Site S14/331, NIMT Bridge 273: archaeological investigation (HNZPTA authority 2015/59)

report to
Heritage New Zealand Pouhere Taonga
and
KiwiRail Ltd

Arden Cruickshank, Jacqui Craig and Beatrice Hudson

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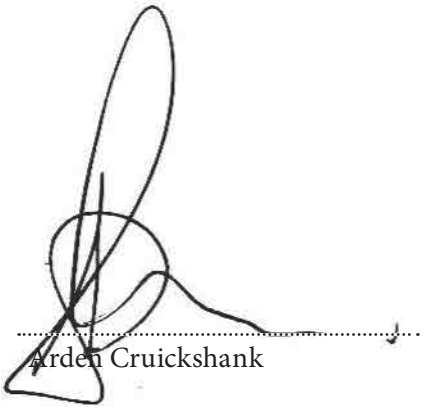

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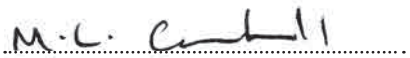

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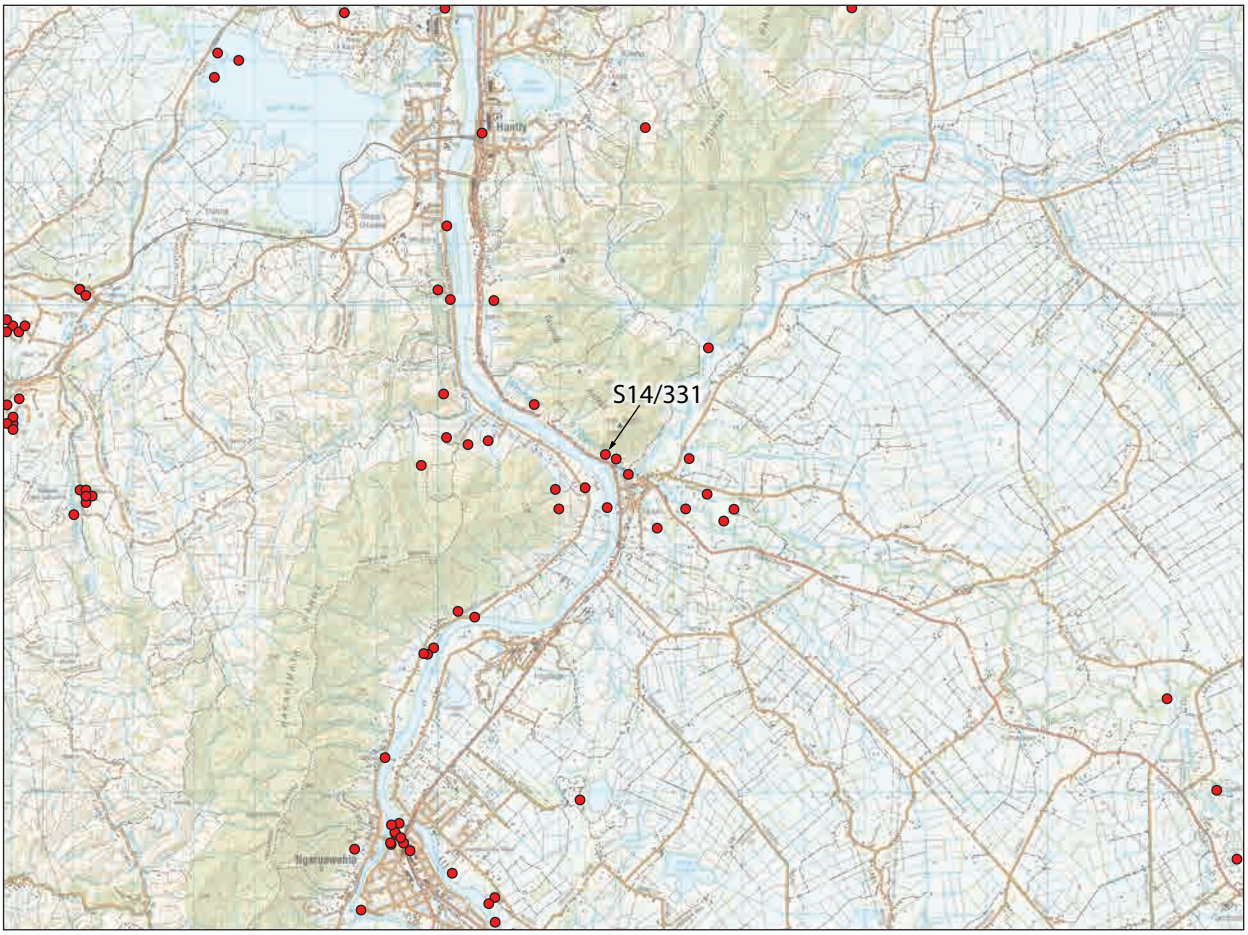
Cover image: Alfred Sharpe. View of Taupiri village and plain from the top of Little Taupiri Hill. Sunset. 1876. (Auckland Art Gallery Toi o Tāmaki, gift of the Rev Charles Palmer, 1951. 1951/10)

Site S14/331, NIMT Bridge 273: archaeological investigation (HNZPTA authority 2015/59)

Arden Cruickshank, Jacqui Craig and Beatrice Hudson

KiwiRail replaced Bridge 273 and realigned the North Island Main Trunk line (NIMT) at Taupiri to accommodate the new bridge. The new bridge crosses the Mangawara Stream at the same location as an earlier 1937 bridge and close to the location of the original 1877 bridge. The northern portion of the bridge and the rail realignment is within ground used by Waikato Tainui as an urupa. An archaeological assessment was undertaken in 2014 (Cruickshank and Campbell 2014) in which site S14/331 was identified as a sparse midden scatter within the new rail alignment. This site was unable to be avoided, and archaeological authority 2015/59 was granted by Heritage New Zealand Pouhere Taonga (HNZPT) to modify or destroy the site as part of the works. Investigation of the site began on 16 October 2014 and was completed 23 March 2015.



1. Location of S14/331. The hills to north and south of the site form the north west boundary of the Waikato Basin.

Background

Environment

Taupiri Maunga is the western most tip of the Taupiri Range, an outcrop of late Triassic rocks of the Newcastle group of the Murihiku Terrane. The Newcastle Group forms both the Taupiri and Hakarimata ranges, which are separated by the Taupiri Gorge (Edbrooke 2005: 13). These ranges form the northern rim of the Waikato Basin, a geological catchment which is one of the most agriculturally productive regions in New Zealand.

Following the eruption that formed Lake Taupo 27,000 years ago the immediate vicinity was blanketed with pumice. The lake level built up to 120 m higher than its current level, but a catastrophic breakout flood around 22,000 years ago lowered the lake level by 80 m and huge quantities of pumice were swept down the Waikato River. The river formed a new course that took it through the Waikato Basin to exit at Taupiri before flowing to the Tasman Sea, rather than to the Hauraki Gulf, where it had flowed previously. Much of this pumice and associated sands and gravels were deposited across the basin as the Hinuera formation. The river formed multiple routes across the basin before settling into its current course. The Hinuera formation has since been blanketed with several layers of alluvium and volcanic tephras that form the fertile agricultural soils of the Waikato (McCraw 2011).

Pre-European Maori history

The pumice sands and gravels of the Hinuera formation were exploited by Maori for kumara cultivation. Sands were mined in 'borrow pits' and added to the overlying loams, either as a sheet mulch, dug in to the soil or in small planting hollows that may have had growing mounds (puke) over them. These friable, made soils encouraged kumara tubers to grow fat, rather than long, which made them survive winter storage better. Garden areas are often recorded on the basis of borrow pits, which can be extensive, as well as subsurface evidence of made soils (Gumbley et al. 2003; Campbell and Harris 2011; Campbell 2012).

To the east of the Waikato Basin sits the Hauraki Basin, which was the previous route of the Waikato River (McCraw 2011). The Hauraki Basin, which had silted up through sediment deposits carried by the Waikato, and subsequently by the Waihou and Piako Rivers, eventually became the largest wetland in New Zealand (Hatvany 2008). This wetland was utilised by Maori as a rich source of eels and waterfowl, which was able to be accessed by following the Mangawara Stream inland from Taupiri.

The area surrounding Taupiri has a long and extensive occupation history. There are numerous sites in the area connected with gardening, with borrow pits and modified gardening soils. There are several important pa near Taupiri, including Kaitotehe, home of Potatau Te Wherowhero (S14/7) on the other side of the Waikato river (Kelly 1940: 157). This site is located at the base of Taupiri Maunga which also contained a pa (S14/6) and later became a prominent urupa for Tainui and the kingitanga, and which is still in use.

Taupiri

Taupiri Maunga has long been a prominent feature of the landscape, strategically located at the confluence of the Mangawara and Waikato Rivers. The summit commands a wide view of the area. To the east lie the Mangawara and Komakorau Streams with the hills above Piako in the distance; west is the Taupiri gorge, and south the Waikato Basin. Visible from the ramparts of the pa were also the villages

of Kaitotehe and Pepepe, on the opposite bank of the river, and communication was occasionally kept up by a system of signalling (Kelly 1940).

Taupiri was also the centre of several important transport routes, the most important of which was the Waikato River. Another was a track which, starting from Taupiri, followed the Mangawara to the Piako Valley and eventually to Hauraki or Tauranga. Another commenced from Kaitotehe and, following the ridge of the Hakarimata Range led, by a series of ridges, to Aotea and Kawhia. The swamps and lagoons in and around Komakorau teemed with eels and birds, important food sources. Fish and other seafood were occasionally obtained by expeditions to the coast or from the people living at the mouth of the river (Kelly 1940).

The maunga was the home of Te Putu, a prominent chief of the Waikato Tainui. He was killed by Nga Tokowaru of Ngati Raukawa following a battle at nearby Pepepe, which led to the abandonment of the Taupiri pa (Kelly 1940: 155). The pa became tapu, which was still enforced at the arrival of Europeans, with early travellers noting that they were required to cross the Waikato River and head up the opposite bank when travelling past (Kelly 1940: 157). Eventually, the pa became an urupa, which is the final resting place for Waikato Tainui and the kingitanga.

19th century history

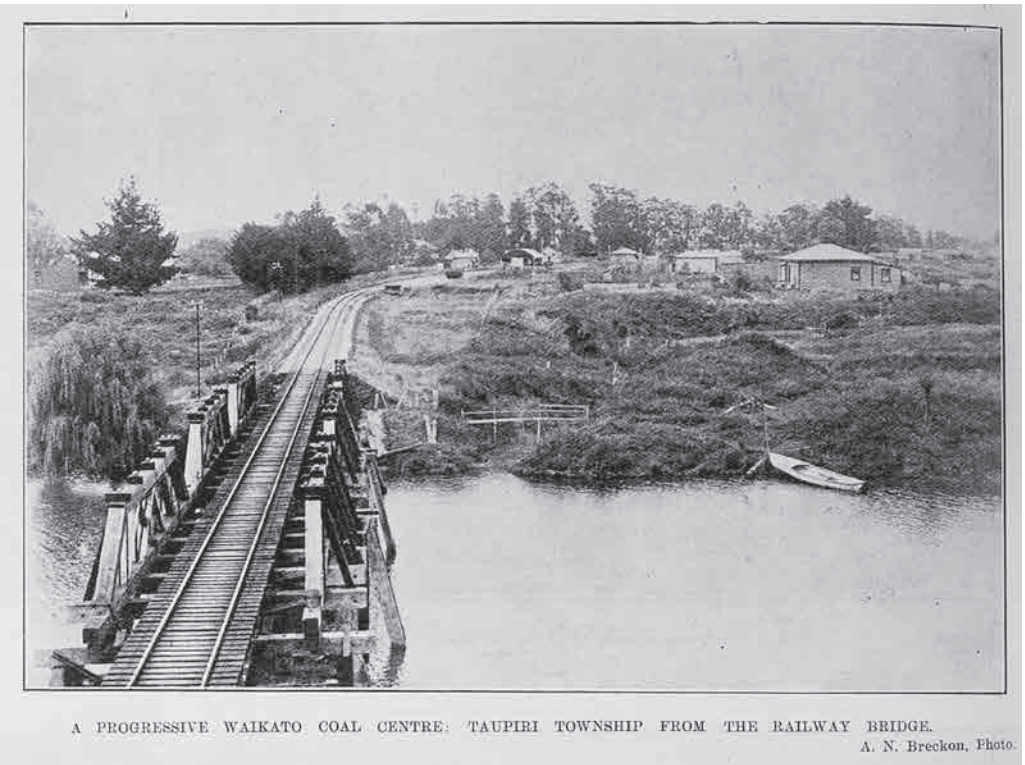
The original crown land grant of 150 acres in the area in which Taupiri Township is located was granted in 1867 to George Edward Thoms (Innes 1989: 05). Taupiri then saw settlement by Europeans in the 1870s and served as an important centre for flax production (Swarbrick 2012). Taupiri Township was surveyed and town lots of approximately half acre blocks were plotted out to encourage settlement. Although there was plenty of flax and production was booming, it was difficult to get produce to the markets, which required taking a horse and cart up the Great South Road to Auckland.

The North Island Main Trunk

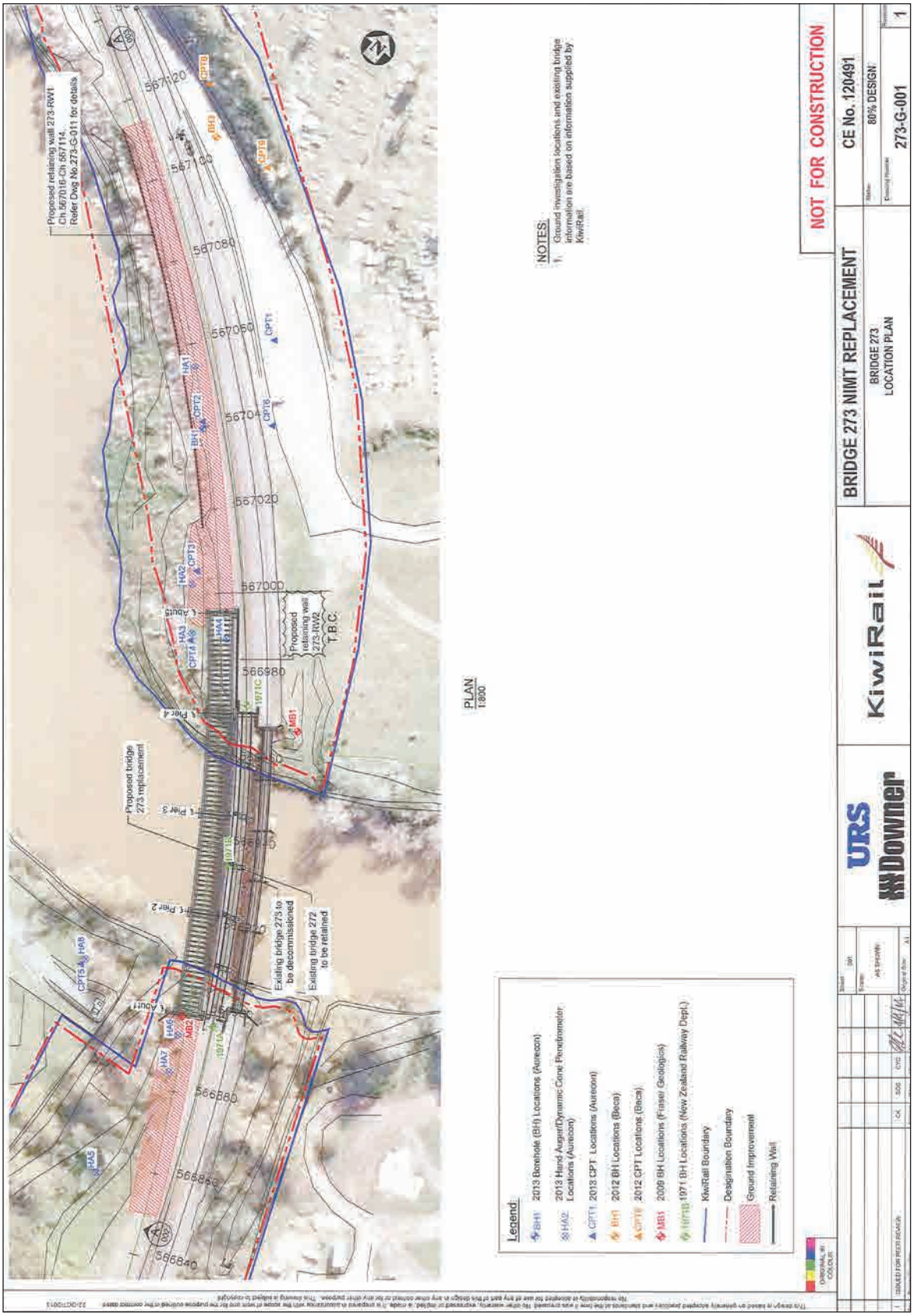
The North Island Main Trunk was first proposed by Julius Vogel in 1870 to join the Auckland and Wellington rail networks (Scholefield 1906: 9). Construction began in 1877, connecting Taupiri to Mercer. In 1909 the line was completed, linking Wellington to Auckland, providing logistical support for many towns like Taupiri and a means to get their products to markets which were previously only accessible by horse and cart over less than reliable tracks.

There have been a series of bridges constructed over the Mangawara Stream since the NIMT was first installed through Taupiri. The original bridge (Bridge 57) was built in 1877, and was a single track, wooden trestle style bridge (Figures 2 and 3). It was probably built of local timbers such as totara, but these would have deteriorated quite quickly and been replaced with Australian ironbark as was common with many early railway bridges. Although individual elements of the trestle would have been continually renewed above ground, the original piles may survive subsurface – it is recorded as site S14/330 (Cruickshank and Campbell 2014). The rail alignment north of the bridge was on a tight radius and land close to the Mangawara Stream was taken under the Public Works Act to widen out the radius when the line was eventually double-tracked.

2. View of the original bridge alignment taken in 1906 looking south toward Taupiri. (NZG_19060818_7_2, photographer J. Collings, Sir George Grey Special Collections, Auckland Libraries)



3. View of the original bridge alignment taken in 1909 looking south toward Taupiri. (AWNS-19090506- 10-3, photographer A.N. Breckon, Sir George Grey Special Collections, Auckland Libraries).



4. Design drawings showing area modified through the rail bridge construction work hatched in red.

Methodology

The area was substantially modified by the installation of the new bridge and re-alignment of the rail corridor. Part of the design for the site includes more than 400 piles being driven into the bank to provide stability. These works would destroy any remaining archaeology within the zone identified for the piles to be driven.

The investigation required stripping back of the topsoil within the affected zone to expose the shell midden below and record it. Upon discussion with tangata whenua it was decided that the shell would be removed and relocated to the grassy area on the eastern side of the rail corridor and placed in a depression that is a significant hazard. Once the shell was removed, the area was investigated to see if any other related archaeological features were present. Once these features were recorded, the ground was cut down to final levels for piling.

Topsoil was removed using a 5 tonne hydraulic excavator with a 1200 mm weed bucket. Once the surface was exposed it was cleaned down by hand to define the archaeological features, which were excavated by hand. Digital photographs were taken before, during and after excavation, and the site was mapped by tape and measured off set datum points that were surveyed in using a total station. Samples were taken for analysis and radiocarbon dating.

The excavation team consisted of Matthew Campbell, Arden Cruickshank, Greg Gedson, Beatrice Hudson, Bernie Larsen and Gareth Walter.

Results

On stripping the topsoil in the area, it was noted that the shell extended much further than initially identified, over an area of 14 x 6 m within the works area, and a test trench revealed that there were multiple occupation layers present at the site. Features were noted in the wall of the rail corridor batter, which could not be removed at the time because it would affect the stability of the rail line.

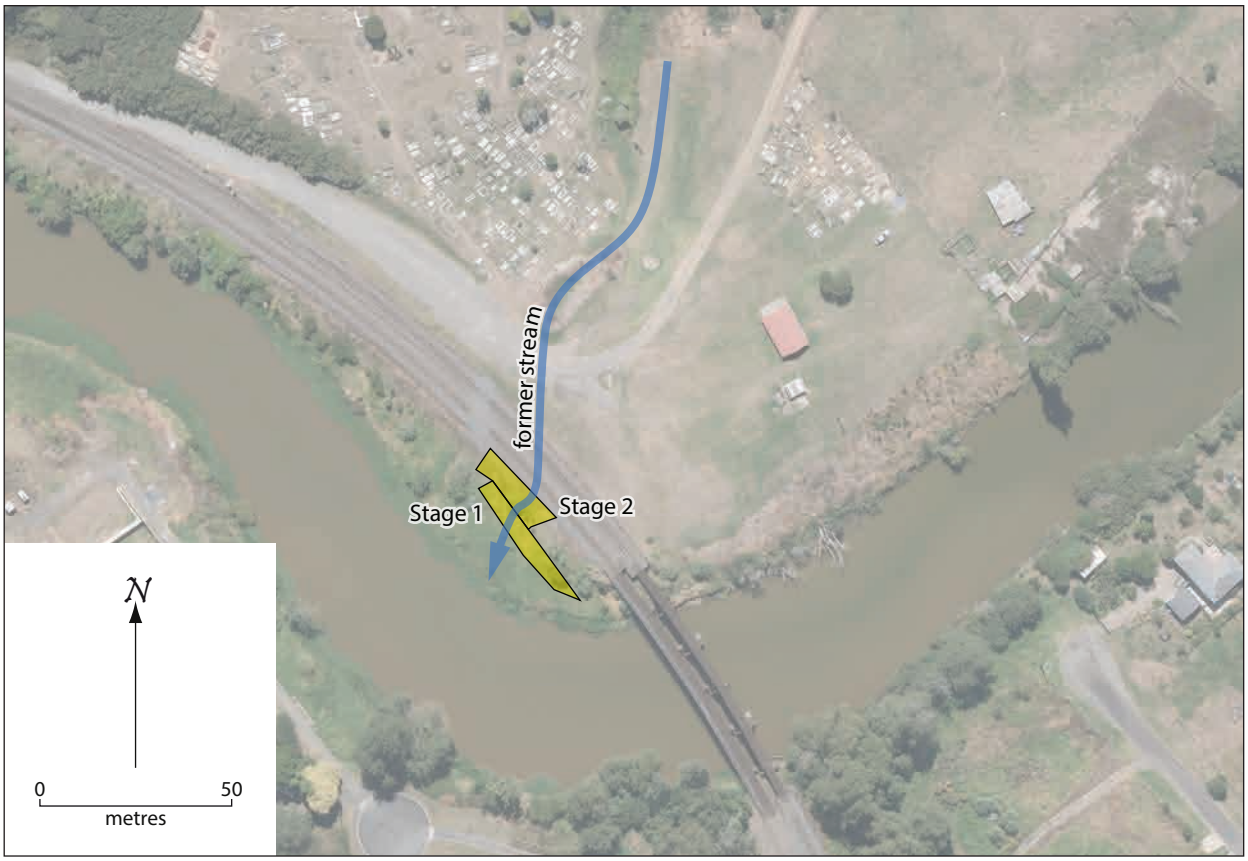
The site was excavated in two stages in order to work around the piling and cut and fill being undertaken at the site. Stage 1 incorporated the area on the southern side of the batter, and was investigated between 16 and 31 October 2014. Stage 2 included the ground between Stage 1 and the existing rail corridor, where structural piles were installed. A driven steel retaining wall was installed next to the rail corridor allowing access below the batter and this area was investigated between 19 and 22 January 2015.

There were four distinct phases of cultural material, with three of them representing pre-European occupation. The uppermost cultural phase is historic, with artefacts and features relating to the construction and use of the NIMT. Below this were three distinct pre-European cultural phases designated A, B and C, with A being the earliest.

The historic use of the area had impacted the upper pre-European cultural phase (Phase C), and led to some ambiguity of features that were truncated and intercut. Rabbit burrowing has also had a heavy impact on the archaeology of the site.

Site formation processes

Interpretation of the site was initially difficult, as multiple clean fill layers were visible between the cultural layers. As shown in Figure 6, there was approximately 500 mm of clean flood-deposited material between Phases B and C. A 1 m deep trench was dug below the lowest cultural layer (Phase A), multiple layers of flood events are still evident below this (Figure 7).



5 (above). Location of S14/331 with repect to the railway bridges prior to the current works, showing the extents of the two stages of excavation and the former course of the now culverted stream.

6. The eastern wall of trench A showing approximately 500 mm of clean flood deposits between Phase C and Phase B features.

The flood event layers often had patches of dark organic staining and pumice in them, and were a mix of loam, silt and sand. Sparse cultural material within some of the flood layers are indicative of archaeological features being washed out and redeposited.

A clean, fine white silt was noted in a couple of features (Figure 8), and as stratigraphic layers within the site, which was too clean to be flood deposits. One afternoon a strong northerly was blowing down the Taupiri Gorge and the site was inundated with this same white silt. It is most likely a discrete deposit of fine-grained silt within the Puketoka formation downstream. The source of the material is not able to be identified from the road.

7. An exploratory trench below Phase A shows more layers of flood deposit.

8. Fine windblown white silt overlying Feature 181.

Rabbits have also damaged the site. The soft loam deposits are easily dug, and shell and historic material have been dragged down into lower layer. This effected the collection of samples as any feature which had been affected by rabbit borrowing could not be viewed as having a secure context. The lowest midden layer (Feature 54) was an example of this, where no dates or analysable material was retained as it was not possible to positively identify a secure context for sampling.

There is a small unnamed creek which runs down from Taupiri Maunga and empties into the Mangawara by a culvert next to the site. This culvert would presumably have been installed during rail construction in the 1870s. It was noted through the flood depositions and the location of the features, especially those from Phases A and B that the creek used to flow through the central part of the site. The redeposited midden (Features 1 and 58) appear to be placed over this area, and this could have been a result of contouring the area as part of the initial rail works.

Historic features

Nine historic features were uncovered during the investigation, all either mixed into, or cut into Phase C. The three main midden concentrations (Features 1, 54 and 106) consisted of topsoil intermixed with crushed shell, ballast, rail construction and repair rubbish, cattle bone and historic artefacts, many of them probably thrown from the train. It is likely that the three midden layers were redeposited material from a larger midden, which got destroyed during the construction of the rail corridor.

Two historic rubbish pits (Features 37 and 40) (Figure 9) were uncovered. These contained sheep and cattle bones, and contained similar fill to what was observed in Features 1 and 54. These pits appear to be contemporaneous with Feature 1.

The most prominent historic feature of the site was Feature 105, a small cobbled area. A number of fire affected nails and pieces of slag were noted and retained from in and around the cobbled area. The cobbles consisted of broken bricks and pieces of pumice. Some larger pieces of pumice were cut into blocks similar in size to the brick fragments to fit into the brick pattern. It is likely that this was the location of a small smithy, either related to the initial rail and bridge construction, or farming activities in the area.

Pre-European features

The original identified midden scatter was designated Feature 1. At the time of initial site recording It appeared as a sparse distribution of fragmented shell, mainly pipi and freshwater mussel, and no historic material was noted in the matrix. Once it was exposed, it was noted that it had been heavily disturbed, with historic and modern rubbish mixed into it. Once the excavation extended underneath the rail corridor, a second concentration of redeposited midden was noted (Feature 106). This had a similar composition to Feature 1, and although the two did not join, they are thought to be contemporaneous. It is likely that they were redeposited during railway construction and subsequent realignment and bridge replacement works.

Phase C

Below these two layers, the uppermost phase of pre-European occupation was noted. This phase appeared to be the most intricate, where a large number of activities including cooking, storage, tool manufacture and koiwi burials were noted. One hundred and thirty pre-European features were identified: 59 postholes; 57 firescoops; with the remainder including two large pits (Features 112, 114), three

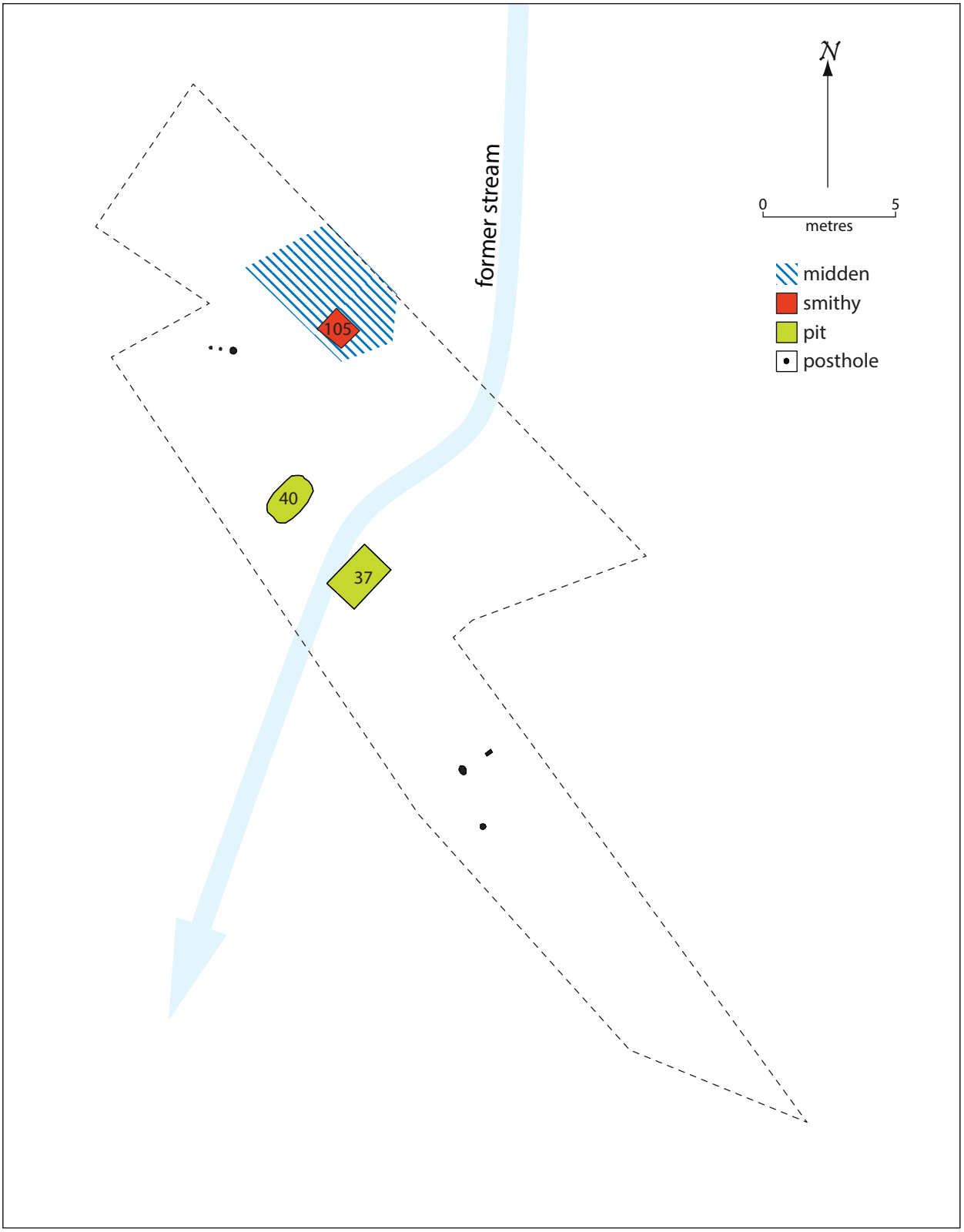


Figure 9. Historic features.

10. Feature 37 in the eastern baulk of the original test trench.

11. Feature 105, the brick and pumice cobbled floor of a probably smithy.

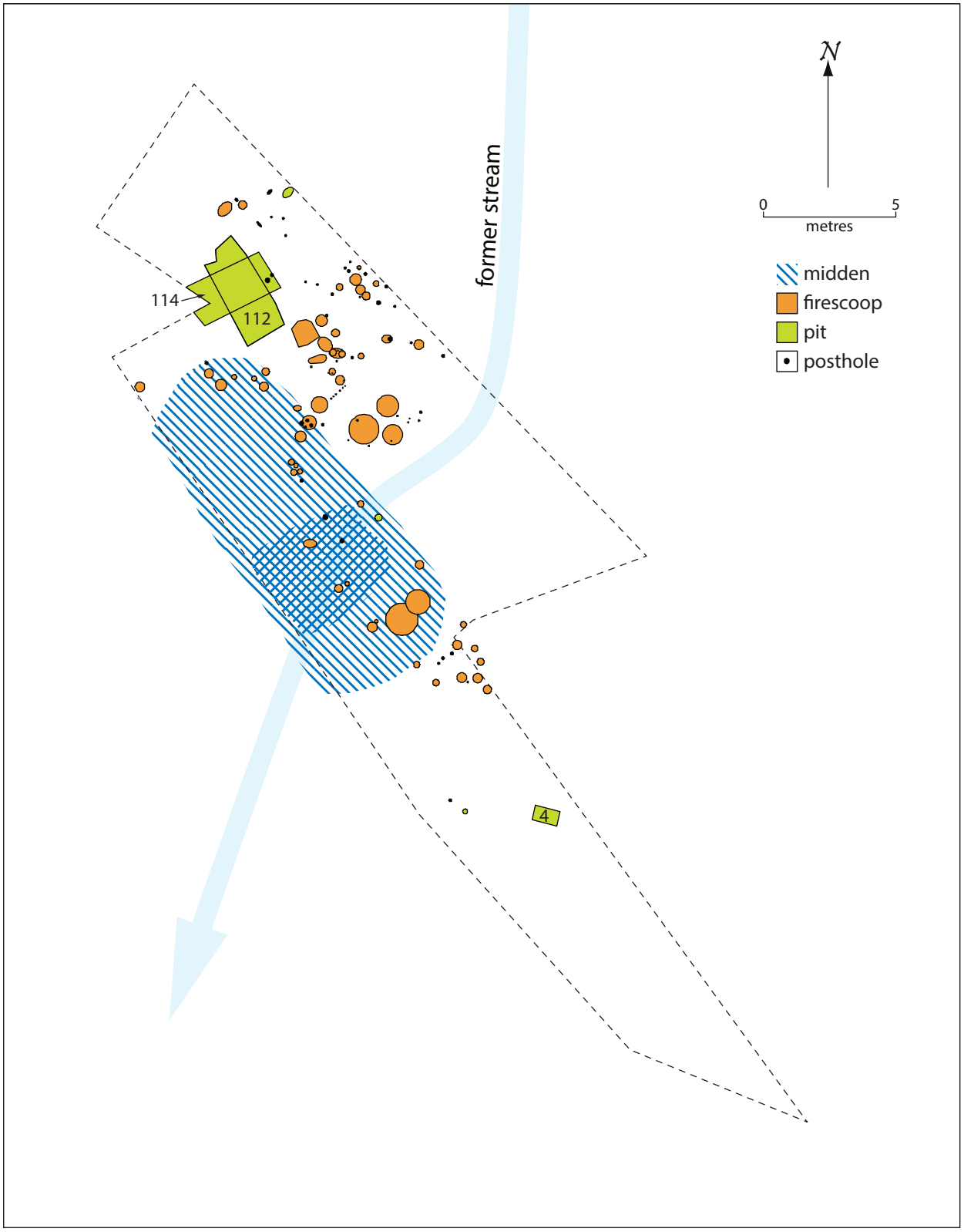
bin-pits and two burials. The third midden scatter (Feature 54) was uncovered within this phase, but as mentioned above, it is not considered to be from within a secure context, so was not sampled.

The two large pits were intercutting, with Feature 114 more discernible that Feature 112. These features did not have associated post holes and it is unknown what their purpose was for. One of the bin pits (Feature 4) contained a large amount of flaked stone. These flakes are discussed in more detail in the artefacts section of this report. Several of the postholes formed clear, but short alignments that could be related to drying racks or windbreaks.

Two burials and some fragmented bone from a third koiwi tangata were also uncovered during excavation, which appear to have originated within this phase.

12. Bricks and shaped pumice blocks form Feature 105, with slag adhering to them.

13. The Feature 1 midden prior to topsoil stripping.



14. Phase C features, showing the likely route of the old creek.

These are reported in Appendix C – note that this appendix is not included in digital versions of this report.

The features did not have any distinct distribution, and no activity areas were noted. The upper layers of the site had been heavily disturbed by the initial installation of the NIMT and subsequent repair and replacement works, so it is difficult to make any robust reconstruction of the activities that were being undertaken.

Eight 10 litre bulk samples were taken from this phase for faunal analysis, from which two pipi shell samples and one charcoal sample were submitted for radiocarbon dating.

Phase B

This phase occurred approximately 500 mm below Phase C, and was mainly located in the northern end of Area A. Twenty-six features were associated with this phase: 18 firescoops; six postholes; and two cooking stone caches.

Of the eighteen firescoops, thirteen of them occur within a 6 x 4 m area on the north side of the old stream channel. The postholes could represent two small alignments, possibly related to drying racks or windbreaks.

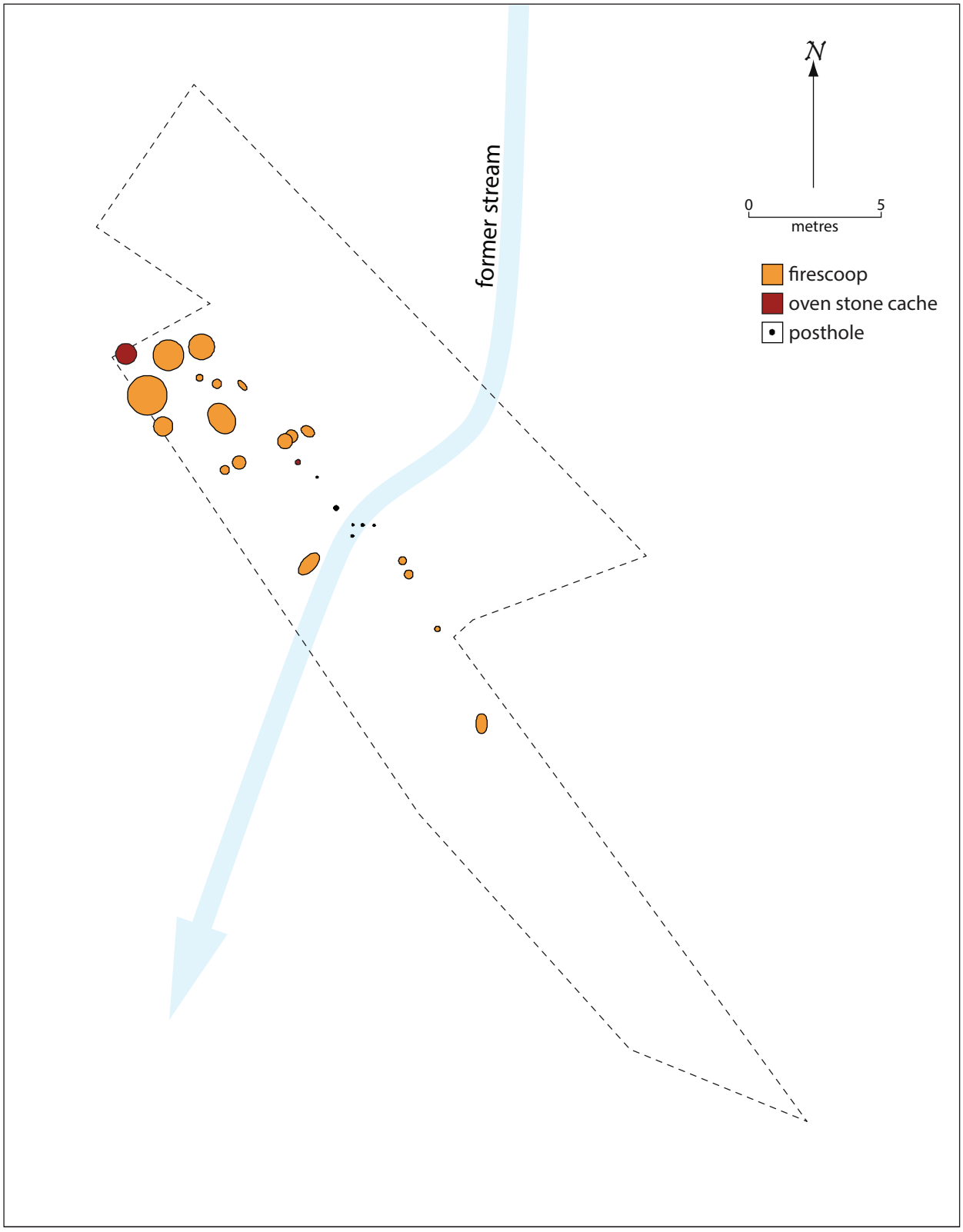
There were two identified cooking stone caches in this phase. These, along with most of the hangi stone on the site appear to be non-welded ignimbrite, and where present, they display water rolled cortex. These hangi stones are most likely sourced locally along the river bank.

Four 10 litre bulk samples were taken from this phase for faunal analysis, from which three charcoal samples were obtained for floral analysis. One sample of charcoal was submitted for radiocarbon dating.

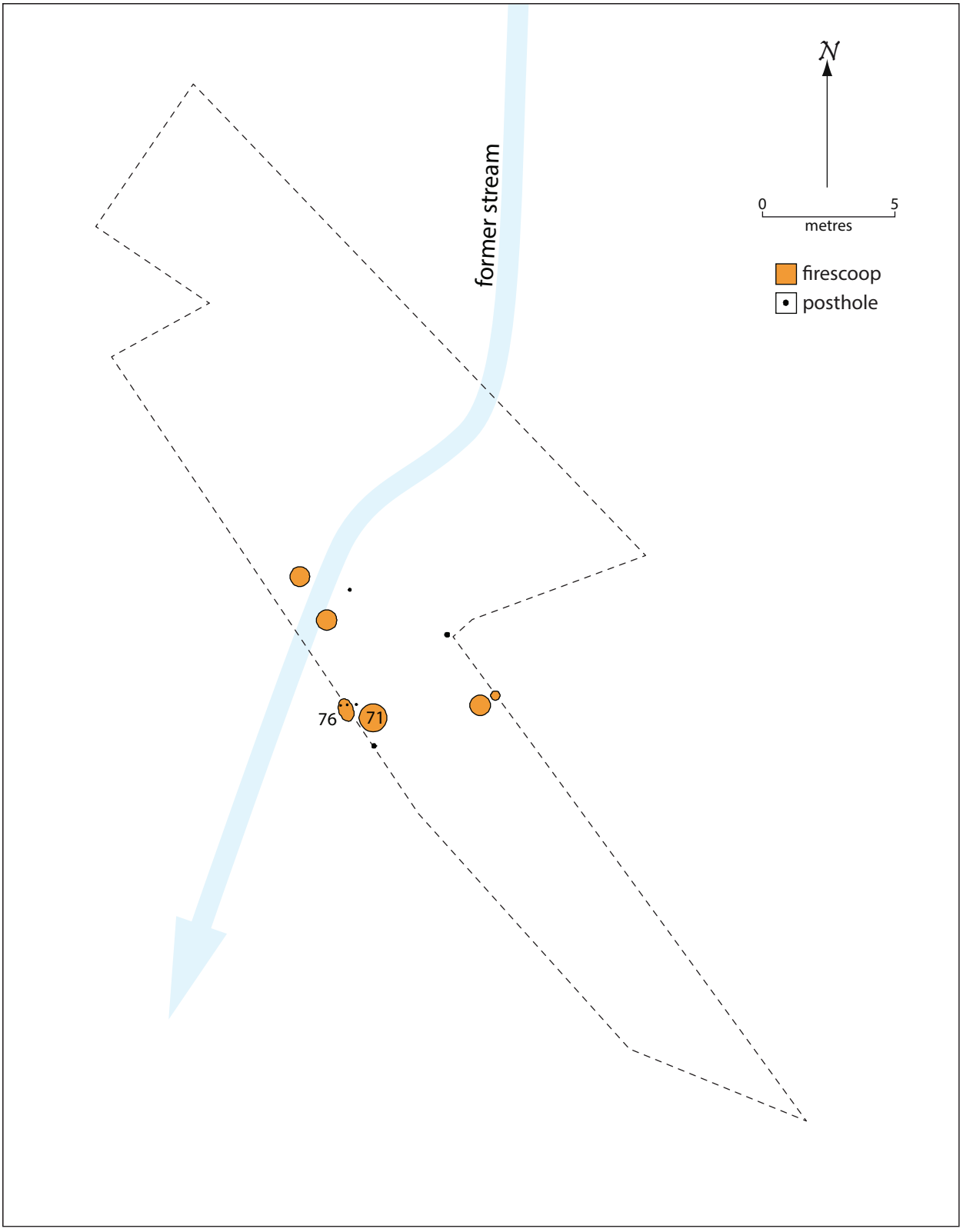
Phase A

This phase was the sparsest, and contained the least material culture. It was separated from Phase B by a number of flooding events which again appear to be concentrated in the vicinity of the unnamed stream.

15. Feature 70, a cache of cooking stones.



16. Phase B features, showing the likely route of the old creek.



17. Phase A features, showing the likely route of the old creek.

Twelve features were found associated with this phase, six firescoops and six post holes. Three of the post holes are within close proximity of two of the firescoops (Features 71 and 76), and could be associated with drying or a windbreak. Two of the firescoops contained fresh water mussel, but no other faunal material was observed in the features in this phase of occupation.

Samples of the fill were retained for analysis, including one 10 litre bulk sample. Two samples of charcoal were used for floral analysis and submitted for radiocarbon dating.

Historic artefacts

A number of historic artefacts were recovered from the site, mainly within the disturbed midden deposits of Feature 1 and Feature 54 and the historic rubbish pits (Features 40 and 37). Due to the disturbed nature of the midden deposits, all of the historic artefacts from the site were analysed as a single assemblage. These artefacts are broken down into three main categories; artefacts associated with the serving of food, personal items and metal artefacts associated with the rail line construction or farming. A number of artefacts which were recovered from Feature 105 are also discussed as part of the third category.

Food Service

The majority of these artefacts are the remains of cups, saucers and glass drink or sauce bottles, as well as more specialised items such as egg cups and tea pots, and were presumably thrown out of windows as the train went along. Although most of the fragments are unidentifiable and therefore un-datable, other than in general terms, there are a few diagnostic items.

New Zealand Railways ceased on-board food service on their trains in 1917 and didn't resume it until the late 1960s or early 1970s (New Zealand History, 2013). In the interim, food and drinks were provided at refreshment rooms located at certain stations. People were permitted to bring their plates and cups on board, and although they were to be cleaned and sorted by porters before being sent back to their respective refreshment rooms they often ended up being thrown off the moving train. This resulted in massive losses for NZR, in excess of 100,000 cups in some years.

One intact Temuka-Ware N.Z.R. mug which dates to c. 1947 (Puke Ariki 2016, Ancestry 2016) was recovered from the site. Fragments of these cups are often found along the NIMT, and cup and saucer sets are sought after by collectors due to their rarity. It is reasonable to assume that items that date prior to 1917 were part of on-board service, while those dating between 1920–1970 are from the refreshment rooms en route.

Ceramics

There is a range of dates represented by the ceramic artefacts. The majority of the fragments are blue or brown transferware patterns, on cups and saucers. Although there are five transferware patterns present, the only identifiable one is Asiatic Pheasant which was found on two different plate rims and a base. The base has a small portion of a maker's mark visible but as it is a generic crown on top of a circle it's not possible to assign it to a particular maker. The most common pattern, present in both blue and brown and on a variety of vessels, was also found on the Wellington Inner-City Bypass and is known as WICB 007 'EA262'. As transferware was losing popularity by the end of the 19th century it suggests that these items are likely pre-1900s in date, although Asiatic Pheasants was produced into

the 20th century. There are also a few fragments of spongeware, edge banding, as well as applied blue sprigged porcelain (egg cup and saucer) and five white glazed pieces with raised relief decoration around the rim.

Three items can be more accurately dated, the earliest is part of a plate rim bearing the crest of the Railway Battalions, New Zealand Engineers which features "an approaching locomotive [and] crossed guns…" (New Zealand History 2015). This battalion was formed in 1911 and members saw service through the First World War (New Zealand History 2015). The other two other items are later in date. One of the items was the Temuka-ware NZR mug mentioned above, and the other the base of a saucer marked 'John Maddock & Sons Ltd./Made in England' which is post-1945 (Godden 1964:40). These two later date items most likely relate to the refreshment rooms phase of catering for NZR.

Glass

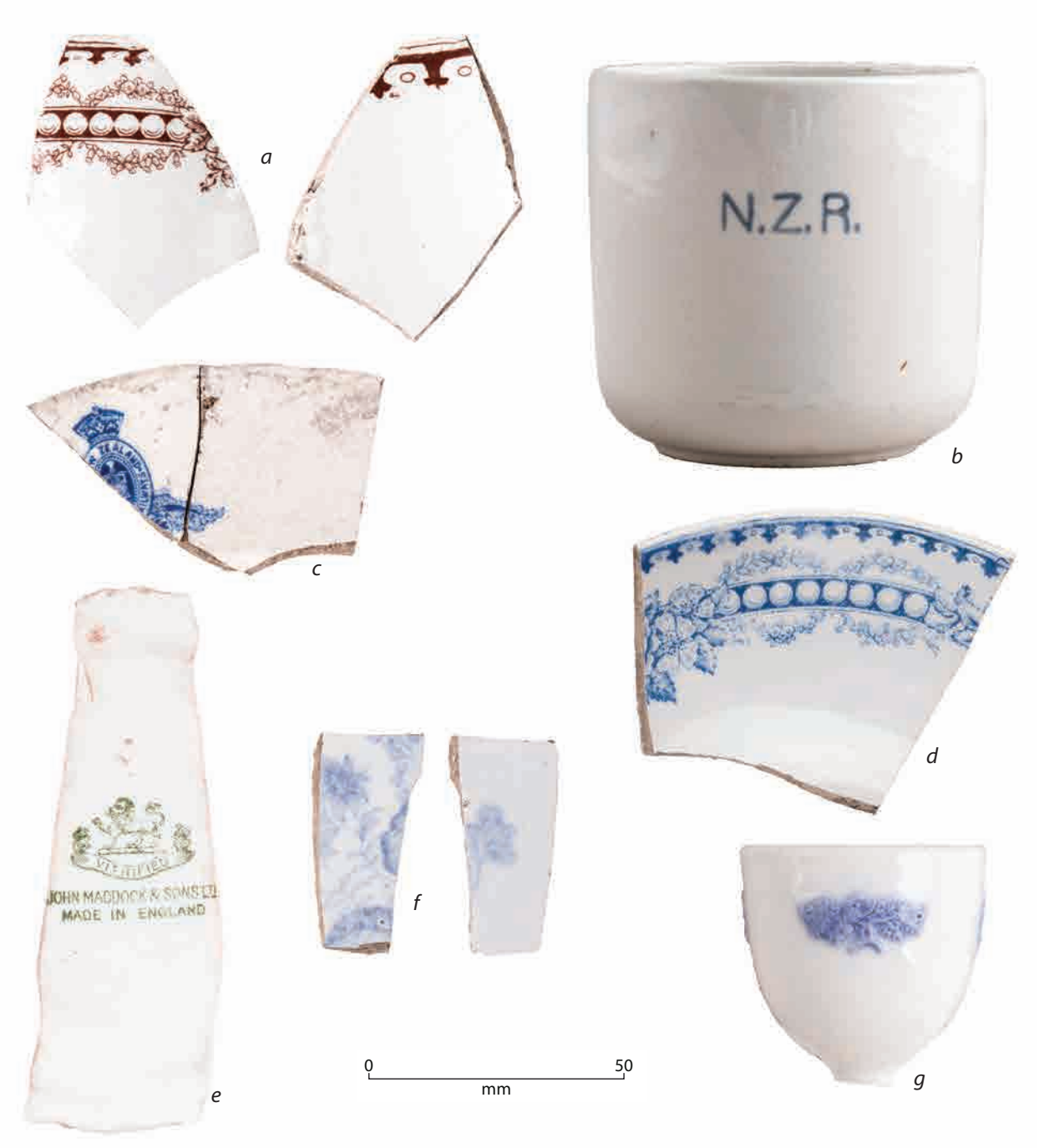
A Lea & Perrins bottle top and stopper could date from as early as the 1850s to as late as 1958, when the use of a glass stopper surrounded by cork was discontinued (Lindsey 2016). Another glass stopper with circular divots around the rim is probably from a similar type of sauce bottle. The various bottle fragments are from a range of types including aerated water, beer, case gin and champagne and possibly soft drink. A beer bottle marked GREAT NORTHERN BREWERY LTD/ REGISTERED TRADE MARK/ AUCKLAND/ LION/ ALE & STOUT dates to between 1907 and 1915 and an aerated water bottle marked THOMSON LEWIS & CO LTD/ WELLINGTON PET[ONE] dates to between 1917 and 1957 based on the period their Petone plant was in operation. Another aerated water bottle was marked GREY & MENZIES LTD/ NEW ZEALAND. Grey & Menzies were in operation in different locations in the North Island from 1902 to 1968 (Manukau Courier 2009). Four fragments of olive bottle glass had polished horizontal bands of various widths running across them, and it appears the bottle was reused for some purpose.

Metal

This category is represented by a teaspoon and a food tin. The teaspoon is possibly silver plate but the stamps on the back of the handle are illegible due to corrosion. The food tin is of the shallow rectangular type, with a peel pack lid that is still attached. These types of tins commonly held potted meats or fish such as anchovies.

Personal items

Five items of a personal nature were uncovered; a thimble; a metal token, a folding comb, a decorative hair comb and a fragment of a clay pipe bowl. The folding comb, which looks like a switchblade when closed, is made of Bakelite. Bakelite became popular for personal items such as jewellery and buttons in the 1920s but was beginning to be superseded by other plastics by the 1940s, so this comb probably dates to the early-to-mid 20th century. The other comb, which is blue plastic with moulded flowers along the top edge, is more recent. Stylistically it appears to date to the 1940–50s, and this type of comb would have been in decline by the 1960s as fashions changed. The clay pipe could date from any time in the 19th century up until the beginning of the 20th century. The copper token dates to around 1860 as was issued by Andrew Mather in Hobart and worth one penny (Museum Victoria Collections, 2016). Although it is well-worn, the front inscription reads R. ANDREW MAT[HER]/ FAMILY DRAPER [&c.]/ [HOBAR]T TOWN, and the



18. Ceramics: a, WICB 007; b, Temuka Ware N.Z.R. cup; c, Railway Battalion plate; d, WICB 007; e, John Maddock & Sons makers mark; f, Asiatic Pheasants; g, sprigged eggcup.

19. Personal and other artefacts: a, folding Bakelite comb; b, thimble; c, shaped stone of unknown function; d, 1860 Andrew Mather token; e, plastic comb.

reverse: [T]ASMA[NIA]. The design shows a female standing, holding scales and cornucopia with a ship in the distance.

Railway and farming artefacts

These are largely spikes and nails, along with a few unidentifiable fragments and a 160 mm metal strap with regular holes. The spikes are presumably related to the rail line, and range from 130 to 160 mm in length. All spikes have a rectangular cross section. The nails are all of the wire variety and probably used in fencing. Wire nails were widely available by the 1870s (Issacs, 2009).

Feature 105, the probable smithy, contained a number of nails and bricks which were analysed. The nails that were recovered were heavily corroded, but appear to be 2 ½" and 2 ¾" wrought iron nails, similar to the 'Eubanks' style nail. The United Kingdom was the dominant source of nails in New Zealand until 1893, where the Eubanks style nail comes from (Issacs 2009).

The bricks appear to be from two distinct sources, with both wire cut and handmade bricks identified. The handmade bricks were distinctly redder in colour, and had slightly smaller dimensions. These also had some lime mortar attached to the handmade bricks indicating they were recycled. No maker's marks were identified on any of the bricks.

Pre-European Maori artefacts

Seven formal artefacts were examined by Dr Rebecca Phillips of the Department of Anthropology, University of Auckland. Of these artefacts, four were complete tools, with the remainder being fragmented portions. Two were identified as type 2B adzes and do not appear to have any use wear on them. This appears to be the same for the chisel that was uncovered, as this did not have any obvious use wear or reworking on it.

A single stone pounder uncovered, which is possibly a patu muka. Pounders and beaters were used for a variety of purposes, but are typically associated with preparation of fern root and flax (Davidson 1984: 103). This artefact is not well formed compared to other examples in the literature but this may not necessarily affect the functioning of the tool. The artefact has some hammer dressing and shaping along its length from the handle. The distal end is flattened and shows evidence of damage, possibly from pounding. This tool may have function as a pestle (Furey 1996: 153, cf. Phillipps 1939 for discussion of miroi for curling flax). There is no decoration on the handle.

The remaining four artefacts were all fragments, with one being a fragment of a grindstone, and the remainder being adze fragments. The grindstone fragment is made from a soft sandstone, and is most likely attributed to manufacture of smaller implements. The adze fragments represent at least two different adzes.

The adzes and the pounder are all manufactured from basalt, of a similar quality to the flakes recovered from feature four. It is likely that everything was created from material from a single source, which could be Raglan basalt.

20. Pre-European Maori artefacts: a, adze; b, chisel; c–e, broken adzes; f, patu muka.

Flaked stone

There were 213 flaked stone artefacts uncovered from the site, 95% of which were recovered from a single bin pit (Feature 4). These artefacts were analysed individually and attributes were recorded based using Holdaway and Stern (2004) for metric recording, Beyin (2010) and Turner (2005) for identifying use wear and Cruickshank (2011) for categorising the quality of stone.

Chert

There were 10 chert artefacts, which most likely represent two sources. The first is buttery-yellow in colour, of a medium flaking quality. The second type is black, and although it exhibits a good conchoidal fracture, has impurities and veins that probably made it of medium flaking quality.

Due to the quality of the stone, only three of the chert artefacts had any identifying characteristics. Two were recorded as complete flakes, and the third as a core fragment. Metric data was recorded for the remaining seven artefacts, but no further analysis is possible.

Basalt

Two hundred and three pieces of flaked basalt, most likely from the Raglan source, were recovered from Feature 4, a bin pit. The majority of the assemblage (n=102) had no identifying characteristics, but the remaining artefacts were dominated by complete flakes (n=64), followed by transverse fragments (n=33), and lesser numbers of lateral fragments.

The lack of cores, high proportion of transverse fragments and undiagnostic pieces within the assemblage is likely a result of the reduction process of adze manufacture, where emphasis is on the final shape of the piece, not on making usable flakes. The majority of this task is usually undertaken at the source quarry, and pre-form blanks transported, with fine trimming being undertaken in the domestic setting away from the quarries (Turner 2000: 26). The high proportion of larger cortical flakes within this assemblage appears to indicate reduction of cobbles rather than simply fine trimming. This is a risky procedure, but because the flakes are only present in a single bin pit, and there are no broken or discarded adze blanks within the site, it must have proved successful.

Sourcing

Chert

There are many sources of metamorphic rock throughout New Zealand that are capable of producing a usable flake, but only a handful have ever been studied. There are chert sources of similar colour located at Raglan (Moore and Wilkes 2005) and in Whangaparapara harbour on Aotea / Great Barrier Island, but both of these are recorded as having high quality material. Although it is likely that both of those sources have some degree of poorer stone within them, that stone would not likely be transported anywhere, and based on the flaking floor at Whangaparapara, cobbles were likely being dressed and inspected prior to transportation. These pieces most likely came from an unknown local source, or a poorer quality deposit at Whaingaroa / Raglan Harbour.

Basalt

There closest known basalt source to the site is at Whaingaroa / Raglan Harbour, most likely olivine basalt that belongs to the Okete volcanic formation of the Alexandra Volcanic group (Turner 2000: 49; Edbrooke 2005).

This source was described as being a fine-grained basalt, distinctive from Tahanga basalt, and mainly exploited in coastal Waikato. Evidence of basalt adze production is abundant in the coastal middens around Whaingaroa / Raglan, Aotea and Kawhia harbours. It is coarser than Tahanga basalt, not as flakable or as tough, but with a similar hardness factor (Turner 2000: 49). It is probable that this material has come from this source, but further geochemical research would need to be carried out on this source to be able to compare the material.

Charcoal

Ten charcoal samples were sent to Dr Rod Wallace, Department of Anthropology, University of Auckland for species identification, and to obtain samples for AMS dating from the Phase A firescoops, as these had no usable faunal material. The samples vary somewhat in their species content, with many being dominated by shrub and scrub species but others by forest trees. The assemblage as a whole is dominated by large broadleaf (31%) and conifer tree species (26%). Larger scrub species (26%) typical of well-developed secondary regrowth also supplies a significant component. Smaller shrub species typical of bracken fern-land such as Tutu, Hebe and Coprosma form only a minor component (16%). If regarded as a single assemblage this data suggests the local area had a well-developed forest cover that included areas of secondary scrub that indicating some forest clearance had occurred locally prior to occupation.

Faunal analysis

Thirteen ten litre bulk samples were taken for faunal analysis, representing midden, firescoops and pits (Table 1). The samples were dried and weighed, wet sieved through a 6 mm screen, re-dried and re-weighed. They were then sorted to class (shell, bone, stone) for specialist analysis. Shell that did not have any diagnostic portions was classed as residue. Other bone was hand-picked during excavation. Shell identifications followed Morley (2004). Fish, bird and mammal identifications used comparative collections housed at CFG Heritage. Fish identification followed the methodology outlined in Campbell (2016), adapted from the methodology developed by Leach (1986).

Shell

The dominant shell species of was pipi (*Paphies australis*), making up 89.47% of the total number of identified specimens. This was followed by kakahi (freshwater mussel, *Hyridella menziesi*) (9.52%). The remaining two taxa made up 1% of the assemblage.

Kakahi was a valuable resource for inland Maori. They were common and widespread throughout New Zealand, in habitats ranging from small, fast-flowing streams to lakes. These shellfish would have been easily found in the waterways surrounding the site. The shells are relatively soft and they do not survive well in archaeological sites, and are easily damaged during excavation (Campbell 2005), so it is probable that they may have been the dominant shell species at the site. Only in one sample (Feature 28) did the freshwater mussel have a higher NISP count

Feature	Phase	Feature type	Volume (litres)	Dry weight (grams)	Sieved weight (grams)
71	A	Firescoop	10	5200	374
61	B	Firescoop	10	6470	940
62(II)	B	Firescoop	10	5750	480
65	B	Firescoop	10	6080	590
69	B	Firescoop	10	7460	1870
4	C	Bin Pit	10	7880	619
55	C	Firescoop	10	6138	120
106	C	Midden	10	8290	665
124	C	Firescoop	10	8140	2320
139	C	Firescoop	10	4580	730
145	C	Firescoop	10	7980	2116
177	C	Firescoop	10	7540	1360
178	C	Firescoop	10	7940	1782

Table 1. List of 10 litre bulk samples retained from S14/331.

than pipi, but it is probable that locally sourced kakahi were more commonly consumed on site than pipi, which had to be imported from the coast.

Pipi is a soft-shore species, and is restricted to harbours and estuarine environments. This type of environment can be found at the mouth of the Waikato river, and other harbours along the west coast, including Whaingaroa / Raglan Harbour, where there are high quality chert and basalt sources available. Tuangi cockle would also be found in this environment, along with gastropods. They were probably bought up river by canoe, but another possible source is the Hauraki Gulf, which can be accessed via the Mangawara.

Taxon	NISP	Percentage
Pipi (*Paphies australis*)	1513	89.47%
Freshwater mussel (*Hyridella menziesi*)	161	9.52%
Tuangi cockle (*Austrovenus stutchburyi*)	8	0.47%
Miscellaneous gastropod	9	0.53%

Table 2. Counts for identified shellfish, all contexts.

Fish

Nine fish bones were identified. These represent both marine and freshwater species, which would have been easily available and able to be obtained at the same time as shellfish collection was being undertaken.

Introduced species

A number of samples of faunal material were of a historic origin, and these were all associated with either historic pits (Features 37 and 40) or the disturbed midden layers (Features 1 and 54). There was a wide range of animals represented in this assemblage including dog, sheep, chicken, cow, rat and possibly horse. There was no burning or cutting noted on the samples.

Taxon	Element	Side	NISP
Snapper (*Pagrus auratus*)			
	Caudal vertebra	UP	1
	Palatine	L	1
	Hyomandibular	L	1
	tooth	–	2
Freshwater eel (Angullidae sp.)			
	Dentary	L	1
Shark (Chondricthyeas)			
	Vertebra	UP	3

Table 3. Fish Bones which were identified within the assemblage.

Chronology

Four charcoal and two shell samples were submitted to the Radiocarbon Dating Laboratory at the University of Waikato for dating: two from Phase A, one from Phase B and three from Phase C.

The results have proved to be somewhat enigmatic, with the dates not corresponding to the phasing (see Figure 20). The two results from Phase A were AMS dates and these have produced multi-modal distributions which extend from the late 17th century to present day. The Phase B date returned a bi-modal distribution of cal AD 1656–1689 and 1727–1805. The charcoal date from Phase C returned a bimodal date of cal AD 1696–1726 and 1807–present.

The two pipi samples from Phase C proved to have the most secure dating samples, with Feature 106 returning a date between cal AD 1456–1649 and Feature 145 returning a date of cal AD 1490–1679. These two dates appear to be the most reliable and are the only samples submitted which had unimodal distributions. These two dates have an overlap of 159 years, between AD 1490 and 1649.

The dates which were returned for this site do not correlate with the phasing, and this is most likely due to some form of contamination of the samples. The cause of this is unknown. Phase A features were found intact below Phase B and C features and so must be of an earlier date, even though the dating results do not support the archaeology. The two pipi dates have returned good unimodal distributions and were most likely deposited between 1456 and 1679 AD. These features are both likely the result of a similar period of exploitation of coastal shellfish for cooking onsite.

Although Feature 106 has been disturbed and possibly redeposited, Feature 145 was found in good condition within a secure context. These dates should be viewed as the latest phase of pre-European occupation at the site, which was later abandoned.

Discussion and Conclusion

19th century

A number of historic features, most likely related to the construction of the NIMT and its subsequent repair and realignment were identified, cut into the pre-European features of Phase C. These features included a bricked area which was most likely used as a smithy and a number of rubbish pits which contained the bones of sheep and cattle that may have been eaten on site. The remains of a dog which were also found in one of these pits did not have the appearance of any butchery, and

Phase	Feature	Material	Lab No.	Type	CRA BP	cal AD 68%	cal AD 95%
A	71	charcoal	Wk-42822	AMS	182 ± 20	1673–1706 (24.2%) 1721–1741 (13.4%) 1773–1777 (1.8%) 1797–1811 (10%) 1837–1846 (4.5%) 1866–1879 (7.6%) 1931–1949 (6.7%)	1669–1784 (51.4%) 1795–1815 (11.1%) 1832–1893 (21.5%) 1922… (11.4%)
A	74	charcoal	Wk-42824	AMS	166 ± 20	1682–1711 (18.2%) 1720–1730 (6.4%) 1803–1812 (5.7%) 1837–1848 (6.6%) 1856–1880 (15.1%) 1927 … (16.1%)	1675–1739 (31.7%) 1797–1820 (9.5%) 1825–1895 (33.9%) 1905… (20.2%)
B	65	charcoal	Wk-42821	AMS	218 ± 20	1670–1676 (7.1%) 1738–1786 (58.1%) 1794–1796 (3%)	1656–1689 (19.2%) 1727–1805 (76.2%)
C	106	shell	Wk-42825	standard	767±21	1476-1590	1456-1649
C	129	charcoal	Wk-42823	standard	113 ± 30	1710–1720 (6.4%) 1812–1837 (19.3%) 1847–1857 (5.4%) 1880–1928 (37.2%)	1696–1726 (13.4%) 1807… (82%)
C	145	pipi	Wk-42820	standard	709 ± 21	1538–1646	1490–1679

Table 4. Results of radiocarbon dating.

most likely ended up in the rubbish pit as a result of dying near to or on the NIMT. Much of the 19th century material found would probably have been thrown from moving trains and is no indication of occupation.

Pre-European Maori archaeology

Firescoops

Phase C contained 141 of the 182 features excavated, the most numerous of which were firescoops. Although the number of firescoops in each phase increased over time, they generally got smaller. The mean diameter of a firescoop in Phase A was 825 mm, Phase B 680 mm and Phase C 510 mm.

Freshwater mussel was noted in most of the firescoop fills, but this shell was mostly degraded and unable to be sampled. As it is not suitable for radiocarbon dating, samples were not generally taken of the shell, which often turned to powder during excavation making collection difficult. Samples for dating were obtained through charcoal separation for most of the site, as pipi shell samples were only present in in significant quantities inPhase C.

Cooking stone caches

Two cooking stone caches were uncovered, both associated with Phase B. They both contained approximately 10 litres of cobbles, which featured extensive heat discolouration. While only identified in the field, they all appeared to be basalt.

Postholes

There were 71 postholes recorded in the site, and although some alignments were noted, it is not possible to determine what their use was. It is likely that they were used for drying racks and windbreaks associated with the firescoops, and no evidence of them being associated with significant structures was identified.

Pits

There were two large intercutting pits uncovered in Phase C, which are of an unknown use, but appear similar in shape and dimensions for food storage pits. No associated features such as central support post holes were noted.

There were three bin pits identified in Phase C, one of which, Feature 4, contained a high number of basalt flakes which appear to be the result of adze manufacture. Two whole and four broken adzes recovered during excavation, and these all appear to be made of basalt, probably from the Raglan source.

Burials

The remains of at least three individuals were identified during excavation. These remains were excavated, analysed and reburied within the established urupa on the eastern side of the NIMT. These are discussed in more detail in Appendix C.

Site use

The site is dominated by firescoops, being 81 of the 181 features recorded in the site (45%). The next most frequent features were postholes, which made up a further 39% of features. The remaining 16% consisted of a number of features, including midden, find spots, burials, cooking stone caches and an historic smithy.

The firescoops had been used primarily for cooking pipi and freshwater mussel, with small quantities of fishbone also noted. The disturbed midden layers (Features 1, 54 and 106) were most likely originally created through rake out and processing of these food items, but had been heavily disturbed and redeposited through railway and farming activities, including levelling and battering for the rail bridge. This area is an ideal location for the cooking and processing of food items as it is on the bank of the Mangawara Stream and close to its confluence with the Waikato River, providing both water and access for imported goods.

The taonga that was recovered indicate the manufacture and refurbishment of adzes and other woodworking tools on site, with the assemblage dominated with basalt, most likely sourced from Whaingaroa / Raglan Harbour. The manufacture of these tools would also require water for grinding, so it is likely for this type of activity to be undertaken near to a water supply.

The historic artefacts and features are most likely related to the construction of the NIMT, and subsequent littering since the 1870s. The smithy and rubbish pits containing sheep and cattle bones could be indicative of a workshop/smoko area, but the rebuilding of bridges and rail alignment has modified the landscape a number of times so attributing these activities to any particular phase of works is difficult.

While it is not possible to date most of the historic artefacts with any accuracy, it seems that many of them, such as the ceramics and glass, are most likely to have been deposited in the late 1800s and into the first two decades of the 1900s. The more modern artefacts, such as the N.Z.R. mug and plastic combs, cluster around the 1940s and 50s. The use of the NIMT for passenger travel declined from the

1950s onwards, which would decrease the amount of consumer rubbish deposition along the railway.

It would appear that the site was subject to regular flooding. During a record flood event in 1998 water flow through the Taupiri Gorge was three times its normal rate, and without the use of the flood gates at Taupo and the hydro dams upstream, the flood levels would have been 500 mm higher at Taupiri (Munro 1998). Heavy rainfall would effect this site easily, as it would be effected by three different catchments; Mangawara catchment within the Central Hills, the Waikato River catchment and also the Taupiri Maunga catchment, which exited via the small unnamed creek that ran through the site. Although frequency of these floods is not able to be estimated from this site alone, it would appear that they were frequent enough that the site was frequently flooded and re-established.

Phasing and chronology

The phases represented repeated flood events at the site, with use, abandonment and re-use of the area for food preparation and tool manufacture. Unfortunately, the radiocarbon dates submitted for the site proved difficult to interpret so it is not possible to reasonably estimate the length of time the site was used, or how much time passed between phases.

Two dates were able to be used, both samples being pipi shell from the uppermost phase of occupation (Phase C). Although Feature 106 should be viewed with caution as there is historic material intermixed with pre-European midden, the shells themselves should be seen as reliable and they have returned a date which corresponds with Feature 145, with processing of pipi most likely occurring between AD 1490 and 1649.

Based on these two dates, it is probable that the site was no longer used for shellfish processing beyond the mid to late 17th century. It is probable that all food processing on the maunga ceased after the death of Te Putu when the pa was declared tapu, and became an urupa.

References

Campbell, M. 2005. The archaeology of kakahi (*Hyridella menziesi*). Archaeology in New Zealand, 48(2): 101–112.

Campbell, M. 2012. Cambridge Section of the Waikato Expressway: archaeological desktop study. Unpublished CFG Heritage report to The New Zealand Transport Agency and The New Zealand Historic Places Trust.

Campbell, M. 2016. Body part representation and the extended analysis of New Zealand fishbone. *Archaeology in Oceania*, 51: 18–30.

Campbell, M and J. Harris. 2011. The Taupiri Link, S14/158 and S14/198. Unpublished CFG Heritage report to New Zealand Historic Places Trust, Bloxham Burnett & Olliver and The New Zealand Transport Agency.

Cruickshank, A. and M. Campbell 2014. NIMT Bridge 273 replacement: archaeological assessment. Unpublished CFG Heritage report to KiwiRail.

Davidson, J. 1984. *The Prehistory of New Zealand*. Longman Paul, Auckland.

Edbrooke, S.W. 2005. *Geology of the Waikato Area*. Institute of Geological and Nuclear Sciences Ltd, Lower Hutt.

Furey, L. 1996. Oruarangi: The archaeology and material culture of a Hauraki Pa. *Bulletin of the Auckland Institute and Museum*, 17.

Gumbley, W., Higham, T.F.G, and D.J. Low. 2003. Prehistoric horticultural adaptation of soils in the Middle Waikato Basin: review and evidence from S14/201 and S14/185, Hamilton. *New Zealand Journal of Archaeology*, 25: 5–30.

Hatvany, M. 2008. Environmental failure, success and sustainable development: The Hauraki Plains Wetlands through four generations of New Zealanders. *Environment and History*, 14(4): 469-495.
Innes, C.V. 1989. A *Crown for the Lady: The Unravelling of a Pioneer Story*. Moana Press, Tauranga.
Issacs, N. 2009. Nails in New Zealand 1770–1910. *Construction History*, 24: 83–101.
Kelly, L. 1940. Taupiri Pa. *Journal of the Polynesian Society,* 49: 148–159.
Leach, B.F. 1986. A method for the analysis of Pacific Island fishbone assemblages and an associated database management system. *Journal of Archaeological Science*, 13: 147–159.
McCraw, J. 2011. *The Wandering River: Landforms and geological History of the Hamilton Basin*. Geoscience Society of New Zealand, Levin.
Morley, M.S. 2004. *A Photographic Guide to Seashells of New Zealand*. New Holland, Auckland.
Munro, A. 1998. The Waikato Regional Flood Event of 9–20 July 1998. *The Australasian Journal of Disaster and Trauma Studies*, 2.
Phillipps, W. J. 1939. An Introduction to Maori Pounding Implements. *Journal of the Polynesian Society*. 48: 71–91.
Scholefield, G. H. 1906. *North Island Main Trunk railway: Its Progress and History.* The North Island Main Trunk Railway League, Wellington.
Swarbrick, N. 2012. 'Waikato places - Ngāruawāhia', *Te Ara - the Encyclopaedia of New Zealand*. URL: http://www.TeAra.govt.nz/en/waikato-places/page-5 (Accessed 14 July 2014).
Turner, 2000. *The Function, Design and Distribution of New Zealand Adzes*. Unpublished PhD Thesis, University of Auckland.

Appendix A Charcoal identification

Ten charcoal samples from excavations near the base of Taupiri Mountain (S14/331) were submitted for identification, C14 dating sub-sample selection and palaeo-environmental report. The results are given below.

Phase A

Feature 71, Firescoop

Coprosma	1
Lancewood	4
Mapou	2
Porokaiwhiria	7
Tawa	3
Matai	6

Comments - A C14 dating sub-sample consisting of Coprosma, Mapou, Lancewood and Porokaiwhiria was separated out.

Feature 74, Firescoop

Mapou	1
Hard Beech	5
Tawa	2
Matai	2

Comments - A C14 dating sub-sample consisting of Mapou and Hard Beech twigs was separated out.

Feature 76, Firescoop

Lancewood	3
Rata	1
Bark	5
Tawa	2
Matai	15

Comments - A C14 dating sub-sample consisting of Lancewood and Rata twigs was separated out.

Phase B

Feature 62, Firescoop

Tawa	1
Matai	25 (98%)

Comments – No material suitable for C14 dating was present.

Feature 65, Firescoop

Tutu	2
Fivefinger	1
Lancewood	3
Olearia	1
Manuka	1
Mapou	3

Mahoe	1
Porokaiwhiria	4
Hinau	2
Hard Beech	2
Tawa	4
Tawa? seed	1
Matai	1

Comments - A C14 dating sub-sample consisting of Tutu, Fivefinger, Olearia, Lancewood, Manuka, Porokaiwhiria, Mapou, and Tawa twigs and seeds was separated out.

Phase C

Feature 4, Bin Pit

Manuka	11
Porokaiwhiria	1
Totara	2
Kauri	1

Comments - A C14 dating sub-sample consisting of Manuka and Porokaiwhiria was separated out.

Feature 106, Midden

Tutu	1
Hebe	1
Manuka	1
Mahoe	4
Mapou	2
Tawa	6
Kohekohe	1
Rewarewa	1
Tarairi/Mangaeo	2
Hinau seed	1
Rata	1
Hard Beech	2
Matai	3
Totara	2

Feature 129, Firescoop

Fernroot	1
Kanuka	3
Hard Beech	9
Tawa	2

Comments - A C14 dating sub-sample consisting of Fernroot, Kanuka and Hard Beech twigs was separated out.

Feature 144, Firescoop

Mapou	1
Mahoe	10
Titoki	7
Tawa	2

Kohekohe 1
Comments - A C14 dating sub-sample consisting of Mahoe, Mapou and Titoki twigs was separated out.

Feature 145, Firescoop

Coprosma 2
Fivefinger 7
Lancewood 1
Akeake 2
Olearia 4
Pittosporum 1
Manuka 1
Mahoe 1
Mapou 2
Pukatea 1
Tawa 9
Comments - A C14 dating sub-sample consisting of Coprosma, Fivefinger, Olearia, Lancewood, Manuka, Pittosporum, Akeake, Mahoe and Mapou was separated out.

Species	# pieces	Plant type (%)
Fernroot	1	0.5%
Tutu	3	Shrubs (16%)
Hebe	1	
Coprosma	3	
Fivefinger	8	
Lancewood	11	
Pittosporum	1	
Akeake	2	
Olearia	5	
Manuka	14	Scrub and small trees (26%)
Kanuka	3	
Porokaiwhiria	12	
Mapou	11	
Mahoe	16	
Rewarewa	1	Large broadleaf trees (31%)
Pukatea	1	
Kohekohe	2	
Hinau	3	
Tarairi/Mangaeo	2	
Rata	2	
Titoki	7	
Beech	18	
Tawa	32	
Matai	52	Conifers (26%)
Totara	4	
Kauri	1	
Total	216	

Table A1. Summary of charcoal results

Discussion

Only one of the bags from which a C14 dating material was requested failed to yield a suitable sample.

The samples are from separate features, mainly firescoops, and vary somewhat in their species content, many being dominated by shrub and scrub species but others by forest trees. The assemblage as a whole is dominated by large broadleaf (31%) and conifer tree species (26%). larger scrub species (26%) typical of well-developed secondary regrowth also supplies a significant component. Smaller shrub species typical of bracken fern-land such as tutu, hebe and coprosma form only a minor component (16%). If regarded as a single assemblage this data suggests the local area had a well-developed forest cover that included areas of secondary scrub that indicating some forest clearance had occurred locally prior to occupation.

Species Names

Fernroot	Pteridium esculentum
Tutu	Coriaria sp.
Hebe	Hebe sp.
Coprosma	Coprosma sp.
Fivefinger	Pseupopanax arboreus
Lancewood	Pseudopanax crassifolius
Pittosporum	Pittosporum sp.
Akeake	Dodonaea viscosa
Olearia	Olearia sp.
Manuka	Leptospermun scoparium
Kanuka	Kunzea ericoides
Mapou	Myrsine australis
Mahoe	Melicytus ramiflorus or M. lanceolata
Porokaiwhiria	Hedycarya arborea
Rewarewa	Knightia excelsa
Pukatea	Laurelia novae-zelandiae
Kohekohe	Dysoxylum spectabile
Tarairi/Mangaeo	Beilschmiedia tarairi / Litsea calicaris (NB. These are hard to separate)
Rata	Metrosideros sp.
Titoki	Alectryon excelsus
Hinau/Pokaka	Elaeocarpus dentatus or E. hookerianus
Tawa	Beilschmiedia tawa
Beech	Nothofagus sp.
Matai	Prumnopitys taxifolia
Totara	Podocarpus totara
Kauri	Agathis australis

Appendix B Radiocarbon results

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Tuesday, 15 December 2015

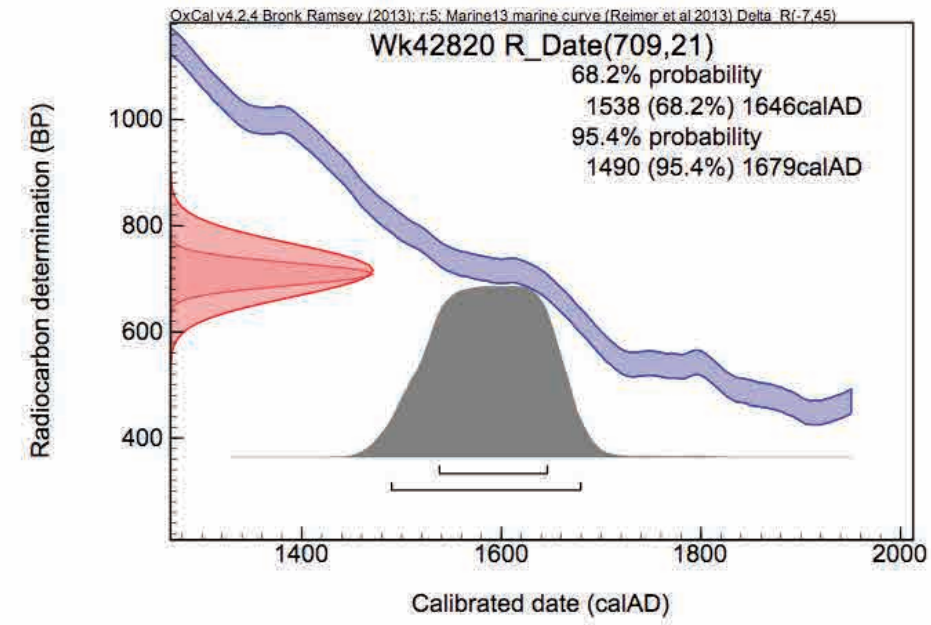
Radiocarbon Dating Laboratory

Report on Radiocarbon Age Determination for Wk- 42820

Submitter	M Campbell
Submitter's Code	F145
Site & Location	Taupiri, Waikato, New Zealand
Sample Material	Paphies australis
Physical Pretreatment	Surfaces cleaned. Washed in an ultrasonic bath. Tested for recrystallization: aragonite.
Chemical Pretreatment	Sample acid washed using 2 M dil. HCl for 120 seconds, rinsed and dried.

$\delta^{13}C$	1.1 ±	0.2 ‰
$D^{14}C$	-84.5 ±	2.4 ‰
$F^{14}C\%$	91.6 ±	0.2 %
Result	**709 ± 21 BP**	

Comments



- Explanation of the calibrated Oxcal plots can be found at the Oxford Radiocarbon Accelerator Unit's calibration web pages (http://c14.arch.ox.ac.uk/embed.php?File=explanation.php)
- 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 and is measured on sample CO_2.
- $F^{14}C\%$ is also known as *Percent Modern Carbon (pMC)*.

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Tuesday, 15 December 2015

Radiocarbon Dating Laboratory

Report on Radiocarbon Age Determination for Wk- 42821

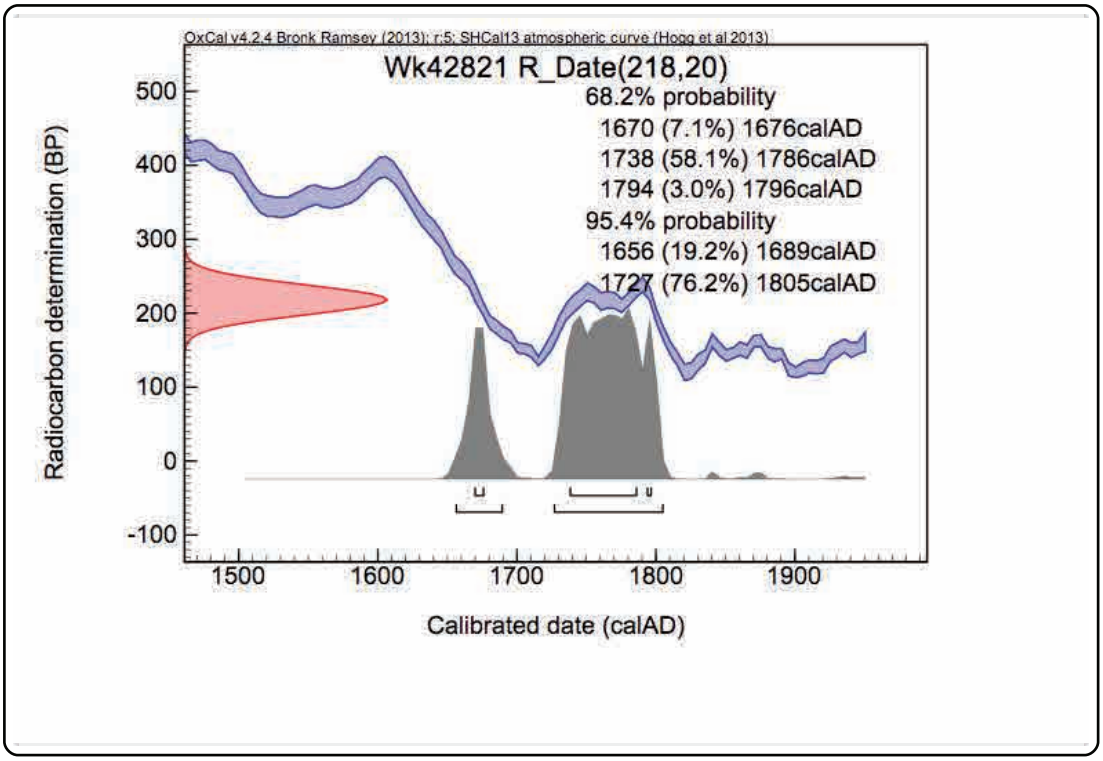
Submitter	M Campbell
Submitter's Code	F65
Site & Location	Taupiri, Waikato, New Zealand
Sample Material	Charcoal (id)
Physical Pretreatment	Sample cleaned.
Chemical Pretreatment	Sample washed in hot HCl, rinsed and treated with multiple hot NaOH washes. The NaOH insoluble fraction was treated with hot HCl, filtered, rinsed and dried.

$D^{14}C$	-26.8 ±	2.3 ‰
$F^{14}C$%	97.3 ±	0.2 %
Result	**218 ± 20 BP**	

(AMS measurement)

Comments

Please note: The Carbon-13 stable isotope value ($\delta^{13}C$) was measured on prepared graphite using the AMS spectrometer. The radiocarbon date has therefore been corrected for isotopic fractionation. However the AMS-measured $\delta^{13}C$ value can differ from the $\delta^{13}C$ of the original material and it is therefore not shown.



- Explanation of the calibrated Oxcal plots can be found at the Oxford Radiocarbon Accelerator Unit's calibration web pages (http://c14.arch.ox.ac.uk/embed.php?File=explanation.php)
- 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 and is measured on sample CO_2.
- $F^{14}C$% is also known as *Percent Modern Carbon (pMC)*.

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Tuesday, 15 December 2015

Radiocarbon Dating Laboratory

Report on Radiocarbon Age Determination for Wk- 42822

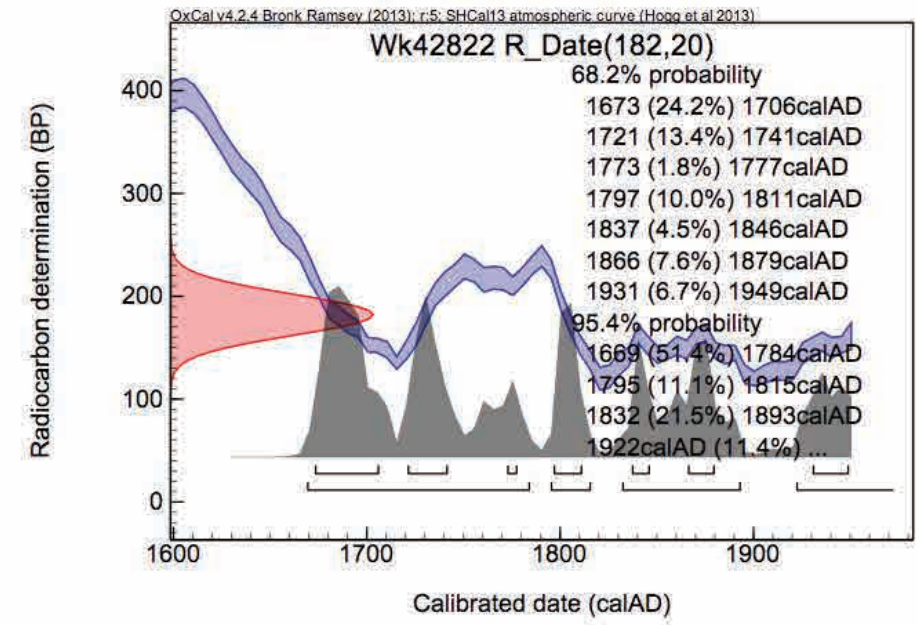
Submitter	M Campbell
Submitter's Code	F71
Site & Location	Taupiri, Waikato, New Zealand
Sample Material	Charcoal (id)
Physical Pretreatment	Sample cleaned.
Chemical Pretreatment	Sample washed in hot HCl, rinsed and treated with multiple hot NaOH washes. The NaOH insoluble fraction was treated with hot HCl, filtered, rinsed and dried.

$D^{14}C$	-22.4 ±	2.4 ‰
$F^{14}C\%$	97.8 ±	0.2 %
Result	**182 ± 20 BP**	

(AMS measurement)

Comments

Please note: The Carbon-13 stable isotope value ($\delta^{13}C$) was measured on prepared graphite using the AMS spectrometer. The radiocarbon date has therefore been corrected for isotopic fractionation. However the AMS-measured $\delta^{13}C$ value can differ from the $\delta^{13}C$ of the original material and it is therefore not shown.



- Explanation of the calibrated Oxcal plots can be found at the Oxford Radiocarbon Accelerator Unit's calibration web pages (http://c14.arch.ox.ac.uk/embed.php?File=explanation.php)
- 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 and is measured on sample CO_2.
- $F^{14}C\%$ is also known as *Percent Modern Carbon (pMC)*.

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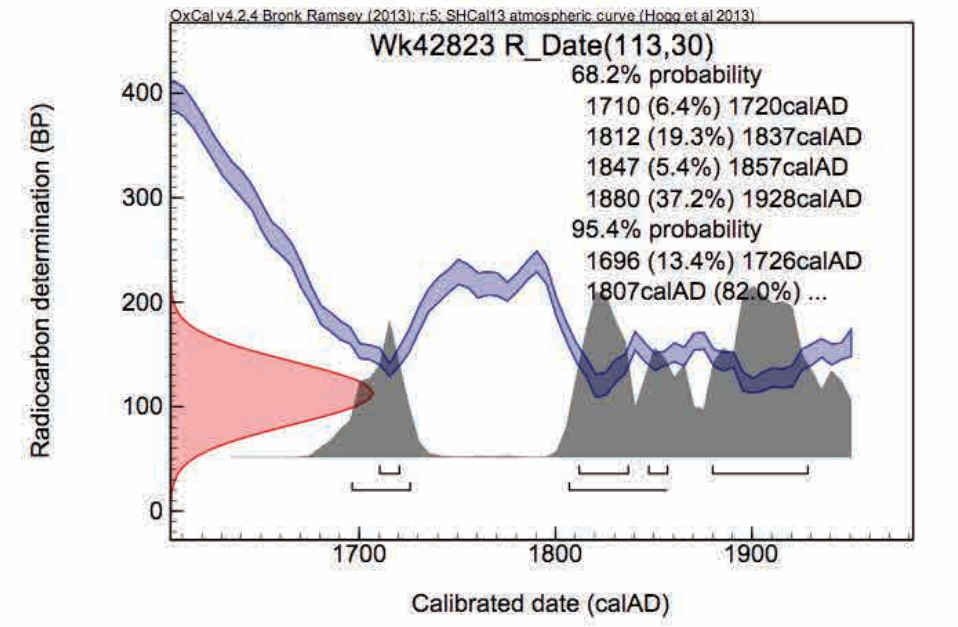
Tuesday, 15 December 2015

Report on Radiocarbon Age Determination for Wk- 42823

Submitter	M Campbell
Submitter's Code	F129
Site & Location	Taupiri, Waikato, New Zealand
Sample Material	Charcoal (id)
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.

$\delta^{13}C$	-31.6 ±	0.2 ‰
$D^{14}C$	-14.0 ±	3.6 ‰
$F^{14}C\%$	98.6 ±	0.4 %
Result	**113 ± 30 BP**	

Comments



- Explanation of the calibrated Oxcal plots can be found at the Oxford Radiocarbon Accelerator Unit's calibration web pages (http://c14.arch.ox.ac.uk/embed.php?File=explanation.php)
- 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 and is measured on sample CO_2.
- $F^{14}C\%$ is also known as *Percent Modern Carbon (pMC)*.

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Tuesday, 15 December 2015

Radiocarbon Dating Laboratory

Report on Radiocarbon Age Determination for Wk- 42824

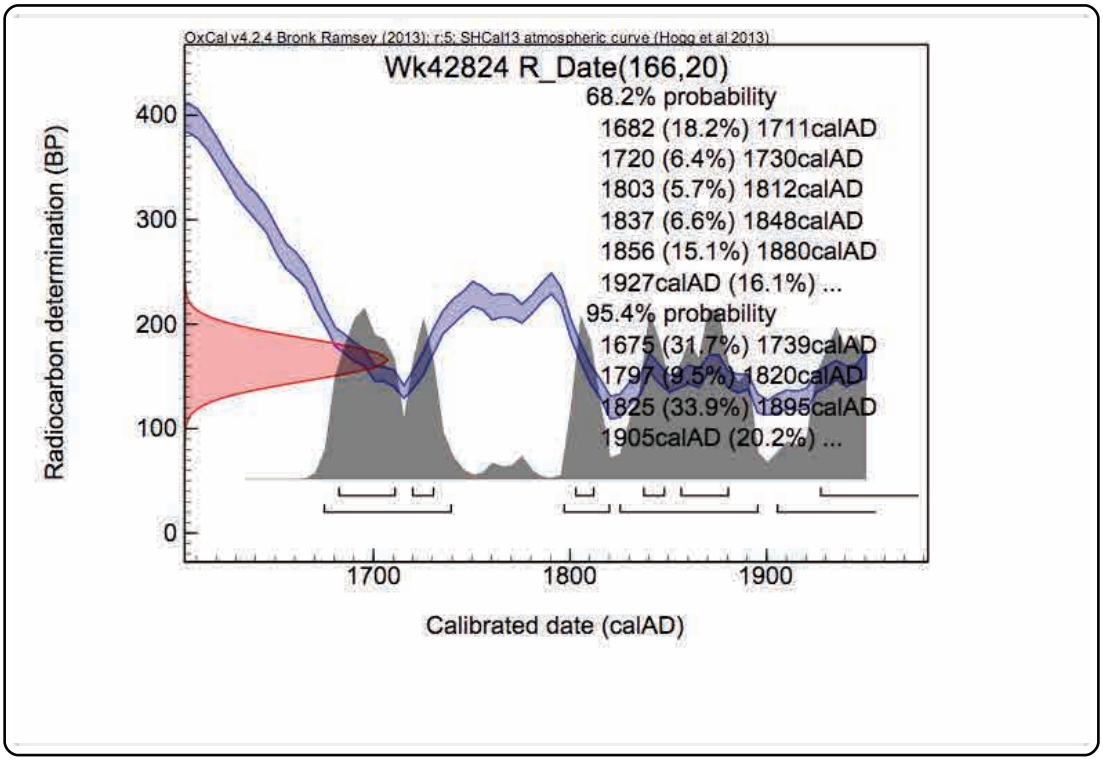
Submitter	M Campbell
Submitter's Code	F74
Site & Location	Taupiri, Waikato, New Zealand
Sample Material	Charcoal (id)
Physical Pretreatment	Sample cleaned.
Chemical Pretreatment	Sample washed in hot HCl, rinsed and treated with multiple hot NaOH washes. The NaOH insoluble fraction was treated with hot HCl, filtered, rinsed and dried.

$D^{14}C$	-20.5 ±	2.3 ‰
$F^{14}C$%	98.0 ±	0.2 %
Result	**166 ± 20 BP**	

(AMS measurement)

Comments

Please note: The Carbon-13 stable isotope value ($\delta^{13}C$) was measured on prepared graphite using the AMS spectrometer. The radiocarbon date has therefore been corrected for isotopic fractionation. However the AMS-measured $\delta^{13}C$ value can differ from the $\delta^{13}C$ of the original material and it is therefore not shown.



- Explanation of the calibrated Oxcal plots can be found at the Oxford Radiocarbon Accelerator Unit's calibration web pages (http://c14.arch.ox.ac.uk/embed.php?File=explanation.php)
- 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 and is measured on sample CO_2.
- $F^{14}C$% is also known as *Percent Modern Carbon (pMC)*.

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Tuesday, 15 December 2015

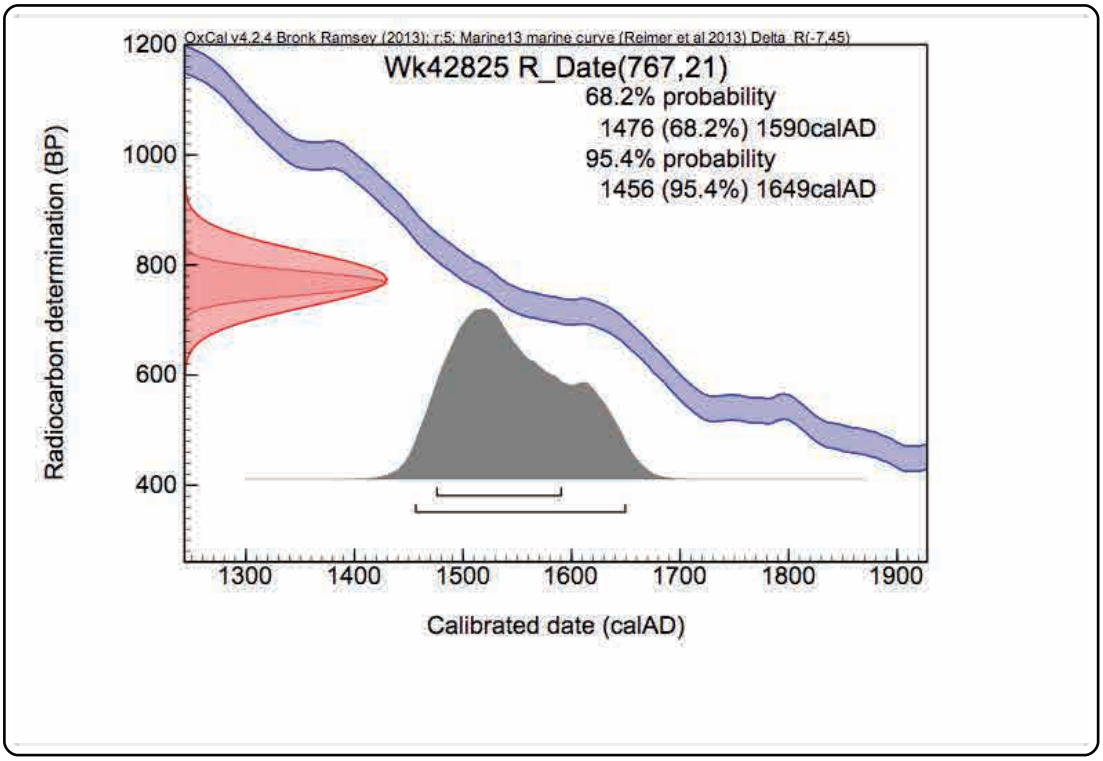
Radiocarbon Dating Laboratory

Report on Radiocarbon Age Determination for Wk- 42825

Submitter	M Campbell
Submitter's Code	F106
Site & Location	Taupiri, Waikato, New Zealand
Sample Material	Paphies australis
Physical Pretreatment	Surfaces cleaned. Washed in an ultrasonic bath. Tested for recrystallization: aragonite.
Chemical Pretreatment	Sample acid washed using 2 M dil. HCl for 120 seconds, rinsed and dried.

$\delta^{13}C$	1.1 ±	0.2 ‰
$D^{14}C$	-91.1 ±	2.4 ‰
$F^{14}C\%$	90.9 ±	0.2 %
Result	**767 ± 21 BP**	

Comments



- Explanation of the calibrated Oxcal plots can be found at the Oxford Radiocarbon Accelerator Unit's calibration web pages (http://c14.arch.ox.ac.uk/embed.php?File=explanation.php)
- 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 and is measured on sample CO_2.
- $F^{14}C\%$ is also known as *Percent Modern Carbon (pMC)*.

Ali Hogg