (e.g. Allen 1977a:424; Oram 1982:9), while Boera, Tatana and Vabukori have different origin stories (Oram 1981:213-16) and the last two also engaged in the specialised manufacture of ageva, the small spondylus disc beads used as valuables.
(Seligman 1910:93). (Note: publications by C. G. Seligman are variously spelled Seligman and Seligmann; throughout this monograph I have standardised to Seligman for consistency.)

Figure 1.3. Map of Motu, Koita and Koiari villages at time of European contact. Koita villages: 1 Roauna, 2 Kido, 3 Papa, 4 Konekaru, 5 Boteka, 6 Namaru, 7 Aimakara, 8 Bogemunime, 9 Iboko, 10 Buegarara, 11 Roko, 12 Eholasi, 13 Korebada, 14 Akorogo, 15 Kilakila. Koiari villages: 16 unknown, 17 Vaivai, 18 Maiberi. Adapted from Bulmer (1982:119); data from Seligman (1910) and Dutton (1969).

Ethnographically these were the only two Port Moresby villages producing these disc beads, although they were also made at Boera; at the same time Tatana and Vabukori residents may not have made pottery, unlike the remaining Western Motu villages (Barton 1910:114).

The Western Motu share their section of the coast with Papuan or non-Austronesian speaking Koita. In the late 19th century Koita occupied 15 villages on, or within a few kilometres of the coast, and, as well, all western Motu villages with the exception of Manumanu contained Koita sections. The Koita are closely related linguistically to their inland neighbours the Koiari, but at
the time of European contact generally feared them, ostensibly for their power in sorcery. Detailed accounts of each of these groups appear elsewhere (Allen 1977a, 1984; Oram 1977 and refs in both) and will not be reiterated here.

However, the sharing of the coastal region by Koita and Western Motu remains important. The early accounts (e.g. Seligman 1910) were clear that even when the Motu and Koita shared single villages they maintained separate cultural identities, particularly in language and occupation. Traditionally the Koita owned the land, gardened and hunted, in distinction to the much more marine-oriented activities of the Motu who fished, made pottery, and traded both inland and along the coast. Yet as Oram has pointed out (1977:80, 86) these distinctions blur when the evidence is examined in more detail; among other things the Western Motu also gardened and the Koita participated in the long-distance trading expedition, the *hiri* (Seligman 1910:45). The Koita and Motu freely intermarried (Groves *et al.* 1958:229). I have argued (Allen 1984) that the European intrusion disturbed a process of cultural fusion which may have eventually obliterated the Koita/Motu distinction in the Motu villages that had Koita sections.

A detailed examination of the linguistic picture (Dutton 1969:26-36) and the independent relevant oral histories (Oram 1981) agree that the Koita shift to the coast had transpired in relatively recent times, although before the arrival of Europeans. Such a view receives support from the archaeological work so far done in the region. Without reviewing the evidence in detail, both the excavation of the Nebira sites and Eriama sites (Allen 1972; Bulmer 1978) and the analysis of site survey material from the region (Bulmer 1979:13) have led to absolute and relative dating schemes which would suggest about 1500 AD for the beginning of this Koita coastwards movement. A small but significant contribution to this discussion is made in Chapter 15 of this report.

A similar, but apparently earlier inland movement to the coast had also taken place between the Koiari and the Eastern Motu (Oram 1977:87) where Koiari people joining Motu villages had been completely assimilated. However the Eastern Motu also traded with the Koita living in the hinterland, as did the Western Motu with the Koita and with other people living west of Koita territory, the Gabadi and the Doura.

This general demographic configuration occurring towards the end of the 19th century can be seen, then, to have no great antiquity. Oram worked for some years to untangle the threads of former movements of patrilineal groups in the existing villages and suggested the following general pattern (1981:227-8):

Motu speakers moved along the coast from the southeast, settling in Bootless Bay. Here they divided into the Western Motu group and the Lakwaharu or Eastern Motu group. Motupore and other settlements on the northern shores of the bay were abandoned, and subsequently, about seven generations ago, the Western Motu settlement of Taurama at the western end of the bay was destroyed by the Lakwaharu. The Western Motu then settled further westward in the vicinity of Port Moresby harbour (a.k.a. Fairfax Harbour) and from here settled the other Western Motu villages of Pari, Porebada, Rea Rea and Manumanu. The Lakwaharu settled at Tubusereia at the eastern end of Bootless Bay, in conjunction with inland Koiari. The other Eastern Motu villages were subsequently settled from Tubusereia.

A separate migration of Motu speakers had settled near the present boundary of the Gulf and Central Provinces. Moving back towards the southeast they settled in the Yule Island area and one section settled at Boera in Western Motu territory.

The Koita and Koiari separated in the mountains in the Sogeri area. The Koita moved initially to the Nebira region of the Laloki River and subsequently dispersed to the coast.
As will be seen in this volume, the archaeological evidence from Motupore and elsewhere does not obviously fit a model that sees it settled from the southeast, although this cannot be entirely discounted. It is equally likely that Motupore was settled from the Boera area to the northwest.

Building on Oram's research, Golson (1968:70) offered the following chronology, based on genealogies, for the events in Bootless Bay: Motupore settled at some unknown date; Taurama founded c. 1575 AD; Taurama destroyed c. 1725 AD.

By implication Motupore had been abandoned prior to c. 1725 AD. Evidence will be presented in later chapters to suggest that Taurama and Motupore were both settled by ancestral Western Motu c. 1200 AD.

Motupore Island and coastal site archaeology in Papua

This section places Motupore in the wider context of archaeology in Papua in order to provide background for this volume and to infer the ways in which Motupore will contribute important data. It does not aim to provide a prehistory of Papua, in any sense.

When Motupore was being excavated notions of cultural sequence were defined exclusively by ceramics. While ceramic sequences remain the fundamental underpinning of Papuan south coast prehistory today, at that stage the sequence was based on excavations by Susan Bulmer at Nebira 2 (ACJ) in 1968-69, Eriama (ACV) 1969, and Taurama (AJA) in 1972; my excavation at Nebira 4 (ACL) in 1969-70; five sites excavated by Ron Vanderwal in 1969-70, being Oposisi, Sirirou and Urouina on Yule Island and Abe and Kukuba Cave on the nearby mainland (Vanderwal 1973); the Papuan Gulf site of Samoa (now called Emo) excavated in 1971 by Sandra Bowdler (see Rhoads 1983, David et al. 2010); and four sites, 01, 02 and Mailu 3 on Mailu Island and Selai on the adjacent Amazon Bay mainland by Geoff Irwin in 1973 (Irwin 1985). Surface sites had been recorded in various locations by many of these researchers; in the Port Moresby area Susan Bulmer had instigated systematic surveys of the coast and hinterland during the late 1960s (Bulmer 1969) and supported by the data from the excavations just listed, she proposed six ceramic styles as a first sequence for the region (Bulmer 1978) spanning the then known period for pottery on this coast, from about 2000 years ago to the ethnographic present. I return to the six ceramic styles below.

Lapita in Port Moresby

Writing in 2016, the situation has vastly altered. Foremost among these changes has been the recent discovery of several find spots in the Boera area yielding late Lapita pottery and subsequent pottery that possibly dates to before 2000 years ago (David et al. 2011, 2012; McNiven et al. 2011a, 2011b). Here these find spots are referred to in a general sense as the Caution Bay sites, following these authors. It is not my purpose here to comment specifically on these finds for two reasons. The first is that as important as this first identification of Lapita on the Papua New Guinea mainland may be, it adds only marginally to the context for examining excavations at Motupore by extending its antecedent ceramic history in the region by perhaps 600-900 years. The second is that while substantial and controversial claims have been made for the significance of these discoveries it is not possible to assess them in advance of a more extensive publication of the data that underwrite them.

Early Papuan Pottery (EPP)

In contrast to Lapita on the Papuan south coast as presently known, the advent of extensive and interactive pottery making and using communities around 2000 years ago was a qualitatively different event, highly visible even in the 1970s. Irwin (1985:Table 17) identified 30 early period (EPP) sites among 120 surface sites he surveyed in the Amazon Bay area in 1973, and between 1968 and 1972 Bulmer (1978: 82) recorded 71 sites in the Port Moresby area, of which 30 were
EPP. In contrast to EPP visibility on the Papuan coast and earlier Lapita visibility elsewhere in the Pacific, more than a dozen archaeologists working along this coast for 40 years had failed to find pre-EPP pottery in perhaps 30 excavations and many hundreds of surface collections. No EPP or later sites, all dug into sterile deposits or onto basal rock, had come down onto earlier pottery horizons.

For the same reasons advanced for Lapita – that it is mostly peripheral to Motupore - again I will pass over any detailed description of EPP here, including why I now prefer this neutral term to the various technological and geographic names previously ascribed to the sequence of pottery decorative styles that comprise this archaeological horizon. For this and other related EPP matters, such as the re-dating of the Oposisi site, see Summerhayes and Allen (2007), Allen (2010) and Allen et al. (2011). However a general brief review is necessary because it impinges on our understanding of the later Port Moresby sequences and Motupore’s place within them.

In 2010 I offered a synthesis of the chronology of the Papuan sites (Allen 2010: Table 1) that is reproduced here (Tables 1.1 and 1.2) as a general guide only. Anyone using it should take note of the many caveats to it discussed in the original article. At a general level the table indicates that starting around the birth of Christ, a series of pottery using villages appeared right along the Papuan coast; and that starting around 7-800 years ago a number of villages maintained continuous occupation until the recent past, although only three, Mailu 3, Kinomere and Emo (previously Samoa) exist as villages today.

An important pattern to emerge is that while some sites contain both early and late phases, few, perhaps none, show connected sequences between these early and late phases.

It was quickly recognised that culturally related EPP sites occur along a 1200 km stretch of south Papuan coast from the Gulf of Papua in the west to well along the Louisiade Archipelago in the east (Irwin 1991). Evidence that this system (or large parts of it) were connected for some hundreds of years is seen in the repeated presence in sites of a chronological succession of similar pottery decorative styles within the EPP horizon and by the presence of obsidian derived from West Fergusson Island. The overall horizon and styles within it have been given a bewildering number of names by various workers, but the neutral term EPP is currently in use (e.g. David 2008; Negishi and Ono 2009) although standard nomenclature for the distinctive ceramic styles within EPP is still wanting.

Everywhere on the coast EPP was succeeded by more local pottery sequences that show very little or no ceramic continuity with EPP and, in general, significant differences from each other. Other material culture differences are noted from site to site, the most notable being that obsidian no longer reached Port Moresby or sites further west, but continued to reach Mailu and perhaps the Aroma coast.

The earliest EPP pottery is characterised by intricate shell-impressed designs and it is this pottery that is clearly present in the early sequences from Mailu to Yule Island (Vanderwal Type A, 1973: Fig VI-6; Allen Type H 1972: Figure 7; Bulmer 1978 Plate 1; Irwin 1985: Plate 1, upper). Subsequently, successive EPP styles in the Port Moresby and Yule Island sequences show close correspondence in decorative motifs and techniques. Some particular styles reflect good temporal sensitivity while other styles occur throughout the sequences (compare Vanderwal 1973: Figure VI-4 and Table VI-8 with Allen 1972: Table 4). The shell-impressed pottery is frequently associated with a groove below the rim, while subsequently multiple horizontal body grooves occur in a restricted period early at Oposisi but throughout the Nebira 4 sequence.

Following this early phase much of the EPP pottery at Nebira 4 is decorated with incised motifs incorporating multiple arcs in lines or columns enclosed in single or multiple
rectangles (Allen 1972: Figure 7, 1-17). While similar decoration also occurs at Oposisi, some differences also occur in this mid-phase. For example Vanderwal notes painting on the interior of the rim of his Type B jar form (1973:100) and elsewhere (1973:177, 206) suggests that carinated water jars may have had a wide painted band above the carination. This is different from the painted designs common at Nebira 4 (Type B, Allen 1972:105, Figure 6, Table 4). However in the late EPP both sites share what Vanderwal referred to ‘the spectacular, not to say flamboyant’ etched decoration, created by removing the slip prior to firing.

Thus while researchers could isolate valid differences between the EPP ceramics of Oposisi and Nebira 4, the continuing similarities that I have stressed strike me as more important because they attest to a continuing connection between the two sites.

In contrast it remains unclear how many of the middle and late EPP styles from Yule Island and Port Moresby continue at Mailu.

Most recently David et al. (2012) proposed a modification to EPP designed to argue for its direct evolution from Caution Bay Lapita. This paper contains theoretical, methodological, terminological and data problems that will require detailed examination elsewhere. For EPP as defined here, these authors divide off the earliest style from the later styles and dump the later styles into a single ‘tradition’ reminiscent of Vanderwal’s (1973) division of the earliest Oposisi phase from those that followed, but without Vanderwal’s finesse.

<table>
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<tr>
<th>Years calBP</th>
<th>Mailu</th>
<th>Seina</th>
<th>Mailu 3</th>
<th>Enama</th>
<th>Nebira 2</th>
<th>Nebira 4</th>
<th>Tumana</th>
<th>Motupore</th>
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Table 1.1. A general chronology of sites in the Mailu and Port Moresby areas. Numbers indicate the central tendencies of calibrated radiocarbon dates. Shaded areas indicate suggested sequences. Question marks indicate increasing uncertainty in the absence of dates. Many caveats apply (see Allen 2010 for details).
Regional sequences

This section looks briefly at the sequences from each region. For each of them, also refer to Tables 1.1 and 1.2.

Mailu

The Mailu 01 site contains EPP throughout the whole sequence and Irwin reports no break in deposition. The charcoal sample that provided the end date for EPP in this site was hand-picked from all of the deposit constituting Layer B3 and gave an age of 780±230 BP (763±192 calBP) (using the 2007-HULU calibration [Weninger and Jöris 2008]). This layer contained much non-artefactual stone thought to have eroded from a higher location behind the site and while Irwin thought this date acceptable in 1977 he also had less confidence in it than in the other 01 dates (Irwin 1985:86).

Mailu 03 documents the development of the middle and late periods in Irwin’s sequence, respectively called by him Mayri and Mailu. This sequence begins in site 03, Layer C5 and is dated at its beginning to 710±80 BP (654±70 calBP). But while Irwin (1991:506-7) saw the ceramic transformation at the end of the EPP phase everywhere along the Papuan south coast as a related event that resulted in new regional styles, he could only date this change in Mailu to the general period 1200 BP to 800 BP. Importantly, while he saw the ceramic transformation as an abrupt and widespread change, other data from the Mailu region - settlement patterns, local chert and imported obsidian patterns and clay sources - continued unchanged, indicating that the area was not abandoned. So while Irwin noted that his chronological data ‘may not be inconsistent’ with an end of the EPP at 1200 BP (pers. comm. 2010), the wider Mailu area data base is better understood if EPP continued there to 800 BP. A more detailed discussion of this point is undertaken in Allen (2010).

Port Moresby

While Sue Bulmer’s sites, Nebira 2, Eriama and Taurama, have produced cultural deposits related to both EPP and later phases, there appear to be gaps in the sequences of all three. At Nebira 2 EPP appears eroded and in secondary position, derived from higher on the hill (Bulmer 1978:132). At Eriama the early date came from a ‘crevice’ at the rear of the shelter, separated from the main deposit where the oldest of the late phase dates came from the basal layer F in the main shelter area. The shelter contained perhaps 48-50 burials in an area of c.16 m² probably interred after domestic occupation of the site ceased (Bulmer 1978:217), suggesting serious disturbance to the deposits. No EPP sherds were associated with the older date and the fewer than 10 EPP sherds from Eriama came from mostly disturbed contexts elsewhere in the shelter (see Bulmer 1978:206ff and Table 7.10). At Taurama in situ EPP was confined to the area at the western end of the beach while most of the late ceramics came from square 101/A. These two areas are c.140 m apart and were originally given separate site designations (AJA and AGN). Although Bulmer maintained continuity of occupation at Taurama from c.2000 BP until c.300 BP (e.g. 1978:322-3) this would require contemporaneity of her ceramic styles II, III and IV, which cannot now be sustained. The Taurama site is examined in more detail below.

The crucial sites for this part of the sequence are the Papa Salt Pan and Ava Garau, near Boera. Together with other Port Moresby sites like Nebira 4, Daugo Island and Ranvetutu, the Papa Salt Pan site contained the latest styles of EPP and yielded a date from a hearth at the top of the site of 1280±170 BP (1183±162 calBP) (Swadling and Kaiku 1980). Ava Garau, also excavated by Pam Swadling, produced a basal date from layer 16 of 1220±95 BP (1140±84 calBP) (Swadling and Kaiku 1980; Swadling 1981). The long sequence at Ava Garau contained pottery ‘quite different’ from the late EPP from the Papa Salt Pan and other
Moresby sites (Swadling and Kaiku 1980:86). Swadling (1981:242) saw this pottery reflecting introduced ideas from ‘the Goodenough, Amphlett and Trobriands Islands area of the Milne Bay Province.’ Here Swadling was following Bulmer (1971) who had excavated similar pottery at Nebira 2 (and later Eriama) and called it ‘Massim’ style, a designation she herself moved away from in 1978, preferring Style II and Style III or Eriama Styles (Bulmer 1978:371-73). Despite this localisation of labels Bulmer continued to see these styles as ‘intrusive’ and related in some way to Massim pottery, although the link was elusive without excavated and dated sequences from the Massim.

Unfortunately the Ava Garau assemblage has been in Australia for some decades and has remained unavailable for detailed study. However I examined the Ava Garau pottery in the Papua New Guinea National Museum and Art Gallery in the early 1980s as part of sourcing studies reported in Chapter 9 and my notes refer to the ‘long sequence’; to ‘painted’, ‘finely incised’ and ‘applied’ decorations, all characteristics of Bulmer’s Styles II and III; and most importantly to distinctive shell impressed ‘herringbone’ bowl decorations at the top of the Ava Garau sequence. This same distinctive bowl decoration is found in the lowest layers of both Motupore Island (see Chapter 8) and the Urorina site on Yule Island (Vanderwal 1973: Figure VI-12(7)). This motif is also a component of Bulmer’s Style IV at Taurama (e.g. sherd 7D/2/19 in Bulmer 1978: Figure 8:37 opposite p.317).

| Years calBP | Yule Island | | | | Gulf of Papua | | | | | |
|------------|------------|-------------|-------------|-------------|--------------|-------------|-------------|-------------|-------------|
|            | Abe        | Kukula      | Opopisi     | Urorina     | Maene        | Loe/Lupua   | Kinomere    | ODR         | Kulugwari   | Emo          | Papi         |
| 2000       |            |             |             |             |              |             |             |             |             |             |              |
| 1700       | 890        |             | 1774        |             |              |             |             |             |             |             |              |
| 1400       | 1620       |             | 1620        |             |              |             |             |             |             |             |              |
| 1100       | 1040       |             | 1040        |             |              |             |             |             |             |             |              |
| 800        |            |             |             |             |              |             |             |             |             |             |              |
| 500        | 674        |             | 674         |             |              |             |             |             |             |             |              |
| 200        | ?          |             |             |             |              |             |             |             |             |             |              |
| 0          | ?          |             |             |             |              |             |             |             |             |             |              |

Table 1.2. A general chronology of sites in the Yule Island and Papuan Gulf areas. Numbers indicate the central tendencies of calibrated radiocarbon dates. Shaded areas indicate suggested sequences. Question marks indicate increasing uncertainty in the absence of dates. Many caveats apply (see Allen 2010 for details).

Ava Garau thus provides the sequence link between the early and late phases of pottery use in the Port Moresby region and demonstrates that Bulmer’s Styles II, III and IV are not contemporary (as does evidence in this report). As with Mailu there is no suggestion that the general Port Moresby area is abandoned at any stage but a case can be made that unlike
Mailu, settlement patterns were disrupted and perhaps also that the use of various clay sources varied across these pottery sequence breaks (e.g. Swadling 1980, 1981).

Yule Island

Vanderwal’s work in 1969 remains the stand-alone data for this region so that the temporal gap between EPP and the second millennium AD site of Uourina remains unfilled. The 2007 date for Oposisi IB, the youngest intact analytical unit on the site, returned an age of $1573\pm33$ BP ($1468\pm43$ calBP) (Allen et al. 2011) suggesting this gap might be longer than previously supposed, although such an hypothesis conflicts with earlier dating evidence by Vanderwal (1973) and related ceramic and dating evidence from Port Moresby just discussed.

While Bulmer’s ‘Massim’ styles II and III intruded as far as Port Moresby, there is no evidence so far that they reached Yule Island, although Frankel et al. (1994:28) reported late versions of these styles at Lou’upuru (site OFA) near Kerema in the Papuan Gulf, a site mainly dominated by Bulmer’s Style IV pottery.

Returning to Yule, it seems improbable that the island and the adjacent mainland were abandoned at this time and thus the ceramic data gap need not be a prolonged ceramic sequence break. But around 700 calBP the links between Yule Island and Moresby seen previously throughout the EPP were re-established (or continued) at Uourina.

Papuan Gulf

Two points can be noted for the Gulf data.

Firstly, David (2008) published 99 AMS radiocarbon dates from 16 sites from the middle Kikori region of the Papuan Gulf. While details of the cultural associations of those sites have not yet been offered, these dates identify two ‘pulses’ of more intense prehistoric occupation, one spanning c.1450-950 calBP, the other commencing c.500 calBP and continuing to the recent past. This suggests that the gap between EPP and the later second millennium AD pottery sites is more pronounced than at Yule Island, and points to an aceramic period between the EPP and the late pottery phase in this region. Even so the evidence is uneven, with Emo having no EPP dates younger than c.1400 calBP (for EPP ceramics at Emo (Samoa) see Rhoads 1983:99; dates from David et al. 2010) but with EPP continuing at Kulupurari until c.1200 calBP (Rhoads 1980:138-9, 154; Jim Rhoads pers. comm. 2011).

The second point, related to the first, is that a series of pottery sourcing studies (Rye 1976; Worthing 1980a, 1980b; Mackenzie 1980; Thompson 1982; Allen and Duerden 1982; Allen and Rye 1982; Rye and Duerden 1982; Bickler 1997) discussed in more detail in Chapter 9, indicated that all Gulf pottery was made further east, in either or both the Yule Island and Port Moresby areas in the early phase and the Port Moresby region in the later phase. The gap in the ceramic sequence in the Gulf sites may reflect a period between c.1000 calBP and c.500 calBP when trade wares from further east did not reach the Gulf sites, although some contrary evidence exists that would extend this latter date back to c. 700 calBP.

The end of EPP

To summarise, although the dating is still flimsy, an end to EPP is best accommodated at c.1200 BP for the Gulf, Yule Island and Port Moresby data. In Port Moresby the period c.1200 BP to c.800 BP is taken up by the ‘Massim’ (Swadling 1981) or ‘Eriama’ (Bulmer 1978) pottery style(s) but so far this period is a gap in the Yule Island and Gulf sequences when pottery from further east did not reach the Gulf villages (see also Frankel et al. 1994:46).
However such a model does not immediately fit the Mailu data, where Irwin’s ‘Early’ period may continue without a break from 2000 BP to c.800 BP and where, if it does not, no ceramics are identified between Irwin’s Early (EPP) and Mayri periods, with Mayri starting around 700 years ago.

Finally for Port Moresby, Swadling (1981:245) associated the appearance of ‘Massim’ pottery (if not potters) with the establishment at this time of ‘a vast village complex’ in the Boera area and notes the absence of this pottery elsewhere on the Port Moresby coast. Swadling sees the Boera area being the main population centre for around 400 years, after which the Bootless Bay to the east of present-day Port Moresby became the main focus of the local population. Changes in settlement patterns and pottery styles and perhaps clay sources (e.g. Swadling 1980) at this time are sufficient to indicate a second sequence disruption in the Port Moresby area c. 800 BP, also reflected in the Yule Island and Gulf sequences.

The initial settlement of Motupore coincides with these disruptions.

Taurama

Taurama not only looms important in the oral traditions of the Western Motu but also in the archaeology of Bootless Bay. Taurama is linked to Motupore not only by the archaeological evidence presented here, but also by the oral traditions already discussed.

I contend in this report that Taurama and Motupore were settled at the same time and shared an ongoing and close relationship reflected particularly in pottery manufacture. At Taurama this settlement occurred on or close to a previously abandoned EPP site. Since I have a long-standing and fundamental disagreement with Sue Bulmer’s interpretation of the Taurama archaeology, it is necessary to lay out both sides of the argument in some detail.

Re-assessing the Taurama excavation data

This section offers a different appraisal of the Taurama archaeology to that proposed by Sue Bulmer in various publications and especially Bulmer (1978 and 1979).

The Bulmer interpretation

Bulmer (1978:323) summarises her Taurama excavations as follows:

The archaeological evidence from Taurama beach represents a community or series of communities probably spanning nearly 2,000 years, from the first centuries B.C. to about the end of the 17th century A.D. This chronology is partly based on three radiocarbon dates in the middle of the sequence, but also on the known chronology of the pottery styles from other sites at Yule Island, Eriama and Nebira. Oral histories refer to a village at Taurama from about 1575 to 1725 A.D. The occupation areas excavated probably relate not to this traditional community but to earlier occupation at the site. It may be that the settlers recalled in oral history joining an existing community, rather than founding a new settlement at an unoccupied place, but this is not remembered in the traditions referring to Taurama.

The archaeological evidence at Taurama seems to show a continuous occupation of the site up until its abandonment.

Despite the caveat (community or series of communities) Bulmer appears to be arguing not only for the continuous occupation of the site, but also implicitly for a continuity of the cultural group occupying the site. This comes out most clearly in her discussion of the changing styles of pottery. In her thesis Bulmer (1978) defined six styles spanning 2000 years of Port Moresby prehistory, from Style I (about 2000 BP to 1000 BP), to the most recent Style VI. Styles I and IV predominate amongst the excavated material from Taurama. Although questions about the basis for this
typology are raised elsewhere in this monograph, for the present discussion these style groups are
taken as given.

Bulmer (1978:374) summarises the Taurama ceramic sequence as follows:

In the stratified pottery from Taurama Site AJA evidence was found that could support a
hypothesis of the local evolution of Style I into Style IV. In the final period of Style I a
minority of Style IV bowls are present, and these possess a range of design units shared
with Style I. The proportion of Style I decreases in the final layer, to be finally totally
succeeded by Style IV. It seems plausible that the shouldered bowl of Style I could have
been transformed, with the use of different decorative techniques, into Style IV...

The same general interpretation of continuity in the wider Port Moresby context appears in a
subsequent publication (Bulmer 1979). Having defined an Early (50 BC- 1000 AD), Middle
(1000-1500 AD) and Late (1500-1870 AD) chronological sequence, Bulmer notes (1979:23) that,
during the middle period, three sites, Taurama, Nebira and Eriama, which were all occupied during
the Early period, 'appear to have continued their unspecialised existence'. In addition:

...Nebira was not abandoned in A.D. 1000, but rather the settlement was moved to the top
of the hill. The early pottery style was not discontinued, but at least at Taurama ...
appears to have developed into the style of pottery present at Motupore (1979:23).

And:

the other three communities contemporary with Motupore ... were unspecialised in their
economies and show no signs of economic change around A.D. 1000 (1979:23).

Stratigraphy

At Taurama Bulmer excavated at two locations which for convenience I will here label Area A and
Area B. Bulmer differentiated these locations as site AJA and site AGN (Bulmer 1978: Fig. 8.2)
but elsewhere Taurama was sometimes glossed as one site (e.g. Bulmer (1978:374). In Area A at
the foot of Taurama Hill (a.k.a. Pyramid Point), designated ‘the main excavation at the western end
of the beach’ (Bulmer 1978:268), two lines of trenches were laid out at right-angles, meeting in
square 7. Some excavation squares were adjacent to each other, others separated by distances up
to 14 m, including two test squares west of the main excavation. In all, a little over 24 m² of
deposit was excavated in this area (Bulmer 1978: Figure 8.4 and associated text).

Across the area of these excavations the depth of deposit ranged from 75 cm (Bulmer 1978: Table
8.3) or 85 cm (Bulmer 1978:268) to 113 cm. The stratigraphy was consistent across the entire area
investigated and consisted of two soil horizons. The upper portions of both these horizons were
stonier than the lower portions (Bulmer 1978: Table 8.3) and each horizon was subdivided on this
basis. All the cultural deposits from Area A were thus allocated to one of four Standard Layers, Ia,
Ib, IIa or IIb, the latter being the oldest. As well as arfactual evidence, postholes were common
and the burial of a dog was excavated.

Area B consisted of a single six feet by six feet (c. 1.83 x 1.83 m) square originally labelled 101A,
approximately 140 m north of Area A (Bulmer 1978: Figure 8.2). This was excavated to test the
depth and character of the deposits on this other site or part of the same site, particularly to see if
there was an early horizon containing Style I pottery. Although habitation relating to this earlier
horizon in Area A was initially considered to also be present in Area B, it was later recognised as
relocated material in younger cultural strata. The Area B deposit contains beach sand and other
beach material as well as waterworn Style I sherds, suggesting that any early habitation material
was disturbed by the sea at some point (Bulmer 1978:273).
Bulmer defined two stratigraphical units in Area B which could not be directly related stratigraphically to the Standard Layers from Area A, although the subsequent analysis of the ceramics strongly associates the two layers defined in Area B with Standard Layer Ia in Area A. It should be made clear that this conclusion is extrapolated by me from Bulmer’s data. I can find no direct Bulmer statement which connects Layers I and II in square 101A (Area B) with the Standard Layers in Area A, and in dealing with the pottery (e.g. 1978:309, Figures 8.21, 8.22) the stone (e.g. 1978: Table 8.11) and the bone (e.g. 1978: Table 8.9b - although here the relevant squares are labelled 101A/B and 101A/A rather than the more usual 101A/II and 101A/I) Bulmer distinguishes between the finds from the two areas. Similarly the areas are separated in respect of the shell analysis (e.g. 1978: Tables 8.6, 8.8). I have thus assumed that the reference to postholes in 'Square 101A (Standard Layer II)' (1978:280) is in error for 'Square 101A (Layer II)'.

Radiocarbon dates

Only three radiocarbon determinations were obtained from the Taurama excavations, one from Area A and two from Area B. In Area A, a date of 865 ± 140 BP (I-6863) was obtained from the lower levels of Standard Layer IIb in square 3 on a charcoal sample which was recognised to come from 'an in situ, if wave-washed, fireplace' (1978:276). Bulmer concluded that this sample was 'possibly contaminated' on the basis of the association of pottery excavated from this Standard Layer, which equates to two of Vanderwal’s earliest types at the Yule Island site of Oposisi. Bulmer’s view that this sample should date ‘to over 2,000 years ago on parallel dating to Yule Island’ is a reasonable rejection of this sample. Calibrating this date using CalPal gives a determination of 814±113 calBP, again outside the range for EPP suggested by Allen (2010).

Two dates on charcoal were obtained from Area B ‘in order to assess the duration of the occupation associated with Layer II there' (1978:274). From excavation level 6 Bulmer obtained a determination of 775 ± 85 BP (I-6887B) and from excavation level 9 a determination of 560 ±85 BP (I-6862). The stratigraphic inversion of these two dates was thought to indicate possible redistribution of the deposits in this layer. By applying a Masca Correction to these dates and taking a range at two standard deviations, Bulmer concluded that the occupation represented by these samples could fall between 1026 AD and 1527 AD. By pooling the means of the samples and applying two standard deviations Bulmer arrived at a period from 1150 AD to 1390 AD (1978:274-6) for the Layer II occupation, and a similar range of 1100 AD to 1390 AD was later published as dating the excavation in Area B (Bulmer 1979:19). Obviously deposits contained in Layer I of the Area B excavation would likely fall beyond the younger end of this range. Further dating samples from both areas submitted in 1978 (Bulmer 1978:276) were not reported to my knowledge. Calibrating these dates today suggests that I-6887B is 738±69 calBP and I-6862 is 584±55 calBP. While these dates still overlap at two standard deviations they also remain outside any accepted range for EPP and are best seen as dating later deposits at Taurama.

Human disturbance of the Taurama site

The historic and prehistoric disturbance of the Taurama site was raised on several occasions by Bulmer. Areas of the site had been disturbed by bulldozing, which may have been associated with sand quarrying and/or army constructions; gardens were also made on the site by villagers from Pari during the excavations (1978:264-6). The areas of excavation were chosen to avoid European disturbance and present gardening. Prehistoric disturbances by non-human agents such as the sea (e.g. 1978:271, 273), crabs (1978:271) and free-ranging pigs and dogs (1978:297, 324) were also acknowledged.

In Area A, excavations uncovered 36 or 37 postholes relating to five phases of occupation and in Area B four postholes relating to three phases of occupation (1978:276). In square 7 in Area A, 18 (1978:277) or 19 (1978: Figure 8.12) postholes related to these five phases but also exhibited 'at
least four phases of truncation' (1978:281), which I assume to mean subsequent disturbance. Finally the deposition of eroded soils from outside the excavated area, and attributed to possible human activity, was advanced as an explanation for site formation processes in square 7X (1978:287).

The taphonomic processes ongoing in the Taurama site need not be considered to be any greater than those affecting other sites of this sort in Papua. It can be assumed, however, that a degree of admixing of cultural materials between layers is likely to have occurred.

*Continuity: the artefactual evidence*

In terms of the stratigraphic evidence from the site and the radiometric determinations obtained, 2000 years of continuous occupation of Taurama is not demonstrated (although neither is the opposite). In stratigraphic terms, the central point at issue which emerges is whether in Area A Standard Layer Ia is separated in time from Standard Layer Ib. Although the section drawing (1978:Figure 8.5b) shows a clear distinction between the two Standard Layers, because this subdivision is not further discussed, and since there is no suggestion of any sterile deposit in this part of the site, Bulmer assumes no temporal break in occupation at this point in deposition. There are, however, some differences in the nature of the occupations represented by Standard Layers Ia and Ib.

To begin, although the posthole activity in Area A were seen to represent five phases of activity, none of these related to Standard Layer Ia (1978:277) and in respect of square 7X Bulmer (1978:287) observed that Ia represented midden deposition but Ib did not, so that some change is implied for this particular square, if not Area A generally. Turning to artefact distribution each of the artefact classes can be briefly summarised.

**Shell**

The distribution of shell by weight in the four squares analysed in Area A gives widely different results in terms of their percentage distributions by Standard Layer (1978: Figure 8.14). While in squares 3 and 7D the distributions did not appear to differ significantly from Standard Layer Ib to Ia (in both cases decreasing slightly), in squares 7 and 7X the percentage of shell by weight increased enormously. While these data are therefore equivocal they can be read to suggest different site use in Ia compared with earlier Standard Layers.

In terms of shell artefacts, 24 of a total 34 shell net weights in Area A occur in Standard Layer Ia (1978: Table 8.7), and while this distribution may not be independent of a higher density of midden in Ia compared with the earlier Standard Layers, and therefore may not be taken to imply changed economic activities in the site, these data reflect a further data distinction between Ia and the other Standard Layers. This artefact type was also commonest in the upper levels of Area B (1978:291). The remaining shell artefacts were recovered in insufficient numbers to pursue the present question further (Bulmer 1978: Table 8.8).

**Bone**

A total of only 556 g (573 fragments) of bone was recovered from the entire site (1978: Table 8.9a). These few remains not allow a meaningful comparison of either density or species between Ia and the other Standard Layers.

**Stone**

In all but square 7A there is a distinct increase in the percentage of flakes and cores between Standard Layers Ib and Ia (1978:8.16). In absolute numbers nearly 2.5 times as many flakes and cores were recovered from Ia than from Ib. Since neither concentration indices nor volumetric measurements for the Standard Layers were presented, these data cannot be investigated further.
Pottery

In all but square 3, where there is a minor increase, there is a massive increase in the percentage number of sherds between Standard Layers Ib and Ia. Apart from square 3, pottery in Standard Layer Ia for the other six squares reported, represents well over 50% of the pottery in each square (1978:Figure 8.21) and in total, pottery from Ia accounts for 8908 sherds out of a total of 12,099 excavated from Area A. Similarly the upper layer in Area B had about three times the amount of pottery found in the lower layer. Bulmer (1978:307) remarked on this increase:

There is a consistently larger amount of pottery in the most recent Layer (Ia), and a smaller proportion in Standard Layer Ib. It has been argued that Standard Layers Ia and Ib are a soil horizon and that the irregular surface of Standard Layer IIb indicates the upper soil horizon has been dug over as a garden soil, so that the lower proportion of pottery in Standard Layer Ib may mean pottery from Standard Layer Ia has been introduced into Ib through digging from above. This pattern of pottery distribution was not present in square 3, but this square is too close to the beach for much gardening to have taken place.

The specific meaning of the central sentence is unclear and presumably the reference to Standard Layer IIb is a misprint, but whether Ib or IIa is substituted, the meaning of the sentence remains obscure. Leaving this aside, Bulmer’s view was that there had been a likely downward movement of pottery from Ia to Ib except in square 3 where gardening may not have occurred. However elsewhere Bulmer (1978:308, 309) identified the downward movement of pottery in square 3 through crab disturbance.

In summary, while the density distribution of artefactual material in the site adds support to the hypothesis that Standard Layer Ia is different from Ib and the earlier layers in Area B as well, this evidence is far from conclusive. Equally, it offers little support for the cultural continuity hypothesis. I turn now to Bulmer’s further examination of the excavated data.

Continuity: the ceramic style evidence

Bulmer’s argument for continuous site occupation and for cultural continuity, as summarised at the beginning of this section, depended mostly on the continuity of her ceramic styles and the lack of economic change at the point in the sequence when Style I finished.

With regard to the ceramics, the important question is whether Style I is demonstrated to evolve into Style IV. Bulmer (1978:308-9) outlined a number of distinctions in the distribution of the two styles:

There are some distinct patterns in the stratigraphic distribution of the ceramic styles, particularly in respect to Styles I and IV. Style I is the exclusive style in Standard Layer IIb and nearly so in Standard Layer IIA, with the exception of two Style IV rims and 1 Style VI rim. Considering the number of postholes in the deposits and the burrowing of crabs, particularly in square 3, it is to be expected that a certain proportion of cultural material would have been displaced, so the three sherds are probably introductions from later deposits through the digging of postholes or other disturbance. Style I tapers from 100% in Standard Layer IIb to 12% in Ia, with a sharp drop between Ib and Ia. This small proportion of Style I in Standard Layer Ia can be interpreted as the result of redistribution of earlier material into later deposits through garden digging of the upper soil. It may be hypothesized that Layer Ib is primarily associated with habitation relating to Style I.

On the basis of data from Square 101A, Style I seems to be mutually exclusive to and earlier than Style IV. There were no examples of Style I bowls in this square, but eroded
body sherds showing slip and slipped and burnished pot rims indicate that this part of the site was previously occupied at least to some extent during the same period as the earlier occupation of the west end of the site. In Square 101A the habitation appears to be associated with Style IV; the earlier layer (II) contains uneroded Style IV pottery and structures, while the later layer (I) is apparently a midden deposit left by people living elsewhere, not necessarily at any great distance, and also associated with Style IV. Style IV at the west end of the site is the most predominant style in the most recent Standard Layer (Ia) and therefore may be associated with the possible gardening and some of the later structures of this part of the site.

Here Bulmer appears to be arguing for the position I have been developing and against her later conclusion of ceramic evolution and no clear site behavioural changes. This differs from her claim of ceramic continuity (1978:374) that in 'the final period of Style I ... a minority of Style IV bowls are present, and these possess a range of design units shared by Style I.' There are two Style IV bowls in Standard Layer IIa and possibly six in Ib (calculated from Bulmer 1978: Figure 8.22) while there are five Style I bowls in Standard Layer Ia, distributions which Bulmer attributed to site disturbance in her long quotation just cited.

Part of the problem stems from the fact that the style distribution of excavated pottery at Taurama is based on a sample of only 171 sherds, of which 66 come from 101A/I, nine from 101A/II, 41 from Ia, 20 from Ib, 23 from IIa and 12 from IIb. Of this sample 50 sherds are Style I and 103 are Style IV (1978: Figure 8.22). Remaining representations are Style II = 4 sherds; Style III = 9 sherds; Style V = 0 sherds; Style VI = 1 sherd; unassigned = 4 sherds.

On the basis of the general arguments developed on stratigraphy, dating, disturbance and artefact distributions, together with some of Bulmer's own statements, it seems reasonable to define two broad temporal groups, an earlier one comprising Standard Layers IIb, IIa and Ib, and a later one comprising Standard Layer Ia and the two layers from square 101A. If the distributions of pottery Styles I and IV are considered in these early and late groups, there appears to be 45 Style I sherds and eight Style IV sherds in the early group and five Style I and 95 Style IV sherds in the later group (calculated from 1978: Figure 8.22). Chi-square demonstrates a significant difference between these distributions at greater than the .001 probability level. It would thus seem that Bulmer's suggestion of site admixing is the most plausible explanation of the physical overlap of the two styles in the Taurama excavations. It may also be noted that all five of the Style I sherds present in Standard Layer Ia are undecorated and that their attribution to this style is based on form only. Bulmer (1978:312-3) notes that although this is too small a sample to be certain, this could possibly indicate that Style I decoration was discontinued during or earlier than the period of habitation represented in Standard Layer Ia, but that the same form of bowl continued to be made at Taurama.

The principal argument thus seems to rest with the continuity of design units. From the excavated material from Taurama, Bulmer observed that 44 design units are used in the Style I pottery (1978:312) of which she illustrates 43 (1978: Figure 8.9). There are 32 design units amongst the excavated Style IV pottery (1978:315). In observing that the Style IV bowls associated stratigraphically with the final period of Style I possess a range of design units shared by Style I (1978:374) Bulmer offers no specific figures. However, figures can be calculated from her Appendices 8.3a and 8.3c. Using both Standard Layers IIa and Ib, there are three design units, numbers 41, 50 and 73, which occur on Style IV pottery in these layers, and which are also shared by Style I. In other words, of the 76 design units found on the Style I and Style IV stratified sherds only three design units (3.9%) of this universe are held in common at the point of stratigraphic overlap. Given the small sample of eight Style IV sherds in Layers IIa and Ib this may not be surprising, but it also allows no confidence in the original statement. This line of enquiry can
however be extended to a comparison of Style I and Style IV design units on all of the excavated material from Taurama. Of the 44 Style I and 32 Style IV design units, 14 units (18.4%) are common in both. In that 82% of the design units are exclusive to one or other style, the differences would appear more striking than the similarities.

Of the 14 shared units it is possibly significant that the 17 Style II and III sherds from the excavations and bulldozed spoil (1978:314) also shared eight of these design units (1978: Appendix 8.3b). If comparisons are extended beyond these samples to the design units recorded by Bulmer for the six pottery styles in the Port Moresby area (1978:Figures 5.3, 5.6, 5.8, 5.10, 5.12 and 5.14) of the 14 design units in question one is common to all six styles, three to five styles, six to four styles, and three to three styles. Design unit 101 is the only design unit shared exclusively by Style I and Style IV.

Bulmer calculated the percentage of shared design units by style (1978: Table 5.14) which range from 3.6% (Style I units shared with Style VI) to 81.4% (Style VI units shared with Styles IV and V - there are, however, only 18.8% and 20% of Style IV units and Style V units shared with Style VI). The ultimate question is what do these numbers represent? Methodologically, as Bulmer pointed out (1978:109, 112) there are two choices:

- The assumption may be made that if two styles show sufficient similarity, a relationship can be hypothesized. On the other hand it cannot be assumed that because two styles are very different that they are not the products of the same community of potters.
- [The second choice is that] it should be considered likely that any two pottery industries may have a certain number of characteristics in common, such similarity not necessarily reflecting historic relationship.

In short, the meaningfulness of simple design units cannot be demonstrated, and must be taken as an article of faith. This is not unusual in choosing attributes for pottery analysis, but their efficacy is either subsequently demonstrated in clear patterning amongst the sample populations or rejected. In the case of the distributions of Bulmer's 148 design units there is no demonstration that the patterning she perceived was not occurring at random, except for the Style I bowls which have 71.4% unique units as opposed to the next highest, Style V with 28.9%. As Bulmer (1978:112) remarks:

> the design units used in Style I form a very different 'suite' from those in the other styles; 40 (71.4%), of the design units used in Style I are not used in the other styles at all. As well, the relatively low percentage of shared units with each of the other styles makes Style I seem more distantly 'related', if related at all.

In agreeing with this last observation I am more persuaded by the differences than the similarities. Part of the problem, I believe, is in the very simple nature of the units as defined; Thompson (1982) used more complex motifs on similar pottery from six sites in the Gulf of Papua and found distinct patterning among them. It may be no coincidence that Bulmer's best results occurred with the Style I pottery where the motifs and units were more complex.

Ultimately, whether the 14 style units which are maintained between Styles I and IV are more meaningful than the 30 units that fall out and the 18 new units that appear, is a matter of choice. My view remains that the Taurama evidence is best interpreted as an important sequence change from the EPP styles to the later Port Moresby styles of the second millennium AD and that this change can be viewed in current evidence right along the south Papuan coast. Additionally, there is a clear time gap in the Taurama sequence.

Allowing this, other Taurama site data fall more comfortably into place. The stratigraphic distribution of pottery styles suggests two major components to the Taurama site, the earlier
comprising Standard Layers Ib, IIa and IIb, and the later including Standard Layer Ia and layers 101A/I and 101A/II. The increased density of midden materials in the upper component, especially shell and pottery, was explained by Bulmer (1978:324) as the result of the frequent movement of houses, with the earlier site component representing more a residential and less a dumping area. While this seems likely to have been a contributing factor to the depositional nature of the areas excavated, the possibility that the later component represents a substantial increase in the density of artefacts in use on the site, and therefore that there may have been a substantially larger population present in this second phase, cannot be discarded.

Economic change

Assessing cultural or economic change from the remainder of the artefacts is a difficult proposition for two reasons. Firstly they were not recovered from Taurama in sufficient numbers to investigate quantitatively and secondly many of them are non-diagnostic, being found widely in a variety of temporal contexts in the western Pacific region. Reference has been made above to the apparent increase in shell net sinkers in the upper component of the site where they are made from *Anadara* species only, and this together with the increase in shell food debris might point to an intensification of capturing marine resources in the later period of occupation. On the other hand, Bulmer (1978:323) offered as evidence for continuity of occupation the fact that the growth patterns of two species of shellfish eaten by the community indicate that these shellfish populations did not return to the state of an unexploited natural population during the lifetime of the Taurama site, although more precisely this means only that the shellfish beds in the vicinity remained under human predation, not that these humans were necessarily living at Taurama. The local shell beds are still under heavy predation today, although the site has been abandoned for several hundred years as a permanent residence site (Swadling 1977:296-8).

Attention can also be drawn to the distribution of obsidian, imported probably from Fergusson Island in the Milne Bay Province, in the Taurama site. I proposed (Allen 1977b:393 and fn.5) that the presence of obsidian in Port Moresby sites and those further west only occurs in association with EPP pottery and that the disappearance of EPP pottery is also marked by obsidian no longer reaching these regions. This latter disappearance is taken to indicate an economic change of some sort, either a changed alliance/exchange configuration or a straightforward switch to more local stone resources. Bulmer (1978:361, 1979:19-20) opposed this hypothesis, arguing that obsidian flakes had been found in small numbers in 'all sites and virtually all layers' (presumably meaning Taurama, Eriama and the Nebira hilltop site). In Taurama 17 obsidian flakes were among nearly 23,000 stone artefacts recovered from the site. One was collected from the surface of the site, 10 came from Standard Layer IIa, four from Standard Layer Ib, and two from Standard Layer Ia. In square 101A there was no obsidian among the 1217 stone artefacts. Thus, in terms of my suggested two component nature of the site, 14 or the 16 stratified obsidian flakes are contained in the lower, predominantly EPP pottery component. That the remaining two pieces occur in the upper component should occasion little surprise, given Bulmer's acknowledgement of general disturbance in Taurama; equally telling is the total absence of obsidian from square 101A, where *in situ* EPP pottery is not represented.

Lastly, as various chapters here explore and verify, it is impossible to doubt that Style IV pottery was made at Taurama and exported to sites in the Gulf of Papua.

It would seem to me that the available data from the Taurama excavations can be best explained in terms of the transition from Bulmer’s Style I pottery to the later Style IV representing replacement rather than evolution. As well, several data sets suggest concomitant changes in other aspects of human behaviour on the site. In choosing between this and Bulmer's continuity model, the data from Taurama are basically insufficient to demonstrate either position absolutely, and the question must rest at least in part on the evidence from other sites. It should also be stressed that the
alternative model presented here does not necessarily imply the total or even substantial replacement of the original population (allowing, of course, for a gap of at least several centuries at this site). Even taking all the other known sites into account there are too few data to even begin to approach that question.

It should also be noted that subsequently Bulmer (1982:123) proposed a different four-phase chronological scheme that without explanation separated Styles I and IV, not only by Styles II and III, which are barely represented at Taurama, but also by some 200 years. It is nowhere stated that this new scheme replaced her earlier evolutionary formulation (see next section).

Since Motupore is contemporaneous with at least some, and probably all of the more recent deposits at Taurama and is only a few kilometres from it, it can be seen that Motupore is directly relevant in assessing some of the specifically archaeological claims made for Taurama and vice versa. Beyond this Motupore’s associations with other sites around Port Moresby and some further afield, like Urourina, are further considered later in this volume.

The ceramic chronology of the Port Moresby area

Bulmer’s chronologies

Bulmer (1978:340 ff., 1979:11-13, 1982:123) has offered two chronological frameworks for the Port Moresby region (Tables 1.3 and 1.4).

<table>
<thead>
<tr>
<th>Period</th>
<th>Ceramic Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early 0 – 1000 AD</td>
<td>I</td>
</tr>
<tr>
<td>Middle 1000-1500 AD</td>
<td>II, III, IV</td>
</tr>
<tr>
<td>Late 1500-1875 AD</td>
<td>V, VI</td>
</tr>
</tbody>
</table>

Table 1.3. Port Moresby ceramic chronology after Bulmer (1978:340). The later published version (Bulmer 1979:11-13) varies the dates slightly.

<table>
<thead>
<tr>
<th>Period</th>
<th>Ceramic Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 BC – 1000 AD</td>
<td>I  The Red Slip tradition</td>
</tr>
<tr>
<td>1000 – 1200 AD</td>
<td>II, III  The Eriama styles</td>
</tr>
<tr>
<td>1200 – 1650 AD</td>
<td>IV  Taurama shell and comb decorated</td>
</tr>
<tr>
<td>1650 – 1870 AD</td>
<td>V  Taurama incised-punctate</td>
</tr>
</tbody>
</table>

Table 1.4. Port Moresby ceramic chronology after Bulmer (1982:123). Bulmer’s original terminology has been maintained here. The absence of Style VI is not explained.

As just noted, the basis on which Style IV was subsequently seen to be separate from Styles II and III was not explained by Bulmer, nor did she pursue the implications for the Taurama sequence of this separation in time of Styles I and IV. The two hypotheses implicit in this later Bulmer chronology are that Styles II and III are intermediate between Styles I and IV and that there is a genuine break in ceramic continuity between Styles I and IV.
Accepting for the present the legitimacy of Bulmer's style classes, it is still difficult to pursue the first implication. As noted above, so few Style II and Style III sherds occur at Taurama that no assessment can be made, and Bulmer (1978:314) concluded on stratigraphic grounds that Styles II, III and IV might be contemporary at this site. Bulmer's two inland sites, Nebira (ACJ) and Eriama, also fail to help. At Nebira 2, 198 sherds of Styles I, II, III and IV are distributed so that all styles occur in all levels, without significant patterning (Bulmer 1978:183, 186-7, Figure 6.26). At Eriama there are only six sherds representing the four styles and these are distributed in no apparent order through five of the seven major layers (Bulmer 1978:253, Table 7.10). The second implication, of a break in ceramic continuity, has been discussed in detail in the previous section and is the conclusion I accept.

The post-Style I period

The period between the termination of EPP and the beginning of the Motupore sequence remains the least well understood period in the chronological sequence. As discussed, the Ava Garau site represents the only excavated sequence that appears to fit into this period. On both the pottery decoration and the few available dates, I interpret the uppermost levels of Ava Garau to be directly ancestral to the earliest levels at Motupore. Without pre-empting the results of this study, the Boera area is, on archaeological grounds, currently a strong candidate as the region from which both Motupore and Taurama in its later phase were directly settled.

The degree to which Bulmer's Styles II and III occur in the Ava Garau sequence is not well known (but see Swadling 1981:243). However, these styles occur in a number of surface collections and excavated sites (especially the Koukou site at the head of Port Moresby harbour, excavated by Les Groube). Currently they are best described from the set of Eriama sites investigated by Bulmer - hence her designation of these styles as the Eriama styles (Bulmer 1978:371ff) previously named the 'Massim' style by Bulmer (1971:57-60) because of an overriding similarity between this pottery and prehistoric pottery from Goodenough Island, the Amphlett Islands and the Trobriands (see Lauer 1970, 1974; Egloff 1971; see also Allen 2010).

If these styles are 'intrusive' as Bulmer (1978:373) argued, a better understanding of their temporal and spatial distribution is still required, if for no other reason than such a view is not necessarily compatible with Bulmer's own 'continuity' thesis. On the available evidence it would appear that they must fit into this 800-1200 AD period, although it is still possible that the sites on which they are found are a subregional event within the general Port Moresby area, and that they are contemporaneous with another tradition, presumably Bulmer's Style IV. This appears to be what Bulmer (1978:399) originally argued, although it is not compatible with her more recent chronology (Table 1.4).

From approximately 1200 AD until immediately before the historic period the ceramic chronology is presently dominated by the Taurama and Motupore sequences. This is a statement of our current archaeological knowledge rather than historical reality, for it is certain that other Port Moresby sites were also occupied at this time. From the ceramic point of view, however, we do appear to be looking at a single tradition in the Port Moresby area during this late prehistoric period. The degree to which Bootless Bay was a major focus of this tradition is a question addressed in later chapters. My own views on a useful general chronology on current data are expressed in Table 1.1.

Ethnographic reflections and archaeological research

The 1970s and 1980s saw a proliferation of syntheses of the rich ethnographic data on the traditional inhabitants of the Port Moresby region. A range of analyses, interpretations and arguments based on these data and dealing with them in cultural, economic, ecological, linguistic and archaeological terms is freely available (Dutton 1969, 1982; Allen 1977a, 1977b, 1977c, 1984;
Ethnographic overview

As stated, the Motu are divided into Eastern and Western groups with the dividing line being drawn at Bootless Bay. At the eastern end of Bootless Bay the village of Tuplesereia is Eastern Motu, while Pari, the nearest contemporary village westwards, is Western Motu (Figure 1.3). The Motu are a tightly coastal group living in permanent villages either on the shoreline or over shallow water. At contact there were more Western Motu than Eastern Motu villages and higher population densities in Western Motu villages, particularly around Port Moresby harbour, where the amalgamation of four villages had produced a settlement, Hanuabada, of over 1000 people, in addition to other villages in close proximity. This population distribution is interesting because the highest densities are associated with the least productive gardening land in the region. Most Western Motu villages at contact contained sub-populations of non-Austronesian speaking Koita, although this latter group also maintained separate settlements near the coast and on the inland plains. A further non-Austronesian speaking group, the Koia, occupied the hills further inland, but at no great distance. Each of these groups specialised in subsistence activities that reflected the ecological niches they occupied, and they traded (as well as fought) with each other. The inland groups supplied mainly vegetables, animal foods and raw materials and the coastal people supplied marine products and a range of manufactured items, principal among them being pottery and shell ornaments.

The Western Motu also conducted, and to some extent coordinated a long-distance coastwise trade. The most significant event was the annual *hiri* expedition to the Papuan Gulf. This trading voyage was principally to exchange pottery for sago and canoe hulls (e.g. Oram 1982). The rationale of the *hiri* has been exhaustively debated in the publications of Oram, Bulmer and myself cited in this chapter, and more recently (e.g. Mennis 2014; Skelly 2014). Two competing interpretations are firstly that poor gardening resources coupled with a highly seasonal climate forced the Western Motu to seek external food sources to overcome the lean period of the year around Port Moresby. The second view rejects this cause-and-effect explanation, suggesting that subsistence trading as a viable economic pattern had developed prior to population build-up around Port Moresby and that the concentrations of people there, as seen in the 19th century, reflect the successful exploitation of a range of other logistical advantages of the region, such as the presence of potting clay, good quality cherts and shell resources, protected harbours and a sailing corridor provided by the barrier reef, and a central location between areas of richer agricultural potential which were open to entrepreneurial manipulation through the transfer of goods between them. One aim of this monograph is to support the second proposition.

Early research objectives

Excavations were begun at Motupore in 1970 with extremely limited objectives. As discussed, at that time only the two sites at Nebira and the Eriama shelter had been excavated and only preliminary results from each were forthcoming. Thus there was no sequence for the Port Moresby region, nor any real chronology. Among the known sites in the region, Lampert's preliminary assessment of Motupore (Lampert and Golson 1967; Lampert 1968) suggested it as a prime location for extending knowledge of the Port Moresby sequence, as well as for elaborating some of Lampert’s initial observations of the site. It was also desirable at that time that Motupore should be used for training undergraduate prehistory students from the University of Papua New Guinea.

Consequently the primary objectives of the five short seasons between July 1970 and July 1972 were obtaining a chronology and a pottery sequence for the site, together with investigating what
other remains might exist there by testing various areas of the site. All of these early seasons were carried out in the context of student fieldtrips.

By 1973 these objectives had been broadly achieved. However the richness of the site, together with indications in the data themselves posed new queries and possibilities for further excavation and testing. The work of Dutton and Oram, reviewed above, together with my own reading of the ethnography, firmly placed Motupore as an ancestral site of the modern Western Motu, about whose cultural and specialised economic behaviour much was known. How far could this behaviour be traced in the archaeology of Motupore? Thus the fieldwork design for the 1973 season was twofold - to expand the excavations from the previous seasons in order to clarify specific field questions and at the same time to acquire a sufficient sample of material to test a range of theoretical propositions concerning the behaviour of the site's prehistoric inhabitants, and in particular the general proposition that these people had been, like their descendants, specialised maritime traders. In other words, these excavations were to test the view, outlined above, that the Western Motu had not retreated to locations in and around Port Moresby harbour and been forced to trade for subsistence, but rather that they moved there as specialised traders who could take advantage of that location and its resources. The aim of the Motupore research was to test the proposition that the economic strategy of subsistence trading had been developed by Western Motu groups prior to its florescence in the ethnographic *hiri*.

Other more immediate and specific objectives are discussed below, when dealing with excavation strategies. What remains for this introductory chapter is to elaborate the important theoretical underpinning on which a number of subsequent associations will depend.

*Ethnographic analogy and cultural identification*

Childe (1956:46-51) laid down some sensible guidelines for the best use of ethnographic analogies in interpreting artefactual remains and the behaviour of the original users of these objects. His views can be summarised as follows: that the most efficient or valid use of ethnographic parallels for interpreting archaeological evidence occurs when the past and ethnographic situations suggest a similar manipulation of similar environments by people with similar technological accomplishments. Childe argued that it was more valid to interpret Northern European archaeological relics in terms of the modern folk culture of that area than to take parallels from Tierra del Fuego or British Columbia, even though in specific cases the latter might appear more exact. My own views do not entirely coincide with Childe’s, but they provide a clear starting point here.

On Childe’s criteria, the use of Western Motu ethnography to aid in the interpretation of the archaeological remains from Motupore would appear entirely justified. More directly, the independent evidence of the oral traditions of the Western Motu, as reviewed earlier in this chapter, indicates that Motupore was an ancestral site of this group. Thus, without reference to analogies between archaeological remains and ethnographic accounts, the most recent inhabitants of the site can be identified as ancestral Western Motu. Such a situation of cultural identification is rare in prehistoric archaeology and it provides substantial reassurance that extensions of behavioural interpretation from the archaeological data, based on Western Motu ethnography, have a greater probability of being valid for Motupore than might normally be the case with such analogies. In normal circumstances it is uncertain and unwise to ascribe social identification or behaviour which is not directly reflected in the archaeological evidence. Here I would argue that the particular case of Motupore permits such an exercise. At its most simplistic, if the archaeology indicates no sequence breaks, then it is reasonable to assume that the original settlers of Motupore were ancestral Western Motu. If this is the case, then explanations for particular archaeological patterns might appeal to long-term and fundamental aspects of Western Motu social organisation such as patrilineal descent or patrilocal settlement patterns. Such appeals do not deny the
possibility of change in the way that direct historical analogies, common in past archaeological interpretation, frequently do; and such explanations here are clearly different to those. However, they are also different to uniformitarian principles of how humans behave in general. Theoretically these latter appeals are justifiable but are not at issue here.

Lastly, it has sometimes been suggested to me that in published accounts of Motupore I have relied too heavily on Motu ethnography for interpretation. Notwithstanding my views in the previous paragraph, I am content that my interpretations are first and foremost grounded in the archaeological data from the site and that even without the ethnography, the analysis of these data would have taken me to similar, if sometimes more cumbersome and less precise conclusions. I have discussed some theoretical considerations of my ethnographic approach in the Preface to this volume and I return to other aspects of ethnographic analogy in Chapter 3.
CHAPTER 2  THE GEOGRAPHICAL SETTING

The land in the neighbourhood of Port Moresby is barren and unproductive (Turner 1877:481).

Bootless Bay

The western shore of Bootless Bay from Pyramid Point to Bogoro Inlet forms the eastern boundary of the National Capital Province (Figure 2.1). Its outer mouth, from Pyramid Point to Tupusereia Head is 8 km wide, so that the majority of the bay is exposed to the dominant south-east trade winds. However a barrier reef 4-5 km offshore largely protects its entrance so that the waters in the bay are relatively calm. Approximately 35 km\(^2\) in area, Bootless Bay contains some 30 km of coastline which is mainly mangrove-lined, although small sandy beaches occur at a number of places. It is flanked by coastal hills c. 200 m high, while the imposing Astrolabe Range 10 km inland rises to c. 1000 m. No major streams empty into the bay, although several minor ones do. There are three main islands in the bay, Motupore, Loloata and Manununa, also known as Lion Island. All three have fringing reefs and some patch reef also occurs. The bay is for the most part shallow, less than 5 m, although deeper channels occur.

Figure 2.1. Bootless Bay, showing fringing and barrier reefs, mangroves, and the location of places mentioned in the text. 1 = Pyramid Point; 2 = Taurama; 3 = Bogoro Inlet; 4 = Motupore Island; 5 = Loloata Island; 6 = Manununa Island; 7 = Tupusereia Village.
The physical environment

While an understanding of the physical environment in the general Port Moresby area is a necessary introduction to the succeeding chapters of this report, in this section I avoid exhaustive reviews of all aspects of the natural environment in the research area. I can claim no original research expertise in the various disciplines which will be briefly covered here and rely upon summaries of the work of others. Instead I have tried to focus on those environmental factors relevant to understanding the archaeology and pertinent to the questions being asked of the data. Thus the objectives here are to provide a general overview of the environment but also to examine specific aspects of it that are pertinent to various debates and interpretations in the literature that will be raised later in this volume.

Figure 2.2. Bootless Bay, showing the submerged hilltop islands of Loloata (nearest camera) and Motupore.

Geology and geomorphology

The geology and geomorphology of the Port Moresby region is well described (Glaessner 1952; Mabbutt 1965; Speight 1965; Pieters 1978; Rogerson 1981). The dominant feature of the landscape around Port Moresby is a series of ridges, separated by narrow valleys, aligned on a north-west-south-east axis (Figures 2.2, 2.3).

The ridges and valleys comprise a south-west-facing thrust belt. Each ridge is a thrust slice, or series of thrust slices, of resistant Palaeocene and Eocene fine-grained sedimentary rocks (Burns Peak Formation and Port Moresby Beds). The valleys are underlain by thrust-bounded recessive easily-weathered Oligocene tuff and sediments (Dokuna Tuff). The ridges commonly are asymmetric with steeper slopes towards the south-west and gentler slopes to the north-east, conforming to the north-easterly dip of the thrust faults.
Both the Palaeocene Burns Peak Formation and Eocene Port Moresby Beds include fine-grained siliceous siltstone with chert lenses and nodules, and beds of bioclastic limestone, commonly partly replaced by silica.

At present the two rock units are distinguished primarily on microfossil content. Port Moresby Beds also include fault-bounded blocks of nummulitic limestone and of turbiditic part-calcareous sandstone.

The rocks that form the main ridge of Motupore Island are fine-grained siliceous sedimentary rocks with near-vertical dip. Finely-bedded fine sandstone encloses large chert nodules on the shoreline at the north-western point of the island. Toward the
south-western point of the island there is evidence that siliceous fluids have moved along fractures and have replaced the original sediments. Near the south-eastern point small-scale tight folds can be seen in well-bedded siliceous siltstone.

Minor areas of tidal flat/beach ridge formation comprise the other principal landform in the vicinity of Bootless Bay.

Toolstone sources

A range of cryptocrystalline sedimentary rocks commonly glossed as fine grained cherts are widely available close to Bootless Bay. These were first reported by Maitland (1892, cited in Glaessner 1952) who described lenticular nodules of black and yellow 'flint'. Among this group used for artefacts on Motupore, jasper, mainly black, brown or yellow, is common and is distinguished from grey chert, also abundant, by the wax-like lustre of the former type.

Also common is a range of chalcedonic to opaline silicas, both cryptocrystalline and transparent to translucent. Chalcedonic varieties range from colourless to off-white, while opaline silica is usually pink with white inclusions, possibly microfossils.

Other stone types are foreign to the immediate area and will be described in Chapter 11.

Soils

Scott (1965) categorised the soils of the wider Port Moresby-Kairuku region and the main synthesis of these data was made by Mabbutt (1965:15-16). In respect of the coastal hill zone surrounding Bootless Bay he observed the strong geologic control of the soils in this region, noting that

- fine-grained sedimentary rocks give fine-textured soils, with widespread alkaline soils on limestone. Ridges and hills in this zone have lithosols, lowlands have texture-contrast or brown clay soils, and minor alluvial plains or valley flats have dark cracking clay soils.

In the small patches of littoral flats, mangrove soils on tidal flats are dominant, with smaller areas of beach soils (Mabbutt 1965:16).

Coastal soils are widely considered to be nutrient-poor gardening soils.

Potting clay

The widespread presence of suitable potting clay has been noted for the wider area (Bulmer 1978:15) and was also demonstrated for the area immediately around Bootless Bay by Rye (1976:124; 1981:124-31). A detailed analysis of Bootless Bay clays appears in Chapter 9 and will be passed over here. It is sufficient to note that clay deposits are sufficiently widespread to provide easy access and to prevent any village maintaining any monopolistic control over this resource.

Climate

The detailed analysis of Port Moresby climate by Fitzpatrick (1965) still stands as the most authoritative account. This is unfortunate in the sense that unlike landforms or soils, the data at Fitzpatrick's disposal were for the most part records of only a few years duration which could not accommodate long term trends or extreme seasonal variations. In particular, the effects of the El Niño Southern Oscillation may have been especially influential on human behaviour in the Port Moresby region (Allen 2010:12-13) and require further study. Nor is it possible to determine how well or
badly Fitzpatrick's data relate to Bootless Bay since his principal recording stations, at Government House in Port Moresby, at Boroko and at Jacksons Airport, are some little distance from the immediate research area.

Figure 2.4. Monthly wind roses for the Port Moresby region (from Fitzpatrick 1965).

Seasonality

Climate in the Port Moresby area largely reflects the seasonality of the prevailing wind systems interacting with the dominant physiographical feature of the landscape, the general north-west-south-east alignment of the coast and coastal hills and ridges. The wind systems parallel this alignment. This accounts for both the low levels of mean annual rainfall and its high seasonality.

The north-west monsoons occur between December and April usually bringing with them the heaviest and most frequent rainfalls. From May until November the south-east trade winds dominate, blowing with greatest intensity from June until September. These winds are associated with distinctly lower and occasionally no worthwhile rainfall. These wind systems and their intensities are demonstrated in Figure 2.4.
As well as influencing the low rainfall, temperature and humidity are largely controlled by these alternating winds, with the north-west season being warm and wet and the south-east cooler as well as drier. Since this latter season is controlled by air moving in from the ocean, the transition to the south-east season is not characterised by high temperatures and low humidity as in northern Australia (Fitzpatrick 1965:85).

Rainfall

The rainfall data supplied for five to seven years from recording stations near Port Moresby used by Fitzpatrick are summarised in Figure 2.5. While Bootless Bay figures might be slightly different to these, Jacksons Airport receives c. 160 mm more rain per annum on average than Port Moresby.

![Figure 2.5. Mean average rainfall showing the relationship to altitude as one moves inland from Port Moresby (adapted from Fitzpatrick 1965).](image)

Bootless Bay is likely to be between these mean annual averages. Rainfall increases as one moves inland at right angles to the coast, so that rainfall in Bootless Bay may not be as high as Jackson’s Airport. Figure 2.5 illustrates the low levels of rainfall but not its extreme seasonality in the Port Moresby area, where there are many fewer rainy days and less rain per rainy day in the south-east season. The mean annual figures, which are likely to apply only generally to Bootless Bay area are: Government House Port Moresby, 93 rain days for 988 mm; Boroko (between Government House and the Airport) 106 rain days for 1110 mm; and Jacksons Airport, 123 rain days for 1148 mm. As Fitzpatrick demonstrates, mean annual rainfall increases dramatically as one moves inland across the Astrolabe Range escarpment.

A second set of unpublished rainfall figures have been supplied by Bryant Allen, Department of Human Geography, Australian National University. From Port Moresby Government House station monthly records for between 47 and 52 years provide a mean annual average of 996 mm per year. For Jacksons Airport figures from 1945 until May 1984 give a mean annual average of 1182 mm per year. These more extensive data smooth out the bumps of Fitzpatrick's shorter term data and confirm the general trends of the earlier study.

The second important factor concerning Port Moresby rainfall is its variability. Fitzpatrick (1965:89) suggests a coefficient of variation of approximately 20% at Port Moresby for annual rainfall. Nor is rainfall persistent. During the north-west season rainless spells of five to ten days are common, while during the south-east season months may pass without effective rainfall (Fitzpatrick 1965:90).
Temperature, humidity and evaporation

Annual temperature variation in the Port Moresby area is small, with maxima ranging from 28°C to 32°C in August and December and minima ranging from 23°C to 24.5°C in the same months. Similarly mean relative humidity remains high between the narrow range of 74% and 82% in January and September respectively (Fitzpatrick 1965:90-3). The relatively cool temperatures are a result of advection of cooler air from the sea during the day and the slightly higher percentage humidity during the south-east season is the result of lower temperatures.

Mean daily duration of sunshine varies between 6 hours in February and 8.4 hours in November, with an annual mean average of seven hours per day. One result of this is a mean average annual evaporation rate of approximately 1800 mm per annum (Fitzpatrick 1965: Table 13) well in excess of mean average annual rainfall.

The salient point is that Port Moresby is among the driest areas in Papua New Guinea. The majority of its low rainfall occurs during the north-west monsoon between December and April; and annual evaporation far exceeds rainfall (Fitzpatrick 1965). Between 1957 and 1963 in Port Moresby three dry spells lasted for more than 50 days, the longest of 100 days occurring between May and August 1957 (Brookfield with Hart 1971:14).

Vegetation

A detailed analysis of the vegetation of the wider Port Moresby-Kairuku area was undertaken by Heyligers (1965). From his tabulated summary (1965: Tables 21 and 22) vegetation of the coastal hill zone is dominated by savannah. In the areas most immediate to Bootless Bay the dominant savannah is Themeda australis - Eucalyptus, with the tree storey consisting of E. alba, E. confertiflora and E. papuana. Patches of Ophiuros - E. alba savannah occur, as do patches of semi-deciduous thicket and deciduous forest. A minor but important vegetation type, the tall grass Saccharum spontaneum occurs behind Taurama beach (Vasey 1982: Fig.1) and perhaps elsewhere in small pockets close to the bay. Cycads (Cycas circinalis) occur commonly.

Around the bay itself the shoreline consists of reasonably extensive stands of mid-height mangroves (Rhizophora and Bruguiera spp.).

The wider environment

Mabbutt et al. (1965) have delineated six major and partly discontinuous environmental zones which parallel the coast in the Port Moresby-Bootless Bay region and these are reproduced in Figure 2.6. The primary differences between these zones are geomorphic. However each has a different geology and each is affected to some degree by the coast to inland climate transition with its pattern of higher temperatures and increasing rainfall. Thus soil types and vegetation follow the same pattern (Mabbutt 1965:12). Important from a human perspective in this mosaic are the relatively short coast/inland distances involved in intercommunication between different resource zones.

Terrestrial animal resources

From the basic works of Laurie and Hill (1954), Mackay (1970), George (1973) and Schodde (1973), Bulmer (1978:22-31) has summarised the large variety of terrestrial, marine and freshwater animals, birds and insects which could conceivably have provided food in the various ecological zones that might directly or indirectly be tapped by the prehistoric inhabitants of the Port Moresby area. Of these, those most likely to occur in the archaeological record are summarised here.
Marsupials

In the lowland forests the three species of cuscus that occur are Phalanger maculatus, P. orientalis and P. gymnotis. Less likely to occur are the possums Dactylopsila trivirgata and Pseudocheirus canescens and the sugar glider Petaurus breviceps, which, while widespread in lowland forests, are not significant food species. Among the bandicoots, the three that are widespread in lowland forests are Echymipera kalubu, E. rufescens and Peroryctes broadbenti, while the Brindled Bandicoot, Isoodon macrourus is common in the savannah grassland. Some dasyurids also are present.

Among the wallabies, the Agile Wallaby, Macropus agilis was common in the savannah woodlands and grasslands and was ethnographically a principal hunting target. It is now scarce or absent around Port Moresby. Other, smaller wallabies occurring in the forest/forest edge are Dorcopsis hageni and Thylagale bruijni.

Rodents

Among a wide variety of rats occurring in the area those commonly encountered include the endemic Pogonomys macrourus, Uromys caudimaculatus, the water rat Hydromys chrysogaster, the Polynesian rat Rattus exulans and the widespread grassland rat R. sordidus.

Monotremes, bats and reptiles

The Short-beaked Echidna, Tachyglossus aculeatus, although the only monotreme in the region, is adaptable to the grassland environment and is likely to have been common in the past.
Among a variety of bats in the lowland forests, the fruit bats *Dobsonia moluccensis* and several species of *Pteropus* are considered important as a food resource. There is a wide variety of snakes and lizards.

**Birds**

Among a rich avifauna of both sea and land birds around Port Moresby those most economically important include the mound-building brush turkey *Megapodius freycinet*, the cassowaries *Casuarius bennetti* and *C. casuarius* and the Goura pigeon, *Goura sheepmakeri*. In addition various birds of paradise and the Papuan hornbill, *Aceros plicatus* were favoured species for decoration. Given the present distribution of these birds, it is uncertain to what extent they may have been exploited on a regular basis in the vicinity of Port Moresby and Bootless Bay.

**Domestic animals**

Within the time frame considered in this volume it can be taken that pig, dog and chicken were already introduced to the research area and were present as domestic animals. In addition feral pig was undoubtedly present on the inland plains. The status of the goat as a pre-European introduction is discussed by Bulmer (1978:31). Although she was unable to find any reference to the presence of the goat when Europeans arrived in Port Moresby, she reports goat bones at both Eriama and Nebira in contexts dated to before the European arrival, and suggests that the presence of goat in Timor over 3000 years ago possibly indicates that its arrival in new Guinea may pre-date Europeans.

**Marine animal resources**

**Marine animals**

A comprehensive survey of marine resources along the Papuan coast by Pernetta and Hill (1981) provides the basis for this review. Among the large mammals, while whale and dolphin species occur in archaeological contexts, it may be that their exploitation was opportunistic. On the other hand, the deliberate pursuit of the dugong, *Dugong dugon*, is widely attested in the literature, although Pernetta and Hill question whether dugong capture was ever high in the Port Moresby area (1981:176).

Of the two species of crocodile present in the region, *Crocodylus porosus* occurs widely and is presumed to have been persistently hunted. Also widespread are turtles, particularly the Green Turtle, *Chelonia mydas*, and the Hawksbill Turtle, *Eretmochelys imbracata*, both of which are exploited for their eggs and flesh.

**Fish**

Munro (1967) has recorded over 1000 species of fish from Papua New Guinea, of which the highest diversity of species are associated with reef areas. Here the dominant components of the fish fauna include the following families: Scaridae, Holocentridae, Apogonidae, Epinephelidae, Lutjanidae, Lethrinidae, Labridae, Coridae, Siganidae, Carangidae and Balistidae. Pelagic fish such as tuna can be exploited seasonally when they spawn inshore.

Among crustacean resources, the widespread mud crab, *Scylla serrata*, is the most important, although the crayfish, *Panulirus ornatus*, may be important in reef areas, where they migrate to spawn. Among the echinoderms, the sea urchin, *Tripneustes gratilla*, is widely eaten and occurs commonly on reef flats and sea grass beds.
Shellfish

Swadling (1977) has reviewed the nature of the extensive shellfish resources in the Central Province. The reef platforms in the Port Moresby-Bootless Bay region provide an extensive inter-tidal zone for herbivorous molluscs, of which those most commonly gathered today are the Strombidae and the Neritidae. On the narrow fringing reefs *Anadara antiquata* are common, while in the mangroves *Polymesoda erosa* and *Telescopium telescopium* predominate. Table 2.1 gives the main species gathered for food in the 1970s at Pari village, between Port Moresby and Bootless Bay.

A full analysis of Motupore shellfish by Pamela Swadling appears as Chapter 12 in this report.

<table>
<thead>
<tr>
<th>Bivalves</th>
<th>Gastropods</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Anadara antiquata</em> (Linnaeus 1758)</td>
<td><em>Conomurex luhuanus</em> (Linnaeus 1758)</td>
</tr>
<tr>
<td><em>Asaphis violascens</em> (Forskal 1775)</td>
<td><em>Gibberulus gibbosus</em> (Röding 1798)</td>
</tr>
<tr>
<td><em>Atactodea striata</em> (Gmelin 1791)</td>
<td><em>Canerium urceus</em> (Linnaeus 1758)</td>
</tr>
<tr>
<td><em>Gafirarius pectinatum</em> (Röding 1798)</td>
<td><em>Lambis lambis</em> (Linnaeus 1758)</td>
</tr>
<tr>
<td><em>Hippopus hippocus</em> (Linnaeus 1758)</td>
<td><em>Littoraria scabra</em> (Linnaeus 1758)</td>
</tr>
<tr>
<td><em>Tridacna crocea</em> (Lamarck 1819)</td>
<td><em>Nerita</em> species</td>
</tr>
<tr>
<td><em>Tridacna maxima</em> (Röding 1798)</td>
<td><em>Turbo crassus</em> (Wood 1828)</td>
</tr>
<tr>
<td><em>Tridacna squamosa</em> (Röding 1798)</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2.1.** Main species of shellfish gathered at Pari village (Swadling 1977:295). Some scientific shellfish names here have been altered to agree with those now listed by the World Register of Marine Species, see Table 12.1.

Humans in the landscape

While it is a truism to say that human activity is to some extent everywhere determined by the constraints of environment, prehistorians of the Port Moresby region (including me) have found appeals to environmental determinants to reconstruct the area's prehistory irresistible. In attempting to evaluate the Turner quote at the beginning of this chapter, I have summarised the salient backdrop data. I now turn to some of the specific aspects of these data which bear on our understanding of human interactions with the landscape.

**The status of the Port Moresby savannah**

A central issue in assessing the fertility of the coastal hills around Port Moresby is whether the savannah is a natural climax vegetation of the region or whether it is anthropogenic, replacing forest and thicket species.

Heyligers (1965:147) was ambivalent on this question, pointing out that in the coastal hills clear boundaries between these vegetation types did not coincide with changes in soil conditions or topographic boundaries, but that in the inland foothills, under a higher rainfall regime, such correlations suggested that adjacent savannah and forest were a natural occurrence. In a more detailed examination Heyligers (1966:488) reaffirmed his view that correlations of soil conditions and vegetation types in the coastal hills have only a localised validity and that fire was the probable overriding factor in savannah formation.
In a further examination of the question Eden (1974), again on the basis of the environmentally inconsistent distributions of forest and savannah/grasslands, concluded that these latter formations, over at least a part of their extent, were anthropogenic. He extended human interference using fire from shifting cultivation alone to more general burning, for example for hunting. Nevertheless he remained equivocal on the origin of the savannah and grasslands, suggesting that some areas might be natural formations established during a drier climate phase and contenting himself with the conclusion that the maintenance and extension of these formations, as distinct from their origin, is anthropogenic (1974:97, 109).

While overall there is no clear answer to the question of the origin of the grassland and savannah, both Eden and Heyligers thus suggest that it is not the natural dominant vegetation in the area. It is therefore not a good indicator of the actual fertility of the region.

**Soil fertility and rainfall**

In attempting to judge the environmental imperative in the trading activities of the Western Motu, Vasey (1982) contributed to the debate on the general fertility of the coastal savannah by adding to the earlier work of Heyligers and Eden. Vasey undertook a chemical assessment of Port Moresby soils. Amongst the various nutrients, he found that calcium, magnesium, sulphur, potassium and phosphorus are all present at levels sufficient for plant growth but that nitrogen is the limiting factor. Organic carbon levels are high, however, so that a sufficient to substantial reserve of nitrogen should be present in this organic carbon.

However the release of these nitrogen reserves depends on adequate rainfall, and in particular on its annual distribution and variability, which, as we have seen, is highly uneven in both parameters. Thus while we might accept Vasey's (1982:133) conclusion that the soils of the coastal hills are generally of good nutrient status, and considerably better than those further inland, the ultimate productivity of the coastal soils is governed by the vagaries of low and variable rainfall. As we have also seen, this rainfall is lowest of all in the immediate vicinity of Port Moresby.

Vasey notes in particular that the most fertile soils are those that also retain moisture the longest. Best among these are those which coincide with the distribution of *Saccharum spontaneum* grass, called by the Motu *siriho*. Vasey's study area was the coastal hill zone of Port Moresby, from the western end of Bootless Bay to the top of Port Moresby harbour and inland to the Waigani Swamp (1982: Fig.1). Within this area of c. 5500 ha he estimated that there exists between 306 and 317 ha of *siriho*, of which 98 ha are perennially moist soils (1982:134).

**Potential productivity of the Port Moresby area**

Assuming an even distribution of people, Vasey set out to test the question of whether the estimated contact population of 2000 could support themselves from the local environment, or whether the potential productivity of the area was below such a level, forcing these people to undertake long-distance trading to obtain necessary subsistence.

Apart from the highly productive *siriho* land, Vasey estimated that 70% of the remaining land in the study area is arable, and that with fallow lengths being equal to, or shorter than cultivation periods on the better lands and grading to a 2:1 fallow/cultivation ratio on the marginal soils, then 2000 people would have 0.9 ha per person of garden at any one time. This is several times the norm for subsistence cultivators (1982:135).
On questions of productivity Vasey calculated that the fertile *siriho* gardens, which are almost exclusively given over to banana cultivation, should be able to produce the majority of energy requirements for 2000 people. Vasey also examined the case for yams and coconuts in the region, as well as the collecting of cycad nuts and mangrove 'fruits'. It is clear from the figures he generated that theoretically sufficient productivity exists, at least potentially, to supply the subsistence requirements of such a population. However, as Vasey pointed out, the long dry south-east season poses obvious difficulties. Yams are the one staple which could be stored for long periods, but even this staple could not be stored, by the methods used, from one main harvest to the next, without rotting. Thus the time from when the yams gave out, suggested to be November or December, until bananas ripened nine or ten weeks after the onset of the rains - that is, February in a normal year, but sometimes as late as mid-March - is regarded as a 'lean season'.

During this time the main local sources of food would be gardens on moister soils, coconut palms, fish, game, and wild plants, of which cycads and mangroves figure in contemporary accounts and oral traditions (Vasey 1982:136).

Vasey's analysis of the potential productivity of lean season foods, together with his appraisal of the costs and risks involved with various lean season strategies led him to the conclusion that with the correct set of strategies '2000 people could have obtained nearly enough food for a four month lean season' (1982:139). To this he added the rider that 'it should not be concluded, however, that there was no need for the *hiri*. The low-risk strategies do not provide much of a safety margin'. In one sense this confuses the issue at hand, in that there are other conceivable alternative strategies to the *hiri*, for example a reduction in population size, population movement or improved yam storage techniques.

In summary, in seeking an environmental imperative for the actual disposition of ethnographic populations in the Port Moresby area, where the majority of the populations were not only unevenly distributed, but indeed in such a way that the densest populations were in the least fertile areas (Vasey 1982:140; Allen 1984:414), it would appear simplistic and wrong to suggest that famine forced the Western Motu to undertake the *hiri* long-distance trading expedition each year.

I agree in general with Vasey's conclusion:

The *hiri* was not an inevitable outcome of the cultural ecology of the pre-colonial Port Moresby area, but it does appear to have been a part of an advantageous adaptive strategy. Given other historical circumstances this trade cycle may well have not developed, and yet this would not necessarily have precluded settlement at the same levels of population (1982:141).

From an archaeological viewpoint it is possible to test the alternative hypothesis outlined at the end of Chapter 1 by demonstrating that the 'advantageous adaptive strategy' of subsistence trading had been developed by ancestors of the Western Motu prior to their arrival in Port Moresby harbour and their subsequent intensification of the *hiri*.

Again, however, it can be seen that rainfall is the vital factor in all these equations, with annual volume being probably less important than the variation, persistency and timing of its occurrence. In particular the effects of the El Niño Southern Oscillation, while not yet well understood, cannot be underestimated (Allen 2010).

The importance of *Macropus agilis* as a food resource

While the earlier section on local fauna indicates the wide variety of animal resources available in the research area, the ethnographic literature clearly stresses wallaby as a
principal game target which was seasonally hunted, with large quantities being traded to coastal villages in the Port Moresby region. In his assessment of the local productivity potential of the Port Moresby area, Vasey (1982:139) categorised wallaby hunting as a high risk strategy, whose value had been overestimated in the ethnographic literature. He pointed out that in a survey on Goodenough Island, Liem (1977) had demonstrated that *Macropus agilis* is carried at about one animal per ha on *T. australis* grasslands. Vasey considered a similar carrying capacity around Port Moresby to be generous, since the Goodenough dry season is less severe than that around Port Moresby. Using this figure and allowing a sustained annual yield of one quarter of the carrying capacity, Vasey calculated that wallaby yields would be 1.5 animals per person per annum for his notional population of 2000. In addition, Vasey questioned one account which suggested that a single hunt yielded between 500 and 1000 animals, concluding that even if taken on face value 'it would best be interpreted as evidence of boom and bust cycles in hunting' (1982:139).

While Vasey’s consumption rate appears accurate within the parameters and premises he employs, the figure of 1.5 animals per person per annum can be questioned as a measure of prehistoric consumption of wallaby on several grounds. Firstly, since no carrying capacity studies of *Macropus agilis* in the Port Moresby region have been undertaken, it is not possible to judge how accurately Goodenough Island figures can be adopted for Port Moresby, even allowing for a longer dry season there. Secondly, savannah, and presumably the distribution of wallabies, extends well beyond the artificial research area used by Vasey. I calculate that between Boera and Bootless Bay and 15 km inland along this stretch of coast that there are between 30,000 and 40,000 ha of savannah and grassland, so that the 12,000 ha figure used by Vasey should not be taken to indicate any real hunting ‘zone’. Thirdly, while such an area is within easy trading distance as well as local capture distance of all the people living within its boundaries, we have no idea of human population sizes within it through time, nor any real understanding of their extractive strategies. On the one hand Vasey’s putative 2000 is estimated to occupy and exploit an area much smaller than the one considered here and thus we might assume a larger human population in the larger area. Equally the ethnographic population figures used by Vasey, even if accurate, might as easily represent a period of increased population, and that for significant periods of the past millennium the larger area possibly contained fewer people.

Lastly and possibly most importantly, wallaby hunting was a predominantly seasonal activity which supplied meat at a particular time of the year, so that per annum consumption rates have little meaning.

**Ethnographic accounts of wallaby hunting**

It is obvious that references made in passing to wallaby hunting by missionaries and administrators at the end of the nineteenth century may not be accurate in detail, nor will they necessarily provide a satisfactory alternative to Vasey’s attempt to estimate productivity of this food source. They do however provide a qualitatively different conclusion to that reached by Vasey, and at the same time add further understanding of the ways in which wallaby meat contributed to the diet. Utilising the north-west to south-east trending valley floors, the consistent south-east trade wind and the usually extremely dry grass cover towards the end of the dry season, the principal hunting technique was to fire a valley and drive the game in it in a north-west direction towards a barrier of nets about 1.5 m high, where the animals would be despatched with spears or captured in smaller hand nets (Turner 1877:487; Lawes 1880:610; Romilly 1893:224-5). Such hunts were obviously communal, involving according to Lawes (1880:610) ‘all the men and boys of the whole village’; according to Romilly
'hundreds of natives' - quite likely to be an exaggeration but still indicating a lot of people; 'a great many natives' (Chalmers and Gill 1885:36); and the amalgamation, at least in Koiari territory, of groups of men from different hamlets: 'A fortnight ago there was a great wallaby hunt down at Moumiri, and natives from all the districts round were present' (Chalmers and Gill 1885:121).

The method of fire-driving, requiring that the understorey in the valleys be sufficiently dry enough to burn, at least partially dictated a particular time of year as a hunting season, since this technique ensured much higher returns for effort expended than opportunistic spear hunting at other times.

Given this, it seems reasonable to question Vasey's categorisation of wallaby hunting as a high risk strategy since extreme dry season dryness is one of the more reliable aspects of the regional environment.

Bulmer (1978:43) suggests June and July as the hunting season. Turner (1877:487) says the season begins at the same time as the hunting season 'at home', presumably meaning late summer/early autumn in Great Britain. The hunt witnessed by Romilly (1893:321-9) took place a few days before June 20 1878 (1893:311). Better data are supplied, inter alia, by Chalmers and Gill. Late in October 1877, possibly the 29th, a large wallaby hunting party departed from Hanuabada, returning the same afternoon after a 'successful day's hunting' (Chalmers and Gill 1885:36). In 1879 Chalmers undertook an inland expedition visiting many villages and exploring the mountainous country along the courses of and between the Goldie and Laloki Rivers, reaching villages directly inland from the eastern end of Bootless Bay. This trip started on 15 July and concluded on 26 September. Despite detailed descriptions of the people, their activities and the food locally supplied to himself and his party, Chalmers makes no mention of wallaby hunting prior to 18 August, although he talks of pig and cassowary hunts and an unidentified hunt on 9 August, involving everyone in the particular village (Chalmers and Gill 1885:101, 106). On the 18th of August 1879 Chalmers notes that he cannot get carriers because all the men are off hunting wallabies (1885:108). They return on 21st with 'large supplies' (1885:110). The Moumiri hunt, referred to above, had taken place around the 15th of August (1885:121). Chalmers further reports wallaby hunting on the 31st (1885:121), eats smoked wallaby on 6 September in a village behind Bootless Bay (1885:127) and mentions wallaby hunting which had occurred again near Moumiri prior to 24 September but after 29 August. While the earlier absence of references to wallaby hunting does not prove that these animals were not being hunted prior to mid-August in 1879, they were certainly taken in late August and probably throughout September.

In summarising these references for the three year period 1877-9 it can be seen that wallaby hunting continued to the end of October in 1877, recommenced before June 20 in 1878 and occurred from at least mid-August to late September in 1879. However it should not be concluded from this that a normal hunting season continued for up to five months. More likely, local conditions of relative dryness dictated when the season might commence in any particular year. It might also vary across the landscape.

While the Western Motu at contact participated in wallaby hunting, it was principally an occupation of the Koita and Koiari. After capture the carcasses were smoked, presumably to aid short term preservation and 'large quantities' were bartered by the Koita and Koiari in the coastal Motu villages for other items (Lawes 1878:373).

Without being able to estimate wallaby carrying capacities on the savannah and grasslands around Port Moresby and on the inland plains, Europeans moving through the area at the end
of the nineteenth century frequently commented on their numbers. Thus, for example, Chalmers in late October 1877 spoke of 'great herds' between Port Moresby and the Laloki River (Chalmers and Gill 1885:32), the annual report for 1885 commented on the large numbers of wallabies (BNGAR 1886:20), Turner (1877:487) noted that they 'abound through the bush' and Romilly's account, discussed below, also suggests large numbers.

Quantitative accounts of the return on hunts in the ethnographic accounts are limited to the single testimony of Romilly (1893). In reviewing this account Vasey notes that some topographic features are exaggerated, and that Romilly states that on the day of the hunt, 23 June, it had not rained in six months, and yet grass was six to eight feet tall, which would indicate a long previous wet season. Vasey took this to mean that, if accurate, the wet and dry season of the previous year would be in reverse order from normal. He concluded that even if the account is taken at face value it would best be interpreted as evidence of boom and bust cycles in hunting (Vasey 1982:139).

Leaving aside the question of whether or not the seasons had been reversed, which is not obvious to me from the stated facts, it is clear from reading Romilly's letters that he tends towards exaggeration and imprecision in quantitative statements - thus, for example, the 'six months' might only have been four, which would imply a more normal dry season. For example, as the Port Moresby rainfall records discussed earlier show, no January or February since 1891 have had no rain although monthly records have regularly been less than 100 mm. In 1905, a particularly dry year, the monthly rainfall totals were January 89 mm, February 334 mm, March 7 mm, April 0 mm, May 7 mm, June 14 mm, July 25 mm and August 3 mm, so that from March to August there were only 56 mm of rain. The accuracy of any of Romilly's statements may only be judged from the nuances of his prose and it is worthwhile, therefore, to reproduce verbatim extracts of his account.

Romilly arrived at the hunt some time after its commencement. 'A huge tract of country was on fire, quite fifteen miles square as we estimated' (1893:323). This probably means 15 square miles for shortly after he writes 'the ground was certainly well chosen, for in the existing state of the wind the natives could fire the grass four or five miles away from the hill, and a wall of fire, three miles in width, would then come sweeping along ... and in that long dry grass seemed to take huge strides of fifty yards at a time' (1893:324) driving the game towards a strong barricade of nets, which stretched for some hundreds of yards across the narrow pass, into which all game which had escaped fire and spears would of necessity be driven' (1893:325).

'The grass averaged about five feet in height, but was in many places as high as eight or ten feet, and it was as dry as tinder, for, for six months no single drop of rain had fallen' (1893:324).

Finally the hunt was over:

There was at no time a dense rush of kangaroos such as one sees sometimes in Australia, but for all that a heavy slaughter which we could not see was being kept up all along the line of fire. Nor could we tell at the conclusion of the day's sport what the total bag was, for each man made off with the portion that had fallen to his share as fast as his legs could take him. I have no doubt, to put it at the lowest estimate, that 500 kangaroos were killed, and perhaps fifteen or twenty pigs. Perhaps the figures might have been double that amount (1893:327).
Estimating meat values for hunting

Whatever the real figure, the general order of magnitude of the capture from this single hunt, together with the general ethnographic observations which suggest that such a hunt was not disproportionately large, allow some reconstructed figures to be generated. Ten such hunts in a three month season, which would seem at a guess to be reasonable, would yield between 5,000 and 10,000 wallabies. If each animal averaged 10 kg of edible meat this would result in between 0.25 and 0.5 kg of meat for 2,000 people every day for three months.

My edible meat figure is based on the following estimates. *Macropus agilis* attains weights up to 16 kg for the female and 26 kg for the male (Merchant 1976:93). Sexual maturity is attained at c. 12 months after a pouch life of c. 7 months and the normal life expectancy is 10-12 years (Ross 1977:7). If the animals are at adult size for three quarters of their natural life span and allowing for sexual dimorphism, an average capture weight of 15 kg can be conservatively estimated. Dwyer (1980) in a study of edible to waste ratios on 27 species of highland New Guinea mammals found that the edible parts of these species ranged between 50% and 82% (1980:111), with the figures for the Lesser Forest Wallaby, *Dorcopsis vanheurni*, being 69% and the Ornate Tree Kangaroo, *Dendrolagus goodfellowi*, being 75%. Dwyer (1980:110) considered that these figures might be fractionally underestimated. While these figures may not be directly comparable to *M. agilis*, 66% of 15 kg provides a conservative edible meat estimate of ca. 10 kg per animal.

A second independent set of hypothetical figures for seasonal capture rates can be calculated from Romilly's figures. Fifteen square miles is approximately 3800 ha. Thus, the capture rate for Romilly's hunt was between one animal per 3.8 ha and one animal per 7.6 ha. If the full extent of the grassland, estimated at 35,000 ha, was exploited at this rate it would yield between 4,600 and 9,200 wallabies, a figure similar to that generated above. As well, it is interesting that the capture rate of one animal per 3.8-7.6 ha generated by Romilly's figures does not conflict with Vasey's hypothetical carrying capacity of one animal per ha.

Whatever the variations that can be reasonably built into such calculations might be, it would seem that seasonally, and every season, wallaby meat made a significant contribution to diet in the general area at the time of European contact. As will be seen in Chapter 14, the quantities of wallaby bones recovered from Motupore, a predominantly marine-oriented site on the periphery of this hunting locale, will extend this exploitation of wallabies back into the pre-European period and confirm in general terms its suggested volume. The question of whether or not wallaby carcasses can be shown to have been traded to Motupore, thus paralleling the ethnographic situation of inland groups trading carcasses to the coast, is a separate one which will also be addressed in that chapter.

Port Moresby Harbour and Bootless Bay as resource zones

Oram's argument (1977:94-5) that in shifting from Bootless Bay to Port Moresby harbour ancestral Western Motu groups moved into a 'poorer' environment, is a basic premise upon which the 'famine forced trade' corollary depends. It can be seen from Vasey's research that this can be questioned on the grounds of potential productivity, had the populations existing at the end of the nineteenth century been differently deployed across the landscape. Whether, by might or alliance, they could have been differently deployed is a question which will be returned to in the last chapter.
However here it remains relevant to examine Oram’s basic premise further to understand the differences between the two regions.

Rainfall

While correctly pointing out that the Motu-occupied coast, like the coast-inland traverse, can be broken up into micro-environments, Oram was uncertain where Bootless Bay should be placed. On the basis of rainfall, Oram (1977:80) defined a central area around Port Moresby harbour with the boundaries at Rea Rea in the west and Pari (between Port Moresby and Bootless Bay) in the east, which would align Bootless Bay with the proposed more fertile eastern area. Elsewhere, however, Oram (1977:88) observes that rainfall is higher 'east of Bootless Bay and west of Rea Rea' than in the central area. This presumably includes Bootless Bay in the central area of lesser rainfall. As seen from the data presented earlier in this chapter, rainfall in Bootless Bay is likely to be higher than in Port Moresby harbour, but only marginally so. Likewise, soils and vegetation patterns would appear to be generally similar.

Plant Resources

Oram points to two factors to support his contention that the move from Bootless Bay to Port Moresby was one into what he describes (1977:95) as the poorest environment on the south Papuan coast:

The eastern area is correspondingly more fertile than the central area.
Evidence is provided by extensive areas of *siriho* (*Saccharum spontaneum*) and by the abundance of uncultivated foods (Oram 1977:83).

The evidence for this is undemonstrated. Apart from the Vasey study, which included the *siriho* stand behind Taurama beach, no detailed mapping of *siriho* lands near Bootless Bay, nor either north or south-east of it, has been done to my knowledge. Heyligers' (1965) land system assessment reconstructed vegetation from aerial photograph mapping and ground checks in query areas, of which there were fewer than 20 within an approximate 10 km wide corridor around Bootless Bay. On these data he characterised the vegetation pattern around Bootless Bay as predominantly savannah with mixed herbaceous vegetation. At the specific land system level, of all the land systems within this 'radius', only in the Bomana Creek system, north of the western end of Bootless Bay, is *Saccharum spontaneum* a subdominant species, occupying somewhere between 15% and 50% of that area. In all other land systems it is either absent or minor, constituting less than 15%. Thus while *siriho* may well be more extensive around Bootless Bay than around Port Moresby harbour, any great difference is not demonstrated, particularly in respect of what access previous inhabitants of Bootless Bay might have had or not had to it - which is, of course, another question.

Whether the eastern area contained a greater abundance of uncultivated foods is also not substantiated by Oram's testimony (1977:86) that when asked about them Pari people led him straight to the area behind Tupesereia (at the eastern end of Bootless Bay). Clearly the status of bush foods is important, particularly if they could make a significant contribution to alleviating lean season shortages. Oram notes (1977:83) that he has listed 35 edible plants used in the region but supplies identification for only some of these, so that a full assessment of their ecology cannot be made. Some observations can, however, be attempted. Two of the more important bush foods are cycads and the edible hypocots of certain species of mangroves. Both involve
relatively labour-intensive preparation; the cycad fruit is poisonous without first leaching it.

The harvest season for cycad nuts roughly corresponds with the lean season. While cycads are possibly more plentiful in the area around Bootless Bay than around Port Moresby harbour, Vasey (1982) calculated that they might provide in the central area between 15% and 21% of the energy requirements of 2000 people during the four month lean period. In the case of mangrove Oram observed that it was widely eaten and in 1977 was still being sold in the Port Moresby market. Oram (1977:84) quotes a report from Lawes written in February of 1876: ‘The people are all very hungry now, living almost entirely on mangrove fruit and the bottoms of banana trees’. Vasey (1982:138) on the other hand, questions the reliability of mangroves as a lean season food, noting that there was no crop after November 1980, following one of the longest dry seasons on record. He suggests that the production of mangrove biomass, including fruit, is dependent upon fresh water supplies and peaks around the end of the wet season. Vasey calculated that there are today c.180 ha of mangroves in the central area of the coast and there is a suggestion that more existed in the past. The availability of this resource in Bootless Bay is roughly equivalent.

Of the other bush foods less can be said. Oram refers to a 'wide range of tubers' including a wild yam called locally *taitu kava* and *Amorphophallus campanulatus*, but nothing is known of their distribution or density. Oram claims *Terminalia complanata* as a feast food found only in the eastern area (1977:86) but whether it occurs near Bootless Bay is not known.

Marine Resources

There is no physical reason to assume that marine resources such as fish, turtle and dugong were not equally available to the inhabitants of both Port Moresby harbour and Bootless Bay see Chapter 13). In terms of shellfish resources both areas have steep rocky shores, prominent headlands, sandy or mangrove bays and extensive reef localities. In this respect the central area cannot be considered a poorer environment.

Summary

In terms of natural resources, the Bootless Bay 'catchment' would seem on available evidence to be only marginally better off than Port Moresby harbour, if that. There are, however, other aspects which might support Oram's contention that Port Moresby harbour was a more difficult area in which to maintain self-sufficiency.

As Figure 2.6 demonstrates, Bootless Bay is closer to the foothill zone and the upland zone, although conversely Port Moresby harbour is also nearer the fluvial plains and swamp resources to its immediate north. However, as Figure 2.3 shows, ease of access to the inland plains is afforded from the head of Bootless Bay up through the Dokuna Syncline. While this access might have been easier than from the Port Moresby harbour region, ringed as it is with the coastal hills, it must also be remembered that the inland plains and foothills were occupied by Koita groups during the period under consideration (Bulmer 1979:13). Thus the question is not just the simple one of proximity and ease of access, but must also have involved inter-group relationships, whatever land routes were used.

Most importantly for this argument, while the productive capacity of Bootless Bay might have been marginally better than Port Moresby harbour in terms of local subsistence, Port Moresby possessed the strategic advantages of a large and safe harbour, a protective reef corridor, associated marine resources and perhaps defensive
benefits from its close landward hills. It was on these factors, decidedly advantageous ones for specialised traders, that I based the suggestion that the move westward from Bootless Bay might be considered one into an ‘ideal’ rather than marginal niche (Allen 1977a:451-2). While Oram (1977) chose to contradict this proposition on the grounds of 'the poorest environment on the coast', the real issue was not one of comparative food productivity, nor was it, as Oram stressed, a matter of the Western Motu being forced into inferior locations that in turn forced them to trade for food. My model proposed that if the Western Motu in Bootless Bay had already developed a specialised economy prior to moving to Port Moresby harbour, then such an economy provided the opportunity to utilise the physical geographical advantages of Port Moresby harbour, that were of less value to groups with more generalised and locally-oriented economies.

Whether such specialisation could be seen in the archaeology of Motupore Island became a central question directing the excavations there.

Motupore Island

As stated, Motupore Island and nearby Loloata are the submerged ridge top extensions of the Idumava anticline and are thus long, narrow islands running in a roughly north-west - south-east orientation parallel to the main orientation of the coast (Figure 2.3). Motupore is almost exactly 800 m long and 275 m wide at its widest point, although for the majority of its length it is less than 200 m wide. It is approximately 600 m from the nearest point of the mainland and separated from it by a reasonably deep channel (Figure 2.7).

As Figure 2.8 demonstrates Motupore is for the most part a single steep ridge, rising to a maximum 61.4 m above sea level, with the 50 m contour running about half its length and with the 40 m contour running three quarters of its length. Thus is it uniformly steep with no real plateau areas suitable for level house construction. The exposed south-western side of the island is particularly steep, falling to a rocky shoreline with fringing platform reef which extends around the northern end of the island.

Figure 2.7. Motupore Island showing the relationship between the island and the mainland.
Figure 2.8. Contour map of Motupore Island. The black rectangles on the (white) sand spit at the northern end indicate houses on the island in 1970. Darker brown = reef; lighter brown = shallow sandy reef platform; darker green = mangroves.
The eastern, landward shoreline is currently mangrove-lined. Like the adjacent mainland hills the dominant floral cover is *Eucalyptus-Themeda australis* savannah. Currently there is a relatively good tree cover on Motupore, although this may be due to conservation practices of the last 40 years and the absence of regular burning. The local marina proprietor in 1970 reported that the tree cover increased considerably after the end of the Second World War, so that the island may have been predominantly grassland in the nineteenth century.

There is no fresh water on the island.

In 1970, access to the island was most easily made at the northern end where a large stabilised sand spit formed a shallow bay and sandy beach which provided a protected anchorage during the south-east season. On the north-eastern side a tidal sand spit added further protection. The subsequent construction of a wall behind the beach to prevent erosion of the dry land is a likely cause of the sand that previously formed the beach being now scoured out down to rocks.

**Formation of the sand spit**

The stabilised sand spit is a small cuspatc foreland covering c. 1.4 ha. It has built up as a series of low beach ridges and swales, indicating former shoreline positions. The oldest ridges run parallel with the hillside, with the younger ones fanning around so that the youngest ones are roughly transverse to the oldest ones. It is currently covered in grass and carries some planted coconuts. At least some of the sand spit area was rotary-hoed prior to 1970 and this obliterated some of the low relief features. However, test-pitting on the sand spit in 1973 by Roger McLean, a geomorphologist then at the Australian National University, confirmed this explanation of spit formation.

This test pitting also indicated that pottery with recent styles of decoration, on or near the surface where the sand spit sits against the hill, were to be found below surface to depths of up to c. 600 mm on the outer perimeter of the sand spit. In these locations few if any sherds occurred in the higher levels. This stratigraphy indicated that the formation processes leading to the present sand spit configuration were ongoing during the period of the site's occupation and continued after its abandonment as a permanent village site. If houses were being constructed in shallow water, as were ethnographic Motu houses, it is probable that the configuration of house posts contributed to the sand spit formation, as would rubbish disposal on the beach and into the sea.

The direct question of whether such a village pattern existed on Motupore is returned to after reviewing different pertinent aspects here and in Chapter 3.

Early test excavations on Motupore near the present shoreline produced, in a matrix of beach sands and gravels, a good deal of water-rolled pottery and stone, but no bone material, suggesting that either the artefacts had been deposited originally in the inter-tidal zone or else that dry cultural deposit had been eroded and subsequently reconsolidated by natural marine processes. In either case the organic component was lost.

The timing and vertical position of mid-Holocene high sea level varies geographically because the shape of ‘solid’ earth has deformed as ice and water distribution have changed. Thus the precise changes in Holocene sea levels and the dating of those changes is a matter of continuing research and debate (e.g. Lambeck and Chappell 2001; Bird et al. 2007). It is however generally accepted that the western Pacific experienced a mid-Holocene high stand. Data compiled by Lambeck (2002) indicates that between 7000 and 3000 years ago sea levels along the tectonically stable Australian coast were between 0 and 3 m higher than today, the variation largely reflecting hydro-isostatic deformation of the continental margin. In the Port Moresby region, Pain and Swadling (1980) inferred a
Holocene high-stand of about 3 m from data collected at the mouth of the Vaihua River, some 45 km north-west of Bootless Bay, and suggested that this high stand occurred 'during the last few thousand years'. According to Chappell (pers. comm. 2012), a large number of coral reef dating studies indicate that post-glacial rising sea level reached its peak relative to north-east Queensland around 6000 radiocarbon years BP, when relative sea level varied from ~1 m above present along the Cairns-Cape York coast to 2.5 m at Karumba in the southern Gulf of Carpentaria. Extrapolating from these data, Chappell suggests that sea level around Port Moresby was 0.5 to 1.0 m higher than today at c. 6000 BP, and has fallen relatively smoothly since then.

These data suggest that the Motupore sand spit formed after this time, since its surface is, on average, only 0.5-1.0 m above the present high water mark.

This interpretation was partially confirmed by work on Motupore by Roger McLean. Working below the bottom levels of cultural deposition in excavation square K22/III against the hill and 65 m from the nearest present shoreline, McLean encountered beachrock formation less than 40 cm below the cultural materials and separated from them by coarse angular pebbles presumably derived from natural erosion of the face of the hillside above. (The locations and descriptions of the excavation squares will be produced in Chapter 3.) Beachrock is friable to well-cemented sedimentary rock formed along a shoreline within the intertidal zone in tropical areas. It can contain gravel, sand, shells or coral cemented by carbonate minerals. On Motupore, McLean interpreted the formation of this beachrock as reflecting periodic inundation by high tides, separated by drying out periods. Two radiocarbon samples taken to date the beachrock yielded ages of 3110±118 calBP (ANU-1647) and 2594±121 calBP (ANU-1648). On this evidence McLean believed that the Motupore sand spit did not start to form until after c. 2500 BP.

Figure 2.9. West section of Motupore square K21/III showing hearth dug into basal sterile sand. See text for details.
A second related piece of evidence is that the earliest indication of human use of the island so far encountered in the excavations is a small discrete hearth dug into white sand in square K21/III (Figure 2.9), some 5 m further out onto the sand spit from the beachrock area investigated by McLean but at roughly the same 65 m distance from the current shoreline. This hearth is sealed by grey sand, which although discoloured and containing a few artefacts, is not interpreted as a true occupation layer, but rather one containing intrusions and discoloring from the layer above. Higher in the section is the first of three red gritty layers, each separated by sandy midden layers. These red grit layers are interpreted as hill avalanche debris (see Chapter 3). If the hearth represents a discrete, one-off event, such as a fishing party or people sheltering from bad weather, its location probably indicates that only a relatively narrow strip of beach was present at this time. While the radiocarbon date for this hearth, 920±93 calBP (ANU-1219) is the oldest date associated with human activity found on the island, it overlaps at two standard deviations with the oldest dates for the full-time occupancy of the island and is thus not clearly separate from it. However this seemingly older date, together with the stratigraphy, does make such an interpretation of earlier casual use likely.

The notion that no great sand spit development had occurred by roughly 1000 BP remains arguable but likely. If accepted, it provides a basis on which some further hypotheses of general and specific relevance to this volume can be projected.

If no sand spit existed 1000 years ago, then there is no obvious change in natural processes (wind patterns, tides, currents, et cetera) to explain its formation since. However, the arrival of permanent human residents on the island introduced an additional agent for geomorphic change. Evidence will be presented in Chapter 3 to show that significant erosional processes on the hillside occurred after humans occupied the island, thus increasing the amount of natural deposition either on dry land and/or into the shallow water. The subsequent patterns of human use and rubbish dumping to be described also support such a hypothesis.

Returning to the question of the location of past houses, if no sand spit existed there are only two possible scenarios.

The first is that people lived on the hill. There is no evidence of terracing on the hill, nor have I or others been able to find shell, pottery or other artefacts more than a few metres above the sand spit. Even allowing that erosional processes may have brought such material down the hill, isolated findspots in gullies or behind boulders would be expected. The second possibility is that people built their houses in the sea, as did both the Eastern and Western Motu in the nineteenth century. Given that house posts were likely to have been of mangrove trunks of frequently insubstantial diameter (Figure 2.10), many posts would have been used for each house, such posts would have acted as sediment traps. Coupled with the deposition of rubbish in the shallows, such activities would have promoted the development of the sand spit. The presence of water-rolled artefacts in lower layers of squares dug on the sand spit are consistent with such an interpretation, although of course they could have been thrown into shallow water without there being houses there.

The alternative hypothesis, that the earliest occupiers of Motupore moved onto an existing sand spit, is not consistent with the data just reviewed, nor with the ceramic stratigraphy from McLean's test soundings, nor, as will be seen in succeeding chapters, with the pattern of site usage recognised in the excavation.

Summary

This chapter has attempted to place Motupore Island and the Bootless Bay region in the context of local environmental and resource advantages and constraints. In respect of major environmental determinants such as geology, vegetation and climate, Bootless Bay
is subjected to the highly seasonal, relatively low rainfall regime of the general Port Moresby area. While Bootless Bay may have a marginally higher rainfall than Port Moresby harbour, and perhaps easier access routes into the interior, the availability of local subsistence resources also appears similar between the two locations. While the micro-environmental differences between Port Moresby and the eastern zone proposed by Oram would appear to have validity, Bootless Bay would seem to be intermediate between the two areas and should perhaps be considered a part of the central zone in respect of local productivity potential. Despite being closer to the 'more fertile' east, Bootless Bay would have experienced the same lean season restrictions on potential productivity that have been documented for the Port Moresby harbour area.

Figure 2.10. Houses built in shallow water at Tuplesereia, at the eastern end of Bootless Bay. Photograph J. W. Lindt (1887: following p. 60).

Vasey's study is important in putting into proper perspective the previously general opinions that the region is barren and infertile. However, his general conclusion, that the region probably could support populations equal to those recorded at the time of European contact depends on two assumptions: the first being that the population be distributed in relationship to resources more or less equally and the second being that wet season rains be reliable. As has been seen, neither condition can be met in the real world situation.

Motupore Island is a small, relatively steep, waterless island which does not immediately recommend itself as a site for major human occupation in terms of making a generalised living by gardening, hunting and collecting. Locations on the mainland would give better access to gardening land and water and no appreciably different access to shell beds and other marine resources. While all the reasons for settling Motupore may be complex and never fully understood, it is impossible not to consider the proposition that this small offshore islet offered better defensive potential than a mainland site.

As discussed in Chapter 1 the ultimate demise of the village on Motupore is attributed
ethnographically to warfare. While warfare is difficult to identify archaeologically, ethnographic references to people fighting with their neighbours are common in Melanesia (e.g. Thompson 1892:50), including between villages around Port Moresby (e.g. Seligman 1910:41). Oram (1977:93) observed that warfare between the Eastern and Western Motu was ‘incessant’. In the Mailu area Irwin (1985:244) noted that Mailu Islanders fought with the same villages with whom at other times they traded, so that ‘both raiding and trading must have been institutionalised in a single interaction system’. There is no reason not to suppose similar conditions prevailed at least periodically in Bootless Bay. If so, a defensive location might be important, especially where adult males were away from the village on trading expeditions.

More detailed data will be presented in Chapter 3 to support the proposition that the stabilised sand spit on Motupore is the product of human occupation during the last 1000 years. The likely implication of this is that at least some houses built on Motupore were in the sea. Without pre-empting the data too far, the model proposed at this point is that settlement initially occurred on a fringing beach that had formed 2-3000 years ago and that this dry land provided the initial focus of communal activities with domestic dwellings mostly or wholly in shallow water. The construction of these houses either initiated or hastened sand spit formation so that as more dry land formed, activities moved out from the hill. Such a model is certainly influenced by ethnographic descriptions of Western Motu villages, where residence units were based on patrilineal lineages called iduha (Groves 1963). Each iduha traditionally lived in a line of houses with the house of the iduha leader being closest to the shore, although nineteenth century photographs show much variation to this ‘rule’. Data presented in succeeding chapters will support the idea of such a settlement pattern for Motupore. Even without it, the occupation of the island argues for a strongly marine-adapted population. If Motupore was settled from the Boera area as argued in Chapter 1 and in later chapters, it might be possible to test the degree to which the specialised economy argued here for Motupore existed in the putative ancestral villages to the north-west, in the available sequences from Ava Garau or the new sites in Caution Bay.
CHAPTER 3   FIELD METHODS AND A SUMMARY OF THE EXCAVATIONS

A modern empirical discipline ought to be able to aim at more rewarding results than the piling up of data (Clarke 1968:11).

Excavation – a point of view

Excavation embodies the collection of data for solving both highly specific and extremely general problems, ranging from the immediate questions of site formation processes to those of regional prehistory. Both during excavation and subsequently, data are analysed to provide solutions to these and many other questions. Importantly, few questions and no excavation strategies can be immutably fixed before excavation starts, since during excavation some questions will be resolved or abandoned and new ones formulated. Each can affect the excavation strategy.

If excavation is an exercise which brings together the experience of the excavator and the theoretical and practical questions being asked of sites, then it follows that excavation must be creative and cannot be mechanical. This means that there is no single, proper way to excavate a site. Equally, in large excavations, methodologies need not remain constant for all of the excavation. Different aims will dictate specifically different approaches to excavation and will lead to specifically distinct interpretations of what a site represents. An excavation report reflects the approach and ongoing interpretations of the excavator as much as any inherent truth in the data.

My early training led me through the methodological contradictions of whether 'archaeology is anthropology or nothing' from one side of the Atlantic and whether 'archaeology is history or nothing' from the other. I began my career debating whether archaeology should belong in the humanities or in science; and subsequently, both in Australia and in Papua New Guinea, found myself juggling the systemics of the New Archaeology on the one hand and ethnographic particularities on the other.

In excavating and subsequently analysing the material from Motupore I attempted to move away from questions of sequence and artefact typologies and closer to questions of human behaviour and process as the questions which most interested me. My own important discovery was that answering the second set of questions required more precise concentration on the first, if I was to avoid creating fictitious narrative. Importantly I came to understand Clarke’s (1968:13) view that archaeology is a discipline separate from history or anthropology, having its own data, its own procedures of analysis and eventually its own archaeological conclusions, whether these be of sequence or process or both.

Even so, such conclusions still reflect specific social and historical realities that rely directly on the degree to which particular sites provide archaeological data that allow valid inferences to be made concerning these realities. The spectrum of inferences from most to least valid is well understood: technological processes are mostly straightforward and economic reconstructions are frequently possible, while societal reconstructions and beyond grow increasingly hazardous. Somewhat paradoxically, while inappropriate questions can lead to dubious interpretations, modern archaeology is increasingly concerned with challenging interpretive boundaries, aided by increasingly sophisticated scientific technologies. This is as it should be, as long as, 1) archaeological questions dictate the technologies used, rather than the reverse - ‘techniques in search of a problem’ is an increasingly insidious syndrome in current archaeology; 2) technologies are appropriate to the archaeological questions; and 3)
assumptions on which the derived interpretations depend are clearly stated. While this last point is obviously pertinent for the archaeological data, assumptions attached to the technologies in use also need to be specified rather than accepted on blind faith. As one example, few archaeologists appear to be sufficiently aware of the limitations inherent in the array of radiometric dating techniques that they commonly use.

Using ethnographic analogy

It has already been argued in Chapter 1 that Motupore is an unusual site, where, without reference to analogies between its archaeological remains and local ethnographic data, it can be demonstrated that the site was occupied by a particular cultural group, the ancestral Western Motu. By extension, provided changes throughout the site can be shown to be evolutionary, this cultural identification can be extended to the beginning of the occupation of the Motupore site. Given the opportunity to excavate such a site demands that this characteristic be fully exploited. Thus where archaeological evidence is independently associated with a cultural group for whom there is an extensive ethnographic record only two or three centuries after the abandonment of the site, I would argue that not only can comparisons between Motupore archaeology and Western Motu ethnography be confidently made, but also that assumptions concerning behavioural patterns associated with the archaeological data can be based on such analogies.

Previously I made a brief attempt to do this (Allen n.d. (1978):53-5). There I identified particular characteristics shared between the archaeology of Motupore and ethnographic accounts of the Western Motu, where in turn they were an integral part of a specialised trading economy. This comparison was used to argue for a similar trading economy on Motupore. This was subsequently attacked as 'a faulty use of ethnographic analogy' on the basis of the single and irrelevant argument that elsewhere in New Guinea some specialist traders do not have such material assemblages and that some groups who do have them are not specialist traders (Bulmer 1982:117). Even if true - and the proposition was not supported by examples - demonstrated material similarities between different generations of the same cultural group, as a basis for hypothesising similar behaviour between these generations, cannot be rejected because different cultural groups may have one or other set (the material or the behaviour) but not both. Such an argument has no logic. Making comparisons between the archaeological data from Motupore and Western Motu material culture to consider their possibly similar behavioural implications thus remains an important analytical tool and a continuing theme of this report.

Having considered these preliminary matters, I now review the questions and strategies which guided the various excavation seasons at Motupore.

Methodology

As discussed in Chapter 1 the overarching processual question for Motupore was the degree to which the site and its archaeological evidence reflected a developing and increasingly specialised economy of subsistence trading. At a more immediate and mundane level the very first questions concerned establishing a site chronology and pottery sequence that would provide a framework for the processual questions.

Preliminary exploration of the site rapidly defined the area of major concentration of surface artefacts. This area is entirely coincidental with the stabilised sand spit at the north-western end of the island. While this stabilised sand area might more properly
be called a cuspate foreland, in order to distinguish it from the tidal sand spit that is
inundated at high tides and which moves seasonally, I refer throughout this report to
the dry area as the sand spit or stabilised sand spit. Wherever mention of the tidal spit
is made, this distinction is made clear. Many fewer surface artefacts are visible along
the eastern, mangrove-lined edge of the stabilised spit, although they occur there and
across the whole sand spit; sherds are also visible on the tidal sand spit. By
comparison, very dense midden occurs at the junction of the sand spit and the backing
hill, in several places forming distinctive and discrete mounds of midden oriented at
right angles to the contours of the hill. Elsewhere on the sand spit topographic
features are non-existent or barely discernible, comprising mainly low and
presumably natural beach-ridge formation. As previously noted this might reflect
artificial levelling by the previous European owner of the island.

The hill was diligently searched for any indication of artefacts higher than c. 5 m
above the sand spit. Nothing was located and this absence of any indication that
people previously lived on the hill has held for all subsequent searches by me and
others.

Datum, site grid, and square identification

A concrete datum was erected in the approximate middle of the sand spit and all
vertical and horizontal distances were subsequently related to this point. The site was
mapped (and subsequently re-mapped in 1973) and gridded in 5 m by 5 m squares
along north-south and east-west axes (Figure 3.1). In 1970 the central section of this
grid, then presumed to contain all areas in which we were likely to excavate, was
labelled using a letter system from west to east and a number system from north to
south. Subsequently, the grid was extended westwards, using a double-letter system
from east to west. The gridded portion of the site, encompassing all excavations
between 1970 and 1975, is illustrated in Figure 3.1. Each 5 m x 5 m square on the
site is thus identified by a letter/number combination, such as M23 or LL8. Each
square was further divided for excavation into four 2 m x 2 m squares, leaving a 1 m
baulk on the south and west sides of each 5 m x 5 m square. Each 2 m x 2 m square
in any particular 5 m square is identified by a Roman numeral I, II, III or IV,
indicating, in order, the north-east, south-east, north-west or south-west 2 m x 2 m
square, such as M23/IV or LL8/II. The 2 m x 2 m square was used throughout all
seasons as the basic unit of excavation and this basic unit was only very occasionally
dispensed with. Each special case is noted as it occurs. Within each excavation
square, excavation layers (spits) were labelled with Arabic numerals from the top of
the square to the bottom, such as M23/IV/18 or LL8/II/7. While the depths of spits
could be arbitrary or determined by stratigraphic changes, arbitrary spits were
normally c. 100 mm in depth. Any further excavation subdivisions were given a final
lower case letter designation, such as M23/IV/18a. On those occasions when baulks
were removed, SB (south baulk) or WB (west baulk) was substituted for or added to
the Roman numeral as appropriate, depending on whether the baulk was itself
subdivided.

Thus M23/WB would indicate the whole west baulk of M23, while M23/IVWB
would indicate only that portion of the west baulk adjacent to M23/IV. When both
baulks were removed in the same 5 m x 5 m square, the overlapping corner 1 m x 1 m
was always removed as the south baulk.

Figure 3.1 (over page). Motupore excavations 1970-1975, showing superimposed alpha-
numeric grid. Verticals are north-south with north at bottom of page. See text for details.
Excavation procedures

Deposit was removed from squares using trowels, dustpans and plastic buckets only; this procedure was maintained for all excavations.

Excavated deposit was passed through either 0.5 inch or 0.25 inch (12.7 mm or 6.35 mm) sieves. Further discussion of sieve sizes appears below. On occasion, as discussed more fully below, some cultural material was removed with only partial or no sieving. All recognised cultural material, with the exception of unworked shell, was retained for further analysis. In the case of shell, excavations produced such huge quantities that an initial decision was taken that all the shell from a selected square should be retained and in other cases this material should be abandoned. This meant the loss of data on the variability of shell deposits across the excavated areas but was seen as a logistical and analytical inevitability. In 1973-4 Pamela Swadling excavated a square (N21/II) designed to address this issue (see below and Chapter 12). All shell produced from the later excavations undertaken by Groube was initially kept for analysis and is now in the National Museum and Art Gallery in Port Moresby.

Excavation levels in all squares were measured by dumpy level and keyed into the datum to enable depth comparisons to be made between squares. Depths were measured in each corner and in other parts of the square where the revealed surface was particularly uneven. This allowed the later calculation of volumes of individual layers for use in artefact density analyses. All sections were drawn in completed squares, as were ground plans of post holes, burials and other features, as encountered.

Personnel

I account in the Preface for my particular debt to three people, who each in different ways made a prolonged contribution to my research on Motupore. These were the island’s caretaker, Guma Lumb, Ian Saem Majnep, a University of Papua New Guinea technician, who assisted me during all the field seasons I undertook there, and Mary-Jane Mountain, who succeeded me as the archaeologist at UPNG, spent many short seasons on the site both assisting me and running her own field schools.

All my early field seasons were conducted as practical classes for archaeology students at the University of Papua New Guinea, sometimes assisted by members of the university community, particularly on weekends. During the major 1973 season, by which time I had left UPNG, these classes continued as university schedules permitted, assisted as noted by Mary-Jane Mountain. At other times I maintained a small (2 to 4) team of local men, plus Saem and other volunteers as available.

Because all excavation teams lived on the island during excavation, the standard working day commenced at sunrise and excavation and associated activities continued until about 1 pm. With breaks for breakfast and morning tea this usually meant approximately six hours digging per day. Especially with a large team, any longer schedule than this meant an increase in mistakes, such as items being missed in the sieves or bags mis-labelled. As well, usually by midday the south-east trade wind had firmly established itself, adding to discomfort and error. A long break in the early afternoon allowed the crew to sleep or swim and allowed me to write notes or take measurements on the site. From mid-afternoon until dark all the morning's finds were washed, sorted, counted, weighed and labelled. Depending on the amount excavated in the morning this normally took 2 - 3 hours.
Apart from the first season, when one pit was left open and damaged by collapse during the wet season, all excavations were backfilled at the end of each season. Again because of the huge volume of potsherds recovered, after washing, sorting, counting and weighing, undecorated body sherds were dumped at the extreme north-western end of the island beyond the limits of the prehistoric occupation. At this time neither the University nor the Museum was able to store these sherds. As will be seen in Chapter 9, this left a gap in some of our data when carrying out technological studies on the pottery.

**A summary of the excavation seasons**

**1970**

The first season of excavation on Motupore took place between 6 and 18 July. I was accompanied by Wallace Ambrose of the Australian National University who was at that time on six months secondment to the University of Papua New Guinea. The field crew averaged about 12 on any particular day.

**Questions**

As noted, in 1970 there had only been my own and Bulmer's excavations carried out at Nebira and the central question was whether or not Motupore could provide a good ceramic sequence and chronology for the prehistory of the most recent millennium. The indications were good, based on Lampert's earlier investigation. His report (Lampert 1968, see also Lampert and Golson 1967) also indicated that other classes of artefacts and probably burials and structural evidence would be recovered. In this sense the first questions posed were very broad - what was the site likely to contain, could it provide dated ceramic sequences into which other surface collections from the area could be placed, and along what other avenues might it lead us in reconstructing Port Moresby prehistory?

This last question, although in 1970 poorly defined, included notions of island settlement and relationships between the archaeology and ethnography of the region, particularly in respect to pottery manufacture. It was also recognised that, geographically at least, Motupore marked the boundary between existing and ethnographically described Eastern and Western Motu settlement areas. The nature of the relationship between this ethnographic boundary and the Motupore archaeological signature provided a further interest.

**Strategy**

In archaeological terms Motupore divides into the midden bank against the hill and the sandy flat. In order to get some perspective on the nature of occupation of the total site, together with pursuing the objective of developing a ceramic sequence for Motupore, it was decided to investigate both areas in 1970. Accordingly Wallace Ambrose opened up three 2 m x 2 m squares on the sand spit, while I began excavating a single 2 m x 2 m square in the centre of the largest mound of shell midden (Figure 3.1).

**Sand spit squares P20/I, P20/III, O20/II**

All deposits in this area were screened through 6.35 mm sieves. In all three squares, sandy deposits contained cultural materials for depths between 650 mm and 1100 mm with a general gradient direction of thicker deposits to thinner ones away from the hill. Below the cultural material, sterile beach sand was encountered in all three squares. In P20/I and P20/III this beach sand was underlain by a coral limestone platform. In the places where this rock basement was uncovered there was between 400 mm and 600 mm of sterile sand separating it and the lowest cultural layers. This indicated that the beach sand was thicker closer to the hill.
In all three squares, three stratigraphic units could be distinguished. The upper series consisted of a loose grey sandy soil containing shell and pottery. In depth this layer averaged between 200 mm on the northern side of P20/I and P20/III and 450 mm on the southern side of O20/II. The middle series comprised yellow to orange compacted sand layers, again ranging in depth between 250 mm and 500 mm. Nowhere was there a sharp division between this middle series and the bottom series; rather there was a gradation into cleaner, less consolidated and coarser sands again varying in depth between c. 200 mm and 300 mm. As stated, sterile natural beach sands occurred beneath these layers in all three squares.

On the southern and western sides of O20/II a fourth stratigraphic unit was apparent, separating the upper and middle units seen elsewhere. This comprised thick black shell midden with high densities of bone, shell, stone and pottery. As can be seen from Figure 3.1, this unit is obviously the northernmost extension of the large midden mound directly to the south.

Besides the artefactual material recovered, the excavation was complicated by many natural and human disturbances in the region. Many crab holes were encountered and both the middle and lower series revealed post holes, pits and burials. Little can be said of the post holes in these squares since they exhibit little regularity in either size (with diameters ranging between 100 mm and 400 mm) or alignment. Within the difficulties of dealing with poor stratigraphy and little colour differentiation, where these post holes were located (and best defined by textural differences) it was clear that not all of them were contemporaneous, but rather had been dug at various times during the build-up of the lower and middle series of deposit. Four pits, circular to oval in shape and having a maximum horizontal dimension of up to 1 m, were delineated as having been dug into the sterile beach sand at an early point in the occupation of this area of the site, although again they are not contemporaneous and at least one was dug from the middle series layers and is c. 800 mm deep. Although carefully excavated, they contained nothing, each being filled with the deposit of more recent layers. The suggestion that they were intertidal post holes that had collapsed after the posts had been removed could not be substantiated by excavation, but no other function could be suggested for them, nor were similar pits recognised in any of the subsequent excavations. As subsequent excavations revealed other suggestions of intertidal dwellings, this explanation for these post holes remained feasible.

Three burials were encountered in these squares. In the field human burials were designated by square and layer numbers plus a Sk number, discussed further in Chapter 15. P20/1/5-Sk 1, although first encountered in P20/I was mostly in P20/III. It was an extended burial lying on its back in a very shallow grave oriented north-east to south-west with the head to the north-east. Various bones, notably the left foot and left upper arm and shoulder area were missing, although the remaining bones were in positions of articulation. The skull and facial areas were crushed. P20/1/6-Sk 1 (in field notes Sk 2) occurred right in the south-east corner of P20/I, where only the right femur and some finger bones of the right hand were uncovered. Like P20/1/5-Sk 1, this burial was in a shallow grave, on its back and apparently oriented the same way, with the head to the north-east. Stratigraphically it might have been interred slightly earlier. O20/II-7-Sk 1 was located in the north-west corner of O20/II, where too little was exposed to say anything about it, apart from the fact that it was sealed with a thin layer of pebbles which suggested that the grave was no more than c. 250 mm deep.

Of the artefacts themselves, apart from shell and bone food debris throughout, the finds included our first introduction to stone drill points, shell ornaments and styles of pottery not seen on the surface. I had seen stone artefacts described as awls in local collections and in the Nebira 4 excavation, but these drill points reflected a distinctly different technology, as
will later be described. At the time these were a new local stone artefact type. Also in retrospect, it can now be demonstrated that the lowest levels contained pottery styles similar to those associated with the earliest evidence of permanent occupation found on the site.

**Midden square M23/IV**

Given almost 200 lineal metres of midden distribution against the hill slope, the earliest sampling of these deposits could have been attempted in a number of places. However, given the objective of looking for a ceramic sequence as complete as possible, the attraction of the large midden mound bounded by squares O21, O24, L21 and L24 proved irresistible. Why a large midden mound at right-angles to the hill might exist at this point along the slope remained a puzzle (but now see the last section of this chapter). In any case the mound was cleared, revealing an extremely thick concentration of large sherds and shells on the surface. Two strategies for excavation suggested themselves. A trench coming in from the side of the midden towards the centre promised good stratigraphic control on the steeply sloping surfaces; but this strategy guaranteed that if surface densities continued through the deposit huge quantities of material would be recovered, a daunting prospect given the short seasons and limited opportunities available to me for analysis at the time. The second alternative was to sink a sondage through the centre of the mound and risk the possibility that the contours of the mound might also follow and sit upon a small promontory of the hill itself. Despite this, the second, 'telephone booth' alternative was chosen. Influenced by both the major objective and the density of surface artefacts, excavation was commenced using 12.7 mm sieves. In the event, this sieve size was maintained throughout the excavation of this square.

![Figure 3.2. M23/IV midden at the beginning of the excavation, indicating densities of cultural materials present. This density continued for more than 2 metres of deposit.](image)

The square chosen for excavation, M23/IV, is in the centre of the mound, at the point where it was expected that if no subsurface anomalies were encountered then the deposit should be deepest, taking into account the natural slope of the hill. On the southern side of this square surface deposits continued in towards the hillside for approximately 4 m. As the excavation progressed we were staggered by the quantities of cultural material encountered (Figure 3.2). One excavator could easily keep eight people busy on the sieves and thus progress was slow.
By the end of this first season we had only managed to reach c. 1100 mm below the surface, encountering layers of loose shelly midden full of bone, stone artefacts and large pot sherds throughout.

1971

During the wet season of 1970-71 sea erosion of the grass bank in the vicinity of LL7 resulted in human bones being dislodged from the deposit. I was on leave from the University at the time and on my return to Port Moresby, the whereabouts of the bones could not be discovered. At the same time I was told that Michael Pietrusewsky, a physical anthropologist from the University of Hawaii, would be visiting the university later in the year, primarily to work on the human skeletal material excavated by Susan Bulmer at Nebira (see Pietrusewsky 1976) plus any other material available in the region. I was thus persuaded to attempt to locate more burials on Motupore for his inspection. Since such an attempt coincided with the continuing objective of determining the nature of variability of deposits on the site, it was agreed to carry out a week of excavation in April 1971. In the event, excavations were begun on 12 April, continuing to 19 April and being concluded between 11 May and 16 May. A second 1971 season from 21 June to 7 July returned to the task of completing M23/IV. For the April excavation I was assisted by Sandra Bowdler, who had joined the University of Papua New Guinea as a tutor, plus Saem Majnep and variously three or four students. I undertook the May work with Saem, Sandra Bowdler and two students. The June-July excavation involved me, Saem Majnep and variously five to eight students at any particular time.

Questions

For the April-May exercise the objectives were straightforward. The first was to further test the proposition, based primarily on the testimony of the previous owner of the island and the earlier work of Wood and Mackay (see Chapter 1), and partly confirmed by the 1970 excavations, that extensive numbers of burials existed on the sand spit area of the site. The second and associated aim was to explore further the variability of the deposits in other parts of the site.

The single task for the June-July season was to complete the excavation of M23/IV.

Strategy

Given the availability of Bowdler, it was possible to excavate two separate locations simultaneously, as I had done in 1970 with Ambrose. Thus Bowdler began the square adjacent to the shoreline from where the human bones had eroded earlier in the year. On the basis of the described location of these bones we abandoned the grid approach, instead placing the square where we felt it most likely to encounter any parts of the skeleton which might remain in situ. Although the material was labelled LL8/III in the field, this 2 m x 2 m square actually encompassed part of LL7/IV, part of the west baulk of this square and part of MM7/II (see Figure 3.1). The analysis now refers to this sample as LL7/IV. Meanwhile I opened Square G13/I, chosen for excavation on the basis that it was close to the house where burials had supposedly been disturbed while building.

Sand spit square LL7/IV (previously LL8/III)

All deposits in this square were screened through 6.35 mm sieves.

A total depth of c. 600 mm of deposit was excavated in LL7/IV, coming down onto a base of clean sterile beach sand. While no true midden layers were encountered in this square, the deposit differed from the sand spit squares excavated by Ambrose the previous year. Three different cultural layers could be discerned. The upper soil component was c. 120 mm thick.
and contained pottery, some shell, flaked stone including drill points, and shell beads. Below this c. 150 mm of deposit contained fewer artefacts within the same general range. However the matrix consisted of graded and rounded small pebbles in thin but distinct layers, consistent with it having been sea-washed. Some of the pottery and stone had rounded edges. This zone was thus interpreted as having been laid down in a dry land situation that was subsequently inundated by the sea and then finally overlain again by dry land deposits.

The lowest series of cultural layers confirmed this reconstruction to some extent in that they consisted of compact reddish gritty sand, which, while containing fewer artefacts than above, produced a number of post holes clearly developed on dry land. No burials were encountered in this square. The cultural layers were underlain by sterile beach sands.

At this stage the significance of the red sand layer and the post holes was not apparent in this small square, but would become important data as the excavation developed.

**Sand spit square G13/I**

While this square was begun using the normal excavation techniques employed on the site, including 6.35 mm sieves, these were abandoned after the top 250 mm produced only continuous grey-yellow beach sands and pebbles containing no bone or shell food debris and only heavily water-rolled sherds and pieces of flaked stone with heavily rounded edges. Further investigation with a shovel showed that this situation continued for another 800 mm, with the matrix grading into pure coarse beach sand and artefactual finds growing increasingly scarce. This area had in the past eroded under sea action and had reconsolidated with redeposited artefactual material. Given this, it is unlikely that the construction of the adjacent house disturbed any *in situ* burials.

**Sand spit square G16/I**

This square was placed 15 m immediately south of G13/I to attempt to get beyond the area of sea disturbance. All deposits were sieved through 6.35 mm mesh sieves.

G16/I was taken to an average depth of 1300 mm below the ground surface at which point the water table was encountered. The upper 250 mm consisted of developed topsoil grading into yellow sand and containing pottery and shell. This upper unit graded into yellowish orange sand, more compacted on the southern side. No well-defined stratigraphic breaks occurred for the next 500-600 mm, the deposit comprising orange-brown sand, soft in places and consolidated in others, containing large quantities of pottery, shell and shell artefacts, including beads and shell net sinkers, but little flaked stone material. This unit contained the bulk of the artefactual material, often in distinct layers that formed a genuine shell midden. Below it was a gradual gradation into lighter coloured sands, still containing artefacts but with a significant decrease in density. Below this the matrix grew increasingly damper and coarser - a true beach sand.

This beach unit had two features of particular interest. Firstly it dipped sharply towards the north-west corner of the square, with the top of the slope on the diagonal between the north-east and south-west corners. Secondly, while it produced 2,050 sherds in c. 0.3 m³ of deposit, the vast majority were water-rolled and few other artefacts were contained in it. The succeeding deposits above it followed the general line of this slope. The strong indication here was *not* that this lowest cultural material was redeposited but that it had been discarded directly into shallow water. It seemed likely that this area later became a beach edge and eventually dry land. As will be seen, subsequent work in this area in 1972 and 1973 added support for this interpretation.
Midden square M23/IV: continuation of work commenced in 1970

Part of the southern wall of M23/IV had collapsed during the previous wet season and the loose nature of the deposit generally made it dangerous to continue working in this square without protection. The upper exposed metre of deposit was thus shored up with timber planks before continuing.

Figure 3.3. The M23/IV excavation nearing completion. The inset provides more detail on the shoring-up of the top 1100 mm of deposit. The galvanised pipes used in the shoring in each of the four corners were still visible in 2016, defining the location of this square in the absence of the site datum, long since removed.
One result of this operation was that subsequent layers in this square were reduced in size to 1.8 m x 1.8 m (Figure 3.3). On the basis of the previous season's work the larger sieve size of 12.7 mm mesh was maintained throughout this excavation.

The detailed stratigraphy of this square will be presented in Chapter 4. From the surface, an upper unit consisting of a number of layers and lenses of loose shell midden continue to Level 14 (M23/IV/14), c. 2400 mm below the surface in the north-west corner. In Level 14 the deposit became much sandier, and this matrix continued through Levels 15 and 16. Two other changes occurred in these latter two levels: whereas in the earlier levels no structural elements apart from areas of burning had been encountered, Level 15 contained a burial, and two post holes were recorded in Level 16. As well, while artefact densities remained high in these levels they represented a significant decrease from the layers above, and below Level 16 they decreased equally dramatically, as demonstrated in Figure 3.4.

Level 17 consisted of a 100 mm band of small red angular fragments. This gritty gravel was unlike any matrix so far encountered on the site, although in colour it was similar to the red gritty sand in LL7/IV. At first this grit was thought to be the base of M23/IV. However it was not sterile and quickly passed into a layer of sandy midden. From here to the bottom this succession of red grit layers and sandy midden lenses was twice more repeated, with the basement comprising a compacted layer of black broken stone. Several more post holes were encountered and the lower density of artefacts continued through these lower levels.

Two other features were recorded, the first being an area of fine white ash c. 60 mm thick in the north-west corner of Level 18, the possible significance of which was not to be recognised until the field season of 1973, and the second an artificial channel 450 mm wide and 300 mm deep running diagonally across the surface of Level 22, a red grit layer. This contained stones and sandy fill but had no obvious purpose.

![Figure 3.4](image-url)  
**Figure 3.4.** Sherd numbers by excavation layer for M23/IV, uncorrected for variations in layer thickness (volume). Numbers decrease dramatically in the habitation layers at the bottom of the square. Layers 2, 6 and 10 were volumetrically small spits.

As well as thousands of non-ceramic artefacts, and using the very coarse 12.7 mm mesh sieve, this single square produced 130,889 sherds at an average density of 10,052 per m³, weighing 1113 kg, or 85.5 kg per m³.
1972

In 1972 I left the University of Papua New Guinea and the field season that year, carried out primarily as an undergraduate training exercise, was under the control of Sandra Bowdler. Bowdler excavated for a total of 33 days in April-May and June-July with approximately a dozen people, including Mary-Jane Mountain and Saem Majnep. Previously established procedures were maintained in respect of the grid system, excavation, processing and sorting. All material from this season was screened through 6.35 mm sieves. A nine page unpublished report of this work (Bowdler n.d.) provides the basis of the present summary.

Questions

Since the excavation of M23/IV produced a series of problems (further addressed below) Bowdler chose to avoid the hillside midden and returned to the sand spit area. The excavation of G16/I had raised questions in respect of the sand spit formation and, like all the excavations of 1971, had failed to produce evidence of the previous owner’s claim of large numbers of burials. The season’s aims were to pursue these questions and to further clarify the nature of the sand spit occupation.

Strategy

Bowdler chose to move in towards the hill working directly from the previously excavated G16/I, opening up G16/II, G16/IV and G17/I and also removing the central metre of the baulk, G16/II-IVSB, in order to recover a burial, one of six approximately contemporaneous interments (Figure 3.5).

Figure 3.5. G16/I was opened in 1971. The remaining squares were excavated by Sandra Bowdler in 1972. Plan indicates the non-random distribution of the six most recent burials she excavated.
Sand spit Squares G16/II, G16/IV, G16/SB, G17/I

Bowdler described these squares collectively. The average depth of excavation throughout was 1200 mm and the stratigraphy in general correlated with that already described for G16/I.

A topsoil layer came down in most places onto a compacted orange sand surface, the top of a layer which, being in places 600 mm deep, was excavated in arbitrary units. This in turn gave way to a lighter softer sand layer sitting on damper, grittier beach sand. Bowdler considered this to be 'natural sand' presumably meaning the basal level. However it was not sterile, containing both pottery and stone, 'though the pottery had a rolled appearance'. Excavations ceased when water seepage became noticeable.

Of particular interest was the recovery by Bowdler of the skeletons of seven individuals. Bowdler labelled these G1 to G7. While it is possible to relate these to excavation square, the excavation levels were not included in the report. For the stratigraphically earliest burial within the orange sand in G16/II (possibly layer 6) the lower limb bones and a few rib bones of one person were found (Figure 3.6). Although there was no sign of the remainder of this person, the leg bones were in the position of articulation.

Bowdler was able to locate neither a grave nor any signs of post-depositional disturbance, although this obviously must have taken place at some time.

The remaining six individuals came from well-defined graves dug into the orange surface, and were therefore buried more or less contemporaneously (Figure 3.5). They are stratigraphically younger than G16/II-Sk 1. Each grave had been filled with beach grit that contained water-rolled pottery, and all were similarly oriented with the head to the north-west. All were fully extended burials with the individuals placed on their backs. The placement of these six burials was of particular interest. While none occurred at this level in G16/II, one extended from the southern half of G16/IV into G16/SB, and the remaining five were mostly inside G17/I. Thus they were neither randomly nor evenly spaced in these excavations.

Figure 3.6. Partial (but articulated) skeleton of G16/II-Sk 1, excavated by Sandra Bowdler in 1972. See text for discussion.
Bowdler comments on the general distribution of artefacts, noting that all classes diminished in number between G16/I on the one hand and G16/II and G16/1V on the other. Densities in G17/I diminished even more noticeably. The six approximately contemporaneous burials dug into the surface of the compact orange sand layer occurred in G16/IV and G17/I, squares with low artefact densities.

Bowdler (n.d.:4-5) concluded that:

Allen's 1971 excavations in G16/I uncovered two or more post holes; none were found in the area under discussion. This, together with the decrease in cultural debris, suggests either that we are moving away from a living area, or that this is in fact the area covered by the house itself. If the latter case be true, then the burials would have been under the house. If there were a house here, however, it would have been in use over a considerable period of time as the paucity of material extends throughout the depth of deposit. The burials on the other hand are very recent and appear to represent the final period of this part of the site's occupation. An alternative hypothesis might be that this part of the island was not a living area, and was used in comparatively recent times as a graveyard area only.

With the hindsight of subsequent work and experience on the site it is now possible to consider some of these propositions further. Both from further work done in this area of the site in 1973 and from Bowdler's section drawings (Figure 3.7) it seems likely that post holes did occur in the area of her 1972 excavations. At the time Bowdler suggested that such possible post holes were more likely areas of water penetration or old tree root casts. Most of these features were associated with the same compacted orange surface that the burials were dug into and were difficult to identify in terms of either contrasting colour or texture of the fill. They varied in depth between 500 mm and 1000 mm and in diameter between 200 mm and 400 mm. I am unable to determine any water penetration action which might match these features, and tree roots seem unlikely both on the grounds of the verticality and regularity of the holes and on the remote likelihood that trees of such size ever grew on this sand spit. On the basis of subsequent experience on the site there can be almost no doubt that these are post holes.

Bowdler's suggestion of different activity areas is supported by the disposition of the burials (see Figure 3.5 and Figure 3.12 below), the different densities of material and by the differences in average sherd size, which is 6.3 gm in G16/I but only 4.2 gm in G17/I - a difference of 50% over a distance of only 5 m. However Bowdler's concept of 'living areas' being defined by the lower density of artefacts creates some problems, since there are nearly 10,000 sherds as well as other artefacts from G17/I.

An alternative suggestion is that living areas might well be cleaner and that the higher concentrations of material, as well as larger sherd sizes in G16/I might indicate that relatively more relocation of rubbish took place on the edges of activity areas (or possibly under houses). Ethnographically the Western Motu buried their dead in front of the house according to Turner (1877:485) and Figure 3.8 shows a similar practice from a Central Province village further east in Hood Bay.

As well, it is known that newly made pots were dried under pile houses out of direct sunlight and these areas were also used for storage. The G17/I area may have been a street or other open space, rather than an area covered by a house and this might explain why artefact densities remained consistently lower throughout the period of deposition of G17/I. This matter is returned to, below.
Figure 3.7. Bowdler’s stratigraphic sections for G17/I and G16/II (continued next page).
Figure 3.7 (continued). These sections are redrawn and post holes are my interpretations. See text for discussion.
The data do not suggest that this artefact distribution remained the same for the total period of occupation in these squares. However there is also no necessity to postulate a period of time equal to the site's total occupancy for the deposit in this area, as a closer examination of the data suggests. If the deposits of G16/I and G17/I are compared on divisions of an upper unit of topsoil and upper sand deposits, a middle unit beginning with the consolidated orange surface and a bottom unit of the coarser beach sands, it can be seen (Table 3.1) that sherd densities are only different in the upper two units. The sherds from these units contain no early styles, even at the base of the middle (dry land) unit. As the radiocarbon determinations discussed in the next chapter indicate, Bowdler is correct in suggesting that the burials are recent.

These data have a further important implication. Despite apparently different activities taking place between the two squares in the middle and upper units, the spectacular decrease in sherd numbers between the middle and lower units in both squares is also suggestive. The water-rolled nature of the pottery in these lower units, coupled with the huge increase in pottery in the middle layers, where we are clearly dealing with a dry land situation, suggests that the most plausible explanation for this radical change is that the lower unit reflects at least an intertidal zone.

Figure 3.8. Photograph from Lindt (1887) titled ‘Mourners and Dead House at Kalo, Kemp Welch R.’ It appears from the text that the deceased was yet to be interred and it was unclear whether he or she would be finally buried at this location.
In support of this, in addition to the ceramics, there is the stratigraphic evidence of a sharp downwards slope to this lower unit on the north-western side of G16/I, the absence of structural features in this unit - in contrast to the unit above - and a similar decrease in other artefactual material. The presence/absence of bone in particular is relevant, since it is particularly prone to deterioration in the sea. While bone occurs in this lower unit in all squares, the percentage of bone by weight found in the lower unit for each square varies between 0.03% in G16/I and 0.16% in G17/I as a percentage of the total weight of bone by square. Most bone occurs in the upper levels of these lower units and the vast majority comes from later dry land deposits in these squares.

<table>
<thead>
<tr>
<th></th>
<th>G16/I</th>
<th>G17/I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Unit</td>
<td>14,322</td>
<td>2,715</td>
</tr>
<tr>
<td>Middle Unit</td>
<td>25,412</td>
<td>5,216</td>
</tr>
<tr>
<td>Lower Unit</td>
<td>2,050</td>
<td>1,803</td>
</tr>
</tbody>
</table>

Table 3.1. Sherds counts for three units in G16/I and G17/I. Unit volumes are approximately equivalent. See text for details.

In addition, if we refer again to Bowdler's section drawings for the east section of G16/II and G17/I, it is difficult not to conclude, given that these sections are only separated by a one metre baulk, that the two lowest units in G16/II correspond to the large lower unit of 'white grittier sand' in G17/I, despite the different notation in G16/II. If this is indeed the case, the next lowest unit in G17/I, unit 7, described by Bowdler as 'lighter softer sand', does not extend into G16/II and may represent an old beach edge deposit. If so, this becomes relevant for an argument developed later in this chapter that evidence exists for another beach edge, later in time than this one, further out towards the present shoreline.

Significant to this later argument, these sections also indicate that the shell layer in G16/II disappears in G17/I.

Overall this evidence leads to the hypothesis that the earliest cultural deposition in this area was in an intertidal zone, whether or not there were houses built in this zone.

**Summary of excavations 1970-1972**

It is convenient at this juncture to summarise what we had learnt about Motupore by the end of 1972 because the seasons after this took on a different nature both in size and scope and in the orientation of the enquiry. This summary pre-empts some of the data to be presented in succeeding chapters, in particular the discussion on radiocarbon dates, but it is appropriate to do this here, to maintain the historical narrative.

**Sand spit squares**

Excavations at four separate locations on the sand spit had indicated very clearly that the present day configuration of the sand spit does not represent the dry land area available at various times in the past, including some periods when the site was occupied on a full-time basis. The hypothetical extension of this observation is that any cuspate sand spit was either smaller or non-existent when Motupore was first occupied. The evidence from G13/I suggested that any previous dry land occupation in this area had been obliterated by a later and probably post-abandonment marine erosion event, and below this any material in a
primary depositional context was likely to have been discarded in an intertidal or shallow marine situation. In LL7/IV a different situation was encountered. Here, while some of the middle levels had been sea-washed, earlier occupation levels had maintained their structural integrity and contained a full range of cultural material, above sterile beach sands. The upper levels were again undisturbed by the sea. Thus the sea-washed levels probably reflect a minor sea incursion - possibly a single event coupling high tides and high (storm?) wave action. Nonetheless it probably indicates that the shoreline at that time, like today, was adjacent to this square.

By the end of 1972 the best evidence of a previous intertidal zone in what is now a dry land area, and one which occurred during the period of occupation - that is, since c. 1200 AD - had come from the series of squares G16/I to G17/I. Here the evidence strongly suggested, in its earliest phases, deposition in an intertidal or even shallow marine situation, with later occupation being on dry land. Fifty metres to the south-east a similar situation was suggested by the P20/I, P20/III and O20/II squares. There, pits located in the earliest deposit, a matrix of coarse beach sand, were subsequently accepted as post holes originally dug into a tidal zone, again with later cultural deposits laid down on dry land.

Using evidence from M23/IV (Figure 3.1) as marking a point close to the hill/sand spit interface, then this point is approximately where the 4 m contour is on this plan. If this is consistent along the full extent of the sand spit – hillslope interface, it can be estimated that P20/I is c. 24 m north of such a point, G16/I is c. 28 m north and LL7/IV is c. 20 m north. Thus the suggestion that a strand beach c. 20-25 m wide existed in this area at about the time that full-time occupation began would accommodate the archaeological evidence from these sand spit squares.

While clear-cut stratigraphy had not been apparent in any of the sand spit squares, and while this situation was further confused by crab disturbances, nevertheless some broad stratigraphic units appeared to be common to all the sand spit excavations. Coarse beach sands, either sterile, artefact-bearing, or sequentially both, formed the basal unit. A middle unit comprising orange to yellow and compact to soft sands contained the majority of artefacts, as well as post holes, pits, and in squares P20/I, P20/III, O20/II, three burials. Parts of a fourth early, and perhaps generally contemporaneous burial had been found in G16/II. The surface of this middle unit in the area of G16/II-IV to G17/I was compact and distinguishable from the material above and appeared to comprise a well-defined 'living floor' with sherds and other material horizontally distributed and having post holes and six more burials dug into its surface.

When the field notes were compared, it was clear that all skeletons so far encountered were apparently buried in a similar manner, fully extended on their backs in shallow graves, which in most cases had been subsequently filled in with shell grit that was easily distinguishable from the surrounding matrix and sometimes contained water-rolled sherds, with both the grit and the sherds indicating that this material was transported from the beach. In the case of the group of six burials from the G squares, these were close together and similarly oriented with the head towards the north-west. Since they were neither randomly nor evenly spaced across the area excavated, this suggested that functionally different areas of the same living surface had been exposed. New questions were thrown up by these data. For example, in the apparently stratigraphically earlier burials in the P squares, heads were oriented towards the north-east, unlike the G square burials; and both sets were different in this respect from the mainly unexcavated burial in M23/IV/15, where the head was presumed to be oriented towards the south-west, while being buried in a similar manner to the other burials, fully extended on the back in a shell-grit filled, shallow grave.
While only a single square of midden had been excavated by the end of 1972 its four square metres had produced as much material as had come from the 28 square metres so far opened up on the sand spit. While this provided an excellent data base for the primary objective of developing a ceramic sequence for the site, it was also apparent that many small objects such as beads, drill points and small bones had been lost through the large mesh sieves. As well, the transition from midden dumping to the deeper habitation layers was demonstrated but not clearly understood. How did these lower layers (or, for that matter, the midden layers higher up) relate to the sand spit occupation? Were the red gravel layers natural or artificial layers? In 1972 three radiocarbon determinations suggested that the uppermost metre of midden deposit was radiometrically ‘modern’, and three others indicated that there was a significant time gap spanning the change from habitation to midden in M23/IV. Did this indicate a real break in the occupation of the site?

Attempts to answer these questions from the data at hand were equivocal. While the basal deposits of M23/IV were below the present ground surface level of the sand spit, the deposits of the midden and sand spit areas themselves were unmatchable and comparisons between artefacts from both areas inconclusive. Similarly, analyses of the pottery above and below the change in M23/IV indicated both similarities and differences in decoration styles.

Preliminary analyses of the non-ceramic artefacts also raised some questions. In particular the rich faunal sample, while largely comprising marine fauna, had also produced large numbers of wallaby bones, but few examples of other terrestrial fauna. This immediately brought to mind the ethnographic descriptions of wallaby hunting and trading in the area. Could this be the archaeological reflection of similar trading in the prehistoric past? Once this idea took hold other parallels between Western Motu ethnography and the archaeology of Motupore suggested themselves for investigation - pottery manufacture, shell bead manufacture, the probability that some houses at least on Motupore were built in the sea or intertidal zone, the location of the site on an offshore, waterless islet, the oral traditions linking some ancestors of the Western Motu with Motupore. Ultimately, if these links could be substantiated through the detailed analysis of the material from the site, there could be no avoiding the question of whether the occupants of Motupore had, like their descendants, also been specialised subsistence traders.

**Later excavations**

**1973**

In 1973 I returned to Motupore to continue excavations as a Research Fellow in the Department of Prehistory in the Australian National University, accompanied by Noel Ridgway and our daughter, Tess. In collaboration with, and with the full co-operation of the University of Papua New Guinea we lived on Motupore from late March until early September that year, having full use of the facilities there. For the most part the excavation team consisted of myself and Saem Majnep and three paid assistants from local hamlets, although at various times in the year and often on weekends I was assisted by Mary-Jane Mountain and archaeology students from the University.

During this six month season two principal areas were opened under my direction, one on the hill slope in squares K20, K21, K22, J21 and J22 (Figure 3.9), the other on the sand spit in squares H16, H17, I16 and I17 (Figure 3.10).
Figure 3.9. The J and K squares excavation looking north. Nearest corner is the south-east corner of K22/I. Ranging poles are 1800 mm long, calibrated in 200 mm units.

Figure 3.10. The excavation of the H and I squares. H16/III in the foreground is fully excavated. Two adjacent graves, H16/III-IV/2-Sk1 and H16/IV/2-Sk1 have been excavated and the remaining living surface cleaned. Three large square holes in a line, the nearest cutting through the grave of H16/III-IV/2-Sk1 were dug by the former owner of the island to plant coconut palms.

The nature of the deposits out from the base of the hill slope was explored with a series of post hole borer tests in M12, M14, M16, M18, M20 and G18. Other areas investigated were two 1 m x 1 m test trenches opened by advanced students from the university as a course project in OO8 and OO9, two test trenches in K13 and R9 opened by geomorphologist Roger McLean, as part of his geomorphological assessment, and a 2 m x 2 m square N21/II, opened in the foot of the large midden mound by Pamela Swadling of the National Museum and Art Gallery in Port Moresby, in pursuit of her study of shellfish remains on Motupore, reported in
Chapter 12. This last excavation was carried out after my departure from the island. The square L23/I, adjacent to M23/IV, was partially excavated by me in order to obtain check samples for radiocarbon dating of the upper metre of deposit, for which the previous samples had given modern readings.

Questions

While the general question of whether the occupants of Motupore possessed a specialised trading economy, as discussed in the previous section, had become important by the beginning of 1973, pursuing it did not dictate any particular excavation strategy beyond getting as full a representation of the site's contents as possible, with sample sizes sufficiently large to undertake a variety of subsequent analyses with at least statistical confidence. Whether ultimately they would or could confirm or deny such an hypothesis would depend on these post-excavation tests: for example, the burials so far uncovered had revealed no suggestion of grave goods which might include imported items, nor, with the exception of some polished stone axes which were probably not local, had such goods been recovered elsewhere on the site. Structural evidence in the form of post holes, even if these could be identified as relating to structures of known form, seemed unlikely to inform this question. Any answers would come from the artefacts themselves and the best hope was to make these as representative of the site as possible.

However, more immediate and more mundane questions had been thrown up by the previous work. It was important to resolve the question of whether the break in the M23/IV sequence was real, and to expose a larger area of the habitation deposits against the hill, not only to increase the sample of earlier material but also to investigate the nature of the red grit deposits. This in turn might have implications for the formation of the sand spit and the nature of the earliest settlement on the island. Thus it seemed necessary to try and trace the stratigraphy from the hill slope midden region to the sand spit in order to attempt to relate the two areas to each other. It also seemed valuable to extend the excavation of the G squares to pursue the question of whether the earliest deposits there were or were not in an intertidal situation and also to see whether the living surface of the middle depositional unit on the sand spit could be traced over a sufficient distance to be able to delineate possible house plans.

Strategy

In order to resolve the problems created by the excavation of M23/IV it was decided to open up an area immediately to the north-west of that square beyond the main mound of midden, but sufficiently far enough into the hill slope to have midden deposit sealing the presumed habitation layers. A second strategy was then to run a trench northwards onto the sand spit. This work had two proposed options. The first was to identify a sufficient correlation between the deposits in the new squares and M23/IV to relate the two areas and then to connect these squares to the sand spit. If a satisfactory stratigraphic connection between the new squares and M23/IV could not be made, the second option was to excavate a connecting trench between the two and forego the trench onto the sand spit. In the event, this latter alternative was not required.

On the sand spit it was decided to open up a large square east of, but adjacent to the squares opened by Bowdler in 1972 to pursue the questions outlined above for this area of the site. Specifically this meant exposing the ‘living surface’ of the middle sand spit unit previously defined.
Much of the stratigraphic and chronological data from these squares will appear in Chapter 4. Here the object is to summarise where and how the squares involved were excavated and to provide an overview of how they fitted into later analyses.

Overall, a 2 m x 12 m trench was run from K22/III to K20/III, beginning at the southern end. In K22/III eight distinct strata were defined that were mostly repeated in the other squares. These were:

- overlying heavy midden
- a buried soil horizon
- sandy midden deposits
- a red grit layer in which a large number of post holes occurred
- a sandy midden lens
- a second red grit layer
- grey sand containing some cultural material
- a basal stony black sterile layer.

At the deepest point (northern end) cultural deposits were c. 1800 mm deep. At the northern end of this trench, in K20/III, cultural deposits ceased at c. 1000 mm below the ground surface, with the matrix comprising sandy layers variously disturbed by pits, crab holes, post holes and burials. Overlying these layers the buried soil seen in K22/III was, in turn, sealed by later surface deposits.

At some locations the two red grit layers seen in K22/III were added to by a third stratigraphically distinct red grit layer extending out from the hill. However none extended beyond the south baulk of square K20; that is they were absent in K20/III.

Locating and identifying the number, nature and disposition these red grit layers and the intervening sandy midden layers provided a sequence that so closely approximated the similar layers in M23/IV that it was considered unnecessary to join the two areas physically. As well, an early preliminary radiocarbon date obtained while still in the field suggested that the material immediately overlying the uppermost red grit layer appeared to fill the apparent chronological gap in the M23/IV sequence. However, while the desired correlations with M23/IV had been achieved, the attempt to trace hill slope strata directly onto the sand spit was thwarted on the eastern side of the trench by a very large and very recent disturbance (thought to be a World War II bomb crater – Motupore was used as a practice target by Allied planes taking off from nearby Jackson’s Airport, see Chapter 4) and elsewhere in the northern squares by burials, pits and crab holes to the extent that no stratigraphy could be continuously followed from the south to the north of this trench except for the buried soil horizon, which, as will be seen in the next chapter, became an important horizon marker.

Altogether, in the 7 m x 2 m section of the trench between K21/III and K20/III, 13 burials, many of them disturbed prehistorically, occurred in roughly the same stratigraphic level. These were contained in the sandy midden layer below the buried soil horizon described; all burials were clustered at the northern end of the K trench. Unlike the six burials excavated the previous year by Bowdler, a sequence to their interment could be suggested for some of these burials, but this does not appear to have occupied a long time in the overall history of the site. Again, all 13 had similar orientation, this time with the head to the south-west. This orientation was again different from the three previous sand spit sets of burials but similar to the single burial in M23/IV/15. In other aspects these were similar to burials previously located – extended burials lying on their backs in shallow graves. Although a further 45 square metres was eventually opened up immediately south and west of this area of burials,
no further burials were located, again indicating different site usage at contemporaneous times.

The stratigraphic unit containing these burials sat immediately above the most recent red grit layer, labelled red grit A, the surface of which reflected a confusion of large post holes (Figure 3.11). Some of the northern most burials in this trench, dug into sandy deposits, may have been interred at a time contemporaneous with the red grit A surface. The post holes extended across every exposure of the red grit A surface and although earlier post holes were noted in preceding units the profusion of these post holes clearly reflected some different phase of concentrated use.

Eventually in order to increase the sample of the earlier material from the habitation layers and also to attempt to make sense of the structural evidence from these levels, a rectangle 5 m x 9 m was opened across J21, J22, K21 and K22.

The huge quantities of recent midden materials in this region made it necessary to make decisions about discarding recent materials without complete sieving. Such decisions were not taken lightly. In K22/I one bucket in six was sieved (still producing c. 4,000 sherds in c. 450 mm depth of deposit); in K21/II all midden material above the buried soil layer was discarded, and towards the end of the season, when it became imperative to extend the structural information, the west baulk of K22/III, the south baulks of J21/II and J21/IV and the squares J22/I and J22/III were removed as a block, labelled as J22/Extension. Initially the
overburden was taken off, using trowels, down to the red grit A layer, with only diagnostic material uncovered in trowelling being retained and labelled as J22/Extension Z(one) 1. This was then taken down to the red grit B layer using the same procedure, with diagnostic material being labelled J22/ExtensionZ2. The excavation was discontinued at this point.

As previously stated, a square immediately adjacent to the western edge of M23/IV was taken down c. 1100 mm in order to obtain check samples for radiocarbon dating. Again only diagnostic pieces were retained and labelled L23/II.

While the majority of squares and levels were sieved through 12.7 mm sieves, occasionally, and particularly when small objects were being encountered while trowelling, sieves were switched to 6.35 mm mesh. The squares and layers where this occurred were: K22/I/4, K22/I/5, K22/I/6, K22/I/11, K22/III/5a, K22/III/5b, K20/IV/5 and K20/IV/6.

Sand spit squares excavated by Allen - the H and I series

Excavation was commenced in square H16/III in an attempt to extend and confirm the hypothesis generated from G16/I that the lower levels in this part of the site were originally beach edge and/or intertidal, and also to examine in more detail the surface and upper layers of the previously defined middle unit. As before, rich black topsoil and loose sandy midden came down onto a heavily compacted orange sand surface. This level contained a burial dug into the surface and extending into H16/IV. Three clear post holes were noted also dug into this surface. The distribution of cultural material in the sands overlying this compact surface was distinctive. Very thick concentrations of shells and sherds occurred at the northern end of this layer but thinned out quite noticeably as the square moved south into the area of the burial and the post holes. As can be seen this paralleled the findings of Bowdler in the adjacent Square G, and as will be shown below, the same pattern continued when H16/IV was opened. Almost certainly associated with this distribution of material, the compact orange sand surface sloped towards the north-west corner of the square and actually disappeared right in the corner, thus defining a clear edge to this surface. Further excavation showed that the underlying sand deposit continued across the entire square.

The discovery of an edge to this compact surface enabled some wider associations to be developed which have significant implications for the occupation of Motupore. In the 1971 excavation of G16/I this surface had not been encountered; instead very heavy concentrations of pottery, shell and bone had been recovered at this depth. Bowdler reported a similar situation in G16/II, immediately to the south. Here her notes report no clear surface; instead a 'shell band' was encountered. In the section drawings for the eastern side of this square this extends along the whole section, sloping downwards towards the northern end where it is some 80 mm thick; at the southern end it has thinned to only 20 mm thick. The western section of G16/IV is different. Here the shell layer is somewhat thicker, confined to the southern end of the section, and slopes sharply downwards so that in c. 1200 mm from south to north the base of this deposit is 400 mm lower down. Unfortunately in her brief description of the layers of G16/IV this shell layer is not mentioned specifically by Bowdler. Importantly, however, in describing the compact orange sand layer, Bowdler cryptically notes 'southern half of square only'.

One slight anomaly requires mention. In H16/III the dense shell layer clearly overlies the compact orange sand surface, while in Bowdler's section drawings for G16/II and G16/IV there appear to be two orange surfaces which sandwich the shell layer. There are two possible explanations for this anomaly. The first is that further south-west in Bowdler's squares, after the shell was deposited, the orange sand surface extended back out to cover it, and that this was not seen in H16/III. The second possibility is that what is represented as the same
deposit above and below the shell by Bowdler is two different sand deposits, with the upper one being equivalent to the loose sand sandwiched between the dark topsoil and the heavy shell layer in H16/III. This latter explanation seems more probable.

**Figure 3.12.** Disposition of the G and H squares showing the northern extent of the compacted orange sand. Shell distribution further north suggests midden dumping on a then-existing beach. The relative location of the graves in this area (see also Figure 3.5) is also indicated.

These specific aspects of the archaeological data demonstrate very clearly that the compacted orange sand 'living surface' has an outer edge running from the north-east to the south-west (that is, approximately parallel to the existing shoreline now further to the north-west) which cuts through H16/III, probably through the southern side of G16/I where it was not clearly recognised during excavation, and through the centre of G16/IV. Deposited on the down curve of this edge is an area of midden dumping, itself sloping downwards towards the shore. This edge thus delineates an area of midden on the seaward side and a living area with a compacted orange surface into which both post holes and graves have been excavated, and which contains, on and above it, much less refuse than is present a few metres north-west (Figure 3.12). Such a reconstruction makes more sense of the distribution of the graves excavated by Bowdler. It suggests that this edge represents the separation of the living surface to the south and east from midden dumping on a beach to the north. As will be seen in the next chapter, radiocarbon dates from some of the burials dug into this living surface further east suggest that these interments occurred close to the end of full-time occupation of the site, perhaps shortly before the end of the seventeenth century AD.

This suggests that the present-day size of the sand spit is possibly significantly larger than when the prehistoric settlement was abandoned.
The remaining three 2 m x 2 m squares in H16 were also excavated down to this consolidated red sand surface, with the predicted fall-off in the density of artefacts occurring as excavation moved towards the hill. As an example of this, the total sherd counts for the deposits overlying the consolidated surface in each of the four relevant squares are listed in Table 3.2. It will be remembered that H16/I and H16/III are the two northern (beachfront) squares and H16/II and H16/IV are the inland squares. Sherds in these latter squares total 3,610 compared with 21,217 sherds in the adjacent shoreward squares. These data confirm Bowdler’s earlier impression that a similar fall-off in artefact densities occurred in the G16 and G17 squares as she moved south towards the hill.

<table>
<thead>
<tr>
<th>H16/I</th>
<th>H16/II</th>
<th>H16/III</th>
<th>H16/IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>8,407</td>
<td>1,602</td>
<td>12,810</td>
<td>2,008</td>
</tr>
</tbody>
</table>

Table 3.2. Sherd counts in deposits above the compact orange sand surface in the H16 squares. The two ‘shoreward’ squares, H16/I and H16/III have significantly more sherds that the two landward squares.

Figure 3.13. Brushing the surface of the compact orange sand in the H and I squares. The excavated square H16/III is visible in the far corner.

A second interesting aspect of these densities is the continuing high numbers in H16/I despite the fact that it is east of the line of the edge delineated in H16/III. One hypothesis to explain this is that the beach edge swings towards the east at this point and begins to run more parallel to the line of the hill. Further excavation would be needed to confirm this.

Given that we had been able to delineate the compact living surface in each of these squares, in addition to uncovering another grave, it was decided to attempt to follow this surface both east and south. Accordingly a further 65 square metres were stripped down to this level, the overburden being discarded and only diagnostic pieces being retained. As can be seen from Figure 3.1 this thus formed a 9 m x 9 m square encompassing H16, H17, I16 and I17.

By carefully brushing the last few centimetres of loose sand from above the compacted surface it was possible to trace the compacted surface over most of this area (Figure 3.13).
places, particularly in the north-eastern and south-eastern corners the surface proved to be far less compact. The brushing technique, while very slow, enabled us to delineate most if not all disturbances in this surface, including definite and possible post holes, crab burrows and other natural disturbances, and a number of graves, recognised by their shell grit fill. The detailed analysis of these data will appear in Chapter 15, but several observations are relevant here. Thirteen more graves, in addition to the two already mentioned for H16, were recognised, all continuing the north-west to south-east orientation previously seen in the burials excavated by Bowdler. From the distribution of the grave fill it was considered that several of these graves might contain more than one individual. Figure 3.14 shows the distribution of these graves and it can be seen that they form in the main a line running east-west through the centre of the excavated area, with additional graves north and south of this line at the western end. It is relevant here to note that the two major areas where graves do not occur coincide with areas where the compacted surface is less detectable. On the northern side in particular, one hypothesis for future testing might be that this area was not any great distance from the beach on the north-eastern side of the sand spit at the time of deposition, as suggested above.

Figure 3.14. Disposition of the graves dug into the compact orange surface in excavated sand spit squares. See text for details.

Because of a lack of time in 1973 no attempt was made to excavate the additional graves nor to excavate this deposit further. Instead the exposed surface was carefully covered with heavy black plastic sheeting and the backfill replaced, except in I17/II, where Mary-Jane Mountain continued a student exercise later in 1973 after I had left the site.

**Additional 1973 excavations by Mountain, Swadling, UPNG students and McLean**

**II 7/II**

During the latter part of September 1973 Mary-Jane Mountain excavated the remaining layers of this square below the living floor surface. With the very notable exception of a dogs' teeth necklace associated with a secondary burial, discussed below and described in Chapter 11,
none of the material from this excavation came into my care, nor has been analysed by me. Instead it was deposited in the Papua New Guinea Museum and Art Gallery.

To judge from Mountain's field notes, nothing apart from the burial was unexpected, nor did the stratigraphy add any new insights into site formation processes, although Mountain noted that pottery in the basal layer was quite 'worn', consistent with it being water-rolled.

In I17/II/4 - only a matter of a few centimetres below the living surface previously exposed - Mountain uncovered two burial pits unique to the excavated site. The two pits had been dug from the same level and were c. 200 mm apart. It was immediately clear that these pits reflected an entirely different burial procedure to that seen elsewhere on the site, being a secondary interment. Although the contents from each pit were originally thought to be separate bodies, the bones of only a single individual were distributed between the two pits, presumably when all the bones would not fit into one pit.

![Secondary pit burial in I17/II/4, with dogs' teeth necklace overlaid. Photo: M-J. Mountain.](image)

Covering the surface of one of these pits were 73 units of dogs' teeth in a clear position of articulation as a necklace (Figure 3.15). The majority of them were still whole teeth and represented at least 21 animals. Amongst all the burials on Motupore this necklace represents the clearest indication of 'grave goods' recovered from the site. The cultural implications of this burial are discussed in Chapter 15.

**N21/II**

Pamela Swadling began this 2 m x 2 m square in September 1973 completing it in 1974. The primary purpose of this square was to recover all the shellfish remains as a data base for the study of shellfish exploitation on Motupore which is presented separately in this report as Chapter 12. Situated towards the northern extreme of the discrete midden mound in which I had previously excavated M23/IV, the general stratigraphic evidence that came from this
excavation again confirmed the dichotomy reported in M23/IV, with midden dumping overlying sandy habitation layers. Significantly the red grit layers seen elsewhere closer to the hill did not occur in this square, a result in agreement with the evidence recovered from the K20 to K22 trench.

Within the sandy layers of this square, Swadling encountered part of a burial intruding into it. Again the grave was filled with beach grit. Only a femur and foot bones were uncovered. These were lifted to allow the excavation to continue, so that most of this individual remained undisturbed. It seems probable that the head of this individual points towards the south-west and, if so, is similar in this respect to the burials uncovered in the K squares and M23/IV/15. While a precise stratigraphic correlation is not possible, it would seem likely that this burial is roughly contemporaneous with the K series of burials. Again all the material recovered by Swadling was placed in the Papua New Guinea Museum and Art Gallery and does not form a part of this report beyond Swadling’s important contribution on shellfish (Chapter 12).

**OO8 and OO9 test pits**

Two senior undergraduate students from the University of Papua New Guinea, Gary Collins and Rosemary Kinna, each excavated 1 m x 1 m test pits in OO8 and OO9 as a practical exercise under the supervision of Mary-Jane Mountain. The test pits were placed on a small mound of midden projecting from the hill side, being in configuration a small version of the mound containing M23/IV (see Figure 3.1). About 300 mm of shell midden overlaid a series of habitation layers resting on a rocky base in OO8 and c. 150 mm of sterile sand in OO9. The depths of cultural deposit were c.800 mm. One red grit layer, not sterile, was identified at c. 600 mm below the surface. A radiocarbon date of 550±50 BP came from a sandy layer above the red grit in OO8 (see dating section in Chapter 4).

In the sandy beach layer in OO9 a burial was encountered, again fully extended on the back, with the head oriented towards the south-west. While no clear grave was noticed by the excavator, a layer of pebbles and grit above the skeleton can be clearly associated with this burial as being grave fill. Since only the upper part of the burial had been exposed by excavation the lower half of the skeleton was not removed and the basal sand was not excavated prior to backfilling. In general nothing unexpected was recovered from these excavations in terms of the artefactual material, and the stratigraphic division of dense midden overlying sandy habitation layers repeated and thus confirmed the stratigraphy seen in the larger excavations against the hill further east. The relatively thin sandy layer at the base suggests that not much beach existed at this location at the time of initial occupation. Again this is in line with the general reconstruction of site formation processes advanced in this chapter.

The material from OO8 came into my possession and was subsequently analysed, but the material from OO9 is presumed to have been deposited in the Papua New Guinea Museum and Art Gallery. Unfortunately both squares were wrongly labelled, so that all material from OO8 has been labelled OO7 and all material from OO9 has been labelled OO8. In my analysis I maintained the labelling OO7 to avoid confusion.

**K13 and R9 test pits**

Finally in 1973, Roger McLean, in addition to his investigation of the geomorphology revealed in the K20 to K22 series of squares, excavated two further test pits, each 1 m x 1 m square on the sand spit. In K13 he encountered an upper unit of redeposited sands similar to that seen previously in G13/I, overlying coarse beach sands containing rolled sherds. A further 40 m north on the sand spit, McLean excavated the R9 test pit. The first 600 mm
contained virtually no cultural material. This unit again came down onto coarse sands with coral and other beach detritus in it.

While it contained rolled pottery, all identifiably decorated pieces consisted of the most recent types found in the sequence further in towards the hill. These results were totally consistent with the idea of these outer parts of the sand spit being of recent formation and overlying intertidal or shallow water deposits whose cultural contents reflected deposition into the sea, probably from over-water houses.

1974

J21/I

During 1974, Pamela Swadling completed the excavation of N21/II as previously described. A new square was excavated, when Mary-Jane Mountain with a team of students opened up square J21/I. Again, the material from this excavation was deposited in the Papua New Guinea Museum and Art Gallery and is not included in the analyses reported here. From the field notes of this excavation it is clear that the stratigraphy encountered in the adjacent K squares the previous year was continued in J21/I, with a large number of post holes being discovered dug into the upper red grit layer, Red Grit A.

While the field notes indicate earlier decoration styles on the recovered pottery, the field school concluded without sterile layers being reached; the excavation concluded at excavation level 4.

In 2008, Georgia Stannard (2008) undertook an analysis of the human skeletal material excavated on Motupore. Much of this material had previously been listed in the 1970s by Peter Brown (nd) but Stannard added data on c.10 individuals not listed by Brown. These included two individuals labelled by her J21/III/5 and J21/III/5-Sk2 (Stannard 2008: Appendix 3).

Neither Mary-Jane Mountain nor I have any record of square J21/III being excavated. The remote possibility that Mountain extended the J21/I excavation into J21/III sometime between September and December 1974 can be ruled out on various grounds, including the lack of any field notes, the fact that the teaching year was coming to an end and the wet season approaching (the site was not normally excavated in this season), and particularly because the J21/I had not yet been completely excavated by the end of September 1974 and would normally be completed before extending the excavation. Mountain completed J21/I when she returned to Motupore to also complete the excavation of J17/III (see next section) between June and October 1975. In 2016 I discussed various explanations with Mary-Jane Mountain who searched her notes and diary and reported that ‘I have absolutely no record of ever digging in J21/III, whereas I certainly continued digging in J21/I. I have details of layer 5 being dug in Sept 1975. However, I have no record of any burials or bones from that excavation.’

While it is clear that the two burials identified as deriving from J21/III were at some stage mis-labelled, all other burials on Motupore can be related to the written records. Even so, the possibility remains that they may derive from J17/III despite the fact that the skeletons and labels from that square accord with each other, at least superficially. There remains sufficient ambiguity in the field notes to consider the possibility that further burials from J17/III were mis-labelled as J21/III.
1975

**Burials from H16, H17, I16, I17**

In May 1975 I accompanied the late Alan Thorne, Prehistory Department, Australian National University, to Motupore to excavate the burials that I had delineated but not excavated in the H and I squares in 1973. While the plan was for Thorne to analyse and describe these burials, this did not eventuate. All burials are further considered in Chapter 15.

**J16 and J17 burials**

In addition to excavating the graves identified in 1973, a small extension was made by Thorne in order to complete the excavation of a burial at the eastern edge of the area first uncovered in 1973; however this exposed the western half of another large grave, so that the extension was subsequently enlarged to a 3m x 3 m square as shown in Figure 3.1. While this extension included parts of J16 and J17, it was labelled for convenience J17/III.

The large grave, when excavated, proved to contain five individuals, all interred as a single event. Up to this point no other multiple burial had been identified on this site, which made this of interest; as well, whereas all the other burials taken out in 1975 had continued the head to the north-west orientation, the orientation of the five individuals in this grave had been rotated through 180°, so that the feet now pointed to the north-west.

This different orientation opened up the question of whether this reflected a deliberate act which might, in some way, be associated with the multiple nature of the burial, or whether, given that orientations had been seen to change in other parts of the site, that some sort of boundary had been encountered. Two further patches of grave fill, unexcavated, had been recognised in the north-east and south-west corners of the extension. Between June and October of 1975 Mountain excavated these burials with a view to testing these propositions. In the southwest corner, two burials were recovered, with the graves cut into each other and badly disturbed. However, it was clear that both of these individuals was oriented in the usual manner, i.e. with the head to the north-west.

Since these burials were west of the multiple burial, they did not necessarily answer the question of whether the orientation of burials east of the multiple burial might also change, so that Mountain also excavated the area of grave fill to the north-east of the multiple burial. Again she recovered the badly disturbed remains of two individuals, one an infant and the other an adult male. Again the adult was aligned with head towards the north-west. Thus the reverse orientation of the multiple interment appears to have been deliberate, even if obscure in meaning.

Apart from a brief return to Motupore by Mountain in June 1976, no further excavation took place on the site until Les Groube recommenced work there in 1979. Subsequently John Burton took University of Papua New Guinea students to Motupore and carried out excavations that exposed burials but these burials were apparently not exhumed (Cox 1989). No other details are known.

**Summary**

This chapter has discussed the survey, square designation system and excavation and on-site processing techniques employed on Motupore for all excavations between 1970 and 1975. It has outlined, in chronological sequence, all excavations undertaken there by myself and others during that time, indicating the aims of each excavation and the general field strategies employed to achieve those aims. It has also indicated some of the implications of the field evidence as it came to hand. In the six years involved, some 206 squares metres of the site...
had been opened up, although for reasons discussed, not all of this area was taken down to sterile levels. Even so, this represents only c. 1.5% of the 1.4 ha which the site ostensibly covers. Because of the depth and density variations across the site described in this chapter, the total sample of artefactual material recovered for analysis may be as little as c. 1% of that present on Motupore. On the one hand the representative value of such a small sample has to be borne in mind when assessing the conclusions that will be drawn from these data; on the other hand the richness of the site has produced very large quantities of data, which have made it imperative to reduce even this data set for many analyses. For example, more than 512,000 sherds are included in the sample I analysed; if the material not in my possession and the material not sieved while excavating were added to this, the figure would likely approach >750,000 sherds. This suggests that there could be as many as 50 million sherds on the island.

The dichotomy between midden and sand spit squares elucidated here means that no very satisfactory stratigraphic relationship has been established between the two areas. Thus while some analyses have been able to incorporate all data, particularly in situations where temporal (i.e. stratigraphic) control and division have been deemed unimportant, in other situations analysis has had to be restricted to areas where sequential differentiation can be firmly identified. Thus many of the squares described in this chapter will be infrequently referred to in subsequent ones. I have therefore attempted here to give a general summary of these squares and what they produced. The next chapter will deal with the stratigraphy and chronology of the M23/IV and the K squares in more detail, since it is from these that the artefacts most closely analysed have come.

Lastly I have attempted to account generally for the burials recovered from these excavations. In all, these excavations unearthed > 56 individuals. The precise number is uncertain for reasons examined in Chapter 15. At least six further burials were either placed in the Papua New Guinea Museum and Art Gallery or were not lifted from the site.

The summary of one central emphasis of this chapter, site formation processes, will be carried over into the next chapter and will be more fully reviewed there.

Addendum 2016

As further noted in Chapter 16, in June 2016 I assisted Matthew Leavesley from UPNG, to run a two week field school for UPNG students on Motupore, funded by a grant from the Australia and Pacific Science Foundation (Grant # APSF 15/1). Also involving Glenn Summerhayes, this is projected to be a three year investigation of aspects of the archaeology described in this volume. For the 2016 season the principal research objective was to gather new radiocarbon dating samples for the site, to address anomalies outlined in the next chapter. Samples were collected and the results and implications will be published elsewhere.

A 2m x 1m trench was excavated into the eastern half of N23/I on Figure 3.1 (see Figure 3.16). From the point of view of pertinent new information, the interesting part of the stratigraphy occurs early in the sequence (Figure 3.17). At the base, we encountered sterile calcareous sand containing shells, coral pieces, rounded stones and patches of cemented sand. This must sit above the coral platform, although this was not reached. A shovel sample penetrated this sand to c. 400-500 mm. Twelve buckets of this material was sieved, but no cultural material was present.

Sitting above this sand was a dark brown sand layer containing a layer of small angular, but water-rolled stones similar to those currently visible on the existing beach. This layer was only 50-100 mm thick, with the brown colour reflecting staining from above. This has the appearance of a sea-washed layer. Although mostly sterile, this layer produced a small shell
bead and one or two tiny potsherds less than 0.5cm square. While there is no absolute way to
tell whether these are in situ or not, my own suspicion is that they may have descended
through the overlying layer.

Above the brown sand layer we encountered a solid horizontal layer 200-230 mm thick.
Today it comprises a dark chocolate coloured fine soil with few inclusions, but originally it
was laid down by the sea as a marine mud that almost certainly carried mangroves.

![Figure 3.16. Map showing location of 2016 excavation in N23/I (in red) in relation to nearby squares excavated in the 1970s (in green). For wider site location see these latter squares on Figure 3.1. (House has had an addition compared with Figure 3.1.) The blue line approximates the edge of the dry land/beach at time of initial settlement, dry to the west, sea to the east. See text for further explanation.

Inspection of crab holes at the back of the existing mangroves, some 30 m to the north of this
excavation shows the same dried mud substrate.

The lower part of this layer in particular reflects its marine origin by the presence of tens or
hundreds of small rounded pieces of pumice, floated in from some unknown volcano.
Pumice samples for this layer were retained. Artefactual shell, stone and pottery sherds were
common in the uppermost spits of this unit, and are unambiguous evidence of human
presence and dumping at this point in the sequence. It is probable that this higher cultural
material is the source of diminishing quantities of cultural items in the lower spits of this mud
unit and into the top of the brown sand/pebble beach unit, noted above.

This unit has significant geomorphological and cultural implications. The south edge of
square N23/I is on the same east-west alignment as the northern edge of M23/IV, with only 6
m separating the two pits. There was no indication of the mud layer in M23/IV, nor in Pam
Swadling’s description of the stratigraphy in N21/II, 6 m due north of the present excavation
(Figure 3.16). However Swadling did come down onto the sterile coral sand, as did Ambrose
in 1970 in squares P20/I, P20/III and O20/II, 12-15m north and slightly east of the present excavation.
Figure 3.17. Stratigraphic drawing of the south face of N23/1 (drawn by Teppsy Beni and JA), 16.6.2016). Key: 1 = Grey/black organics and disturbed shell midden from higher on slope; 2 = yellow-brown sandy shell midden; 3 = grey shell midden; 4 = brown sandy deposit; 5 = red grit; 6 = dried chocolate soil (mud); 7 = dark brown sand; 8 = water-rolled pebbles and sediment; 9 = sterile coral beach sand.
These data suggest a boundary between the present N23/I pit and M23/IV and N21/II, with these latter squares reflecting slightly higher dry land and the mud stratum in N23/I a lower mud/mangrove area on the other. This adds to the accumulated evidence noted earlier in this chapter that the original settlers encountered a small strip beach and not the existing sand spit on arrival. Importantly these new data suggest the beach ended and mangroves began at the approximate location of the later large midden.

Immediately overlying the chocolate mud layer is a familiar red grit layer reflecting a local hillslope avalanche event, described in Chapter 4 for the K and J series squares and also recorded in M23/IV. The red grit deposit in N23/I is likely to be either Red Grit B or Red Grit C, described for M23/IV. As such, the artefactual material beneath this red grit and within the mud layer is an early phase of occupation.

Above the red grit the stratigraphy of N23/I becomes increasingly familiar, showing a similar general sequence to that recorded further west and described in more detail the next chapter. Some 260-300 mm of deposit comprises largely undifferentiated grey-brown sands, considered to be habitation layers. Above these, midden layers comprise c. 650 mm of heavy *in situ* shell midden, containing many sherds and stone tools, plus limited amounts of bone. The uppermost unit comprise dark grey/black midden containing much vegetal material (sticks, leaves, seedpods and roots) and artefactual materials that are considered to have moved down the slope and not to be *in situ*.

Although tens of thousands of artefacts were likely processed from this small excavation, overall the numbers and varieties of artefact finds were limited, compared with other areas of the site. These diminished artefact numbers emphasised a sense of boundary to the main area of site activity. The mud/mangrove layer offered new evidence of a physical boundary between this area and the nearby pits that showed only dry land occupation. Even allowing that subsequent artefactual deposition at N23/I was on dry land, less deposition was recorded there than further west on the site. Even less human activity seems likely to have occurred further east on the present sand spit, if surface indications are reliable, perhaps indicating that even when the site was abandoned the mangrove fringe on the eastern side of the site was distinctly nearer the main midden than it is today.

Figure 3.16 shows a blue line representing a hypothetical boundary between dry beach deposits further west and mangrove/mud/salt water to the east at the time of initial occupation around 1200 AD. The boundary separates M23/IV and N21/II as dry locations, from N23/I (mud/mangrove) and Ambrose’s 1970 excavations in squares P20 and O20 (tidal sand over coral bedrock) as outlined above and in more detail in Chapter 15.

Such an idea perhaps make sense of a long observed puzzle about the site (see above). Given the current sand spit formation, the large midden containing M23/IV and N21/II appears to be in the middle of the hillslope that forms the south-west edge of the site. Given this new evidence, the large midden might now be considered to mark the approximate eastern boundary of the village site proper. Even at the termination of occupation around 1700 AD the sand spit may not have extended much further east beyond this point before the line of mangroves was encountered. This hypothesis makes more sense of the midden’s shape and formation. It is testable by digging further test pits east of N23/I.

The associated stratigraphic evidence from N23/I of a sea-washed beach preceding the mangrove layer also accords with evidence presented in Chapter 4 for a high sea stand present at the base of K22/III (Figure 4.13) between c. 2500 BP and c. 3000 BP. Without
more precise dating and more precise measurement of the relative heights of the two data points this cannot be demonstrated absolutely, but is a supposition worth noting.
CHAPTER 4 STRATIGRAPHY AND CHRONOLOGY

Wherever anything lives, there is, open somewhere, a register in which time is being inscribed (Bergson 1907:20).

Introduction

In Chapters 2 and 3 I presented evidence to show that the Motupore sand spit has developed only since humans occupied it in a permanent way. In this chapter I begin by reiterating some of these points as a basis for describing the general stratigraphy of the site. Salient and specific aspects of the stratigraphy are then presented in more detail and the suite of available radiocarbon dates is discussed. An overview of the stratigraphy is elaborated which forms the basis for developing the analytical units employed in the subsequent chapters.

Geomorphology of Motupore

The sand and gravel accumulation which gives Motupore its name (motu, island; pore, sand spit) has been built as a series of low beach ridges and swales which indicate former shoreline positions. The oldest ridges run parallel with the hillside along a north-west/south-east axis, while the youngest ones are approximately at right angles to that direction. Along the hillside the oldest beach ridges are covered by a series of short steep fans of stratified hill slope detritus intermixed with the debris of human occupation. At the inner edge, in the areas sampled, this deposit is at least 2 m thick. Here the surface and bedding slopes are >15° and therefore steep. Only at the thin outer edge, where slopes are <5° is there an inter-fingering of marine and hill-derived sediments.

Roger McLean, who carried out a geomorphological survey of the island in 1973, reported that the nature of the sediments and their stratification indicate temporally discrete influxes of sediment delivered from the hill slope above as debris avalanches, rock falls and soil falls. Periods of hill slope activity, presumably triggered by heavy rain or human interference with the vegetation cover (or probably both) were separated by periods of slope inactivity during which midden layers, representing predominantly human activity, accumulated. Apart from the human contribution, the deposit contains three types of mass-movement products: 1) an open framework of coarse angular pebbles presumably derived from the hillside free fall faces; 2) red gritty layers of smaller angular fragments from the same location or from the hill crest higher up; and 3) a dark brown finer buried soil that either represents topsoil stripped from the hill crest or weathering and in situ soil development. Figure 4.1 offers a representation of this model.

Sediment grain size analysis

A bulk column sample was collected from the south baulk of square K21/IV in the corner where this baulk overlapped the west baulk. A particle size analysis of this material was carried out by passing each of ten designated stratigraphic units through a set of 18 nested sieves. Artefacts and bone and shell debris were removed, and the remainders in each sample were weighed. Figure 4.2 gives the results using the phi scale (Krumbein 1934). In this figure the basal black material is sterile and probably derives from the hillside face. While all the rest of the layers contain artefacts, four further layers (the surface material and the three red grit layers) comprise hill slope erosion, possibly exacerbated, as stated, by human interference (burning, tree and plant reduction) and the wet season rains. The four remaining layers are considered predominantly beach sand derived through wind and/or human activity. As stated, the buried soil may either be hillcrest erosion or more likely in situ soil development.

An inspection of the particle size data by Dr. P.F. Ballance (sedimentologist, Department of Geology, University of Auckland) found them to be consistent with this interpretation.
Red grit layers

As will be seen in the ensuing pages, the buried soil horizon and the three red grit layers provide important stratigraphic markers for linking parts of the site. As Figure 4.3 demonstrates, all of the red grit layers are quite similar in terms of particle size. They are discrete episodes of hill wash which occur in the earlier part of the human occupation, although, as will be seen, it is difficult to date these events much more closely than this.

As previously discussed, it is accepted that houses were not built very far up the hill because of the lack of artefactual debris above the first few metres of slope and also because the shallow soils and rock substratum would have made sinking house posts a laborious task. Similarly, gardening on the hillside is unlikely to have occurred, given the slope, poor soil and lack of water. As stated, incidental activities that denuded the hill slope of its timber resources, coupled with wet season erosion seems the more likely explanation for the periodic red grit deposition phases.

Square M23/IV

An overview of the excavation of this deep midden square was presented in Chapter 3. Since this square produced the majority of the finds that were subsequently used in the artefact analyses, here the depositional sequence is discussed in more detail.
Figure 4.3. Cumulative graph showing particle size analysis of selected units. Vertical axis shows percentages; horizontal axis shows sieve sizes in mm. SDB = sterile basal deposit; AS = artefactual sand between red grit A and red grit B; RG = the three red grit layers, A, B and C.

Upper layers of M23/IV midden dumping

During the 1970 season the top metre of deposit was removed. Although small discrete lenses of midden could sometimes be determined, for the most part distinguishable strata variously up to 300 mm thick were recognised; excavation units either followed these strata or were partitioned arbitrarily when they appeared to be getting too deep. Strata sloped gently downwards away from the hill, that is, from south to north, and could normally be traced right across the 2 m square (Figure 4.4).

This stratigraphic continuity argued for the undisturbed nature of these deposits, a view which was confirmed by various aspects of the archaeology. Sherds were predominantly large and clearly larger than those coming from the excavation on the sand spit (Figure 3.2). Animal bones were often complete enough for easy identification. In Layers 3 and 4 complete valves of *tridacna*, were sometimes uncovered in an ‘upside-down’ position, where they housed discrete mounds of rubbish that looked like sweepings transported to the midden in the shell (Figure 4.5). In Layer 8, eight sherds that joined together were lying side-by-side, suggesting that they broke apart when an already broken pot was dumped, and remained subsequently undisturbed.

Conclusions about the nature of the upper deposition

Before commencing his own excavations at Motupore in 1979, Les Groube asked whether this large midden might either be rubbish dumped from further up the hill, or, alternatively, rubbish collected from other dumping areas and relocated at this spot to facilitate human access to the hill. The evidence already discussed disallows these interpretations.

In addition, specific disturbance of the midden by dogs and/or pigs is not indicated. That the inhabitants had few of either of these animals is suggested by the faunal remains discussed in Chapter 14. It is also attested to by the excellent preservation of bones in the site. Even though more of Motupore was excavated than Taurama, disproportionately more bone (c. 64 kg vs.0.5 kg) was recovered. Disturbance contributed by free-ranging dogs and pigs is acknowledged for Taurama (Bulmer 1978:297, 324) and this bone discrepancy between these sites can be attributed, at least in part, to the presence of few free-ranging scavengers on Motupore.
This also holds true for the lower deposits of M23/IV as well as to other parts of the site. Generally the upper deposits in M23/IV have suffered minimal disturbance and are accepted as being in situ.

When the 1970 excavation had ceased at the bottom of Layer 8, it was recognised that the nature of the midden had changed between Layers 7 and 8, where the darker matrices and heavy shell compositions of the higher layers gave way to sandier deposits with less shell. When excavation recommenced in this square in 1971 the upper walls were re-enforced with timber to prevent collapse (Figure 3.3, see also Figure 4.4).

The excavation then continued through sandier midden layers, often containing noticeably less shell than the upper layers but occasionally with lenses of densely packed shell. Again these midden layers contained huge numbers of artefacts and sloped gently downwards from the hillside, from south to north.

Lower layers of midden dumping

The major characteristic of these layers was the very loose nature of the deposits which suggested rapid build-up and little trampling. Excavation layers continued to follow the stratigraphy or were halted arbitrarily when no layering could be discerned during excavation. Layering across the square was continuous (Figure 4.4). These deposits continued down until the bottom of Layer 14 when a clear depositional and artefactual change occurred. At this point the upper and lower midden units combined were 2.1 m deep. Artefact numbers diminished through Layers 15-16, decreasing sharply below this.

Figure 4.5. M23/IV/4; overturned tridacna shell, revealing discrete pile of rubbish possibly carried to the dump in this shell. Note small, fragile bone.
Habitation layers

The remaining nine cultural layers in M23/IV comprised an additional 1.6 m depth of deposit sitting above sterile black hill-fall material, giving M23/IV a total depth of 3.7 m (Figure 3.3). Although here labelled 'habitation layers' these deposits reflect different activities over time and contain the stratigraphically important red grit layers discussed above.

Layer 15 burial and Layer 16

Whereas Layer 14 had continued the pattern of rich midden layers seen from the beginning of the excavation, in the north-west corner it came down onto a layer of apparently sterile beach grit and shell (Figure 4.4). While this was later to become a familiar and reliable indication of grave fill, at this time it was the first indication of something other than rubbish dumping in over 2 m of deposit.

The grave was dug from the level of much sandier and much less shelly deposits, taken out as Layer 15. Below this, Layer 16 consisted of similar sandy deposits which contained two post holes. The first of these, dug from the Layer 15 - Layer 16 interface, revealed in its stratigraphy the uppermost of the red grit layers and Layer 16 was taken down to this surface. The second post hole, against the south wall of the square, was also dug into this red grit layer, but from immediately above it.

With the exception of some finger bones, the M23/IV/15 burial remained undisturbed in the west wall of the square, with the right femur visible. Enough of the skeleton was exposed in the section to determine that the body had been fully extended, on its back with the head towards the south-west. The orientation of this burial became subsequently important, as will be discussed in Chapter 15.

It was also apparent in the field that despite Layers 15 and 16 being substantial ones, they had not produced the prolific amounts of cultural finds, and especially potsherds, seen in the midden layers. This change was noted in Chapter 3 (see Figure 3.4); here it is sufficient to reiterate that the artefact densities were significantly less in these layers than in the layers above, but at the same time, significantly greater than in the levels below. Thus they represent an intermediate phase when this location had structures and burials but when dumping of rubbish in the area was also increasing. As will be seen in the stratigraphy of N21/II (Chapter 12) this intermingling of episodes of post hole digging and burials is separated in that square by a distinct midden layer.

Layer 17 to Layer 23

The three red grit layers found in various squares in this part of the site were labelled 'A', 'B' and 'C', from youngest to oldest. M23/IV Layer 17 comprised the red grit A layer and here it was a relatively thin unit. Layers 19 and 20 contained the red grit B layer, at this point mainly between 200 mm and 300 mm thick. Layer 22 comprised the red grit C layer.

Layers 18 and 21 represent interludes where the deposits are sandy layers considered to derive predominantly from human activities. Most of the finds in Layer 22 came from a channel or gutter, some 400 mm wide and 350 mm deep, cut into the red grit C material and running diagonally north-west to south-east; similarly most of the finds from Layer 23 derived from the sandy fill of a large post hole cut into the underlying sterile black grit. While the nature and disposition of the deposits did not clearly allow that these two features - the gutter and the post hole – were contemporaneous with either each other or the Layer 21 sandy midden, this is very likely the case.

While Layers 17-23 together constituted c. 1.6 m of deposit, the artefactual yield from them was very low compared with the younger deposits above. Artefacts were clearly contained in the red grit A layer as well as the intervening sand layers, but both the red
grit B and red grit C layers in M23/IV were either largely or wholly devoid of cultural material. (Subsequently these latter two layers were shown to contain artefacts elsewhere on the site.)

Layers 17-23 combined produced only 3,687 sherds which can be compared with the richest of the midden layers, Layer 8, which produced 12,908 sherds in approximately 25% of the volume of deposit in these lower layers.

**Summary M23/IV**

By the time sterile deposits were reached in M23/IV at 3.7 m below the surface, we had defined two distinct phases of human activity at this location: habitation deposits followed by midden dumping. Each of these units could be further subdivided, the lower into a series of sub-units marked by successive red grit hill-wash layers followed by a deposit of intermediate artefact richness containing a burial. The upper midden deposits divided somewhat less certainly into two broad sub-units differentiated on soil colour that probably indicated greater organic content in the uppermost layers.

While the red grit layers reflect hill slope erosion/collapse, the absence of rocks and pebbles seen in the particle size analysis raised the possibility that the inhabitants took advantage of these small avalanches by levelling these deposits and removing the larger rocks and pebbles to provide a usable living surface. The unexplained gutter indicates some sort of site maintenance, supported by the further evidence of a rock-filled pit in the red grit C unit from the J squares, reported below. It is reasonable to assume that before the outward growth of the sand spit, communal dry land would have been limited and these avalanche episodes provided material to organise such space in a more useful way.

As discussed in Chapter 3 and further elucidated below, the radiocarbon dates available by 1972 suggested that the physical division of the M23/IV deposits into habitation and dumping phases was also marked by a time break of perhaps several hundred years in this square. In part, investigating this apparent hiatus in occupation led to much of the 1973 season being spent opening the J and K squares (Figure 3.1).

**The J and K series of squares**

The 59 square metres opened up in the excavation of the J and K squares represented the major excavation undertaken by me on Motupore. What commenced as a trench to show the stratigraphic relationship between the midden against the hill and the sand spit deposits ended up as a hatchet-shaped excavation where the 'handle' represents the original trench and the 'blade' the extensions made from this trench to explore further the structural evidence that was uncovered (Figures 3.9, 4.7). The height relationship of these squares to M23/IV is shown in Figure 4.6.

The squares in this area were not sequentially dug. Rather, excavations in particular squares were variously halted to obtain wider exposures of particular levels than were offered by a 2 m by 2 m square; in other cases several squares might be dug simultaneously, a strategy dictated by the particular site problem being pursued.

The strategy of the excavation is apparent in the sequence in which these squares were opened. Referring to Figure 4.7 this sequence was K22/III, K21/IV, K21/III, K20/IV, K20/III, which together provided the central north-south trench running from sand spit to hill slope with the exception of the two baulks, left for stratigraphic control; then K22/I, K20/IVSB, K21/IVWB, J21/II, J21/IV, K21/IVSB, K21/IISB, K21/II and finally a block of squares collectively labelled the J22/EXTENSION were cleared as far as the red grit 'B' surface. This block included J22/I, J22/III, J21/II SB, J21/IV SB, K22/IIWB, and the overlapping corner baulk of K21 - in all, 15 square metres.
Figure 4.6. A diagram indicating the approximate height relationship between M23/IV and the K squares. Since the transect was drawn through the K squares and M23/IV is further east, this surface representation is not precise.

Somewhat paradoxically, the stratigraphy of this series of squares was complicated at the specific level but straightforward at the general level. The prehistoric digging of several hundred post holes in this area, together with some 13 burials in the northern part of the long trench (Figure 4.8) (together with one major and some minor twentieth century post-depositional disturbances) have guaranteed the significant churning of parts of the deposit. At the same time, the red grit layers seen in M23/IV could be identified over much of this excavation and thus provided convenient stratigraphic markers. As well, a distinctive buried soil horizon covered most of the deposits in this region and indicated where post-occupational disturbance had occurred.

Figure 4.7. Plan of J and K squares discussed in this chapter.
Figure 4.8. J and K squares showing the relationship of post holes dug into the red grit A and approximately contemporaneous burials. See text for discussion.

In parts of this excavation area the buried soil had been covered with midden, demonstrating its stratigraphic position in the sequence. Elsewhere midden formed without the buried soil forming first, indicating that the midden formation was not separated by a long time period from the habitation deposits, as the M23/IV had suggested.

Stratigraphy of the J and K squares

During the course of the excavation, all exposed internal baulk and square sections were drawn before they were excavated and the 42 metres of the perimeter were also recorded before the area was backfilled. From the combined use of these sections and associated plans of structures and burials, together with the written descriptions of each excavation unit, it is possible to reconstruct the major phases of site formation in this area of the site.

In order to simplify this procedure reference will be made only to the four illustrated sections:

- the south section of K22/I, K22/III and K22/III WB; for convenience this will be called the 'south section' in this discussion (Figure 4.9)
- the east section of K21/II, K21/II SB and K22/I, referred to here as the 'east section' (Figure 4.10)
- the east section of K20/III, K20/IV, K20/IV SB and K21/III, which is here designated the 'north-east section' (Figure 4.11)
• the west section of K20/III, K20/IV, K20/IV SB and K21/III, which is simplified here to 'west section' (Figure 4.12).

Figure 4.9. South section of K22/I, K22/III and K22/III WB. This section is 5m long. Red grit layers are infilled for easy recognition. ph = post hole. The key to numbered strata is contained in Table 4.1.

Figure 4.10. East section of K21/II, K21/II SB and K22/I. This section is 5m long. Red grit layers are infilled for easy recognition. ph = post hole. The key to numbered strata is contained in Table 4.1.
Figure 4.11. East section of K20/III, K20/IV, K20/IV SB and K21/III. This section is referred to in text as the north-east section. This section is 7m long. Red grit layers are infilled with light grey and graves with darker grey. ph = post hole. The key to numbered strata is contained in Table 4.1.

Figure 4.12. West section of K20/III, K20/IV, K20/IV SB and K21/III. This section is 7m long. Red grit layers are infilled with light grey, the graves with mid-grey and the early hearth (see Figure 4.14) with dark grey. ph = post hole. The key to numbered strata is contained in Table 4.1.
**Table 4.1.** Key to Figures 4.9, 4.10, 4.11, 4.12.

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gritty red-black topsoil</td>
<td>17</td>
<td>Grey shell midden</td>
</tr>
<tr>
<td>2</td>
<td>Buried black topsoil</td>
<td>18</td>
<td>Ash and red grit</td>
</tr>
<tr>
<td>3</td>
<td>Black topsoil with heavy midden</td>
<td>19</td>
<td>Grey ashy midden</td>
</tr>
<tr>
<td>4</td>
<td>Red grit A</td>
<td>20</td>
<td>Concentrated pottery and shell</td>
</tr>
<tr>
<td>5</td>
<td>Red grit B</td>
<td>21</td>
<td>Concentrated grey shell midden</td>
</tr>
<tr>
<td>6</td>
<td>Gritty brown soil</td>
<td>22</td>
<td>White sand</td>
</tr>
<tr>
<td>7</td>
<td>Grey-brown sand</td>
<td>23</td>
<td>Undifferentiated pebbly grey sand</td>
</tr>
<tr>
<td>8</td>
<td>Grey sand</td>
<td>24</td>
<td>Consolidated reddish-brown sand</td>
</tr>
<tr>
<td>9</td>
<td>Grey midden with charcoal</td>
<td>25</td>
<td>Grey topsoil</td>
</tr>
<tr>
<td>10</td>
<td>Red grit C</td>
<td>26</td>
<td>Red grit</td>
</tr>
<tr>
<td>11</td>
<td>White ash</td>
<td>28</td>
<td>Grey-yellow sandy midden</td>
</tr>
<tr>
<td>12</td>
<td>Brown-black grit</td>
<td>29</td>
<td>Gritty brown with charcoal</td>
</tr>
<tr>
<td>13</td>
<td>Heavy grey shell midden</td>
<td>30</td>
<td>Consolidated yellow-brown midden</td>
</tr>
<tr>
<td>14</td>
<td>Grey sandy midden</td>
<td>31</td>
<td>Disturbed red grit</td>
</tr>
<tr>
<td>15</td>
<td>Purple grit</td>
<td>32</td>
<td>Consolidated red-brown sand</td>
</tr>
<tr>
<td>16</td>
<td>Grey sandy ash</td>
<td></td>
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</tr>
</tbody>
</table>

Figure 4.6 indicates the general location of the J and K series of squares in relationship to the hill slope and sand spit. As can be seen these are located at the base of the hill and encompass the transition between the two zones. It is appropriate to trace the formation of the deposits from the basement upwards.

**Black and brown-black grit: grey sand**

As discussed in Chapter 2 the absolute basement uncovered in the area of this excavation was a beachrock formation located in the SW corner of K22/III (Figure 4.13). Radiocarbon dates suggest that this beachrock formed between c. 2500 BP and c. 3000 BP and that subsequently a beach sand deposit accumulated above it. In this square loose beach sand is only 100 mm thick but thickens considerably towards the north (Figure 4.13). Twelve metres to the north of this excavation, in K20/III, some 500 mm of clean, yellow, and culturally sterile beach sand was dug out, without encountering a rock basement. As discussed in Chapter 3, in P20/I and P20/II a coral platform was noted some 400 mm below the earliest deposits in that area; it is thus assumed that at the point when people began to occupy Motupore on a regular basis, there was a fringing beach at least 25 m wide in the area of this excavation.

The clearest evidence of early human use of the island is a small hearth dug into the sterile yellow sand seen in the west section of K21/III (Figures 4.12, 4.14). This hearth is overlain by grey beach sand which contains a few artefacts and which extends from K20/III in the north into squares K21/II, K21/IV and barely in J21/II (Figure 4.15). It remains uncertain whether this grey sand layer is merely discoloured from the deposits above, whether the artefacts in it derive from above as well, or whether it is *in situ* deposit (or perhaps both). Two pieces of evidence support the idea that it is *in situ* deposit, at least at the southern end of this excavation. Firstly, in K21/IV, a patch of charcoal in the grey deposit was interpreted to be another undisturbed hearth. Secondly, as Figure 4.15 indicates, grey sand deposits in this area are overlain by the stratigraphically more recent
black-brown rock and grit layer; the downward movement of large sherds through or from this grit layer seems less likely than in straight sand deposits.

**Figure 4.13.** Roger McLean’s excavation into beachrock in K22/III. Note the earliest sand formation immediately above. See text for discussion.

**Figure 4.14.** West section of K21/III showing early hearth dug into clean beach sand and overlain by grey sand. The buried soil can be seen towards the top of the section, adjacent to the upper black/white junction on the ranging pole.
The brown-black grit represents the earliest cultural deposit in the southern-most squares of this excavation. Whereas in M23/IV this dark grit layer had been totally sterile, in the K squares it contained low levels of cultural material; also, nowhere in the K squares was it as thick as it had been in M23/IV, where a post hole dug from the layer above revealed a depth of > 670 mm for this material. The best interpretation is that brown-black grit represents a hill slope rock fall event at about the time of initial occupation.

Overall, the black-brown grit and grey sand layers are taken to represent approximately contemporaneous and early occupation of this area, albeit at low rates of cultural deposition. The grit layers are seen to be the result of human interference with the hill side. It seems possible, given the depth of this material in M23/IV, and its continuation at right-angles to the hill slope in these K squares (the two instances being c. 20 m apart) that it was a single and substantial avalanche event above the then existing beach.

Red grit C

Like the black-brown grit layer, the red grit C layer in M23/IV is very thick (in places >300 mm) and largely sterile, although it encased both structural features and sandy deposits containing artefacts, as previously described. In the J and K series of squares it is barely represented, occurring as a relatively thin layer c.100 mm thick, on the eastern side of K22/I, K21/III and K21/IV only (Figure 4.16).

In these squares red grit C is seen clearly to underlie a pocket of sandy midden not seen further west, being absent in K22/III and K21/IV. This sandy midden is seen to equate with the sandy midden enclosed in red grit C in M23/IV.

Red grit B

As Figure 4.16 indicates, red grit B is much more widely distributed than red grit C, extending northwards into K21/III and covering all the squares to the south except in the south-west corner of the J22/Extension where it abuts against a thick layer of different brown grit.

At the western end of this excavation a large but shallow pit had been dug into the red grit B layer, mainly in J21/IV and J21/IVSB but also intruding into all the surrounding squares on the east, south and west. This pit, covering an area of more than 4 square metres, contained many sherds and stones. The stones were country rock (calcareous mudstones and low grade cherts) and did not have the appearance cooking stones; nor were they burnt. This, together with the horizontal size of the pit, its shallowness and the absence of charcoal or other signs of burning, indicates that this was not a cooking pit. The most probable interpretation of this large feature is that it represents a borrow pit subsequently filled in with rubbish and especially larger pebbles and rocks, as part of living area clearing and maintenance. If this interpretation is accurate it is the best evidence encountered for the clearing and levelling of living surfaces in this part of the site.

Above the red grit B layer a well-defined and relatively rich sandy midden layer was encountered everywhere except along the western end of the J22/Extension. In the K series trench to the north this deposit can be traced in the west section intermittently into K20/III (Figure 4.12) but in the north-eastern section (Figure 4.11) it cannot be seen north of another large pit disturbance, which is discussed further below.

Red grit A

The red grit A layer and the overlying sandy midden deposits represent an important chronological marker in the sequence and an important point in the formation processes and human use of this part of the site. Three main points can be briefly made:
Figure 4.15. Distribution of grey sand and brown-black grit layers in the J and K squares. The area south of J21/II-J21/IV was not excavated to this depth.

- Red grit A represents the last major hill slope deposit in this part of the site (but see comments below on the ambiguous nature of the buried soil layer). The red grit A layer provided a basis for much more intensive activity in this part of the site than seen in the earlier deposits. Approximately 250 post holes were dug into the part of this surface exposed in the excavation, either from this surface itself or from within the sandy midden deposits immediately above (Figures 3.11, 4.8). These post holes are discussed further in Chapter 15; here it can be noted that few of these holes cut into other holes, implying a relatively short period for this activity, a view substantiated by three radiocarbon dates taken from post hole fill, which are essentially identical (see below). As discussed above, two post holes were cut into this surface in M23/IV, so it can be assumed that more such holes occur in the intervening unexcavated space. This latter square is c. 20 m from the K square exposures.

- The increased activity represented by post holes is also reflected in the increased amount of artefact discard contained in the sandy midden overlying the red grit A layer. This will be seen, for example, in the pottery distributions discussed in the next chapter.

- The distribution of the red grit A layer is across the entire southern block of this series of squares and out towards the beach reaching the southern side of K20/IV (Figure 4.8). Where the red grit A ceases, so does the profusion of post holes. This is not a matter of seeing these holes more easily in the grit material; indeed a further four were recorded at this approximate level in squares K20/III and
K20/IV. Rather, the northern part of this trench, moving out onto the sand spit proper, was an area of predominantly different activity at this period of the site's history, an area for human burials.

Figure 4.16. Distribution of red grit C and red grit B layers in the J and K squares. The large pit in J21/II-J21/IV-J22/III is discussed in text.

Burials

Figure 4.8 illustrates quite clearly the distinction between the horizontal distributions of red grit A (and the associated post holes) and the series of burials found between K20/III and K21/III. These burials are not all totally contemporaneous, with graves cutting through each other, but they are restricted to the same depositional period as the sandy midden immediately above the red grit A.

Two pieces of stratigraphic evidence lead to this conclusion. In squares K20/IVSB and K21/III these burials cut into but clearly post-date the red grit A material which extends into these squares. At the same time, as both the north-east and west sections (Figures 4.11 and 4.12) demonstrate, the graves are clearly sealed by the buried soil, which in the squares further south seals the sandy midden which overlies the red grit A layer (see, for example the K21/III section in Figure 4.11).
It is also clear from the presence of post holes into the red grit A layer in K21/III that the burials slightly higher in this square post-date these particular post holes. However, some of the post holes dug from higher in the sandy midden layer and further south may well be contemporaneous with these burials; equally the burials in K20/III and K20/IV may be slightly earlier than these K21/III burials. While no absolute demonstration is available, it seems unlikely that all the burials postdate all the post holes dug from the sandy midden above the red grit A layer, a conclusion arrived at independently in assessing the radiometric dates (below). Thus, some structural relationship between the location of the graves and the post holes is suggested.

*Early midden layers*

As all the stratigraphic sections in this report indicate, the period of intensive activity in the vicinity of the J and K series of excavated squares represented by red grit A post hole digging, burials and associated activities was followed by different and for the most part less intensive human use of most of this part of the site. As Figure 4.17 illustrates, most of this area was at this stage capped by the buried soil, discussed next (it can also be seen in Figure 4.14). This soil does not occur in the extreme south-east corner of this excavation, where a series of midden deposits accumulate immediately prior to and contemporaneously with the buried soil.

![Image](image_url)

**Figure 4.17.** The buried soil exposed in K21/IV WB and being excavated in J21/II further west.

The earliest midden development here was an ashy grey shell midden layer apparent in the east section of K22/I (Figure 4.10); on the south side of K22/I this same layer was less shelly and ashier and did not extend into K22/III (Figure 4.9). This layer certainly pre-dated the buried soil development and is contemporaneous with the post-red grit A sandy midden, merging with it on the north-western side of K22/I. Immediately above it, a discrete and featureless layer of fine white ash, at its deepest some 150-200 mm thick, covered the entire K22/I square (Figure 4.18) and can be seen clearly in the south and east sections (Figures 4.9 and 4.10). As will be argued in a later chapter, this is interpreted as a pottery firing locality. While this feature developed it abutted upon a distinctive layer of very loose shell midden intruding from the south-west.
Figure 4.18. K22/1 partially excavated showing thick layer of white ash, abutting and overlain by shell midden. The ash is interpreted as a pot-firing locality.

Figure 4.19. K22/1-K22/III south face, showing loose midden layer sloping right to left (west to east) and underlying later midden spreading east to west.
As can be seen from the south section (Figures 4.9 and 4.19) this loose shell layer slopes sharply downwards from the west to the east (right to left) in the section rather than from the direction of the large hill of midden to the east and south (into which M23/IV was excavated). The white ash feature appears to be on the eastern edge of this loose midden layer and was subsequently covered with midden seen to be part of the large midden into which M23/IV was excavated. Stratigraphically, this loose midden layer is an additional layer of midden between the sand overlying red grit A and the earliest midden seen in M23/IV and was thought during excavation to fill the chronological gap then identified in M23/IV (although this argument was subsequently revised – see below).

**Buried soil and later deposits**

Figure 4.20 indicates the distribution of the buried soil. It does not occur in most of K22/I and K22/III where additional and more recent midden layers accumulated as just described, the latter clearly associated with the large midden into which M23/IV was excavated. As can be seen in the east section (Figure 4.10) one of these midden layers sits immediately on top of the buried soil.
Further to the west the buried soil is visible throughout all sections. In the northernmost square, K20/III, this layer represents the layer of deposit immediately beneath the gritty surface layer.

As previously discussed it is not known whether the matrix of the buried soil derives from topsoil stripped from the hill crest to the south, or whether it represents *in situ* weathering. Archaeologically this layer contains consistent amounts of cultural material, although more in those southern squares where it occurs (K21/II, K21/IV, J21/II, and J21/IV). The soil does not appear in the sequence in K22/I and K22/III but this may only be because the earlier midden was already a mounded deposit. Thus any hill slope wash would have flowed around it, but equally, any *in situ* soil development here may have been forestalled by the continued dumping of rubbish in this area.

![Diagram](image)

**Figure 4.21.** Distribution of the gritty topsoil layer in the J and K squares, showing relationship to the midden layer in K22/I and K22/III.

The north-east stratigraphic section (Figure 4.11) indicates a major disturbance to the deposits in K20/IVSB and K21/III which obviously extends into the unexcavated K20/IISB and K21/I squares at least. This is a very large pit which at the edge of the excavated trench is c. 2 m wide. The pit was ‘created’ from the top of the buried soil and is sealed by the red-black gravelly top soil. It had cut through two graves (Figure 4.22). As Figures 4.22 and 4.23 indicate, this gravelly top soil also trapped a thin layer of white beach sand over a wide area. The same sand is visible in the K20/IVSB section seen from the south side in Figure 3.11. This clean sand must derive from the base of this pit, which penetrated > 400 mm into the sterile beach sand.
Figure 4.22. Large pit disturbance in K20/IV SB-K21/K21/III. See text for discussion.

Figure 4.23. Large pit disturbance in K20/IV SB-K21/K21/III (vertical arrow). Basal white sand trapped in the section above the buried soil is indicated in two sections by horizontal arrows. See also Figure 3.11. See text for discussion.

Immediate explanations for this feature were not forthcoming. The pit contains only the backfilled material originally taken from it (including some human bones from the disturbed graves), at least in the part exposed by excavation. It appears to have been backfilled soon after it was dug, to judge by the vertical southern edge and the undercut nature of the northern one, which would have likely fallen in if left exposed. However the fill itself differentiates stratigraphically into a lower section of horizontally laid materials and an upper unit of sloping deposits which look like in-wash, so that at least some time differentiation is implied. The white sand lying on top of the buried soil is also puzzling. Since clean sand is seen nowhere else in this series of squares in this stratigraphic position it also certainly relates to this pit. Clean sand would have been the last unit to come out of this pit, so it is difficult to understand how it might remain after
the pit was backfilled, and to be the only pit material left trapped between the red-black grit and the buried soil.

The best explanation concerns a story told by Bill Tomasetti, formerly of the University of Papua New Guinea, who was stationed in an army camp on the hills above Bootless Bay during the Second World War. Tomasetti described how Allied planes taking off from Jackson's airstrip would fly down the June Valley and test their guns by firing at the deserted Motupore Island. Bullets and cannon shells were commonly found in the upper levels of the excavation. The suggestion that this pit is a bomb crater satisfies some of the characteristics previously described for it; whether the near-vertical walls could have been created this way seems uncertain as does its effective back-filling - if this was naturally rather than humanly done. Excavation of the pit itself might lead to a more satisfactory explanation. If it could be demonstrated to be a bomb crater it would be a positive demonstration that the uppermost red-black gravelly soil layer was laid down in the last century.

Summary of the J and K squares

Integration with the sand spit

The general stratigraphy of the J and K series of squares is relatively straightforward. However the attempt to integrate these excavated layers with those from the various squares dug on the sand spit proper by tracing the stratigraphy northward in the K squares trench failed because at the point where the distinctive red grit layers and other layers offering stratigraphic control ran out, contemporary layers could not be distinguished. This was partly due to the large pit just described, but also partly due to the profusion of graves encountered in this trench which cut and re-cut the various layers.

Integration with M23/IV

The attempt to relate the stratigraphy described for the J and K series with that from M23/IV was, in contrast, quite successful. The correlations between excavation units in both areas depend upon the assumption that the three red grit layers in the J and K series of squares are the same three red grit layers encountered in M23/IV. This assumption is considered reasonable because the sequence, moving back through time in both areas, is 1) midden dumping, 2) sandy habitation deposits containing shallow, beach grit filled graves with the bodies all oriented head to the south-west, 3) post holes into the most recent red grit layer, 4) interleaved sandy habitation layers and black/brown grit layers. This similarity in sequential events is taken as sufficient justification for accepting the assumption which could only the otherwise demonstrated by physically linking the two excavations.

The M23/IV sequence break

As stated in Chapter 3, one aim in opening the J and K series of squares was to investigate whether the apparent stratigraphic and chronological break in M23/IV could be resolved to be either a site-wide phenomenon or alternatively an anomaly specific to the M23/IV square. This problem was thought to be resolved with the excavation of K22/III. A radiocarbon date, determined in Canberra while I was still in the field, was obtained for the midden layer which slopes down towards the east in the south section of K22/III (described above). In its preliminary form this date neatly filled the gap in the M23/IV dates and the stratigraphic evidence suggested that it represented midden dumping not present in the M23/IV sequence. As discussed in the next section the final calculation of this date changed considerably. As well, the stratigraphic correlations also suggested that the layer of loose midden in K22/III which had initially been thought to fill the M23/IV 'hiatus' and from which this date had come, was in fact contemporaneous with the lower midden dumping levels in M23/IV, a view subsequently supported by relevant artefact analyses.
Eventually a different explanation for the apparent 'hiatus' in M23/IV developed. As this chapter has been at pains to demonstrate, the change from 'habitation' to 'dumping' levels first seen in M23/IV is simply a shift in the uses made of this part of the site. The notion of a temporal gap accompanying this shift had derived from the early radiocarbon dates in M23/IV. As the following section on the Motupore dates demonstrates, the M23/IV/15 date for the sandy midden overlying the red grit A layer is probably too young. There is in fact little or no hiatus in the M23/IV sequence. A stylised representation of the stratigraphy represented by the squares discussed in this chapter is given in Figure 4.24.

![Figure 4.24. Schematic reconstruction of the sequence in the excavated J, K and M squares. Clearly, this is not to scale.](image)

**Summary of the geomorphic history of the Motupore site**

Somewhere after 3,000 years ago a fringing sand beach developed along the north-east edge of Motupore Island above a coral reef platform that had formed earlier in the Holocene. The impetus for this beach development may have been mid-Holocene sea level fluctuation along this coast. The beach may have extended from the north-west corner of the island south-east for c. 200 m before giving way to fringing mangroves just beyond the location of the M23/IV excavation in the large midden.

At the commencement of the full-time occupation of the island evidence indicates that this beach may have been up to 25 m wide.

The advent of humans on the island introduced two vectors for geomorphic change, interference with the hill slope above the beach and an expansion of the beach into a cuspatate sand spit. Most notably, the first resulted in a series of small hill slope avalanches probably accentuated by wet season rains. Overall, these proved beneficial to
the settlers, by providing a stable base material for concentrated occupation which was manipulated and maintained as a valuable living space.

The second was possibly the result of the construction of houses on the coral platform in shallow water, as described elsewhere for the Motu during ethnographic times, coupled with the dumping of rubbish from the edge of dry land as demonstrated archaeologically on the site. Both activities would have provided sediment traps for rapid sand build-up. As seen, this was not a one-way process, with sea erosion of land deposits occurring on more than one occasion on the island. But progressively the sand spit grew to the north, providing more dry land living space for houses and other activities such as burials. One result of this progressive change was that locations at the base of the hill, previously intensely used for living activities, saw a change in its uses, becoming a location for firing pots and perhaps other industrial activities, but increasingly a place to dump rubbish. It is clear that indiscriminant dumping of rubbish in living areas and into the sea changed in the final period of the village. The more structured dumping of rubbish along the base of the hill accelerated, and in favoured locations midden accumulated to significant depths.

The time dimension for these developments was short and underlines the rapid rate of deposition involved, as the next section on radiocarbon chronology demonstrates.

**Radiometric Chronology**

*Dates as data*

In the 1970s funds for radiocarbon dating were difficult to obtain and the processing of samples was slow. Today even smallish projects can attract funding for tens or hundreds of AMS radiocarbon dates (e.g. David 2008). In addition the development of other dating techniques such as optically stimulated luminescence, together with a range of improvements to $^{14}$C itself has led to the view that dates assayed today are always more accurate than dates measured in the 1970s (e.g. McNiven et al. 2006) despite the fact that a radiometric date is still only as good as its provenance. However, there is certainly some truth to the notion that modern dates are ‘better’, since samples today are frequently very much smaller and cleaner than the ‘bulk’ 5-10 gram samples of the 1970s and can be in both senses more precise, as is the technical ability now available to measure them. Even so, earlier dates should not merely be dismissed, since the re-dating of sites today can equally demonstrate the particular accuracy of earlier dates that were carefully chosen and properly handled (e.g. at Oposisi - see Allen et al. 2011).

The greater reliance on radiometric dates has also led to a fundamental methodological shift in excavation that is not so immediately recognised. The combination of small depth excavation units and many radiometric dates is now seen to be a sufficient surrogate for the detailed stratigraphic analysis that once provided the relative chronological basis for artefact analysis. Stratigraphic sections, when provided, are frequently merely descriptive and sometimes only a visual background on which to overlay arbitrary excavation units and radiometric dates. Questions about site formation processes and post-depositional disturbance are infrequently asked, partly because the modern propensity to sample rather than excavate sites often precludes such questions. Excavation units become by proxy the analytical units, where only major disturbances will be identified within the standard deviations of radiometric dates. Rarely will the day-to-day reworking of deposits commonly seen in Melanesian beachside villages be identified in this manner.

Being a Luddite, I believe that determining site analytical units should begin with the stratigraphy, if for no other reason than stratigraphic units, properly interpreted, may divide sites into meaningful behavioural units, as I have attempted to do here for Motupore. It goes without saying that excavation units will vary in thickness both within and between analytical units. The alternative is arbitrary excavation units of equal thickness, stitched together with radiometric dates that are seen to divide or group these
units, which are then superimposed on the stratigraphy. This is the antithesis of the approach adopted here.

This is a methodological debate wider than the aims of this report. Suffice to say here that with Motupore (and all of my major excavations since) I have viewed radiometric dates as another data set, like pottery, stone tools or animal bones, that initially is fitted into its stratigraphic context and informs (in this case) the chronological dimensions of the site. However, while radiometric dates are vital in defining the time spans of sites and phases within them, they can also be used predictively for testing various stratigraphic hypotheses (e.g. Allen 1996:108; Hewitt and Allen 2010:6) rather than being the principal referent for the stratigraphy in the first place.

**Dating Motupore**

As discussed in Chapter 1 the Motupore excavation began without any developed prehistoric chronology for the Port Moresby region. Oral traditions suggested an end point for this site 2-300 years ago, but its starting point was unknown either in terms of its relationship with other known sites, notably Nebira 2 and Nebira 4, or in relationship to its earliest cultural artefacts, then yet to be uncovered. Defining the chronological range of the prehistoric settlement at Motupore was a primary aim. Dating intermediate developments in the sequence became a later objective. It thus makes more sense to report these dates in the approximate chronological sequence of their production.

**December 1970 Gakashuin dates**

Following the first season of excavation, five charcoal samples were submitted to Gakashuin University in Tokyo for assay. Two samples derived from deep layers in the sand spit squares P20/I and O20/II, while three came from Layers 2, 5 and 8 from M23/IV (Table 4.2).

<table>
<thead>
<tr>
<th>Motupore square/spit</th>
<th>Laboratory Number</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>M23/IV/2</td>
<td>Gak-2990</td>
<td>Modern</td>
</tr>
<tr>
<td>M23/IV/5</td>
<td>Gak-2991</td>
<td>Modern</td>
</tr>
<tr>
<td>M23/IV/8</td>
<td>Gak-2992</td>
<td>Modern</td>
</tr>
<tr>
<td>P20/1/6 Pit B</td>
<td>Gak-2993</td>
<td>Insufficient carbon</td>
</tr>
<tr>
<td>O20/II/9</td>
<td>Gak-2994</td>
<td>Modern</td>
</tr>
</tbody>
</table>

**Table 4.2.** Radiocarbon results, Gakashuin University 1970. See text for discussion.

As can be seen the results were disappointing, with one result yielding insufficient carbon to provide a date and the other four being assayed as ‘modern’, meaning less than c. 200 radiocarbon years old.

In hindsight these results were suspect on several grounds. Subsequently the reliability of Gakashuin results was questioned (Spriggs 1989) and also subsequently we were able to show that pottery from the relevant layers in the sand spit squares belonged to the earlier/earliest styles of pottery recovered from Motupore. In 1970 our disquiet rested on the related facts that reliable oral traditions indicated that the site had been abandoned at least 200 years earlier; that chronologies based on such traditions rarely increase the ages of past events (the usual pattern is to decrease time lines because time is recorded in lineal generations of historically remembered individuals, where some individuals drop out of the remembered lineage); and because Gak-2992 and Gak-2994 came from locations...
beneath c. 1 m of different types of deposition prior to the abandonment of the island. If these dates were correct they implied that the whole site might be less than 200 years old, which was logically impossible.

September 1971 Teledyne Isotopes dates

Dissatisfied with the previous season’s dates, three samples collected during the 1971 season were submitted to Teledyne Isotopes in the United States (Table 4.3). Initially these dates were better, being in stratigraphic order and with I-5902 and I-5903 offering a first indication of a finite radiometric age for the early layers in the site. I-5901 was somewhat problematic for two reasons. The first was that M23/IV/15 was between 2.3 m and 2.4 m below the surface. This meant that allowing a hypothetical 200 years between abandonment and the present, according to the Motu oral history, c. 2.4 m of midden deposit had accumulated at this location in the preceding c. 200 years. Such a deposition rate was not totally impossible and was lent credence by the Gakashuin modern dates from higher in the profile. However it appeared too rapid. As will be seen, I was wrong in this initial assessment.

May 1973 onwards – The Australian National University dates

The strategy for opening up the J and K squares has been outlined above. The excavation was begun in K22/III to understand the relationship of the cultural deposits to the hill slope deposits, but also to address the question of a depositional hiatus just reviewed, since surface indications were that the large midden of which M23/IV was a part, covered at least part of this square. Figure 4.9 shows that c. 700 mm of midden overlies the white ash material on top of red grit A deposits in K22/III; however, as noted above, these upper midden levels slope down from east to west (left-to-right on the section) on top of earlier midden layers sloping downwards from west to east that might have filled the perceived hiatus.

A charcoal sample labelled K22/III/4-5 interface, taken at c. 210 mm below the surface, was sent to the ANU Radiocarbon Laboratory from the field, since understanding whether there was a hiatus in deposition was fundamental to the strategy for the on-going excavation. The logic behind dating this sample was that the sloping stratigraphy suggested that the sample came from the same midden complex as sampled in M23/IV; that the lower midden in K22/III, sloping west to east, was likely to be either contemporaneous with the lowest M23/IV midden layers or older than them; and that in

<table>
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<tr>
<th>Motupore square/spit</th>
<th>Laboratory Number</th>
<th>Radiocarbon years BP</th>
<th>Radiocarbon years cal BP</th>
<th>Calibrated range BP (68% prob.)</th>
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</thead>
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<td>M23/IV/15</td>
<td>I-5901</td>
<td>380±90</td>
<td>414±82</td>
<td>332-496</td>
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<td>M23/IV/18</td>
<td>I-5902</td>
<td>715±90</td>
<td>663±77</td>
<td>586-740</td>
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<tr>
<td>M23/IV/22</td>
<td>I-5903</td>
<td>740±105</td>
<td>695±96</td>
<td>598-791</td>
</tr>
</tbody>
</table>

Table 4.3. Radiocarbon results, Teledyne Isotopes 1971, also showing the dates calibrated using the CalPal2007_HULU calibration (Weninger and Jöris 2008). See text for discussion.
both locations they appeared to seal a similar set of habitation layers, the top of which was dated in M23/IV/15 by I-5901.

A telegram in May 1973, received in the field, indicated that the sample, now labelled ANU-1163, was 550±120 BP. While the error was wide, the central tendency fitted well with I-5902 and I-5903 and suggested that I-5901, stratigraphically below the ANU date, was too young. Thus the best conclusion at the time was that there was no hiatus, or if there was, that it was filled by the lower midden in K22/III. The excavation continued on this basis.

Subsequently, in December 1974, ANU-1163 was issued with a final age of 740±80 BP, a date that was stratigraphically impossible. Before investigating this problem further it is necessary to consider the full set of Motupore dates assayed in the ANU dating laboratory.

The ANU date list

Table 4.4 lists the 22 14C dates assayed in the ANU dating laboratory for Motupore. As discussed in Chapter 2, the two oldest dates, ANU-1647 and ANU-1648 relate to the beachrock dates assayed for Roger McLean and suggest this material formed c. 2,500 - 3,000 years ago. ANU-1219 dates the early hearth in K21/III/9, discussed above and illustrated in Figure 4.14. Calibrated, the central tendency offers a date of c. 900 BP, which chronologically and stratigraphically provides the earliest date for human presence and one that pre-dates later continuous settlement.

L23/II, adjacent to M23/IV, was opened specifically to obtain check dating materials for the three Gakashuin dates that provided ‘modern’ readings. ANU-1218, between 180 mm and 240 mm below the surface equates with M23/IV/2 and returned a date of 385±68 cal BP; ANU-1217, between 680 mm and 760 mm below the surface equates with M23/IV/5 and returned a date of 411±77cal BP; and ANU-1212, between 980 mm and 1050 mm below the surface equates with M23/IV/8 and returned a date of 421±75cal BP.

Statistically these three dates are the same age, confirming evidence already reviewed, that the upper midden accumulated very rapidly. At 1sd this 800 mm of deposit might have accumulated in as little as 30 years and at most in less than 200 years. Assuming that the final 200 mm of deposit at this location accumulated at about the same rate, these dates provide a firm basis for nominating a date of 300 cal BP for site abandonment – that is, sometime in the seventeenth century and certainly by 1700 AD.

ANU-1279 provided a date for a student project in OO8/IV, taken from Layer 4 in the middle of the sequence. Although without any direct stratigraphic connection to other excavations, the sample came from sandy deposits above a red grit hill wash layer and its age suggests that this layer equates with the sandy deposits above red grit A in the J and K squares.

Dates on four sand spit burials

As discussed in Chapter 3, in 1975 Alan Thorne excavated burials from the H and I squares. These are further described in Chapter 15, where the excavation designations are related to the numbers given to the skeletons in analysis. The four skeletons that provided bone samples for dating are labelled M6, M7, M10 and M13.

It has been argued that these burials should date very closely to the end of the occupation on stratigraphic grounds. However they were risky dates because it was uncertain whether these samples could be distinguished from background and also because apatite and collagen dates were prone to contamination problems and were subsequently partly superseded by amino acid dating for this reason.
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<th>Motupore square/spit</th>
<th>Laboratory Number</th>
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<th>Radiocarbon years cal BP</th>
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<td>K22/III/ beachrock</td>
<td>ANU-1647</td>
<td>2940±80</td>
<td>3110±118</td>
<td>2991-3228</td>
</tr>
<tr>
<td>K22/III/ beachrock</td>
<td>ANU-1648</td>
<td>2530±80</td>
<td>2594±121</td>
<td>2472-2715</td>
</tr>
<tr>
<td>L23/II/1</td>
<td>ANU-1218</td>
<td>310±60</td>
<td>385±68</td>
<td>317-453</td>
</tr>
<tr>
<td>L23/II/2</td>
<td>ANU-1217</td>
<td>370±80</td>
<td>411±77</td>
<td>334-488</td>
</tr>
<tr>
<td>L23/II/3</td>
<td>ANU-1212</td>
<td>390±70</td>
<td>421±75</td>
<td>345-496</td>
</tr>
<tr>
<td>OO8/IVT/4</td>
<td>ANU-1179</td>
<td>550±50</td>
<td>583±46</td>
<td>537-629</td>
</tr>
<tr>
<td>I17/III/M06</td>
<td>ANU-3373 (apatite)</td>
<td>240±60</td>
<td>275±126</td>
<td>149-401</td>
</tr>
<tr>
<td>I17/IV/M07</td>
<td>ANU-3374 (collagen)</td>
<td>310±220</td>
<td>301±209</td>
<td>92-510</td>
</tr>
<tr>
<td>I16/II/M10</td>
<td>ANU-3375 (apatite)</td>
<td>190±70</td>
<td>168±122</td>
<td>46-290</td>
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<tr>
<td>I17/II/13</td>
<td>ANU-3376</td>
<td>Insufficient collagen</td>
<td></td>
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Table 4.4. Motupore radiocarbon results from the ANU Dating Laboratory, 1973 onwards, also showing the dates calibrated using the CalPal2007_HULU calibration (Weninger and Jöris 2008). See text for discussion.
<table>
<thead>
<tr>
<th>Stratigraphic unit</th>
<th>M23/IV Layers</th>
<th>J21/III</th>
<th>J21/IVSB</th>
<th>K20/III/3</th>
<th>K20/IVSB</th>
<th>K21/III</th>
<th>K21/IV</th>
<th>K22/I</th>
<th>K22/III</th>
<th>L23/II</th>
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<tbody>
<tr>
<td>Gritty red/black</td>
<td>NR</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topsoil/midden</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy midden</td>
<td>2 to 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>385±68</td>
<td>411±77</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sandy midden</td>
<td>7 to 12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>421±75</td>
<td></td>
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<td>Loose midden</td>
<td>13-14</td>
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<td>683±73</td>
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<tr>
<td>Buried soil</td>
<td>NR</td>
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<td></td>
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<tr>
<td>Burials</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>410±67</td>
<td>425±76</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Post-RG A midden</td>
<td>16</td>
<td>366±59</td>
<td>582±51</td>
<td></td>
<td></td>
<td>594±43</td>
<td>597±47</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disturbed RG A</td>
<td>NR</td>
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<td></td>
</tr>
<tr>
<td>Red grit A</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>788±84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-RG A midden</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Red grit B</td>
<td>18-20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midden lens</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>601±46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red grit C</td>
<td>22-23</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Grey sand</td>
<td>NR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>777±124</td>
<td>518±40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black grit/clean sand</td>
<td>NR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>920±93</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4.5. Calibrated $^{14}$C dates for Motupore squares and spits for which stratigraphic correlation with M23/IV has been attempted. All are set against the sequential stratigraphic units developed in this chapter. NR = not represented in M23/IV; various stratigraphic units were also missing in the other squares. See text for discussion.
The results reflected these expectations. One sample, ANU-3376 did not yield enough collagen to date the sample. John Head (ANU Radiocarbon Dating Laboratory) reported that the collagen fraction of ANU-3373 was likely contaminated, but that the $^{14}$C activity was not significantly different between all the other samples, with mean activity being $98.17\pm0.36\%$, the equivalent of a conventional age of $148\pm30$ BP. Using an early calibration curve (Stuiver 1982) Head (letter dated 18.7.1983) proposed that the oldest samples (ANU-3373 and ANU-3374) most probably derived from a period 1670-1690 AD, while extending the range to 1670-1760 AD would cover ‘most of the probabilities’ for all dates.

ANU dates and stratigraphy

The remaining ANU dates in Table 4.4 can all be directly related stratigraphically and are considered in these terms in Table 4.5, which makes more general sense of the chronology. ANU-1219, discussed above, pre-dates continuous occupation, but overlaps at 1sd with ANU-1510 (777±124 cal BP), which dates the beginning of continuous occupation. On this basis it is reasonable to consider that Motupore was permanently settled by c. 1200 AD.

Three samples, ANU-1511 (582±51 cal BP), ANU-1178 (594±43 cal BP) and ANU-1210 (597±47 cal BP) provide almost identical results for the sandy midden immediately above the red grit A. ANU-1511 and ANU-1178 are samples from post hole fill, while the third date is from the surrounding deposit. These suggest a date of c. 1350 A.D. for the upper part of the habitation layers. ANU-1179 (583±46 cal BP) from OO8/IV T/4, just mentioned, offers the same date from a location with similar stratigraphic characteristics but c. 130 m to the west.

A fourth date from this level, ANU-1512 (366±59 cal BP) also derives from a post hole in the red grit A deposit but appears too young. One explanation is that this post hole was dug from higher up; another is that it was eventually filled by younger material (implying that the post remained in the hole for longer than assumed for the vast majority of these post holes). It is possible that both explanations pertain.

Two dates from the layer of burials, ANU-1177 (410±67 cal BP) and ANU-1508 (425±76 cal BP) sit stratigraphically and chronologically above the red grit A post holes, but are almost identical in age to the lowest of the L23/II check dates (ANU-1212, 421±75 cal BP). This is difficult to resolve because if the layer of burials in K20/III/3 and K20/IVSB/4 that provided the dates is contemporaneous with the burial in M23/IV/15, as is argued here on stratigraphic grounds, this provides little or no time for the accumulation of the lower midden in M23/IV, which comprises c. 900 mm of deposit. Three possible explanations can be considered to explain the situation.

1. The dates are ‘wrong’.

This seems improbable because it implies that all the dates from habitation layers are either too young and need to be chronologically older than they are, or that the stratigraphically younger midden dates all need to be younger than they are to find ‘space’ for the midden. Even allowing that 1970s radiometric dates might be less precise than today, this scenario is so improbable that it is rejected.

2. The stratigraphic reconstruction is wrong.

This explanation can be considered because the buried soil horizon, a fundamental component of the stratigraphic reconstruction, is not directly found in M23/IV. However, as argued earlier in this chapter, in the K squares this buried soil overlies the layer of
burials and sits stratigraphically beneath the earliest midden layers in this area. Also, this soil does not occur in the south-east corner of the K squares; in K22/I and K22/III it was noted above that midden deposits accumulated immediately prior to and contemporaneously with the buried soil. Thus it is unsurprising that the buried soil is absent in M23/IV, which is further to the south-east and higher on the hill slope. It is thus possible that midden dumping was occurring in the area of M23/IV at least as early as the formation of the buried soil. However this allows little more time for the early midden formation in M23/IV. Overall it appears unlikely that the stratigraphic reconstruction could be so wrong that this could explain this chronological constriction.

3. Both the \(^{14}\)C chronology and the stratigraphic reconstruction are essentially accurate.

If both the stratigraphic reconstruction and the chronology are correct they indicate a very rapid accumulation of the upper and lower midden units in M23/IV. This implication has been noted several times earlier in this section, where the idea has been treated as improbable. What if it is correct?

To pursue this explanation, I presume that the burials in K20/III/3 and K20/IVSB/4 are contemporaneous with the burial in M23/IV/15 and that the dates of ANU-1177 (410±67 cal BP) and ANU-1508 (425±76 cal BP) also approximately date the M23/IV/15 burial and predate the midden formation in that square. The Teledyne Isotopes date I-5901 (414±82 cal BP) also from M23/IV/15, was previously thought to be too young, but is seen in this reconstruction to be ‘identical’ to ANU-1177 and ANU-1508 and to confirm the stratigraphic reconstruction.

The problem now shifts firmly to the available time span for the accumulation of the upper and lower midden in M23/IV above Layer 15. The relevant dates are produced again in Table 4.6.

<table>
<thead>
<tr>
<th>Motupore square/spit</th>
<th>Laboratory Number</th>
<th>Equivalent M23/IV layer</th>
<th>Radiocarbon years cal BP</th>
<th>Calibrated range BP (95% probability)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L23/II/1</td>
<td>ANU-1218</td>
<td>M23/IV/2</td>
<td>385±68</td>
<td>249-521</td>
</tr>
<tr>
<td>L23/II/2</td>
<td>ANU-1217</td>
<td>M23/IV/5</td>
<td>411±77</td>
<td>257-565</td>
</tr>
<tr>
<td>L23/II/3</td>
<td>ANU-1212</td>
<td>M23/IV/8</td>
<td>421±75</td>
<td>270-571</td>
</tr>
<tr>
<td>M23/IV/15</td>
<td>I-5901</td>
<td>M23/IV/15</td>
<td>414±82</td>
<td>250-578</td>
</tr>
<tr>
<td>K20/III/3</td>
<td>ANU-1177</td>
<td>M23/IV/15</td>
<td>410±67</td>
<td>275-544</td>
</tr>
<tr>
<td>K20/IVSB/4</td>
<td>ANU-1508</td>
<td>M23/IV/15</td>
<td>425±76</td>
<td>272-577</td>
</tr>
</tbody>
</table>

Table 4.6. Radiocarbon dates relating to the midden deposits in M23/IV calibrated using the CalPal2007-HULU calibration (Weninger and Jöris 2008). See text for discussion.

The six dates are chronometrically identical, all overlapping at 1sd. Table 4.6 also indicates that at the 95% probability range, all six dates fall within the range of 249 cal BP to 578 cal BP; in other words, at this probability level the dates may fall into a spread as narrow as 26 calibrated \(^{14}\)C years or as wide as 329 calibrated \(^{14}\)C years. The central tendencies of the six dates suggest that the real age span is likely to be towards the lower end of this range.
Of these three possibilities it appears to me most likely that the c. 2.4 m of midden was deposited exceedingly fast, even perhaps in less than a century. This is, to say the least, a surprising result, with fundamental implications for everything from structuring the artefact analysis to assessing population growth in Bootless Bay. Taking a mid-point in this range for convenience I accept for further chronological discussions in later chapters that this midden accumulated in c. 150 years.

K22/III dates

I reported above how the preliminary date ANU-1163 appeared to fit the sequence but how the final date for this sample (683±73 cal BP) was stratigraphically too old. Two further dates from lower layers in this square, ANU-1211 and ANU-1509 were also aberrant, the former again too old and the latter too young in terms of the stratigraphy.

Reference to Table 4.5 indicates that should the bottom date ANU-1509 replace ANU-1163 in Layer 4 and the other two dates move down, so that ANU-1163 replaces ANU-1211 and ANU-1211 replaces ANU-1509, all three dates would be stratigraphically perfect, with all being within 1sd of their stratigraphic neighbours in adjacent squares.

One aspect of radiocarbon dating from the consumer’s viewpoint is the necessary acceptance that dating laboratories never make mistakes. Could the date change for ANU-1163 and the stratigraphic inversions for the three K22/III dates occur by chance?

Of course the answer is yes. But since eleven of the other twelve dates in the Figure 4.5 set make stratigraphic sense (the exception, ANU-1512 has been discussed above) I explored the possibility of laboratory error with the late John Head, at that stage in charge of the dating laboratory at ANU. Attempts were made to resolve the issue by comparisons of data on the submission sheets and laboratory records, such as sample weight, but these proved inconclusive. Laboratory procedure was to number samples as they arrived in the laboratory so that the non-sequential sample numbers suggested the dating samples arrived in the laboratory at different times and were not confused this way. This did not preclude later confusion with the results of the three samples since the ANU-1211 and ANU-1509 may have arrived in the laboratory at approximately the same time (suggesting that the sample numbers should have been much closer) and that the final date for ANU-1163 was not issued until 20 months after submission.

No other explanation for these inversions is forthcoming, so the dates are accepted as reported. Resolving this issue further would require further sampling of the site.

Les Groube’s dates

As reported by Cox (1989) Groube’s excavation was ‘drawn out’, beginning in 1979 and continuing to 1983. Seasons were short, sometimes a week, sometimes week-ends and frequently separated by long periods of inactivity. Attempts to cover the open trench were not successful. Cox (1989:6) quotes from an unpublished document by Groube that during periods of inactivity ‘it was not unusual for shells, bones and pottery to erode from the sections’. Thus the eight adjacent 2 m by 2 m squares that formed the trench were excavated as separate ‘Excavation Units’. This term was an unfortunate choice, since it is easily confused with its more normal use as a single removal unit or spit. Here I use ‘Excavation Unit [square]’ to avoid this confusion.

Presumably because of the damage to the sections, each of these squares became a self-contained unit, excavated in such a way that no stratigraphic relationship linking each square was immediately maintained, although a section drawing was completed (Cox 1989: figure 5a). These squares were dug to different depths, and some were apparently not completed; for example Excavation Unit [square] 2 had c. 550 mm of deposit removed and Excavation Unit [square] 4 had c. 1.5 m of deposit removed, while
Excavation Unit [square] 3, in between, had c. 3.5 m removed. As well, half of Excavation Unit [square] 5 was excavated to > 3 m while the other half was excavated to c. 700 mm below surface. Whether the excavation was never finished or whether there was some other explanation for this is not known, nor does the section drawing inform this problem, since it is presented without a key.

This horizontal self-containment also applied vertically. An alpha-numeric labelling system was employed ‘to segregate each excavation interlude. … This was necessary as drying out of the deposits or washing with rain in the interval often so changed the appearance of the layer that it was necessary to re-label’ (Groube cited in Cox 1989:7). The final recovery led to ‘more than 100 ‘stratigraphic units’ (actually 96, see Cox 1989:22). An early analytical task was to integrate these excavation units (i.e. spits) into a ‘more manageable and coherent series’, the strategy for which was seriating the pottery as a method of relating these units (see Chapter 6).

Figure 4.25. The re-casting of Groube’s ‘stratigraphic units’ into chrono-stratigraphic units after Cox (1989: figure 5b). The correlation of the Groube units within this grid are: A = 1; B = 1, 1BOT; C = 1; D = 1, 2; E = 1, 1A, 1Eq, 1M, 1MX, 1TP, 2; F = 1, 1MX; G = 1, 1A; H = 1, 1X, 2, 2SW, 2TP; I = 1BOT, 2A, 2AB; J = 2A, 2AB, 2BD, 2 BM; K = 2, 2A, 2B, 2BMG; L = 2A, 2F, 2M; N = 2, 2A; O = 2, 2A, 3; P = 3, 3SW; Q = 2E, 2EF, 2F, 2G; R = 2C, 2F, 2G; S = 2F; T = 3, 3A, 3B; U = 2AG, 3; V = 4, 4A, 4B, 4C, 4TP; W = 4A, 4B; X = 4A, 4C, 4D; Y = 3A, 3TP; Z = 3G, 3TP, 3Z, 3ZA, 3ZB, 3ZC; AA = 3X, 3Y, 3Z, 3ZA, 3ZB, 3ZB/D; BB = 4A, 4C, 4D, 5A; CC = 3ZC, 4A, 4A/S, 4B, 4C, 4D, 4E, 5A, 5B, 5D. This correlation accounts for 89 of Groube’s 96 ‘stratigraphic units; the other seven may not have contained pottery or were omitted for some other reason. See text for further comment.

The stratigraphy of the Groube trench was complicated by being ‘discontinuous and complex’, although Groube’s choice to excavate using natural stratigraphic layers might have made it easier to follow the stratigraphy in a single continuous excavation. Excavation Unit [square] 1 at the base of the hill slope encountered midden dumping that ‘had proceeded in discrete episodes’. At the southern end of the trench, up the hill, the matrix was ‘almost entirely talus and fine gravelly soil derived from down slope movement and outwash’ (Groube cited in Cox 1989:70-71). These layers were inter-fingered with the sandy midden layers in the middle of the trench. This clearly indicates similar formation processes to those described in this report for the J and K squares.

According to the Cox (1989) stratigraphic drawing, Groube dug to a depth of just under 4 m from the surface in Excavation Unit [square] 6 and only marginally less in Excavation
Units [squares] 3 and 7 (but less than 500 mm in Excavation Unit [square] 2). In the deeper pits it is unclear how deep the human occupation layers reach and how much is sterile. Certainly in the southern squares (Excavation Units [squares] 6 and 7) the total excavation depth is twice as deep as occupation in the J and K squares, although some of this difference can probably be attributed to much thicker hill slope gravel wash layers in the Groube trench.

This brief review has been necessary to put the nine radiocarbon dates from the Groube trench into some sort of context. As it stands, the only chrono-stratigraphic framework for these dates is that produced by Cox (1989: figure 5b) based on the seriation of 1,638 bowl rim sherds and reproduced here as Figure 4.25. As can be seen, this analysis by Cox groups Groube’s ‘stratigraphic units’ into five sequential vertical units (1, 2, 3A, 3B, 4, following Cox), further lumped into three phases, early, middle and late. There is no apparent way to relate these vertical units to any absolute depths or particular strata or to the stratigraphic section drawing.

Table 4.7 lists Groube’s nine radiocarbon dates in approximate stratigraphic order as determined from Figure 4.25. It is immediately apparent that all the finite dates are statistically identical and centred around 350 to 450 cal BP, thus covering the middle to upper period of the occupation documented in the J, K and M squares. As will be seen in Chapter 8, comparisons of the ceramic assemblages from both areas approximate this same temporal difference. No more detailed assessment of these dates can be offered here.

Groube’s ‘modern’ dates

The question of whether the ‘modern’ results of ANU-4442, ANU-4443 and ANU-3372 should be accepted at face value requires further discussion. Cox (1989:79) accepted them, suggesting that pottery was still being made on Motupore ‘almost up to the start of the Colonial Period’ and citing Groube’s view that the samples were from secure contexts and that there were no grounds to reject them.

The location from which these samples were taken, from the northern end of the trench in Excavation Units [squares] 1 and 2, is the precise point where the hill and the sand flat meet. As noted in Chapters 1 and 3, there is reason to believe that the flat area of the sand spit was modified by the previous owner. Also during my time on Motupore and before that, Guma Lumb used to cut all the grass on the sand spit and along this edge; but whether such activities could have created this dating problem is unknown. It might be telling that the one finite date from the same late horizon comes from Excavation Unit [square] 5, further up the hill.

As has been seen, after the Gakashuin dates of 1970, no sample from my Motupore excavations yielded a modern result. While, in part, this reflects the fact that few samples came from the very top of the site, the results from L23/II/1 and L23/II/2 and the 1975 sand spit burial dates do not support abandonment close to the beginning of the ‘Colonial Period’, taking this to mean the European settlement of Port Moresby in 1883 (ten years after John Moresby sailed into Port Moresby harbour).

In order to pursue this problem as far as possible, I was able to access to the original sample submission sheets with the permission and assistance of Dr Stewart Fallon (Radiocarbon Dating Laboratory, Research School of Earth Sciences, Australian National University) who in 2015 was curating the records. While not of exceedingly great use, they offered some more detail on this matter.

ANU- 3372. This was a large sample (145.35 gm) taken from a ‘gravel spread’ sandwiched between Layers 1 and 2 in Excavation Unit [square] 2. No depths were
provided for this sample, but extrapolating from ANU-4442 it probably derived from between 50 mm and 150+ mm below the surface. No information on how the sample was retrieved is offered. It is unclear what the ‘gravel spread’ might imply and the size of the sample suggests large pieces of charcoal were present, perhaps indicating minimal post-depositional disturbance at this location. At this distance it is impossible to determine how ‘secure’ this location was.

<table>
<thead>
<tr>
<th>Stratigraphic Unit</th>
<th>Ceramic Unit (after Cox 1989)</th>
<th>Laboratory Number</th>
<th>Radiocarbon years BP</th>
<th>Radiocarbon years cal BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/1X</td>
<td>1</td>
<td>ANU-4442</td>
<td>Modern</td>
<td></td>
</tr>
<tr>
<td>1/2</td>
<td>1</td>
<td>ANU-4443</td>
<td>Modern</td>
<td></td>
</tr>
<tr>
<td>5/2A</td>
<td>2</td>
<td>ANU-3371</td>
<td>350±100</td>
<td>392±91</td>
</tr>
<tr>
<td>2/2A</td>
<td>2</td>
<td>ANU-3372</td>
<td>Modern</td>
<td></td>
</tr>
<tr>
<td>5/2F</td>
<td>3A</td>
<td>ANU-3370</td>
<td>290±70</td>
<td>357±87</td>
</tr>
<tr>
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<td>3A</td>
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<td>454±81</td>
</tr>
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<td>1/4AB</td>
<td>3A</td>
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<td>440±70</td>
<td>446±81</td>
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<td>6/4D</td>
<td>3B</td>
<td>ANU-4444</td>
<td>250±70</td>
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<tr>
<td>6/5A</td>
<td>3B or 4</td>
<td>ANU-4445</td>
<td>Modern</td>
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</tr>
</tbody>
</table>

Table 4.7. ANU radiocarbon dates obtained from the Groube trench arranged in the sequential order derived from the pottery seriation by Cox (1989). See text for explanation and discussion.

ANU-4442. The sample size was sufficient at 18.8 gm. This sample was sieved from a block of deposit called by Groube a ‘total sample’. This was apparently done in the laboratory because the sample was wet-sieved with dilute HCl, then the charcoal was hand-picked from the residue. The sample derived from somewhere within a layer ‘black with humus’ that extended from 50 mm to 200 mm below the surface. Comment: together with ANU-4443, this sample was part of Groube’s second set of dates. These two samples were to test the notion derived from the modern result of ANU-3372 that the abandonment of Motupore was more recent than previously thought: Groube estimated a date of <150 BP on the sample submission sheet. The sample was thus deliberately taken from as young a context as Groube considered feasible, thus increasing the risk of surface contamination.

ANU-4443. The purpose of this date was to confirm ANU-4442 and was predicted to be younger than the ‘date for layer 1/2A’. Groube nominated 190 BP. Since no date was assayed for layer 1/2A, this either refers to 5/2A (ANU-3371) the only late finite date, or to 2/2A (ANU-3372), in which case Groube was predicting it to also be modern. The charcoal sample was on the small side at 7.0 gm and came from the layer immediately below ANU-4442 at a depth of between 200 mm and 300 mm below surface. The sample was hand-picked during excavation.

Summary of Groube’s ‘modern’ dates

The location of the Groube trench, in against the hill, would seem to preclude later occasional use of the island (for example by fishing parties) as an explanation for these
modern dates although the large sample size for ANU-3372 and the ‘gravel spread’ might indicate some post-occupational activity that could have occurred even in the 20th century.

However it is well known that after c. 1700 AD reliable age determinations for samples are not possible because fluctuations in the calibration curve lead to multiple possible time ranges for these samples (Wild et al. 2000). Such samples are conventionally designated modern. All the dating evidence reviewed here suggests that the abandonment of the full-time occupancy of Motupore occurred perilously close to this technical divide. This is indicated especially with the sand spit burial dates.

No absolute resolution of the meaning of Groube’s modern dates can be forthcoming on the available data. On balance I continue to favour an abandonment date at c. 300 BP, swayed by the coincidence of the finite dates and the oral history, previously discussed. As noted, the retrieval of new samples from N23/I in June 2016, might address this issue when assayed, especially if newer 14C techniques like ABOX preparation and AMS processing are employed.

Groube’s two deep dates

ANU-4444. This smallish sample (7.3 gm) was hand-picked from the deposit and was thought to reflect scattered charcoal washed down the slope with a ‘heavy talus’ described as ‘the earliest of the major hill slope collapses’. The sample was collected at a depth of 2.5 m below the surface. The deposit was said to contain rare sherds of early pottery and to probably reflect early occupation and probably gardening on the steep hill slope above the site, although no reason was advanced for this notion. The date was younger than predicted, even though Groube apparently thought by the end of 1984 (date of submission of this sample) that the whole sequential history of human occupation on Motupore might be contained in the period after 450 BP, since this was the outside range he nominated for this date.

If the pottery from this unit could be shown to correlate with pottery associated with the earliest ‘hill slope collapses’ (red grit C) in the J and K squares, the associated dates there would put this event at 600-700 BP. Stratigraphically ANU-4444 appears too young and the explanation for this might lie in the uncertain origin of the sample, although again on stratigraphic grounds the date should be older.

ANU-4445. This was referred to on the submission sheet as a ‘risk’ date, thought to be a little earlier than ANU-4444, and designed to date the beginning of occupation. This sample, considered by Groube to be charcoal, was hand-picked from the deposit and was thought to have been ‘washed in’ with basal water-laid deposits onto ‘beach/coast rocks’ at a depth of c. 3 m below the present surface. The matrix is said to be ‘natural’ and lacking pottery or other artefacts. Although the sample weighed 7.2 gm, its CO₂ yield was very low (85 cm Hg on the laboratory manometer, whereas ~1000 cm is expected from 4 gm of carbon), implying that the sample carbon content was very small. In these circumstances the association of the carbon with original deposition of the surrounding sediment is highly uncertain, and it is unlikely that this date is accurate (John Chappell pers. comm.).

One interesting aside is that these last descriptions seem to imply that the sea was against the hill at the time represented by this stratigraphic deposit. This generally accords with the data from the J and K squares and elsewhere on the sand spit, as developed in this chapter and Chapter 3.
Thermoluminescence (TL) sherd dating

During the 1970s experiments were conducted by David Price, then in the Department of Physics in the School of General Studies in the ANU, into the utility of dating prehistoric pottery by thermoluminescence. The theory was that originally firing the pottery zeroed the thermoluminescence ‘clock’ and that measuring the thermoluminescence reflected the radiation acquired since manufacture, from which a calendrical age could be calculated. As part of this experiment I collected seven sherds from various localities on Motupore during the 1973 season. Sherds were taken straight from the deposit and wrapped in foil, as were samples of the deposit surrounding each sherd. In the laboratory small samples were extracted from the inner fabric of each sherd and subjected to the 110°C-Single Disc test.

Five of the seven samples were chosen so that they could be directly matched to radiocarbon dates on charcoal.

Sample 1 came from L23/II/1 (=M23/IV/2) radiocarbon dated to 385±68 cal BP. The sample had insufficient TL output to provide a date.

Sample 2 came from L23/II/2 (=M23/IV/5) radiocarbon dated to 411±77 cal BP. The sample returned an age of 375 years, within 1sd of the radiocarbon age.

Sample 3 came from L23/II/3 (=M23/IV/8) radiocarbon dated to 421±75 cal BP. The sample returned an age of 670 years, outside 2sd of the radiocarbon age.

Sample 4 came from K21/II SB/7, immediately adjacent to K22/I/11, radiocarbon dated to 601±46 cal BP. The sample returned an age of 670 years, within 2sd of the radiocarbon age.

Sample 5 also came from K21/II SB/7, immediately adjacent to K22/I/11, radiocarbon dated to 601±46 cal BP. The sample returned an age of 1310 years, well outside 2sd of the radiocarbon age and from the same square and layer as Sample 4.

Samples 6 and 7 derived from I16/II/1 and I16/III/1 respectively. Although not immediately associated with a dated stratigraphic unit, both sit on the living surface exposed in H16, H17, I16 and I17, described in Chapter 3, and thus can be seen to be approximately contemporaneous with the four dated graves dug into this surface. Unfortunately, neither sample had acquired sufficient TL to produce a date.

The results from this experiment were equivocal. The three stratigraphically youngest sherds were seen to be young because their TL take-up was insufficient to be measured, but this achieved little. Of the four sherds that offered a TL result, two matched the radiocarbon ages and two were aberrant. No further samples were assayed.

TL dating of pottery is currently seen to be less accurate than other dating techniques, despite it still being the only technique that directly dates pottery. Today it is mostly used for authenticating antiques and identifying forgeries.

Summary of dating

Notwithstanding the K22/III inversions, the stratigraphy and the radiometric dates offer a relatively tight range for the general chronology of the Motupore settlement. Earliest permanent settlement occurred after 920±93 cal BP and certainly by 777±124 cal BP; a ‘best estimate’ being in the twelfth century AD and almost certainly by 1200 AD. Deposition on the M23/IV midden ceased sometime after 385±68 cal BP with a ‘best estimate’ for abandonment being the early seventeenth century AD and possibly no later than 1650-1700 AD. In the K and J and M series of excavations the intensive period of post hole digging and contemporary, or probably slightly later, burial activity is bounded by a tight set of dates between 597±47 cal BP and 410±67 cal BP.
The sand spit burials from squares H16, H17, I16 and I17 were always argued to be recent events in the Motupore sequence. Although the bone dates were equivocal, John Head’s independent assessment that these dates were best seen to fall into a range between 1670 AD and 1760 AD supports the other dating evidence for abandonment around 1700 AD.

As discussed, the dates suggest that the M23/IV midden could have accumulated in as little time as 50 to 100 years, although I consider 150 years to be an appropriate approximation that most readily accommodates the various strands of data to be examined in subsequent chapters. Even this span implies very deliberate garbage disposal in the late stages of settlement, suggesting a deliberate reversal of the earlier modes of using the available space. The implications of this change are further examined in Chapter 15. However this change at the very least indicates likely significant population increase on Motupore by this period.

Chronologically, the rise and fall of Motupore is encompassed in 400 to 500 years.

**Determining analytical units**

**Correlating excavation units**

Given the nature of the stratigraphy, post-depositional taphonomy and the short period of prehistoric occupation on Motupore, it made sense to consider various structures for subsequent artefact analyses, each based on what questions were being asked of each data set. Pottery and pottery decoration seemed likely to be sensitive to cultural and economic change through time and thus likely to provide a time-related typology for both intra- and inter-site comparisons. In this instance samples needed to derive from chronologically secure areas. Other artefact classes such as stone drill points were of interest for their technology which implied a specialised production activity. While it was important to determine whether these tools were present throughout the whole sequence or only a part of it, as tools they exhibited no apparent evolutionary change and were found across the whole site. Thus chronological control was less important in their analysis, so that individuals could be included from anywhere on site to maximise sample size.

The squares where satisfactory control of stratigraphic relationships could be established are M23/IV, K21/II, K21/IISB, K21/II, K21/IV, K21/IVSB, K21/IVWB, K22/I, K22/III, J21/II and J21/IV.

**Integrated Site Levels as analytical units**

Table 4.8 shows the correlation of the above excavation units in these squares. This developed the idea of using a version of the stratigraphic divisions shown in Table 4.5 as 'integrated site levels' (ISLs) which formed one early set of analytical units. As seen, creating these ISLs mainly employed extrinsic attributes in their formation - stratigraphic contexts and argued relationships between them (see Frankel 1988:41) - but also occasionally used intrinsic evidence such as the high or low density of shell midden in particular layers.

As the foregoing stratigraphic discussion made clear, these units varied in volume both vertically and horizontally in the areas of the excavation from which they were taken. Since I use stratigraphy as a fundamental defining characteristic of the analytical units, a case might be made that the vertical and horizontal distributions of these strata contain an intrinsic human behavioural reality that should be retained within the analysis.
Table 4.8. Proposed stratigraphic correlation between M23/IV and the J and K squares where data allow it. NR = not represented. See text for discussion.
Thus raw frequencies of artefacts between units should distinguish different behavioural (and perhaps especially human versus natural) formation activities, regardless of, or indeed specifically because of different volumes in these units. For example, ISL 13 in Table 4.8 is a restricted unit whose distribution suggests a quantitatively different behavioural reflection to that suggested by ISL 7. This difference might be more clearly observed by altering the frequency of one or other artefact group so that the different volumes of deposit are equalised.

At the same time it might equally be the case that these two ISLs sample two sets of behaviour which are in every respect identical, except that they occurred at different locations on the site (and, of course, at different times) resulting in different archaeological reflections. Since we are trying to recreate human behaviour at the whole site by sampling part of it - and not merely the behaviour in that part of the site we have sampled - it might then be a more accurate procedure not to apply density correction factors.

Additionally, whether or not density correction factors are applied, comparisons of artefact frequencies between ISLs do not provide comparisons between units of equal time length. However, as discussed earlier, the combined use of small excavation units and tens or hundreds of radiocarbon dates at the expense of the stratigraphic evidence places an emphasis on equal time units as analytical units that may be equally deficient as a structure to understand past behaviour in the archaeological record.

The solution, such as it is, is to consider what might be the most appropriate units for the questions being asked and to explain these units and their shortcomings and strengths. For example, in this report the development of a sensible pottery typology is a central aim of the analysis. For this task the ISLs provided too fine a scale to best perceive time-related changes in the pottery. A coarser grouping of six analytical units was developed, detailed in Chapter 5. There is no suggestion that these six groups encompass equal periods of time – it is clear that they do not; but in this case, the fact that they do not encompass equal time periods adds a chronological emphasis to the analytical importance of the identified changes.

**Density correction factors**

Because of these reasons I only sometimes employed density correction factors when making artefact frequency comparisons between units. Table 4.9 provides these correction factors for the excavation units in M23/IV, K21/II and K22/III from Layer 4a onwards. These are the three squares that provided the samples for the ceramic typology. Table 4.9 also provides the correction factors for the ISLs.

The correction factors have been calculated using the four corner layer depths for each excavation unit to calculate volume; thus an excavation unit with four measurements of 80 mm, 100 mm, 100 mm and 120 mm averages 100 mm in depth. In a 2 m by 2 m square the volume of this excavation layer would be 2 m x 2 m x 0.1 m = 0.4 cu. m. This figure divided into the number of artefacts from this excavation unit gives a number of artefacts per cubic metre, e.g. 200 artefacts in 0.4 of a cubic metre = 500 per cu. m. In the case of ISLs involving more than one excavation unit the volumes of each unit were added and the same formula applied, e.g. 0.4 cu. m + 0.6 cu. m + 1.0 cu. m equals 2.0 cu. m. Thus 200 artefacts in 2 cu. m = 100 per cu. m. Finally, it can be observed that excavation units are never even along their surfaces, so that these correction factors are unlikely to be more accurate than ± 10%.
Table 4.9. Density correction factors (CF) used in some Motupore analyses. See text for explanation.

Chapter Summary

This chapter has reviewed in detail the stratigraphy of the excavations in M23/IV and the J and K series of squares because these are the squares that produced the best sequence and also the most chronologically secure sequence for creating units for artefact analysis. Inter alia, site formation processes, both human and natural, have been discussed in more detail than in Chapter 3.

The radiocarbon dates have also been reviewed in relation to the stratigraphy.

The product of this review has been a general discussion of appropriate analytical units with which to approach the artefact analysis. It is argued that each analysis should employ groupings, whether spatial or temporal, that are appropriate for the questions being asked of the data. My fundamental preference for Motupore has always been to use units based mainly on stratigraphic differentiation, as argued here and in the previous chapter, but not to be tied to this approach when specific exceptions appear more appropriate. Most importantly, these analytical units have not been established on the basis of any perceived typological differences between the artefacts within them.

Following the discussion by Frankel (1988), establishing the sorts of analytical units that I have generated does not presuppose that they will be different in content, while at the
same time the broadness of the units should identify change where it exists, without emphasising it. In short I have actively sought to create content-neutral units for the analyses that follow.

**Could there have been earlier occupation on Motupore?**

Related to the chronology reviewed in this chapter, the question of whether earlier occupation might have occurred on Motupore emerged primarily from the results of a small excavation carried out on Loloata Island immediately to the south-east in Bootless Bay (Sullivan and Sassoon 1987) (see Figure 2.2). These researchers distinguished two phases of midden deposit. The more recent was related ceramically to a phase of Les Groube's later Motupore excavations and could be placed at c. 300 years BP. The earlier phase contained pottery from the EPP period. A single shell date of 2300±100 BP (ANU-4808) is consistent, when adjusted for marine reservoir effect (Gillespie and Swadling 1979), with an early phase of occupation by EPP people on Loloata Island.

The presence of this group of people on Loloata c. 2000 BP raised the question of whether earlier settlement might also have occurred on Motupore. This now seems highly improbable on the evidence reported here. As discussed, Les Groube excavated a 16 m by 2 m trench against the hill in the vicinity of BB16-BB19 (Figure 3.1). Part of Groube’s strategy in locating this trench was that he thought he might secure earlier materials than I had, because the hill contours form a small natural embayment at this point. In fact it appears from the foregoing discussion of radiometric dates that cultural deposits in this area of the site were mostly or completely younger than in the area of the J and K series of excavations, a notion strengthened by the more recent pottery that dominated the analysis by Cox (1989). As seen, excavations in K22/III passed through the deposits dating between 1000 BP and 2500 BP - the EPP period - without encountering any indication of material relating to this period. To date, none has ever been seen anywhere on Motupore Island.

Sullivan and Sassoon (1987:4) assumed that the sand spit on Loloata existed in some form 2000 years ago and that this spit provided sand that was blown inland against the hill, accumulated behind a beach ridge. This living space was partially covered during or shortly after occupation by a cone of debris resulting from hill slope failure. One explanation for the occupation of Loloata in preference to Motupore might well be the presence of this living space on Loloata and its absence on Motupore 2,000 years ago. It is of interest that by 1200 AD Motupore became the preferred location for settlement and that the later occupation of Loloata, around 300 years ago, or perhaps slightly earlier, might have coincided with the appearance of similar sites all around Bootless Bay (see Chapter 16).

Different prehistoric occupation histories on Loloata and Motupore could mean several different things. For example, continuing beach development at the sheltered north-east end of Motupore by 1200 AD might have resulted in a larger beach area than at Loloata, or the longer length of sheltered leeward coastline on Motupore compared with Loloata, might have been preferred by a group who built their houses out over shallow water. The Loloata evidence of EPP settlement certainly lends support to the view that the sand spit now on Motupore did not exist in anything like its present form 2000 years ago.
CHAPTER 5  POTTERY ANALYSIS: AIMS, ATTRIBUTE SELECTION AND INITIAL ANALYSES

The most elementary level of description is the listing of archaeologically significant attributes (Spaulding 1960:62).

Introduction

Broken pottery was recovered from Motupore in prolific quantities. Despite the fact that small pieces were lost through the sieves and that more sherds were intentionally discarded as described in Chapter 3, the relatively small excavations on the island resulted in the recovery and processing of more than 512,000 sherds, weighing almost four tonnes. The sheer volume of material required that decisions be made early in the excavation concerning processing and analysis, which hinged upon considerations as diverse the ultimate intellectual objectives of the excavation on the one hand and the physical constraints of transport on the other.

As the excavations progressed, all such considerations were tempered by my increasing familiarity with the material recovered. Field notebooks reflect my generally subjective opinions about the material which developed while still excavating. It is useful to summarise the opinions formed in the field as an opening statement of the nature of the Motupore pottery.

Motupore pottery: initial responses

The overall collection of Motupore pottery gave the impression of homogeneity rather than diversity. Although in the bowl profiles in particular there was little uniformity, there did not appear to be a wide range of overall shapes; no obvious paste or temper distinctions suggested themselves on visual inspection; and decoration appeared simple, both in motifs used and the range of decoration techniques employed.

This is not meant to imply that changes in the Motupore ceramic assemblage did not take place - indeed there is no way that even a casual typologist could confuse the pottery from the latest and earliest levels in the site. Rather this observation is meant to suggest that no sudden changes and few distinct 'types' suggested themselves in any subjective examination of the material. Changes through time appeared to have been of an evolutionary rather than revolutionary nature.

Field procedures

After excavation ceased each day all finds were washed and sorted. In the case of the pottery, all rim sherds, decorated body sherds, lugs and other special pieces were isolated from the plain body sherds that made up the bulk of the collection. Sherds of the former group were individually labelled, bagged and returned to the laboratory for further analysis. The latter group were counted and weighed and discarded on the island away from the area of prehistoric occupation.

Thickness measurements of the plain body sherds were not attempted because of the variation noted on individual sherds caused by the usually obvious paddle-and-anvil construction technique and also because, despite this individual variation, some early trial attempts at measuring thickness suggested that there was no great absolute variation for a large proportion of the sample. Instead, abnormally thick sherds (no abnormally thin ones were noted) were retained as special items, even when these were plain body sherds (Figure 5.1).
Figure 5.1. Motupore sherd M23/IV/14/216, external surface at bottom. At an abnormal 37 mm thick this is the thickest sherd recovered during the excavation. It is thought to derive from a large storage vessel. These were used ethnographically to store imported sago.

The decision to dump the plain body sherds seemed logistically sensible at the time but subsequently restricted the possibilities of the technological studies undertaken by Owen Rye, since the only body sherds available to him for analysis were the painted or otherwise decorated body sherds returned to the laboratory. Consequently I would caution against similar disposal in the future.

Structure of the analyses

The analyses of the pottery attempt to proceed in a logical fashion. Commencing with a summary of my thinking on how to approach the classification of the Motupore pottery, I consider the central objectives of the pottery analysis. The remainder of this chapter is concerned with a closer description of the material, beginning with the methodology employed in sampling the collection for more detailed analysis, a description and justification of the attributes chosen for examination, and finally various frequency and distribution analyses. Chapters 6 and 7 deal with previous classifications of Papuan pottery and with the typological analyses carried out, their theoretical underpinnings and the results achieved. Chapter 8 considers further aspects of the pottery, particularly decorative motifs, and compares my results with those produced by Jillian Cox, working on Motupore pottery excavated by Les Groube between 1979 and 1983. Chapter 9 discusses Owen Rye’s various technological and sourcing studies. Chapter 10 examines the distributions of ceramic types through time.

Approaches to pottery classification on Motupore

One advantage of excavating a site is that impressions formed during excavation frequently provide foundations for subsequent analysis. Intuitively one perceives patterns in the data that are influential in determining subsequent approaches to classification. If artefacts are passed to other analysts this important link is lost.

At the time I first considered the classification of the Motupore pottery three aspects influenced my thinking. One was the experiences and approaches of others, here
particularly Vanderwal’s thesis and the then on-going analyses of Irwin and Bulmer, discussed more fully in Chapter 6. A second was the ethnographic record of Papuan pottery production coupled with the ability to watch the continuation of pottery making in local villages (plus participating in Rye’s experimental work). The third, as stated, was the particular nature of pottery from Motupore and my subjective impressions of it during excavation.

*Nature of the Motupore pottery*

There are two aspects of the Motupore pottery assemblage that are relevant here. The first is that the assemblage comprises many large sherds. In addition to this it was common to find sherds adjacent to each other that derived from the same vessel and could be re-joined to provide even more complete representations of the original pots. This meant that the analytical sample of 1,932 sherds comprised individuals large enough to carry representations of all the attributes chosen for the analysis; in other words each sherd provided a reasonable proxy for complete pots even though the lower body sections were far less well represented.

![Figure 5.2](image)

**Figure 5.2.** Reconstructed late period small Motupore bowl from K20/IV/2, showing crudeness of manufacture and decoration. Maximum diameter at lip 138 mm.

The second aspect concerns the general unevenness of the pottery. While this might be expected with handmade pottery, the execution of a noticeable proportion of the Motupore assemblage borders on carelessness. Figure 5.2 shows a reconstructed late period small bowl from K20/IV/2. While this bowl might be ‘sprung’ (that is, the tension in the original body that was released when the bowl broke has slightly distorted the sherds) the closeness of the joins indicates that this is not the cause of the crude finish. The rim is not level, the orifice is not round (but not intentionally ovoid), the internal and external profiles both vary markedly around the pot and the band of shell impressed decoration is variable and haphazard. If this is not the product of a child, which is possible, it indicates rapid and careless production.

Figure 5.3 shows a painted globular pot recovered in 1969 from the bank of the Lakekamu River, in the eastern Gulf Province (Bulmer 1971: Plate 1). As argued in
Chapter 8 there is reason to consider that this pot was probably made on Motupore. Again the rim is uneven in terms of placing it in any horizontal plane; the lip shape varies around the circumference of the orifice; and the angle of the rim also varies around its circumference. Many photographs of ethnographic Motu pots indicate similar variability within what would be considered a single pottery ‘type’.

Figure 5.3. The Lakekamu pot. Size unknown, but assumed to be 200 – 300 mm high (Bulmer 1971).

Ethnographic observations

Bulmer (1971: figure 5a) summarised the descriptions of Motu pottery by ethnographers Stone, Chalmers and Finsch in the late nineteenth century, Seligman in 1904 and Groves in the 1950s (Table 5.1). There is a close agreement in these lists and they suggest a restricted range of vessels. More recently Skelly (2014:22ff) published a more exhaustive and valuable account. Ignoring the fine detail, there are four forms of globular pots with everted rims include the large and small cooking pots, the *uro* and the *keikei*; the *tohe* used for storing sago; and the water vessel, the *hodu*. The first three of these are separated on size rather than shape, with the *tohe* said to be several times larger than the *uro*. Stone (1876) put the diameter of the *uro* at 380-450 mm, while Seligman suggested 250-300 mm. The *hodu* is differentiated by having a narrow aperture and a rim that approaches the vertical, more so than the rim of the *uro*. Bulmer describes the *kaiwa* (= *kaiva* according to Chalmers (in Lindt 1887:122)) as a spherical pot with a horizontal collar below the everted rim, following Finsch’s (1914: Taf. XVII, Abb. 359) illustration (reproduced in Figure 5.4). While this illustration does not match its profile detail (Finsch 1914: Taf. XVII, Abb. 358; Figure 5.4) an example of this pot type was photographed in Hanuabada in 1903-04 by the Cooke-Daniels Ethnographic Expedition (Figure 5.5) and was also
described by Chalmers (in Lindt 1887:122). Groves (1960) did not record this form at Manumanu village in the 1950s and it has not been recognised in archaeological collections from the Port Moresby area to my knowledge, nor does it occur on Motupore.

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Table 5.1. Western Motu ethnographic pottery types, following Bulmer (1971; Fig. 5a). See text for discussion.

All commentators identify a circular open dish as a *nau*, while Finsch illustrated a *nau* with lugs at either end with an apparent ellipsoid appearance (see Figure 5.4 and discussion below). Chalmers (in Lindt 1887:122) listed *ohuro* as a large cup, but Finsch described *oburo* as a deep incurving bowl, much like a globular pot without everted rim. Chalmers also identified large and small basins *kebo* and *kibokibo* respectively, and a small cup, *ituru* (called *itulu* by both Finsch and Groves). Finsch’s illustration (Figure 5.4) suggests it is a goblet with stem and base, while Groves’ Boera informant (1960) described the *itulu* as a small basin on legs, used to hold tattoo dye.

As well as written descriptions there are many specific photographs of pot making (e.g. Figures 5.6, 5.7 and 5.8) and pottery for trade (Figures 5.9 and 5.10) dating to the late 19th and early 20th centuries that show the common types mentioned here and that also reflect the manufacturing techniques that were still being practised in the 1970s and that were detected in the Motupore pottery (Chapter 9). Collectively these also reflect the variability to be seen in single types of handmade earthenwares.

**Theoretical approaches to archaeological classification**

In addition to the literature already cited, my thinking on classification was enlightened and clarified by David Clarke’s *Analytical Archaeology* (1968) and by discussions with Clarke in Cambridge in 1971.
Figure 5.4. Ethnographic Motu pot types. These are slightly modified from Finsch (1914). Each depiction is not drawn to the same scale. a. uro; b. hodu; c. nau; d. oburo; e. itulu; f-g. kaiva. This last form is shown as drawn by Finsch. The profile detail (g) does not accord with the larger drawing. See text for discussion.

Figure 5.5. A kaiva photographed (without scale) in Hanuabada in 1903-4 by the Cooke-Daniels Ethnographic Expedition. British Museum Oc. B118.104.
Figure 5.6. Women making pottery, Port Moresby, 1898. Note upturned broken rims used to rotate new pots. The water container might be either wood or pottery. Partially obscured bowl in bottom left of photograph contains sand used as temper (visible in other photographs). Photograph: A.C. Haddon. Museum of Archaeology and Anthropology, Cambridge: ID number N.36020.ACH2.

Figure 5.7. Woman forming globular pot rims, Port Moresby, 1898. Accompanying notes suggest she is marking the rim with her trademark. Photograph: A. C. Haddon. Museum of Archaeology and Anthropology, Cambridge: ID number N.36022.ACH2.
One area of discussion involved the long-standing debate in anthropology concerning whether types were arbitrary constructions imposed on assemblages, as suggested by Ford (1952) and Dunnell (1971a, 1971b) among many others, or whether types reflected the typological perceptions of the people who made the artefacts (e.g. Gifford 1960).

This became known as the insider/outside or emic/etic debate (terms coined by linguist Kenneth Pike (1954) from phonemics and phonetics). While the debate continues (see papers in Headland et al. 1990), in 1970 it provided me with a dilemma: how to resolve an emphasis on logical and comprehensive analysis that is falsifiable and replicable, that I saw to represent ‘objective science’ at the time (the ‘etic’ position) with the ‘emic’ evidence of an ethnographically described, on-going and observable traditional pottery industry? My Port Moresby colleagues at the time were experiencing similar epistemological problems – see Swadling’s discussion of scientific and folk taxonomies of shellfish in Chapter 12 or Ralph Bulmer’s (1967) discussion of why a cassowary is not a bird in Kalam taxonomy.

It took me some time to realise that the two positions were not necessarily mutually exclusive and that emic knowledge could be used to inform etic formulations and hypotheses in classification.

Figure 5.8. Woman in Hanuabada village making bowls, 1885. Photograph: J. W. Lindt (1887).
Figure 5.9. Globular pots and bowls to be traded on the *hiri*, assembled in Hanuabada village in Fairfax Harbour. Note how cooking pots (*uro*) outnumber bowls. Photograph: W. G. Lawes between 1881 and 1891. British Museum Registration Number Oc. B25.29.

Figure 5.10. Pots being transported to the large double-hulled *lakatoi* for the voyage to the west. Port Moresby Harbour, with Ekevaka in the distance, 1885. Photograph: J. W. Lindt (1887).
Objectives of the ceramic analysis

As discussed in earlier chapters, in 1970 no ceramic sequence and very little understanding of the prehistoric ceramic range existed for the Port Moresby region. Thus initial objectives were extremely general in their conception. Despite the subsequent appearance of Bulmer’s (1978) description and analysis of the pottery from several excavations and a large number of surface collections in the Port Moresby area, these general objectives have remained valid for the Motupore site, since the Motupore pottery calls into question some of Bulmer's conclusions.

Thus, the general objectives of this analysis remain similar to those determined in 1970:

1. To describe the assemblage by defining meaningful attributes and examining their frequency and distribution through the site. By concentrating the analysis on pottery from areas of the site where a well dated sequence of material could be isolated, this exercise was aimed at providing a relative chronology for extrapolation to other parts of the site. As well, such a description was intended to facilitate comparisons with other collections of pottery both from Port Moresby and from further afield. A fundamental part of this was to determine that pottery was actually made on Motupore, rather than assume it.

2. To construct a typology useful in examining the nature of ceramic stability and/or change through time in the site.

3. To integrate these pottery studies into wider socio-economic interpretations of the site, where possible. This latter objective became more clearly defined as the project developed. Two related approaches, ceramic technology and sourcing, were subsequently introduced to help to address socio-economic issues.

More specifically, these re-directions aimed:

4. To analyse the pottery from the aspect of its manufacture. Understanding the manufacturing constraints on Motupore potters could offer a better basis for discussing the socio-economic functions of pottery on the site. It was also considered that correlations might be made between technological groups and archaeologically defined types. Thus the technological studies might provide independent verification of these types.

5. To source the Motupore pottery. This objective partly derived from the technological studies and partly from the developing hypothesis that Motupore represented a pottery trading village. It thus became imperative to initiate a series of sourcing studies to determine whether a Motupore 'signature' could be attached to pottery recovered from other Port Moresby sites and/or further afield. Since this was predicated on the needed demonstration that pottery was even made on Motupore, further discussion of technology and sourcing occur in Chapter 9, after the typological analysis.

Sherd size

Although no whole pots were recovered from the site, the sherds were, on average, very large, particularly when compared to collections from other Port Moresby sites. Sherd size comparisons with Taurama, the only excavated contemporaneous site in the region, cannot be made since Bulmer (1978) provided no data on size or weight of the Taurama sherds. Bulmer (1978:307-8) does note however that the excavated material from Taurama contained 651 rim sherds 'potentially useful for style analysis'.
from a total sample of 25,000 excavated sherds. The square M23/IV on Motupore yielded 6,334 rim sherds in a total sample of 130,876 sherds; thus rims in this sample represent 4.8% compared with 2.6% at Taurama. The recovery of proportionately almost double the number of rim sherds from Motupore might suggest a greater degree of secondary breakage at this site. However it seems likely that 'potentially useful for style analysis' implies that there were more rim sherds from Taurama, but of smaller sizes that rendered them less useful for style analysis.

All that can be said is that Motupore sherds were large and that this was not greatly affected by post-depositional secondary breakage, especially in areas of midden dumping, although such breakage occurred. Consistent with this view is the fact sherds from the same vessel were frequently recovered adjacent to each other, not only in areas considered living surfaces, where this might be expected, but also in midden refuse deposits. This was seen to reflect the dumping of already broken sherds from a single vessel rather than subsequent breakage in the midden; it also attested to the general stratigraphic integrity of the midden.

Reconstruction of almost whole vessels was occasionally achieved (Figure 5.2, see also Cox 1989) and was a useful exercise in the negative sense of demonstrating the limitations of precise measurement in the collection, by illustrating the variability of rim diameters, shapes and angles which might be encountered on a single vessel. Beyond this, reconstruction seemed to be of limited analytical value and was not pursued in any systematic fashion in this analysis.

However, when the sample eventually selected for detailed analysis was assembled, a systematic attempt was made to identify multiple sherds belonging to a single vessel. This search had two different purposes: the first was to limit as far as possible the representations (i.e. sherds) of individual vessels in the sample to one, and the second was to use matching sherds from a single vessel as a test of the disturbance in the site. Matches of two sherds were most common, although matches of four or five sherds were not uncommon and up to eight sherds were occasionally rejoined. In all matched cases only one set of attribute measurements was taken in order to maintain comparability with other measured items (Irwin 1985:100-101, for discussion) and in only two instances did matched pieces come from different excavated units. In both cases the sherds were recovered from vertically adjacent levels and in each case the stratigraphically earlier sherds were included for analysis in the more recent level.

Pots and bowls: visual differentiation

The pottery rims from Motupore were hand-sorted into two basic categories of vessel shape, everted rimmed globular pots and bowls. The distinction between pots and bowls is most concisely visualised by considering the ratio of the diameter of the aperture to the total height of the vessel. For Motupore bowls, where sufficient amounts of the lower body exists to judge, the diameter of the aperture is always equal to, and usually greater than the total height, whereas for the globular pots this is never the case. Globular pots always exhibit a flaring rim above a constricted neck, while bowls do not. For pots the maximum diameter of the vessel usually exceeds the diameter of the aperture, while for bowls the maximum diameter of the vessel is often that of the aperture.

In the present collection these two general shape categories possessed a sufficient integrity and ease of visual identification to preclude the need devise tests to
differentiate them, and their sorting prior to carrying out more detailed analyses simplified the subsequent analytical tests. The same policy was adopted for Motupore by Cox (1989), for the wider Port Moresby ceramics by Bulmer (1978), for Yule island by Vanderwal (1973 and by all workers dealing with imported ceramics in the Papuan Gulf.

**Selection of attributes**

Attributes selected for analysis of prehistoric pottery are prescribed firstly by the pottery itself - that is, they must be exhibited by the pottery under examination - and secondly by the aims of the analysis. Within these constraints there are nevertheless a variety of characteristics available for consideration. Irwin (1985:101-2) lists form, decoration, technology, function and context as the five major categories whose descriptions are commonly most useful to archaeologists.

Form attributes describe the shapes and sizes of pottery. Decoration attributes can be divided into those which delineate motifs, techniques, or location zones on the pots where decoration occurs. Technological attributes are concerned with how the pots were made - with forming techniques, composition of the fabric, firing temperatures *et cetera*. Functional categories can be derived from other analyses or by recourse to ethnographic comparisons. Lastly, contextual analyses examine the distribution of chosen attributes in an archaeological space-time framework.

In general the analysis of the Motupore pottery makes recourse to all of these categories. In attempting to develop a classification of the pottery in conventional archaeological terms however, two approaches previously used in Melanesia have been excluded in the current study.

**Paste**

Specht (1969:69) elected to use paste categories as one of the primary elements underlying his entire analysis of the pottery from his excavations on Buka and Sohano Islands, but in general, archaeologists working in Melanesia have usually encountered difficulties in differentiating pastes in their excavated pottery (see Chapter 6). This difficulty was also encountered in the Motupore pottery. The ceramics comprise low-fired earthenware, tempered with shell/sand. While in section some sherds appear to have more or less temper present, no objective criteria could be determined for hand sorting the sherds on this basis. Instead discussions of paste have been grouped with the technological analysis of the pottery conducted by Owen Rye (Chapter 9).

**Analysis of decorative motifs**

The use of decorative motifs as a meaningful analytical device has been used successfully in Melanesia to study Lapita pottery (e.g. Green 1979:40-4), a tradition characterised by the formality of intricate and precisely executed motifs shared to greater or lesser degree by a large number of geographically dispersed sites. Within the general range of prehistoric Melanesian pottery traditions however, Lapita is unusual in terms of this consistency of formal and complex motifs. It seems not surprising therefore that decorative motif has been relegated to a minor role in the formulation of Melanesian pottery classifications in non-Lapita contexts. Specht (1969: 80-4) used decoration motifs that were formulated in conjunction with location on the pot and technique of execution rather than as individual attributes. An examination of the motifs alone (Specht 1969: plates 8-21) suggests a strong element of subjectivity in the groupings used. Irwin (1985:110) found that sherd size precluded any systematic study of motifs and excluded them from his major analysis,
and Vanderwal also rejected their use in forming his primary classification on the grounds that their use would be 'intuitive' (1973:60).

Examination of the pottery from Motupore and a large number of Port Moresby surface collections also led me to the decision to exclude motifs from my primary analysis on the grounds that they are mainly too simple to quantify in any objective fashion. I was (and remain) not confident differentiating between single rows of short straight line incisions which may be vertical or slope to the left or right, particularly when on some of the larger sherds such lines may grade from vertical to sloping (e.g. Figure 5.2). Despite Shepard's (1968:358-63) dictum that decoration motifs are a sensitive indicator of cultural change, such simplified motifs seem unlikely to be useful discriminating attributes in describing the Motupore wares.

On the other hand, Bulmer based her analysis of the nearby and contemporaneous Taurama pottery assemblage, and a number of other Port Moresby sites, almost entirely on decoration technique, position of decoration and 'design units', adding only lip shape to her list of systematically investigated attributes (1978:77-9; Chapter 6). Bulmer defined 148 design units which she describes as follows (1978:75):

Like the Lapita studies mine has attempted to describe a decorative 'vocabulary', but this has been found to be less complex and I have been obliged mainly to deal with design elements rather than motifs. In [my] study I have combined elements and motifs as 'design units', for there are very few units that are motifs.

Since comparisons between Taurama and Motupore loom large in this study an attempt was made to classify a sample of Motupore pottery using Bulmer's design units. One hundred decorated sherds were sorted by three different people on two occasions a week apart. An 83% correspondence was achieved by one person's two attempts, while the other two people achieved lower scores. The best correspondence between different people was 69%. Two problems emerged: firstly difficulty was experienced in choosing one or other of the design units since they are often very similar; secondly, although minor differences of decoration become different design units in Bulmer's list these did not accommodate all the minor variations in the Motupore sample. Thus the familiar problem of forcing individual examples into ideal types emerged. On the basis of the poor results from this test no further comparisons were undertaken. There is thus no existing systematic basis for comparing the Motupore and Taurama assemblages but some general comparisons will be attempted in Chapter 8, which deals with the decoration of the Motupore pottery as a separate and subsidiary study.

**Sampling the population for detailed analysis**

By retaining only the rim sherds and decorated body sherds, as described, a sample of 28,425 sherds was available for analysis from the Motupore site as a whole. A subset of this assemblage was required for typological analysis for various reasons outlined here. Ideally, this subset would come from a single square to maximise the stratigraphic integrity. However, as seen in Chapter 4 (Table 4.8), no single square encompassed the full sequence. Consequently the M23/IV sequence was chosen to form the basic sample since this constituted the fullest sequence in one area and this was supplemented for those levels which were either not represented or had only small sample numbers with additional sherds from two nearby squares, K21/II and K22/III. In the former square material had only been retained from those levels below the dense midden deposits; thus levels 1 to 6 in K21/II represent ISLs between ISL 7
and ISL 15. For K22/III only the levels between 4a and 10 (between ISL 5 and ISL 15) were added to the sample for detailed analysis.

The potential bias of sherd size

The quantity of sherds available for analysis in the collection and their overall large size allowed certain choices to be made about which approaches would provide the most information for the questions outlined earlier in this chapter. Since each choice narrowed not only the size of the absolute sample, but also perceptions of the nature of the collection as a whole, each had to be objectively justified to demonstrate that the ultimate sample fairly represented the original collection.

Irwin (1985:101) argues cogently against an analyst’s inclination to choose large sherds - the procedure that was adopted for the analysis of the Motupore pottery. He points out that the selection of only the larger rim sherds assumes in advance of the analysis that these sherds will hold the largest information content, and that the assumption may be unwarranted. He cites as an example measurements of thickness undertaken on pottery from the Solomon Islands, where variations were an indicator of relative chronology.

Mention has already been made of the body thickness variable in the Motupore collections, where thickness was seen to vary on individual sherds, but overall did not vary greatly between sherds or through time. As well, a different test was carried out on the Motupore collection. As will be discussed more fully below, the samples used for analysis are those on which all selected attributes can be measured. Thus two sets of sampled and rejected sherds from different layers in M23/IV, one of pots and one of bowls, were measured, with the sampled and rejected individuals in each set being compared. Of all the attributes able to be measured in the rejected samples, all were also present in the sampled population. Equally, all attributes measured in the sampled population could be found in the collective rejection group. As well, choosing larger sherds diminishes (but does not overcome) the problem of attributes absent because of the fragmentary nature of sherds.

On reflection, I am satisfied that the sampling required by the conditions of the analysis has not biased the results in any significant way. Choosing larger sherds carries the advantages of simplicity. It allows for the exclusion of absent data categories in the analyses and this has practical advantages in the mechanics of the analyses. It also allows the reader a clearer understanding of what is going on in the analyses and also for making other comparisons in the future. Lastly, the analyses are carried out on those sherds which most closely approximate whole pots.

Discrete and continuous variables

While the attributes chosen for analysis are described below, the principles underwriting their selection were influenced by a combination of my familiarity with the pottery and the attributes previously used by Vanderwal and Irwin. The earlier analyses of Vanderwal and Irwin (see Chapter 6) had both used a mixture of continuous and discrete variables. The former are measured on interval or ratio scales, while the latter are measured at nominal or ordinal scales.

Discrete variables were mostly uncontroversial. As discussed, it was an obvious procedure to consider globular pots with everted rims separately from the bowl forms and within these two groups to consider discrete aspects like decoration location, decoration technique, rim curvature on pots (e.g. ‘direct’, ‘restricted’ et cetera), whether bowls were carinated or not, and so on. Some characteristics like lip shape
on pots were considered from ethnographic observation to be an incidental characteristic of the forming techniques of individual potters and were thus excluded. As a general principle and so as to avoid creating numerous attribute categories, my tendency was to group rather than split; instead of a myriad of individual bowl profiles requiring intuitive reduction to ‘ideal’ representations, I considered bowl profiles as unmodified, thickened or carinated. Categories are fully described below.

Continuous variables were more contentious. On the one hand my emic knowledge suggested that vessel size and shape were the fundamental attributes to be considered in the classification. Ethnographically, Motu potters set out to make utensils with particular functions: they are containers for storage, cooking, food preparation et cetera. These functions are reflected primarily in shape and size. Decoration might have been an integral component and culturally important but this was secondary to their functional purposes. Thus orifice diameter, rim angle, body angle and so on should be important and relevant attributes in this type classification.

On the other hand, my experience outlined above suggested that Motupore pottery is so variable in manufacture that the measurements of such variables at the millimetre scale could easily separate sherds from the same vessel.

Equally these are measurements that are difficult to make accurately on vessels more regular than those from Motupore; Thompson (1982) carried out tests and suggested that many common attributes have a low level of accurate, reproducible measurement. My solution was to convert the continuous measurements into classes, so that, for example, rim width on globular pots was divided by experimentation into 4 classes: <3 cm; 3-4 cm; 4-5 cm; and >5 cm. One obvious deficiency in this approach is that while two sherds with rim width measurements of 3.9 cm and 4.1 cm are more alike in this attribute than two sherds measuring 3.1 cm and 3.9 cm, the former two would be separated and the latter two combined. In practice, however, and despite the probability that a small number of sherds may have ended in the wrong categories through measurement error, this approach captured the essence of size - ‘smallness’ and ‘bigness’ - in this attribute in a way that proved effective for the analysis, as will be seen. Concerning seriation, Irwin (1985:118) noted that the most appropriate methods for analysis may be selected logically – in his case ‘how well the mathematical assumptions correspond to the configuration of assumptions in the archaeological data’ or on their utility – in other words how well they work. The same precept can be offered for attribute selection here.

In effect, in many analyses where continuous variables are used, they are subsequently lumped in an empirical frequency distribution (Doran and Hodson 1975:39-40) in similar fashion to the size classes used here. Alternatively they must be analysed separately from discrete variables because of the incompatibility of the data sets, although as Irwin pointed out (1985:163) when he did this, it helped to provide independent confirmation of results achieved with the discrete variable set.

As noted, in the case of Motupore pottery, the variation of the same measurement on different parts of the vessel may be often so great that it introduces a problem of false accuracy by using continuous variables. Less obvious advantages and disadvantages in converting continuous to discrete variables emerged in some of the statistical analyses subsequently undertaken.
Like truly discrete attributes (e.g. decorated/non-decorated), measured data converted to classes is coded on a binary 1/0 basis in sets of classes that are mutually exclusive. While this is an efficient way of processing the data, interval scaling carries with it the further difficulty of where to define the intervals. I experimented to find the appropriate interval boundaries, where ‘appropriateness’ was necessarily determined intuitively by seeing where obvious boundaries occurred in the data. One example will suffice. All widths of globular pot rims were measured and found to lie within the range of 9 mm and 92 mm, with the distribution along a 10 mm scale being shown in Table 5.2.

<table>
<thead>
<tr>
<th>0-10</th>
<th>11-20</th>
<th>21-30</th>
<th>31-40</th>
<th>41-50</th>
<th>51-60</th>
<th>61-70</th>
<th>71-80</th>
<th>81-90</th>
<th>91-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>181</td>
<td>71</td>
<td>598</td>
<td>260</td>
<td>21</td>
<td>4</td>
<td>8</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 5.2. Motupore globular pot rim width frequency distribution in 10 mm classes.

This suggested that there are at least two size classes and possibly three, namely less than 30 mm, 31-40 mm and greater than 40 mm. For safety, the category 41-50 mm was also retained while coding, and retained for most analyses. Obviously these categories could have been lumped and/or split in other ways. I might have created two groups - one smaller and one greater than 30 mm or added the 21-30 mm category to the 31-40 mm category rather than the 11-20 mm category. Any such manipulations of the data were obviously subjective and provided categories that were judged, as Irwin says, on how well they worked.

Other category boundaries were equally arbitrary, although always erring towards more rather than fewer categories that would permit subsequent collapsing. I always considered this last approach important, providing a failsafe mechanism where categories could easily be grouped but where further splitting would require the irksome task of re-measurement.

The sample

Following the precepts outlined above, the sample for analysis consisted of 1143 pot sherds and 789 bowl sherds. When undertaking statistical processing on the Australian National University mainframe computer I was required to limit the sample size of pots to 999. This was done by reducing globular pot sample numbers within ISLs on the basis of their proportional ISL representation in the original sample. The distribution of the whole sample by ISL is shown in Table 5.3.

<table>
<thead>
<tr>
<th>ISL</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pots</td>
<td>0</td>
<td>42</td>
<td>264</td>
<td>391</td>
<td>129</td>
<td>0</td>
<td>72</td>
<td>0</td>
<td>35</td>
<td>8</td>
<td>0</td>
<td>29</td>
<td>31</td>
<td>28</td>
<td>64</td>
<td>1143</td>
</tr>
<tr>
<td>Bowls</td>
<td>0</td>
<td>50</td>
<td>184</td>
<td>331</td>
<td>84</td>
<td>0</td>
<td>73</td>
<td>0</td>
<td>25</td>
<td>3</td>
<td>0</td>
<td>8</td>
<td>7</td>
<td>4</td>
<td>20</td>
<td>789</td>
</tr>
</tbody>
</table>

Table 5.3. Distributions of globular pot and bowl sample sherds chosen for analysis, by Integrated Site Level.

In Chapter 4 it was argued that while Integrated Site Levels formed one stratigraphic division of the site, they would not provide appropriate categories for all analyses because some of these ISLs were not represented in the squares that provided the ceramic sample. This is the explanation why, in Table 5.3, ISLs 6 and 8 contain no pot or bowl samples but ISL 7 contains 195 items. Even if this was not the case, 15
analytical units would necessarily divide the site with its short 400 to 500 year time span into such short intervals (even if they were of approximately equal) that they would not identify change through time either appropriately or effectively.

**Pottery Analytical Units**

For this reason six pottery analytical units (PAUs) were formulated by simplifying the ISLs according to the stratigraphy of the squares and levels chosen for analysis (M23/IV/1-23; K21/II/1-6; K22/III/4-10). These PAUs, sample locations and the sample frequencies are shown in Table 5.4.

It should immediately be stressed that the six PAUs do not provide equal units of time. Despite the poor radiometric chronology discussed in Chapter 4, in general terms we can accept that PAU 6, PAU 5 and PAUs 1-4 provide three units roughly equal in length to 150 years each. Given that each PAU was formulated on the stratigraphy, it is useful to note that the total sherds excavated in each PAU range between 15,687 (PAU 6) and 33,001 (PAU 3). While this range is wide the large numbers of even PAU 6 are assumed to be representative. The heavy midden accumulation in M23/IV, described in Chapter 4, begins in the top of PAU 5, so that PAU 5 contains about twice as many sherds as PAU 6 over a similar time period, while PAUs 1-4, again over a similar (or perhaps shorter) time period contain more than three times the number of sherds in PAU 5. The inescapable implication is that escalating numbers of broken pottery sherds were being discarded through time.

<table>
<thead>
<tr>
<th>PAU</th>
<th>Sample location</th>
<th>Sherds</th>
<th>Sample Pots</th>
<th>Sample Bowls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M23/IV/1-3</td>
<td>22130</td>
<td>161</td>
<td>150</td>
<td>311</td>
</tr>
<tr>
<td>2</td>
<td>M23/IV/4-6</td>
<td>22789</td>
<td>145</td>
<td>84</td>
<td>229</td>
</tr>
<tr>
<td>3</td>
<td>M23/IV/7-9</td>
<td>33001</td>
<td>199</td>
<td>181</td>
<td>380</td>
</tr>
<tr>
<td>4</td>
<td>M23/IV/10-12</td>
<td>25343</td>
<td>192</td>
<td>150</td>
<td>342</td>
</tr>
<tr>
<td>5</td>
<td>M23/IV/13-16; K21/II/1; K22/III/4</td>
<td>32442</td>
<td>231</td>
<td>147</td>
<td>378</td>
</tr>
<tr>
<td>6</td>
<td>M23/IV/17-23; K21/II/2-6; K22/III/5-10</td>
<td>15687</td>
<td>215</td>
<td>77</td>
<td>292</td>
</tr>
</tbody>
</table>

**Table 5.4.** The numerical distribution of total excavated sherds, together with the numbers of globular pot and bowl sherds chosen for analysis, according to the six pottery analytical units.

**The limitations and implications of the Pottery Analytical Units**

Given this situation, the reader needs to be clear on the limitations and implications of the analytical structure employed by using PAUs. The unequal distribution of items
in the sample through time does not affect the development of a typology because, unless I deliberately seek to bias the result by manipulating the choice of attributes to use, types are to be objectively drawn from the sample as a whole. It is in the exploration of the developed types through time that the variability in sample numbers within the analytical units might possibly influence the results. The six stratigraphic units in Table 5.4 contain somewhat uneven numbers of both pots and bowls, but it seems unlikely that these variations would mask typological variability at any significant level when the data are examined in this framework.

In this form the data offer a temporal progression of stratigraphic units approximately similar in numerical content. But as just noted, if converted to ‘real time’, PAUs 5 and 6 each have an approximate time span equal to the combined timespan of PAUs 1 to 4. How might this affect the results of the analysis?

Three hypothetical scenarios are worth examining. 1) If the rate of the evolution of different sets of ceramic types (created and lost) is constant through the lifetime of the settlement, then we would anticipate PAUs 1-4 to be similar in the number of types present to those existing in PAU 5 and PAU 6. If this was true we would expect any individual PAU in the PAUs 1-4 set to have either the same number or fewer ceramic types as the others in this set. 2) If the rate of evolution decreased through time, we would expect both the PAUs 1-4 set and any of its individual PAUs to have fewer new types than PAU 5, which in turn would have fewer new types than PAU 6 (but in each case not necessarily fewer types overall since earlier types would not necessarily be lost at a faster rate than new ones would be created). 3) If the rate of evolution of ceramic types increased through time, we would anticipate more new types in both the PAUs 1-4 set and some or all of its individual PAUs, although again not necessarily more types overall.

It is not possible to predict which of these scenarios might exist on Motupore. While appeals to other site evidence suggest that the trajectory through time is one of increasing population where, logically, more potters were making more pots, it does not follow that more variability would necessarily occur in the ceramic types produced. Instead the utility of this exercise is to suggest that, individually, PAUs 1-4 are likely to reflect the same general trajectories of the ceramic types as would be seen in PAUs 1-4 taken as a set, only in more detail. Given that my argument is that the significant increase in numbers of sherds through time reflects increased production (and not merely the difference between the contents of habitation and midden layers, although this is significant) examining this period in greater detail is thus warranted. Therefore the six phase division of Table 5.4 is to be preferred to three equal time periods; and, of course, the data from PAUs 1-4 can be collapsed into a single unit as required (see Chapter 10).

The typological analysis in the following chapters has been undertaken with these provisos in mind. I return to them in the final chapter.

Choosing ceramic attributes

As noted, the initial choice of attributes depended primarily on them being ones present in the assemblage to be analysed. Beyond this, the initial choice of attributes for analysis depended on the specific questions being asked of the material, the history of previous analyses and the suitability of the attributes chosen for the analyses in mind. The questions being asked have been discussed above, as well as the bases for rejecting paste and motif analyses as a primary analytical strategy. Previous Papuan south coast analyses are assessed in Chapter 6. Beyond this, my initial selection of
attributes was inclusive rather than exclusive, and selective runs were carried out on several small data sets to test the efficacy of the attributes selected to provide meaningful results. Modifications were then made to the attribute list accordingly. It was found, for example, that although over 80% of the rim profiles of pots are straight, the 16% of concave rims and the 3% of convex rims correlated with other particular variables, so that this attribute class was retained.

Two excluded attributes: impressed decoration and lip shape

Initial attempts to code the pottery according to the attributes first selected threw up an immediate problem of always being able to distinguish between the decoration techniques of incision, where a narrow ended tool is drawn across the surface of the pot with sufficient pressure to cut it, and impression, where the tool is impressed into the clay so as to leave a negative impression. Where a scalloped tool, such as the edge of a shell, was used, the distinction was easily made and shell impression was retained as a category of decoration technique. The difficulty was encountered when the impressing tool was a simple short, straight-edged one. Microscopic examination revealed that both techniques were employed in decorating pottery from Motupore but the distinction could not be made consistently with the naked eye. Thus both techniques were subsumed under the single category incision. Thompson (1982:57) encountered the same difficulty on similar pottery collections and adopted a similar solution.

The shape of the lip of a vessel in profile, lip form, has been a favourite attribute of ceramic analysts of Melanesian prehistoric pottery, either as a separate attribute (Irwin 1985:105-7; Specht 1969:79; Thompson 1982:51) or as a distinguishing aspect of rim form (Vanderwal 1973:Ch.5; Rhoads 1980:130, Fig.VI-11). Bulmer (1978:77, Appendix 5.1e) used lip shape as the only shape characteristic in her analysis. Irwin (1985:105-7) however, makes some cogent criticisms of the usefulness of this attribute:

This variable provides an almost classic example of how certain shape attributes may be over-elaborated. However, only two major lip form classes, each with a variant form, have been isolated for study in this [the Mailu] analysis. In some cases the classes appear to be valid in that the lips of some sherds conform to them. In other cases the classes are clearly unsatisfactory for it is possible for almost all of the forms to appear on different parts of the rim of a single pot. Variability at this level diminishes the utility of lip form as an indicator of spatial or temporal patterns of ceramic diversity.

In other words, this attribute is so variable that the analyst has three choices; either include all variations, simplify to a very few, or exclude the variable. Irwin chose to simplify, setting up the classes 'round' and 'flat', each with a subclass where the 'rim contours change at tip' - either thickening or flaring on the exterior surface. Thompson (1982:51-2) exactly followed Irwin, and in order to compare this attribute with Bulmer's material he simply collapsed her 14 lip form states to his own round/flat, simple/elaborate categories.

My own visual examination has indicated that the variability in lip form on single sherds from Motupore supports Irwin's observation that a number of different lip forms can occur on a single vessel. It seems highly probable (Owen Rye pers. comm.) that this is a product of the general rim forming technique used; the use of the thumb and forefinger and the rotation of the pot on a stand, or manually drawn around the rim, can produce a range of lip profiles on a single vessel. If the tips of the thumb and
forefinger are used the lip will tend to be pointed, the central part of the forefinger and the palm may create a rounded lip, or the tip of the forefinger applied to the lip may produce a flat lip. A series of A.C. Haddon photographs taken near Hanuabada village in 1898 show these and other techniques being employed to form pot rims (see Figures 5.6 and 5.7). This suggests that rim form, within general constraints, may be idiosyncratic in Port Moresby pottery. Similarly, the Motupore rims suggest that rim forms may reflect the individual whims of the potter rather than any conscious attempt to conform to one or other particular ideal. It is for this reason that lip form was excluded from the attribute list employed in this analysis.

These comments hold true most particularly for globular pots. In the case of bowls, the upper body was frequently thickened, either by folding the rim over on itself or by adding clay to the upper body. This sometimes resulted in particular lip profiles being created. I considered developing this category for the bowls, but experimentation indicated that I began ‘forcing’ lip profiles into ideal categories. Thus bowl profiles are treated separately in Chapter 8.

Associated with this, I did not find the concept of simple and composite vessels a useful one in respect of this assemblage and did not persevere with coding these attributes.

The attribute list – globular pots

The attributes are described with the variables in each attribute class numbered sequentially.

Rim width

This is a straight-line distance measurement taken between the lip and the point where the rim changes direction to become the body. This measurement was always taken from the upper surface of the rim. As discussed earlier, trial-and-error testing suggested four interval divisions as follows:

1  30 mm or less
2  31 - 40 mm
3  40 - 50 mm
4  greater than 50 mm

In some analyses attributes were combined.

Rim profile

No pot rims in the collection are elaborate, that is, thickened or otherwise modified, particularly at the lip. While most are straight, some concave and a few convex items occurred. Concave was defined in the following manner: if any point of the inner surface of the rim fell below a straight line drawn between the endpoints of rim width, it was considered concave; convex was defined in a similar but converse manner. All other rims were classified as straight. This classification was efficient and quickly performed with the edge of a ruler.

5  Straight
6  Concave
7  Convex
**Rim diameter**

Rim diameter was determined by fitting each sherd to a set of concentric circles calibrated at 10 mm intervals, and having a radius representing 8% of each circle drawn on it. Any sherd which had less than 8% of the original rim present was excluded from the sample.

8 160 mm or less  
9 161 - 200 mm  
10 201 - 240 mm  
11 241 - 280 mm  
12 281 - 320 mm  
13 321 - 360 mm  
14 Greater than 360 mm

In many later analyses these variables were collapsed into fewer categories.

**Rim angle**

This attribute was always measured on the right-hand profile of the pot and with the rim oriented in the horizontal plane, as illustrated (Figure 5.11a).

![Figure 5.11](image)

**Figure 5.11.** a. globular pot rim angle; b. globular pot body angle; c. pot and bowl rim angle and bowl body angle, showing the method of distinguishing between rim and body on direct bowls; d. rim not carinated but modified (thickened); e. rim not modified but carinated.

A three dimensional measuring device was constructed, consisting of a 180° scale beneath a horizontal line, with the scale divided into 10° units. Both the horizontal line and the scale were etched into clear perspex sheeting and a flat wooden board was fixed behind it, so that the under-edge of the board ran along the horizontal line on the perspex. The horizontal orientation of the rim sherd could be determined against the underside of the board and the angle interval read off. An ideal, 'best fit' straight line was visually determined through the mid-points of the outer and inner extremes of the rim if it was not straight, and this line was used for the measurement.
As implied by definition, no globular pots could have in-turned rims (i.e. $> 90^\circ$). In some later analyses these variables were collapsed into fewer categories.

**Body angle**

As with rim angle, body angle was also always measured on the right-hand profile with the rim oriented on the horizontal plane, as illustrated (Figure 5.11b). The device used to measure rim angle was also used to measure body angle. Again, an ideal straight line was visually determined for the actual measurement.

15 $50^\circ$ or less
16 $51^\circ - 60^\circ$
17 $61^\circ - 70^\circ$
18 $71^\circ - 80^\circ$
19 $81^\circ - 90^\circ$

As was predicted by the definition of a globular pot, in the sample of 1143 pot sherds none fell in the category of less than vertical; four aberrant sherds were approximately $0^\circ$, and 11 others were also in the category $0^\circ - 10^\circ$, suggesting that these pots would look distinctly ‘bag-like’ rather than spherical. It is not impossible that these pots were misshapen during firing. Thus 99% of the sample were $>10^\circ$ in this attribute, as was expected. In some later analyses these variables were collapsed into fewer categories.

**Decoration position**

This attribute class defined zones on the vessel where decoration occurred. Initially it was considered useful to include an undecorated category in this class and make it a coded attribute, however this led to the undue weighting of this variable for some statistical analyses, as discussed in Chapter 6.

29 Undecorated
30 Internal Rim
31 On Lip
32 External Rim
33 Neck
34 External below Neck (Body)
Decoration technique

Amongst the variety of techniques used to decorate Motupore pottery, reference has been made to the difficulty encountered distinguishing between incision and simple impression.

A second aspect which requires some brief discussion is the inclusion of the category 'buff surface' in this attribute class. Examining the pottery in the field and subsequently in the laboratory, it was obvious that painting frequently occurred on a distinctly different coloured ware - it being lighter and yellower than the normal orange-red fabric of most sherds on the site. My first impression was that this painted ware might also be slipped. Owen Rye's opinion was that even the best 'slipped' examples were only examples of 'self-slipping' and that this term should be avoided. As, however, he also considered the fabric to possess a distinctly different colour he carried out a series of experiments. His conclusion was that painted pots are likely to have been deliberately fired to a higher temperature than non-painted pots. In order to monitor the correlation between fabric colour and painting both techniques have been included in this attribute class. However, I found no absolutely satisfactory way to quantify this colour differentiation; thus it should be borne in mind that the ‘buff’ variable within this attribute class is particularly subjective. Further discussion of this surface appears in Chapter 9.

The original variables list for this attribute included punctuation and finger impression. However no globular pots in the sample had these decoration techniques and they were thus excluded.

35 Incision
36 Slashing
37 Shell Impression
38 Combing
39 Applied Nubbins
40 Buff Surface
41 Painting

As discussed above, incision includes simple tool (other than shell) impression because of the difficulty of always being able to distinguish the two techniques in the present collection. It represents the cutting of the clay surface prior to firing by using a narrow-ended and sometimes pointed tool. Slashing is a variant of incision. In the present collection a small number of sherds (and more frequently bowl forms) were decorated with significantly deeper and wider incisions and it seemed worthwhile to differentiate these from other incised sherds. Shell Impression entails impressing the soft clay with a shell tool prior to firing. In the present collection this virtually always means the use of the edge of a bivalve, similar to Anadara species, to produce a series of short crenellated impressions in the surface. As discussed in Chapter 11 (see Figure 11.19) a class of shell tools from Motupore, similar in size and shape to a guitar plectrum, are likely pottery decorating tools. Combing is a variant of incising, using a multi-pronged implement to produce straight or wavy parallel lines on the soft surface. In this collection the use of a two-pronged comb is most common, but occasionally the tool has three or four prongs. The use of appliqué decoration in the real sense is absent in the Motupore assemblage, however single applied nubbins
occur. Although few in number, it was considered worthwhile incorporating this attribute in initial coding in order to monitor their stratigraphic occurrence. As discussed above, *buff surface* is not strictly a decorative device, but was included in order to monitor its relationship to painted decoration.

A number of both pot and bowl sherds from Motupore are decorated with *painting*. The likely colourant is ground haematite, although this was never definitely determined. It has been applied with some form of brush in a variety of simple lines, dots and chevrons and is the only form of decoration to occur consistently on the body portion of pots.

**The attribute list - bowls**

Attributes chosen to classify the Motupore bowl forms are similar to those used with the pot forms, with variations employed to accommodate the fundamental shape difference between the two categories.

**Rim diameter**

This was measured in the same manner as it was for globular pots, with the same condition, that sherds which had less than 8% of the original rim present were excluded from the sample.

1. 100 mm or less
2. 101 - 140 mm
3. 141 - 180 mm
4. 181 - 220 mm
5. 221 - 260 mm
6. 261 - 300 mm
7. 301 - 340 mm
8. 341 - 380 mm
9. Greater than 380 mm

For some later analyses these categories were collapsed into smaller groups to provide a general 'small, medium and large' grouping.

**Rim angle**

The distinction between rim and body on the Motupore bowls had in many cases to be determined arbitrarily since the majority of them are simple or 'direct' bowls. The rule applied was to define the rim/body boundary as the point at which a projected straight line from the mid-point of the lip reached the outer surface of the bowl, as illustrated (Figure 5.11c). Extreme lip modification such as external flanging occurred so infrequently that this did not complicate this approach with this collection. In other respects this measurement was made in the same manner as for pots.

10. 50° or less
11. 51°-60°
12. 61°-70°
13. 71°-80°
14. 81°-90°
For a number of later analyses these categories were collapsed to provide three general categories of 'everted', 'vertical' and 'inverted'.

**Body angle**

The upper body angle was taken from a straight line drawn from the rim/body boundary in the direction indicated by the first 20-30 mm of the body wall. Body angle was always measured on the right-hand profile with the rim oriented on the horizontal plane, as illustrated (Figure 5.11c). While in most cases this measurement was easily taken, there were some examples where the continuous and extreme curvature of the body made this measurement difficult.

For a number of later analyses these categories were collapsed to provide three general categories of 'shallow', 'deep', and 'restricted'.

**Profiles**

The collection of bowls from Motupore contained an extensive variety of lip and rim profiles. As discussed earlier, no attempt was made to develop a suite of ideal shapes against which to match the sampled collection as an attribute class. A considerable amount of alteration to the external surface of the rim was, however, a common feature on much of the pottery. This has taken the form of a distinctly thickened rim (and/or lip) created in the forming process either by a particular distribution of the clay when the walls were drawn up (such as folding the rim over), or by the addition of clay immediately after this process. This thickened portion of rim/lip was often the focus of decoration and was thus an important attribute to quantify. Each rim is thus classified as either modified (thickened) or unmodified.

The external profile of the thickened rim allows some vessels to be thought of as carinated. However some bowls that have no rim thickening are also carinated. From experience with the collection I felt that these latter bowls might form a separate group with temporal significance. For this reason I distinguished rim thickening and carination as follows: a rim was considered thickened when the directions of the inner and outer walls visibly deviated from each other, and thus, usually, diverging from being approximately parallel. A true carination was distinguished from a thickened rim by the inner and outer walls remaining approximately parallel and also by the
sharp external change in direction also being present on the inner wall, as illustrated (Figure 5.11d-e). Both modified and unmodified rims could either be carinated or not carinated.

27 Unmodified rim  
28 Modified (thickened) rim  
29 Carinated  
30 Not carinated

*Decoration position*

As with the globular pots these are basically self-explanatory.

31 Undecorated  
32 Internal  
33 On lip  
34 External on rim  
35 External on body

From the previous definitions, decorations on modified rims and on the point of carination fit properly into attribute 34 rather than 35.

*Decoration Technique*

Comments previously made concerning decoration techniques on globular pots pertain equally to decoration techniques used on the Motupore bowls.

36 Incision  
37 Slashing  
38 Finger Impression  
39 Shell Impression  
40 Combing  
41 Applied Nubbins  
42 Buff Surface  
43 Painting

These decorative techniques have been described as attributes on pots in the collection. The only additional technique used on bowls is *finger impression*. This comprises the use of the finger to displace clay, almost always on a thickened rim, upwards into a series of arcades.

Two other techniques were initially considered but subsequently excluded from the analysis. While the majority of undecorated surfaces were smoothed, thus obliterating surface indications of bowl forming processes, a number had only been roughly finished by scraping the surface with an edged implement, probably a smooth-edged shell. It was eventually decided that this surface treatment would not be identified as decoration. Secondly, the manipulation of some thickened rims during manufacture occasionally resulted in a groove below the thickened rim.
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Table 5.5. Number and weight in grams for all pottery sherds recovered from the listed excavation areas, divided into categories. Note: For J22/Extension only some rim and body sherds were retained.
Unlike the multiple grooving seen on bowls in the Port Moresby EPP sites, the removal of surface clay to form distinct grooves in the surface of the Motupore bowls is so highly infrequent that it was excluded on the basis that it probably an accidental by-product of rim thickening that would not inform the classification by its inclusion.

**Numerical Analyses**

*Raw counts*

Although total data counts are not always provided in reports like this one, they are offered here in support of arguments that have put forward in this and earlier chapters.

**Whole site**

Table 5.5 gives the distribution by number and weight for pottery from each excavation area of the site. From these data the average weight of sherds from each area was calculated. Average sherd weight is reasonably consistent across the site, with sherds from the designated midden areas against the hill and midden areas on the sand spit being slightly heavier, and therefore probably larger, than those from the squares on the sand spit which were interpreted to have been predominantly habitation areas. This distribution is consistent with that interpretation. For most squares the rim and decorated body sherds retained for analysis are more than twice as heavy as the average sherd weights within their squares and thus even heavier than the discarded body sherds. The total weight of processed sherds was 3.989 tonnes.

**Sampled units**

As already described, square M23/IV and particular levels of squares K21/II and K22/III were chosen on the basis of the stratigraphic analysis to provide a full sequence of pottery for detailed analysis. Raw counts from these sampled units have been given in Table 5.4 according to the six pottery analytical units; here Table 5.6 provides these data by squares and excavated levels.

As expected from the whole site data, the rim sherds in the sample group are normally much heavier (and thus presumed to be larger) than the body sherds, a difference accentuated in this table by the separation of decorated body sherds into a separate category.

Missing decorated body sherd data for K22/III/9 is best explained by the large numbers for this category for K22/III/8, thus suggesting a mis-labelling episode in the field. Since both layers are incorporated into the same pottery analytical unit (PAU 6) this creates no further problem.

The stratigraphic break in M23/IV discussed previously in Chapter 4 is reflected in Table 5.6 in terms of the sudden fall in absolute sherd numbers between levels 14 and 17 of this square, with the break encompassing the changed use of this area of the site from an area of habitation to one of dumping. The numerical trends for K21/II and K22/III indicate the same changed use of these areas of the site. *Inter alia*, these distributions support the allocation of the levels in these squares to their particular pottery analytical units.

A check was made to ensure that trends in the raw figures were not the product of differential volumes of deposit producing different numbers of sherds. Table 5.7 shows the raw sherd counts corrected for density. These data again show the drop in
sherd densities from the midden layers to the habitation layers beneath. The midden layers above red grit A have substantial numbers, though fewer than the midden, and those below have many fewer.

These data also show clearly that in each square, each of the red grit layers contain appreciably fewer sherds than the intervening sand layers, a result which is consistent with the suggestion that their deposition as geomorphological events were short-spaced individual erosional events from the hill slope behind. However these were unlikely to be instantaneous hill slope collapses. They more likely reflect periods of increased and significant erosion such as might be expected during intense wet season rains.

A second diachronic trend is apparent in the frequency of decorated body sherds. Figure 5.12 expresses these sherds as a percentage of the total sherdage in each of the six pottery analytical units. Although these percentages are small they show a clear trend through time of a decreasing percentage of decorated body sherds. While this category includes handles and lugs as well as decorated body sherds, it will be seen in Chapter 6 that this distribution is essentially a proxy for painted decoration.

![Figure 5.12](image)

**Figure 5.12.** Decorated body sherds expressed as a percentage of all sherds by pottery analytical unit (PAU).

**Summary of raw counts for sampled units**

The three squares and layers chosen to provide the sample for detailed analysis confirm, in terms of their raw ceramic counts, the stratigraphic arguments presented in Chapter 4 for their selection. The manner in which they were related stratigraphically and integrated into the ISL scheme and subsequently into the PAU groups is supported by these initial raw count analyses as being a realistic basis on which to proceed to finer levels of analysis. In other words they possess the stratigraphic integrity required to undertake the diachronic enquiries discussed at the beginning of this chapter.
<table>
<thead>
<tr>
<th>Square/Level</th>
<th>Rim sherds</th>
<th>Decorated body sherds</th>
<th>Undecorated body sherds</th>
<th>Total</th>
<th>Average weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>Wt</td>
<td>No</td>
<td>Wt</td>
<td>No</td>
</tr>
<tr>
<td>M23/IV/1</td>
<td>276</td>
<td>4198</td>
<td>7</td>
<td>95</td>
<td>8404</td>
</tr>
<tr>
<td>M23/IV/2</td>
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<td>3</td>
<td>59</td>
<td>4728</td>
</tr>
<tr>
<td>M23/IV/3</td>
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<td>0</td>
<td>8013</td>
</tr>
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<td>M23/IV/4</td>
<td>413</td>
<td>8761</td>
<td>15</td>
<td>305</td>
<td>7721</td>
</tr>
<tr>
<td>M23/IV/5</td>
<td>538</td>
<td>8350</td>
<td>77</td>
<td>1271</td>
<td>10539</td>
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<tr>
<td>M23/IV/6</td>
<td>169</td>
<td>3025</td>
<td>29</td>
<td>620</td>
<td>3288</td>
</tr>
<tr>
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<td>35</td>
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<td>11490</td>
</tr>
<tr>
<td>M23/IV/8</td>
<td>662</td>
<td>12773</td>
<td>102</td>
<td>1887</td>
<td>12144</td>
</tr>
<tr>
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<td>7738</td>
<td>128</td>
<td>1817</td>
<td>7570</td>
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<tr>
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<td>43</td>
<td>570</td>
<td>5111</td>
</tr>
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<td>2395</td>
<td>8650</td>
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<tr>
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<td>12525</td>
<td>77</td>
<td>1259</td>
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<td>10337</td>
<td>152</td>
<td>2454</td>
<td>7786</td>
</tr>
<tr>
<td>M23/IV/14</td>
<td>408</td>
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<td>72</td>
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</tr>
<tr>
<td>M23/IV/15</td>
<td>162</td>
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<td>15</td>
<td>286</td>
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</tr>
<tr>
<td>M23/IV/16</td>
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<tr>
<td>M23/IV/17</td>
<td>14</td>
<td>167</td>
<td>19</td>
<td>169</td>
<td>358</td>
</tr>
<tr>
<td>M23/IV/18</td>
<td>33</td>
<td>512</td>
<td>30</td>
<td>444</td>
<td>567</td>
</tr>
<tr>
<td>M23/IV/19</td>
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<td>111</td>
<td>7</td>
<td>73</td>
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<td>28</td>
<td>2</td>
<td>33</td>
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<td>1370</td>
</tr>
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<td>Number</td>
<td>Weight (g)</td>
<td>Number</td>
<td>Weight (g)</td>
<td>Number</td>
</tr>
<tr>
<td>----------</td>
<td>--------</td>
<td>------------</td>
<td>--------</td>
<td>------------</td>
<td>--------</td>
</tr>
<tr>
<td>M23/IV/22</td>
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<td>1455</td>
<td>31</td>
<td>748</td>
<td>460</td>
</tr>
<tr>
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<td>400</td>
<td>32</td>
<td>544</td>
<td>223</td>
</tr>
<tr>
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<td>2503</td>
<td>96</td>
<td>1240</td>
<td>3592</td>
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<tr>
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<td>17</td>
<td>285</td>
<td>207</td>
</tr>
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<td>27</td>
<td>559</td>
<td>342</td>
</tr>
<tr>
<td>K21/II/4</td>
<td>6</td>
<td>125</td>
<td>37</td>
<td>388</td>
<td>192</td>
</tr>
<tr>
<td>K21/II/5</td>
<td>6</td>
<td>75</td>
<td>36</td>
<td>440</td>
<td>163</td>
</tr>
<tr>
<td>K21/II/6</td>
<td>4</td>
<td>59</td>
<td>8</td>
<td>112</td>
<td>65</td>
</tr>
<tr>
<td>K22/III/4</td>
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<td>5334</td>
<td>9</td>
<td>152</td>
<td>4380</td>
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<tr>
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<td>75</td>
<td>1024</td>
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<tr>
<td>K22/III/6</td>
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<td>16</td>
<td>160</td>
<td>365</td>
</tr>
<tr>
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<td>1450</td>
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<td>1118</td>
<td>586</td>
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<td>K22/III/8</td>
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<td>1384</td>
<td>235</td>
<td>3361</td>
<td>1143</td>
</tr>
<tr>
<td>K22/III/9</td>
<td>31</td>
<td>592</td>
<td>0</td>
<td>0</td>
<td>93</td>
</tr>
<tr>
<td>K22/III/10</td>
<td>4</td>
<td>106</td>
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<tr>
<td><strong>Total</strong></td>
<td>7340</td>
<td>149534</td>
<td>1731</td>
<td>28004</td>
<td>142321</td>
</tr>
</tbody>
</table>

**Table 5.6.** Number and weight in grams for all pottery sherds recovered from M23/IV, K21/II and K22/III divided into rim sherds, decorated body sherds (including lugs and handles) and plain body sherds.
Table 5.7. Density corrected sherd numbers for squares and levels chosen to provide the pottery for detailed analysis. NR = not represented. See text for discussion.

Beyond these trends, the overriding impression of these analyses is one of continuity in the pottery throughout the period of site usage. While this may not be surprising in straight numerical analyses, it is a pattern which will be repeated in the analyses reported in the following chapters.
CHAPTER 6 APPROACHES TO POTTERY TYPOLOGY IN PAPUA

Exigencies of language require us to think and talk about pottery types as though they had some sort of independent existence. "This sherd is Baystown Plain." Upon sufficient repetition of this statement, the concept of Baystown Plain takes on a massive solidity. The time comes when we are ready to fight for dear old Baystown (Phillips, Ford and Griffin 1951:66).

Like other scientists, archaeologists classify the objects they excavate as a means of describing them, but beyond this they do so to present data in forms that will facilitate subsequent analysis. Traditionally, the analyst defined artefacts as a series of attributes, and then grouped artefacts into types, types into assemblages, and then assemblages into higher entities such as cultures. This seemingly uncomplicated procedure is anything but simple, moving rapidly from particular physical attributes considered important for defining the archaeological entity, to conceptual structures that are frequently seen to ‘explain’ the archaeological record.

Even at the first step this progression is problematical on two grounds, the first being that the attributes chosen to define the artefact – here ceramic vessels - are almost always intuitive. As well, this process immediately moves from the ‘real’ world of pots to the abstract one of sherd attributes that become proxies for pots. One dilemma is that while typologies seek to uncover patterns by simplifying attribute variability in data bases that frequently comprise hundreds or thousands of entities, different dimensions of attribute variability may reflect different dimensions of cultural variability (Binford 1965; Frankel 1991). Thus it is necessary to understand the specific objectives of the typology beyond general description and exactly how it will achieve the chosen objectives.

Additionally today, attempts to classify fabrics using a barrage of physical and chemical analyses, including petrography, scanning electron microscopy, x-ray and mass spectrometry and neutron activation analysis, to name just some, provide different approaches particularly useful for sourcing pottery. Our own attempts to source Motupore pottery are examined in Chapter 9.

Typology in the United States – the type-variety approach

Vast amounts of time, effort and argument have been devoted to understanding, developing and defining the elements of classification, especially for pottery and especially in the United States, where meetings like the 1927 Pecos Conference (Kidder 1927) began to establish methods to standardise ceramic classification. It was from meetings such as this that the type-variety binomial system emerged, widely used to name North and Central American types. In this scheme the first descriptor frequently offers a geographical location and the second a reference to the surface treatment, e.g. ‘Death Valley Brown’ or ‘Baystown Plain’. Such hold-all categories have apparent utility in their simplicity but frequently conceal aspects of form and decoration that might more accurately define the type. Worse still they frequently limit understanding of the variability among entities in such groups.

In north and central America the widely used type-variety system separates an assemblage into four hierarchical groups: the primary and overarching category is ware which is used to incorporate attributes of paste composition and surface finish; type is used to combine decorative techniques and vessel form; variety to differentiate
within a type to reflect an element not universal at the type level, such as a distinctive temper, a particular form element such as a handle design, or a specific decorative motif; and finally, group. In practice group is used for several different tasks, sometimes to collect together contemporaneous types of the same ware occurring in the same horizon, sometimes to absorb sherds of the same ware that span multiple phases, and sometimes to group small and weathered sherds of the same ware that cannot be attributed to one type or another.

Refinements and debates, some heated, have modified the type-variety approach and the development of an alternative modal approach based on attributes rather than sherds (Rouse 1939) and in some instances the merging of the two (Sabloff and Smith 1969). Debates continued through the twentieth century (e.g. Colton, 1943; Brew 1946:44-66; Taylor 1948; Dunnell 1971a, 1971b; Phillips 1958; Wheat, Gifford and Wasley 1958; Gifford 1960; Smith, Willey and Gifford 1960; Spaulding 1953, 1976; Wright 1967) and continue today (Culbert and Rands 2007; Adams 2008; Rice 2013).

This brief overview is meant to indicate that ceramic typology is neither simple nor straightforward. Three central points emerge from this and other literature on classification. The first is that both the forms and the efficacy of any typology are directly related to the nature of the data under analysis; attributes that are a pertinent measure for one assemblage may not work for the next. The second is that, like any other analysis, typology needs to be geared towards the questions being asked of the data. The third, emerging from the first two and a point made by many others before me (see the epigram at the head of this chapter), is that typology is a just a tool, not an end in itself. To quote Dunnell (1971b:118): ‘Classifications are logical constructs whose justification lies in their utility. They are not inherent nor do they explain.’

Monothetic versus polythetic types

Earlier definitions of the type concept in archaeology were monothetic, where a type was considered to be a group of entities that always shared a unique set of attributes that was both sufficient and necessary for membership in the group (e.g. Childe 1956:5-6; Kreiger 1944:277; Sokal and Sneath 1963:13). It was subsequently recognised that archaeological pottery types in practice were mostly polythetic in nature, where each individual in a group possessed some but not necessarily all of the attributes of that group (e.g. Clarke 1968:191; Whallon 1972). Clarke (1968:37) defined polythetic types as a group of entities such that each entity possesses a large number of the attributes of the group, each attribute is shared by a large number of entities in the group and no single attribute is both sufficient and necessary for group membership.

However Whallon (1972:15) argued that with polythetic clustering there is a hierarchy of importance among the attributes that are considered in turn and that the criteria for defining types change from one level to the next in this tree type classification. Not all attributes are considered when defining a type and the number of attributes that define a type can vary. Such types are fundamentally different to monothetic or ‘paradigmatic’ types.

It is instructive at this point to consider the approaches to pottery classification adopted by the principal researchers along the Papuan south coast.
Ceramic classification on the Papuan south coast

Vanderwal at Yule Island/Hall Sound

Three early analyses of south coast prehistoric pottery undertaken in the 1970s (Vanderwal, Irwin and Bulmer) adopted different procedures. Ron Vanderwal, trained in Michigan and Wisconsin, sought initially to implement the type-variety approach. He began by advocating the use of as wide a list as possible of descriptive (discrete) variables together with a smaller range of continuous variables. The former included ‘paste, surface treatment of sherds, rim form and decorative motifs and techniques’ and the latter a range of measurements on the sherds themselves (Vanderwal 1973:59-60).

Immediately these objectives stumbled on the data: ‘No paste categories suggested themselves on visual grounds. …. post-depositional changes had affected the surface of the pottery to a degree which made positive identification of vessel treatment on many sherds impossible’ (1973:59). Likewise, rim and body thicknesses showed ‘no readily discernible differences in the pottery collections’ (1973:60). Wishing to avoid intuitive (‘eye-ball’) classifications, Vanderwal instituted what he called ‘statistical classification’ where rim shapes became the main discrete variable against which he tested aperture radius, several wall angles (depending on whether the vessel was ‘direct’ or ‘composite’) and an index describing the relationship of wall angles on composite vessels.

Vanderwal’s analysis came at a time when computer analyses of archaeological data in Australia were still novel, and he elected to employ a punch-card system of analysis with which he was familiar. This limited the potential scope of the analysis. Vanderwal was influenced by the tenets of numerical taxonomy (Sokal and Sneath 1963) including the arguable notion that each attribute (= Vanderwal’s feature) should be of equal weight (see below).

These analyses led to the globular pots (= Vanderwal’s jars) being divided into two main types characterised by larger and smaller apertures, with the latter having a more globular form (1973:72). Bowls, having more variability, proved more complicated and required the re-introduction of surface treatments (rim and body grooving and the presence/absence of decoration) as categories. The end of this preliminary stage resulted in 26 vessel forms, six being globular pot forms, decorated and undecorated; twelve being direct bowl forms; and eight being composite bowl forms.

This preliminary classification was then tested against its chronological distribution to separate out meaningless and inconsistent classes of vessel form and thus to produce types defined as temporally significant attribute sets (1973:85). Ultimately this led to the creation of 18 pottery types. These were subsequently used in the overarching formations of technological and cultural complexes.

Vanderwal’s work prompts several observations. This was a monumental piece of work undertaken as a pioneering study in an archaeologically unexplored landscape, where quantities of sherds from a number of sites were integrated into a chronological framework by the use of an original taxonomic approach and without the aid of a computer. Beyond this, several points emerged in Vanderwal’s analysis that informed subsequent ones, including the present study. The first was Vanderwal’s early discovery that classifications based on the visual discriminations of different pastes, the primary discriminator in the type-variety approach, were not possible with prehistoric Papuan earthenwares. This general truism has not been seriously
questioned by subsequent analysts. The second was that Vanderwal’s analysis demonstrated the uncomfortable fit between numerical taxonomy applied in biological studies and archaeological ones. It was immediately difficult to follow Sokal’s and Sneath’s (1963) precept that an ideal taxonomy uses as many characters (= attributes) as possible and should employ at least 60, whereas Vanderwal’s study used only a handful. Vanderwal’s (1973:69) explanation, that the biologist has many characters but few organisms whereas the archaeologist chooses few attributes but has many entities (individual sherds), does not obviate this problem. It also impinges on another Sokal and Sneath precept: that all characters have equal weight. Obviously, by reducing attributes to manageable numbers, no weight had been given to excluded attributes. In other words, within the taxonomic process this effectively (and subjectively) assigned greater importance to some attributes over others. Such choices must almost always be intuitive, and are subsequently reinforced or rejected by whether or not they work.

If this is admitted, it leads to other considerations. Significant attribute relationships in Vanderwal’s statistical classification were established using a matrix of student t test null hypothesis rejections designed to give the selection of related attributes some mathematical objectivity. This implied, as does Sokal’s and Sneath’s numerical taxonomy, that types are to be defined as monothetic sets, where membership requires that included entities possess all the attributes that comprise the set. However Vanderwal (1973:99) abandoned this precept, concluding that ‘as the types may be identified by certain key attributes, a specific attribute set may be limited to only a few attributes’ and that ‘all the attributes described for a type need not be on every sherd’. By this stage Vanderwal’s types were polythetic.

The final elephant in the room was the growing importance throughout the analysis of the locations, techniques, and to a lesser extent the motifs of decoration, initially avoided by Vanderwal for their subjectivity, but which emerged throughout the study as important attributes.

None of these comments should be construed as criticisms of the Vanderwal typology. This work pointed up the problems future analysts would face in this region and took a number of us through a steep but important learning curve. The degree to which Vanderwal’s typology maintains great centrality in EPP studies after 40 years is a measure of its success.

**Irwin at Amazon Bay-Mailu Island**

Geoff Irwin’s approach to classification in his research area bore some similarities to Vanderwal’s earlier work but many more fundamental differences. Trained at the University of Auckland, Irwin was aware of the early analyses of Pacific and especially Lapita pottery and the approaches adopted in that sphere of archaeological research. More importantly, Irwin had undertaken research into settlement patterns in the Shortland Islands and had developed the analytical tools to pursue them (Irwin 1972, 1973). His research at Amazon Bay was developed to ask similar questions and to employ similar approaches. Pottery analysis was central to both these studies.

The initial approach in Amazon Bay was to classify the formal attributes of the pottery, then to construct a ceramic sequence in the excavations that would offer a relative chronology for dating his surface collections, as a basis for delineating settlement patterns. From this would develop a typology to examine chronological
change, with the ultimate aim of examining the rise of Mailu as a central place, based on its monopoly of pottery manufacture in the area (Irwin 1985:100).

Thus while the methodology was similar to Vanderwal’s approach in its stepped progression of primary tasks, and while it also adopted the principles of numerical taxonomy advocated by Sokal and Sneath (1963), it was very different in its intentions and its implementation. Irwin delineated 58 attributes in six discrete attribute classes (class of sherd [i.e. body sherd, everted rim sherd, et cetera]; class of rim shape, lip shape, surface modification, decoration location and decoration technique) and a seventh class of continuous attributes (orifice diameter and various other measurements). Irwin did not distinguish between globular pots and bowls in the manner of Vanderwal and later Port Moresby archaeologists, probably because a category of restricted necks and everted rims on globular pots was not a common form in much of his ceramic sequence. Motifs could not be dealt with systematically because of the fragmentary nature of the sherds, but were identified and illustrated according to their stratigraphic locations in various sites.

Irwin initially established c. 350 attribute combinations simply by inspection, obviating the need to determine them by more complicated analysis. This number was much larger than Vanderwal’s initial 26 types partly because of the larger number of attributes included in Irwin’s analysis and partly because Vanderwal had excluded many combinations by his initial statistical classification.

Because Irwin’s initial attribute list was exhaustive, attributes could be culled or merged on various grounds, such as when the differences between attributes were minimal or arbitrary, or when a class had too few members, or on the basis of their distributions in layers and sites, and so on. Irwin eventually arrived at 115 attribute combinations where combinations (as opposed to classes) were defined on as few as two attributes and on a maximum of seven. Membership in any combination could be as low as a single member.

At this point Irwin turned to a seriation of the archaeological units he had established (site layers, spits and surface collections) to create a cultural sequence. Attribute combinations with as few as one member did not compromise this analysis, because attribute combinations with only a few members were only a part of the many such attribute combinations that defined layers or surface collections. Thus for this exercise and the subsequent cluster analyses that Irwin undertook, small membership combinations were data points that were as equally valid as combinations with many members. Irwin also moved further away from the Vanderwal approach at this point by introducing the use of a computer for his complex statistical manipulations.

Irwin’s later analyses need not concern us here except to note that while he continued to adhere to the tenets of numerical taxonomy, he made specific note of the necessity to sometimes abandon the equal weighting condition in creating classes (Irwin 1985:118).

Because Irwin turned to seriating and clustering data at the layer or surface collection level, the 115 attribute combinations were as close as Irwin got to a pottery typology in the orthodox sense, although his descriptions of attributes and some of the simple seriations have typological uses. He made no attempt to simplify, formalise, or otherwise group and describe his 115 attribute combinations because the aim of his analysis, to explain the rise of Mailu as a centrally placed entrepôt, did not require this, or initiating external ceramic comparisons. Instead Mailu’s rise was explained in
terms of local processes. The disadvantage of this strategy is that it has made comparing external collections to the Mailu pottery a difficult task, frequently limited to visual comparisons of decoration motifs on illustrated Mailu sherds (e.g. Allen 2010).

Irwin’s 115 groups could be collapsed into many fewer, on various grounds, but this would transform their character. Currently these combinations are monothetic and generally non-hierarchical (equally weighted) in composition. Reduction would require bestowing greater importance on one or another of the attributes and forming types where members did not necessarily possess all of the attributes of that type. This would change the typology to polythetic sets of hierarchical attributes.

Bulmer at Port Moresby

Sensu stricto Sue Bulmer did not produce a typology of Port Moresby ceramics, arguing instead that her excavated materials from Nebira, Eriama and Taurama came from habitation deposits that yielded small quantities of highly fragmented and heavily weathered sherds not amenable to such detailed analysis. In contradistinction to Irwin, who seriated his stratified data to provide a chronological framework for analysing his surface collections, Bulmer (1978:74) argued that the classification of larger sherds in the surface collections provided a useful basis for ordering the stratified pottery, although it was unclear how this might work, apart from intuitively. Bulmer chose to concentrate on pottery decoration, seeing it as a sensitive indicator of social change. Like Irwin, Bulmer was trained in Auckland and attempted to adapt the methodology of early analysts of Lapita ceramic decoration such as Mead and Shaw (Mead et al. 1975) in order to create a decorative ‘vocabulary’, although the relative simplicity of the decoration on Port Moresby pots forced her to use design elements as her basic unit rather than motifs. ‘Design units’ were a higher order unit classification that combined design elements with motifs (Bulmer 1978:75) but the methodology for formulating design units (and indeed the distinction between these and design elements in the analysis) is unclear.

The primary sampling criterion was one of form. Like Vanderwal, Bulmer separated globular pots and bowls as a first step and then chose the sample on the criteria of sherd size and presence of decoration, with most of the 903 globular pot sherds in her sample being undecorated and most of the 2074 bowl sherds decorated (Bulmer 1978:76). The role of undecorated vessels in an analysis based on decoration is unclear.

The sample was assembled to include 67 sites in five geographic zones, those around four major site locations, Taurama, Eriama, Nebira and Boera and a remainder category. Twenty-four sites fell into this latter category and were further apportioned to the region’s major ecological zones: coast (14 sites), estuarine plains (0), coastal hills (6), river plains (1) and foothills (3). The four named site groups only incidentally reflected these ecological zones and were mainly chosen to facilitate the subsequent integration of the stratified pottery into the wider classification based on the surface collections (Bulmer 1978:77).

Four attributes were used: decoration technique, decoration location, design units and lip shape. No analysis of the data was undertaken to define Bulmer’s six style categories; instead, the sample was divided intuitively and depended on pottery characteristics weighted by Bulmer. For example:
The most obvious inter-community contrast in the surface collections is between the Eriama and Taurama pottery. The former is almost entirely decorated with fine-line incising or with appliqué and heavy incised decoration. In contrast, the Taurama pottery is about half shell and comb-decorated and half decorated in incised motifs (1978:80)

or

For the purposes of the selection of the Style I study sample.....all sherds are either slipped or burnished (1978:81).

Eventually Bulmer described six styles primarily on decoration techniques and the design units within them, although as the Taurama discussion in Chapter 1 indicates there is considerable overlap of design units across the different styles. While the styles were sequentially numbered, the implication of chronological succession was not clear, again as indicated in Chapter 1 in this report. For example, Style I, which encompasses all of the EPP styles pre-dated the others, Styles II and III might be contemporaneous and might have overlapped in time with Style IV on the available comparative evidence available when these styles were formulated – again see Chapter 1. At the same time Thompson (1982:104, 123ff.) concluded from several Papuan Gulf analyses that Styles V and VI were contemporaneous and distinct from each other, interpreting this to mean that there were at this time at least two separate pottery manufacturing villages in the Port Moresby region that were exporting to the Papuan Gulf.

Bulmer’s classification was by far the most subjective and intuitive of the early major Papuan classifications (although my first short description of EPP from Nebira 4 (Allen 1972) was equally so). Bulmer separated her six styles directly on her experience of handling her collections, intuitively recognising and weighting some characteristics over others and establishing polythetic sets. Her sometimes exhaustive numerical distribution analyses served less to define her six styles than to describe them.

The important point to make is that Bulmer’s style classification was shown to have utility in comparative studies (Thompson 1982; Frankel et al. 1994; Rhoads 1994) even while the wider chronological and/or cultural significance of these style classes remained less understood.

Thompson in the Gulf of Papua

During 1980-81 David Frankel, Ron Vanderwal and then undergraduate student Kym Thompson excavated a number of sites in the Gulf Province around the provincial capital, Kerema, and further west around Kinomere (Frankel et al. 1994). Pottery from the six principal excavations was analysed the following year by Thompson for his BA honours thesis (Thompson 1982) and his analysis was abbreviated to form the subsequent pottery analysis chapter published by Frankel et al. (1994).

While the 1994 published version of this analysis is entirely adequate, anyone wishing to understand its full rationale, the basis for the selection of some attributes over others, the straightforward explanations of the statistical tests applied and the interpretations of the results should go to the thesis. It is a remarkable document. Thompson was already expert in understanding the statistics that he used, but beyond this, this thesis is exceptional in its organisation, argument, and expertise. It is of a quality beyond most other undergraduate theses and stands easily within the corpus of important works on Papuan prehistory.
The primary objective of Thompson’s classification was to seriate the pottery from the six major sites that had been investigated, using multiple statistical tests to determine the relative similarities of the six assemblages. The six sites were taken to be single phase entities (that is, they were not further divided stratigraphically) and thus seriating the pottery also seriated the sites as ‘two dimensional summaries of linkages’ between them (Frankel et al. 1994:3). It was argued therefore that differences between sites were primarily time related and that the analysis established a relative chronology of the sites. (One radiocarbon date from each of five sites yielded three modern results, one calibrated at 1sd to 187-461 calBP, and one calibrated at 1sd to 348-510 calBP that pre-dated most of the pottery in that site (Frankel et al. 1994:13). These dates were rightly considered to be ‘of little help’.

Secondary aims of the analysis were to understand various aspects of the pottery trade from the Central Province to these sites.

Thompson’s study was confined to rim sherds, which, as usual, he divided into pots and bowls. The pots showed less variation than the bowls and thus the analysis concentrated mostly on bowl forms. Since the research aims did not immediately determine the data to be used and analyses to be followed, Thompson sought patterning in the data in a series of heuristic procedures common to many archaeological analyses. Attributes of form and decoration were chosen intuitively, although Thompson carried out experiments where he rejected some measurement attributes commonly chosen in other studies because original results could not subsequently be replicated at any acceptable level (Thompson 1982:41-6). Such attributes included rim angle, body angle and the diameter of the vessel at the lip. On the other hand decorative attributes were generally found to be good in this respect.

In choosing attributes for analysis, Thompson avoided those which his experiments indicated could not reasonably be replicated, and simplified others; for example, where Bulmer had isolated 14 lip shapes, Thompson used two classes of two variables. Lip form 1 was either round or flat and lip form 2 was either simple or elaborate, the latter indicating any deviation from a basic round or flat form. Other form attributes were equally simple, concerned with profiles, body angles to distinguish simple and composite vessels, and two measurement variables, rim length and body thickness. Pots and bowls required slightly different variable sets, but shared the same decorative attributes. These were plastic decoration, involving the addition or removal of clay, tooled decoration (combing, shell impression, incision et cetera), decorative fields and decorative motifs.

In the multiple analyses that followed, Thompson convincingly established a sequence for the six sites that was interpreted to be chronological, and isolated sets of attributes of form and of decoration that appeared to be chronologically sensitive. However, and somewhat frustratingly for subsequent users, analyses of form, decoration techniques and motifs – and subsequent fabric analyses (Frankel et al. 1994: chapter 5) – proceeded largely independently of each other. For bowl forms, various initial attributes were grouped to define composite and simple bowls and subsequently eight bowl forms, mostly defined by one or another dominant attribute, emerged (residual sherds were placed in a ninth group) that subsequently were offered, somewhat ambiguously, as bowl types (Frankel et al. 1994:25). But types defined by correlating variables from across the attribute classes, as with Vanderwal’s typology for example, did not emerge.
Cox on Motupore Bowls

As discussed in Chapter 4, one (perhaps the) principal aim of Cox’s analysis of bowls from the Groube excavation on Motupore was to provide a means to correlate the 96 separate stratigraphic units that Groube had delineated in his trench. This depended on developing a formal sequence of morphological and stylistic change already intuitively recognised to exist in this data base (Cox 1989:21). Cox only analysed the bowl forms, because of their perceived greater information content when compared to the globular pots (Cox 1989:72), and the analysis was restricted to rim sherds.

Attributes were selected intuitively after examining the assemblage and consulting some of the available literature, notably Irwin (1985) and Vanderwal (1973). Attribute choice concentrated on form, involving both discrete and continuous attributes and decoration location and technique. Variables within the attribute classes tended to be exclusive rather than inclusive (separated rather than combined). For example the attribute class Rim Shape comprised six attributes each having between two and seven variables, while the attribute class Decoration Technique comprised 28 variables, such that, again for example, combing, painting and combing, and painting represented three separate variables.

Citing and following Irwin, Cox quantified her sample of 1638 bowl rim sherds by inspection, but also by examining the frequencies and distributions of her attributes using a computer SPSS-X program (Cox 1989:29). The raw scores are neither provided nor precisely described, which adds to the opacity of the analysis.

Cox (1989:72) decided that since the pottery was fundamental to integrating Groube’s stratigraphic units, she would analyse the morphology and decoration separately so that the results from one could be verified against the other. While I am not concerned here with that integration, this point is important as it offers the rationale to the strategy of analysis that followed.

Cox’s analysis consisted of choosing one set of attributes, Rim Profile, then indicating relationships with some of her other variables for each of the varieties of rim profile. She then moved to a set of decorative ‘classes’ manufactured from the decorative attributes (see below) and treating them as she had the varieties of rim profile.

There, bowl sherds were initially divided into ‘simple’ (i.e. with direct, unmodified rims) and composite bowls whose rims were carinated, flanged or collared. Sets of statistics were then offered for the varieties (= Cox’s classes). For example, simple rims were (1) subdivided into un-grooved and grooved varieties and their frequencies noted; (2) their first appearances in the sequence noted; (3) the decoration ‘classes’ that occur with the two forms listed; (4) frequencies of orifice shapes (round or ellipsoid) for the two forms listed; and (5) the average orifice diameter for each form given. Some of these are difficult to understand. For example, ‘first appearance in the sequence’ is data that as far as I can tell had to be derived after the stratigraphic sorting was completed, implying some circularity; even so, when listed, first appearance is given, for example, as ‘Layer 4’. However where Layer 4 is depends on which of Groube’s trenches (= squares) the sherd came from, since Layer 4 occurs at three different stratigraphic locations (Cox 1989: figure 5b) along the full trench. As well, accompanying written description is unclear, offering impressions of form and decoration that are difficult to follow, partly because they introduce new and unexplained terminology.
Figure 6.1. Cox’s correlation of rim and decoration varieties for Motupore bowls from the Groube trench. For identification of the ‘classes’ see Cox (1989). Numbered diamonds indicate large memberships. Re-drawn from Cox (1989: figure 4az).

Similar statistics and commentary are offered for four varieties of flanged rim, three varieties of collared rim and six varieties of carinated rim, where some are identified as Middle or Late Period. Again, these chronological attributions were apparently determined after the analysis was complete, but are presented before the analysis is undertaken in the thesis.

Cox then describes her decoration ‘classes’. These are different from the decoration attributes described earlier and carry some similar and some different names, for example ‘Combing’ and ‘Painting’ but also ‘Line Bars and Shell Bands’ and ‘Shell Rimfill’. These classes appear to sit between the more common ‘decoration techniques’ and ‘motifs’ and are described and illustrated with similar sets of statistics to the rim forms, particularly indicating correlations with those rim forms, together with further written description.

Ultimately Cox (1989:68) returned to her computerised frequency distribution data to correlate rim forms and the elaborated decoration classes, which were then sorted into a chronological matrix, according to the ‘order of appearance in the trench of particular rim forms and decoration styles’ (1989: figure 4az reproduced here as
Figure 6.1). A second matrix (Cox 1989: figure 4aaa) elaborated this data set by separating round and ellipsoid bowl forms to make 185 combinations.

For the same reasons described for Irwin in Amazon Bay, small sample numbers in the attribute combinations were not a significant problem in ordering Groube’s 96 stratigraphic units (although small sample numbers within the stratigraphic units were, and obviously led to an extensive grouping of units to arrive at the five stratigraphic layers illustrated here in Figure 4.25). However, as a typology, 185 ‘types’ where 41 have only one member, and only 41 have more than 10 members, and only 7 have more than 50 members (where 50 = c. 3% of the total sample) provides little comparative utility.

Cox did not discuss her figure 4az (Figure 6.1) in any detail. The correlations between rim forms and decoration do however suggest two points of interest. The first is the general homogeneous nature of the assemblage. All but one of the 15 rim varieties are associated with multiple decoration classes, ranging from 3 (Rim 13) to 14 (Rims 4 and 5) out of a possible 16, given that ‘undecorated’ is kept as a variable. Rim 12 is mainly associated with one decoration class (M) although this decoration appears on 7 other rim varieties. No decoration class occurs on fewer than 6 rim varieties and Decoration Class E occurs on all 15 rim varieties. To some extent this reflects sample size: Rim 13 has only five members, whereas Rims 4 and 5 have 235 and 158 members respectively. Decoration Class E occurs on 135 sherds.

The second related point is that despite this homogeneity, when associations are made between the two attributes, rim profile and decoration class, chronological trends are apparent. Cox chose to separate the matrix in Figure 6.1 into early, middle and late phases. The middle phase comprises many ‘types’ with small memberships that bridge the division between the early and late groups, while indicating continuing relationships to the earlier phase in particular. This again points to the homogeneity of the assemblage. Cox’s diagram also highlights seven attribute pairs which have large memberships within the rim/class/decoration class categories.

Cox’s classification is again not a typology in the Vanderwal style. It is hierarchical in the sense that emphasis is placed on two attributes at the expense of others that she measured, for example orifice diameter and rim form; and it is monothetic in the sense that membership in any of the 185 groups is exclusive (no members have only some attributes) because the attributes are so limited.

It is uncertain how far these groups should be considered as usable comparative types because it is easy to imagine other groupings that might be more meaningful with the addition of other attributes (for example those used by Thompson). At the same time, while Cox’s procedures are sometimes opaque and her classification frequently more descriptive than analytical, her analysis is a valuable contribution to the archaeology of Motupore, to which I will return. It is an example of a specific classification that achieved its principal aim, to a large extent at the cost of its comparative utility.

**Historical summary**

While this review of earlier Papuan pottery classifications has led me away from my central purpose of offering yet another pottery classification, I found it instructive in formulating and clarifying the procedures and purposes of my own typology. Interestingly, of the five analysts just reviewed, only Vanderwal produced a typology *sensu stricto*, and in particular, one able to act as an analytical tool to measure cultural change and to offer a classification useful for regional comparisons. The discussion at
the head of this chapter recognises these two objectives as a central purpose of typology.

Without intending to be ‘holier than thou’ I continue to believe that a robust typology is the basic and necessary structure for describing any excavated pottery assemblage. This was certainly true of the Motupore pottery and analysing it in pursuit of my research agenda. At the same time the utility of any typology can also be measured by how well it facilitates comparative studies within its immediate region. Although I commit the sin myself elsewhere in this report, I am dissatisfied with casual visual comparisons of individual pottery decorations as a basis for measuring cultural connectedness and developing regional sequences, if for no other reason than that it lacks objectivity. Beyond that, simple decorative motifs need not indicate historical connectedness. In Chapter 7 and beyond I elaborate what I hope is a transparent typological analysis that will allow more detailed comparisons with other Papuan pottery assemblages.

Before that, I offer an account of my early attempts to arrive at a statistical solution to developing a typology of Motupore pottery. I recognise that any manuscript editor who might deal with this report will want to delete what follows (and perhaps even this whole chapter), but I believe it serves at least three purposes. Firstly it documents the mistakes and blunders that I made, despite expert statistical guidance, in seeking to gain the authority that complex statistical/computer generated data might convey, even though I have never been convinced that ‘statistically significant’ automatically means ‘archaeologically significant’. Secondly, and related to this, this section helps explain my life-long suspicion of ‘black box’ analyses where I lose control and understanding of what is happening to the data. This is not to say that complex statistical analyses do not have a place in archaeology, just not in my archaeology, for better or worse. Lastly, despite the mistakes, these early analyses produced a result. At that point I had no confidence in the accuracy of the result and embarked on the quite different analysis detailed in Chapter 7, where the most complex mathematical manoeuvre is the use of percentages. However, and much to my surprise, the results of both analyses bear many similarities and thus offer some added confidence in my ultimate typology, despite the approaches being quite different. This seems sufficient reason to report both.

**Early statistical approaches to classifying Motupore pottery**

*First attempts*

Persuaded by the possibilities of pursuing a ‘rigorous’ and ‘scientific’ classification of Motupore pottery that was by the mid-1970s available via computers capable of handling large data bases, I began by preparing matrices of paired correlation coefficients for various data sets. The short results were that many attributes that were not mutually exclusive were found to correlate positively with each other, suggesting a homogeneous single group of pots and another of bowls. This was initially puzzling until I realised that the types I ‘saw’ inside these sets did not conform to the monothetic type definition I thought I was using; I was intuitively weighting the importance of some attributes over others.

I discussed these results with Herb Weinand (then of the Department of Geography, University of Papua New Guinea) who responded by suggesting I use association analysis. Weinand wrote a program, later called Herb.Divide, that allowed the pot and bowl assemblages to be divided monothetically in a tree-type hierarchy on the
presence/absence of individual attributes. The program first considered the whole assemblage, dividing it on the attribute that had the highest coefficient of similarity using the phi coefficient. All of the entities in each group were identical in respect of the defining attribute; in one group all entities had this attribute and in the other no entities possessed it. The program would then consider the two groups formed by possessing or not possessing the first attribute and repeat the procedure, forming four groups, then eight groups and so on. The logical end point of this process is a set of groups containing sherds identical in terms of the attributes tested. Since frequently such groups would have only a single member, in practice some other stopping criterion could be used, for example a percentage of the original sample or a particular number of iterations. The members of such groups are still identical in terms of all the attributes tested along their branch but any further iteration would result in two new groups with fewer entities (unless all group members either possessed or did not possess the newest attribute and thus remained as a single group).

While, as created, the groups form monothetic types, the process identified hierarchical attribute sets that comprise both the positive and negative attributes along the branch of the particular set.

The problem with Herb.Divide and similar association programs is that they do not allow entities to be re-allocated. For example in the dendrogram represented as Figure 6.2 (see later in this chapter) the initial division is made on whether there is decoration on the neck of everted globular pots. Decoration at this location on Motupore pots is always paint and/or buff surface. If either of these decoration techniques does not occur on the neck on any particular sherd it will be separated from those that have this decoration on the neck at this first division, even though the sherd in question might be painted and/or have buff surface colour at all other locations and share this characteristic with all members of the group from which it is excluded.

Here it might well be considered intuitively that painting and/or buff surface are ‘more important’ defining attributes for classification than a specific decoration location identified on statistical distance. But to do so is to move from the monothetic hierarchical groupings provided statistically to polythetic groupings where particular decoration attributes are intuitively given more weight than the locations where they occur on the vessel.

Using a program like Herb.Divide has to produce groups. While groups resulting from preliminary runs appeared to make logical sense, they differed from ethnographic types, dividing principally on aspects of decoration rather than shape. They were also different in some instances from my intuitively perceived types. I was confronted with groups that were objective in the sense that they were reproducible and thus provided a basis for external comparisons; but these were groups that were different from those of my field perceptions or ethnographic types. I was in the middle of the etic/emic dilemma.

Whallon’s ‘New Approach to Pottery Typology’1972

At about this time I encountered Robert Whallon’s paper on Owasco typology published a few years earlier in *American Antiquity* (Whallon 1972). In attempting to duplicate the 16 types of Owasco ceramics that had for some years successfully placed Owasco sites in space and time, Whallon discovered that when testing for significant associations between attributes using chi square, he could only produce a
single cluster of attributes and thus only two types (those possessing and those lacking these attributes). Whallon recognised that the formative principles underlying the 16 type typology did not conform to the paradigmatic type definition. His solution, like Weinand’s, was to turn to association analysis. He produced a tree-type classification that closely approximated the original typology and thus elaborated the view that there is a hierarchy of importance in the defining attributes of Owasco pottery types. At the same time this remained a monothetic typology.

*Another statistical approach to classifying Motupore pottery*

Encouraged by Whallon’s success I modified my attribute list and attempted to produce a more meaningful typology that still adhered to the classic type definition. With the considerable help and direction of statistician Yvonne Pittelkow (Research School of Social Sciences, Australian National University) I undertook, over a period of months, a vast array of analyses using Herb.Divide, and at the same time a set of comparisons with an agglomerative clustering program called RELOCATE, a program in Clustan 1C (Wishart 1975) that produced polythetic groups. Computer runs were made on the Australian National University PDP-10 mainframe computer (then commonly referred to as the DEC-10).

Various runs using both programs and applying various criteria – different numbers of clusters, masking various attributes, using sub-sets of the data *et cetera* – resulted in groupings that appeared to make some practical sense and that showed a reasonable level of ‘agreement’ between Herb.Divide and RELOCATE.

*The Kym Thompson study*

Despite the fact that a classification of the Motupore pottery now existed and appeared to be supported by similar results from different analyses, I remained uneasy about what the results actually meant. This stemmed partly from my own tenuous understanding of the statistics involved in the programs I had used – what exactly had been measured and how; and partly from the fact that there appeared to be no adequate procedures for determining whether the results should be accepted as meaningful, apart from comparing them against other assemblages analysed in similar fashion.

Subsequently in Melbourne in the mid-1980s Kym Thompson undertook a review of my earlier work in order to codify those analyses into a formal typological framework. What follows is a summary of his unpublished report to me.

As noted, Herb.Divide is a program that starts with a complete assemblage (in this case pots or bowls) and divides it into two groups on the presence or absence of the attribute that results in the smallest resulting within-group variability, thus creating the two most dissimilar groups. The procedure is repeated until some stopping point is reached. This is a monothetic dividing process that has several particular shortcomings. The monothetic structure of Herb.Divide means that very similar cases may be separated at an early stage in the process, not on the basis of the attributes on individual sherds, but rather on the overall associations of attributes in the entire assemblage. (The case of painted pots lacking paint at the neck, just reviewed, is an example of this.) Since the program does not allow vessels to be re-assigned, in this instance the distinctive painted vessels can never form a single type that includes all painted sherds, regardless of how many other attributes in addition to painting that they have in common. At the same time the strength of this program is that it discovers clusters of associated attributes and defines them in terms of key attributes.
RELOCATE on the other hand begins with individual entities and assigns them randomly to a chosen number of groups specified by the analyst. On the basis of some measure of within-group homogeneity or between group dissimilarity the program reviews the results case by case and either re-allocates individuals to other groups or leaves them where they are. This process continues until no improvements can be made. It is of course possible to take this result as a starting point for reducing the number of clusters even further, where RELOCATE will allow cases to migrate as the number of clusters is reduced. While RELOCATE differs from Herb.Divide in that it builds larger groups rather than dividing to produce smaller ones, it also differs in that it is a polythetic classification rather than a monothetic one and is not hierarchical - its results cannot be presented as a dendrogram.

RELOCATE is seen to overcome the shortcoming of Herb.Divide outlined above, by allowing entities to be re-assigned to other groups. While this is true, because relocations are only made on a case-by-case basis, the results obtained by RELOCATE are however influenced by the starting point of the process. The technique will reach a point where no single relocation will improve the result, but where the simultaneous relocation of a number of cases could make a substantial improvement. RELOCATE is unable to recognise these situations. Starting from a different random set of groupings can thus affect the final clustering.

On reflection and further consideration of the nature of these techniques it became likely that the apparent confirmation of the groups developed from one technique by the similarity with the groups developed by the other technique was the product of the data. The two methods do not provide genuinely independent approaches, as they both analyse attribute associations and were both affected in the same way by unintentional attribute weighting. This resulted partly from converting continuous measurement variables into discrete variables and partly from the choice of particular variables that weighted some variables more than others. Two examples follow.

As noted, the data were recorded in binary form (1/0 = presence/absence). In the analyses undertaken, pot variable #29 (undecorated) stands out because the following 13 variables (variables #30 to #42) concern decoration position and technique. Thus when any of these latter variables = 1, variable #29 = 0; and the converse, variable #29 = 1, variables #30 to #42 = 0, is also true. Thus by definition there is an association between variable #29 and these other variables that any cluster analysis will reveal. This gives undue weighting to variable #29. If this variable was omitted, associations may have been revealed between the size, shape and decoration attributes that were masked by the strong negative correlation between variable #29 and the decoration variables.

A similar problem exists for rim shape. Three shapes were defined, straight, concave and convex. Since fewer than 3% of rims are convex, this variable is essentially a constant. Allocating a presence/absence value to each of the other two rim shapes created a very strong negative correlation between them, since the absence of one is approximately equivalent to the presence of the other. In effect each variable measured the same thing, a two-state variable defining rim shape. This unintentional weighting created a correlation that will always be discovered by cluster analysis. To confuse matters a little more, and as will be noted later, the small number of convex rims may have typological importance that has been obscured by its small representation.
Results from Herb.Divide and RELOCATE

Given the inherent limitations of these statistical approaches and the flaws in the data base, there appeared to be three alternatives for going forward.

- Change the data base and re-run the tests
- Seek a new statistical approach
- Seek an alternative approach

The first two options were not viable because the collections had been returned to Papua New Guinea and would require several months re-analysis in the National Museum there to accommodate either option. I thus devised the non-statistical approach that is the subject of Chapter 7.

Despite the limitations of the analyses and the data base, this chapter concludes with an examination of the results of Herb.Divide and one run of RELOCATE each applied both to the sample of globular pots and to the sample of bowls. Despite the shortcomings, the results are instructive, firstly as a descriptive device and secondly as a different (if flawed) typological structure to be compared with the results from Chapter 7.

Using the results of the Herb.Divide and RELOCATE analyses to produce typologies for the pottery, the procedure used the following progression: cluster analyses produce groups of sherds; these groups are described in terms of their attributes; key attributes are selected for each group; these are used to define types; and sherds in the assemblage are allocated to these types.

Globular pot groups using Herb.Divide

Figure 6.2 shows the globular pot sample as divided by Herb.Divide. Both here and for RELOCATE the sample was reduced from 1143 items to 999 items because this was the maximum that the DEC-10 computer could accommodate. The sample was reduced by removing items at random from each excavation unit on a basis proportional to their representation in the original sample.

This was achieved by calculating the percentage of each unit comprising the original 1143 sample and then multiplying that percentage by 999. For example, excavation unit 9 contributed 58 items to the original sample; this was 5.074%, multiplied by 999 = 50.69; so seven sherds were randomly removed from this unit. For the six Pottery Analytical Units (PAUs – see Chapter 5) the new sample sizes are given in Table 6.1.

As noted, the first division of the 999 globular pot sample separated items decorated externally on the neck between the body and the rim. Subsequent divisions of the 193 items so decorated formed a strong hierarchical chain (right hand side of Figure 6.2), listing in turn the following decoration zones, on lip, internal, external above neck and external below neck. There was a small leakage of items at each of these iterations, totalling 28 sherds, all of which were painted and/or buff surface. The next two divisions involve the decoration techniques, painting and buff surface and then split on straight or other rim profile and rim width of 3-4 cm or other. Although most of the rims are straight (93 of 117 items) the rim width categories divide more evenly.

While these last two attributes form part of this hierarchical string they are not key attributes in defining this cluster, because they also occur prominently in other clusters. The same is true of variable 31, decoration on lip. Decoration at this location in the sample includes all three major techniques of pot decoration.
Figure 6.2. The division of Motupore globular pots using Herb.Divide. Key: 1= Rim width < 30 mm; 2= Rim width 300-400 mm; 4= Rim width 400-500 mm; 5= Straight rim profile; 6= Concave rim profile; 8= Lip diameter < 160 mm; 16= Rim angle 50°-60°; 17= Rim angle 60°-70°; 18= Rim angle 50°-60°; 26= Body angle 40°-50°; 29= Undecorated; 30= Internal; 31= On lip; 32= External above neck; 33= On neck; 34= External below neck; 35= Incised; 38= Shell impressed; 41= Buff surface; 42= Painted.
Table 6.1. The reduced sample sizes for the six PAUs used for the Herb.Divide and RELOCATE analyses of Motupore globular pots.

<table>
<thead>
<tr>
<th>PAU 1</th>
<th>PAU 2</th>
<th>PAU 3</th>
<th>PAU 4</th>
<th>PAU 5</th>
<th>PAU 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>140</td>
<td>127</td>
<td>174</td>
<td>168</td>
<td>202</td>
<td>188</td>
</tr>
</tbody>
</table>

Thus the key attributes of this cluster are decoration at locations other than the lip that are painted and/or have a buff surface. Painting and/or a buff surface also occurs frequently on the lip; this location variable does not define the cluster but helps characterise it. In contrast, the other locations used define the monothetic cluster and should also be included in any polythetic set of painted globular pots (see below).

Most of the 806 items in the sample are not decorated on the neck and the next split for this cluster is made on whether they have a straight rim profile or not. Those with a straight rim profile next split on whether they are decorated on the lip. As with the painted cluster these two variables characterise the new set but do not define it. This string is defined by variable 38, shell impression, and subsequently divides on rim width and rim to body angle. Items that are not shell impressed are almost all incised and these again subdivide on rim width, indicating that there are two sub-groups in this cluster, defined on the two decoration techniques, incision and shell impression.

The sherds that have straight rim profiles but are not decorated on the lip (438 items) split into a small group (40 items) that are decorated elsewhere (and include painted sherds not decorated on the neck or the lip), but overwhelmingly comprise a different string of undecorated sherds (398 items). These further divide on rim width, rim angle and rim to body angle with some indication of a tendency towards the mid-range variables in these attribute classes.

The final cluster comprises 139 items that are not decorated on the neck and do not have straight rim profiles. The vast majority of these (128 items) have concave rims and follow the pattern of the straight rim string, dividing on variable 31 (decoration on lip) and identifying shell impression as the dominant decoration. This might mean that concave rims are more closely related to shell impression than to incision, but this is not clear in the data.

**Summary of Herb.Divide (Pots)**

The small number of variables and their repetition in different strings suggests that the sample as a whole is quite homogeneous, with only painted and/or buff surface pots separating clearly from the rest. This occurs because both painting and the buff surface occur on areas of pots not decorated by other techniques. Four general groups emerge, painted pots, straight rim decorated pots, with shell impressed and incised subgroups, an undecorated straight rim profile group, and a concave rim profile group that contains both undecorated and shell impressed subgroups. Herb.Divide suggests there is more distance between sherds with straight rim profiles and concave rim profiles, than between decorated and non-decorated pots (painting excepted) but this may be a result of the weighting problem discussed earlier. That shell impressed sherds as a group and incised sherds as a group can be split on rim profile, without the possibility of reallocation into a single group, is a product of this monothetic divisive process, as discussed. The program simply finds more statistical distance between rim profiles than between decorative techniques.
**Globular pot groups using RELOCATE**

As discussed, RELOCATE produces polythetic clusters in an agglomerative process that requires the number of clusters to be specified in advance. The application reviewed here was set to establish ten clusters. The resulting set is described in Table 6.2, where dominant attributes are considered to be those occurring on more than 70% of the cases in that set, frequent attributes are those that occur on 40% to 70% of cases in the set, and minor attributes being those that occur on 20% to 40% of cases.

It is immediately apparent from this table that

1. Clusters are made primarily on decoration (technique and location), rim profile and rim width.

2. Associated attributes frequently comprise similar variable sets between clusters and where more than one of the defining variables belong to the same measurement attribute they are normally contiguous, for example body angle in Cluster 6 or rim angle in Cluster 2.

3. General similarities can be seen between the RELOCATE clusters and the groups formed by Herb.Divide.

4. Distinctions between clusters are frequently small, indicating that the number of clusters could be considerably reduced.

Taking these points in turn

1. While there is no way of deciding whether the clusters have been influenced by the unintentional weighting of some attributes as discussed earlier in this chapter, this remains a definite possibility. The distributions of variables in the clusters suggest two things, that there is little shape/size variability between clusters and that within clusters there is a range of measurements that suggest that precise size/shape control by the potters did not occur. This is what might be predicted for pottery being hand-made using the paddle-and-anvil technique. This might indicate that the potters regulated their pots on body wall thickness rather than size, raising the issue of sherd thickness discussed in Chapter 5. There it was noted there was little variation in sherd thickness when measured in trial samples and thus it was not a useful variable for distinguishing Motupore pottery types. With the present result, it might be that body sherd thickness has other uses. For example, Mailu trade pottery is thin-walled, especially when compared to contemporary Melanesian ceramics, but it is unclear whether this is cultural preference, an aspect of the technological qualities of Mailu clay, an attempt to conserve clay resources, planned obsolescence, or some other reason. At a different level it might be an indicator of cultural or technological change over time, as Irwin showed (1985:107).

2. It would be useful to add thickness measurements to any future studies of the Motupore pottery, on the assumption that Motu potters worked to produce an ‘optimum’ body thickness and that overall pot size variations reflect variations in the precise amount of clay originally used to form the pot. This would suggest that there might be several gross ‘ideal’ sizes (for example, small, medium and large) but that the boundaries between them were blurred by the nature of the hand-made forming process.
<table>
<thead>
<tr>
<th>Cluster</th>
<th>Items</th>
<th>Dominant attributes</th>
<th>Frequent attributes</th>
<th>Minor attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>209</td>
<td>Undecorated (99)</td>
<td>RA: 60°-70° (44.5)</td>
<td>BA: 20°-30° (37.3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RP: straight (99)</td>
<td></td>
<td>BA: 30°-40° (36.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RW: 30-40 (98.1)</td>
<td></td>
<td>LD: 200-240 (36.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RA: 70°-80° (21.1)</td>
</tr>
<tr>
<td>2</td>
<td>114</td>
<td>Undecorated (98.2)</td>
<td>LD: 200-240 (41.2)</td>
<td>BA: 20°-30° (39.5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RP: straight (97.4)</td>
<td></td>
<td>BA: 40°-50° (32.5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RW: 40-50 (83.3)</td>
<td></td>
<td>RA: 50°-60° (20.2)</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>RA: 60°-70° (37.7)</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>RA: 70°-80° (30.7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LD: 240-280 (26.3)</td>
</tr>
<tr>
<td>3</td>
<td>63</td>
<td>Undecorated (100)</td>
<td>RW: 30-40 (54)</td>
<td>LD: 160-200 (31.7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RP: concave (98.4)</td>
<td>RA: 60°-70° (44.4)</td>
<td>BA: 20°-30° (43.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>BA: 30°-40° (42.9)</td>
<td>LD: 200-240 (34.9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LD: 240-280 (22.2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>RW: 40-50 (28.6)</td>
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<td>RA: 50°-60° (23.8)</td>
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<td>RA: 70°-80° (22.2)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>RA: 40°-50° (22.2)</td>
</tr>
<tr>
<td>4</td>
<td>141</td>
<td>RW: &lt;30 (100)</td>
<td>Undecorated (63.1)</td>
<td>Decorated on lip (29.8)</td>
</tr>
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<td></td>
<td>RP: straight (92.9)</td>
<td>BA: 40°-50° (41.1)</td>
<td>Shell impressed (26.2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LD: &lt;160 (83.7)</td>
<td>RA: 70°-80° (41.1)</td>
<td>RA: 60°-70° (26.2)</td>
</tr>
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<td>5</td>
<td>194</td>
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<td>RW: 30-40 (44.3)</td>
<td>BA: 30°-40° (33)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decorated on neck (97.9)</td>
<td>BA: 40°-50° (41.8)</td>
<td>LD: 200-240 (32)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decorated internally (97.4)</td>
<td>RA: 60°-70° (41.2)</td>
<td>BA: 160-200 (30.9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decorated above neck (91.8)</td>
<td></td>
<td>LD: &lt;160 (21.6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decorated below neck (91.8)</td>
<td></td>
<td>RW: 40-50 (31.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Painted (91.2)</td>
<td></td>
<td>RW: &lt;30 (20.6)</td>
</tr>
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<td></td>
<td></td>
<td>RP: straight (83.5)</td>
<td></td>
<td>RA: 50°-60° (25.3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Buff surface (77.3)</td>
<td></td>
<td>Shell impressed (22.7)</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>RP: straight (98.7)</td>
<td>RA: 60°-70° (52)</td>
<td>BA: 50°-60° (30.7)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Incised (97.3)</td>
<td>LD: 200-240 (42.7)</td>
<td>BA: 20°-30° (24)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decorated on lip (89.3)</td>
<td></td>
<td>BA: 30°-40° (28)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RW: 30-40 (84.4)</td>
<td></td>
<td>RA: 40°-50° (25.3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>LD: 160-200 (21.3)</td>
</tr>
</tbody>
</table>
| 7       | 96    | Shell impressed (99) | BA: 40°-50° (45.8)  | 188
|         |       | RP: straight (97.9)  | RA: 60°-70° (42.7)  | BA: 20°-30° (35.4)  |
|         |       | Decorated on lip (94.8) | LD: 160-200 (41.7)  | RA: 70°-80° (32.3)  |
|         |       | RW: 30-40 (84.4)     |                     | BA: 30°-40° (31.2)  |
| 8       | 49    | RW: 40-50 (100)      | LD: 240-280 (59.2)  | BA: 50°-60° (28.6)  |
|         |       | Decorated on lip (89.9) | RA: 60°-70° (46.9)  | BA: 70°-80° (20.4)  |
|         |       | Shell impressed (75.5) | BA: 40°-50° (44.9)  | BA: 30°-40° (36.7)  |
|         |       | RP: straight (73.5)  |                     | Incised (24.5)      |
|         |       |                     |                     | RP: concave (24.5)  |
|         |       |                     |                     | LD: 200-240 (22.4)  |
| 9       | 43    | RP: concave (97.7)   |                         | BA: 30°-40° (56.5)  |
|         |       | Decorated on lip (93) |                     | RA: 60°-70° (58.1)  |
|         |       | RW: 30-40 (83.7)     |                     | LD: 200-240 (48.8)  |
|         |       | Shell impressed (65.1) |                         | Incised (30.2)      |
|         |       | BA: 30°-40° (60.5)   |                     | LD: 160-200 (25.6)  |
| 10      | 15    | Decorated above neck (100) | BA: 30°-40° (53.3) |                         |
|         |       | RW: 30-40 (93.3)     | RA: 70°-80° (40)     |                         |
|         |       | Shell impressed (73.3) | LD: 160-200 (40)    |                         |
|         |       | RP: straight (73.3)  |                         |                         |

**Table 6.2.** Ten globular pot clusters determined by RELOCATE. Bracketted numbers are percentages. Abbreviations: BA = body angle; LD = lip diameter; RA = rim angle; RP = rim profile; RW = rim width. See text for discussion.
3. Since both Herb.Divide and RELOCATE ultimately analyse attribute associations they are not truly independent of each other. In addition, while they take different approaches to forming groups, both techniques will be affected by the unintentional weighting problems already discussed. Theoretically this could induce the formation of similar groups.

4. *Clusters 1-3* group the undecorated sherds. Cluster 1 identifies the mid-sized range with straight rim profiles, while Cluster 2 separates sherds with slightly larger dimensions, but still with the straight rim profile. Cluster 3 identifies undecorated sherds with concave rim profiles.

*Cluster 4* is particularly interesting, because it combines some undecorated items and some items decorated on the lip with shell impression in a cluster where the dominant attributes are the smallest class of rim width (< 30 mm) and the smallest class of lip diameter (< 160 mm), coupled with straight rim profile. This is the only cluster primarily defined on size attributes. This cluster identifies the equivalent pot form to the small aperture, ethnographic water pot, the *hodu*.

*Cluster 5* comprises sherds that are painted and/or have the buff surface and are decorated in all major zones as dominant attributes. This cluster encompasses a range of sizes, including minor percentages of the small rim, small aperture pot identified in Cluster 4. This subgroup has been located here on the strength of the association of decoration techniques and locations in this cluster. The cluster also acknowledges an association between painting and/or buff surface and shell impression on the same items.

*Clusters 6 and 7* are very similar to each other in almost the full range of attribute variables present and are separated by high levels of shell impression in one group and high levels of incision in the other.

*Clusters 8 and 9* comprise items that repeat the general size distinctions of Clusters 1 and 2, above. Both clusters are mostly decorated with shell impression (75.5% and 65.1% respectively) but also with incision (24.5% and 30.2% respectively). Importantly, inspection of the data base shows that the two decoration techniques do not overlap with each other on individual items, as they do with painting and shell impression, for example. Thus, the primary clustering attribute is size rather than decoration technique, as it was in Clusters 6 and 7, but after this the size groups in Clusters 8 and 9 split on decoration technique.

One can see in these clusters the deficiency of RELOCATE discussed earlier, that the technique will reach a point where no single relocation will improve the result, but where the simultaneous relocation of a number of cases – in this instance grouping all cases on size, or alternatively, on decoration technique -could make a substantial improvement to the clusters.

Lastly, *Cluster 10* isolates a small group of 15 items that are decorated externally above the neck, not with paint or buff surface, as in Cluster 5, but with shell impression. While the group is noteworthy in the sense that the underside of the everted rims of globular pots is rarely decorated except with paint, the cluster is small and does not form an important sub-type of the Motupore globular pots.
Reducing 10 clusters

While examining the 10 cluster RELOCATE output is instructive in understanding how the program worked, the results indicate that apart from Clusters 4 and 5, the small aperture, narrow rim pots and the painted pots, the distinctions between the remaining eight clusters are blurred, separating on the one hand on mid-size and larger size/shape characteristics, and on the other on the distinction between shell impressed and incised decoration techniques occurring predominantly on the lip. At the same time about half of the sample is undecorated. At a different level of generalisation, the associations between these eight clusters are as visible as the distinctions between them, again identifying the homogeneous nature of much of the sample.

While there are clear similarities between the attribute groupings of RELOCATE and Herb.Divide that might or might not be best attributed to unintentional attribute weighting, one distinction between the two is Cluster 4 (small aperture, narrow rim pots) which only occurs as a minor subgroup in Herb.Divide (Figure 6.2, string -33, 5, -31, 29, -2, 1, 8) and which comprises only 62 items, all undecorated. In comparison, Cluster 4 comprises 141 items, because it includes both decorated and undecorated items.

Intuitively, one might reduce the ten clusters to five groups, one that maintained the small aperture, narrow rim group and four others defined on decoration categories: undecorated, paint/buff surface, shell impression and incision. To do so throws up two problems. The first is that precedence has to be given to the small aperture, narrow rim group since examples of all four decoration techniques occurred within it; this in turn means that each of the decoration categories will not contain all of their representatives in the sample. As well, the small aperture, narrow rim group is part of a continuum rather than a discrete group, since some items have rims < 30 mm but apertures > 160 mm, while other items have apertures < 160 mm and rims > 30 mm. Including the next category of lip diameter (< 200 mm) changes but does not alleviate the problem. While small aperture, narrow rim pots form a group that is probably important in the analysis, it is an ‘ideal’ type that shows continuities in its attributes that move beyond any arbitrary size classes needed to define it. In other words it is a cluster in a wider continuum that reflects homogeneity as much as differentiation.

One obvious way to proceed would be to nominate groups on the basis of decoration techniques and seek more comprehensive divisions within them by creating sub-groups.

Group 1 - Undecorated globular pots. Undecorated globular pots provide a perfect example of the homogeneity just discussed. Clusters within this large group (539 items = 47.2% of the sample) are predominantly in the attribute classes, rim width and lip diameter. Isolating the two smallest lip diameter classes (<160 mm and 160 mm to 200 mm) provides a group of 251 items, where rim width = < 30 mm (107 items) and rim width = 30 mm to 40 mm (114 items) account for 88.1% of this small lip diameter class. Such a division is supported by further examination of the rim width = < 30 mm class; only 10 further examples of rim width = < 30 mm exist in the sample on larger diameter lips, indicating that 91.5% of rims = < 30 mm are associated with the two smallest lip diameter classes and signalling that a small aperture, narrow rim sub-group does exist. This close association can also be examined in the decorated sample. Here almost exactly the same proportion (90.3%) of rims = < 30 mm are associated with the two smallest lip diameter classes.
Returning to the undecorated globular pots, the small aperture, narrow rim sub-group is, however, not supported by further examination of the rim width = 30 mm to 40 mm variable, just noted to have 114 items with the two smallest lip diameter classes (<160 mm and 160 mm to 200 mm); here there are a further 160 items related to larger lip diameters. The majority (149 items or 93.1% of this sub-group) relate to the next two lip diameter variables, lip diameter = 200-240 mm and lip diameter = 240-280 mm. Again the respective results for decorated pots mimic those for undecorated pots. There are 322 decorated items with rim width = 30 mm to 40 mm; 138 (42.9%) of these are associated with lip diameters < 200 mm, 172 (53.4%) with lip diameters 200 mm to 280 mm and 12 (3.7%) with larger rim widths.

Such data suggest that there are no clear-cut sub-groups among the Motupore undecorated (or decorated) globular pots. On the other hand this ignores a recognisable tendency in the data that suggests two or more sub-groups based on size attributes. For the current exercise we might consider four sub-groups:

- **Group 1a** comprises 107 items with rim width = < 30 mm and lip diameter = < 200 mm.
- **Group 1b** comprises 114 items with rim width = 30-40 mm and lip diameter = < 200 mm.
- **Group 1c** comprises 149 items where rim width = 30-40 mm and lip diameter = 200-280 mm.
- **Group 1d** comprises 146 items where rim width = >40 mm. This sub-group has all the lip diameter variables represented, from one example of lip diameter = < 160 mm, to 99 examples where lip diameter = 240-320 mm; in general, larger rim width more frequently occurs on items with larger lip diameter.

These four sub-group account for 516 of the 539 undecorated globular pot items (95.7%). The 23 ‘residue’ items comprise 11 sherds with rim widths < 30 mm and lip diameters > 200 mm, and 12 sherds with rim widths 30-40 mm and lip diameters > 280 mm.

Whether this subdivision is valuable beyond demonstrating a general relationship between rim width and lip diameter is moot; it does not offer strong support for a separate small aperture, narrow rim category, because it fails to suggest clear boundaries between this group and the remainder. Further investigation of other associated attribute classes did not clarify the matter.

**Group 2 - Painted and/or buff surface globular pots.** There are 232 items in this group, representing 20.3% of the sample. Of these 154 (66.4%) are painted on a buff surface, 58 (25.0%) are painted on a non-buff surface and 20 (8.6%) are buff surface sherds without paint; as noted this last group is thought possibly to reflect sherds of otherwise painted vessels where the painting is absent as a result of the breakage isolating an unpainted area.

Investigation of size/shape attribute classes resulted in similar results to those obtained for undecorated globular pots. The highest number of items with rim width = < 30 mm fall in the lip diameter range = < 160 mm (63.8%); with rim width = 30-40 mm 63.6% of the sample have lip diameters between 160 mm and 240 mm, and so on.
Three preliminary sub-groups were considered on the relationships between paint/buff decoration and the other two dominant decoration techniques, shell impression and incision.

- **Group 2a** comprises 167 items where painted/buff surface decoration is the only decoration technique present. This group comprises 72.0% of Group 2.
- **Group 2b** comprises 51 items with painted/buff surface decoration associated with shell impression. This group comprises 22.0% of Group 2.
- **Group 2c** comprises 13 items with painted/buff surface decoration associated with incision. This group comprises 5.6% of Group 2.

In addition four items that have painted/buff surface decoration are associated with combing. Note also that in these groups some items have been counted twice because several other decoration techniques occur together: one item has shell impression and incision and two items have shell impression and combing in addition to paint/buff surface decoration.

**Group 3 – Incised globular pots.** There are 145 items in this group, representing 12.7% of the sample. As with Groups 1 and 2, investigation of size/shape attribute classes failed to isolate distinctive groups, showing the same continuities as previously. There is a strong correlation between decoration = incision and location = on lip, with 128 items (88.3%) in this group. Thirty incised items are decorated internally and 19 decorated externally above the neck. Because these are unusual locations for incision, it can be noted that 12 in the former group and 11 in the latter group are associated with paint/buff surface decoration and are most likely to be painted at these locations rather than incised. The remaining 8 items decorated externally above the neck consist of one item that is also decorated on the lip and seven that are otherwise undecorated. Of the remaining 18 items decorated internally, eight are associated with on lip decoration and 10 are otherwise undecorated. These are likely to be trade marks, discussed further in Chapter 8.

The general homogeneity of this group denied the utility of dividing it further. Note however, that 17 items in this group were also counted in Groups 2 and 4.

**Group 4 – Shell impressed globular pots.** There are 291 items in this group, representing 25.5% of the sample. Again, investigation of size/shape attribute classes failed to isolate distinctive sub-groups, indicating the same continuities as previously described. As with incision there is a strong correlation (88.7%) between shell impression and the on lip location. Although 72 items are decorated internally only 12 of these are not also decorated elsewhere. In the other 60 cases decoration occurs on the lip; 47 cases in this latter group carry paint/buff surface decoration in multiple decoration zones. Thus, excluding painting/buff surface items, 25 sherds in this group are decorated internally, and 13 are also decorated on the lip. As with the incised group at least some of these internal decorations are likely to be trade marks, discussed further in Chapter 8.

As with the incised group, the general homogeneity of this group denied the utility of dividing it further. Importantly, note that 55 items in this group have also been counted in Groups 2 and 3. The vast majority of these (51 items) are associated with painting/buff surface, two of these also carrying combing and one of them also having incision. These 51 sherds have also been considered separately as Group 2b, but are also incorporated here to give a truer impression of the distribution of shell impressed
decoration. Three other shell impressed sherds are also incised and one other is also combed.

Distribution of globular pot groups through time

One basic test of the utility of these groups is to examine their distributions through time. Figure 6.3 shows distributions of the four basic decoration groups by PAU. The sub-groups of Groups 1 and 2 were also examined but showed no different information to that contained in their more general categories, again suggesting that they might not have any utility beyond their descriptive value.

Undecorated items are frequent in all pottery analytical units (PAU), being only slightly fewer in PAU 6 but most numerous in PAU 1. Painted and/or buff surface decoration has a high representation in PAU 6 and then diminishes through time, but is still present in PAU 1. Incised items show almost exactly the reverse trend, being infrequent in the earlier part of the sequence and most numerous in PAU 1. Shell impression maintains a similar representation for most of the sequence, but diminishing significantly in PAU 1.

Figure 6.3. Distribution of the four globular pot decoration groups discussed in the text, by pottery analytical unit. Numbers in brackets show sample sizes.

It is unclear why all three decoration techniques are commonly together through the central part of the sequence but interact with each other differently. As noted, 51 shell impressed items, representing 17.5% of this group, are also painted and/or buff surface, but incised items have much lower associations with the other decoration attributes; just 13 incised sherds are also painted and only 4 incised sherds are also decorated with shell impression (2.7%). These latter associations most occur early in the sequence; by the time incision is dominant it is almost always the only technique occurring on an incised sherd.

Summary – globular pots

In the somewhat tedious search for groupings of globular pots to emerge from the clustering analyses, I have avoided using the word ‘type’; this concept will be returned to in Chapter 10. The search suggests that size/shape sub-groups might be defined, but that their boundaries are indistinct. While matters of interpretation are further pursued in later chapters, the simple divisions into decoration technique are shown to have temporal variability and thus utility in a typological sense. Beyond
this the analysis has offered no sensible subdivision of globular pots. Globular pots come in a generally continuous size range where the smaller variables of one size attribute are mostly associated with the smaller variables of other size attributes, and larger with larger, but in no exclusive fashion. As has been shown, it is possible to isolate potential groups such as the narrow rim, smaller aperture set, seen to equate with the *hodu*, the ethnographic water pot, but to do so does not account for significant numbers of items that have narrow rims and large apertures or wide rims and small apertures. These data have important implications when we approach questions of simplification and standardisation in Chapter 10.

**Results from Herb.Divide and RELOCATE for bowls**

*Bowl groups using Herb.Divide*

As can be seen in Tables 5.3 and 5.4 the Motupore bowl sample now comprises 789 items. This contrasts with 814 bowl sherds used in the statistical tests reported here. After these tests were completed and the pottery was returned to the National Museum and Art Gallery in Port Moresby, slight coding errors or ambiguities were noted in 25 items in the original data base. Without the collection available to clarify these ambiguities, removing them from the data base before further analysis was considered the sensible thing to do. It is believed that these discrepancies in the data base used for Herb.Divide and RELOCATE have not influenced the results to any appreciable extent.

Figure 6.4 shows the division of the bowl sample using Herb.Divide. Interestingly the sample first divides on whether or not decoration occurs on the upper external zone of the vessel. Since only c. 10% of the bowl sample sherds are undecorated it is unlikely that this result is the product of unequal variable weighting discussed earlier for the globular pots.

About 85% of all decorated bowls sherds are decorated on the external upper zone. Those that are not are mostly also not carinated and divide next on whether they are decorated on the lip or not. Those that are not decorated on the lip are predominantly undecorated and form two relatively small clusters at the extreme left of Figure 6.4, characterised firstly by whether or not they have a modified (thickened) rim profile. Those that have a thickened profile are mostly restricted or vertical in terms of rim angle, while those without the modified rim profile tend towards smaller lip diameters.

Items that are not decorated on the external upper zone but are decorated on the lip again divide on whether they have thickened rim profiles or not. Of interest, those that do not have thickened rim profiles show a tendency to be shell impressed, while those that do, tend to be incised, and like the thickened and undecorated forms, tend towards restricted or vertical rim forms.

As seen, 623 items from the sample of 814 items are decorated on the external upper zone. Following the pattern already noted, these divide next on whether they are carinated or not. A small group (75 items) that are carinated form a distinctive group (in the upper centre of Figure 6.4). These form a tight cluster; even though they divide on whether decoration occurs on the lip or not, both these subgroups are associated with shell impression and unmodified rims.
Figure 6.4. The division of Motupore bowls using Herb.Divide. Key: 2=Lip Diameter 100-140 mm; 4=Lip Diameter 180-220 mm; 5=Lip Diameter 220-260 mm; 6=Lip Diameter 260-300 mm; 7=Lip Diameter 300-340 mm; 14=Rim angle 80°-90°; 15=Rim angle 90°-100°; 16=Rim angle 100°-110°; 17=Rim angle 110°-120°; 18=Rim angle >120°; 19=Body angle <40°; 20=Body angle 40°-50°; 21=Body angle 50°-60°; 22=Body angle 60°-70°; 23=Body angle 70°-80°; 24=Body angle 80°-90°; 27=Unmodified rim; 28=Modified rim; 29=Carinated; 30=Not carinated; 31=Undecorated; 32=Internal; 33=On lip; 34=External upper zone; 35=External lower zone; 36=Incised; 39=Shell impressed; 42=Buff surface; 43=Painted.
In the subgroup with decoration on the lip, decoration also frequently occurs in the lower external zone, an area that, if decorated, is otherwise almost exclusively painted (see next section).

Bowl sherds that are decorated on the external upper zone and are not carinated again divide on whether they are also decorated on the lip. Those that are form a positive cluster (on the right hand side of Figure 6.4) that can also be decorated internally and externally on the lower external zone with painting and/or buff surface. Some in this cluster have thickened rims, or may be also decorated with incision or (less frequently) shell impression, in addition to paint.

Two associated subgroups split from this cluster by lacking internal decoration. One is immediately characterised by shell impressed decoration, associated with unmodified rims. The other group is incised and is associated with modified (thickened) rims, again tending towards restricted rims on mid-depth lower bodies.

The final major division is one with four principal associated clusters. Again commencing as items decorated on the external upper zone that are not carinated, this cluster is then defined by being not decorated on the lip; a group that is without modified (thickened) rims divides into incised and shell impressed groups with the latter having mostly unrestricted rims. Those with modified rims divide similarly into a smaller group with shell impression that is characterised by mid-depth lower bodies; the much larger group (202 items out of 276) are incised. Two items that are also painted are shed at this time, while the remaining 200 describe a long ‘kite’s tail’ that define five small clusters based primarily on shallow to mid-depth body profiles determined by the upper body angles. These also tend towards restricted rims.

**Summary of Herb.Divide (Bowls)**

Several points stand out in this analysis:

1. The strong propensity for clusters to divide on rim profile characteristics (unmodified and modified; carinated and not carinated) is assumed to reflect the inadvertent weighting ascribed to these variables by the way they were set up. Were the analysis to be run again, these would be reduced to modified and carinated and coded present or absent. The nagging question remains: would these characteristics still prove to be of significant diagnostic importance? Intuitively I think this is likely. That said, several interesting groups were thrown up in this analysis that will be further examined after discussion of the RELOCATE analysis of the bowls.

2. While the bowls are clearly less homogeneous than the globular pots, there are some familiar and recurring themes to be seen, as well as different ones. Among the former are the groups formed by different decoration techniques. Painting and/or buff surface again groups because it is found on all the major decoration zones, unlike incision and shell impression. Meanwhile these latter techniques again separate away from each other, while both are seen to occur with painting.

3. There is a strong suggestion that incision is more closely related to modified (thickened) rims and to direct or restricted vessels with shallow to medium depth profiles (as are undecorated bowls), while shell impressed bowls might tend more to unrestricted rims.

4. The separation of a cluster of carinated, unmodified rim bowls warrants further consideration (see below)
Bowl groups using RELOCATE

As with the globular pots, the application reviewed here was set to establish ten clusters. The resulting set is described in Table 6.3, where dominant attributes are considered to be those occurring on more than 70% of the cases in that set, frequent attributes are those that occur on 40% to 70% of cases in the set, and minor attributes being those that occur on 20% to 40% of cases.

Unlike the globular pots, most of the bowl groups have dominant attributes and minor attributes but many fewer frequent attributes. Thus the bowls appear to have more distinct groups than the globular pots and it is easier to perceive separations between them. Again, some clusters are sufficiently similar to suggest that fewer than ten types are indicated. Also there are clear similarities between Herb.Divide and RELOCATE, but as noted for the globular pots, since both techniques ultimately analyse attribute associations they are not truly independent of each other and both are affected by the weighting problem.

Clusters 1 and 2 group the undecorated sherds, differentiating them on whether the rim is unmodified (Cluster 1) or modified. The former group tend towards direct, unrestricted rims, while the latter have more restricted profiles.

Clusters 3 and 4 comprise the two largest groups and are very similar in respect of all listed variables apart from decoration techniques, with the former being incised and the latter shell impressed. Again these techniques appear not to overlap to any great extent. Items in these groups have modified rims and are frequently decorated on the external upper zone and to a lesser extent on the lip.

Clusters 3 and 4 together represent more than half the sample and are virtually identical in the variables represented as dominant and marginal. As said, the attribute that differentiates these clusters is decoration technique, with 299 of 303 items being incised in Cluster 3 and 110 of 118 items being shell impressed in Cluster 4. Otherwise these bowls tend towards medium to large lip diameters, medium to shallow lower bodies and vertical to restricted rims. Among the dominant attributes, all of the rims are modified (thickened), most are not carinated and c. 85% of them are decorated on the external upper zone. Both clusters have on lip decoration occurring on about one third of their items.

Cluster 5 contains 75 items that are painted and/or buff surface. As with the globular pots this decoration occurs in all the decoration zones, but unlike the pots painting occurs with incision more frequently (32 of 75 cases) than it does with shell impression (22 of 75 cases). In only two instances do incision and shell impression coincide with painting and/or buff surface and the general separation of incision and shell impression seen on the globular pots continues with the bowls, with only 18 examples (2.3% of the whole bowl sample) of items where these two techniques occur together.

Cluster 6 represents the carinated bowl group also discovered by Herb.Divide. Again, carinated bowls predominantly have unmodified rims and are associated with shell impression on the upper external zone and in two-thirds of cases on the lip. Around a third of the sample is also decorated below the carination on the lower external zone and combing also occurs on a third of the items in this cluster.
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**Table 6.3.** Ten globular pot clusters determined by RELOCATE. Abbreviations: BA = body angle; LD = lip diameter; RA = rim angle. See text for discussion.
Clusters 7 and 8 are again similar clusters that separate from each other on the decoration technique attribute. Cluster 7 has all of its 36 members incised, while Cluster 8 has 56 of its 64 members shell impressed. Clusters 7 and 8 are separated from Clusters 3 and 4 on the basis of the latter clusters all having modified rims and the former two clusters all having unmodified rims. Clusters 7 and 8 are again mostly decorated on the external upper zone (all items for Cluster 8 and two-thirds for Cluster 7); a major difference however is that Cluster 7 has on lip decoration on 20 of 36 items, while Cluster 8 has none out of 64 items.

Cluster 9 comprises 52 sherds that would group with Cluster 6, except that they are not carinated (although they tend to be restricted). They are mostly shell impressed with unmodified rims and associated with combing and decoration on the lower exterior zone.

Lastly Cluster 10 is a small group of 13 individuals with unusual variables in this bowl sample. All are shell impressed and while 11 items are decorated on the lip only two are decorated on the upper external zone. Seven have unmodified rims while six have modified rims, 12 have small lip diameters between 100 mm and 140 mm, eight are more heavily restricted (>120°) than other rims in the sample and seven have large body angles suggesting these vessels tend to be deep. These sherds are thus seen to be eccentric in this assemblage.

Reducing 10 clusters

As discussed with the globular pot samples, any attempt to reduce RELOCATE’s ten clusters invokes the structural problem of altering the hierarchies established by the program and re-allocating some dominant attributes to lesser positions. Examining Table 6.4, one obvious initial move would be to divide the whole sample into modified and unmodified rim groups, which would accommodate all the clusters except for Cluster 10, where the 13 sherds in this cluster would split. Leaving aside the question of whether the importance of these two rim treatment variables is the product of unequal weighting, as previously discussed, further divisions would logically be made on the major decoration techniques, painting, incision and shell impression. This would mean splitting these decoration attributes (and other decoration techniques present but less significant) into the modified and unmodified rim categories. The alternative would be to follow the system for the globular pots and give primacy to the decoration techniques. Both approaches were attempted and are briefly reported.

Bowl decoration techniques through time

In examining bowl decoration attributes through time, it was useful to consider all decoration techniques present on the bowl sherds in the sample, not merely the major techniques indicated by Herb.Divide and RELOCATE. As with the globular pots, every example of each technique was counted, so that items carrying more than one technique were counted more than once.

Figure 6.5 shows the percentage distributions of the seven bowl decoration groups according to pottery analytical unit. There are some similarities between the behaviours of different decoration techniques on the bowls and on globular pots, most noticeably with the increase through time of incision and the decrease of shell impression. Undecorated bowl sherds increase from PAU 6 to PAU 3, decrease in PAU 2 and increase again in PAU 1. Painting and/or buff surface again decreases in the three most recent PAUs, but whereas these decoration techniques are the most prominent on globular pots in the earliest unit, PAU 6, this is not true of bowls.

Among the decoration techniques present on bowls but not on globular pots, finger impression occurs throughout the sequence but is slightly more frequent in the younger half of the sample, while combing and slashing occur most frequently in the two earliest PAUs.
Compared with incision, shell impression and to a lesser extent painting, these three new techniques are much less frequent, there being only 46 cases of finger impression, 36 of combing and 20 of slashing, compared with 360 cases of incision and 307 of shell impression. At the same time it needs to be remembered that small groups can have typological importance, as we will now see.

Given the prominence of the attribute bowl rim form (modified or unmodified) in the Herb.Divide and RELOCATE analyses it was also considered useful to consider the temporal progression of these forms and the decoration types within them. Figure 6.6 shows the distribution across the six PAUs of modified and unmodified rims. It is clear that the two forms behave differently through time, with unmodified rims being prevalent in PAUs 6 and 5, but with modified rims being more frequent in the younger PAUs 1 to 3. This alteration to Motupore bowl forms appears to have significance beyond the weighting problem previously described.

Since decoration techniques were seen to change through time for the whole bowl sample, I also investigated the distributions of decoration techniques within the modified and unmodified rim profile groups.

Figure 6.7 shows the percentage distributions according to pottery analytical unit, considered in terms of modified and unmodified rim forms. Clearly, the percentages of decoration techniques vary between the two groups. A higher proportion of unmodified bowls are undecorated, especially in PAU 1. The data also indicate a strong tendency for incision to increase on modified rim bowls as they become more common, whereas the opposite is true of shell impression.
Throughout the sequence shell impression is proportionally more frequent on unmodified bowls, while following a similar diminishing trend. The differences between the two profile groups is also apparent among the less dominant techniques, with painting occurring more frequently on modified forms, especially in the early analytical units. Finger impression is also more frequent on modified forms, but combing is the opposite, occurring most frequently on unmodified bowl forms.

Combing is particularly noteworthy. After shell impression, it is the most common decoration technique in the earliest set of unmodified bowl rims. Following the groupings nominated by the two statistical tests, it was found that of 36 combed items in the total bowl sample, 32 of them (89%) are also shell impressed and of these, 20 (63%) are also carinated. All but one of these have unmodified rim profiles and 12 of the 20 (60%) are decorated on the lower external zone.

Importantly, only one of these 12 is painted, indicating that the lower external zone is an important location for shell impression and combing, independent of painting.

Table 6.5 shows a sub-group initially defined by the presence of shell impression and unmodified rims. There are 171 items where these variables occur together with decoration occurring predominantly in the exterior upper zone.

Two points emerge from this table. The first is that the variable group [unmodified rim, carinated, shell impressed, combed, exterior upper zone and exterior lower zone] form a polythetic set where the combinations of these variables define a type where the ideal form would be described as ‘a bowl with unmodified rim that is frequently carinated and that is often decorated on both the upper and lower exterior zone with a combination of shell impression and combing’. It is clear that shell impression and decoration on the external upper zone are not key attributes (because they occur widely elsewhere in the sample) but are important components of the type. The three key attributes, carination, combing and exterior lower zone, may only occur together on 11 items, but as a polythetic set the membership increases. The second point is that these key attributes are most numerous in PAU 6 and to a lesser extent in PAU 5 thus suggesting that this group has a limited temporal span.
Figure 6.7. Percentage distributions of the seven bowl decoration techniques by pottery analytical unit, comparing items with modified versus unmodified rims. See text for discussion.
Table 6.5. Presence by number of the variables carinated, combed, and exterior lower zone occurring on 171 shell impressed, unmodified rim bowl items, shown individually and in combination.

Additionally, it will be seen in Chapter 8 that this set of items is closely associated with the most distinctive (and elaborate) motif to be found among the bowl sample, the herringbone motif.

Summary – bowls

As can be seen, I did not attempt creating groupings and sub-groupings for the bowl sample in the way attempted for the globular pots, partly because the lack of size/shape resolution there would have been repeated with the bowls, but also, contrarily, because other groupings of the bowl sample were more apparent. Grouping the bowl sample by decoration technique has temporal variability similar to the globular pot sample and thus has typological utility.

Beyond this, the bowl analysis indicated that rim modification or the lack of it, and to a lesser extent carinated and non-carinated forms yielded groups with particular associations with various decoration techniques. A small but potentially important bowl type associated with combed decoration was identified. These analyses also indicated that vessel forms could be defined, but that little general shape variability (as opposed to profile variability) was apparent through time. This is pursued further after additional analysis is undertaken in Chapter 7.

Summary of statistical analyses

Despite methodological flaws that could not be rectified when they were eventually recognised, the clustering programs still proved instructive in defining the nature of the Motupore pottery assemblage.

Firstly the assemblage is homogeneous. This is particularly true of the globular pots where difficulty was encountered separating these vessels on size and/or shape. Instead there is a progression from small to large in each of the attribute classes, where employing arbitrary boundaries in one does not result in meaningful boundaries in the other attribute classes. The clustering programs did suggest a grouping of globular pots with small mouths and narrow rims tending towards the vertical, but, as noted, each of these three variables was commonly found on items where the other two were not present.

While there was more variety among the bowl forms, they also were homogeneous in form, in the sense that particular variables repeated themselves in the analysis; although imprecise, they indicated a range of direct, open hemispherical forms together with composite forms with vertical or restricted upper walls. The body angle data suggested most vessels probably ranged from shallow to mid-range depths that did not exceed their lip diameters and very frequently were much shallower than this measurement.
Secondly, change through time is *evolutionary*. There are clearly no breaks in the ceramic sequence for either pots or bowls, as there were no sequence breaks in the stratigraphic and dating evidence. At the same time chronological change is indicated for both globular pots and bowls in the decoration techniques employed. Consistencies between both vessel forms are seen in the replacement through time of shell impression with incision and these two techniques are by far the most common in the assemblage as a whole, for both bowls and globular pots. As with shell impression, painting/buff surface items diminish through time and here there are differences between globular pots and bowls with these decoration techniques. Perhaps oddly, painting is more common on the globular pots than on the bowls. This is particularly noticeable in the earliest analytical unit, PAU 6, where proportionally many fewer bowls are painted than globular pots, which, contrarily, are mostly painted.
CHAPTER 7 A DIFFERENT POTTERY CLASSIFICATION

Any group which may be labeled a ‘type’ must embrace material which can be shown to consist of individual variations in the execution of a definite constructional idea (Krieger 1944:272).

While the cluster analyses discussed in Chapter 6 offered coherent results, errors in their application and minor flaws in the data base that could not be corrected without returning to the collections in Papua New Guinea, made these results suspect. This, added to structural limitations of the analyses themselves, meant that the results comprised a typology, but perhaps not the most appropriate typology for addressing the questions being asked of the Motupore pottery. In particular the analysis remained opaque, at least to me.

Of importance, and as already discussed in earlier chapters, I had begun by assuming that shape and size attributes might be more important in developing a relevant pottery classification in the first instance, rather than decoration location, decoration technique, or motif, if for no other reason than that the primary purposes of these pots were utilitarian – designed for cooking, preparing/serveing food and as storage containers. In other words function should be the primary design constraint.

Paradoxically, I recognised while excavating Motupore that decoration would likely be a more sensitive indicator of where Port Moresby pottery assemblages sit in space and time. This paradox is a variation of the etic/emic dilemma. Fairly obviously, Motu potters set out to create a general size and form with each pot. However, the statistical analysis demonstrated that neither size nor shape measurements produced clear typological groupings. As well, differentiation became more obscure when the various size and shape attributes were considered together, even as polythetic sets. It was suggested in Chapter 6 that this might be a product of the manufacturing process, where wall thickness rather than a preconceived notion of size might be the determining factor of the achieved size, with wall thickness perhaps determined, in turn, by the nature of the firing process.

Nonetheless, utilitarian function was the primary objective of the Motupore potters, since neither ethnographically nor archaeologically is there any suggestion of specific ceremonial or other sorts of pottery being made in the area. However, against this, the statistical approaches described in Chapter 6 emphasised the primacy of decoration in clustering similar entities in the assemblage, and in persuasive ways. This suggested that there might be insufficient classificatory differentiation in vessel forms after the manual division of pots and bowls. Thus, trends in decoration might simply be more visible than trends in pot shapes in fragmented archaeological assemblages. The original clustering analyses did not address such possibilities. Dissatisfied, I decided that I needed a different analysis where the relationships between data and the questions I was asking were readily apparent to me.

After some consideration, I decided to attempt a quantitative but non-statistical analysis. While this decision ran contrary to the fashions of modern archaeological analysis, for me advantages included transparency, my ability to control the data directly and that the results could be compared as ‘independent’ results with the cluster analyses attempted in Chapter 6. Of course, since the actual data recording had not changed, this comparison would only be independent to the degree allowed by the structure of the data base.
My procedure was to begin by examining the numerical distributions of each attribute class, mainly using percentage distributions. Visual assessment of the results then identified those attribute classes and particular attributes that showed change through time and might therefore be valuable in forming a time-sensitive typology to apply to the questions under analysis. Particular attributes were then combined and tested for their utility against the data base. It was expected that from this additive approach a polythetic typology would emerge that could locate a large majority of the sherds in the assemblage in a manageable number of types.

Again, for these analyses, the total assemblage was separated into globular pot and bowl sherds.

**Globular pots**

*Attributes*

**Rim Width**

Figure 7.1 shows the distributions of the four attributes in this class. (Note on this and other diagrams in this chapter, PAU is reduced to AU and measurements are offered in centimetres rather than millimetres, for convenience in producing the diagrams.) For rim width the data show a general similarity in their distributions; however there is a clear trajectory through time towards standardisation of rim width. In the earliest analytical unit, PAU 6, there are approximately equal percentages of sherds in the 30-40 mm and 40-50 mm categories as well as the highest percentage of >50 mm sherds. By PAUs 1 and 2, two thirds of the sherds fall in the 30-40 mm category. However a significant percentage of sherds (18-27%) with the smallest rim width of <30 mm maintain a close grouping throughout the history of deposition at the site.

![Figure 7.1. Percentage distributions of rim widths (cms) by analytical unit.](image)
Rim Profile

Figure 7.2 shows the distributions of the three attributes in this class. The high percentage use of straight rims shows consistency in this attribute through time and suggests that its use as a discriminating attribute for this assemblage is limited. Concave profiles may well be the inadvertent result of rim manufacture, where using the thumb and forefinger to shape the rim accidentally tends towards a concave profile. However convex profiles would seem to require deliberate production. The higher percentage of convex rims in PAU 6 provides a further attribute for differentiating the pottery from PAU 6 from later analytical units.

Figure 7.2. Percentage distributions of rim profiles by analytical unit.

Lip diameter

The lip diameters of globular pots are sometimes taken as a rough proxy for pot size. While a moment’s thought suggests that such an assumption is tenuous, it can be partially tested by examining lip diameter, rim angle and body angle in unison (see discussion below). A more prudent initial approach is to analyse potsherds as potsherds and not as whole pot proxies. Thus, here lip diameter variability is considered initially as a visible archaeological entity rather than a measure of whole pot size; but, as will be seen, this attribute does in fact appear to be the best indicator of pot size in this assemblage.

Figure 7.3 shows the distributions of the seven variables for this attribute. Overall, rim diameters follow similar trajectories throughout the history of the site, with the earliest and latest analytical units again showing the greatest divergence from the norm. Between 17% and 22% of individuals in all units cluster in the <160 mm class; recalling the similar cluster of small rim widths, this identifies a possible correlation in these attributes. In terms of differences, PAU 6 is again distinctive, having more small lip diameters and fewer large lip diameters in its sample.
As with other attributes, PAU 1 shows the most difference to PAU 6. The data for PAU 1 run contrary to the notion of increasing standardisation through time, since if lip diameters do reflect different pot sizes it suggests a wider range of sizes were being manufactured at the end of the site’s history.

Rim Angle

Figure 7.4 shows the distributions of the five variables for this attribute. Rim angles remain relatively consistent throughout the occupation of the site, with the majority of sherds in every PAU having the 60°-70° attribute. Unlike in many other attribute classes, PAU 6 is not the outlier in terms of rim angle, with the middle analytical units PAU 3, 4 and 5 showing the most variability. The move towards the standardisation of the rim angle at 60°-70° is seen most strongly in the samples from PAU 1 and PAU 2.

Body Angle

Figure 7.5 shows the distributions of the nine variables for this attribute. The inclusion of this attribute in the analysis was primarily to combine it subsequently with lip diameter and rim angle to get some sense of the whole pot profile, and this is done below. Taken as a single measure on the sample assemblage it shows general similarity through time between the first five analytical units, but with noticeable change occurring in PAU 1, where the body angle becomes more acute, moving from a more spherical shape to a ‘bag’ or ‘teardrop’ shape.
Figure 7.4. Percentage distributions of rim angles (in degrees) by analytical unit.

Figure 7.5. Percentage distributions of body angles (in degrees) by analytical unit.
For the whole sample, 14 of 16 sherds with body angles 80°-90° occur in PAU 1, with similar percentage increases in the 70°-80° and 60°-70° categories in this unit, compared to the earlier units. This change could be a deliberate change in style, or it might be that less time was being taken towards the end of the island’s occupation to create the spherical shape that had characterised globular pots in the earlier levels. Again PAU 1 and PAU 6 are the most disparate, with many pots in PAU 6 tending towards a ‘flattened orange’ profile; PAU 1, as just noted, is the reverse.

Decoration Location

Figure 7.6 shows the distributions of the five variables for this attribute. Note that since not all pots are decorated and some pots have decoration in more than one location, this graph is constructed as the percentage use of that decoration location amongst the whole sample, decorated and undecorated, for each analytical unit. Thus percentage occurrence for all locations used in any PAU can be less than or more than 100%. Again, PAU 6 stands out as distinctly different from the other PAUs; this reflects both the fact that decoration on pots is most prolific in the earliest analytical unit and that the predominant type of decoration is painting and/or buff surface, both of which usually occur on most and frequently all zones of the pot surface. Other types of pot decoration occur mainly on the lip and this is true of all analytical units. The stronger presence of zones other than the lip for the four middle analytical units again mostly reflects painting all over the pots, although on fewer individuals. A clear indication of a diminution of decoration of pots through time is also apparent in the data representing PAU 1 which shows the lowest percentages of decoration in all locations. A corollary of these data is shown in Figure 7.7, which shows the distribution of undecorated sherds in each of the analytical units. The fewest are in PAU 6, while they occur most frequently in PAU 1.

Decoration Technique

Figure 7.8 shows the percentage distributions of decorated sherds according to technique of decoration. There are no finger impressed globular pots, and slashing, combing and appliqué/nubbins represent tiny percentages. The only notable point amongst these minor attributes is than combing occurs on 3.2% of sherds in the PAU 6 sample, a point to remember when we consider the bowl forms later in this chapter.

The three common decoration techniques, incision, shell impression and painting, each behave differently through time. In PAU 6 painting occurs on more than half the sample and is clearly associated with buff surfaces although painted examples occur on non-buff surfaces. Painting continues through all of the five succeeding analytical units but in much smaller and decreasing percentages, with PAU 1 having proportionally the fewest painted and buff surface items. Shell impression maintains a steady presence from the beginning of occupation to and including PAU 2 but decreases sharply in PAU 1. Incision increases steadily throughout the occupation sequence, from less than 2% in PAU 6 to more than 27% in PAU 1, even though as noted in the previous section, decoration as a whole decreases in this most recent analytical unit.

Summary of single attribute analysis

Single attribute distributions indicate in their similar trajectories through time that the Motupore ceramics form a single, unified ceramic tradition.
Figure 7.6. Percentage distributions of decoration location by analytical unit.

Figure 7.7. Percentage distributions of undecorated sherds by analytical unit.
While various distributions distinguish the latest analytical unit (PAU 1) and especially the earliest (PAU 6) as the most different from the median distributions of attribute classes, the similarity of the trajectories of each is overwhelming in its support for a model of continuity in the globular pot forms over time.

It is assumed that many of the differing characteristics of the PAU 6 ceramics reflect homeland styles brought to the site at its founding that underwent rapid change on Motupore. Reasons for such changes might be 1) social – changes in the roles of pottery within the new social structures on the island, or social distance from any homeland village(s); 2) economic – the changing roles of Motupore pottery within and beyond Bootless Bay, loosely configured as exchange; or 3) technological – a product of dealing more or less efficiently with local raw materials. The changes to the most recent ceramics, those from PAU 1, reflect simplification and standardisation in some of the attributes. Simplification and standardisation are clearly not the same things and will be further considered in a Chapter 10. Here they can be considered to reflect general trajectories towards increasing the speed of production.

Equally, the increase in the range of pot sizes noted in the lip diameters and body angles appears less likely to reflect a conscious move towards a wider range of shapes and sizes than an increasing carelessness in production, where increasing the output has resulted in less adherence to a perceived ideal of what a globular pot should look like.

Speculation along these lines requires considering a wider range of evidence than so far presented, so while some morphological and decorative aspects of the sherds have been
summarised in this section, their fuller contextual consideration will be found in the discussion chapters of this report.

**Correlating measurement attributes**

I have made comment above on the potential interactive nature of the four measurement classes, rim width, rim angle, lip diameter and body angle and begin by looking at these attributes. Since the earlier analyses indicated that globular pots comprise a single homogeneous group, these tests were confined initially to the globular pot sample as a whole, rather than within stratigraphic analytical units.

I chose as a measure of association the percentage of occurrences of both variables on a single item compared to the total occurrences of both variables in the sample. For example, if variable X occurs with variable Y on 10 sherds and variable X occurs in total on 20 sherds and variable Y on 30 sherds, the measure is $2 \times 10/(20+30) \times 100$, which equals 40%. Note that a perfect 1:1 correlation would be expressed as 100% and could only occur when variables X and Y always and only occur with each other. A perfect negative correlation occurs as 0%.

It is important to note that this procedure does not exclude small sample numbers *per se*, but rather it excludes from the developing typology those cases where both attributes coincide only infrequently on sherds within a sample. In effect this helps to define a polythetic type because one of its defining characteristics is that each contributing variable is shared by a large number of individuals in the group. This is an important distinction; in this analysis a small number of individuals can still form a type, provided the variables that define the type are each shared by a large proportion of them.

The significant weakness of this measure is that it is not a simple measure that can be easily compared on a 1:1 basis across all correlations. As is obvious, the generated correlation numbers will be smaller where the sample numbers for the two variables being tested are very different. For example from 598 sherds with a rim width 30-40 mm, 232 also have a lip diameter of 200-240 mm, while a further 128 sherds with this lip diameter have a different width. This means that while 232 sherds share both these variables a further 494 sherds possess only one or other of these variables (i.e. $598 + 128 - 232$). Even so, these data produce a correlation figure of 48.4 for these two variables which is relatively ‘high’. At the same time there are only 35 sherds with a rim width >50 mm. Even if, hypothetically, all of these sherds had a lip diameter of 200-240 mm, the correlation figure would reduce to 17.7 because there are 360 sherds in the 200-240 mm lip diameter category.

This can be assessed in two ways. On the one hand it can be considered that these two variables do not correlate strongly because one of the variables is shared by a range of other rim width variables. Alternatively, if the first hierarchical split was made on rim width in this hypothetical case, the fact that all >50 mm rims possessed the same lip diameter would have this diameter contribute as a strongly defining variable for this potential group, even though this same lip diameter might exist in greater numbers within other groups but not be a defining variable in those groups.

Here I accept the first view because my objective is to categorise the sample in terms that are useful for both the research questions and the overall description of the pottery. This obliges me to seek groups that eventually include significant sherd numbers rather than the exclusive approach, where many groups contain only a few sherds. There is little utility for me in defining
200 groups for 2000 sherds (although it would be easy enough to do so). Thus I see more utility in a correlation where 175 sherds having rim widths <30 mm and lip diameters <160 mm in total samples of rim width <30 mm = 251 and lip diameters < 160 mm = 222, than in 5 sherds with lip diameters >360 mm also having on four of them rim widths >50 mm (from a total sample = 35). My measure of association makes such a difference obvious (Table 7.2). Values on Table 7.2 equal to, or greater than 30 are highlighted for easier identification.

However, because of this ambiguity, here I have chosen to use the data generated in this exercise not as a definitive measure of association but as a method for discovering trends in the relationships between the variables. I do this by perusing the comparative relationship between any one variable in an attribute class and all the variables in the other attribute class being compared to the first (e.g. >50 mm rims against all lip diameter variables). This in turn helps formulate hypotheses for further examination. For example, if we compare rim width to lip diameter in Table 7.2, it is immediately obvious that there is a general correlation between rim widths and diameters, moving from small-with-small to large-with-large. In particular, the strong correlation between the smallest rim width and the smallest diameter signals the possibility that small pots will separate from larger ones as a separate type. This becomes an hypothesis for further examination. At the same time the tendency for large rim widths to link with large lip diameters also signals the possibility that this might also reflect a separate group, but one of lesser importance because it has many fewer members.

In order to better assess the central trends of these data I produced graphs of each of the four attribute classes against each other, with the data derived from Table 7.2.

Rim Width and Lip diameter

Figure 7.9 shows the percentage correlations of rim width and lip diameter for the globular pot sample. There is a clear size relationship between the variables in these attribute classes, with smaller rims associated with smaller diameters and larger rims associated with larger diameters.

The separation of sherds with narrow rims and small diameters and especially the strong correlation between rim widths <30 mm with diameters <160 mm are seen to reflect a separate type, although exactly where any boundary should be drawn is uncertain. Rims 160-200 mm in diameter are meaningfully related to slightly larger rim widths 30-40 mm, but also overlap with the two adjacent categories of rim width. Similar rim width overlaps are seen on globular pots with diameters up to 280 mm, but beyond this the correlations are few and weaker, but do not rule out a third type, namely a large pot. This overall picture is taken reflect a) the general homogeneity of the globular pots and b) the relative variability in rim width on the large diameter pots. It should be remembered that there are many fewer pots with diameters >280 mm, there being a total of 55 or 4.8% of the sample.

Rim Width and Rim Angle

Figure 7.10 shows the percentage correlations of rim width and rim angle for the globular pot sample. While several minor trends are apparent, the bulk of the data suggest that for most sherds rim angle is relatively constant in the assemblage regardless of rim width. The widest rims (>50 mm) do not show any strong relationship with any rim angle although rim angles approaching vertical appear to be meaningfully associated with the narrower rims, adding some support for a small globular pot type; but narrow rims also occur in a weak relationship with more ‘flattened’ rims.
<table>
<thead>
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<th>Rim Width</th>
<th>Lip diameter (cms)</th>
<th>Rim Angle (degrees)</th>
<th>Body Angle (degrees)</th>
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<td>20-24</td>
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<td>473</td>
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<td>8</td>
<td>10.6</td>
<td>19.8</td>
</tr>
<tr>
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<td>50</td>
</tr>
<tr>
<td>&gt;5</td>
<td>6.5</td>
<td>26.1</td>
<td>33.4</td>
</tr>
</tbody>
</table>

| Sample    | <16 | 16-20 | 20-24 | 24-28 | 28-32 | 32-36 | >36 | <30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 |
|-----------|------------------|---------------------|---------------------|
| <50       | 22   | 137   | 422   | 374   | 137  | 36   | 15  |
| 50-60     | 0    | 3.8   | 4.8   | 12.6  | 15.2 | 21.4 | 4.5 |
| 60-70     | 0    | 9.6   | 17.3  | 28.2  | 8.9  | 10.8 | 4.2 |
| 70-80     | 1.2  | 10.7  | 45.8  | 38    | 18.6 | 2.4  | 3.2 |
| >80       | 4.6  | 25.8  | 34.4  | 2.5   | 8    | 2.4  | 0   |

| Sample    | <16 | 16-20 | 20-24 | 24-28 | 28-32 | 32-36 | >36 | <30 | 30-40 | 40-50 | 50-60 | 60-70 | 70-80 | 80-90 |
|-----------|------------------|---------------------|---------------------|
| <30       | 22   | 137   | 422   | 374   | 137  | 36   | 15  |
| 30-40     | 0    | 3.8   | 4.8   | 12.6  | 15.2 | 21.4 | 4.5 |
| 40-50     | 0    | 9.6   | 17.3  | 28.2  | 8.9  | 10.8 | 4.2 |
| 50-60     | 1.2  | 10.7  | 45.8  | 38    | 18.6 | 2.4  | 3.2 |
| 60-70     | 4.6  | 25.8  | 34.4  | 2.5   | 8    | 2.4  | 0   |
| 70-80     | 22.3 | 25.1  | 10.1  | 7.7   | 0.9  | 0    | 0   |

<table>
<thead>
<tr>
<th>Lip diameter</th>
<th>Body Angle (degrees)</th>
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<td>Sample</td>
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<tr>
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</tr>
</tbody>
</table>

Table 7.2. Percentage correlations between pot measurement attribute classes, rim width, rim angle, lip diameter and body angle.
Figure 7.9. Percentage correlations of pot rim width and lip diameter (cm).

Figure 7.10. Percentage correlations of pot rim width (cm) versus rim angle (in degrees).
Apart from this slight trend it appears that the remaining data reflect a single population where
the mid-range rim widths occur most frequently with the mid-range rim angles in a normal
distribution and the strongest correlation is between rims 30-40 mm wide and angled between
60\(^\circ\) and 70\(^\circ\). These are by far the most numerous variable categories among these two attribute
classes, further indicating the homogeneity of the globular pots.

Rim Width and Body Angle

Figure 7.11 shows the percentage correlations of rim width and body angle for the globular pot
sample. Since rim width and rim angle on the one hand and rim angle and body angle (see next)
on the other show some correlations, it was anticipated that related correlations would be
demonstrated here. Small rim widths do correlate with more spherical bodies, but otherwise the
relationship is mostly dominated by the homogeneity of the sample in respect to these two
attributes. The significant correlations are between mid-sized rim widths and mid-range body
angles where the bulk of the sherds in the sample are situated. No significant relationship is
apparent here between wide rims and more sharply angled bodies. This again diminishes the
likelihood that large pots may have a particular set of characteristics that distinguish them as a
type in this collection.

Rim Angle and Body Angle

Figure 7.12 shows the percentage correlations of rim angle and body angle for the globular pot
sample. The correlations involving rim angles <50\(^\circ\) and those involving rim angles >70\(^\circ\) overlap
in the centre of the distribution in the body angle range 40\(^\circ\)- 60\(^\circ\). While this emphasises the
homogeneity of the globular pot shapes, these data also suggest that ‘flattened’ rims occur with
more steeply angled upper bodies, with the reverse true of rim angles approaching the vertical, where the upper body angles less steeply.

However examining a different measure, the approximate external angle between rim and upper body, suggests that this angle may remain relatively constant (within c. 25°) between flattened and near vertical rims. Taken together these data imply differences in overall pot shape, where near vertical rims frequently sit on pots with flattened spherical shape, like an orange, while flattened rims sit on pots that angle away more sharply, here best envisaged as an inflated bag or teardrop shape. I return to these distinctions below.

**Figure 7.12.** Percentage correlations of pot rim angle (vertical measure) and body angle (horizontal measure, both in degrees).

**Rim Angle and Lip diameter**

Figure 7.13 shows the percentage correlations of rim angle and lip diameter for the globular pot sample. As with rim width and lip diameter (compare Figure 7.9 above) there is a meaningful correlation between near-vertical rims (80°-90°) and the smallest lip diameter category, continuing into the adjoining rim angle and lip diameter categories (70°-80° and 160-200 mm). However remaining correlations show a mainly homogenous distribution where a range of rim angles occur across a range of diameters. Among the 55 sherds with lip diameters >280 mm the strongest (but low) correlations are with flattened rims.
**Figure 7.13.** Percentage correlations of pot rim angle and lip diameter (degrees).

**Figure 7.14.** Percentage correlations of pot lip diameter and body angle.
Lip diameter and Body Angle

Figure 7.14 shows the percentage correlations for lip diameter and body angle for the globular pot sample. As with several of the other comparisons above, lip diameter and body angle show weak correlations such that smaller diameters are associated with the more spherical body angles and the larger diameters with more sharply angled upper bodies. Stronger correlations occur only with the mid-range diameters and median body angles but these variables are themselves spread across multiple ranges, once more emphasising the homogeneity of the sample in terms of shape. Again noticeable are the generally weak correlations between diameters >280 mm and body angles greater than 70°. This again suggests that the largest diameters and most acute body angles reflect outliers in the sample rather than any separate type.

Summary of measurement attribute comparisons

Examination of these tables and figures shows three principal trends.

- As previously demonstrated with the single attribute analysis, each of these variables is approximately normally distributed when considered in conjunction with each other, although lip diameter in particular is skewed towards the smaller sizes within the total range.

- There is a strong trend in the data for associations between attribute variables to be related to size in the case of rim width and lip diameter. These can be further associated with particular variations of rim and body angles. At one end of the continuum, small rim widths are associated with small lip diameters, more steeply angled rims and more acute body angles, while towards the other end the opposite conditions apply. This trend is shown most clearly in the relationships between lip diameter and the other attributes, but exists to a lesser extent between all four attribute classes. This is taken to indicate that lip diameter is the best proxy for pot size among these four attributes and that this is a primary attribute on which to divide the globular pot assemblage.

- The strong associations between the smaller and mid-range variables in these attribute classes are not demonstrated between either large rim widths or large lip diameters in relation to rim and body angles. This suggests that the smaller numbers of larger rim sherds do not form any coherent grouping(s). As previously noted this is not because there are fewer individuals in the larger size/angle categories; rather it suggests that these larger pots simply reflect outlier variability within the range of pots being manufactured, or put differently, noise.

While repetitive, this exercise has strengthened the view that on the basis of size and shape the globular pots form a continuum that, at best, divides into two general types, one that conforms in its small lip diameter to ethnographic descriptions of water pots and the other to larger cooking and storage pots.

Hierarchical type distribution within the globular pots

The analysis so far indicates that the most appropriate hierarchical ordering of the four size/shape attributes is 1) lip diameter, 2) rim width, 3) rim angle and 4) body angle. This was tested in a range of data sets, of which only a couple of the most relevant are reproduced here. The first was trying to characterise a 'small lip diameter pot'.
Globular pot sample = 1143. Next split = lip diameters <160 mm. There are 222 such rims. Next split = rims < 30 mm wide. The sample reduces to 175 sherds. Next split = rim angles between 60° and 90° above the horizontal. The sample reduces to 160. This is still a respectable size group being 14% of the original sample and 72% of sherds with lip diameters <160 mm. But if the next split is made on body angle <40° only 49 sherds remain. In other words almost 78% of sherds with lip diameters <160 mm have fallen out of this sample.

This is taken to indicate that, as expected with hand-made pottery, no clear boundary exists between sets of measurement variables even though the potter may have set out to make a ‘small lip diameter pot’.

The suggestion here is that ‘types’ of globular pots from Motupore based on size and shape do not form discrete groups, but rather grade into each other. This notion was examined further by considering the sample of 313 sherds with slightly larger lip diameters of 160-200 mm. Of these, 53 (16.9 %) have rims <30 mm wide and a further 210 (67.1%) have rims 30-40 mm wide; these percentages have changed significantly from the smaller <160 mm category of lip diameter above but taken together still accommodate the majority (84%) of the sample of 313 sherds; however while high, this percentage is lower than the comparative percentage for these rim widths for the sample with lip diameters <160 mm, being 97.7%. This test suggested that

- Rim widths generally increase with lip diameter.
- What are still small mouthed pots still tend to have small rim widths.
- However there is less coherence in this group compared to the sample with lip diameters <160 mm.

Further analysis, not reported here, indicated that the principle established with small mouthed pots that ‘types’ of globular pots from Motupore based on size and shape do not form discrete groups, but rather grade into each other in terms of the variables of these measurement attribute classes, also applies to the larger sample. It is also apparent in Figures 7.9 to 7.14, above.

For larger pots, combining lip diameters 200-240 mm (360 items) and 240-280 mm (193 items) provide a mid-range sample of 553 items. These two diameter ranges encompass 48.4% of the entire sample, suggesting that this mid-range size provided an important perceptual target for the potters. Of this sample 321 (58%) have 30-40 mm rim width and 187 (33.8%) have 40-50 mm rim width. Together these make up 91.9% of the 200-280 mm lip diameter sample, again a strong correlation. Within this subgroup of 508 sherds, 261 (51.8%) have a rim angle 60°-70°, but if this variable is widened to include rims between 50° and 80° then 465 sherds (91.6%) remain. Of these 465 sherds 193 (41.5%) have a body angle in the range 40°-50°, 162 (34.8%) are in the range 50°-60° and 63 (13.5%) are in the range 60°-70°; in other words 89.8% fall in the range 40°-70°. This final group, now defined as lip diameter = 200-280 mm; rim width = 30-50 mm; rim angle = 50°-80°; and body angle = 40°-70°, numbers 418, being 75.6% of the original sample of 553 sherds with lip diameters between 200 mm and 280 mm.

These three examples show that in order to maintain a high in-group membership the variable categories have to be widened to combine the previously discrete, arbitrarily determined categories in the data base. Three groups can be made on lip diameter and rim width categories that widen the original variable categories among these two attributes. At the same time the associated trends noted in the other two attributes provide additional qualifying description.
Globular pot types based on size and shape

In terms of size attributes it is useful to define two types of globular pot at Motupore to facilitate further examination of the collection. One of these groups is further divided into two sub-types. Hierarchical division has been made firstly on lip diameter and then on rim width.

Together these three types account for 98% of the globular pot sample.

**Pot Type 1a** comprises small pots with lip diameter <200 mm and rim width <30 mm. This group accounts for 228 sherds in the sample. Of these 90% of the rims are straight and only a single rim is convex. More than 88% of the rims are angled >60° and 59% are angled >70°, indicating that they trend towards the vertical, here labelled ‘upright’ as opposed to ‘flattened’. More than 87% have a body angle >60° and 65% are >70°. This indicates a strong tendency towards a flattened spherical shape like an orange. Nearly half (47%) of the rim sherds in this group are undecorated. Ethnographically, the *hodu* approximates this type.

**Pot Type 1b**, comprises small pots with lip diameter <200 mm, as with Type 1a, but with rim width >30 mm. This group accounts for 307 sherds in the sample. Although this group includes rims in all categories >30 mm, over 82% fall in the 30-40 mm category and only 1% in the >50 mm category; thus the general size relationship trend previously noted is preserved in this group. Rim angles tend more towards the middle of the measurement range. More than 86% are between 50° and 80°, with 38% between 60° and 70°. In contrast to Type 1a, less than 35% are >70°. Similarly, the bodies on these pots as a group are less spherical with nearly 71% having body angles between 50° and 70°. Also in contrast to Type 1a only 14% are >70°. As with Type 1a, nearly 47% of the rim sherds in this group are undecorated. Ethnographically, the *keikei* approximates this type.

**Pot Type 2** comprises large pots with lip diameter >200 mm and rim width >30 mm. This group accounts for 585 sherds. As with the whole sample, rims are predominantly straight (78%) with only 3% being convex. Some 91% have rim angles between 50° and 80°, with 48% between 60° and 70°. The trend for larger pots to have bodies that are less spherical than the smaller pots is reflected in the body angles where 73% have body angles between 30° and 50°, similar to Type 1b, but where a further 18% have body angles <30°. Undecorated pots account for 48% of the sample. As can be seen, this figure is very similar across the three types. Ethnographically, the *uro* approximates this type.

Globular pot type distribution through time

These three pot types occur in generally similar proportions throughout the Motupore sequence. As Figure 7.15 shows, there are more Type 1b and fewer Type 2 sherds in PAU 6 making it the most aberrant analytical unit. Type 2 sherds increase gradually from c. 40% in PAU 6 to c. 58% in PAU 1. In general the three types remain in much the same relationship to each other throughout the site history, with a gradual increase through of Pot Type 2.

Globular pot decoration

The question whether particular sets of decoration location and technique (and also non-decorations) correlate with particular sized globular pots is important because these attributes might help distinguish further types. I tested this against the three types just described and also by establishing four arbitrary sub-samples on size attributes.
Table 7.3 and Figure 7.16 give the results for the three established types. Table 7.4 describes the arbitrary groups. These again depended principally on increasing lip diameter as the most sensitive size attribute, with less separation in succeeding attributes. Table 7.5 and Figure 7.17 give the results for the alternative samples. If there is no relationship between pot size and decoration, the results from the two tests should be similar.

The results show that there is a close similarity between the two differently formed groups, but also between the groups and the whole sample of 1143 sherds. This shows that the percentages of decorated and non-decorated pots, decoration locations and decoration techniques hardly vary with pot size. The little variation that occurs more likely relates to some size variation through time. In short, pot size and decoration are unrelated.

These data also demonstrate clearly that painting, shell impression and incision are the dominant decoration techniques on Motupore globular pots. No finger impression was recorded and only a few examples of slashing, combing and applied nubbins were recorded. Even so, Motupore globular pots are frequently decorated with more than a single technique. Painting and buff surface occur together in 152 instances (72.4% of all occurrences of painting). The 21 instances of buff surface without painting probably reflects the fragmentary nature of sherds and the space between painted motifs; however painting occurs on non-buff surfaces on 58 occasions. Shell impression occurs with painting on 50 sherds, but incision rarely occurs with other decoration techniques on globular pots. In the whole sample, incision and painting occur together 12 times and incision and shell impression twice. Shell impression occurs once with combing. Small numbers of decoration combinations occurred in each of the four size samples used above.

![Globular Pot Types by Analytical Unit](image_url)

Figure 7.15. The percentage distribution of the three defined globular pot types by analytical unit.
<table>
<thead>
<tr>
<th>Type</th>
<th>Undec</th>
<th>Internal</th>
<th>On lip</th>
<th>Ext upper</th>
<th>On neck</th>
<th>Ext lower</th>
<th>Incised</th>
<th>Slashed</th>
<th>Shell Imp.</th>
<th>Combed</th>
<th>Appli/Nubs</th>
<th>Buff</th>
<th>Painted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>107 (46.9)</td>
<td>45 (19.7)</td>
<td>109 (47.8)</td>
<td>48 (21.1)</td>
<td>41 (18.0)</td>
<td>24 (10.50)</td>
<td>0</td>
<td>0</td>
<td>59 (25.9)</td>
<td>1 (0.4)</td>
<td>0</td>
<td>34 (14.9)</td>
<td>38 (16.7)</td>
</tr>
<tr>
<td>1b</td>
<td>142 (46.3)</td>
<td>84 (27.4)</td>
<td>142 (46.3)</td>
<td>77 (25.1)</td>
<td>72 (23.5)</td>
<td>34 (11.1)</td>
<td>0</td>
<td>0</td>
<td>76 (24.8)</td>
<td>3 (1.0)</td>
<td>0</td>
<td>60 (19.5)</td>
<td>70 (22.8)</td>
</tr>
<tr>
<td>2</td>
<td>279 (47.7)</td>
<td>124 (21.2)</td>
<td>284 (48.5)</td>
<td>101 (17.3)</td>
<td>98 (16.8)</td>
<td>81 (13.8)</td>
<td>2 (0.3)</td>
<td>1 (0.3)</td>
<td>152 (26)</td>
<td>2 (0.3)</td>
<td>2 (0.3)</td>
<td>76 (13.0)</td>
<td>98 (16.8)</td>
</tr>
</tbody>
</table>

Table 7.3. Numbers and percentages in brackets of decoration attributes according to the three established Types 1a, 1b and 2.

<table>
<thead>
<tr>
<th>Group</th>
<th>Sample Size</th>
<th>Rim Diameter (mm)</th>
<th>Rim Width (mm)</th>
<th>Rim Angle</th>
<th>Body Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>111</td>
<td>&lt;160</td>
<td>&lt; 30</td>
<td>60° - 90°</td>
<td>&gt;60°</td>
</tr>
<tr>
<td>2</td>
<td>112</td>
<td>160 - 200</td>
<td>&lt; 40</td>
<td>60° - 90°</td>
<td>&gt;50°</td>
</tr>
<tr>
<td>3</td>
<td>390</td>
<td>200-280</td>
<td>30-50</td>
<td>50° - 80°</td>
<td>&lt; 60°</td>
</tr>
<tr>
<td>4</td>
<td>55</td>
<td>&gt;280</td>
<td>all</td>
<td>all</td>
<td>all</td>
</tr>
</tbody>
</table>

Table 7.4. Arbitrary pot size groups for testing decoration correlations.

<table>
<thead>
<tr>
<th>Group</th>
<th>Undec</th>
<th>Internal</th>
<th>On lip</th>
<th>Ext upper</th>
<th>On neck</th>
<th>Ext lower</th>
<th>Incised</th>
<th>Slashed</th>
<th>Shell Imp.</th>
<th>Combed</th>
<th>Appli/Nubs</th>
<th>Buff</th>
<th>Painted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50 (45.0)</td>
<td>15 (13.5)</td>
<td>53 (47.7)</td>
<td>23 (20.7)</td>
<td>16 (14.4)</td>
<td>15 (13.5)</td>
<td>15 (13.5)</td>
<td>0</td>
<td>31 (27.9)</td>
<td>1 (0.9)</td>
<td>0</td>
<td>13 (11.7)</td>
<td>16 (14.4)</td>
</tr>
<tr>
<td>2</td>
<td>52 (46.4)</td>
<td>32 (28.6)</td>
<td>53 (47.3)</td>
<td>28 (25.0)</td>
<td>25 (22.3)</td>
<td>24 (21.4)</td>
<td>8 (7.1)</td>
<td>0</td>
<td>33 (29.5)</td>
<td>0</td>
<td>0</td>
<td>21 (18.8)</td>
<td>27 (24.1)</td>
</tr>
<tr>
<td>3</td>
<td>171 (43.8)</td>
<td>92 (23.6)</td>
<td>203 (52.1)</td>
<td>78 (20.0)</td>
<td>77 (19.7)</td>
<td>71 (18.2)</td>
<td>50 (12.8)</td>
<td>1 (0.3)</td>
<td>117 (30.0)</td>
<td>1 (0.3)</td>
<td>0</td>
<td>58 (14.9)</td>
<td>75 (19.2)</td>
</tr>
<tr>
<td>4</td>
<td>27 (49.1)</td>
<td>10 (18.2)</td>
<td>22 (40.0)</td>
<td>11 (20.0)</td>
<td>8 (14.5)</td>
<td>7 (12.7)</td>
<td>9 (16.4)</td>
<td>0</td>
<td>11 (20.0)</td>
<td>0</td>
<td>1 (1.8)</td>
<td>7 (12.7)</td>
<td>7 (12.7)</td>
</tr>
<tr>
<td>Sample</td>
<td>538 (47.1)</td>
<td>259 (22.7)</td>
<td>547 (47.9)</td>
<td>230 (20.1)</td>
<td>215 (18.8)</td>
<td>198 (17.3)</td>
<td>145 (12.7)</td>
<td>2 (0.2)</td>
<td>291 (25.5)</td>
<td>6 (0.5)</td>
<td>2 (0.2)</td>
<td>173 (15.1)</td>
<td>210 (18.4)</td>
</tr>
</tbody>
</table>

Table 7.5. Numbers and percentages of decoration attributes according to the arbitrary size groups defined in Table 7.4, with whole sample for comparison.
**Figure 7.16.** Percentage distributions of decoration attributes according to the three established types 1a, 1b and 2.

**Figure 7.17.** Percentage distributions of decoration attributes according to the arbitrary size groups defined in Table 7.4.
Creating types by form or decoration

The cluster analysis of globular pots in Chapter 6 identified the problem of whether the Motupore globular vessels are better grouped according to form or decoration. There the clustering programs divided the assemblage primarily on decoration techniques, but indicated some grouping of small aperture, narrow upright rim vessels also identified in the present analysis. Here my intuitive approach has looked more thoroughly at the form attributes and suggests that a limited number of different forms can be identified, although the boundaries between them are not clear-cut. In this chapter I make no further attempt to consider the grouping power of decoration techniques on the globular pots, since it would closely repeat the analysis of these techniques in the previous chapter. Instead I consider the utility of defining types by form and creating varieties within them according to decoration locations and techniques.

Globular pots - types and varieties

On the basis of the present analyses I have determined that for each of the three types of globular pot there are essentially five varieties of each. These are:

Painting, either on buff surfaces or not, is likely to occur on all zones of the vessel (Table 7.6). While 36% of painted but non-buff sherds carry associated incision or shell impression, 29% of painted buff sherds also carry associated incision or shell impression, suggesting the occurrence of painting and another decoration technique on non-buff sherds is not a separate variety.

<table>
<thead>
<tr>
<th>Internal</th>
<th>On lip</th>
<th>Ext upper</th>
<th>On neck</th>
<th>Ext lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>92.4</td>
<td>96.2</td>
<td>86.2</td>
<td>93.3</td>
<td>85.7</td>
</tr>
</tbody>
</table>

Table 7.6. Percentage distribution of 210 painted sherds according to decoration location on pot.

Painting plus shell impression occurs on 24% of all painted sherds and on this basis is considered a separate variety.

Painting plus incision occurs on only 6% of all painted sherds. At this stage of the analysis it was kept as a separate variety in order to examine its distribution through time. One consideration was ultimately to omit it, another was to combine it with the previous variety.

Shell impression and Incision were both maintained as separate varieties because of their numerical presence.

Undecorated pots represent 47.2% of the total sample and are thus common. As noted above (Figure 7.7) there is a high component of undecorated pots in all PAU but the fewest (< 30%) occur in PAU 6 and the most (> 60%) occur in PAU 1.

Table 7.7 shows the numerical and percentage distributions for the pot types and varieties. Figure 7.18 shows the same data visually. As could be predicted from Table 7.3, the varieties distribute in similar proportions amongst the three types.

Decoration through time

More interesting is the distribution of types and varieties according to PAU (Table 7.8a-f). Trends in this data set are somewhat more erratic, perhaps as a result of the smaller sample sizes. In order to test this further, Figures 7.19 to 7.21 graph the distributions for painting, incision and
shell impression as percentages of the total decorated sherds in each analytical unit, collapsing
the smaller varieties (paint plus incision, paint plus shell impression) into paint and also into
incision and shell impression respectively (thus some items have multiple representations).

Viewed in this amended fashion the data make a little more sense. For painting the only
difference between the three types is in PAU 6 where painting occurs more frequently on the
larger vessels. Subsequently all three types follow similar trajectories in regards to painting.
Incision follows a similar trajectory between the types until the end of the sequence where
incision increases on the larger pots but decreases on the Type 1a vessels. This latter group is
not decorated in some other fashion; instead they become in this analytical unit increasingly
undecorated. Shell impression operates randomly between the types until PAU 1 where it
decreases sharply on Type 2 pots.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Paint</th>
<th>Paint plus Incision</th>
<th>Paint plus Shell Imp.</th>
<th>Incision</th>
<th>Shell Impressed</th>
<th>Plain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1a</td>
<td>228</td>
<td>33 (14.5)</td>
<td>1 (0.4)</td>
<td>4 (1.8)</td>
<td>24 (10.5)</td>
<td>59 (25.9)</td>
</tr>
<tr>
<td>Type 1b</td>
<td>307</td>
<td>48 (15.6)</td>
<td>8 (2.6)</td>
<td>14 (4.6)</td>
<td>26 (8.5)</td>
<td>61 (19.9)</td>
</tr>
<tr>
<td>Type 2</td>
<td>585</td>
<td>65 (11.1)</td>
<td>3 (0.5)</td>
<td>31 (5.3)</td>
<td>78 (13.3)</td>
<td>122 (20.9)</td>
</tr>
</tbody>
</table>

Table 7.7. Numbers and percentages (in brackets) of Motupore pot types and varieties for the whole sample.

Figure 7.18. Percentages of pot types according to decoration technique for the whole sample.
### PAU 1

<table>
<thead>
<tr>
<th></th>
<th>Sample</th>
<th>Paint</th>
<th>Paint plus Incision</th>
<th>Paint plus Shell Imp.</th>
<th>Incision</th>
<th>Shell Impressed</th>
<th>Undecorated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1a</td>
<td>27</td>
<td>1 (3.7)</td>
<td>0</td>
<td>1 (3.7)</td>
<td>3 (11.1)</td>
<td>3 (11.1)</td>
<td>19 (70.1)</td>
</tr>
<tr>
<td>Type 1b</td>
<td>38</td>
<td>2 (5.3)</td>
<td>0</td>
<td>0</td>
<td>10 (26.3)</td>
<td>6 (15.8)</td>
<td>20 (52.6)</td>
</tr>
<tr>
<td>Type 2</td>
<td>94</td>
<td>3 (3.2)</td>
<td>0</td>
<td>0</td>
<td>30 (31.9)</td>
<td>2 (2.1)</td>
<td>59 (62.8)</td>
</tr>
</tbody>
</table>

**Table 7.8a.** Numbers and percentages (in brackets) of Motupore pot types and varieties in PAU 1.

### PAU 2

<table>
<thead>
<tr>
<th></th>
<th>Sample</th>
<th>Paint</th>
<th>Paint plus Incision</th>
<th>Paint plus Shell Imp.</th>
<th>Incision</th>
<th>Shell Impressed</th>
<th>Undecorated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1a</td>
<td>30</td>
<td>3 (10.0)</td>
<td>0</td>
<td>0</td>
<td>5 (16.7)</td>
<td>8 (26.7)</td>
<td>14 (46.7)</td>
</tr>
<tr>
<td>Type 1b</td>
<td>33</td>
<td>3 (9.1)</td>
<td>2 (6.1)</td>
<td>0</td>
<td>7 (21.2)</td>
<td>6 (18.2)</td>
<td>15 (45.5)</td>
</tr>
<tr>
<td>Type 2</td>
<td>81</td>
<td>3 (3.7)</td>
<td>2 (2.5)</td>
<td>1 (1.2)</td>
<td>18 (22.2)</td>
<td>26 (32.1)</td>
<td>30 (37.0)</td>
</tr>
</tbody>
</table>

**Table 7.8b.** Numbers and percentages (in brackets) of Motupore pot types and varieties in PAU 2.

### PAU 3

<table>
<thead>
<tr>
<th></th>
<th>Sample</th>
<th>Paint</th>
<th>Paint plus Incision</th>
<th>Paint plus Shell Imp.</th>
<th>Incision</th>
<th>Shell Impressed</th>
<th>Undecorated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1a</td>
<td>45</td>
<td>8 (17.8)</td>
<td>0</td>
<td>0</td>
<td>8 (17.8)</td>
<td>6 (20.0)</td>
<td>20 (44.4)</td>
</tr>
<tr>
<td>Type 1b</td>
<td>47</td>
<td>3 (6.4)</td>
<td>1 (2.1)</td>
<td>2 (4.3)</td>
<td>5 (10.6)</td>
<td>13 (27.7)</td>
<td>23 (48.9)</td>
</tr>
<tr>
<td>Type 2</td>
<td>106</td>
<td>10 (9.4)</td>
<td>0</td>
<td>6 (5.7)</td>
<td>16 (15.1)</td>
<td>29 (27.4)</td>
<td>44 (41.5)</td>
</tr>
</tbody>
</table>

**Table 7.8c.** Numbers and percentages (in brackets) of Motupore pot types and varieties in PAU 3.

### PAU 4

<table>
<thead>
<tr>
<th></th>
<th>Sample</th>
<th>Paint</th>
<th>Paint plus Incision</th>
<th>Paint plus Shell Imp.</th>
<th>Incision</th>
<th>Shell Impressed</th>
<th>Undecorated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1a</td>
<td>34</td>
<td>4 (11.8)</td>
<td>1 (2.9)</td>
<td>1 (2.9)</td>
<td>4 (11.8)</td>
<td>12 (35.3)</td>
<td>11 (32.4)</td>
</tr>
<tr>
<td>Type 1b</td>
<td>49</td>
<td>6 (12.2)</td>
<td>2 (4.1)</td>
<td>2 (4.1)</td>
<td>2 (4.1)</td>
<td>14 (28.6)</td>
<td>22 (44.9)</td>
</tr>
<tr>
<td>Type 2</td>
<td>106</td>
<td>15 (14.2)</td>
<td>0</td>
<td>8 (16.3)</td>
<td>8 (16.3)</td>
<td>20 (18.9)</td>
<td>54 (50.9)</td>
</tr>
</tbody>
</table>

**Table 7.8d.** Numbers and percentages (in brackets) of Motupore pot types and varieties in PAU 4.
**Table 7.8e.** Numbers and percentages (in brackets) of Motupore pot types and varieties in PAU 5.

<table>
<thead>
<tr>
<th>Type</th>
<th>Sample</th>
<th>Paint</th>
<th>Paint plus Incision</th>
<th>Paint plus Shell Imp.</th>
<th>Incision</th>
<th>Shell Impressed</th>
<th>Undecorated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1a</td>
<td>66</td>
<td>9 (13.6)</td>
<td>0</td>
<td>1 (1.5)</td>
<td>3 (4.5)</td>
<td>19 (28.8)</td>
<td>33 (50.0)</td>
</tr>
<tr>
<td>Type 1b</td>
<td>74</td>
<td>7 (9.5)</td>
<td>0</td>
<td>3 (4.1)</td>
<td>3 (4.1)</td>
<td>13 (17.6)</td>
<td>48 (64.9)</td>
</tr>
<tr>
<td>Type 2</td>
<td>137</td>
<td>12 (8.8)</td>
<td>0</td>
<td>4 (2.9)</td>
<td>6 (4.4)</td>
<td>37 (27.0)</td>
<td>74 (54.0)</td>
</tr>
</tbody>
</table>

**Table 7.8f.** Numbers and percentages (in brackets) of Motupore pot types and varieties in PAU 6.

<table>
<thead>
<tr>
<th>Type</th>
<th>Sample</th>
<th>Paint</th>
<th>Paint plus Incision</th>
<th>Paint plus Shell Imp.</th>
<th>Incision</th>
<th>Shell Impressed</th>
<th>Undecorated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1a</td>
<td>26</td>
<td>8 (30.8)</td>
<td>0</td>
<td>1 (3.8)</td>
<td>0</td>
<td>7 (26.9)</td>
<td>10 (38.5)</td>
</tr>
<tr>
<td>Type 1b</td>
<td>66</td>
<td>39 (59.1)</td>
<td>1 (1.5)</td>
<td>6 (9.1)</td>
<td>1 (1.5)</td>
<td>11 (16.7)</td>
<td>14 (21.2)</td>
</tr>
<tr>
<td>Type 2</td>
<td>64</td>
<td>22 (34.4)</td>
<td>1 (1.6)</td>
<td>13 (20.3)</td>
<td>0</td>
<td>8 (12.5)</td>
<td>19 (29.7)</td>
</tr>
</tbody>
</table>

**Figure 7.19.** Percentage distribution of painted decoration according to type, for the six analytical units.
Figure 7.20. Percentage distribution of incised decoration according to type, for the six analytical units.

Figure 7.21. Percentage distribution of shell impressed decoration according to type, for the six analytical units.
These data suggest that towards the end of the sequence decoration on Type 2 pots begins to operate differently to decoration on the smaller pots. While all three types increase their percentage of undecorated sherds, a move is made with the large pots to switch from shell impression to incision. The question of whether this represents a simplification of decoration on pots which are still being decorated (perhaps for trade) is better held until assessments of the bowl forms and an examination of decoration motifs are made in the next chapter.

Lastly I considered the same decoration data from a different perspective, beginning with the three pot types and looking at change through time. Table 7.9 and Figure 7.22 show the distribution of decoration techniques through time on Type 1a pots. Although more than 30% of these pots were painted in PAU 6, this pot type remained mostly undecorated through the entire sequence with the undecorated component rising to 70% in PAU 1. Shell decoration was most common in PAU 4, where plain pots are fewest, while incision was uncommon early, in PAU 5 and PAU 6.

Table 7.10 and Figure 7.23 show the decoration data for Type 1b pots. While these follow a similar overall trajectory to Type 1a pots, several significant differences are apparent. Firstly almost twice as many Type 1b pots are painted in PAU 6, more are incised in PAU 1-PAU 3 and fewer are undecorated in PAU 1, mostly because of the significant difference between the amounts of incision on these two types in PAU 1.

Finally Table 7.11 and Figure 7.24 show the decoration data for Type 2 pots. While the overall trends seen with Types 1a and 1b are also apparent here, in many ways decoration on the Type 2 pots best exemplifies the nature of pot decoration throughout the site history. The earliest and latest analytical units are in most instances the most divergent, this being true in the painting, painting plus shell impression, incision and plain ware categories. The only exception is shell impression. While present in PAU 6, shell impression increases in frequency up to PAU 2; but in what is one of two dramatic changes in the Motupore globular pots, shell impression all but disappears in PAU 1, where almost 95% of the pots are either undecorated or incised. The second major change is the decrease in the frequency of painted pots in all three pot types after PAU 6.

### Type 1a

<table>
<thead>
<tr>
<th>PAU</th>
<th>Sample</th>
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<th>Paint plus Incision</th>
<th>Paint plus Shell Imp.</th>
<th>Incision</th>
<th>Shell Impressed</th>
<th>Undecorated</th>
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Table 7.9. Distribution of decoration techniques on Type 1a pots through time. Percentages are in brackets.
Figure 7.22. Percentage distribution of decoration techniques on Type 1a pots by analytical unit.

<table>
<thead>
<tr>
<th>PAU</th>
<th>Sample</th>
<th>Paint</th>
<th>Paint plus Incision</th>
<th>Paint plus Shell Imp.</th>
<th>Incision</th>
<th>Shell Impressed</th>
<th>Undecorated</th>
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</tbody>
</table>

Table 7.10. Distribution of decoration techniques on Type 1b pots through time. Percentages are in brackets.
**Figure 7.23.** Percentage distribution of decoration techniques on Type 1b pots by analytical unit.

**Table 7.11.** Distribution of decoration techniques on Type 2 pots through time. Percentages are in brackets.
Summary of this analysis of globular pots

Overwhelmingly this analysis has underlined the homogeneity of the Motupore globular pots through time. Even so, some time-related changes are apparent. Having argued for size to be a primary distinguishing feature of this hand-made pottery - at least to best achieve the descriptive and analytical aims of this analysis - lip diameter proved to be the most useful archaeological proxy for pot size and this provided the first hierarchical split in the type formation. The strong clustering of narrow rims with small lip diameters, reinforced with the tendency for the angles of these rims to sit more towards the vertical, suggested one grouping; but while narrow rims correlated highly with small lip diameters, such lip diameters also occurred with wider rims. Primarily on this basis Type 1 pots were divided into two sub-types Type 1a and Type 1b. Type 2 pots comprise all the globular pots with lip diameters >200 mm and rim widths >30 mm. Attempts to further divide this group proved indecisive. Again this underlines the homogeneity of this group of globular pots.

Decoration location was analysed but was shown to have little discriminatory use (see Figure 7.6). Throughout the sequence Motupore globular pots were most frequently decorated on the lip and then on other zones in approximately similar proportions. Much higher frequencies for decoration in all zones for PAU 6 can be attributed mainly to the frequency of painting in this analytical unit and the propensity to paint all zones of a pot. However the occurrence in all zones of other decorative techniques in PAU 6 such as shell impression on the lower body, also contribute, at least in a minor way, to this difference. Later in this chapter, lower body decoration of PAU 6 bowls will also be demonstrated as important. These aspects, unimportant in forming a typology, maintain importance in other areas, especially in differentiating PAU 6 from the succeeding analytical units.
Having split the assemblage on size and shape attributes, attempts to further subdivide the size/shape types proved pointless because the distribution of decoration techniques across the three types was very similar for the whole assemblage. At the same time decoration techniques were shown to have chronological implications, both in their own right and when considered within the three types established on size and shape. For this reason it seemed structurally sensible to consider decoration techniques as variants within the three types. While Motupore globular pots predominantly comprise undecorated wares throughout the sequence, there are, concurrent with them, three principal decoration techniques, painting, shell impression and incision.

While noting and acknowledging the presence of other minor techniques (combing, slashing, applied nubbins et cetera) and the occasional use of multiple techniques on individual sherds, it was decided for typological purposes to identify three types each with five varieties, undecorated, painted, shell impressed, incised and painted plus shell impressed. This last variety was retained because it has a noticeable presence in PAU 6 and thus helps to define the difference between this and the more recent analytical units.

The statistical clustering analyses reported in Chapter 6 placed primary importance on decoration locations and techniques as defining attributes for classifying the Motupore globular pots, and this same path could have been taken in this more intuitive analysis. At the same time the approach adopted in this chapter has more clearly defined the similarities and differences in the sizes and shapes of the globular pots from the same data base that was used in Chapter 6. Despite the differences in the two approaches, the results are otherwise very similar, 1) in recognising similar changes through time in decoration techniques, 2) in the identification of the small diameter, narrow upright rim pots, and 3) in the over-riding homogeneity of the assemblage. Given that both analyses employed the same data base, this is not surprising, but adds confidence to the overall results.

Lastly, these typological analyses lead us towards the behavioural inferences to be drawn from them. While these are more fully addressed in later chapters, several brief points can be made. Repeatedly the data indicate clear differences between PAU 6 and those that succeed it. It has been suggested that this analytical unit reflects the cultural influence of the ancestral homeland village or village(s). As has been argued, it is possible that this reflects migration from the Boera area west of Port Moresby.

The succeeding analytical units reflect the evolutionary transition to decorative styles characteristic of Motupore and perhaps other contemporary Bootless Bay sites. At least superficially there are two trends in the globular pots which accelerate towards the end of the sequence. Sizes and shapes began to vary from the relatively controlled forms of earlier analytical units to become less unified, as indicated in Figure 7.5. At the same time, as Figures 7.1 and 7.4 show, rim widths and angles of the globular pots became more standardised. This superficial contradiction will be shown in Chapter 10 to reflect the increasing production of Type 2 globular pots at the expense of Types 1a and 1b. Decoration also changed through time; both the Type 1a pots and the larger globular pot forms became increasingly undecorated, but where decorated, they showed a relatively dramatic late replacement of shell impression with incision. Whether this was a move to simplification will become clearer after the analysis of the bowls. At this point it is tempting to associate this directional change with the pressures of increasing production, as suggested by the sherd densities reported in Chapter 5. Whether this equates with increasing trade is a matter returned to in a later chapter.
Bowls

Attributes

As with the globular pots I began the bowl analysis by considering the distributions of each of the individual attributes through time within the six analytical units.

Lip diameters

Figure 7.25 shows the distributions of the nine variables of this attribute. There are very few bowls with diameters smaller than 100 mm or greater than 380 mm, with the majority falling into the 180-260 mm range. Bowls with diameters >260 mm occur more frequently in PAU 1, with a concomitant reduction of bowls with diameters less than 180 mm, making this analytical unit somewhat different. Small bowls show the greatest variations through the analytical units, but not in any chronological order, with PAU 4 being most variable in this respect.

Figure 7.25. Percentage distributions of bowl rim widths (cms) by analytical unit.

Rim Angles

Figure 7.26 shows the distributions of the nine variables of this attribute. This figure shows interesting changes in bowl shape over time. Very open, platter-like rim forms provide low percentages throughout the site’s history, with higher percentages of bowls possessing vertical and restricted rim forms. PAU 6 provides the tightest grouping of form, with almost 75% having rim angles between 80° and 110°. While the PAU 6 bowl sample is relatively small at 61 items, it is not assumed that this has affected this result. There is a slight tendency for heavily restricted bowls to be present in PAU 1 and PAU 2.
Figure 7.26. Percentage distributions of bowl rim angles (degrees) by analytical unit.

Figure 7.27. Percentage distributions of bowl body angles (degrees) by analytical unit.
Body Angle

Figure 7.27 shows the distributions of the eight variables of this attribute. While some variation exists between analytical units, most units indicate similar trajectories. The upper bodies of the Motupore bowls fall mostly between 50° and 90° suggesting that most bowls are roughly hemispherical in shape, rather than having flatter bases with vertical upper walls at one extreme or being hammock-shaped at the other. The result for PAU 1, with 12% of sherds with body angles <40° moves against this trend in a minor way.

Rim Modification

As previously discussed, bowl rims were frequently modified by being thickened with additional clay, either by drawing up clay from the body of the vessel or by direct application. Figure 7.28 shows the distribution of unmodified rims by analytical unit. Obviously, the distribution of modified rims is a reciprocal of this graph. It shows a strong and clear trend through time moving from more than 70% of rims being unmodified in PAU 6 to almost 90% being modified in PAU 1. While this is seen to be an evolutionary progression through time, modified and unmodified rims were seen at the same time to provide a typological distinction to be further pursued.

Carination

Figure 7.29 shows the percentage of carinated bowls by analytical unit. Again there is a strong trend in the data that differentiates PAU 6 from the later units. More than 44% of the PAU 6 bowls are carinated, but this falls sharply to 13% in PAU 5 and less than 8% for the four most recent analytical units. This trend appears to be related to the increase in rim thickening, since only 11 items (1.4%) of the total sample are both modified on the rim and carinated. This relationship is further explored below. However the presence/absence of carinations also provides a typological distinction to be further explored. Here it should be remembered that my definition of carinated (see Chapter 5) may differ slightly from other analysts.

Decoration Location

Figure 7.30 shows the percentage distribution of decoration location by analytical unit. Being different to globular pots, bowls are only infrequently left undecorated. Bowls are most frequently decorated on the external upper zone. While the central four units behave very similarly in respect of decoration location, again PAU 6 and PAU 1 are the most divergent. More than 75% of PAU 6 bowls are decorated on the lip compared with a little over 13% in PAU 1. Also significant, more than 44% of PAU 6 bowl sherds are decorated on the lower external zone compared with less than 20% in all other analytical units. Despite these differences, the continuities in decoration location through time are equally apparent.

Decoration Technique

Figure 7.31 shows the percentage distribution of decoration technique by analytical unit. Two clearly dominant trends are apparent. The first is the consistent decrease through time of shell impression, from 82% in PAU 6 to a little over 13% in PAU 1 and a concomitant rise in the use of incision, from 8% in PAU 6 to 78% in PAU 1. Painting occurs on bowls throughout, but in much smaller percentages than with the pots, even in the earliest PAUs. Combing, present in all units except PAU 2 is only a significant technique in PAU 6. A small but persistent percentage of finger impression occurs throughout. Slashing occurs on 7.4% of sherds in PAU 5; this represents 12 sherds in a total of only 20 slash-decorated sherds in the sample. While it is only a
minor component it is notable that it has a brief fluorescence in PAU 5, the unit that is transitional between PAU 6 and the later units in a number of respects.

It is apparent that decoration technique percentages on bowls differ significantly from those on globular pots and this is considered further below.

**Figure 7.28.** Percentage distribution of unmodified rims by analytical unit.

**Figure 7.29.** Percentage distribution of carinated bowls by analytical unit.
Figure 7.30. Percentage distribution of bowl decoration location by analytical unit.

Figure 7.31. Percentage distribution of bowl decoration technique by analytical unit.
Correlating measurement attributes

I began the more complex correlating analyses with the three measurement attributes and using the same correlation measures as described for the globular pots.

Table 7.12 shows the variable correlations by number for the three bowl measurement attributes, as originally recorded. As can be seen many of the outlier variables carry only small numbers. These variables were thus concatenated as in Table 7.13 and presented as percentages. The percentages were calculated in the same way as with the globular pots: if variable X occurs with variable Y on 10 sherds and variable X occurs in total on 20 sherds and variable Y on 30 sherds, the measure is \( \frac{2 \times 10}{20 + 30} \times 100 \), which equals 40%. The highest shared percentages for each attribute pair on Table 7.13 were highlighted, then the data were graphed, again to facilitate visual interpretation.

Rim angles and body angles

Figure 7.32 shows the percentage correlations of rim angle and body angle for the bowl sample. Some clear overall trends in this data set are apparent. The most open rims (outwardly flaring) are most strongly associated with the most open body angles and the most closed rims with the most closed (vertical to inward-sloping) body angles. In between, the central variable ranges of both attributes correlate with each other and it is these attribute categories that are most numerous in the sample. This suggests a good deal of individual variability around a perceived ideal shape, where attributes are subtly varied to achieve a familiar form.

At the same time meaningful correlations exist between vertical and inward-sloping body angles and the most restricted rim angles. While this might suggest either a different type of bowl or the extremes of the ranges of these attributes, overall the data most strongly suggest a common tendency for bowls to be more or less direct - that is with rim angles tracking body angles with only small changes in direction.

Rim angles and lip diameters

Figure 7.33 shows the percentage correlations of rim angle and lip diameter for the bowl sample. It is immediately apparent that the size of the bowl measured by the lip diameter has little influence on the angle of the rim. Many weak relationships exist between most variables in these two attribute classes. Reference to this figure and Table 7.12 shows that numerically, lip diameters cluster weakly between 180 mm and 260 mm and rim angles above 70°, but beyond this there are few precise trends. Motupore bowls are predominantly of small to medium size with rims mostly approaching vertical or restricted. These data indicate no obvious points of division in this continuum.

Body angles and lip diameters

Figure 7.34 shows the percentage correlations of body angle and lip diameter for the bowl sample. Mid-range lip diameters are weakly correlated with steep upper body angles up to but not beyond the vertical. While the same tendency is seen with the larger bowl diameters as well, they also associate with a wider number of upper body variables. There is however no particular correlation between increasing body angle and size measured by lip diameter. It will be noted that the stronger correlations involving the extremes of body angles (<40° and >90°) occur only with the mid-range diameters.
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Table 7.13. Percentage correlations between bowl measurement attribute classes. See text for explanation.

Again these data point to continuities rather than points of separation. To the previous observation that Motupore bowls are predominantly small to medium sizes with rims mostly restricted, we can add mostly with upper body angles between 50° and 90°.
Figure 7.32. Percentage correlations of body angle (vertical measure) versus rim angle (horizontal measure, both in degrees).

Figure 7.33. Percentage correlations of lip diameter in cm (vertical measure) versus rim angle in degrees (horizontal measure).
Summary of bowl measurement attributes

This analysis has been useful in formulating the main trends in the size and shape ranges of the Motupore bowls but less useful for identifying those attributes that might assist in dividing the sample into meaningful groups. Despite my view that the size and shape of globular pots were the primary concern of the pot makers, these variables provided little utility in dividing the bowl sample, except arbitrarily. The partial exception to this conclusion was that the correlation between vertical and inward-sloping body angles and the most restricted rim angles might indicate a separate type. This possibility was examined by separating those bowl sherds with rim angles >110° and body angles >80° and seeking meaningful correlations with other recorded attributes. The sample was only 30 sherds, less than 4% of the original sample, and this group showed no meaningful correlations with any of the other attribute classes. On this basis it was concluded that this group formed one end of the continuum of the relationships between rim and body angles on these bowls as discussed in reference to Figure 7.32, and not a separate type.

Thus the conclusion was reached that measurement attributes of the Motupore bowls did not provide meaningful attributes to divide the sample into separate types. At the same time the range of measurements included those one might expect for the ethnographic Motu forms, the open bowl (nau) (see also Figure 5.2) and the restricted hemispherical bowl the oburo (see Figure 5.4).

This result – that measurement attributes did not substantially aid forming a bowl typology - coincided with the conclusions reached when these attributes were considered individually (see above). There the most significant trends involved unmodified and modified (thickened) rims and carinated versus non-carinated bowls. I thus examined the relationship between these
attributes and also between these attributes and the wider attribute classes. This proved more interesting.

Eighty-five sherds (10.8% of sample) are from carinated bowls. It was shown from the single attribute analysis (Figure 7.29) that while carinated sherds represent between 5% and 10% of sherds in PAUs 1-4, their representation rises in PAU 5 and sharply in PAU 6 to nearly 45%. It was noted in Figure 7.28 that a similar increase in the earlier analytical units occurred with unmodified rims and it was considered possible that the two were related. The relationship of both carinated and non-carinated sherds to unmodified and modified (thickened) rims is shown in Table 7.14.

<table>
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<th>Modified</th>
<th>Unmodified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carinated</td>
<td>85 (10.8%)</td>
<td>11 (12.9%)</td>
<td>74 (87.1%)</td>
</tr>
<tr>
<td>Non-Carinated</td>
<td>704 (89.2%)</td>
<td>507 (72%)</td>
<td>197 (28.0%)</td>
</tr>
</tbody>
</table>

Table 7.14. Numbers and percentages of carinated and non-carinated bowls according to whether their rims are modified or unmodified.

Clearly carinated bowls tend to have unmodified rims. Also the tendency for non-carinated rims to be modified suggests a second grouping, while the third group (non-carinated, unmodified) also lends itself to further examination. In support of this, of the 518 sherds that have modified rims 97.9% are not carinated and 72.7% of the 271 unmodified rims are also not carinated.

However by considering groups that combine two attributes in this way I was no longer adhering to the analytical procedure previously adopted, which sought meaningful associations within the full range of the attributes and their variables by considering the percentage of occurrences of both variables on a single item compared to the total occurrences of both variables in the sample. Thus I undertook this for the four variables concerned. Note that while the variables carinated and non-carinated are mutually exclusive, their behaviour with the variables of each of the other attributes is independent. The same is true for the attributes modified and not modified. The four attributes are considered together for convenience.

Relationships between the body treatment attributes carinated, non-carinated, modified and not modified

Table 7.15 shows the shows these correlations by percentages. Again some small sample cells at the extremes of the variable ranges for some attributes have been concatenated as described earlier. As earlier, the highest percentage correlation in each set has been highlighted on this table. The data are then shown in graph form and discussed.

Body treatment attributes and lip diameter

These data are presented in Figure 7.35. In general all four body treatments occur across the range of bowl diameters present, with concentrations of all body treatments coinciding with the central diameter ranges. One point of interest is the small number of carinated bowls with diameters <140 mm. These represent 3 sherds from a total of 85 (3.5%). By comparison 15.6% of unmodified rims fall into this diameter range.
Table 7.15. Percentage correlations between bowl body treatment attributes and variables in the other attribute classes. Measurements are in cm. See text for explanation.
**Figure 7.35.** Percentage correlations of the four bowl body treatment attributes with lip diameter variables.

**Figure 7.36.** Percentage correlations of the four bowl body treatment attributes with rim angle variables.
Taking the data and discussion about Table 7.14 above, one explanation to be further examined is that most carinated bowls have unmodified rims, but that unmodified rims also occur frequently on bowls that are not carinated.

Body treatment attributes and rim angle

These data are presented in Figure 7.36. Again in general all four rim and body treatments occur across the range of rim angles. Unmodified rims tend more strongly towards the open bowl forms while modified and not carinated forms tend towards vertical and slightly closed forms. The low correlation between carinated sherds and the 90-100° rim angle category implies that there are two carinated forms, one with an open to vertical rim, the other a closed rim. However given the smaller sample numbers of carinated rims, sample error cannot be discounted in this one case.

Body treatment attributes and body angle

These data are presented in Figure 7.37. While the four rim and body treatments are found associated across the full range of body angle variables there are several significant trends. The most noticeable is that despite low sample numbers the strongest associations of the shallowest body angles is with carinated bowls, while the other three treatment categories have their strongest associations with mid-range body angles. Equally noticeable is that none of the four treatments associate very strongly with vertical or slightly restricted body angles. This adds to the low sample number data for these forms seen in the single variable data (Figure 7.27) and suggests that these forms are typologically unimportant, forming the end of one body size continuum. The same is not true of lower sample numbers at the ‘shallow’ end of the bowl body angle attribute where, as just noted, these associate with carinated bowls.

Body treatment attributes and decoration location

These data are presented in Figure 7.38. As previously noted decoration occurs predominantly on the lip and external upper zone of Motupore bowls and this remains broadly the case regardless of rim and body treatment. Undecorated bowls are infrequent across all four of these attributes and in some cases it is assumed that these bowls may have carried decoration on other parts of their circumference. Again carinated bowls and to a slightly lesser extent unmodified bowls are more closely associated with decoration on the lower external zone. The difference is that this zone forms the strongest association with carinated bowls, whereas unmodified rims have stronger associations with decoration on the lip and on the external upper zone. These data suggest that decoration on the lower external zone might be an important typological marker.

Body treatment attributes and decoration technique

These data are presented in Figure 7.39. While all four body and rim treatments associate with shell impression, the association between not-carinated and modified bowls and incision is very strong and emphasised by the disassociation of incision with carinated bowls and to a lesser extent with unmodified rims. In contrast the use of combing is largely confined to carinated bowls and unmodified rims. Painting, a relatively minor decoration technique on bowls, occurs on all body treatments, often in association with buff surfaces. Equally finger impression occurs with all body treatments.
Figure 7.37. Percentage correlations of the four bowl body treatment attributes with body angle variables.

Figure 7.38. Percentage correlations of the four bowl body treatment attributes with decoration location variables.
Figure 7.39. Percentage correlations of the four bowl body treatment attributes with decoration technique.

Summary of body treatment attributes

The trends thrown up by this analysis suggest that different bowl types can be defined in these data. The relatively small number of carinated sherds (n=85) appear different in a number of these tests and separate away from modified rims in most of them, especially body angle, decoration location and the strong association with combing. As seen, 507 out of 518 modified rims are not carinated and only 11 of 85 carinated sherds are modified. Thus while 72 carinated sherds have unmodified rims there are a further 197 unmodified bowl rim sherds that are also not carinated. In a number of these tests, bowls with unmodified rims trend differently to carinated sherds, being more like the modified rim sherds; however in some of them, particularly decoration technique, they differ markedly from modified rims and possess rim and body angle distributions that suggest that they are intermediate between carinated and modified forms.

Before considering typological groupings I carried out further tests on the two major decoration techniques (incision and shell impression) and three minor techniques (painting, combing and finger impression). This was done for two reasons, 1) because multiple bowl decoration techniques frequently occur on individual items (thus the total numbers for these variables are different to the sherd numbers) and 2) because the relative frequencies of decoration techniques between globular pots and bowls in the same analytical units differ markedly in some cases. Whereas decoration techniques were generally of low hierarchical importance in separating globular pot types (since they occurred more or less equally on the three types) until the variety level, this appeared to be unlikely to be the case with bowls.

Analysing bowl decoration

Three decoration attributes, slashing, buff surface and appliqué/nubbins were separated from this analysis firstly because, as seen with the globular pots, buff surface treatment is ambiguous as far
as being a decoration technique at all and secondly because slashing and appliqué/nubbins constitute very low sample numbers. Table 7.16 provides the sample numbers for these minor techniques and their occurrences with the other bowl decoration techniques.

In similar fashion to the globular pots, buff surfaces occur with painting in 84.7% of cases; buff surfaces are also associated with incised, shell impressed and combed sherds, but mostly where these are also painted (painting itself is associated with other decoration techniques in more than 75% of cases). Slashing occurs on unmodified rims (75%) but rarely on carinated sherds (15%).

<table>
<thead>
<tr>
<th>Other Techniques</th>
<th>Slashed</th>
<th>Appliqué/Nubbins</th>
<th>Buff Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sample</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incised</td>
<td>360</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>Shell Impression</td>
<td>307</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>Painted</td>
<td>81</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>Combed</td>
<td>37</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Finger Impression</td>
<td>46</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 7.16. The occurrence of major bowl decoration techniques with slashing, appliqué/nubbins and buff surface.

Interestingly, 80% of the 20 slashed bowls occur in PAU 4 and PAU 5, suggesting that this decoration had a brief period of popularity and is thus a sensitive chronological marker. Of the four remaining slashed sherds one came from PAU 6, one from PAU 2 and two from PAU 1, where they might well reflect redeposited items.

**Correlating decoration techniques with each other**

As noted, it is common on Motupore for bowls to be decorated using more than a single technique. I thus began the analysis of bowl decoration by examining the correlations between the major decoration techniques (Table 7.17). The results indicate some potentially useful relationships for further exploration. The two most numerous techniques, incision and shell impression only rarely occur on the same sherd (2.3% of the total sample). Incision tends to coincide with painting and finger impression but not with combing. Shell impression, given the sample size discrepancies, also correlates with finger impression and also with combing and to a lesser extent with painting. Painting occurs with combing and finger impression less frequently than with incision and shell impression. Combing occurs frequently with shell impression but is entirely separate from finger impression and mostly separate from incision. Finger impression occurs most frequently with shell impression. It seems highly likely that these relationships are influenced by chronology and this will be further examined below.

**Correlating decoration techniques with the other attribute classes**

Table 7.18 shows the percentage correlations between decoration techniques on bowls and variables for the other attributes. Again, the highest percentage correlation in each set has been highlighted. These data are then presented in graph form for discussion.
<table>
<thead>
<tr>
<th></th>
<th>Shell Impression</th>
<th>Painting</th>
<th>Combing</th>
<th>Finger Impression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sample</td>
<td>307</td>
<td>81</td>
<td>37</td>
</tr>
<tr>
<td>Incised</td>
<td>360</td>
<td>5.4</td>
<td>12.7</td>
<td>0.5</td>
</tr>
<tr>
<td>Shell Imp</td>
<td>307</td>
<td>14.9</td>
<td>18.6</td>
<td>20.5</td>
</tr>
<tr>
<td>Painting</td>
<td>81</td>
<td></td>
<td>8.5</td>
<td>6.3</td>
</tr>
<tr>
<td>Combing</td>
<td>37</td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

Table 7.17. Percentage correlations of the five major decoration attributes with each other.

<table>
<thead>
<tr>
<th></th>
<th>Lip diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;14</td>
</tr>
<tr>
<td></td>
<td>Sample</td>
</tr>
<tr>
<td>Incised</td>
<td>360</td>
</tr>
<tr>
<td>Shell Imp</td>
<td>307</td>
</tr>
<tr>
<td>Painting</td>
<td>81</td>
</tr>
<tr>
<td>Combing</td>
<td>37</td>
</tr>
<tr>
<td>Finger Imp</td>
<td>46</td>
</tr>
</tbody>
</table>

Table 7.18 continued next page.
### Body angle

<table>
<thead>
<tr>
<th></th>
<th>&lt;40°</th>
<th>40-50</th>
<th>50-60</th>
<th>60-70</th>
<th>70-80</th>
<th>80-90</th>
<th>90-100</th>
<th>100-110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>36</td>
<td>60</td>
<td>116</td>
<td>170</td>
<td>180</td>
<td>167</td>
<td>41</td>
<td>23</td>
</tr>
<tr>
<td>Incised</td>
<td>360</td>
<td>10.1</td>
<td>11.4</td>
<td>33.6</td>
<td>33.6</td>
<td>28.5</td>
<td>28.5</td>
<td>10</td>
</tr>
<tr>
<td>Shell Imp</td>
<td>307</td>
<td>5.8</td>
<td>15.3</td>
<td>23.6</td>
<td>25.6</td>
<td>27.5</td>
<td>28.3</td>
<td>7.5</td>
</tr>
<tr>
<td>Painting</td>
<td>81</td>
<td>3.4</td>
<td>9.9</td>
<td>9.6</td>
<td>17.5</td>
<td>16.9</td>
<td>12.9</td>
<td>6.6</td>
</tr>
<tr>
<td>Combing</td>
<td>37</td>
<td>8.2</td>
<td>6.2</td>
<td>11.8</td>
<td>7.7</td>
<td>10.1</td>
<td>1.9</td>
<td>0</td>
</tr>
<tr>
<td>Finger Imp</td>
<td>46</td>
<td>4.9</td>
<td>9.4</td>
<td>11.1</td>
<td>8.3</td>
<td>8</td>
<td>10</td>
<td>9.4</td>
</tr>
</tbody>
</table>

### Rim and Body Treatment

<table>
<thead>
<tr>
<th></th>
<th>Unmodified</th>
<th>Thickened</th>
<th>Carinated</th>
<th>Not Carinated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incised</td>
<td>360</td>
<td>15.6</td>
<td>70.8</td>
<td>5.8</td>
</tr>
<tr>
<td>Shell Imp</td>
<td>307</td>
<td>59.4</td>
<td>33</td>
<td>33.2</td>
</tr>
<tr>
<td>Painting</td>
<td>81</td>
<td>10.3</td>
<td>20.7</td>
<td>9.6</td>
</tr>
<tr>
<td>Combing</td>
<td>37</td>
<td>21.6</td>
<td>1.1</td>
<td>37.7</td>
</tr>
<tr>
<td>Finger Imp</td>
<td>46</td>
<td>4.4</td>
<td>13.8</td>
<td>7.6</td>
</tr>
</tbody>
</table>

### Decoration Location

<table>
<thead>
<tr>
<th></th>
<th>Internal</th>
<th>On lip</th>
<th>Ext upper</th>
<th>Ext lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incised</td>
<td>360</td>
<td>13.2</td>
<td>42.4</td>
<td>63.3</td>
</tr>
<tr>
<td>Shell Imp</td>
<td>307</td>
<td>16.5</td>
<td>50.7</td>
<td>57.8</td>
</tr>
<tr>
<td>Painting</td>
<td>81</td>
<td>81.5</td>
<td>35.5</td>
<td>23.7</td>
</tr>
<tr>
<td>Combing</td>
<td>37</td>
<td>10.2</td>
<td>15.5</td>
<td>11.3</td>
</tr>
<tr>
<td>Finger Imp</td>
<td>46</td>
<td>6.3</td>
<td>13</td>
<td>13.9</td>
</tr>
</tbody>
</table>

**Table 7.18.** Percentage correlations between major bowl decoration technique attributes and variables for the other attributes. See text for explanation.
Figure 7.40. Percentage correlations of the five major bowl decoration techniques with lip diameters.

Decoration technique and lip diameter

These data are presented in Figure 7.40. As seen previously, lip diameter does not provide a sensitive discriminating measurement. All decoration techniques occur on bowls of all diameters with the exception of combing, which does not occur on the smallest diameter bowls. The strongest correlations mostly occur with the central diameter sizes although finger impression tends towards the larger end of this range.

Decoration technique and rim angle

These data are presented in Figure 7.41. As seen previously rim angles appear to provide little discrimination for grouping Motupore bowls and this is also the case with their relationship to decoration techniques, which are arrayed across the full range of rim angles. The strongest correlations for all techniques are within the rim angles from 70° to 110°.

Decoration technique and body angle

These data are presented in Figure 7.42. The strongest correlations for all decoration techniques are with body angles between 50° and 90° but since this is where the majority of the sample is located it again reflects the spread of techniques when compared to body angles and the lack of utility in this measure for separating the sample. The general homogeneity of bowl sizes, shapes and decoration techniques is only disturbed by the combed sample which tends towards the shallow body angles.
**Figure 7.41.** Percentage correlations of the five major bowl decoration techniques with rim angles.

**Figure 7.42.** Percentage correlations of the five major bowl decoration techniques with body angles.
Decoration technique and rim and body treatments

These data are presented in Figure 7.43. In contrast to the previous tests, decoration techniques correlate with the four rim and body treatments in specific and diverse ways. Incised decoration is highly correlated with modified rims and bodies that are not carinated. Combed decoration is closely associated with unmodified rims and carinated bowls. Finger impression is more strongly associated with thickened rather than unmodified rims and painting is similar to this. While shell impression is associated with all four rim and body treatments, it is most strongly associated with unmodified rims. This is the opposite of incision in this regard. These distinctions provide important directions for developing bowl types.

Decoration technique and decoration location

These data are presented in Figure 7.44. As discussed in relation to Table 7.17 above, many bowl sherds carry two and sometimes three different decoration techniques. In some cases these different decoration techniques occur in different locations, so that in isolating all cases of a particular technique the data base probably suggests some locations for it that are erroneous. For example, the data base suggests that all four techniques (other than painting) occur on the internal surface of the bowl. In reality, this usually indicates the presence of painting on the interior of bowls that also carry other types of decoration externally. More than 80% of painted sherds in the sample have painting on their interiors. In another example, combing does not occur internally or on the lips of Motupore bowls; but it is a technique which in the 37 examples in the sample occurs with other techniques that do (mostly shell impression – see Table 7.17).
Figure 7.44. Percentage correlations of the five major bowl decoration techniques with the four decoration locations.

Thus, thought was given to excluding this test, however it still provided pertinent information in my quest for types. Thus:

- while both incision and shell impression occur predominantly on the lip and the external upper zone, shell impression also occurs on the external lower zone
- painting occurs in all zones but its predominance on the inside of bowls and on the lower exterior, suggests that this might be an important association
- the occurrence of combing on the lower zone and its strong association with shell impression indicates a connection for further examination.

Summary of decoration technique attributes

Bowl decoration techniques are not strongly related to bowl size, rim angle or body angle. The possible exception here is combing. As seen in Figure 7.31, combing is an early decoration technique in the sequence, occurring mainly in PAU 6; it is not found on the smallest diameter bowls and correlates most strongly with shallow body angles. Combing is strongly associated with unmodified rims and carinated bowls and appears commonly with shell impression on the exterior lower zone of bowls (as well as the upper exterior zone).

The two major decoration techniques, incision and shell impression, only rarely occur together. Incision associates strongly with modified rims on bowl sherds that are not carinated, while shell impression diminishes in frequency through the sequence (an opposite trajectory to incision – see Figure 7.31) and occurs with all body treatments, but most strongly with unmodified rims.

Among the minor decorative techniques, some 81 sherds are painted but >75% of these carry other decoration techniques. Painting on bowls differs from painting on globular pots, being
frequently applied on complete surfaces, particularly on the interiors of bowls. Painting also occurs most frequently on bowl sherds with modified rims. Finger impression occurs most commonly with shell impression or incision and also most frequently on modified rims.

Hierarchical type distribution within the bowl sample

Following the procedures discussed at length for the globular pots I experimented with attribute and variety sets for the bowls. It was readily apparent that the initial split should be made on modified rims versus rims that were not modified. I then tested subsequent splits based on the results obtained above.

It is important to note here that I proceeded with the typology for Motupore bowls along somewhat different structural lines to the globular pots. With globular pots I determined that size and shape rather than decoration attributes provided the most productive typology relevant to the questions being pursued and that decoration attributes, occurring in roughly similar proportions on each pot type, did not operate to distinguish further types. While some chronological change was noted, I thus chose to divide different decorative elements as varieties occurring with the three size/shape types.

As has been seen and is further demonstrated below, decoration attributes form a more central role in defining bowl types, both because of their relationships to the other attributes, their greater variety and greater temporal sensitivity.

Bowl Type 1. The first split of the whole sample of 789 bowls was made on modified rims = 518 sherds. The next split was made on bowls not carinated = 507 sherds. The next split was made on the combined decoration locations, on lip and external upper zone. (I combined these two decoration locations for two reasons, firstly, as discussed previously, lip decoration sometimes impacts the upper external zone and secondly, decoration on these two zones occurs together in more than 28% of cases in this group.) This split resulted in 454 cases remaining, being 87.6% of the sample that resulted from the first hierarchical split. Of the 53 remaining cases 48 (90.6%) were undecorated (see below).

The next suggested split was on decoration technique. Of the 454 cases 306 were decorated with incision and 127 cases with shell impression. Only nine sherds were shared by the two groups, i.e. there were only nine bowl sherds that carried both incision and shell impression. Following the procedure developed for the globular pots these techniques defined two varieties within the type.

Thus, Bowl Type 1 is defined as having a modified rim without carination and with decoration on the lip and/or external upper zone. Bowl Type 1, Variety 1 is decorated with incision and Variety 2 with shell impression. Together these varieties account for 95.4% of Bowl Type 1. The remaining 30 sherds (not 21 as the math [454 – (306 + 127)] might suggest, since 9 sherds with both incision and shell impression have been counted twice) comprise those carrying the minor decoration techniques of which painting occurs on 18 items.

Both varieties of Bowl Type 1 are also associated with finger impressions. Bowl Type 1, Variety 1 accounts for 38.3% of the 60 painted items and 50% of the 36 finger impressed sherds still in this sample. The percentages are slightly lower for Bowl Type 1, Variety 2, being 30.0% and 25.0% respectively. When examined, the relationships between these two varieties and the three sets of measurement attributes were generally similar although there was a slight tendency for
Variety 2 sherds in this group to occur more frequently on smaller diameter bowls than the Variety 1 examples.

The choice of opting for incision and shell impression as the preferred splitting variables over the other decoration techniques was solely on their numerical dominance, so before moving to the other groups I examined painting and finger impression independently among the 454 cases isolated above by the first three splits. This indicated that these two attributes provided no basis for seeing them as separate varieties within Bowl Type 1. This suggested that they should function as minor descriptors as offered here.

**Bowl Type 2** comprises 165 sherds with unmodified rims, not carinated, and decorated on the lip and/or the external upper zone. As with Bowl Type 1, two varieties can be proposed, **Bowl Type 2, Variety 1** (40 sherds) is decorated with incision and **Variety 2** (112 sherds) with shell impression. Together these include 92.1% of Bowl Type 2 sherds. Although Bowl Type 2 can be seen to be differentiated from Bowl Type 1 only on the unmodified versus modified rim attributes, it is also apparent that whereas there are 2.4 times more incised than shell impressed sherds in Type 1, roughly the reverse is true of Bowl Type 2. The two decoration techniques in Bowl Type 2 separate from each other in similar fashion to Bowl Type 1, with incision and shell impression occurring together on only four items (2.4%) within Type 2. The remaining 17 sherds are mostly painted or slashed, either separately or with incision and shell impression. Small numbers of Type 2 bowls carry other minor decoration techniques; in particular 11 of 12 examples of combing among Type 2 occur with shell impression. Decoration on the lower exterior zone is also common on Type 2 bowls, occurring on 28 items, 20 of them being Variety 2 sherds.

**Bowl Type 3** comprises unmodified rims decorated on the lip and/or the external upper zone but here carinated. These number 68 items. Within this wider type 61 sherds (89.7%) are shell impressed. Combing occurs on 21 items, 19 of them in association with shell impression and in 11 of these cases occurring on the upper and lower external zones. Shell impression without combing also commonly occurs on the external lower zone. It is clear that here I am reproducing the same type identified in Chapter 6 as variable group [unmodified rim, carinated, shell impressed, combed, exterior upper zone and exterior lower zone](see also Table 6.5).

These associations can also be seen if we consider all the carinated bowls in the wider sample. From a total of 85 carinated sherds, 84.7% occur on unmodified rims, 76.5% are shell impressed, 32.9% are decorated on the lower external zone and 27.1% carry combed decoration.

Bowl Types 1-3 have been created relying on decoration as well as shape, thus a final type **Bowl Type 4** can be defined for the 82 undecorated bowls in the sample. Apart from being undecorated, 95.1% are not carinated, with the four carinated items occurring with unmodified rims. Two varieties can be usefully employed; **Bowl Type 4 Variety 1** comprises 48 items with modified rims, while **Bowl Type 4 Variety 2** has 34 items with unmodified rims. These two varieties were compared by measurement attributes. While there are no appreciable differences between the wide ranges of lip diameters and body angles in the two groups, there is a strong tendency for the modified forms to exhibit restricted rim forms and the unmodified variety to be more open. These are the same trends that were recognised earlier with the whole sample (see Figure 7.36). It is of further interest that these two varieties comprise many smaller bowls, with 64.5% of Variety 1 and 73.6% of Variety 2 occurring on bowls with diameters < 220 mm. One
suggestion is that these smaller bowls provided food bowls and cups for domestic use and that most remained undecorated for this reason.

Discussion of the hierarchical types

Constructed in this hierarchical fashion, the four broad types account for 97.5% of the bowl sample, with only 20 sherds not able to be incorporated into these groups. Of these 20, four represented entry errors in the data base, four were decorated internally but not externally and twelve formed a small group of sherds with modified rims and carinations; all are decorated on the lip and/or the external upper zone, with either incision, shell impression, painting or finger impression. A further 21 sherds were lost reducing Type 1 and Type 2 bowls to two varieties each, making a total of 41 sherds (5.2%) lost from the sample of 789 sherds. Thus, this typology contains most of the sample within the four types and varieties, describes the salient features of the pottery, and provides a basis for answering the questions being pursued.

It will be noted that the seven type and variety groups are indeed more like each other than different from each other; the varieties are identified by the same pair of decorative techniques in each type and the three decorated types differ from each other in only one or two attributes, while the plain wares are identified simply by being undecorated. Vanderwal (1973:69) noted a similar problem in his typology, concluding that the archaeologist chooses (weights) a few attributes above others but has many entities (sherds), whereas biologists, for example, usually have many more attributes but fewer organisms.

As is apparent, comparisons between these bowl types and those determined statistically (e.g. see Table 6.3) show a number of concordances, despite the hierarchical splits being predicated on different attributes. As with the globular pots this may not be unexpected, but provides some confidence in the results nonetheless. The subjective decision to divide the bowl sample primarily on shape attributes rather than on decorative techniques as in Chapter 6 provides a better functional base for separately examining trends in the data that might differ from those based on decoration techniques, already examined in Chapter 6. What both analyses indicated is that apart from a few cases (see below) measurement attributes showed distributions across the range of variables that did not separate groups in any distinctive way.

It should be immediately noted that this process moves away from the normal polythetic group definition. While the procedure normally conformed to the rules that each entity in the group possesses a large number of the attributes of the group and that each attribute is shared by a large number of the entities, the hierarchical types presented here do not follow the rule that no single attribute is itself sufficient or necessary for membership. The types constructed here deliberately define one or more attributes that are deemed necessary for membership.

Apart from decoration technique, the most apparent distinction within the bowl sample (as seen) is between modified and unmodified rims and further examination of these attributes indicated several interesting trends in relation to size and shape. Table 7.19 provides the details. The data are also presented visually in Figures 7.45 to 7.47.
<table>
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<tr>
<th>Lip diameter</th>
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<th>14-18</th>
<th>18-22</th>
<th>22-26</th>
<th>26-30</th>
<th>30-34</th>
<th>&gt;34</th>
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<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Modified and Decorated</td>
<td>470</td>
<td>6.2</td>
<td>12.1</td>
<td>24.7</td>
<td>22.1</td>
<td>18.9</td>
<td>11.1</td>
</tr>
<tr>
<td>Modified and Undecorated</td>
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<td>18.8</td>
<td>27.1</td>
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<tr>
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<td>35.3</td>
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<td>16.5</td>
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<tr>
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<td>8.3</td>
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<td>8.3</td>
<td>8.3</td>
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<td>14.7</td>
<td>11.8</td>
<td>11.8</td>
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<tr>
<td>Unmodified and Decorated</td>
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<td>5.5</td>
<td>13.1</td>
<td>22.8</td>
<td>22.4</td>
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</tr>
<tr>
<td>Modified and Decorated</td>
<td>470</td>
<td>4.3</td>
<td>6.4</td>
<td>14.3</td>
<td>22.1</td>
<td>23.4</td>
<td>21.5</td>
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<tr>
<td>Modified and Undecorated</td>
<td>48</td>
<td>4.2</td>
<td>4.2</td>
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<td>Unmodified and Decorated</td>
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<td>9.7</td>
<td>15.6</td>
<td>22.8</td>
<td>19.4</td>
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</tr>
</tbody>
</table>

Table 7.19. Percentage distributions of decorated and undecorated bowl sherds according to rim modification in relation to lip diameter (in cm), rim angle and body angle.
Figure 7.45. Percentage distributions of undecorated bowl sherds by lip diameter (cm). The undecorated sherds are divided according to the presence/absence of rim modification. The comparative data for decorated sherds are also shown.

Figure 7.46. Percentage distributions of undecorated bowl sherds by rim angle. The undecorated sherds are divided according to the presence/absence of rim modification. The comparative data for decorated sherds are also shown.
Undecorated bowl sherds and lip diameter

Figure 7.45 indicates that undecorated sherds with both modified and unmodified rims differ from their decorated counterparts in tending towards bowls with smaller diameters while still mostly occurring across the full range of diameters. This is particularly true for undecorated bowls with unmodified rims, where 35% of them fall into the smallest lip diameter category. Very few large diameter bowls are undecorated.

Undecorated bowl sherds and rim angle

Figure 7.46 shows further deviation for undecorated sherds from the decorated sherds, particularly for the unmodified rim bowls which are more out-flaring than the other three groups; this makes sense in that the exteriors of bowls of this shape would not be readily visible. Undecorated sherds with modified rims show less differentiation from their decorated counterparts, with the apparent differences with the restricted rims thought to reflect small sample size.

Figure 7.47. Percentage distributions of undecorated bowl sherds by body angle. The undecorated sherds are divided according to the presence/absence of rim modification. The comparative data for decorated sherds are also shown.

Undecorated sherds and body angle

Figure 7.47 indicates that undecorated sherds mostly follow their decorated counterparts in terms of body angle. These undecorated sherds follow the pattern seen in Figure 7.37 where there is very weak association with restricted body angles for either modified or unmodified rims.

Higher percentages of undecorated and unmodified sherds occur with shallower body angles than their decorated counterparts, and if the small sample data are to be trusted, undecorated and unmodified sherds present a bimodal curve, perhaps suggesting there are two variants of this group, one with shallow body angles and a more common one with body angles approaching the
vertical. One aspect of this analysis was that it provided further evidence to support establishing two varieties of the undecorated Type 4 bowls.

**Distribution of bowl types through time**

Table 7.20 shows the numerical distribution of the seven bowl types and varieties by PAU.

<table>
<thead>
<tr>
<th></th>
<th>PAU 1</th>
<th>PAU 2</th>
<th>PAU 3</th>
<th>PAU 4</th>
<th>PAU 5</th>
<th>PAU 6</th>
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<td>Bowl Type 1 Var 2</td>
<td>16</td>
<td>10</td>
<td>34</td>
<td>31</td>
<td>22</td>
<td>15</td>
<td>128</td>
<td>17.1</td>
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<tr>
<td>Bowl Type 2 Var 1</td>
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<td>3</td>
<td>9</td>
<td>14</td>
<td>10</td>
<td>0</td>
<td>40</td>
<td>5.3</td>
</tr>
<tr>
<td>Bowl Type 2 Var 2</td>
<td>1</td>
<td>7</td>
<td>11</td>
<td>17</td>
<td>58</td>
<td>18</td>
<td>112</td>
<td>15.0</td>
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<tr>
<td>Bowl Type 3</td>
<td>7</td>
<td>4</td>
<td>8</td>
<td>17</td>
<td>6</td>
<td>17</td>
<td>68</td>
<td>9.1</td>
</tr>
<tr>
<td>Bowl Type 4 Var 1</td>
<td>8</td>
<td>3</td>
<td>17</td>
<td>13</td>
<td>5</td>
<td>1</td>
<td>47</td>
<td>6.3</td>
</tr>
<tr>
<td>Bowl Type 4 Var 2</td>
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<td>7</td>
<td>8</td>
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<td><strong>Total</strong></td>
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<td>168</td>
<td>151</td>
<td>127</td>
<td>70</td>
<td>748</td>
<td>100</td>
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</table>

**Table 7.20.** The numerical distribution of the Motupore bowl sample by type and variety within the pottery analytical units.

A number of points can be made. As noted above the seven groups account for c. 95% of the sample, the remainder (41 items) being decorated by the minor techniques not in association with either incision or shell impression, or being decorated not on the lip or upper external zone, but on another location. For the purposes of this typology, this group is not significant.

The two varieties of Bowl Type 1 comprise almost 60% of the sample, the two varieties of Bowl Type 2 about 20% and the other two types 9% and 11% respectively.

Figure 7.48 shows the distribution of the seven bowl types and varieties according to their percentage distributions within the six PAUs. With one exception, all types occur in all PAUs, adding to earlier recognition of the homogeneous nature of the bowls. At the same time there is more variability between the bowl types through time than with the globular pots. This is attributable to both shape and decoration techniques and to a lesser extent decoration on the lower external zones of some vessels.

The important trends include the numerical dominance of Type 1 Variety 1, but especially the growth of its popularity from PAU 4 onwards. This growth is at the expense of Type 1 Variety 2; in other words this trend is driven by the gradual replacement of shell impression by incision on bowls with modified rims. The same trend is not so apparent in Type 2 bowls, where the numerical downturn in both varieties is driven by the replacement of unmodified rims with modified ones. Both varieties are most dominant early in the site’s history, even though incision is absent in PAU 6.

Type 3 bowls are also mostly early in the sequence and in their distribution are most like Type 2 Variety 2 bowls; this is unsurprising since most Type 3 bowls carry shell impression, the dominant characteristic of Type 2 Variety 2 bowls. Nonetheless they also positively link unmodified rim bowls with carinated bowls as a distinctive early form. The undecorated Type 4 bowls show few trends, forming a small but persistent percentage throughout the sequence.
Figure 7.48. Distributions of the Motupore bowl types expressed as percentages within each PAU. Take note especially the different scales for each type and variety when making comparisons.
Sub-varieties of Motupore bowls

While the types and varieties of Motupore bowls identified above fulfil many of the requirements of the typology to answer questions raised in earlier chapters, these broad groupings disguise finer trends contained within them. Here I consider several such groups.

Sub-variety A is a sub-group of Type 3 already discussed and described in the latter part of Chapter 6 and summarised in Table 6.5. As noted, this sub-variety comprises items with unmodified rims and shell impression that are variously carinated, decorated on the lower external zone (in addition to lip and/or upper external zone) and frequently also exhibiting combing.

This sub-variety is again identified here because while the sub-variety with combing present comprises only 30 items, it is temporally important with more than 63% of this group occurring in PAU 6 and more than 83% occurring in the two earliest analytical units. (Of only seven other combed items in this sample, three are on unmodified rims without shell impression, two are with shell impression on modified rims, one is associated with painting and one has combing as the only decoration.) Sub-variety A with shell impression but without combing is more prevalent (141 items =17.9% of the bowl sample) and occurs in all analytical units but predominantly (>80%) in Analytical Units 4-6.

This sub-variety is identified here because it will be shown in Chapter 8 to have relevance to the consideration of decoration motifs on Motupore bowls.

As noted, in defining the types and varieties I determined that painting, finger impression and slashing were attributes subservient to those used for the definition of types and varieties. For completeness I now consider these variables briefly as sub-varieties, but unlike sub-variety A, none of these fit within the types and varieties delineated above. Instead their memberships are encompassed across the types and varieties.

Sub-variety B comprises bowl sherds that are painted on the lip and/or the external upper zone. Frequently they are associated with mid-range diameters (> 140 mm, < 340 mm), are not carinated and may also be painted internally. Most commonly they occur with modified rims and are also painted on the lower external zone (thus, like globular pots, painting on bowls is often on all decoration zones). Sub-variety B comprises 81 sherds (= 10.3% of the bowl sample). Painted sherds occur in PAU 6 (10 items = 12.3%), are most frequent in PAU 5 (25 items = 30.9%) then steadily decline in frequency to PAU 1 (3 items = 3.7%), again mirroring painting on globular pots.

Sub-variety C comprises bowl sherds that are finger impressed on the external upper zone, that are not carinated and have modified rims. This combination comprises 36 of the 46 finger impressed items in the sample (78.3%). Of the 10 remaining, three occur on modified rims that are carinated and seven occur on unmodified rims, two carinated and five not carinated. Overall, finger impression is a minor but distinctive sub-variety. It occurs in all PAUs, but predominantly in PAUs 1-3 (63%) with PAU 3 the most populous.

Sub-variety D is a small group (20 items) in the sample. Decorated with slashing on the upper external zone, this sub-variety occurs mostly on unmodified rims that are not carinated. This sub-variety has been identified because 16 of the 20 items occur in PAUs 4 and 5 (80%, with 60% of them in PAU 5). It thus has chronological significance.
Chapter Summary

The nature of this typology

In this chapter I have attempted to develop a ceramic typology for the Motupore pottery that has not relied on computer generated statistical measurement. My alternative hands-on approach has had both advantages and disadvantages. Among the former has been my ability to understand precisely how the data have been manipulated at any point and the freedom to alter the direction of my enquiry in response to the sequential run of results that emerged and influenced me.

One criticism might be the intuitive nature of this study. Computer generated clustering programs might divide an assemblage more ‘objectively’ based on some mathematical measure of distance between the variables and attribute classes, provided that they are not biased by an eccentric choice of attributes (if this is possible). While I have tried to argue for my splitting choices from within the data, I have also used my understanding of the wider prehistoric and ethnographic ceramics of central Papua and also the wider archaeological evidence of Motupore to determine the divisions of the whole ceramic sample from the site. Even then, with the Motupore bowls I have identified two pathways that divide some of the same data differently (types and varieties versus sub-varieties). Thus the results in this chapter should be considered in no way objective. Rather they should be judged on their utility.

The types formed in this study move away from the normal polythetic group definition – namely that each entity in the group possesses a large number of the attributes of the group, that each attribute is shared by a large number of the entities and that no attribute is itself sufficient or necessary for membership. The types formed here take on some characteristics of polythetic types in that they can comprise different attributes, such as in sub-variety A, and also different numbers of attributes. However unlike normal polythetic types, particular attributes here can also occur as defining attributes of more than a single type. Also I have moved from normal polythetic types by ascribing typological importance to particular attributes (and variables within attribute classes) in a hierarchical order determined intuitively after preliminary investigations of the data. Since any initial split means that all entities in one group must always possess the splitting attribute, this attribute can be deemed necessary for membership. Equally these are not monothetic types because the defining attributes and variables are not exclusive to any particular type.

The fundamental problem with creating a typology for Motupore pottery, for both globular pots and bowls, is that there is an array of similarities and differences between all the variables of all attributes that might be defined for the physical sherd assemblage. These can appear on any individual item. This speaks not only to the homogeneous nature of the assemblage, already noted in numerous tests, but equally to the variability of hand-made pottery and, I suspect, to the socio-cultural framework within which the potters worked. This last concept is not meant to be complex or abstract; here I simply mean the day-to-day interactions of a few women potters, likely to be related, sharing the tasks of raw material acquisition, pot-making and firing.

While changes occur, homogeneity through time in this assemblage is self-evident. However in the sense used here the idea of homogeneity speaks to the perennial problem of lumping items together or dividing them when creating a typology. If we consider Kreiger’s observation that heads this chapter, we could be forgiven for accepting that there are two types of pottery at Motupore, globular pots and bowls. However, divisions at the type level in this chapter do attempt to define definite constructional ideas beyond globular pots and bowls. Varieties within
these types speak to variations in decoration that much more specifically reflect changes through
time. In distinction, the sub-varieties purposely look at groupings that cut across the types and
varieties to examine minor decorative components that elaborate the typology while not being a
part of it. Further discussion of the typology occurs in Chapter 10.
CHAPTER 8   WHISPERING SHERDS

James B. Griffin once said that you have to poke, prod, and dissect every sherd until it speaks to you (Mangold 2011:100).

The Real Mesoamerican Archaeologist loves to work with pottery, but if there’s one thing he can’t stand, it’s ‘whispering potsherds’ (Flannery 1976:251).

In this chapter I begin by briefly reviewing the physical evidence for pottery-making on Motupore, to clear the way for the central consideration of identifiable decorative motifs and ‘trade marks’ on Motupore pottery. This section also considers the origin of the Lakekamu pot, mentioned in Chapter 5. A further short section reviews handles, lugs, string holes and repairs and considers the question of ovoid bowls on Motupore. I discuss pottery profiles as a conclusion to the typological quest. I offer some comparative comments on Cox’s work on Motupore bowls and Bulmer’s Port Moresby sites and pottery typology, then the Yule Island site of Urourina and various sites in the Papuan Gulf. I conclude by considering the implications of the data presented in this chapter for the Bulmer style sequence and the nature of the pottery industry on the island.

Was pottery made on Motupore?

There can be no doubt that pottery was made on Motupore. This is attested to by the vast number and frequently large size of sherds recovered from the site, as documented in Chapter 5 (see Table 5.5). Any comparison between this pottery assemblage and those from sites where pottery is not made (such as those in the Gulf of Papua), show orders of magnitude differences between the numbers and volumes of sherds recovered. Breakage during firing is a likely major source of sherds. Ethnographically, high loss at this production stage is noted by Groves (1960:18). See also Figure 8.1.

- the presence in the Motupore assemblage of the negative scars on the surfaces of some sherds where the surfaces have spalled off during firing (see Figures 8.1, 8.2), as well as the spalls themselves (Figure 8.2). Even if pots damaged in this way remained serviceable, it is unlikely that they would be considered to be good enough to trade.

- the identification of pot firing locations in the site during excavation. These were marked by fine whitish ash different from general burning because it is in localised areas c. 4-5 m in diameter. The example from K22/1 (see Figure 4.18) is also up to 200 mm thick, suggesting multiple firings. An ethnographic example from the Western Motu village of Hanuabada is shown in Figure 8.3.

These are the physical characteristics of the assemblage that indicate pottery manufacture on Motupore. More conclusive are the chemical sourcing tests reported in Chapter 9.
Figure 8.1. Firing pots in Hanuabada village 1898. One pot has broken in firing and the other has a large spall off the shoulder. Photograph A. C. Haddon. Museum of Archaeology and Anthropology, Cambridge: ID number N.36031.ACH2.

Figure 8.2. Motupore pot spalls. Left: Item M23.IV.23.100 (PAU 6) showing internal surface of a spalled item, indicates pottery manufacture at first settlement. Right: Item M23.IV.8.2 (PAU 3) shows large spall scar on globular pot, caused by too rapid heating during firing.
Decorative motifs on Motupore pottery

Theoretical considerations

One extreme of the emic position is the attempt to use pottery decoration and particularly decoration motifs to identify social groups such as households or clans, and even individual potters. In the United States in particular, numerous articles have explored variations on this theme, based on the premise that motifs carry messages beyond their overt decorative function. Given the highly elaborate decoration of many of the prehistoric pottery traditions in the Americas, this predilection is understandable. As noted in Chapter 5, motif analysis amongst Melanesian prehistoric pottery assemblages is at best uncommon, principally because of the simplicity of these motifs. This observation explicitly excludes Lapita pottery of course, where complex motifs have been used to explore exactly such perceived social organisation – for example, Lapita ‘faces’ being the ‘materialized social memory in ancient house societies’ (Chiu 2005).

Even if it was possible to interpret decorative motifs in this way for Motupore pottery my tendency would be to share the scepticism of Flannery’s Real Mesoamerican Archaeologist. At the same time it is reasonable to assume that decoration motifs carry cultural meaning beyond the desire to decorate, if for no other reason than that we can see repetition and longevity as well as evolution in them – in other words decoration is not random. Rye (1981:3) separated the stages of pottery production into those that are essential (gathering the raw material, forming the pot, firing et cetera) and those that are not essential, in that they do not contribute to the serviceability of the vessel being made. These non-essentials are mostly forms of surface treatment and decoration. Rye notes that decoration can be more variable
than the essential components and that it provides the easiest discernible evidence of differences for archaeological classification. While for Motupore this appears to be true for decorative techniques as seen in Chapter 7, we still need to test whether in fact such wide variation occurs in decorative motifs. If, as argued in this chapter, it does not, then it follows that any identifiable motifs may represent a signature of some sort, either of Motupore itself or of sites in the region (say, Bootless Bay sites), or alternatively of external sites that exported pottery to Motupore. The ability to identify the raw materials of manufacture (Chapter 9) provides a signature similar in its utility but different in its approach. Together, motifs and manufacturing sources form a powerful combination that at the simplest level will satisfy the question of whether pottery flowed to Motupore from external but potentially identifiable villages, or from it, or both. At more complex levels, and if the data are sufficient, it has the potential to determine both the timing and volume of prehistoric trade and even prehistoric trading alliances on the village level.

**Motupore pottery decoration motifs and design fields**

Shepard (1965:266-7) observed that motifs are composed of elements, these being the irreducible and most basic individual components of the motif, the product of an individual action of the potter – a short incised or painted line, or a dot, or a fingernail impression, or an impressed circle, and so on. Shepard noted that for fragmented archaeological assemblages recognition of repeatedly juxtaposed elements frequently identifies motifs that are only fully observed on whole vessels. As reviewed in Chapter 6, Bulmer’s analysis of Port Moresby assemblages was mostly based on decorative elements and repetitions of these that she labelled *design units*, not because of the fragmented nature of the pottery but rather because the decoration was so simple that she considered that very few units were ‘motifs’ (Bulmer 1978:75). While I take Bulmer’s point, to some extent this is a semantic distinction. Following Shepard, motifs, simple or complex, are created by combining elements, so that a single dotted line is either a motif or a part of a motif. One problem with using elements as a basis for analysis is that they are often too simple to distinguish between coincidence and cultural association when using them comparatively. An alternative proposal to the use of the term motif is to adopt the more neutral concept, *design field* following Kirch (2000:102). In the Motupore assemblage the sherds are frequently large enough and numerous enough to determine if one repeated element reflects a design field, despite its simplicity. Although they are fewer, the Motupore assemblage also contains examples of multiple elements combined to form more complex design fields. However, for simplicity, here I continue to use the term *motif* as synonymous with design field.

Motupore pottery decorative motifs, such as they are, fall into two broad groups 1) a set of invasive motifs and 2) a set of painted motifs. The first set can be taken to include all motifs created by disturbing the pre-fired surface of the vessel by stick, or finger, or fingernail incision, by shell impression, by combing or by other invasive means that contrast with the second, additive process of painting.

Surface invasion and painting result in the production of different elements and by extension, different motifs. Both processes occur on bowls and globular pots on Motupore, but as seen in previous chapters, in uneven proportions, with painted motifs mostly associated with globular pots and invasive motifs mostly associated with bowls. Even so, both processes can be seen together on individual bowls and globular pots sufficiently often to consider this conjunction not uncommon. As well, both processes can be observed on vessels where they do not represent motifs as such. Some bowls, for example, may have the whole interior painted; here painting becomes more a surface treatment than decoration. Globular pots and bowls very frequently have the lip decorated by transverse incision or shell impression.
These and other examples are better considered styles of decoration rather than motifs. The point for Motupore pottery is that almost all the sample can be assessed in terms of decorative techniques and locations, but fewer sherds can be classified in terms of motif, especially where sherds are small.

The other theoretical issue of importance to the argument here is the question of the devolution of a decorative motif through time. This frequently takes the form of a simplification of the motif, and in the case of naturalistic representations in particular, can lead to simple abstract representations, although this does not apply to Motupore. On occasions devolution can also be reflected in a simplification of the techniques of decoration through time. Such progressions appear to be widespread and cross-cultural. For example, Celtic imitations of Philippic staters (coins) show progressive abstraction that can reduce the representation of a horse to a few straight lines (Evans 1850), while seventeenth and eighteenth century New England gravestones show similar trajectories in the representations of death’s heads, cherubs and the willow and urn motif (Dethlefson and Deetz 1966:503). In the Melanesian domain the same sort of trajectory can be seen in Lapita pottery (Kirch 2000:102) and in EPP (Summerhayes and Allen 2007).

From data presented in previous chapters, the presence of decoration is most frequent in the earliest part of the Motupore sequence. Here I suggest that while the earliest and latest invasive motifs look quite different from one another, it is possible to argue an evolutionary progression from one to the other along a pathway of progressive simplification.

![Figure 8.4](image-url)  

**Figure 8.4.** Two partially reconstructed Motupore bowls decorated with the vertical herringbone motif. On left: item M23.IV.22.4; on right: M23.IV.22.16. Both are from early stratigraphic excavation units of PAU 6. Note that this and other photographs in this chapter have been digitally enhanced to emphasise the decorations.

**Incised motifs**

*The vertical herringbone motif*

Figure 8.4 shows two versions of the most common early incised decoration motif on Motupore bowls. Both items derive from PAU 6, the earliest of the pottery analytical units. The essential features of this motif are columns of oblique but parallel shell impressions separated by one or more continuous lines. While these columns are mostly approximately vertical in the earliest stratigraphic levels, sometimes they slope left or right or are
represented horizontally (when they cease to be columns and effectively become layered motifs better thought of as rows). In many cases the continuous dividing lines are incised using a two, three or four pronged comb, although two is the most common. These continuous lines may also be stick incised or sometimes grooved with a tool or finger. In naming this general pattern I have used the term ‘herringbone’, partially following Bulmer (1978:91), and the version in Figure 8.4 the vertical herringbone motif. It should be noted that Bulmer uses this term only where there are adjacent rows of opposing oblique hatching, as on parts of item M23.IV.22.16 in Figure 8.4. Bulmer would describe the vertical decorations elsewhere on this item and on item M23.IV.22.4 in this figure as hatching.

Some general aspects of these two bowls, beyond this motif, are worth noting. While M23.IV.22.4 is not carinated and M23.IV.22.16 is, both carry lip notching and both have the upper and lower external body zones separated by a horizontal band of vertical or sloping shell incisions. Both these design units continue through time; but in contrast, incised decoration on the lower external zone disappears in later PAUs and indeed quite soon after initial settlement. Even more unusual, in the case of M22.IV.23.16, decoration is continued across the base of the bowl and is the only clear example of this in the entire assemblage.

Despite the extensive decoration on these two items the execution is careless and irregular. The motif does not continue in regular fashion from the upper to the lower external zones of these bowls. On M23.IV.22.16 the more normal single column of oblique shell impressions gives way to a chevron design at one point on each of the upper and lower external zones; however, one is not immediately above the other. This general imprecision suggests that these are not new designs, but rather that they are more likely homeland designs, a view that is supported by the rapidity with which they devolve and simplify through the Motupore sequence.

The vertical herringbone motif (Figures 8.5, 8.6) continues with many individual variations from PAU 6 to PAU 3, but becoming increasingly rare through time. In general terms the motif grows simpler and is restricted to the upper external zone of Motupore bowls. Yet even in PAU 6 and PAU 5 there is considerable variability in the design. In some instances, (e.g. Figure 8.6f) the motifs are separated into panels with deliberate spaces in between, while in others (e.g. Figures 8.5f, 8.6b) the continuous vertical lines are absent. The shell impressions may be simple sloping lines or chevrons or combinations of both.

The horizontal herringbone motif

A second variant of the general motif occurs in horizontal form (Figure 8.7). Although it occurs in PAU 6, even there it is already less complex than the earliest vertical versions of this motif. These items again reflect the rapid devolution of this motif on Motupore. In this respect Figure 8.7a is of interest in that it combines both vertical and horizontal motifs on the one bowl, again separated into panels. This general directional change is emphasised by the younger examples from PAUs 5 and 3. In some examples the multiple horizontal rows reduce to a single row on the upper external zone; one such item, M23.IV.11.387 (Figure 8.12e), preserves the memory of the herringbone motif but foreshadows one dominant later bowl motif, the sloping incised band motif (see below).

The chevron herringbone motif

A second minor variant of the herringbone motif places the columns of incised elements seen in the vertical form into a chevron pattern, probably as an extension to the horizontal form (Figure 8.8). Although uncommon, it occurs in PAU 6 but expands as a style in PAU 5 where it shows a lot of variability.
Figure 8.5. Vertical herringbone motif. All sherds derive from PAU 6: a, J22.Ext.Z2.4; b, J22.Ext.Z2.28; c, J22.Ext.Z2.42; d, M23.IV.21.10; e, M23.IV.22.87; f, M23.IV.23.40.
Figure 8.7. Horizontal herringbone motif. Sherds a, b and f derive from PAU 5; c, d and e from PAU 6. a, J22.Ext.Z1.18; b, J22.Ext.Z1.44; c, J22.Ext.Z2.15; d, J22.Ext.Z2.18; e, J22.Ext.Z2.71; f, M23.IV.16.27.
Figure 8.8. Shell impressed chevron herringbone motif. All sherds are from PAU 5 except b, which is from PAU 6. a, J22.Ext.Z1.23; b, J22.Ext.Z2.38; c, K21.II.1.30; d, K21.IV.4.999; e, M23.IV.14.428; f, M23.IV.15.87.
Figure 8.9. Lip incision and incised chevron motif. Sherds a and b are from PAU 5, sherds c-f are from PAU 1. a, M23.IV.14.6; b, M23.IV.14.221; c, M23.IV.2.88; d, M23.IV.2.160; e, M23.IV.2.169; f, M23.IV.3.353.
Figure 8.10. Finger arcade motif. Sherd a derives from PAU 5, b = PAU 1, c and d = PAU 2, e = PAU 3 and f = PAU 4. a, K22.III.4a.220; b, M23.IV.3.12; c, M23.IV.4.32; d, M23.IV.6.21; e, M23.IV.8.787; f, M23.IV.11.125.
Figure 8.11. Sloping incised band motif. Sherds a-c derive from PAU 1, d and e = PAU 2, and f = PAU 3. a, M23.IV.2.126; b, M23.IV.2.214; c, M23.IV.3.75; d, M23.IV.4.340; e, M23.IV.6.60; f, M23.IV.8.7.
An interesting transition can be seen in item M23.IV.15.87 (Figure 8.8f) between the shell impressed chevrons (e.g. Figure 8.8b and 8.8d) and the combed chevrons of Figure 8.15a. By the middle of the Motupore sequence the herringbone motif has largely disappeared although simple incised chevron designs continue into PAU 1 (Figure 8.9).

The finger arcade motif

Unconnected to the herringbone motif, a prominent Motupore bowl motif is a single horizontal band of closely spaced finger impressions that push the clay towards the lip to form a continuous arcade (Figure 8.10). This motif occurs alone or in conjunction with other decoration. While it occurs throughout the sequence it is more common in the upper half, making it mostly a mid-to-late motif.

The sloping incised band motif

In its classic form this motif comprises the repeated use of two elements to form a continuous band of decoration always on the upper external surface of the bowl (Figure 8.11). It is frequently also associated with lip incision (Figure 8.9a and b) but may stand without it.

The lower band of elements consists of a line of vertical serrations frequently coinciding with the junction between the upper and lower external zones. Its location is frequently on the thickest part of modified rims and the increase in popularity of modified rims through time is strongly correlated with a similar increase in this design element.

The upper band consists of closely spaced incised parallel lines that slope either to the left or right. While most normally oblique they may also occasionally be vertical.

Although unmistakeably different from the vertical herringbone motif, the sloping incised band motif can be seen to be the simplified (and to some extent standardised) end product of a single tradition that begins with the herringbone motif. There is a clear progression of style and application that sees a demarcation between decoration on the upper external zone of bowls and the lower, with the rapid abandonment of the lower zone as a field for decoration. Where Figure 8.11 shows the ‘classic’ form of this motif from the recent layers of the site, related early forms from PAUs 5 and 6 are shown in Figure 8.12 where they are executed with shell impressions and labelled the shell impression sloping band motif. These show the absence of the lower serrated bands on bowls where the modified (thickened) lip is mostly absent, but may still be present, for example, on Figure 8.12c.

From this set, attention has been drawn above to item M23.IV.11.387 from PAU 4 (Figure 8.12e). This sherd retains elements linking it to the horizontal herringbone motif (notably the continuous lines flanking the panel of oblique incisions) and to the sloping incised band motif, especially the lower band of incisions on the thickened rim. The transitional nature of this piece, both stratigraphically and stylistically, clearly indicates the process of simplification of the early motif and the development of the later one.

The sloping shell impressed band motif on globular pots

As noted in earlier chapters, a little more than half the globular pot sample is decorated (604 decorated items in the 1143 item sample). Of these, 539 are decorated on the lip and of these 383 (63.4%) are either incised or shell impressed, with the remainder mostly painted. Two examples are shown in Figure 8.9a and b. As noted, lip decoration on both bowls and globular pots is considered here to be style rather than motif.
Figure 8.12. Early shell impressed sloping band motif. Sherds a-c derive from PAU 5, d = PAU 6, and e = PAU 4. a, M23.IV.13.501; b, M23.IV.14.357; c, M23.IV.16.3; d, M23.IV.21.13; e, M23.IV.11.387.
Figure 8.13. Sloping shell impressed band motif on globular pots. Sherd a-c = PAU 1, b and c = PAU 4, d = PAU 5, e = PAU 3. a, K21.IV.2.17; b, M23.IV.11.26; c, M23.IV.12.61; d, M23.IV.14.13; e, M23.IV.8.159.
Figure 8.14. Other incised motifs - combing. Sherds a and c derive from PAU 5; b, d = PAU 6; e = PAU 3. a, K21.IV.4.177; b, J22.Ext.Z2.1; c, J22.Ext.Z2.35; d, M23.IV.8.228; e, M23.IV. 21.182.
Figure 8.15. Other incised motifs - combing. Sherds a, c and d derive from PAU 5, b = PAU 1 (see text), e = PAU 6. a, J22.Ext.Z1.21; b, M23.IV.3.217; c, J22.Ext.Z1.22; d, M23.IV.15.125; e, J22.Ext.Z2.26.
Figure 8.16. Other incised motifs - punctate. Sherds a and b derive from PAU 1, c = PAU 4, d and e = PAU 5, f = PAU 6. a, M23.IV.1.57; b, M23.IV.3.168; c, M23.IV.11.52; d, M23.IV.13.193; e, M23.IV.15.193; f, J22.Ext.Z1.44.
Many of the remaining incised globular pots reflect the use of ‘trade marks’ (see below). However there are a small number of globular pots that carry a single band of sloping parallel short incised lines or equivalent shell impressions. Of interest, these occur mostly in the middle PAUs 3, 4, 5 whereas this motif on bowls is predominantly late. However this might be partly the product of small sample size. Equally strange, this motif on globular pots occurs as frequently midway down the exterior rim (Figure 8.13c-e) as on the interior of the rim (Figure 8.13a and b), despite the fact that it would not be easily seen at this location unless the pot was inverted.

**Incised bowl decoration – variability within and beyond motif**

While the general trajectory of incised and shell impressed decoration on Motupore pottery moves through time towards simplification and standardisation of motifs, those already discussed here neither sufficiently emphasise the variability within them, nor do they accommodate many other decorative designs that do not fit comfortably within them. Figures 8.14-16 provide a sample of these. Almost always, they remain within the parameters of the Motupore assemblage in terms of decoration location and decoration techniques and are only different in terms of the precise patterns that are produced. The possibility that at least some of these were not made on Motupore remains untested. Meanwhile, some are worthy of further comment.

**Combed decoration**

The use of combs with two to four teeth or tines as a design element of the herringbone motif has been discussed. As well, however, combing as a separate decoration technique occurs frequently, mostly in the earlier PAUs. In these instances combs may have as many as 10 or 12 tines. One repeated pattern is a series of separate vertical comb strokes again reminiscent of the herringbone pattern (Figures 8.15b and e). Item M23.IV.3.217 (Figure 8.15b) is clearly out of place in PAU 1 and is assumed to have been moved from an earlier stratigraphic location and re-located to the midden during the site’s occupation. Another repeated motif is the combed chevron pattern. In some items (e.g. Figure 8.15a) the combed representation links with the herringbone chevron shown in in item M23.IV.15.87 (Figure 8.8f); elsewhere (e.g. Figures 8.14d and 8.14e) some items show tight and careful patterning. The PAU 6 item M23.IV.21.182 (Figure 8.14e) reflects the regularity of a stamped pattern, although I could not verify this technique on this small and fragmented sherd. Bulmer (1978:276) claimed the presence of dentate stamping at Taurama, but only in respect of EPP ceramics there. (My own view is that no EPP ceramics are dentate-stamped, as we understand this term in Lapita studies and for this reason the term should be avoided. Elsewhere (1978:314) Bulmer refers to combs as ‘dentate tools’; clearly these are not stamps.)

Both the fabric and the surface colour, as well as the relative complexity of the pattern on item M23.IV.21.182 suggest this vessel may have been imported rather than made on Motupore. The same is likely to be true of item J22.Ext.Z1.22 (Figure 8.15c) for similar reasons.

Finally, rough vertical combing occurs on two rim sherds (Figures 8.15a and b) that have very small rim diameters. If these are bowl forms, originally they must have been little bigger than cups. However they might equally be narrow diameter rims from otherwise large vessels; the sherds are ambiguous on this point. In either case they are unusual.

**Punctate/Gouged Decoration**

Less prevalent than combing, the use of punctations nevertheless occurs throughout the Motupore sequence (Figures 8.16). These may, but need not be comb punctations. These
elements are used to form simple lines, either alone or in conjunction with other techniques. Occasionally (e.g. Figures 8.16c and f) they are used to frame decoration panels containing other motifs. A subset of this group involves patterns created by gouging small holes out of the vessel surface (Figures 8.17d-f). Again, these can occur alone or in conjunction with other design elements.

Moulded/Excised Decoration

A very small number of bowl sherds are decorated with what appear to be moulded additions to the upper external zone (Figures 8.17a-c) to produce straight line or curvilinear designs. In some cases (e.g. Figure 8.17a) clay is also excised to accentuate the pattern. Although this decoration stands out in this assemblage as unusual, there is no other reason to suppose that these vessels were not made on Motupore.

Figure 8.18 shows two unusual shell impressed items and two examples of slashing.

**Summary of incised motifs on Motupore bowls**

The sloping incised band motif, almost universal on bowls in the most recent levels of Motupore, appears, superficially, to have nothing in common with the vertical herringbone motif that dominates bowl decoration at initial settlement. However, intermediate examples from the middle PAUs of the site can be interpreted to reflect transition from the early motif to the later one. This transition follows a trajectory of motif simplification through time, leading to a more standard as well as a more simple design. This trajectory is clearly associated with the rise in popularity of the thickened rim form, where the profile of the pot provides a protruding ridge that locates the lower band of the motif and defines the division between the upper and lower external zones. Motupore potters appear to introduce only one different motif, the finger impressed arcade, into this evolutionary development of incised decoration, although many bowls show individual decorative variations, as just noted.

Various pathways can be followed in this evolution. One clear one moves from the shell impressed vertical herringbone pattern to its horizontal forms and then to its chevron form. The evolution of this last motif into otherwise identical incised versions (compare Figures 8.8 and 8.9) reflects the transfer from the shell impression technique to incision, documented more generally in Chapters 7 and 10. In both places there can be seen a clear and related change in the chrono-stratigraphic associations of these styles as well. On a parallel pathway we can plot the development from simple shell impressed bands to the classic sloping incised band motif that dominates the most recent levels of the site.

This ultimate association, directly linking the earliest herringbone and most recent sloping incised motifs indicates that the site continuities, argued for various data sets in previous chapters, are also reflected in the decoration motifs.

Enveloping this central theme of motif evolution, and sometimes obscuring it, is the great variability in bowl decoration at Motupore, throughout its history. This variability is partly to be explained in the hand-made nature of the pottery, but not entirely. Lapita pottery is also hand-made, but with Lapita the precision and complexity of the dentate-stamped decoration sets it apart, specifically because this is a product of the repetitious use of the stamps.

While Motupore pottery decoration has structure, in the way locations and spaces are used and in the use of panelling around the bowls, it is also careless and untidy in its conception and its execution. This pottery does not whisper of social memory nearly as much as it shouts about its utilitarian purpose.
Figure 8.17. Other incised motifs – moulded (a-c) and large punctate. Sherds a and b derive from PAU 3, c, e, and f = PAU 5, d = PAU 1. a, M23.IV.7.123; b, M23. IV.7.125; c, M23.IV.15.144; d, M23.IV.1.88; e, K21.II.1.287; f, K21.IV.3.162.
If, as Summerhayes and Allen (2007) have argued, the phenomenon of early phases of colonisation coinciding with an elaboration of pottery decoration is a case of ‘costly signalling’ (Smith and Bliege Bird 2005) to signal the newcomers’ worth, then the occupation of Motupore was less colonisation at a distance and more likely local relocation where the new island occupants remained in (or in touch with) the same social (and probably economic) landscape as before.

As observed, even the earliest forms of bowl decoration on Motupore are carelessly executed and devolve rapidly in their complexity. PAU 5 in particular is characterised by great variability in decoration design and technique, but from PAU 4 onwards decoration moves steadily towards a predominance of the sloping incised band motif. Even though the growth in popularity of this motif identifies a movement towards simplification and standardisation, variability remains, even within this motif. The decoration of the band separating the upper and lower external zones almost always occurs when the bowl rim is modified and frequently...
occurs at the same location when the rim is not modified. The sloping incisions may slope to the left or to the right or approach the vertical. The lip may be decorated or not.

The data for incised motifs can be read to suggest the arrival of potters with a set of homeland motifs that very soon thereafter experienced a period of experimentation and change and evolved into a classic new style of associated shape and decoration. As is probably common with pottery decoration, this change almost certainly reflects the social and economic pressures experienced by people on Motupore, themselves subjects for a later chapter. The variability in decoration designs and techniques seen at Motupore would be unexpected in a centralised pottery industry; instead the varied execution of the incised motifs points to individual household production carried on within village- or regional-level cultural styles which were on the path to standardisation, but without having yet reached it.

**Painted motifs**

Painted decoration on Motupore vessels is mostly geometric in form, with the predominant elements being straight lines and dots and less frequently chevrons. Lines and dots can occur together, with dots either framed by lines or in open field. Curving lines do occur, but only rarely, either as chevrons or as part of an ‘amoeba blob’ design.

As noted earlier, while painting occurs on bowls and globular pots, it is more frequently found on globular pots. Occasionally the interior of a bowl might be entirely painted, where it becomes surface treatment rather than decoration. Painted motifs are generally large, and despite the large size of Motupore sherds, no complete painted motifs were observed in the assemblage (but see below). On globular pots, painted decoration can occur in any or all of the zones of the vessel and Figures 8.19-21 contain examples of painting on the lips, the interiors and exteriors of the rims, and on the necks, shoulders and bodies of these pots.

*The clustered dot motif*

Multiple dots are the most common painted design element on Motupore globular pots, present in clusters, and usually on the shoulder of the vessel (Figures 8.19c-f). These dots are sometimes arranged in rows and columns, but are sometimes more randomly distributed. While it is not always easy to tell, the clustered dots are at least sometimes framed with straight painted lines, creating panels of decoration.

Dots in small numbers may also occur as elements with other motifs (e.g. with chevrons, Figure 8.20b; or the horizontal grille motif (Figure 8.22).

The clustered dot motif is a mid to late motif in this assemblage. Since painting occurs most frequently in the beginning of the sequence, this motif is possibly Motupore- or Bootless Bay-specific.

*The painted chevron motif*

The distribution of this motif occurs mainly in PAUs 5 and 6 (Figure 8.20). By PAU 4 the execution of this motif has deteriorated to a careless representation (Figure 8.20a). In PAUs 5 and 6 this motif appears to be mainly restricted to the interior and exterior of rims but this might also be the product of sample error. On some globular pot rims a solid chevron, like a triangle with the apex at the bottom, occurs on the interior rim (see below).
Figure 8.19. Painted motifs – ‘amoeba’ (a, b) and clustered dots. Sherd a derives from PAU 5, b = PAU 6, c = PAU 2, d and e = PAU 3, f = PAU 4. a, M23.IV.13.298; b, J21.II.7.1; c, M23.IV.5.549; d, M23.IV.9.124; e. M23.IV.11.27; f, M23.IV.11.416.
Figure 8.20. The painted chevron motif. Sherd a derives from PAU 4, b = PAU 5, c-e = PAU 6. a, M23.IV.11.457; b, K21.II.1.116 c, J21.II.7.2; d, J22.Ext.Z2.9; e, M23.IV.22.33.
Figure 8.21. The painted parallel lines motif. Sherd a derives from PAU 2, b and c = PAU 5, d-f = PAU 2. a, M23.IV.6.200; b, M23.IV.13.275; c, M23.IV.14.15; d, J21.II.7.36; e, K21.IV.8.8; f, M23.IV.22.33. Note that this last sherd shows the exterior, while the interior, with chevron motif, see Figure 8.20e.
The ‘amoeba’ motif

Although there are only a few examples in the assemblage, a move away from geometric forms is found with the ‘amoeba’ motif; it is given this name because amoebas are frequently described as random blobs of no specific shape, although the Motupore form mostly consists of a central blob with protruding ‘arms’ (Figures 8.19a and b). This motif occurs early in the sequence, in PAUs 5 and 6. Without better examples it is not possible to tell what a complete motif would look like; however, Bulmer (1978: Figure 7.25i) illustrates a complete painted motif from the Eriama rock-shelter comprising a central dot and two separated rings, with the outer-most ring having the same protruding ‘arms’, a motif that she calls ‘sun-star’ (1978:256). The date of this Eriama item is uncertain.

The parallel straight lines motif

Straight painted lines should more accurately be considered elements rather than motifs but several examples exist in the assemblage where sherds are sufficiently large to demonstrate the repetition of this element in sets of parallel lines (Figure 8.21). Some are painted, others
might be dribbled or finger daubed. One example, item M23.IV.6.200 (Figure 8.21a) is more elaborate, with tapering lines suspended from another angled element that is unfortunately mostly missing from this sherd. Other examples are on sherds insufficiently large enough to determine whether the painted lines are examples of this motif or the horizontal grille motif (see next). Parallel straight lines occur earlier and late in the sequence and with clustered dots they comprise the most common painted decoration elements.

The horizontal grille motif and the Lakekamu pot

Mention was made in Chapter 5 of the Lakekamu pot, recovered in 1969 from the bank of the Lakekamu River, in the eastern Gulf Province (Bulmer 1971: Plate 1). One representation of this pot is presented in Figure 5.3 and a second view is provided in Figure 8.22. The Lakekamu pot clearly shows a recurring, relatively complex motif comprising four horizontal bars bounded by touching vertical bars on either side that extend beyond the positions of the top and bottom horizontals to form the grille or wide ladder effect. Two dots sit above the centre of the top horizontal. This motif forms a panel that occurs three times around the circumference of the pot and each panel is separated from its neighbours by two painted free-standing verticals. As well, a solitary solid chevron is painted on the interior of the rim; this might be a 'trade mark'. The availability of this whole pot allows us to see a complete painted motif and the structured way it is used, even if the representation is crude. The immediate relevance of the Lakekamu pot is that a strong circumstantial case can be made that the pot was made on Motupore, or at a minimum, within the direct cultural milieu in Bootless Bay in which the Motupore potters worked.

Figure 8.23 illustrates three Motupore sherds that carry identical decorative elements to those on the Lakekamu pot. One item, M23.IV.9.1 comes from PAU 3; the other two sherds are stratigraphically at least 150 years older; both come from PAU 6 but from excavation squares approximately 15 m horizontal distance from each other. Thus we are dealing with certainly two vessels (also confirmed by the differences in style in the depiction of the decoration) and almost certainly with three. While the solid chevron on the rim of item M23.IV.22.44 does not necessarily mean that it was decorated with the horizontal grille motif, it is sufficiently distinctive to add corroborating evidence to the connection between Motupore and the Lakekamu pot (which carries a similar chevron (see Figure 8.22)).

Item K21.III.7.6 depicts two bars of the horizontal grille with the right-hand upright and one of the dividing verticals. The painted neck above it locates the motif on the upper part of the body of the pot, as with the Lakekamu example.

Item M23.IV.9.1 is a much more careless depiction of the motif, but one which preserves the most elements on a single sherd, including the left hand upright, the four horizontal bars and the two dots.

The visible fabric of the Lakekamu pot shows both sand temper and visible quartz inclusions that are also encountered on Motupore sherds (e.g. Figure 8.6f).
As will be discussed in Chapter 9, Owen Rye defined clay and sand temper mixes from various Bootless Bay sources that produced successful pots. One set of samples consisted of clay from various locations in Guma’s garden, the closest and most easily accessible clay source to Motupore. Rye’s sample G3 comprises Guma’s garden clay and Motupore beach sand. By chance Rye sourced sherd M23.IV.9.1 and demonstrated that it was a G3 source sherd. If the pot represented by item M23.IV.9.1 was made on Motupore as the sourced materials and its deposition in the site strongly suggest, the similarity of its motif and other
similar physical characteristics, argues strongly that the Lakekamu pot was also made on Motupore.

Sherd M23.IV.9.1 derives from one layer below a radiocarbon date of 421±75 cal BP from L23.II.3 (argued in Chapter 4 to be equivalent to M23.IV.8). Sherd K21.III.7.6 is more difficult to date but derives from a pre-Red Grit A layer and is thus stratigraphically older than the three matching dates of c. 600 BP from sands above Red Grit A (see Chapter 4). Minimally this sherd must date at least to the 14th century AD and is possibly a century earlier.

Effectively, if the Lakekamu pot was made on Motupore, it could have been made at any time during the site’s history, somewhere in the 500 year range between 1200 AD and 1700 AD, although the rapid reduction of painted globular pot sherds in the latest PAUs from 15% in PAU 3 to <5% in PAU 1 (see, for example, Figure 7.8) suggests that pre-1600 AD may be more likely. So while the data do not tell us when this pot travelled from Motupore/Bootless Bay to the Gulf of Papua, it is hard to interpret these data in any way other than indicating that Motupore/Bootless Bay pottery did travel to the Gulf. The Lakekamu pot provides an individual piece of evidence to support this view, which will be more extensively developed in the sourcing studies reviewed in Chapter 9.

To return to the horizontal grille motif, one point to make is that at least some (but not all) of the examples of the parallel straight lines motif may be fragments of this motif. A second point is that the longevity of this motif means that it was not the motif of a single potter, but may well have been a motif favoured by a household or an iduhu, which is a patrilineal descent group that in a wider Western Motu context might be considered a clan, or within a village, a ‘section’ (Groves 1963; Oram 1981; Goddard 2001).

**Summary of painted motifs on Motupore globular pots and bowls**

Painted motifs on Motupore pottery expand our understanding of decoration in this assemblage. Painting is a much more precise medium than incising in the sense that we get a more exact impression of the conventions in use even when they are carelessly executed, and even in this fragmented archaeological assemblage. Motifs comprise multiple elements that are presented in panels that can readily be assumed to occupy the whole vessel; here our ability to link the complete Lakekamu pot directly with the painted globular pots of Motupore, makes these interpretations more readily visible. Additionally this pot directly links pottery production in Bootless Bay with pottery transfer into the Papuan Gulf circumstantially before 1600 AD and perhaps well before that. This is evidence independent of the sourcing studies described in the next chapter.

This assessment of decoration motifs on both globular pots and bowls reinforces the strong division between these two vessel forms seen in earlier chapters. Incised and impressed forms of decoration occur principally on bowls and painting on pots. While there are crossovers in both directions, why this difference between pots and bowls should occur is unclear; but one suggestion is that pots and bowls performed different domestic, social and export roles. This idea can be further considered, noting as a beginning that the trajectory towards simpler and more limited incised decoration on bowls through time, was paralleled by a similar reduction of painting on globular pots through time.

This leads to the important question for the globular pots. If, as fundamentally assumed everywhere, a significant proportion of these pots were intended to be cooking pots, why paint them at all, if the painting would likely be obliterated the first time they were used over an open fire?
Although provocative, the only sensible apparent explanations - to make them attractive for sale/exchange, and/or to identify them as Motupore/Bootless Bay pots - inevitably imply that pots for trade were part of the Motupore economy from first settlement. This of course does not imply trade as far as the Papuan Gulf, but does not deny it either.

Such an explanation finds support in the archaeological evidence. Decoration is both more extensive on individual vessels and more frequently encountered in the assemblage from PAU 6 and less extensive and less frequently encountered in PAU 1, when the importance of Bootless Bay pottery is established and the volume of production most intense. A further and different measure of traded pottery may be the question of trade marks, to which I now turn.

Trade Marks

Several nineteenth and twentieth century ethnographers describing the manufacture of Motu pottery made reference to the use of personal identification marks by potters. Chalmers (1887:122) noted that ‘every woman has her private mark, and marks everything she makes.’ Groves (1960: 11, 13) observed that ‘each woman in a household makes her own pots with her own trade mark on them’ and that before the drying process the potter will cut a trade mark on the pot’s rim: ‘traditionally they used simple geometric figures as trade marks’ that by the 1950s had been replaced with the potters’ initials.

Geometric incisions, isolated by undecorated space surrounding them (and thus not part of a continuous band of decoration) and occurring almost exclusively on the interior rims of globular pots (with one exception, see next section) are very common in the Motupore assemblage, occurring in all PAUs through the sequence. Those illustrated (Figure 8.24) derive from PAUs 5 and 6 to demonstrate their presence at the beginning of the sequence. These incisions are usually <50 mm square and formed using simple incision or shell impression. These marks, while common on globular pots, are not obviously present on the bowls (but again, see next section).

At some level these marks must have always functioned to identify the maker. In turn, this implies that marked pots are moving beyond the household. My own experience in Melanesian potting villages is that most women can identify the maker of any pot in their village at a glance; if this was the case on Motupore, it implies that marked globular pots were moving beyond the village and were being traded by someone other than the maker. No credible alternate explanation suggests itself for the use of these marks, especially if all or most households in a village had at least one potter. Even if not all women made pots, if consumption was only within the village, pots would not require a trade mark to identify the potter. If this argument holds, it suggests Motupore pottery was moving off the island very soon after it was settled. Equally interesting is why globular pots carried makers’ marks but bowls apparently did not. One unlikely explanation is that throughout the life of the settlement globular pots were traded but bowls were not; another is that more extensive decoration on the bowls may have provided sufficient identification of the maker. Both these explanations assume that such pots were traded by someone other than the maker. Figures 5.8 and 10.14, which show hiri pots assembled in Hanuabada, includes some bowls in the foreground, and Figure 10.13 suggests that at least some were decorated. Groves (1960:10-11), describing pottery manufacture at Manumanu observed that uro [the globular cooking pot] ‘vastly outnumber the other three varieties of pot manufactured at Manumanu. They are the standard export product, though small quantities of the other three varieties are also exported. In three seasons of field work at Manumanu it was possible to observe in full the manufacture of several hundred uro, for in those three seasons many thousands were made; but if any of the other three varieties was made in that time, its manufacture escaped [my] attention.’
Figure 8.25. Bases. Sherds a, b and c derive from PAU 2, d = PAU 3, e = PAU 4. a, M23.IV.4.100; b, M23.IV.5.460; c, M23.IV.6.15; d, M23.IV.7.27; e, M23.IV.12.102.
Evidence reviewed at the end of this chapter and in Chapter 9 indicates that Bootless Bay bowls were exported as far as the Gulf villages. Given this, trade marks on globular pots probably reflect the much lower level of decoration on this form, where about half of the Motupore sample, for example, was undecorated. They also imply that the trading of these vessels was done by an agent (following the ethnography, a male relative) acting for more than one potter and thus needing to distinguish between the pots in his care: ‘Each man keeps a tally of the pots that he transports on behalf of his kinswomen and the members of each household keep a tally of the pots that men from other households carry on their behalf. The custom is called *siaisiai*’ (Groves 1960:19).

**Bases, handles, nubbins, lugs and string-holes**

**Bases**

Ethnographically, bases occur on only one form of Western Motu pottery, the *itulu* (or *ituru*). This is variously described as a small cup (Chalmers 1887:122), a small basin with legs used to hold tattoo dye (Boera informants in Groves 1960:14) and a cup with goblet-like stem and base (Finsch 1914). A copy of Finsch’s illustration is reproduced as Figure 5.4. Cox (1989: Plate 1) illustrates part of a footed vessel that she links to the *itulu* (1989:12) excavated from a recent level in the Groube trench; this is apparently the only base recovered in that trench. Bases are relatively common in the middle and upper PAUs of the excavations reported here.

As with the Cox example, as far as I can tell from her photograph, none of the Motupore bases I excavated have goblet-like stems; instead the upper profile of the base curves in from the edge rarely more than c. 10 mm before curving out again as the vessel wall, with the ‘stem’ not more than c. 10 mm high. These bases are better considered as ring bases or footed bases; there is no real stem in the manner portrayed by Finsch. The bases are also larger than a goblet base, with most examples between 50 mm and 100 mm in diameter (Figure 8.25). None of the extant examples retain a sufficient amount of the vessel wall to determine whether they supported bowls or globular pots or both. While a foot would seem superfluous for a cooking pot, it could function as well for a water or storage pot as for a bowl. The underside of the base curves moderately inwards; this is more pronounced on some items than on others.

![Figure 8.26](image-url)  
*Figure 8.26.* Motupore vessel base M23.IV.7.27 (PAU 3) showing a, opposed but identical trademarks and b, one mark in close-up.
An unlikely possibility is that these bases are in fact handles for lids. This would seem to be improbable as almost all examples are badly chipped around the outer circumference of the base, damage more likely to occur if these were bases.

One surprise is item M23.IV.7.27 (Figure 8.26). Assuming it is a base, it carries two identical trade marks on diagonally opposite under-sides of the circumference. It is the only example in the assemblage of a trade-marked bowl. As noted above, all other trade marks occur on the interior rims of globular pots.

**Handles**

True handles, as opposed to lugs, are infrequent on Motupore (Figure 8.27a-d) occurring mostly in mid to late PAUs and always on bowls. With only a few exceptions (e.g. Figure 8.27d) these take the form of ring handles above or below the rim line; these might also serve the same purpose as suspension holes.

**Lugs and suspension holes**

Lugs, with and without suspension holes, occur far more frequently in the assemblage than true handles (Figures 8.28 and 29) again always on bowls. They occur in all PAUs but become much more frequent in the upper part of the site. Lugs are mostly sub-triangular extensions of the rim but occasionally may be somewhat more elaborate (e.g. Figure 8.28e). Suspension holes can either be poked through the unfired clay wall or drilled after the pot is fired. There may be a single hole or two adjacent horizontal holes (with assumed corresponding holes diametrically opposite on the complete bowl. Suspension holes do occur on bowls where lugs are absent (Figure 8.30) but for the most part they are closely associated with lugs. It is possible that at least some of these former examples are repair holes rather than suspension holes; this seems certainly the case with other examples in the assemblage (e.g. Figure 8.11a), but why potters would bother to repair pots is unclear, unless a particular vessel had some other intrinsic value.

Cox (1989: Plates 4-6) illustrates further examples of these various classes. All of Cox’s examples fit the categories described here, with the exception of a vertical pierced lug (Cox 1989: Plate 6, item 2/S.71).

**Ellipsoid bowls**

Mention was made in Chapter 6 of Cox’s identification of ‘ellipsoid bowls’. Although no specific description of this form was given, Cox referred to ‘orifice shapes (i.e. either round or ellipsoid)’ (Cox 1989:29. Cox identified 99 examples of ellipsoid bowl sherds (1989: Figure 4aaa) in her sample, but any further basis for these identifications is not discussed.

None of the bowls that I analysed had a sufficient amount of rim present to obviously distinguish ellipsoid (or ovoid) orifices from sloppy manufacture and/or minor distortions in firing. The attachment of opposing lugs to the rim can give the appearance of an ellipsoid shape when the orifice is actually round. Examining Cox’s thesis photographs lead me to a similar opinion about the Groube material, that no ellipsoid form can be clearly identified. Two reconstructed and largely complete bowls excavated by Groube (Cox 1989: Plates 12 and 15b) are both described as ellipsoid but neither photograph is sufficiently convincing to demonstrate this form. Cox’s Plates 4a and 4b, illustrating lugs, some from above, again do not indicate ellipsoid orifices.

In Cox’s illustrations all claimed ellipsoid bowls have lugs, but whether Cox merely identified all lugs as indicating bowls with ellipsoid orifices is unknown. As my Figures 8.28
– 29 indicate, at least some lugs occurred on bowls with apparently circular orifices, although it is possible to see lugs like Figure 8.29f deriving from an ellipsoidal bowl.

Ethnographically, ellipsoid bowls with lug handles occurred (e.g. Figure 5.6), but it is uncertain whether this Hanuabada example is made from pottery or wood (see below). Pottery bowls with ellipsoid orifices certainly occurred on the Papuan coast, and possibly from a time period that might associate them with the occupation of Motupore. The Papua New Guinea National Museum and Art Gallery has a number in its collection from burial caves in the hills behind Hood Bay. Guise (1985: Figure 6) illustrates one from site AWZ, a cave called Galogrigorigo near Babagarupu village, that has lug handles and decoration on the external upper zone that is reminiscent of the sloping herringbone pattern, executed with a combed or impressed technique in turn reminiscent of the decoration on the Motupore sherds in Figures 8.14d and 8.14e. Sherds collected from this site (Guise 1985: Figures 8-22) include at least one or two more ellipsoid bowls, but perhaps more importantly, collectively suggest stylistic links with Motupore. This is discussed further in Chapter 16.

As noted in Chapter 5 (Figure 5.4c) Finsch (1914) illustrated a nau with lug handles, although, again, it is not immediately apparent that this has an ellipsoid orifice. However the range of pottery made in Hanuabada photographed by the Cooke-Daniels Ethnographic Expedition to British New Guinea in 1903-1904 did not contain ellipsoid bowls (Skelly 2014:Figure 10) nor indeed any bowls with handles. The ellipsoid bowl with lug handles in Figure 5.6 was photographed in or near Hanuabada in 1898 by A. C. Haddon, but it does not seem possible to determine whether it is made from pottery or wood. Ellipsoid wooden bowls are also ethnographically common on the Papuan coast, for example Guise (1985: Figures 23-25, Plates 14).

The common presence of lug handles on Motupore certainly allows the presence of ellipsoid bowls in the site if the two attributes are connected, even though I could not identify any. Importantly, bowl rim sherds with lug handles were excluded from my sample. This does not mean that no sample items could have come from bowls with ellipsoid orifices, but if the shape/lug association holds, this exclusion has minimised the possibility that some of my rim diameter data are in error because of this problem.

**Bowl profiles**

Cox (1989:27) noted that on first appraisal Motupore bowls exhibited ‘a wide and confusing assortment of thickened rim profiles’ and that assigning any particular sherd to a rim profile class was ‘a process of approximation’ (following Irwin 1985:105). I had arrived at a similar conclusion when considering attributes for the typological analysis, and following my decision to ‘lump’ rather than ‘split’, I chose only to distinguish between rim forms that had been modified (thickened) and those that had not. My view about Motupore hand-made bowls is that it is unlikely that any two are absolutely identical in profile, even if made by the same potter.

Despite this, visual representation of a variety of bowl profiles conveys information for comparative studies; thus a selection of profiles is offered in Figures 8.31 and 8.32. It can be noted that rim modification in my terms can occur on the lip or the external area of the rim and that while some general forms might be discernible within the overt variability of the sample, I have not pursued this.

In her analysis, Cox (1989) first divided bowl forms into simple and composite categories and then divided the composite bowls into carinated, flanged and collared bowls, each with multiple forms. Most of her illustrated forms can be approximated in the profiles presented here.
Figure 8.27. Handles (a-d) and nubbins (e and f). Sherds a and b derive from PAU 1, c and d = PAU 5, e = PAU 3, and f = PAU 5.  a, K21.IV.3.24; b, M23.IV.2.46; c, M23.IV.14.212; d, M23.IV.15.1; e, M23.IV.7.38; f, M23.IV.14.228.
Figure 8.28. Lugs. Sherd a derives from PAU 1, b and c = PAU 2, d and e = PAU 5, and f = PAU 6.
a, M23.IV.3.339; b, M23.IV.4.407; c, M23.IV.6.29; d, M23.IV.14.15; e, M23.IV.14.188;
f, M23.IV.21.19.
Figure 8.29. Lugs with suspension holes. Sherd a derives from PAU 1, b and c = PAU 2, d = PAU3, and e and f = PAU 5. a, M23.IV.2.96; b, M23.IV.6.60; c, M23.IV.7.114; d, M23.IV.8.910; e, M23.IV.13.13; f, M23.IV.15. 82.
It should be noted that Cox’s definition of a carination is different to mine (see Chapter 5) and accounts for the numerical discrepancy between each of our samples in this category. Cox’s flanged forms (1989: figure 4h and Plate 11) show many direct comparisons with my sample, although I have not used this term, nor isolated this form from the wider modified (thickened) category. Similarly, Cox’s collared forms (1989: figure 4k and Plate 14) can also be replicated in my sample, although again I do not differentiate this form. Sherds clearly collared, as in Cox (1989: Plate 13), occur only rarely in my sample. In keeping with this assessment, Cox’s collared forms comprise only 7.3% of her sample, by far the smallest of her groups (Cox 1989: figure 4b).

The re-use of broken vessels and sherds

The use of upturned rims of globular pots missing their bases in the manufacture of new vessels was frequently observed among ethnographic Motu potters (e.g. Figures 5.5, 5.6) but like whole pots, none were found surviving on Motupore. Body sherds, flaked or ground into a circular shape with a central ground hole (Figure 8.33) were however common. While these might have functioned as fishing net weights, this function was normally filled by using bivalve shells (Chapter 12). More likely is that they functioned as drill weights for drills used in the manufacture of shell beads (Chapter 11) and described ethnographically (Williams 1928). They were also recovered from the Nebira excavation (Bulmer 1978:195). Bulmer also noted sherds used as drill bases, and one was retrieved in the 2016 excavation undertaken as a UPNG field school (Chapter 16). Flat oyster shells were also used for this purpose (Chapter 11).

Papuan comparisons

As indicated by the analysis of typological approaches in Chapter 6, comparisons of the Motupore pottery assemblage with other relevant Papuan assemblages mostly devolves to comparisons of decorative motifs and pottery forms presented as rim profiles.
Figure 8.31. Motupore bowl profiles. Scale in cm.
Figure 8.32. Motupore bowl profiles. Scale in cm.
Assuming that similar motifs imply historical connections (as I have done here with the Lakekamu pot) we can begin to compile networks of either pottery distribution, the movements of potters themselves, or both, through these data. These comparisons also provide a comparative basis for the chemical analyses reported in Chapter 9.

The Groube trench on Motupore

The data from this trench, itself an extensive excavation, is known only by the analysis of the bowl forms by Gillian Cox (1989), undertaken as a graduate thesis in the 1980s. This is a valuable piece of work, not least because of the diametrically opposite approach to typology that Cox adopted, compared to my own. While our typologies offer few points of comparison and our terminologies differ, it should be clear from foregoing comments that there is a huge overlap between our two data bases. Of course it would be disturbing if this was not the case, given that the data bases were assembled from excavations that were only c. 60 m apart.

Reference to more than 30 photographs of groups of sherds in the Cox thesis indicates that almost all could be accommodated within the motif categories designated in this chapter and similarly that my bowl assemblage would fit into the categories established by Cox. This is true of both the incised and painted motifs on bowls; since Cox does not deal with globular pots, painted decoration is limited to c. 5% of the Cox bowl sample, roughly in line with my own, at c. 10% of bowls. A possible reason for this 5% difference is that it is unlikely that the Groube trench uncovered the earliest occupation on Motupore, which might have yielded more painted bowls. As discussed in Chapter 4, Groube’s oldest radiocarbon dates are only c. 450 cal BP. A close examination of the Cox photographs and drawings suggests that early
versions of the herringbone motif (such as Figure 8.4 above) are absent from the Groube trench and that few, if any, of the Groube bowls are decorated on the lower external zone. In my system, the earliest sherds illustrated by Cox (e.g. 1989: Plates 15a, 16 and 18a) comprise mostly horizontal herringbone, painting and combing that mainly occur in PAUs 4 and 5 and only occasionally into the upper levels of PAU 6.

**Taurama, Eriama, Nebira II**

Chapter 1 offered reviews of the Taurama site that suggested that much of the material excavated there by Sue Bulmer related to the EPP phase. In the area of major excavation only the uppermost unit Ia appears to be contemporary with Motupore. While the second area tested, 101/A, is more fully contemporaneous with Motupore, only a single 1.8 m by 1.8 m square was excavated at that location. My analysis of the data indicated that in terms of Bulmer’s six pottery styles, Style I (which equates with EPP) is directly overlain with Style IV and that this implies a gap of up to 400 years between the two depositions. Bulmer Styles II and III (regardless of what they mean) are thought to be chronologically and stratigraphically intervening, but are only represented by 13 sherds in the site on Bulmer’s own attributions.

Together with the small amount of excavated deposit that equates in time with Motupore, subsequent site disturbance, mainly through gardening but also possibly military activity (the area is [or was] used for training by soldiers from the local barracks), resulted in only small samples of diagnostic sherds. As noted in Chapter 1, the style distribution of excavated pottery at Taurama is based on a total sample of only 171 sherds (I assume this means rim sherds). Of these, 116 derive from the relevant (that is, contemporary with Motupore) areas; Bulmer (1978: Figure 8.22) identifies 103 sherds as Style IV, there are no Style V sherds and only one Style VI sherd. The remainder are other styles or unassigned sherds. Elsewhere a slightly different number of 122 Style IV sherds is provided (Bulmer 1978:315), but the point remains the same.

Taurama comparisons begin with the excavated Taurama sherds and are subsequently widened to consider the regions and styles that were examined in her 1978 doctoral thesis.

**Excavated Taurama sherds**

Comparisons with these sherds are reduced to a consideration of the profiles, motifs and design units of the 20 illustrated and excavated sherds of Style IV and one sherd of Style VI (Bulmer 1978: Figures 8.37 and 8.42). The Bulmer thesis has only a few photographs, with most pottery illustrations being line drawings that offer only impressionistic representations. Despite this a number of clear parallels exist with the Motupore assemblage. Most immediately noticeable is a body sherd (7D/2/19) decorated with the vertical herringbone motif that extends down over the lower external zone and appears very similar in other respects to item M23.IV.22.16 in my Figure 8.4. Other versions of the herringbone pattern also occur (e.g.7B/1/4 and 101A/7/34). Simple shell impressed sloping bands (e.g. 101A/1-3/1, 101A/3/87 and 7X/1/41) are identical to my shell impressed sloping band motif (Figure 8.12). Combed examples (3/5/1, 3/4/4, 3/5/10 and 101A/3/86) find parallels with combing on Motupore, especially between 3/4/4 and my Figure 8.14d. Taurama item 10/6/8 appears to be very similar to item K21.IV.3.162 (Figure 8.17f). [All Taurama items just mentioned are from Bulmer (1978: Figure 8.37)]. Finally, Taurama item 3/8/1 (Bulmer 1978: Figure 8.42) is a classic example of my sloping incised band motif (Figure 8.11, note especially 8.11a and 8.11f).

With one or two noticeable exceptions, especially item 7X/4/34, the profiles of the Taurama Style IV vessels do not have thickened rims, whereas the one Style VI bowl does, and in this respect the assemblages are very similar, sharing a common range of vessel profiles.
A further striking similarity is the presence of painted globular pots at Taurama and the comparative paucity of painted bowls, there being only two; both carried ‘painting as well as shell/comb decoration’ (Bulmer 1978:320). For the site as a whole (which means that some might belong to Styles I, II or III) 52 globular pot rims were painted and a further 88 painted body sherds reported; five of the painted globular pot rims have either shell or comb decoration all from Standard Layer 1a, thus likely belonging to Style IV. Bulmer (1978:320, Figure 8.41) notes that the painted designs are simple, consisting of parallel lines, terminating lines, zig-zags (= my chevrons) and spots. One Taurama item 10/2/-, would fit into my ‘amoeba’ category. The painted designs can be considered almost identical between the two sites (and Boera, see below).

The point that the pottery assemblages from Motupore and the relevant parts of Taurama could be merged requires no further emphasis.

Eriama and Nebira II

These are the other two excavated sites reported by Sue Bulmer in her 1978 thesis. The Eriama rock-shelter (ACV) is one of 26 recorded sites in the immediate area. It is c. 10 km north of Motupore. The shelter contained the remains of 48-50 burials and is considered disturbed as a consequence (Bulmer 1978:208). The base of the deposit has a radiocarbon date c. 2000 BP and Style I pottery, but the other three radiocarbon estimations would suggest general contemporaneity with the Motupore occupation. The small amount of pottery (1,530 sherds) provided only 74 rim sherds for analysis, 23 being bowls and 51 globular pots. Among the bowl sherds, one was ascribed to Style IV, none to Style V and three – all sherds of the same bowl – to Style VI (Bulmer 1978:249-52). Despite this meagre tally, the illustration of the assemblage (1978: Figure 7.25) indicates some parallels with Motupore. The one decorated Style IV bowl, Eriama 3A/5/4 is an example of my sloping incised band motif. The sherd presumably nominated as Style VI, Eriama 3A/1/1 (there is a text confusion) is again a classic example of my sloping incised band motif. Among the few decorated globular pots at Eriama, 2B/3/1 has vertical parallel painted lines on the interior surface of the rim, and item 4/5/6 has the sloping shell impressed band motif on the interior surface of the rim seen on Motupore globular pots (e.g. Figures 8.13a and b).

Nebira II (ACJ) is an open site in the saddle between the twin peaks of Nebira hill, now mostly destroyed for road gravel. It is c. 7 km north-west of Eriama and c. 14 km north-west of Motupore. Bulmer noted surface concentrations of pottery and other artefacts at six separate locations on the hill and listed a seventh general site designation, ACH, for artefacts that could not be associated with any of the six sites. All surface sites contain at least four of Bulmer’s six pottery styles and three (in addition to ACH) contain all six (Bulmer 1978: Figure 6.3). Nebira II was Bulmer’s largest excavation in the Port Moresby region, covering an area of 76 m² (1978:124). The excavation uncovered 45 burials and 90 post holes, which suggested much disturbance (1978:126, 133,135). Six radiocarbon dates were not in stratigraphic order but all dated to the second millennium AD and could be interpreted either to reflect occupation throughout that millennium, or briefly between the 13th and 15th centuries AD (Bulmer 1978:128).

The excavations produced 55,073 sherds of which 1,322 were rim sherds, 813 were neck sherds and 783 were decorated body sherds (Bulmer 1978: Table 6.15). However only 234 rim sherds were large enough to include in the style analysis, although 360 items contributed to the study of decoration techniques (1978:182, Figure 6.26). All five standard layers (= analytical units) in the site contained examples of Styles I to IV, attesting to the site disturbance, and the upper two contained Style V, with Style VI absent on Bulmer (1978: Figure 6.26) but with two illustrated examples on Bulmer (1978: Figure 6.28). Style I (17 rims), Style II (32 rims) and Style III (80 rims) are suspected of being re-deposited from further up the hill (Bulmer 1978:186).
Style IV is represented by 69 rim sherds and Style V by 14 sherds (1978:187-8). It would appear that some, but not all of the 22 missing sherds in this count are Style VI.

Comparisons with Bulmer’s relevant line drawing, Figure 6.28, are limited by the small number of illustrated items. Only three illustrated sherds relate to Style IV, four to Style V and two to Style VI. Item 22H/2c-SE/2 carries a simplified (?early) version of the sloping incised band motif as does item 22F/1/13. Item 21-22H/3c/6 appears to be a late version of the vertical herringbone motif (the motif actually slopes to the right), with item 21-22F-G/1/1 another late version of the same motif; item 21F/1/12 is an example of the incised chevron motif (compare my Figure 8.9e); item 22H/2b/2 fits into my chevron herringbone motif (compare especially Figure 8.8a); and finally Bulmer items 21K/2a/1 and 2 again are standard examples of my sloping incised band motif. The matching profiles to these items fit into the non-modified and modified rim profiles seen on Motupore.

These comparisons with Motupore cover Bulmer’s Styles IV-VI, but it can be noted that several illustrated sherds from Nebira II classified as Style III also have parallels on Motupore, especially items 21-22F-G/N/1 and 22G/4b/2, which are very similar to the moulded decoration on item M23.IV.7.123 (Figure 8.8a) and items 22G/4a/37 and 21H/3c/4, which appear in illustration to be incised versions of the horizontal herringbone motif. These similarities are further discussed below.

While the evidence is slender, general associations exist between the Motupore and Nebira II pottery assemblages.

**Bulmer pottery decoration styles from surface collections**

As noted in my review of Bulmer’s typological approach in Chapter 6, the poor quality of her excavated pottery data led her to formulate her style sequence using her surface collections of pottery and then to use this sequence to group her excavated assemblages. Intuitively, this approach is ‘back-to-front’ and indeed Bulmer encountered difficulty in ordering her styles chronologically, being uncertain about whether some styles were sequential or overlapping (see Chapters 1 and 6 and below). Painted decoration had to be treated as a separate entity because it offered few stylistic links. Here I have deliberately dealt with the excavated sequences first to emphasise the limited nature of Bulmer’s excavated ceramic data, at least from a typological perspective. The surface collections provided Bulmer with a much more extensive data base, but no chronological control except for Style I, via other EPP excavations.

Bulmer’s surface sample consisted of 2,074 bowl rims and 903 globular pot rims derived from 67 sites that grouped around each of her excavations, Taurama, Eriama and Nebira, as well as from the Boera area; a fifth group was geographically spread (Bulmer 1978:76-77). Even so her style sample remained relatively small; while Style I was defined by sherds from all sites where it occurred, Styles II and III were defined only from surface sites near Eriama and Styles IV and V were only defined from surface sites near Taurama, with unknown effects on the analysis.

Thus the defining sample totalled 503 sherds (Bulmer 1978: Figure 5.1), of which a third (164 sherds) were designated Style I (EPP), passed over here since it pre-dates Motupore occupation by c. 400 years.

Style II (sample 97 sherds) the first of two so-called ‘Eriama’ styles, carried ‘heavy incision and appliqué’ decoration and was sub-divided into three further groups on bowl form. Style II was seen to have stylistic links with Milne Bay and had been originally labelled ‘Massim’ (Bulmer 1971) but by 1978 this term had been dropped in favour of ‘Eriama’. Style III (sample 24 sherds)
was linked by Bulmer to Style II because Style III was found on all but one of the Eriama sites where Style II was also present; at the same time Style III occurred in only very minor quantities on these sites (Bulmer 1978:88). Beyond this, these two styles themselves were distinctly different from each other; Style III occurred on simple bowls, unlike Style II, and decoration was executed with fine incisions and some punctation unlike the heavy incision and appliqué of Style II.

Bulmer (1978: Figure 5.9) illustrates 14 examples of Type III vessels. Mention was made in the previous section of similarities between some of the Style III bowls excavated at Nebira 2 and material on Motupore, and those similarities are again evident in this figure. Bulmer notes that Style III is predicated on fine incision and punctation, but also includes a shell impressed sherd (1978:88, Figure 5.9, item POM25/S/50) that is a classic horizontal herringbone motif in Motupore terms, and similar motifs in fine line incision rather than shell impression are also represented (e.g. POM1/S/11, POM25/S/5, ACQ/S/7). Without labouring the point, while many Style III motifs are different to the suite of motifs on Motupore, and while where similar motifs occur they are incised in Style III rather than shell impressed as on Motupore, nonetheless there are generic similarities between Style III and the Motupore assemblage. These are further discussed below.

Bulmer (1978:90-91, Figure 5.11) offers only brief descriptions of Style IV (sample 104 sherds), where the defining characteristic is the presence of ‘comb or shell impressions or combed designs’. Half of her sample had only shell impressions, while ‘another 38% are also decorated with other techniques in combination with shell impressions’, assumed to mean combing and other techniques, but not incision. Bulmer notes that only one item is decorated below the rim; this is taken to mean on the external lower body; she identifies ‘horizontal relief bands’ and ‘decorative grooving’ as prominent decorative techniques. The decoration is ‘most commonly a series of bands of vertical or oblique hatching or parallel lines’ and Bulmer suggests two sub-styles, one with simple design units in horizontal bands, and one with complex patterns of lines or grooves and oblique or ‘herringbone’ shell or comb impressions. Of the twelve items illustrated as Bulmer’s Style IV (1978: Figure 5.11), half fit immediately into my vertical and horizontal herringbone motifs and most of the others into my sloping incised band motif, with the incisions being made with the edge of a shell, as in my Figures 8.12a-c. Both Bulmer’s Figure 5.11 and her written description indicate defining characteristics for Style IV that are strongly represented on Motupore, generally in the earlier PAUs.

As noted, Bulmer’s use of the term ‘herringbone’ is more restrictive and strictly speaking, more accurate than mine; I also includes single columns of multiple shell impressions that Bulmer terms ‘hatching’. Bulmer also uses terms like ‘relief’ and ‘grooving’ that I avoid. As noted in Chapter 5 I am unconvinced that grooving is an intentional design element on Motupore, despite the use of this term here by Cox (1989). Some items in my assemblage certainly appear horizontally grooved, but these can frequently be interpreted as the unintended consequence of rim thickening, or in the case of Style IV, gouging. What Bulmer means by ‘relief’ and ‘decorative grooving’ is very common on Motupore, for example the left hand item in my Figure 8.4, Figures 8.5c and 8.5d, and Figures 8.7d, 8.7e and 8.7f.

Bulmer (1978:91-93, Figures 5.13, 5.15) is similarly brief on Styles V (89 sherds) and VI (25 sherds). Style V is decorated using ‘a sharp pointed tool’ to incise or puncture the clay surface ‘on a distinctive thickened outer band below the lip’ and in several instances on the lip. Bulmer believes that Style V ‘contrasts considerably’ with Style IV, although the two share 16 of her design units, including ‘motifs of lines and herringbone hatching’. There are many overlaps between items illustrated on Bulmer’s Figure 5.13 and the Motupore sample including incised chevrons (compare my Figure 8.9), punctate lines (compare Figure 8.16) and incised herringbone patterns (compare Figure 8.6e and 8.6f). Bulmer sees Style VI as a minor style, rare at Taurama
and absent at Eriama but occurring on several coastal hill sites and surface sites at Taurama and Nebira (as well as Motupore). The incised designs occur on thickened rims and ‘shoulder angles’ and comprise oblique parallel lines. This style is identical to my classic sloping incised band motif (Figure 8.11). Bulmer notes that all her examples slope to the right, but as Figure 8.11 demonstrates, the parallel lines can slope to the left or right. Bulmer also illustrates one example of the finger arcade motif (compare Figure 8.10) that she includes in Style VI.

Bulmer was again not able to integrate painted decoration into her six style scheme. However she illustrates 10 painted sherds from Boera (1978: Plate 5) that show decorations closely similar to Motupore painted sherds, including parallel lines, painted lips and ‘amoeba’-like forms. There are no examples of dots, but one sherd appears to have similar rows of short strokes.

It is of interest that Bulmer (1978:93) notes that Style VI occurs on the three coastal hill sites, where the only other Styles present are IV and V. Further comment on Bulmer’s style sequence is made in the conclusion to this chapter.

Ava Garau

As noted elsewhere in this report, this open site near Boera village was excavated by Swadling (Swadling and Kaiku 1980; Swadling 1981). As also noted, a detailed report of this excavation is still awaited; however Swadling (1980: Figure 6) illustrates three decorated bowl sherds from the site. One of these, AMH/A/7/37, is clearly an example of my horizontal herringbone motif, directly comparable to my Figure 8.7e. Interestingly, the other two sherds, both from level 16 deeper in the site, are unlike Motupore sherds, especially in profile.

Urourina, Hihiro and Kukuba Cave

Urourina is an open beach site on Yule Island excavated and reported by Vanderwal (1973). A single radiocarbon date from 850 mm below surface and near the bottom of the cultural deposit yielded an uncalibrated date of 720±105 BP. Vanderwal (1973:52) considered that the date might be too old, but it can now be seen to equate directly with the earlier deposits at Motupore.

Globular pots at Urourina were mostly undecorated but some had decorated rims. ‘The notched variety is characterised by a series of small depressions on the lip. A hachured decoration is executed on the inside of the rim’ (Vanderwal 1973:115), which might possibly be a trade mark.

Descriptions of the bowls are equally familiar. Vanderwal (1973 112-13) divided the bowls according to ‘decorative attributes’, noting that the majority of decorations used combs with between two and eight tines. To judge from Figure VI-12, combing is the dominant decorative technique in this assemblage and on some pieces (e.g. Figures VI-12, 3 and 5) is used more extensively to fill in the surface than seen at Motupore. On others (e.g. Figure VI-12, 4) a comb has been used to make short and separated vertical slashes, much like my Figure 8.15e. A single band of gouges on Figure VI-12, 2 and Figure VI-12, 8 echoes the same technique on Motupore sherds and Figure VI-12, 1 is decorated with a panel of horizontal and vertical comb strokes above a band of closely spaced vertical serrations seen commonly as the lower design unit on my sloping incised band motif. One item carries a combed chevron motif (seen occasionally on Motupore sherds) bounded on either side by single rows of punctations, a technique seen on Motupore associated with the horizontal herringbone motif. Most telling is Figure VI-12, 7. This shows the horizontal herringbone motif on the upper external zone of the bowl set in panels separated by vertical herringbone columns, all executed with shell impression, with some combing. On Motupore it finds an almost identical parallel in my Figure 8.7a.
At the same time, there are many decorative differences between the two sites, not least being the absence of painting on the Urourina pottery.

It is clear that the Urourina assemblage has at least distant stylistic relationships to Motupore that do not necessarily suggest trade from one site to the other; instead if evidence came to light that suggested both places had in their ‘lineage’ a common ancestor, the similarities and differences in their pottery assemblages could be accommodated in that way.

**Hihiro**

Hihiro is a large open village site on the mainland near Bereina, north of Yule Island. It is located on an alluvial floodplain formed by the Angabunga River to its south. Vanderwal was unable to excavate there, but was able to use a collection previously made by local schoolboys (Vanderwal 1973:55). Vanderwal analysed this collection as well as he was able and concluded that both in form and decoration the site was very similar to Urourina; all decoration types found at the latter site also occurred in the Hihiro surface collection. The same was true of globular pots forms although their numbers were low. Further examples of shell impressed decoration came from Hihiro, however it is unclear whether these were specifically like the herringbone motif noted at Urourina.

**Kukuba Cave**

This cave site is on the mainland south of Yule Island on Ou Ou Creek. Originally test-excavated by Carmel Schrire in 1964, the site was initially more famous for its pre-ceramic occupation dating to c. 4,000 years ago than for the metre of ceramic occupation above it.

It was re-excavated by Vanderwal (1973:44 ff.). Most of the pottery relates to the EPP occupation of the region, however from the uppermost levels plain globular pot rims were recovered that proved to be identical in form to the Urourina globular pots (Vanderwal 1973:115).

The data from these sites suggest culturally related groups occupying at least 30 km of coastline in the Yule Island-Hall Sound region of Papua at a time contemporaneous with the early centuries of Motupore occupation. In terms of pottery decoration at these locations, it can be suggested that these areas shared historical links.

**Popo and other Gulf sites reported by Rhoads**

Popo is an open beach ridge site in the Gulf Province approximately half way between Kerema and the Purari River Delta. The site was test-pitted in 1976 by Rhoads (1994). A single radiocarbon date of 410±80 BP (ANU 2181) (Rhoads 1994:55, earlier reported as 430±110 BP (ANU-1829 [Rhoads 1982:143]) derived from a depth of 350 mm below surface in an area of the site where cultural deposits were c. 1000 mm deep.

A total of 254 sherds were recovered of which 100 were surface finds that included 23 bowl rims and 28 globular pot rims. In the excavated sample 16 were bowl rims and 11 were globular pot rims. Decoration included incision, gash incision, shell impression, punctation, perforation (suspension holes), drag-relief, grooving, combing and appliqué. Only three globular pots were decorated, one with shell impression and two with incision. To judge from Rhoads (1994: Figure 5) these are likely to have been decorated on the lip, since among five globular pot sherds illustrated, three carry lip decoration. While Rhoads reviewed Bulmer Styles IV to VI, he chose not to make direct comparisons with them, despite the sourcing studies he reported indicating Port Moresby connections (see also Chapter 9). Instead he compared form attributes with pottery from the Kerema area to the east (Rhoads 1994:65) although concluding (1994:67) that after examining
the Motupore pottery assemblage he was persuaded about the Port Moresby connection by the ‘tenable similarity of contemporaneous pottery styles at Popo and Motupore’. Of the 10 bowl sherds illustrated in Rhoads (1994: Figure 6) while the decoration techniques are difficult to identify on the line drawings, three sherds are decorated with the classic form of my sloping incised band motif (my Figure 8.11), all three occurring on thickened rims, and a further two with punctate lines (my Figure 8.16).

As noted above, punctuation occurs throughout the Motupore bowl assemblage and is seen by Bulmer to be a component of Style V, while the sloping incised band motif is a principal identifier of Style VI.

Rhoads (1983) also reported on surface ceramics collected from seven unexcavated sites discovered by both Sandra Bowdler in 1971/72 and himself in the Kikori delta in 1976 (sites OAD, OAE, OAF, OAI, OCK and OCG). These sites produced only 47 rim sherd suitable for analysis that were seen to hold a ‘general similarity’ to Bulmer’s various styles, with ‘critical elements of Bulmer’s Style IV pottery’ occurring at some sites (1983:106, 111). Examination of the few illustrated pieces (1983: Figure 4) suggests that variants of the herringbone motif and the incised sloping band motif (executed with both shell impressions and stick incisions) and the single punctate line motif all occur. Both unmodified and thickened rims occur. One item (1983: Figure 4p) is the classic form of the sloping incised band motif with the lower band of vertical serrations on the external angle separating the upper and lower external surfaces, with sloping incised lines above. In Bulmer’s scheme this would be Style VI. Thus, elements of Bulmer Styles IV, V and VI all occur on the sherds from this set of sites.

**Ouloubomoto**

This rock-shelter is close to the Kikori River just below its junction with the Sirebi River; the site is perhaps 75 km in a straight line distance from the sea. Excavated by Rhoads as part of his doctoral research (Rhoads 1980) the sequence contains pre-ceramic deposits dating >2,000 years ago and ceramic deposits relating to the EPP; of interest here is the site’s brief re-occupation c. 700 years ago where the deposits contain painted pottery thought by Rhoads to be identical in decorative style to painted pottery from the early layers of Motupore (Rhoads 1982: Table 1). This is of interest on several levels. Apart from the Lakekamu pot, it is the only reference I know to painted pottery from the second millennium AD identified in the Gulf sites and thought to come from the Port Moresby area (not to be confused with painted sherds as part of the EPP sequences that occur even in Ouloubomoto). While the radiometric date for this re-occupation is similar to the commencement date for Motupore, the Ouloubomoto painted pottery should not be taken to imply a direct link with Motupore; for example I have noted above the presence of similar painted pottery at Boera. What it may well be reflecting, however, are changes in Port Moresby subsistence patterns that see a brief fluttering of long-distance trade on the one hand, and on the other re-settlement of some people in Bootless Bay from within the same general cultural region. This re-settlement might well be from Boera; this idea is further examined in Chapter 10.

**Kerema and Kinomere**

In Chapter 6 I discussed Thompson’s (1982) analysis of ceramics excavated by Frankel, Vanderwal and Thompson from one site (OAP) near Kinomere village in the Kikori delta and five sites (OEB, OFC, OEA, OFF and OFA) from the hinterland behind Kerema. OAP was an old mound within Kinomere village, while the Kerema sites are open ridge-top settlements. Thompson’s thesis was subsequently edited and published by the three excavators (Frankel et al. 1994). To facilitate access to the data, here I refer mostly to the published version, but note that
the analysis was almost entirely Thompson’s. It is beyond my purpose here to offer a full synthesis of the ceramic analysis but several aspects of it are relevant to the present discussion.

It is believed that all sites were only occupied for a few generations (Frankel et al. 1994:45) and single radiometric dates from each site appear to confirm this. Dates from OEA, OEB and OFA yielded modern ages, while OFC produced an age of 310±100 BP and OAP an age of 410±80 BP. This latter site was deep, one section being excavated to a depth of 1750 mm, while the Kerema sites were shallow, typically only 200 mm to 500 mm deep (1994:5-13). The ceramics were seen to have few fabric differences between sites and were identified to be ‘of the same coarse, friable fabric, tempered with beach sand and containing shell grit’ as described by Rye (1981) for Motupore (Frankel et al. 1994:19-20).

Despite there being more than 16,500 sherds in the combined assemblages from these sites, including 831 rims, analysed rim sherds were limited. For the form analyses of bowls, samples ranged between 18 (site OFA) and 43 (OAP) and for globular pots between 38 (OEB) and 57 (OFC) (1994: Table 4). However 350 rims were used for the decorative analysis (1994:27). Typically, each site had 20% to 30% more globular pots than bowls (1994:14).

The sites were treated as single entities (i.e. not further divided stratigraphically) and were seriated on bowl form, using firstly a matrix of similarity coefficients and then a close-proximity analysis. These resulted in a sequence of the six sites based their statistical proximity to one another. The main direction of the seriation matrix was interpreted to represent time, such that site OFA in the series OFA - OFF - OEA - OFC - OAP - OEB is the oldest site and OEB is the youngest (1994:23).

As argued in the text, this proposition looks superficially strong. It appears to accord with Kerema migration traditions (1994:23) and the final seriation of selected bowl shape attributes (1994: Figure 11) is seemingly textbook perfect. However the selected attributes are not mutually exclusive. External angles and internal angles are related to profile angles and both are used to define simple bowls (1994:16-17). Inevitably this means that some of the ‘battleship curves’ are measuring essentially the same things and some the reciprocals of others. Allowing for this, the seriation is still instructive. There is a general simplification of bowl forms seen here in the reduction of composite bowls in favour of direct bowls that mirrors the reduction of carinated bowls at Motupore (see my Figure 7.29). Similarly, ‘thickened lips’ (= modified rims at Motupore) increase through time both in these Gulf sites and at Motupore.

At the same time this site seriation finds little support in the radiometric dates, although various explanations can be put forward to explain this. Several are offered (Frankel et al. 1994:24). More interesting is the comparison between the decoration on these assemblages and Bulmer’s decorative styles. Here OFA appears to be the earliest site, as claimed, since it is seen to be the only site with Styles II and III present; it holds 96% of the 124 Style IV sherds across the six sites, but only 10% of the Style V sherds and no Style VI sherds. However for site OFF, the next ‘oldest’, there are amongst its 37 bowl rim sherds, none identified as Styles II, III or IV, and only one sherd of Style V, but 20 sherds of Style VI (with 16 sherds unassigned). If the Bulmer styles are chronological, then OFF would on this test be the youngest, rather than the second oldest. The claim that the Bulmer styles ‘provide even further support for the interpretation of OFA as the earliest site, and of OFF as the next most recent’ (1994:28) are correct for OFA but not for OFF. Similarly, site OFC would move to a younger position and OAP to an older one.

The argument rests with the Thompson sequence and the Bulmer style sequence both actually being chronological. On the former, Frankel et al. (1994:24) acknowledge the possibility that other non-chronological dimensions of variation may be acting on these assemblages (such as
different suppliers). On the latter, the authors go on to suggest that on the basis of a principal components analysis of motifs (actually decoration elements) Style IV gives way to ‘two later, partly contemporary Styles (V and VI)’ (1994:29). This idea develops into the notion that these late styles might reflect different manufacturing centres (1994:47; Thompson 1982:104, 123) an idea also proposed by Bulmer (1978:377): ‘it can be suspected that V and VI are contemporary sub-styles, one made at Motupore and the other at Taurama or some other mainland site. They can possibly be interpreted as ‘daughter’ styles to IV.’

Comment on these ideas will be made after the evidence from Motupore is summarised later in this chapter.

As with other assemblages reviewed above, comparisons using the line drawings of pottery from these six Gulf sites (Frankel et al. 1994: Figures 8 and 9) are hampered by the difficulty of deciphering the decorative techniques employed, which in turn are a central determinant of Bulmer’s six styles. Even so, many of the motifs represented in these illustrations also occur on Motupore pottery. There is only one clear representation of the vertical herringbone motif, from site OEC (not one of the six sites otherwise used for analysis) but degraded versions also occur at OEA and OFC. The item from OEC appears to have the motif continue to the lower external zone, the only example of this decoration zone being used in this set of assemblages. Classic examples of my sloping incised band motif occur at OFF and OFC and (incised?) chevrons are common at OAP and occur at OEB and OEA; punctate lines occur at OAP, OFC and OEA. In short, many parallels can be drawn between the decorative motifs on pottery from these sites and pottery from Motupore.

In more general terms these assemblages are defined by a range of characteristics that are in accord with the results from the analyses of Motupore pottery. These include:

- A greater diversity of bowl types (in terms of shapes) in the earlier sites, changing to more uniformity in the later ones.
- A lack of variability in globular pot shapes, such that all vessels were seen to conform to one broad ‘type’. Interestingly, no small aperture, vertical rim pots (of the *hodu* water container type) were recorded in these sites (Thompson 1982:111).
- A trend to simpler bowl forms with a concomitant increase in ‘lip swelling’ (modified rims).
- An increase through time of undecorated bowls.
- Most globular pot decoration occurring on the lip or inside the rim (? trade marks) employing simple impression or incision. The majority of globular pot rim sherds are undecorated; only in OFC do decorated globular pot rims out-number plain ones (Thompson 1982: Table 7.6).
- In terms of decorative motifs there is again decreasing diversity through time. There is a clear trajectory moving from ‘the early sites, where impression is more common than incision, and comb techniques are used, to the two middle sites where incision becomes more frequent than impression, and comb techniques become rare, to the most recent sites, where impression is rare and comb techniques are absent altogether’ (Frankel et al. 1994:30-31).

This final quotation is important for two reasons. The first is that it could be substituted, word for word, to describe the sequence of use of decoration techniques on Motupore (compare, for example, my Figures 6.3 and 6.6). The second is that it points, consciously or unconsciously, to the chronological overlapping of these techniques, to which I turn in the next section.
In summary, there are ceramic stylistic connections between Motupore and all the sites reviewed in this section, with the exception of Kukuba Cave. This is still a long way from proposing direct links between all these sites and Motupore. I can hypothesise direct links between Motupore and the Port Moresby sites with ceramic similarities, many of which will be shown to have pottery sourced to Bootless Bay clays in Chapter 9. The generic similarities with the second millennium AD Yule Island-Hall Sound sites would seem to favour the occupation of those sites and Motupore at about the same period from the same or related homeland locations that stylistically might well be in the Boera area. Further west, where pottery was imported, links with Bootless Bay appear to be strongly supported on chronological, stylistic and probably technological (raw material sourcing) grounds.

**Kouri Lowlands sites**

In 2014 Robert Skelly published his then recent PhD thesis, a work that delineated the prehistoric ceramic sequence in the Kouri Lowlands, a stretch of middle Papuan Gulf coastline situated between Kerema and the Vailala River. Excavations were undertaken at 13 sites that provided a ceramic sequence dating from before the birth of Christ to the ethnographic present. Of interest to this study is a break in the Kouri sequence from approximately 1200 BP to 700 BP, or in Skelly’s terms 1178 cal BP to 678 cal BP, a period of significant cultural disruption right along the Papuan south coast (see Allen 2010). Also of interest, within the limits of the poor radiometric dating of Motupore, is the generally similar date for the beginning of settlement on Motupore and the re-establishment of the pottery trade from the Port Moresby-Yule Island region to the Gulf.

Skelly (2014:508) directly linked pottery from his site OJX to both Urorina on Yule Island and Motupore. This site dated to the period 537-678 cal BP (2014:196). Among the 2318 stratified sherds recovered, only 180 were 30 mm (or more) in maximum dimension and only 192 were considered diagnostic. The few decorated pieces (2014: Figures 124, 125) show only generic similarities to Motupore decoration, but more direct comparisons to Urorina (2014: Figures 129-133) with an emphasis on punctation and combing.

The most direct ceramic decorative comparison between the six or so Kouri sites of relevant age and Motupore is item OKE-S-132, a surface find on the OKE site which in my terms is decorated with the horizontal herringbone motif.

Skelly’s summary of the ceramic trajectory of this late phase in the Kouri sequence is nonetheless instructive.

- ‘[B]ody decorations shortly after 678 cal BP involved arrangements of shell-lip impressions or linear incisions aligned with punctations; after 537 cal BP, decoration became structurally less complex, often consisting of single rows of punctations or gash-incisions along changes in vessel wall angles representing thickened collars or carinations (2014:467, figure references omitted).’
- ‘[L]ater decorations are visually less complex than decorations from the period immediately after 678 cal BP. The diminution in the structural complexity of body decoration through time culminated in the exclusively plain ware assemblages of recent sites OJY and OJQ, when oral traditions, historical records and artefact assemblages strongly suggest site use during the 19th and early 20th centuries AD (2014:469, figure references omitted).’
- ‘[L]lip decoration became less elaborate after c. 537 cal BP…[and]…is entirely absent from sites OJY and OJQ, suggesting that, as is also the case with body decoration, lip decorations were not commonly used in the 19th and early 20th centuries AD (2014:473, figure references omitted).’
These data reflect the continuation of the Motupore trajectory towards decorative simplification identified above and further considered in Chapter 10.

**Motupore and Bulmer’s Style sequence**

At various points in this report I have been critical of Susan Bulmer’s arguments and interpretations and in particular her major work on Port Moresby archaeology, her doctoral thesis (Bulmer 1978). This is a large sprawling narrative, much of it unpolished, a document with errors and contradictions in the data and inconsistent arguments.

For all this, the thesis is, and remains, a valuable and remarkable document that continues to be cited by those involved in Papuan archaeology, more than 38 years after it was written. In 1967 Sue Bulmer initiated the first systematic study of the archaeology of the Port Moresby region. She gathered around her a dedicated group of local volunteers, foremost amongst them Bill Tomasetti, Gabrielle Johnston and Jessica Prosser, and each weekend they would first survey and subsequently excavate sites in this challenging countryside. By 1978, 130 local sites had been recorded (Bulmer 1978: Appendix 4.1), the majority by Bulmer and her team. Set the task of making sense of these surface collections, only partly aided by the results from three excavations of sites all seriously disturbed, Bulmer carried out an intuitive seriation of the decorated sherds in something over a half of these collections.

The formulation of her six ceramic decorative styles for the Port Moresby sequence is arguably the most significant result of Bulmer’s doctoral research. These were used to formulate three ‘style periods’, Early (Style I), Middle (Styles II, III and IV) and Proto-historic (Styles V and VI) as a basis for discussing settlement patterns (Bulmer 1978:341ff., 1979). As noted by Frankel *et al.* (1994:33-34) these three periods soon after became four and the dates for the styles changed (Bulmer 1982:123) without explanation. This new formulation put more emphasis on regional variation and the existence of several production centres (1982:124) and interestingly, Style IV was now separated from Styles II and III and Style VI had disappeared, apparently merged with Style V.

The intention of this brief historical detour has been to acknowledge the significance of Bulmer’s work and her six decorative styles but also to note her difficulty in ascribing chronological dimensions to them in the face of a fragmentary stratigraphic framework for the last two millennia in Port Moresby. Belatedly Motupore can now supply something of this framework for Styles IV to VI.

*The basis of Bulmer’s seriation*

The Motupore assemblage has no discernible connection with Styles I and II and these are passed over here.

I have (above) described the defining characteristics of Bulmer’s six styles and will not repeat them here in any detail. Although found together with Style II and sharing design units with it, Style III was defined by the presence of fine line incision. The major decorative component comprises bands of vertical or sloping short incisions separated by incised or gouged continuous horizontal lines; on some items these components are reversed with columns of sub-horizontal short incisions separated by continuous vertical lines. These motifs are very like the herringbone motif on Motupore pottery, except that they are incised rather than shell impressed. Associated bowl profiles are mostly unmodified, direct or restricted, on steep-sided bowls. Thus Style III motifs and bowl forms strongly anticipate the earliest decorated bowls in the Motupore assemblage.
It is useful at this stage to consider the distribution of Style III pottery in Bulmer’s surface collections organised into Bulmer’s four geographical clusters, Taurama, Eriama, Nebira and Boera. Table 8.1 shows the percentage distributions according to style (data taken from Bulmer 1978: Appendix 5.2a).

<table>
<thead>
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<th></th>
<th>Sample</th>
<th>Style I</th>
<th>Style II</th>
<th>Style III</th>
<th>Style IV</th>
<th>Style V</th>
<th>Style VI</th>
<th>Total</th>
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<tbody>
<tr>
<td>Taurama</td>
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<td>44.4</td>
<td>35.8</td>
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<tr>
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<td>28.1</td>
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<td>19.6</td>
<td>3.2</td>
<td>4.4</td>
<td>100.1</td>
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<tr>
<td>Boera</td>
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<td>36.0</td>
<td>3.5</td>
<td>0.0</td>
<td>100.1</td>
</tr>
<tr>
<td>Total</td>
<td>30/1062</td>
<td>191/18.0</td>
<td>260/24.5</td>
<td>111/10.5</td>
<td>315/29.7</td>
<td>155/14.6</td>
<td>30/2.8</td>
<td>100.1</td>
</tr>
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</table>

Table 8.1. Percentage distribution of surface sherds from four Port Moresby site clusters defined by Bulmer (1978). Sample indicates number of sites in each region and the total number of sherds from these sites making up the sample.

Despite the fact that in the Bulmer scheme Style II and Style III are linked and termed the ‘Eriama decorative styles’ (Bulmer 1978:86; 1982:123), and while Style II is dominant at Eriama, there are proportionally more Style III sherds in the Boera collections than in the samples from the other three areas. Boera also has a significant proportion (39.5%) of Style II sherds, as well as Style IV. While some reservations might exist about the robusticity of the evidence from surface collections, especially where collector bias obviates systematic surface sampling by selectively collecting decorated sherds, on face value Styles II and III (and perhaps IV) might equally be called the ‘Boera decorative styles’, regardless of where they were made. Whether they were made at Boera could now be tested, since Boera clay can be identified chemically. Unfortunately, as touched on in Chapter 1 and above, despite Boera being probably the largest prehistoric settlement in the Port Moresby region in the relevant period from 1200 BP to 800 BP (Swadling 1981:245) the only excavated sequence from the area and time period, from Ava Garau, remains unpublished and the material inaccessible.

Bulmer Style IV is primarily defined on the presence of combing and/or shell impressions. Combing may be impressed (punctate) or ‘dragged’. Shell impressions can occur alone or in conjunction with decoration techniques other than incision. Style V, in contrast, is decorated with incisions and punctations. While Bulmer argues that the design units for Styles IV and V differ considerably, some 16 of them are shared. While some motifs are chevrons, frequently they are lines of hatching repeated in horizontal bands. As I argued above, the Motupore evidence suggests the evolution of one style into the other, rather than replacement. Finally Bulmer differentiated Style VI on the basis of its ‘design fields’, with nearly all decoration occurring on the shoulder angle, the thickened rim (which also occurred on Style V) or the lip, with decoration consisting of incised oblique parallel lines or finger arcading.
At its most basic, Style IV was separated from the incised forms that came before and after by the presence of shell impression and to a lesser extent, combing. By definition, Style IV differed from the incised and punctate decoration of Style V, and Bulmer (1978:91) noted that shell impression and incision were almost totally mutually exclusive in Style V, a separation also generally observed in the Motupore assemblage (see Table 7.17 and associated text).

Bulmer’s principal dilemma concerned the ordering of her styles in the absence of any firm stratigraphic or radiometric chronology (e.g. see Bulmer 1978: Table 9.1) other than the EPP chronology for Style I. However, there were sufficient clues for her to approximate a chronological sequence that is still generally correct and found to have utility in analysing the Gulf assemblages by Thompson (1982).

Even so, were these styles sequential and possibly ancestral, or penecontemporary? Bulmer remained undecided. In comparing her styles (1978:109ff.) she concluded that there is a discontinuity between Style I and the other styles (despite elsewhere considering Style I directly ancestral to Style IV [1978:322-3]) but that there was a ‘possible sequence of development’ for Styles II to VI (1978:113) with Styles V and VI ‘daughter’ styles to Style IV (1978:377).

Elsewhere she allowed the possibility of styles being contemporary or nearly so (1978: 93) and thus reflecting geographical as well as chronological dimensions: Style VI could be argued to be ‘a sub-style made by the same potters as Style IV and V, either at the same time or in sequence’ (Bulmer 1978:93) and again ‘it can be suspected that V and VI were contemporary, and thus might better be considered sub-styles, perhaps made at two nearby villages during the same period’ (1978:322), a proposal subsequently elaborated to suggest the possibility of two or three contemporary manufacturing centres in the Port Moresby area throughout the sequence (1978:377-8).

**Summary of the ceramic evidence from Motupore**

It has been argued throughout this report that Motupore archaeology reflects a site occupied by the same cultural group whose history reflects an evolutionary progression rather than cultural replacement in any form. This is seen to be true of the physical development of the site as much as the pottery produced there, and the same implication will emerge from the subsequent data chapters.

In this chapter I have reviewed the motifs on the Motupore pottery, mounting an argument that despite significant and rapid changes through the short (c. 500 year) sequence in the decoration of bowls and to a lesser extent the globular pots, these changes follow a trajectory of simplification (also seen in the analysis of contemporary Port Moresby ceramics in Papuan Gulf sites by Frankel *et al.* [1994] and Skelly [2014]). These changes can be interpreted as being to some degree chronologically sequential from the stratigraphic evidence and evolutionary in terms of decoration from examination of the motifs themselves. In this latter observation they accord strongly with the quantitative analyses of form, decoration technique and decoration location undertaken elsewhere in this report, especially in Chapter 7. The fact that this argument, based on the evolution of motifs, *must* be subjective is one reason why motifs are so often represented differently by different analysts, and why they are frequently omitted from Melanesian ceramic analysis (see Chapter 6). My only defence can be that the sherds have whispered to me, but readers should note that the second part of the Griffin admonition that heads this chapter is ‘but be careful because they are good liars’.

The Motupore motif groups delineated in this chapter can be readily associated with Bulmer’s styles. Bulmer (1978:91) proposes two sub-styles of Style IV, one with ‘lines or grooves and oblique or ‘herringbone’ shell or comb impressions’ and the other with ‘simple design units repeated in horizontal bands.’ The former equates directly with the vertical, oblique and horizontal
herringbone motifs described here, while the latter would be classified with the shell impressed sloping band motif. Bulmer makes no mention, per se, of the chevron motif in Style IV, but her most elaborate Style IV design unit (1978: Figure 5.10, design unit 9) consists of two parallel chevrons, possibly executed with a two-tine comb, separated by short vertical shell impressions. This design unit is precisely similar to my Figure 8.8c and generally similar to the other members of this motif group.

I have noted above the progression of this design motif executed initially with an impressed shell into the incised form of the same motif, where it becomes a principal motif of Bulmer’s Style V, along with vertical, oblique and mostly horizontal lines, both incised and punctate, frequently on bowls with thickened rims. Direct comparisons can be made between Bulmer (1978: Figure 5:13) and my Figures 8.9 and 8.13. Bulmer’s Style VI, as noted, can be identified almost entirely with my classic incised sloping band motif and my finger arcade motif (compare Bulmer 1978: Figure 5.15 with my Figures 8.10 and 8.11). As with Style V, Style VI is characterised by thickened rims. As previously demonstrated, this rim form dominates the mid to late levels in Motupore (Figure 7.28).

The obvious conclusion from this analysis is that Bulmer’s Styles IV, V and VI all occur in the Motupore assemblage. Taking their earliest appearances in this assemblage they support the Bulmer sequence, with Style IV earliest and Style VI the most recent. However, it is equally apparent that they overlap considerably in the Motupore assemblage.

This conclusion helps reframe the chronology of Bulmer’s styles because they can be linked to the Motupore chronology. Even so, the Motupore data lend little precision to this question. While the Motupore deposits appear to be more secure, in terms of fewer disturbances than other Port Moresby sites, grave and posthole excavations during the site’s occupation have had unknown effects on the absolute integrity of the deposits; as well, the Motupore dating samples were assayed in the dark ages of radiocarbon dating. With these caveats, I suggest that Style IV arrived with the first settlers on the island (i.e. its beginning predates Motupore), Style V can be best estimated to be fully established at the point at which incised decoration on modified rims overtakes shell impression on modified rims, at PAU 4 in the Motupore sequence (see Figure 6.6 and Table 8.2) and that Style VI becomes dominant possibly in PAU 2 and certainly by PAU 1, this latter being the period coinciding with incision overtaking shell impression as the dominant decoration on unmodified rims (again see Figure 6.6 and Table 8.2).

<table>
<thead>
<tr>
<th></th>
<th>PAU 1</th>
<th></th>
<th>PAU 4</th>
<th></th>
<th>PAU 6</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Modified</td>
<td>Unmodified</td>
<td>Modified</td>
<td>Unmodified</td>
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<td>Unmodified</td>
</tr>
<tr>
<td>Incised</td>
<td>90.9</td>
<td>63.6</td>
<td>87.5</td>
<td>40.5</td>
<td>30.4</td>
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</tr>
<tr>
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<td>12.4</td>
<td>36.4</td>
<td>12.5</td>
<td>59.5</td>
<td>69.6</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 8.2. Relative percentages of incised and shell impressed Motupore bowl sherds, according to the presence/absence of rim modification (thickening) by pottery analytical unit (PAU). Note the percentages for modified bowls in PAU 1 exceed 100% because four sherds carry both forms of decoration.
In very general terms this suggests that Style IV was in use on Motupore by c. 1200 AD; that Style V had clearly taken over from Style IV by c.1450-1500 AD (and possibly earlier) and that Style VI was fully established some time before 1600 AD. Given the imprecise chronology, the exact chronological overlap of these styles cannot be accurately established from the existing Motupore data. At Motupore, both modified and unmodified rim forms occur throughout the sequence, as do the dominant decorative techniques, incision and shell impression. At the same time there is a dramatic increase in modified rims from 34% in PAUs 5 and 6 combined, to 68% in PAU 4 and to more than 87% in PAU 1 (Figure 6.6), and similar changes in the two decorative techniques, as demonstrated in Table 8.2.

Table 8.2 demonstrates how bowls with and without rim modification behave differently through time, according to the two dominant techniques used to decorate Motupore bowls. As noted, unmodified forms dominate the earliest site layers and are decorated entirely with shell impression (here contrasting only shell impression and incision; other decoration techniques are present in smaller quantities). By the most recent layers, modified forms dominate and are predominantly incised, indicating that presence/absence of rim modification and incision/shell impression remain good typological attributes. The two decoration techniques do not closely track each other on the two forms. On bowls with unmodified rims the replacement of shell impression is gradual; dominant in the earliest levels, shell impression still represents more than a third of decoration in the most recent levels. But as modified rims increase in number, shell impressions on them decrease from 70% to 13% from PAU 6 to PAU 4, but decreases only marginally from then on.

Thus the Motupore data throw up a new interpretation. Whereas Bulmer (e.g.1978:93) and Frankel et al. (1994:47 and Figure 12) both recognised the probability that the later Bulmer styles might be at least partly contemporaneous, both opted for the explanation that this contemporaneity reflected different styles of pottery from different manufacturing centres. The evidence from Motupore, to be supported by the sourcing study reported in Chapter 9, is that Bulmer Styles IV, V and VI were all made on Motupore.

This does not deny the possibility that any or all three styles were also made in other Port Moresby villages; indeed it is almost certain that they were. This is further considered in Chapter 10.

That styles overlap in the Motupore sequence is not surprising. Given the repeated indications reviewed in the analyses in earlier chapters of progressive and evolutionary change in the ceramics and the use of the site itself, chronological overlap would be the prediction made for an analysis of Motupore motifs. If motifs were chronologically successive and exclusive, this would be the model of cultural replacement. Evolutionary progression and change, where one type or style or motif waxes while another wanes is a model of cultural continuity, and this is what is reflected in the Motupore pottery.

In the final section of this chapter I sought comparisons between the Motupore pottery assemblage described here and contemporary assemblages to the west, beginning with the Groube trench on Motupore and extending to sites in the Gulf of Papua.

Almost all of these comparative exercises threw up direct and general comparisons with the Motupore pottery sequence that allow no other conclusion than that by the end of this sequence considerable quantities of Bootless Bay pottery was moving westwards as far as the Gulf. Gaps in the archaeological record do not yet allow an understanding of whether Bootless Bay pottery was also moving east. This a question that is passed over here, but one that should remain on notice (see Chapter 16).

Currently less certain on the available evidence is how early in the Motupore sequence local pottery might have reached the Gulf. Somewhat ambiguous clues, such as the timing of the re-establishment of pottery trading to the Gulf seen in Gulf sequences and the trajectories of the...
Motupore sequence delineated in the last few chapters towards increasing production of a more standard range of vessels, allow that this probably occurred earlier rather than later in the sequence. I return to this matter in Chapter 10, but note here that this is not meant to imply any Bootless Bay monopoly in pottery production in the wider Port Moresby region at this time. More needs to be known about the local sequences in and around Fairfax Harbour and Boera to assess that.

At a more specific level, however, comparisons with local Port Moresby sites do reflect the influence of Bootless Bay. This will also be noted in the sourcing analyses reported in Chapter 9 for a number of sites that I have passed over here. Instead here I want to draw attention to the close ceramic comparisons outlined for Motupore and Taurama. Despite poor chronology and small samples for the late phase occupation at Taurama, the contemporaneity of the occupation of Motupore and late-phase Taurama is strongly reflected in their ceramic inventories and will be further emphasised in the sourcing data reviewed in Chapter 9. A reasonable speculation to be further pursued is that these sites were sister settlements, occupied and abandoned at around the same time by the same cultural group.