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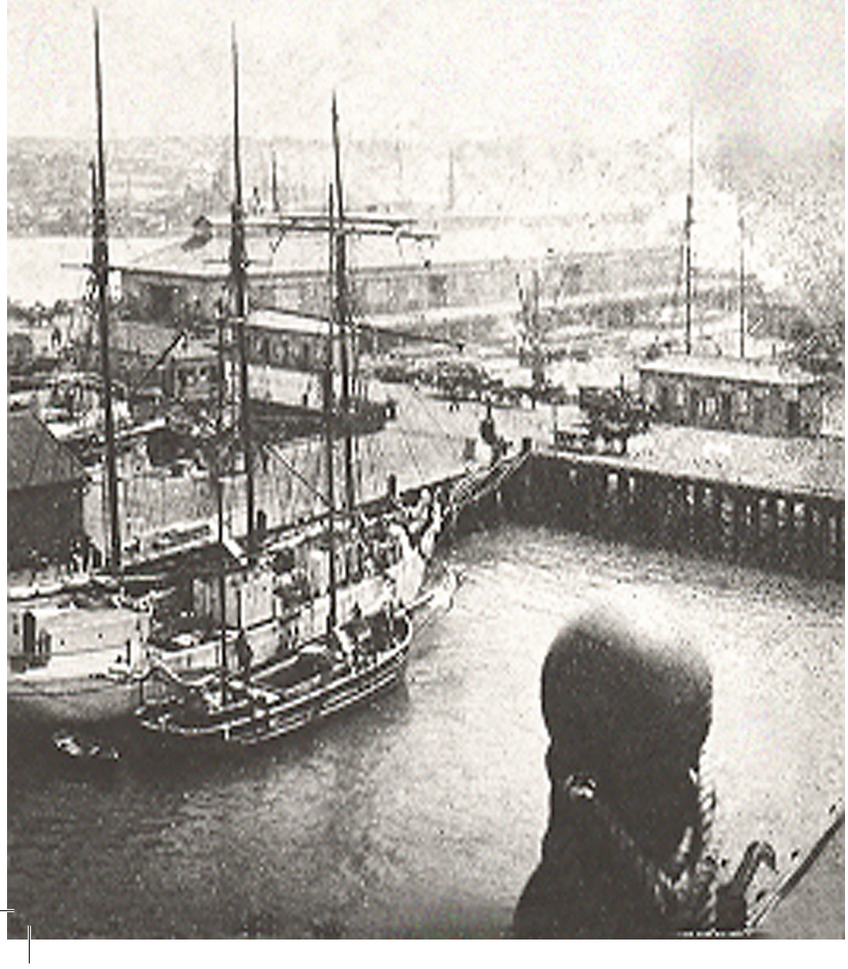
SITE T11/1030, HAHEI, COROMANDEL PENINSULA

Final Report on Archaeological Investigation. In fulfilment of NZHPT Authority No. 2012/515



Prepared for
R. & M. Stanners
and Brewer Davidson

by

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February 2013

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SITE T11/1030, HAHEI, COROMANDEL PENINSULA: FINAL REPORT ON ARCHAEOLOGICAL INVESTIGATION

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INTRODUCTION

Project Background

The landowners of the property at 25 Wigmore Crescent, Hahei, in the Coromandel Peninsula (Lot 25 DPS 15008 and Lot 2 DPS67043; Figure 1–Figure 3) have constructed a new house with associated outbuildings and landscaping at their beachfront Hahei property.

A human burial was accidentally discovered during demolition works for the construction of the new residence in 2011. The postcranial remains of the burial were largely removed by the contractors, and the area was later inspected by Andrew Hoffman. Minor investigations were undertaken under his supervision (2011) with representatives of Ngati Hei. The cranium had been removed with spoil from the site and was later recovered from the dump site. Analysis of the koiwi was undertaken by Beatrice Hudson with cranial analysis by forensic odontologist, Zafer Khouri.

Minor testing undertaken by Hoffman around the works suggested the presence of an archaeological site relating to pre-European Maori settlement of the area. The site was recorded under the New Zealand Archaeological Association (NZAA) site recording scheme as T11/1030 (burial/occupation site). An Authority was applied for and granted by the New Zealand Historic Places Trust (NZHPT) (No. 2012/515) to investigate the area of the site that would be affected by the proposed development works.

The investigation of site T11/1030 was undertaken by Clough & Associates in February 2012. This report constitutes the final investigation report as required under the NZHPT Authority.

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INTRODUCTION, CONTINUED

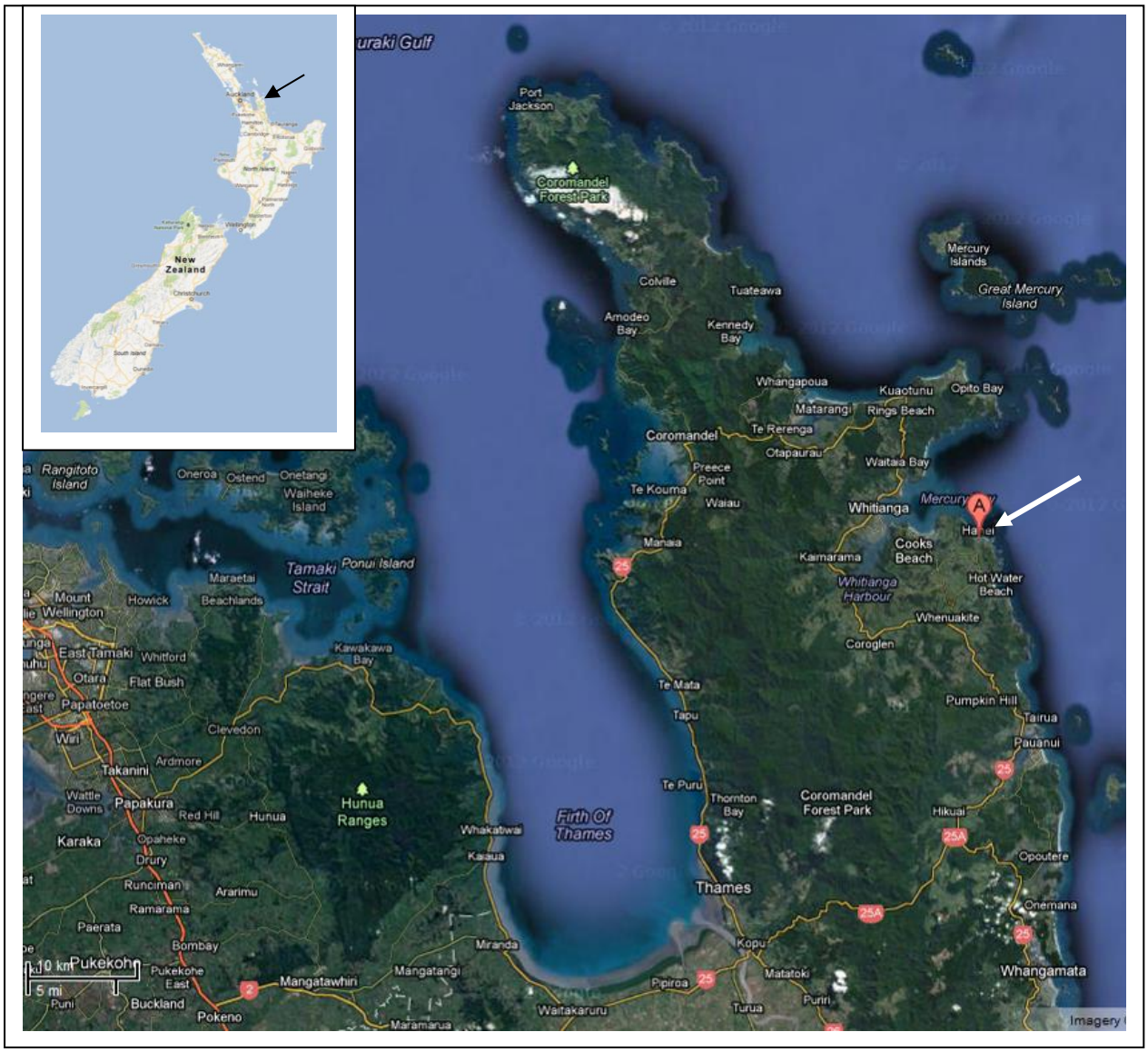

Figure 1. General location map (source: Google Maps 2011)

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INTRODUCTION, CONTINUED

Figure 2. Location of 25 Wigmore Crescent, Hahei

Figure 3. Property boundary of 25 Wigmore Crescent (outlined in red). Source: Thames and Coromandel District Council GIS 2012

PHYSICAL LANDSCAPE

Environment and Topography

Hahei is located on the east coast of the Coromandel Peninsula, close to the southern margin of Mercury Bay. The township is settled around a 1.4km stretch of white sandy beach, into which Wigmore Stream flows out to the ocean at the southern end.

Site T11/1030 is located within the property at 25 Wigmore Crescent and is likely to continue into the property at 27 Wigmore Crescent. These properties are located on the moderately elevated sand dunes located immediately behind the foreshore of Hahei Beach (Figure 4).

The original dune landscape of Hahei was heavily modified during large scale residential subdivision undertaken during the 1960s. The naturally undulating topography of the dune system was cut and filled in order to create a largely flat surface suitable for development. The dunes are now covered in residential housing, sealed roads and large areas of landscaping.

The properties at the eastern end of Wigmore Crescent are located on the end of a peninsula bounded by Wigmore Stream to the west and south and Hahei Beach to the east (Figure 5). In early times the location would have enabled immediate access to both freshwater and marine resources, and the position at the mouth of the stream would have provided easy access through to areas inland and the hot water springs. The site is located within 0.5km of Te Pare pa at the southern end of Hahei beach.

Figure 4. Looking west from Hahei Beach towards the subject property (marked with arrow)

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Figure 5. Looking towards the site from the mouth of Wigmore Stream

HISTORICAL BACKGROUND

Maori History

From earliest Maori settlement, the Coromandel, or Hauraki, was a much sought after area. The peninsula has long stretches of coastal beaches, an abundance of freshwater streams, sheltered bays and harbours, extensive kauri forests and bush clad hills and rich fertile soils – all of which provided an abundance of resources from coastal fish (including snapper, trevally, kahawai, kingfish, mackerel, gurnard and shark), deep sea fish (tuna and swordfish) and shellfish to eels, birds and berries as well as opportunities for cultivation.

The traditional name for the Coromandel Peninsula is Te Paeroa A Toi, translated as 'Toi's long mountain range' (King & Morrison 1993). Maori settled the coastal regions of the Coromandel Peninsula during the earliest ('Archaic') period of settlement (Lucas 1980).

In prehistory Maori made tools from local stone and traded basalt from the local Tahanga hill near Opito Bay to as far north as Houhora and as far south as the Wairarapa Coast. Obsidian was also utilised both from local sources and from the coveted Mayor Island source in the Bay of Plenty (King & Morrison 1993).

King summarises the early settlement of the Coromandel as follows:

The era of tribal settlement on the Coromandel was said to have begun with the arrival of the Arawa canoe, whose captain Tamatekapua laid claim to the northern part of the peninsula by announcing that he wished to be buried there, on Moehau Mountain (Moengahau A Tamatekapua). According to tradition this request was carried out by his kinsfolk. Two of them, his brother Hei and his grandson Huarere, brought back to the region followers who intermarried with descendants of the original inhabitants and formed the tribes which occupied the peninsula exclusively until the middle of the sixteenth century AD: Ngati Hei, Ngati Huarere, Ngati Hako and others. (King & Morrison 1993:41 and 43).

The earliest settlers were primarily hunters and gatherers who settled along the coast and the shores of estuaries and river mouths (King & Morrison 1993). However, by around AD 1500, a change in the make-up of society through population growth and possibly climate changes led to conflict over land and access to resources. This resulted in the development of defended settlement sites (pa). When Cook arrived in 1769, fortified settlements were evident along much of the Coromandel coast, including the impressive Hereheretaura pa and Te Pare pa at the southern end of Hahei (Black 1985; see Figure 6–Figure 7).

Continued on next page

Figure 6. Distribution of recorded pa on the Coromandel Peninsula (Black 1985)

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HISTORICAL BACKGROUND, CONTINUED

Maori History, *continued*

With the turn of the 16th century, the tribes of the Coromandel came under attack from the Waikato Tainui tribes, who claimed traditional rights over the area. The campaign against the tangata whenua tribes of the Coromandel lasted for generations, by which time only Ngati Hei and Ngati Hako had survived with 'their separate mana and identity intact'. The remaining tribes were absorbed by Tainui and became the Marutuahu confederation (King & Morrison 1993:43).

By the late 18th and early 19th centuries Ngati Hei's territory had been compressed through pressure from Ngapuhi to the north and the Bay of Plenty tribes to the south (King & Morrison 1993). Around 1820, Ngapuhi descended upon Ngati Hei at Te Pare pa at the southern end of Hahei. This pa was taken by Ngapuhi, who then had a vantage point from which they could shoot down at those defending Hereheretaura pa (Figure 7). These attacks devastated Ngati Hei. These two pa are now tapu (Ngati Hei 2012; Black 1985). After generations of warfare between Ngati Hei and Ngapuhi, peace was finally settled with the Northland tribe in 1838 (Ngati Hei 2012).

Today, Ngati Hei are the recognised tangata whenua of the eastern side of the Coromandel Peninsula.

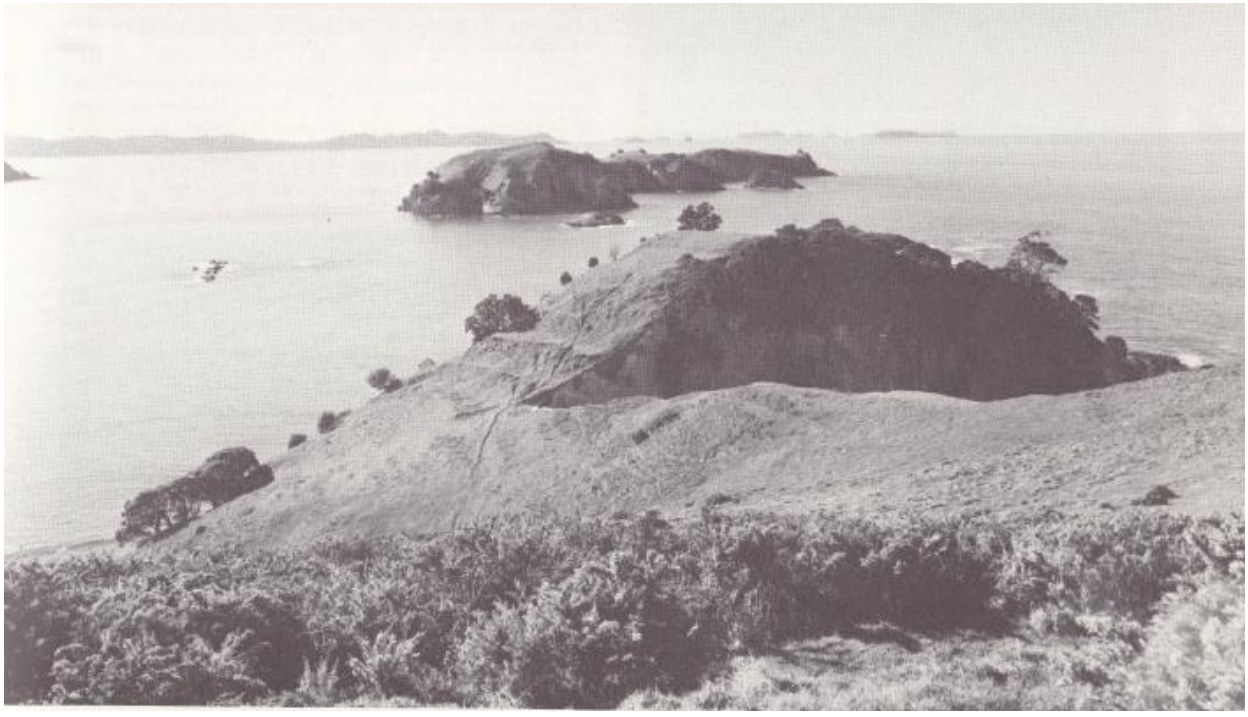

Figure 7. Looking over Hereheretaura pa from Te Pare pa (Black 1985)

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Early European Contact

The first Europeans known to have visited the Coromandel were Captain Cook and the crew of the *Endeavour* in November 1769. The *Endeavour* arrived at Mercury Bay on 3 November. Cook and his crew came ashore and met members of both Ngati Hei and Ngati Whanaunga in a friendly meeting. The sailors were provided with fish and shellfish and were assisted in finding wood and fresh water. It was at this time that Cook renamed the bay Mercury Bay as it was from here that he observed the transit of Mercury over the sun and was thus able to determine the longitude of New Zealand (King & Morrison 1993).

At this time, Cook reported that the local Maori inhabitants were poor 'to the highest degree' with many having no plantations or houses and others living on small fortified islands. It was observed that the impoverished state of the population was possibly due to the 'frequent wars in which they are certainly engaged' (Beaglehole 1955:192-203; Moore 1976).

Some mention of Hahei is made by Joseph Banks, the natural historian on board the *Endeavour*. Banks states:

[l]ate in the evening the ship came into a bay which appeard [*sic*] well shelterd [*sic*] by Islands and gave hopes for the morn. Several Canoes with people like the last came about the ship and talkd [*sic*] very civily [*sic*] to us….Just at night singing their song of Defiance and attempting to tow away the buoy of the anchor; 2 or 3 musquets [*sic*] were fird [*sic*] over them which had not the least effect, they threatned [*sic*] hard and promisd [*sic*] that tomorrow they would return with more force and kill us all and dispatchd [*sic*] a boat who told us that he was going to another part of the bay for assistance (Beaglehole 1962:425).

The next ship to arrive was the *Fancy* led by Captain Dell in 1794/95. The crew of the *Fancy* were there to find spars for the naval vessels of the East India Company. They were welcomed by local Ngati Maru and Ngati Paoa people at Hikutaia and proceeded to fell and load 213 kahikatea spars (King & Morrison 1993).

Over the next few years, at least five more ships arrived to fell timber and trade flax and potatoes with local Maori. In 1820 the Royal Naval storeship *Coromandel* arrived – a ship that was ultimately to give its name to the peninsula itself. On board the *Coromandel* was Samuel Marsden of the Anglican Church Missionary Society (King & Morrison 1993).

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HISTORICAL BACKGROUND, CONTINUED

European Settlement of Coromandel

Small scale European settlement began around the Coromandel coast during the 1830s. The Europeans were often protected by local hapu in return for the supply of tobacco, blankets and other imported goods (Black 1985).

By the 1840s major trading posts had been established at Mercury Bay and Tairua, specialising in the trade of timber (especially kauri), meat, dried fish, vegetables, fruit and firewood (King & Morrison 1993). The peninsula had now come under increasing pressure from the new colonists and the Crown as extensive forest areas were leased for timber (Black 1985).

The early 1840s were also to see a change in focus of the early European settlers on the Coromandel. In 1842, visiting whalers found traces of gold. This discovery resulted in an early gold rush in the 1850s around the Coromandel township, Cape Colville and Mercury Bay. Gold was exploited in bursts in the Coromandel until the early 20th century (Black 1985).

By 1858, the population of the Coromandel was dominated by Europeans, with Maori being overwhelmed not only by social change but also by introduced diseases including whooping cough, dysentery and tuberculosis, and through the effects of alcohol (Black 1985). Since the mid 1800s, large tracts of land on the peninsula were gradually taken and/or purchased by the Crown and individual European settlers for the purposes of logging, mining, farming and settlement. Today, very little land on the peninsula remains in Maori ownership.

Wigmore Family in Hahei

The earliest European settlers at Hahei were Robert and Fanny Wigmore, who settled the area with their children in either the late 1860s or early 1870s. The family purchased a large block at Hahei under the Auckland Waste Lands Act on 2 April 1872. The area comprised the main Hahei Bay block of 184 acres and the pa block (at the southern end of the beach) of 40 acres. The farm was used primarily for sheep grazing and wheat, maize and vegetable cultivation, with rows of pine trees as well as ornamental trees and fruit trees (Harsant & Harsant 1994; Hahei Community Plan).

Robert Wigmore continued to farm the property until his death in 1890. Fanny Wigmore continued to live at Hahei until her death in 1911.

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Harsant Family in Hahei

In the early 1900s, Robert and Fanny's son Harry Wigmore married Kate Harsant. The Harsant brothers, Walter, Horace and Fred, farmed the Hahei Block in partnership with Harry, before purchasing it in 1911 (Hahei Community Plan).

Horace, Walter and his wife Mabel and their five children came to live in the homestead at Hahei in 1915. Horace later married Florence Woodhead in 1918 and had three sons – Fred, Vaughan and Charles – and a daughter, Joan (Hahei Community Plan). The Harsants removed hundreds of radiata pines and ploughed and re-grassed much of the arable land for continued sheep grazing over both the pa and the flats (Figure 8). The first lot of timber was towed to Auckland and sold to a timber company. The remaining timber was cut at Hahei and sold to the Kauri Timber Company based at Mercury Bay (Harsant & Harsant 1994).

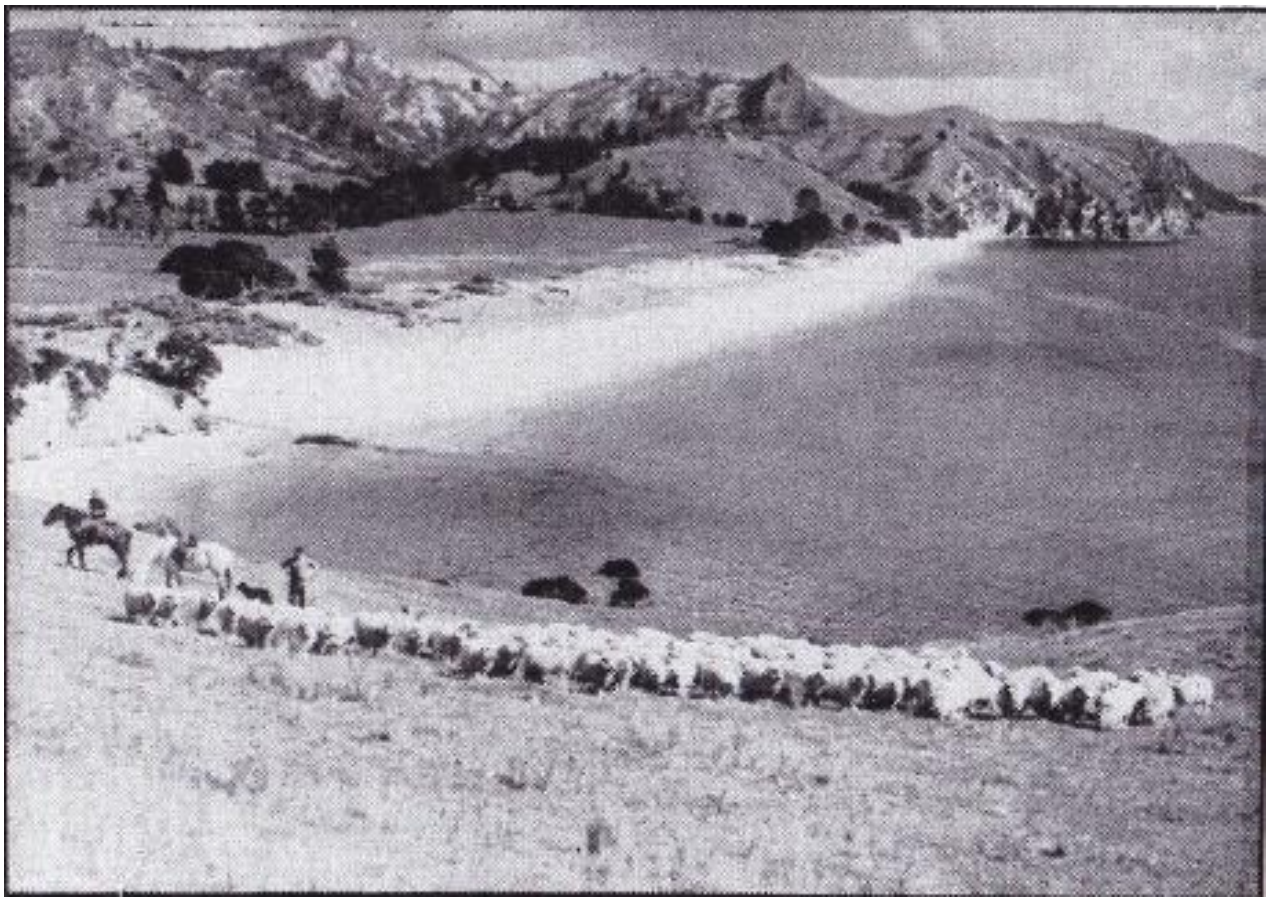

Figure 8. Fred and Walter Harsant mustering sheep on the pa overlooking Hahei (Harsant & Harsant 1994)

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Hahei in the 20th Century

The first school at Hahei was established in 1919 and was held in one room of the Harsant homestead with a roll of 10 pupils who travelled from as far as Purangi and boarded at the Harsant house during the week. The school closed down in 1930 when the roll had dwindled to five pupils (Harsant & Harsant 1994).

Hahei remained isolated until the early/mid-20th century. Early transport was primarily by water, especially for large or heavy items. By the 1920s, the only road connecting Hahei to Mercury Bay consisted of a bridle track with portions of roughly formed road (Harsant & Harsant 1994).

Between 1913 and 1994 the Harsant family noted three times when large storms stripped the sand from the beach and revealed an underlying natural clay deposit. The clay is said to extend for approximately 400 yards from the boat ramp to past the entrance to the motor camp. At these times, large quantities of kauri gum were exposed in the clay and could be dug (Harsant 1968; Harsant & Harsant 1994).

In 1945, the Hahei farm was split into two with a road surveyed through to the beach. Walter chose to continue sheep farming, while Horace converted to dairy farming. The farm was split again in 1946, with Vaughan taking over the bottom coastal flats for a 60 cow herd dairy farm. The establishment of the new road provided public access to the beach, resulting in Hahei becoming a popular camping destination (Figure 9).

By 1958, the area was so popular that it became necessary to provide some services. In response to this, Vaughan established a motor camp near the beach, purchasing the old homestead to live in and selling six sections on Hahei Beach Road to pay for it. This led to the development of the Tutaritari Road subdivision and relocation of the camp ground. The campground was established on the beach front, accessible by Harsant Avenue, and continues to be a popular campground today (Hahei Community Plan).

During the 1960s, Vaughan and his wife Dawn initiated the Dawn Avenue subdivision, established a public sewer plant, planned and built the Hahei commercial area and offered 80 acres of land to the Land and Survey Department as Recreational Reserve. This Reserve land became known as the Cathedral Cove Reserve (Hahei Community Plan).

Continued on next page

HISTORICAL BACKGROUND, CONTINUED

Figure 9. Summer camping at Hahei Beach c.1950s? (Hahei Community Plan)

The Changing Landscape and Impacts on Archaeology

Not much is known about the early pre-European landscape of Hahei. However, the discovery of large amounts of kauri gum along the foreshore of Hahei Beach at various times during the 20th century indicates that there must once have been a dense grove of coastal kauri. Moore suggests that the area may well have been covered in bracken and scrub with areas of boggy/swampy ground which are now drained (Moore 1999).

Captain Cook makes some mention of the landscape of the eastern side of the Coromandel Peninsula, stating '[t]he Main land appears here with a hilly, rugged and barren surface, no Plantations to be seen nor no other signs of its being well Inhabited' (Beaglehole 1968:192). He continues on to describe the landscape at Mercury Bay as '[t]he Country Especialy [*sic*] on the East side is barren and for the most part destitute of wood or any other signs of fertillity [*sic*] but the face of the Country on the other side looked much better and is in many places cover'd [*sic*] with wood' (Beaglehole 1968:197).

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The Changing Landscape and Impacts on Archaeology, *continued*

Extensive farming of Hahei during the late 19th century saw the clearance of vegetation to provide more pasture. The farming method was controlled burning of the pasture to encourage new growth (Harsant & Harsant 1994). Moore suggests that this method of burning the original vegetation cover may have resulted in large blowouts of the main coastal dunes which are evident on a 1940s aerial, with ongoing erosion exacerbated by the grazing of livestock during the early 20th century (Moore 1999). Moore also suggests that severe wind erosion after vegetation clearance would have resulted in large amounts of sand being blown off the coastal dunes onto the rear dune systems. This extensive sand movement would have caused 'considerable damage to some of the prehistoric archaeological sites on the main dunes' and could have 'resulted in some spatially extensive sites (e.g. middens, working floors) being reduced to isolated remnants on higher parts of the dunes. Coarser material (stone, shell, bone) eroded from these sites would tend to become concentrated in the deflation hollows as "lag deposits"' (Moore 1999:6).

An assessment undertaken by Furey and Darmody (2010) to assess the extent of archaeological site survival along the eastern coast of the Coromandel Peninsula also identifies natural processes as having a detrimental effect on coastal dune sites, with the influence of human activities having caused the coastline to be more exposed to storms and flooding (2010:2). They report that archaeological sites that are located within pocket beaches, such as that at Hahei, 'have suffered a severe rate of site damage since they were recorded' (Furey & Darmody 2010:27).

The Wigmore family were known to have planted rows of pine trees as boundaries and wind breaks throughout the farm. These rows of pine are evident along with groves of manuka on an early survey plan of the area dating to 1905 (SO 13366). Harsant and Harsant (1994) also recall that the only trees by the time of the arrival of the Harsants in the early 20th century were pohutukawa trees on the cliff faces, and state that if there were any other native trees, they must have disappeared 'many years prior' to the arrival of the Harsants (Harsant & Harsant 1994).

Aerial photographs taken from 1965 and 1984 show the immense changes that Hahei underwent during these two decades (Figure 11, Figure 12). With the popularity of the area for camping during the 1960s came the subsequent staged subdivision of coastal land. Earthworks associated with the early subdivisions were extensive and resulted in the flattening of coastal dunes, which exposed a number of archaeological remains (see below).

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HISTORICAL BACKGROUND, CONTINUED

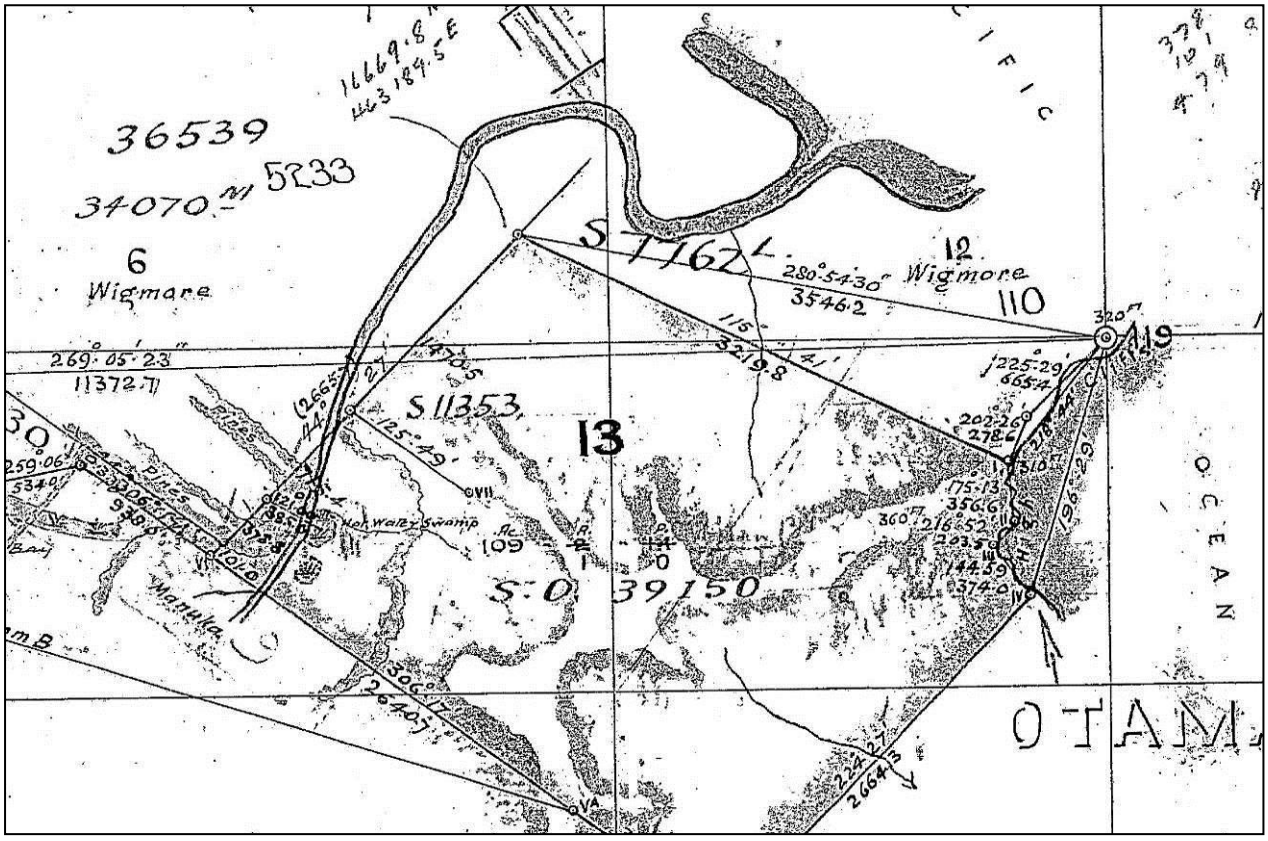

Figure 10. Section of SO 13366 (1905) showing rows of pines and patches of manuka within the Wigmore property

Figure 11. Whites Aviation aerial photo of Hahei Beach in 1965 (Alexander Turnbull Library WA-63214-G). Location of subject property indicated with white arrow

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Figure 12. Whites Aviation aerial photo of Hahei 1984 (Alexander Turnbull Library WA-77785-F). Location of subject property indicated with white arrow

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HISTORICAL BACKGROUND, CONTINUED

Subdivision

Wigmore Crescent was subdivided in 1970 (DPS 15008, Figure 13). The subdivision was bounded by the beach to the northeast, Wigmore Stream to the south, east and west, and the Hahei campground to the northwest. As with previous subdivisions, extensive earthworks involving flattening of the coastal dune system and deposition of topsoil was undertaken to allow for flat building platforms. The Wigmore Crescent subdivision is now a densely populated residential housing area with sealed roading, utilities and extensive landscaping.

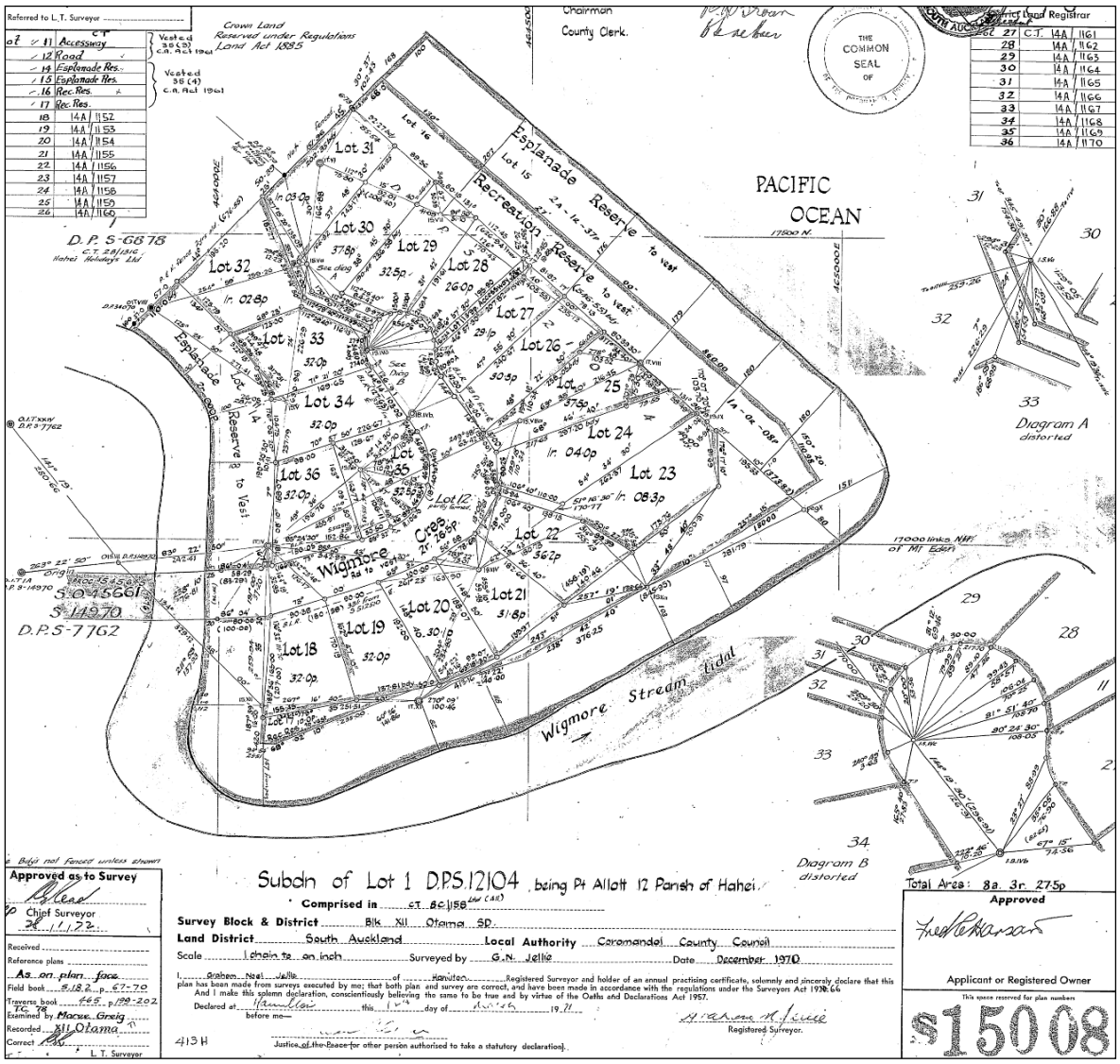

Figure 13. DPS 15008 Subdivision of Lot 1 DPS 12104 (1970)

ARCHAEOLOGICAL BACKGROUND

Early Site Recording and Investigation on the Eastern Coromandel Peninsula

Site recording on the Coromandel Peninsula began largely in the late 1950s (Green 1959). Through the 1960s and 1970s small-scale assessments resulted in the recording of many more coastal sites. However, it was not until 1982 that a systematic survey of 21 east coast beaches was undertaken by Easdale and Jacomb through the Hauraki Catchment Board (Easdale & Jacomb 1982).

A number of site investigations were undertaken along the coastal margins of the Coromandel Peninsula during the 1950s/1960s. These investigations tended to focus on early ('Archaic') Maori sites that were rich in artefact material and were in many cases actively eroding along foreshore dune systems. In the 1950s investigations were undertaken by Jack Golson at an early Archaic Maori occupation site at Sarah's Gully (T10/167). The excavation showed multiple periods of occupation and dated back to the earliest period of settlement on the Coromandel. The midden included shellfish, mammal and fish bone, lithic material and moa bone (including fish hooks) (NZAA site record form).

Archaic midden site T10/171 was also excavated in 1960 by Birk and Birk. The site showed two separate periods of occupation, with the lower layer relating to early Archaic Maori occupation (NZAA SRF). The Archaic midden site on the other side of the stream (T10/399) was excavated by Sewell in 1983. The excavation provided evidence of five separate periods of occupation dating to the 13th/14th centuries. The midden included a wide range of shellfish, mammal bone, fish bone, moa bone, lithic material and shell/bone fishhooks (NZAA site record form).

Excavations at the adjacent Opito Bay were begun as early as the 1930s with the excavation of Archaic coastal midden site T10/162 by Fisher. The investigation uncovered one occupation layer that contained moa bone fish hooks and Tahanga basalt adze pre-forms (Sewell 1990). Subsequent excavations at Opito were undertaken by Arthur Black of Archaic midden site T10/164 and by Furey of site T10/657 in 2001.

In 1969 a rescue excavation of an early Archaic Maori settlement site (T11/115) at Hot Water Beach was undertaken under the auspices of the Auckland Museum. The site was reported as being an early Maori occupation site with evidence of cooking as well as stone flaking located 'on the sandy flats across the stream from the pa' (Leahy 1974:23; Gumbley 2001).

During the 1970s/1980s an early Archaic Maori occupation site T11/326 located at Hahei was investigated by Edson and Brown (1976) and Harsant (1984). In addition, coastal midden site T11/242 (previously N44/215) was sampled by Nichol in the mid 1980s (Nichol 1986). (See the Hahei section for further information.)

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Recent Work on the Coromandel

Matarangi

More recently, an excavation of a coastal midden site (T10/993) located on the dunes of the Matarangi sandspit was undertaken by Furey. The investigations uncovered multiple midden deposits, shallow firescoops and one posthole. Shell midden comprised predominantly cockle (*Austrovenus stutchburyi*), tuatua (*Paphies subtriangulata*) and pipi (*Paphies australis*), with some scallop (*Pecten novaezelandiae*) and gastropod. Radiocarbon dates obtained indicated a date of occupation between the late 16th and early 17th centuries (Furey 1999).

Tararu

In 2000, Sewell investigated midden site T12/937 located on the foreshore at Tararu (on the western side of the peninsula). Postholes, firescoops and midden deposits were revealed, indicating an extensive settlement area. Midden analysis showed a dominance of pipi and cockle. No stone or obsidian artefacts were recovered from the site and the presence of a metal belt buckle suggested that the site was occupied during the early Contact period (Sewell 2001).

Tairua

In 2002, Gumbley investigated an extensive pre-European Maori occupation site comprising terraces and middens (T12/1028) located on a hillside overlooking Tairua Harbour, Pauanui. The site was interpreted as 'an aggregate of a number of kainga occupying the ridge spurs' east of the stream (Gumbley 2003). Investigation was limited to proposed areas of development and included investigation of some terrace features and midden deposits. The investigation uncovered evidence of occupation from a cultural layer and posthole features. Analysis of midden samples identified a restricted range of species dominated by cockle and pipi, with ostrich foot (*Struthiolaria papulosa*) and cats eye *(Turbo smaragdus*) also present. Bone identified included red gurnard, possible mackerel (not confirmed) and possible lizard (not confirmed). Two radiocarbon dates obtained from the site provided dates of occupation between 1500 and 1670 AD (Gumbley 2003).

Whangapoua

In 2004, Gumbley undertook an investigation of shell midden sites T10/751, T10/752 and T10/753 located on the low ridges at the foot of the hills behind Whangapoua Beach (Gumbley 2008). The investigations indicated that the three sites were in fact part of one larger occupation site with associated structural postholes and stakeholes and a series of four rectangular pits with internal drains cut into the clay subsoil. Midden samples were dominated by pipi and cockle.

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Recent Work on the Coromandel, *continued*

A small stone artefact assemblage of 14 items was recovered, comprising obsidian cores and flakes, a chert core and a basalt (probably Tahanga basalt) flake. The obsidian was sourced to Mayor Island and the Coromandel Peninsula. Five radiocarbon dates were obtained from the site, providing a date of occupation of late 16th to 17th century (Gumbley 2008).

Whangamata

In 2008, Gumbley and Hoffman excavated part of midden/flaking floor site T12/3 located on the coast at Whangamata harbour. The investigations uncovered a total of 98 archaeological features including firescoops/ovens, postholes, piles of oven stones, concentrations of dog coprolites, fishbone deposits and gardening soils. Midden deposits contained a wide range of shellfish and over 4000 artefacts were recovered including obsidian flakes/cores, basalt flakes, adzes and adze performs, chert drill points, flakes and cores, sandstone abraders, hammerstones, sinkers and fish hooks. Radiocarbon dates obtained from the site indicate that it is an early Archaic site dating to 1350–1400AD (Gumbley & Hoffman 2008).

Kuaotunu

In 2009, Hoffman undertook the excavation of pit site T10/824. The investigations uncovered three food storage pits with internal postholes and drainage cut into the sterile clay subsoil located along the ridge crest behind the foreshore at Kuaotunu, Coromandel. Artefactual material included six fragments of Mayor Island obsidian, a Tahanga basalt flake and part of a large Tahanga basalt adze (Hoffman 2009).

Opito

In 2007, test investigations were undertaken under an NZHPT S18 Authority of an early Maori occupation site T10/777 located at Opito Bay. The investigations located a shell midden/working floor area and storage pits. A radiocarbon date obtained from the midden indicated that at least part of the site relates to early Archaic settlement (Bickler in prep.). In 2012, the site was extensively investigated by Clough & Associates under Authority from the NZHPT. The excavation uncovered numerous storage pits, postholes and firescoops relating to early Maori occupation of the area. Radiocarbon dates have not yet been obtained for the 2012 excavations.

Other investigations

Minor investigations within the coastal regions of the Coromandel Peninsula have also been undertaken at Tahanga Hill, Kuaotunu Peninsula in 1992 (Clough & Sheppard 1993) and at Whangapoua Beach (Furey 2008).

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ARCHAEOLOGICAL BACKGROUND, CONTINUED

Site Recording at Hahei

There are a number of archaeological sites recorded at Hahei Beach from Hereheretaura Point in the south to the northern end of the beach (Figure 15). The recorded sites range from shell midden deposits and stone tool flaking floors to defended headland pa sites, all of which relate to pre-European Maori settlement of the area. Ten of these recorded sites are located along the dunes.

Early archaeological recording of sites in Hahei was undertaken in the 1950s, when Bruce McFadgen and Roger Green recorded the prominent pa sites on Hereheretaura Point and midden/flaking floor sites exposed on the deflated dune surfaces towards the southern end of the beach. Further sites were exposed as a result of earthworks associated with the early subdivisions during the 1960s (Edson & Brown 1976).

In the 1970s, the subdivision of the Wigmore Road area uncovered two burials: the first, probably located on Lot 23 (27 Wigmore Crescent) (?N44/93=T11/135), was buried beneath 2m of sand; while the second was located adjacent to Lot 21 (29 Wigmore Crescent) on the roadside verge (Edson & Brown 1976). The location of these burials supports the statement by both Peter Johnston (Ngati Hei) and Phil Moore that the dunes behind the southeastern end of Hahei within the area of the Wigmore Road subdivision may have been an urupa (Johnston pers. comm. 2012; Moore 1999). Johnston states that *Agave* or *Aloe* were planted around Maori graves to discourage curio hunters (Johnston pers. comm. 2012; Moore 1999). However, as Moore states, this could not have been until after c.1869 when *Agave* was first recorded as growing in New Zealand (Moore 1999). A large amount of the plant can be seen growing along the foreshore dunes around the Wigmore Road area.

Other sites located as a result of earthworks included a stratified shell midden deposit containing fish and dog bone, possibly located within Lot 27 (23 Wigmore Crescent). Working floors were identified along the northern bank of Wigmore Stream within Lots 18, 20 and 22 (32, 30 and 28 Wigmore Crescent). Artefacts identified included basalt adze roughouts, drill points, chert and obsidian flakes and moa bone. On the southern bank of Wigmore Stream, a variety of drill points, basalt and obsidian flakes, dog teeth and other unidentified bones were collected. Preserved wooden horticultural implements were also recovered from the swampy margins of Wigmore Stream. Edson states: 'it is clear that the overburden of recent dune sands behind Hahei Beach preserves substantial evidence for the area's occupation by the Maori at the earlier end of the N.Z. prehistoric sequence' (Edson & Brown 1976: 2).

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ARCHAEOLOGICAL BACKGROUND, CONTINUED

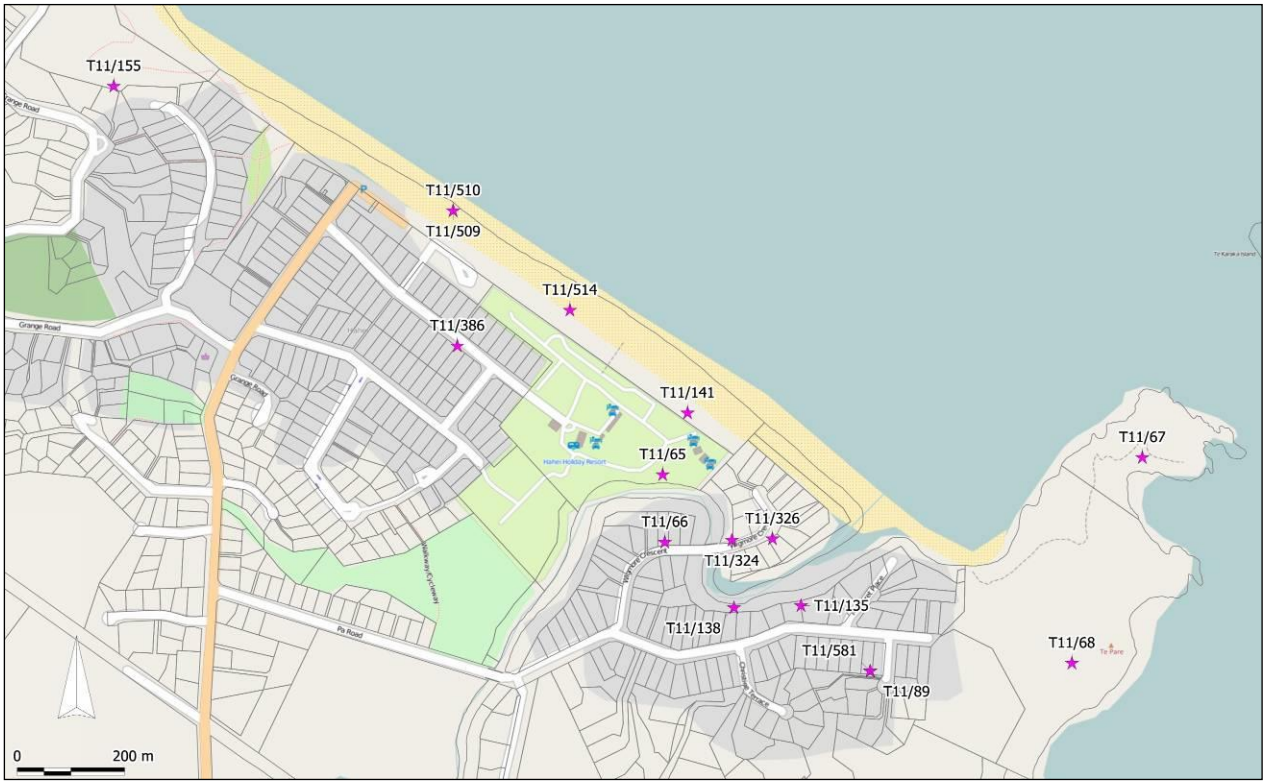

Figure 14. Recorded archaeological sites at Hahei (source: NZAA Archsite 2012)

Site Recording at Hahei, *continued*

Many of the sites recorded within the area were located during field assessment undertaken by Phil Moore in the late 1970s. The next extensive archaeological survey of Hahei Beach was undertaken by Easdale and Jacomb in 1982 as part of a large-scale coastal survey of archaeological sites on the beaches of the Coromandel Peninsula (Easdale & Jacomb 1982). The survey report noted that there were a number of middens visible along the beach front, mostly comprising scatters of shell and flake material. The assessment also noted the existence of a substantial Archaic midden deposit (N44/215=T11/242) located within the beach dune system towards the centre of the bay.

In 1999, Phil Moore undertook an archaeological assessment of the Hahei Holiday Resort which lies to the northwest and within 100m of the subject property. The assessment involved extensive probing and hand digging of eight test pits within the campground area, and two small areas of midden were located within the 'landward part of the main sand dunes'. Moore suggests that the previously unrecorded midden deposits are probably a remnant of a once more extensive midden site recorded as T11/66 (Moore 1999).

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Archaeological Excavations in Hahei

Archaeological investigations at Hahei have previously been undertaken as a result of subdivision and earthworks for residential development along the beach dunes. The investigations comprise: the excavation of site N44/97 (T11/326) undertaken by Stephen Edson and Dorothy Brown in 1976 and Wendy Harsant in 1979 and 1981 (Figure 15). In addition, Phil Moore undertook a small scale test investigation of N44/67 (T11/114), located on Poikeke Island off the coast of Hahei in 1977 (Moore 1977).

In the mid 1980s, Reg Nichol of the University of Auckland undertook the sampling of coastal dune midden site T11/242. The sample provided evidence of shellfish gathering and fishing (in the form of bones from 13 different species of fish including snapper). Artefactual evidence was scant but included an adze rough out and partially finished fish hook formed from a dog's innominate bone. Fragments of *Cookia* shells may relate to the manufacture of fish hooks from this species. Radiocarbon dates obtained from the site provided dates around the 14th–15th centuries AD (Nichol 1986).

Investigations of T11/326

The investigations by Edson and Brown at N44/97 (T11/326) were undertaken after an 'unusually rich archaic burial' was discovered with an 'early occupation floor' on the property at 31 Wigmore Road (Edson & Brown 1976, Figure 15). The investigations were undertaken within three squares (B1, B2 and B4) with a total excavation area of 11.5m² and concentrated on a disturbed burial with associated grave goods and part of a stone working floor. Edson and Brown found that there were three layers within the excavated areas. Layer 1 comprised a recent imported topsoil/clay layer that was substituted by a light grey wind-blown sand in some areas. Layer 2 was variable between the test squares, being a loose grey sand containing root matter in square B1, a grey/black charcoal enriched soil with shattered hangi stone in square B2 and a mixed yellow/brown sand in square B4 (ibid.:3-4).

Within square B1, Layers 1 and 2, although being rich in artefactual material including flaked stone, were 'demonstrably recent', overlying a spread of builders' mix or roading metal used during the 1970s subdivision. Layer 3 was found to be a partially intact occupation floor containing evidence of cooking and manufacturing of stone tools. The burial was found to be not in situ and had probably been removed to its excavated location during bulldozing for the subdivision. Edson & Brown considered it likely that the burial post-dated the occupation floor (1976:3).

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Archaeological Excavations in Hahei, ***continued***

Within square B2, Layer 1 was again found to be rich in artefactual material but demonstrably recent. Layer 2 was described as a 'charcoal silhouette', being the remains of an oven area that had been exposed to weathering. Layer 3 was the natural dune surface. Little additional information was obtained from square B4.

Edson and Brown also inspected exposed sections within Lots 18 and 20 (32 and 30 Wigmore Crescent, located respectively west and east of the excavations. An exposed 2.8m long section along the eastern side of the driveway to Lot 20 showed the following stratigraphy:

- Layer 1 – dune sand with vegetation on surface (0-65cm)
- Layer 2 – darker sand (65-72cm)
- Layer 3 – clean sterile sand (72-82cm)
- Layer 4 – working floor (82-92cm)
- Layer 5 – stained sand (92 – 134cm)
- Natural clean yellow dune sand

Artefacts noted within Layer 4 comprised: two flakes from polished basalt and greywacke adzes, numerous basalt and siliceous flakes, a few obsidian flakes and sandstone pebbles. Edson and Brown reported these finds as being identical to those recovered from the T11/326 investigations (Edson & Brown 1976:4).

Inspection of exposed soils on the common boundary of Lots 18 and 19 (32 and 31 Wignmore Crescent) located several fragments of bone (including moa), a drill point and a fish hook tab, although the stratigraphy showed that the occupation floor had been destroyed at this location (Edson & Brown 1976).

Edson & Brown obtained one radiocarbon date from a thin charcoal layer of unidentified wood species located within a previously disturbed area of the site. The sample provided a date of 740 ± 50 years BP (Edson 1980).

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Archaeological Excavations in Hahei, *continued*

Harsant excavations

In 1979 and 1981, a previously undisturbed section of site T11/326 within Lot 21(29 Wigmore Crescent) was investigated by Wendy Harsant. The excavation was undertaken over an area of 72m² adjacent to the exposed cutting that was detailed by Edson and Brown (1976) above. Artefacts included hundreds of Tahanga basalt flakes, chert and chalcedony drill points and bone fish hook tab cores. The investigation also located three rectangular and two oval-shaped pits cut into the working floor (Harsant 1984, 1985).

Harsant obtained four radiocarbon dates for the site from charcoal obtained from four fire pits over two separate occupation layers. Harsant reports that although the majority of the charcoal obtained was from short-lived tree species, some of the charcoal was from longer living species that may have caused some discrepancies in the dates. In fact, there is an almost 200 year discrepancy between two dates obtained from the same fire pit. The dates range from the early 14th century through to the 17th century (Harsant 1984).

The discrepancies in the dates could not be explained, and Harsant stated that although the earlier dates are preferred (based on the artefactual evidence), the later date cannot be discounted. Harsant also noted the marked discrepancy between the date obtained for the site from the Edson and Brown investigations in 1976 and the later 1979/1981 investigations (Harsant 1984).

Figure 15. Location of properties that have been the subject of previous investigations in relation to the subject property at 25 Wigmore Crescent

ASSESSMENT OF T11/1030

2011 Assessment

An assessment of the subject property was undertaken by Hoffman (2011) who suggested that T11/1030 probably related to the early period of Maori occupation of New Zealand commonly known as the Archaic. Hoffman (2011), described the site as:

> a small but significant component of a once extensive archaeological site (represented by sites T11/66, T11/135, T11/138, T11/324, T11/326), which spanned the entire subdivided area of Wigmore Cres and across the southern bank of Wigmore Stream. (Hoffman 2011:5).

Hoffman's test pits recovered a number of artefacts:

- Large grey obsidian flakes and small waste flakes of Tahanga basalt
- Stone cobbles
- A single part of a broken reworked hogs-back adze
- Shell (limpet, cook's turban, tuatua, pipi, ostrich foot, mudsnail and cockle)
- Bone (fish, dog and bird)
- Moa (?) bone blank possibly for a fish hook.

The testing suggested that the site covered an area of around $50m^2$ (Hoffman 2011; Figure 16).

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ASSESSMENT OF T11/1030, CONTINUED

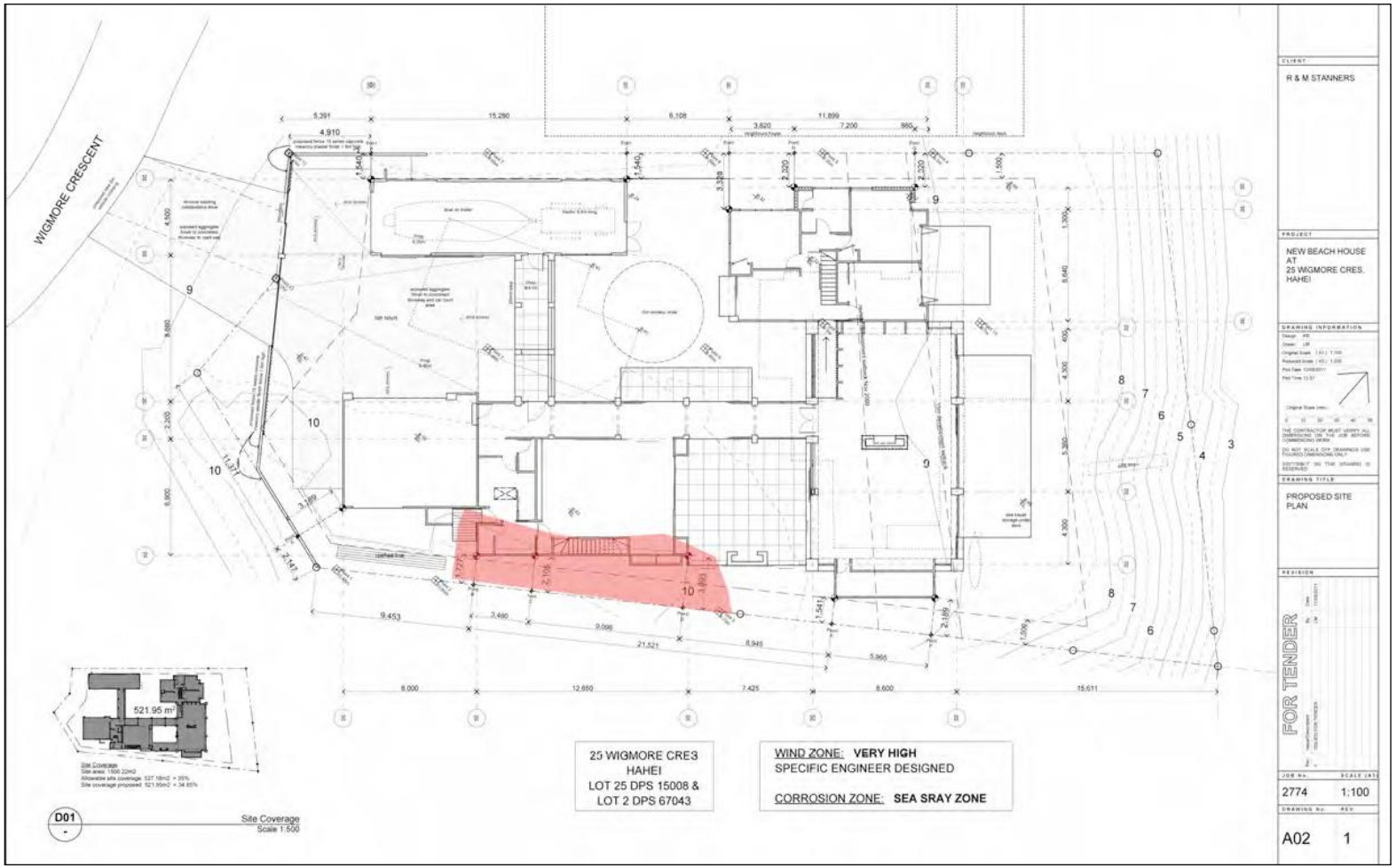

Figure 16. Proposed building design and estimated extent of site area (Hoffman 2011: Figure 4)

Investigation of T11/1030

EXCAVATION

Overview

At the time of the 2012 investigation, the site had already been exposed and the koiwi removed. Investigations of part of site T11/1030 were undertaken from 7 to 10 February 2012. The investigation uncovered the remains of pre-European Maori settlement of the Hahei coastal dunes in the form of storage pits, hearth features and structural postholes. The site was overlain with a homogenous wind-blown, redeposited layer of charcoal-stained sand with numerous stone and obsidian flakes and other artefacts. This layer appears to have been deposited through natural dune movement, weather and movement of people over the surface. The koiwi reported by Hoffman (2011) had been buried in the surface of this layer.

Excavation Methodology and Stratigraphy

All areas around the site extent indicated on Figure 16 had been previously modified as reported by Hoffman (2011). This was confirmed during site inspection prior to the start of the investigation and through test trenching as part of the investigation.

Investigations were initiated with the cleaning down of the surface of the site using hand tools. The site showed on the surface as areas of mid-dark grey sand with numerous pieces of tahanga basalt stone flake material, obsidian flakes and occasional shells included (Layer 2). Some areas were overlain with a yellow clean wind-blown sand. The area excavated is shown in Figure 17 and the extent of the archaeological remains identified and investigated is illustrated on Figure 27, below.

Test pits were dug across the defined site area to determine the depth of the stratigraphy and, in turn, the depth of the cultural layer(s). The depression from which the koiwi had been recovered was visible on the exposed surface cut into the uppermost layer. The location of the depression from which the koiwi were removed prior to the excavation was mapped in within the surface of Layer 2 prior to the site being investigated.

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EXCAVATION, CONTINUED

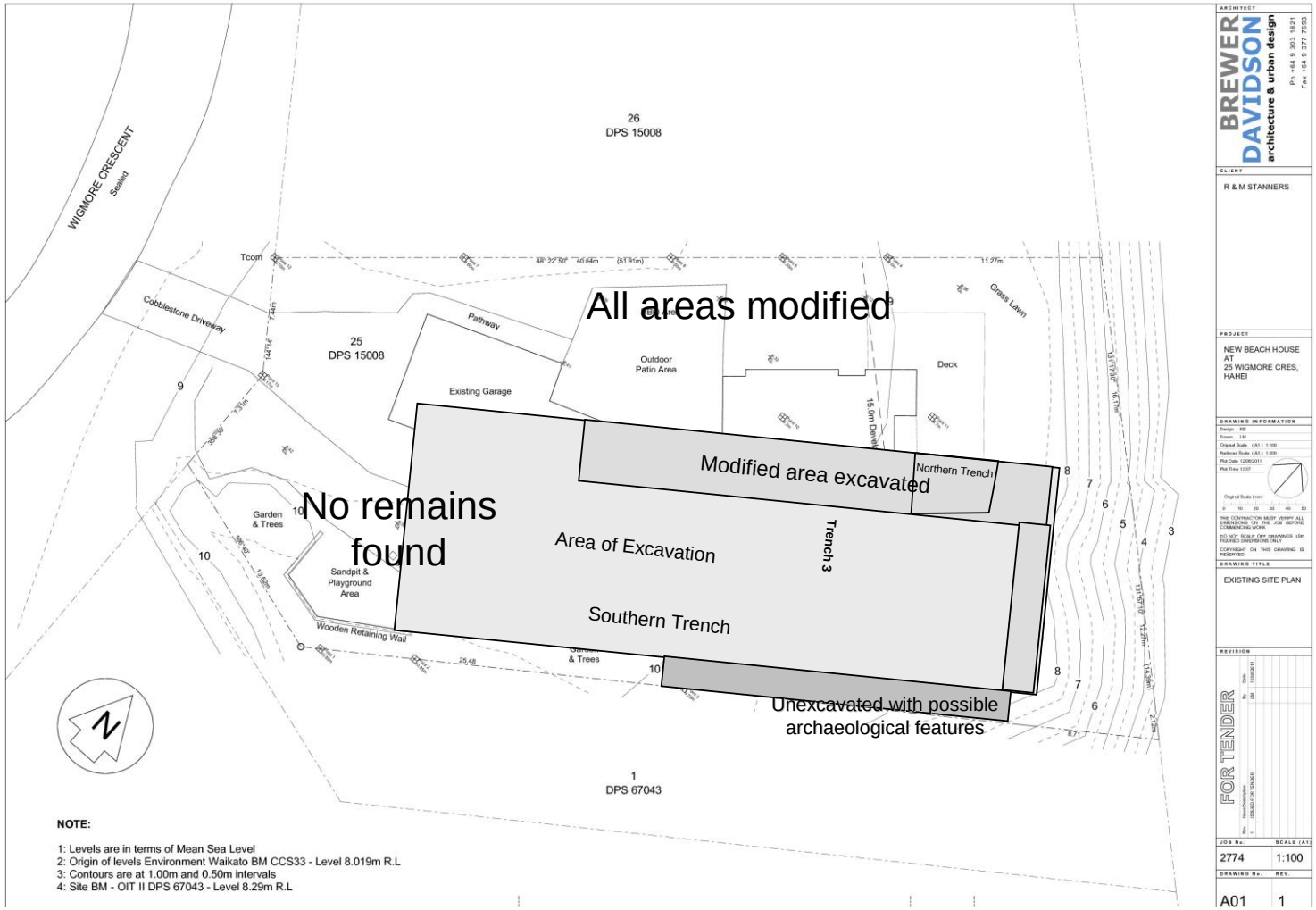

Figure 17. Existing site plan (source: Brewer and Davidson, 2011), with overlay of area of excavation

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EXCAVATION, CONTINUED

Excavation Methodology and Stratigraphy, *continued*

A c.2m x 3m x 1m deep test trench was excavated outside the known northern extent of the site using a mechanical digger (Figure 18). This trench was undertaken to determine whether there was any intact archaeological material located beneath the modern modified soils to the north of the known extent of T11/1030 and to clearly define the northern boundary of the remnant site within the property. The test trench revealed the high degree of modification of the subsoils in this area and no intact archaeological deposits were identified. The stratigraphy was largely homogenous throughout, showing a mid-grey mixed sand with small patches of soil mixed in (Figure 19). Hangi stones and fire-cracked rock were evident at 0.8m below the surface while brick was recovered from 0.9m below the surface and pieces of plastic and nylon fishing wire were recovered from 0.9 to 1m below the surface. Occasional flakes of Tahanga basalt were also recovered throughout the fill.

An additional trench was dug outside of the southern known extent of site T11/1030, close to the southern boundary fence of the property (Figure 20). The dimensions of this test trench were 2m x 7m x c.0.8m deep. The trench revealed that the old dune surface dipped beneath a sterile yellow sand layer towards the south.

The southern trench also enabled a clear understanding of the stratigraphy (Figure 21, and Figure 37, below):

- Layer 1: Natural yellow wind-blown sand – present overlying the site in some areas in a 0–c.36cm layer
- Layer 2: Mixed grey mottled sand containing flaked Tahanga basalt, obsidian flakes, flecks of charcoal and occasional shell through the upper lenses. Koiwi were also cut into the top of this layer. Evident in a layer 20–30cm thick
- Layer 3: Evident in patches across the site as a yellow natural sand with mottled brown sand mixed at the top. The mottling is due to vegetation and bioturbation on the old dune surface and this layer is essentially the natural sand dune.
- Old dune surface evident as a consolidated sterile yellow/orange sand. No vegetation or bioturbation evident.

The excavation of the southern trench also enabled determination of the western extent of the site, as a modern modified layer was clearly evident cutting into the western end of the trench.

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EXCAVATION, CONTINUED

Excavation Methodology and Stratigraphy, *continued*

The site was gridded out into 2m squares. Excavation of the mid-dark grey sand labelled Layer 2 was undertaken with hand tools in 5-10cm spits (dependent on conditions) to identify any features that may have been present within the layer and to correctly locate any recovered artefacts. Some modern modification to this layer was evident through the presence of utilities trenches and modern fill towards the southwestern end.

A hand-dug trench, Trench 3 (Figure 22, Figure 23 and Figure 38 below) was excavated to half section the depression from which the koiwi had previously been recovered to determine whether there was any clear burial cut evident. The trench uncovered what appeared to be the remains of a wooden post (Figure 24) at the southern end of the burial depression. This possible 'post' was removed completely (Figure 25), placed on a wooden board and covered in plastic cling wrap for later analysis. No clear burial cut was evident in the profile and it was clear that the burial did not extend down into either the base of Layer 2 or the natural sand layer.

Figure 18. Excavation of northern trench

Continued on next page

EXCAVATION, CONTINUED

Figure 19. Northern trench profile, showing the mixed modified fill

Figure 20. Southern trench, beginning of excavation

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Figure 21. Southern trench, looking west showing northern profile

Figure 22. Test Trench 3 dug to show profile of burial depression

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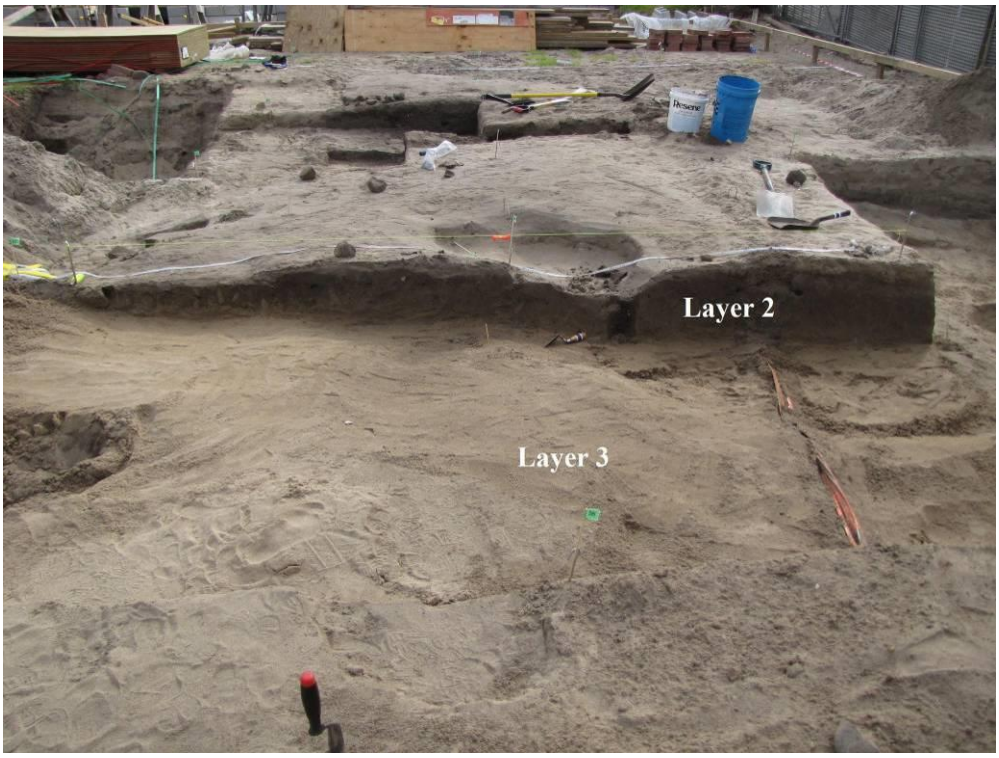

Figure 23. Looking north-east showing profile of test Trench 3 with burial depression in centre of picture

Figure 24. Profile of burial depression showing 'post' (marked with arrow)

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Figure 25. Removal of 'post' from edge of burial area

Layer 2 Features

Excavation of Layer 2 across the site made it clear that the majority of this mid-dark grey sand layer had been wind blown, resulting in the deposition of artefacts from nearby archaeological sites across the dune. Layer 2 varied in depth between 5cm and 50cm thick across the site – getting deeper as it dropped down the slope towards the south. However, given that the site had been formed as a flat surface for subdivision, it is likely that the northern and western ends of Layer 2 were cut down and removed along with a major component of the original due system.

Layer 2 comprised a largely homogenous layer of grey slightly charcoal stained sand with charcoal flecking, stone and obsidian flakes and occasional shells throughout. Bulk samples of Layer 2 were sieved on site to recover artefactual material (Figure 26). The majority of artefacts (including all Archaic material), shell and stone material were located in the upper spits of the layer and were not associated with any intact archaeological context.

All of the intact features (excluding the koiwi) were dug from the base of Layer 2, which was in effect the cultural surface of the old dune system. The majority of the features were evident either resting on the top of the natural sterile sand or cut into it.

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Layer 2 Features, *continued*

The features were infilled and surrounded with the basal sand from within the base of Layer 2; the artefact-rich layer appeared to overlay an older dune surface that had formed the living area of the site. The mixed grey sand also filled the storage pit features that were evident cut into the underlying sterile dune sand.

Features (Table 1, Figure 27– Figure 31) included:

- 4 storage pits (two of which were intercut)
- 1 hearth feature
- 5 firescoops and 3 postholes.

Limited artefactual and faunal material from intact contexts was recovered, and comprised obsidian flakes and fish bone from Features 2 (firescoop) and 5 (hearth).

Figure 26. Shell and artefactual material recovered from sieved samples of Layer 2

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EXCAVATION, CONTINUED

Table 1. Feature list

Feature	Location	Type	Description
1	Cut into surface of Layer 2	N/A	Modern feature related to service trench
2	Square 3A, Layer 2/3	Firescoop	Circular 50 x 50cm x 20cm deep with rounded base. Feature was cut into the base of Layer 2 and descended through Layer 3. Fill comprised a mid brown sand matrix with some charcoal, fishbone and obsidian flakes.
3	Square 3B, 3C, surface of Layer 2	Burial	Irregular shaped burial hole dug into the surface of Layer 2
4	Square 3A/3B, resting on sterile sand surface	Firescoop	53 x 82cm, moderate amount of fired rock with dense charcoal deposits, some shell flecking
5	3B, 3C cut into base of Layer 2 and partially resting on surface on sterile sand surface	Fire/hearth	Circular 85 x 85cm x 15-20cm deep, rounded base. Surrounded by and capped by stones. Stones were scattered over a 0.5m radius from centre of feature as well as bordering the hearth. Heavily charcoal stained soil and charcoal pieces surrounded the stones. Fishbone and obsidian also identified.
6	3A, 2A, evident cut into surface of sterile sand layer	Firescoop?	Cut from base of Layer 2 into sterile sand. Western section excavated. Feature measured 51cm diameter, round base. Fill comprised a mid grey sand with minimal charcoal flecking and shell fragments.
7	3A, 3B, resting on surface of sterile sand	Firescoop	Oval shaped firescoop 70 x 50 x 7cm deep. Comprised heavily charcoal stained sand with concentrations of charcoal and ash.
8	Square 2A, 2B cut into sterile sand	Pit	Pit intercutting with pit feature 12. 12cm deep below surface of Layer 3. 135 x 80cm? Fill homogenous with Layer 2.
9	Squares 2A, 2B, cut into sterile sand	Pit	125 x 50cm x 53cm below the surface of the sterile dune sand. Fill homogenous with Layer 2. Fire pit/hangi (Feature 10) cut into northern corner of feature.
10	Square 2B, cut into fill of Feature 9	Firescoop	Intercuts the fill of Feature 9. Thick charcoal deposit at base of pit. Refer profile drawing for further information.
11	2B, cut from base of Layer 2 through to sterile sand	Posthole	Circular posthole 17cm diameter x 32cm deep. Fill comprised a slightly mottled sand consistent with Layer 3 – only slightly darker than the natural.
12	2A, 2B, cut into surface of sterile sand, intercuts with Feature 8	Pit	Pit feature intercutting with pit feature 8. Depth 40cm below surface of the sterile dune sand. Fill homogenous with Layer 2. Large circular stone located at southern end of pit – possibly for a post support.
13	2C, cut into surface of Layer 3	Posthole	Circular posthole 22cm diameter x 38cm deep, same fill as Feature 11.
14	3B, cut into surface of Layer 3	Posthole	Circular posthole with tapered base, 39cm wide x 42cm deep. Fill comprised a brown-yellow sand with minimal inclusions of charcoal flecks and shell fragments.
15	3B, resting on surface of layer 3, adjacent to F5	Firescoop	Rounded firescoop feature, 40 x 50cm. Fill comprised a mottled mid grey sand with charcoal fragments and staining.
16	3A, cut into surface of sterile sand	Pit	60cm wide, continued into baulk on edge of southern boundary. Fill contiguous with that from other pit features.

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EXCAVATION, CONTINUED

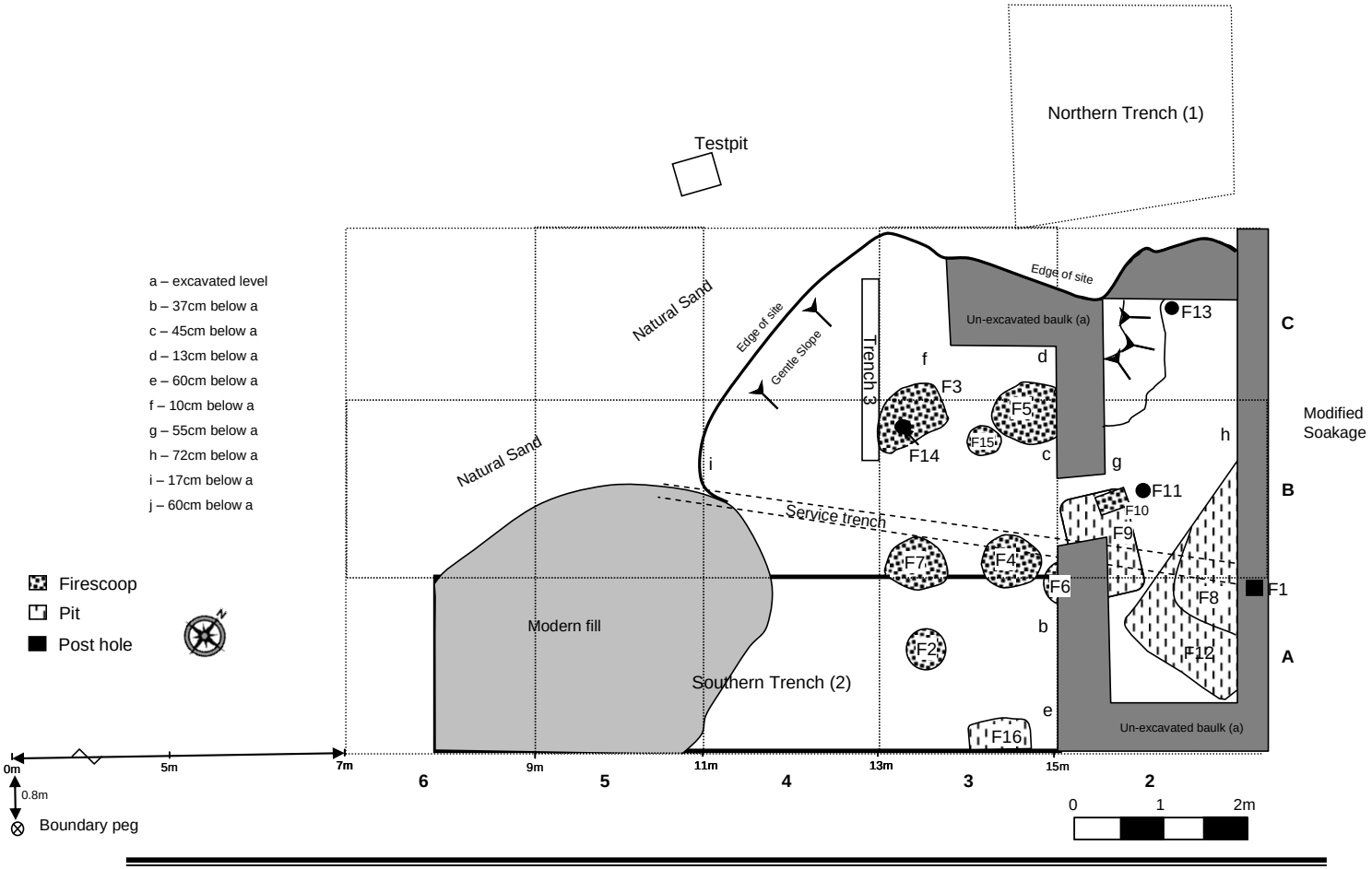

Figure 27. Archaeological site plan

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Figure 28. Excavation of features within Layer 3 - looking south (Feature 5 evident in bottom centre with scales)

Figure 29. Overlooking site towards north-east

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EXCAVATION, CONTINUED

Figure 30. Overlooking site towards south-east

Figure 31. Overlooking site towards south-west

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Firescoops

The remains of five firescoops were uncovered during investigation. The firescoops averaged in size around 50cm x 70cm x c.7-20cm in depth. Features 6 and 7 were found to be largely charcoal-stained sand in oval depressions cut into the sterile natural dune sand. Feature 2 was similar, but was also found to contain fragments of non-diagnostic fishbone and small obsidian flakes. Feature 4 also contained fire-cracked rock that was evident mixed through a charcoal-stained sand with dense charcoal deposits and some crushed shell flecking (Figure 32). All of these firescoops appeared to be contemporary with the pits and posthole features.

Feature 10 comprised a firescoop intercut into the base of Feature 9 (pit). Charcoal from the firescoop had then been mixed through some of the fill of Feature 9 (Figure 33).

All of the firescoops had been surrounded and later covered with the mixed grey sand that formed Layer 2, indicating that they had been exposed until being covered through natural processes.

Figure 32. Feature 4, half sectioned

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Figure 33. Feature 9 (firescoop – outlined in white) evident in the base of Feature 10 (pit)

Hearth (Feature 5)

One hearth (Feature 5) that was excavated was distinguished from the firescoops by the presence of large amounts of burnt stone in a largely circular formation containing thick deposits of charcoal (Figure 34, Figure 35). Feature 5 measured 85cm x 85cm in extent with a circular formation of stones and a capping of stones over the top of the dense charcoal deposit – presumably placed to tamp out a fire.

Three postholes were also located around the hearth, seemingly equidistant from the hearth feature. The postholes possibly represent a small hut of which the hearth was the centre piece.

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Figure 34. Feature 5

Figure 35. Feature 5 in profile

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EXCAVATION, CONTINUED

Storage Pits

The four storage pits were cut directly into the sterile natural sand surface below Layer 2/3 and varied little in size, the smallest being 50cm in width x 125cm in length and the largest being 80cm in width x 135cm in length. The fill of all the pits was the same, comprising a mid-grey/brown sand comparable to that forming Layer 2 with occasional natural shell inclusions and sparse small fragments of charcoal. One piece of either dog or sheep bone (Hudson, pers. comm.) was recovered from the fill of Feature 8. The sides of the pits, although in sand, remained fairly clear cut, indicating that they were quickly filled with relatively clean sand as the site was abandoned.

Figure 36 Looking north over storage pit complex (Features 8, 9, 10, 11, 12 and 13)

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EXCAVATION, CONTINUED

Summary

The excavation of the remnant section of site T11/1030 provided evidence of a short-term settlement. Features comprised storage pits, firescoops, a hearth and postholes. The site was overlain by a wind-blown grey sand deposit with Archaic artefact inclusions that were likely to have come from adjacent Archaic sites. None of the Archaic artefact material was found within intact archaeological contexts. A burial that had been previously removed from the site had been buried into the modern surface and post dated both the short-term settlement features and the deposition of the mixed grey sand layer with Archaic artefact inclusions.

The plan of all the features is shown in Figure 27 and summarised in Table 1. Section drawings for the trenches are shown Figure 37–Figure 40.

The remnant area of intact archaeological remains within the property covered an area of 6m x 4m. The site is bounded to the north, west and east by modified soils but is likely to continue to the south onto the neighbouring property.

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EXCAVATION, CONTINUED

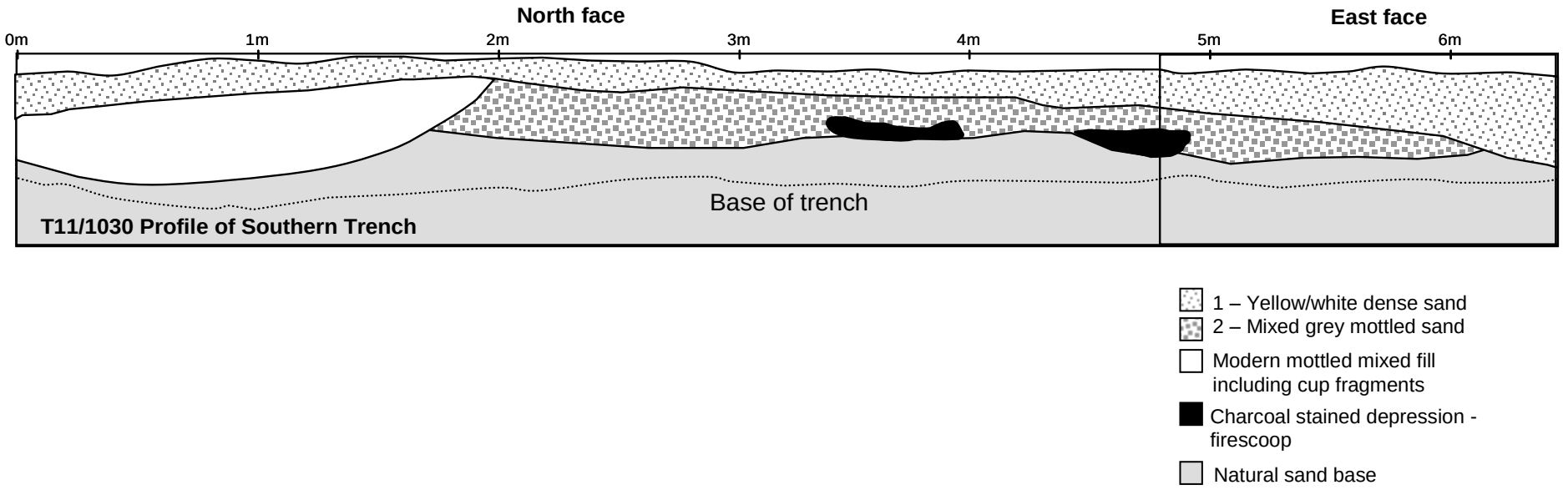

Figure 37. Profile of southern trench

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EXCAVATION, CONTINUED

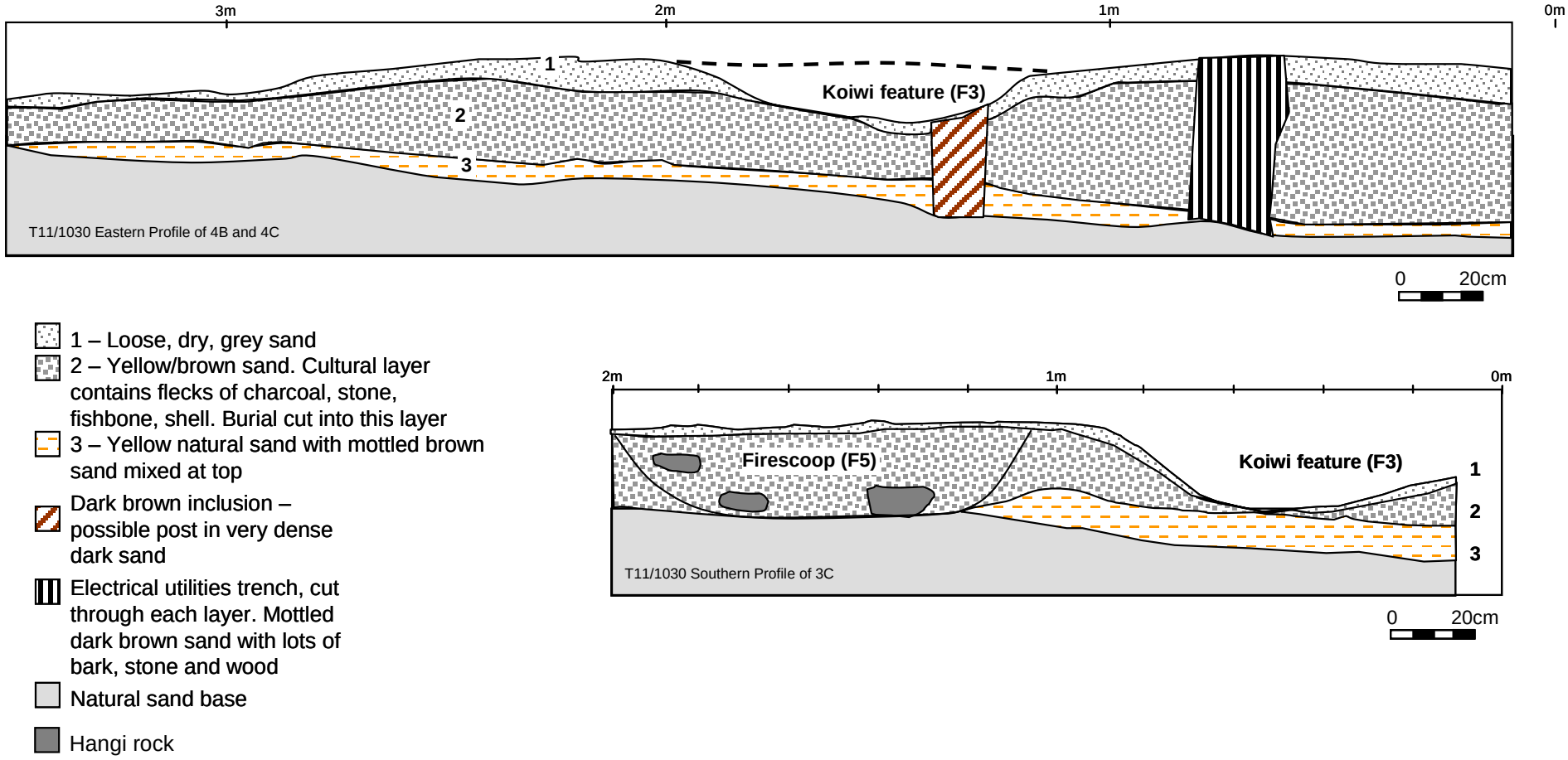

Figure 38. Section drawings for areas 3C, 4B and 4C near koiwi feature

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EXCAVATION, CONTINUED

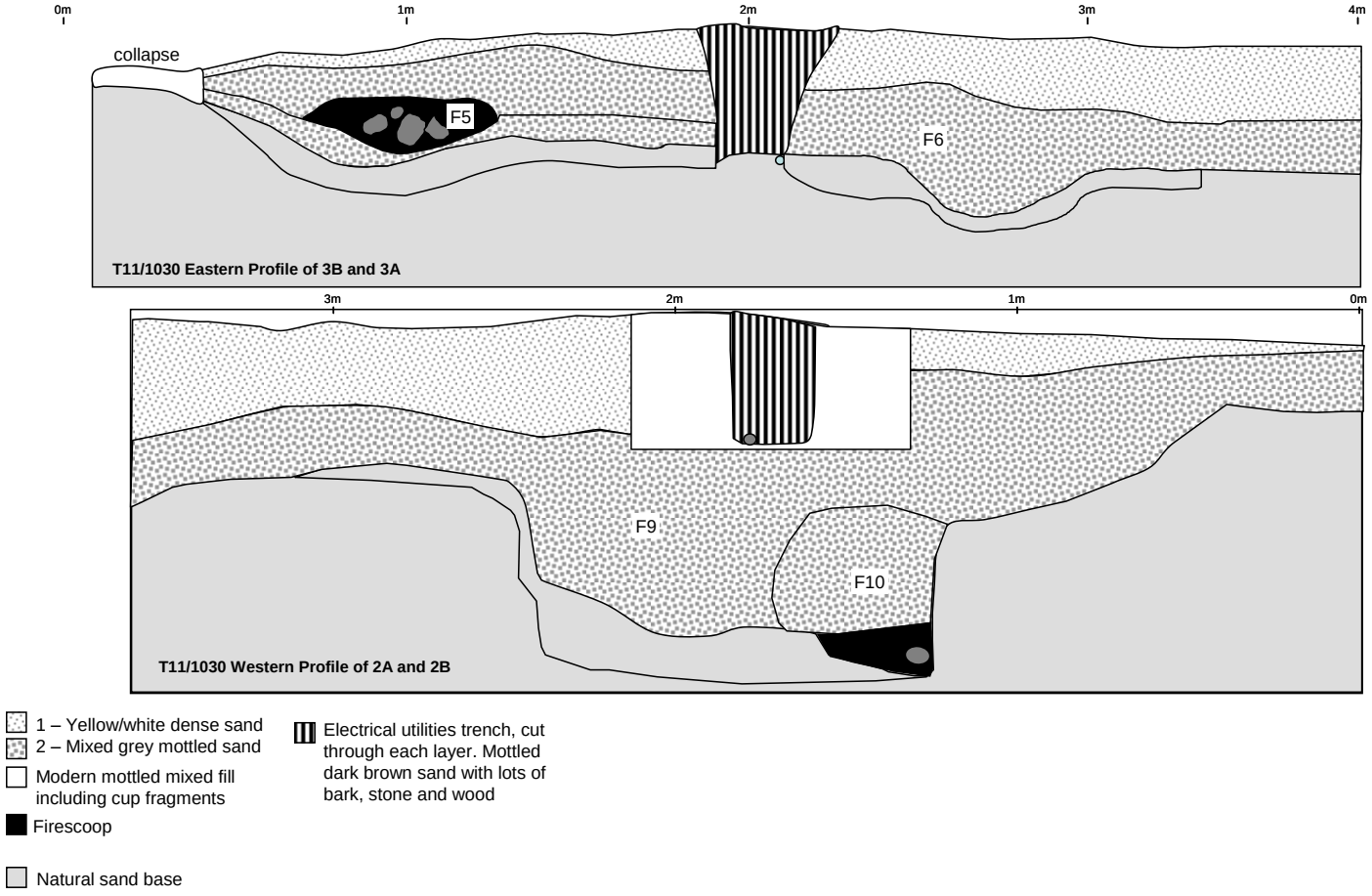

Figure 39. Section drawings for areas 3A, 3B, 2A and 2B showing firescoops

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EXCAVATION, CONTINUED

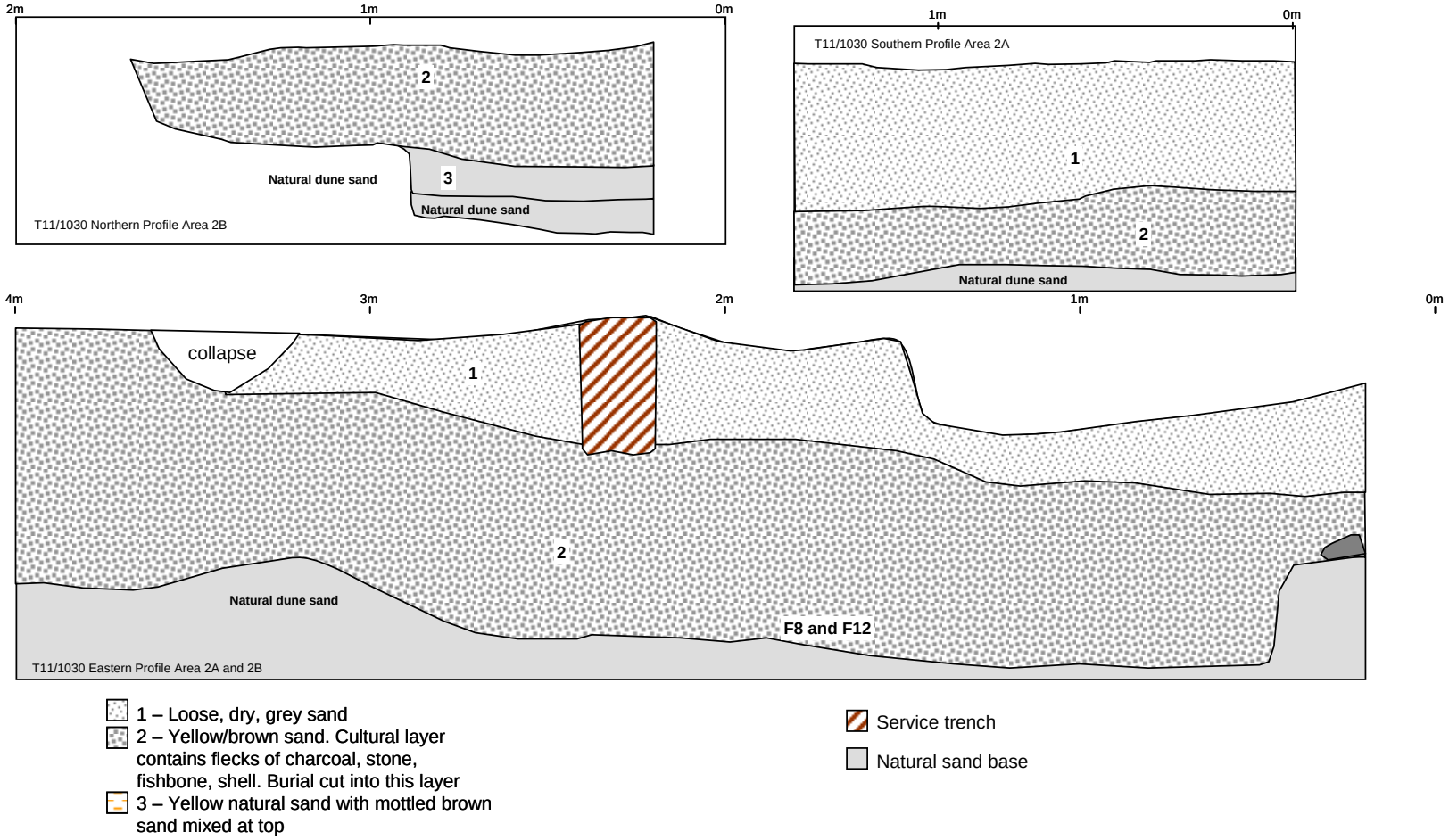

Figure 40. Section drawings for areas 2A and 2B

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Analysis

STONE AND OBSIDIAN ARTEFACTS

By Marianne Turner

Introduction

A total of 1185 stone and obsidian artefacts were recovered from the site. As much of the material was found in a disturbed context, it has been treated as one assemblage for the purpose of analysis. The characteristics of the assemblage itself also suggest that it can be treated as a discrete unit. All the artefacts recovered are consistent with those that make up assemblages drawn from exclusively 'Archaic' or early period sites dating to pre-1500 A.D.

Not surprisingly, Tahanga basalt flakes dominate the assemblage (76.8%), followed by obsidian (17.9%) and chert (4%) flakes. Of the remaining 16 artefacts, there were five adze and pre-form pieces, two hammerstones, three Motutapu greywacke and Nelson/Marlborough argillite adze flakes, and six sandstone artefacts, two of which were files. These artefacts are described and discussed in detail below.

Methodology

Analysis of the adzes, pre-forms, hammerstones and flakes of various lithic materials employed typologies that have been developed by the author from extensive replication experimentation and the analysis of many archaeological assemblages. These typologies are discussed in detail in Turner (1992, 2000, 2004, 2005) and Turner and Bonica (1994).

For the Tahanga basalt flakes a mass analysis technique was developed, partly as a way of dealing with large assemblages, but also because, apart from a few distinctive types of flake, it was the relative frequencies of certain flake types that proved to be informative. This is demonstrated in Table 2–Table 5with reference to the experimental data in particular. Data from other archaeological assemblages and from experiments are provided for comparison, including the assemblage from previous excavations at Hahei (Harsant 1984, 1985). Table 6 provides details on the obsidian artefacts and Table 7 on the chert artefacts. Descriptive data on the other 16 artefacts is provided in Table 8.

It should be noted that flakes 10mm and under for obsidian and chert, and adze flakes 3g or less, are counted but not submitted for further analysis. Experimental evidence has shown that useful information gained from detailed analysis of these very small pieces is negligible, not least because there are sampling issues with regard to archaeological assemblages (Turner 1992, 2005). Ratios of these compared to the larger ones can be valuable, however, especially for the obsidian and chert assemblages (see below).

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Methodology, *continued*

A further observation to make is that the 'Size' typology for Tahanga basalt and other adze flakes is based on weight, while the one for obsidian and chert flakes is based on maximum dimension. The reason for this is that weight is a more meaningful variable for the evaluation of 'size' for adze flakes (and has been shown in previous research to be highly co-related to dimension in any case), but 'maximum dimension' is more valuable for obsidian and chert flakes, not least because dimension determines its potential use regime more than weight does.

Tahanga Basalt

Tahanga basalt flakes N = 910 (383 over 3g)

During the Archaic period, Tahanga basalt was the most heavily exploited and the superior source of adze stone in the North Island. It is thus not surprising that every Archaic site in the general vicinity of the quarry at Tahanga Hill, Opito Bay has abundant evidence of adze manufacture. This is mainly in the form of flakes (e.g. Figure 41**)**, the primary by product of the technology employed. Tahanga basalt adze manufacture was confined to the east coast of the Coromandel Peninsula, from Great Barrier Island to the Tauranga Harbour. Hahei falls within this 'adze production' zone, as do all the other sites listed in Table 2–Table 5 with the exception of Mt Camel (included to provide a contrast in the nature of adze flake assemblages in sites outside production zones).

Previous research has established (see above) the technological strategies that these flake assemblages (together with adze preforms) represent. People within the production zone went to the quarry primarily to find and break up good quality stone, and then to roughly reduce the 'blanks' into the basic adze shape. The process included testing the stone for flaws and removing much excess weight.

The fine shaping and other finishing processes, however, took place back at a home base, despite an increase in the risk of breakage. There were several reasons for this. One was that the fine shaping process, due to the high risk of breakage, was a much slower and a more careful procedure that required considerable concentration. The other was that there was a back-up plan for the broken pieces. By making preforms as large as possible at the quarry, the pieces could be salvaged to make smaller adzes if they broke later at home. Reworking a partially shaped broken piece was much easier than starting a new adze from scratch.

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Tahanga Basalt, *continued*

This practice of reworking explains an oft-noted characteristic of Tahanga basalt artefact assemblages within the production zone (and the same can be said for other adze production zones such as those centred around Motutapu greywacke and Nelson/Marlborough argillite); that while the size of many flakes suggest the manufacture of large adzes, the broken preform pieces found among them are usually small and rough. These small pieces are usually the by-products of reworking failure, the others having been reworked successfully, turned into finished adzes, and then removed from the manufacturing context.

Comparisons with other assemblages

From comparisons of the T11/1030 assemblage with others presented in Table 2–Table 5, it is apparent that the data deviates little, and that the same processes are represented. These include primarily the fine trimming stage of adze manufacture, with some reworking of both unfinished and finished broken adzes.

Among the small number of Tahanga basalt flakes with grinding were two from the blades of adzes. At least one of these flakes suggests that it was created as an outcome of adze use rather than reworking.

Distinctive flakes such as 'truncated' blades (flakes that travel the whole width of the face or side of an adze or preform) and long narrow blades or 'beaks' were present in small numbers indicating that Type 1, Type 2 and Type 4 adzes were being manufactured at the site.

One difference between the T11/1030 and other assemblages noted in Table 2 relates to the higher frequency of use-wear on Tahanga basalt 'waste' flakes. This may relate to differences in methodology in identifying such material and earlier analysed assemblages may have underestimated the amount of usage. Even more than obsidian and chert, Tahanga basalt flakes can be used in certain tasks (on soft materials like wood and fibre, for example) that will leave no visible evidence on the flake. That these waste flakes could be readily converted into a range of useful tools suggests another reason why adze preforms were taken home before the risky flaking stage was completed.

The nature of the use wear and modification on these flakes was similar to other Tahanga basalt assemblages within the production zone, however. The sharp strong edges were useful for sawing and scraping. Such tools were probably used to create the blanks for sandstone files, and for sawing bone. A wide range of pointed tools are also in evidence. These include robust awls and reamers, and smaller drill points (of the kind commonly rendered in chert) for making and/or cleaning/smoothing perforations in wood and bone. Others are fine sharp cutting and incising points.

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STONE AND OBSIDIAN ARTEFACTS, CONTINUED

Table 2. Adjusted breakdown of processes indicated by the Tahanga basalt flake data

Site	N =	% Waste	% reworked	% reworked	% Used
			Preforms	adzes	
T11/1030	**383**	**75**	**14.6**	**10.4**	**50.4**
Tahanga Quarry	4706	100	0	0	0
Opito Bay	575	93.7	6.2	0	0
Cross Creek	1960	77.4	18.5	4	24.2
Whitianga	24597	62.7	33	4.2	25.6
HAHEI (Harsant 1985)	5022	63	25.8	11	4
Hotwater Bch	909	67.3	17	15.6	2.8
Opoutere	1309	48.2	39.1	12.6	36.2
Whitipirorua	3435	58.7	30.4	10.8	10.5
Whangamata	2040	47.7	46	6.1	28.7
Bowentown	4186	39.5	41.8	19.7	18.1
Mt Camel	918	8.4	5.6	83.6	4.3

Table 3. Size for Tahanga basalt flakes

Site or Experiment	N =	Size 1-2	Sze 3	Size 4	Size 5	Size 6
		200g +	101-200g	51-100gm	21-50g	3-20g
Experiments						
Blank Production	1740	9.3	8.9	16.3	25.4	40
Preform roughing out	602	0	4.3	4.1	31.7	59.6
Preform fine trimming	432	0	1.3	2.6	21.7	74.3
Edge straightening	50	0	0	0	7	93
All manufacturing experiments	8825	1.3	4	4.7	24.8	65.1
Preform reworking	798	0.7	2.3	5	12	79.6
Adze reworking	66	0	0	0	0	100
Archaeological Assemblages						
T11/1030 Hahei	**383**	**0**	**0.8**	**4.9**	**14.3**	**80.1**
Tahanga Quarry	4706	9.3	8.9	16.3	25.4	40
Opito Bay	575	0.5	0.6	1.1	20.9	76.8
Cross Creek	1960	0.1	0.8	3.3	12.3	83.4
Whitianga	24597	0.2	0.2	1	17.4	81.1
HAHEI (Harsant 1985**)**	**5022**	**0**	**0**	**0.6**	**8.1**	**91.2**
Hotwater Beach	909	0	0.4	4.7	22.4	72.3
Opoutere	1309	0	1.1	3	14	81.7
Whitipirorua	3435	0	0.3	1.1	17.1	81
Whangamata	2040	0	0.2	0.6	14.6	84.5
Bowentown	4186	0	0.5	1.1	17.4	80.8
Mt Camel	918	0	0.5	2.1	27.6	69.5

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Table 4. Tahanga basalt flakes – dorsal surface characteristics (refer to Turner & Bonica 1994 for typology)

Site/Experiment	N =	CO	CP	CS	ALL	OO	OP	OS
					Cortex			
Experiment								
Blank Production	1740	35.5	15.2	0	50.7	2.1	44.4	2.8
Preform roughing out	602	24.9	33.4	6.3	64.6	0	31.2	3.9
Preform fine trimming	432	6.1	14.7	9.4	30.2	5	39.2	25.4
Edge straightening	50	1	6	3	10	0	21	69
All manufacturing Experiments	8825	18.2	27.3	3.4	48.9	7.7	32.3	10.9
Preform reworking	798	0	2.5	6.2	8.7	0.3	15.9	74.9
Adze reworking	66	0	0	0	0	0	30.2	69.7
Archaeological Assemblages								
T11/1030	**383**	**1.3**	**8.9**	**4.9**	**15.1**	**0.7**	**19.1**	**59.8**
Tahanga Quarry	4706	23	23.3	2.1	48.4	10.2	32.3	9
Opito Bay	575	1.1	5.7	9.2	16	1.1	15.8	67
Cross Creek	1960	1.5	4.7	6.1	12.3	2.2	15.4	69.8
Whitianga	24597	1.4	5.2	5.1	11.7	1	16.3	70.9
HAHEI (Harsant 1985)	5022	1.3	6	7.4	14.7	1.5	13.4	70
Hotwater Beach	909	1.2	5.9	6.1	13.2	1	17	69
Opoutere	1309	3.4	9.8	8.2	21.4	0.3	14.4	63.7
Whitipirorua	3435	2.4	6.2	7.11	15.7	2.2	15.6	66.2
Whangamata	2040	1.1	4.4	8.2	13.7	1.9	11.4	72.8
Bowentown	4186	1.2	5.1	9.8	16.1	0.7	10.3	72.6
Mt Camel	918	0.5	2.4	9.7	12.6	0.7	10.5	76.1

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Table 5. Shape for Tahanga basalt flakes

Site/Experiment	N =	A %	B %	C %	D %	E %	F %	Used
Experiments								
Blank production	1740	15	22.5	38.3	10.2	9.8	4	0
Preform roughing out	602	21.3	31.3	2.1	3.5	16.7	25	0
Preform fine trimming	432	14.6	49.1	2.1	1.5	11	21.6	0
Preform edge straightening	50	13	71	0	0	2	13	0
All manufacturing experiments	8825	17.6	45.5	5.1	3.2	8.6	19.9	0
Preform reworking	798	30.9	30	6.3	5.4	18.1	10.1	0
Adze reworking	66	12	50	0	0	20	18	0
Archaeological Assemblages								
T111/1030	**383**	**20.6**	**27.1**	**10.4**	**19.3**	**7.8**	**14.6**	**50.4**
Tahanga Quarry	4706	13.2	44.6	14.1	4.4	7.8	15.8	0
Opito Bay	575	18	41.3	9.6	9.1	10.9	10	0
Cross Creek	1960	29.1	29.9	4.2	13.5	9.6	13.5	24.2
Whitianga	24597	38.4	24.8	6.7	18.7	6.2	5	25.6
HAHEI (Harsant 1985)	5022	18.5	31.6	8.6	19.4	9.7	11.9	4
Hotwater Beach	909	16.3	46.6	8.2	11.1	10.7	7	2.8
Opoutere	1309	38.3	19.4	4.6	18.5	8.4	10.4	36.2
Whitpirorua	3435	22.7	53.4	0.6	1.2	12.2	9.8	10.5
Whangamata	2040	35	29.8	8.7	11.6	7.5	7.1	28.7
Bowentown	4186	39.5	21.7	7.5	11	9.5	10.5	18.1
Mt Camel	918	21.8	35.2	8.7	10.3	16.6	6.4	4.3

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Obsidian

Obsidian Artefacts N = 214

Table 6 displays the data for the obsidian artefacts. Mayor Island obsidian (green in transmitted light) made up 39.7% of the total, which includes the tiny flake or 'shatter', but was numerically more dominant when the shatter was not included (44%). The slightly more dominant material was grey in transmitted light. The east Coromandel coast has numerous sources of obsidian including a source at Hahei itself. We cannot, however, assume that all the grey is from this local source, as typically grey obsidian found in early Coromandel sites indicates a range of sources, including Great Barrier Island. Assigning grey obsidian artefacts to specific sources, however, can only reliably be done by geo-chemical analysis (XRF).

The presence of Mayor Island obsidian is a common feature in early east Coromandel sites also, despite the presence of closer sources. Experiments have demonstrated that Mayor Island obsidian is stronger, but no less sharp, than other obsidian sources. Added to this is the sheer abundance of the material and its accessibility as banks, large boulders and chunks on a number of beaches around the island. These physical advantages may be outweighed by another possibly more significant factor. It is likely that the people who had direct access to Tahanga basalt and to Mayor Island obsidian were one and the same. Close proximity and direct access to the two most valued sources of stone in the North Island, as well as plentiful supplies of chert and other sources of obsidian, may partially explain why Archaic sites are so common along the eastern seaboard between Great Barrier Island and Tauranga Harbour; this was a wealthy environment. Both products, obsidian cores and Tahanga basalt adzes, were distributed around the North Island in large numbers, some making it to the South Island.

Overall, however, there was little difference in how the different obsidian sources were used. Mayor Island flakes tended to be somewhat larger, and their use histories more extended. That is, they tended to be used for longer periods (as is evident in the build up of use-wear and in modification patterns – see Table 6), for more heavy duty tasks and possibly for a wider range of tasks.

This is not a surprising result given the greater strength of Mayor Island obsidian as noted above. This is possibly also why the frequencies of shatter (less 10mm maximum dimension) are lower for Mayor Island; it is less inclined to shatter when flakes are struck from the core than material from other sources.

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STONE AND OBSIDIAN ARTEFACTS, CONTINUED

Table 6. Obsidian artefacts (refer to Turner & Bonica 1994 for typology)

VARIABLE	ALL (N)	ALL (%)	Mayor Is (N)	Mayor Is (%)	Grey (N)	Grey (%)
SIZE						
1cm or less*	98		34		64	
2cm	57	49.1	21	41.2	36	55.3
3cm	30	25.8	16	31.3	14	21.5
4cm	16	13.8	9	17.6	7	10.7
5cm	10	8.6	4	7.8	6	9.2
6cm	1	0.9	1	1.9	0	0
7cm	2	1.7	0	0	2	3.1
FORM						
Complete flake	60	51.7	24	47.1	36	55.4
Broken flake	40	34.5	20	39.2	20	30.7
Chunk	16	13.8	7	13.7	9	13.8
DORSAL SURFACE						
CO	2	1.7	0	0	2	3.1
CP	15	12.9	1	1.9	14	21.5
CS	7	6	0	0	7	10.7
OO	5	4.3	3	5.7	2	3.1
OP	42	36.2	22	43.1	20	30.7
OS	45	38.8	25	49.1	20	30.7
All cortex	24	20.6	1	1.9	23	35.4
SHAPE						
A	6	5.1	2	3.8	4	6.2
B	32	27.6	9	17.6	23	35.4
C	20	17.3	7	13.7	13	20
D	34	29.3	19	37.2	15	23.1
E	7	6	4	7.8	3	4.6
F	17	14.6	10	19.6	7	10.7
USE EVIDENCE						
Yes	72	62.1	40	78.4	32	49.2
Possible	40	34.5	10	19.6	30	46.1
No	4	3.4	1	1.9	3	4.6
MODIFICATION TYPE						
snap	6	5.1	3	5.7	3	4.6
usewear only	39	33.6	16	31.3	23	35.4
snap + usewear	52	44.8	21	41.1	31	47.7
snap + retouch	7	6	3	5.7	4	6.2
usewear + retouch	8	6.8	7	13.7	1	1.5
none	4	3.4	1	1.9	3	4.6
POSSIBLE FUNCTION						
edge	32	27.6	14	27.4	18	27.7
pointed tools	78	67.2	34	66.6	44	67.7
scraper	1	0.8	1	1.9	0	0

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saw	1	0.8	1	1.9	0	0
none	4	3.4	1	1.9	3	4.6
DEGREE OF USE						
low	60	51.7	20	39.2	40	61.4
moderate	46	39.6	26	52	20	30.7
high	6	5.1	4	7.8	2	3.1
none	4	3.4	1	1.9	3	4.6
TOTAL 1-7cm	**214**		**85**	39.7	**129**	60.2
Total minus S1	**116**	54.2% of 214	**51**	44	**65**	56
***not included in other data sets**						

Obsidian, ***continued***

Use of obsidian

Generally the modification and use wear patterns suggest application in a similar range of activities seen with the Tahanga basalt flakes. Ironically, the activities that obsidian flakes are most suited to, the cutting of soft materials like flax, for example, do not leave any visible damage on the flake unless it is used to cut materials against a hard surface like an anvil. It is possible that this type of activity was the first round of use when the flake was freshly struck from the core and as sharp as a modern day scalpel blade. However, from observations made of obsidian assemblages including the T11/1030 one, flakes appear not to have been discarded when they became blunt but were commonly reused in other tasks. The T11/1030 assemblage shows that a high percentage of the artefacts had visible evidence of use particularly for Mayor Island obsidian (78%) compared to the grey (49%). If we include those artefacts classified as 'possible' (as in possibly used, but the damage could be accidental or due to post-depositional processes), then the difference is more one of extent and degree of use as addressed above.

In Table 6, those tools identified as 'edge' tools have damage consistent with sawing and scraping (experiments have demonstrated that both these actions produce almost identical use wear patterns) involving hard materials like bone or wood. The fact that they had a stronger material for these tasks, Tahanga basalt, might explain why point tools are much more dominant among the obsidian artefacts. Small drilling and reaming tools are present, but very sharp incising and perforating points are far more common. These sharp, often delicate tools are more effective at making the cut across the flax leaf for the extraction of the silky fibre (muka) than are wide sharp edges (Dante Bonica pers. comm.).

Suitably sharp natural projections are common on flakes, but where they were not, or where they have broken off during the first round of use, the simple technique of snapping can quickly create or 're-create' them. Snapping is also a useful 'backing' technique, especially for tools that will be used for sustained periods and with some pressure. Snapping removes the sharp edge that could otherwise cut into the hand holding the tool.

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Obsidian, ***continued***

This practice, also common in other archaeological assemblages examined by the author (both Archaic and Classic), is probably responsible for high frequencies of broken flakes and chunks (49% for the T11/1030 assemblage). In experiments reducing cores, the frequency of flakes that broke during flake strike averaged 11.5% per experiment, and the number of chunky bits that popped from the core was only 2.9%. It is unlikely that post-depositional processes are implicated as usually these flakes are snapped across the thickest part of the flake, yet conversely they often have fine fragile edges that show no such random damage.

Parent material

The data in Table 6 also tells us something about the parent material or blocks the flakes were derived from and whether obsidian artefacts were made as well as used in this context. The shatter (10mm or less) to larger artefact ratio is valuable for a number of reasons. These flakes are generally too small to be used effectively, and this is one of the reasons for their exclusion from any further analysis. Whether in adze manufacture or obsidian/chert tool creation, the flaking technique always generates a certain amount of this type of debris as an accidental by product. In the experiments mentioned above, 66% of all the pieces produced from making flakes from cores were 10m or less, a number being so minute that they would fall through any sieve in the field no matter the mesh size.

Good retention of material in the field notwithstanding, the rather high frequencies of shatter in the T11/1030 assemblage is surprising given its disturbed context. This evidence, coupled with the consistent patterning in the Tahanga basalt flake assemblage, suggests that while the artefacts may have been mixed up and dislodged from their original intact context, they have retained their spatial integrity with little if any loss of material. This evidence certainly suggests that flakes were made, used (for quite a variety of tasks), discarded and probably stockpiled in this general location.

That the flakes were derived from different types of parent material is evident in the dorsal surface characteristics data (Table 6). Cortex was only present on one Mayor Island flake indicating an inter-tidal source, likely from chunks and cobbles that would have rolled from their primary source into the sea. Mayor Island obsidian is present in thick seams that run almost continuously around the island. Obsidian also forms coastal platforms and outcrops around the crater. The most accessible material would have been the big chunks that had eroded out of the seams onto the foreshore below, as they continue to do today. Mayor Island obsidian, therefore, rarely has a cortical rind.

Continued on next page

Obsidian, *continued*

In contrast, mainland Coromandel and Bay of Plenty obsidian sources were more commonly in the form of small cortical cobbles. As a consequence grey obsidian assemblages often have high frequencies of cortical flakes. It is, thus, not surprising that 35% of the grey obsidian in the T11/1030 assemblage had cortex. That said, this is still quite low, and suggests that the people at Hahei had access to larger cobbles than can be found in the vicinity today. XRF analysis could clarify this further.

Cores

No cores were identified in the T11/1030 assemblage. This is not unusual, particularly for Mayor Island obsidian. It is possible that some of the chunks are pieces broken from cores. Cores usually only turn up in archaeological sites when they are exhausted, but they are often then re-used as tools themselves, for example, as light hammers. I suspect that others have, in one simple blow, been smashed up to create a multiple of useful sharp shards and chunks, though this is difficult to prove when the morphological characteristics of the core have been obliterated.

Obsidian Sourcing

Fourteen obsidian samples were submitted to Andrew McAlister at the University of Auckland for XRF analysis. Three distinct source groups were identified within the assemblage submitted. Group 1 was sourced to Mayor Island (6 samples), Group 2 was sourced to the Cooks/Purangi source (2 samples) and Group 3 was sourced locally to Hahei (6 samples) (Appendix 2).

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Chert Artefacts

Chert Artefacts N = 37 (Table 7**)**

Sources of chert, and similar materials like quartzite and chalcedony, are very common along the east Coromandel coast. The variety in terms of quality, colour and parent form is wide. This variety often characterises the chert assemblages from Archaic sites in the area, and T11/1030 is no exception. Flaws and cortical irregularities are characteristic of Coromandel chert sources, however, and can cause problems when trying to create flakes. Though the frequency of cortical flakes was not high at T11/1030 (27%) these flakes dominated among those that showed no signs of being used (29%).

The drill point is the most common 'formal' artefact made from chert. These are strongly associated with one piece fish hook manufacture where they are used to drill out the central hole that will form the inner shank. Indeed, the previous excavation at Hahei demonstrated this association clearly in an area where the deposit was relatively undisturbed (Harsant 1985). Chert makes a suitable material for this task as it is stronger than obsidian but still hard enough to cut into dense materials like bone. Other uses of chert are not so well known.

Drill points were present in the T11/1030 assemblage, with two complete and two broken examples in chert. On the east Coromandel coast, however, Tahanga basalt flakes were also commandeered for reshaping into drill points. In the T11/1030 assemblage more were made from Tahanga basalt (N = 6) than chert.

As a whole, the use of chert artefacts follows similar patterns to Tahanga basalt and obsidian flakes. A variety of pointed tools predominate with reaming and incising tools more common than drill points. Use wear on edge tools suggests scraping and sawing activities.

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Table 7. Chert artefacts (for typology refer to Turner & Bonica 1994)

	N =	%
Total	**47**	
Size 1	10	21.2
Size 2	14	37.8
Size 3	17	45.9
Size 4	5	13.5
Size 5	1 core	2.7
CO	2	5.4
CP	5	13.5
CS	3	8.1
OP	15	40.5
OS	12	32.4
A	4	10.8
B	3	8.1
C	9	24.3
D	14	37.8
E	1	2.7
F	6	16.2
Core	2	5.4
Chunk	7	18.9
Broken flake	15	40.5
Complete flake	13	35.1
awls	5	13.5
drillpoints	4	10.8
other point	13	
edge	4	10.8
no visible use	11	29.7
All Size 2 - 5	37	78.7

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Other Artefacts

Other Artefacts N = 16

Data on these artefacts are shown in Table 8.

Complementing the adze flake data are four reworked preform and adze pieces. What might be considered surprising is that two of these are not Tahanga basalt, but of materials from 'rival' production zones and adze rock sources, Nelson/Marlborough argillite and Motutapu greywacke. The presence of Nelson/Marlborough argillite might be explainable given that its quality is superior to that of Tahanga basalt, but Motutapu greywacke is not.

An extensive study on the distribution patterns of Archaic adzes from these sources (Turner 2000) revealed that it is a common pattern for adzes from a variety of sources to be present in Archaic sites (though the closest source dominates), as is also seen among obsidian assemblages. This has long been interpreted as a measure of the amount of interaction between people and the freedom of movement between areas during the Archaic period. The aforementioned study concurred, but suggested that people were making sojourns from established settlements within areas/regions, not moving between temporary camps in different areas/regions. Trade and exchange transactions may have taken place during the occasion of social gatherings and may not have been purely motivated by economic concerns.

All the reworked pieces were no longer of a size or shape to be viable for reworking, or were the result of a reworking failure. The Motutapu greywacke specimen is notable as a piece that has had a long history of use. Originally it may have been a large Type 4 adze that had been reduced at the time of discard to less than a quarter of its initial size as a result of blade damage and possibly more than one episode of breakage. Yet this stubby piece had been used in this state, as a much smaller version of the original tool. The butt had been hammer dressed flat in order to fit it into a recessed or possibly socketted haft, and it was reused until the blade was damaged again, this time beyond repair.

The Nelson/Marlborough specimen was similar except that it had suffered a further break after a period of use as a reworked adze. Originally it may have been a Type 2 adze, but after breakage one of the broken pieces had been reworked and used as a chisel until it broke again, with this fragment likely to have been discarded because of its small size.

Three flakes from the reworking of Motutapu greywacke (N = 1) and Nelson/Marlborough argillite (N = 2) adzes were also recovered but did not match the reworked adzes. The largest argillite flake was struck from one side of the adze and followed through to the other, indicating that it was from a well-made Type 1 or Type 2 adze, and came from the intersection of butt and body where the hammer dressing pattern suggested a slight tang.

Continued on next page

Table 8. Other lithic artefacts

Context	Artefact Type	Stone	Condition	Weight	Length	Max	Min	Thick	Other
				g	mm	Width	width	mm	
Spoil Heap	Reworked adze	Tahanga basalt	broken	420	45	50	35	41	bevel portion, Type 1 originally, reflaked sides, failed
Surface find	Adze flake	Nelson/Marlborough argillite	complete	5	32				from reworking rectangular Type 2 adze, well ground
Sq 2b, L.2, Sp 2	Chip	Sandstone	broken	8	15				could be from making sandstone artefacts or chip from large grinding stone
Sq 2b, L.2, Sp 2	Chip	Sandstone	broken	9	14				could be from making sandstone artefacts or chip from large grinding stone
Sq 2b, L.2, Sp 1	Reworked adze	Motutapu greywacke	complete	55	54	28	14	26	much modified, chunky chisel, heavy bruising at butt from hafting into socket/recessed foot, exhausted
Sq 2c, L.2, Sp 3	File	Sandstone	complete	19	57	20	4	12	oval, one of these fits the cook's turban fish hook from same context (see below) perfectly - inner shank curve
Sq 2c, L.2, Sp 3	File	Sandstone	complete?	13	59	20	7	8	oval, one of these fits the cook's turban fish hook from same context (see below) perfectly - inner shank curve
Spoil heap	Preform	Tahanga basalt	complete	221	99	57	24	30	flared blade, lenticular, rough flake preform, possibly hand held tool with fortuitous resemblance
Sq 2c, L.2, Sp 2	Grinding stone piece	Sandstone	broken	15	45				1 face smooth from rubbing, square
Sq 4c, L2, Sp 1	Adze flake	Motutapu greywacke	complete	9	18				B type, quite well ground with some hammerdressing, from reworking
Sq 4c, L2, Sp 2	Hammerstone	Grey andesite	complete	202	68	48	25	36	oval, both ends bruised flat, groove started to one end - turning into sinker?, symmetrical, for adze manufacture
Surface find	Hammerstone	Grey andesite	complete	161	62	44	23	40	oval, not much use wear at each end - one more than the other, symmetrical, adze manufacture
Sth trench west end	Adze flake	Nelson/Marlborough argillite	complete	6	14				no grinding, from corner of Type 2 adze probably
Surface-utility trench	Reworked adze	Nelson/Marlborough argillite	broken	7	12				small piece from Type 2 or chisel, from adze reworking, hammerdressing and grinding remnants
Sq 2c, L.2, Sp 1	Reworked preform	Tahanga basalt	broken	29	46	33	27	12	butt piece, reflaked, rectangular, probably from Type 2 adze
Sq 4c,L.2,	File blank?	Sandstone	broken	22	35	20	20	10	butt half, not smoothed, roughed out, plano convex

Continued on next page

Other Artefacts, *continued*

The bevel portion of a Type 1 Tahanga basalt adze had also seen previous modification as a result of bad blade damage. This had reduced the blade width to such an extent that it would have functioned more like a heavy chisel. There is evidence of an attempt to repair further bad damage to the blade. This is a dangerous undertaking with a high risk of transverse fracture, and may have caused the adze to break if it was not already broken. There has then been an attempt to thin down the broken piece by reflaking the sides and the butt area. This has not been very successful, and while it could have been possible to turn this piece into an operational adze again, the amount of work this would entail is formidable.

The Tahanga basalt butt portion from an unfinished Type 2 adze indicates a similar problem with a critical loss of length. The re-flaking process was also a failure and probably led to the discard of the piece.

Another Tahanga basalt artefact is a small complete rough flake preform (Figure 42). I am not convinced that this was ever intended to be an adze. These forms are common in Archaic sites within adze production zones and do look like adze performs, though finished ground specimens are rare. These types of tools were also present in large numbers in a preform and adze assemblage from Pitcairn Island (Turner 2010) and it became apparent from the uniform edge damage present along the blades that these tools were never intended to be adzes, but hand-held pecking and light pounding tools. The same sort of edge damage is present on the Tahanga basalt specimen from T11/1030, and might signify a similar function.

Adze manufacture is also indicated by the recovery of two small oval grey andesite hammer stones. The Coromandel east coast is blessed with suitable water-rolled symmetrical cobbles of the kind needed for adze manufacture (in particular). In experiments such hammers proved ideal for flaking Tahanga basalt adze preforms, but they were too heavy to be used to create obsidian or chert flakes or to make small artefacts like drill points.

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Other Artefacts, *continued*

Six sandstone artefacts were identified in the assemblage. Good quality sandstone was yet another valuable local resource. These artefacts include two finely made and probably complete files (Figure 43), and are also commonly found in association with one piece fish hooks and drill points in Archaic sites. One of their main functions would have been to smooth out the rough marks on the inner shank left by the drill points, as well as creating the notches for line attachment. They are shaped accordingly with a roughly lenticular cross section. Often one side edge is flatter than the other and was probably used for the inner shank while the other sharper edge was used to create the notches. Both the T11/1030 specimens match this description. In support of this, one of the files fitted the inner shank of the one piece fish hook (made from cook's turban shell) exactly (it should be noted that this fish hook was found in the same square and layer as the two files).

Other items of sandstone include a broken piece of a possible file blank, a small piece with one smoothed surface that may have broken from a hoanga (grinding stone) and two small chips that may have been by-products from the manufacture of sandstone artefacts.

Conclusion

The stone artefact assemblage from T11/1030 shares the same set of characteristics as those from other east coast Coromandel Archaic sites, including those from previous excavations at Hahei. Notably this included the same level of involvement in Tahanga basalt adze manufacture, employing the same effective technological strategies where reworking played a pivotal role. The assemblage showed a typically wide range of lithic materials from various sources but largely reflected the wealth and quality of these materials in the local area. People from outside the area probably had a greater need to visit people in the area than the other way around.

The assemblage also indicates that a wide range of activities was being undertaken involving the manufacture and use of items of bone, wood, fibre, stone and shell.

It is likely that this assemblage in its original intact context represented a working floor, a 'workshop' area set aside for the manufacture and use of a variety of tools. These may have been attached to individual domestic residences or may have been part of larger communal area; both types were identified at Shag River Mouth (Anderson & Smith 1996).

Continued on next page

Figure 41. Tahanga basalt flake with ground edge

Figure 42. Tahanga basalt rough flake preform

Figure 43. Sandstone files

OTHER ARTEFACTS

Shell Fish Hooks

One complete and three partial shell fish hooks were recovered from the Layer 2 assemblage (Figure 44–Figure 46). The fish hooks were made from cook's turban (*Cookia sulcata*) shell. All are one piece fish hooks, three of which appear to be plain with no barbs or ornamentation, while one partial fish hook has a small barb evident.

Unbarbed one piece fish hooks were usually formed from moa bone, although hooks of other bone, ivory and shell have also been found on early sites throughout New Zealand (Davidson 1984). These types of hooks are the most 'common items of fishing gear in early northern sites' up until c.1500 AD (Davidson 1984:68). Davidson states that these types of one piece fish hooks have a general resemblance to those of pearl shell from Maupiti, Vaito'otia and the Marquesas (1984:67).

Barbed and decorative fish hooks are thought to have been a minor feature of early Maori fishing gear and became more prevalent later on (Davidson 1984).

Figure 44. Partial one piece shell fish hooks

Continued on next page

OTHER ARTEFACTS, CONTINUED

Figure 45. Partial one piece shell fish hooks – reverse

Figure 46. Complete one piece shell fish hook

Continued on next page

OTHER ARTEFACTS, CONTINUED

Miscellaneous Artefacts

Four pieces of *Dentalium nanum* shell were recovered from the upper lens of Layer 2. The pieces vary in length between 9 and 15mm. As with those recovered from the Whitipirorua excavations (T12/16, Furey 1991), they were all from the straight lower end of the *Dentalium* shell and could well have been used for threading for jewellery and other decoration.

Figure 47. *Dentalium nanum* shell pieces

ENVIRONMENTAL ANALYSIS

Shell Midden

No shell midden was recovered from the site. Naturally occurring shell or shell mixed within the redeposited Layer 2 comprised: tuatua (*Paphies subtriangulata*), pipi (*Paphies australis*), limpet (*Cellana radians*), cook's turban (*Cookia sulcata*), and cockle (*Austrovenus stutchburyi*). All of these shell species are locally available at Hahei.

Faunal and Fishbone Analysis

Faunal bone recovered from the site was located within Layer 2 and therefore had no intact provenance. A dog mandible, vertebrae and other fragmented bones – some possibly sheep – were found across the site within the upper levels of Layer 2. Some of the bones appeared to have been butchered (Hudson pers. comm. 2012). No faunal bones were found within intact archaeological contexts.

Fish bone was recovered from both Layer 2 bulk sampling and from Features 2 and 5 within Layer 3. Fishbone recovered from Layer 2 was generally highly fragmented, with the only jaw bones/teeth recovered being Snapper (*Pagrus auratus*). Fish bone recovered from Features 2 and 5 was also highly fragmented, although vertebrae survived intact. No diagnostic pieces were identified.

Microfossil Analysis

Two soil samples from the base of pit Features 8 and 9 were submitted to Dr Mark Horrocks for microfossil analysis. Both samples were found to contain large amounts of microscopic charcoal fragments and spores of fern including bracken. The spores and charcoal, together with low proportions of tree pollen, were indicative of major forest disturbance/clearance. The abundance of bracken spores is 'almost always associated with large-scale repeated burning of forest by early Maori' (Appendix 3).

Pollen of puha was also found to be present within the samples – puha was a food source for early Maori and also indicated vegetation disturbance. Small amounts of kauri type pollen were also identified in one of the samples indicating that kauri was part of the remnant forest at this time (ibid.).

Phytolith samples from both features were found to be dominated by spherical verrucose phytoliths common in the leaves and wood of rewarewa trees. The presence of grass phytoliths also supported the pollen evidence of forest clearance. Nikau palm phytoliths were also present, indicating its local presence (ibid.).

Starch grains from kumara were also identified in both samples, providing evidence of kumara storage on the site (ibid.).

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ENVIRONMENTAL ANALYSIS, CONTINUED

Charcoal and Wood Analysis

Charcoal samples were obtained from Features 4, 5 and 10 and were submitted to Dr Rod Wallace at the University of Auckland for identification. The possible post located adjacent to the burial feature was also fully extracted from the site, wrapped in plastic cling film and submitted to Dr Wallace for analysis and identification.

The results of the charcoal samples from the three separate hearth/firescoop features showed a dominance of small coastal shrub species in Features 4 and 5 including Hebe, *Pittosporum*, Ngaio, *Olearia*, Tutu and *Coprosma*. The sample obtained from Feature 10 was dominated by coastal tree and forest conifer species (Mahoe, Pohutukawa, Puriri, Totara, Matai) with some coastal shrub species present (*Coprosma*, *Pittosporum*) (see Appendix 4).

The possible post that was submitted for examination showed no woody material present. Examination of the sample under magnification showed that it 'consisted of sand that appeared to be lightly cemented together by a translucent dark golden brown material' (ibid.). Wallace flooded the sample with acetone and filtered it. The extracted material was reported to have 'a light golden colour identical to kauri gum'.

As a result of this Wallace has determined that the possible post may have been a 'very resinous piece of kauri now totally decayed away that had left only the resin behind which cemented the sand together' (ibid.). Highly resinous kauri wood is found in both the branches and roots of the kauri tree, indicating that the feature was either the remains of a post made from branch wood or an ancient kauri tree root (ibid.).

RADIOCARBON DATING

Radiocarbon Dates

Two radiocarbon dates were obtained from suitable samples from two hearth features, F4 and F5. The dates were obtained from charcoal taken from concentrated deposits towards the base of the features. These features are well associated with other features excavated within Layer 3, including large storage pits excavated nearby. The dates pre-date the burial recovered from Layer 2. The results are shown in Figure 48 (and Appendix 5) and appear to be effectively indistinguishable from each other. Combining the dates does little to refine the date of occupation of the site, with a median date of around 1560 AD indicative of a short-lived 16th century occupation (Figure 49).

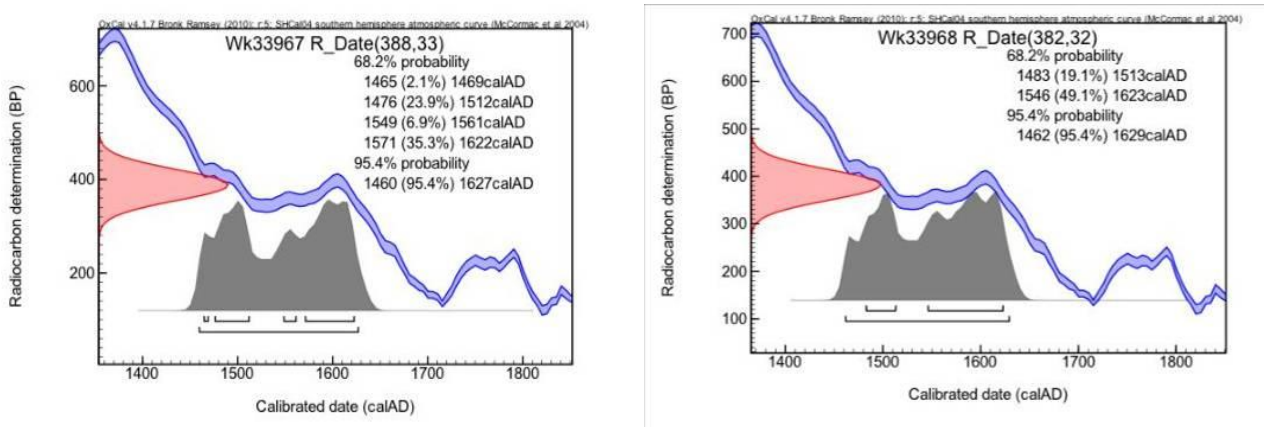

Figure 48. Radiocarbon dates from site

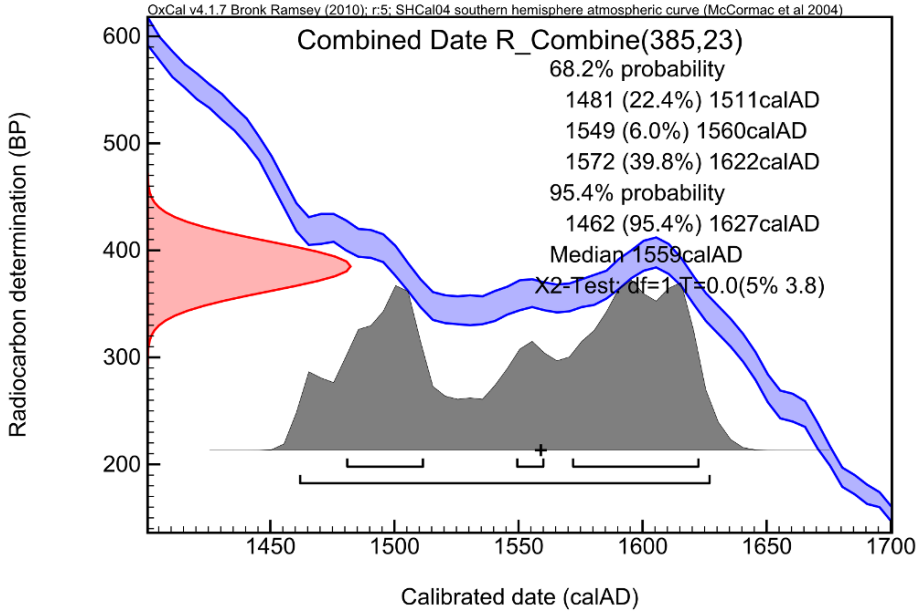

Figure 49. Combined radiocarbon date

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RADIOCARBON DATING, CONTINUED

Comparison of Dates with Other Nearby Sites

The NZ Radiocarbon Database contains a number of dates from nearby excavations. Many of these were obtained prior to modern protocols regarding the identification of charcoal samples and modern calibration techniques. The dates therefore need to be regarded with some caution. In this situation the shell dates from sites to the west – T11/242 (NZ6642, NZ6646) and T11/514 (NZ5422) – are probably relatively reliable and date to the earlier half of the 15th century, perhaps around 50 years to 100 years earlier than the samples from T11/1030 (Figure 50).

Figure 50 also shows a cluster of dates from the nearby T11/326 site to the south of T10/1030. The dates here were all from unidentified charcoal and cannot therefore be considered reliable (Table 9). Recalibration did suggest that this site dated to the 14th to early 15th century (with one date apparently modern charcoal), but the association with pits there may suggest that these dates carry some inbuilt age.

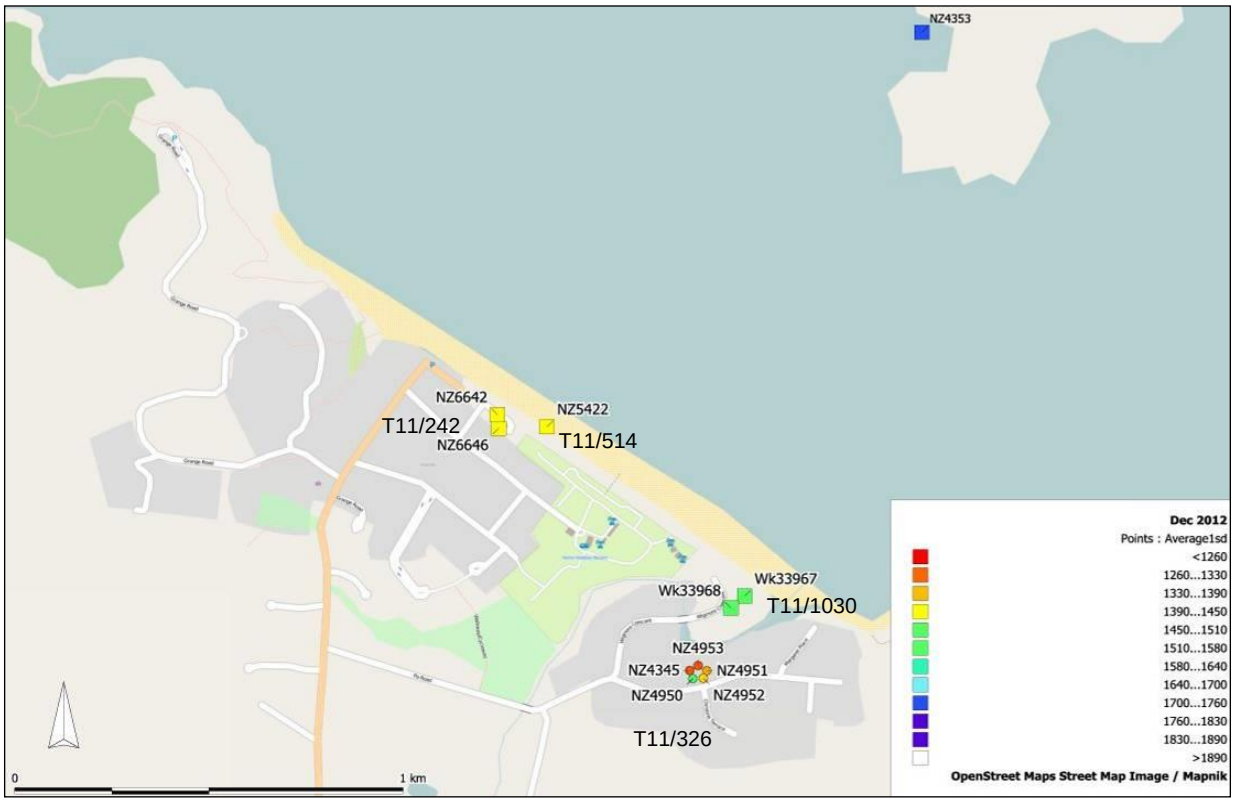

Figure 50. Dates from nearby sites (shaded by average date)

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Table 9. Unidentified charcoal dates (years AD) from T113/326

Samples	CRA	Error	-1σ	1σ	-2σ	2σ	median
NZ4344	-100	52	N/A				
NZ4345	743	46	1273	1381	1227	1390	1303
NZ4950	300	45	1510	1791	1496	1799	1623
NZ4951	556	61	1330	1451	1301	1484	1415
NZ4952	548	59	1395	1451	1308	1494	1420
NZ4953	700	59	1286	1390	1235	1409	1337

Regional Perspective

A broader comparison, using more reliable shell dates from the T11 Mapsheet (see Appendix 6 and Figure 51), demonstrates how the dates from T11/1030 fit into a regional sequence that ranges from the mid 14th century to the modern era. The pits excavated at T10/1030 date to the 16th century during a time when there was a shift in focus from coastal food processing and occupation sites to settlements more focussed around agriculture and food storage. The majority of dates recovered so far from the area come from midden sites typical of the coastal resource extraction focus throughout prehistory.

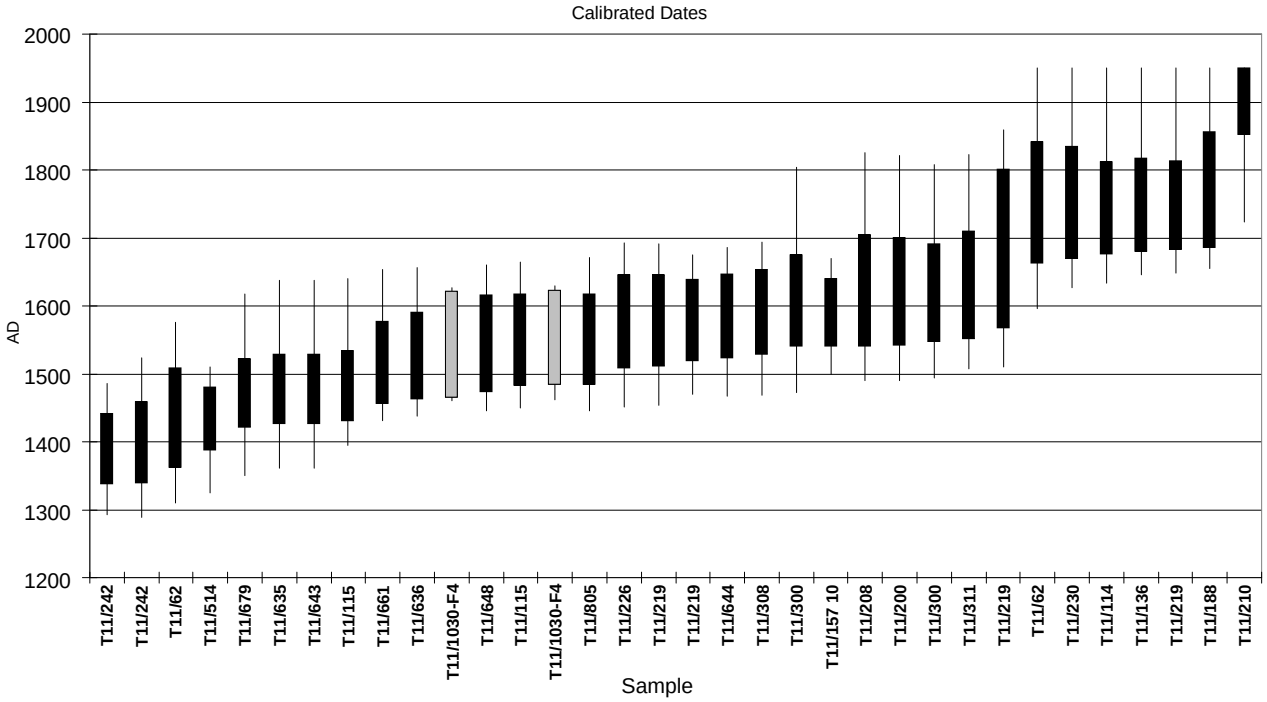

Figure 51. Radiocarbon dates from T11/1030 (grey) and other T11 sites (NZ Radiocarbon database)

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KOIWI ANALYSIS

The Burial

Analysis of the post-cranial human remains recovered from the site prior to excavation was undertaken by Beatrice Hudson. The cranium that was discovered at the dump site had been sent by police to forensic odontologist, Dr Khouri, for examination. Hudson reported that '[j]udging by the number and kinds of bones present, it appears that this had originally been a complete, primary burial that had been placed in a grave' (Appendix 7:3).

The bones recovered were all found to belong to a single individual. The skeleton was found to be near complete with only bones from the right shoulder and right hip missing. Hudson states that this indicates the body had lain on its left side in the grave, with the right side being closest to the surface and subject to disturbance (ibid.:5).

Hudson determined that the skeletal remains were that of a pre-European Maori, based on the appearance and location of the bones and the burial position; the burial appears to have been placed in a very small confined grave in a crouched position – typical of prehistoric Maori burials (ibid.:7). In addition, the cranium was found to be angular and pentagonal as opposed to the rounded shape typical in Europeans. Squatting facets were also noted on the tibia and clear blood vessel impressions were noted in the frontal bone and shafts of the tibiae (Appendix 7).

Due to the lack of part of the pelvis, the sex of the individual was determined through examination of the sciatic notch and the base of the ischiopubic ramus as well as the diameter of the femoral head. The examination indicated that the individual is likely to have been a female – which concurred with Dr Khouri's estimation from the cranial analysis.

The age of the individual was estimated through analysis of fused bones, pelvis and teeth. The fused bones, pelvic joint and extremely worn teeth indicated that this was a mid-aged adult probably in her mid 30s to mid 40s. The woman was also found to be relatively tall, at between 167 and 171cm in height, with slender, gracile bones (ibid.).

The woman had some bone degeneration in her neck and lower spine that may indicate that she underwent particular strain in this area and may have engaged in some activity that 'demanded more weight-bearing or repetitive motion of her left upper body' (ibid.:10). There was also evidence of the early stages of arthritis.

There was also evidence of a mild injury to the right ankle – possible a bad sprain or tearing of joint tissue. The bones of the tip of one finger were also deformed, which may have been the result of a specific injury.

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KOIWI ANALYSIS, CONTINUED

The Burial, ***continued***

The teeth showed severe wear with most of the enamel of the incisors ground away – probably due to the coarse diet, which would have included sandy shellfish, and the use of the front teeth as tools.

Her skeleton showed no indication of how she died.

Discussion and Conclusion

INVESTIGATION RESULTS

Discussion

Investigation of site T11/1030 provided evidence of at least three separate periods of activity. The earliest features that were cut into the natural sand dune layer comprised storage pits, a hearth, firescoops and postholes; however, some of these features had been cut into by others. The site is likely to be a remnant of what may have been a much larger settlement across the Hahei dune systems during the mid-16th century.

The mixed grey sand with Archaic artefact inclusions (Layer 2) post-dating these features appears to have been deposited over the site as a result of natural dune movement – primarily through strong winds. Deposition of artefacts may also be a result of human movement over the site. The artefacts recovered were comparable to those recovered from adjacent site T11/326.

The burial post-dates both the 16th century occupation site and the Layer 2 deposition process, but is likely to pre-date European settlement of the area. It is possible that the remnant of the post excavated near the koiwi was the remains of some sort of grave marker (perhaps even a cross, which would suggest a 19th century date), but the high degree of decomposition prevented any dating of the sample or identification of any diagnostic characteristics that would clarify its origin or purpose.

Environmental analysis undertaken on samples obtained from secure contexts within Layer 3 showed that the landscape at this time was dominated by small coastal shrub species with some coastal tree and forest conifer species still remaining. The abundance of bracken spores confirmed that the area had likely been previously subject to large-scale repeated burning of the forest by Maori (Horrocks, Appendix 3). Analysis of starch grains from the storage pits also provided evidence of kumara cultivation and storage.

The pit/firescoop features recorded at T11/1030 are comparable to those excavated by Harsant in 1979 at T11/326. Artefactual material recovered was also clearly similar from sites T11/1030 and T11/326. As with T11/326, no concentrated midden deposits were located associated with subsurface features, although small amounts of shell were found scattered through the excavation area. Although Harsant's dates from T11/326 generally pre-date those from T11/1030 by up to 200 years, those dates may be unreliable due to the presence of long-lived tree species within the charcoal.

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Conclusions

The research strategy proposed for the project had been to focus on the recovery of samples suitable for dating from secure archaeological contexts relating to the early ('Archaic') occupation of Hahei. Recent research in Polynesia has highlighted the importance of obtaining archaeological dates from secure deposits to determine the timing of the settlements of the major Polynesian Island groups (see e.g., Wilmshurst et al. 2010; Mulrooney et al. 2011; Walter et al. 2010 for recent discussion on this topic) and the initial recovery of artefacts from the site by Hoffman (2011) and the close proximity of T11/326 were promising.

However, the dates recovered from the 2012 excavations showed that the firescoops and their associated storage pits most probably dated to the mid-16th century and well into the commonly described 'Classic' period of pre-European Maori history and are an example of a developing agricultural shift in the Coromandel during the 16th century. Thus, despite the presence of earlier (Archaic) artefacts on the site, these were not in a secure context, and the excavation results could not confirm the reliability of the dates obtained from site T11/326 by Harsant (1985) and Edson and Brown (1976; Edson 1980).

The results presented here represent a small but valuable contribution to the archaeology of the Coromandel. T11/1030 appears to have been a short-term settlement with small storage areas located near to the hearth and fire places. Unfortunately, the area surrounding the excavated features has been mostly modified by modern housing development, although a few features extend to the south onto the neighbouring property and may still provide additional information.

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Acknowledgements

We would like to thank the following for their assistance during the project:

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- Our hard working crew, Brigid Gallagher, Jessica Hendy, Anna Judge
- The on site building and earthmoving crew
- Mark Horrocks for the microfossil analysis
- Beatrice Hudson for the koiwi analysis
- Rod Wallace for the charcoal analysis
- Andrew McAlister for the obsidian XRF analysis
- Rod Clough and Sarah Macready

Appendices

APPENDIX 1: SITE RECORD FORM

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

ARCHSITE archaeological site recording scheme

Site Record Form

NZAA SITE NUMBER: T11/1030

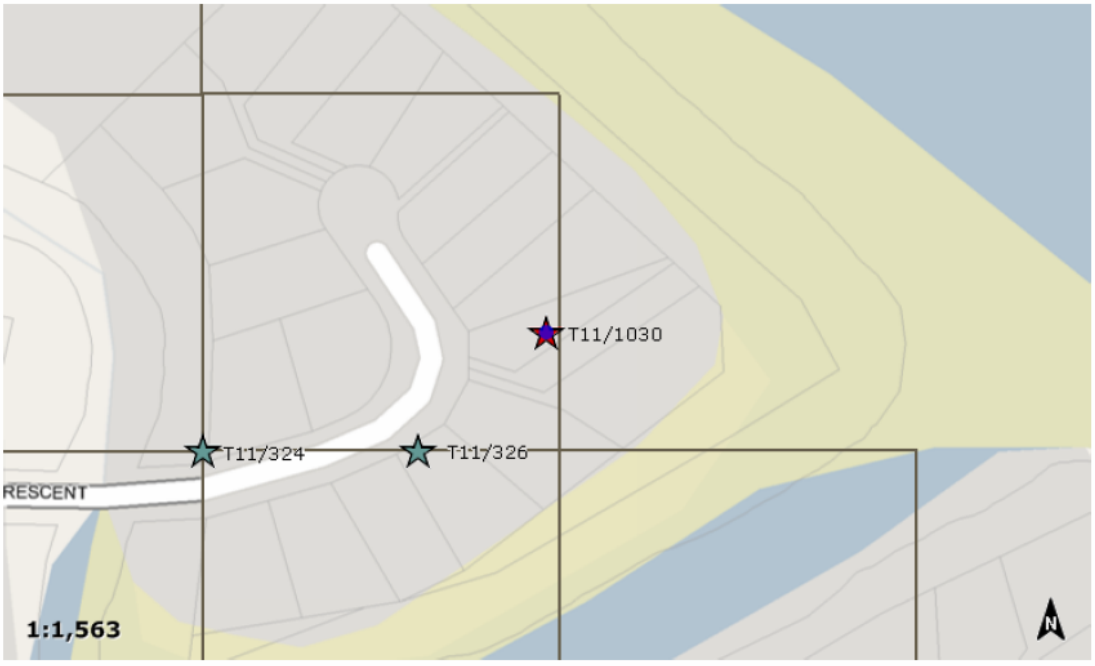
SITE TYPE: Burial/ cemetery

SITE NAME(s):

DATE RECORDED: 03/12/2011

SITE COORDINATES (NZTM) Easting: 1850778 **Northing:** 5918930 **Source:** Handheld GPS

IMPERIAL SITE NUMBER: **METRIC SITE NUMBER:**



Finding aids to the location of the site

25 Wigmore Cres, Hahei.

Brief description

The site comprises a burial disturbed during recent redevelopment at 25 Wigmore Cres [Lot 2 and Lot 25 combined], found in a discrete preserved remnant of an early Polynesian period archaeological deposit estimated at c.50 m2.

Recorded features

Artefact - adze, Artefact - chert, Artefact - fishing gear, Artefact - obsidian, Artefact - stone flakes, Fireplace/ hearth, Occupation layer, Pit - rectangular, Post hole, Skeletal remains - human, Working area/ flaking floor

Other sites associated with this site

T11/326

Continued on next page

APPENDIX 1: SITE RECORD FORM, CONTINUED

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

Site description

Updated: 03/12/2011, Visited: 30/11/2011 - NZTM E1850778 / N5918930 (Handheld GPS).

The burial occurred within an area of a dark grey stained sand of a roughly, c. 7 x 3 m, exposed on the ground surface. Numerous artefacts of obsidian, tahanga basalt flakes, a single part of a hogs-back adze, occasional shell and bone (including dog and bird), was found during the inspection for NZHPT site damage assessment. The surface exposed area was not excavated to any depth. The burial had been virtually completely removed by the time of our visit. The bones were examined by B. Hudson and will be reported later.

The remainder of the deposit is buried by between 400 and 900 mm of sterile y-b sand, and comprises a layer of dark grey to very dark grey stained sand between 300 – 600 mm thick. The deposit was identified in three test pits and was estimated to extend through an area of c.30 m2. The buried deposit seems to be related to the original slope of the dune, or may be an in filled swale? Each test pit yielded numerous artefacts, including a part of a moa? bone blank for fish hook, basalt and obsidian. Also shellfish was present but not part of an intact midden layer in any place. The species included limpet and cooks turban, tutatua. The test pits showed a c. 50 -100 mm thick layer of mottled sand at the base above sterile y-b sand and suggests some evidence of activity at the lowest depth may be found.

Refer also to attached plans ('A4EXISTING SITE PLAN-arch overlay', 'FIGURE - SITE VIEW').

Inspected by: Hoffmann, Andrew; Hudson, Beatrice.
Updated: 06/03/2012 - Updated: 6/3/2012,
Site was investigated by Clough & Associates from 7th-10th February 2012 under NZHPT Authority #2012/515

Condition of the site

Updated: 03/12/2011, Visited: 30/11/2011 - A total of 12 test pits were dug across the property, each down to between 1 – 1.5m depth to check for further buried layers. The other tests all indicated extensive modern disturbance outside the area above described. The site is subject to an application to the Trust to damage modify and is likely to be subject to mitigation excavation in the near future.

Updated: 06/03/2012 - Updated: 6/3/2012,
The excavation of site T11/1030 revealed a remnant section of a possibly early Maori settlement site. The features were evident along the southern boundary of the property and covered an area of approximately 6 x 5m. The land to the north, east and west of the site has been substantially modified and testing of these areas produced no evidence of the site continuing in these directions within the property. The site however likely extends over the southern boundary into the property at 27 Wigmore Road.
The site comprised a mixed mid-dark grey sandy layer containing numerous stone artefacts, fishbone, charcoal and some shell. This layer (layer 2) overlay an intact occupation layer with a large fireplace, additional firescoops nearby and four pits dug into the old dune surface. Few artefacts were recovered that were identified as being associated with the earliest layer (layer 3) although the upper dune (layer 2) contained a significant about of fishbone, charcoal, stone and obsidian flakes and some shell.
The koiwi that was originally exposed on site and removed in late 2011 was found to have been cut into the top of Layer 2 and therefore post-dates the occupation layer evidenced by the pits, postholes and fire scoops (layer 3).

Environmental analysis including: charcoal samples (from fire scoops and hearth) and soil samples (from storage pits) are being sent to Dr Rod Wallace and Dr Mark Horrocks respectively for further analysis.
Charcoal samples will also be analysed for appropriateness for proposed radiocarbon dating of the site. Suitable carbon samples will be submitted to the Waikato Radiocarbon Dating Laboratory for dating.
The extensive artefact assemblage recovered from the site is currently being analysed by Dr Marianne Turner. Fishbone analysis will also be undertaken by the appropriate specialist. The results of all analyses will be presented in the final report.

Statement of condition

Updated: 07/02/2012, Visited: 30/11/2011 - Good – Majority of visible features are intact, but some minor loss of definition and/or damage

Current land use:

Updated: 03/12/2011, Visited: 30/11/2011 - Rural residential

Threats:

Updated: 03/12/2011, Visited: 30/11/2011 - Property development

Continued on next page

APPENDIX 1: SITE RECORD FORM, CONTINUED

Continued on next page

APPENDIX 1: SITE RECORD FORM, CONTINUED

NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION **ADDITIONAL INFORMATION FORM** **Metric map number sheet: T11** **Metric map name:** **NZMS 260 map:**	**NZAA METRIC SITE NUMBER : T11/1030** **DATE VISITED: February 2012** **SITE TYPE: Pits/postholes/firescoops/hearth/ stone working/burial** **CODE:** **SITE NAME:** **OTHER**
Grid Reference **Easting** 1850778 **Northing** 5918930	
Aids to relocation of site (attach sketch map). 25 Wigmore Crescent, Hahei, Coromandel Peninsula	
2. State of site and possible future damage. Excavated under NZHPT Authority 2012/515. A small section of the site may remain intact along the southern boundary fence of the property. The site also likely extends into the property immediately to the south.	
3. Description of site (Supply full details: history, local environment, references, sketches, etc. If extra sheets are attached, include a summary here) Clough & Associates with assistance from Ngati Hei representatives undertook the excavation of early Maori settlement site T11/1030 at Hahei, Coromandel Peninsula from 7th – 10th February 2012 under NZHPT Authority 2012/515. The site was found to be a remnant section of what was potentially a larger settlement site that may have extended over much of the dune system. The site likely forms part of the same complex of which part was investigated by Edson & Brown (1976) and Harsant (1984) – T11/326. The excavation of site T11/1030 revealed a remnant section of a possibly early Maori settlement site. The features were evident along the southern boundary of the property and covered an area of approximately 6 x 5m. The land to the north, east and west of the site has been substantially modified and testing of these areas produced no evidence of the site continuing in these directions within the property. The site however likely extends over the southern boundary into the property at 27 Wigmore Road. The site comprised a mixed mid-dark grey sandy layer containing numerous stone artefacts, fishbone, charcoal and some shell. This layer (layer 2) overlay an intact occupation layer with a large fireplace, additional firescoops nearby and four pits dug into the old dune surface. Few artefacts were recovered that were identified as being associated with the earliest layer (layer 3) although the upper dune (layer 2) contained a significant about of fishbone, charcoal, stone and obsidian flakes and some shell. The koiwi that was originally exposed on site and removed in late 2011 was found to have been cut into the top of Layer 2 and therefore post-dates the occupation layer evidenced by the pits, postholes and fire scoops (layer 3). Environmental analysis including: charcoal samples (from fire scoops and hearth) and soil samples (from storage pits) are being sent to Dr Rod Wallace and Dr Mark Horrocks respectively for further analysis. Charcoal samples will also be analysed for appropriateness for proposed radiocarbon dating of the site. Suitable carbon samples will be submitted to the Waikato Radiocarbon Dating Laboratory for dating. The extensive artefact assemblage recovered from the site is currently being analysed by Dr Marianne Turner. Fishbone analysis will also be undertaken by the appropriate specialist. The results of all analyses will be presented in the final report.	
4. Owner : **Address:** 25 Wigmore Crescent, Hahei	**Tenant/manager.**
5. Nature of information (hearsay, brief or extended visit) - Site investigation **Photographs (reference numbers and where held) photos taken Refer final report** (Clough & Associates 2012 pending) **Aerial photographs (reference numbers and clarity of site)**	

APPENDIX 2: OBSIDIAN XRF ANALYSIS

By Andrew McAlister, Department of Anthropology, University of Auckland

Analyses were run using an Innov-X Delta series pXRF analyzer. All samples were run whole for 300 seconds livetime.

The geochemical data indicate that there are three distinct groups. Group1 is clearly associated with Mayor Island and Group 2 clusters closely with the Cooks/Purangi source (Figure 1). The third group clusters with four possible sources- Central N.I. (e.g., Taupo), Maketu, Rotorua and Hahei. A plot of Zr against Rb separates these sources better and indicates that the Group 3 samples are closest to the Hahei source (Figure 2).

Sample Number	Analysis #	Group	Probable Source	K_2O %	CaO %	TiO_2 %	Cr ppm	MnO %	Fe_2O_3 %	Ni ppm	Cu ppm	Zn ppm	Ga ppm	Pb ppm	Th ppm	Rb ppm	Sr ppm	Y ppm	Zr ppm	Nb ppm
LoQ[1]				0.01	0.01	0.01	60	0.01	0.10	25	25	5	10	1	1	1	1	1	1	1
SQ4C L2 22	#1	3	Hahei	4.18	1.23	0.12		0.05	1.23			46	10	22	17	139	94	33	118	7
SQ2C L2 spit2	#2	1	Mayor Island	4.33	0.53	0.24	95	0.07	3.36			209	38	32	22	141	5	120	1118	92
SQ2C L2 spit3	#3	1	Mayor Island	3.72	0.37	0.22	101	0.06	3.03	26	25	203	37	34	18	133	5	120	1094	93
SQ2C L2 spit3	#4	1	Mayor Island	3.72	0.39	0.26	100	0.09	4.01			254	41	41	23	147	6	138	1299	113
SQ2C L2 spit3	#5a[2]	3	Hahei	4.65	1.37	0.11		0.05	1.25	37		48	10	22	18	139	94	32	122	9
SQ2C L2 spit3	#5b[2]	3	Hahei	4.63	1.40	0.11		0.05	1.25	38		49	11	22	19	140	96	33	124	8
SQ2C L2 spit3	#6	2	Cooks/Purangi	3.75	0.95	0.12		0.05	1.02	27		40		13	16	124	72	32	114	8
SQ2C L2 spit3	#7	3	Hahei	4.11	1.12	0.10		0.05	1.20			46		23	17	136	92	33	118	7
SQ2C L2 spit3	#8	2	Cooks/Purangi	3.66	1.01	0.12		0.05	1.13			47	10	15	17	135	73	33	117	11
SQ2C L2 spit3	#9	3	Hahei	3.62	0.96	0.10		0.05	1.18			48	11	24	16	140	95	32	118	8
Spoil heap?	#10	2	Cooks/Purangi	3.56	0.84	0.12		0.04	1.01			40		11	16	123	70	30	109	9
Spoil heap?	#11	1	Mayor Island	4.57	0.59	0.42	109	0.10	4.38	31	25	252	43	36	25	151	6	147	1362	116
Spoil heap?	#12	3	Hahei	4.35	1.19	0.14		0.05	1.27	40		49	12	23	16	141	96	33	124	9
Spoil heap?	#13	1	Mayor Island	3.73	0.21	0.24	113	0.07	3.43			252	47	44	22	156	5	135	1221	105
Spoil heap?	#14	1	Mayor Island	3.47	0.20	0.28	141	0.11	4.66		27	355	66	65	25	179	5	168	1518	137

1) LoQ = Limit of Quantitation (i.e., the accurate range of instrument). Blank values are below LoQ.

2) Same sample analyzed twice to check for consistency.

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APPENDIX 2: OBSIDIAN XRF ANALYSIS, CONTINUED

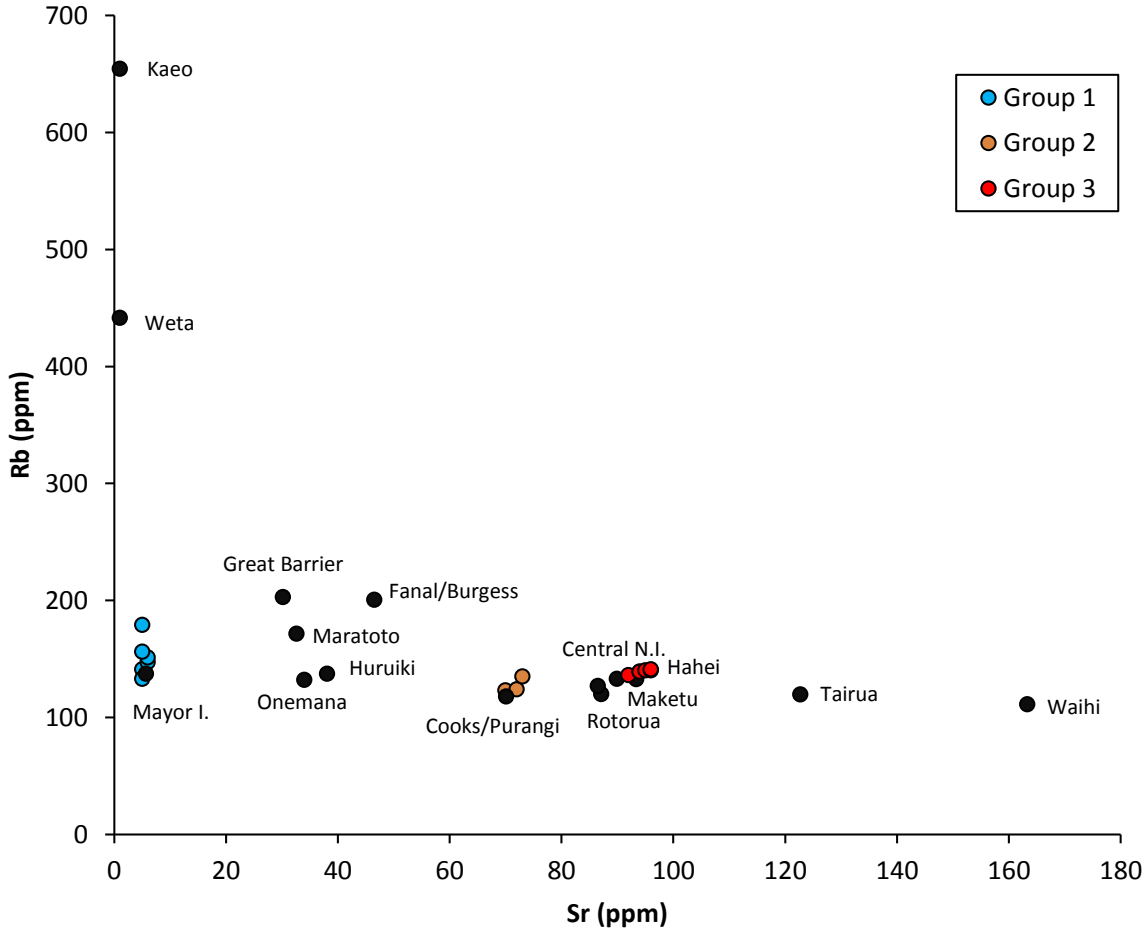

Figure 1. Plot of Sr vs Rb. Coloured circles show archaeological specimens. Black circles show mean values for known NZ sources. Source data derived from UoA collections (*see* Sheppard et al 2011. Characterization of New Zealand obsidian using PXRF. *Journal of Archaeological Science* 38 (2011) 45-56, Table 3).

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APPENDIX 2: OBSIDIAN XRF ANALYSIS, CONTINUED

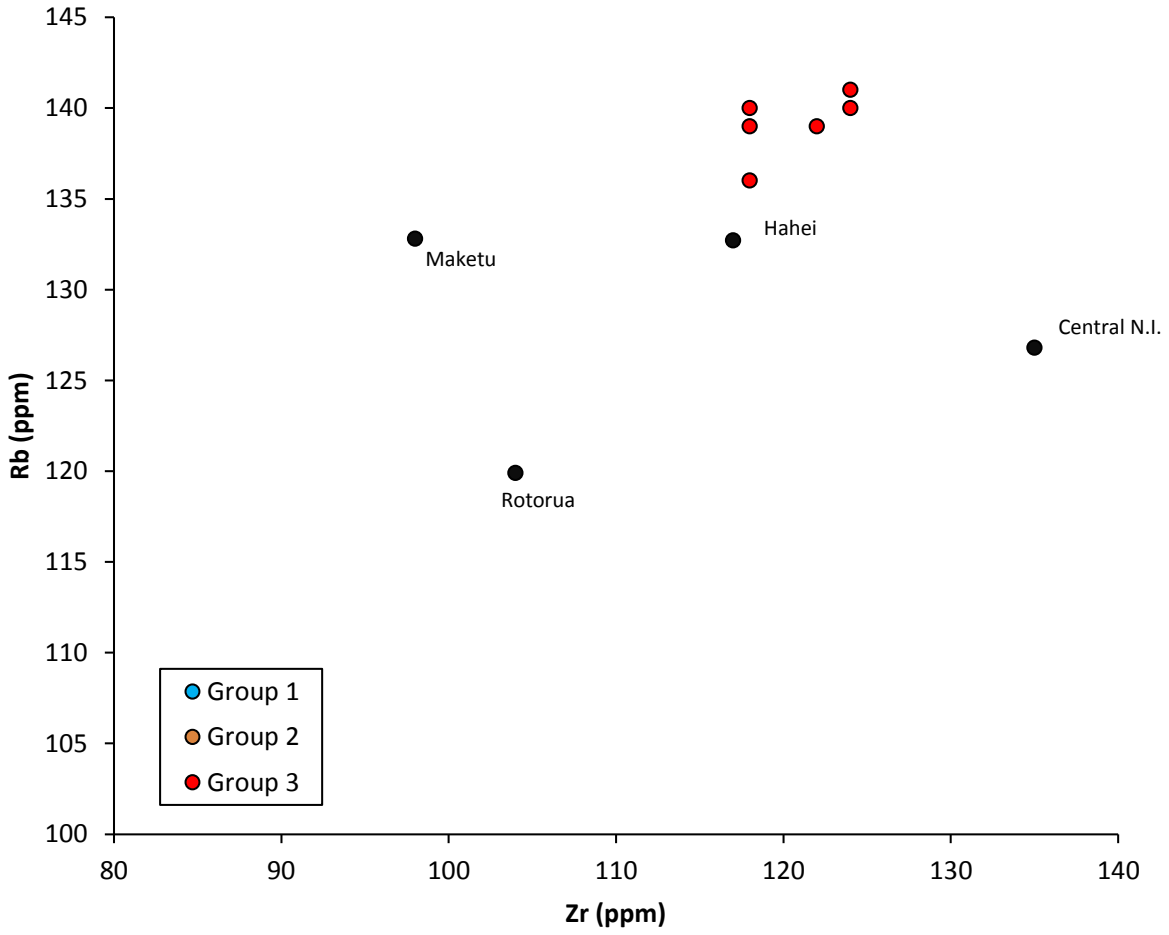

Figure 2. Plot of Zr vs Rb showing the four sources closest to Group 3 samples in more detail

APPENDIX 3: MICROFOSSIL ANALYSIS

Microfossil Research

Dr Mark Horrocks
Microfossil Research Ltd
31 Mont Le Grand Rd,
Mt Eden, Auckland 1024, New Zealand

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info@microfossilresearch.com
www.microfossilresearch.com

20 March 2012

Plant microfossil analysis of pits at Hahei, Coromandel Peninsula (T11/1030)

Summary

Plant microfossils from the pits show large-scale forest clearance by early Maori, and provide direct evidence of local cultivation and processing of kumara.

Methods

Two samples each from the base of a pit (Features 8 and 9) at Hahei were analysed for pollen, phytoliths and starch to provide a record of past vegetation, environments and human activity. Detailed methods of analysis are described in the Appendix.

Results and interpretation

Both Hahei pit samples have large amounts of microscopic fragments of charcoal, and are dominated by spores of ferns, namely bracken, *Cyathea* and ferns with monolete spores (Fig. 1). Hornwort spores also feature. The spores and charcoal, coincident with low proportions of tree pollen, indicate major forest disturbance. Bracken, an invasive ground fern with widely dispersed spores, is often abundant in New Zealand pollen spectra of the last millennium, almost always associated with large-scale repeated burning of forest by early Maori. Many of New Zealand's other disturbance-related ground fern species have monolete spores, which are difficult to differentiate between species. Hornworts are small, inconspicuous plants that colonise freshly exposed soils, and are also associated with forest burning in pollen spectra of the same time span. The high values of *Cyathea* spores represent tree ferns colonising gullies in local fernland. (Notwithstanding this evidence of deforestation, the relatively large

Continued on next page

APPENDIX 3: MICROFOSSIL ANALYSIS, CONTINUED

proportions of fern spores are partly due to superior resistance to decay compared with pollen.)

Pollen of puha is also present in the samples, likewise indicating vegetation disturbance. The leaves and young shoots of puha were a food source for early Maori. Small amounts of the locally dispersed pollen type kauri in one of the samples indicate this tree was part of local forest remnants at the time.

Both samples are dominated by tree and shrub phytoliths, especially spherical verrucose type (Fig. 2). This type is common in the leaves and wood of rewarewa trees. Grass phytoliths also feature, supporting the pollen evidence of forest clearance. Nikau palm phytoliths are also present, indicating its local presence. Nikau is one of the few taxa that can be identified to species level in the New Zealand phytolith flora. The small amount of fern phytoliths relative to tree/shrub phytoliths is because ferns are under-represented and trees/shrubs over-represented in New Zealand phytolith spectra. This in part reflects the durability of phytoliths, which are non-organic, and their consequent persistence in New Zealand soils. Phytoliths from pre-settlement forest may thus be found in soils after the forest has been cleared. Other biosilicates in the samples, namely diatoms and sponge spicules, reflect the coastal location of the site.

Starch grains and xylem cells from the tuberous root of kumara were identified in both samples, providing direct evidence of local cultivation and processing of this crop (Fig. 2). Kumara is part of the small group of six introduced species cultivated by Maori at the time of European contact in the late 18th century. Almost all the many plant species (72) identified as intentionally introduced to Polynesia by prehistoric people are native to various regions within the broad area from Africa to Melanesia (Whistler 1991). Kumara (known elsewhere as sweet potato) however, originated in South America, its introduction to the Pacific a result of Polynesian contact (Hather and Kirch 1991).

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APPENDIX 3: MICROFOSSIL ANALYSIS, CONTINUED

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APPENDIX 3: MICROFOSSIL ANALYSIS, CONTINUED

Appendix: Plant microfossil methods.

Pollen analysis

Pollen analysis includes pollen grains of seed plants and spores of ferns and other plants. It provides insight into past vegetation and environments and in New Zealand allows the differentiation of sediments deposited in pre-settlement, early Maori and European times (McGlone et al. 1993; Hayward et al. 2004). Pollen may also provide direct evidence of Polynesian-introduced plants, for example bottle gourd and paper mulberry, and European crops such as maize (Horrocks 2004; Horrocks et al. 2008).

The samples were prepared for pollen analysis by the standard acetylation method (Moore et al. 1991). At least 100-150 pollen grains and spores are usually counted for this type of analysis, however in this case pollen was sparse therefore counts were lower (shown in Fig. 1).

Phytolith analysis

Phytoliths are particles of silica formed in inflorescences, stems, leaves and roots of many plants (Piperno 2006). Phytolith analysis compliments pollen analysis and, like pollen, may provide direct evidence of bottle gourd and paper mulberry (Horrocks 2004). Other types of microscopic biosilicates, notably diatoms, radiolarians and sponge spicules, are extracted along with phytoliths during preparation. Diatoms are unicellular algae and have cell walls composed of silica; radiolarians are a type of amoeboid protozoa with siliceous skeletons; sponges are multi-cellular animals with skeletons often composed of siliceous spicules. Diatoms are found in aquatic and sub-aquatic environments; radiolarians and sponges are exclusively aquatic. Diatoms and sponges are found in both marine and freshwater environments; radiolarians are exclusively of marine origin.

The samples were prepared for phytolith analysis by density separation (Horrocks 2005). At least 150 phytoliths were counted for each sample and slides were scanned for types not found during the count.

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APPENDIX 3: MICROFOSSIL ANALYSIS, CONTINUED

Analysis of starch and other plant material

This analysis includes starch grains and other plant material such as calcium oxalate crystals and xylem (Torrence and Barton 2006). Starch is the main substance of food storage for plants and is mostly found in high concentrations of microscopic grains in underground stems (e.g. tubers, corms), and roots and seeds. The crystals, comprising raphides which are needle-like and druses which are compound and chunky, are found in both the aerial and underground parts of many plant taxa. Xylem is a vascular tissue comprising elongated cells through which most of the water and minerals of a plant are conducted. Starch analysis may provide direct evidence of Polynesian-introduced starch crops, namely kumara, taro and yams, and European-introduced crops such as potato (Horrocks et al. 2008). Starch and other remains were prepared for analysis by density separation and presence/absence noted (Horrocks 2005).

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APPENDIX 3: MICROFOSSIL ANALYSIS, CONTINUED

Fig. 1 Pollen percentage diagram from pits at Hahei, Coromandel Peninsula (T11/1030)

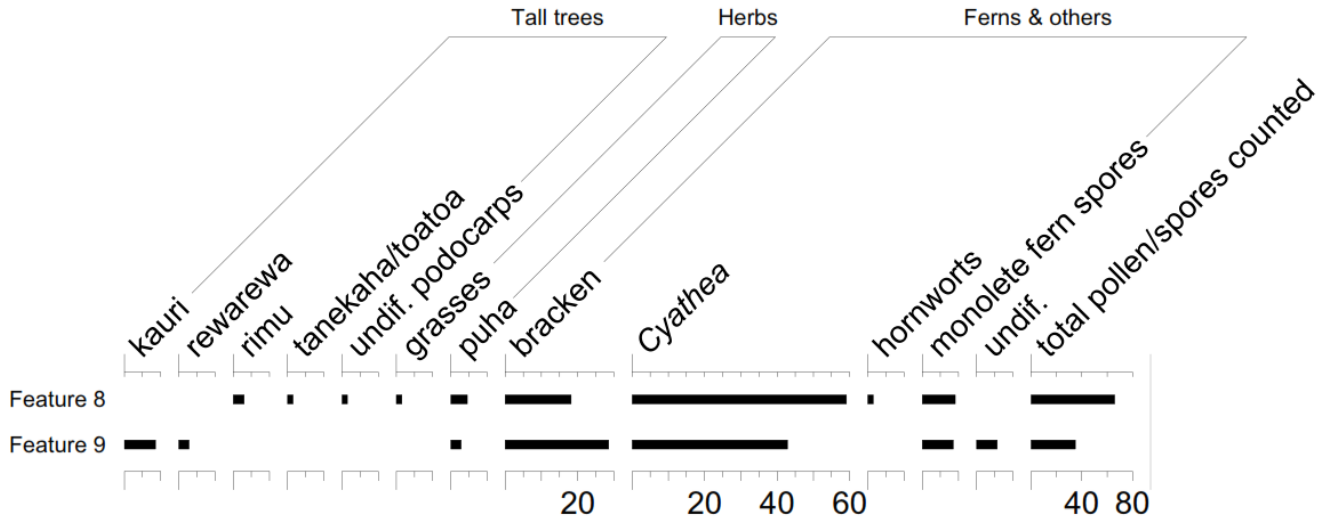
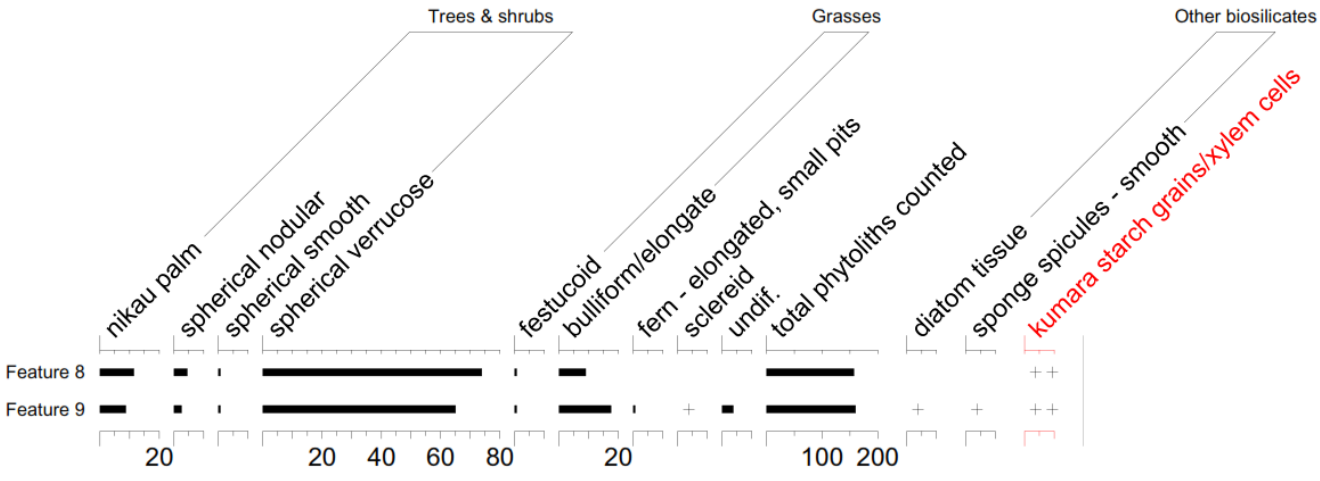


Fig. 2 Phytolith percentage and starch diagram from pits at Hahei, Coromandel Peninsula (T11/1030) (+ = found after count, ++ = present)



APPENDIX 4: CHARCOAL & WOOD IDENTIFICATION

Rod Wallace, PhD

Charcoal and wood Identification, site T11/1030, Hahei, Coromandel Peninsula

Report to Charlotte Judge
Clough&Associates Ltd, 321 Forest Hill Rd, Waiatarua, Auckland 0612
09 8141946 021 30 40 83 www.clough.co.nz

13th March 2012

Three charcoal samples and a block lifted item reported to be a post were submitted for identification. The results are as below.

T11/1030 – F5 – Sq. 3B – 10.02.2012

Hebe sp.	3
Pittosporum sp.	6
Ngaio	4
Olearia sp.	11

Comments – all small diameter twig wood of small shrubs, ideal for C14 dating.

T11/1030 – F4

Hebe sp.	15
Tutu	1
Coprosma sp.	4

Comments – all small diameter twig wood of small shrubs, ideal for C14 dating.

T11/1030 – F10

Coprosma sp.	3
Pittosporum sp.	2
Mahoe	2
Pohutukawa	3
Puriri	2
Totara	1
Matai	3

Comments – a mixture of short and long lived species. Not recommended for C14 dating.

Discussion

Two of the above samples are totally dominated by small coastal shrub species while the last one has coastal trees and forest conifers present.

Continued on next page

APPENDIX 4: CHARCOAL & WOOD IDENTIFICATION,
CONTINUED

The Post

A block of material reported to be a post, possibly a grave marker, was submitted for identification. Careful examination revealed absolutely no woody material was present even when the block was broken up into chunks (see image One below).

Image One – blocks of cemented sand

Examination under magnification showed that it consisted of sand that appeared to be lightly cemented together by a translucent dark golden brown material (see image Two below).

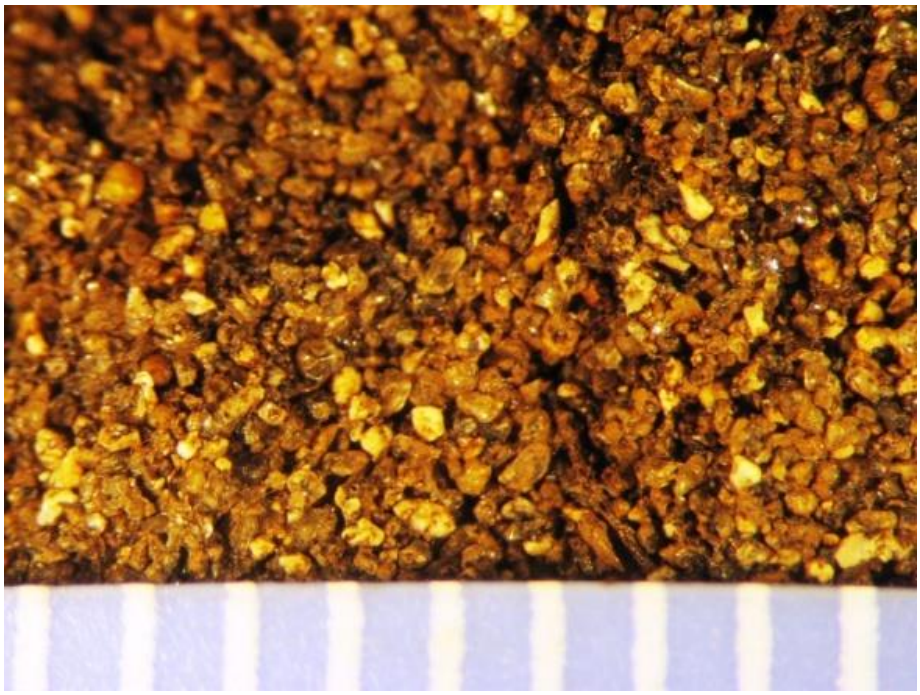


Image Two - cemented sand magnified (Scale in mm)

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APPENDIX 4: CHARCOAL & WOOD IDENTIFICATION, CONTINUED

A lump of the cemented sand was placed in a beaker and flooded with acetone whereupon a dark brown material passed into solution. This solution was passed through filter paper and then dried. The results are shown on Image Three below.

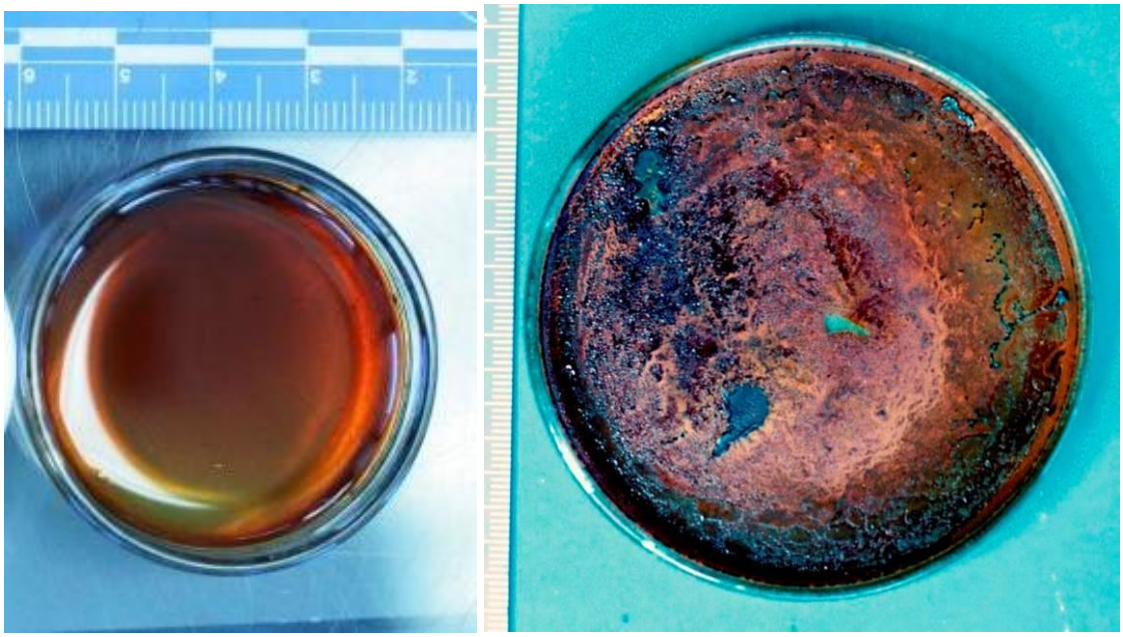

Image Three – extracted dark material - in solution (left) and dried (right) (Scale in mm)

When dried in a thin layer the extracted material had a light golden colour identical to kauri gum. Consequently I strongly suspect the "post" had been a very resinous piece of kauri now totally decayed away that had left only the resin behind which cemented the sand together. Highly resinous kauro wood occurs in branches and roots of of kauri and the feature was either remains of a post made from kauri branch wood or an ancient kauri tree root.

I am often sent wood samples that are very degraded but never before to the extent that all that is left is a residue that can be dissolved in acetone and passed through filter paper. I am somewhat flattered that it was believed I would be able to identify to species level something so ephemeral.

APPENDIX 5: RADIOCARBON DATES

The University of Waikato
Radiocarbon Dating Laboratory

Private Bag 3105
Hamilton,
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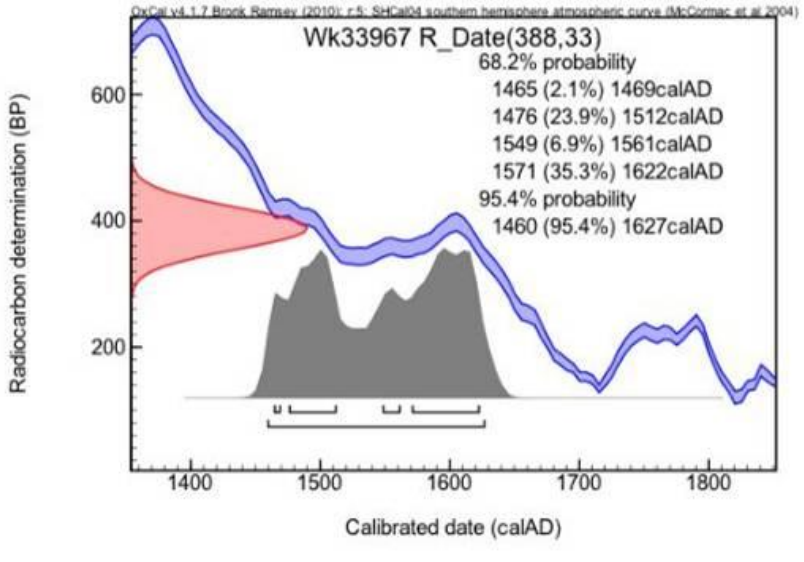
Fax +64 7 838 4192
Ph +64 7 838 4278
email c14@waikato.ac.nz
Head: Dr Alan Hogg

Report on Radiocarbon Age Determination for Wk- 33967

Submitter	C Judge
Submitter's Code	T11/1030 F4
Site & Location	Hahei, New Zealand
Sample Material	all small diameter twig wood of small shrubs (Wallace 2012)
Physical Pretreatment	Possible contaminants were removed. Washed in ultrasonic bath.
Chemical Pretreatment	Sample washed in hot 10% HCl, rinsed and treated with hot 1% NaOH. The NaOH insoluble fraction was treated with hot 10% HCl, filtered, rinsed and dried.

$\delta^{13}C$	-26.6 ±	0.2 ‰
$D^{14}C$	-47.2 ±	4.0 ‰
$F^{14}C$%	95.3 ±	0.4 %
Result	**388 ± 33 BP**	

Comments



AG Hogg
28/06/12

- Result is *Conventional Age or Percent Modern Carbon (pMC)* following Stuiver and Polach, 1977, Radiocarbon 19, 355-363. This is based on the Libby half-life of 5568 yr with correction for isotopic fractionation applied. This age is normally quoted in publications and must include the appropriate error term and Wk number.
- Quoted errors are 1 standard deviation due to counting statistics multiplied by an experimentally determined Laboratory Error Multiplier.
- The isotopic fractionation, $\delta^{13}C$, is expressed as ‰ wrt PDB.
- $F^{14}C$% is also known as *Percent Modern Carbon (pMC)*

Continued on next page

APPENDIX 5: RADIOCARBON DATES, CONTINUED

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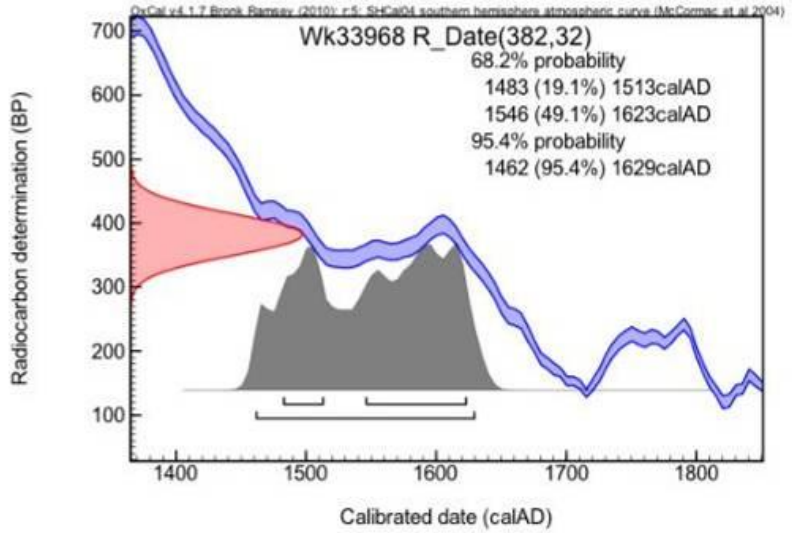
Report on Radiocarbon Age Determination for Wk- 33968

Submitter	C Judge
Submitter's Code	T11/1030 F5
Site & Location	Hahei, New Zealand
Sample Material	All small diameter twig wood from short lived shrub species (Wallace 2012)
Physical Pretreatment	Possible contaminants were removed. Washed in ultrasonic bath.
Chemical Pretreatment	Sample washed in hot 10% HCl, rinsed and treated with hot 1% NaOH. The NaOH insoluble fraction was treated with hot 10% HCl, filtered, rinsed and dried.

$\delta^{13}C$	-25.6 ±	0.2 ‰
$D^{14}C$	-46.4 ±	3.8 ‰
$F^{14}C\%$	95.4 ±	0.4 %
Result	**382 ± 32 BP**	

Comments



28/06/12

- Result is *Conventional Age or Percent Modern Carbon (pMC)* following Stuiver and Polach, 1977, Radiocarbon 19, 355-363. This is based on the Libby half-life of 5568 yr with correction for isotopic fractionation applied. This age is normally quoted in publications and must include the appropriate error term and Wk number.
- Quoted errors are 1 standard deviation due to counting statistics multiplied by an experimentally determined Laboratory Error Multiplier.
- The isotopic fractionation, $\delta^{13}C$, is expressed as ‰ wrt PDB.
- $F^{14}C\%$ is also known as *Percent Modern Carbon (pMC)*

APPENDIX 6: SHELL DATES FROM T11 MAP ZONE (SOURCE: NZ RADIOCARBON DATABASE)

project	sample	raw	error	Site	-1σ	1σ	-2σ	2σ	species	feature type
Poikeke Island	NZ4354	569	32	T11/114	1675	1813	1633	1950	*Paphies australis*	Midden
Hot Water Beach Peninsula	NZ1296	761	44	T11/115	1483	1617	1450	1665	*Amphibola crenata*	Midden
Hot Water Beach Peninsula	NZ1297	832	44	T11/115	1430	1535	1395	1641	*Paphies australis*	Midden
Mahurangi Island	NZ4353	561	32	T11/136	1680	1818	1646	1950	*Paphies subtriangulata*	Pa
Brier Block Whitianga	NZ6161	540	54	T11/188	1684	1856	1655	1950	*Austrovenus stutchburyi*	Midden
Brier Block Whitianga	NZ6162	652	55	T11/200	1542	1701	1490	1822	*Austrovenus stutchburyi*	Midden
Brier Block Whitianga	NZ6157	649	55	T11/208	1540	1705	1490	1826	*Austrovenus stutchburyi*	Midden
Brier Block Whitianga	NZ6159	385	54	T11/210	1851	1950	1724	1950	*Austrovenus stutchburyi*	Midden
Brier Block Whitianga	NZ6158	728	55	T11/219	1511	1646	1454	1692	*Austrovenus stutchburyi*	Midden
Brier Block Whitianga	NZ6982	626	50	T11/219	1566	1802	1511	1860	*Austrovenus stutchburyi*	Midden
Brier Rock Whitianga	NZ7025	728	36	T11/219	1519	1640	1470	1675	*Austrovenus stutchburyi*	Pit
Brier Block Whitianga	NZ7044	561	24	T11/219	1683	1814	1649	1950	*Austrovenus stutchburyi*	House
Brier Block Whitianga	NZ7219	730	56	T11/226	1508	1645	1452	1692	*Austrovenus stutchburyi*	Midden
Brier Block Whitianga	NZ6160	560	51	T11/230	1669	1835	1627	1950	*Austrovenus stutchburyi*	Midden
Hahei	NZ6642	932	64	T11/242	1338	1459	1289	1524	*Paphies subtriangulata*	Midden
Hahei	NZ6646	952	51	T11/242	1338	1442	1293	1487	*Paphies subtriangulata*	Midden
Tairua	Wk3952	660	50	T11/300	1547	1691	1494	1809	*Paphies australis*	Midden
Tairua	Wk3953	680	50	T11/300	1540	1675	1473	1804	*Paphies australis*	Midden
Paku, Tairua	Wk3100	710	45	T11/308	1528	1654	1469	1695	*Austrovenus stutchburyi*	Pa
Whitianga	Wk1151	640	45	T11/311	1551	1710	1507	1823	*Paphies subtriangulata/ Austrovenus/ gastropods*	Pa
Hahei	NZ5422	904	33	T11/514	1387	1481	1325	1510	*Paphies australis*	Midden
Tairua	NZ1875	885	58	T11/62	1361	1509	1311	1576	*Paphies australis*	Midden
Tairua	NZ1876	566	57	T11/62	1662	1841	1596	1950	*Cellana denticulate / Turbo smaragdus*	Midden
Whangapoua Forest	Wk0974	840	45	T11/635	1426	1530	1361	1637	*Paphies australis*	Kainga

project	sample	raw	error	Site	-1σ	1σ	-2σ	2σ	species	feature type
Whangapoua Forest	Wk0969	780	45	T11/636	1462	1591	1438	1657	*Paphies australis*	Kainga
Whangapoua Forest	Wk0970	840	45	T11/643	1426	1530	1361	1637	*Paphies australis*	Kainga
Whangapoua Forest	Wk0973	720	45	T11/644	1522	1648	1467	1687	*Paphies australis*	Kainga
Whangapoua Forest	Wk0975	770	45	T11/648	1472	1616	1446	1661	*Paphies australis*	Kainga
Whangapoua Forest	Wk0972	790	45	T11/661	1455	1578	1431	1654	*Paphies australis*	Kainga
Whangapoua Forest	Wk0971	850	45	T11/679	1421	1522	1350	1617	*Paphies australis*	Kainga
Tairua	Wk3386	760	50	T11/805	1484	1618	1446	1671	*Paphies australis*	Midden

APPENDIX 7: KOIWI ANALYSIS RESULTS

Human Remains (Koiwi tangata) discovered at Wigmore Crescent, Hahei, Coromandel (T11/1030): osteological report.

By Beatrice Hudson

April 2012

Introduction

Archaeologists were contacted regarding the discovery of prehistoric human remains – koiwi tangata – at a house site that was being redeveloped at 25 Wigmore Crescent, Hahei, Coromandel. Firstly, a cranium had been discovered at a dump site in Whitianga where spoil from 25 Wigmore Crescent was being taken. At that time, two different development sites were dumping spoil there and it was initially unclear where the cranium came from. Following this, bones from the rest of the skeleton were discovered at 25 Wigmore place.

On the 30th of November, 2011 the site was visited by archaeologists Andrew Hoffmann and Beatrice Hudson. Following a blessing of the area by Peter Johnson of Ngati Hei, the property and burial were inspected in order to both assess the site archaeologically (c.f. Hoffmann 2011) and also to identify, examine and record the human remains prior to their reburial. Findings regarding the human bones are reported here.

Osteological recording of the bones is essentially a process of reading the bones to see what they can tell about that individual and how they lived and died. To a small degree this brings the person from anonymous skeletal remains to some known identity. This can also give some insight into a society's beliefs or practices surrounding death and burial. Ideally this information should be recorded before koiwi tangata are reburied, and reported on in order to preserve the information for future generations.

Legal matters surrounding the discovery of archaeological human remains

Human remains at an archaeological site are at the meeting point of a few different laws and concern various different interested parties. **The Coroner's Act 2006** states that: "*a person who finds a body in New Zealand must report that finding to a member of the police as soon as practicable*" (Section 14(1)). Therefore, discovery of any human remains requires notification to the

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New Zealand Police. It is the responsibility of the police to establish whether or not the site is a crime scene.

Many instances of accidental discovery of human remains are from an archaeological context however. If there is cause to suspect the site may be archaeological, then the Police should seek the advice of a trained archaeologist to confirm this. Archaeological sites are governed by **The Historic Places Act 1993** (HPA), which is administered by The New Zealand Historic Places Trust (NZHPT). The Act contains statutory powers in relation to the protection of archaeological sites. From an archaeological perspective, the context of human remains and any other archaeological material in an archaeological site is extremely important. Therefore, disturbance of the grave and the site should be minimised. It is unlawful to disturb, damage or modify an archaeological site without an archaeological authority from the NZHPT.

The HPA defines an archaeological site as:
"… any place in New Zealand that-
(a)
Either-
(i)
was associated with human activity that occurred before 1900; or
(ii)
is the site of a wreck of any vessel where that wreck occurred before 1900; and
(b)
Is or may be able through investigation by archaeological methods to provide evidence relating to the history of New Zealand."

This is a broad definition that encompasses a wide variety of site types of both Maori and European origin and includes burials and cemeteries, both in isolation and where they occur with other archaeological evidence.

Most of cases of discovery of archaeological koiwi tangata/human remains are of tangata whenua derivation. It is essential, therefore, that hapu/iwi are contacted immediately following discoveries to ensure cultural protocol is adhered to and decisions for exhumation and re-interment are culturally appropriate. Iwi and archaeologists should work together to ensure that both cultural and archaeological processes are satisfied, since the archaeological site and the grave itself are protected by the HPA and require archaeological recording.

Further details of these laws and others governing human remains in New Zealand are given, along with guidelines for procedures surrounding the discovery of archaeological human remains, in the NZHPT's document "Archaeological Guidelines Series No. 8: Koiwi Tangata/ Human Remains" (2009).

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Field work

Context of the remains

On arrival at the site we found that the postcranial bones had already been removed from the ground, leaving a shallow oval hollow. The bones had been placed in a cardboard box and kept on site. In addition to this, a scatter of small bones – phalanges (finger/toe tips), a couple of carpals (wrist bones) and a twelfth rib – were sitting on the surface around the hollow. Judging by the number and kinds of bones present, it appears that this had originally been a complete, primary burial that had been placed in a grave. Bones from all parts of the body were present and small details of the skeleton such as sesamoid bones of the hands and feet, the distal phalanges (tips of fingers and toes), the xiphoid process of the sternum (breastbone) and a distal segment of the coccyx (tailbone) were present. These small bones are unlikely to be present in a secondary burial for which bones have been dug up or gathered together to be reburied in a second location. Furthermore, groups of adjacent vertebrae were still held together by roots growing through them, showing that they had been articulated in the grave.

The site was cleared down with hand tools to try to establish any grave cut or fill remaining and to determine whether there was any intact prehistoric site, or whether it was all disturbed ground. Unfortunately, no clear grave cut or fill remained, having been dug into to remove the bones. The original grave was probably approximately the size and shape of the remaining hollow in the ground – a shallow oval depression measuring 131 cm x 66 cm and only 17 cm deep (Figure 1 and Figure 2).

Figure 1 On arrival at the site we found that bones had been removed from the ground, placed in a cardboard box and replaced in the remaining hollow. Picture facing northeast. Scales 1 m and 2 m (foreground).

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This depression had been cut into a thick deposit of grey sand that contained prehistoric Maori artefacts such as obsidian flakes. Seventy centimetres to the north of the hollow was a cluster of stones in which a large piece of a broken stone adze head was found (Figure 2). Test pits and examination of the stratigraphy showed that this grey sand into which the burial was dug was an undisturbed 'island' – probably all that remained intact of the original site. All around it had been disturbed by building the original house, activities related to its removal, or preparations for the new house to be built. Wigmore Crescent is located in an area that has a number of previously recorded archaeological sites and is also an area in which prehistoric burials are reported to have been encountered during the construction of the road and other buildings.

Figure 2 The remaining hollow in the ground, probably the approximate size of the grave cut. In the foreground is the small scatter of rocks and the broken adze chunk (indicated by arrow). Facing south, scales 1 m.

The cranium discovered at the dump site had been sent by police to Hamilton to be examined by a forensic odontologist, Dr Khouri, whose report is attached as an appendix to this report. There is little doubt that the cranium and postcranial remains belonged to the same individual, since they were compatible in matters of condition and estimates of age and sex. Furthermore, the cranium was filled with grey sand very similar to that at the site where the other bones were

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found. The fine roots filling the cranium also appeared similar to those adhering to some of the other bones.

Osteology

The forms and condition of the bones of the skeleton can be 'read' by a trained specialist to gain estimations of the age, sex, stature and ancestry ('race') of that individual. Furthermore, the skeleton and teeth often hold information about disease or injury that person may have suffered. In a case such as this – when koiwi are to be reburied with as little disturbance as possible – this examination is usually just a matter of observing with the naked eye. When further information is required, radiographs (x-rays), microscopic examination or chemical tests can be performed. For this skeleton, the bones were only observed with the naked eye.

Estimations of ancestry, age, sex, and stature are discussed below along with description of features indicating disease or injury. Tables of the osteological data from which these estimations are made are given in Appendix 1.

Inventory and condition of the bones

The bones were all human and from a single individual. The skeleton was near complete, but bones from the region of the right shoulder and the right hip were missing. This suggested that the body had lain on its left side in the grave, with the right side closest to the surface and subject to disturbance. The right femur had been broken in the middle of the shaft, with only the distal (lower) half remaining. The broken end of the femur had scrape marks that were no doubt caused by the heavy machinery that exposed the burial. It is likely that the burial was intact until it was uncovered by redevelopment, and it is probable that a few more bones than just the cranium were taken to the dump site. Figure 3 shows a diagram of which parts of the skeleton were present.

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

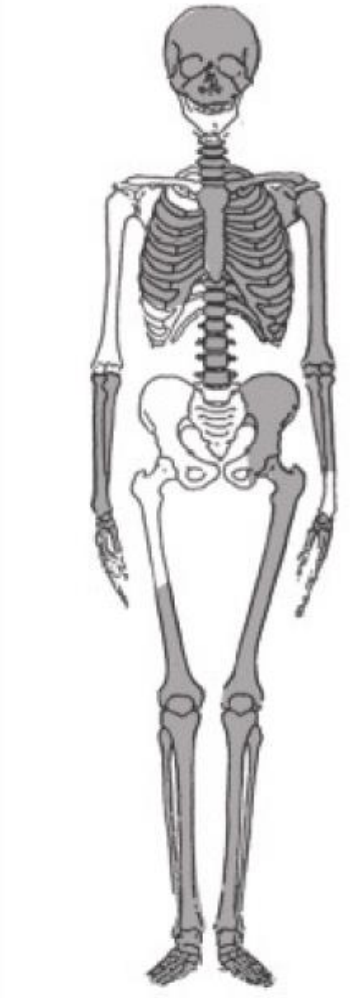

Figure 3 Diagram showing which bones were present. Shaded bones were present.

The bones were in very good condition – not fragile or highly fragmented – and their surfaces were not weathered, which made observation of their features easy. A few key bones were missing however, such as the mandible (jaw) and informative parts of the pelvis. It was notable that the right fibula and right radius were slightly bleached and paler than the others (Figure 4), indicating that they had been close to the surface of the grave and at some point been more exposed to sun bleaching than the rest of the skeleton. This supports the suggestion that the body lay on its left side. The fact that the distal (lower) left radius and ulna were broken off, and the left ulna was also slightly bleached, indicates that the left arm was probably crossed over the chest and lying against the right shoulder or hip and was then disturbed with them.

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

Figure 4 The right radius and right fibula were bleached compared to the rest of the bones.

Antiquity of the remains

The bones were stained by the earth and were light and brittle, having long since lost the shiny, elasticity of living or fresh bones. Lack of modern dentistry and the fact that they were found in the top of an undisturbed part of an archaeological site in an area where it is known that other skeletons have been found during previous development add to the conclusion that these were prehistoric human remains. Furthermore, this appears to have been an articulated, complete burial in a very small confined grave – probably in a crouched position, something that is typical of prehistoric Maori burials.

Radiocarbon dating can sometimes be used to chemically date human bone and narrow the estimate of when that person died. It is however a destructive technique and would require a small amount of bone to be crushed. Furthermore, human bone is a problematic material to date this way and can produce inaccurate results. The difficulty is due to the consumption of foods from more than one environment, or 'reservoir' of ^{14}C, some of which can differ from the atmospheric ^{14}C. The result therefore needs to be calibrated to correct for this. Calibration is based on an estimation of diet gained from proportions of other carbon and nitrogen isotopes in the bone (Petchey n.d.: 9).

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

Estimation of ancestry/ 'race'

There are a number of skeletal features that have been noted to occur with higher frequency in people of Polynesian descent and which are used by archaeologists and forensic scientists to identify a skeleton as likely to be of Polynesian ancestry. This individual's skeleton displayed many of these typical Polynesian traits (see table in Appendix 1), particularly the shape of the cranium, which was angular and pentagonal when viewed from the back, as opposed to the more rounded shape that is typical in Europeans, Figure 5, top left). The shapes of the femur (oval fovea in the femoral head; Figure 5, top right) and the fact that there were squatting facets in the tibia (small facets in the ankle that develop due to habitual squatting; Figure 5, bottom) are also typical Polynesian traits.

Figure 5 Top left: the angular, pentagonal (when complete) shape shown here is very commonly seen in Polynesian crania. Top right: the fovea capitis of the head of the femur is distinctly oval, as opposed to round. Bottom: the squatting facet is the smooth 'dent' in the front of the ankle-end of the tibia (shin bone).

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Additional observations were that there were clear blood vessel impressions in the frontal bone and in the shafts of the tibiae (shin bones). Similar blood vessel impressions were noted in the leg bones of a large number of prehistoric Maori koiwi from the NRD site in Mangere (Hudson and Campbell 2011) and may be a trait related to vascularity of the typically well-muscled Polynesian body type.

Estimation of sex

Sex estimations were based primarily on the shape of certain features of the pelvis and skull. The scoring systems presented in Buikstra and Ubelaker (1994) were used as a guide. The diameter of the head of the femur was also used to help distinguish sex (Bass 1987).

The pelvis is the most important part of the skeleton for estimating sex. Following that in importance is the skull and the femur. Unfortunately only part of the left side of the pelvis remained, and that was broken. The pubis (the front of the pelvis) was missing. Based on the sciatic notch and the base of the ischiopubic ramus, the pelvis indicated a possible female. The diameter of the femoral head then confirmed this, since it measured only 41 mm – well within the range for female (Bass 1987).

The sex estimate from the cranium was also independently estimated by Dr. Khouri to be probably female (see attached report).

Estimation of age

The woman had completed her growth and was skeletally and dentally mature. All of her bones had finished fusion, indicating that she was at least over 25. One of the joints of her pelvis used for estimating age (the auricular surface) indicted that she was a mid adult in her early forties. Her teeth were extremely worn; the front teeth had worn down to enamel-less stumps and she had lost at least one of her molars while she was still living. This degree of wear shows that she was no longer a young adult.

The joins between the plates of her cranium (cranial sutures) had begun to fuse – the timing of this is very variable, but generally open sutures suggest a young adult and fully fused sutures suggest an old adult. Some of this woman's sutures had begun fusion, and others were open, supporting the suggestion that she was a mid-aged adult.

Some features of her skeleton indicated youth however: the line of fusion of her proximal tibia was still very faintly visible, and although the annular rings of her vertebra were fused, they were still very clearly distinct from the vertebral bodies. Her joints did not show a lot of the wear and tear of old age, though some degeneration in her spine was noted and this is described below under Pathology.

On balance, she is estimated to have been a mid adult, likely in her mid 30s to mid 40s.

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

Estimation of stature

An estimation of a person's height can be gained by measuring any of the limb bones (the femur gives the most reliable result) and plugging that measurement into regression equations developed for the purpose. This calculation used the regression equations developed by Houghton *et al.* (1975) which are specifically for Maori. This equation (see Appendix 1) gave the result as between 167 to 171cm tall. This is relatively tall when compared to the female average calculated by Houghton (1996) for prehistoric Maori (161.5 cm – calculated using measurements from koiwi from a variety of time periods and regions) and also to the female average from a large, late prehistoric site in Mangere, Auckland (161. 1. cm, Hudson and Campbell 2011). In addition to this, her bones were generally small and gracile – similar to many of the females from the Auckland site.

Pathology – ill-health/ injury

Neck

This woman had bone changes in her neck that were the mild beginnings of what would have progressed into arthritis had she lived longer. Smooth osteophytes ('lipping') had developed around the edges of the mobile joint surfaces on the left side of her 3rd to 5th neck vertebrae (Figure 6). These were not dramatic changes, but they show that degeneration had begun in this specific location, suggesting that the middle, left side of her neck underwent particular strain. She probably engaged in some activity that demanded more weight-bearing or repetitive motion of her left upper body.

Figure 6. The difference in size between the left and right articular surfaces of these three vertebrae is obvious. The bone has reacted to some kind of stress by extending around the articular surface.

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Lower back

This woman also had some degenerative problems in her lower spine: six of her vertebrae had Schmorl's Nodes. These are hollows in the vertebral bodies caused by herniation of the intervertebral disks (Figure 7). This means that the pulpy inside of the disk protrudes through the fibrous outer casing and places pressure on the vertebral body, gradually creating a hollow. Clinically, these lesions are common in individuals over the age of 40 (Ortner and Putschar 2003: 549).

Figure 7 Depressions in the surfaces of the vertebral bodies – Schmorl's nodes.

Ankle

The woman had bone changes in two of the bones of her right foot (the calcaneus and talus) that suggested she had sustained a mild injury to her ankle (Figure 8; bone changes detailed in Appendix 1). There was no evidence of broken bones or any other bones of the foot or leg having been injured, and only the right foot was affected. The bone changes were most likely caused by damage to the soft tissue connecting these bones, which had destabilised the joint. The bones had then reacted by creating more bone around the edges of the joint between them, extending the area of the articulating surfaces. In other words, this woman probably suffered a badly sprained ankle, possibly straining or tearing a ligament or other joint tissue, and this had de-stabilised her foot long enough for the bones to react with these changes.

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

Figure 8 Top left: abnormal bone on the right talus. Top right: bone changes on the right calcaneus. Bottom: inferior surface of the left and right tali compared.

Finger

The bones of the tip of one of her fingers were deformed (Figure 9). The joint surfaces between her intermediate and distal phalanges (finger bones) of one of her middle fingers (either an index, middle or ring finger) were misshapen, which may have been as a result of some specific injury to that finger. All of the other finger bones recovered were normal.

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Figure 9 Deformed distal and intermediate hand phalanges (finger bones).

Rib and Knee

Minor bone changes in the head of one right rib and the medial articular surfaces of both patellae (kneecaps) are also the beginnings of mild degeneration in these joints. The bone changes included the development of excess bone (osteophytes) and porosity. In the patellae these were small areas (7 x 7 and 10 x 6 mm) of lumpy, remodelled bone with small smooth-edged pores (Figure 10).

Figure 10. Bone changes on the patellae and the head of one rib.

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

Teeth

Since the mandible (lower jaw) was missing, only the teeth of the upper jaw could be observed. As mentioned above, her teeth were extremely worn, and most of the enamel of her incisors had been ground away, probably due to a coarse diet and/or use of the front teeth as tools (Figure 11). Two of her right molars (M2, M3) had been lost post-mortem. Her left third molar had fallen out while she was still alive, but not long enough before she died for the socket to heal over. The bone surface around and above this socket on the outside of the upper jaw was porous, probably in reaction to infection there (Figure 12). What likely happened was that the tooth was either worn or eroded away so far as to reveal the tooth's pulp cavity. This leaves a tooth vulnerable to infection and abscessing at the root tip, death of the tooth and eventually loss of the tooth. The bone changes around the socket show that infection spread from the tooth to the surrounding bone. Infection was also evident in three other teeth (Left P2, Right M1, Right P2), where small holes in the bone above the teeth showed that they had abscesses (Figure 13), would have caused the woman a lot of pain.

Severe dental wear, leading to infection and abscessing and often tooth loss is far from uncommon in prehistoric Maori skeletons. This progression has in fact been described as occurring with "monotonous regularity", particularly in the late prehistoric period (Houghton 1980: 122).

Figure 11 The enamel of the front teeth and right first molar was mostly or completely worn away.

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

Figure 12. The porous bone surface above the socket of the left third molar, indicating infection.

Figure 13. Holes above the right second premolar and first molar indicate painful abscesses at the root tips of those teeth.

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Conclusion

This was the skeleton of a Maori woman who lived and died during prehistoric times. She was in her mid adult years, probably in her mid 30s to mid 40s. She had slender, gracile bones, but was not short for her time – estimated to have stood between 167 and 171 cm tall. Her skeleton gives no clues to how she died, but it does show some matters of injury and illness she suffered during her life. An injured ankle and fingertip would have caused her pain and some impaired mobility, but were relatively minor problems. More painful problems were the abscesses in her teeth. Changes to the bones of her spine show that she engaged in heavy or repetitive work that had begun to leave its mark on the left side of the bones of her neck. Heavy work had also caused bone changes in her lower back. Her teeth also had hard work to do, as they had been ground down – no doubt by a coarse diet, which probably included a lot of sandy shellfish. She appeared to have been buried in a primary burial, laid on her left side and probably in a tightly crouched position that required only a small, roughly oval grave.

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

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Appendix: Osteological Data

1) Table of features indicating Polynesian Ancestry

Characteristic	Polynesian	West European	25 Wigmore Crescent skeleton
Back of skull	Pentagonal	Rounded	Pentagonal
Cranial form	High rounded, angular	Medium	Angular
Cranial base	Flat	Angled	
Malar form	Visible from superior view	Not visible from superior view	Visible from superior view
Temporals	Straight	Rounded	Medium
Cheekform	Malars turn back at right-angles to face	Rounded, reduced	Malars turn back at right-angles to face
Orbital form	Rhomboid	Rhomboid	Rounded
Nasal Breadth	Medium	Narrow	Medium
Nasal sill	Dull/absent to rounded	Sharp	Rounded
Nasal profile	Concave/concavo/convex	Straight	n/a
Face protrusion	Flat	Moderate	Flat
Palate form	Hyperbolic	Parabolic	Hyperbolic
Mandibular angle	Square	Oblique-square	n/a
Rocker jaw	Rocker, robust	Medium	n/a
Mandibular body	Long continuous curve (rocker form), robust	Non-"rocker", medium	n/a
Coronoid process	Tall, broad	Reduced	n/a
Chin	Median projection, Submental arch	Bilateral form, prominent projection	n/a
Mandibular condyle	Oriented upwards or forwards	Oriented backwards	n/a
Incisors	Blade, some shovelling (c75%)	Blade, shovelling rare	n/a
Femoral torsion	>25 degrees	<c15 degrees	ca. 25 degrees
Femur shaft	Proximal flattening	Round shaft	Mild proximal flattening
Tibia	Squatting facets	No squatting facets	Squatting facets
Fovea	Oval	Circular	Oval
Humerus	Development of deltoid tuberosity	Reduced	Development of deltoid tuberosity
Tibia	Horizontal tibial platform	Angled	Horizontal tibial platform
Shafts of long bones	Bowed	Straight	Femur bowed.
Clavicle	Costoclavicular ligament Insertion marked	uncommon	Not marked

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2) Table of scoring of features for estimation of sex

Osteological data for the estimation of sex. Scores based on standards published by Buikstra and Ubelaker (1994).

Pelvis					
	Left	**Right**		**Left**	**Right**
Sciatic Notch score	2	n/a	Subpubic concavity	Base of I-P ramus curved	n/a
Pubis shape	n/a	n/a	Ventral arc	n/a	n/a
Medial ischio-pubic ramus	n/a	n/a	Preauricular sulcus	absent	n/a
Sacrum shape	n/a		Dorsal pubis pitting	n/a	n/a
Cranium					
	Left	**Right**		**Left**	**Right**
Mastoid process	3	3	Supraorbital margin/glabella	1	n/a
Mental eminence	n/a		Supraorbital ridge	1	n/a
Nuchal crest	3				
Femoral Head					
Diameter	41 mm				

3) Table of scoring of features for estimation of age

Osteological data for the estimation of age. Scores based on standards published by Buikstra and Ubelaker (1994). Fusion scores 0 = open/ unfused; 1 = fusion begun; 2 = partial fusion; 3 = complete fusion.

Pelvic joint surface scores					
	Left	**Right**		**Left**	**Right**
Auricular surface	Phase 5 (age 40-44)		Pubic Symphysis	n/a	n/a

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

Fusion of late-fusing joints					
	Left	Right		Left	Right
Medial clavicle	3 – fully fused	n/a	Iliac spine fusion	3 – fully fused	n/a
Annular rings	Fused but still distinct		Spheno-occipital fusion	n/a	
Cranial suture fusion					
	Fusion score			**Fusion score**	
Midcoronal	1		Lambda	0	
Anterior saggital	1		Midlambdoid	0	
Obelion	2		Pterion	2	
Incisive	3		Inferior sphenotemporal	0	
Median palatine	1		Transverse palatine	0	

4) Metrics: long bone lengths and humeral/femoral head measurements

Bone	Left (mm)	Right (mm)
Femur	454	
Tibia	368	367
Fibula	354	356
Humerus	310	
Radius		245
Ulna		266
Femoral Head diameter	41	
Humeral head diameter	41.2	

5) Regression equation for estimating stature

Regression equation after Houghton *et al.* (1975) Bold indicates femur measurement.

Regression equation (L Femur, Female)	Stature Est. (cm)	Std dv.(cm)
2.176 x **454** -4.528 x 20 + 796.8 =1694.144	169.4	2

6) Vertebrae with Schmorl's Nodes

Vertebra	Superior surface	Inferior surface
T11	Yes – mild	Yes – mild
T12	Yes	Yes
L1	Yes	Yes – severe

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L2	Yes – severe	Yes
L3	Yes	Yes
L4	Yes – mild	No

NB: all vertebrae from C3-L4 were present. These six vertebrae were the only ones with Schmorl's Nodes.

7) Description of pathological bone changes in the right foot

Bone	Side	Description of bone changes
Talus	Right	Thick, smooth, remodelled osteophyte extending (max. 5 mm) laterally from the lateral border of the posterior calcaneal articular surface. This was not porous and had smooth edges.
Calcaneus	Right	Smooth remodelled osteophytes extending (2-3 mm) from the anterior and posterior borders of the lateral talar articular surface. Porous, bone over approx. 12 x 7 mm area of posterior lateral surface of this articular surface.

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

8) Inventory of bones present

Bone	Side	Present	Approx. %	Notes
Cranium				
- frontal		Yes		
- parietal	Left	Yes	100	
	Right	Yes	100	
- temporal	Left	Yes	100	
	Right	Yes	50	
- occipital		Yes	100	
- sphenoid	Left	Yes	100	
	Right	Yes	0	
- zygomatic	Left	Yes	100	
	Right	Yes	100	
- TMJ	Left	Yes	100	
	Right	Yes	100	
- maxilla	Left	Yes	100	
	Right	Yes	100	
- palatine	Left	Yes	100	
	Right	Yes	100	
Mandible			0	
Clavicle	Left	Yes	100	
	Right		0	
Scapula	Left	Yes	100	
- body		Yes	100	
- glenoid		Yes	100	
Scapula	Right		0	
- body			0	
- glenoid			0	
Hyoid			0	
Ossified thyroid/cricoid cartilage			0	
Cervical vertebrae				
- Atlas			0	
- Axis			0	
- C3-7		Yes	100	Osteophytes on left articular facets of C3-C5.
Thoracic Vertebrae				
- T1-12		Yes	100	Two with Schmorl's Nodes
Lumbar vertebrae				
- L1-5		L1-4	100	All with Schmorl's Nodes
Ribs (MNI)	Left	12		
	Right	6		One with osteophytes and porosity on articular surface of tubercle.
Sternum		Yes	100	

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

- manubrium		Yes	100	Not fused to body
- body		Yes	100	
- xiphoid		Yes	100	Not fused to body
Pelvis	Left			
- ilium		Yes	100	
- ischium		Yes	100	
- pubis			0	
Pelvis	Right			
- ilium			0	
- ischium			0	
- pubis			0	
Sacrum		Yes	Fragments	
Coccyx		Yes	30	S2
Humerus	Left	Yes	100	
	Right		0	
Radius	Left	Yes	50	
	Right	Yes	100	
Ulna	Left	Yes	75	Bleached
	Right	Yes	100	Bleached
Carpals	Left			
- scaphoid			0	
- lunate			0	
- capitate			0	
- triquetral		Yes	100	
- pisiform		Yes	100	
- trapezium		Yes	100	
- trapezoid		Yes	100	
- hamate			0	
Carpals	Right			
- scaphoid		Yes	100	
- lunate		Yes	100	
- capitate			0	
- triquetral		Yes	100	
- pisiform		Yes	100	
- trapezium		Yes	100	
- trapezoid			0	
- hamate		Yes	100	
Metacarpals (1-5)	Left	1-5	100	
	Right	1, 2	100	
Hand Phalanges (MNI)	L/R			
- proximal		6		
- intermediate		4		One with pathological changes
- distal		5		One with pathological changes
Hand sesamoids	L/R	?		
Femur	Left	Yes	100	Distal epiphyseal line still faintly visible

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

	Right	Yes	50	
Tibia	Left	Yes	100	Blood vessel impressions on medial midshaft
	Right	Yes	100	Extra articular facet on proximal end, blood vessel impressions on medial midshaft
Fibula	Left	Yes	100	
	Right	Yes	100	Bleached
Patella	Left	Yes	100	Vastus notch, degenerative changes on medial articular surface.
	Right	Yes	100	Vastus notch, degenerative changes on medial articular surface.
Tarsals	Left			
- talus		Yes	100	
- calcaneus		Yes	100	
- navicular		Yes	100	
- cuboid		Yes	100	
- 1st cuneiform		Yes	100	
- 2nd cuneiform		Yes	100	
- 3rd cuneiform		Yes	100	
Tarsals	Right			
- talus		Yes	100	Pathological changes – osteophytes
- calcaneus		Yes	100	Pathological changes – osteophytes
- navicular		Ye	100	
- cuboid		Yes	100	
- 1st cuneiform		Yes	100	
- 2nd cuneiform		Yes	100	
- 3rd cuneiform		Yes	100	
Metatarsals (1-5)	Left	1-5	100	
	Right	1-5	100	
Foot Phalanges	L/R			
- proximal		9		Includes both Px1 – neither with path
- intermediate		7		
- distal		7		2 intermediate + distal phalanges fused
Sesamoids (hand/foot)	L/R	4		

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

8) Dental inventory

Tooth	Side	Present	Wear Score*	Notes
Maxillary	Left			
I1		Yes	8	Horizontal wear
I2		Yes	8	Horizontal wear
C		Yes	7	More worn on lingual side
P1		Yes	7	More worn on lingual side. More worn on lingual/distal side.
P2		Yes	8	Fenestrated abscess.
M1		Yes	33	More worn on lingual/mesial side
M2		Yes	19	Horizontal wear.
M3		No		Lost ante-mortem, infection in surrounding bone
I1	Right	Yes	8	Horizontal wear
I2		Yes	8	Horizontal wear
C		Yes	6	More worn on lingual side
P1		Yes	7	More worn on lingual side
P2		Yes	8	Fenestrated abscess. More worn on lingual side.
M1		Yes	40	Fenestrated abscess. Worn lingually, including lingual root surface.
M2		Yes	n/a	Crown missing, broken root remains in socket
M3		No		Lost post-mortem
Mandibular				
I1	Left	No		
I2		No		
C		No		
P1		No		
P2		No		
M1		No		
M2		No		
M3		No		
		No		
I1	Right	No		
I2		No		
C		No		
P1		No		
P2		No		
M1		No		

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

M2		No		
M3		No		

*wear scores – incisors, canines and premolars after Smith 1984, molars after Scott 1979 – both reproduced with diagrams by Buikstra and Ubelaker 1994.

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Appendix 2: Copy of Forensic Odontologist's report

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DR ZAF KHOURI
FORENSIC ODONTOLOGIST

REPORT TO POLICE ON BONES FOUND AT WHITIANGA 14 NOVEMBER 2011

My full name is Zafer KHOURI.

My professional address is 1100 Victoria Street, Hamilton.

I am a duly qualified and registered dental surgeon and forensic odontologist. I hold the degree of Bachelor of Dental Surgery from the University of Otago and the Graduate Diploma in Forensic Odontology from the University of Melbourne. I am a founding member and past President of the New Zealand Society of Forensic Odontology. I am a member of the American Society of Forensic Odontology and a member of the Australian and New Zealand Forensic Science Society.

I hold fully credentialed status with the New Zealand Society of Forensic Odontology in the following scopes of practice:

- General Forensic Odontology Practice
- Forensic Odontology Extended Scope – Bite marks
- Forensic Odontology Extended Scope – DVI
- Forensic Odontology Extended Scope – Forensic Auxiliary Procedures

I have been involved in post-mortem identification work since 1980 and have attested to the identification of hundreds of individuals.

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APPENDIX 7: KOIWI ANALYSIS RESULTS, CONTINUED

On 21 November 2011, I received a telephone call from Detective Gavin HALL of the Thames Police.

Detective HALL requested my assistance with the examination of some bones, thought to be human skull bones and teeth, that had been found at a dump site on Link Road, Whitianga on 14 November.

The bones were thought to have come from excavation works that were continuing at Wigmore Crescent, Whitianga.

On 22 November 2011, I was visited at my rooms by Constable Laura STEINER of the Thames Police.

Constable STEINER gave me a sealed bag, which was immediately opened in her presence.

Observations:

The bag contained several dried & separated bony fragments and included several teeth:

- The cranial vault (top of skull) including most of the frontal bone and both parietal bones.
    - The inside of the cranial vault was infiltrated with a dense matte of vegetation roots.
    - The left parietal bone had a semi-circular depressed fracture of some 65mm diameter. This was due to post-mortem damage.
- There was a separate, near-complete occipital bone (base of skull) that extended from the lambdoidal suture only to the distal rim of the foramen magnum. This fragment had reasonably pronounced superior and inferior nuchal lines and external occipital protuberance (anatomical features suggestive of male sex).
- A separate left temporal bone (left side of skull) that included a small-to-moderate sized mastoid process and a gracile zygomatic process.
- A separate right temporal bone (right side of skull) that included a small-to-moderate sized mastoid process and a gracile zygomatic process.
- A fused middle 1/3 of the facial skeleton including:
    - Maxillae (both sides of the upper jaw), complete
    - Zygomatic bones (cheek bones), both sides

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- Sphenoid bone (base of skull bone)
- Part of an ethmoid bone attached.
- This bony complex also contained the following teeth:
  - 16, 15, 14, 13, 12, 11, 21, 22, 23, 24, 25, 26, 27
- The sockets of teeth 18 and 17 were well formed but were filled with sand.
- There were small fragments of root seen in the open sockets of tooth 17 and 18 after the sand was removed, suggesting that these teeth were lost either at or after the time of death.
- The location of tooth 28 showed signs of bony erosion, suggesting an infection may have been present for some time around this location.

- There were ten other small bony fragments that I did not attempt to identify.

Together, these disarticulated fragments constitute an almost complete cranium. The associated mandible (lower jaw) and mandibular teeth were not present.

Commentary:

There are undoubtedly additional unrecovered skeletal remains of this individual at one of the sites referred to above.

Recovery of the lower jaw (and lower teeth) and the pelvis would be very helpful in increasing the confidence around opinion evidence as to gender, given the conflicting features of the occipital and other bones.

Recovery of long bones, particularly of the lower limbs would allow an estimate of stature (height).

Post-mortem interval will be best estimated by radiocarbon dating. It is suggested that the University of Waikato Radiocarbon Dating Laboratory be contacted for assistance in this regard.

Conclusions:

/After an examination of the bones, I have come to the following conclusions:

1. The bones are definitely human remains;
2. The remains are those of a single individual;

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3. The bones had typical anthropologically 'Polynesian' characteristics;

4. The cranium appeared relatively diminutive, had small to moderate sized mastoid process and relatively sharp supra-orbital margins, no pronounced supra-orbital ridges and a broad upper dental arch with very worn, relatively small teeth – all indicative that the remains are most probably those of a female. The associated occipital bone, in contrast, showed more male features. It is my assessment that, on the balance of probability, this is a female specimen;

5. The individual was a skeletally mature adult, aged approximately 30 years when they died;

6. The remains were old – the post-mortem interval (time since death) is almost certainly many decades. These remains may well date back to pre-European times.

7. A more precise estimation of post-mortem interval will require radiocarbon dating.

8. I could not see any feature that would indicate a cause of death.

This statement is true to the best of my knowledge and belief and I make this statement knowing that it might be admitted as evidence at court and that I may be prosecuted for making a statement that is known by me to be false or intended by me to mislead.

Zafer KHOURI

Dated

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