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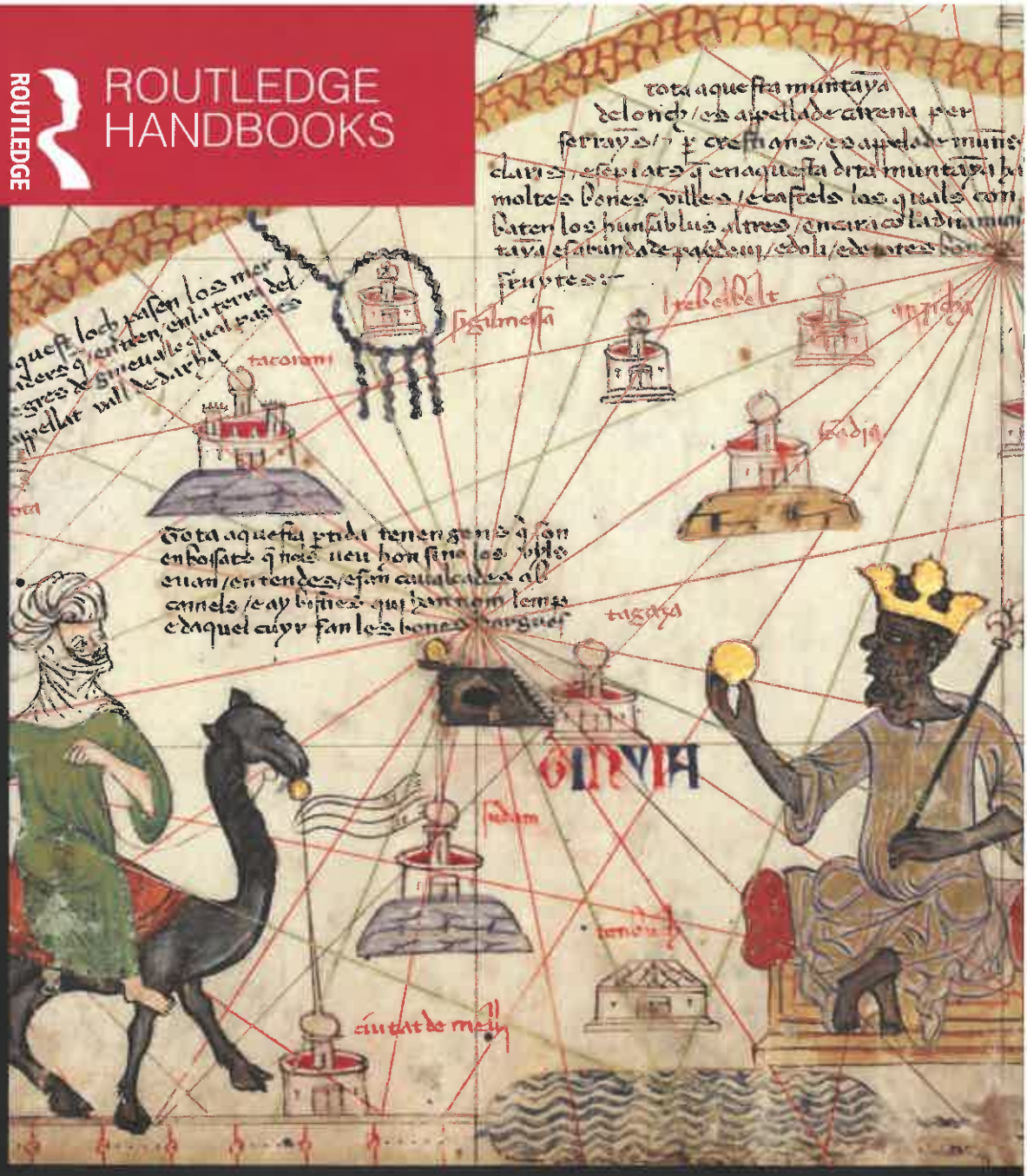

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4.7
East Polynesian connectivity

Marshall Weisler and Richard Walter

Introduction

Prehistoric East Polynesia was never part of the truly global community, but many of the processes that underpin and drive globalization were incorporated into the region's social fabric from the beginning. These processes are concerned with connectedness, as globalization has been defined simply as a form of connectivity (Robertson 2014; see also Feinman this volume, Jennings this volume, Knappett this volume). Connectedness is about the establishment and maintenance of social and economic ties between communities and, in most parts of the world, it is described as *emerging* out of social, demographic and technological processes. East Polynesia is fundamentally different, as connectivity was introduced in finished form by the first settlers. This distinction is important because the East Polynesian case highlights the pivotal role of connectivity as a colonization strategy, as a condition of geography and as a process contributing to long-term sustainability. Furthermore, determining the spatial, temporal and diverse nature of connectedness between island societies at the scale of island, archipelago and broader region is essential for understanding prehistoric East Polynesian culture change. Indeed, the hallmark of East Polynesian societies was the expansive and diverse nature of community inter-connections, a trait inherited from Austronesian forebears.

The most significant distinction of Oceania is between the large, geologically diverse and closely spaced islands in the southwest Pacific and those scattered across the rest of the region which are generally smaller, consisting mostly of oceanic basalts, and rarely inter-visible (Figure 4.7.1). This distinction between 'Near' and 'Remote' Oceania (Green 1991) has important implications for island colonization strategies (Irwin 1992) and the subsequent development of insular communities. Oceanic islands were recognized early on as ideal 'laboratories' for systematically predicting non-human species numbers and relationships based on island size (McArthur and Wilson 1967), and archaeologists were quick to acknowledge that islands – as clearly bounded territories – provided a unique canvas upon which to study the development of prehistoric economies, social systems and political structures over time, and between contrasting ecological settings. The first colonists of Near Oceania arrived about 50,000 years ago and the seafaring 'Lapita people', of Austronesian ancestry represented a secondary migratory wave around 3500 BP. They rapidly spread across Near Oceania then into Remote Oceania as far

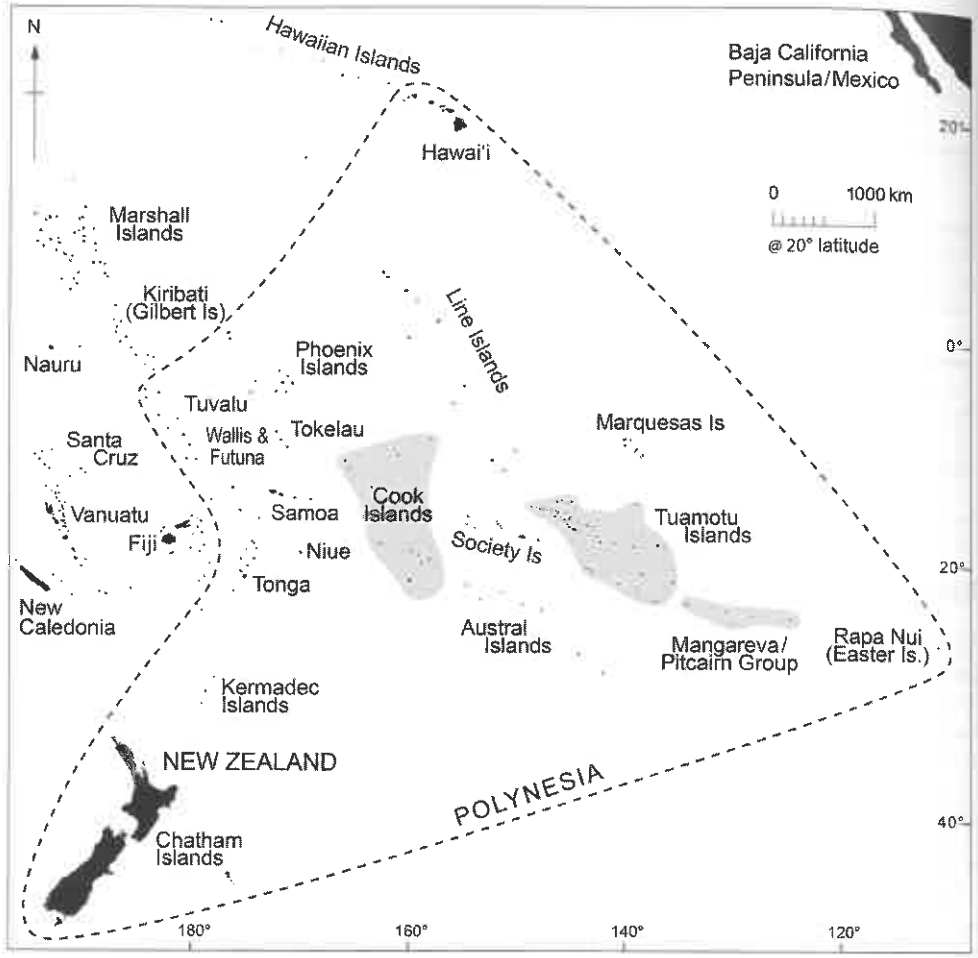

Figure 4.7.1 The Pacific Islands showing the Polynesian triangle and the location of case study areas: Cook Islands, Tuamotus, Mangareva-Pitcairn Group and New Zealand

east as Samoa. The Lapita colonists were the immediate ancestors of the Polynesians who form a phylogenetic unit recognized by related languages, biology and cultural institutions (Kirch and Green 1987). Within Polynesia it is possible to divide West from East archipelagos based on a range of cultural traits (Burrows 1938).

In this chapter we document the changing scale, configuration and temporal dimensions of connectivity in East Polynesia. We show that East Polynesian connectivity did not emerge out of evolving social processes, but was a deliberate enabling strategy essential for colonising the remote Pacific (Irwin 1992). We demonstrate how this process played out on a canvas of different archipelagos with contrasting resources, both small and large islands, and with varying levels of ecological diversity and remoteness. In particular, we highlight the significance of the geographic position of archipelagos, such as the isolation of New Zealand and the Pitcairn Group in contrast to the centrally located Tuamotus.

There are two major expressions of connectivity in East Polynesia: (1) as a colonization strategy, where vital links were developed and maintained between parent and multiple-daughter communities to support the establishment of economically and socially viable groups and (2) as marked by post-colonization voyaging not necessarily to maintain basic functional viability, but to support socially mediated imperatives such as the acquisition of high-status goods, the fostering and maintenance of strategic alliances and the establishing of individual and group prowess or *mana*.

The archaeological signatures of connectivity are easily identified by the spatial and temporal distributions of pottery and obsidian – two commodities that are found throughout much of the world. However, in East Polynesia obsidian is only found in the two distant corners (New Zealand and Easter Island) and all the archaeological pottery currently known wouldn't even fill a small coffee cup. Consequently, tracking connectivity in East Polynesia requires the geochemical 'fingerprinting' of fine-grained basalt (Weisler 1997a), which was fashioned into wood-working adzes and other cutting tools. Since the refinement of protocols and geochemical techniques during the past 20 years, we can identify exotic basalt artefacts in distant habitation sites. Indeed, one Tuamotuan adze was identified as originating from the Hawaiian Islands, a distance of ~4000 km – making it the longest known, continuous maritime trip in world prehistory (Collerson and Weisler 2007). In addition to basalt, imported Black-lipped pearlshell (*Pinctada margaritifera*) can be visually distinguished from local shellfish (such as *Turbo* gastropods and *Isognomon* bivalves) for tool and ornament manufacture.

The following four case studies highlight the variability in connectivity or interaction systems even within the relatively homogenous culture area of East Polynesia (Figure 4.7.1). The spatial and temporal distributions of exotic materials we identify were the result of different circumstances: the geographic position of archipelagos, differences in colonization strategies, and the need for sustaining distant daughter communities.

The Cook Islands: bridging West to East Polynesia

Venturing from West Polynesia about a millennium ago, the Cook Islands were the first archipelago encountered and whose 15 islands stretching ~1000 km from north to south provided a bridge or gateway into previously unseen islands scattered across the far reaches and remote corners of East Polynesia. It is a diverse group of islands, with eight low-lying coral atolls (six of which form a dispersed group to the north), one 'almost-atoll' of Aitutaki, which has a central volcanic core surrounded by a barrier reef, the five *makatea* or raised reef islands of Miti'aro, Atiu, Ma'uke, Takutea and Mangaia – all with central ancient highly eroded volcanoes with a perimeter of deeply dissected and rough coral limestone fronting high cliffs – and the volcanic island of Rarotonga, the highest (652 m) and largest (64 km^2) of the group. Low coral atolls, consisting of unconsolidated coralline sands atop reef platforms, are amongst the most precarious islands for long-term habitation since gardening soils must be developed by mulching over many human generations and potable water is limited to subterranean lenses. However, there is typically a huge expanse of lagoon and oceanside reefs that provide abundant marine resources. *Makatea* islands, also challenging landforms for sustainable human habitation, have limited agricultural lands, which were highly sought after in late prehistory. Because of the uplift history, coastal margins are narrow and, consequently, reefs are poorly developed. Rarotonga has the most extensive agricultural lands and best water resources, with a system of barrier reefs that surround the island.

Fine-grained basalt for manufacturing adzes typically has been used for documenting prehistoric interaction throughout East Polynesia, yet appropriate sources have a very limited

distribution in the Cook Islands. Geological sampling of volcanic flows on Rarotonga, Aitutaki and Mangaia have identified adze-quality material from most of the valleys, and a single source has been documented on Atiu and on Ma'uke (Sheppard *et al.* 1997). It is not yet clear, however, which of the potential sources were used prehistorically. Flake concentrations at the archaic site of Anai'o suggest the local basalt source was used in prehistory (Walter 1998: 48) and an undefined source is known from Mangaia near Mata'are (Weisler *et al.* 1994). There is also evidence of the flaking of boulders to make adzes at Moturakau, a barrier island on Aitutaki's reef (Allen and Johnson 1997: 119). Recent geochemical studies point to several additional sources throughout the Cooks at Rarotonga, Mangaia and Atiu (Weisler *et al.* 2016). The atolls have no sources of volcanic rocks but they do have stocks of Black-lipped pearlshell (as perhaps did Aitutaki) that was likely transferred to the southern Cooks. There is a source of chert on Mangaia. These sources, then, contain the main raw materials whose geochemical signatures (or visual identification in the case of pearlshell) are used to track ancient patterns of connectivity.

The dates for Oceanic island colonization routinely elicit debate and discussion and there is rarely a consensus. This is also true of the Cook Islands, where some have argued for colonization before 2000 BP based on purported evidence of human disturbance identified in lake cores as dispersed charcoal particles (Kirch and Ellison 1994). This particular claim was questioned by Anderson (1994), but there is general agreement for colonization sometime between 1000–1300 CE (Allen and Wallace 2007; Kirch *et al.* 1995; Walter 1998).

In his monumental treatise on ancient Polynesian societies, Goldman remarked that the Cook Islands 'reveal almost the full range of Polynesian social systems' (1970: 76). The generally resource-poor northern atolls were classified as 'traditional' societies, where seniority is central and establishes rank and allocates authority and power (Buck 1932: 43; Goldman 1970: 20). Mangaia and Rarotonga, on the other hand, were classed as 'open' societies, where coercion and military might played a fundamental role in structuring society and maintaining rule (Buck 1934; Goldman 1970).

Despite the variability in island environments, the southern Cook Islands trace a broadly similar pattern of change in material culture, settlement patterns and economy. The earliest phase of settlement is represented on Rarotonga, Aitutaki, Ma'uke, Mangaia and probably Atiu, suggested by dense settlements located adjacent to major reef passages (Walter 1996a). These sites contain evidence for a full range of domestic activities and are interpreted as small, sedentary villages. The material culture of these sites falls within the broad umbrella of the East Polynesian Archaic (Bellwood 1970; Sinoto 1970) and includes rectangular and reverse-triangular tanged adzes, one-piece shell fish hooks, tattooing chisels and shell and bone ornaments. It is also characterized by the presence of non-local material sources – particularly pearlshell and basalts – as well as a handful of ceramic sherds. From approximately the beginning of the sixteenth century there are marked changes in settlement patterns. The nucleated coastal sites are abandoned in favour of a more dispersed settlement pattern based around occupation of the planting lands of the river valleys and inland coastal plain (Bellwood 1971; Walter 1996a). *Marae* (temple) construction commenced around the same time, signalling the emergence of the Cook Island chiefdoms described at European contact with their twin axis of secular and sacred power (e.g. Goldman 1970; Reilly 2003, 2009; Walter and Reilly 2010).

The evidence for connectivity comes, first, from oral tradition, which throughout the Cook Islands records a period, immediately following colonization, of high levels of long-distance voyaging. This is the time of the great heroes, Tangi'ia, Karika and others whose exploits traversed the islands of Central Eastern Polynesia (Walter and Moeka'a 2000). This contrasts with later traditions, which record lower levels of interaction and normally only refer to nearby islands (Walter and Reilly 2010: 369). Hard evidence of connectivity comes from the archaeological record.

Table 4.7.1 Evidence for connectivity during the Cook Islands archaic period

Island	*Site*	*Date of occupation*	*Imported commodity*	*Origin*	*References*
Aitutaki	Ureia	1225–1430	FGB	Samoa, Society Islands, Mangaia	Allen and Johnson 1997; Allen and Wallace 2007
Ma'uke	Anai'o	1290–1446	FGB, PS, ceramics	Samoa, Tonga, Fiji, N & S Cooks	Walter 1996, 1998; Walter and Dickinson 1989
Mangaia	Tatangatatau	1200–1500	FGB, PS	Samoa, Australs, Marquesas, S Cooks	Kirch *et al.* 1995; Weisler *et al.* 1994; this article
Rarotonga	Ngati Tiare	Archaic	FGB	Samoa	Bellwood 1978; Walter and Sheppard 1996

Note: FGB= fine grained basalt adzes, debitage; PS= pearlshell (*Pinctada margaritifera*)

Although space limitations do not allow us to present the detailed archaeological evidence for connectivity in the Cook Islands, there are four key archaic period sites on Aitutaki (Allen and Johnson 1997; Allen and Steadman 1990; Allen and Wallace 2007), Ma'uke (Walter 1996a, b, 1998; Walter and Dickinson 1989), Mangaia (Kirch *et al.* 1995; Weisler 2016; Weisler and Kirch 1996) and Rarotonga (Bellwood 1978; Walter and Sheppard 1996) that, together, report the spatial and temporal distributions of 71 basalt artefacts, three ceramic sherds and numerous pieces of imported Black-lipped pearlshell from 161 m^2 of excavation (Table 4.7.1).

Other evidence for connectivity

Black-lipped pearlshell is abundant in the lagoons of the northern atolls (and perhaps Aitutaki), while there are no suitable habitats surrounding the *makatea* islands or the shallow coastal waters of Rarotonga. Large bivalves of pearlshell provided an 'open slate' for manufacturing a broad range of fish hooks, vegetable scrapers and peelers, and ornaments. In later prehistory, pearlshell was replaced with the inferior and locally available gastropod (*Turbo* sp.) for artefact raw material. Walter (1998: figure 11.1) summarized the frequency of imported pearlshell for five sites in the southern Cook Islands. All show a persistent decrease in pearlshell from the archaic to later prehistory, attesting to increasing isolation.

Connecting West and East Polynesia

There are marked changes in connectivity between the archaic and later prehistory in the Cook Islands, which mirrored trends throughout East Polynesia in general. During the archaic, contact was maintained – perhaps only for a few human generations – with distant archipelagos including Fiji, Samoa, Tonga, the Australs, the Society Islands and much farther afield to the Marquesas (Figure 4.7.2). It was during this time that the Cook Islands acted much like a bridge connecting the archipelagoes of West and East Polynesia. Over time, there was increasing isolation of communities previously tied to distant locales many hundreds to thousands of kilometres away. Later prehistory witnessed the end to extra-archipelago communication with communities only connecting within the southern islands (Walter 1998: figure 11.3), most frequently to landfalls that were inter-visible.

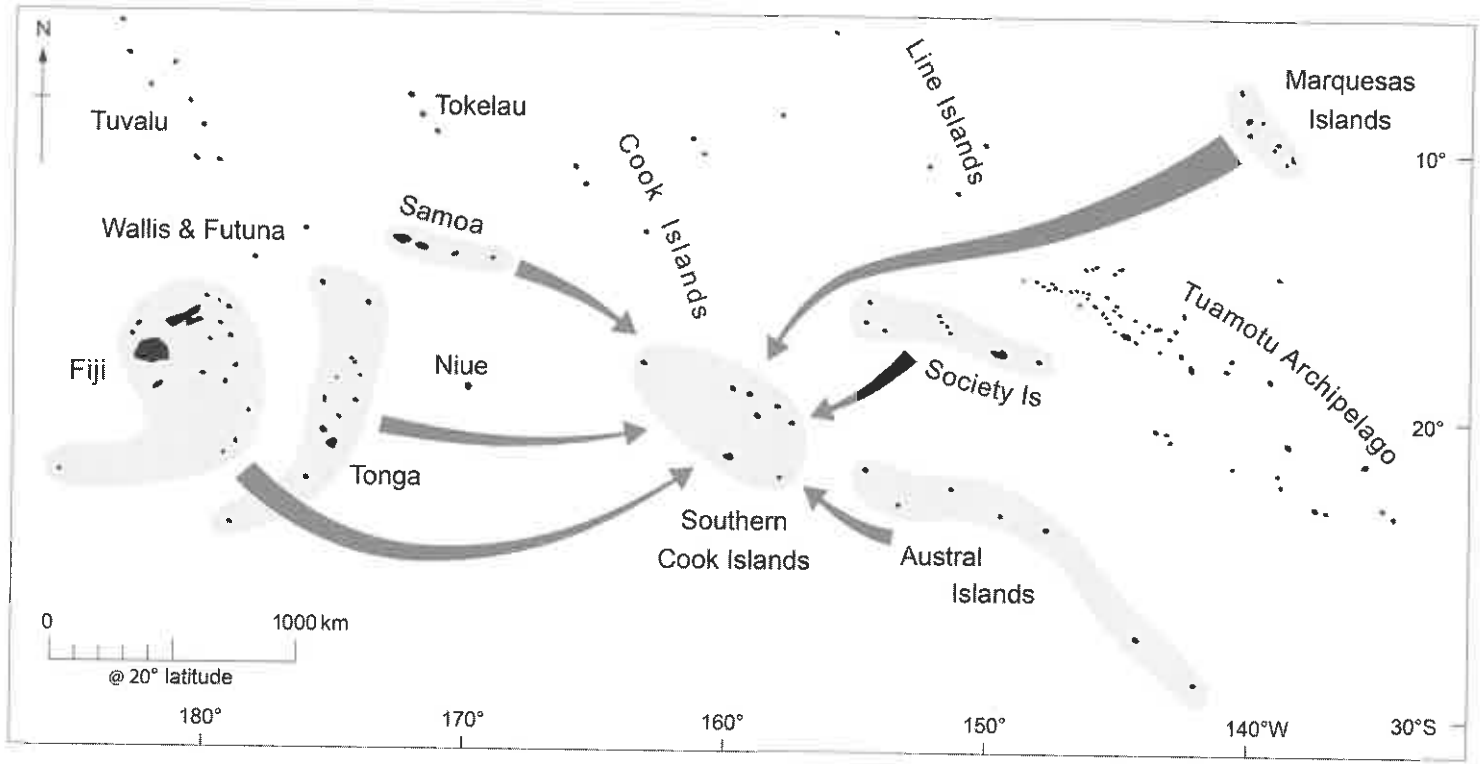

Figure 4.7.2 East Polynesia with archipelagos connected to the Cook Islands between *c.*1100–1500 CE

The Tuamotu Archipelago – crossroads of East Polynesia

Occupying a pivotal position in Central East Polynesia, the 76 islands of the low-lying Tuamotu Archipelago begin just east of the Society Islands then trend ~1500 kms southeast to Mangareva. Aside from one raised coral island without a lagoon, the Tuamotus consist entirely of low coral atolls, scarcely a few metres above sea level, with few terrestrial resources, no standing potable water and nutrient-poor soils, but their marine ecosystems are species diverse and plentiful. The Tuamotus could never support large human populations typical of nearby high volcanic islands, but one thing was unique in setting the Tuamotus apart from all other groups in East Polynesia: location. The long arc of islands, traversing a greater distance than any inhabited Polynesian archipelago, was a navigational screen whose islands provided hard-to-miss

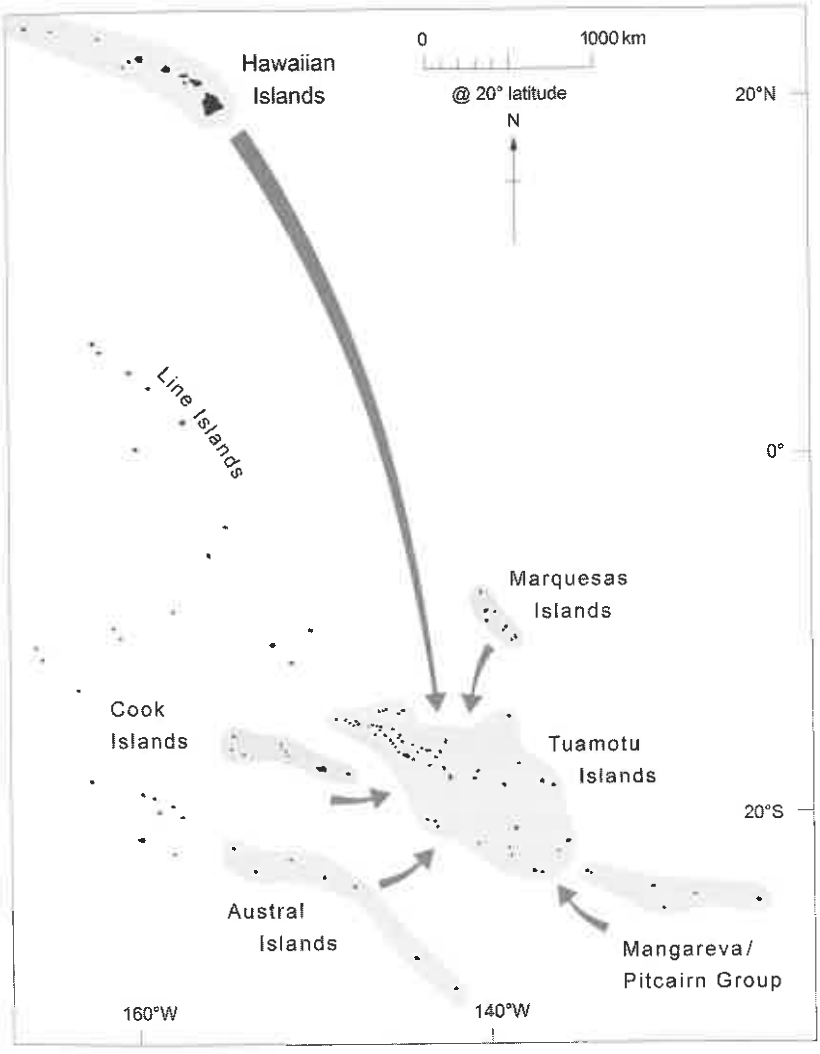

Figure 4.7.3 Tuamotus connectivity based on results in Collerson and Weisler (2007)

landmarks for canoes traversing to and from the surrounding island groups. In effect, the Tuamotus provided a crossroads that connected distant island groups. Indeed, archaeological evidence from geochemically 'fingerprinted', fine-grained basalt stone adzes found on numerous atolls of this group (Collerson and Weisler 2007; Figure 4.7.3) connected the Tuamotus to the surrounding archipelagos of the Marquesas, the Pitcairn Group, the Australs and the Society Islands. Transport of a Society Islands adze to Mangareva (Weisler and Green 2001), and Marquesan adzes to the Cook Islands (McAlister *et al.* 2013; Weisler *et al.* 2016) and the Society Islands (Weisler 1998) strongly point to the Tuamotus as an intermediary for down-the-line exchange (Renfrew 1977).

The Tuamotus are one of the least archaeologically studied archipelagos in Polynesia. Gardening systems and *marae* have been mapped (Emory 1975), but few controlled excavations have taken place (Chazine 1982, 1990). Consequently, human colonization of the group is likely to coincide with settlement of archipelagos to the west, such as the Society Islands, the Cook Islands or the Australs where first settlement is about 1000–1200 CE (Bollt 2008; Hermann 2013; Wilmshurst *et al.* 2011). This is further suggested by the timing of atoll emergence at about this time (Dickinson 2004).

In the widely scattered atolls of the Tuamotus, each with near-identical kinds and abundance of resources, it is unlikely that communities ever joined together for the purposes of barter or exchange as the possibilities for distinctly localized production were rare. Yet in the atoll archipelago of the Marshall Islands, the marked rainfall gradient provided a rainfall disparity from the dry north to the wet south which fostered specialized production of finished goods (fish hooks and mats) for agricultural produce (Weisler 1997b: 10). However, the difference in resources from the Tuamotuan atolls to high volcanic islands, such as Tahiti, fostered opportunities for transfer of long white dog hair from the atolls for various high-island resources from the Society Islands (Forster 1778: 366, quoted in Oliver 1974: 1148 n. 2). These occasions undoubtedly provided opportunities for the transfer of marriage partners, a vital addition to small communities with limited genetic diversity. In fact, future genetic studies of ancient human remains may document that the Tuamotus were more genetically diverse than the larger populations on the adjacent islands due to the diversity of traffic from the peripheral island groups. So while the Tuamotus were resource-poor, with low human populations and limited incentive for internal barter, exchange or trade, their centrally located position in East Polynesia was undoubtedly their greatest asset facilitating connections to distant external communities. Indeed, the Tuamotus were the most externally connected archipelago in East Polynesia and their geographic position was their greatest 'commodity'.

The Mangareva–Pitcairn group: sustainability only with connectivity

How do remote, isolated, and resource-poor communities survive without connecting to larger, resource-diverse communities that, in essence, provided a lifeline for survival? The two remote outposts of Henderson and Pitcairn islands, near the extreme southeast corner of Polynesia, provide the classic example of 'sustainability only with connectivity'; in this example with the volcanic island group of Mangareva, a three-day sail to the west.

This dispersed Pitcairn Group consists of four islands that are arguably the most remote and isolated in the world. They are situated 1,600 km west of Easter Island (Rapa Nui) and 400 km east of Mangareva (Figure 7.4.1). The 4.5 km^2 rugged and steep volcanic island of Pitcairn, the 36 km^2 raised limestone Henderson Island, and the two low coral atolls of Oeno and Ducie comprise the Pitcairn Group. Pitcairn, of course, was made famous by the *Bounty* mutineers

that arrived in 1795 only to exceed the island's carrying capacity some 40 years later. Indeed, the community was forced to relocate to Norfolk Island as the isolated Pitcairn community was no longer sustainable. The Pitcairn coastline is rocky and there are no developed reefs, so island-based fishing yields limited returns and prime agricultural land is solely rain-fed and found on sloping ground in the centre of the island. Archaeological surveys and limited excavations (Weisler 1995) document colonization during the thirteenth century. An overnight sail north from Pitcairn, Henderson Island is the classic 'desert island', with only small pockets of gardening soil and no fresh water aside from ceiling drips in caves after heavy rains. Typical of raised limestone islands, the reefs have sparse coral cover with narrow beaches fronting cliffs that, at Henderson, are a uniform ~30 m high around the island. Wave-cut notches, raised during the 300,000 year uplift history, provide numerous rockshelters that are concentrated on the north and east coasts (Weisler 1997c: figure 9.3). These locales were the primary habitation sites on the island, aside from one extensive north coastal midden, with residential features such as pavements and postmoulds. Excavations in 15 sites totalling ~42 m^2 yielded more than 150,000 bones (of mostly fish, bird, turtle and rat), shell midden, and local and imported artefacts. Some 31 radiocarbon age determinations bracket occupation from about the eleventh to seventeenth centuries. Oeno Atoll has limited prehistoric archaeological evidence, while Ducie Atoll has no archaeological sites. The diminutive islands of the Pitcairn Group had limited resources, but Pitcairn Island had the largest fine-grained basalt source in southeast Polynesia (used primarily for fashioning into adzes), with geochemical sourcing evidence that it was transferred to Henderson Island and Mangareva. It also had the most significant source of volcanic glass, with nodules in excess of 10 cm in diameter, for manufacturing into small sharp cutting tools, which have been found on Henderson. It seems likely that Green Sea Turtles (*Chelonia mydas*), that still nest on Henderson's east beach today, and the long feathers from the Red-tailed Tropicbird (*Phaethon lepturus*) may have been exchanged to Mangareva after these resources were depleted there (Steadman and Justice 1998).

Goldman categorized Mangareva as 'a small version of the Stratified society' (Goldman 1970: 150). Whereas economic surplus is often a hallmark used, in part, to explain the drivers of political evolution, Goldman avers that Mangareva exhibited the opposite situation; that is, 'the stimulus of economic scarcity' (1970: 150). The uneven distribution of resources, most notably arable lands were, at least during late prehistory, the focus of traditional rivalries between competing groups. This situation was key to understanding the development and then collapse of inter-archipelago connections (Weisler 2002). The islands of Mangareva surround a lagoon some 25 km across. The largest island, named after the archipelago, is 14 km^2 – more than half of the total land mass of the group. The six largest volcanic islands are steep sided, with one or more crescent-shaped embayments fronting narrow coastal flats that evidence prehistoric settlements consisting of households defined by stone pavements and terraces, dryland and irrigated gardening systems, middens and rockshelters (Weisler 1997c: figure 9.1). The earliest sites date to the eleventh to thirteenth centuries CE (Kirch *et al.* 2010: 78; Green and Weisler 2000, 2002). Aside from having the best agricultural soils and potable water sources in southeast Polynesia, the Mangareva lagoon has abundant stocks of Black-lipped pearlshell used to fashion a range of fish hooks, vegetable peelers and ornaments. Despite an archipelago-wide survey (Weisler 1996), sources of fine-grained basalt for manufacturing adzes and other cutting tools were not located. However, vesicular basalt for oven stones is plentiful and Mangareva was undoubtedly the source for the Pitcairn Group of all introduced commensal animals (pig, dog and rat), planting stock such as coconut, bananas, Giant swamp taro (*Cyrtosperma* sp.), candlenut (*Aleurites* sp.), the ornamental *Hibiscus*, and *Cordyline* whose long and broad leaves were used for bundling food parcels for earth oven cooking and whose roots provided a starch-rich food

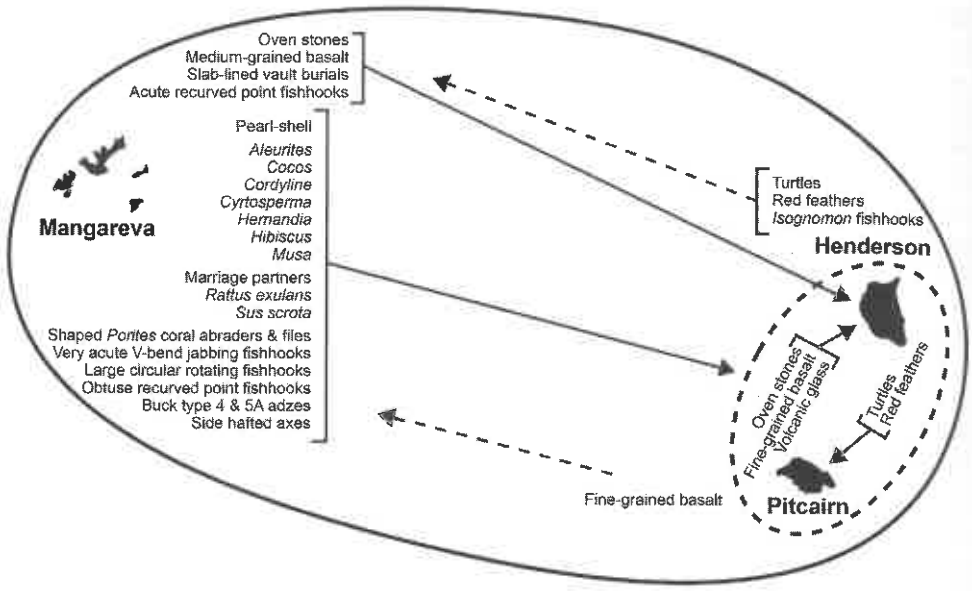

Figure 4.7.4 The Mangareva–Pitcairn interaction sphere (from Green and Weisler 2002)

when cooked. In summary, then, Mangareva was the source of commensal animals, cultigens and other economically useful plants, oven stones, pearlshell, and undoubtedly marriage partners to the resource-poor islands with small isolated communities that could, however, supply fine-grained basalt, volcanic glass and perhaps turtles and red feathers. Figure 4.7.4 illustrates the southeast Polynesian interaction sphere based on extensive excavations and detailed geochemical studies of artefacts (adze material, volcanic glass tools and oven stones) and geological sources (Weisler 1995; Weisler and Woodhead 1995; Woodhead and Weisler 1997).

Considering the radiocarbon dating corpus and distribution of imported artefacts on Henderson, island colonization is suggested by about the eleventh century CE, with the period of voyaging between Pitcairn and Henderson, and from the Pitcairn Group to Mangareva, continuing until 1450 CE. By the early 1400s, there is a decline of imported materials (especially artefacts made from Mangarevan pearlshell and Pitcairn fine-grained basalt and volcanic glass), signalling the end of external resources reaching the isolated communities in the Pitcairn Group with abandonment of Henderson (and probably Pitcairn) by the early 1600s. A lifeline provided by the circulation of vital external resources from resource-rich to resource-poor islands has also been documented for areas in Micronesia (Alkire 1965) and in the Mediterranean (Cherry 1985). In all examples, especially for the Pitcairn Group–Mangarevan interaction sphere described here, commodities (such as adzes and cultigens) and marriage partners were required to sustain isolated communities and the occasion provided the opportunity to circulate prestigious products (such as red feathers and perhaps turtle meat). In this latter regard, the isolated communities were not just on the receiving end. That is, they did supply resources that were depleted or extirpated from the parent group.

In the example of the Pitcairn Group–Mangareva interaction sphere, the isolated communities of the Pitcairn Group could only be sustained by repeated resourcing from the parent populations on Mangareva. This interaction sphere, at the margins of southeast Polynesia, was clearly

tied into the broader and more distant archipelagos of East Polynesia. There is archaeological evidence for Mangareva receiving stone adzes from the Society Islands and the Marquesas (Weisler and Green 2001). So it is likely that events taking place at these distant island groups eventually filtered back to the Pitcairn Group. For example, during late prehistory across East Polynesia, human populations were at their highest, marine resources (shellfish stocks, turtles and fish) and birds were universally depleted, and inter-social tension, status rivalry and aggression were on the rise. This is well documented archaeologically (Green and Weisler 2000; Kirch *et al.* 2015). In Mangareva during late prehistory food scarcities drove people to steal growing crops and rob breadfruit storage pits (the main staple), and there are even instances of fresh meat cannibalism and unearthing graves of newly buried corpses for food (Goldman 1970). In Mangareva, agricultural production and therefore arable land was at a premium since this was now the supreme expression of wealth (Buck 1938: 146; Goldman 1970: 150) and a major factor in competitions for status rivalry. Consequently, constructing 'expensive' voyaging canoes and resourcing their crews was no longer a priority. Indeed, it was risky to leave agricultural lands unprotected to engage in long-distance voyaging trips. The small human communities of the isolated, diminutive, and resource-poor islands of the Pitcairn Group were, indeed, part of this much larger global community of East Polynesia and events that took place even hundreds of kilometres distant had a decided, and in this example, negative effect on sustaining isolated landfalls at the margins of southeast Polynesia.

New Zealand – connectivity in isolation on a large continental island

Major differences between New Zealand and the tropical homeland provided opportunities for the new settlers, but also placed limitations on earlier lifeways. The most striking difference is geology; New Zealand is a continental land mass with highly variable landforms and a diversity of stone types. Tropical East Polynesian islands are volcanic and less geologically complex. New Zealand lies south of the tropical zone and, with a north–south orientation, spans climatic zones ranging from sub-tropical to sub-Antarctic. The tropical Polynesian horticultural system was unviable in New Zealand; only a few crop plants would grow in the colder climes and horticulture was effectively limited to the northern two-thirds of the country. Dogs were introduced, but pigs and fowl, two mainstays of the Polynesian domestic economy, were not. Offsetting these limitations, New Zealand supported a rich biomass of easily won meat resources and the hunting of sea mammals and birds (including the flightless Moa) quickly became an important part of the economy, alongside fishing and shellfish gathering.

Lying 3,000 km from the homeland, the most significant issue for the first colonists was isolation. Regular two-way voyaging between colony and homeland was unviable and the colonists could not rely on any sort of 'lifeline' to the parental community. Although the island(s) of departure are currently unknown, New Zealand was settled out of an active interaction zone spanning the southern Cook Islands, the Australs and perhaps the southwest Society Islands (Weisler 1997a). The actual date for New Zealand settlement has been hotly debated, but a consensus is now emerging around the view that the major colonization event occurred early in the fourteenth century CE (Walter *et al.* 2010). This period is remarkably well preserved and provides insight into colonization and the role of interaction. Although New Zealand was isolated from the tropics from first settlement, new networks of interaction evolved rapidly – rapidly enough to suggest that network behaviour was an integral part of the colonization process.

There are no archaeological sites dating earlier than 1300 CE, but by the mid-fourteenth century sites are found from the far north to the far south of the country. New Zealand was

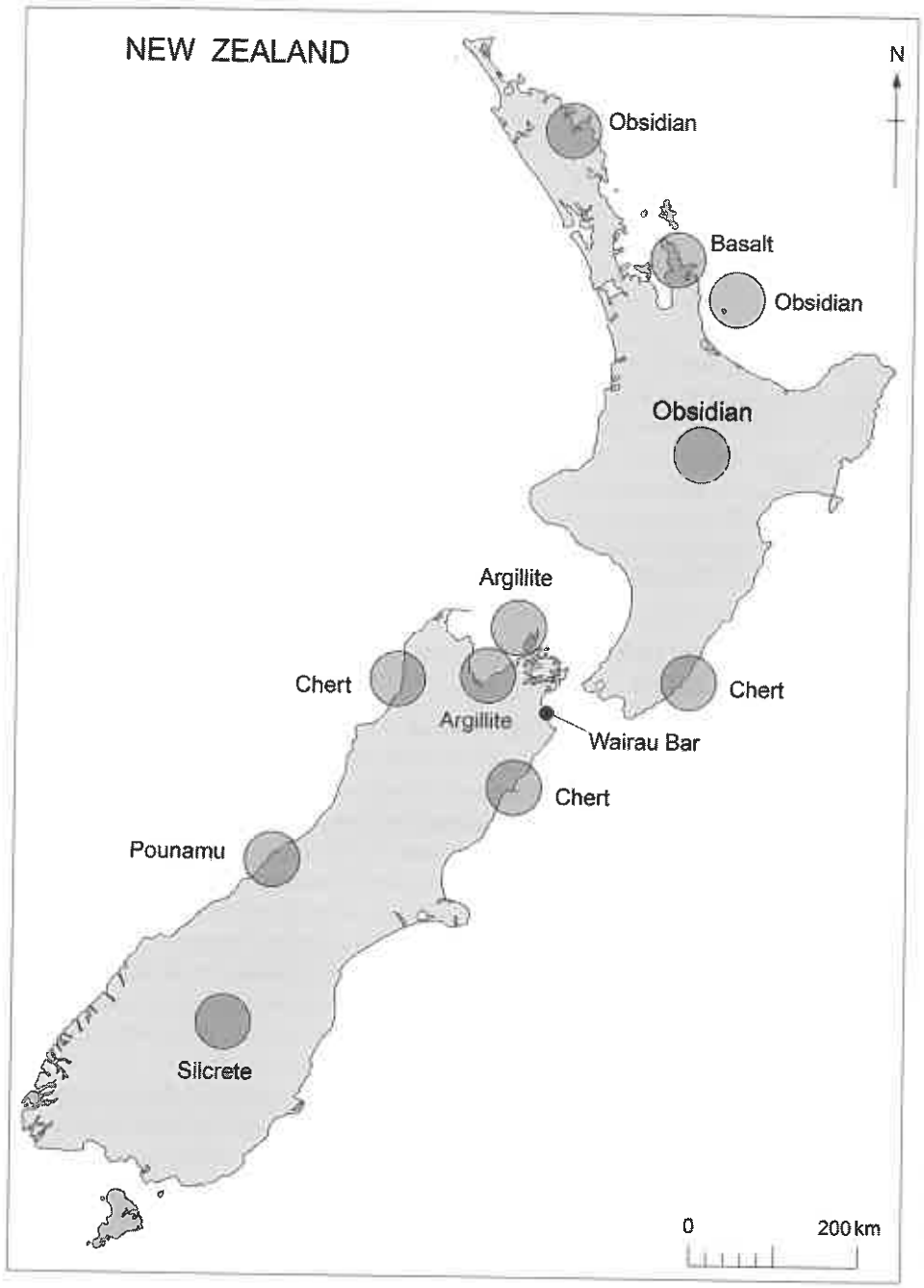

Figure 4.7.5 Source zones, distribution of Mayor Island obsidian and major adze stone in use by 1400 CE

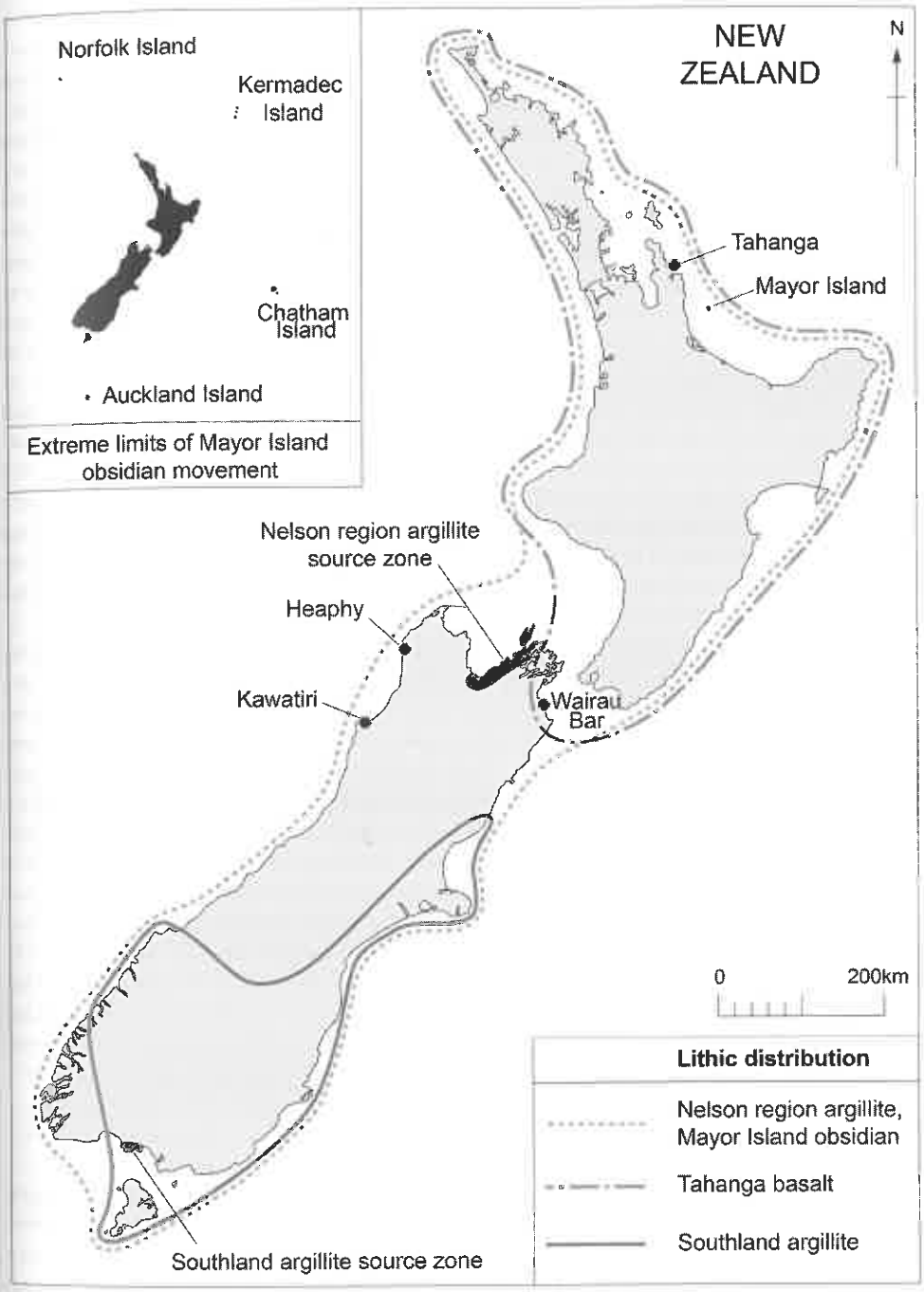

Figure 4.7.6 Geological origin of stone recovered from the Wairau Bar site (*c.*1320 CE)

not settled through a wave of expansion but by the establishment of multiple, small settlements sited in strategic locations around the country. Many of these communities would have been economically unviable as isolated settlements, but high levels of mobility during the fourteenth century led to the emergence of a communication and exchange network linking distant communities into a functioning collective. The evidence for this is found in the record of stone tool production and distribution.

In contrast to the patchy distribution of resources in the topics, New Zealand has a wide range of adze-grade stone including basalts, gabbros, greywackes, nephrites (*pounamu*) and argillites. All these types were discovered rapidly; in fact, exploration was so rapid that all major high-grade industrial sources appear to have been discovered before 1400 CE. Three sources of adze stone stand out as particularly important in the early period and the source location and archaeological distribution of stone from these sources in fourteenth-century sites is shown in Figure 4.7.5.

New Zealand is also rich in flakeable stone suitable for the production of smaller edged tools – a resource that is poorly represented in the tropics. These include obsidian, cherts, porcellanites, flints and silcretes. Obsidian, found in three North Island geological zones, is useful for tracing the development of interaction networks (Figure 4.7.6). The most important source was on Mayor Island and it was one of the most widely used of all New Zealand industrial stone sources. It is not only found in fourteenth-century sites all over the country; it has been identified in the earliest known sites in the Kermadecs, Norfolk Island, Auckland Islands and Chatham Islands (Walter *et al.* 2010: 503).

The best model of the colonization phase interaction network can be developed by examining a single site – Wairau Bar in the Marlborough region. Wairau Bar is a colonization phase site as early as any other site in the country. Figure 4.7.6 shows the location of lithic resources identified at Wairau Bar and demonstrates that despite its first-generation status, the occupants participated in a network that spanned the entire country.

The founding population of New Zealand, estimated at about 500 based on mtDNA variability (Whyte *et al.* 2005), grew and dispersed rapidly. The key mechanism for colonization was the development of an interaction network allowing settlements to be established in strategic, but marginal, locations. For example, many fourteenth-century sites were located in marginal zones, such as the southern and western coasts of the South Island that were effectively abandoned by the fifteenth century and remained so until European arrival. Sites like Heaphy and Kawatiri are like Henderson and Pitcairn: sustainable only with connectivity. That they were connected is evidenced by the rich and varied inventory of their stone tool sources, including obsidian from at least two of the three obsidian zones. The shortest path journey to Mayor Island from Kawatiri is 1,400 km.

Discussion

Interaction and exchange is so much a part of the fabric of Pacific life that they became the major focus of early ethnographic attention. In fact the birth and growth of anthropology as a discipline owes much to pioneering studies of Pacific exchange systems and the insights these provided into cultural processes (e.g. Malinowski 1922). The archaeological study of interaction depends on being able to identify transported objects and, in the near absence of pottery, in East Polynesia this means assigning stone tools to geological origin. Over the last three decades archaeologists have improved their 'sourcing' techniques and the spatial extent of prehistoric interaction networks has been reconstructed with increasing confidence. Despite technical advances, however, there has been little progress in understanding the role and origin of interaction.

Only some East Polynesia interaction networks exemplify the notion of 'complex connectivity' (see Clark this volume) as espoused by Jennings (2011, this volume), where interactions are intense, dense, and connected different regions (Knappett this volume). Yet much of the complexity we identified within East Polynesian 'interaction networks' has been obscured by the umbrella term 'interaction network'; a term that masks significant variation in form, function and the underlying drivers of interaction as documented in our four case studies.

The Cook Islands were probably the first group settled out of West Polynesia. They served first as a stepping stone into the more clustered islands of Central East Polynesia and then as a bridge between these two zones. While the Tuamotus certainly connected different regions, on present evidence these connections were not dense and intense (Knappett this volume) hallmarks of complex connectivity – and were solely involved in interaction because of their location – they had little or no resources of export value, but enough resources to be self-reliant. There was little economic reason to travel to the Tuamotus, but their location made them a navigational screen that captured any movement in the region – and no doubt they benefited from this. In contrast, the Mangareva–Pitcairn network was all about economic viability or survival. The small, impoverished and isolated islands of Henderson and Pitcairn were only viable when linked via an interaction network with the richer resources of Mangareva and, indeed, their combined fates were tied to social and economic processes across East Polynesia (Weisler 2002). In essence, the isolated Pitcairn communities were 'globally' connected where local integration was incorporated on the regional stage (Hodos 2010). New Zealand is the only place in East Polynesia that did not participate in inter-archipelago interaction networks. Yet the founding colonies deliberately reproduced the interaction systems of tropical East Polynesia as an instrument of colonization. While the New Zealand example 'illustrates complex connectivity' (Jennings 2011, this volume), there were no inter-archipelago connections; that is, connections to different regions or culturally distinct populations.

In teasing out the blanket concept of interaction, we have highlighted variability in East Polynesian systems. Yet East Polynesian interaction systems also shared certain elements such as a common pattern of an early period of widespread communication and interaction, followed by a contraction of interaction spheres, and changes in basic modes and materials of exchange. It is possible that our focus on the physical advantages offered by interaction behaviour misses the significance of other deep social or cultural drivers. In addition to exchange, interaction networks provide social services such as access to marriage partners of appropriate genealogical distance and participation in socially meaningful secular and sacred transactions (see also Knappett this volume). This must have been particularly important during the colonization phase. We also note the potential role of interaction (and voyaging behaviour more generally) in socio-political and religious contexts. In Melanesia, for example, power and prestige is frequently generated and transferred through successful participation in the interaction systems. As the case studies show, interaction and colonization are not entirely separate enterprises in East Polynesia, so if competition amongst ranking chiefs to dominate interaction networks was a factor of early East Polynesian society, this may go some way towards explaining colonization itself.

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