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UNDERSTANDING AOTEAROA'S PAST THROUGH THE RECOVERY AND CONSERVATION OF A 15TH-CENTURY CANOE AND ITS FIBREWORK FROM PAPANUI INLET, OTAGO PENINSULA

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In 2001 Kirch and Green estimated that up to 80% of the material objects used in pre-European-contact Polynesian everyday life were of organic origin, emphasising the importance of wet organic conservation when at-risk archaeological assemblages are encountered. In keeping with this opinion, the discovery of a 15th-century assemblage of canoe sections and fibrework, eroding from the anoxic, archaeological site at Papanui Inlet, New Zealand (Fig. 1), is significant. Initially the *waka* 'canoe' findspot, J44/47 in the New Zealand Archaeological Association's (NZAA) Site Recording Scheme, was distinguishable by a wood section, 1.2 m long by 40 mm deep, which had been uncovered during low tide. Because of ongoing threat to the site with each tide, Te Rūnanga o Ōtākou, the Department of Conservation, and Heritage New Zealand Pouhere Taonga authorised a salvage excavation. The red rectangle in Figure 1 indicates the location of three recovery sites between 2007 and 2014. Findspots 005 and 006 are where the 6.33 m *waka* section and fibre assemblage were recovered in October 2014. GPS waypoints #111 and #135 indicate the location of additional canoe fragments, strakes and an outrigger recovered in December 2007 and August 2014 (Briden 2009, 2014).

IWI PERSPECTIVES OF ARCHAEOLOGY AT PAPANUI INLET

Te Rūnanga o Ōtākou is based at Ōtākou Marae on the Otago Peninsula and is one of 18 *papatipu rūnanga*[1] of Kāi Tahu,[2] the predominant *iwi* 'tribe' of Te Waipounamu (South Island). The Te Rūnanga o Ngāi Tahu Declaration of Membership Order (2001) states that the *mana whenua* 'traditional authority' of Ōtākou extends over a *takiwā* 'territory' of which Pūrehurehu (Heyward Point) forms the northern coastal boundary, and stretches southwards to

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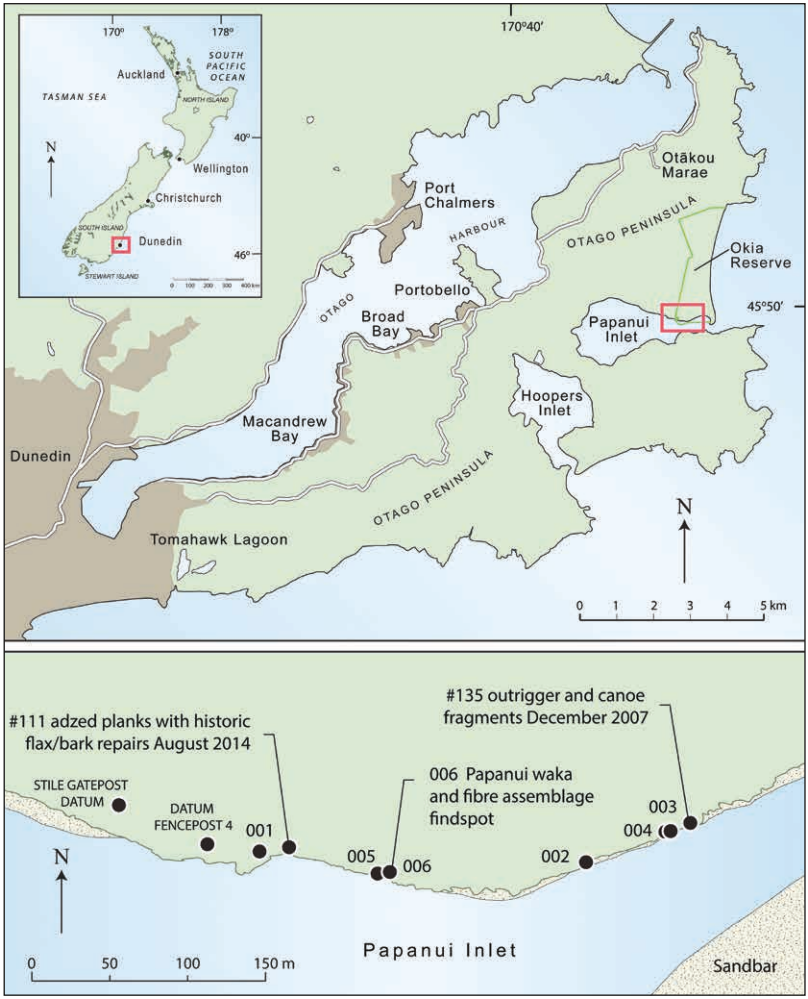

Figure 1. Location of the waterlogged *waka* sections and associated artefacts recovered from Papanui Inlet, up to October 2014.

the Mata-au (Clutha River), as well as sharing interests inland with other neighbouring *rūnanga*. *Mana whenua* is recognised through a long history of *whakapapa* 'genealogy', as well as occupation and use of the land.

Papanui Inlet is firmly within the stronghold of the *takiwā* of Ōtākou and features recurrently in the traditions of the *hapū* 'kinship group', particularly around the tensions between Kāti Māmoe and Kāi Tahu in the period prior to European arrival in southern New Zealand (Anderson 1998; Anderson and Tau 2008; Taylor 1952; White 1887). It was included in the Ōtākou Native Reserve, set aside from the sale of the Otago Block to the New Zealand Company in 1844 (Evison 2006). However, subsequent sales of land have seen ownership transferred firstly to Pākehā (non-Māori New Zealanders, predominantly of European descent) owners, before current joint ownership by the Dunedin City Council and the Yellow-Eyed Penguin Trust. Oral traditions passed down from generation to generation have emphasised the importance of the area to the identity of the people and *hapū* of Ōtākou. As *mana whenua* it is the responsibility of Te Rūnanga o Ōtākou to safeguard and act as a *kaitiaki* 'guardian' for its cultural heritage, both in its contemporary forms and in the forms that lie within the land and within the archaeological record.

The archaeological sites at Papanui Inlet and Ōkia Flat have been subject to fossicking for over 100 years. Amateur archaeological excavations peaking around the 1930s were followed by intermittent collecting by beachcombers. A number of significant *taoka* 'treasures or artefacts' and *kōiwi tāngata* 'human remains' have been removed from the site, particularly from locations that were considered *tapu* 'forbidden' to the people of Ōtākou. One such item, a wooden *atua* 'diety, supernatural being' (now housed in the Otago Museum), was removed from a cave burial at Ōkia in 1934, despite information provided to the amateur archaeologist of the connection between the *atua* and a particular *whānau* 'family' from Ōtākou (Sinclair 1940). The theft and misappropriation of cultural heritage has been a concern for *mana whenua* for many decades—accounts of actions such as leaving rotting cow carcasses at important sites as a deterrent for fossickers are still recounted in contemporary times (Pōtiki pers. comm. 2017). A level of frustration and sadness still remains over the disregard shown by curio collectors and so-called scientists towards the cultural identity and *taoka* of the people of Ōtākou.

Archaeology as a discipline is fixed in Western concepts of knowledge and originated in colonial ethnocentrism, which has resulted in a deep mistrust towards archaeologists by indigenous groups, not only in New Zealand, but also on a global level (Atalay 2006). Over the last 35 years, however, there has been a slow shift towards archaeologists working with the Rūnanga at Papanui Inlet. Initially this was in seeking permission to assess sites and inviting *mana whenua* representatives as accompaniment. During the last 15 years, there has

also been a concerted effort to involve *mana whenua* as active participants in decision-making processes regarding management and excavation (Briden 2009, 2014). This has advanced partly as a result of legislation but also from a growing awareness of archaeologists in acknowledging Māori authority and *tikanga* 'protocols and customs' and that *iwi* and archaeologists have shared goals in common (Phillips 2010). The collaborative nature of working together at Papanui Inlet has contributed to a deeper sense of connection within the *hapū* towards the landscape and has provided an opportunity, especially for the *rakatahi* 'youth' of Ōtākou, to engage with their history through archaeology and conservation projects in their *rohe* 'area'.

PREVIOUS ARCHAEOLOGY AND RECOVERIES AT PAPANUI

Papanui Inlet contains several Early Period sites which fit into a wider regional pattern of mobility first described systematically by Anderson (1982). Briefly, the inlet contains multi-function coastal sites that served as semi-sedentary and permanent bases. Comparable coastal sites are the 14th-century Shag River Mouth (Anderson and Smith 1996) to the north, together with Waitaki River Mouth and Papatowai occupied, both around 600 years ago (Anderson and McGovern-Wilson 1990; Anderson and Smith 1992). It is believed expeditions from the coast to temporary inland specialised function sites for resource procurement may regularly have occurred during this timeframe (Anderson 1982; Jacomb and Easdale 1986). Although formal investigation has not been undertaken at Papanui Inlet recently, Hamel (2001) proposed that the site is significant and possibly on a par with Waitaki River Mouth in terms of size and importance.

Currently the north-trending estuary channel in Papanui Inlet is causing considerable erosion of archaeological sites (J44/47) located in the sand dunes. This destruction, together with tidal erosion and recurrent severe weather events, has resulted in cultural material scattered over the foreshore, including tool kits of adzed wood wedges, adzes with grindstones and bird-bone awls and needles. *Taoka* have been collected by volunteers walking the Papanui Inlet foreshore west and east of the *waka* site for the last decade (Hamel *et al.* 2013; Wesley 2015). Since the initial recovery of a collection of waterlogged materials in 2007 (Briden 2009) and the subsequent 2014 excavation (Briden 2014) a steady stream of artefacts has continued to be salvaged from the area under Heritage New Zealand Authority 2015/170 and 2017/186 by Briden and a team of dedicated volunteers, *iwi*, archaeologists and other heritage professionals (Briden *et al.* 2017).

In light of ongoing active deterioration of Papanui Inlet's archaeological sites on the northern shoreline, an Authority to excavate (2017/827) has

been issued by Heritage New Zealand Pouhere Taonga to allow further systematic investigations. This excavation to recover at-risk environmental and archaeological information is planned for January 2018.

Figure 1 indicates the location of a structure excavated on the northern foreshore in December 2007 (Briden 2009). Timbers represented here included Tōtara (*Podocarpus totara*), Māpou (*Myrsine australis*), Kanuka (*Kunzea ericoidies*) and Mānuka (*Leptospermum scoparium*) with some possibly re-cycled *waka* elements and a collection of stakes similar to those found at Kohika in the Bay of Plenty (Wallace and Irwin 2004: 115). A well-defined outrigger (Fig. 2) made from Tōtara with distinctive holes from the pegs that formerly attached the outrigger to a cross-boom of the canoe, was recovered lying across the south of the structure (Wallace 2008). As Māori canoes had no keels, lateral stability, which is a prerequisite for sailing, had to be provided either by an outrigger or a second hull. Although the outrigger was not found in stratigraphic association with the canoe, it is possible it could be related to it given that Papanui Inlet is a sheltered location for settlement with good access to the sea, where an outrigger sailing canoe would have been well suited.

In addition four adzed *waka* planks were excavated in August 2014 (Briden 2014); one of these pieces had been historically repaired using Tōtara bark and mountain cabbage tree (*Cordyline indivisa*) strips, to cover a long split in the plank (Fig. 3). Three others had fine adzing present on the outside with rougher adzing on the inside (Figs 4 and 5). One, illustrated in Figure 4, has eight punched or drilled lashing holes along one surface. This plank may also have been lashed to the side of the hull dugout section to increase freeboard of the *waka*.

OCTOBER 2014 *WAKA* AND FIBRE RECOVERY

Following the discovery of the 1.2 m section of what appeared to be a canoe emerging from the Papanui foredune at findspots 005 and 006 (see Figs 1 and 6) in October 2014, it was decided to attempt to uncover the complete waterlogged wood feature. To do this the beach was cut back 1.5 m at right angles to the shoreline and 1.6 m of sand overburden was removed to reveal the 6.33 m long *waka*. Figures 6 and 7 show the location of the *waka* in relation to the Papanui Inlet estuary channel and the overlying sand dune.

There were two cultural layers visibly eroding from the sand dunes. These layers contain predominantly shell, mainly cockle (*Austrovenus stutchburyi*), with smaller amounts of Tuatua (*Paphies subtriangulata*), Pipi (*Paphies australis*) and mudsnail (*Amphibola crenata*). Five layers were identified and the *waka* lay within the lower cultural layer (Fig. 7).

Figure 2. Tōtara outrigger excavated in December 2007 about 150 m away from the *waka* site (Briden 2009). Note peg holes where the outrigger was attached to the cross-boom and main hull. Conserved by Johns at the University of Auckland Conservation Laboratory

Figure 3. This Tōtara plank, possibly a *waka* strake, is smooth on one side and roughly adzed on the other. A breached lashing hole is present on the flared end. A series of 14 holes have been drilled on either side of a split which runs almost to the end of the plank, and mountain cabbage tree cord has been used to repair this damage. Conserved at the University of Auckland Conservation Laboratory.

Figure 4. Adzed Tōtara plank with eight lashing holes along one edge. One hole contains organic material. The plank has rough adzing on one side and finer adzing on the other side, seen in the above image. Currently being conserved by Johns in the satellite laboratory at Ōtākou Marae.

Figure 5. Tōtara plank with one punched hole. Note rough adzing on the inside and a smoother outer surface to prevent drag in the water. A groove, possibly from lashing or rigging, is present on the smooth side. Recovered August 2014. Currently being conserved by Johns in the satellite laboratory at Ōtākou Marae.

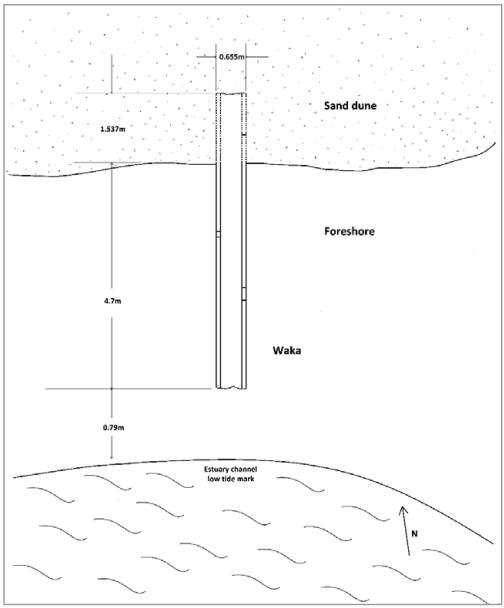

Figure 6. Plan showing *waka* location in relation to estuary and sand dune foreshore, during excavation October 2014.

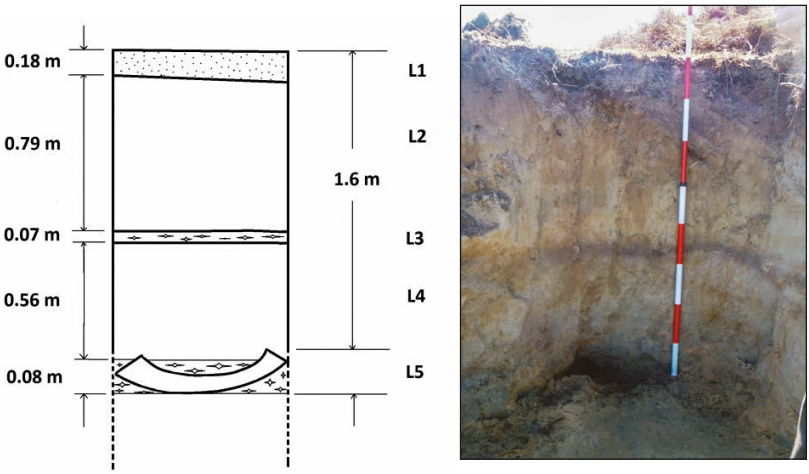

Figure 7. Diagram and photograph of the stratigraphy above the *waka*.

The layers were briefly as follows:

Layer 1: topsoil humus, dark grey to black, coarse-grained sand, to 18 cm below the ground surface

Layer 2: clean non-organic, non-cultural, coarse sand, down to 97 cm below the ground surface

Layer 3: cultural layer, charcoal-flecked, dark grey sand, 7 cm thick

Layer 4: clean non-organic, non-cultural, coarse sand, down to top of *waka* at 1.6 m depth

Layer 5: cultural layer, charcoal-flecked dark grey to black sand, 8 cm thick. The layer was located outside the *waka*, on the west side at 4 cm below current foreshore sand level and only cockle shell (*Austrovenus stutchburyi*) was evident at this level.

A uniform brown/grey discoloured sand with plant fibres from 9 to 30 cm depth was inside the *waka* hull. The sand was removed from either side of the *waka* to 1.9 m wide, enabling room for people to work and ultimately release the *waka* from its resting place (Fig. 8). Recovery entailed the *waka* being lifted onto a padded ladder and floated to a sandbar, and then attaching the *waka* to a whale pontoon in preparation for *iwi* members and volunteers walking the ensemble across the inlet to the south side, where a digger was waiting to lift it out of the water.

Figure 8. Kiringaua Cassidy of Te Rūnanga o Ōtākou keeps a watchful eye on proceedings during the final stages of freeing the Tōtara *waka* from its sandy matrix. Keeping the degraded wood wet and cool with saturated sacks was an important first conservation step for the *waka* to prevent irreversible damage to the degraded wood.

ANALYSIS OF THE PAPANUI CANOE HULL

The Papanui canoe hull, recently documented in Irwin *et al.* (2017: 36-37), came from a large *waka*. Two associated pieces of flax cordage (*Phormium tenax*) and one hank of processed but unidentified fibre (Wallace 2015) have provided radiocarbon dates to the mid-to-late 15th century for the *waka*'s last use (Table 1). Both the ends and the sides of the hull are missing, so the original dimensions are unclear; however, the remaining piece is 6.33 m long and as much as 0.65 m wide. Undoubtedly, it is the main body of a large dugout hull, but we are unsure whether the original hull was carved in a single piece or in two long sections joined together (Irwin *et al.* 2017: 36).

A notable feature is a longitudinal ledge inside the hull running the length of one side with a flat adzed surface approximately 40 mm wide. Traces of the matching ledge survive on the other side of the hull, which indicates the hull was bilaterally symmetrical (Figs 9 and 10). These ledges could be an early feature. They added longitudinal strength to the hull similar to a girder, which allowed the hull to be carved thinner and lighter above and below. The ledges could also have supported internal canoe decking or other fittings, and two lashing holes present on this side of the canoe, one of which is visible in Figure 11, support this suggestion. More holes may have been

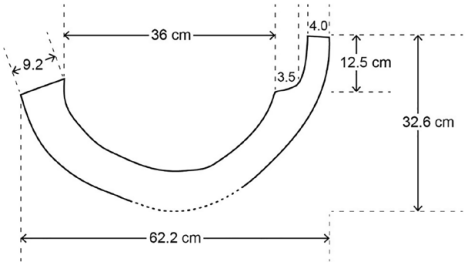

Figure 9. Cross-section at the south end of the *waka* prior to complete removal from the site. Note the longitudinal ledge down one side and the remnant flare of a corresponding ledge on the other side, illustrating bilateral symmetry.

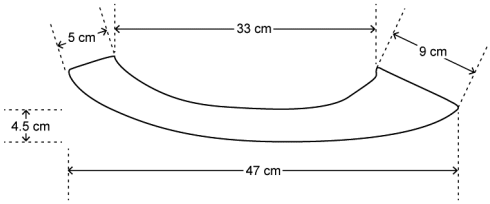

Figure 10. Cross-section of the *waka*'s broken north end recovered from underneath the 1.6m deep sand dune.

present originally, but the breakage of the upper sections of the *waka* limits interpretation of strakes or an outrigger float being attached to the hull.

It is very likely that the freeboard of the hull was originally raised by planks or side strakes. No original gunwale or lashing holes survive, however, at least two adzed planks (e.g., Fig. 4) have a series of lashing holes along one edge, which may indicate that side strakes were used to increase freeboard of the dugout vessel.

Two rectangular sections have been cut out of the hull on the opposite side to the longitudinal ledge and both measure c. 130 mm long by 100 mm high. The function of these is at present unclear; however, they may indicate reuse or recycling of the hull (Fig. 12).

The hull was laser scanned on-site using a Leica Scan Station C10 Laser Scanner. Prior to scanning, the exposed end, seen in Figure 9, suggested that

Table 1. AMS radiocarbon dates of Papanui Inlet fibrework and the Henley *waka* hull timber.

Provenance[1]	Waikato lab number	Material submitted	Conventional ^{14}C age BP[2]	Cal range (68%) AD[3]	Cal range (95%) AD[3]
Papanui Inlet, Sample #51, from under the hull	Wk40630	Processed flax fibre (*Phormium tenax*, Harakeke)	463 ± 21	1442–1464	1435–1496
Papanui Inlet, Sample #25, from inside the hull	Wk40628	Unidentified processed fibre	456 ± 24	1445–1479	1436–1500, 1597–1611
Papanui Inlet, Sample #38, from inside the hull	Wk40629	Processed flax fibre (*Phormium tenax*, Harakeke)	440 ± 21	1450–1488	1446–1502, 1594–1613
Henley *waka* hull	Wk44686	Wood, Matai (*Prumnopitys taxifolia*)	386 ± 24	1480–1512	1461–1526

[1] All samples were submitted by Johns (see also Irwin *et al*. 2017: 34).
[2] The carbon-13 stable isotope value (δ^{13}C) was measured on prepared graphite using the AMS spectrometer, therefore the radiocarbon date has been corrected for isotopic fractionation. However, as the AMS-measured δ^{13}C value can differ from the δ^{13}C of the original material this value is no longer provided by the Waikato Radiocarbon Dating Laboratory.
[3] The dates were calibrated using SHCal13 (Hogg *et al*. 2013) and OxCal v4.2 (Bronk Ramsey 2009).

Figure 11. The Papanui *waka* hull in situ. Note lashing hole on the bottom left to fix a seat or another fitting into place on the longitudinal ledge. The bung of Tōtara bark was found dislodged from this hole during recovery.

Figure 12. Base of the Papanui *waka* showing the flat keel facet on the hull. Note rectangular cutouts on the damaged side of the canoe where only remnants of the longitudinal ledge were visible.

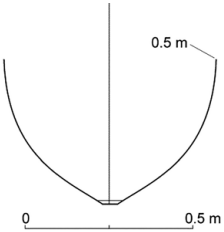

Figure 13. A scanned profile of the Papanui hull section 0.5 m from the wider (southern) end. Note the flat keel facet similar to the Henley canoe, also from Te Rūnanga o Ōtākou *rohe*.

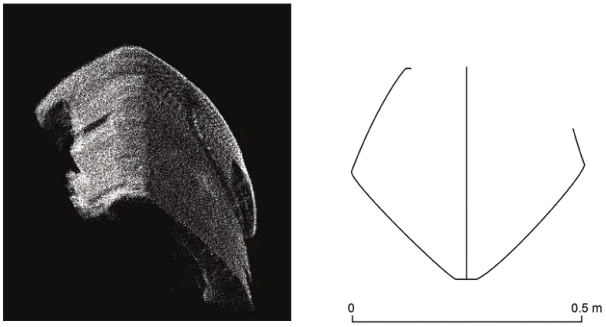

Figure 14. A scanned image of the Papanui *waka* (left) showing the flat facet along the keel line and a drawing (derived from scanning) of the profile of the later Henley *waka* in mid-section (right), which displays the same feature.

the hull profile had a rounded cross-section. Scanning of the complete hull, however, revealed that in fact the cross-section was V-shaped, as shown in Figure 13. There is also a suggestion of a soft shoulder, representing a slight change of angle in the upper sides of the surviving hull. A noteworthy feature of the hull, also identified in the later Henley canoe from the same region (see below), is a flat narrow facet along the keel line (Fig. 14), which would be useful when the canoe was launching or landing (Irwin *et al*. 2017: 39). The underwater form of the Papanui *waka* suggests a durable sailing canoe used for coastal transport (Irwin and Flay 2015).

WIDER SOUTH ISLAND AND KĀI TAHU *WAKA* COMPARISONS

Conservation of canoes and canoe fittings in the South Island over the last 20 years has resulted in a wide-ranging study sample that spans much of the pre-European period (Irwin *et al*. 2017). These include the remains of a canoe hull from Mokomoko Inlet, Foveaux Strait (Dudfield 2011; Johns 2012), a piece of decking from Doughboy Bay, Rakiura (Stewart Island) (Johns 2000), and a carved canoe prow (or stern piece) from nearby Mason's Bay (Gillies and Skerrett 1996; Johns 1996). In addition there is the well-known complete plank from a complex composite early sailing canoe recovered from Anaweka on the northwestern coast of the South Island (Johns *et al.* 2014). Outriggers have been found at Monck's Cave (Skinner 1924) and Lake Brunton in Foveaux Strait (Williams and Gillies n.d.) as well as at Papanui. Clearly coastal communications were extensive and canoe transport was effective on the exposed coasts of the South Island and Rakiura (Stewart Island).

The Papanui *waka* section is from the main body of a large hull, but it is uncertain whether the hull was carved in a single piece, or in more than one large section like the Anaweka *waka*, or with detachable ends (*haumi*), as described ethnographically by Best (1976; see also Haddon and Hornell 1997). Simple butt joints in the hull can be regarded as an early feature, as with Anaweka (Johns *et al.* 2014), and mortise and tenon joints as a later feature, as seen at Kohika (Wallace and Irwin 2004: 104), but neither are present on the Papanui *waka*.

The Papanui hull is firmly dated to the 15th century AD, which is early in New Zealand archaeology, yet it was already strikingly different from the canoe section found at Anaweka dated to the 14th century AD. Evidently canoe construction had already adapted to the New Zealand environment and the abundance of large straight-grained trees. Papanui was a sizeable dugout canoe with sides raised by planks, whereas Anaweka had a less extensive dugout underbody with more substantial carved planks attached on both sides. A longitudinal stringer in the Anaweka piece featured both notches and lashing holes for attachment of other sections of the hull, which contrasts with the more robust longitudinal ledge or girder in the Papanui hull. Another difference is the ribs present in the Anaweka plank, which are absent at Papanui.

In general, the Papanui canoe could be described as an adaptation from early canoes made of planks similar to the Anaweka *waka* towards the later Māori dugout canoes sighted by New Zealand's earliest European explorers in the 17th century. We think these details, in the absence of a larger sample of form variability, demonstrate a clear technological change which can be regarded as an early adaptation of East Polynesian canoe technology to New Zealand.

Another interesting comparison can be made with the Henley canoe, a small one-piece *waka* found around 1895 in the Taieri Plain south of Dunedin (Best 1976), and identified by Wallace (2016) as Matai (*Prumnopitys taxifolia*). It has a deep and narrow hull 6.95 m long and 0.50 m deep (Fig. 14). Like the Papanui *waka*, the hull has a V-bottom with a flat facet 5 cm wide along the keel line (Figs 12, 13 and 14). However, unlike Papanui, the radiocarbon date first published in Irwin *et al.* (2017: 34) for the Henley canoe hull suggests it is late but pre-European (see Table 1). These two canoes show a continuity of form over time in the same region of the South Island. Without an outrigger the narrow Henley canoe would have been unstable in the water, however there are holes in the gunwale for attaching an outrigger. The Papanui canoe could have had a double hull, but we have also noted the presence of an outrigger close to the *waka* recovery site. Both canoes were certainly sailing canoes, but they could also have been paddled as necessary.

WATERLOGGED FIBREWORK

Typically, fibrework excavated from wet archaeological sites is in an advanced state of degradation and, if not immediately attended to after exposure, usually survives in poor condition, creating analysis and interpretation complications. Consequently, only a few examples of wet archaeological fibrework exist in the literature, highlighting the importance of this Papanui collection. Earlier notable examples include Lander (1992), who worked with the charred, wet cloak fragments excavated from Raupa on the Hauraki Plains; the 12-strand, round cordage recovered from Mason's Bay, Stewart Island (Gillies and Skerret 1996); McAra's work (2004) which described the woven fabrics, rope and netting excavated from Kohika; and Smith's (2014) analysis of the damp, carbonised material from Kaitorete Spit, Lake Ellesmere, interestingly another lower South Island site occupied at a similar time to Papanui c. 500 years ago (Jacomb *et al.* 2004; Johns 2011a and b; Johns 2013). At present, the importance of the waterlogged fibrework recovered at Papanui is that it has allowed accurate dates for the last use of the *waka* and the site to be established, as the radiocarbon dates were on short-lived materials, in close agreement with each other, and with small standard errors (Table 1). The Henley *waka* sample, in contrast, was taken from outer tree rings of the manufactured canoe. Because an indeterminate amount of wood was removed during construction, the associated date (Table 1) contains an unknown amount of inbuilt age. Consequently, all we can currently confirm with confidence in this case is that the canoe is younger than the tree it was made from.

The degraded fibrework was preserved in anoxic, sandy layers inside and underneath the hull (Figs 15 and 16). Each section was carefully removed, frequently with the aid of a gentle stream of water as an excavating tool. In

Figure 15. Recovering braided fibrework c. 500 years old, from the anoxic layers inside the hull (Sample 51 in Table 1).

Figure 16. Hank of processed and folded material, yet to be identified, found inside the Papanui hull, dated to 456 ± 24 BP (see Table 1).

keeping with Connor's (1983) classification of Māori fabrics, the collection consists of 51 three-ply braided cordage lengths, where the three elements of one set are interworked across one another in an ordered fashion to produce a narrow fabric. The three-ply braided fragments range in size from 45 mm to 75 mm long and are up to 19 mm wide. One short length, No. 20, has a knot at one end which may have been a commencement or finishing knot. All the braided fragments, with one exception, were identified as being manufactured from prepared or dressed flax leaves (Wallace 2015). Examination of the one exception under high magnification revealed it was made from strips of unprepared flax leaf rather than the dressed fibre. In addition to the above braided cordage a large hank of prepared, and yet to be identified, folded fibrous material was found in the hull (Wallace 2015) (Fig. 16).

As Best (1977: 34) explained, Māori are "extremely dexterous at the work of manufacturing small cord and twine. Their fishing-lines and fine-binding twine … were marvels of neat work", and this is reflected in Papanui's material, as most of three-ply braids are neat and flat. However their thicknesses and widths vary, as some of them are fine and tight while others have a coarser thread and looser tension. Unfortunately a few of the ends are degraded, unravelled and frayed, making it difficult to discern manufacture.

At this stage it is thought the cordage was probably linked to fishing or rigging activities. However, our conclusions are based on limited analysis to date and remain speculative. We anticipate textile specialists will comprehensively analyse this important assemblage at a future date.

CONSERVATION OF PAPANUI WATERLOGGED ORGANIC MATERIALS

In order to survive, waterlogged wood artefacts are usually surrounded by an impervious matrix, which reduces fungal and bacterial decay due to the lack of oxygen. However, prolonged anoxic conditions, similar to those in which archaeological deposits are found, result in slow hydrolysis of hemicellulose and cellulose from the cell walls. This deterioration leaves behind a lignin framework in which water resides. If the water which fills the degraded cell walls and lumen evaporates, the weakened cell walls, which cannot resist capillary forces, collapse inwards. This cell collapse is an irreversible process. Cell collapse of waterlogged wood artefacts manifests itself in many ways, including distortion, warping, cracks, splitting, delamination and, in extreme cases, complete disintegration of the artefact. Because most of the material at Papanui was in an advanced state of degradation, conservation began as soon as the site was opened in an attempt to prevent this irreversible damage (Gregory and Jensen 2006; Johns 2001).

Excavation is a crucial stage for waterlogged artefacts for four main reasons: loss of support during removal of the matrix in which the artefacts

may have existed for hundreds of years, increased oxygen and light resulting in increased biota levels, water evaporation from the deteriorated organic artefacts and surrounding matrix, and post-excavation handling (Johns 2013). During recovery, the wood was kept supported as it was exposed, and light levels and water loss were kept to a minimum by covering the *waka* in sacks which were rewet at frequent intervals.

Prior to the excavation a brief was issued to the builder to construct a plywood tank which could be used to contain the freshly excavated *waka* and amended later for conservation treatment. The tank was manufactured as excavation progressed, and we communicated frequently with the builder throughout the recovery to request additional length as more of the buried *waka* was exposed. The *waka* tank increased from an initial request of 2 m to a final length of 7 m. *Kaumātua* 'elder' Edward Ellison made available a secure, interim home to house the tank, which was lined with plastic sheeting prior to being filled with rainwater and the canoe being lowered into it.

After the excavation, discussions with Te Rūnanga o Ōtākou addressing the feasibility of treating the *waka* on the peninsula took place, and it was decided that Johns would establish a satellite conservation laboratory at Ōtākou. Locating the large, fragile, two-tonne, waterlogged canoe close to its source community had the added advantage of reducing the inevitable risk and expense involved with transporting the *taoka* to an alternative venue. Accordingly, in December 2014 the *waka* was moved to its new treatment venue at Ōtākou Marae (Fig. 17).

As with all conservation projects, assessment of the artefacts prior to, during and after treatment is an integral part of a conservation regime. For this project measurements to calculate tangential, radial, longitudinal and volumetric shrinkage together with wood identification, species-specific moisture content calculations, estimates of specific gravity (SG) and calculations of percentage of cell matter lost though deterioration were completed. These tests were used in conjunction with other visual and microscopic appraisal for waterlogged wood assessment (Hoffman 2013).

On the completion of the above assessments, the first 15-month phase of treatment for the *waka* commenced. This included washing to clean sand and other inorganic materials from the whole surface and the removal of chlorides from the salt-impregnated artefact. Subsequently a treatment regime was designed using the synthetic polymer of ethylene oxide, Polyethylene Glycol (PEG or polyoxy 1-2 ethanediyl), as the principal conservation chemical. Because both sound and degraded wood are represented, stages will involve incorporating a low-molecular-weight PEG to limit cell-wall shrinkage and one of a higher molecular weight to offer some structural strength to the heavily degraded wood (Hoffman 2009).

Figure 17. Purpose-built satellite conservation facility at Ōtākou Marae, Otago Peninsula. The polycarbonate-clad enclosure provides dry, secure storage for conservation chemicals and promotes higher temperatures during cooler months of the year to facilitate treatment progress. Additional shelving and small tanks have now been installed to accommodate the continuous stream of artefacts as they are recovered.

Controlled drying of the *waka* will take place in the existing satellite conservation facility by slowly lowering the relative humidity inside a bespoke plastic enclosure. Data loggers, to record environmental conditions in the enclosure, have been installed and will be reviewed remotely at regular intervals as required. A comprehensive conservation plan for the storage and display of Papanui's *taoka*, involving all parties, will be finalised in advance of treatment completion.

Shortly after completion of the *waka* recovery Te Rūnanga o Ōtākou and the conservator decided conservation of the fragile, waterlogged cordage would be better undertaken in a controlled laboratory environment at the University of Auckland rather than at the satellite *waka* facility. Conservation of these *taoka* is now complete and packing will occur shortly with input from Te Rūnanga o Ōtākou prior to the materials returning home.

Currently the Heritage NZ Authority (2017/186), issued for a five-year period in September 2016, ensures recovery of significant *taoka* and *kōiwi*

tāngata from the Papanui northern shoreline with the help of volunteers. Materials are recovered regularly from the site, washed and subsequently delivered to the satellite conservation laboratory at Ōtākou Marae, where they are assessed and registered for conservation with the Ministry for Culture and Heritage under the Protected Objects Act (1975), and conservation commences.

* * *

During the last few years archaeological discoveries at Papanui Inlet have improved our knowledge, particularly in the areas of collaboration and conservation of waterlogged organic materials. Below we discuss how each has contributed to this study.

Collaboration

Behind each *waka* recovery lies a team of indispensable collaborators from a wide range of specialities. For this project they included archaeologists, heritage and ecological professionals, material culture specialists, engineers, builders, wood and fibre identification specialists and radiocarbon laboratories who have complemented each other to ensure a comprehensive and successful outcome.

The recognition of Māori authority and *tikanga* at the outset of the project firmly established a two-way relationship with Te Rūnanga o Ōtākou who hold *mana whenua* for the inlet and confirmed our opinion that source communities justifiably expect to be able to share responsibility for protection their *taoka*. For the Rūnanga, this has strengthened spiritual connections to a significant location in the *hapū* identity, particularly for the *tamariki* 'children' that participated in the excavation. It also renewed relationships, paving the way for further collaboration around the management of Papanui Inlet and the conservation of the *waka* in the future. This project has also benefitted from a large number of volunteers, including members of Te Rūnanga o Ōtākou, over an extended period of time, who have given their time to safeguard Papanui's archaeological heritage.

Waka *and Fibrework*

Analysis and conservation of the wet organic materials found at Papanui has provided a hereto unavailable glimpse into the life of Papanui Inlet's inhabitants around 550 years ago. The rare assemblage of three-ply cordage and processed fibre recovered from Papanui allowed accurate dates to be established for the site and its contents.

In addition, laser scanning reconstructions verify that the Papanui and Henley *waka* were early, substantial and effective coastal sailing canoes which could easily have come from a large double canoe or from an outrigger canoe up to 150 years before Tasman sighted double canoes in Golden Bay. Unexpectedly we found that the canoes fitted into an emergent timeframe

for early canoe forms conserved in New Zealand over the last 20 years, as discussed in Johns *et al.* (2014) and more recently in Irwin *et al.* (2017).

Our results suggest some of New Zealand's earliest immigrants adapted quickly to their new home using endemic timbers and modifying their canoe manufacturing skills to enable changing *waka* practises soon after their arrival, culminating in the production of lighter, faster craft capable of offshore voyaging which was readily available at Papanui Inlet and, for the Henley canoe, via the Taieri River close to the Henley canoe findspot.

At present we conclude the wet organic material recovered from different locations along Papanui Inlet on the northern foreshore points to a probable *waka* wreck, construction or refitting site, with *waka* components being manufactured, repaired and recycled there.

Conservation

As outlined earlier, reaching post-excavation equilibrium for artefacts recovered from wet sites is imperative in order to ensure their optimal survival, and this was demonstrated at Papanui both on-site and post-excavation as we worked through infrastructure requirements to establish the satellite laboratory. More importantly conserving *taoka* on-site within its source community permits *iwi* participation and the sharing of cultural knowledge strengthening spiritual and ancestral connections to their past, which we believe is especially important for all parties involved.

Future Work

The continual recovery of organic artefacts from the northern shore of Papanui Inlet over the last ten years has emphasised its status for new information enabling us to understand New Zealand's past though the study of wet organic materials. Ongoing research exploring different avenues for dating and analysis of the *waka* are underway and an imminent excavation will no doubt continue to reveal the archaeological prominence of Papanui. Regardless of impending discoveries, from now on, the Papanui *waka* and associated materials will always be considered as an inalienable emblem of Papanui Inlet and Te Rūnanga o Ōtākou into the future.

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NOTES

1. *Papatipu* is defined as the ancestral home, customary title, or traditionally owned land. A *runanga* is a Māori assembly or council.
2. Kāi Tahu is southern dialect for Ngāi Tahu. The Kāi Tahu dialect is used in this article, as for example, *taoka* rather than *taonga* 'treasures, artefacts' and *rakatahi* for *rangatahi* 'youth'.

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ABSTRACT

When Tasman and Cook arrived in New Zealand in 1642 and 1769 respectively they both sighted double-hulled canoes (*waka*) on New Zealand's coast. However, over the next 100 or so years these canoes disappeared. Fortuitously the recent rescue and conservation of a waterlogged *waka* and fibrework assemblage on the shores of Papanui Inlet has allowed rare insight into the lives of its inhabitants nearly 550 years ago, when New Zealand's seminal migrants established themselves in the remote south of New Zealand. These discoveries reinforce traditional stories around early Māori occupation of Te Waipounamu and offer additional clarification of *iwi* 'tribal' activities in their local environment many generations ago. Conservation of these *taoka* 'treasures' on Ōtākou Marae has provided easy, continuous access for descendants of the *waka* to their *taoka* throughout the process and aided the development of constructive relationships for *iwi* and conservation and archaeological agencies. Here we discuss recent fieldwork with an emphasis on conservation, cross-cultural engagement and the assemblage recovered to date, followed by comparison of the *waka* reported here with another discovered within the Te Rūnanga o Ōtākou *rohe* 'territory' over 120 years ago by Elsdon Best. Imminent investigations to excavate cultural material from Papanui Inlet's actively degrading coastline are scheduled for January 2018, and the resulting environmental and archaeological information from this research will be discussed fully elsewhere.

Keywords: conservation, archaeology, canoe, wet organic, Māori, New Zealand

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