Tropical Agroforestry, Coastal Lagoons, and Holocene Prehistory in Greater Near Oceania

John Edward TERRELL
Field Museum of Natural History

A fundamental concern in archaeology and anthropology is understanding the relationships between population growth, the development of complex societies, and the shift in prehistoric times from foraging to food production. That there are connections between these historical processes has long been apparent. Precisely how they are interrelated is controversial. Frequently discussed is the lack of agreement on what characterizes complex or simple societies. It is less widely recognized that the subsistence practices of many communities in the region that van Steenis called eastern Malesia (the Celebes, Moluccas, and New Guinea) cannot be positioned unambiguously along a typological spectrum between hunter-gatherers and agriculturalists. Modern research indicates that people in this region have long been following broad-spectrum approaches to subsistence that have made agriculture or horticulture the mainstay only where (and when) local circumstances have narrowed their subsistence strategies. Today the lagoons at Sissano and elsewhere on the Sepik coast of northern Papua New Guinea are complex, highly productive habitats (fish and shellfish as well as extensive mangrove and sago swamps) that support some of the largest village communities on the coast. Systematic ethnographic and archaeological research in the Aitape district since 1990 has led us to rethink the Holocene foundations of subsistence and demography in the western Pacific. We hypothesize that around 6,000 years ago newly forming lagoons along New Guinea’s long northern coastline may have started to be productive enough in conjunction with already established traditions of agroforestry to fuel culture change in the voyaging corridor between Asia and the Pacific that had far-reaching ramifications.

Keywords: Oceania, Holocene, coastal ecosystems, archaeology, agroforestry

Introduction

Understanding the evident relationships between population growth, the development of complex societies, and the shift in prehistoric times from foraging to food production is a central concern for many archaeologists and
anthropologists today. That these developments are linked historical processes has long been apparent. Precisely how they are interrelated is controversial. While the parameters of population growth have long been recognized and mathematically modeled, there is little agreement on how to define agriculture (Gremillion 1997; Matthews and Gosden 1997; Terrell et al. n.d.), or on what are the decisive characteristics that distinguish so-called simple and complex societies (Feinman 1998).

During debates on such matters, it is not often recognized that the subsistence practices of many communities in the area that van Steenis (1950: map 1) included in eastern Malesia\(^1\) cannot be positioned unambiguously along a typological spectrum between hunter-gatherers and agriculturalists (Gosden 1995) for subsistence strategies in this region of the Pacific not only combine elements of both but defy simple characterization (Latinis 2000).

The staple carbohydrate-producing plants traditionally used for food throughout the region of the southwestern Pacific that I propose to call “Greater Near Oceania”\(^2\) are commonly roots, tubers, and trees such as taro (*Colocasia esculenta*), Dioscorea yams (notably *D. alata* and *D. esculenta*), breadfruit (*Artocarpus altilis*), and sago palm (*Metroxylon spp.*), rather than cereal grains and pulses (Hather 1992; Ohtsuka and Suzuki 1990). In the seemingly depauperate rainforests of this part of the world, transplanting useful nut trees (e.g., almonds, *Canarium spp.*; coconut, *Cocos nucifera*; pandanus spp., and candlenut, *Aleurites spp.*) and other species (e.g., *Cyrtosperma spp.*) from more productive habitats has also been an important management practice at least since mid Holocene times (Spriggs 1993). Modern research is showing that people in this region have long followed broad-spectrum approaches to subsistence that have made more narrowly focused agriculture the mainstay evidently only where (and when) local circumstances have forced greater specialization.\(^3\)

Today the lagoons in Greater Near Oceania at Sissano and elsewhere along the Sepik coast of Papua New Guinea are complex, highly productive habitats (fish and shellfish as well as extensive mangrove and sago swamps) that support some of the largest village communities on this coast. Systematic ethnographic and archaeological research at Sissano and elsewhere in the Aitape district since 1990 is leading us to rethink the Holocene foundations of subsistence and demography in the western Pacific. We hypothesize that around 6,000 years ago newly forming lagoons along New Guinea’s long northern

---

\(^1\)Specifically his (arbitrary) geographical units VII – Celebes and neighboring islands; VIII – the Moluccas; and IX – New Guinea and neighboring islands.

\(^2\)This proposed region would include both Near Oceania as conventionally recognized by scholars today (Green 1991) and also the islands of the region of Wallacea in eastern Indonesia (see Latinis 2000).

\(^3\)Much depends, of course, on how broadly one defines “agriculture.” Here I am using this terms to mean subsistence systems focused on a small number of domesticated cultigens.
coastline may have started to be productive enough that in combination with already established traditions of agroforestry, they fueled culture change in the voyaging corridor between Asia and the Pacific that had far-reaching ramifications—some of which are usually credited to the introduction of foreign cultivars and agricultural practices from somewhere on or near the Asian mainland (Bellwood 1997).

While we have begun to investigate this hypothesis on the Sepik coast, its foundations were established by field research in the interior basin of the Sepik and Ramu rivers and are paralleled by Kyle Latinis’ (2000) continuing investigations in Wallacea. Here I discuss these foundations and note how we are building on them.

1. Ethnography

On Monday, 18 October 1993, my colleague Robert Welsch, the German ethnologist Frank Tiesler, and I traveled in two dugout canoes to the back of the small coastal lagoon at Serai (Serra) village on the Sepik coast west of Aitape (Fig. 1). Here and there in the channels and along the shores of the lagoon were fish weirs and the occasional old house post—including those of a former haus tambaran (men’s house)—for this area well behind the beach had formerly been a village site. We were on the lagoon with our host to visit a rockshelter of direct importance to his family. They had, for instance, taken refuge there during the last World War.

While people in this region of New Guinea subsist chiefly on starch harvested from the inner pith of the sago palm and on seafoods from such lagoons, everyone has a plot of land with small plantings of sweet potatoes, taro, yams, vegetable greens, and the like. We landed at a spring near where our host had his garden and had built a small garden shelter on his family’s land at the back of the lagoon.

We passed quickly across the garden and started off through the forest in the direction of the rockshelter where his ancestors held sway and where we hoped to find archaeological evidence of their former occupations. What struck me immediately as we walked inland was that our host was not just passing through the forest but was pointing out to us trees both large and small that had been planted mostly by his forebears, and which in many cases were apparently not yet ready for his use: to offer an example, he pointed out a promising but not yet imposing pandanus tree (family Pandanaceae).

I am not sure that Frank Tiesler had the reaction that Welsch and I had during this seemingly unremarkable journey to a small rockshelter (where we did find potsherds of indeterminate age); Tiesler had not worked in the Pacific before and had only been living on the Sepik coast for a month. Welsch and I, however,
saw significance in what we were being told, and we exchanged a meaningful glance.

What our host was explaining to us seemed to solve a riddle that we had often discussed since our first journey to the coastal villages around Aitape in 1990. Both of us had previously worked in other parts of Papua New Guinea. We were perplexed by the gardens we saw beside the roads and paths here on the coast. Hundreds, even thousands, of people live in some of these villages. Yet their gardens seem so small and insignificant. Are their economic lives really focused so narrowly on sago and fish? Does agriculture (or horticulture) truly play only a minor role?

Fig. 1. Sepik coast of Papua New Guinea

Here we had an answer to these questions at last. We were not walking through a pristine or secondary-growth rainforest. We were walking through what might be described as a vast garden of trees and other useful plants that had evidently been selected and periodically tended, in some instances apparently for generations. And our host was not merely the heir to this tall, dark garden. He reported he was adding to these holdings while taking from it, and he was nurturing this abundance so that his own heirs would benefit from it even after he himself was no longer alive to share its fruits and other resources.

Those of you who are botanists perhaps find this related experience so unremarkable that you may wonder why I am telling you this anecdote. If so, I plead that by training I am an archaeologist, not a botanist. For me, the implications of this story are profound. Dictionaries tell us that agriculture is the science or art of cultivating the soil, growing and harvesting crops, and raising livestock. Key seems to be the assumptions that the plants and animals at the focus of these human activities have been domesticated, and that observable
changes distinguishing them from their wild ancestors in their size, morphology, and genetics are the tangible sign that they came under human domestication at some time in the past (Matthews and Gosden 1997: 129-130).

Key also is the idea that agriculture thus defined and marked represents an intensification of our ancestors’ use of—and reliance on—the restricted range of selected species that they had decided to domesticate. They had, in effect, domesticated themselves and their heirs by the very act of domesticating other species, for these acts of domestication that led our forebears away from hunting and gathering wild foods to selecting and cultivating a restricted range of species had meant that human beings could extract more food more reliably from any given unit of land (Hunt 2000). By increasing yields while lowering risk, human population numbers had grown and settled village life had become possible and sometimes necessary (Bellwood 1996: 288-290).

Archaeologists and others continue to offer refinements on these basic observations (e.g., Hart 1999; Price and Gebauer 1995), but you may agree with me that they are in keeping with what has been written for years about the origins and impact of agriculture and domestication on human societies and social life since the end of the Pleistocene.

This is why Welsch and I exchanged that meaningful glance at the back of the lagoon in 1993. We had found the subsistence strategies of the villagers on the Sepik coast difficult to place on an evolutionary scale from hunter-gatherers to agriculturalists. Most of their activities seemed to be grounded on wild or semi-wild foods (fish and sago). Their commitment to gardening and livestock management seemed minimal (in comparison with other parts of New Guinea, especially the Highlands, pigs are relatively few in numbers on the Sepik coast and chickens are perhaps more often heard than seen). Hence our questions had been several. Why is sago more important in their diet than domesticated yams, sweet potatoes, taro, and the like? How dependable and productive is their economy? Why had they not become agriculturalists the way others in the Pacific had during the Holocene?

2. Significant Issues

My colleague Eve Emshwiller, an ethnobotanist, reminds me that questions such as these are not new and that they are currently being asked elsewhere in the world, too. Writing about South America, for instance, William Balée remarks that “large portions of Amazonian forests appear to exhibit the continuing effects of past human interference” (1989: 14). He concludes that we “should avoid considering indigenous Amazonians as merely “responding” to natural exigencies, since they have transformed much of Amazonia over the millennia” (1989: 2).
Far from detracting from the importance of our questions, however, Emshwiller emphasizes that botanists and others around the globe today agree that these are significant issues, and that their resolution has relevance beyond New Guinea and Southeast Asia since interest in such questions is not just academic. They are relevant also to international efforts to conserve the earth’s biodiversity and design sustainable agricultural systems to feed the ever growing number of human beings. Seen in this light, it is not surprising that some say understanding traditional subsistence practices in different parts of the world is a priority need; these practices and the species they make use of could serve all of us as historically tested models of ecologically balanced food production (Anderson 1990; Eghenter 2000).

Although household subsistence practices throughout the tropics exhibit genuine variability, Emshwiller (1992) notes that they often display a number of common properties that contribute to the sustainability of the efficient small-scale agroecosystems that they promote. Generally speaking (1) these households make use of a diverse polycultural mix of species; (2) there is layering in the vertical use of space; (3) species are harvested for a variety of reasons (e.g., for subsistence, market produce, building materials, etc.); (4) nutrients are cycled through them fairly effectively; and (5) animals are often integrated into these subsistence systems. Unlike gardening in temperate zones, there is frequently an emphasis on tree crops and other perennial or vegetatively propagated crops; seeded annuals are usually much less important. Furthermore, the work needed to manage these broad-spectrum agroecosystems is spread throughout the year, and so too is the return of useful produce and products nurtured by labor investment. Of strong importance for the world’s future needs, there is usually a good fit between what and how species are managed and the idiosyncrasies of local garden sites—ecological fine-tuning that contributes to their promise as living gene banks of species and cultivars that have been selected to do well in specific and varying local conditions (Fernandes et al. 1985).

In the Pacific, pioneering investigations by the ethnobotanist Douglas Yen (1974, 1990, 1995) have brought the role of tree cropping in tropical subsistence systems to the attention of many scholars (Gosden 1995). Recently Kyle Latinis argued that trees are not just a peripheral component but rather a central focus of tropical household subsistence in Wallacea, New Guinea, and Near Oceania, the region I am referring to as Greater Near Oceania. Here agroforestry provides much of the food (both vegetable and animal), building materials, medicinal plants, and other economically important products (e.g., raw materials for manufactured items) both locally consumed and also traded or sold.

Latinis sees the emergence of this emphasis on agroforestry as a broad regional phenomenon of great antiquity. Unfortunately, as Matthews and Gosden have noted, “there are, in fact, no ready-made theoretical or empirical frameworks for understanding the history of tree use by humans.”
Domestication—defined as the genetic modification of species due to human selection—need not be a notable characteristic of these economic practices (Yen 1985: 323), which further complicates their assignment to a position on a classificatory spectrum between hunter-gatherers and agriculturalists (Spriggs 1993: 137). Nonetheless:

Because forest resources, especially trees, often have long maturation rates, management practices involve a significant degree of long-term planning and stewardship. Furthermore, species introductions and replacements, as well as modifications to the overall spatial and temporal species/genera compositions, frequently occur. (Latinis 2000: 43)

Hence, for most intents and purposes, perhaps household subsistence practices in Greater Near Oceania should be classified as a kind of human agriculture, nonetheless—perhaps best labeled “tropical agroforestry” (Terrell et al. n.d.).

Archaeologists today generally agree that Homo sapiens sapiens arrived in Greater Near Oceania around 30,000-60,000 years ago (35,000-40,000 years is a currently favored date; see O’Connell and Allen 1998). It is routine to say that this was long enough ago that we may safely assume that the first settlers were hunter-gatherers and that the transition to agriculture in Oceania only began in the Holocene, that is, sometime in the last 10,000 years (improved calibration of radiocarbon dating shows that 11,500-11,600 years is a better estimate; see Dickinson 2000: 483).

However, considering the central importance of agroforestry in Greater Near Oceania, it is anyone’s guess when agriculture started to be prominent in this region. It is a good wager that people must have been fairly knowledgeable of the kinds of subsistence resources available to them in coastal, marine, and forest-edge ecozones from the earliest days of human settlement (Groube 1989). Therefore, while narrowly-focused agricultural practices may be mostly a Holocene advancement, it is a reasonable assumption that the economic foundations of life in Greater Near Oceania must date back before then well into the Pleistocene. As Yen has remarked about the exploitation of Metroxylon: “The sago palm M. sagu would seem to be a primary candidate for early domestication in New Guinea. The Pleistocene hunter-gatherers who settled northern Sahul should have carried a tradition of exploitation of palm stem starch that extends northwest for Metroxylon to the Malay peninsula, and other genera of Palmae to the Indian peninsula” (1995: 836).

---

4 The massive continent, also called “Greater Australia,” that formed when lower sea levels during the Pleistocene coalesced New Guinea, Australia, and Tasmania into a single landmass (see Allen and O’Connell 1995).
3. Reasons for Doubt

I have been noting that many people in Greater Near Oceania today cannot be easily called agriculturalists or hunter-gatherers, and that the roots of traditional subsistence practices in this part of the Pacific date back into the last Ice Age. How are these two observations important?

During much of the 20th century, it was conventional to say that Asia was the source of almost all of the civilizing traits found in the Pacific, including agriculture and its plants and animals (Yen 1993). By the 1960s, however, diffusionism had fallen out of favor in Oceania, possibly because Heyerdahl’s (1953) extreme diffusionism had discredited such thinking. It became easier to suggest that some of what we see in the Pacific actually originated there.

Nevertheless, the opinion is still widely held that Asia was the source of much that transformed Oceania after the end of the Pleistocene (Spriggs 1997). While those who favor this point of view argue for it in a variety of ways, Yen’s (1993: 91) phrasing of this popular idea catches one of this interpretation’s main threads: New Guinea was “the site of the blending of two independently developed agricultures”—a coming together of Asian and New Guinea species that established the biotic and cultural foundations for all Oceanic subsistence practices thereafter.

There are a number of reasons to be skeptical about this widely accepted view. Here I want to note only two. The first is obvious. If there are many people in Greater Near Oceania who cannot be classified even now as living an agricultural way of life marked by “good indications of intensive plant cultivation” (Allen and O’Connell 1995: viii), then how important is the search for the origins of agriculture in the Pacific? Is this conventional research focus in archaeology and anthropology as central—or as singular—as many evidently believe?

The second reason is equally straightforward. While people have been living in Asia and the Pacific for quite a long time, Asia and the Pacific are not worlds apart. There is much to be learned about how people in Greater Near Oceania may have been involved with one another perhaps from the earliest days of human settlement (Bellwood et al. 1998; Swadling 1996; Terrell 1989, 1998; Terrell and Welsch 1997). But current scholarly ignorance about prehistory in this part of the world is not reason to imagine that people in Asia and the Pacific were ever so isolated from one another in the past that it makes sense to talk about the blending of two independently developed agricultures even if we accept that the origins of Pacific agriculture is a question of central importance.

Nor is modern politics a good reason to talk about Asia and the Pacific as if they were worlds apart. Irian Jaya (West Papua) and the many islands of Wallacea may be in the modern nation-state of Indonesia while Papua New Guinea is not, but this is a statement about contemporary political realities, not about prehistory (Terrell 1989). It makes sense for botanists to talk about how the
“two floras and faunas” of ancient Gondwanaland and the Laurasian Plate have contributed to the present-day distributions of plants and animals in this part of the world (Yen 1990); given how little is known about the human management of plants and animals in Greater Near Oceania in the past, it makes less sense for social scientists to do so.

4. Circumstantial Isolation

This admonition does not mean, however, that geological processes and continental plate tectonics are irrelevant to prehistory in Greater Near Oceania. The northern coastline of New Guinea (the second largest island in the world with a land area of 808,000 km²) runs from northwest to southeast between 0º–6º south of the equator along the edge of the Australian Plate where it strikes into the West Pacific Plate. The mountain ranges of New Guinea are folds in the earth’s crust that have been thrust up by the impact of these two great continental plates. The northern coast of the island is a zone of continuing tectonic instability leading to frequent earthquakes and landslides in the mountains (Löffler 1977).

Most often, people on this coast are able to cope successfully with the dangers of living in such a geologically unstable region, but not always. On Friday, July 17, 1998 three seismic sea waves caused by a relatively minor local earthquake measuring 7.1 on the moment magnitude scale battered Sissano Lagoon and other nearby localities (Fig.1). Debris later found hanging from the tops of palm trees revealed that the waves had reached heights of ~15m. The precise human death toll may never be known. It is thought that somewhere between 2,000 and 3,000 men, women, and children were killed instantly, swept out to sea, or maimed in a just few minutes. Approximately 9,000 people were left homeless. The communities at Malol, Arop, Warapu, and Sissano were totally destroyed or suffered extensive damage. Arop and Warapu, which were each located on the narrow strip of sand and beach that divides Sissano Lagoon from the sea, lost roughly a third of their inhabitants. The first sea wave scoured these villages clean; the other two huge waves covered what was left with sand. These villages were some of the most populous communities on the coast.

This was not the first time that earthquakes and sea waves have caused human suffering here in New Guinea. While earth tremors have rarely led to such extreme devastation, photographs taken in 1909 show what an earthquake in 1907 had done to the Non-Austronesian speaking Warapu people who were living then on what had been a small islet inside Sissano lagoon. The ground under their feet had literally fallen away, leaving only house posts and trees sticking up out of the brackish waters of the lagoon (Welsch 1998: vol. 1:127-131, Figs. 2.56, 2.57).
Tsunami hitting this coast may be so destructive at times because just offshore the seabed drops off precipitously at the edge of the Australian Plate (Fig. 2). In many places, the coastal mountains are also close to the beach. Hence there is often only a narrow strip of flat land between the mountains and the sea suitable for human settlement.

![Bathymetry in the vicinity of Aitape on the Sepik coast of New Guinea](http://ingrid.ldeo.columbia.edu/SOURCES/.WORLDBATH/.bath/)

**Fig. 2.** Bathymetry in the vicinity of Aitape on the Sepik coast of New Guinea (downloaded from [http://ingrid.ldeo.columbia.edu/SOURCES/.WORLDBATH/.bath/](http://ingrid.ldeo.columbia.edu/SOURCES/.WORLDBATH/.bath/)) based on the ETOPO5 5x5 minutes Navy database.

Experts argue about the magnitude of the eustatic downdraw of sea level during the last glaciation, but estimates of 120-130m are common (Dickinson 1995: 2). It is not clear how inviting this coastline was during the last Ice Age (Fig. 3). We know from Paul Gorecki’s work near Vanimo close to the international border with Irian Jaya that people were living on this coast 35,000 years ago (Gorecki, pers. comm.). However, our working hypothesis at the moment is that this part of the island was only sparsely inhabited until around
6,000 years ago when global sea levels had risen to within a few meters of their current highstand.

We suspect that much of the genetic and cultural distinctiveness of human populations in this area of the Pacific may be a reflection of these Pleistocene circumstances. To phrase our suspicions colloquially, during a large part of human history, New Guinea had turned a cold shoulder to Asia. To be more formal in our phrasing, if relatively few people were living beside the northern beaches of the island for so many thousands of years, New Guinea’s links with people elsewhere in Greater Oceania must have been much weaker than they would have been under other, more favorable circumstances.

This hypothesis, however, is only about Pleistocene New Guinea. We think that by mid Holocene times—that is, around 6,000 years ago—being on the northern coasts had become much more inviting. In fact, we now suspect that life there had changed radically enough to alter the give-and-take between people in Greater Near Oceania.

Fig. 3. Bathymetry in the vicinity of New Guinea based on the ETOPO5 5x5 minutes Navy database, giving bathymetry/topography on a 5 minute by 5 minute grid (downloaded from http://ingrid.ldeo.columbia.edu/SOURCES/.WORLDBATH/.bath/).

5. Holocene Coastal Geomorphology

The geologist William Dickinson (1995: 1) has said it is a truism that “the postglacial landscape has coevolved with the culture of modern humans.” He adds that this truism is widely disbelieved, since many people continue to see our world as a timeless place where environmental change is only something recent and almost entirely human-induced—a nasty side-effect of modern
industrialization and globalization. However, as Dickinson insists, the Holocene history of every coastline on earth has been a story of dramatic change, not stasis. “No shoreline in the world, and no associated estuary or tidal mud flat or baymouth bar, has held its present position for more than a few thousand years” (Dickinson 1995: 2).

Along many of the world’s coasts, the postglacial advance of the sea was followed by Holocene outbuilding of land as sediment-laden rivers constructed their modern deltas (Dickinson 2000: 488-490). Rivers alone, however, have not been the only major element in the Holocene evolution of New Guinea’s northern coastline. In this geologically unstable zone, earthquake-induced landslides have also contributed directly to progradation. While Figure 1 shows only a portion of New Guinea’s northern coastline, note how close the foothills of the northern ranges come to the sea. The coastal embayments now infilled with fairly flat land are all chiefly the end result of Holocene shoreline progradation.

Staff from the Papua New Guinea National Museum in Port Moresby under the direction of Pamela Swadling began archaeological research in the drainage basin of the Sepik and Ramu rivers of northern New Guinea in the 1980s (Swadling 1997; Swadling et al. 1991; Swadling and Hope 1992). Communities along both of these sizable rivers are famed throughout the world as some of most linguistically varied and (to a lesser degree) culturally diverse people not only on New Guinea but anywhere in the Pacific.

Today the Sepik-Ramu basin is filled with swamps and broad flood plains. However, as I have already noted, except for the last 6,000 years, the seas offshore were always lower than their present highstand for the entire time that people have been present in New Guinea (Chappell 1982, 1993a, 1993b). These meandering river channels are quite new, geologically speaking.

In collaboration with John Chappell from the Department of Biogeography and Geomorphology at Australian National University, Swadling and her colleagues have shown that by 6,000 years ago, much of the Sepik-Ramu basin had been flooded by the last marine transgression and had become an inland sea (Swadling 1997). Drill logs kept during geological prospecting in the Sepik-Ramu basin evidence a complex history of the changing shorelines of this former sea.

When she began research here in northern New Guinea, Swadling’s (1990: 71) working hypothesis was that “sediment studies around the edge of the Sepik-Ramu basin should reveal . . . the former presence of intertidal mudflats, characterized by blue, sandy muds, carbonized wood, and marine and intertidal shellfish.” Following this logic of discovery, Swadling and her colleague Nick Araho from the National Museum soon found a shell midden in 1986 resting directing on recrystalized Pleistocene reef limestone under 3m of river alluvium at Dongan 17 km from the coast in the lower Ramu basin (Swadling et al. 1991).
The midden was composed primarily of marine shells from mangrove and mudflat habitats, as well as fish bone from a number of marine species, and plant remains of what are currently important New Guinea tree crops (including *Areca catechu* [betelnut], *Canarium indicum* [canarium almonds], and *Cocos* sp [coconut]). They also found remarkably well-preserved marine shells in the bank of the Djom River, a tributary of the Ramu, 110 km inland. The Djom shells may date to the interglacial high sea levels of 120,000 years ago; the Dongan midden dates to around 5,800 radiocarbon years ago (Swadling 1997: 2, 6).

Thus there is now reason to think that around 6,000 years ago when the world’s sea levels had risen to within a meter or two of their present stand, the inland Sepik Sea was brackish and shallow (~ 3m in depth). Its entrance at the coast was partially blocked by an island, now an area of low hills surrounded by swamp and coastal sediments. Where the great volume of fresh water discharged by the Sepik and Ramu rivers did not discourage their growth, there were mangrove stands and their associated fauna, including edible shellfish. With the gradual sediment infilling of this prehistoric Sepik Sea over time, the extent of these mangrove stands grew. By 3,500 years ago, however, the sea was no longer brackish and the coastline was prograding rapidly (Swadling 1997: 5). Five midden sites located by Swadling and her colleagues on the eastern side of the lower Ramu River near Awar Lagoon show that people were fishing and gathering shellfish throughout much of this time. Obsidian flakes recovered from several of these middens attest also to long distance trade with the Bismarck Archipelago east of New Guinea (Swadling and Hope 1992: 33-36).

During the life of this Sepik Sea and the smaller—but still sizable—freshwater lake that temporarily replaced it (vestiges of which still exist, e.g., the Chambri Lakes), communities in the Sepik basin would also have had more direct access to people (and their products) in what are now the remote Highlands of New Guinea (Swadling and Hope 1992: 37). Even when the inland sea was at its fullest extent, however, people living along its shores would have been cut off from easy contact with people on the Sepik coast by the intervening coastal mountain ranges, just as modern communities in the Sepik-Ramu basin are at the present time.

Considering its vast size and the archaeologically attested richness of its flora and fauna (as shown by the middens excavated by Swadling and her colleagues), it is probable that the Sepik Sea (and the large freshwater lagoons that temporarily replaced it) must have played a major role in determining the character of prehistoric interactions within and beyond northern New Guinea for much of the last 6,000 years, as Swadling (1997) has suggested. And the infilling of the Sepik-Ramu basin, as she also argues, may have caused dramatic changes in how people in the Sepik-Ramu basin lived their lives—which may partially explain the complex accounts of migration and resettlement recorded in local oral traditions (e.g., Roscoe 1989; Tuzin 1976).
6. “Ancient Lagoons” Hypothesis

Where to draw the line between the Pleistocene and the Holocene largely depends on why you are drawing a line at all. The last glacial maximum persisted until ca. 16,000-18,000 years ago, after which the world’s glaciers shrank, sometimes slowly, sometimes more rapidly, until around 5,000-6,000 years ago (Dickinson 1995: 1). The date of ~10,000 years ago which is often said to mark the end of the Pleistocene and the beginning of the Holocene signals the approximate end of the Younger Dryas glacial re-advance which had affected climatic conditions around the world. Judging, in part, by what Swadling and her colleagues have learned about the changing shorelines of the former Sepik Sea, however, it seems likely that the time of critical local importance was ca. 5,000-6,000 years ago when the world’s sea levels stabilized near their present highstand. As Bailey and Parkington (1988: 5) have written about this period in the earth’s history:

It is arguable that the stabilisation of world sea-levels during the Holocene, combined with modern climatic conditions, has created widespread coastal and marine habitats favourable to human subsistence on a scale which cannot be matched until one goes back to the previous interglacial period ~ 120,000 years ago. Inundation of the continental shelves [where these exist] to provide fertile, shallow seas, favourable conditions of temperature and salinity under a modern climatic regime, and stabilisation of shore-edge processes long enough to allow the development of shallow mudflats and rock platforms in inshore areas, are just some of the factors which could be invoked in support of this view from a global perspective.

Currently my own major working hypothesis—one I have been calling “the ancient lagoons hypothesis”—that newly stabilized coastlines during the mid Holocene may have reached levels of natural productivity great enough to support significant population growth is largely based on Swadling’s discoveries in the Sepik basin and on reasoning such as this. While the ancient lagoons hypothesis has strong implications for human settlement, population growth, and the pace of island colonization throughout Greater Near Oceania, present and planned research focuses once more on the archaeology and geomorphology of the Aitape district of West Sepik (Sandaun) Province (Fig. 1).

---

5 This is not, however, a hypothesis about “intensification”; see Lilley 2000; Lourandos 1997.
Based on topographic and offshore bathymetric data (e.g., Löffler 1977:Figure 36), we estimate that the shoreline at Aitape during the first half of the Holocene (ca. 10,000 – 6,000 years ago) was probably located somewhere near the base of the present 80-100m contour lines (Fig. 1) south of its present position. We hypothesize that over the last 6,000 years, this coastline has gradually advanced northwards forming temporary large brackish lagoons in old embayments and elsewhere when the local configuration of the shoreline and the offshore islands trapped sediments in sandbars and small river deltas: a process of progradation and infilling that can still be seen in action today in the changing modern lagoonal systems behind the beaches at Malol, Sissano, Serra, and elsewhere along the northern coast.

Six thousands years ago there were two different kinds of coral islands near Aitape: high, steep, upraised reefs of Pliocene/Miocene age; and flat, slightly elevated Recent coral platforms farther offshore (Haantjens et al. 1972). The latter islands are still extant, and are named Tumleo, Ali, and Seleo. The former, however, were eventually trapped or “captured” at different times during the last 6,000 years by the advancing (prograding) shoreline. These old upraised reef systems now form the steep hills around and to the west of Aitape.

In addition, an extensive parallel series of beach ridges behind the strand on the east side of Aitape abuts these hills and runs parallel to the coastline: the product of sediment-laden offshore currents losing some of their energy when they hit the Aitape Hills while they were still exposed enough offshore to form an elevated headland peninsula. Comparable headland peninsulas can still be seen along the coast near Wewak and Vanimo.

Based on these geomorphological observations, we hypothesize that as New Guinea’s northern coastline has built out seaward during the last 6,000 years beyond its former steep Pleistocene shores, extensive coastal lagoons have temporarily formed and then infilled—except in the case of the surviving lagoons at Sissano, Malol, and elsewhere that continue to provide people living beside them with an abundance of foods.

We also hypothesize that as these flourishing lagoons formed along this coastline (and probably elsewhere in Greater Near Oceania after 6,000 BP), their natural productivity in combination with already well-established local traditions of broad-spectrum agroforestry may have fueled major human population growth, the implications of which at the present time can only be guessed at. One implication, however, stands out. While it is commonly said that much happened in Asian and Pacific prehistory after 6,000 BP as a consequence of the domestication of certain plants and animals in Asia (Bellwood 1996; 1997; Gosden 1995; Spriggs 1989: 607, 609), there is no reason to think that the process of coastal progradation and landscape evolution that we are talking about here was confined to the north coast of New Guinea. We suspect that the foundations of the subsistence practices (and almost all of the cultivars) later carried by
voyagers to eastern Melanesia and Polynesia owe their origins to the skills and discoveries of the people of Greater Near Oceania whose ancestors had perfected them, starting in the Pleistocene (Clark 1991).

**Discussion and Conclusions**

Our preliminary subsurface coring at Aitape in 1996 has confirmed that blue-grey clays believed to be a sign of former lagoonal swamps are to be found at depths of about 3m both at Aitape and at the base of the foothills inland. Woody material extracted from this stratigraphic layer has been dated by AMS assay to c. 6,000-5,750 years ago (Beta-105207, 5190 +/- 40 bp). We think it likely that by then infilling on the western side of what are now the Aitape hills had created an extensive lagoon, or series of lagoons, now filled in—except for the remnant lagoons at Sissano, Malol, and elsewhere.

The Aitape district was an important focus of anthropological research before the First World War. However, in comparison with other areas of New Guinea after the war, this locality received little systematic study until we began our investigations there in 1990.

The A. B. Lewis Collection at Field Museum of Natural History in Chicago is the largest and best documented ethnographic collection ever assembled in the southwest Pacific by a single field researcher. It also has better archival and photographic documentation than most museum collections made in the Pacific before the First World War. This collection, which was assembled by Curator Albert B. Lewis (1867-1940) during the 1909-1913 Joseph N. Field South Pacific Expedition, is a valuable resource for understanding the early colonial history of Melanesia (Welsch 1998).

The Lewis Collection was assembled at a time when it was routine for scholars to catalog similarities and differences in material culture to define cultural relationships between local groups and tribes. Consequently, the collection and its documentation also serve as a cultural benchmark illustrating the diversity of local communities on the Sepik coast at the turn of the century (Welsch 1999).

Lewis was impressed while he was on the Sepik coast in 1909-1910 by the variety and geographic range of exchanges in foodstuffs (notably, sago and fish), raw materials, and handicrafts taking place among coastal, island, and interior communities. Combining museum studies and new field research, the New Guinea Research Program at the Field Museum has now confirmed that these communities all share a fundamentally similar community of culture (Terrell and Welsch 1997; Welsch and Terrell 1991, 1998; Welsch, Terrell, and Nadolski 1992).
Between March 1993 and February 1994, Robert Welsch, Wilfred Oltomo from the Papua New Guinea National Museum, and I learned about how exchange relationships on the Sepik coast unite people and local communities there into larger human associations (or “regional systems,” see: Terrell 1993) that extend well beyond the level of economic and socio-cultural integration represented by what anthropologists conventionally refer to as “face-to-face” communities. This commonality of material and social culture is nurtured by a fascinating local social institution: *inherited friendship*.

These friendships, which are an empirical example of what the anthropologist Alexander Lesser (1961: 43) once called social fields of “structured friendships,” are grounded on widely shared ideas and expectations about how people ought to behave toward one another as friends, i.e., the social institution that binds people in different communities on the coast together even though they may speak utterly different and unrelated languages is the custom of having friendships between individuals and families that have been handed down from one generation to the next.

The vast network of human relationships maintained in this way extends for many hundreds of kilometers along this coastline and some distance inland. It is largely through these friendships that people on the coast and nearby islands share so much in common despite the fact that along the 700 km of coastline between Jayapura in modern Irian Jaya and Madang in Papua New Guinea, people speak a total of 60 different languages belonging to 24 different language families.

As we learned more about how and why individuals and family groups on the Sepik coast share a widespread community of culture in spite of this astonishing linguistic diversity, we began to see how inherited friendships maintain ties of mutual advantage between generations on the coast that are directly analogous to the intergenerational responsibilities that are so essential to the success of agroforestry as an economic institution on the coast. And both of these institutions hint at what “community” means in this part of New Guinea. It seems evident that people here have ties to the past and obligations to the future that intimate and enduring.

It soon also became obvious that we needed to know more about the antiquity of this remarkable social institution. While we were on the coast in 1993-1994, therefore, we also conducted archaeological surveys in the area between the Serra (Serai) Hills west of Aitape and the town of Wewak east of Aitape. In 1996 we carried out the first archaeological excavations in this part of New Guinea (Terrell and Welsch 1997).

We are now planning new archaeological and ethnobotanical research at Aitape to (1) chart the history of coastline progradation in this locality and study the development of coastal lagoons over the past 6,000 years; (2) locate buried midden deposits that may tell us—as they did Swadling in the Sepik
basin—about human settlement and prehistoric economics on the coast; and (3) document current agroforestry practices and lagoon fishing so that we can begin to model more accurately how the changing shorelines of Greater Near Oceania may have changed the very fabric of social and cultural life in the Pacific during the Holocene.

References

Allen, Jim and James F. O’Connell  

Anderson, Anthony B., ed.  

Bailey, Geoff and John Parkington  

Balée, William  

Bellwood, Peter  


Bellwood, Peter, Goenadi Nitihaminoto, Geoffrey Irwin, Dunadi, Agus Waluyo and Daud Tanudirjo  
Chappell, John

Clark, Jeffrey T.

Dickinson, William R.

Eghenter, Cristina

Emshwiller, Eve

Feinman, Gary M.

Fernandes, Erick C. M., A. Oktingati and J. Maghembe

Gosden, Chris


Löffler, Ernst 1977 Geomorphology of Papua New Guinea. Canberra: Commonwealth Scientific and Industrial Research
Organization in association with Australian National University Press.

Lilley, Ian
2000  So Near and Yet So Far: Reflections on Archaeology in Australia and Papua New Guinea, Intensification and Culture Contact. *Australian Archaeology* 50:36-44.

Lourandos, Harry

Matthews, Peter J. and Chris Gosden

O’Connell, James F. and Jim Allen

Ohtsuka, Ryutaro and Tsuyguyoshi Suzuki, eds.

Price, T. Douglas and Anne Birgitte Gebauer, eds.

Roscoe, Paul B.

Spriggs, Matthew


Swadling, Pamela


Swadling, Pamela and Geoff Hope


Swadling, Pamela, Nick Araho and Baiva Ivuyo


Terrell, John Edward


Terrell, John Edward, John P. Hart, Sibel Barut, Chaparukha Kusimba, Kyle Latinis, Rahul Oka, and Joel Palka


Terrell, John Edward and Robert L. Welsch


Tuzin, Donald F.


van Steenis, C. G. G. J., ed.

1950 *Flora Malesiana* 1(1). Djakarta: Noordhoff-Kolff N.V.
Welsch, Robert L.  


Welsch, Robert L. and John Edward Terrell  


Welsch, Robert L., John Terrell and John A. Nadolski  

Yen, Douglas E.  


