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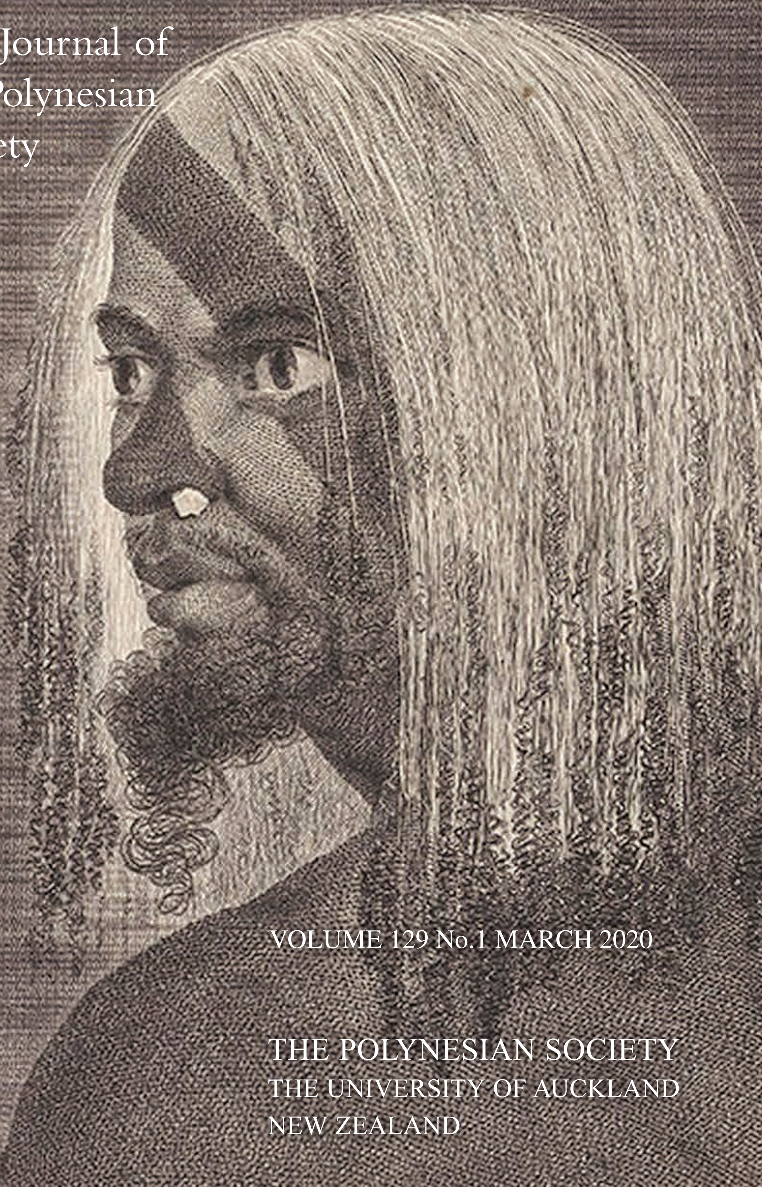

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Cover image: *Man of the Island of Tanna*, engraving by J. Basire after W. Hodges (Cook 1777: plate 26).

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Other Notes

Errata: In issue 128 (3) (September 2019) an incorrect price was listed for Richard Moyle's new book, *Ritual and Belief on Takū: Polynesian Religion in Practice* (Adelaide: Crawford House, 2018). The correct price is AU$39.00 (softcover).

Corrigendum: For noting, the Polynesian Outlier of Takū, located off the east coast of Bougainville, is under Papua New Guinean administration.

PANPIPES AND CLUBS: EARLY IMAGES OF TANNA ISLANDERS

LAMONT LINDSTROM
University of Tulsa

ABSTRACT: William Hodges, James Cook's artist on his second voyage, produced notably popular and influential drawings and paintings. These included several illustrations of Tanna Islanders (Vanuatu) that shaped European visions of the island from the 1770s through the 1830s, after which they were supplanted by Christian missionary depictions. Influenced by neoclassicist artistic convention, Hodges's engravings, which subsequently were much copied, commonly paired panpipes with clubs in islander hands. A chain of early engravings that feature panpipes and clubs reveals an initial heroic vision of natural island dignity, as both these accessories evoked European classical ideals. Although subsequent Christian and social evolutionary views later disavowed noble savage tropes, these persist in contemporary touristic appreciation of island musical talent and tradition.

Keywords: island imagery, William Hodges, music, panpipes, clubs, Tanna, Vanuatu

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James Cook and his second expeditionary crew were the first Europeans to land on Tanna Island (Vanuatu). The voyage also produced the first illustrations of the island and its inhabitants. HMS *Resolution* anchored from 5 to 20 August, in Tanna's best harbour, which Cook would name after his ship. Artist William Hodges was on board, along with naturalist Johann (John) Reinhold Forster and his son Georg (George), who came along to draw the specimens his father collected. Cook's first Pacific voyage had likewise included several artists and draughtsmen employed either by the Admiralty or by Joseph Banks, the enlightened dilettante who, along with his party of natural scientists and servants, had squeezed onto Cook's original ship, *Endeavour.*

Charts, paintings and prints from Cook's three expeditions both served naval and scientific interests and fed increasing popular curiosity about distant shores.[1] William Hodges, on the second voyage, produced notably popular and influential drawings and paintings. These included several illustrations of Tanna Islanders that shaped European visions of the island from the 1770s through the 1830s, after which they were supplanted by Christian missionary depictions. Influenced by neoclassicist artistic convention, Hodges's engravings, which subsequently were much copied, commonly paired panpipes with clubs in islander hands. Both these accessories evoked classical ideals. Although Christian and social evolutionary views later reworked earlier visions of nobly musical islanders, these persist and shape contemporary touristic appreciation of island musical talent and tradition.

Two previous expeditions before Cook's had chanced upon Vanuatu, but neither produced much graphic imagery or called at Tanna. Spanish/Portuguese navigator Pedro Fernández de Quirós sailed through the archipelago's northern islands in 1606, but his charts and several drawings the voyage produced remained secreted in Spanish and Church archives. Quirós's narrative remained unpublished until 1876 (Kelly 1966: 6). French explorer Louis-Antoine de Bougainville also passed through northern Vanuatu in 1768, a few years before Cook. This voyage generated fewer island images insofar as Bougainville "did not take a competent natural history draughtsman with him. His naturalist, Philibert Commerson, though well-trained and enthusiastic, possessed neither the patience nor the skills of a good scientific draughtsman" (Smith 1985: 7).

Art historian Bernard Smith concludes that "it was left therefore to Banks to establish the value in practice of taking skilled artists on scientific voyages and of collating verbal and visual observations" (1985: 7), and that "the appointment of naturalists and artists became thenceforth a normal feature of the organization of scientific voyages" (p. 54). When Banks declined to participate in Cook's second voyage following a dispute about space on board allotted to his scientific party, the Admiralty appointed William Hodges and Johann Forster (travelling with his son Georg) as voyage artist and naturalist (Hoare 1967). *Resolution* thus anchored at Tanna carrying a cargo of cannon and muskets but also inks, chalk, crayons and paints.

VIRTUAL GREEKS

Smith (1985, 1992; Joppien and Smith 1985) has cogently analysed the "European vision" that shaped the images of islands and islanders produced during Cook's three voyages. Smith explores tensions between the demands of emergent scientific illustration and the genre constraints of neoclassical representation, but also the effect of Pacific experience on these conventions. There was notably, in Cook's time, lively interest in classicism. Island visions were doubly influenced by Enlightenment attention to Europe's classical roots. Cook and other eighteenth-century voyagers who encountered Pacific Islanders at least occasionally presumed these to resemble ancient Greeks, although those in Cook's party were more inclined to perceive Hellenic echoes in Polynesian Tahiti and Tonga than they were later on Tanna. Second, by the later eighteenth century, neoclassicist artistic conventions dominated graphic representation. "The ancient Greeks were seen as noble and refined … and a model against which all other art should be measured" (Schneiderman 2014: 14; but see Campbell 1980). Even when Europeans encountered islanders who were clearly unbecoming of some classical ideal, they nonetheless drew on neoclassical conventions graphically to depict them.

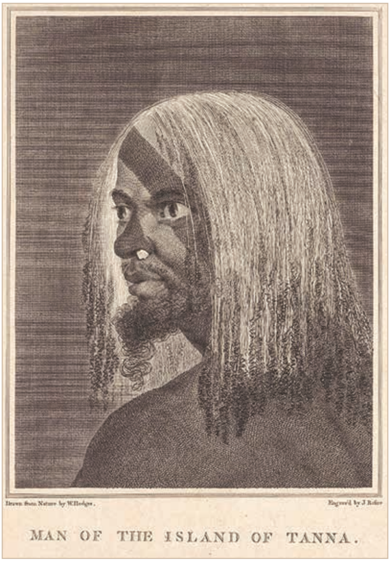
I draw on Smith to examine a series of depictions of Tannese men and women, based originally on William Hodges's work, and subsequently redrawn and republished from 1777 through the 1830s. Hodges studied under several London artists including Giovanni Battista Cipriani, and he was schooled in neoclassicist style. His artistic visions of Tannese men and women were for many years recycled and repurposed. In 1841, with illustrative remembrance of the death of missionary John Williams on Erromango, just north of Tanna, Hodges's nobler island views yielded to a second stream of Pacific imagery that occluded previous classical allusions. This drew on a new, Christian sort of European vision and also on developing social evolutionary theory wherein distant others were taken to be mere lowly savages needing tutoring and salvation.

During his two weeks on Tanna in 1774, Hodges wandered about Port Resolution's shores sketching people and the landscape. Back home in Britain, he drew on these sketches to create oil paintings and drawings, several of these reproduced as engravings in Cook's 1777 published journal of the voyage, and then subsequently copied and modified elsewhere. Hodges's artistic sensibilities are evident in his work. Despite marked as "Drawn from Nature", for example, his *Man of the Island of Tanna* and *Woman of the Island of Tanna* evoke classical prototypes (Figs 1 and 2; see Jolly 1992: 347–48; 2009: 82).

Whoever (perhaps engraver George Noble) subsequently redrew these portraits for George William Anderson's (1784–1786) serial retelling of Cook's voyages made Hodges's Tanna man and woman appear even more classically European (Schneiderman 2014: 2) (Fig. 3).[2]

Hodges's landscape *View in the Island of Tanna* also displays similar artistic tension between the "grand style versus the topographic" (Joppien and Smith 1985: 92). This features a family group in a pastoral landscape (Fig. 4). As in his *The Landing on Erramanga*, Hodges here "adopted classic poses, such as the *Discobolos* and the *Borghese Gladiator*, to portray the islands" (pp. 94–95; see Guest 1989: 43). The foregrounded man, for example, in contrapposto and surrounded by women with children, leans on a huge club.

Printed versions of Hodges's work, to be fair, depended on the work of journeyman engravers such as William Wollett, James Basire (or possibly his apprentice William Blake) and John Keyse Sherwin. These London artists drew upon their own artistic conventions to transform field drawing and studio painting into engraving. As Smith concluded, "the canons of taste operated powerfully to transform the field studies into acceptable imagery" (1992: 179). The neoclassicist artistic canons of the time ennobled both islanders and Oceanic landscapes, rendering these accessible to contemporary consumers.



Figures 1 and 2. *Man of the Island of Tanna*; *Woman of the Island of Tanna*, engravings by J. Basire after W. Hodges (Cook 1777: plates 26, 45).

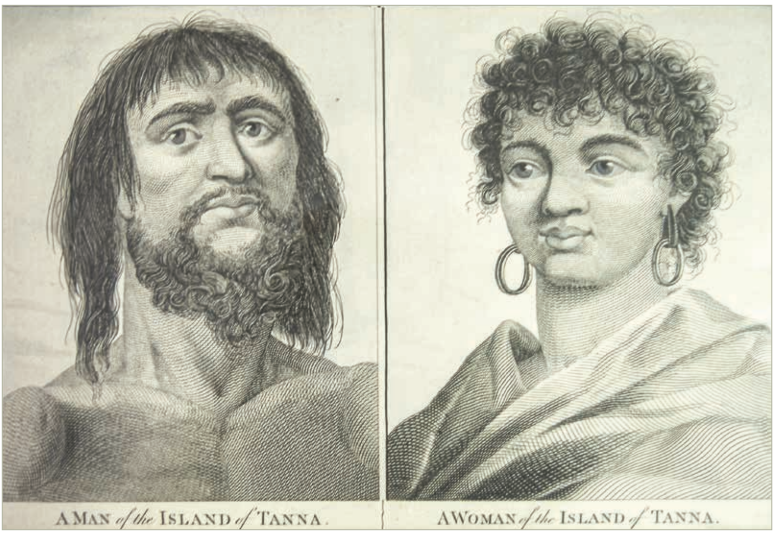


Figure 3. *Man of the Island of Tanna*/*Woman of the Island of Tanna* in Anderson (1784–1786).

Figure 4. *View in the Island of Tanna*, engraving by W. Woollett after William Hodges (Cook 1777: plate 29).

PANPIPES AND CLUBS

We might note emblematic material objects that Hodges and his copyists chose to include in their island portraits and views. Derivational island portraits would focus mainly on native clothing and "exotic facial ornaments" (Anderson 2017; Morrell 2010: 70), but artists also placed stereotypical objects in Tannese hands—notably panpipes and clubs.

Clubs were the more obvious artistic choice. Narrative description and accompanying graphic representation of weaponry within voyage journals and chronicles reflected the Admiralty's strategic concerns. Cook's instructions during his first voyage directed him "to observe the Genius, Temper, Disposition and Number of the Natives" (Smith 1985: 16), and he and the scientists on board all took notes about the relative friendliness or bellicosity of islanders the voyagers encountered across the Pacific, including calculation of the quality of their weaponry (Jolly 1992: 338). These strategic and ethnographic interests shaped second-voyage attentiveness as well. Cook, the Forsters and other voyage chroniclers all described a variety of clubs, spears, bows and arrows, slings and other armaments as *Resolution* crossed the Pacific.[3] Cook (1961: 506–7) dedicated a couple of pages to Tanna weaponry in his published journal. Hodges (and his engraver, J.K. Sherwin) depicted several upraised Tannese clubs and spears in *The Landing at Tanna, One of the New Hebrides* (Cook 1777: plate 59), and also muskets in the hands of Cook's marines. Johann Forster produced a rough sketch of five Tanna clubs with accompanying descriptions (Hoare 1982: 625, also fig. 37; Joppien and Smith 1985: 233). All who could, moreover, including many ordinary seamen, avidly collected whatever curiosities that islanders could be enticed to hand over. Clubs, spears, bows and arrows were among the most common of these.

The club, for Hodges and his copyists, signified accepted aspects of islander character and "temper" and also graphically illustrated frequent conflict and other nervous encounters reported in voyage chronicles. Observations of island clubs and other simple weaponry also spurred classical associations. Cook quoted his astronomer, William Wales, on Tannese expertise with spears. When Wales saw "what these people can do with their wooden ones", he was convinced of Homer's accounts of heroic feats (Cook 1961: 507). If Hodges's clubs suggested islanders' possibly violent character, his art ennobled their ferocity.

But what about panpipes? If clubs signalled an essential native wariness and occasional although heroic belligerence, panpipes implied pastoral idylls, evoking haunting tones that enlivened romanticised landscapes. Vanuatu's musicians fabricate a range of instruments including bamboo flutes, rattles, shell trumpets and the large carved slit drums famous in the north-central part of the archipelago. Cook and crew, however, had little chance to collect examples of these during *Resolution*'s short anchorages off Malakula, Erromango or Espiritu Santo. Only panpipes became a recurrent musical motif in voyage imagery.

The British arrived with a general interest in music (Andersen 1932). Both the Royal Society and the Admiralty advised Cook to employ music to soothe and create rapport with islanders during first encounters (Agnew 2001: 6). *Resolution*'s bagpipers, pipers and fiddlers performed at several of the ship's ports of call. Voyage chroniclers, moreover, appreciated island music "relative to its context, but also imposed their own interpretive criteria, resulting in a hierarchical ordering of not only indigenous musical traditions, but of the islanders themselves" (p. 18). Within this Oceanic musical appraisal Tanna finished well, at least according the critical ear of Georg Forster.

Voyage gentlemen, artists and scientists would have been schooled in musical appreciation, but Georg Forster's particular attention to music also may have been encouraged by his friendship with young James Burney. Burney, son of English musicologist and church organist Charles Burney, served as a lieutenant on *Adventure*, the expedition's second ship (Irving 2005: 208). The Forsters, Cook and the crew enthusiastically collected musical instruments, as they did weaponry, as exotic curiosities, including Tahitian nose flutes and Māori "trumpets" (p. 207). Back in Britain, these instruments invited scholarly interest: "One of the earliest articles on Polynesian instruments [collected during Cook's first voyage] described music systems of two Tongan panpipes and a Tahitian nose flute" (Kaeppler 1978: 57; see Steele 1775).

On Tanna, Georg Forster, along with fellow voyage naturalist Anders Sparrman, swapped songs with Port Resolution villagers. Forster wrote:

> As I happened to hum a song, many of them very eagerly intreated me to sing to them, and though not one of us was properly acquainted with music, yet we ventured to gratify their curiosity, and in fact, offered them a great variety of airs. Some German and English songs, especially of the more lively kind, pleased them very much; but Dr. Sparrman's Swedish tunes gained universal applause … When we had performed, we desired them in return to give us an opportunity of admiring their talents, and one of them immediately began a very simple tune; it was however harmonious, and, as far as we could judge, superior to the music of all the nations in the tropical part of the South Sea, which we had hitherto heard. (Forster 2000: 534–35; see also Agnew 2001: 15)

Passing time with Forster, the Tannese had with them at least one panpipe: "Our friendly natives likewise produced a musical instrument, which consisted of eight reeds, like the syrinx of Tonga-Tabboo, with this difference, that the reeds regularly decreased in size, and comprehended an octave, though the single reeds were not perfectly in tune" (Forster 2000: 535).[4] This instrument, or another like it, was carried back to *Resolution* as it features in an engraving produced to illustrate Cook's 1777 voyage account. This engraving, *Weapons, &c at Mallicolo and Tanna*, featured the "musical reeds" alongside a Tanna club (and also a bow, arrow and nose ornament), a material arrangement suggesting the evident salience of both island weapons and music—clubs and panpipes—within European visions of islanders (Fig. 5; Andersen 1932: 23).

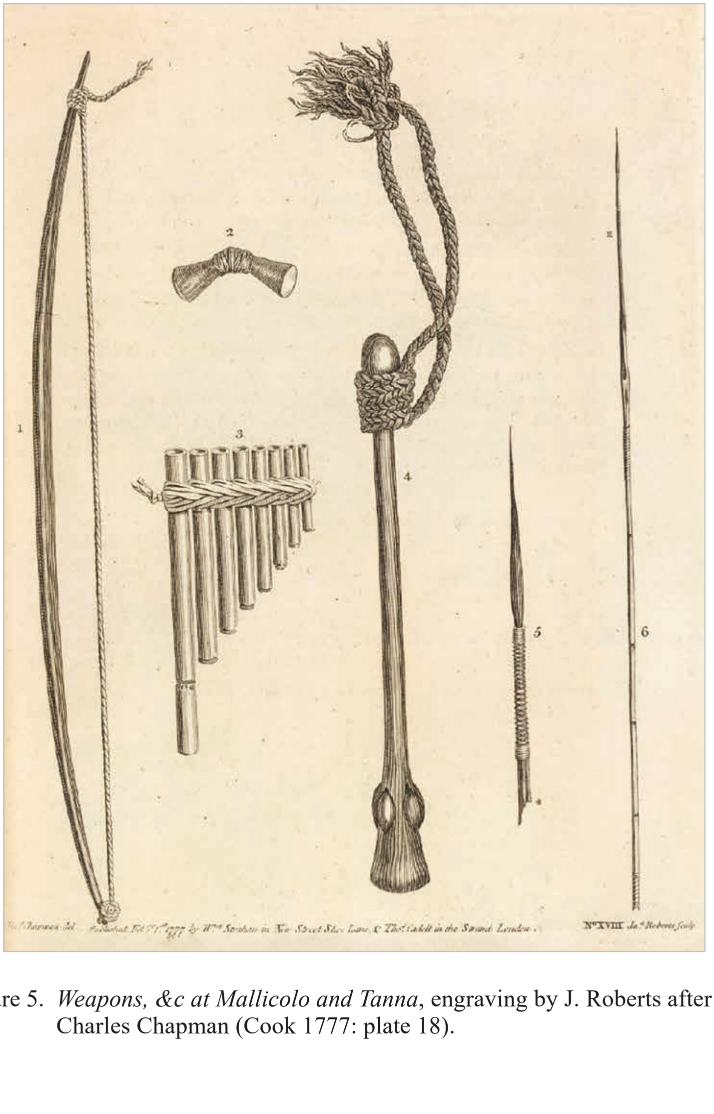


Figure 5. *Weapons, &c at Mallicolo and Tanna*, engraving by J. Roberts after Charles Chapman (Cook 1777: plate 18).

Resolution's officers and scientists with a least a passing classical education also would have understood panpipes' bucolic associations, if not the details of Ovid's *Metamorphoses* origin story of the virginal nymph Syrinx who, when chased by lusty Pan, transformed into river reeds, which Pan transformed into pipes so that he could play her, one way or another. Although similar reed, bamboo or bone wind instruments have been found in China, Southeast Asia, India, Africa, Egypt, Turkey, the Americas, Tonga and elsewhere in Melanesia (Kaeppler 1974; Zemp 1981), bundled or rafted pipes specifically evoked Pan and classical roots. Panpipes signalled pastoral harmonies, Arcadian climes inhabited by men imbued with better natures or essential sagacity, or both. Papageno, in Mozart's 1791 *Magic Flute*, comes on stage with panpipes and stage props that present him "as a spontaneous man at one with organic nature … From an Enlightenment perspective, his structure can readily be imagined as part of a natural order, accessible to all, without the intervention of culture or reflection, and grounded on a natural condition of reason" (Subotnik 1991: 134; see also Cole 2005: 4).

Panpipes had echoed classical ideals since the Renaissance. The frontispiece of a 1532 edition of the *Aeneid*, for example, featured poet Virgil holding a large syrinx (Miziolek 1999: 98). Virgil's *Eclogues* "paved the way for the Arcadian myth" (p. 99), a vision that, "with the herdsmen singing and playing syrinx, became one of the *topoi* ['motifs'] of European culture" (p. 104). This topoi shaped European visions of the peoples that Cook and party encountered in the Pacific. "The Greek revival in Europe", Smith notes, "is conveniently contemporaneous with the European pre-colonisation period in the Pacific" (1992: 213).

Smith suggests that European visions of noble savages in the Pacific quickly eroded after 1795 (1985: 174), replaced by more invidious representations. Nonetheless, Cook voyage chronicles and Hodges's graphics continued to influence subsequent visions of islanders for several decades. Subsequent voyagers, for example, coming to Tanna after Cook likewise were pleased to obtain panpipes as well as the island's bellicose clubs and spears. Russian explorer Vasily Mikhailovich Golovnin arrived next in July 1809, his ship *Diana* mooring in Port Resolution for a few days (Barratt 1990). Golovnin had on board a copy of Georg Forster's *A Voyage Round the World*, which directed his observations. He, too, described island panpipes and clubs, appreciating in particular the latter: "The best work of the Tannese is undoubtedly their clubs which, even though made of extremely hard wood, are well finished" (p. 69). Alongside clubs, he reported, the Tannese "also have a variety of musical instruments consisting of four, six, or eight pieces of reed, bound together in order of length … The pipes are moved along the lips and, as the player blows, an awkward whistling is produced" (p. 69). Golovnin traded for a few examples. Like the Forsters, he also collected Nafe language words (pp. 70–72), including *nep* 'club' and, for 'panpipes', *nau*—close enough to today's term *tarhei nau* 'series of bamboo' in the Nafe (Kwamera) language spoken around Port Resolution.[5]

After *Diana* sailed away in 1809, numbers of sandalwooders, traders and whalers refreshed at Port Resolution in the 1820s and 1830s, but few of these visitors generated much ethnographic description or graphic imagery. Traffic increased in the 1840s thanks to the murder of London Missionary Society luminary John Williams on Erromango in 1839. Williams left Sāmoan teachers at Port Resolution the day before he died and, capitalising on his murder, the Society sent two British missionaries to Tanna in 1842. George Turner and Henry Nisbet endured six months of increasing hostility at Port Resolution before fleeing in January 1843. Turner, in later years, published his memoirs including his ethnographic observations (1861, 1884). In these, he too noted Tanna's "clubs, bows and arrows, and spears" (1861: 81) and also its "Pandean pipe, with seven or eight reed pipes, varying in length" (1884: 312).

Hodges's views of Tanna and their subsequent modifications and reuses dominated the graphic marketplace until the 1830s, even while notions of Greeks-in-the-Pacific and/or noble savages were evaporating. Cook voyage illustrations proved immediately popular, available for purchase at Strahan and Cadell (later W. and A. Strahan), London, publishers of all three Cook voyage accounts (Hawkesworth 1773). Those living outside the city or who couldn't afford the official prints enjoyed reworked variations of Hodges's images featured in a number of contemporary magazines (*The Gentleman's Magazine*, *The London Magazine*, *The Universal Magazine of Knowledge and Pleasure*, *The Lady's Magazine*, among others). They also found these in cheaper abridged accounts of Cook's voyages and in popular "universal geographies", although imagery from the first and third voyages proved more popular than that from the second (Anderson 2017; Morrell 2010).

In France and elsewhere in Europe, Hodges's work was similarly recycled and repurposed, notably in "costume" books that depicted ethnic types from around the world. By the mid-eighteenth century, *costume* had come to mean "both clothing and custom" (Morrell 2010: 18–19). Creators of these compendia offered exaggerated claims "in title pages or prefaces that their books contained new material and original work", but "what is striking is the longevity of some images and their apparent resistance to new information" (p. 98). Jacques Grasset de Saint-Sauveur, an occasional diplomat and prolific author, born in Montréal, was one of the first to publish redrawn Hodges imagery, including portraits of a Tanna man and woman in several collections (see Collins 1984). In Grasset de Saint-Sauveur's 1796 *Encyclopédie des Voyages*, J. Laroque's engravings of a Tanna man and woman appear as separate portraits (Figs 6 and 7). They appear again in his 1806 *Voyages Pittoresques dans les Quatre Parties du Monde,* standing together under a coconut palm in a single, somewhat reworked print.

Grasset de Saint-Sauveur, or perhaps his ghostwriter, Jean-François Cornu, composed a Tanna précis that celebrated the island's happiness, hospitality and generosity, along with its rich soils and beautiful nature. The author, who listed island weaponry (clubs, bows, spears) and also precious panpipes, clearly consulted Georg Forster's account, which was the only one to describe the latter: "These people passionately love music, and please themselves constantly with song; their musical instruments are the same as at Tahiti; but they have one, composed of eight reeds, that they cherish above all others. Their melody is very agreeable; they gather under the trees, and create delicious concerts" (Grasset de Saint-Sauveur 1796: 4 [Tanna section], my translation).

Like sampled voyage texts, Grasset de Saint-Sauveur or his engraver Jacques Laroque blended several elements from Hodges's originals to create derivative illustrations, as Morrell has noted:

> Saint-Sauveur borrows fragments from various sources—while a number of the voyage images were only head and shoulders portraits, Saint-Sauveur either makes up a body or adapts one from a general scene. For example, the heads of Saint-Sauveur's *Homme et Femme de l'Isle de Tanna (Man and Woman of Tanna)* ... are based on engravings of two of William Hodges's head-and-shoulder portraits [Figs 1 and 2 above], but some of the full-body elements are taken from a group of people in *View in the Island of Tanna* after Hodges. (Morrell 2010: 52; see Morrell 2012)

The Tanna man, leaning on his gigantic club (Fig. 6), echoes the contrapposto standing figure in Hodges's *View* (Fig. 4). Grasset de Saint-Sauveur also augmented Hodges's originals, placing panpipes in the woman's hand, although Georg Forster's account indicated that these were played by men (Forster 2000: 535). He read Forster's panpipes anecdote, he found their engraved image in Cook (1777) and he transformed Hodges's portrait into a musical Tanna woman.

Grasset de Saint-Sauveur's brandished panpipes continued to feature in subsequent island imagery. They appeared again in Jean-Gabriel Charvet's celebrated 1804 *papier peint* wallpaper, *Sauvages de la Mer Pacifique* (strip seven) (Morrell 2010: 62). Tanna man and woman here are seated together, panpipes dangling from her hand while the man's club lies between his legs. Smoke rises from a volcano, probably Tanna's Iasur, in adjacent strip eight. Panpipes and club appear again, more elegantly drawn, in an 1803 Dutch geographic encyclopaedia, *De Mensch, Zoo Als hij Voorkomt op den Bekenden Aardbol* (The Human Being as He Appears on the Known Globe) (Stuart 1803; see Morrell 2010: 67). The man, in this, has retrieved and plays the panpipes, with the club now in his left hand and a bow over his shoulder. The woman regains a child, as in Hodges (Figs 2 and 4), and

Figure 6. *Homme de l'Isle de Tanna*, J. Grasset de Saint-Sauveur (1796).

has picked up a basket. Iasur volcano continues conspicuously to erupt in the background. But, in the engraving's caption, the two figures represent all of the Nieuwe Hebriden, not just Tanna (Fig. 8). The burdened woman coming along behind, who lugs both basket and child, would remain a trope in subsequent mission imagery of islanders.

Panpipes jump back into the woman's hand in an 1818 print from an inexpensively produced British costume book written principally for women. This offered "beautifully coloured" man and woman portraits from around the

Figure 7. *Femme de l'Isle de Tanna*, J. Grasset de Saint-Sauveur (1796).

world (Fig. 9) (Venning 1818: facing p. 140). Although the background has been reworked, this image, too, clearly derives from Hodges via Grasset de Saint-Sauveur, as the two figures stand next to a coconut palm and the man (here wearing a turban) leans again on his enormous club.

Nature, even in this elementary reproduction, is yet idyllic and the couple's stance is contrapposto and heroic, or at least their melodious panpipes continue to counterbalance the worrisome club. Twenty years later, however, when missionary imagery of Tanna began to circulate, European visions had

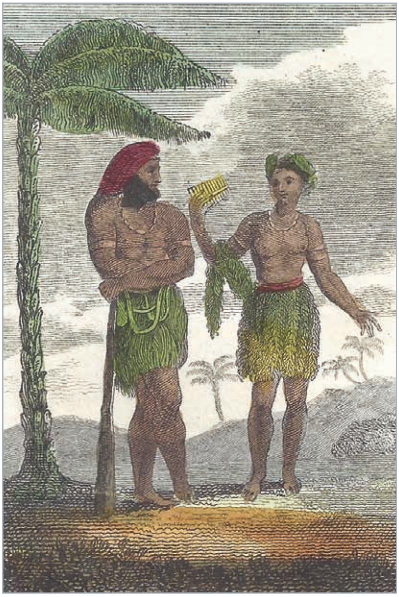


Figure 8. (left) *Nieuwe Hebriden*, engraved by Louis Portman after Jacques Kuyper (Stuart 1803: facing p. 100).

Figure 9. (right) *Man & Woman of the Isle of Tanna* (Venning 1818: facing p. 140).

changed. Clubs and other weaponry remained while panpipes disappeared. Their sweet, classical harmonies would shade the Christian message. London artist George Baxter's 1841 coloured oil print *The Reception of the Rev. J. Williams, at Tanna, in the South Seas, the Day Before He Was Massacred* (Fig. 10), for example, foregrounded a man with a notable club, with plenty of spears rising up behind. Its companion piece, *Massacre of the Lamented Missionary The Rev. J. Williams, and Mr. Harris,* featured even larger and more vigorously wielded clubs.

Mission propaganda liked to play up the cruel dangers that bravely intrepid missionaries who wandered the Pacific might encounter. It would for years circulate darkness versus light, pre- and post-conversion imagery in which the gospel improved and civilised (Lindstrom 2016; Smith 1985: 318). Saved islanders laid down their clubs for garden tools and hymnals. Nineteenth-century Presbyterian missionaries who came to Tanna enthusiastically cultivated hymn singing among new converts, but would

Figure 10. *The Reception of the Rev. J. Williams, at Tanna, in the South Seas, the Day Before He Was Massacred*, George Baxter, 1841.

have disapproved of panpipe music's associations with ancestor spirits. Clubs resonated differently. Although Christian imagery, like Hodges, favoured island family groupings and mothers with child, men in mission iconography continued to display significant weaponry, as in one Tanna family depiction (*Natives of Tanna*) that illustrated George Turner's mission memoir (Fig. 11) (Turner 1861: 76). In addition to his club, father comes heavily armed with a spear and a slingshot tucked into his coconut armband. Mother, though, has lost the panpipes.

Also by the 1840s, pre-Darwinian evolutionary discourse paralleled Christian rejection of onetime romantic, if unsaved, savages and unbedevilled, bountiful island environments. Racial hierarchies that presumed different levels of civilisation solidified during the first half of the nineteenth century. Racial and cultural categories that discriminated Polynesians from southwest Pacific Melanesians emerged in the 1820s (Douglas 2008: 716–17; see Jolly 1992: 334). Cook, Hodges, the Forsters and others on Tanna in 1774 made few invidious racial distinctions between islanders they met at Port Resolution and others they had previously encountered in Tahiti, Tonga, Cook Islands or New Zealand—especially since some of those they met at Port Resolution came from neighbouring Futuna, a Polynesian-speaking Outlier.

Solidifying nineteenth-century theories of human progress, however, eventually "greatly sharpened the antithesis between savagery and civilization" and, within these, "savages were nevertheless generally conceived

Figure 11. *Natives of Tanna*, engraved by William Dickes (Turner 1861: 76).

in negative terms by progressionists and degenerationists alike" (Stocking 1987: 36; see Morrell 2010: 93). Once noble, Greek-like savages reappeared as simply savage. The 1841 *Nouvelle Bibliothèque des Voyages Anciens et Modernes*, which included an abridged French translation of Cook's account, offered a novel Tanna image (Duménil 1841, after p. 167).[6] Rather than Tanna man or woman, this depicts *Naturels de l'Ile Tanna.* Two of these *naturels*, more huddled in the background, hold a clutch of fish and a simple spear (Fig. 12). Panpipes and even clubs have vanished. Virtual Greek becomes virtual ape.

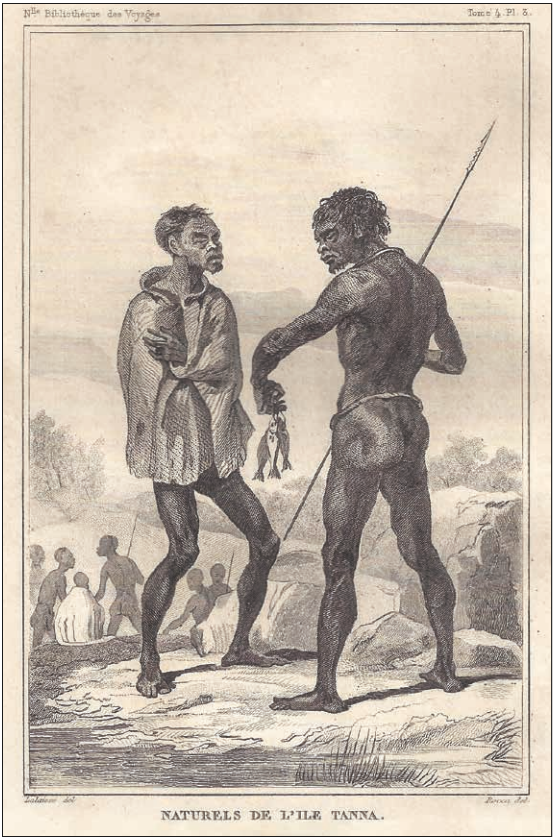


Figure 12. *Naturels de l'Ile Tanna*, engraved by M. de Rocca after François Lalaisse (Duménil 1841, vol. 4, plate 3).

MUSICAL NATURES

The Tanna island visions that Hodges and his copyists produced have long ago morphed into more complicated constructions. The panpipe and the club, musicality and violence, dominated European visions of Tanna from Cook's stopover at Port Resolution in 1774 through the 1830s. Classical allusions after these years evaporated as social evolutionary theory displaced eighteenth-century tropes of noble savagery. Missionaries, beginning in the 1840s, overdrew panpipe imagery in novel portrayals of islanders, often grouped in nuclear families, in dire need of salvation. Today's island imagery (e.g., in postcards and tourist brochures) depicts neither panpipes nor clubs. Instead, it features gorgeous nature, the fiery Iasur volcano, fascinating customs of dance and dress, and friendly people.[7]

Although panpipes and clubs long ago disappeared from island depictions, Hodges's initial Arcadian topoi have bled into contemporary views, at least on some infrastructural level. Common presumptions that simpler, often darker, peoples possess natural rhythm and inherent musicality have significant economic value. Today's visitors may be unschooled in the expeditionary engravings of Hodges and his copyists, but presumptions of island musicality persist. Vanuatu's Office of Tourism boasts that "music surrounds our islands like the ocean" (https://vanuatu.travel/en/experience/artists). If few tourists come to Tanna hoping to hear faint whistlings of island panpipes, many do expect to watch and photograph island dance festivals (Lindstrom 2015). Port Vila's annual Fest'Napuan music festival attracts an enthusiastic audience of locals and tourists. Up in the Solomon Islands, remarkable panpipe orchestras entertain tourists booked into Honiara's hotels (https://www.visitsolomons.com.sb/about-the-solomon/music-art/). And, elsewhere in Vanuatu, tourist promoters eye the attractive possibilities of Banks Islands women's "water music" as a touristic sensation (Dick 2014). Naturally musical islanders are with us still.

On Tanna, unlike clubs, the manufacture of which is only occasional, young men and boys continue to make and play tarhei nau.[8] They lace together, with pandanus fibre, a set of graduated segments of bamboo, usually seven or eight of these according to the maker's whim, in several different styles (Ammann 2012: 93–96). Panpipes come and go in flushes. Forgotten and laid aside for months or years, something will spark a revival, and one newly made example will trigger desire for many more. Young men puff out their own compositions or rehearse songs that community groups have performed previously during *nupu* circle dances or during occasional regional *nakwiari* exchanges of dance, pigs and kava. Panpipe performance is casual and others tend not to sing along. Instead, pipers entertain village audiences, or sometimes only themselves while walking alone down island roads and trails. A few islanders also make and play flutes (*kwataratara*), constructed from a longer and wider single segment of bamboo.

* * *

Panpipes continue to feature in islanders' own visions, as they once did in European, although these differ from Hodges's and Grasset de Saint-Sauveur's classical fancies. Rather, panpipes on Tanna adumbrate a community's tuneful repertoires and spiritual presence. The plaintive tones of bamboo flutes and panpipes impel ancestral spirits to attend and listen. "The main function of panpipe music", reports musicologist R. Ammann, "lies in its power to help the yam grow. In the interior of Tanna the panpipes are therefore only played during the months when the yam is growing in the garden: from April to July and during the planting season from July to November" (2012: 94).[9] The annual yam harvest at Port Resolution runs these days between March and June, while preparing fields, constructing yam mounds and planting seed yams occurs in August and September before the rainy season arrives. Georg Forster's Tanna friends, in August 1774, might indeed have been puffing their panpipes to entice ancestral spirits to protect and nurture newly planted yams. Or, as Ammann also notes, "a second function is to send courting messages to an admired girl" (p. 94). And certainly also to entertain and cultivate new friends, even strange visitors from overseas who come ashore with persistent musical visions that continue to echo and resonate within island encounters.

ACKNOWLEDGEMENTS

I thank the *Journal*'s anonymous reviewers and art historians Kirsten Olds and Prue Ahrens for helpful comment, and friends on Tanna for sharing panpipes and their tunes (although no clubs) with me.

NOTES

1. For recent retellings of Cook's voyages, see Salmond (2003), Thomas (2004) and Douglas (2008).
2. Schneiderman suggests that George William Anderson was likely a pseudonym, a ploy that publisher Alexander Hogg "employed in a number of his publications in order to endow these inexpensive serials with an aura of authoritative knowledge" (2014: 2). Three portraits that Hodges made of Tannese men survive. One drawing, in red chalk and pencil, was a pre-engraving study for *Man of the Island of Tanna* (Fig. 1). A second in charcoal, and a third in red chalk, depict island men in a less classically informed, more naturalistic style (Joppien and Smith 1985: 96–97, 229–30).
3. On Tanna, spears were actually javelins or darts in that men threw these more than they used them to stab some adversary.
4. Only Georg Forster described Tanna panpipes; other voyage journalists—including his father, Johann, Cook, Anders Sparrman, William Wales, and John Marra—did not remark panpipes in their accounts of *Resolution*'s layover in the harbour.

5. *Nau* also means ‘knife’ and the ‘bamboo’ from which knives once were made; a stalk of bamboo is *teki nau* ‘skin of bamboo’. Two centuries later, Golovnin’s word list (1990: 70–71), although rudimentary and including several terms from Futuna-Aniwa, the language of Tanna’s Polynesian-speaking neighbours, is remarkably accurate.
6. Although the title pages list P. Duménil as the compendium’s editor, Charles-Edmond Duponchel wrote, translated or otherwise contributed to the volumes’ text.
7. We can only guess what implements, beyond panpipes and clubs, eighteenth- and nineteenth-century islanders might have chosen to portray themselves. Many contemporary Tanna selfies posted on Facebook include family members, garden and food items and kava cups and bowls.
8. Islanders do make several sorts of dance implements, which men flourish during *nakwiari* dance festivals, but these differ from traditional island club types.
9. Ammann misattributes Georg Forster’s panpipes anecdote to his father Johann.

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THE ARCHAEOLOGY OF MĀORI SETTLEMENT AND PĀ ON PŌNUI ISLAND, INNER HAURAKI GULF, AD 1400–1800

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ABSTRACT: This paper describes previously unreported archaeological work on Pōnui Island, New Zealand. Coastal sites date from the end of the fourteenth century AD, and one, S11/20, has evidence for surface structures, cooking, and tool manufacture and use. The harvesting of marine resources and horticulture were involved from the beginning. Earthwork defenses were built at 23 sites between AD 1500 and 1800. At least six of these fortified sites (pā) were later refortified and some were residential. In this study two sites were excavated at Motunau Bay: one was S11/20, an Archaic site previously excavated in the 1950s, and the other was S11/21, a fortified site. Radiocarbon dates are reported from five further undefended coastal sites and from the earthwork defences of 19 pā, which reveal chronological and spatial trends in their construction. On Pōnui the archaeological signature of the fifteenth century was what New Zealand archaeologists typically call early or Archaic, but in the sixteenth century it became Classic. The transition in the settlement evidence appears abrupt; however, the tempo of change more likely varied in material culture and the economy, and possible changes in land tenure and social organisation are suggested.

Keywords: Pōnui Island, Māori, New Zealand archaeology, Hauraki Gulf, pā ‘fortified sites’, settlement pattern

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There is extensive archaeological evidence of Māori settlement on the islands of the inner Hauraki Gulf and a long history of fieldwork there. This paper describes previously unreported work on Pōnui, which is the easternmost island of the inner gulf 30 km east of Auckland (Fig. 1). Archaeologically the island can be regarded as a discrete sample or microcosm of some of the landscapes of the northeast coast of New Zealand and a suitable place for an island-wide study of changes in the environment, settlement pattern and social organisation that can be compared with other cases of a similar scale elsewhere. The island has rich histories of Māori and European settlement, but this report concerns only the former.

Pōnui is nearly eight km long and up to four km wide. The terrain is hilly with areas of valley and swamp. The east coast is dominated by rocky shores with cliffs and the west coast consists of sandy beaches alternating with low cliffed headlands. It is thought that in the past the island was covered in kauri

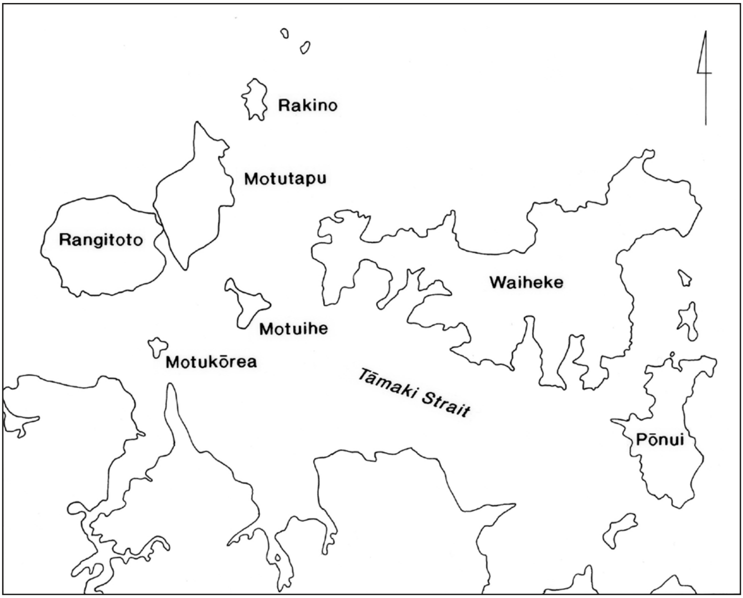


Figure 1. Islands of the inner Hauraki Gulf.

(*Agathis australis*) forest, but today, much of the island is in pasture with some areas in vineyards or regenerating bush.

It is interesting to compare Pōnui with Motutapu, which has been a focus of archaeological study (Davidson 2013; Doherty 1996), as the islands are similar in size and located at opposite ends of Waiheke Island. The field archaeology of Pōnui is better preserved than on Motutapu and the surface features of earthworks more clear. The islands have similar coastal middens and *pā* 'fortified sites', but Pōnui has a little over 100 recorded sites while Motutapu has more than 300 including 12 with defences. The difference in density is due to eruptions of Rangitoto around AD 1400 (Hayward 2019) that created good volcanic soil for gardening on Motutapu, which was substantially cleared of forest in prehistory (Davidson 2013), but it transpires that Pōnui, with poorer yellow-brown earth soils, remained partly forested. However, the two islands had more similar marine resources and access to the wider Hauraki Gulf and mainland.

Archaeology on Pōnui Island began with excavation of an Archaic site in Motunau Bay (S11/20) under the direction of Vic Fisher of Auckland Museum in 1956–1959, with further limited testing in 1962 (Fisher 1964;

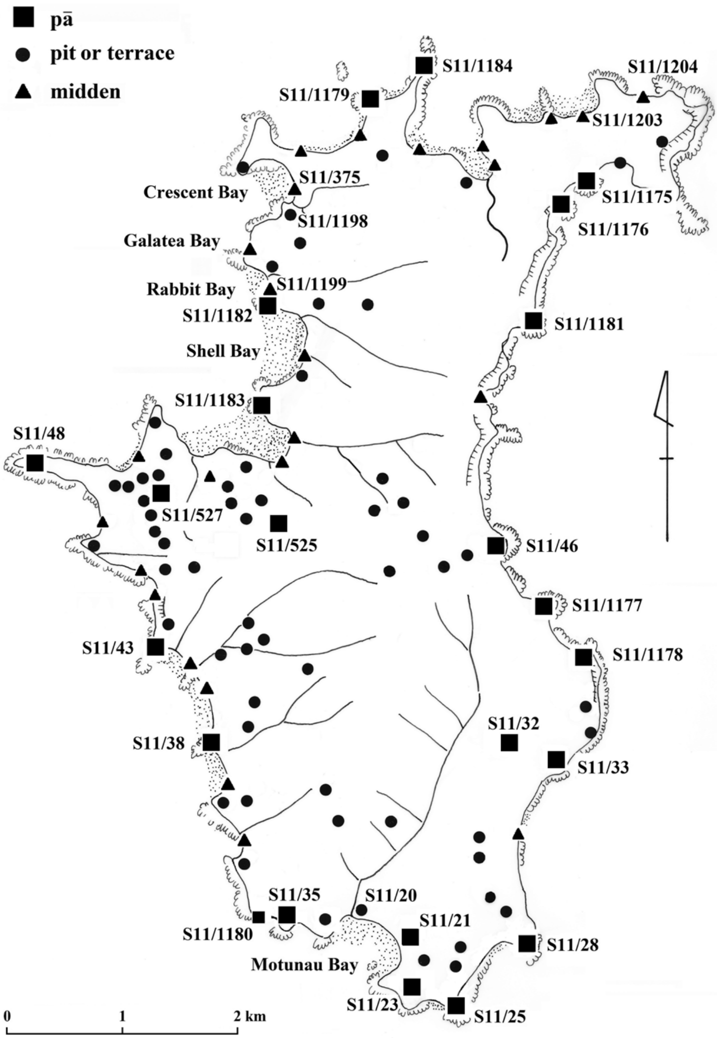


Figure 2. Archaeological sites recorded on Pōnui. Some further sites located in regenerating bush in the south of the islands could remain undiscovered. There are fewer than half as many undefended sites on Pōnui as compared with Motutapu at the other end of Waiheke.

Nicholls 1963, 1964). An archaeological field survey of coastal sites in the south was done by Janet Davidson in 1963 (Davidson 1963), and in 1965 Wilfred Shawcross and John Terrell excavated a late pre-European midden at Galatea Bay (S11/51), which was the basis for an economic analysis that was sophisticated for its time (Shawcross 1968; Terrell 1967). In 1979 Peter Matthews surveyed the central-western part of the island (Matthews 1979), and further survey continued during this project as shown in Figure 2. In 1989 further test excavation at S11/20 was supervised by Simon Best during a University of Auckland field school, and I supervised excavations at an adjacent pā, S11/21. More substantial excavation of S11/20 followed in 1992 supervised by Simon Holdaway. During the early 1990s, with the help of colleagues and students, I mapped 21 pā and excavated radiocarbon samples from their earthwork defences. In 1994 Matthew Schmidt and I collected samples from middens on the west coast of the island for his research on the radiocarbon dating of marine shell (Schmidt 2000), and I later collected dating samples from three further coastal sites. More recently Peter Sheppard used obsidian from University of Auckland excavations of S11/20 for an influential study of portable X-ray fluorescence (Sheppard *et al*. 2011). The outcome of these investigations is that we have an overview of the history of pre-European settlement and an impression of social organisation on Pōnui.

FOREST CLEARANCE AND MĀORI GARDENING ON PŌNUI

Analysis of archaeological charcoal shows that during occupations of the fifteenth century AD much of the island was still under forest, but with the construction of pā from the sixteenth century there was ongoing clearance (see below). However, there are indications—archaeological, botanical and historical—that Pōnui retained patches of forest trees that were not felled until the early European period. During field survey a large number of depressions were observed with the superficial appearance of pre-European *kūmara* ‘sweet potato’ pits (Fig. 3), which occurred in loose clusters typically of 12 to 15 depressions on steeper south-facing slopes. They were vague in outline, unlike more definite kūmara pits, and were never associated with terraces as genuine kūmara pits often are. Two of these depressions were excavated and found to be natural features. Charcoal carbonised *in situ* in the base of one was identified by R. Wallace as the roots of kauri trees, and there was kauri and bracken fern (*Pteridium esculentum*) in the other. A study by W. England (1990) found the features were the remains of stumps of kauri trees which were felled, not wind-thrown, and the farmer, Peter Chamberlin, confirmed they were holes left by forest trees when stumps were burnt during the establishment of European farming.

Figure 3. Depressions left by former tree stumps on a south-facing slope at Motunau Bay. There were patches of remaining forest at the end of prehistory.

Botanical studies of the vegetation of the inner Hauraki Gulf islands have shown remnants of primary and secondary forest on Waiheke and Pōnui, and a survey of Pōnui suggested that "in the past, kauri forest clad the higher ground" (Brown 1979: 14).

> When considered in relation to the present soil pattern and to early accounts, these indicate an original pohutukawa-taraire-kauri forest pattern in which kauri was associated with the strongly leached and in parts podzolised northern yellow-brown earths of the upper valley walls and ridges. (Atkinson 1959: 29)

This contrasts with the vegetation history of Motutapu (Davidson 2013). A review by Wallace (2012) of charcoal samples from several archaeological sites suggests that "most of the forests on the island were cleared by fire at the time of the Rangitoto eruption and that only limited areas of bush remained in the vicinity of the sites at the time they were occupied" (p. 8). A pollen study from the north of the island by Elliot and Neall (1995) found that the post-eruptive sequence was dominated by bracken fern and mānuka (*Leptospermum scoparium*) and took this as evidence that Māori gardening prevented forest regeneration.

Historical records show that European ships were collecting kauri trees for spars in the Hauraki Gulf from the end of the eighteenth century (Furey 1996: 14). In September 1826 the first New Zealand Company attempted a settlement by immigrants on the barque *Rosanna*, and Captain James Herd, the agent, tried unsuccessfully to purchase Waiheke and the islands at its eastern end (McDonnell 2018). A chart was published in London by J.W. Norie & Co. (Herd 1828) with an inset, "Part of the S.W. side of the Frith [sic] of the Thames in New Zealand surveyed by Captain J Herd, 1826", and a version of this chart was lithographed in Sydney in 1839 (Clint 1839; P. Monin, pers. comm., 2017). The chart shows "cowdie" growing on Pōnui and northwestern Waiheke inland from Man O' War Bay. Only "small cowdie" are shown on the adjacent mainland coast and "no timber here" on the southern shore of the Waitematā Harbour. In February 1827, the year after Herd's visit, the *Astrolabe*, under the command of Dumont d'Urville and piloted by a local Māori, Makara, sailed through the Tāmaki Strait and northwards between Waiheke and Pōnui. D'Urville records: "So we sailed among islands for about two hours; some were lofty and mountainous, covered with magnificent forests, others lower and only covered with more ordinary vegetation" [possibly Motutapu] (d'Urville 1950: 162–63).

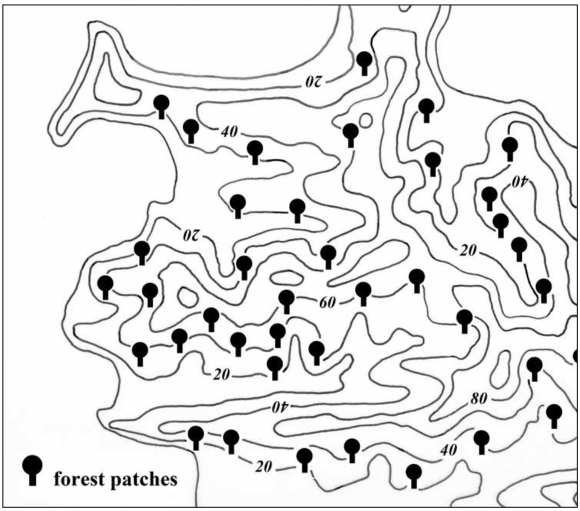


Figure 4. An area in the northwest of Pōnui showing the distribution of forest patches on south-facing and steeper slopes that probably survived into the early European period. Each symbol represents a cluster of depressions resulting from burnt and rotted forest tree stumps.

In 1840 John Logan Campbell saw a large dressed kauri log dragged from the bush by Māori and loaded onto the *Delhi*, which was anchored in Man O' War Bay, and wrote, "in those days Waiheke had many a stately kauri growing on it" (Campbell 1953: 40). Māori labour was used to haul logs from the bush and the channel between Waiheke and Pōnui became a busy waterway (Monin 1992: 95–96). Much of the remaining large timber felled from Pōnui could have gone from around this time, although kauri was still logged from around the highest part of the island at the end of the century (Brown 1979: 5).

At the end of the pre-European period the vegetation of Pōnui was a patchwork of forest, secondary growth and gardens (Fig. 4). The pattern of land clearance and gardening was different from nearby Motutapu and the Auckland isthmus, which had volcanic soils. There had been no wholesale forest clearance by fire. Compared to Motutapu, the vegetation of Pōnui and the lower density of undefended settlements could have been more representative of other coastal regions of the north.

AN ARCHAIC SITE IN MOTUNAU BAY, S11/20

There are at least three early sites on Pōnui (see below), but only one, S11/20, is known in any detail. The site was excavated by V.F. Fisher of Auckland Museum in the years 1956, 1957 and 1959 with further small excavations in 1962 (Nicholls 1963, 1964), and there is a substantial collection of artefacts and faunal remains in Auckland Museum. The site is at the western end of Motunau Bay and extends on both sides of a creek near its mouth. On the eastern side it covers a wide, flat area behind the beach and the occupation deposits are shallow and have been ploughed. On the western bank a deeper and less disturbed shell midden occurs as a strip along the base of a steep hillside. In 1989, during a University of Auckland field school, S. Best supervised the excavation of a 3 × 3 m unit adjacent to the Fisher site, shown as Area A in Figure 5, and a 2 × 1 m unit on a flat on the western side of the stream, Area B. A more substantial excavation, supervised by S. Holdaway, followed in May 1992 (Holdaway and Irwin 1993, 1994) and Areas 1–4 were set out to straddle the Fisher excavation (Fig. 6).

In Area A the site was shallow, around 40 cm deep. The two upper layers had been disturbed by cultivation and contain European materials. Layer C was a compact, dark, greasy layer equivalent to the main cultural deposit found by Fisher. At the interface of layers B and C were lines of buried topsoil inverted by ploughing or disking. In Layer C there was evidence for former surface structures and activities including cooking and tool manufacture and use. Intact features included postholes, ovens and two oval-ended kūmara storage pits (Nicholls 1964, fig. 2). The skull of a beached whale was found in Test 20 and had been used for extraction of bone, which could have attracted early settlement. All items in the 1992 excavation were recorded with an

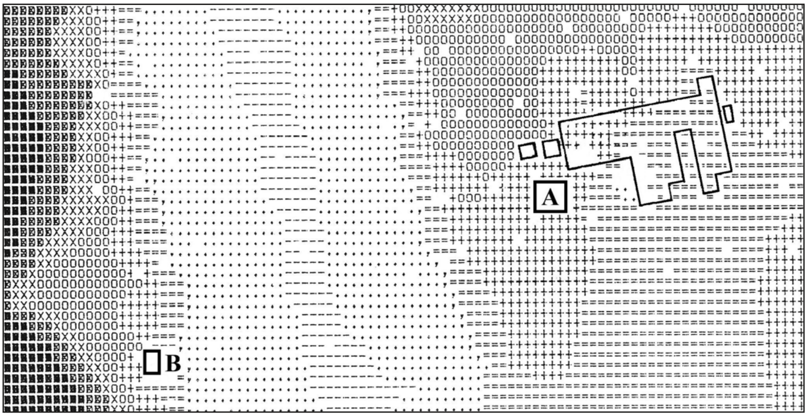


Figure 5. The 1989 test units A and B are shown in relation to the approximate location of the Fisher excavation. The estimated location and the level of the original beach surface were based on a series of 46 spade holes spaced at 6 m intervals by Simon Best.

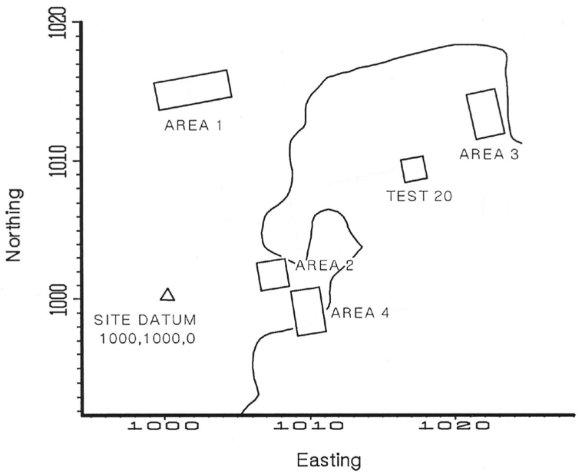


Figure 6. The 1992 excavation unit locations. Areas 2, 3 and 4 straddled the Fisher excavation and several smaller test units in the vicinity were excavated by Simon Best and students (Holdaway and Irwin 1964). Test 20 intercepted the north side of Fisher's backfill, and test units 25 and 28, adjacent to Area 2, intercepted the southern backfill. A resistivity survey of both sides of the creek was carried out in 1992 by Peter Sheppard.

electronic theodolite, and coherent spatial distributions of stone flakes and bones were found (Holdaway and Irwin 1994). Area B on the western bank was deeper and less disturbed, and the deposit consisted mainly of distinct bands of concentrated shell (Fig. 7). One can note a change from rocky-shore to soft-shore shellfish species in this fifteenth-century AD deposit.

Palaeoenvironmental data conformed to the pattern of the New Zealand settlement period. Analysis of charcoal excavated 1989–1994 suggested that forest extended virtually to the shore when the site was first occupied. There was minimal human impact on the coastal broadleaf forest on the flat behind the beach or on the kauri/broadleaf forest on the steep slopes to the west of the stream (Wallace n.d.). The site contained moa bone fishhooks and a small amount of bone from tuatara (*Sphenodon guntheri*), and bird bones identified by T. Worthy included species that later went extinct, including the black swan (*Cygnus atratus*), New Zealand merganser (*Mergus australis*) and

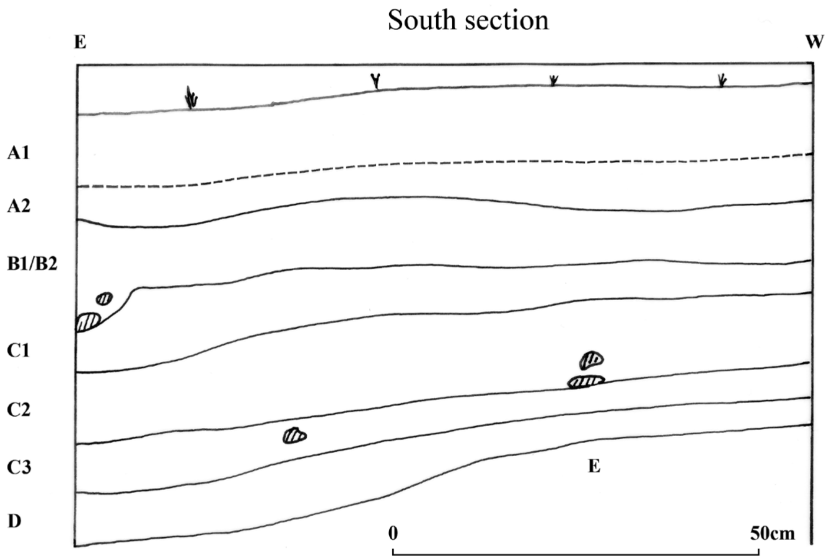


Figure 7. Area B was a 2 x 1 m test unit on the west bank of the stream. Layer A was black topsoil with crushed shell and stones and Layer B was brown sand and shell. Layer C comprised bands of concentrated shell midden in a greasy black sand matrix, with fish bone and cooking stones. Pipi (*Paphies australis*) and cockle (*Austrovenus stutchburyi*) were predominant. Layer D was dense mussel (*Perna canaliculus*) shell and Layer E was the sterile surface of the former beach.

North Island snipe (*Coenocorypha barrierensis*) (T. Worthy, pers. comm., 2011). The archaeological evidence indicates a substantial fishing, hunting and horticultural camp of a group of mobile and maritime people.

Fisher's artefact and faunal collections at Auckland Museum were inspected in addition to the University of Auckland finds, and the spatial data recorded by total station in 1992 survives digitally. Flaked stone analysed by S. Holdaway included a technological study of the obsidian (Holdaway n.d.), faunal remains were identified by M. Taylor, and P. Sheppard identified sources for 565 obsidian flakes that indicated source preferences and patterns of interaction during the settlement phase of the inner Hauraki Gulf (Sheppard *et al.* 2011).

Radiocarbon dates from S11/20 have been reported by Schmidt (2000) and Sheppard *et al.* (2011) from samples collected on both sides of the creek (Fig. 8). In 1989 single dates were obtained from the base of Layer C in Area A (NZ 7764) and from Layer D in Area B (NZ 7765), and these suggest occupation of the site from the end of the fourteenth century AD. Four marine shell samples (Wk 3578–Wk 3591) collected in 1994 from a one-metre test unit adjacent to Area B on the west bank (Schmidt 2000: 56) suggest occupation in the fifteenth century, as does a second charcoal date (Wk 2806) collected during the 1992 excavation (from Feature 3.2).

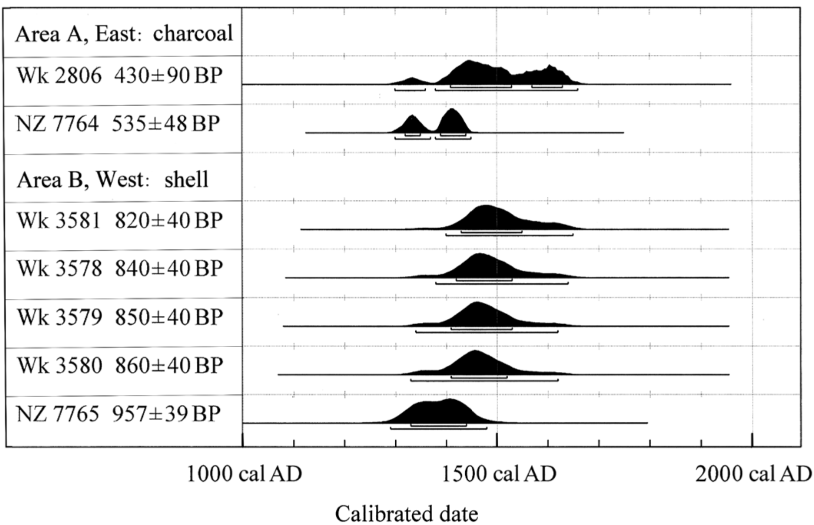


Figure 8. OxCal calibrated radiocarbon dates from S11/20. Marine shell dates are corrected with a Delta R of –7 ± 45.

RADIOCARBON DATES FROM OTHER UNDEFENDED COASTAL SITES ON PŌNUI

In 1994 M. Schmidt, in company with G. Irwin, T. Ladefoged and R. Wallace, recorded exposed sections and collected samples for dating from three midden sites on the west coast of the island at Shell Bay, Rabbit Bay and Crescent Bay, S11/1202, S11/1199 and S11/375 respectively (Schmidt 2000: 55–60). The site in Shell Bay was a mixed natural/cultural deposit and is not considered further, and ^{14}C dates for the other sites are shown in Figure 9. Subsequently, I collected further samples from a pit and terrace site at Crescent Bay, S11/1198, and two coastal middens in the northeast of the island, S11/1203 and 1204 (Fig. 2). The results show there were substantial sites on western and northern beaches of Pōnui from the late fourteenth century AD, and these continued into the pā period, as detailed below.

Rabbit Bay S11/1199

There is a rich and stratified site on a raised beach terrace near the southern end of Rabbit Bay (Fig. 2). An excavation unit of 2 × 1 m reached 1 m deep and exposed four cultural layers. The lowest layer, D, contained charcoal indicative of forest (Wallace n.d.) and abundant fishbone, including conspicuously large head parts of snapper (*Pagrus auratus*) and fish scales in a clean and sandy matrix. Shellfish identified were large pipi (*Paphies australis*) and cockle (*Austrovenus stutchburyi*), together with green-lipped mussel (*Perna canaliculus*) and rock oyster (*Crassostrea glomerata*). The radiocarbon dates are currently the oldest from the island (Fig. 9) and this site would repay further investigation.

Crescent Bay S11/375

A beach midden extends on both sides of the creek in the south of Crescent Bay. The eroded section on the southern side shows a clearly stratified deposit with upper and lower layers of concentrated midden separated by a largely sterile layer of material slumping from higher ground behind. The lower layer contained a small Duff 1A adze, a small stone chisel, a bird bone awl and obsidian (Schmidt 2000: 55). Samples for dating were taken from Layers B and D. The charcoal signature from Layer D indicated forest and the dates are fifteenth century. Layer B represents a late occupation and forest clearance (Fig. 9).

Also, from the top of the headland at the south of Crescent Bay a dating sample was taken from a small, undefended site, S11/1198, with four terraces and two pits. The sample came from an exposure of shell midden on the eroded western side and the site is contemporary with sixteenth-century pā (see below).

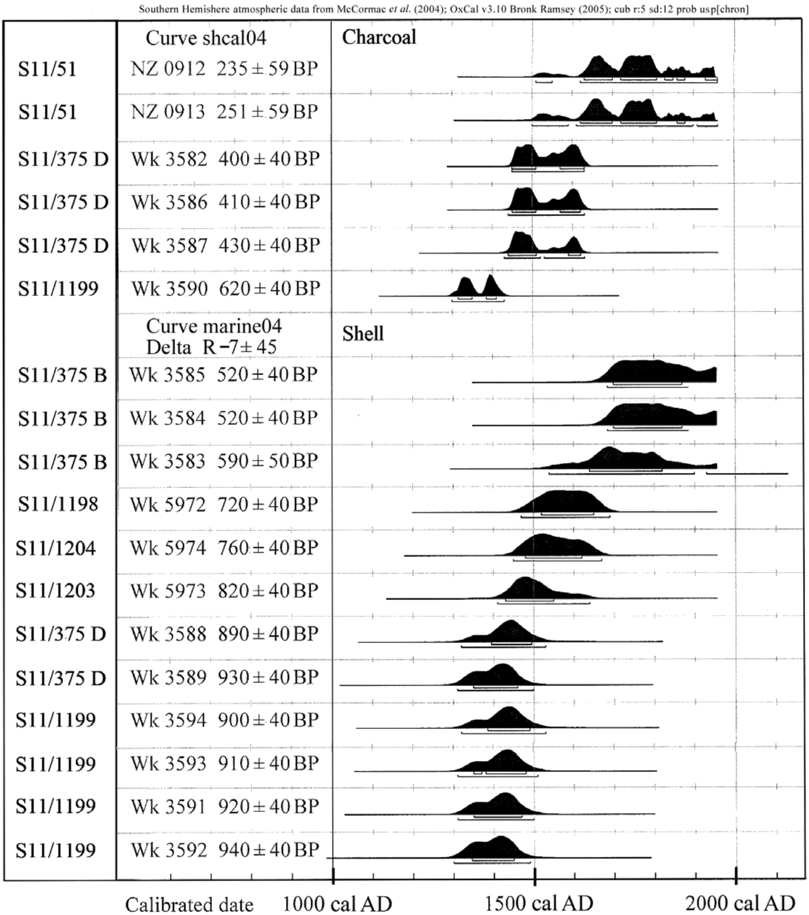


Figure 9. Substantial midden sites on western and northern beaches of Pōnui date from the late fourteenth and fifteenth centuries AD and continued into the pā period. Calibration by OxCal.

Galatea Bay S11/51

This is the next bay north of Rabbit Bay, and a site in a very similar setting was excavated in 1965 by Shawcross (1968) and Terrell (1967). However, the site is much younger with dates from Layer B of 251 ± 59 BP (NZ 0913) and Layer C of 235 ± 59 (NZ 0912). The midden contained predominantly the remains of snapper, pipi and cockle, and the analysis provides information about the marine diet and economy of the seventeenth and eighteenth centuries. Shawcross made an estimate of the human population size and also considered the site might be a seasonal camp. This theory makes a close fit with ethnohistorical research by Agnes Sullivan for the period around AD 1800, which showed that much of the population of the Tāmaki isthmus, including the large settlement of Mokoia on the Tāmaki River, dispersed to small summer camps around the Waitematā Harbour and the inner Hauraki Gulf (Sullivan n.d.).

North Coast

Samples were taken from middens at two beaches at the northeast corner of the island. S11/1203 was exposed at a creek mouth in Oleander Bay and S11/1204 was a concentrated midden eroding from the front of a beach terrace some 1.5–2.0 m high. S11/1203 probably preceded pā construction and S11/1204 was contemporary with it.

THE PĀ OF PŌNUI

The appearance of fortified sites (pā) in New Zealand was by definition a monumental change in Māori settlement patterns. Many perennial questions about them are unresolved, and Pōnui provides a case study. At a general level pā provide evidence for stress in the economy and the social environment. They were diverse in form and function. They protected people from surprise attack, defended food stores in a seasonal economy, protected access to resources and represented places of identity for local groups. More than 7,000 have been recorded and many excavated, but relatively few of the radiocarbon dates from pā came from the actual defences, so it is not known when or where the first ones were built, or the tempo of their subsequent spread (Irwin 2013). There are many theories about these questions but there is still a lack of field data to scrutinise them.

There are 23 fortified sites on Pōnui (Fig. 2). Our interest was not only in individual sites but also in the history and role of pā in the wider landscape. Most are transverse-ditch forms on coastal headlands. Most are of medium size; the smallest is simply two terraces defended by a ditch (S11/1180). There are two ring-ditch forms, S11/21 and S11/527, and one other site, S11/525, with pits, terraces, houses and scarps, but no obvious ditch. Our approach to

Pōnui pā was to map them, to excavate one to examine its features, and then to date the defences of as many of the others as possible to get some sense of their chronological spread and distribution on the island, which could then be compared with other regions.

EXCAVATION OF S11/21

This is a ring-ditch pā on a low hill behind the eastern end of Motunau Bay. I supervised the excavation of five areas in 1989 (Fig. 10). Areas 1 and 5 were trenches cut across the ditches and banks on the eastern and southern sides, Areas 2 and 3 were houses on terraces and Area 4 was an area of pits on terraces. Stratigraphic horizon markers showed that two houses and some pits were contemporary with the defences. Charcoal samples from excavation areas were dominated by bracken and kānuka (*Kunzea robusta*) and indicated that the local vegetation at the time the site was occupied consisted mainly of bracken and tall scrub, with the only common large tree being pōhutukawa (*Metrosideros excelsa*). Clearly there was no forest in the immediate vicinity (Wallace n.d.).

The Defences at S11/21

The defences of S11/21 were fairly typical of those of the wider island. The natural soil profile consisted of topsoil, weathered subsoil and a basement layer of clay into which a ditch was dug and the spoil raised into an inner bank (Fig. 11). The bank fill was mixed with seams of cultural material, mostly close in age to its construction, and there was inverted topsoil at the base of the bank. In Area 1 a trench 8 m long was widened to 4 m to find the palisade line, and samples for dating were taken from the bank fill. In Area 5 the trench was 12 m long and the defence was similar to Area 1 except that at some time after the ditch was first dug a layer of debris accumulated in the bottom, and an additional outer bank was added to the northern and eastern sides of the pā. Three shell samples for ^{14}C dating were taken from under the inner bank, from the inner bank fill, and from under the outer bank, and radiocarbon dates give an age for the earthwork defences as cal AD 1540–1690 at 68%.

The Houses at S11/21

Two houses were excavated on terraces dug into the natural clay at the back and levelled with fill at the front (Fig. 12). The rear house walls were set back into the base of the scarps behind and the back corners were visible from the surface. The front walls and porches faced outwards onto the terrace. The houses were wide in relation to their length and were roughly square in plan including the area of the porch. Drains ran around the backs and sides

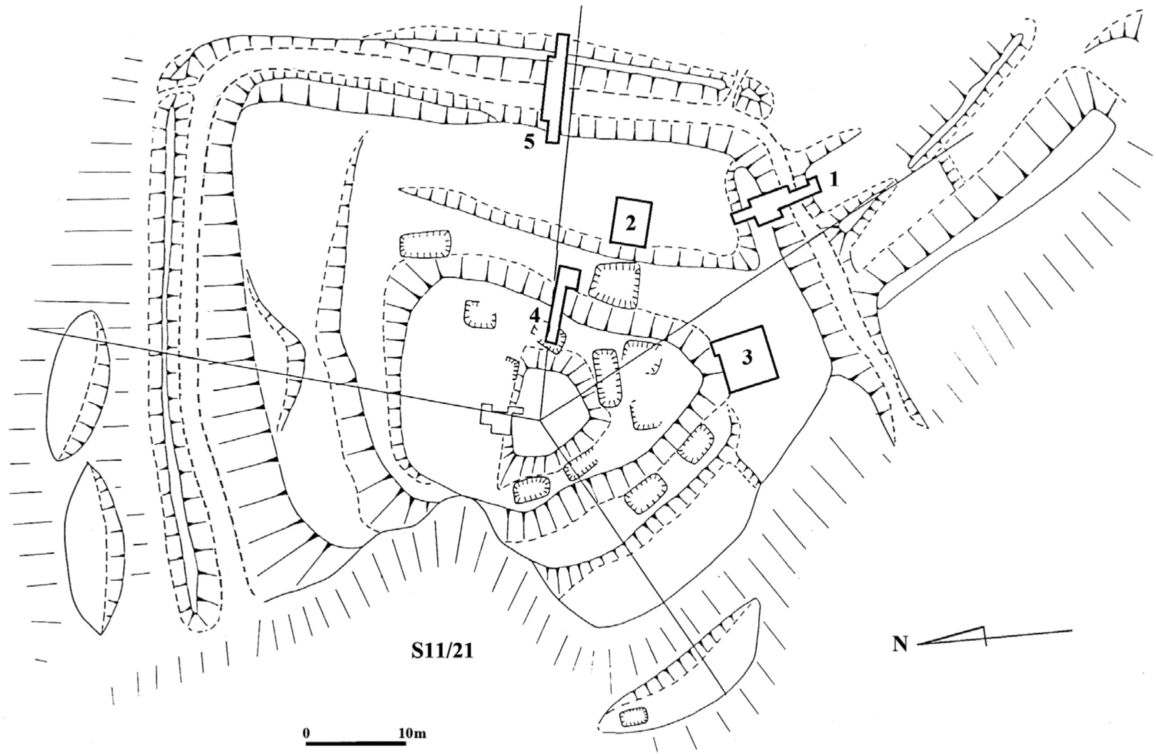


Figure 10. A plan of the ring-ditch pā S11/21 showing areas of excavation, 1–5. An outer bank was built soon after the inner bank and ditch.

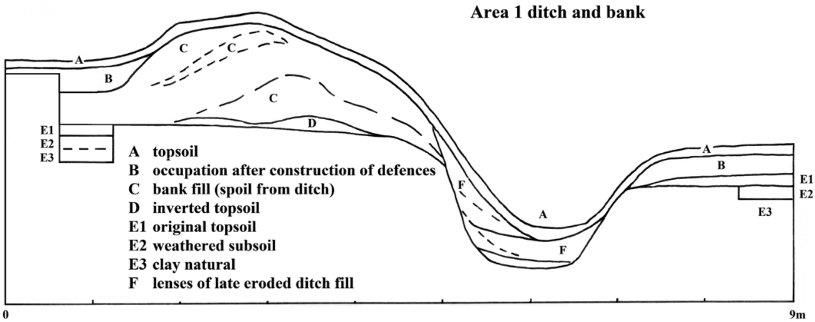


Figure 11. A cross-section of the ditch and bank in Area 1, S11/21 is fairly typical of transverse-ditch pā on the island, and samples for radiocarbon dating were taken from the fill of raised banks. When first constructed banks were higher and ditches deeper than today, but earthworks of pā are unstable and when abandoned the banks erode and ditches fill.

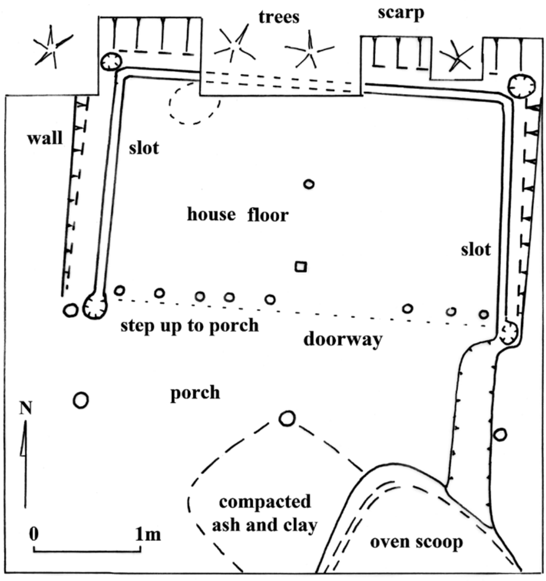


Figure 12. The plan of the house excavated in Area 3 at S11/21.

of both houses and led outside beyond the porches. The front walls had doorways and there were low steps up to the porches, which had evidence for activities associated with the houses. These were substantial dwellings with stout walls and internal drains and the inhabitants would have been sheltered in all seasons.

Both houses were built to the same plan, but the Area 3 house was larger at 4 m^2, and the smaller was 3 m^2. The external drain of the larger house went out on the left-hand side (looking outwards) while that of the smaller ran out the right side. Similar houses with surface evidence of their walls being set against the base of scarps were excavated at four undefended sites on Motutapu; at R10/496, 497 and 557 (Irwin *et al.* 1996) houses had their sides parallel to the scarp, but the house at R10/494 was more or less square in shape and had the back and one side set into the steep slope behind (Ladefoged and Wallace 2010). These houses may have been a distinctive form in the inner Hauraki Gulf.

OTHER EXAMPLES OF RESIDENTIAL PĀ

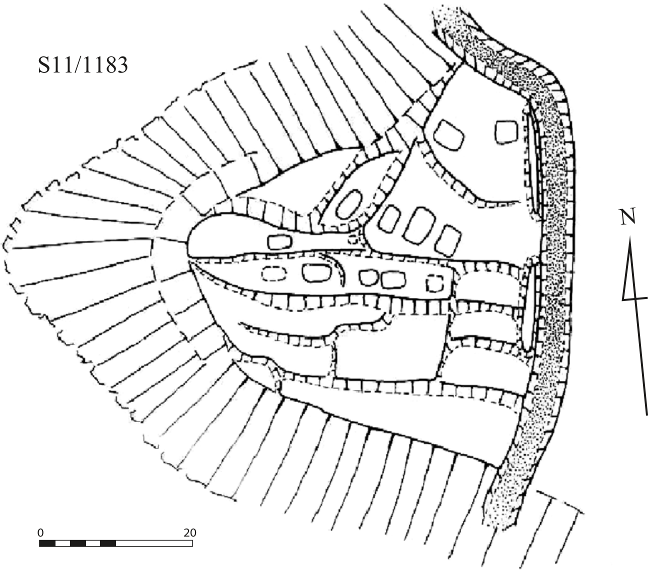
I visited the pā of Pōnui on many occasions and found the surface features of most to be well preserved. Many had coherent spatial layouts with distinct areas for defence, storage and habitation (Fig. 13). All of them had terraces suitable for occupation except S11/527, which was filled with pits, and S11/1181, which was very small and the terraces of which lay outside the defences. Some sites had the same surface evidence as the houses excavated at S11/21 with their corners set back into the base of scarps. It follows that many Pōnui pā could have been residential at times and accommodated a number of households. Kennedy (1969) made the same point for the Bay of Islands of 1772 on the basis of ethnohistoric evidence. There are different opinions about the extent to which pā were residential (Phillips and Campbell 2004), and houses are still elusive features of New Zealand archaeology.

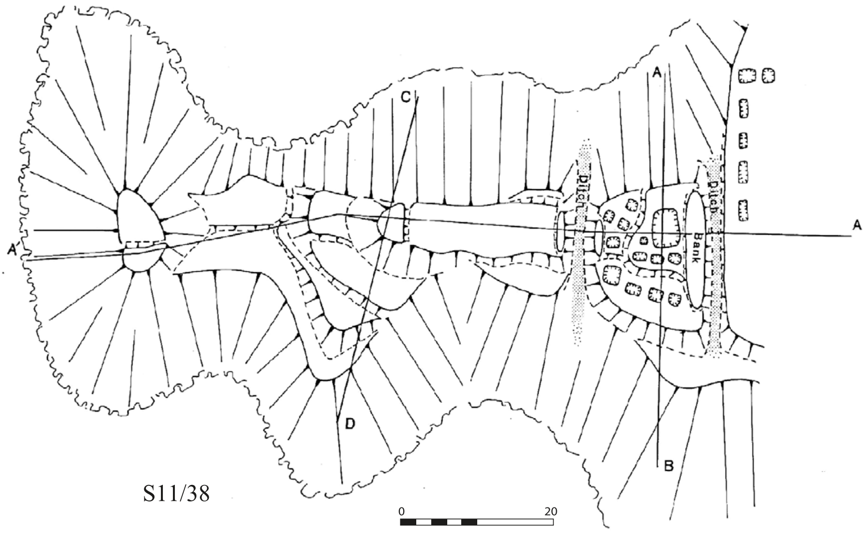
A STRATEGY FOR DATING PĀ IN A LANDSCAPE CONTEXT

Explaining the origins and spread of pā in New Zealand are perennial questions, and such questions require the dating of many pā. Our strategy for investigating pā chronology took account of the following propositions (Irwin 2013):

- At particular times pā were completely surrounded by a defensive perimeter with few exceptions. Therefore earthwork fortifications were more than symbolic. Without doubt some pā were symbols of identity and *mana* (often glossed as ‘power, status’), but all of them defended against attack. (In this regard the lateral terraces on volcanic cones are not considered as essentially defensive.)

S11/1183





S11/38

Figure 13. Many Pōnui pā had coherent spatial layouts with distinct areas for defence, habitation and storage. Several had surface evidence for distinctive house structures.

- Pā often had long and complicated sequences of occupation, but we can date fortification events and extrapolate age horizontally through single-period defences. Multiple defences can be dated independently and overlapping ones can be excavated at points of intersection.
- In most Pōnui pā spoil taken from ditches was used to build banks. Datable material sealed in banks is likely to be close in age to their construction, so we focused on dating banks.
- Dating defences does not inform us about what was being defended, and it is recognised that this strategy usually overlooks the archaeological evidence from the interior of pā.
- The area of defences provides a measure of the scale of a community at the time of construction, which can be compared with other sites.

At the time of the fieldwork 21 pā were known on Pōnui and two more have been found since (S11/1178 and S11/1180). Only 30 ^{14}C dates were available, and it was understood that to spread them wide was to stretch the data thin and increase the risk of error. In the event, three dates were taken from one site (S11/21), two dates from each of seven sites, and one date only from another 13. The dated materials were identified charcoal or marine shell (pipi and cockle).

Field notes will be archived in the University of Auckland Library and the sampling of S11/35 and S11/38 can be taken as typical of the others (Fig. 14). At S11/35, I, along with a supervisor and three students, made six test excavations in and near the inner and outer earthwork defences over two days and samples were taken from two 0.80 m x 0.80 m units which were 1.35 m and 1.0 m deep respectively. At S11/38 samples were taken from four test units, also over two days. At both sites there was evidence for occupation earlier and later than the fortification events, but it was the latter we endeavoured to sample.

However, the archaeological situation was complex and issues inevitably arose.

- At site S11/48 the excavation unit went right through the bank, and the charcoal sample (Wk 2803) was taken from buried topsoil sealed underneath. This produced a date of cal AD 1220–1440 at 95%, which pre-dates the defences and could possibly relate to a fire dating from the time of first settlement. A second sample (NZ 8082) later dated the bank more accurately.
- A shell sample from the bank at S11/1179 (NZ 8091) produced a date of cal AD 1020–1230 at 95% and was plausibly old shell from the beach below the pā used for bank fill, but a second sample (Wk 7970) later allowed for a correction.

Figure 14. A photograph of Richard Jennings in a pit 1.0 m wide and 1.70 m deep excavated into a raised bank at S11/1176.

- By error, samples were taken from ditch fill at three sites, and all post-dated the defences. Two of the dates were <250 BP, from S11/23 (Wk 2797) and S11/43 (Wk 2802), and the third was 270 ± 80 BP from S11/32 (Wk 2798). Another date from S11/1182 (NZ 8087) had an uncertain provenance and was also <250 BP. Later on, second samples were taken satisfactorily from the banks of two of these sites, S11/43 (Wk 7971) and S11/1182 (Wk 7972). In retrospect these were useful mistakes because the late dates showed continuing occupation at the sites concerned.
- A further problem was that six samples of identified charcoal were small and the results had standard errors exceeding 50 years. However, the estimated ages conform to the general pattern of the other samples.
- Dates for the younger pā, in particular, are ambiguous because of the vagaries of the radiocarbon calibration curve.

Dates for the construction of defensive banks of Pōnui pā are shown in Figure 15, which includes 24 radiocarbon dates from 19 sites. The results are interesting and support conclusions that can be tested by further fieldwork. It appears that a significant number of pā were fortified soon after AD 1500, during the sixteenth and early seventeenth centuries. If pā were first built somewhere in New Zealand around AD 1500 (Schmidt 1996), which is still an open question, then there was no appreciable delay before they reached Pōnui. And they continued to be built, rebuilt and occupied later on, as

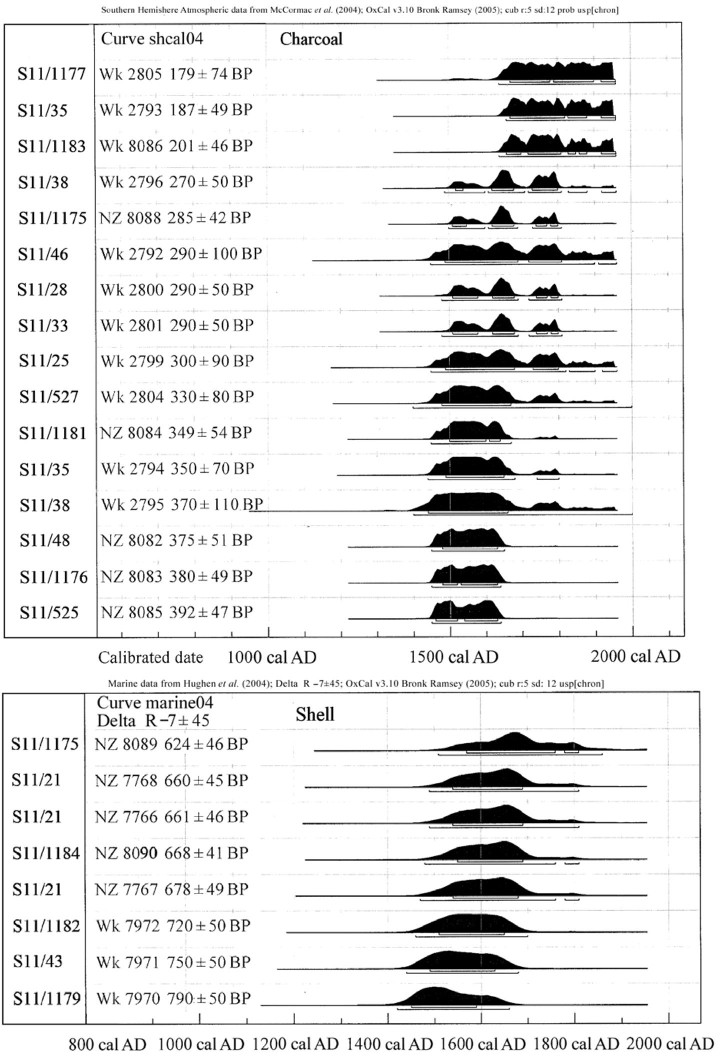


Figure 15. Radiocarbon dates for the construction of the earthwork defences of Pōnui pā. A significant number were first fortified from around AD 1500 during the sixteenth and early seventeenth centuries, and pā continued to be built and rebuilt later. The figure shows the results of 24 ^{14}C dates from 19 sites. One site has three dates (S11/21), three other sites have two dates (S11/35, S11/38 and S11/1175), and 15 have one date each. Omitted from the figure are two dates which preceded the building of earthworks and four dates that post-dated them (above). Six of the charcoal dates shown have excessive standard errors.

Davidson found from the excavation of the pā at Station Bay, Motutapu, which was periodically occupied over a period of up to three centuries, with the final occupation probably close to the end of the eighteenth century or early in the nineteenth century (Davidson 2013: 18).

The dating of individual sites on Pōnui is hardly robust, but when considered as the dating of a set of fortifications in the wider landscape a useful picture emerges. The archaeological landscape allows the possibility of a social landscape of a number of contemporary groups of *whānau* 'extended family' size who were neighbours and kin, and who at times resided in defended coastal settlements. And it is interesting to compare the Pōnui case with episodes of fortification in other regions.

There are six pā on the island with double ditches and banks, and most of the outer banks were more eroded and the ditches shallower than the inner ones. In two cases there are dates that inform on their relative ages. At sites S11/35 and 38 the inner ditches and banks were younger, and the suggestion is that these sites were not expanding but that smaller areas were more strongly defended as required. At S11/28 a date from the inner bank was 290 ± 50 (Wk 2800); however, the outer bank was not dated, but could be expected to be older on this basis.

Spatial and Chronological Patterns of Defence Construction

There are also spatial trends in the order of construction of earthwork defences (Fig. 16). The rank order of radiocarbon dates is by no means statistically assured, but it is clear that defences were first built during the sixteenth and early seventeenth centuries AD along the west coast and on the northeast coast, near beaches. Specifically, the eight earliest radiocarbon dates on charcoal samples and the three earliest dates on shell reported in Figure 15 came from pā on the west coast and in the northeast near Bryants Bay. The next four charcoal dates (Fig. 15) came from pā along the rocky east coast of the Firth of Thames, plausibly built during the later seventeenth century (sites S11/33, S11/28, S11/46 and S11/1175), and two further sites appeared in the west (S11/21 and S11/1184). After around AD 1700, the remaining sites were defended.

The early pā were selected for defensible situations near beaches with ready access to soft-shore shellfish and convenient landing places for canoes, where they could find shelter from gales (the worst of which came from the northeast), and where they could be stored on shore close below pā for protection from raiding parties. The density of western sites influenced the location of the later seventeenth century sites along the higher, rocky and more exposed east coast of the island, where there were no sheltered canoe landing places. After around AD 1700 there is little patterning in the relative order of radiocarbon dates; however, these included new earthworks at S11/1177 and S11/1183, secondary defences added to earlier sites and continuing occupation of several pā.

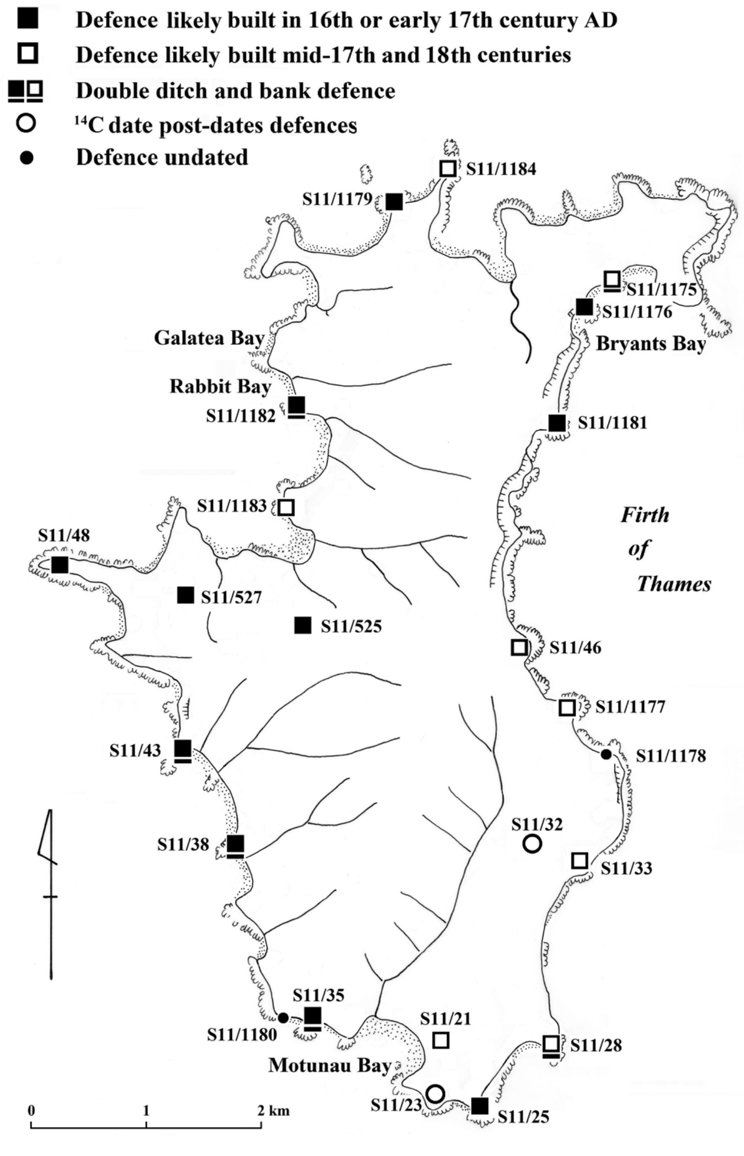


Figure 16. Pā of Pōnui Island.

DISCUSSION

The foregoing information allows for a fairly detailed chronology of Māori settlement and land use on Pōnui. The island was settled from the end of the fourteenth century AD, and from the beginning it involved the harvesting of marine resources and horticulture. The archaeological signature of coastal sites of the fifteenth century was early, or Archaic, and the evidence relates to other early sites on Motutapu (Davidson 1978), and Torpedo Bay and Long Bay on Auckland's North Shore (Campbell *et al*. 2018). With the appearance of pā in the sixteenth century the archaeological signature became Classic. The transition in the settlement evidence appears to be abrupt; however, the tempo of change could have varied in material culture and the economy (Anderson 2016). The charcoal evidence suggests forest near the early sites and clearance for the earthwork defences (Wallace n.d.), but many small patches of forest remained at the end of the Māori period.

Between AD 1500 and 1800 23 pā were built, six refortified with earthworks, and the number of refurbishments of timber palisades was additional but unknown. All of them were close to gardening land and to patches of forest, and it does not require measurement to show that they generally stood apart in the landscape. The dating is not precise but it appears that the density of pā in the sixteenth century AD was as great as in the eighteenth, so the fortification of the island was not gradual and incremental through time. Some pā were already occupied when they were first defended and some continued to be occupied at times long afterwards. It is reasonable to suppose that each site was associated with a social group that resided at times in the vicinity, and the density of sites makes it likely that a number were occupied contemporaneously.

The settlement pattern of Pōnui evidently passed through a stress threshold in the early fifteenth century when the island was quickly fortified. However, fortification occurred at different times elsewhere. At Pōuto in the north Kaipara, 12 pā defences were dated in much the same way as on Pōnui, but many were significantly later (Irwin 1985), and on Urupukapuka Island in the Bay of Islands fortifications date from around AD 1650 (McCoy and Ladefoged 2019).

All of the Pōnui pā were of moderate size (which begs the question of the size distribution of pā, which is unknown), and the largest of them, S11/1184, was not heavily defended. In other words none of the fortifications of Pōnui acted as a stronghold for a regional population in the inner Hauraki Gulf when it came under threat of external attack. On Pōnui and at Pōuto the context of fortification was mainly local involving stress among neighbours and kin, and defence against canoe-borne marauders from further afield. However, in the later pre-European period larger-scale polities developed and episodes of external pressure with the threat of hostile takeover led to more integrated regional defence and the construction of large strategic pā. Pōnui, at that time, was part of a wider polity in the inner Hauraki Gulf, and such strongholds are known on Waiheke as well as on the Tāmaki Isthmus during the late pre-European period and early in the Musket Wars (Crosby 2012; Irwin 2013).

Pā of different forms were contemporary on Pōnui as in Pōuto. All the transverse-ditch ones were on coastal headlands except S11/32, which is on a narrow descending ridge, and the two ring-ditch ones were inland. In these two regions the distribution of pā types is topographical rather than chronological. Groube (1970) thought terraced pā were earlier than ring-ditch ones, and it is interesting that the Pōnui site with the earliest date, S11/525, is a substantial one with pits, terraces and houses on a high knoll apparently defended only by scarps. It was recorded by Matthews (1979) as a "possible pā", but could be a simple early one. In the absence of a bank the sample for dating was taken from a house drain.

I am of the view that pā on Pōnui were often residential, which was also suggested for the coastal Bay of Islands of AD 1772 (Kennedy 1969). Houses with walls and drains set into the base of scarps were excavated at S11/21, and there are surface indications of more houses on other Pōnui pā. Houses of the same basic form have been excavated at four undefended sites on Motutapu (see above).

The building of fortifications implies group leadership, and the size of forts can be used as a proxy for the scale of the communities who built them (Buist 1964). However, in Māori society in AD 1800 the presence of pā in the landscape did not invoke discrete territories of local groups. Bilateral kinship allowed a flexible system of multiple rights to settle land; individual rights to use resources overlapped on the ground and mobility was high (Anderson 1998; Ballara 1998; Phillips 2000). Social changes suggested for late pre-European history were a shift from *hapū* 'sub-tribe' to the multi-hapū community as an operational unit (Anderson 2009; Ballara 1998), and Sissons (1988) suggested a reordering of northern society in the eighteenth century on the basis of a change in the structure of traditions. Allen (1996: 670) concluded that the search for archaeological sites representing a hierarchy of social groups such as whānau, hapū and *iwi* 'tribe' should be abandoned. At Pōuto the archaeological evidence suggested the scale of social relations was fluid among late contemporary pā, and centres of action and influence ebbed and flowed (Irwin 1985: 109).

However, during the early migration period, and for some time afterwards, kinship and residence could have been more directly associated in New Zealand, as in tropical Eastern Polynesia, although not necessarily in central places like Wairau Bar (Walter *et al*. 2017). Land tenure could have become more fragmented through time in the relatively immense and unconstrained landscapes of New Zealand. On Pōnui the pā of AD 1600 could have controlled territories more mutually exclusive than those reported in AD 1800, given their distribution in the landscape. The suggestion is that there could have been significant changes in land tenure and social organisation during a Māori Middle Age (Anderson 2016).

Comparing Pōnui with Motutapu, the two islands had similar coastal midden sites and pā, but there were more than twice as many undefended sites on Motutapu, which had volcanic soil and easier terrain; the latter island was cleared of forest and gardening and habitation sites were spread across the landscape. Such sites are not conspicuous on Pōnui where patches of kauri forest remained in places unsuitable for gardening, yet horticulture was significant, as shown by very large kūmara storage pits on both pā and undefended sites. Motutapu was more like the volcanic landscapes of Auckland than Pōnui, which could partly explain why Tāmaki Makarau was so contested, while Pōnui could have been more typical of the northeastern coast of the North Island than Tāmaki or Motutapu.

* * *

Although a great deal is known about individual pā, it is difficult to generalise about them. Most of the radiocarbon dates from pā are not from the defensive features and so little is known about the origins and spread of fortifications as a cultural or historical process. Recent research into wiggle-match dating of palisade posts has potential for wetland sites (Hogg *et al*. 2017), but other dating methods will be necessary for the dry. It is possible that knowledge of fortification came with migrants from Eastern Polynesia in the fourteenth century AD. Given that pā were built in numbers on Pōnui from early in the sixteenth century, our current knowledge of the age of earthwork fortifications does not preclude them from dating from late in the fifteenth century elsewhere in the North Island, and perhaps even before.

We have a general understanding of why pā developed and were built in large numbers, and various theories invoke climatic variation, increasing population, competition for horticultural land and the late emergence of competitive regional polities. But the effective and actual causes will vary in different parts of the country at different times and will involve the actions of individuals and contingent events, as shown by the Pōnui Island case in comparison to other areas. Further studies of pā in selected landscapes would throw more light on pre-European Māori settlement and society. However, ultimately, only part of this history will be accessible archaeologically, and much of the story will come from tribal history and *whakapapa* 'genealogy', as shown by McBurney (2010) for the inner Hauraki Gulf.

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THE CURIOUS IDEA THAT MĀORI ONCE COUNTED BY ELEVENS, AND THE INSIGHTS IT STILL HOLDS FOR CROSS-CULTURAL NUMERICAL RESEARCH

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ABSTRACT: The idea the New Zealand Māori once counted by elevens has been viewed as a cultural misunderstanding originating with a mid-nineteenth-century dictionary of their language. Yet this "remarkable singularity" had an earlier, Continental origin, the details of which have been lost over a century of transmission in the literature. The affair is traced to a pair of scientific explorers, René-Primevère Lesson and Jules Poret de Blosseville, as reconstructed through their publications on the 1822–1825 circumnavigational voyage of the *Coquille*, a French corvette. Possible explanations for the affair are briefly examined, including whether it might have been a prank by the Polynesians or a misunderstanding or hoax on the part of the Europeans. Reasons why the idea of counting by elevens remains topical are discussed. First, its very oddity has obscured the counting method actually used—setting aside every tenth item as a tally. This "ephemeral abacus" is examined for its physical and mental efficiencies and its potential to explain aspects of numerical structure and vocabulary (e.g., Mangarevan binary counting; the Hawaiian number word for twenty, *iwakalua*), matters suggesting material forms have a critical if underappreciated role in realising concepts like exponential value. Second, it provides insight into why it can be difficult to appreciate highly elaborated but unwritten numbers like those found throughout Polynesia. Finally, the affair illuminates the difficulty of categorising number systems that use multiple units as the basis of enumeration, like Polynesian pair-counting; potential solutions are offered.

Keywords: New Zealand Māori, Polynesian number systems, ethnomathematics, undecimal counting, tally counting, numerical cognition

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In the long history of cultural misunderstandings, the notion the New Zealand Māori once counted by elevens surely stands as one of the most peculiar. The earliest mention of this "remarkable singularity" (Craik 1830: 417) is found in an 1825 article by Adelbert von Chamisso, the German naturalist known for his work on Oceanic languages. At the claim the Māori number system was based on twenty (von Chamisso 1825: 27), a footnote inserted by the French translator, René-Primevère Lesson, reads, "Error. The arithmetic system of the Zealands is undecimal, and the English are the first to propagate this false idea. (*L*.)" (as translated).[1] Lesson, a naturalist himself, had recently returned to France from the 1822–1825 Pacific expedition of the corvette *Coquille*. Lesson would become even more closely linked to the idea the New Zealand indigenes counted undecimally by a letter he wrote to Adriano Balbi, the Italian geographer who published its content in his 1826 *Atlas Ethnographique du Globe.* According to Balbi (1826: 256–57, as translated from the original French),

> With regard to the language of New Zealand,[2] we shall notice that the author of the grammar has made a serious error by indicating as decimal the number [system] of the Zealands, which is obviously undecimal, as several very intelligent natives have given evidence to Mr. Lesson. This naturalist scientist, who has kindly communicated to us the results of his researches on this subject, expresses himself in the following manner in the letter he addressed to us. "We placed coins in front of [the informants], and at the number ten they always said *kagnadou*, and *katekau* for 11. Then we removed a coin and said *katekau*; they answered negatively. Various other carefully conducted experiments allow us to conclude their way of counting, both embarrassing and inconvenient, was purely undecimal; that eleven elevens formed their hundred. The natives who frequent the English missionaries, by the habit they have of hearing them say ten for *katekau*, are not very fixed on their way of counting, while the natives of the remote villages count 121 for their hundred.

Example.

11	Katekau Kotahi.	77	Katekau Kawitou.
22	Katekau Kadoua.	88	Katekau Kawadu.
33	Katekau Katodou.	99	Katekau Kaïwa.
44	Katekau Kawa.	110	Katekau Kagnaoodou.
55	Katekau Kadima.	121	Karaou.
66	Katekau Kaono.	1331	Kamano.

Despite the obsolete orthography used, the terms attributed to Lesson by Balbi recognisably contain the usual words for one through ten (*kotahi*, *rua*, *toru*, *whā*, *rima*, *ono*, *whitu*, *waru*, *iwa* and *tekau*), hundred (*rau*) and thousand (*mano*). The words are strung together oddly, as the more typical way of saying *eleven* would be *kotahi tekau mā tahi*, glossed as *(one) ten and one*.

Contemporary author George Lillie Craik (1830: 417) would further detail the alleged undecimal vocabulary: "The New Zealand method of numeration is, according to M. de Blosseville and M. Balbi, very peculiar, being not decimal, but undecimal, or proceeding by successive multiples of eleven. Thus, after ascending to eleven, they say for twelve eleven and one, for thirteen eleven and two, &.c., till they come to twenty-two, which they call twice eleven." Jules Poret de Blosseville was the *Coquille*'s navigator and geographer for the 1822–1825 expedition, as well as Lesson's close friend (Rallet 1953); Craik's reference to Balbi includes, in a footnote, the applicable pages of his 1826 *Atlas*. Craik (1830: 417) admitted the remarkable singularity of counting by elevens was contradicted by Samuel Lee's 1820 grammar of the Māori language, wherein numbers were "arranged upon the common decimal principle". There is an interesting context to this passage in Craik, the gist and significance of which are discussed below in connection with whether undecimal counting was a prank, a misunderstanding or a hoax.

In 1839, the posthumously published papers of Wilhelm von Humboldt, the German linguist known for his work on South Sea languages, contained an essay whose content so greatly resembled what Balbi had published that at least one contemporary, August Friedrich Pott (1847: 75), also a linguist, connected it to Lesson. Its introduction, written in German by von Humboldt's research associate, Johann Buschmann, stated the essay had been found among von Humboldt's papers. As summarised by Buschmann (in von Humboldt 1839: 763), the essay, undated and described only as written by an anonymous Frenchman, claimed the word *tekau* meant *eleven, not ten*, and that "die Neu-Seeländer" in general followed an undecimal system, rather than a decimal one. The essay was then reproduced verbatim (and is translated here from the original French):

Numeration of New Zealanders

> The authors of the Zealandian grammar have undoubtedly made a mistake, by giving as decimal the number system of the peoples living in the Antarctic islands of New Zealand, whose number system is evidently undecimal, as we have proved by means of several native intelligences. So, placing coins, small stones, etc., before a native of the Thames, this islander (and we repeated the experiment in every possible way), when ten were placed before him, said *ka-gna-du*, and *katekau* at eleven. By removing the 11th item and thus reducing the total to 10 and saying *katekau* in the numerical manner of the missionaries, no, said several natives from Mercury-Bay and Thames, *ka-gna-du*,[3] which they pronounce *kagniadou* following the French way. Several successive experiments, varied, allow us to obtain numbers very different from those known, and to conclude that among these people numbers are undecimal. The English missionaries, almost all artesans, with the exception of Mr. Kendall, an educated man, have never been able to appreciate a manner of counting so opposite to their own, and in their grammar they made *katekau*, or ten of eleven units, a worthless term they do not know how to report. Hence the inconvenience of consulting the Kiddi-Kiddi [Kerikeri] natives on their former numbers, for in their daily relations with the whaling ships they have had the strength to bend their way to count according to that of civilised peoples, so too, they do not have very distinct ideas of what they must call *katekau*,

and the information they are asked about varies from one native to the next. Eleven units make the Zealandian ten, eleven of their tens the hundred, and eleven of their hundreds the thousand, as follows:

10 — *ka-gna-du*	22 — *kadoua*
11 — *katekau*	23 — *kadoua matahi etc.*
12 — *katekau matahi*	33 — *katodou*
13 — ——— *madoua*	44 — *kawa*
14 — ——— *matodou*	55 — *kadima*
15 — ——— *maoua*	66 — *kaono*
16 — ——— *madima*	77 — *kaouitou*
17 — ——— *maono*	88 — *kaouadou*
18 — ——— *maouitou*	99 — *kaïoua*
19 — ——— *maouadou*	110 — *kagnaoudou*
20 — ——— *maouiva (sic)*	121 — *karaou (hundred)*
21 — ——— *magnadou*	1331 — *kamano (thousand)*

(unnamed Frenchman, in von Humboldt 1839: 763–64)

At the essay's conclusion, Buschmann (in von Humboldt 1839: 437–38, 764) said he had compared the numbers 22 to 110 to those in Lee's 1820 grammar and, based on his experience as a linguist, judged them to be erroneous, since *tekau* had been omitted and without it, they were simply a recapitulation of the numbers *one* through *ten*.

Beyond its similarities with Balbi's account, highlighted by Pott (1847: 75), the essay contains two clues suggesting Lesson was likely its otherwise anonymous French author. First, it names Thomas Kendall, the English missionary known for his involvement in early attempts to document the Māori language. Von Chamisso (1821a: 388; 1821b: 413) identified Māori numbers as vigesimal in the second volume on the 1815–1818 voyage of the *Rurick*, but he had corrected this to decimal by the third volume (1821c: 440–42), attributing the error to Kendall's initial confusion over pair-counting and its correction to their subsequent communication and his own consultation of Lee's 1820 grammar. In his translator's correction of von Chamisso's 1825 volume, Lesson (1827a: 91) identified the error as having been propagated by the English; he also associated Kendall with Lee's book, *A Grammar and Vocabulary of the Language of New Zealand*, which Lee published in 1820 based on material from Kendall. Second, the essay lists three places the alleged informants were from—Kiddi-Kiddi [Kerikeri], Mercury Bay and Thames—all located in the northeastern part of New Zealand's North Island, admitting the possibility they might be correlated with the *Coquille*'s movements. And

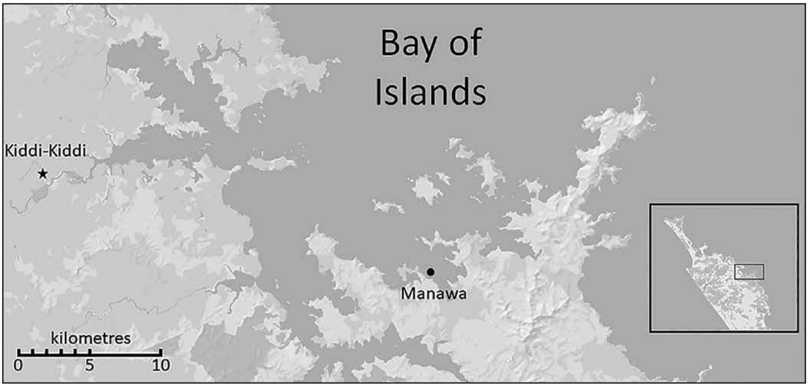

Figure 1. The *Coquille*'s 1824 visit to New Zealand. The ship sighted land on 2 April, anchored at Marion 3 April (not shown) and Manawa 4–16 April and got underway for Rotouma [Rotuma], an island north of Fiji, on 17 April (Duperrey 1829: 84–87). While the positional data put the ship off the North Island's northwest tip, this was undoubtedly an error of longitude, as was typical of the technology of the day; often the ship was recorded as being over land or too far away from it for anyone to have gone ashore. Given the name Manawa and Lesson's frequent mention of Kiddi-Kiddi [Kerikeri], the ship was likely anchored in the Bay of Islands, as was common in the period (Findlay 1851: 712–13), perhaps in Manawaroa Bay, given the similarity of the names. Created by the author using images in the public domain.

in April 1824, the ship did stop for two weeks at Manawa, part of the North Island's Bay of Islands (Duperrey 1829: 84–87; Fig. 1). This visit could have provided Lesson and Blosseville an opportunity to quiz the inhabitants numerically as they interacted with them in the performance of their other duties. Lesson in particular was collecting, among other specimens, Māori names for local species of flora and fauna. He was also impressed enough by the waterfall at Kerikeri to mention the site in many of his publications.

In addition to Lee's grammar, other vocabularies and dictionaries of the period showed Māori numbers as decimal: an earlier vocabulary by John Savage (1807), who had visited the Bay of Islands in 1805, and two later dictionary series, one by Robert Maunsell (1842, 1862) and another by the Rev. William Williams and his son, the Rev. William Leonard Williams (1844, 1852, 1871, 1892). While neither Lee, Savage nor Maunsell mention undecimal counting, the elder Williams most certainly did:

> The Native mode of counting is by elevens, till they arrive at the tenth eleven, which is their hundred; then onwards to the tenth hundred, which is their thousand: but those Natives who hold intercourse with Europeans have, for the most part, abandoned this method, and, leaving out *ngahuru*, reckon *tekau* or *tahi tekau* as 10, *rua tekau* as 20, &c. (Williams 1844: xv)

Beyond crediting an unflattering decimal rehabilitation to European influence, Williams senior (1844: xv) made no attempt to reconcile the decimal numbers in his dictionary series with the purported practice of counting with them undecimally, though he would suggest Māori were following "the principle of putting aside one to every ten as a tally". American mathematician Levi Leonard Conant (1896: 123) speculated that "[e]arly observers among [the Māori], seeing them count 10 and then set aside 1, at the same time pronouncing the word *tekau*, imagined that this word meant 11, and that the ignorant savage was making use of this number as his base". Based on a characterisation of the events communicated to him by the junior Williams, Conant would later report the incident as a "misconception" that "found its way into the early New Zealand dictionary, but was corrected in later editions" (p. 123). In actuality, the material was not corrected but simply removed without comment; further, it remained in the second (1852) edition of the Williams dictionary and was not removed until the junior Williams took over the series with the third edition (1871).

A PRANK, A MISUNDERSTANDING OR A HOAX?

Just before describing the remarkable singularity—in fact, in the immediately preceding paragraph—Craik (1830: 417) observed the South Sea Islanders were known "to amuse themselves with that sort of wit which [Jonathan] Swift calls 'selling a bargain' ". He provided, as an example:

> An instance of this occurred a few years ago. A young missionary, who was reading a book of travels in Sir Joseph Banks's library, was observed every now and then to burst out into a violent fit of laughter; and on the cause of this being asked, it was found that he was reading over a vocabulary in which the natives had cheated the scientific compiler, by giving such answers to his inquiries, that, had any future voyager attempted to use the work of his predecessor, no very good opinion would have been entertained of his morals, and he would have been far distant from the attainment of any object for which he might think he was asking. (p. 417)

The missionary in question might well have been reading the Tongan number words collected and published by Jacques de Labillardière (1799), as the title of the book containing it was listed in the Banks library catalogue as early as 1800 (Dryander 1800: 313), doubtless reflecting Sir Joseph's own great interest in South Seas exploration, as he had accompanied Cook on his first Pacific voyage (1768–1771). Labillardière had been a member of the 1791–1792 expedition searching the South Seas—in vain, as it happened—for signs of the lost 1788 expedition of Jean-François de Galaup de La Pérouse.[4] Despite the serious purpose of his own expedition, on visiting Tonga, Labillardière "had the perseverance to interrogate the natives, and obtain particular names for numbers as high as 1,000,000,000,000,000!!" (Martin 1818: 370–71). These included words that were not in actuality numbers but "Tongan names for sundry unseemly anatomical details, and the polysyllabic word given for 10^{15} was actually an invitation to eat up the things which had been named previously!" (Tee 1988: 402).[5] Craik's sly if oblique reference, positioned to contextualise Balbi's description of Lesson's eyewitness account, suggests he suspected the local inhabitants were having similar fun with a naïve foreign visitor, especially since both situations involved numerical vocabulary.

Interestingly, apart from the footnote in von Chamisso's 1825 article, Lesson does not appear to have published his own account of what would have been a notable discovery. No trace of it is found in his own extensive writings on the *Coquille*'s voyage, his discoveries in multiple disciplines, his impressions of the Oceanic peoples generally, his observations of the New Zealand people specifically or his notes on Rotouma and Oualan [Kosrae], islands visited after New Zealand in 1824 (1825a, 1825b, 1825c, 1826, 1827a, 1827b, 1828a, 1828b, 1829a, 1829b, 1829c, 1830; Lesson and Garnot 1826). While several of these publications contain numerical vocabularies, three stand out in particular. His 1826 volume not only highlighted the use of decimal numbers in the Caroline Islands but also compared them to those in the work by von Chamisso he had translated and corrected in 1825 (Lesson and Garnot 1826: 84). His notes on Rotouma and Oualan, published the same year, included their numbers (Lesson 1825b: 75–76; 1825c: 43). A remark on finding unusual numbers in New Zealand would surely have found any or all of these a suitable venue.

Neither did the ship's commander, Louis Isidore Duperrey (1825, 1826, 1828), nor his second-in-command, Jules Dumont d'Urville (d'Urville *et al.* 1829), mention what would certainly have been a singular discovery on the part of their crew. However, Lesson's friend and colleague, Blosseville, whom Craik (1830: 417) had associated with an early report, apparently did mention it by letter to another colleague, Nell de Bréauté. This correspondence, reported third-hand by yet another gentleman-scholar of the period, Hungarian astronomer Baron Franz Xaver von Zach, was brief and undetailed:

> Mr. Nell de Bréauté writes that, according to the communications he has received from M. de Blosseville, the map of the Carolinas, and especially that of New Zealand, is much changed by the observations made in the

> expedition of the *Coquille* by Captain Duperrey. On this last island, a system of undecimal numbering was found in use. (von Zach 1826: 121, as translated from the original French)

As for Blosseville's (1826a, 1826b) own publications on the voyage, the remarkable singularity is again conspicuously missing. Had the explorers thought the discovery a real one, they would surely have formally claimed its attendant publicity, since the purpose of publishing a voyage was to promote its accomplishments, highlight its importance, assure patrons the investment had been sound and elevate the stature of the officers and scientific explorers. Since the extraordinary claim would continue to gather attention for the next century, these omissions are otherwise inexplicable.

Yet the affair is not so easily attributed to a misunderstanding on Lesson's part, as he encountered many Pacific number systems during his time on the *Coquille* and was familiar with the literature. In 1825 he had, as noted earlier, contested von Chamisso's identification of New Zealand numbers as vigesimal. In his notices on Rotouma and Oualan, also published in 1825, he included number words, comparing them to Pacific numbers generally and concluding their similarities suggested relatedness among the Oceanic peoples (Lesson 1825b: 75–76; 1825c: 43). His grammar of the language of Madagascar contained its numbers (Lesson 1827a: 97–98). In his first volume on zoology, he drew upon his 1824 contact with Oualan, Pénélap [Pingelap] and Doublon [Tonowas], von Chamisso's vocabularies for Bisaya [Cebuan], Pampango [Kapampangan], Tagala [Tagalese], Chamori [Mariana Islands], Radack [Marshall Islands], Eap [Yap] and Ulea [Woleai] (von Chamisso 1821b) and Wilson's vocabulary for Pelew [Palau] (Keate 1788), concluding "decimal numeration is the only one used, and, although the names of the numbers vary, the arithmetic system is the same" (Lesson and Garnot 1826: 84, as translated). In 1828, he compared the numbers of Tahiti to those of Madagascar and the Tahitian language to that of New Zealand; for the numbers, he again said their similarities likely arose from a common source, even though the peoples in question were "so distant and distinct from one another" (Lesson 1828a: 279–80, as translated). And in 1829, he published numerical vocabularies from his travels in the Papuan region, including New Ireland, Doréry, Salwatty, Tidore, Waigiou and the New Guinea interior (Lesson 1829a: 103, 164–66). All in all, excepting the 1825 footnote, Lesson's work on number systems was factual, informed, contextualised and entirely commonplace. It was so unremarkable, in fact, that it cannot easily be reconciled with the possibility he may have misunderstood the numbers he encountered in New Zealand.

The prospect of the affair being a hoax on the part of Lesson and Blosseville cannot be discounted, even though, at least initially and indirectly, they were willing to attach their names to the story. They were after all young, more than a little disenchanted with seafaring and keen to establish their names and reputations (Rallet 1953). And it is tempting to construe the affair as having started with a printer's error. Von Chamisso's (1825: 27) text reads, "le système arithmétique [est] fondé sur une échelle de vingt, comme dans la Nouvelle-Zélande". Lesson's footnote correction states, "(2) Erreur. Le système arithmétique des Zélandais est undécimal", where "un décimal" might have been intended and, moreover, would have been consistent with both von Chamisso's 1821 correction and Lesson's published work on Pacific number systems. As youthful skylarks or prideful justifications go, embellishing this exchange as a fantastical pseudo-scientific tale would have been relatively benign. And as Buschmann (in von Humboldt 1839: 437–38) would later note, the resultant number words were not something an experienced linguist would find credible. Indeed, the same sort of error helped identify as specious the lists of South Sea number words announced by Lanyon-Orgill (1979) some 150 years later (Clark 2011; Geraghty 1983).

Whatever the actuality of the case, if Lesson and Blosseville hoped the lack of formal publication on their part might make the incident fade away, they were to be disappointed, as the notion would continue to percolate through scholarly discourse. By the late nineteenth century, the remarkable singularity was repeated in anthropological works, encyclopaedias, mathematical volumes, numerical treatises and scholarly reviews with greater or lesser credulity and enthusiasm. Some merely reiterated the rumour as fact (Cantor 1880: 9; Fink 1890: 6; Grabowsky 1889: 96; Günther 1888: 1; Reinach 1890: 615), while others attempted to explain or make sense of the practice along the same lines the senior Williams had once employed: as putting aside one item to represent every ten, misunderstood by European observers as counting by elevens (Conant 1896: 123); as calling out the attainment of the tally, not the number itself (Codrington 1885: 246); or as humorous analogue to the baker's dozen (Reuleaux 1885: 275). However, at least one scholar seems to have doubted the report's veracity, saying it needed confirmation or refutation (Schubert 1888: 292). Others merely listed Māori numbers as decimal (Peacock 1845: 385) or discussed their structure without mentioning the remarkable singularity (Tylor 1871: 232), suggesting these authors either were unfamiliar with the tale or rejected it as nonsense on principle.

By the twentieth century, no serious linguist or anthropologist believed the tale, though a few simple, unsourced mentions were made by synthesists or peripheral figures: "In New Zealand, words for 11^2 and 11^3 have been found" (Henrici 1964: 291); "in one case, the one-extra digit system did arise: after the fingers, the whole hand was also counted. This is evidenced, for example, by representations for the 1st, 2nd, and 3rd powers of 11, and also the representations $12=11+1$, $13=11+2$, $22=11\times 2$ for New Zealanders"

(Berjoskina 1982: 32, as translated from the original Russian). Other reports, even more recent and a bit more detailed, recognised the notion as mistaken but suggested the idea and number words for 11^2 and 11^3 had originated with the Williams dictionary, as by this time the affair's Continental origins had been forgotten:

> In New Zealand, the missionary William Williams initially misunderstood Maori counting practice, and in the first edition of his Maori–English dictionary he claimed that the Maori counted by elevens, and he gave words purported to mean 11^2 and 11^3: actually, they meant 10^2 and 10^3. That blunder was corrected in all [*sic*] later editions of Williams's dictionary—but reports have been published in recent years claiming that the Maori used 11 as the base of their number system. (Tee 1987: 1; 1988: 403; in both, Tee cites Berjoskina 1982; Conant 1896; Henrici 1964; and Williams 1844. Kahaner's 1993: 65 near-verbatim account appears to have been based on Tee's 1987 and 1988 publications.)

It is not difficult to explain why such ridiculous farce might proliferate and persist: "No apparent reason existed for this anomaly, and the Maori scale was for a long time looked upon as something quite exceptional and outside all ordinary rules of number-system formation" (Conant 1896: 123). This estimation was accurate because, except for Māori, only one other case of undecimal counting has ever been asserted (for the Pañgwa, a Bantu-speaking people of Tanzania), but this report, like that on Māori, could not be confirmed (Hammarström 2010: 24). Since no undecimal systems have ever been found (Comrie 2011), the discovery of one at any point in time would indeed be worthy of remark.

WHAT THE CURIOUS IDEA ILLUMINATES ABOUT POLYNESIAN NUMBERS

If now half-forgotten and dismissed as historical curiosity, the idea that Māori once counted by elevens nonetheless offers valuable insights for contemporary cross-cultural research in number systems. First, the very oddity of the tale has acted to conceal the counting strategy used: setting aside every tenth item as a tally. This practice is not just pragmatic and clever, it is also key in understanding highly elaborated, unwritten numbers like those of the Polynesians; moreover, it can challenge assumptions about how concepts of exponential value might emerge. Second, the tale illuminates some of the reasons why people enculturated into notationally mediated numbers can find it difficult to appreciate ones that are highly elaborated but unwritten. The third and final insight is more definitional: whether Polynesian number systems are appropriately categorised as vigesimal or decimal, the substance of Kendall's confusion and perhaps the specific point of disagreement between von Chamisso and Lesson. Polynesian number systems, which count not just singly but with multiple objects as the unit of enumeration, share traits with both decimal and vigesimal systems, such that neither category is adequately descriptive.

Counting Exponentially by Setting Aside Every Tenth Item

Those who must work physically—including counting lots of objects—often develop strategies to make their jobs easier, and the Polynesians were no exception in this regard. Tallying by setting aside every tenth item as a counter is a brilliant method of reducing both the physical and mental effort of counting. Physically speaking, the method eliminates the need to create the increasingly large and correspondingly heavy and bulky groups implied if single objects were combined as groups of tens, groups of tens as hundreds, groups of hundreds as thousands and so on. The method reduces handling to a matter of sorting objects into two groups—every nine go into the "counted" pile, while every tenth goes into the "tally" pile—with handling reduced even further when the counted unit is multiple, instead of single. The method is also extensible from units and tens, to tens and hundreds, hundreds and thousands, thousands and tens of thousands and so on, with each new pile of items set aside as tallies understood to mean ten times the previous register. Mentally speaking, sorting and setting aside makes counting a matter of repetitively counting to ten, reducing demands on cognitive processes like attention and memory. The method can be used without needing any kind of ancillary record, since the enumerated objects themselves serve this purpose as they are rearranged, and this further reduces both the physical and mental labour of enumeration.

Tally counting creates temporary piles of objects representing different exponential weights—a pile of *tens*, a pile of *hundreds* and so on. An object assumes a value ten times greater than its counterparts by being sorted into a different pile; this creates a literal place value, exponential weighting acquired from being physically located in a different pile. The piles effectively comprise a representational device, an *ephemeral abacus*: an abacus because it instantiates exponential grouping and facilitates the exchange of value between groups; ephemeral because the device persists only while counting is performed. While such devices are ad hoc and short-lived, they also suggest a mechanism for realising two-dimensional structure in numbers because exponential grouping through sorting is added to the ordinal accumulation of a counting sequence. On this account, numerical structure emerges from exponential distinctions created physically and understood contextually, with linguistic labels emerging to reinforce and perpetuate the exponential distinctions and to help remember and recall the information in the absence of a persisting material device.

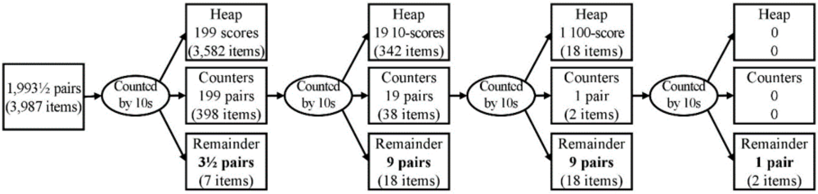

Figure 2. Pair-counting with every tenth pair set aside as a counter. In the first round, 3,987 items counted in pairs (1,993½ pairs) by tens create 199 scores, of which every tenth pair (199 pairs or 398 items) is retained as a counter and 3,589 items (3,582, or nine of every ten pairs, plus the remainder of seven) are added to the heap of items counted. In the second round, 398 items counted in pairs (199 pairs) by tens create 19 ten-scores (numerically valued at 20 each), of which every tenth pair (19 pairs or 38 items) is retained as a counter and 360 items (342, or nine of every ten items, plus the remainder of 18) are added to the heap. In the third round, 38 items are counted in pairs (18 pairs) by tens to create one 100-score (numerically valued at 200), with 36 items (18, or nine of every ten items, plus the remainder of 18) added to the heap. In the fourth and final round, two items counted in pairs (one pair) represents one 1,000-score (numerically valued at 2,000). Note: The term *heap* is taken from Hale's (1846: 247) description of Polynesian counting: "Taking one [item] in each hand, the native, as he throws [the items] into the storehouse, or on to the heap, counts *one*; for two pairs, he says *two*; for ten pairs simply *ten*, and so on".

A Tikopian informant was recorded as using grains of rice to demonstrate the method: he "reckoned nine and then put aside the 10th grain, and so on. Afterwards he reckoned up the tenth grains to reckon the hundreds"[6] (Durrad 1913: 146). Figure 2 shows a detailed example of the method with pair-counting: 3,987 items make 1,993½ pairs. The first round of counting, by setting aside every tenth item to act as a tally, leaves 398 items to represent 199 groups of ten pairs (*tekau* or *scores*) and a remainder of 3½ pairs. The second round produces 38 items to represent 19 ten-scores, numerically valued at 20 each, and a remainder of nine pairs. The third round produces two items to represent one 100-score, numerically valued at 200, and a remainder of nine pairs. The last round leaves one pair to represent one 1,000-score, numerically valued at 2,000. In modern notation, the remainders (3½, 9, 9 and 1) can be multiplied appropriately to produce an anachronistically precise answer: $[(1 \times 2{,}000) + (9 \times 200) + (9 \times 20) + (3\frac{1}{2} \times 2)] = 3{,}987$. However, words for *remainder*, like *tauwhara* in Māori (Best 1906: 166), are common throughout Polynesia and suggest the result might well have been understood as one virtual bundle worth 2,000 and a remainder.

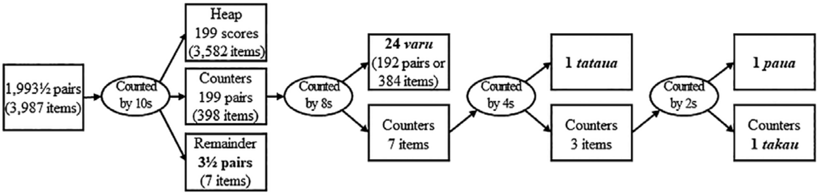

Figure 3. Mangarevan binary counting as an extension of the tally method. The initial value from Figure 2 (3,987) is used to aid comparison with Figure 3, though the computation yields an amount (24 *varu*) that exceeds the upper limit for binary counting, which was 10 *varu* (Hiroa 1938: 417; Janeau 1908: 20, noting these authors calculated the upper limit somewhat differently).[7] The first round, which counts by tens, is identical to that of Figure 2. The 398 counters from the first round are then counted by eights to create 24 *varu*, perhaps also explaining why the higher unit is called *varu*, meaning *eight*. Changing the basis to eight greatly simplifies counting beyond the first round by leveraging productive terms for *ten eights*, *ten fours* and *ten twos* and relations between *eight*, *four* and *two*. Though the amount could be expressed as 24 *varu* with a remainder, the process is also easily carried out further: of the remaining seven counters, four make one *tataua*, two make one *paua* and one makes one *takau*. The full result would be expressed as *rua takau ʻa varu tataua paua takau toru*, or [(24 × 80) + (1 × 40) + (1 × 20) + (1 × 10) + 3] with one single item (half of a pair) remaining. The method thus has the potential to make the final amount more precise, as remainders are part of the final arrangement. When the unit is four, 3,987 single items make 996¾ units, counted as (*taʻi*) *takau rua varu paua takau ono*, or [(12 × 80) + (1 × 20) + (1 × 10) + 6] with three single items remaining. When the unit is eight, 3,987 single items make 498.375 units, counted as *ono varu takau varu*, or [(6 × 80) + (1 × 10) + 8] with three single items remaining.

The method can be used with single items, where counting 3,987 yields [(3 × 1,000) + (9 × 100) + (8 × 10) + (7 × 1)]. It is also extensible to counting with multiple units other than pairs: counting 3,987 by fours yields [(9 × 400) + (9 × 40) + (6¾ × 4)], while counting the same amount by eights yields [(4 × 800) + (9 × 80) + (8.375 × 8)]. Notably, the method explains the curious Hawaiian term for *twenty*, *iwakalua* or *nine and two*, as nine counted in pairs and the last two items set aside as tallies (Fig. 2). It also plausibly underpins the binary steps in one of the Mangarevan counting sequences, a simple extension of the method that incorporates the equivalence heuristics and associated linguistic labels for pairs, fours and eights (Fig. 3).

As René Lesson remarked, Polynesian number words, counting practices and numerical structure are relatively homogeneous across the region. In fact, the geographic distribution of traits (Fig. 4) and related practices like rounding suggest that tally counting was likely practised throughout Polynesia. As settlement moved west into the central and peripheral portions of Polynesia, number systems generally lost their elaborate numeral classifiers and acquired the upward shift in value associated with counting by pairs and fours. Some of the higher terms also shifted downwardly in value in the peripheries: while *afe* means 1,000 and *mano* 10,000 in Sāmoan and Tongan, *mano* means 1,000

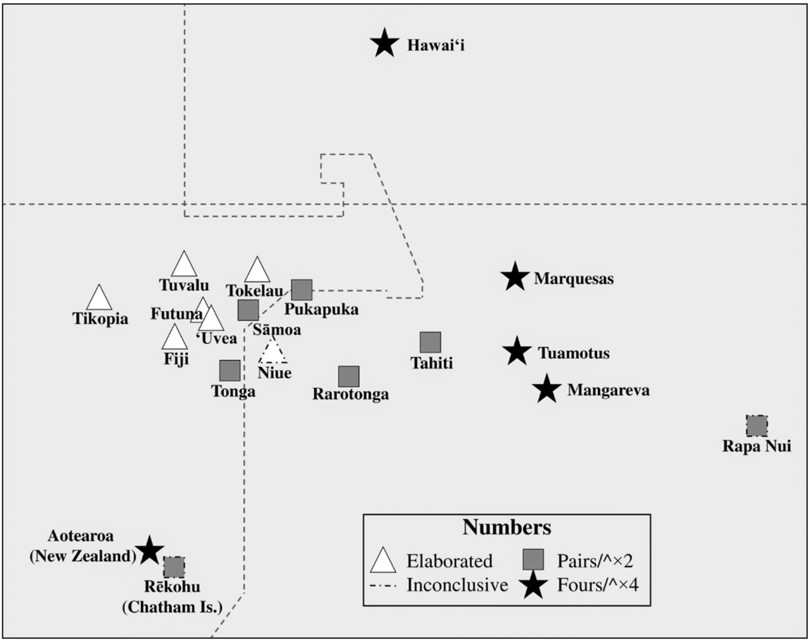

Figure 4. Geographic distribution of counting practices in Polynesia. Throughout Polynesia, counting varies by the type of object being counted. In the western (longest-settled) portion, counting includes the use of elaborate numeral classifiers (white triangles), perhaps as a means of encoding the type of object being counted. In central Polynesia, counting by pairs and fours is characteristic (grey squares), and in most recently settled eastern, northern and southern portions, productive terms are shifted upwardly by a factor of two or four (black stars), as are the base values of terms for hundreds and thousands (not shown). Insufficient information was available to classify Niue, Rapa Nui or Rēkohu according to the type predicted for their geographic location (dashed lines). Historical sources also often fail to differentiate the specific islands or dialects, encountered, instead designating them more generically (e.g., Tonga).

in the languages of Hawai‘i, Mangareva, New Zealand, Nukuhiva, Paumotua, Rarotonga and Tahiti (Hale 1846: 247). The downshift and other changes in the value of higher exponential terms may represent more than simply an imperfect memory for infrequently used higher terms, as it also implies tally counting may have acted as a persistent mechanism for structuring numbers decimally and occasioning names at the exponential points.

Notationally Mediated vs. Unwritten Numbers

If developing a "systematic mathematics requires writing, and hence a non-literate culture cannot be expected to advance mathematics beyond the stage of numeral words and counting" (Tee 1988: 401), it does not follow that unwritten numbers are necessarily unelaborated. Undoubtedly, written notations contribute greatly to numerical and mathematical elaboration, through *handwriting effects*, which influence written numbers to be conceived as entities in their own right, rather than collections of objects; *relational data*, whose bulk accumulation becomes feasible through notational concision, enabling numbers to be conceptualised in relational terms; and *non-numerical writing*, which lets calculations be documented, codified and elaborated, assuming it is available in addition to numerical notations (Overmann 2018a, 2018b, 2019). Yet unwritten numbers span a gamut that includes not just systems with few numbers and relatively little elaboration (e.g., the Mundurucu of Amazonian Brazil count to "about four"; see Rooryck *et al*. 2017), but also systems with many numbers and counting sequences highly elaborated with numerical relations (e.g., the Māori and other Polynesian societies counted into the tens of thousands and often higher, and their counting sequences were related by heuristics equivaluing terms like *twenty* counted singly and *ten* counted in pairs; see Hongi 1909).

Arguably, the use of multiple counting sequences was the crucial circumstance challenging early Western observations of Polynesian numerical practices. Multiple counting sequences, in which various types of items were counted not just one by one but in groups of twos, fours and even eights (Bender and Beller 2014; Campbell 1816; Hale 1846), would have been strange to Westerners more accustomed to counting only singly or counting pairs as *two*, *four*, *six*, *eight*.

Some confusion was practically unavoidable, as observers were likely to have thought of their own, Western numbers as universal and interpreted what they saw accordingly, the cross-cultural analogue to the "backward appropriation" imposing contemporary notions of numbers on those of the past (Rotman 2000: 40). Stated more strongly, Western numbers, elaborated over several thousand years as a notationally mediated system, act as a conceptual barrier: notations structure and organise numbers in ways informing both how numbers are acquired and what they are understood to be (Schlimm 2018). This creates an idea of what numbers *must be*, which would have made it difficult for men educated in the Western mathematical tradition to appreciate fully the non-Western numbers they encountered on their travels.[8]

The scientific explorers were also likely to have encountered both significant faculty in the interchange of different counting sequences (Clark 1839: 93; Ellis 1826: 441) and some variability in the way counting was practised across locales and individuals (Best 1921), further challenging their attempts at describing and categorising. In addition, they were not just educated men but gentlemen; this made them unlikely to have had much hands-on experience with physical enumeration tasks themselves, as it would be unusual for men of their social status to count lots of objects for purposes like inventories and commerce.

Decimal or Vigesimal?

Debate over whether Polynesian numbers should be categorised as vigesimal or decimal has continued since the days of Kendall, von Chamisso and Lesson (e.g., Bender and Beller 2006). At issue is the practice of counting with multiples as the unit of enumeration, which upwardly shifts the higher productive terms. In New Zealand, this created a vigesimal appearance (Best 1906); in Hawai‘i, counting by fours made *forty* productive (Campbell 1816); in the Marquesas, counting breadfruit by fours shifted productive terms upward by a factor of four (Eyriaud des Vergnes 1877; Handy 1923); and in Mangareva, binary steps emerged to prefigure those of Leibnitz in computational history (Bender and Beller 2014). Multiples-counting differs from vigesimal and decimal counting, though it shares qualities with both. Decimal and vigesimal systems, typically based on human digits, reach *twenty* by counting the fingers (decimal) or fingers and toes (vigesimal) of a single individual, and then repeating the cycle on the same or additional people. For decimal systems, the number *twenty-one* represents the initiation of a third cycle, the number *forty* the completion of the fourth, while for vigesimal systems, *twenty-one* represents the initiation of a second cycle, *forty* the completion of the second.

Polynesian pair-counting, in contrast, reaches *twenty* by counting ten pairs (Table 1); *eleven* in the sequence has the numerical value *twenty-two*, while a term meaning *remainder* would be required to append a half-pair to *twenty* to achieve the value *twenty-one*. Its *twenty* is productive in the same way *ten* is in a decimal system; *forty* is analogous, under its logic, to the decimal *twenty*, representing two complete cycles of counting ten pairs. The logic is decimal, but the numerical amounts correspond to those of a vigesimal system. Pair-counting is thus intermediate between a decimal and vigesimal system, and this can confuse how Polynesian number systems are categorised. For example, Lemaitre (2004) and Nishimoto (2015) identify Austral (Rurutu) numbers as vigesimal, when their prototypical form and organisation suggest they are more likely to be just as decimal as other Polynesian numbers. The lack of fit suggests either that new definitions and categories are needed for number systems counting with multiple units, an option that would capture necessary detail but might require more coordination and consensus, or that one of the two distinct categories—decimal for logic, vigesimal for numerical value—should be consistently applied.

Table 1. Prototypical decade formation in decimal, vigesimal and pair-counting systems.

Number	Decimal system	Vigesimal system	Pair-counting
10	**(1 × 10) 10 fingers**	10 fingers	5 [pairs]
20	(2 × 10)	**(1 × 20) 1 person**	**10** [pairs] **(1 *tekau*)**
30	(3 × 10)	(1 × 20) + 10	15 [pairs]
40	(4 × 10)	(2 × 20)	20 [pairs] (2 *tekau*)
50	(5 × 10)	(2 × 20) + 10	25 [pairs]

Note. Productive terms are highlighted in bold.

* * *

Tally counting and the ephemeral abacus it instantiates have also been documented in yam counting in Papua New Guinea (Döhler 2018: 16–18; Williams 1936: 226–27). In these senary systems, exponential structure can reach an impressive seventh power of six (279,936; see Evans 2009: 328; Fig. 5), rivalling that of Polynesia, where counting to the sixth power of ten (million) was attested before significant European influence toward standard decimalisation had occurred (Hale 1846: 247). However related Polynesian and Papuan exponential counting might be through regional proximity, the universality of counting practices across the globe generally suggests that the manuovisual engagement of material artefacts informs and perhaps underlies the development of complex, two-dimensional structure in numbers. This in turn challenges the idea such structure develops without involving material forms and implies devices have a greater role than being simply the passive recipients of mental content.

An awareness of the potential relation between such counting/sorting strategies and the realisation of exponential concepts like *hundreds* and

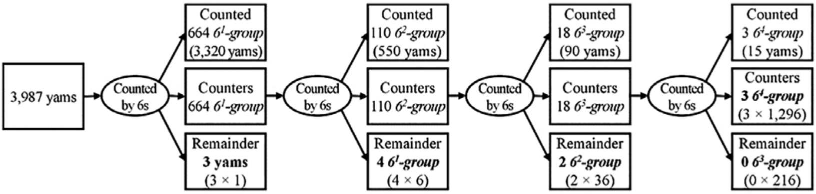

Figure 5. Senary yam counting in Papua New Guinea. The initial value from the previous figures (3,987) is used to aid comparison. Williams (1936: 226–27) described yam counting as a deliberative process involving multiple participants wherein tallies are carefully counted and verified at each stage. The uppermost boxes were retitled from "Heap" to "Counted" to express this difference from the more rapid Polynesian sorting method, but it is worth noting some of the scrupulousness Williams observed might have reflected an unfamiliarity with senary counting, as the Keraki villagers (whose own numbers were "a 1–5 system") were said to have borrowed the method from the Gambadi and Semariji languages. In the first round, 3,987 yams are counted by sixes to create 664 groups valued at six each (3,320 yams), of which every sixth (664 yams) is set aside as a counter, with three yams left over. In the second round, 664 yams are counted by sixes to create 110 groups valued at 36 each (550 yams), of which every sixth (110 yams) is set aside as a counter, with four yams (worth six each) left over. In the third round, 110 yams are counted by sixes to create 18 groups valued at 216 each (90 yams), of which every sixth (18 yams) is set aside as a counter, with two yams (worth 36 each) left over. In the fourth and final round, 18 yams are counted by sixes to create three groups valued at 1,296 each (15 yams), of which every sixth (three yams) is set aside as a counter, with no yams (worth 216 each) left over. The three yams set aside as counters in the final round are valued at 1,296 each.

thousands is conspicuously absent from the literature on number systems, where one gains instead an impression numbers are purely mental entities originating in ratiocination or language alone.[9] As a referee to Overmann 2018a commented, "what the vast majority of cultures actually have [are] verbal representations of quantities, often without any material representations of them"—that is, many words but few devices. Yet this view may assume an overly narrow definition of representational form, which can be biological (fingers), symbolic (notations) or ephemeral (counting/sorting). To those who rightfully object that temporary piles of sorted objects hardly constitute an artefact as one is usually defined, the converse must be noted as well: while admittedly ephemeral, the abaci created by Polynesian tally counting are nonetheless material enough to suggest exponential realisation involves more than mental effort. Further, the manuovisual stimuli they provide would prompt, scaffold and facilitate the conceptualisation process, making concepts more attainable and therefore more likely. Ultimately, Māori tally counting may find its greatest utility in foregrounding the material we may be missing in a way that puts to the test the idea of an unassisted-brain origin for numbers.

In sum, the idea that Māori once counted by elevens can be more than what it has become, an abandoned, bizarre, nineteenth-century relic of cultural misunderstanding. It can let us examine how Polynesians actually counted, consider the material and mental implications of setting aside every tenth item as a tally and admire the method's practical efficiency and its effects on numerical structure and organisation. It can provide us with a novel opportunity to look past our notationally mediated, Western constructs of what numbers *are* and *must be* and discard their constricting effects on how we understand numbers that are neither. And it can enable us to resurface the issue of how Polynesian numbers are appropriately categorised, suggesting either the expansion of current categories or a greater consistency in their application. Above all, it can let us appreciate the beauty of cross-cultural numerical structures, the pragmatic brilliance of Polynesian counting and the wonderful opportunity to examine them afresh through the historical lens.

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NOTES

1. All translations were performed by the author.
2. There are two indigenous languages of New Zealand, Māori and Moriori. The historical references consulted for this research do not differentiate them but instead refer to "the language" of New Zealand. In the context of the idea of counting by elevens, however, it seems probable that Māori was intended, given Lesson's contact with the northern tip of North Island (Fig. 1) and Moriori's association with the more southerly Chatham Islands (Deighton 1889).
3. In a footnote to the original material, Buschmann (in von Humboldt 1839: 763) noted Lee's grammar gave *Ka nga údu* for 10 (also see Lee 1820: 17).

4. The La Pérouse disappearance would capture the national attention for decades, to the point that novelist Jules Verne included it in his 1869–1870 serialisation of *Twenty Thousand Leagues Under the Sea*. As history would ultimately discover, the two ships of the La Pérouse expedition had wrecked amid the Solomon Islands, where they, along with probable survivors, would remain unlocated for the next forty years.
5. Some of the terms were so indelicate Martin declined to list them explicitly, referring interested readers instead only to the general vocabulary included in the volume.
6. Durrad (1913: 146) also noted the Tikopian informant became confused in trying to extend the counting method from hundreds to thousands. This was interpreted here as indicating a lack of practice and not as disconfirming the counting method.
7. Hiroa (1938: 417) said the upper limit of the binary counting system was 800, or 10 *varu* without any of the lower units. Janeau (1908: 20) put the upper limit at 1,440, or 9 *varu* counted in pairs. This is essentially the same limit noted by Hiroa, as half of 1,440 (720) plus the maximum in all lower units yield 799 (9 *varu*, 1 *tataua*, 1 *paua*, 1 *takau* and 9 *tauga*), or one less than 800 counted in pairs (and numerically equivalent to 1,598). As 10 *varu* (Hiroa's method), the upper limits are 800 (singles), 1,600 (pairs), 3,200 (fours) and 6,400 (eights); as 9 *varu* (Janeau's method), the upper limits are 720 (singles), 1,440 (pairs), 2,880 (fours) and 5,760 (eights); as 9 *varu* plus maximum lower units, the upper limits are 799 (singles), 1,598 (pairs), 3,196 (fours) and 6,392 (eights).
8. In perhaps the most extreme case of this conceptual conflation, the Spanish reportedly showed the Rapanui written notations to elicit their words for numbers (Fedorova 1993; González de Haedo 1770).
9. For example, Dutch mathematician Luitzen Brouwer (1981: 90) viewed numbers as emerging from an "inner experience" of the mind. In comparison, American linguist Noam Chomsky (1988: 169) claims the "human number faculty [to be] essentially an 'abstraction' from human language, preserving the mechanism of discrete infinity and eliminating the other special features of language".

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A LARGE TROLLING LURE SHANK FROM AHUAHU GREAT MERCURY ISLAND, NEW ZEALAND

LOUISE FUREY
Auckland War Memorial Museum

REBECCA PHILLIPPS
University of Auckland

JOSHUA EMMITT
University of Auckland

ANDREW MCALISTER
University of Auckland

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ABSTRACT: Large stone trolling lure shanks, greater than 100 mm, are rare and stylistically associated with the early period of Māori occupation of Aotearoa New Zealand. The triangular-sectioned shank is distinctive and reminiscent of Polynesian forms. The 2016 find during excavations at T10/360 at Waitapu in Coralie Bay, Ahuahu Great Mercury Island, is the first to be recovered in an archaeological context and only the third large shank attributed to the North Island. Moreover, the shank is the largest complete example known. Radiocarbon dates from contexts in direct association with the shank indicate deposition in the early 15th century, slightly later than other sites such as Wairau Bar and Shag River Mouth where similar shanks have been found. A comparative analysis of the attributes of all 28 shanks in New Zealand museum collections indicates no regional patterns are evident. We review the context in which the Ahuahu shank was found, and its importance, along with the other items recovered, for the interpretation of the Waitapu occupation. We also consider the various reported interpretations of large trolling shanks and, based on Polynesian examples where symbolism and function are discussed, suggest large shanks were not used directly in fishing but had a fishing-related role.

Keywords: Māori material culture, serpentinite artefacts, trolling lure shank, New Zealand archaeology, Ahuahu Great Mercury Island

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Large stone trolling lure shanks, stylistically associated with the early period of Māori occupation of Aotearoa New Zealand, are rare. The November 2016 find during excavations at T10/360 at Waitapu in Coralie Bay, Ahuahu Great Mercury Island (Fig. 1) (Furey *et al*. 2017), is the first to be recovered in an

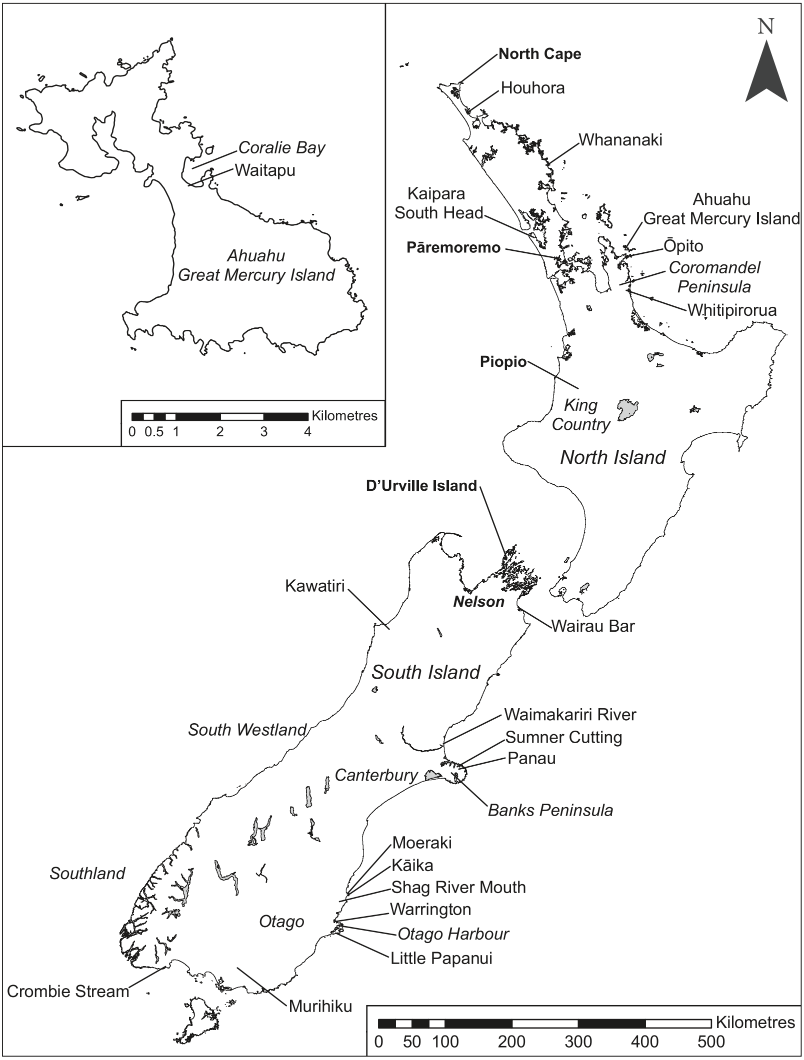


Figure 1. Places mentioned in the text, with an inset of Ahuahu Great Mercury Island. Serpentinite sources are identified in bold.

archaeological context and only the third known large shank attributed to the North Island. Moreover, the shank is the largest complete example known. Here we provide commentary on similar items in New Zealand museum collections, review the context in which the shank (identified as 174914 in the project database) was found and discuss radiocarbon determinations from T10/360. We also consider the function of large trolling shanks and the importance of this one for interpretation of the Waitapu occupation.

COMPARABLE NEW ZEALAND TROLLING LURE SHANKS

Trolling lure fish hooks, comprising a bone point lashed to one end of a stone or bone shank and a groove or perforation at the other end for attaching a line, were pulled through the water to attract pelagic fish. Most trolling lure shanks in museum collections or recovered from excavations are small, of oval cross-section and grooved for line attachment. Shanks from the initial colonisation period are more varied in form and include those with perforations and a triangular cross-section, in addition to more common oval and rectangular forms made from stone, bone and less frequently, shell (Davidson 1979; Duff 1977; Furey 1990, 2002; Teviotdale 1929). Hamilton (1908: 22) called the trolling hooks *manea*, as opposed to the generic *pā* now used, and large fish hooks *whatu*, which had *karakia* 'Māori incantations and prayers' recited over them at appropriate times to ensure a plentiful catch. However, Hamilton did not specify whether these large fish hooks were also functional and used to catch fish.

Skinner (1942: 257–58) observed the resemblance of triangular-sectioned trolling lure shanks from chronologically early southern New Zealand sites to bonito lures of Polynesia, particularly those examples with greatest depth at the perforation and, in profile, a pronounced upper surface curvature from proximal to distal end. The early age of the sites was based on the style of associated material culture and presence of extinct birds.

Museums were canvassed for large-sized objects of similar form, called shanks for want of something to call them because that is what they resemble, but function cannot be assumed from the shape. There are only a few excavated early archaeological assemblages with trolling lure shanks, indicating the rarity of excavated shanks of any size and of large shanks in particular. The assemblage from Wairau Bar, the most well known of early settlement sites, is an exception, and with 248 shanks is the largest assemblage from any site (Duff 1977; Findlater 2011). A large area of the site was, however, dug over using non-archaeological techniques to obtain the quantity of material culture recovered. Kawatiri Buller River Mouth produced 57 shanks fashioned from stone (Findlater 2011). The count at both sites includes fragments and items at all stages of manufacture. While the shanks from Kawatiri are made exclusively from stone, those from Wairau Bar are fashioned from stone (189), bone (5) and shell (54). Around 50% of shanks from Kawatiri and 73% from Wairau Bar are triangular in cross-section (Findlater 2011: 119, 120). Kawatiri shanks are all less than 80 mm in length, and while the largest complete shank from Wairau had a length of 102 mm, and one mid-section fragment is also likely to have come from a large shank (Duff 1977: 390), the remainder of the 248 are less than 80 mm in length, indicating that large shanks were not the norm.

Based on size distributions from the two large archaeological assemblages, a minimum size of 100 mm was set as the criterion for distinguishing large shanks in museum collections. Suitable lures were measured, even when only a fragment was present. The presence of notching on the edges, flaking, and point seat modifications and the presence or absence of projecting fins or incised lines were recorded, including for those examples illustrated in the literature but not relocated. There are 28 complete or fragmentary shanks in total, but not all have a known provenance (Table 1 and Fig. 1). Five fully ground examples lack perforations and a point seat area. Dimensions for the shanks in private or museum collections that were not sighted were obtained from published descriptions.

Ten shanks are attributed to Shag River Mouth in Otago (Anderson and Gumbley 1996: 148; Skinner 1942; Teviotdale 1929). Other Otago examples are from Moeraki, Kāika near Moeraki, and Warrington, and a recently found shank is from Little Papanui (Phillip Latham, University of Otago, pers. comm., 2017). Elsdon Best's (1929: 35–36) provenance of the Moeraki shank was later disputed, without elaboration, by Roger Duff (1977: 207), who claimed it was collected by Augustus Hamilton from Shag River Mouth. There are two examples attributed to the Southland region, locations unknown. Further north in the South Island are shanks from Sumner Cutting in Christchurch, Panau on Banks Peninsula, Waimakariri River Mouth and one in a private collection (C. Griffiths) with artefacts mainly from the South Canterbury and North Otago areas. Two examples are from Wairau Bar. Only three shanks more than 100 mm are known from the North Island: Whananaki north of Whangārei, Kaipara South Head and the lure shank described here from Ahuahu. There are two with no provenance whatsoever.

An item in the Southland Museum from Crombie Stream on the south coast of Fiordland is termed a trolling lure shank in the museum catalogue and fits the size criterion, but instead of a point seat area at the distal end it has grooves on the ventral surface for lashing. It also has circular depressions drilled from both sides which do not meet, and bosses at the ventral margin behind the depressions. While this item might be similar to others described here, given it is made from bowenite, which is brittle, it is interpreted as a pendant in the style of a trolling lure shank and therefore is not included.

One of the Southland-attributed items has the distinctive minnow lure shape but the distal end is broken across a bilateral perforation. Although referred to as having a unique method of point attachment (Skinner 1942: 267), it is more likely to have been reworked and subsequently broken through the perforation.

Approximately half of the shanks described above are made from serpentinite. Stone identification of the remaining items, mostly from Shag River Mouth, has not been confirmed, although Teviotdale (1929: 280) describes the materials as red argillite, basalt, mudstone and schist. The Little Papanui shank is "red claystone" from the Otago Harbour area (Phillip Latham, pers. comm., 2017). Unfortunately, raw material is not identified in a consistent way for most shanks, and during a visit to Otago Museum in 2017, only casts of some were available for measurement. The Southland Museum item is described in the catalogue as "dark grey baked argillite". Canterbury Museum shanks from Sumner, Wairau Bar, Kāika and Shag River Mouth are of black serpentinite, as are the North Island Kaipara and Whananaki shanks.

Skinner (1942) asserted that shanks increased in size from Banks Peninsula south to Otago on the basis that none have been found further north. Duff reiterated Skinner's observation, but since 1956 when the first edition of Duff (1977) was published, more shanks have been accessioned into museum collections and the generalisation of large shanks being exclusively from southern South Island no longer holds true. Duff (1977: 207) reasoned that the large size would prevent the shank and hook being swallowed and the line severed by the sharp teeth of barracouta (*Thyrsites atun*), the dominant fish catch in the south. Following this reasoning, large shanks should occur frequently in museum and excavated southern assemblages. However, Anderson (1981: 281–82) argued the specialised wooden lures and bone points which also occur in early southern sites were designed to catch barracouta, and instead proposed that the large shanks were pendants, although there is no evidence to support this interpretation other than they have perforations which might have been used for suspension.

Of the large lure shanks 17 are complete and range in length from 102 to 218 mm. The remaining 11 are fragments, predominantly the distinctive proximal end, but there is a mid-section fragment from Wairau Bar, and one represented only by the distal end from Shag River Mouth. Teviotdale (1929) referred to an example in Southland Museum that measured 125 mm in length and is possibly the object illustrated by Hamilton (1908: 23, fig. 10, top left). It has a distinctive continuation of the fins over the dorsal ridge, similar to the example (90 mm) in Southland Museum. The breaks are similar in shape and are likely to be the same object despite the difference in reported lengths.

Table 1. List of known objects interpreted as trolling lure shanks. Museum abbreviations: AM, Auckland Museum; CM, Canterbury Museum; OM, Otago Museum; SM, Southland Museum; TM, Thames Museum; TP, Te Papa Tongarewa Museum of New Zealand; PC, private collection. State abbreviations: F, fragment; C, complete. Point attachment abbreviations: PSP, point seating platform on dorsal surface; G, grooves on sides or ventral surface; R, reduction of sides or ventral surface.

Location	Catalogue no.	Museum	State	mm	Perforation	Notched	Fin	Boss	Other	Point attachment	Reference
Southland	85.586	SM	F	90	X		X				Teviotdale 1929: 272; Hamilton 1908: 23
Southland	D29.59	OM	F	100			X			Perforation	Skinner 1942: 267
Shag River Mouth	D21.1046	OM	F	105	X		X				Teviotdale 1929: 280
Shag River Mouth	D27.1047	OM	F	50						PSP/R	
Shag River Mouth	D27.1050	OM	C	100	X		X			PSP/G	Teviotdale 1929: 280
Shag River Mouth	D27.1053	OM	C	102							Teviotdale 1929: 280
Shag River Mouth	D27.1054	OM	C	132	X		X			PSP/G	Teviotdale 1929; Skinner 1942: 266
Shag River Mouth	D27.1312	OM	C	107							Teviotdale 1929: 280
Shag River Mouth	D30.982	OM	F	91.7	X		X				
Shag River Mouth	D40.164	OM	C	167	X		X			PSP/R	
Shag River Mouth	D54.45	OM	C	101	X						
Shag River Mouth	E138.609	CM	C	170	X		X			PSP/G	Duff 1977: 200

Location	Catalogue no.	Museum	State	mm	Perforation	Notched	Fin	Boss	Other	Point attachment	Reference
Warrington	No number	OM	C	156							Allingham 1983
Moeraki? Shag River?			C	140					X	?/G	Best 1929: 35–36; Duff 1977
Little Papanui			C	145	X				X	PSP/G	Latham, pers. comm., 2017
Kāika	E173.166	CM	F	105	X		X				Trotter in Duff 1977: 363
Panau		PC	C	170	X		X			PSP/G	Jacomb 2000
Waimakariri		PC	C	146							Teviotdale 1929: 272
Sumner Cutting	E138.944	CM	C	180	X	X				PSP/G	Duff 1977: 200
Griffiths Private Coll.	D41.157 cast	OM	F	137	X	X					Skinner 1942: 266
Wairau Bar	Eyles 186	CM	C	102	X					PSP/G	Duff 1977: fig. 52
Wairau Bar	Eyles 252	CM	F			X					Duff 1977: fig. 52
Ahuahu			C	218	X			X		PSP/R	
Kaipara	1456	AM	C	141	X		X			PSP	
Whananaki	36255	AM	F	143	X	X		X			Golson 1958
Unknown	ME011757	TP	F	100	X				X		Bollons Collection
Unknown	ME000657	TP	F	120							A. Hamilton Collection
Unknown	No number	TM	C								Sighted 1993

Of the complete examples, none are close in length to the Ahuahu shank, with the next longest being nearly 40 mm shorter. Measurement of the forward edge of the perforation to the nose, with the width and depth measured at the perforations, proved the best indication of length when comparing complete and incomplete items: the Whananaki and Shag River Mouth fragments may be close in size to the Ahuahu shank. The Kāika fragment in Canterbury Museum may have come from a larger shank, although the length from perforation to the proximal end is disproportionately long compared to other examples, potentially providing an overestimate of overall length relative to nose length. The five complete items without perforation and point seat are 101–156 mm. The three from Shag River Mouth are all close in size, with that from Little Papanui being the largest. The fragment of unknown provenance in Te Papa may, if complete, have exceeded the largest measurement.

While all the large shanks have a greater than 100 mm length in common and a triangular cross-section, other attributes such as notches, bosses and fin or gill-like projections may or may not be present. Skinner (1942: 258) described the shallow projections from the ventral edges to behind the perforations as resembling a "shark-like mouth" when viewed from the side (an unlikely association when the shank is intended to mimic a small fish), and the claim of it being a Murihiku (southern South Island) feature is refuted by later finds from other areas. Eleven shanks have fins, including that from Kaipara, and on the Southland Museum example these extend up the sides and over the dorsal ridge. Bosses or lugs, small circular projections below the perforation, are present on two shanks (Ahuahu and Whananaki).

Notching is evident on four shanks: Whananaki and Sumner where three edges are notched from the proximal end, Wairau Bar mid-section where the two ventral edges are notched, and the Griffiths Collection item from an unknown South Island location, notched on the dorsal ridge only. The nose of the Little Papanui shank is reduced in width and depth from forward of the perforations, as is the example from Panau. The unsighted shank from Moeraki or Shag River Mouth (Best 1929: 35–36; Duff 1977: 207) is different in having two criss-crossed incised lines on the ventral surface close to the proximal end. A variation of incised lines is demonstrated in a fragment with an incised line on the right side, angling back and down to the ventral edge then continuing onto the ventral surface (Te Papa Bollons Collection ME011757, provenance unknown). The Whananaki lure also has an incised line near the ventral edge on each side, from the nose to approximately halfway to the perforation. None of the attributes described here appear to be confined to any one region.

All complete examples with perforations have a flattened point seat platform on the dorsal surface, which can be narrow, or broad in the case of the Ahuahu shank. On the ventral surface there are either three or four grooves to confine the fibre lashing, or a broad reduced area with a lip or flange at the distal end. The Kaipara shank is unique in having a point seat platform but no ventral modification. Shank shapes without perforation (three: from Shag River Mouth, from Warrington and of unknown provenance) also have no point seat area. In functional trolling lures these examples would be called incomplete or unfinished, but this interpretation cannot be assumed for the large shanks.

There are also differences in the longitudinal profile, with shanks having either a straight profile where the upper and lower edges are parallel, or a deeper profile at the perforations reducing in a concave curve on the dorsal ridge to the point seating area. This style closely resembles the East Polynesian bonito shank made from pearl-shell in which the thicker shell depth at the hinge forms the proximal end of the shank. The pearl-shell examples, however, are considerably smaller in length and overall proportions to the shanks discussed here. Only four are of this form, none from the North Island.

Breakage occurs most commonly behind the perforations, or mid-body, with a single example from Shag River Mouth breaking towards the distal end. The Southland example has snapped off through the perforation at the distal end, but as discussed earlier this is likely to have occurred later. The notched Wairau Bar fragment is a mid-section with transverse breaks at both ends. Pieces of broken shank may have been reworked, particularly when made from serpentinite, which was also used for pendants, small and large reels and smaller trolling lure shanks.

Trolling lure points are usually made of bone or ivory rather than stone, but none of these large shanks were recovered with an associated point. Teviotdale (1929) did, however, find what he considered to be an associated shank and point at Shag River Mouth, measuring 88 mm and 51 mm respectively, which suggests that if this ratio is the norm, points for large trolling lure shanks would be very distinctive. However, the point does seem disproportionately large for the shank length, and if this ratio was applied to the Ahuahu shank, the point would be an excessively large 126 mm. There are no reported examples of serpentinite points from excavated assemblages or museum collections. However, there is a surface find of what is interpreted as a serpentinite point, with the distal end broken off, from a bay at the south end of Ahuahu. If complete this point would have had a large base, certainly of a comparable size to the point seat area on the Ahuahu shank. It is estimated that if complete the lure point would be approximately 70 mm length. While these two objects were not in direct association, the fact that two extremely rare objects of same material and colour were found on the island, in chronologically early contexts, seems a huge coincidence, and there is a strong possibility they were, at one time, together, or brought to the island together. The shank has polish from the fibre lashings at the distal end, and so did, at some stage in its life, have a point attached.

All shanks are ground. Each was examined for evidence of manufacture including depressions or irregularities in the surface that might suggest remnants of flake scars and initial shaping by flaking. No such indications were found, and it is likely that the stone was worked into shape by sawing, a method employed in the manufacture of other stone tool types such as *pounamu* 'nephrite', and observed on many serpentinite artefacts in the Wairau Bar collection. Grinding with abrasive stone was then used to produce the finished surface.

Trolling lure shanks have been recovered from a number of archaeological excavations on Coromandel Peninsula, but cross-sections tend to be round or oval (Davidson 1979) and bone or petrified wood is the preferred material. Triangular-sectioned trolling lure shanks from the peninsula are rare, and museum collections suggest they were also rare in Northland. The only other known Coromandel example, also in serpentinite and attributed to Ōpito, is 69 mm in length (Bollons Collection, Te Papa; Duff 1977: 389). Shanks attributed to Coromandel Peninsula, regardless of material or cross-section, are generally less than 70 mm in length. The exception is a broken bone shank from Whitipirorua (Onemana) with a length greater than 110 mm (46453, Auckland Museum collection; Furey 1990). The serpentinite triangular-sectioned shank of unknown provenance in Thames Museum may or may not have been found on Coromandel Peninsula, and the donor's family was unable to provide further information.

Summary

There are 28 items interpreted as large shanks (length > 100 mm) in museum collections and/or described in the literature. While there are many archaeologically known examples of lure shanks, the majority do not exceed 80 mm in length, and few of these have triangular cross-sections. Large stone lure shanks are therefore rare and never commonly manufactured. The range of additional attributes, beyond size, cross-section and material, indicates little in the way of geographic pattern.

Unfortunately, because of the way most the shanks were found, it is difficult to draw inferences from their discovery contexts, except to note that large numbers of other types of artefacts were found at Shag River Mouth and Wairau Bar. Ahuahu is the exception, but there is little to be deduced from context. No structures were found, and little bone, as soil conditions generally on the site were not conducive to good bone preservation (Ash 2017).

DESCRIPTION OF THE AHUAHU SHANK

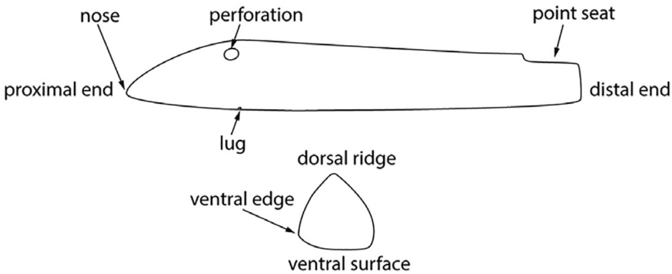
The trolling lure shank from Ahuahu (Fig. 2) is 218 mm in length, a maximum of 38 mm wide and with a maximum depth of 34 mm immediately behind the perforations. It is triangular in cross-section, with the greatest depth at the perforations, tapering to a point at the proximal end where several small chips of stone have detached. The shank is widest slightly behind the perforations, which are placed close to the dorsal ridge. The perforations are drilled bilaterally from each side and each hole angles slightly downwards. The sides of the holes are straight, suggesting use of a non-tapered drill point. The hole on the right side (viewed from top down, proximal end uppermost) is not circular and has two shallow scars on the lower edges that may indicate earlier attempts at initiating the hole. The edges of both holes are sharp and have no macroscopic wear visible.

On each side is a shallow (4 × 3 × 1 mm) round lug or "boss" near the ventral edge below the perforation. The bosses protrude by about 1 mm and have ground edges, but the broad upper surfaces are not ground. At the distal end, the dorsal ridge is shaped to a flattened platform measuring 26 mm length and 15 mm width where a point might be seated. There is a reduced width on the ventral edges, likely for the purpose of confining the fibre lashing, and the distal end also has a raised lip or flange 2 mm high which extends around to the edges of the seating platform and is possibly for the same purpose. On the ventral surface, the shank is laterally convex, and when sitting on a flat surface there is a slight longitudinal curve so that the proximal and distal ends are slightly elevated.

Surfaces are finely ground with shallow longitudinal scratches from the shaping and grinding process. These are most pronounced on the left side from the perforation to the point seating area. Less extensive scratching is present on the right side, again from behind the perforation to the point platform. On the ventral surface the scratches also commence level with the perforations but only extend 116 mm along the sides and not as far as the point seat area. Deep striations are present on the dorsal ridge from the seating platform to an area of hammer dressing (discussed below). Pitting on the surface of the stone on the left and right sides (but not the ventral surface) is possibly due to hammer dressing but may also result from softer minerals weathering out. The dorsal ridge has hammer dressing which commences 11 mm forward of the perforations and continues for 81 mm but shows no flaking. The hammer dressing on the dorsal ridge was carried out post-grinding; however, under magnification (10×) there is polish or faint wear over the scars. Given the dune environment in which the shank was found (see below), the polish may reflect sand abrasion. There are vertical striations on the edges of the point seat

Figure 2 (a) Trolling lure shank from EA67, Waitapu, Ahuahu Great Mercury Island. (b) Terminology used to describe the trolling lure shank. (c) 3D interactive model that can be activated when the PDF article is downloaded to your computer.

(b)



(c)

platform, and on the underside. These scars may relate to the manufacturing process to reduce the width and shape of the point platform but may also have been caused by point lashing. Forward of the point seat, on the right side, are short, deep parallel striations.

Although finely ground all over and finished with perforations and a point seat, a distinguishing feature is the number of shallow flake scars on the ventral edges from behind the perforations to near the point seat. The flake scars are mainly detached from the edges of the ventral surface and are shallow in the distal half on both sides, and deeper with more damage to the edges in the proximal half, but all are less than 1 mm depth. There is faint percussive bruising on the edges between the flake scars. Considerable skill in flaking stone would be required to detach shallow flakes without breaking the object (Dante Bonica, pers. comm., 2018). The flaking has not altered the cross-section shape and the lure does not appear to be in a damaged state which would necessitate repair. The ventral edges were examined under a microscope (10×) to look for any features that might be erased by flaking. Notching on edges is common on some early artefact types including pendants, adzes and large lure shanks (Furey 2014; Prickett 1999), but there were none on this shank.

Polish adjacent to the point seat area suggests that there was lashing at one time in this area, probably for attaching a point. In contrast, the perforations do not have any apparent wear on the edges, as might be expected if there was regular stress and movement of the line lashing as the object moved through the water, or if the shank was suspended and worn as a pendant.

Raw Material

The shank is made from serpentinite and is mid to dark grey in colour, with veining, and mottles indicating deformed breccia. Prominent green veins near the distal end are possibly pumpellyite (Philippa Black, pers. comm., August 2017). Geochemical analysis was carried out using a Bruker Tracer III-SD portable X-ray fluorescence analyser (pXRF). For obsidian and basaltic stone specialised calibrations are used that have predictable ranges of chemical concentrations (Phillipps *et al.* 2016). However, because the chemical composition of the stone was unknown, a "general purpose" calibration, using 44 reference standards selected for a broad range of major and trace element concentration ranges, was used.[1]

A total of 21 elements were quantified as parts per million (ppm) and oxide weight percent (%) concentrations (Table 2). For the majority of elements, the specimen was analysed in an air path through a filter composed of a 12 mil (304.8 µm) layer of Al and a 1 mil (25.4 µm) layer of Ti (Bruker's "yellow" filter), with an X-ray tube setting of 40 keV at 28 µA. To increase sensitivity, the three lightest elements (MgO, Al_2O_3 and SiO_2) were measured without a filter using an X-ray tube setting of 15 keV at 27 µA. The precision of non-destructive pXRF analyses for these light elements is lower than that of destructive WDXRF, so they are rounded to the closest whole oxide weight percent.

The stone was analysed four times on different portions of the surface to check for variation. Additionally, the darker green vein, large enough to cover the analysis area of the detector, was analysed separately.

Table 2. Average chemical concentrations for the stone from analyses on four different parts of the surface, and from a darker vein, compared to two serpentinite samples from D'Urville Island (data from Sivell and Waterhouse 1986: Table 1).

		Typical surface		Darker vein	D'Urville Is.	
	LOD*	Mean	S.D.		KP80	KP92
MgO	*1.2 %*	21	*2.7*	23	32.59	38.12
Al_2O_3	*1.1 %*	7	*1.4*	7	15.66	12.91
SiO_2	3.5 %	34	*3.7*	36	36.12	39.19
K_2O	*0.09 %*	<LOD		<LOD	0.00	0.00
CaO	*0.09 %*	0.61	*0.024*	0.27	0.51	0.33
TiO_2	*0.03 %*	0.83	*0.104*	0.74	1.36	1.01
MnO	*0.02 %*	0.40	*0.002*	0.38	0.77	0.57
Fe_2O_3	*0.14 %*	5.91	*0.247*	7.39	13.05	7.32
V	*22 ppm*	107	*10.9*	133	355	232
Cr	*20 ppm*	81	*48.1*	65	79	103
Ni	*5.5 ppm*	67	*5.4*	30	100	114
Cu	*4.3 ppm*	<LOD		<LOD	36	18
Zn	*2.9 ppm*	167	*7.4*	162	85	59
Ga	*2.0 ppm*	6	*0.9*	7		
Pb	*3.4 ppm*	<LOD		<LOD		
Th	*2.5 ppm*	<LOD		<LOD		
Rb	*2.3 ppm*	<LOD		<LOD	5	4
Sr	*3.8 ppm*	9	*1.1*	7	4	2
Y	*1.3 ppm*	21	*0.9*	21	13	8
Zr	*3.1 ppm*	148	*9.1*	157	92	52
Nb	*1.2 ppm*	6	*2.7*	4	1	1
H_2O+	*%*				10.99	11.66

* Limit of Detection (LOD).

The relatively low concentrations of SiO_2 (34%) and K_2O (< 0.09%) and high concentration of MgO (21%) suggest the stone is ultramafic, supporting the visual identification of serpentinite based on the specimen's green colour and veining. With the exception of Fe_2O_3, which is approximately 1.5% higher in value than the average surface concentrations, the composition of the darker green vein is similar to other portions of the artefact.

For unaltered volcanic rocks such as obsidians and basalts, particular deposits often have distinctive chemical compositions, and on this basis it is possible to identify their geographical origins with a good degree of confidence. Ultramafic rock sources, in contrast, can be difficult to characterise as the degree of serpentinisation can vary within deposits, and this can alter elemental compositions (Challis 1965: 335). In addition, comprehensive geochemical data for New Zealand serpentinites are currently lacking (Nick Mortimer, GNS, pers. comm., 2017).

There are limited locations where such material might be found. In the D'Urville Island–Nelson area they are geologically associated with metasomatised argillites used for making adzes. Sources are also present in Otago and South Westland, and from northern locations including Piopio in the King Country, North Cape and Pāremoremo near Auckland (Thompson *et al.* 1995). None of the North Island sources are known to have been accessed or used by Māori in pre-European times.

Large differences in trace element concentrations might, however, provide some clues to the geographical source. New Zealand serpentinites often have high concentrations of nickel (Ni) and chromium (Cr), ranging from approximately 1,000 to 5,000 ppm (Challis 1965; Sivell and Waterhouse 1986). In contrast, the shank has much lower concentrations of these elements, each below 100 ppm (Table 2). Two serpentinite samples from D'Urville Island reported by Sivell and Waterhouse (1986: Table 1) also have anomalously low concentrations of these elements and broadly similar concentrations for most elements. Also notable is the large range of chemical variation in the two D'Urville Island samples. The similarity in results between the shank and the reported samples suggest D'Urville Island is a possible source of the serpentinite.

ARCHAEOLOGICAL CONTEXT OF THE AHUAHU SHANK

The Ahuahu shank was found at the southern end of excavations on T10/360 situated on a gently sloping ridge bordering Coralie Bay on the east side of the central tombolo of Ahuahu (Fig. 1). The ridge of weathered rhyolite is mantled by sand blown up from Coralie Bay. At the northern end of the ridge there were two distinct occupations that presented very different evidence. The upper occupation, dated to the eighteenth century, was confined to a small area and consisted of fire scoops and postholes. Underneath was an earlier occupation, more extensive in extent, and separated from the upper deposits by 60 cm of sterile sand. The earlier occupation at the northern end consisted of a large quantity of obsidian flakes and little else. Veins of charcoal running through the sand at the base of the excavation represent burnt roots of the original vegetation cover, and samples taken for dating will be discussed in the following section.

Continuous excavation up the ridge for over 23 m revealed that depth below surface of the earlier deposits (layers) reduced with distance up the ridge. The deposits contained stone artefacts including hammer stones, adzes, several pendants, moulded cylinders of *kokowai* 'ochre' and a large number of obsidian stone flakes, along with cetacean teeth, bones of dog (*Canis familiaris*) and sea mammal and a small quantity of moa bone. Teeth of white pointer shark (*Carcharodon carcharias*), several of which were perforated for use as ornaments, were present throughout the excavation area. Bone and shell material were scarce and preservation generally poor.

Volcanic boulders of varying size protruded from the underlying weathered rhyolite on the ridge. Some, including a large, relatively flat boulder near the southern margin of the excavation, were visible on the surface. The shank was found to the east of the boulder approximately 30 cm below the surface near the base of the occupation deposit (Fig. 3). Also nearby were a notched pendant made from petrified wood and a shaped imitation whale tooth pendant. Similar shaped pendants have been found in early settlement sites such as Houhora and Wairau Bar (Duff 1977; Furey 2002).

The stratigraphy was similar over the length of the ridge. A thin turf and recently developed topsoil overlay a thin black sand lens that was interpreted as a washed surface where organic material concentrated. Below this were thin lenses of wind-laid sand over an occupation deposit defined by the presence of stone flakes. The overlying deposits were devoid of in situ flakes and the occupation deposit was easily distinguished from later sand build-up. The shank was found near the interface of the occupation deposit (ID 42510) and natural sand[2] (Fig. 4). A fire feature (ID 42509) containing numerous fire-cracked rocks, charcoal and fragmented decomposed bone of bird, fish and sea mammal was 1.2 m from the lure and contemporary with the occupation deposit. Dateable charcoal samples were obtained. The occupation contained no evidence of cooking, food waste discard other than what was in the fire feature, or postholes. There were also no features other than a shallow depression containing charcoal and artefacts at the northern end of the ridge and the fire feature at the southern end. This absence, contrasting with the presence of so much worked stone, makes the occupation evidence unusual and difficult to interpret.

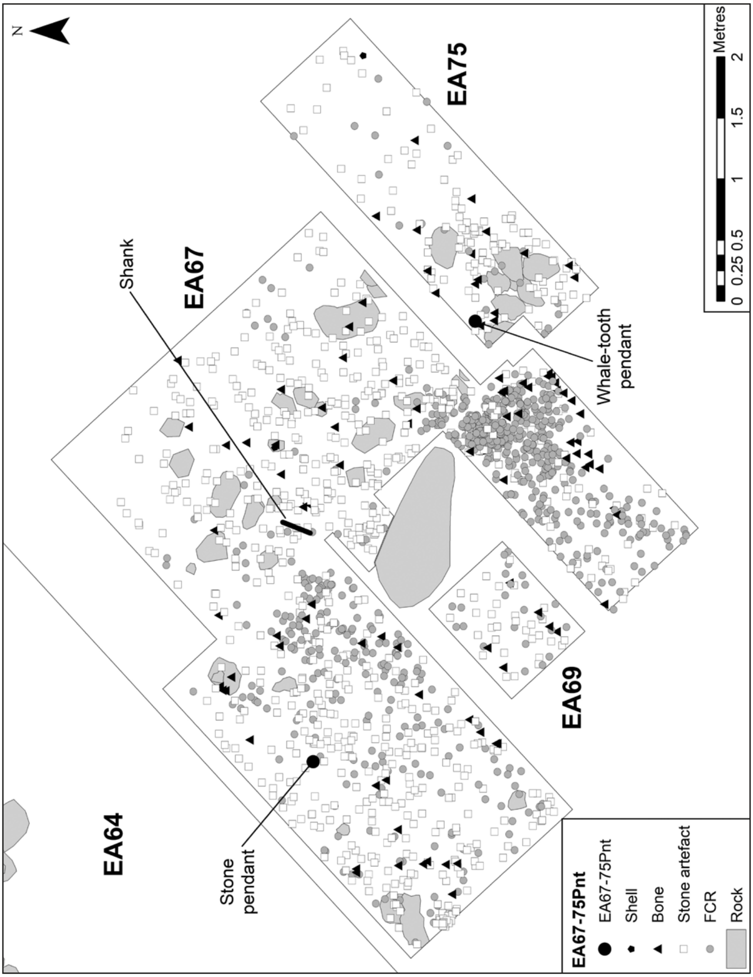


Figure 3. Excavations on T10/360 in the vicinity of the lure shank, showing the distribution of stone artefacts, bone and fire-cracked rock and location of shank, stone pendant and whale tooth pendant.

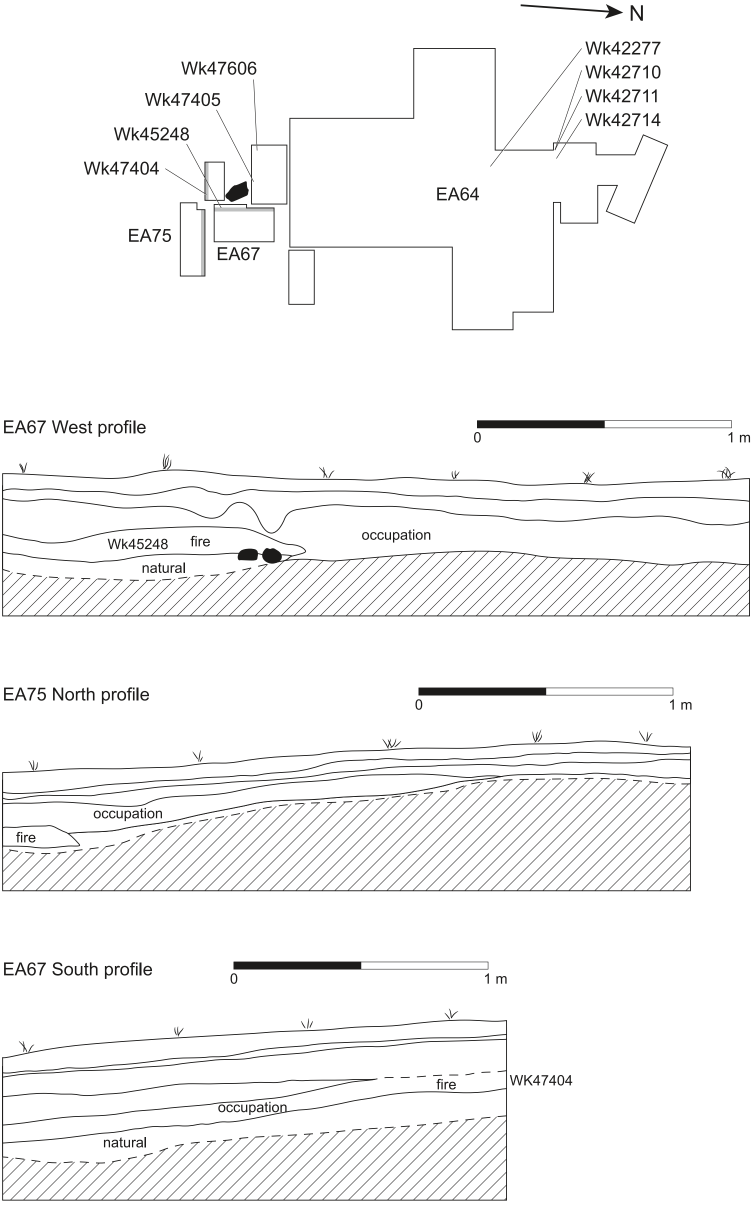


Figure 4. Stratigraphy in the vicinity of the find showing where radiocarbon samples were obtained, and depth of the artefacts referred to in the text.

DATING

Radiocarbon determinations Wk47404 and Wk45248 on short-lived species from the fire feature are in close agreement and indicate use in the early 1400s CE (Table 3; Fig. 5). Wk47406, twig charcoal tānekaha (*Phyllocladus trichomanoides*), was obtained from a lens of charcoal near the base of deposit 42510. While the sample was stratigraphically within the occupation deposit, the result aligns more closely with dates from the northern end of the ridge interpreted as burning of the primary vegetation. A second sample (Wk47405) from the surface of the same deposit consisted of short-lived species: tutu

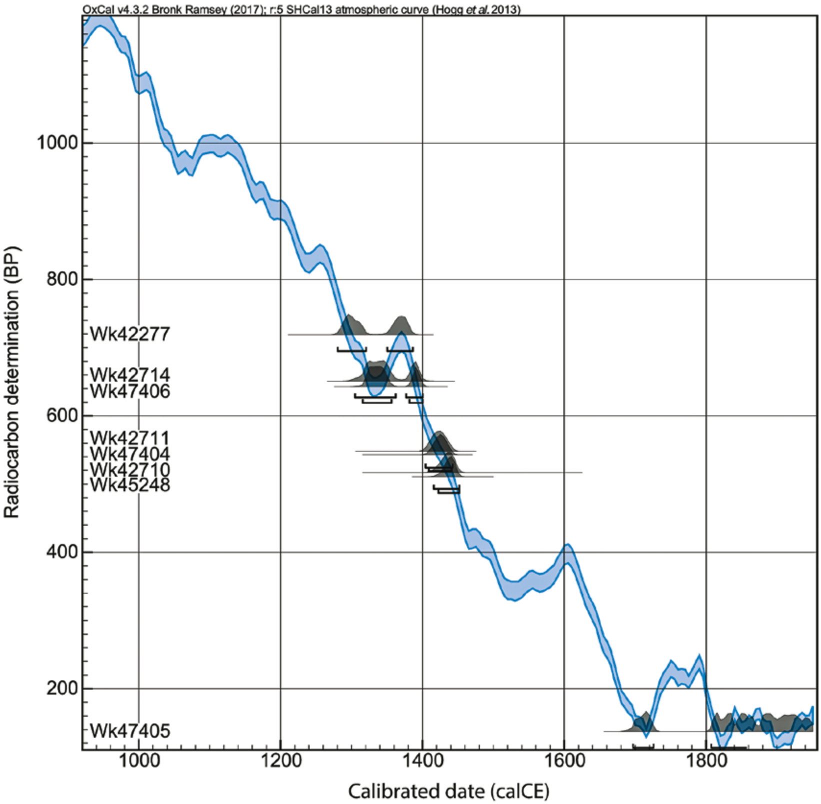


Figure 5. Plotted radiocarbon determinations from Table 3. Calibration completed and plot made in OxCal v4.3.2 (Bronk Ramsey 2009, 2017), using SHCal13 atmospheric curve (Hogg *et al.* 2013).

Table 3. Radiocarbon determinations from deposits T10/360, Waitapu.

Lab No.	Area	Deposit	Conventional ^{14}C age BP	$\delta^{13}C$	Calibrated age at 95% prob. (cal BP)	Context	Material dated[1]
Wk47404	EA67	D41831	543 ± 15	−22.3	549–503	Fire feature contemporary with deposit lure was found (see Wk45248 from equivalent deposit 42509)	Charcoal; coprosma, ngaio
Wk45248	EA67	D42509	511 ± 15	n/a	528–499	Fire feature (see Wk45248 from equivalent deposit 41831)	Charcoal; mangemange
Wk47405	EA67	D42510	137 ± 15	−27.8	254–225 (16.0%); 143 (79.4%)	Charcoal lens on surface of 42510	Charcoal; tutu, hebe, coprosma, five finger, whārangi, mānuka
Wk47406	EA67	D42510	643 ± 15	−26.9	635–594 (70.4%); 569–550 (25.0%)	Charcoal lens within 42510	Charcoal; tānekaha twig/root
Wk42711	EA64	D41568	548 ± 20	n/a	546–508	Firescoop fill	Charcoal; coprosma, five finger
Wk42710	EA64	D41568	517 ± 20	n/a	535–499	Firescoop fill	Charcoal; pittosporum
Wk42714	EA64	D41561	651 ± 20	n/a	646–588 (71.1%); 574–550 (24.3%)	Charcoal layer, burning pre-occupation	Charcoal; pōhutukawa root
Wk42277	EA64	D41112	719 ± 22	n/a	670–630 (51.3%); 600–564 (44.1%)	Charcoal layer, burning pre-occupation	Charcoal; pōhutukawa root

[1] See text for scientific names of dated materials.

(*Coriaria* sp.), coprosma (*Coprosma* sp.), whārangi (*Melicope ternata*), mānuka (*Leptospermum scoparium*), five finger (*Pseudopanax arboreus*) and hebe (*Veronica* sp.). The sample did, however, return a more recent age estimate and is interpreted as vegetation growing on the site post-occupation.

Underneath the cultural deposit in EA64 at the northern end of the ridge were several burnt pōhutukawa (*Metrosideros excelsa*) root balls that were followed outwards to extract small-diameter root charcoal. Two dates (Wk42714, Wk42277) from separate trees give results similar to Wk47406 in deposit 42510 near the shank. Due to fluctuations in the atmospheric curve there are two possible age ranges, although there is a higher probability for the earlier peak, suggesting Māori burnt the primary forest in this area several decades prior to the ridge being lived on and cultural material deposited.

While it has long been accepted that the triangular trolling lure shanks of this form are associated with the early period of Māori settlement, prior to finding the Ahuahu shank none had been recovered in situ and deposition could not therefore be directly dated. The date for the deposit in which the Ahuahu shank was found (CE 1431–1447 at 68.2% confidence, or CE 1422–1456 at 95.4%) is slightly later than most dates from Shag River Mouth that cluster in the fourteenth century (Anderson *et al.* 1996). However, some Shag River Mouth determinations fall outside that range and are comparable to the Ahuahu dates. As the shanks from Shag River lack archaeological context, they cannot indisputably be attributed to the part of the site that was excavated. The radiocarbon determinations from Wairau Bar are from different contexts and multiple materials, and a broad age range of mid-thirteenth century to fourteenth century (Higham *et al.* 1999: 425; Jacomb *et al.* 2014), but again the dating does not relate directly to the shanks that were ploughed or dug up with little or no control. However, the large assemblage of artefacts from Wairau Bar is clearly from the initial settlement period. An age determination from Panau, obtained from a lower part of the site, suggests mid to late fourteenth century (Jacomb 2000: 107), but again artefacts including the shank were from fossicked contexts, and stylistically most are from several centuries later. Locations of other finds are undated.

DISCUSSION

The identification of large trolling lure shanks as an artefact category associated with early occupation of Aotearoa is largely attributed to the activities of collectors rather than archaeological excavation. This makes the well-provenienced Ahuahu shank particularly remarkable. It was found on its ventral surface with other items rarely found in archaeological sites, including unmodified teeth of sperm whale and elephant seal, a notched pendant, perforated white pointer shark teeth, an imitation whale tooth pendant and shaped cylinders of kokowai in addition to the more usually found adzes, hammer stones and flaked stone. This combination of finds is unusual in sites of similar age on the Coromandel east coast where fish hooks of moa bone, adze roughouts and finished adzes are common (Davidson 1979), together with artefacts in the process of being made and the manufacturing tools.

The Ahuahu shank was found in deposits dating to the early to mid-1400s CE. However, this was the time it entered the archaeological record, not when it was manufactured. The rarity of large shanks suggests that, once made, objects of this form were likely carefully looked after, but the history of the lure prior to deposition on Ahuahu is unknown. Use polish adjacent to the point seat area suggests wear from fibre lashing, presumably associated with hook attachment, but the combination of shank and hook does not necessarily indicate that it functioned as a working lure for catching fish. The perforations do not have any wear on the edges as might be expected if there was regular stress and movement of the line lashing as the object moved through the water. Similarly, if the shank was a pendant, as suggested for similar large examples (Anderson 1981), wear would be expected around the perforation—especially as, from observation of reels and other pendant forms, serpentinite can display heavy wear in this area.

There is no direct indication from the archaeological context in which the Ahuahu lure shank was found that might suggest why it was there. The lure is not part of a human burial, nor are such remains indicated in excavated areas of the site. As noted, other rare artefact forms are present, and within the same set of deposits there are numerous stone artefacts, so the shank is not an isolated find. There is no obvious indication it was discarded because it required repair—it appears to be a finished, unbroken object. The most unusual feature is that it was modified by detachment of fine flakes from the ventral surface after grinding was complete. These flakes do not appear to have removed any features such as notching and the flaking is not sufficiently invasive to have altered the profile. The flaking is in sharp contrast to its otherwise ground and polished appearance, and it is highly likely the flaking was not part of the manufacturing process but occurred at some later time in its life history.

The shank was made from stone almost certainly from a South Island source. We are not aware of unmodified blocks of serpentinite having been found in northern archaeological sites, and there are no fragments of the stone in this or any other excavated site on the Coromandel Peninsula. Indeed serpentinite artefacts in the region are very rare, with only four reels and one small trolling lure shank known. The shank is therefore likely to have been made close to the stone source and transported in its finished state. It may have passed through a number of social interactions before finally being deposited on Ahuahu in circumstances unknown.

Serpentinite artefacts of any form are not common, although occurrence of the material is higher in South Island sites and use of the material is confined to sites pre-1500 CE.

The large size of the shank suggests it did not function as a lure to catch fish. With a seat platform measuring 26 × 15 mm, the point would also have been large. Museum and excavated assemblages have no examples of the substantial point required, and trolling lure points (or any other type of fish hook) have not been found in the Waitapu excavations.

If the object did not function as a fish hook, then what was it used for? Archaeology cannot address the question without an awareness of the cultural setting in which it was used, or how an object of this type might have been perceived. It is, however, too restricting and convenient an interpretation to see it solely as a trolling shank, or as a pendant. Large so-called shanks may have been fashioned to resemble functional trolling shanks and acted as such in a symbolic rather than a literal way. Hamilton (1908) hints at this by using the term *whatu* for large hooks and Best (1929: 3–4) uses the same term for a *mauri*, or object the gods inhabit, in relation to fishing. The large shank from Kaipara (AM1456, acquired 1928) is described in the Auckland Museum Ethnology Register as a "*manea* or *kanawhi*, a ceremonial fishing charm in the form of a trolling lure shank", thereby drawing a distinction between a functional fish hook shank and an item used in ritual.

The objects the shank was found with were not everyday items, and whale tooth and shark tooth ornaments are suggestive of culturally relevant messages related through material and form (Neich and Pereira 2004). Large shanks may have had multiple meanings according to the context and may have been an important conduit in communicating and displaying the presence of godly embodiments, as discussed by Clunie (2013) for Tongan *tapua* 'ceremonial gift whale teeth' and trolling shanks. In another example, from Tokelau (Huntsman 2017), a wedding is marked by the gifting of a fishing lure (*pā*) manufactured from a specially selected pearl-shell with markings that resemble those on skipjack tuna (*Katsuwonus pelamis*). The gifting is formalised by the placement of the lure around the bride's neck. In this particular context, and for a short time, the suspended lure is called a *kahoa* or pendant. Later the pendant is rebound as a *pā* and used for fishing. Gifting the specially made lure not only acknowledges relationships between families but also future success in fishing to provide for the well-being of both families. In addition, the material, and its resemblance to the patterning on the sought-after fish, evokes cosmological meanings within Tokelauan society. The object therefore has meaning according to context, with the objective of productivity from the marriage and successful fishing. As an archaeological find, an item symbolically presented in this way would be indistinguishable from other *pā* made solely for fishing.

The Ahuahu lure is not an ordinary lure indistinguishable from others, and the rarity of large items are likely to have overtones of *mana* 'prestige' and a symbolic function, especially when made of a rarely used material. The resemblance to functional trolling lure shanks indicates that the Ahuahu shank, and other large examples, had a specialised role in relation to catching fish. While ethnographic accounts relate the role of such objects in fishing and social transactions, there are no parallels to explain how the shank came to be modified by flaking, and its subsequent incorporation in the archaeological record.

* * *

A serpentinite trolling lure shank excavated from Waitapu, Ahuahu, is the largest yet recorded in Aotearoa. There is no evidence of damage or fracture that might explain its abandonment. Radiocarbon determinations indicate deposition at some time in the first half of the fifteenth century. The lure shank is associated within the broad archaeological context with rarely found objects, and there were no features such as postholes, cooking or food-related discard that are typical components of sites of similar age on the Coromandel Peninsula. There is no direct evidence that the lure shank ever functioned to catch fish, and while an alternative interpretation that it acted as a pendant has been considered, there is equally no evidence that it was hung from a cord. The find has significance not only for extending understanding Māori material culture in the first few hundred years of settlement but also for being able to address ritual in an archaeological setting.

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NOTES

1. The full report on the XRF analysis of the lure can be obtained from Andrew McAlister.
2. Each layer or deposit excavated was assigned a unique identifier in the Ahuahu Project database. As there were several excavations over four years, the

archaeologically continuous deposits were given separate numbers during each excavation and linked together in the geographic information system (GIS). For this part of the excavation, the occupation deposit in the vicinity of the lure and large stone has been assigned 41888, 42510, 41972 and 42028 depending on the excavation area, and the fire feature 41831, 42509 and 41971. The excavation areas (EA) relevant to this discussion are EA64 on the northern end of the ridge and EA67 and EA75 at the southern end.

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REVIEWS

COCHRANE, Ethan E. and Terry L. Hunt (eds): *The Oxford Handbook of Prehistoric Oceania*. Oxford: Oxford University Press, 2018. 513 pp., biblio., illus., index. US$150.00 (cloth).

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The *Oxford Handbook of Prehistoric Oceania*, edited by Ethan Cochrane and Terry Hunt, joins the ranks of the *Oxford Handbook* series that aims to provide "up-to-date surveys of original research in a particular subject area". While sole author surveys benefit from the consistency of their underlying narrative, edited volumes often present a wider range of viewpoints and highlight issues currently under debate. Comprised of 21 chapters written by leading researchers, the handbook is a trove of information organised principally along a regional–temporal framework that will be familiar to anyone studying the deep past of the Pacific.

The first few chapters deal with the arrival of humans and subsequent cultural Near Oceania, and exemplify the strengths of the multi-author survey. O'Connor and Hiscock summarise Pleistocene migrations of humans into greater Australia and Near Oceania from mainland Asia, addressing contested topics like migration routes and megafaunal extinction. Denham presents evidence from island Southeast Asia and challenges the prevailing notion that Austronesian languages dispersed through this region and into wider Oceania as part of a coherent cultural and genetic package carried by voyager-farmers from Taiwan. Complementary chapters on New Guinea and its adjacent islands (by White and Specht, respectively) likewise discuss ongoing debates, particularly related to subsistence practices and interaction, but also address uncertainties from limited investigative coverage.

Heading into Remote Oceania, the book features several chapters on island groups defined by their contemporary political boundaries, an approach that works well since each group has a unique history of archaeological research. This is particularly striking in the chapter from Sand, who reviews the archaeology of New Caledonia against the backdrop of colonialism and Kanak cultural ownership, raising questions of archaeology's value to indigenous people. Along similar lines, Bedford and Spriggs conclude their summary of Vanuatu archaeology by highlighting the growing role of the Vanuatu Cultural Centre in directing archaeological research and coordinating public outreach.

The prominence of movement and interaction is an expected element of a text on the Pacific past, and this becomes increasingly apparent as the text moves further out into Remote Oceania. Mobility is considered key to understanding cultural change in Fiji, where Cochrane uses evidence from a wide range of sources (archaeological, biological, linguistic) to show changing scales of interaction over time, and in Tonga and Sāmoa, where Burley and Addison argue for differences in connectivity and exchange between the two archipelagos driving social differences in both ceramic and aceramic periods. Chapters on western and eastern Micronesia emphasise the importance of voyaging and interaction as a stimulus for social complexity: Fitzpatrick pays particular attention to western exchange networks like the ethnographically known *sawei*, while Athens draws on Petersen's (2006) notion of a subsistence revolution facilitated by hybridisation of eastern and western breadfruit varieties.

Adaptation is also a recurrent theme throughout the text, especially in later chapters dealing with East Polynesia. East Polynesia encompasses substantial environmental variability between islands and island groups, requiring different adaptations from incoming human groups and influencing social organisation. Kahn illustrates this by comparing the cultural trajectories of Central East Polynesian archipelagos, particularly the Austral, Society and Marquesas groups, and Kirch describes how contrasts between dry and humid areas influenced the rise of socioeconomic inequality in an overview of the cultural history of Hawaiʻi. In a chapter on South Polynesia, Anderson avoids the problematic dichotomy between Archaic and Classic phases for Aotearoa/New Zealand with the inclusion of a "Middle Phase" defined by diverging adaptations between the highly productive north and the more ecologically sensitive south. Hunt and Lipo give a thorough review of the history of archaeological research and interpretation on Rapa Nui, where narratives of "ecocide" through deforestation and warfare have shifted toward recognition of long-term agricultural intensification and post-contact depopulation.

Several chapters discuss overarching ideas that do not fit neatly within the regional framework but are thematically important in the context of the Oceanic deep past. Some present these topics in a straightforward manner: Rieth and Cochrane, for example, provide a stock-taking of chronology in Remote Oceania, including a detailed consideration of changing approaches to dating in Hawaiʻi, and a very useful two-and-a-half-page table listing the earliest dates from different island groups and their contexts, and corroborating archaeological and palaeoenvironmental data. Other chapters in this vein include Dickinson's succinct treatment of coastal geomorphology and its implications for human settlement, and Pawley's summary of linguistic research that underlies many models of origins, migration and subsequent interactions in Pacific.

There are also chapters that cover a topic while criticising prevailing thinking or practice. Denham's chapter on island Southeast Asia and Cochrane's essay on Fiji are examples of this, as is Morrison and O'Connor's review of settlement pattern studies in the Pacific. A predominant approach since the 1970s, the authors highlight settlement pattern research in Sāmoa and Hawaiʻi before raising questions about comparability between regions. Drawing on ideas from distributional archaeology and time perspectivism (see chapters in Holdaway and Wandsnider 2008), the authors set a series of practical goals to extend the range of future settlement pattern studies. Terrell's chapter on Lapita also falls into the critical category, invoking "baseline probability analysis" as a way to build more specificity into existing models and drawing on the pedagogical notion of "communities of practice" (Wenger 1998) as a way to bridge between localised behaviour and wider material distributions. This chapter is a thought-provoking contribution to be sure, but given its emphasis on epistemology and limited engagement with the wealth of existing work on Lapita, it is somewhat out of step with the rest of the book.

In the final chapter, Anderson returns for a discussion of Pacific seafaring, commenting on "traditionalist" models that promote voyaging against the prevailing easterly winds of the Pacific. Although many experiments have demonstrated the efficacy of windward sailing for exploration, Anderson points out limitations in the available data on vessel performance characteristics, in particular on the antiquity of triangular, stayed-mast rigs. An alternative, "historicist" model bypasses the need for these by restricting travel to downwind, but also has serious ramifications for many of the ideas related to migration and interaction that occur throughout this book. This continues to be an active area of debate and research, thanks in no small part to Anderson's continued questioning of widely accepted narratives.

The sheer volume and diversity of subjects covered in this book is impressive, but at the same time this makes a few omissions easier to spot. The Solomon Islands, for example, receive little attention, which is curious given how thoroughly other island groups are covered. Also, given the substantial contributions of genetics in the last two decades, it is surprising that this received only passing mention in some chapters.

These issues aside, as a survey of contemporary research, the *Oxford Handbook of Prehistoric Oceania* succeeds and then some. Most chapters are very accessible as introductions to their respective topics, making the text useful for students and teachers. The wealth of information and the variety of views it contains makes this book a worthwhile investment for anyone interested in the deep history of the Pacific.

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Filming the Colonial Past: The New Zealand Wars on Screen looks at the way New Zealand productions have portrayed the colonial conflicts sometimes known as the New Zealand Wars. The wars took place in various regions across New Zealand between 1843 and 1916, causing major divisions between Māori and Pākehā 'New Zealand European' as well as between *iwi* 'tribal' groups. The title itself, *Filming the Colonial Past*, implies that the *construction* of our past occurred through the act of filming the interpretation of the past and, like the interaction between Māori and Pākehā in society, this past has been built through sometimes mutual and not always easy or equal means. The author has worked chronologically discussing the social and political context of the time in which each production was made. The interactions between Pākehā filmmakers and Māori actors, iwi representatives and later cultural advisors and people in senior roles is examined.

The initial sources of the history of the wars are discussed, mainly histories written by Pākehā men such as Elsdon Best and James Cowan. Cowan was fluent in *te reo Māori* 'Māori language' and was the only historian who interviewed veterans on both sides of the wars. Cooper considers the many constraints at play when making films: funding, casting, cultural misunderstandings, locations, partnerships between Māori and non-Māori over time and their respective expectations, practical restrictions and developments in technology, and surrounding social and political impacts. The author looks at each example and uncovers and explains the problems and solutions unique to that particular production, demonstrating along the way the development of how our histories have been constructed, and also how the relationships and expectations between Māori and non-Māori have evolved to where we are today: on the cusp of stronger Māori autonomy in filmmaking.

Creating the colonial past through film can be seen as a process of defining New Zealand's past, particularly during the early twentieth century when there was a search for a New Zealand identity and a desire to build "nationhood". The early films of Rudall Hayward were concerned with this idea of nationhood; in light of the recent experiences of New Zealanders, both Māori and Pākehā, in World War I, Hayward's films contributed to the formulating of national identity through his construction of a shared history and its heroes. The process of his filmmaking included approaching Princess Te Puea Hērangi to make the film in conjunction with Tūrangawaewae Marae and the Waikato people; although initially positive, this negotiation broke down and cast were used from Rotorua, where the film was finally shot. This breakdown seems to have stemmed from Hayward's impatience to get the film made and a lack of funding required to make the necessary financial contributions to the Princess. The issue of funding is a recurring one when it comes to telling our histories without restriction, with some exceptions.

Examining more recent representations of the colonial wars, the author points out that filmmakers from the 1970s onwards were aware that there was an "erosion of the collective memory of the New Zealand Wars through the middle of the twentieth century" (p. 24). The time was ripe to create memory and understanding of our histories in the national consciousness. Filmmaking in the 1970s coincided with the movement of decolonisation and political action taking place across Aotearoa. This "reforging of national identity" took place as social and political upheavals were dismantling historical ties to Britain. Two watershed moments in our screen history were born alongside these upheavals: the well-funded TVNZ series *The Governor* (1977) and Geoff Murphy's feature film *Utu* (1983). Both were wholly New Zealand–funded and both challenged long-held biased views of our histories.

In *The Governor*, iwi perspectives were introduced rather than solely relying on historians' views. Generally held positive views on Governor Grey were challenged; he was a far more complicated character than history had previously painted him to be. *The Governor* lent force to "contemporary Māori claims about land rights and historical injustice" (p. 123). This series could be considered a touchstone for reactivating *mana* ‘prestige, spiritual power’ for Māori involved in the film: “his people had sort of disappeared … this is what I’ve [heard]… I’m giving you this secondhand … they sort of disappeared, and with the programme they found their heritage which had been lost and forgotten, and it gave them their mana back” (p. 109). The issue of funding is a major one when it comes to telling our stories well. The balancing act required to maintain integrity and truth and the necessity to keep within budgets, make profits and do well at the box office is probably the reason it has been so long since we have had anything as good as *The Governor*.

The process of filmmaking is collaborative by necessity; it requires each group to invest and trust in the other, much like a good functioning bicultural society. In this way films have often been sites of unity. Cooper also critically assesses less successful attempts at telling our colonial history, such as *Pictures* and *Greenstone*. The former, produced in 1981, was based on the photographer Alfred Burton but never moved “beyond clichéd interactions between Māori and Pākehā, and there seems to have been little Māori involvement in the film” (p. 127). This was soon overshadowed by the nuanced and vital film *Utu. Greenstone* from 1999 seems to have suffered from the influence of its BBC funders and tensions between the writers, and appeared to have missed the mark; writer Greg McGee’s view was that the production became “a sort of bastard child of the imperialists[;] it perfectly replicated what it was conveying [colonial exploitation]” (p. 188).

Cooper does an excellent job of weaving together the various strands of filmmaking: writing, shooting, political and social influences and pressures, the interactions of Māori and Pākehā, cast, crew and *kaitiaki* ‘caretakers’, funding issues and cultural misunderstandings (from Rudall Hayward to Samantha Morton). It is a comprehensive book, balanced in its overview and its understanding of how the construction of the colonial past has evolved and developed according to contemporary understandings, primary and secondary sources, historical documents and oral traditions and memories.

PUBLICATIONS RECEIVED*

September 2019 to March 2020

BERMAN, Elise: *Talking Like Children: Language and the Production of Age in the Marshall Islands.* New York: Oxford University Press, 2019. 224 pp., biblio., illus., index, notes. £19.99 (softcover).

CHITMAN, Karl, Kolokesa U Māhina-Tuai and Damian Skinner (eds): *Crafting Aotearoa: A Cultural History of Making in New Zealand and the Wider Moana Oceania.* Wellington: Te Papa Press, 2020. 280 pp., biblio., illus., index, notes. NZ$85.00 (cloth).

DAVIDSON, Janet: *The Cook Voyages Encounters: The Cook Voyages Collections of Te Papa.* Wellington: Te Papa Press, 2019. 464 pp., biblio., illus., index, notes. NZ$65.00 (cloth).

HARRIS, Aroha: *Te Ao Hurihuri: The Changing World, 1920–2014.* Wellington: Bridget Williams Books, 2018. 174 pp., illus., index, notes. NZ$59.99 (softcover).

KIRCH, Patrick Vinton and Clive Ruggles: *Heiau, ʻĀina, Lani: The Hawaiian Temple System in Ancient Kahikinui and Kaupō, Maui.* Honolulu: University of Hawaiʻi Press, 2019. 361 pp., biblio., illus., index, tables. US$75.00 (cloth).

O'MALLEY, Vincent: *The New Zealand Wars: Ngā Pakanga o Aotearoa.* Wellington: Bridget Williams Books, 2019. 272 pp., biblio., illus., notes. NZ$39.99 (softcover).

SMITH, Ian: *Pākehā Settlements in a Māori World: New Zealand Archaeology 1769–1860.* Wellington: Bridget Williams Books, 2019. 328 pp., biblio., illus., index, notes. NZ$59.99 (softcover).

* The inclusion of a publication in this list neither assumes nor precludes its subsequent review.