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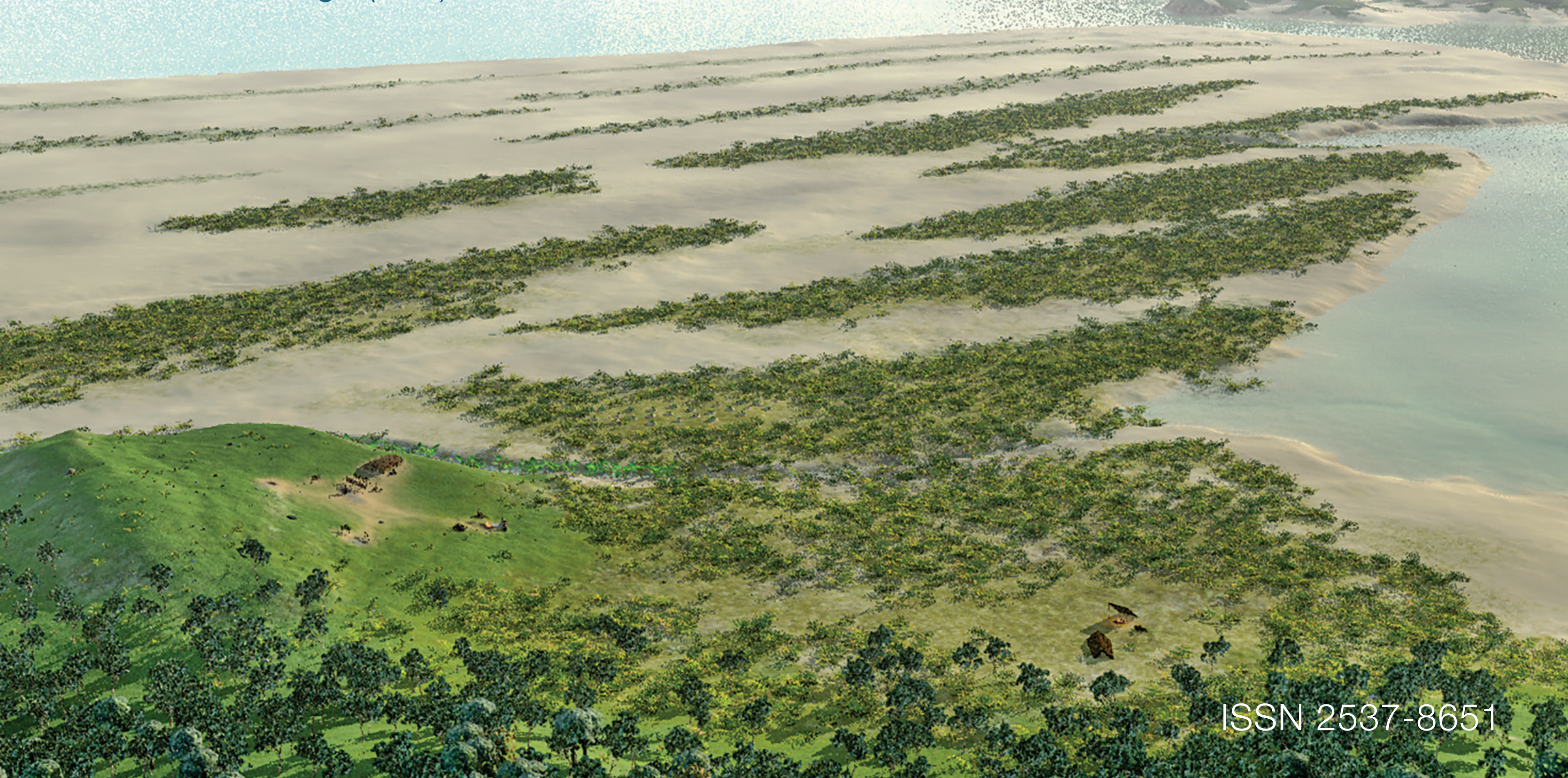
Clough and Associates Monograph Series no. 23

STAGE 2B, 4 AND 5 EARTHWORKS, 720 PURANGI ROAD, COOKS BEACH (PUKAKI), COROMANDEL

Final Report of Archaeological Investigations

By Ben Jones (MA Hons)
Simon Bickler (PhD)
Bernie Larsen (MA Hons)
Kirstin Roth (BA Hons)
Doug Gaylard (MA Hons)
Rod Clough (PhD)

Report prepared for
Longreach Developments Ltd LONGREACH
In Fulfilment of HNZPT Authority 2020/230



ISSN 2537-8651

FINAL REPORT OF ARCHAEOLOGICAL INVESTIGATIONS: STAGE 2B, 4 AND 5 EARTHWORKS, 720 PURANGI ROAD, COOKS BEACH (PUKAKI), COROMANDEL

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June 2021

By

Ben Jones, MA (Hons)

Simon Bickler, PhD

Bernie Larsen, MA (Hons)

Kirstin Roth, BA (Hons)

Doug Gaylard, MA (Hons)

Rod Clough, PhD

Clough & ASSOCIATES LTD

321 Forest Hill Rd,

Waiatarua, Auckland 0612

Telephone: (09) 8141946
Mobile 0274 850 059

www.clough.co.nz

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1 INTRODUCTION

1.1 Project Background

Longreach Developments Ltd undertook earthworks for development at 720 Purangi Road, Cooks Beach, Lot 503 DP 517320 (Figure 1 and Figure 2). The work was for a large subdivision including house lots, roading, and other related infrastructure. Phases 1 and 2 earthworks, to the north of the current project area, were completed in 2018. Longreach Developments Ltd asked Clough & Associates to undertake the archaeological monitoring and investigations during the Stages 2B, 4 and 5 earthworks (Figure 3–Figure 5).

The effects of the development had previously been assessed in reports by A. Hoffman (2014, 2017). His plan identifying the sites in the subdivision area is shown in Figure 4. However, earthworks plans were not completed at that point and an updated addendum was submitted as part of the new Authority application (Bickler 2019).

The archaeological work was carried out in accordance with the recommendations of the Archaeological Management Plan (AMP) and Research Strategy (Bickler and Clough 2019) prepared for the Stages 2B, 4 and 5 authority application, which identified areas of archaeological potential that required monitoring by an archaeologist (Figure 6). The AMP outlines the procedures which were followed during archaeological monitoring of earthworks near the known sites and for recording any archaeological evidence before it was modified or destroyed. Protocols for the exposure of archaeological remains including koiwi tangata (human remains) or taonga (Māori artefacts) were included.

This report details the final results of the archaeological work carried out within Stages 2B, 4 and 5. Specifically, the work relates to the requirements stipulated in authority no. 2020/230 relating to sites T11/1014, T11/1050, T11/1051 and T11/2790 (Figure 7) and describes the sampling, monitoring and excavation of these sites between November 2019 and June 2020 with follow up visits as need for the remaining earthworks.

Hoffman's work provided the framework for the research strategy following recommendations made in previous assessments and reports. Given the extensive and intensive investigations undertaken by Hoffman (2015, 2017), the archaeological work primarily involved following the earthworks programme with excavations undertaken as sites were exposed. Discussion with Bev Parslow (Heritage NZ) led to the agreement that the level of detailed work carried out in the Stage 1 works was not required for Stages 2B, 4 and 5 owing to the information already recovered.

The outcome of the archaeological investigations will be integrated where possible with the previous work reported for Stage 1 and also the previous investigations by Hoffman (2010) on site T11/928, which is within the Stage 2B area (see Figure 4–Figure 5, Figure 7).

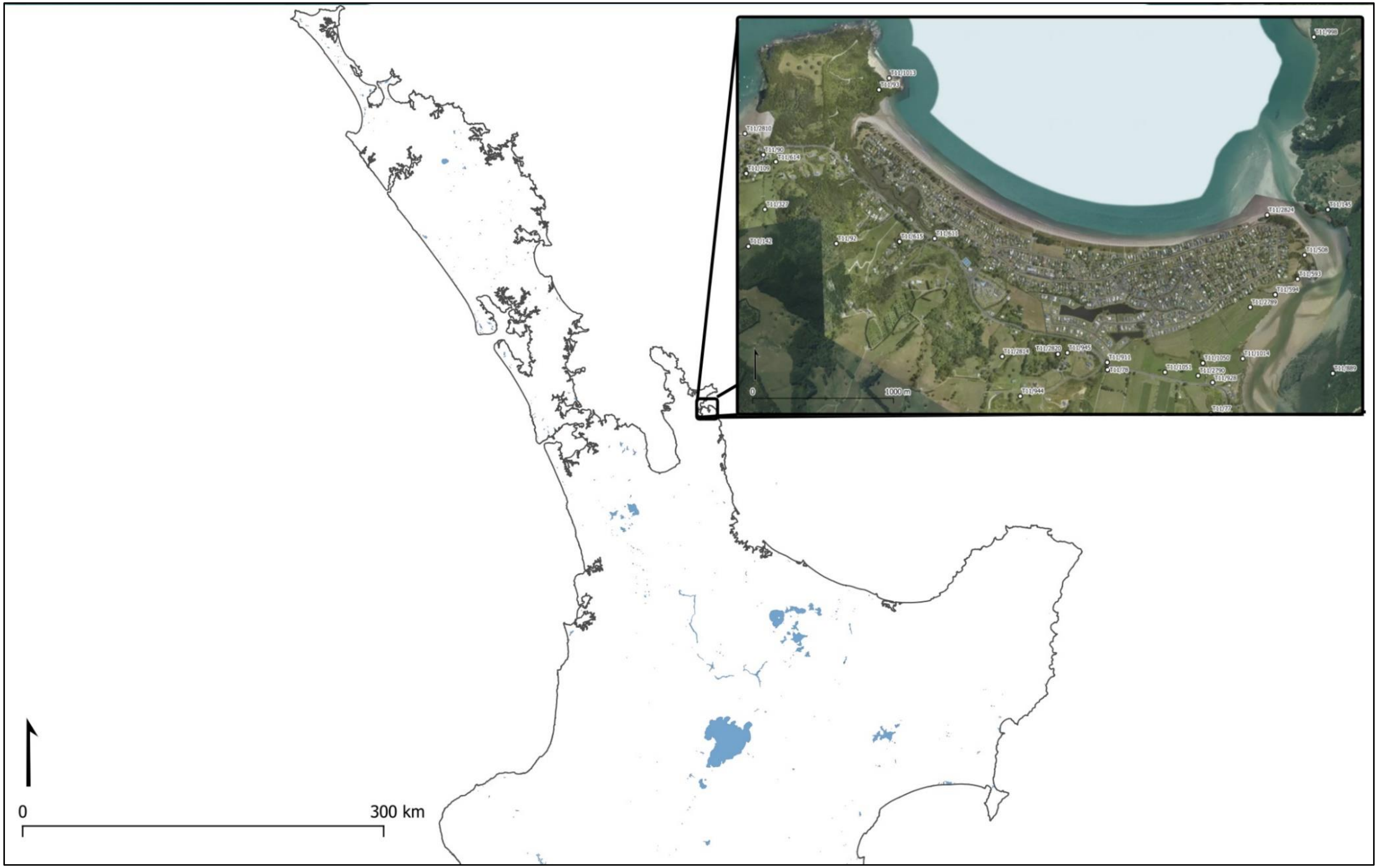

Figure 1. Location of works described in this report

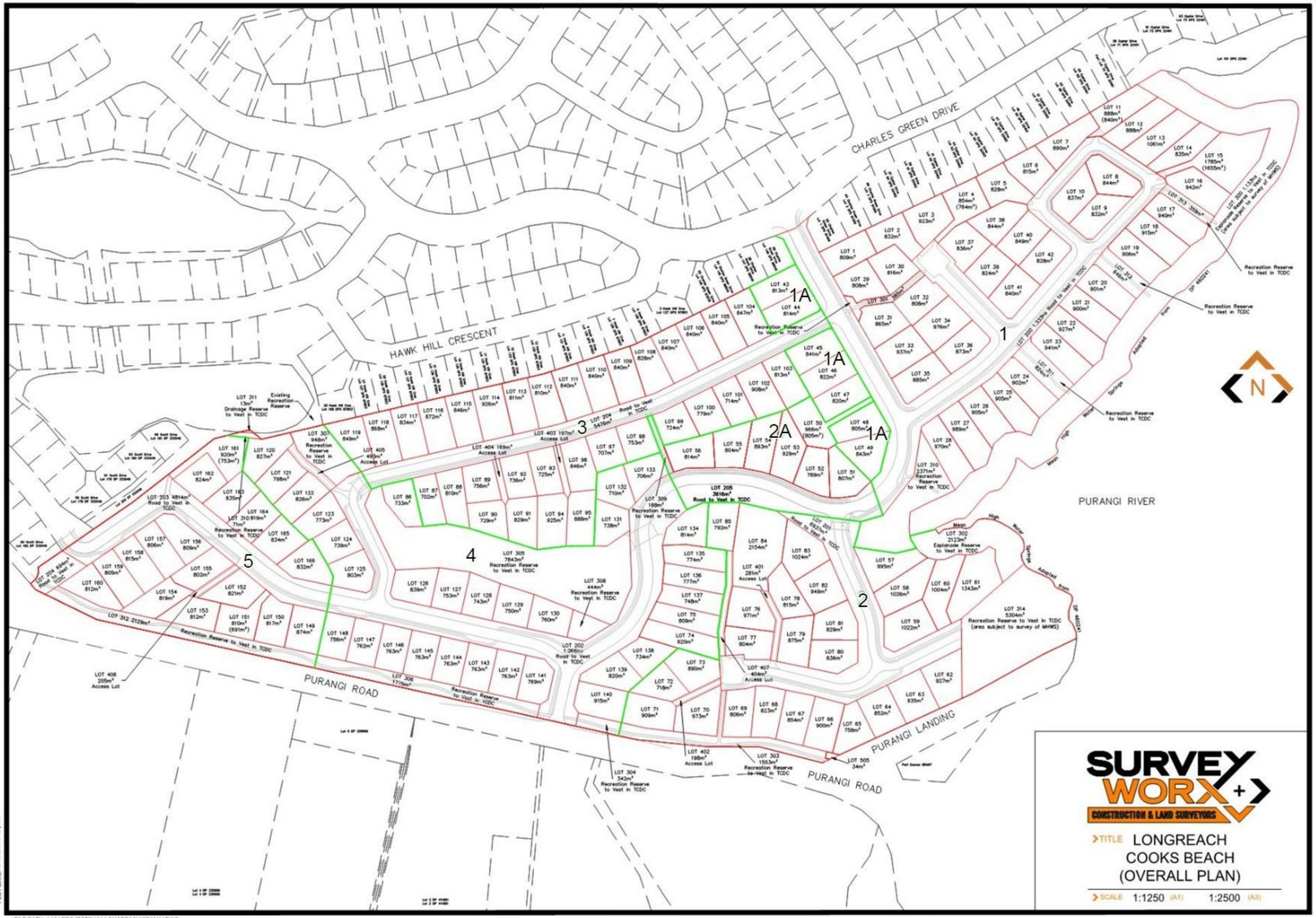

Figure 2. Original overall subdivision plan for Cooks Beach, with stages numbered

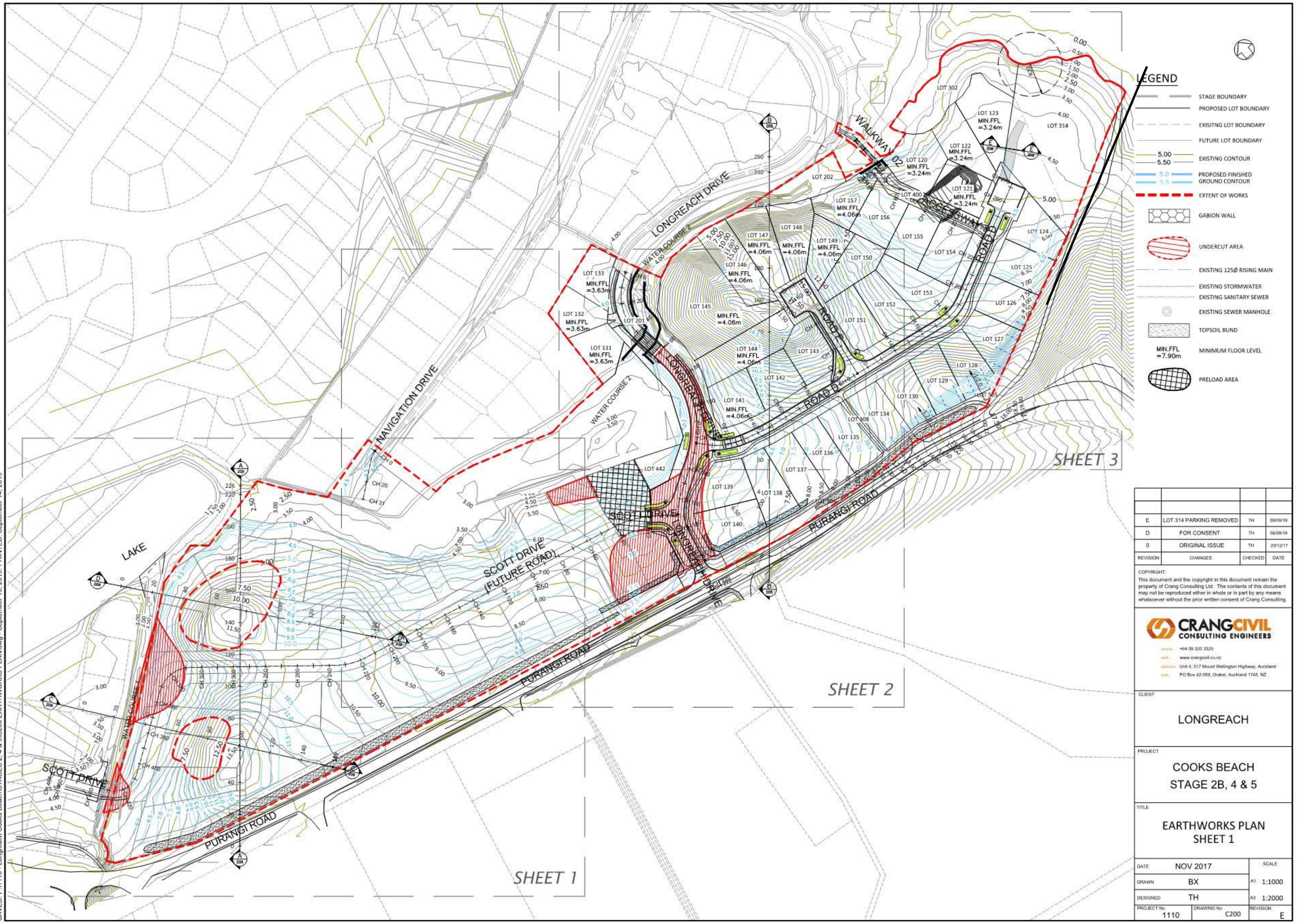

Figure 3. Revised earthworks plan for Stages 2B, 4 and 5 (see Figure 2 for numbering)

Figure 4. Investigations and archaeological features identified by Hoffman (2015) on the wider subdivision property

Figure 5. Earthworks plan for Stages 2B, 4 and 5 showing archaeological site areas from Hoffman (2015) overlaid on cut and fill plan

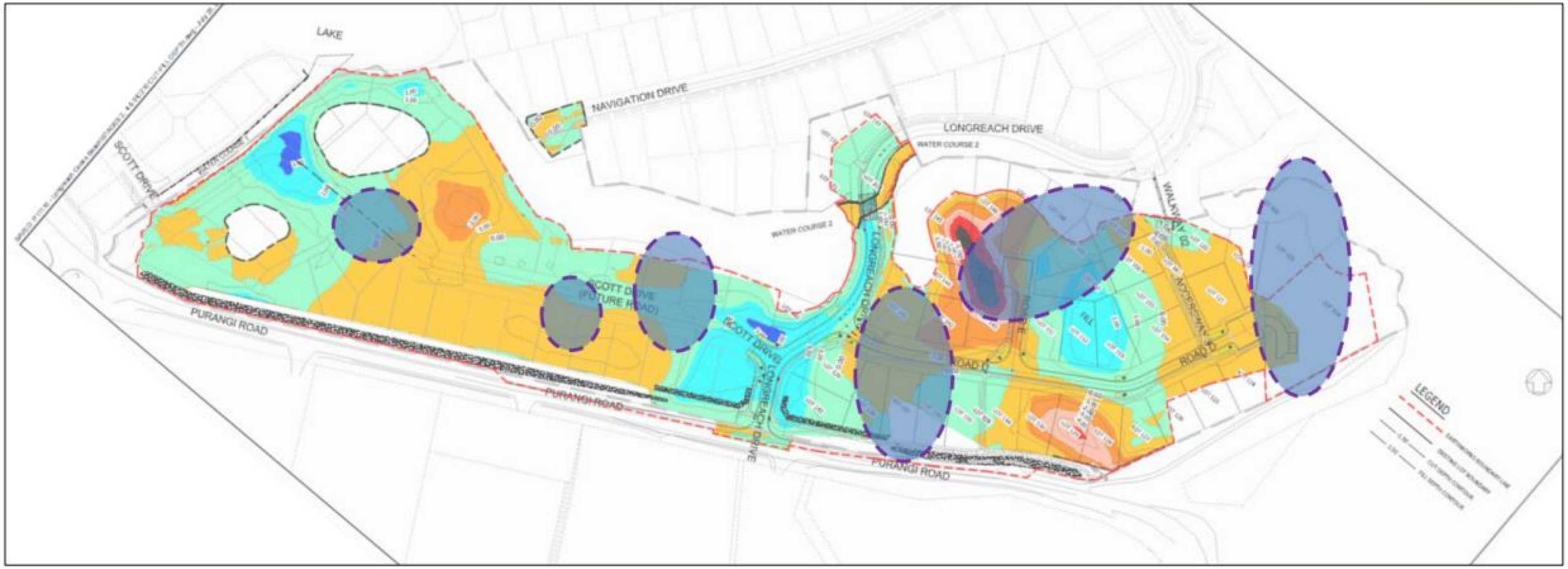

Figure 6. Earthworks plan for Stages 2B, 4 and 5 showing archaeological 'hot-spots' (purple shaded areas inside dashed lines) to be monitored by an Archaeologist (from the AMP, Bickler and Clough 2019)

Figure 7. Location of recorded archaeological sites within and in proximity to Stages 2B, 4 and 5

1.2 Previous Archaeological Work

The original archaeological assessment was undertaken by Andrew Hoffman in 2014:

> A. Hoffmann, 2014. Assessment of the Archaeological Values and Effects of the Proposed Subdivision of SA46A/631, 720 Purangi Road, Cooks Beach, Coromandel Peninsula: Application for Exploratory Authority under section 56 HNZPT Act 2014. Report for Longreach Developments Limited & Heritage New Zealand.

Given the archaeological potential of the property, the assessment concluded that a preliminary investigation was required to determine the potential extent and distribution of archaeological sites. Hoffman conducted the investigation and prepared a report on the results:

> A. Hoffmann, 2015. Results of Exploratory Investigations at Part Dacre Grant SA4A/631, 720 Purangi Road, Cooks Beach, Coromandel Peninsula: HNZ authority 2015/197 – Assessment of Archaeological Values and Effects of Proposed Subdivision Earthworks Stage 1 (Phases 1 and 2) as Background for a General Authority to Destroy. Report to Longreach Developments Ltd.

The results of the investigation established that soils had been modified for gardens by Māori in the pre-contact period, over a large part of the property (Figure 5). Activities associated with horticulture, as well as other clear indications of settlement such as a midden, were also found. A number of sites were identified across the property.

As a result of this work Two Heritage NZ Authorities were applied for to manage the archaeological work resulting from the required earthworks.

The results of the first stage of earthworks have been reported in detail:

> A. Hoffmann, 2017. Investigation of Archaeological Site T11/2789, Cooks Beach (Pukaki), Mercury Bay: Final Report. HNZ Authorities 2015/867 & 2015/1022. Report to Longreach Developments Ltd & Heritage New Zealand.

The archaeological work was very detailed, involving students from the University of Otago to carry out additional research on some of the aspects of the environmental and artefactual results of the investigation of site T11/2789, which was located across most of the Stage 1 earthworks area. Some of this work has been published in a peer reviewed publication.

> J.J. Maxwell, M.D. McCoy, M. Tromp, A. Hoffmann and I.G. Barber, 2017. The difficult place of deserted coasts in archaeology: new archaeological research on Cooks Beach (Pukaki), Coromandel Peninsula, New Zealand. *The Journal of Island and Coastal Archaeology*, DOI: 10.1080/15564894.2017.1285833.

The results of the investigations reported by Hoffman (2017) and Maxwell et al. (2017) have produced a rich picture of pre-contact occupation of this part of Cooks Beach along the western banks of the Purangi River. This includes evidence of landscape modification within the 'first half of the 14th Century, or at the latest within the last 2-decade [sic] of that Century' (Hoffman 2017:25). Subsequent settlement from around 1500AD-1650AD after about 100 years of no occupation, appears to have been relatively small scale and consistent with short-term encampments by a small number of people perhaps accessing the range of available resources, including the local obsidian sources. Midden/hangi identified across the dunes appear to have been small, temporary cooking sites that could have been formed in a matter of days or weeks and were located adjacent to the cultivations (Hoffman 2017:26).

C14 dates generated from the excavations provide a rich source of information. A chronological model of the radiocarbon dates has suggested that the area may have fallen into disuse or been abandoned around 1650AD (Maxwell et al. 2017:15; see Figure 8 and Table 1). Hoffman (2017) and Maxwell et al. (2017) discuss explanations for this abandonment, possibly the result of the local soils becoming less productive and/or the result of greater conflict in the region during that period. The abandonment of the area by the time of Captain Cook's visit in 1769 suggests that conditions had not changed following that abandonment.

Hoffman (2017:29) argues that the results of the excavation contrast in parts with other sites in the region, but the brief and intensive periods of use of the area suggest intentional, innovative strategies to bring poor land into cultivation.

Table 1. Chronological model for settlement at T11/2789 (after Maxwell et al. 2017)

Date (Approximate)	Description
1300 - 1400 AD	Environmental impact/ resource exploitation, etc.
1400 - 1500 AD	Abandonment
1500 - 1650 AD	Cultivation and transient settlement
1650 AD on	Abandonment

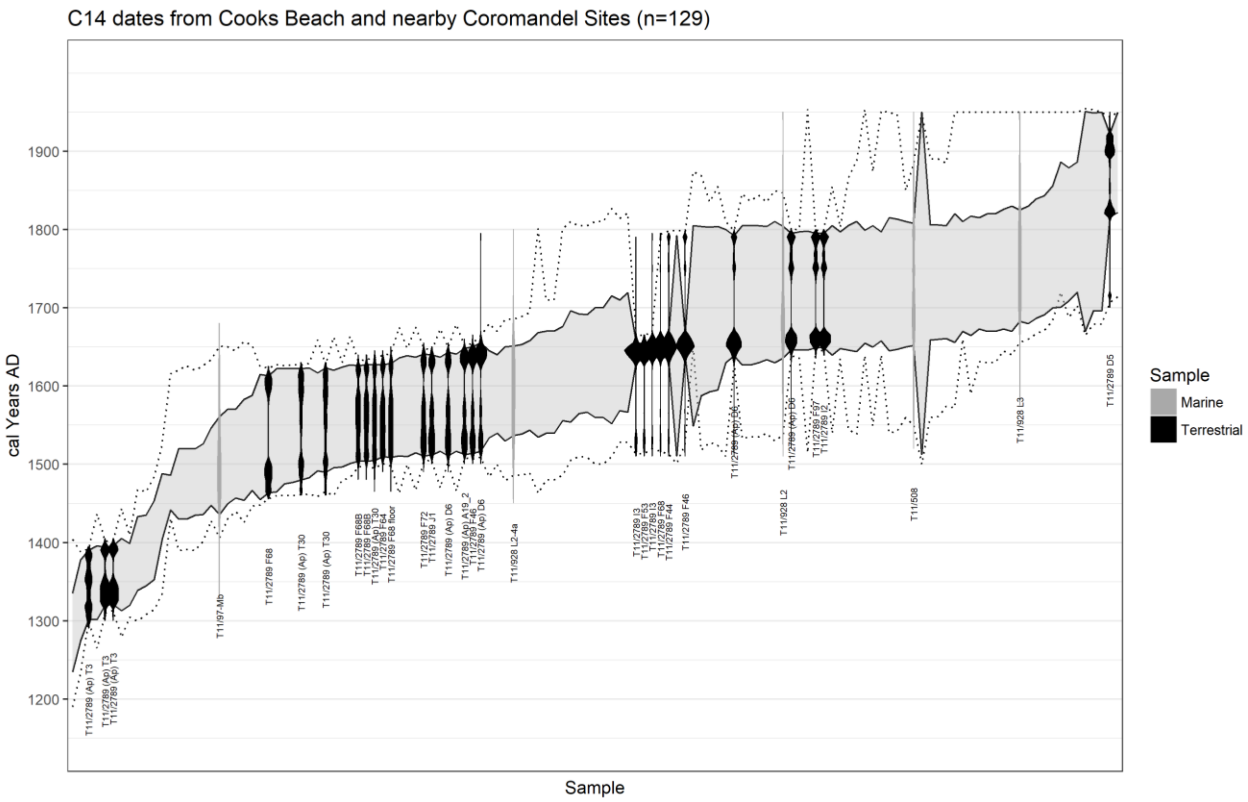

Figure 8. Radiocarbon dates from Cooks Beach (black and grey probability curves) compared with dates from other Coromandel sites (T10-T12)

1.3 Research Strategy

The following research strategy is derived from Bickler and Clough 2019.

1.3.1 Wider Archaeological Background

The settlement of Aotearoa/New Zealand is subject to extensive research, most recently summarised by Walter et al. (2017), suggesting mass migration from Central Polynesia around 1250AD. The settlement of NZ is significant in terms of Polynesia, not least because of the scale of the landscape that they arrived in – c.268,00 km^2, nearly 10 times the size of the next largest group of islands in Polynesia (Hawaii at 28,311 km^2). Those Polynesian ancestors gave rise to the Māori, who set about transforming much of the newly settled landscape, a considerable amount of it for agricultural use.

Hoffman (2017:26ff) has summarised some of the archaeological work relating to Māori agriculture and this represents only part of the ongoing work being undertaken. As well as the work in the Coromandel, numerous excavations from the Auckland region, e.g., at Omaha (Campbell et al. 2004), Waikato and Bay of Plenty (e.g., Gumbley et al. 2004), provide some comparative insight, particularly regarding gardening along the coastal margins.

Damon and Bickler (2017), building on many earlier projects, have recently taken a broader view comparing how Māori agriculture fits within some of the wider Pacific perspectives. What is highlighted from this work is that the agricultural systems adopted by Pacific Islanders involved a three-pronged approach (Figure 9):

- Dryland agriculture managing
- Wetland agriculture
- A fallow/vegetation clearance crop.

In the Austronesian expansion, yams essential in Near Oceania gave way to taro in Central Polynesia. On the temperate margins, sweet potato become dominant as intensification of the wetland systems did not scale well. In New Zealand, Māori were constantly creating strategies to balance these three cropping systems to ensure they had a year-round supply of food. The strategies required to achieve that supply across the hugely variable geologies meant that different crops and land modification systems were required at different times. Taro, a staple in central Polynesia was grown in the top half the North Island, but almost completely dropped away with the arrival of European crops, and its earlier role in the cultivation systems has yet to be fully explored (see e.g., Bickler et al. 2020).

The work undertaken at Cooks Beach by Hoffman (2017) and Maxwell et al. (2017) has shown the importance of the role of the bracken fern rhizome in Māori food pathways. This has sporadically been subject to investigation (see references in Hoffman 2017; and Jones (1989), who also examines the activities at another bay visited by Captain Cook). Identifying bracken agricultural practices has been difficult archaeologically. Storage pits, one of the most common archaeological features in the northern parts of New Zealand, are typically associated with kumara, although in fact there is usually nothing about the pits themselves that determines what was stored in them. To some extent, the situation may have been one of not seeing the wood for the trees, or in this case the carbohydrate in the bracken regrowth, because it is so commonly found, but assumed to be a by-product of land clearance.

As Jones (1989) points out, it is unlikely that bracken was particularly high in calorific content when compared with kumara, but bracken fern has some important advantages. Fernroot is encouraged by fires, and it requires a low labour input in terms of land clearance and cultivation. It also is available across a wider seasonal period and so can be cropped more regularly, especially at the times when kumara and taro, with limited cropping seasons, were not available (Davidson et al. 2006; Jones 1989). This makes it useful when times were lean, but also when populations were on the move. Mobility was an essential aspect of Māori seasonal activities, and the use of bracken allowed groups to move through their territory (rohe) while lowering the usage of their more valuable crops. Bracken also does not require active defensive protection, which kumara storage does.

Excavations at the coastal sites around the top of the North Island have almost always shown bracken as part of the landscape when examined (see e.g., Bickler et al. 2013, 2020; Campbell et al. 2004; see also summaries by Barber 2004 and Furey 2006). The results all show how dryland and wetland agricultural systems appeared to have sat side by side, reflecting local traditions as well as changing focus. Fern root helped to bridge these systems. For instance, at McLaughlins Mountain, (Bickler et al. 2013), which is part of the Auckland Volcanic Field, taro was probably grown in the swamp areas near the volcanic cone, but it was sweet potato, kumara, that required clearing of the basaltic stone to produce a field system mimicking those found in the warmer climates of tropical Polynesia.

At Weiti near Whangaparaoa, the earlier phase of occupation, around the 16th century AD was associated with creation of a wetland drainage system which involved the growing of taro and other swamp crops like cress or puha. However, this was likely to have been replaced by greater emphasis on dryland kumara cropping, probably nearer the foreshore, perhaps around the 17th century AD (Bickler et al. 2020]).

As at Cooks Beach, the Weiti sites are on an old dune system with higher relief behind, alongside a freshwater outlet to the sea. The motivation for the change in cultivation practices at Weiti is not clear but managing the waterflow for taro production of any scale may have required significantly more work than kumara. Increasing pressures from competing Māori groups in the Auckland region may have encouraged a more flexible garden system alongside defendable zones typified by the classic cone pa at McLaughlins and the small pa at Weiti. However, as at Cooks Beach, Omaha Beach north of Auckland (Campbell et al. 2004) and Papamoa (see e.g., Gumbley n.d., 2006; Campbell et al. 2009), land clearance would have allowed re-growth of bracken fern, which itself was considered a valuable, if not particularly desirable, food source, but integrated into a wider dispersed pattern of food acquisition (Figure 10).

Contextualising the current project within this scheme allows further examination of the nature of the evidence uncovered at Cooks Beach by Hoffman (2015, 2017) and Maxwell et al. (2017). Previous work has identified periods of landscape transformation and changes in cultivation, but also drawn attention to the importance of bracken root as a critical food source. What is not so apparent is the way in which the cultivation areas identified at T11/2789 fit within the broader area of Cooks Beach. Did those cultivations represent a specialised adaptation on the local soils that necessitated a broader and dispersed cultivation strategy? Was this the result of the transient nature of occupation of this small part of the area representing the minimal oversight required when compared to other parts of the landscape that may have required more attention or provided better return on intensified agriculture?

The scale of that dispersed strategy is hard to determine given the large amount of development now present at Cooks Beach. The archaeological investigations for the remaining subdivision therefore represented a valuable additional opportunity to add to the work undertaken by Hoffman and colleagues.

1.3.2 Research Aims

The research objectives for archaeological investigations carried out during Stages 2B, 4 and 5 earthworks are set out below.

Coastal Settlement

Several larger middens around the current house were identified by Hoffman (see Figure 4–Figure 5). This suggests the possibility that sites including T11/1050 and T10/1014 might represent a larger site occupied for a longer period than the areas nearby.

Depending on the age of those sites, this might change the settlement model described by Hoffman (2017) and Maxwell et al. (2017), demonstrating changing occupation strategies. Recent reconstruction of sites (Bickler et al. 2017 [now 2020]; Farley and Bickler 2017) is being undertaken to place the somewhat ephemeral remains of Māori sites within their larger physical and cultural landscape. The results should contribute to a better understanding of the intensity and fluctuations of habitation in the coastal zone, as well as exploitation of marine, soil and stone resources. This information can be used alongside information from local iwi and hapu regarding the lengthy history of the region.

Objectives

1. Determine if the occupation areas in the Stages 2B, 4 and 5 areas fit the transient nature described nearby.
2. Identify any occupation structures and provide interpretation of those structures.

Agriculture

Maxwell et al. (2017) and Hoffman (2017) combined analysis of palynology and starch grain analysis of sediments and obsidian tool residue to determine the likely environment and agricultural practices present at T11/2789. Hoffman (2017:27-29) elegantly situates the results of the work on T11/2789 with the debates on prehistoric Māori gardening in the archaeological literature over the last 50 or so years. The results to date have added significantly to our understanding of Māori cultivation and as discussed above, this has broader New Zealand and Pacific wide implications.

Hoffman (2017) notes that while kumara agriculture is 'clear' from the range of storage and gardening features, and typically the crop is assumed to have been the prime target for cultivation at Cooks Beach, the results show almost no direct evidence of kumara agriculture present from the work so far. Starch residues were poorly preserved, which may be the explanation for this absence, but with the exception of a possible starch residue on one of the obsidian tools (CB-3), the evidence of kumara gardening as such is equivocal. Storage pits identified at the site do not inherently imply the presence of kumara *cultivation* at the site, where the soils may have been relatively poor. Hoffman (2017) highlights that the best evidence to date relates to bracken and there is good evidence that this may have been fundamental to activities at T11/2789. The next phase of work will endeavour to explore this further.

Objectives

1. Determine if there is further evidence of kumara agriculture at the archaeological sites on the property.
2. Retrieve any additional environmental data associated with the bracken fern use.
3. Record any other landscape modifications undertaken for prehistoric cultivation.
4. Determine any taphonomic impacts, such as for later historic farming, to explore how soils horizons described by Hoffman (2017) have been developed.
5. Further the comparative work on cultivation described by Hoffman (2017) and Maxwell et al. (2017) in a regional and national level.

Chronology

The sites excavated at during the Cooks Beach investigations described by Hoffman (2017) are one of the main reasons Maxwell et al. (2017) have argued for a three-phase occupation and abandonment model for settlement at Cooks Beach. This is summarised in Table 1.

They argued that the first phase of abandonment may relate to the transient nature of occupation in the area, targeting the main resources such as obsidian; this was relatively intermittent, and no evidence of large-scale settlement has been identified. Following a period of abandonment during the 15th century AD, small scale occupation occurred with cultivation. The area was then abandoned again during the mid-17th century.

The results presented to date examine the main chronological components of T11/2789, although no detailed examination of intra-site variability has been provided. The sites recorded in the Stage 2 earthworks footprint represent part of the landscape described and so the results from those sites add to the overall interpretation of occupation in the area.

Maxwell et al. (2017) provided some additional comparative analysis of the radiocarbon dating chronology from T11/2789. More detailed spatial analysis of the regional context of the dates (Figure 8) from the project will add to the understanding of the regional prehistory (see e.g., Bickler et al. 2013; Judge et al. 2013). As Hoffman (2017:26ff) has argued, the results obtained so far contrast with those from other nearby excavations on the Coromandel Peninsula.

Objectives

1. Dates from sites will add to an understanding of the chronology of Māori settlement at Cooks Beach.
2. Additional dates will be used to test the reality of this occupation abandonment models (see Hoffman 2017:26).
3. The implications of the updated chronology will be examined.

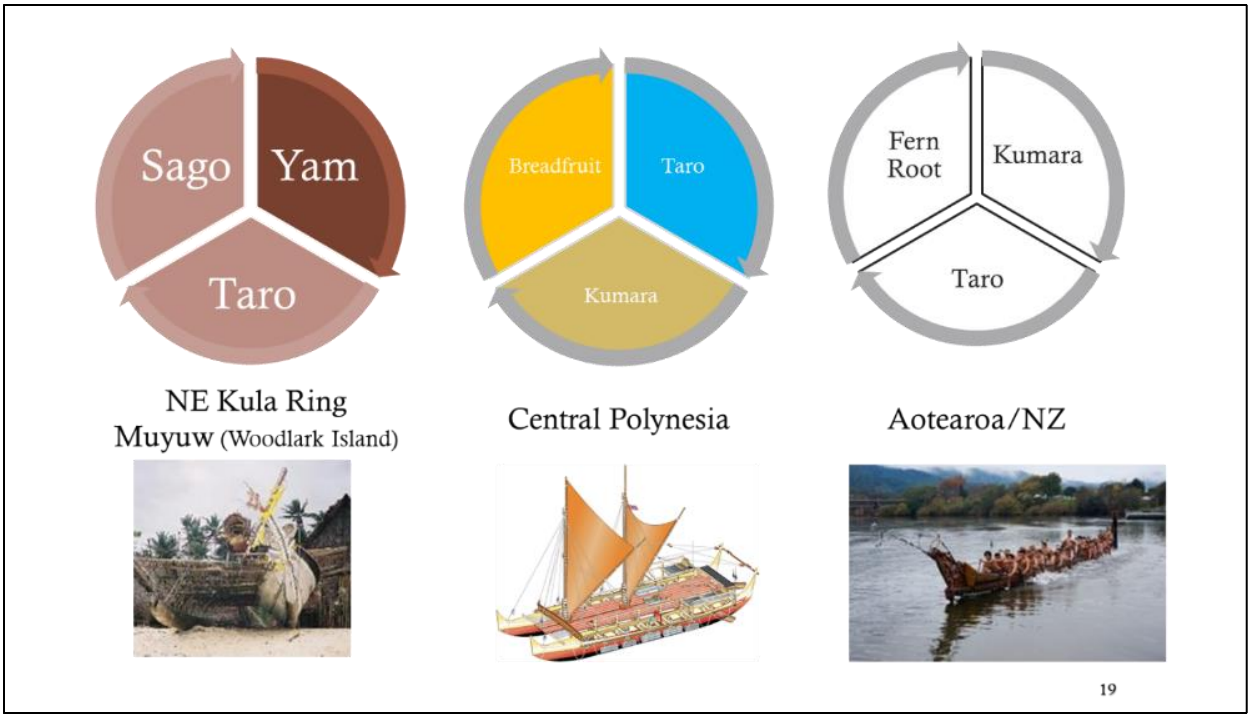

Figure 9. Comparison of the agricultural systems across the Pacific (from Damon and Bickler 2017)

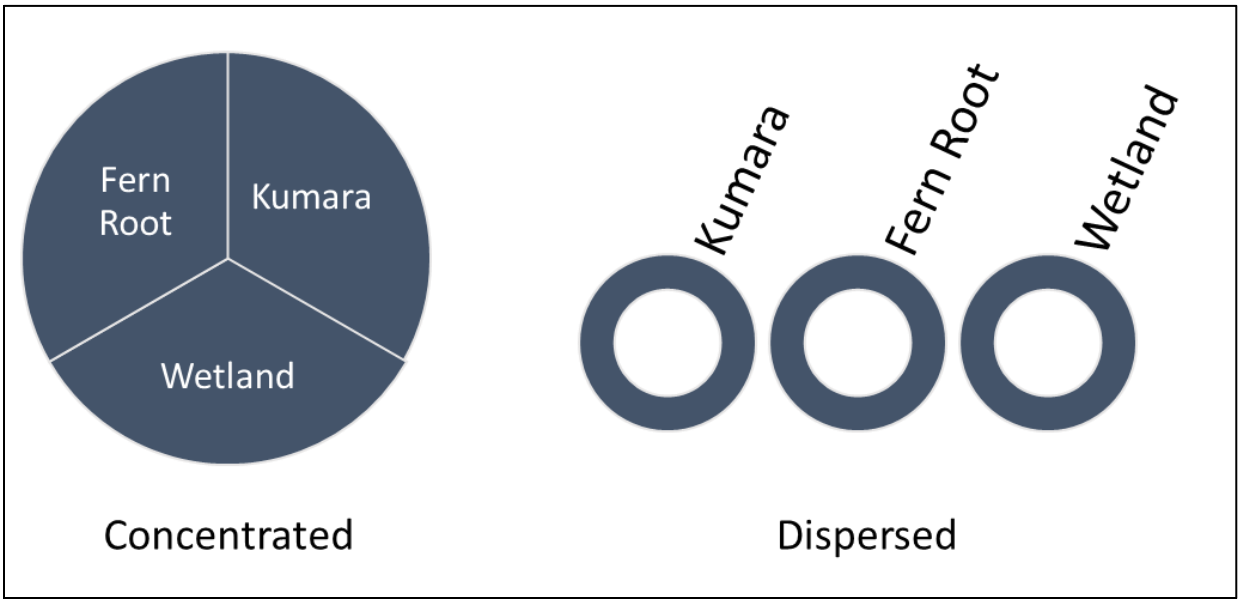

Figure 10. Concentrated versus spatially dispersed cultivation systems

1.4 Sites Modified or Protected

The Stages 2B, 4 and 5 earthworks involved the modification, and protection where feasible, of sites on the subdivision. The AMP (Bickler and Clough 2019) included following the recommendations made in the original AMP by Hoffman (2015).

1.4.1 Sites to be Protected

T11/1014

About half of the defined area of site T11/1014 is contained within the public recreation reserve at the eastern end of Stage 2B vested in the Council. The Reserve was fenced off at the start of works and heavy machinery excluded (Figure 11). Minor works for a spillway were required and monitored as the Authority required, but no archaeology was identified there.

Landscaping crews were informed of the archaeological areas within the reserve.

Figure 11. View of eastern boundary of earthworks looking east towards fenced-off area of T11/1014 reserve (indicated by arrow)

1.4.2 Sites to be Modified or Destroyed

The sites affected by the earthworks were:

- Parts of site T11/1014 (outside the reserve and within the western part of the reserve) (Figure 6);
- Sites T11/1050, T11/1051 and T11/2790, in the earthwork footprint (Figure 6).

The detailed work undertaken by Hoffman (2015, 2017) meant that it was possible to focus more on the structural elements that might represent settlement adjacent to the previously investigated site T11/2978. Although some additional trenching and areal excavation was required, the emphasis of the Stages 2B, 4 and 5 investigations were on recording those features uncovered during the earthworks rather than in depth investigation of the soils and other environmental components that formed part of the Stage 1 and 2 works.

1.5 Methodology

The wider project area has been subject to extensive testing by Hoffman (2015) and the full investigation of the Stage 1 earthworks area (Hoffman 2017; Maxwell et al. 2017). This included test pits across the Stage 2 earthworks zone (Figure 4) which identified the possible spread of archaeological remains. Given this information and the additional reports by Hoffman, no additional field work was undertaken in the Stage 1 area. The results of the previous investigations had been compared with the earthworks plan and the assessment of effects for Stages 2B, 4 and 5 was based on that, allowing a detailed AMP and research strategy to be developed (Bickler and Clough 2019). The archaeological work was carried out in accordance with the AMP and guided by the research strategy.

The archaeological investigations were undertaken in a manner similar to other investigations in the area so that comparisons could be made. The methodology was designed to establish the extent to which the remains of structures, features and associated faunal material and artefacts were still present, and to excavate them as required following standard archaeological practice.

The topsoil of each of the sites was cleared using a mechanical excavator with a tilt bucket under supervision of an archaeologist to expose the extent of the known archaeological deposits. Once cleared, archaeological features/deposits such as midden concentrations were examined, bulk sampled and recorded on the site plan. Trenches along the width of the midden concentrations were dug to investigate internal stratigraphy, which was recorded with section drawings and photography. The midden deposits then were removed by the mechanical excavator to expose underlying features which were excavated by hand, sectioned and intact remains were recorded.

The features with the densest charcoal concentrations such as fire scoops, hangi and post holes were then bulk sampled to retrieve both shell and charcoal for further analysis to provide information on the environmental context at the time of occupation and for dating purposes. Sample locations were marked on the site plan. Descriptions of features and their contents were recorded (see Appendix B), photographed and plotted on site plans.

Stratigraphic relationships between features were established where possible. After initial monitoring and the main excavations at site T11/1050, monitoring followed the protocol of weekly to bi-weekly site visits, and notification by the contractors if suspected archaeological remains were exposed when the archaeologist was not present.

1.6 Project Personnel

Rod Clough had overall direction of the project as the Section 45 archaeologist. Simon Bickler directed the fieldwork and analysis.

The archaeological team included the following:

Name	Role	Responsibility
Rod Clough, PhD	Director	Overall direction of project
Simon Bickler, PhD	Co-Director	Manage fieldwork and prepare report
Ben Jones, MA	Archaeologist	Monitoring, recording, prepare report
Doug Gaylard, MA	Archaeologist	Monitoring, recording
Tom Clough-Macready, BA	Archaeologist	Monitoring, recording
Gideon Bickler	Intern	Monitoring, recording
Kirstin Roth, BA	Archaeologist	Midden analysis
Jaime Grant, MA	Archaeologist	Charcoal processing

Specialist reports were undertaken by:

1. Charcoal Analysis: Dr Rod Wallace
2. Pollen and Phytoliths: Dr Mark Horrocks
3. 3D Models and illustrations: Thomas MacDiarmid.

1.7 Acknowledgements

Our thanks to Ngati Hei for providing cultural support during the project. Thanks are also extended to the crew from Hopper Construction and Longreach Developments. Their assistance during the excavations was instrumental in both ensuring the safety of the archaeologists around large moving vehicles and following the archaeological management plan. The expertise of the mechanical excavator operator was of great assistance during the investigation of the archaeological material.

2 ARCHAEOLOGICAL SITE DESCRIPTIONS

2.1 Sites in Project Area

There were four recorded archaeological sites within Stages 2B, 4 and 5 project area – two Māori horticultural sites (T11/2790 and T11/1051 within Stages 4 and 5, a pit/terrace site (T11/1050 within Stage 2B) and a 'source site' including a chert quarry, working area, midden and horticultural soils (T11/1014 within Stage 2B) (see Figure 4 for site extents, and Table 2). The earthworks affected all of these archaeological sites. However, most of site T11/1014 is contained within the public recreation reserve at the eastern end of Stage 2B vested in the Council. The most important elements of the site, including the chert source material, were avoided.

Figure 12. The distribution of archaeological sites within and in close proximity to the project area

Table 2. Table listing the sites within Stages 2B, 4 and 5

NZAA no.	Easting	Northing	Site Type
T11/1014	1845670	5918983	Chert quarry and working area
T11/1050	1845443	5918965	Pit/Terrace
T11/1051	1845226	5918921	Māori horticulture
T11/2790	1845414	5918897	Māori horticulture

T11/1014

The site was originally identified on the basis of chert and obsidian artefacts within the intertidal zone and at the eroded scarp at the eastern edge of the Stage 2 development. Chert boulders with nodules removed were found, along with old bottle glass and ceramics.

Midden was also identified and concentrated along the exposed scarp and visible within the southern side of the pasture near some cow sheds. Subsequent testing suggested that roughly 1.5 ha of the area had deeply mixed (400-500 mm), or modified soil adjacent to Purangi Landing Road.

T11/1050

This was a small knoll in the middle of the project area near a current modern house. The knoll was systematically probed for midden by Hoffman (2014), who identified eight midden deposits ranging in size from 3 x 3m to 50 x 20m around the flanks and four slight depressions (Labelled A to D), ranging in dimensions from c.2m x 2m to 2m x 3m. Hoffman also suggested that the largest feature could be a terrace of approximately 3m x 5m in size. The depressions were located together on the crest of the knoll, southwest of (above) and adjacent to the farmhouse.

T11/1051

The site was described by Hoffman (2014) as a continuous area of deeply mixed soils spanning at least 45 x 25m in the second paddock west of the Harsant driveway.

Hoffman (2014) suggested that the soil profile was indicative of mixing as a result of kumara gardening. Crushed shell and charcoal were also observed with some shell either added to the soil or the result of midden deposits being affected by later gardening of an earlier occupation site. The western extent of the site was not completely defined. It was considered possible that the site extended west into the next paddock and to the east.

T11/2790

The site was described as around 0.6 ha of more or less continuous pre-European horticultural soils across the paddock south of the old Harsant homestead, adjacent to their driveway and Purangi Road. The mixed soils commonly contained charcoal with shell midden sometimes found mixed in the material or in a lens near the surface (Hoffman 2014).

3 MONITORING AND EXCAVATION RESULTS

3.1 Introduction

A pre-start meeting was held with the contractors of the project on 11/11/2019 by Rod Clough and Simon Bickler (Figure 13).

The requirements of the Authority were discussed, and the implementation and timing of the project established.

Figure 13. Rod Clough undertaking the pre-start meeting with Hopper Construction

The investigations undertaken involved two main phases of work. The first consisted of earthworks monitoring in the flatter areas associated with sites T11/1014, T11/1051 and T11/2790 (Figure 14). This occurred both before and after the main excavation work on T11/1050 which had been identified as the primary focus of this phase of the development project. The earthworks monitoring was carried out between November 2019 and June 2020, with the investigation of T11/1050 carried out in January 2020.

As noted in the research strategy, substantial work had been undertaken by Hoffman (2017) on the gardening sites in the northern part of the development, so the focus of this phase was on investigation of features, ideally structural indicators, rather than the mixed gardening soils. Samples were taken during monitoring for comparative analysis but the main investigation was on T11/1050, which was the likely central occupation area of this zone.

3.2 Monitoring

This section describes the results of the monitoring of the main and auxiliary works which included topsoil stripping and installation of silt ponds and bunds. The identified archaeological hotspots (Figure 14) were monitored during the initial earthworks. Other areas were checked following topsoil removal and prior to subsequent cut and fills. Figure 15 shows the areas where archaeological features were identified during the visits. Monitoring included checks on the protection of site T11/1014 (Figure 11) where bunding and silt fencing were used to manage the earthworks and prevent damage to the protected areas of the reserve.

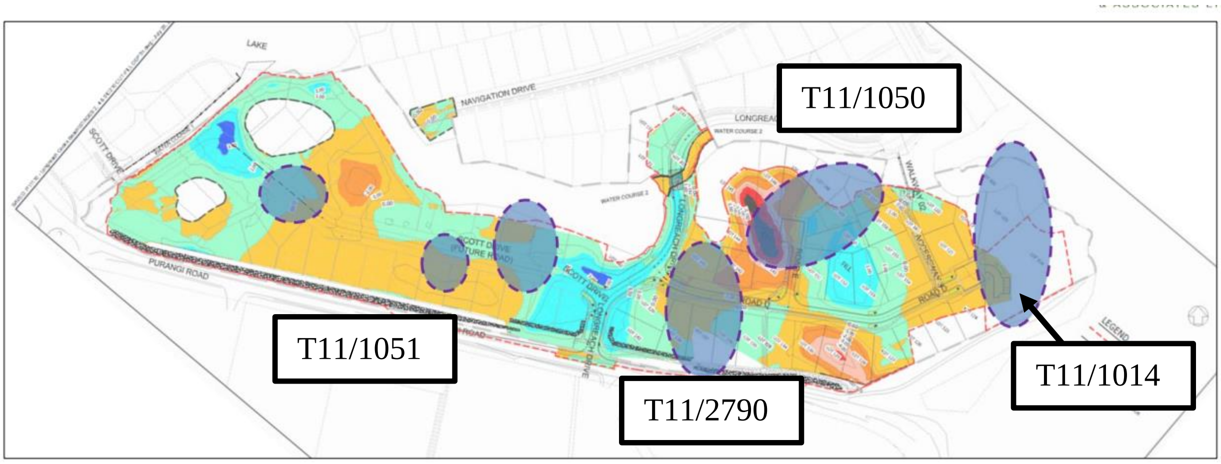

Figure 14. Earthworks plan showing archaeological 'hot-spots' (purple shaded areas inside dashed lines) monitored by an Archaeologist and site locations

Figure 15. Numbers ascribed to contexts uncovered during monitoring (these were not part of the T11/1050 investigation area)

3.2.1 Initial Monitoring, November 2019

The initial stripping of approximately 10cm of topsoil to expose natural surface before construction of the silt pond in Stage 2B was monitored on 14 November 2019. The topsoil strip revealed numerous amorphous scatters of shell (pipi and cockle) in good condition between site T11/1014, T11/1050 and T11/2790. The shell was often associated with modern materials such as plastics and metals (Figure 16–Figure 19). Likewise, shell was present in backfill for narrow irrigation trenches containing PVC piping (Figure 20). It is possible that there may have been an archaeological deposit of shell in this area at some point which may have been damaged or destroyed during earlier installation of an irrigation system, resulting in isolated pockets of shell under existing topsoil. One unstratified obsidian flake and some shattered flakes were found near T11/2790.

A spot check on was made on stripping of flat farmland area in the eastern area of the development between site T11/1014 and T11/1050 on 18 November 2019 (Figure 21–Figure 23) No archaeological features were noted but some unstratified artefacts (obsidian and chert flakes, small chert core) were found during walkover.

Monitoring of bund construction was undertaken at the extreme north of the property boundary on 20 November 2019. No archaeological material was noted.

Features/deposits exposed during monitoring of earthworks in the vicinity of the recorded sites are described below. Where these are outside the site extents previously identified they have been assigned to the nearest site.

Figure 16. Example of amorphous pockets of shell in Stage 2B area (scale interval 0.10m)

Figure 17. Example of amorphous pockets of shell (note unstratified obsidian flake above scale bar) in Stage 2B area (scale interval 0.10m)

Figure 18. Example of amorphous pockets of shell in Stage 2B area (scale interval 0.10m)

Figure 19. Example of amorphous pockets of shell in Stage 2B area (scale interval 0.10m)

Figure 20. Shell backfilling irrigation pipe trench in Stage 2B area (scale interval 0.10m)

Figure 21. Topsoil strip in progress 18/11/2019 close to site T11/2790, facing north

Figure 22. Topsoil strip in progress 18/11/2019 in Stage 2B area, facing northeast

Figure 23. Topsoil strip in progress 18/11/2019 in Stage 2B area, facing north

3.2.2 T11/2790 Monitoring

As the soil profiles had already been recorded for much of T11/2790 (Stage 2B, and 4) with the extent shown in Figure 4, the aim of monitoring was to find and record intact features, midden or artefacts; however, only two contexts were recorded: 18 and 20 (see Figure 15). Both were midden deposits disturbed by modern activity. Figure 23 illustrates the topsoil stripping. Some redeposited shell was found in one area but the possible features observed during the works related to vegetation and bioturbation.

Context 18

Pockets of shell were distributed over an area of 6 x 2m adjacent to driveway entrance (Figure 24). They were examined but did not resolve to a base indicating a primary context. The pockets were adjacent to heavily modified clays and also the driveway cut 6m to east. Secondary context was suspected as these were similar to pockets of shell found along the southern fence line. A sample of one pocket taken (with some gravel inclusions). It was suspected that a reasonably substantial midden was located on or near the roading corridor but had been distributed over a wide area during the construction of the road and during farm modifications.

Context 20

This was a thin ploughed layer of midden which was so ephemeral that when investigated it petered out (Figure 25). It was approximately 7-10cm below the surface, sitting on top of natural orange clay. The shell was intermixed with silty brown sandy soil with charcoal inclusions and included largely cockle 3-4cm in size and small pipi 3-4cm in size with some rare whelk and stone. The midden was amorphous during excavation and kept disappearing; it had a maximum thickness of 4cm and measures 4.3 x 2.3m on the surface and in section was c.20cm deep.

Figure 24. Context 18

Figure 25. Context 20 (scale interval 0.10m)

3.2.3 T11/1051 Monitoring

During an initial walkover of the topsoil strip and bund at the extreme west of the property (Stage 5) several obsidian flakes and unmodified nodules were recovered near site T11/1051. The area was flagged for closer examination. Some of the lower areas were quite swampy; it was difficult to identify any archaeological features in those locations, and nothing was recorded (Figure 26–Figure 27).

Figure 26. Silt works in swampy area close to site T11/1051

Figure 27. Silt works in swampy area in Stage 4 area close to site T11/1051

3.2.4 T11/1014 Monitoring

T11/1014 was mostly left intact within the reserve area in Stage 2B and Stage 4 but monitoring of soil stripping for a small overflow extension in the designated reserve was monitored as required by the Authority, and the relocation of an existing bund was also monitored, on 16 June 2020 (Figure 28).

Figure 28. Above: view of Reserve area and excavated zone of overflow extension. Below: drone view showing reserve area in foreground with bunding and fencing to prevent damage, facing southeast

Stripping of turf and topsoil over an area of approximately 10m x 6m was monitored (Figure 29, Figure 30). Monitoring continued until natural clay substrates and the required depth of overflow were reached.

No archaeological deposits or features were exposed during these works (Figure 31).

Additional monitoring occurred within paddock area to the west of T11/1014, outside the reserve, and revealed several archaeological deposits and features. These can be divided into two areas: Contexts 1 to 7, and the remaining contexts 21, 23, 25 to 30, as shown in Figure 15.

To the southwest of the paddock area on the northeast facing slope within the southern extent of Stage 2B, a midden was found and labelled as context 101 (Figure 15).

These contexts are described below.

Figure 29. Overview of area stripped for the silt pond, facing west. Note redeposited shell in foreground close to site T11/1014

Figure 30. The two photos show stripping at the boundary of the reserve and new roading close to T11/1014 (top photo facing south bottom photo facing north)

Figure 31. The two photos show the stripped overflow channel in the reserve area close to T11/1014

Contexts 1–7

Contexts 1-2 were topsoil and subsoil layers respectively, and contexts 3-7 were shell scatters consisting of small pockets of redeposited fragmented shell, predominantly pipi and cockle intermixed with modern inclusions (gravel, rusted metal) (Figure 32). These irregular patchy dark spots on the ground suggested previous modern burn activity as all the deposits were in a matrix of dark brown silty sand capping a substrate of orange/yellow clay.

The proximity of the scatters to a suspected old farm shed may indicate why these deposits related to T11/1014 were disturbed by modern activity. As they were located at the back of the farm shed, this may have meant the ground close by was levelled and, combined with general ploughing, this may have redeposited any midden present, resulting in the shell scatters noted during monitoring.

Figure 32. Irregular pockets of shell excavated (scale interval 0.10m)

Contexts 21, 23, 25 to 30

A rough ovoid polygon by centroid points of contexts 21, 23 and 25 to 30 was interpreted as a potential processing site. Contexts 23, and 28 to 30 were small to large posthole features, the smallest of which was 0.5 x 0.9 x 0.9m and the largest 0.37m x 0.34m x 0.5cm. The fill contained fragmented marine shell in a dark brown sandy silt. The shallow nature of the postholes and other nearby features suggests the area had been vertically truncated. For this reason, only a few scattered features were uncovered during monitoring.

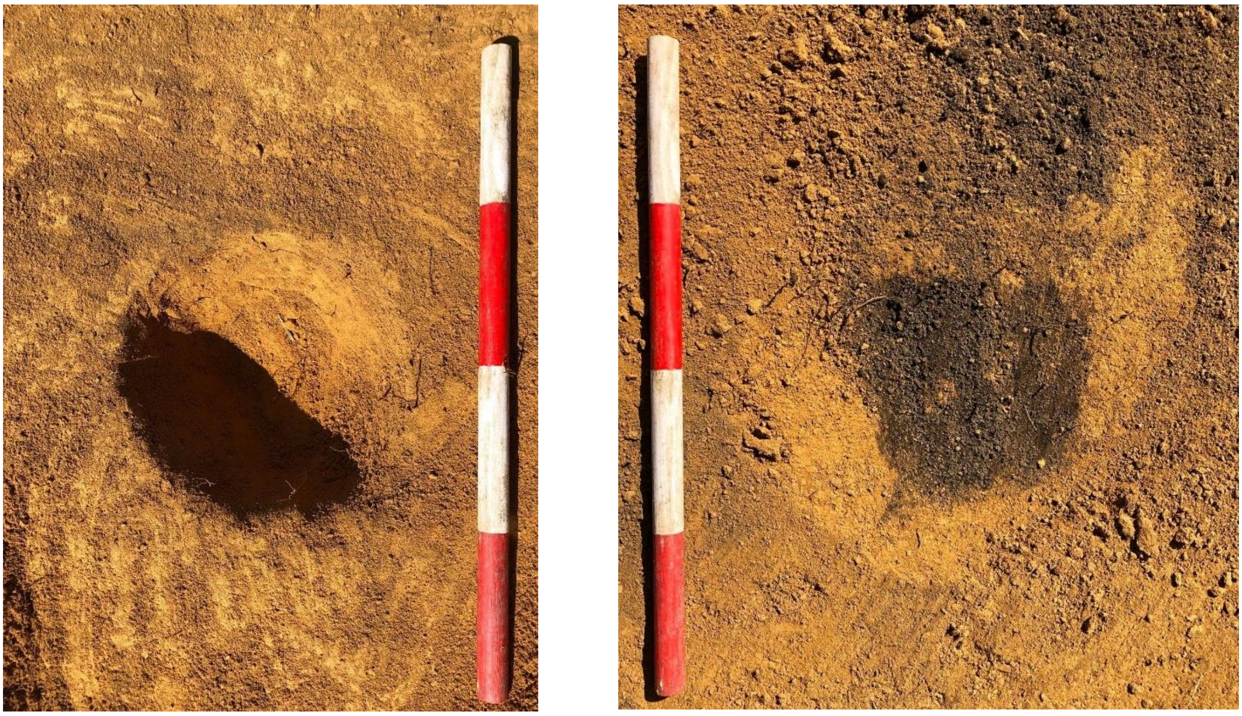

Figure 33. Example of posthole uncovered within the site boundary of T11/1014 – pre and post excavation (scale interval 0.10m)

Contexts 21 and 26 were types of pit features. Context 21 was likely a small storage pit described as a bin pit. Measuring 65 x 90cm on the surface, the fill was composed of dark brown silt with occasional charcoal and pumice inclusions (Figure 34). Half-sectioned the circular feature resolved as a 60 x 60cm bin with sides sloping to north and with a slight overcut on the southern side. The base was undulating and the depth (~15cm) was shallow, adding more evidence that the area was vertically truncated.

Context 26 (Figure 35–Figure 38) provided the most substantial evidence of a more permanent structure with the associated postholes and bin pit indicative of the use of the area for food processing. The proximity to the estuary made it ideal for storing and processing marine and horticultural food sources prior to any subsequent movement of material. The postholes that survived the modern truncation would have functioned as drying racks.

Context 26 was a large storage pit which probably was used to store taro and kumara. The sample taken just above the base of the pit showed the pit contained kumara xylems and taro starch grains. This was determined through microfossil analysis undertaken by Dr Mark Horrocks of Microfossil Research Ltd (see section 5 for more information). Before excavation the pit aerially seemed to be triangular measuring 1.7 x 1.2m orientated east/west, with the 'pointed end' to east. The pit was half-sectioned and turned out to be an oval undercut pit with an undulating base.

The base of the pit held a central posthole surrounded by several small divots/stake holes, each approximately 4cm x 4cm x 2cm deep. One obsidian flake was found in the fill. The fill at eastern end held an abundance of marine shell consisting of pipi, cockle and occasional whelk: ~50% fragmented and 50% whole shell. Overall, the fill of the pit was a moderately compacted matrix of mottled dark brown silt and yellow/orange silt.

Context 25 was a modern feature with archaeological material intermixed within the fill. Context 27 consisted of four surface finds found within the topsoil layer.

Figure 34. Bin pit (21) before and after excavation (scale interval 0.10m)

Figure 35. Unexcavated pit feature 26 (scale interval 0.10m)

Figure 36. Half-sectioned pit feature (26) (scale interval 0.10m)

Figure 37. Half-sectioned pit feature 26 (scale interval 0.10m)

Figure 38. Half-sectioned pit feature 26 with central posthole and divots visible (scale interval 0.10m)

Context 101

Midden 101 was a thin midden layer deposited on a 15 degree north-facing slope c.90m to the southwest of the cluster of features described above (Figure 15, Figure 39, Figure 40). At the thinnest it measured 0.05m and at the widest 0.015m thick. It was loosely compacted. The soil:shell ratio was 40/60 in a matrix of dark brown slightly ashy sand. Cockle shell was the most frequent, then pipi, with some tuatua and whelk. Small fragments of fire cracked rock burnt shell and charcoal were noted. Measuring approximately 7m long by 6m wide, this deposit was spatially aerially substantial but quite thin and without any underlying features. The midden was sampled and analysed with the results presented in Section 4.

Figure 39. Topsoil strip in progress 18/11/2019 in Stage 2B area between sites T11/1014 and T11/2790, facing southeast – red rectangle shows location of midden 101

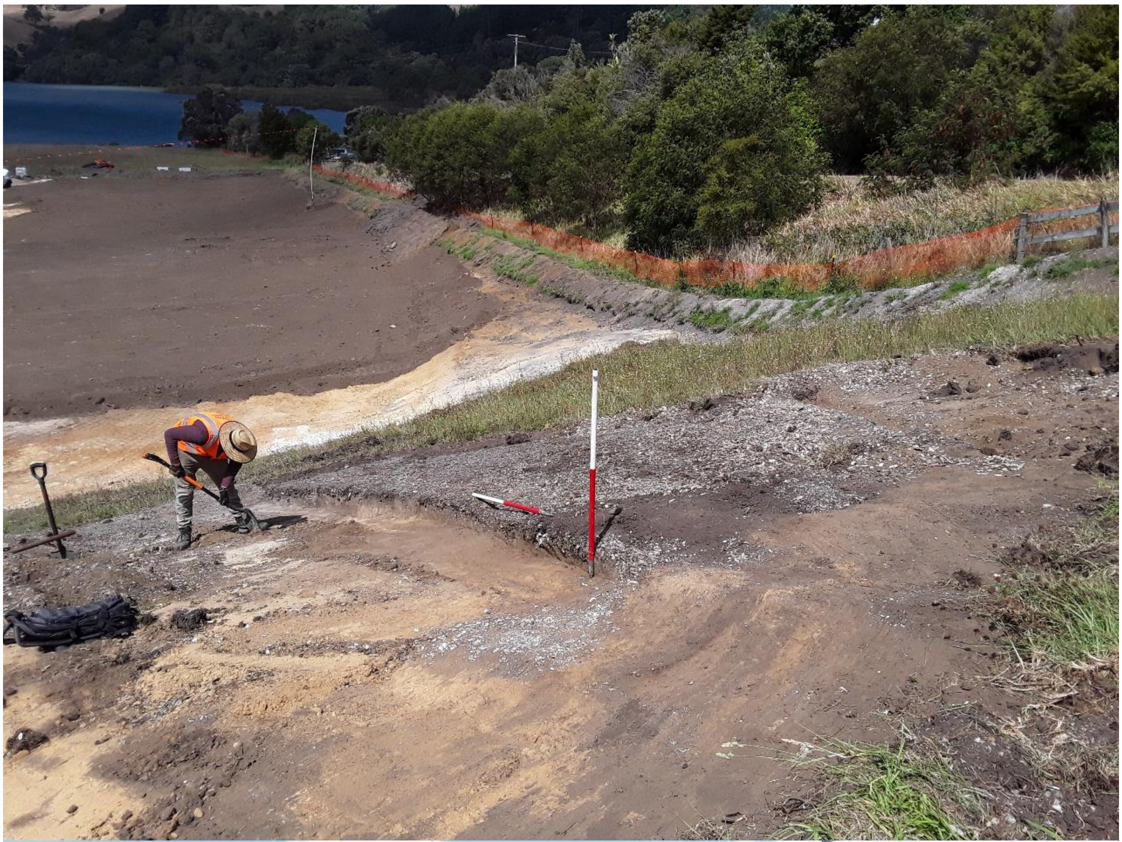

Figure 40. Top: Facing northeast looking towards context 101 (scale interval 0.5m). Bottom: Looking southeast towards the west-facing section (scale interval 0.5m)

3.2.5 T11/1050 House Removal

The area under and around the house was examined following demolition to determine whether any archaeological material remained (Figure 41). However, it was apparent that the benching for the house had been very extensive, and no archaeological features were found under the house as the cut went well below the depth of likely features.

In the section some disturbed shell was observed but was mainly concentrated around an old tree stump which had destroyed any features which may have been present. A rectangular shaped feature was observed in the section (Figure 41, top right) but with a concrete pad at the base, it was clearly modern.

Figure 41. Retaining wall prior to house removal (left - November 2019) and subsequent removal (right – January 2020)

3.2.6 T11/1050 Monitoring

In close proximity to T11/1050 at the base of the north-western slope two contexts (17 and 22) were recorded. One was firescoop and the other a shell scatter.

Context 17

This possible firescoop was ovoid on the surface and measured 70cm x 40cm (Figure 42). There was some visible charcoal. The feature was half sectioned and resolved to 5cm deep. It was suspected to be modern but a sample was taken. A scatter of shells was located on benched area comprising moderately fragmented shell and some whole cockle, pipi and rare whelk. These were thought to be non-archaeological as there was no associated charcoal and much of the shell was mixed within very loosely compacted mid brown silt. The location close to a shed also suggested a non-archaeological origin, with a lot of modern material around (bricks, shed debris, etc) in close proximity.

Context 22

This context consisted of amorphous pockets of shell mixed with topsoil approximately 0.25m thick (Figure 43). The pockets contained mostly whole cockle, with perhaps 20% pipi. There were no other visible inclusions and it was difficult to establish the shape of the pockets. As they were adjacent to roading within property it was suspected that the shell was redeposited through raising/flattening of driveway to enable access to house.

Figure 42. Context 17 (scale interval 0.20m)

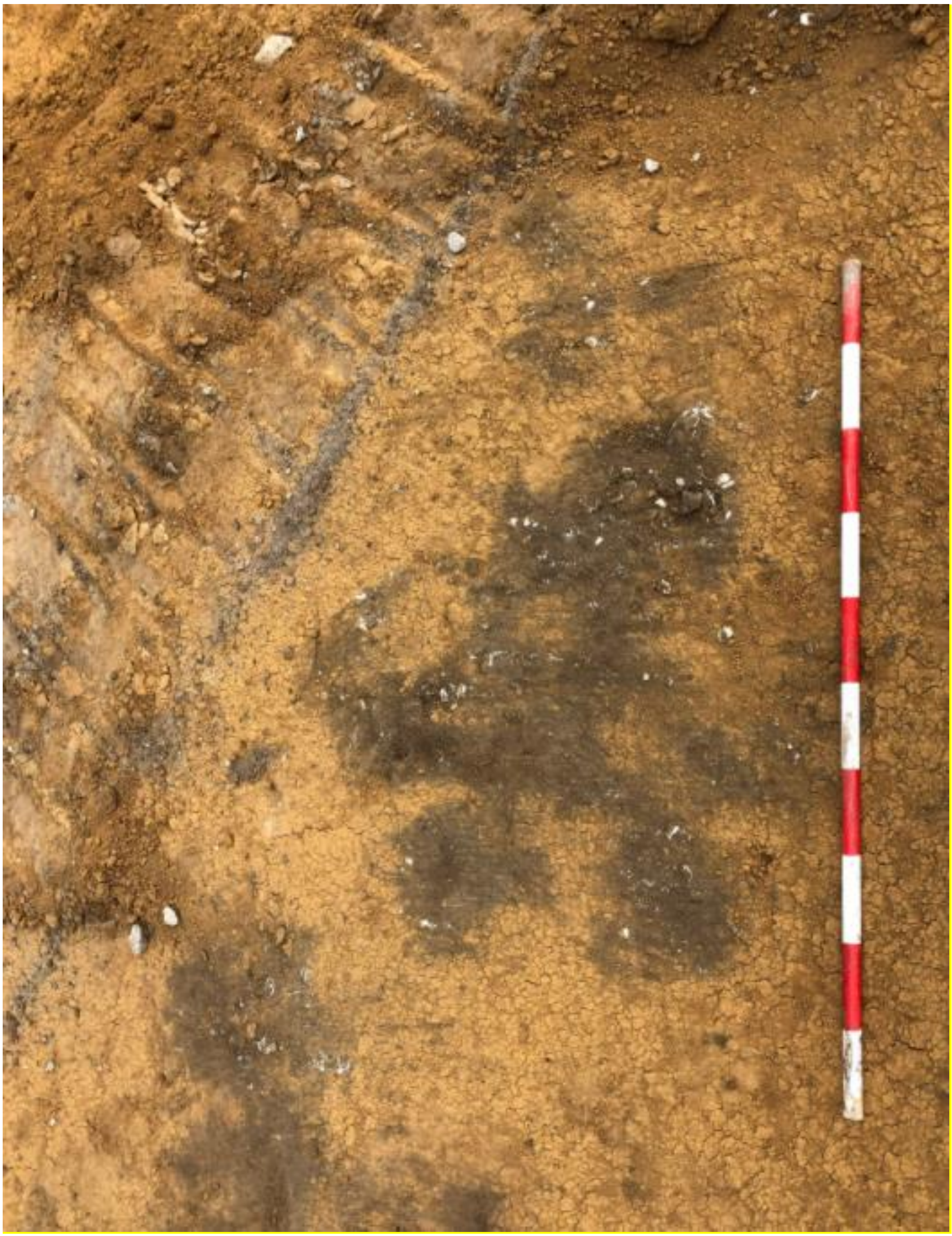

Figure 43. Context 22 (scale interval 0.10m)

3.3 T11/1050 Excavation

3.3.1 Introduction

Excavation of the main areas of T11/1050 was undertaken in January 2020 (Figure 44–Figure 50). As previously noted, this site was recorded by Hoffman (2014) as eight midden deposits, four slight depressions and a possible terrace located near the house that was removed in November 2019 (see 3.2.5, above). Two trial trenches running downslope were dug by machine to ascertain the extent of site T11/1050 (Trenches 1 and 2 Figure 47).

The rest of the south-eastern slope of the knoll below the old house platform was stripped with the aid of a mechanical digger using a tilt flat-edged bucket. In addition, a series of hand dug spade trenches were excavated running the along the long axis of midden deposit 203 and the long and short axis of midden deposit 210 (Figure 50) (see Appendix B for context list).

The hand-dug trench through Midden 203 was 0.5m wide by 11m long and ran downslope. The trench gave an idea of the general stratigraphy of the slope. The hand-dug trenches through midden 210 were dug to ascertain the nature of shell concentrations within the midden. At the centre of midden 210 was a dense white ashy cockle shell concentration. The two trenches bisecting the feature allowed a deeper understanding of the stratified nature of the deposit.

Stratigraphic drawings and column sampling from these trenches were completed before the rest of the area was stripped with the mechanical digger to ascertain the extent of the middens, as well as the extent of features underneath.

As shown in Figure 50, topsoil stripping exposed a range of features, for example, three dense areas of shell midden (203/204, 208 and 210), a range of postholes, rake-out and firescoops of variable sizes, and one temporary structure, possibly a shelter.

The midden layers, postholes and fire scoops were sampled if they were charcoal rich.

Summary of main features and deposits:

- Context 208 was a large midden area on the lower flat downslope from the removed house platform. The midden was stratified with several postholes related to a drying rack.
- Context 210 was also a downslope midden deposit, overlying several postholes and one firescoop.
- Context 203 was a downslope midden deposit overlying a garden soil (205) and another midden deposit (204).
- Context 227 was a cut benched into the upper part of the slope. This was interpreted as being a temporary shelter as it had an internal drain and row of postholes at the front of the structure.

These contexts are discussed in more detail below, after which other works related to T11/1050 are described.

Two additional middens were identified outside the main investigation area: Midden 200 to the southwest and Midden 274 to the northeast (Figure 50). These were hand trenched and sampled, but not fully investigated.

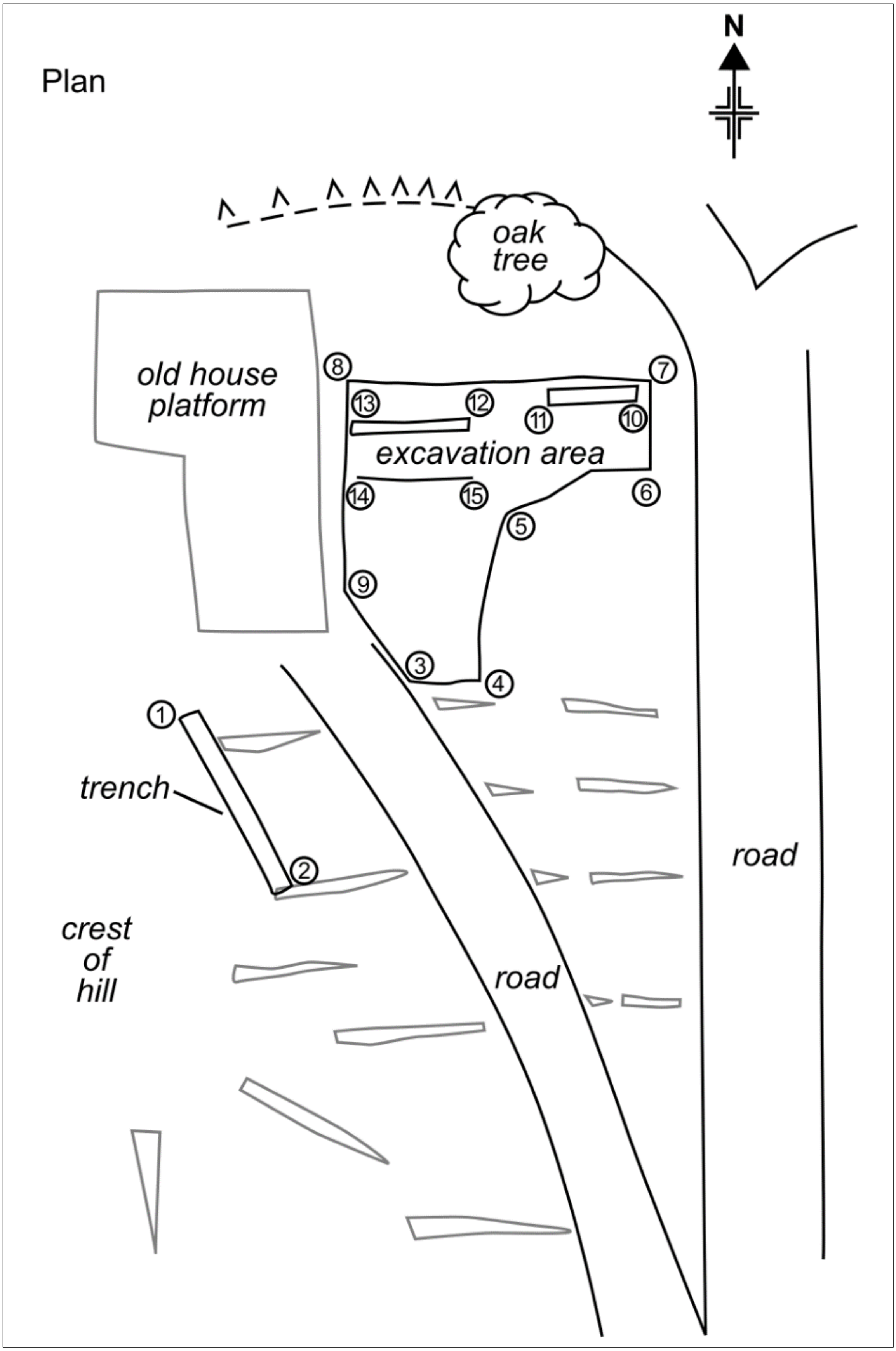

Figure 44. Sketch plan of initial excavations (numbers relate to initial survey points)

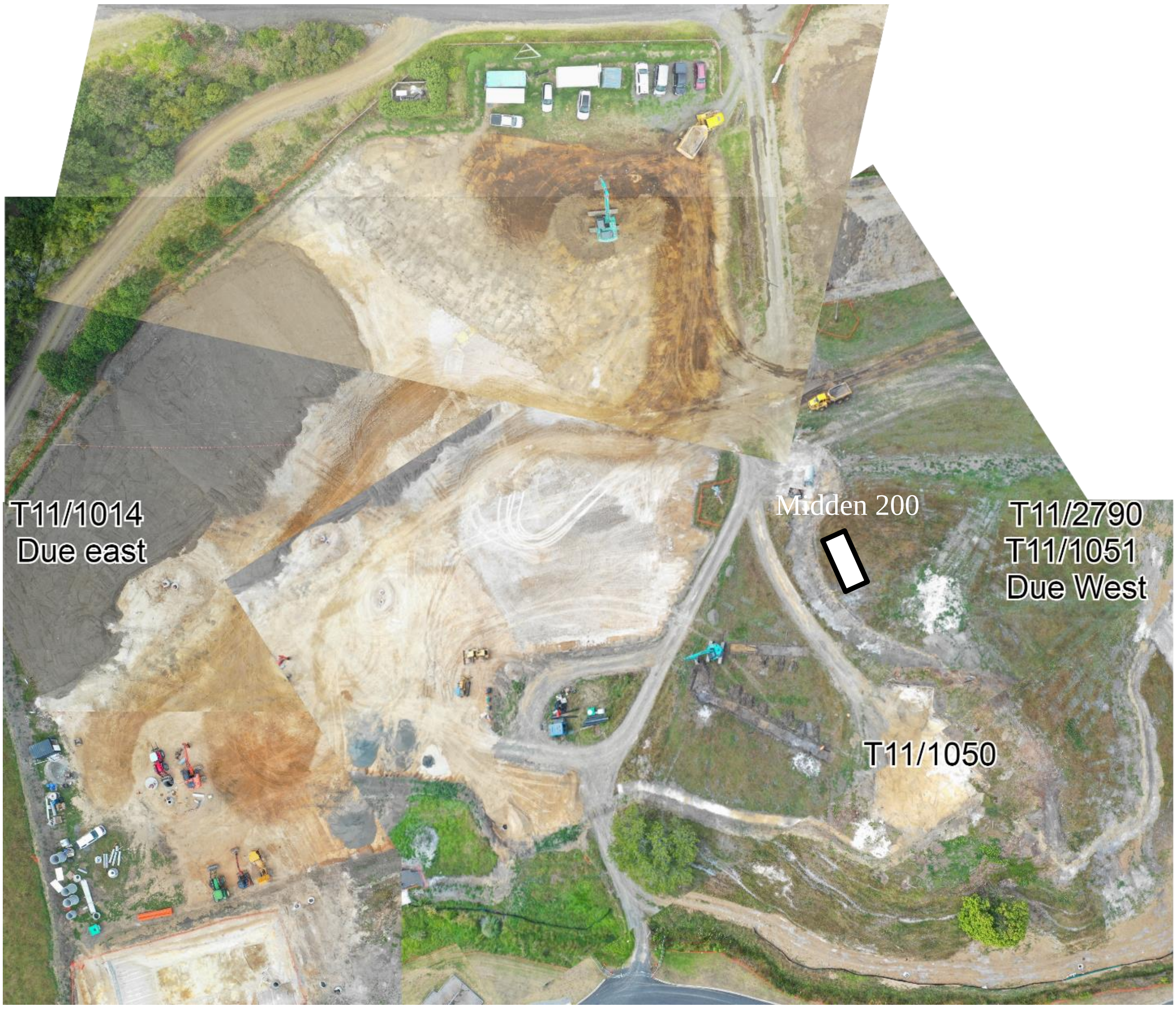

Figure 45. Drone photo mosaic showing excavation in Stage 2B (note reserve area for T11/1014 is not in the photo)

Figure 46. Drone photo showing initial test trenches (1 and 2) for site T11/1050, facing south

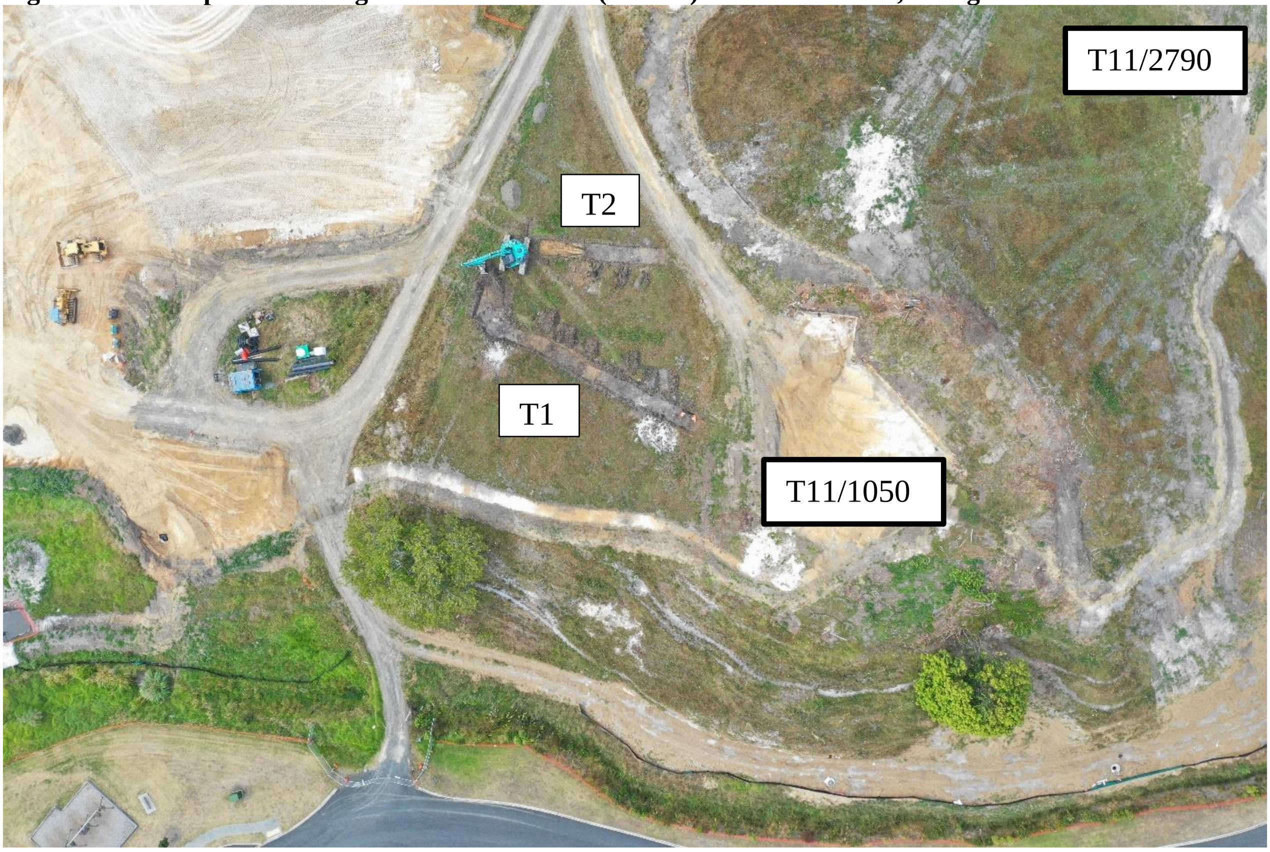

Figure 47. Aerial view of T11/1050 at the start of excavation, following house removal (January 2020)

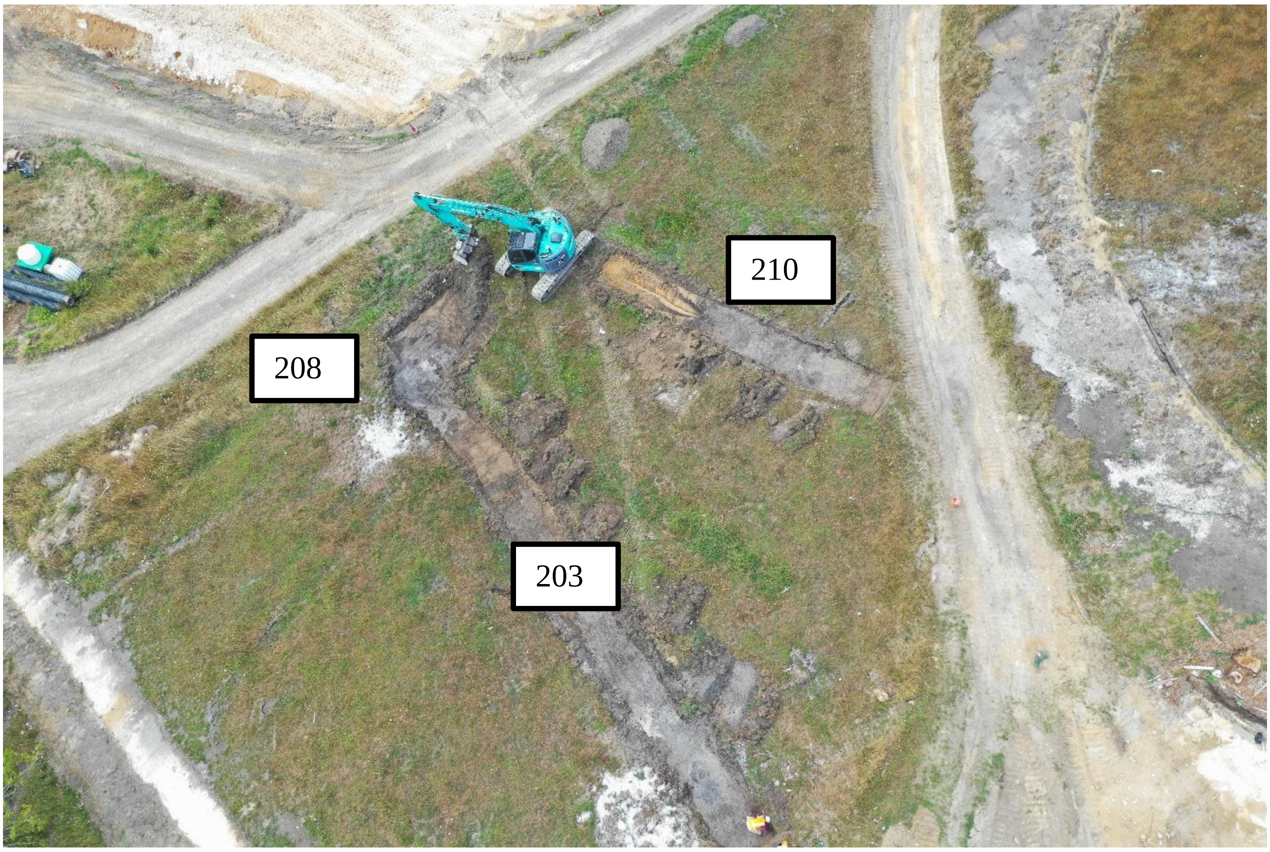

Figure 48. Drone shot of the two machine-dug trenches and the relative locations of midden deposits 203, 208 and 210

Figure 49. Top-down drone photo showing midden 203

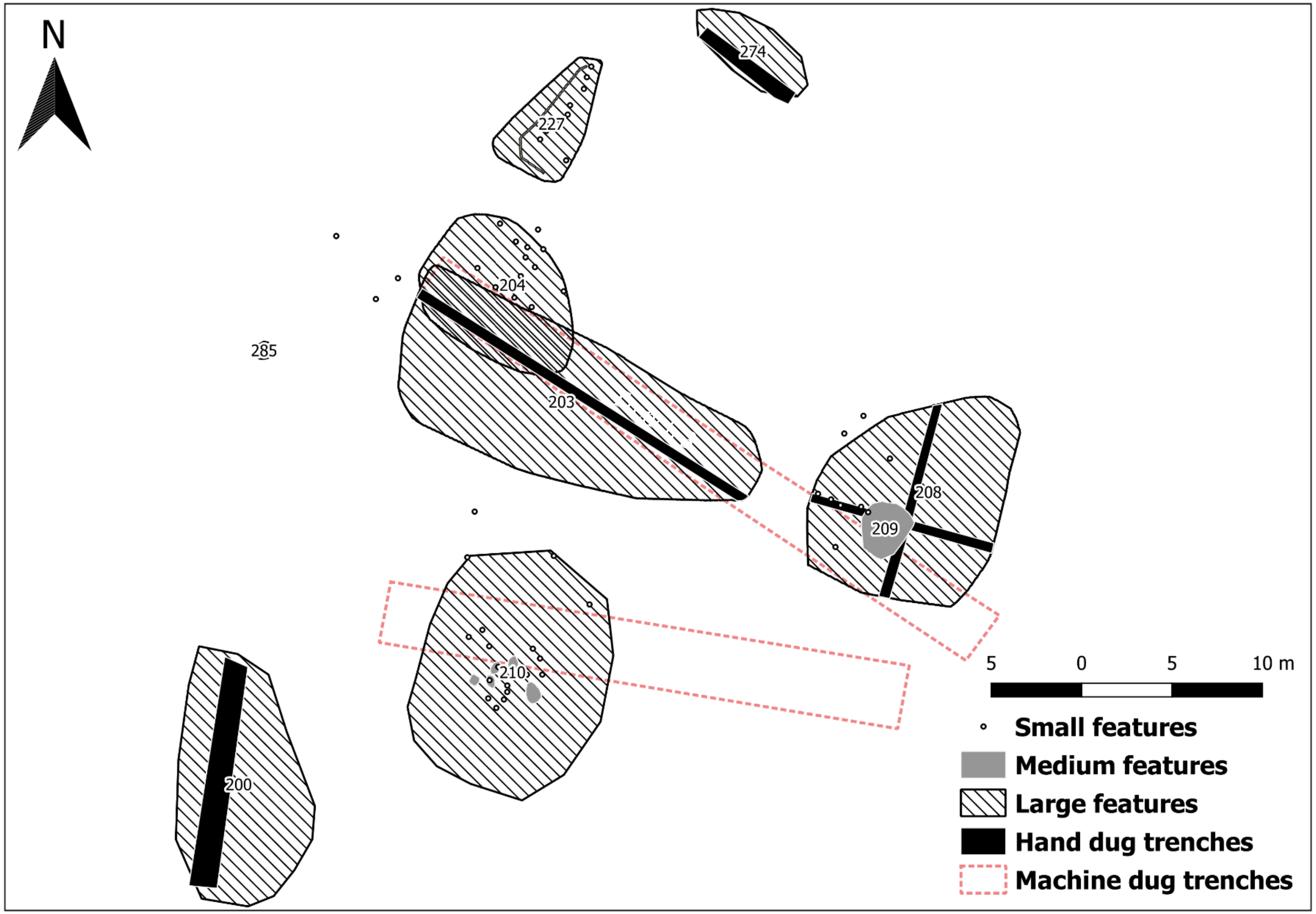

Figure 50. Overall plan of main excavations of T11/1050

3.3.2 Midden (208)

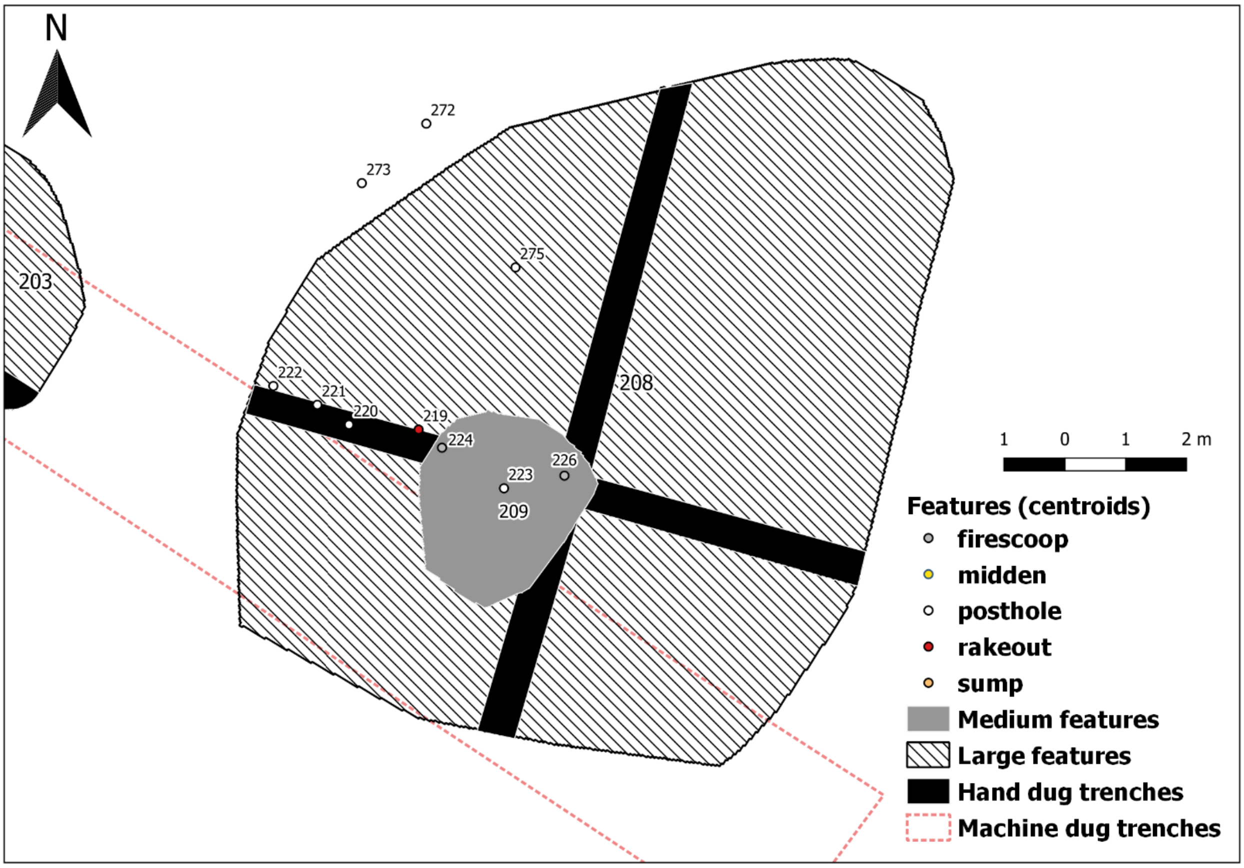

Figure 51. Plan of midden 208

Midden 208 was a stratified midden with a central dense patch (209) (Figure 52–Figure 55) downslope from context 203 (Figure 50). The length of midden measured 13m x 10m with a depth of stratification 0.40m and depth of excavation 0.70m. Situated on a flat area, the internal matrix was composed of layers of shell midden truncated by postholes related to a fence (Figure 52 and Figure 55).

The postholes were generally 0.5m to 0.7m in depth with length between 0.15m to 0.5m and a width of 0.15m to 0.4m. Most postholes found within T11/1050 measured within these ranges (Figure 56). Burnt and degraded shell with the shell midden layers is an indicator of drying and/or processing of shellfish. Postholes 222 and 223 relate to this.

Stratigraphically context 209 was the youngest and highest (vertically) in the stratigraphic sequence. It was a dense rake-out layer, where firmly compacted grey ash sand was intermixed with highly fragmented pipi shell and friable charcoal.

Below this, 208 was a loosely consolidated grey-brown ashy silt intermixed with cockle, pipi, whelk, and occasional friable charcoal. Cobble sized fire cracked rock and obsidian pieces (less than 5mm) were noted within this deposit as well.

Context 205 was a gardening layer as described by Hoffman (2015) (Figure 57). This layer was the oldest and deepest cultural layer before the natural sterile tuff was reached. Context 205 had a light grey-brown silty-sand matrix. Firmly compacted, it was intermixed with fragmented and whole pipi with the layer being approximately 20-30cm thick, and clearly contrasted with the upper shell midden layers, indicating early gardening activities before the upper layers were deposited.

Associated features related to 208 were revealed: one midden rake-out area (219), two firescoops (224 and 226), five postholes (221, 222, 223, 272, 273, 275), and two possible kō marks (220 and 221). These features provide a stratigraphic sequence of what occurred in this area in the past (Figure 53).

The stratigraphy was as follows:

- 223 (posthole) truncates 205 (gardening layer) and is capped by 209 (midden).
- Within 205 (gardening layer) were 220 and 221 (kō marks).
- 209 (midden) truncates 219 (rake-out) and 224 (firescoop), which is below 219

This indicates a scenario where gardening (205) was punctuated by the erection of a structure, possibly a fence (222 and 223). The kō/digging stick marks (220, 221) within the gardening layer could be charcoal rich deposits being added as a gardening technique to improve soil fertility. It is possible that charcoal rich deposits accumulated within divots left by kō marks; however, being charcoal rich deposits it is also possible that they were small firescoop deposits (Figure 54). The rake-out layer (219) seems to cap the gardening layer.

These burnt areas and the gardening layer were finally capped by shell midden (208, 209), suggesting that this area of gardening gave way to shellfish processing.

Figure 52. Facing south looking towards context 208 (Trench 4 partially excavated)

Dwg. 3
South-South-West facing section of trench 208-226

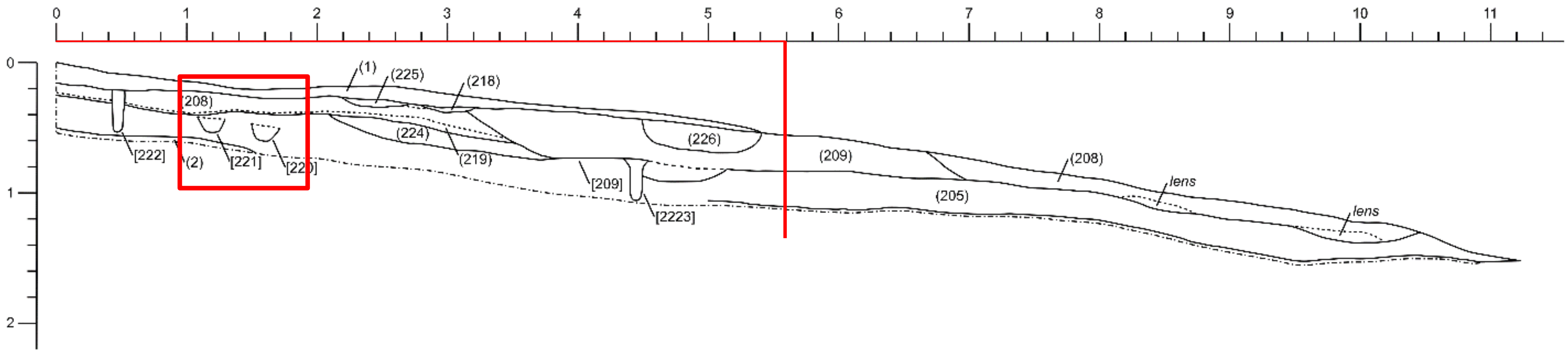

Figure 53. SSW section in trench 4 of midden 208. Red square denotes location of kō marks/horticultural digging stick marks

Figure 54. Kō / digging stick marks (scale interval 0.5m)

Figure 55. Facing southeast looking towards midden 208. Note the small firescoop at the bottom right of the image (scale interval 0.10m) and Trench 5 running through the centre

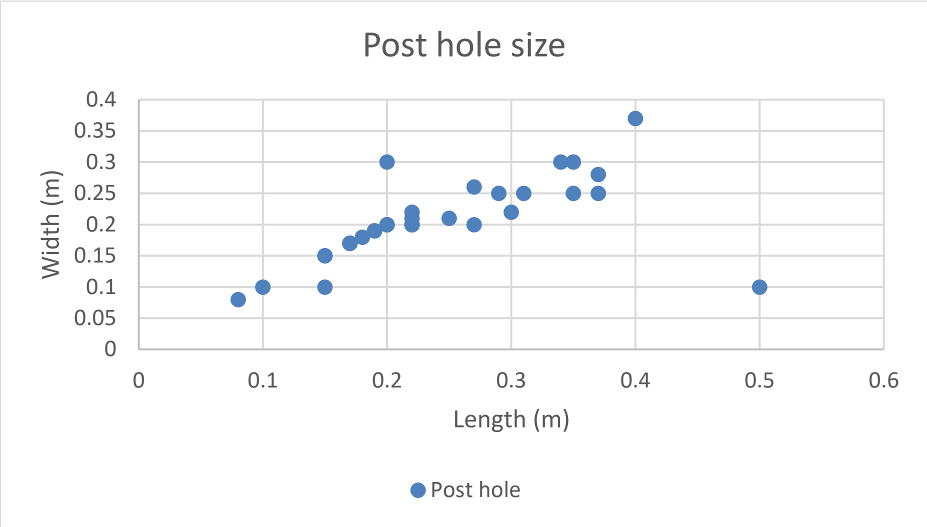

Figure 56. The length and width measurements for postholes found across site T11/1050

Figure 57. North facing section of internal trench of midden 208 (scale interval 0.10m)

Figure 58. Recording stratigraphy in midden 208 showing trench 4

3.3.3 Midden (210)

Context 210 was a shell midden deposit southwest of 208 and south of 203 measuring 13 x 10 x 0.4m (Figure 50, Figure 59). This was highly fragmented and strewn across a large area. The midden deposit overlaid several postholes, one firescoop and a rake-out area.

The most intact portion of the deposit measured 13m (length) x 10m (width) with a depth of 0.15m. Situated on a slight downslope, this deposit related to the downslope discard of shell following shellfish processing and lacked stratification.

Excavation showed that context 210 was somewhat compacted with silty sand intermixed with pipi and cockle shell. The shell showed a degraded and bleached characteristic with shell dispersed and fragmented.

Beneath the midden were several ephemreral features: 11 postholes (217, 249, 250, 251, 253, 254, 258, 259, 260, 262 and 284), five small firescoops (215, 211, 213, 216, 292), and four large firescoops (212, 214, 261, 285) – with two further firescoops (289 and 290) outside the midden area. The postholes were excavated but were quite shallow (0.25m on average) and probably related to ephemeral structures such as drying racks (Figure 60 and Figure 61).

The firescoops related to shellfish processing.

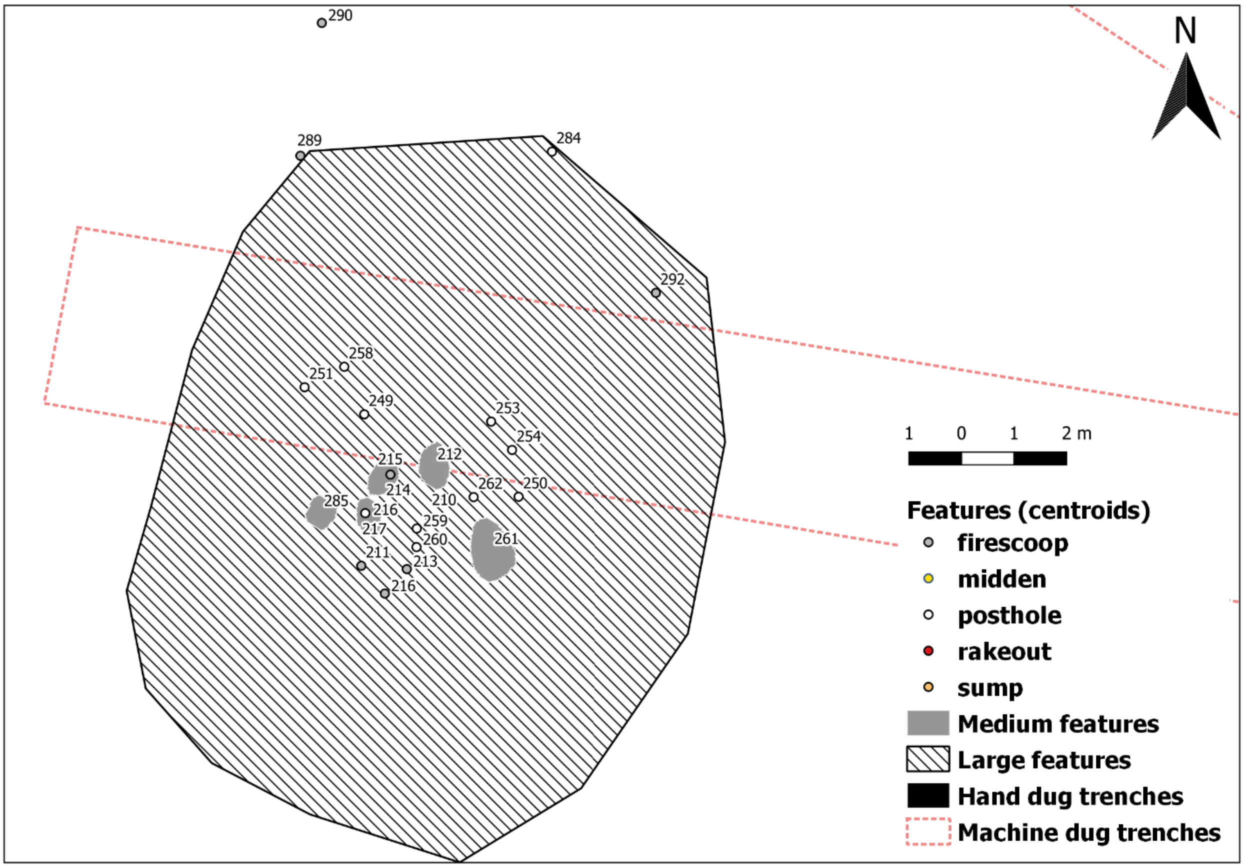

Figure 59. GIS plan of midden 210

Figure 60. Portion of midden 210 exposed (facing ESE – scale interval 0.10m)

Figure 61. Fire scoops and postholes underneath midden 210 (facing NNE scale interval 0.10m)

3.3.4 Midden (203/204)

A thin topsoil (context 1) overlaid shell midden deposited downslope (context 203, Figure 62). The layer was spread 21m (only 12m visible in section was drawn) (length) x 8m in width with an average thickness of 0.25m. The layer appeared to be a 60/40 split between soil and shell.

The soil within the layer was a black brown silty sand, moderately compacted. General inspection of the shell within the layer revealed several patches of fragmented and whole cockle, pipi, tuatua and whelk (Figure 63–Figure 70). Of note was the presence/absence ratio of cockle, and pipi were larger compared to the gastropods and tuatua.

The trench section provided a detailed stratigraphy down to the natural substrate (Figure 66–Figure 70). Two points can be taken from the north facing section. The gardening layer (205) was a intermixed silty sand layer of slight compaction. Within the matrix were fragmented cockle and pipi with occasional tuatua and whelk. The shell was dispersed in the matrix and could have been the result of churning the ground for horticulture. This layer was markedly different to the underlying natural substrate in terms of colour and composition. Its thickness varied between 0.25m and 0.30m. This area seemed similar to midden 208, where an initial gardening layer was capped by a layer related to shellfish gathering. This signalled that gardening was now being done elsewhere, either because gardening had given way to a focus on shellfish gathering, or because the area was fallow or not in use due to poor productivity.

The initial part of the trench dug down the slope also revealed a denser concentration of midden (204). Context 204 was a lightly compacted grey black ash with frequent whole pipi and cockle shell inclusions. Occasional whelk, charcoal and fire cracked rock were noted as well. The shell in this lens was whole and seemed to indicate a more rapid deposition than midden deposit 203. 204 was deposited before 203 and after 205, indicating that gardening was followed by the build up of a small, albeit dense shell midden 204, and then by a larger less dense shell midden, 203:

1. The shell had signs of burning, degradation and trampling. The deposit was therefore the result of shellfish harvesting and burning with discard in a downslope direction.
2. Below 203 sat gardening layer (205) punctuated by 204 (Figure 69–Figure 70).

.

There were a range of postholes below midden 204. These were revealed when 204 was stripped: 15 postholes (228, 230, 232, 233, 234, 235, 236, 237, 238, 240, 241, 242, with 245, 279 and 280 outside the midden area). The postholes seem to align downslope in an east-west orientation. The depth range of 0.25 to 0.35 suggests these were for temporary structures such as drying racks and related to the dense shellfish midden 204. Two small and one large firescoop were recorded at the periphery of the dense shell extent of 203 and 204 (Figure 73): due west was 282, southwest was 285 (Figure 73), and south-south west was 290.

Based on this information it is likely the dense ash and burning noted within 204 was related to the drying racks or smoking racks.

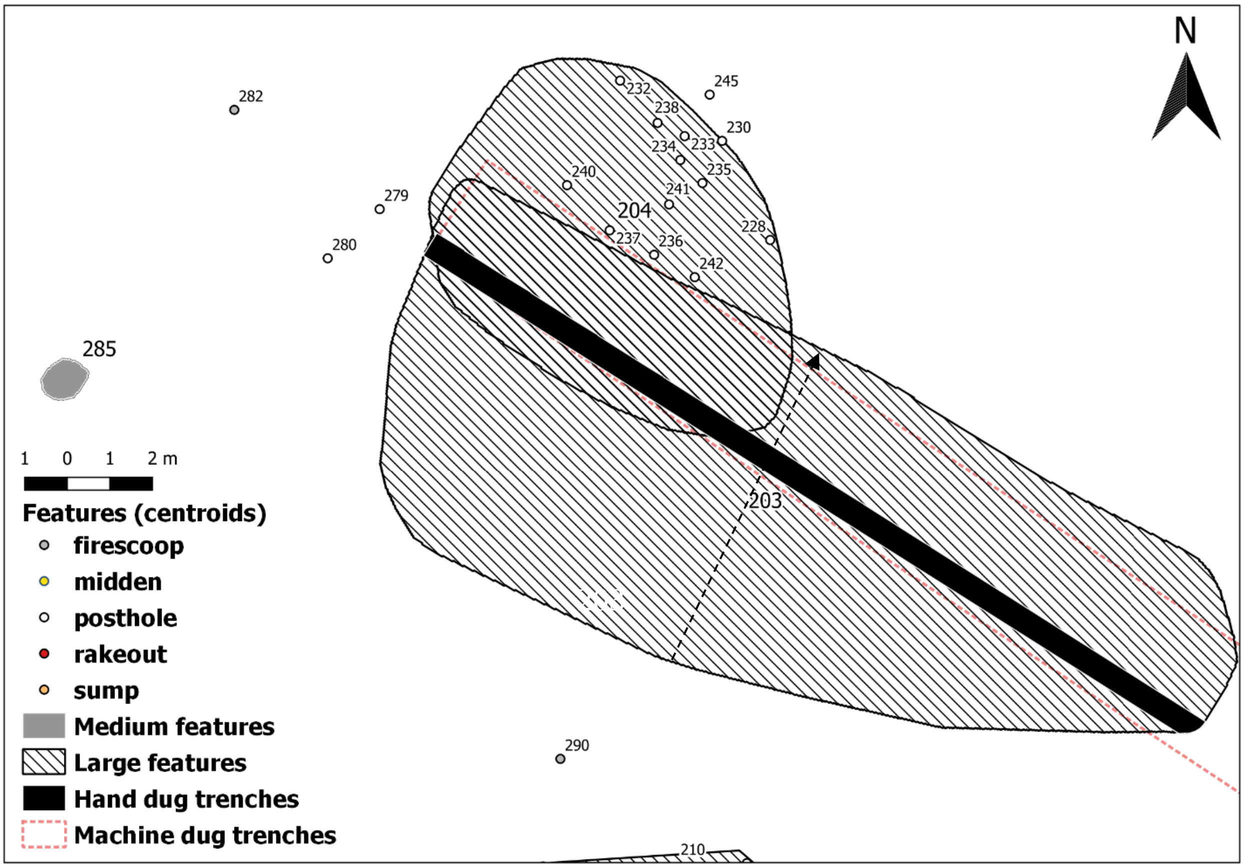

Figure 62. GIS plan of middens 203 and 204 with dense postholes area to the north

Figure 63. Initial investigation of midden 203 following topsoil stripping

Figure 64. Facing southeast, the upper extent of midden 203 exposed (section drawn in red). See Figure 67 and Figure 68 for section drawings

Figure 65. Excavation of midden 203/204, looking east (scale interval 0.10m)

Figure 66. North-facing section of midden 204 [203/205] (scale interval 0.5)

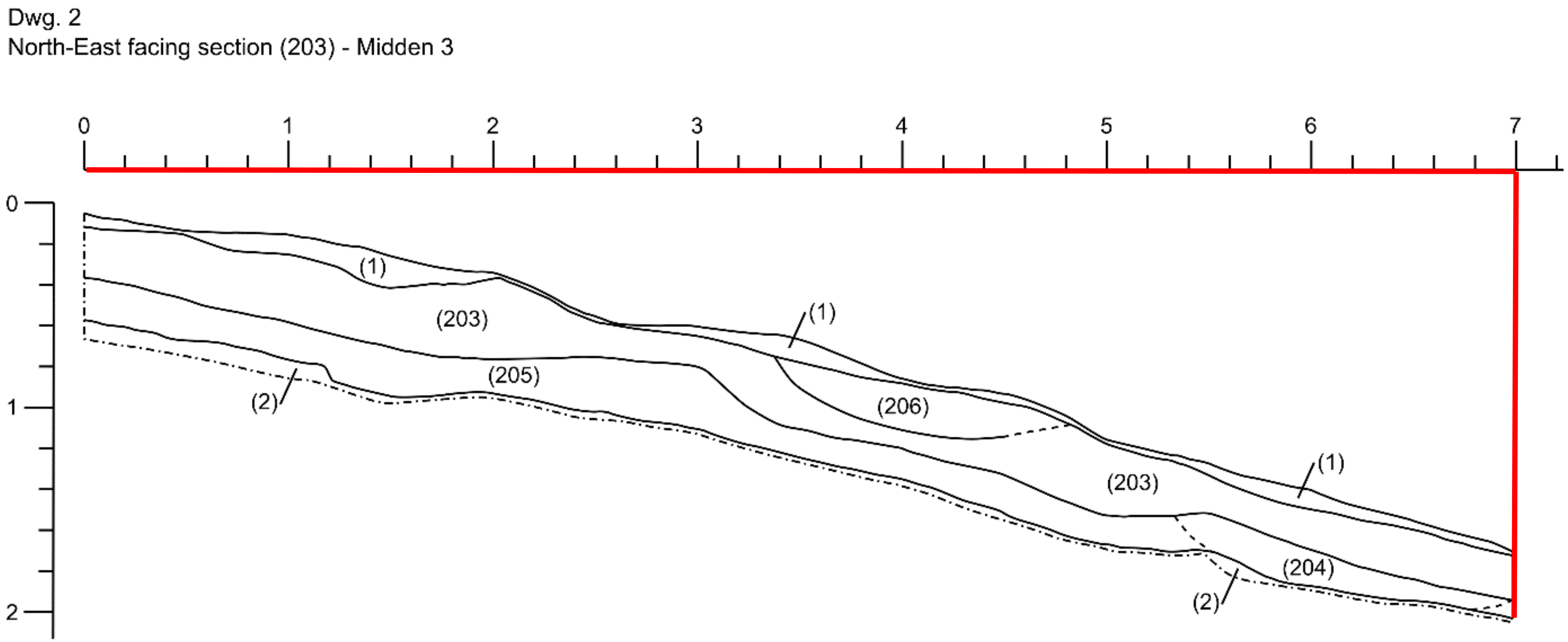

Figure 67. South facing section. The important stratigraphic contexts are 203, 204, and 205. 204 only partly shown and continues downhill to the east

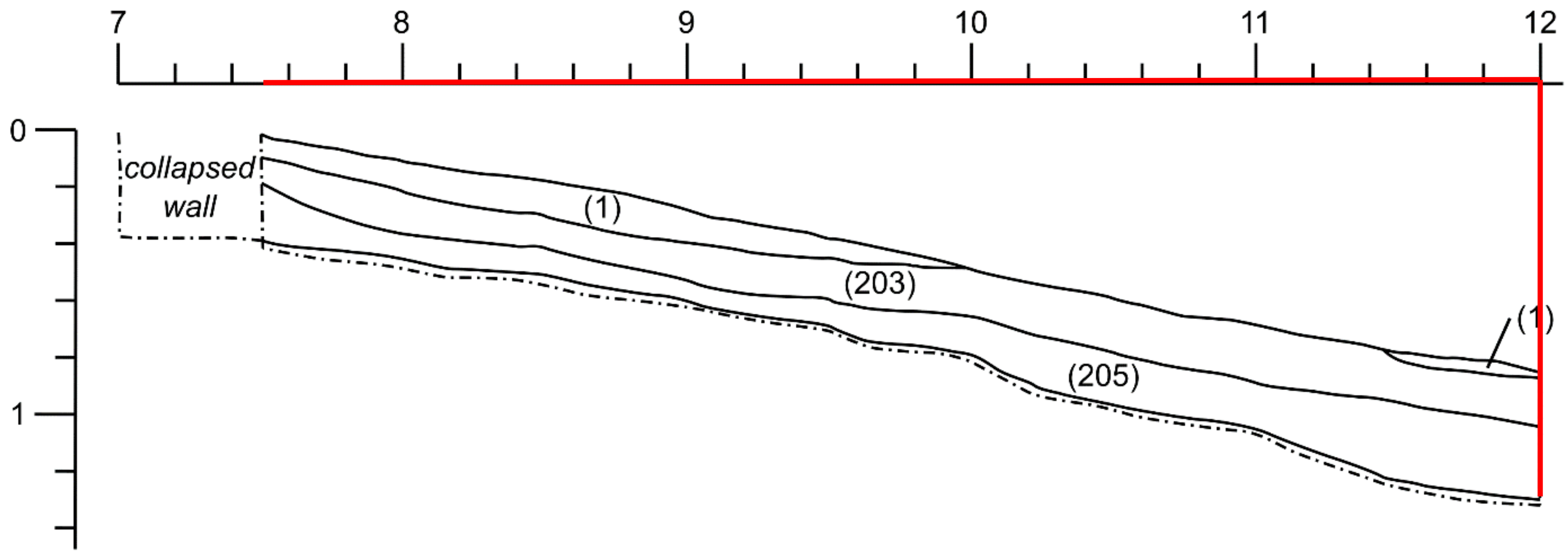

Figure 68. Continuation of south facing section of midden 203

Figure 69. North facing section as seen in Figure 67 and Figure 68 (scale interval 0.5)

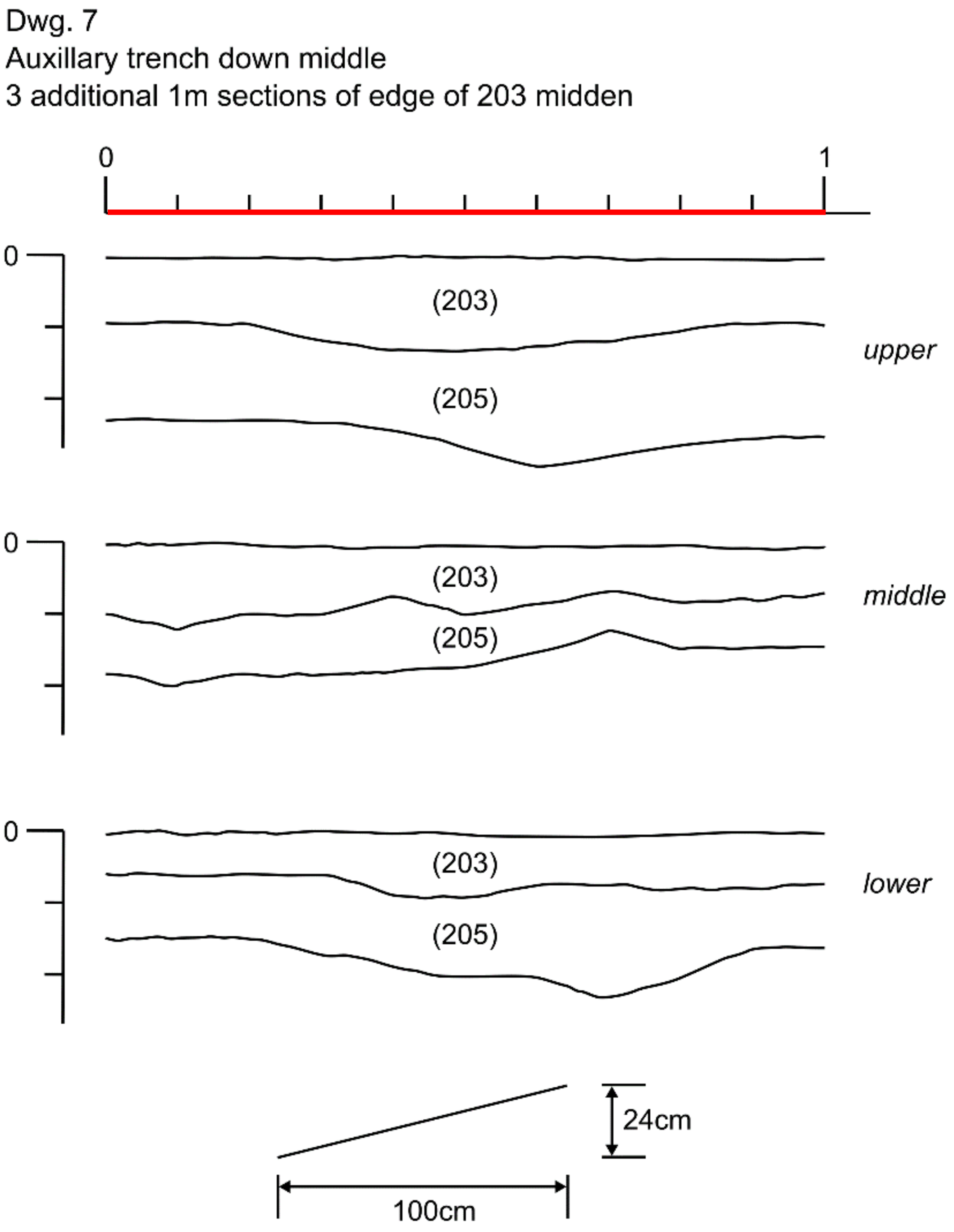

Figure 70. Sections of midden 203 (section drawn in red). The upper, middle, lower relates to sections drawn on the north facing sections of the trench seen in Figure 69

Figure 71. Postholes on the east side of Midden 204 with 203 beyond; centre section relates to Figure 70 (section drawn in red – scale interval 0.10m)

Figure 72. Close up of context 228, following removal of midden 204 (scale interval 0.10m)

Figure 73. Pre- and post-excavation photos of firescoop 285 (scale interval 0.10m)

3.3.5 Shelter (227)

A dark amorphous blob of stained soil on the northern edge of the hill slope proved to be a temporary shelter (227). This feature, with an NNE-SSW orientation, was benched into the slope with a sharp 70° angle. This benched terrace measured 7.4m in length, 4.3m wide and the back scarp measured 0.6m in height (Figure 75–Figure 79). The shape of the shelter was roughly oblong and the back scarp was near vertical where it gave way to a undulating floor.

Context 227 was situated north of 203/204 and there was evidence of internal features. The shelter had an internal drain (246) with a row of postholes along the front (265, 266, 267, 268, 269, 270 and 271) 0.3 to 0.5m in depth. The drain became deeper in the southeast corner with a sump (264), suggesting this is where the water would have been redirected. During excavation three southeast-northwest trenches were dug in the centre to ascertain the stratigraphy (Figure 75 and Figure 76).

The stratigraphy is as follows: the upper fill (1226) was a loosely compacted brown grey well sorted silt. The inclusions ranged from occasional charcoal flecks to obsidian pieces, fire cracked rock and fragmented shell in the form of cockle and pipi. This was attributed to a slumping event after 2227, and 3226 had partially infilled the structure once it fell into disuse.

The secondary fill (2227*)* was a firmer yellowish-brown mixed silt with frequent fragmented shell and charcoal. This layer was interpreted to be a deliberate infilling to smooth out the benched surface because of the well sorted soil. Context 3227 was the first fill with yellowish brown silty clay soil with occasional whole and fragmented cockle shell. Trampling of fragmented shell and the compact nature of the layer suggested this was the trample layer from when the structure was in use.

Although relatively small, the shelter does point to some form of habitation and may be a remnant of a larger complex. Being lower down the slope, this peripheral structure may be all that was left after the modern housing platform was cut. The date and type of charcoal material within the drain and postholes is hoped to shed light on when the structure was in use and what timber was used in its construction.

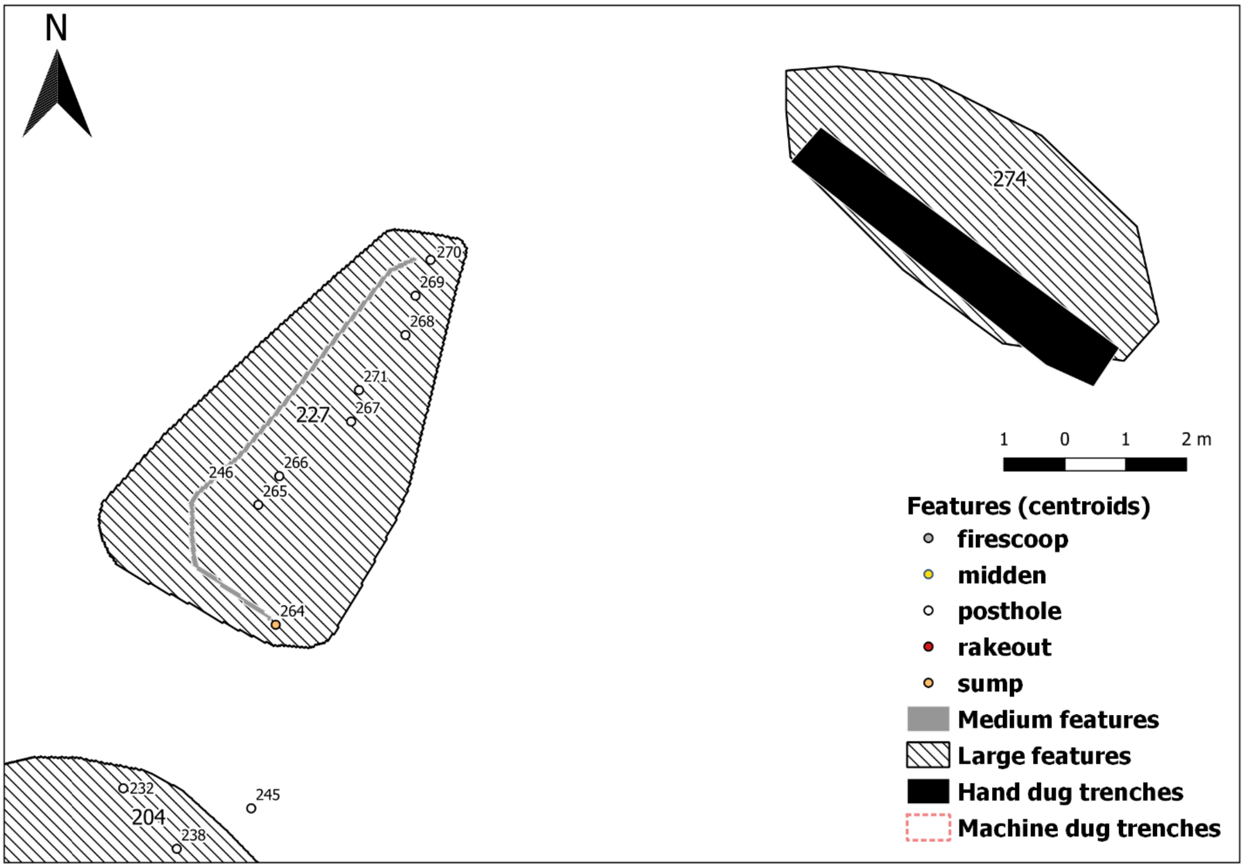

Figure 74. Plan of shelter 227 and midden 274

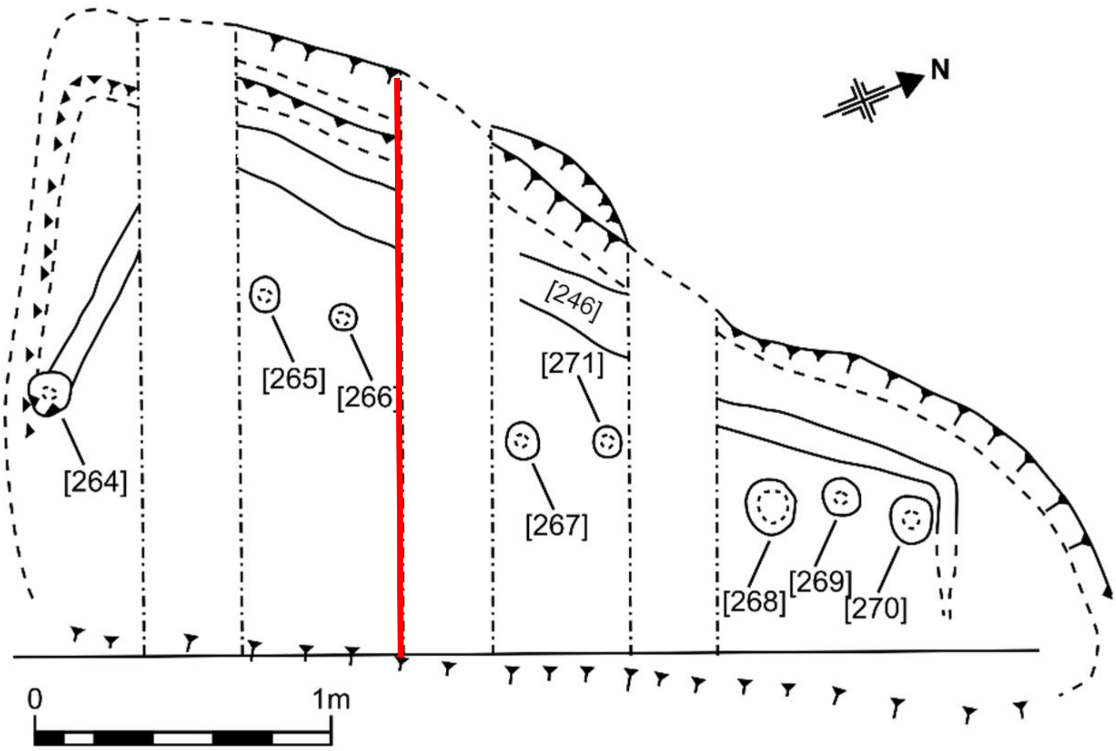

Figure 75. Plan of shelter 227. See Figure 76 for section

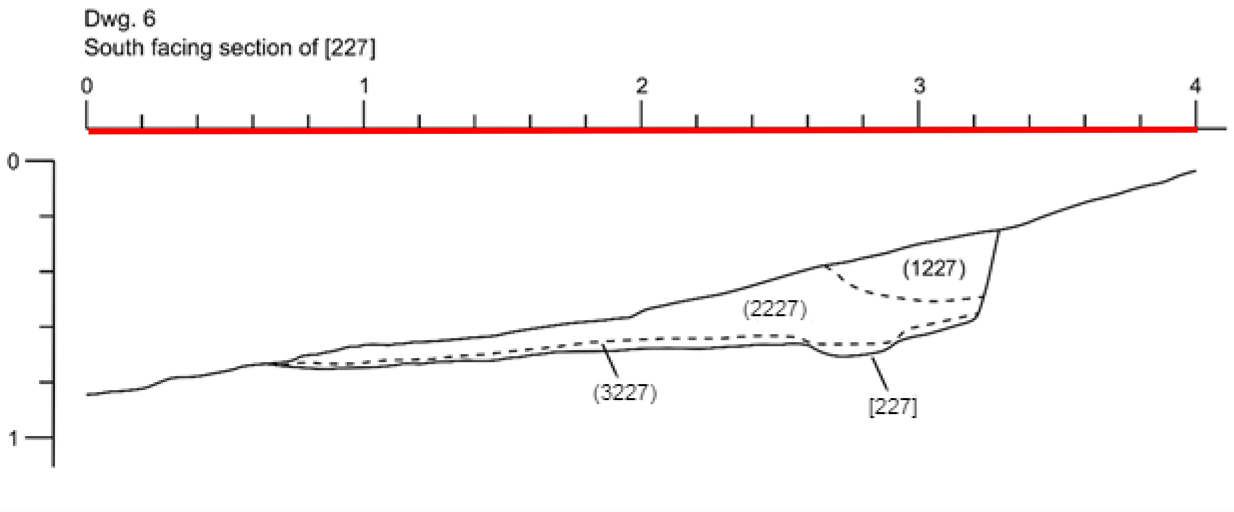

Figure 76. Section through benched terrace (shelter 227)

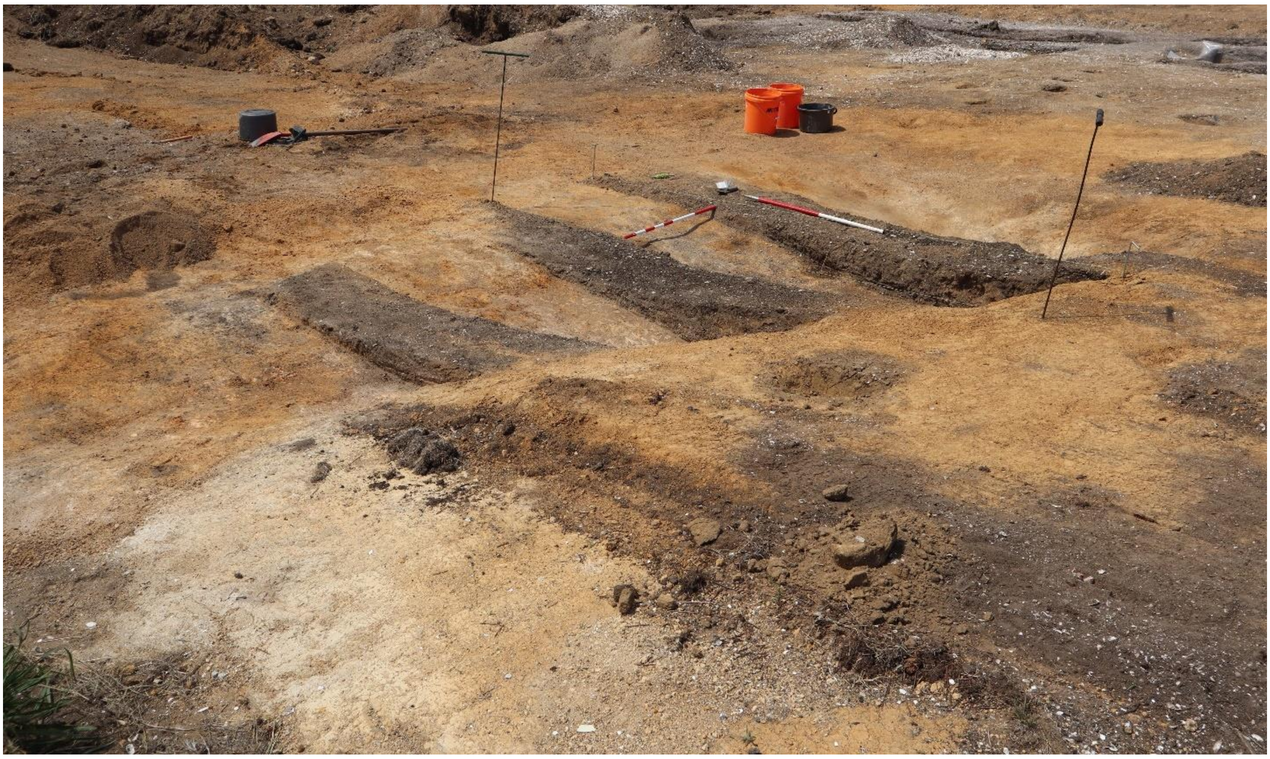

Figure 77. Looking south across terrace/shelter showing sections through the floor (scale interval 0.10m and 0.5m)

Figure 78. Line of postholes at front of for shelter (scale interval 0.5m)

Figure 79. Facing north, showing the stratigraphy of the south facing sections (scale interval 0.10m and 0.5m)

3.3.6 Midden (274)

Northeast of the main excavation area and shelter 227 was a downslope deposited midden 274 (Figure 74, Figure 80, and Figure 81). It was investigated by excavating an east-west trench to expose the midden in section to allow for systematic sampling and to ascertain the stratigraphy of the midden layer. The shell in the midden was relatively intact in a thick layer of pipi and cockle with occasional whelk. The matrix of soil was a moderately compacted greyish brown silt. The full extent of the midden was 11.1m east-west and 9.5m north-south with a overall thickness of 0.42m. Midden 274 was situated on a steepish northeast-facing slope overlying the subsoil. The thickness of 274 sugguests that a large quantity of whole shell had been discarded downslope, where a thick topsoil covered the remnant midden. The lack of fragmentation and bleached nature of the shell suggests a natural rapid burial as a o-horizon accumulated over time.

Figure 80. Facing north at the excavated section of midden 274 (scale interval 0.10m)

Figure 81. North-facing section of midden 274 (scale interval 0.10m)

3.3.7 Midden (200)

A NE-SW trench was dug on the northeastern slope of the hill above the driveway up the hill to the south of the demolished house; this was completed before the main area of site T10/1050 was exposed. Fragmented shell midden material was visible eroding from the summit of hill (Figure 82) This was part of T11/1050. It appeared to represent a deposit similar to 203/204 (see Figure 45).

The trench revealed a stratified midden with three layers visible (Figure 83–Figure 84). The top layer (200) was generally 27cm thick, and the soil was greyish brown sandy silt of loose compaction with frequent fragmented and burnt shell.

The shell species identified were pipi, tuatua, and cockle. Occasional charcoal and fire cracked rock fragments, as well as pebble sized stones were noted. Highly fragmented, this layer was interpreted as being a re-deposition of shell midden material from further upslope due to slumping.

The middle layer (201) was approximately 20cm thick and sat directly below context 200. The shells were situated in a greyish brown sandy silt of moderate compaction. Frequent bleached whole shell in the form of cockle, tuatua and pipi was noted in addition to occasional charcoal fragments.

Below this sat layer 202, which was a compacted dark grey brown sandy layer 14cm thick, interpreted to be a buried topsoil on which the original midden (201) was deposited. The three layers were sampled and it is hoped to reconstruct environmental history from the three layers, with dateable material included as well.

Figure 82. Trench (red square) through context 200

Figure 83. Southwest facing section of the trench (scale interval 0.5m)

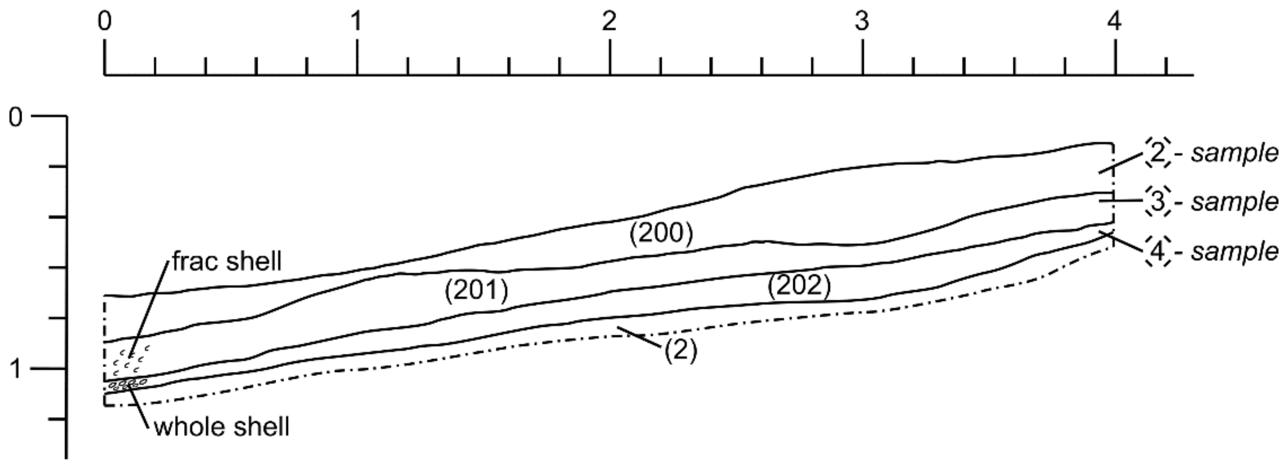

Figure 84. Northeast facing section of the trench

4 ANALYSIS

4.1 Midden Analysis

Twenty-seven samples (57 bags – 285L) were collected from the shell midden at the Cooks Beach site, from various locations within the excavation. The excavation exposed four large midden areas and a shelter containing midden (Figure 50) from which samples from nine contexts were analysed: 203 (context 235), 204, 208 (contexts 205 and 209), 210 (contexts 211, 213, 214 and 215) and 227. Additionally, a sample of midden 274 located near the farmstead (off the main excavation area) and two samples of midden 101 located near the road some distance south of T11/1050 and southwest of T11/1014, were analysed. The report focuses on the identification and quantification of marine mollusc remains from 12 bags of midden samples from 11 of the overall 27 contexts sampled. The samples were selected based on their significance and ability to provide information on the overall focus of the project.

4.1.1 Methodology

Shells from each sample were sorted and identified at as low a taxonomic level as possible. A list of all taxa identified in the analysis is presented in Table 3. Quantification considers Number of Identified Specimens (NISP), Minimum Number of Individuals (MNI) and the MNI percentage. NISP is calculated by counting the total number of identifiable shells for each species. For bivalves to be counted, a hinge was the minimum requirement. MNI for bivalve species was calculated by total number of hinge portions divided by two. For gastropods whole or nearly whole terminal spires (apices) were counted. Gastropod MNI was calculated from either complete examples or the presence of specific portions of the shell. The percentage MNI is calculated to show relative proportions.

4.1.2 Results

The results show that nine of the samples analysed had a large portion of sediment, between 40.5 and 81.5 percent of the total sample weight (Table 4). Three of the samples, however, contained only between 9.9 and 32.5 percent sediment. The second largest portion of the samples was divided into two groupings, unidentifiable shell and identifiable shell. The five samples (214, 235, 274, 204, and 209) that had unidentifiable shell as the second highest percentage ranged between 24.6 and 49.5 percent, with identifiable shell between 3.3 and 35.6%; while in samples 101.1, 101.2, 211, 213, 215, 205 and 227 unidentifiable shells ranged between 2.6 and 12.6 percent and identifiable shell between 13.5 and 59.0%. The remaining components of the samples were small portions of rock and charcoal.

Mollusc remains recovered from the 12 samples analysed all represented marine gastropods and bivalves (Table 3). Gastropods included whelk (cf. Lined whelk (*Buccinulum vittatum vittatum)*, cf. Speckled whelk (*Cominella adspersa)* and cf. Siphon whelk (*Penion sulcatus)*, Cat's eye (*Lunella smaragda)* and fine Wentletrap (*Epitonium jukesianum*), while bivalves included cockle (*Austrovenus stutchburyi*), pipi (*Paphies australis*) and tuatua (*Paphies subtriangulata*).

Bivalve taxa dominated all of the samples. In addition, to the marine mollusc remains, a small number of bone fragments (NISP = 4), from which three fish vertebrae were recovered, was present in sample 213 from midden 210, and one bone was present in midden 204, which appeared to be a bird femur. NISP and MNI number and percentage by taxa are presented for the samples analysed in Table 5 and Table 6.

Comparing the percentage of the total identified taxa by NISP and MNI showed a very similar percentages across all the samples (Table 5 and Table 6). For example, the NISP of cockle percentage of the total (82.9%) in midden sample 214 was very similar to the MNI cockle as a percentage of the total (82.6%). MNI will be used to compare the sample taxa composition as it is a more accurate representation of the number of individuals present.

The results show the middens were broadly similar in composition with low to medium evenness (dominated by two species). The taxanomic results show that cockle (*Austrovenus stutchburyi)* accounted for the majority of identified species with MNI ranging from 24.5 to 96.4 percent. This was followed closely by pipi (*Paphies australis*) ranging from 6.8 to 74.1 percent MNI. The remaining species were very small components, often less than 1 percent of the total.

There was some variation in the MNI counts of cockle. Midden samples 235 and 227 had the smallest number by MNI (26 and 27) and 101.1 had the largest (417). The pipi results showed large variation in the counts from 13 (context 215) to 327 (midden 204).

Table 3. List of identified taxa by scientific and common names and preferred habitat for Cooks Beach

Scientific Name	Common Name	Preferred Habitat
Buccinulum vittatum vittatum	Lined Whelk	Inter-tidal under rocks
Cominella adspersa	Speckled Whelk	Sand, mud and rock shore
Lunella smaragda	Cat's eye	Most shores
Epitonium jukesianum	Fine wentletrap	Sandy shore
Penion sulcatus	Siphon whelk	Deep sea, Sandy/Muddy shore
Paphies australis	Pipi	Muddy and/or Sandy shore
Paphies subtriangulata	Tuatua	Sandy shore – Low tide
Austrovenus stutchburyi	Cockle	Muddy and/or sandy shore

Table 4. Sample components

Weight (g)	101. 2	101.1	211	213	204	209	205	214	215	227	235	274
Soil	1600	1470	1106	1313	228	2051	2130	1629	1594	2178	462	668
Unidentified Shell	235	322	222	137	1141	1595	425	1733	69	71	281	968
Identified Shell	751	719	2008	1261	820	129	769	235	805	361	227	896
Rock	40	39	48	105	115	102	40	156	157	62	170	87
Charcoal	1		22	12	1	14	1	9	26	1	1	1
Bone												
Artefacts												
Total	2627	2550	3406	2828	2305	3891	3365	3762	2651	2673	1141	2620
%												
Soil	60.9	57.6	32.5	46.4	9.9	52.7	63.3	43.3	60.1	81.5	40.5	25.5
Unidentified Shell	8.9	12.6	6.5	4.8	49.5	41.0	12.6	46.1	2.6	2.7	24.6	36.9
Identified Shell	28.6	28.2	59.0	44.6	35.6	3.3	22.9	6.2	30.4	13.5	19.9	34.2
Rock	1.5	1.5	1.4	3.7	5.0	2.6	1.2	4.1	5.9	2.3	14.9	3.3
Charcoal	0.0	0.0	0.6	0.4	0.0	0.4	0.0	0.2	1.0	0.0	0.1	0.0
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 5. NISP and percentage by taxa for Cooks Beach

Sample	Cockle		Pipi		Tuatua		Whelk		Cat's eye		Gastropod sp.		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
214	584	82.9	107	15.2	0	0	6	0.9	3	0.4	3	0.4	704
215	246	88.1	26	9.3	1	0.4	2	0.7	2	0.7	2	0.7	279
227	48	38.7	73	58.9	0	0	0	0	0	0	1	0.8	124
235	48	24.7	143	73.3	2	1	2	1	0	0	0	0	195
274	168	20.8	630	78.4	0	0	0	0	0	0	5	0.6	804
101 1/2	719	83.5	156	16.5	0	0	0	0	0	0	1	0	948
101 2/2	587	78.4	162	21.6	0	0	0	0	0	0	0	0	749
211	254	43.7	307	52.8	0	0	4	0.7	2	0.3	14	2.4	581
213	373	91.2	29	7.1	6	1.5	0	0	1	0.2	0	0	409
204	207	23.9	654	75.4	0	0	5	0.6	0	0	1	0.1	867
209	116	69	51	30.4	0	0	1	0.6	0	0	0	0	168
205	157	40.3	233	59.7	0	0	0	0	0	0	0	0	390

Table 6. MNI and percentage by taxa for Cooks Beach

Sample	Cockle		Pipi		Tuatua		Whelk		Cats eye		Gastropod sp.		Total
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
214	319	82.6	54	14	0	0	6	1.6	3	0.8	3	0.8	386
215	125	86.2	13	9	1	0.7	2	1.2	2	1.4	2	1.4	145
227	27	40.3	37	55.2	0	0	0	0	0	0	0	1.5	67
235	26	25.7	72	71.3	1	1	2	2	0	0	0	0	101
274	118	26.9	315	71.8	0	0	0	0	0	0	5	1.1	439
101 1/2	417	84.1	78	15.7	0	0	0	0	0	0	1	0.2	496
101 2/2	299	78.7	81	21.3	0	0	0	0	0	0	0	0	380
211	131	43	154	50.5	0	0	4	1.3	2	0.7	14	4.6	305
213	187	96.4	14	6.8	3	1.5	0	0	1	0.5	0	0	205
204	108	24.5	327	74.1	0	0	5	1.1	0	0	1	0.2	441
209	59	68.6	26	30.2	0	0	1	1.2	0	0	0	0	86
205	83	41.5	117	58.5	0	0	0	0	0	0	0	0	200

4.1.3 Midden 208

In total, 558 (NISP) fragments of marine shell (MNI 286) were recovered from contexts 205 (gardening layer), and 209 (dense midden layer), below and above midden 208 respectively (Table 5, Table 6). The marine shell included pipi, cockle and one whelk (lined whelk). The most common species in midden 208 was pipi (NISP = 284, MNI = 143), closely followed by cockle (NISP = 273 MNI = 142) (Figure 85).

Taphonomic Assessment

Fragmentation

The fragmentation ratio was low for midden sample 209 (see Table 9), although unidentified shell comprised 41% of the overall weight, while identified shell was 3.3% (Table 4). Midden sample 205 also had a low fragmentation ratio, with the percentage of unidentifiable to identifiable shell at 12.6 and 22.9 percent respectively, and many partial and complete shells throughout the context.

Burning and calcination

There was a low presence of charcoal in both contexts 205 and 209; however, there was no evidence of prolonged exposure to heat.

Measurements

Twenty suitably complete shells from each context were sampled to allow measurement for size estimation. The measurable species for midden 208 was pipi. Pipi from context 205 ranged between 30 and 62mm, with an average measurement of 47 mm.

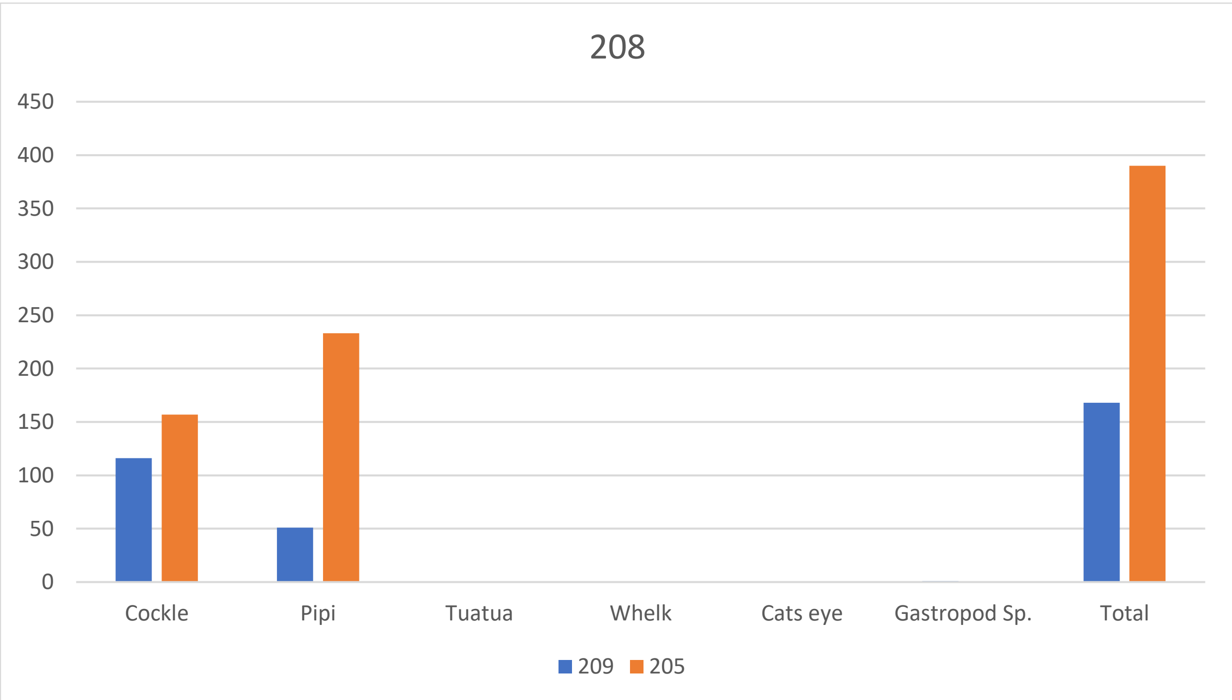

Figure 85. Graph showing shell NISP values of samples from contexts in Midden 208

4.1.4 Midden 203

In total, 195 fragments of marine shell were recovered from posthole 235, located in midden 203 (Table 5). Midden 203 included cockle, pipi, tuatua, and gastropods (lined whelk). Pipi was the most common find within midden 203 (NISP = 143, MNI = 72), with cockle the only other species represented by more than two examples (NISP = 48, MNI = 26) (Figure 86).

Taphonomic Assessment

Fragmentation

The fragmentation ratio was moderate in the sample from midden 203 (see Table 9), taken from posthole 235, with many identifiable partial and complete shells recovered and similar percentage weights of unidentified (24.6%) to identified (19.9%) shell (see Table 4).

Burning and calcination

There was a low presence of burnt shell and charcoal in posthole 235.

Measurements

Twenty suitably complete shells from context 235 were sampled to allow measurement for size estimation. The species measured was pipi. Pipi from context 235 ranged between 35 and 55mm, averaging 43.5mm in length (Table 7).

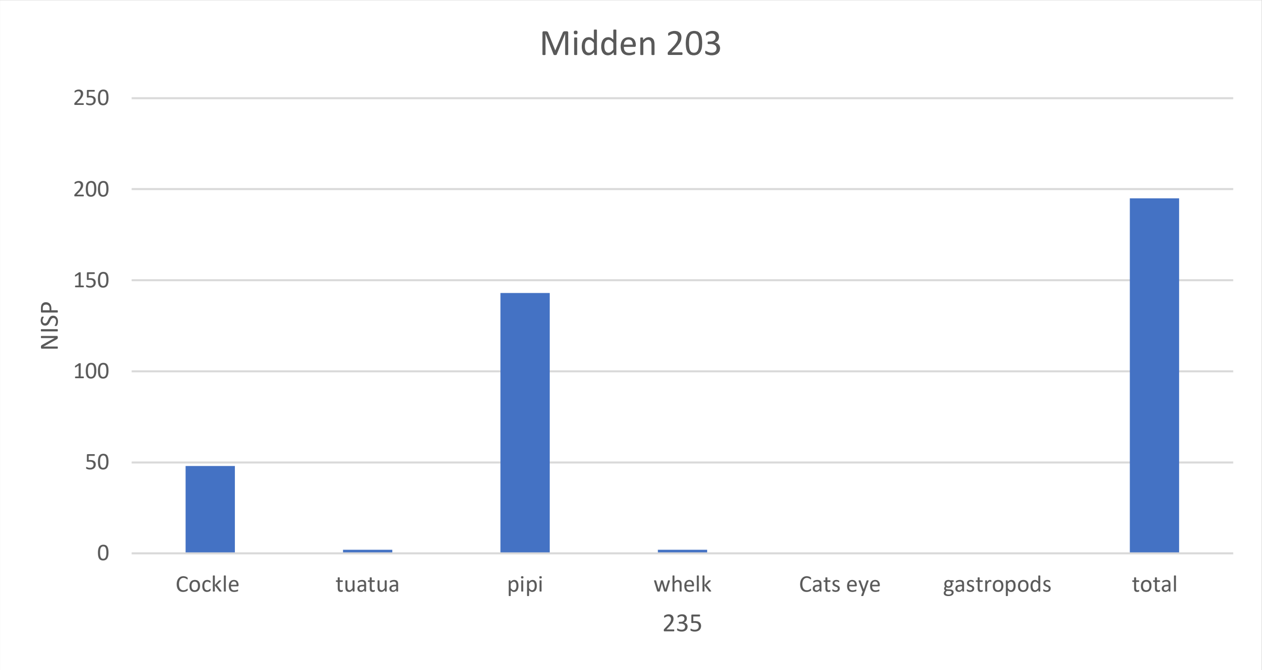

Figure 86. Graph showing shell NISP values of sample from context 235 in Midden 203

4.1.5 Midden 204

In total, 867 fragments of marine shell were recovered from midden context 204, with MNI counted at 441 (Table 5, Table 6). The midden sample included cockle, pipi, tuatua, and gastropods including lined whelk, speckled whelk, and fine wentletrap (Figure 87). Pipi was the most common marine shell in midden 204 (NISP = 654, MNI = 327) with cockle counted at 108 MNI (NISP = 207). Midden 204 contained one bone fragment, which appeared to be a bird femur.

Taphonomic Assessment

Fragmentation

The fragmentation ratio of midden sample 204 was low (see Table 9), with relatively even weights of identifiable (35.6%) and unidentifiable (49.5%) shells (Table 4).

Burning and calcination

Midden 204 contained burnt shell throughout the assemblage.

Measurements

Twenty suitably complete shells from context 204 were sampled to allow measurement for size estimation. The species measured was pipi. Pipi from context 204 ranged between 41 and 56mm, averaging 48.6mm in length (Table 7).

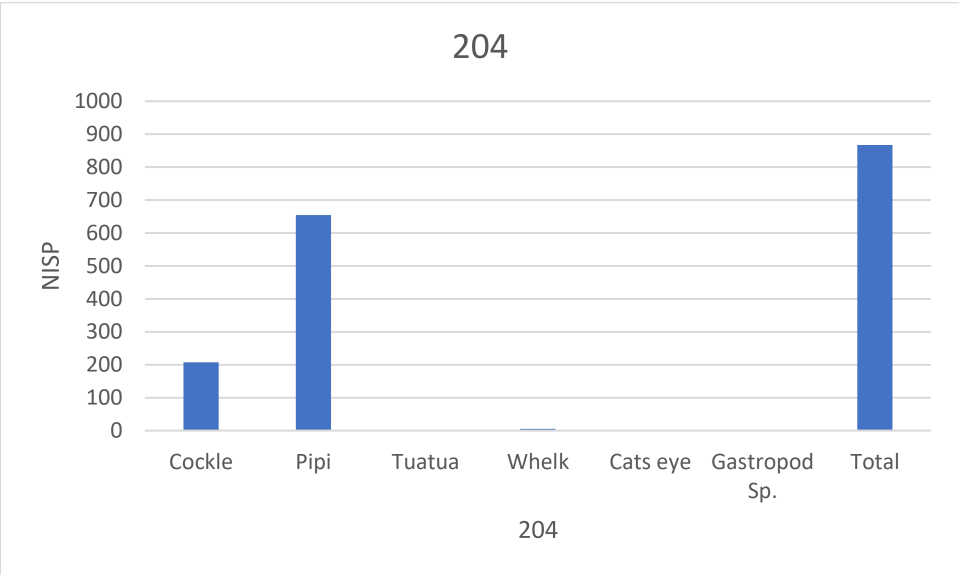

Figure 87. Graph showing shell NISP values of sample from Midden 204

4.1.6 Midden from 227

In total, 124 fragments of marine shell (MNI = 67) were recovered from midden within context 227 (Table 5, Table 6). One sample from context 3227, the earliest layer in 227, taken from a triangular cut, was analysed here. It included cockle, pipi, and fine wentletrap, pipi being the most common (NISP = 73, MNI = 37) followed by cockle (NISP = 48, MNI = 27) (Figure 88).

Taphonomic Assessment

Fragmentation

Midden in 227 had a high fragmentation ratio (see Table 9), although the sample contained a lower proportion of unidentifiable shell by weight (2.7%), with identifiable shell (13.5%) containing many partial and complete shells (Table 4).

Burning and calcination

There was a low presence of burnt shell.

Measurements

Twelve suitably complete shells from the midden in context 227 were sampled to allow measurement for size estimation. The species measured was pipi, which ranged between 31 and 49mm in size, averaging 36.2mm (Table 7).

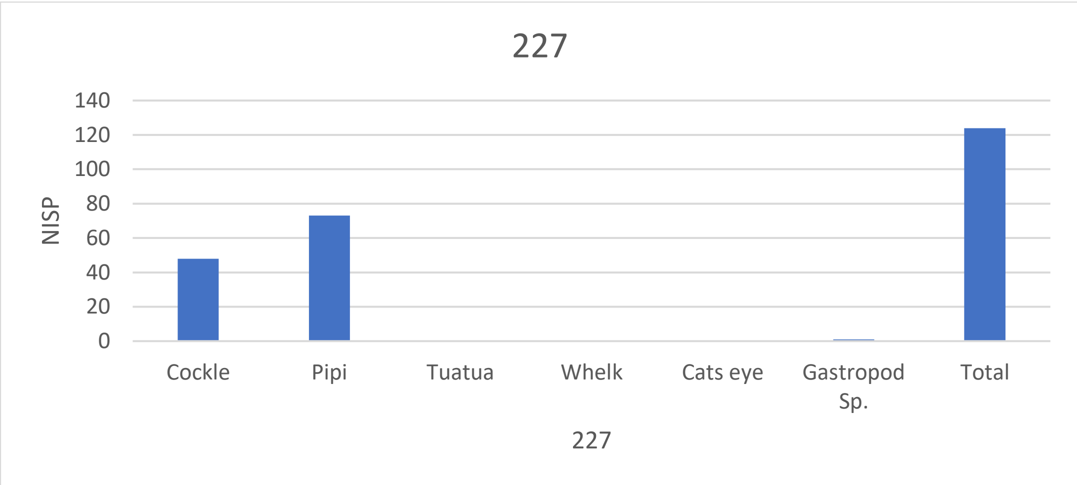

Figure 88. Graph showing shell NISP values of midden sample from Shelter 227

4.1.7 Midden 210

In total, 1973 fragments of marine shell (MNI = 1041) were recovered from four contexts in midden 210, with samples of contexts 211, 213, 214 and 215 analysed (Table 5, Table 6). Midden 210 included cockle, pipi, tuatua, and gastropods (whelk, lined whelk, cat's eye, fine wentletrap) (Figure 89). Cockle was the most common find in Midden 210 (NISP = 1457, MNI = 762), with pipi counted at 469 (NISP) and 235 (MNI).

Taphonomic Assessment

Fragmentation

The fragmentation ratios were moderate to high in the samples from midden 210 (see Table 9), which contained variable percentages by weight of identifiable shell. Context 214 showed a higher weight percentage of unidentifiable shell compared to identifiable (46.1 % to 6.2%), but the other three contexts contained much higher percentages of identifiable shell, ranging from 30.4 to 59% identifiable shell to 2.6 to 5.5% for unidentifiable shell (Table 4).

Burning and calcination

Midden 210 contained burnt shell throughout the assemblage.

Measurements

Twenty suitably complete shells from midden 210 were sampled to allow measurement for size estimation. The species measured was cockle, from context 213, which ranged in size from 21 to 34mm and averaged 28mm (Table 8).

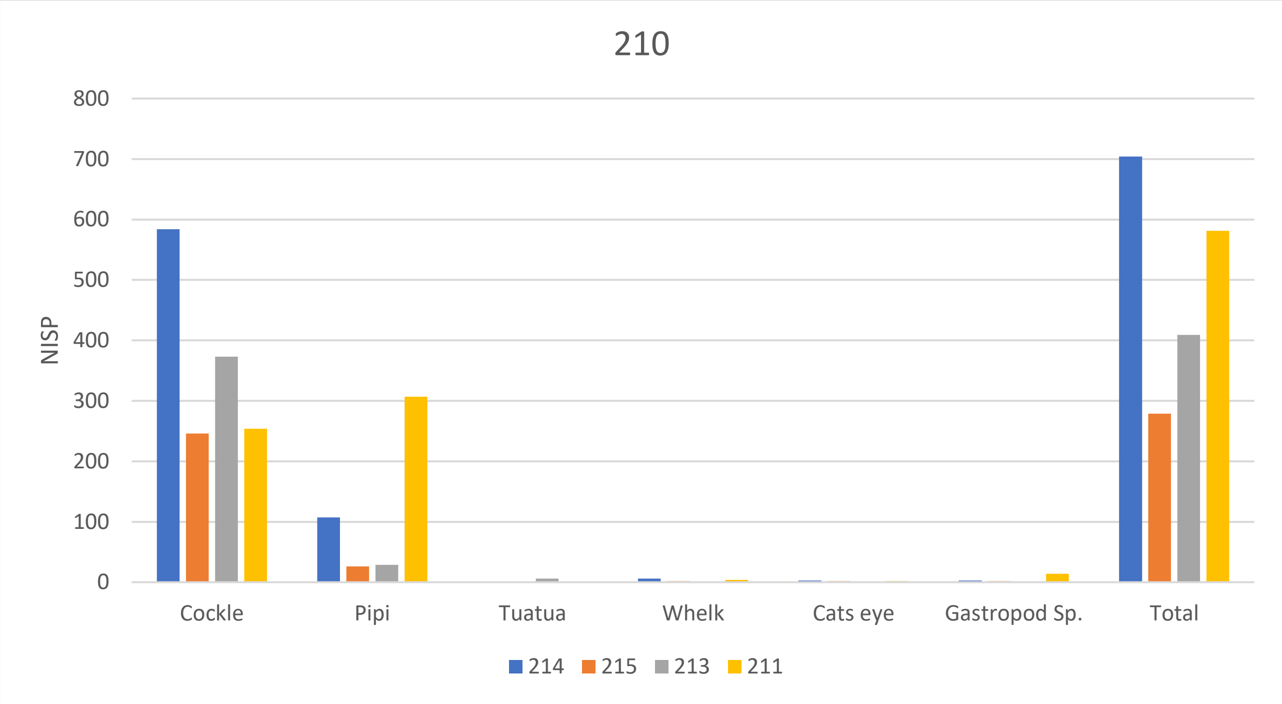

Figure 89. Graph showing shell NISP values of four samples from contexts within Midden 210

4.1.8 Midden 274

In total, 804 fragments of marine shell (MNI = 439) were recovered a sample from midden layer 274 (Table 5, Table 6). Midden 274 included cockle, pipi, and fine wentletrap, with pipi being the most common (NISP = 630, MNI = 315) and cockle counted at 168 (NISP) and 118 (MNI) (Figure 90).

Taphonomic Assessment

Fragmentation

The fragmentation ratio was very low (see Table 9), and there were similar percentage weights of both unidentifiable shells (36.9%) and identifiable partial and complete shells (34.2%) (Table 4).

Burning and calcination

Midden 274 contained burnt shell throughout the assemblage.

Measurements

Twenty suitably complete shells from context 274 were sampled to allow measurement for size estimation. The species measured was pipi, ranging in size between 34 and 56mm and averaging 44.4mm (Table 7).

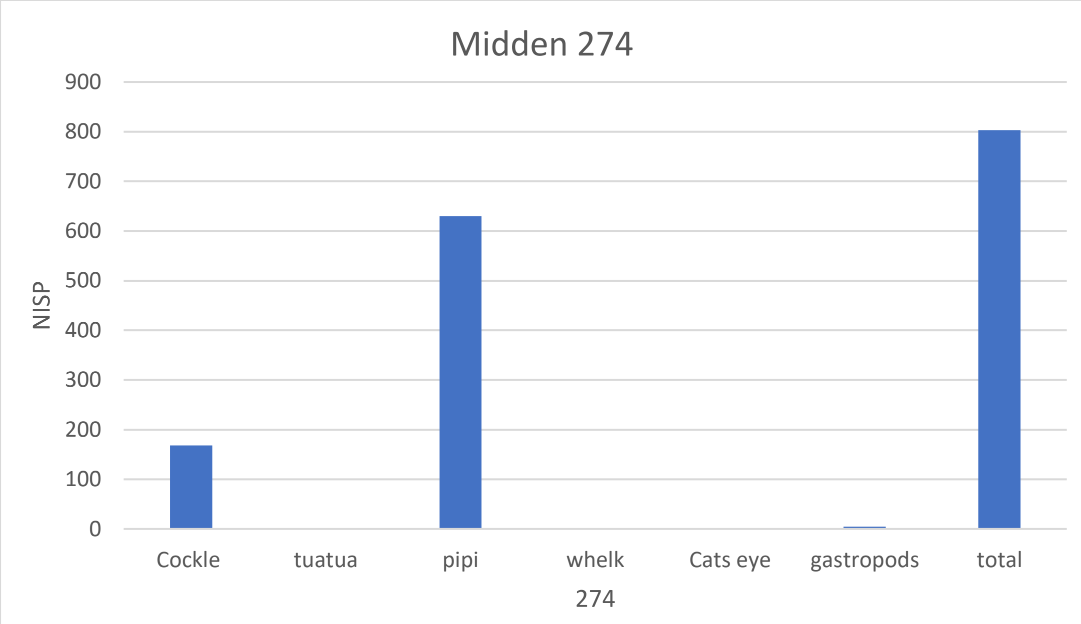

Figure 90. Graph showing NISP values of shell sample from Midden 274

4.1.9 Midden 101

In total, 1697 fragments of marine shell (MNI = 876) were recovered from two samples from midden layer 101 (Table 5, Table 6). Midden 101 included cockle, pipi, and one gastropod (unknown species), cockle being the most common (NISP = 1306, MNI = 716), with lesser amounts of pipi, counted at 318 (NISP) and 159 (MNI) (Figure 91).

Taphonomic Assessment

Fragmentation

The fragmentation ratio was high, and very high in one of the samples (see Table 9), although overall there were relatively low percentage weights of unidentified shell (8.9-12.6%) to identified shell (28.2-28.6%) within the samples (Table 4).

Burning and calcination

Midden 101 contained burnt shell throughout the assemblage.

Measurements

Forty suitably complete shells from context 101 were sampled to allow measurement for size estimation. The species measured was cockle, from context 101.2, which ranged between 20 and 34mm in size, averaging 25.9mm (Table 8).

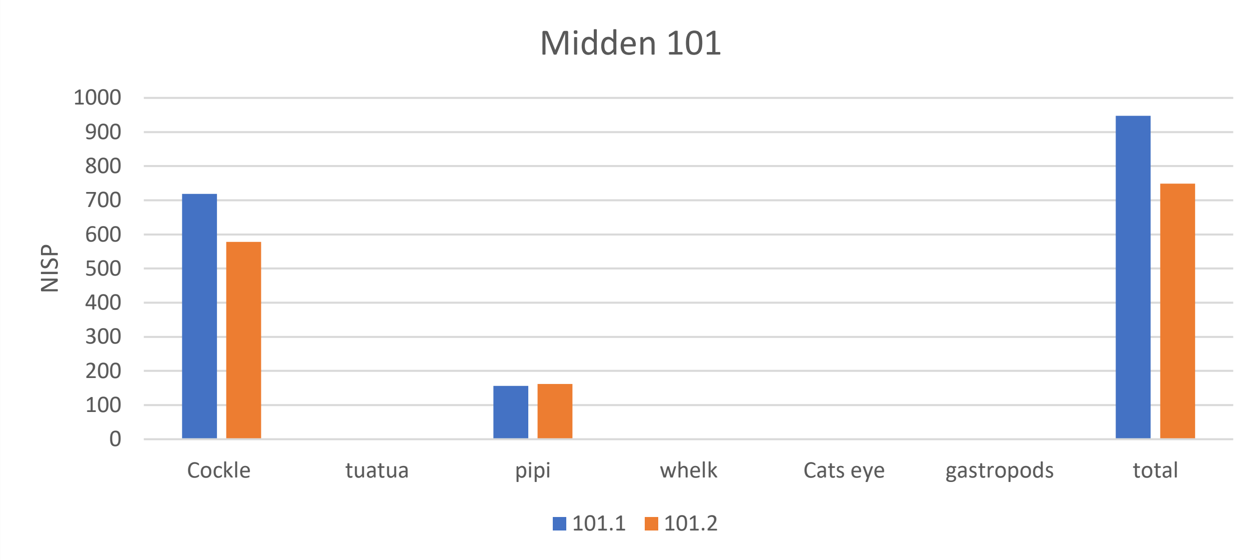

Figure 91. Graph showing shell NISP values of two samples from Midden 101

4.1.10 Dimension Results

A total of 152 cockle and pipi shells were measured across the 12 midden samples taken at Cooks Beach (Table 7 and Table 8). The results show the cockle shell was fairly even in the range of sizes, while pipi shell showed a larger size range. The average mean size value of pipi across all the contexts is 43.96mm ±6.26mm, with a range of 34.2 to 55.6mm. The modern day mean size of pipi is 48 to 83mm, with maturity reached at c.40mm in length (fs.fish.govt.nz), suggesting that the shells from the excavated middens are below average size and include juveniles (Morley 2004). Overall, context 227 had the smallest mean size of 36.2mm with the largest in 204 at 48.6mm. This result may suggest that juvenile pipi were targeted as the source area was over harvested.

The cockle from contexts 213 (midden 210) and 101 had a size range between 20 and 34mm, with an average of 27mm, indicating that all were mature examples, maturity being estimated at c.18mm in length (fs.fish.govt.nz).

Table 7. Descriptive statistics for the dimension results for Pipi shell

Sample	235	227	274	204	205	total
N.	20	12	20	20	20	152
Min	35	31	34	41	30	34.2
Max	55	49	56	56	62	55.6
Mean	43.5	36.2	44.4	48.6	47.1	43.96
St. dev.	5.4739	5.8	7.01	4.7	8.3	6.25678
Median	44	35	43	50	48	44
Mode	40	32	40	50	50	42.4

Table 8. Descriptive statistics for the dimension results for Cockle shell

Sample	213	101	Total
N.	20	40	60
Min	21	20	20.5
Max	34	34	34
Mean	27.95	25.9	26.925
St. dev.	3.4	3.8	3.6
Median	28	25	26.5
Mode	29	25	27

4.1.11 Fragmentation Ratio

A fragmentation ratio was calculated for to assess the level of fragmentation. The reasoning for this follows the argument that greater quantities of broken shells indicate greater levels of damage to the deposit. Therefore, greater quantities of intact shells would indicate a deposit in 'good/whole' condition. Interpretation of this ratio needs to take into account various taphonomic factors influencing the site.

In order to calculate the ratio, the identifiable shells were separated into those with over 50% of the shell intact and those with less than 50%. Only cockle was calculated. The MNI of each portion was measured and the less than 50% portion was divided by the greater than 50% portion. This creates a ratio of broken shells to whole shells, with a higher number indicating more broken shells. The MNI numbers of each portion and the ratio are presented in Table 9.

Table 9. Fragmentation ratios

	214		215		235		227	
	MNI	Ratio	MNI	Ratio	MNI	Ratio	MNI	Ratio
Cockle <50%	254	3.9	108	6.3	20	3.33	23	5.75
Cockle >50%	65		17		6		4	

	274		204		205		213	
	MNI	Ratio	MNI	Ratio	MNI	Ratio	MNI	Ratio
Cockle <50%	58	0.967	70	1.52	34	0.69	153	3.33
Cockle >50%	60		46		49		46	

	209		101.1		101.2		211	
	MNI	Ratio	MNI	Ratio	MNI	Ratio	MNI	Ratio
Cockle <50%	31	1.11	347	4.82	279	13.95	105	4.04
Cockle >50%	28		72		20		26	

The results show that the cockle had a large range of fragmentation rates across the 12 samples, ranging between 0.69 (context 205 in midden 208) to 13.95 (context 101.2). The fragmentation rate especially for 101 suggests this midden may have been disturbed by modern processes such as ploughing, and cattle or stock damage. In midden 210, moderate damage can be seen in contexts 211, 213 and 214 with a higher level of damage in 215, and a moderately high level of damage was also apparent in midden from the shelter 227, which suggests light trampling by humans or hillslope colluvial processes.

4.1.12 Discussion

The remains of marine shell recovered during excavations at Cooks Beach in 2019 and 2020 represent species that are common to the North Island's east coast (e.g., Morley 2004). Many of the species present are popular food items for Māori, and this is especially true for cockle, pipi and tuatua. The low presence of tuatua was also noted in the midden analyses of the earlier excavation at Cooks Beach by Hoffman (2017). Hoffman's interpretation of tuatua harvesting suggested mature beds were likely targeted, or his other hypothesis was that they could have been collected on a by-catch basis. The quantities of pipi and cockle suggests significant consumption of shellfish.

The MNI percentage graph (Figure 92) indicates three different variations in the harvesting focus between pipi/cockle subsistence. One variation is where pipi dominates (274, 235 and 204), another where pipi and cockle are roughly equal (227, 211 and 205), and lastly where cockle is dominant (213, 214, 215, 101.1 and 101.2). Both pipi and cockle occupy soft shore settings and this suggests that Māori were heavily exploiting these areas.

Most cockle and pipi assemblages contained a range of sizes; the vast majority were small bivalves of between 20-50mm, with pipi averaging 43mm and cockle 27mm. In the case of pipi this supports Hoffman's interpretation:

> 'the cockle and pipi sizes represent natural immature cohort groups and were probably "bulk" harvested, perhaps with a dredge type take all method. The minor species were either by-catch, or in the case of Turbo were probably prevalent at times and locally available along the rocky tidal margin' (Hoffman 2017:18).

One apparent pattern is that pipi dominated the lower cultural horizons, while cockle dominated the upper horizons. This may suggest a shift from pipi to cockle exploitation, as demonstrated by context 205 from midden 208, which is earlier in chronological time compared to sample 209 (primarily cockle) situated above it and later in the sequence (Figure 53, Figure 96).

There have been several previous analyses of shells from sites of various ages within the region. Davidson (1972), for example, stated that site R10/38 predominantly contained pipi (earlier in time), while Leahy's site (R10/31) contained primarily tuatua and cockle (later in time) (Davidson 2013). This tentatively suggests that the shift may reflect different occupation periods. For example, in the late 1960s excavations at Station Bay, on Motutapu Island, cockle and pipi were brought from the protected beaches on the western side of the island; while tuatua came from the more open beaches on the north side (Davidson 2013). The different harvesting strategies at different periods in time were suggestive of different occupation periods.

However, environmental conditions cannot be ruled out. For example, McFadgen (2013) suggests a tsunami event is likely to have changed the marine environment around 1400-1600 AD and sand was blown over the Coromandel coast burying many rocky shore environments and causing soft shore areas to be targeted. Lastly, variation due to changes in tikanga or preferences for soft shore species over rocky shore are possible (McFadgen 2013).

The very small sample of only three fish bones is a striking feature of the assemblage. This absence may have been a result of various taphonomic processes, such as acidic soils. Bone was present in sample 204, and was identified as a bird femur; however, further identification to the species level was not undertaken given the small sample size.

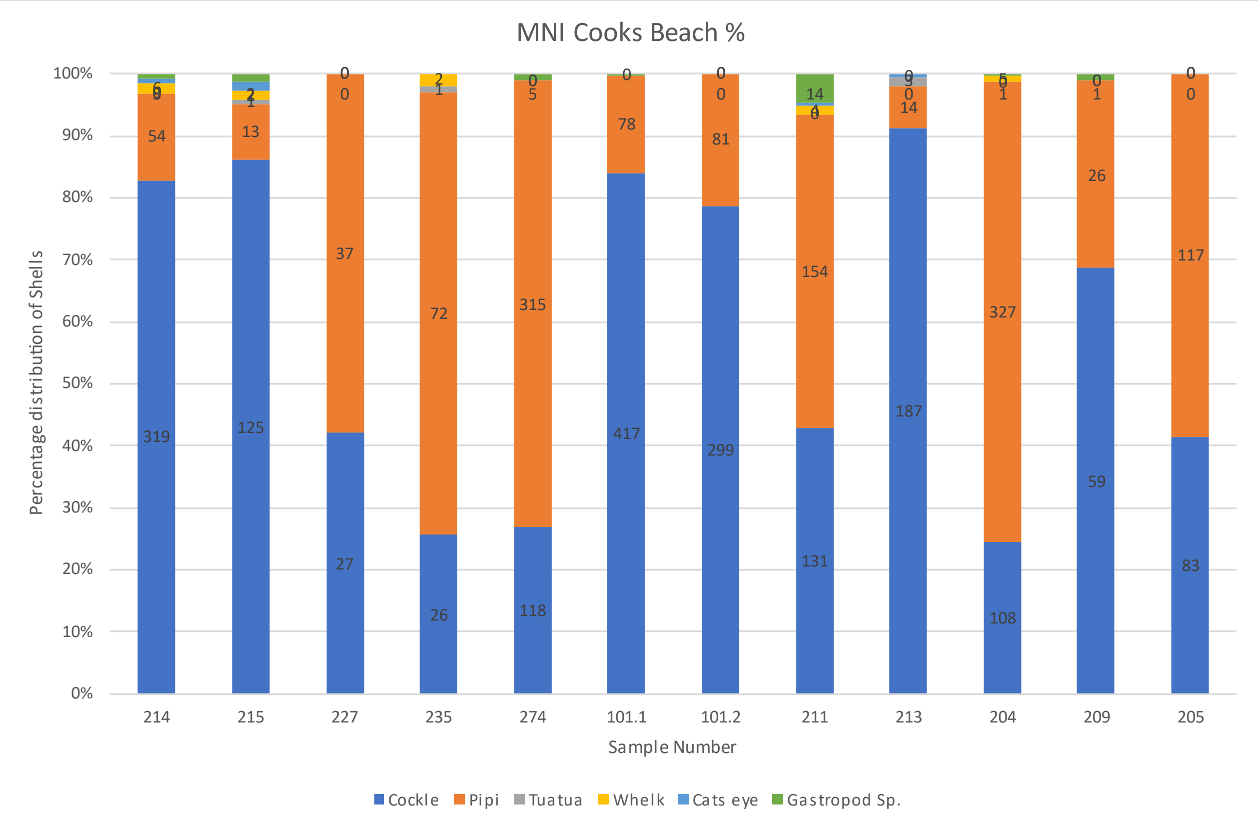

Figure 92. MNI: percentage distribution of shells between the 12 samples that were analysed from Cooks Beach

4.2 Microfossil Analysis

The plant microfossils provide evidence of large-scale landscape disturbance by Māori. There is also evidence for two Māori-introduced cultigens, namely kumara and taro.

4.2.1 Methods

Two archaeological samples from contexts 26 and 227 were analysed by Dr M. Horrocks for pollen, phytoliths, and starch to provide a record of past vegetation, environments, and human activity and compared. Detailed methods of analysis are described in Appendix 4.

4.2.2 Results and Discussion

4.2.2.1 Pollen and spores

Both samples contained abundant microscopic fragments of charcoal, reflecting human fire activity in the area. The pollen/spore assemblages were dominated by spores of bracken fern (rarahu, *Pteridium esculentum*) and *Cyathea* tree ferns (Figure 93), with pollen of tanekaha/toatoa (*Phyllocladus*) and puha/dandelion (*Sonchus/Taraxacum*), and spores of hornworts (Anthocerotaceae) also featured.

Apart from tanekaha/toatoa, these pollen and spore types, coincident with charcoal in the sample and a paucity of pollen of most forest tree taxa, reflect a majorly disturbed landscape largely cleared of forest by people (Figure 93). Bracken is an invasive, indigenous ground fern with widely dispersed spores, common in New Zealand pollen spectra since human settlement and almost always associated with large-scale, repeated burning of forest by early Māori. It can form tall, dense stands over extensive areas, and its rhizome (aruhe) was commonly harvested as a food by Māori (Best 1902). *Cyathea* tree ferns commonly colonise gullies in bracken fernland (Wardle 2002). *Cyathea* can be over-represented in pollen spectra, however, due to greater spore resistance to decay than many other pollen/spore types (Wilmshurst and McGlone 2005). Puha is native to New Zealand while dandelion is European introduced; both are invasive herbaceous plants and pollen of the two can be difficult to differentiate. Leaves and shoots of puha and dandelion were cooked and eaten by Māori (Anderson 1907; Best 1902; Colenso 1881; Crowe 1997). Hornworts are small inconspicuous plants that commonly colonise freshly disturbed and exposed soils (Wilmshurst et al. 1999).

The pollen of tanekaha/toatoa (*Phyllocladus*), a tall forest tree, was present in a moderately large amount in sample 227, indicating that this taxon was a considerable part of forest remnants in the area (Figure 94).

4.2.2.2 Phytoliths and other biosilicates

The phytolith assemblages were dominated by tree/shrub phytoliths, mostly spherical verrucose type (Figure 94). Nikau (*Rhopalostylis sapida*) palm type, from the fronds, recorded a moderately large amount in sample 26. Nikau is one of the few taxa that can be identified to species level in the New Zealand phytolith flora. In the North Island *Rhopalostylis* is found in coastal and adjacent lowlands, and in abundance only near coasts, often persisting after forest clearance (MacPhail and McQueen 1983). The verrucose type of phytolith is generally from the wood, twigs, and leaves of several native trees, namely rata, rewarewa, and tawa (Kondo et al. 1994).

The large amounts of tree phytoliths could seem at odds with the generally small amounts of native tree pollen (Figure 93–Figure 94). This difference could be explained by the tree and shrub phytoliths likely in large part reflecting the pre-settlement forest (Kondo et al. 1994). Phytoliths, being non-organic, can accumulate in substrates for much longer than pollen and spores, due to their generally greater resistance to decay. Another explanation might be that these large phytolith amounts are in part from large amounts of burned tree material in the sampled deposits.

Other biosilicates identified in the samples, in this case sponge spicule fragments, reflect the local coastal environment (Figure 94).

4.2.2.3 Starch and other plant material

Starch from two Māori-introduced cultigens was identified in this study, in both samples (Figure 94). The first type comprised large amounts of starch grains consistent with the tuberous root of kumara (*Ipomoea batatas*). In addition, small amounts of fragments of cells of xylem (a type of tracheary tissue), also consistent with the root of this species, were identified.

The second type of starch comprised small amounts of fragments of amyloplasts (sub-cellular units specialised for starch grain synthesis and storage) consistent with the corm of taro (*Colocasia esculenta*) (Figure 94).

Both types of starch grain showed a generally high degree of degradation, not unusual for these and many other types of organic remains at archaeological sites. The starch grain decay involves progressive loss of the Maltese cross (which has high visibility in cross-polarised light), discoloration, expansion, distortion, and disintegration (Horrocks et al. 2007, 2012a, b). Given this effect, and that to date the study of ancient starch in soils is generally under-researched, the starch evidence should be treated cautiously.

4.2.2.4 Māori agriculture

The Māori-introduced cultigens identified in this study, kumara and taro, are part of the small group of six introduced species cultivated by Māori at the time of European contact in the late 18th century. Almost all the numerous plant species (70+) identified as intentionally introduced to Polynesia by early people are native to various regions within the broad area from Africa to Melanesia (Whistler 2009). The native range of taro is Southeast Asia. Kumara, however, also known as sweet potato, is one of the few exceptions, having originated in South America, its introduction to the Pacific a result of Polynesian contact (Hather and Kirch 1991). The tuberous root of kumara, and corm and shoot of taro, were cooked and eaten (Best 1902; Crowe 1997).

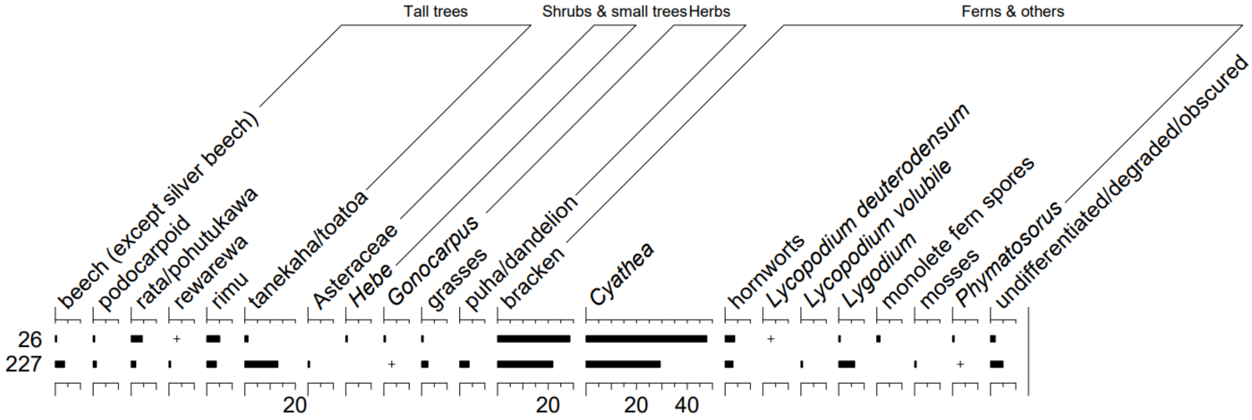

Figure 93. Pollen percentage diagram from T11/1050 context 227 and context 26, Cooks Beach Coromandel (+= found after count)

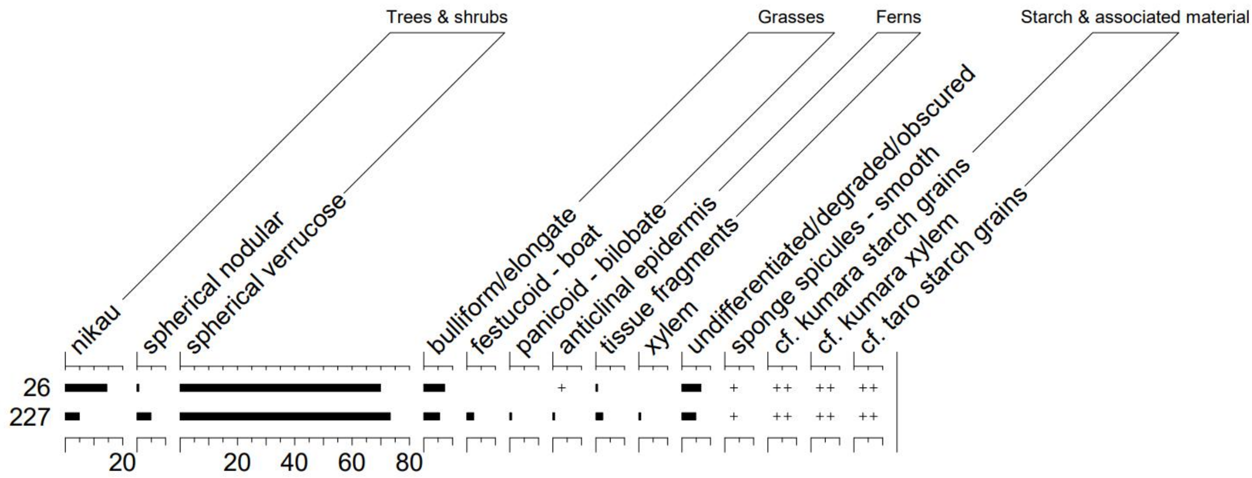

Figure 94. Phytolith percentage and starch diagram from T11/1050 context 227 and context 26, Cooks Beach, Coromandel (+= found after, ++=present)

4.3 Chronology

4.3.1 Charcoal

The analysis of the chronology relied on identifying ‘good’ wood species selected from charcoal sampled from specific features (see Appendix 1 for a detailed breakdown). The selected samples were wet sieved (separated into heavy and light fraction), dried and then using a tweezer, charcoal was separated from the remaining soil. These samples were then re-labelled and sent for charcoal identification, which Table 10 breaks down. Figure 95 provides a photographic reference of these.

The charcoal samples show that they almost exclusively contain pioneering shrub species. A single piece of mahoe is the only larger species but even this is more typical of secondary regrowth than intact forest. Due to the intense scrutiny when sieving, and the focus on sampling deposits with rich charcoal sources, all samples contained abundant material suitable for C14 dating.

Table 10. Breakdown of wood species found from charcoal

Species	Type	# Pieces
Tutu	Shrubs	16
Hebe		63
Coprosma		14
Manuka		32
Ngaio		20
Mahoe	Tree	1
Mangrove	Estuary	3
Total		146

 Tutu Wayne Bennett https://www.nzpcn.org.nz/flora/species/coriaria-arborea-var-arborea/	 Hebe https://www.nzpcn.org.nz/flora/species/coriaria-arborea-var-arborea/
 Coprosma https://www.aucklandbotanicgardens.co.nz/plants-for-auckland/plants/coprosma-repens-poor-knights/#gallery-group	 Manuka https://www.nzpcn.org.nz/flora/species/leptospermum-scoparium-var-scoparium/
 Ngaio http://www.tiritirimatangi.org.nz/ngaio	 Mahoe http://www.tiritirimatangi.org.nz/mahoe

Figure 95. Images of the wood species found within the submitted archaeological samples

4.3.2 C14 dates

A total of seven samples were sent for radiocarbon dating analysis from T11/1050. All samples were charcoal identified from shrub species or twigs to prevent in-built age (see above). The results are summarised in Table 11 and the laboratory reports can be found in Appendix 2. Samples were chosen to identify the main areas and important features excavated and where possible with stratigraphic control to maximise the potential for Bayesian analysis of the dates.

Table 11. Radiocarbon results from T11/1050

Sample	Material	CRA	Error	Context	-1σ	1σ	-2σ	2σ
Wk 52803	Manuka twig	287	18	205	1630	1670	1510	1800
Wk 52804	Hebe	137	17	206	1700	1930	1690	1950
Wk 52805	Tutu	159	17	203	1690	1950	1680	1950
Wk 52806	Hebe	184	17	210	1670	1940	1670	1950
Wk 52807	Hebe	197	16	215	1670	1810	1660	1940
Wk 52925	Tutu	272	18	227	1640	1800	1630	1800
Wk 52926	Manuka twig	166	15	209	1680	1950	1680	1920

Three dates from the area of 203 included: a sample from the top midden (203 itself); context 206, which was cut into 203 from the top; and context 205 at the base of the midden, which appeared to be similar to the Ap type soil relating to Māori horticulture described by Maxwell et al. (2017) and Hoffman (2017). Context 205 dated to around the mid-17th century with context 203 probably relatively soon after, dating to the early 18th century, with context 206 perhaps within a few decades after that.

Unfortunately, calibration of the radiocarbon dates from these samples produces a long ‘tail’, making it possible that they come from samples as late as the early 19th century. While this remains a possibility, taken as a sequential group and using Bayesian analysis (Figure 96), the probability of the earlier dates from the 17th to 18th century becomes more likely.

Two dates from nearby midden area 210 and feature 215 provide similar dates to that of the upper layers of area 203 and are more likely to be from the early 18th century than any later (Figure 96).

The date from structure 227, obtained from charcoal from one of the post-holes, suggested that the structure probably dated to the mid-17th and early 18th centuries, possibly contemporaneous with layer 205 soil nearby.

Context 209, midden, fits with the material from the other shell sites with the calibration suggesting either early 18th century or early 19th century occupation.

A Bayesian model of all the dates was proposed and calibrated treating the contexts from T11/1050 as a general group likely to be in mostly contemporary sequence. The justification for this related to the uncalibrated dates all being roughly similar (and sequential) with the earlier uncalibrated dates rather than a mix of earlier and very late dates that might indicate 19th century occupation as being likely at the site. The results of that calibration are shown in Figure 97–Figure 98). This suggests that the most likely occupation of T11/1050 was between c.1650 and 1750 AD. The implications of the results are discussed in the conclusions.

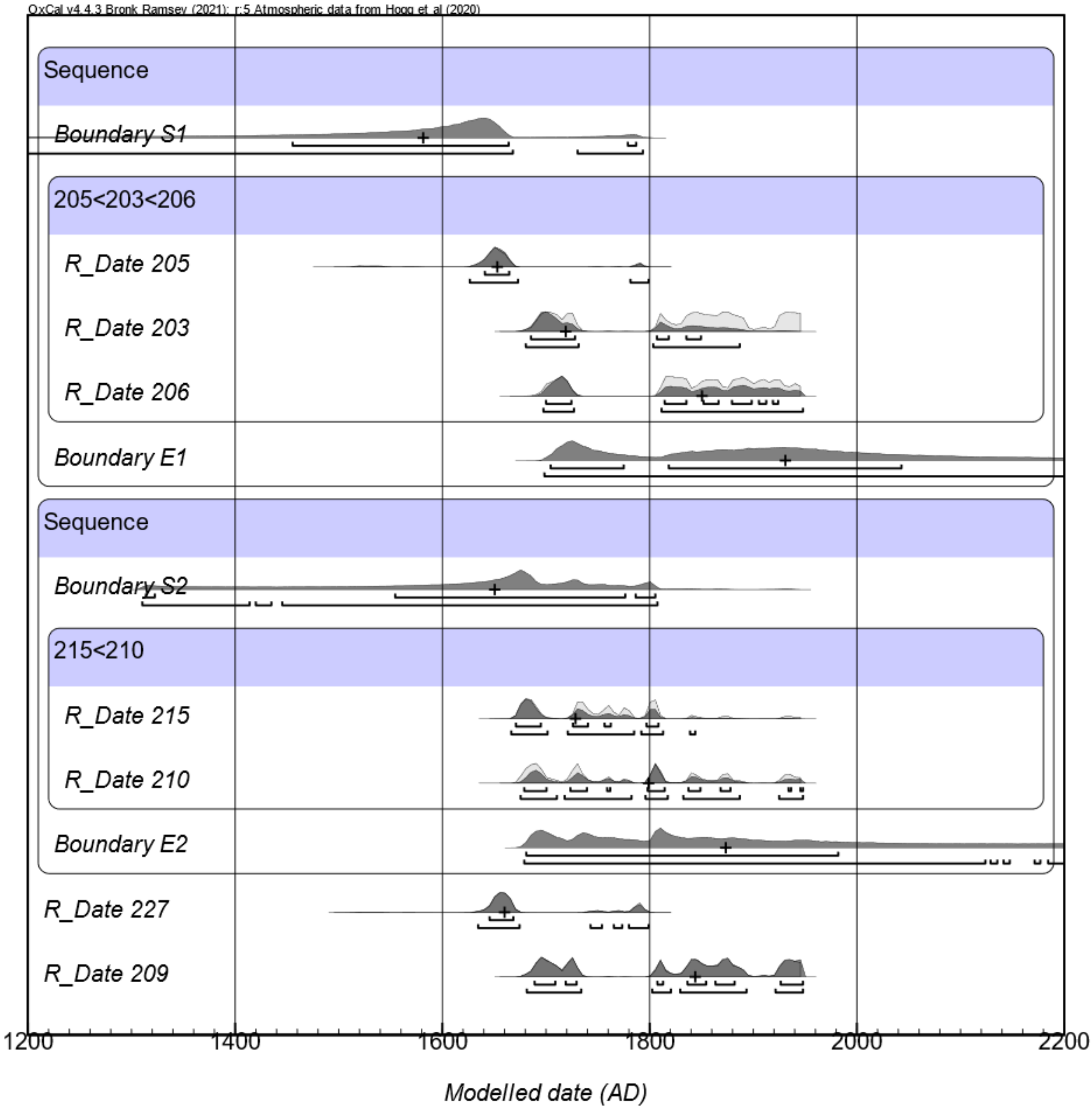

Figure 96. Bayesian analysis of radiocarbon dates for T11/1050 using stratigraphic information for each area

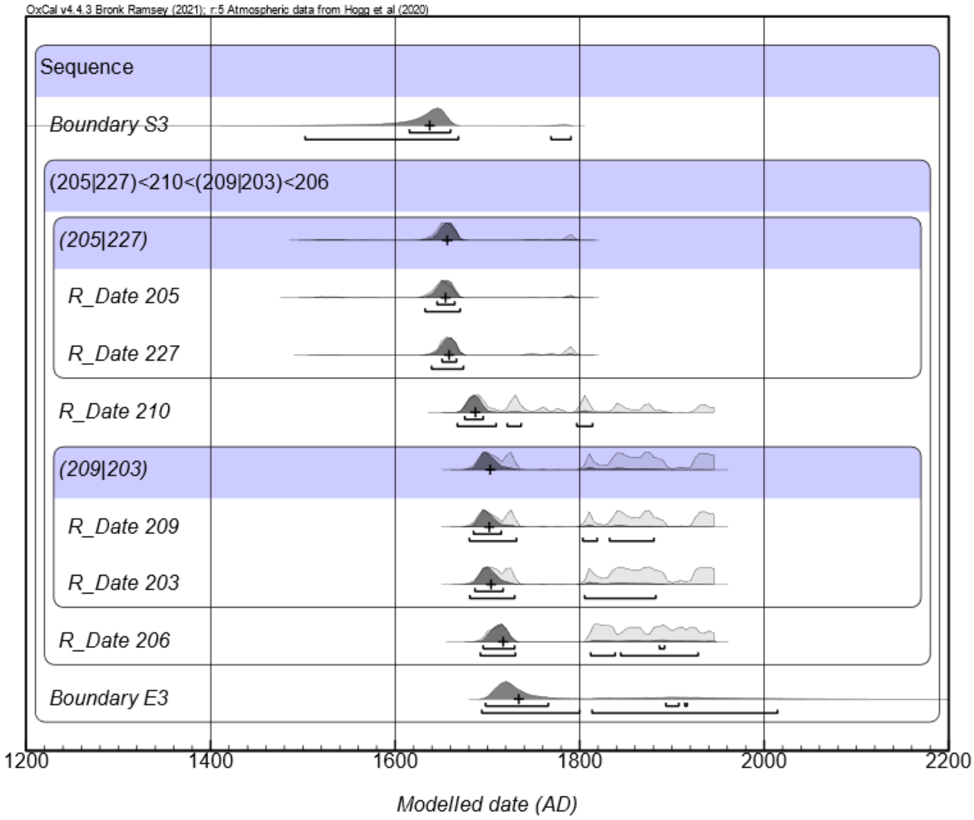

Figure 97. Phased Bayesian analysis of the dates from T11/1050

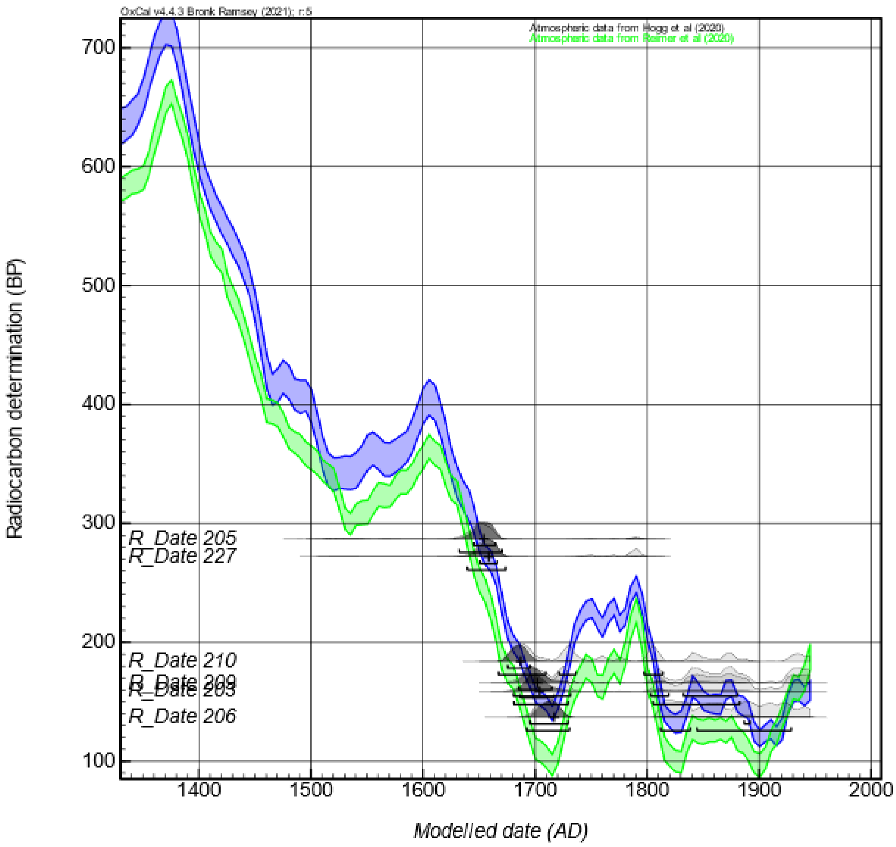

Figure 98. Plot of Bayesian modelled dates from T11/1050 against the calibration curve

4.4 Lithic Material

Lithic material found during monitoring and excavation is broken into size, cortex presence, type, lithology and site or context in Table 12. The majority were found during monitoring and were unstratified, but a few obsidian flakes were recovered from T11/1050 midden 208, and one was recovered from the fill of context 26.

Table 12. Number of lithic artefacts, type, and size found during investigation and monitoring

No.	Size	Cortex	Cortex	Type	Lithology	Site / Context
1	<5cm	Y	>50%	Flake	Obsidian	T11/1050-T11/1014
2	<5cm	N	N/A	Flake	Obsidian	T11/1050-T11/1014
3	<5cm	N	N/A	Flake	Obsidian	T11/1050-T11/1014
4	<5cm	N	N/A	Flake	Obsidian	T11/1050-T11/1014
5	<5cm	N	N/A	Flake	Obsidian	T11/1050-T11/1014
6	<5cm	N	N/A	Flake	Obsidian	T11/1050-T11/1014
7	>5cm	Y	>50%	Core	Obsidian	T11/1050-T11/1014
8	>5cm	N	N/A	Flake	Obsidian	T11/2790
9	>5cm	N	N/A	Flake	Obsidian	T11/2790
10	>5cm	N	N/A	Flake	Obsidian	T11/2790
11	>5cm	N	N/A	Flake	Obsidian	T11/2790
12	>5cm	N	N/A	Flake	Obsidian	T11/2790
13	<5cm	N	N/A	Flake	Obsidian	T11/1051
14	<5cm	N	N/A	Flake	Obsidian	T11/1051
15	<5cm	N	N/A	Flake	Obsidian	T11/1051
16	>5cm	N	N/A	Flake	Obsidian	T11/1051
17	<5cm	N	N/A	Flake	Obsidian	T11/1051
18	<5cm	N	N/A	Flake	Obsidian	26
19	<5cm	N	N/A	Flake	Obsidian	T11/1050 (208)
20	<5cm	N	N/A	Flake	Obsidian	T11/1050 (208)
21	<5cm	N	N/A	Flake	Obsidian	T11/1050 (208)
22	<5cm	N	N/A	Flake	Obsidian	T11/1050 (208)
23	<5cm	N	N/A	Flake	Obsidian	T11/1050 (208)
24	<5cm	N	N/A	Flake	Obsidian	T11/1050 (208)
25	<5cm	Y	>50%	Core	Chert	T11/1050-T11/1014
26	>5cm	N	N/A	Flake	Chert	T11/1050-T11/1014
26	>5cm	N	N/A	Flake	Chert	T11/1050-T11/1014

4.4.1 Chert

A chert core measuring less than 5cm and with less than 50% cortex and a few chert flakes were found between T11/1014 and T11/1050 during monitoring. The small piece of a used core (Figure 99) and the flakes were an exception to the bulk of the lithic material recovered, which comprised obsidian. The proximity to local sources, with evidence of chert quarrying previously noted in the intertidal zone near T11/1014, suggests the material was accessed in the immediate vicinity.

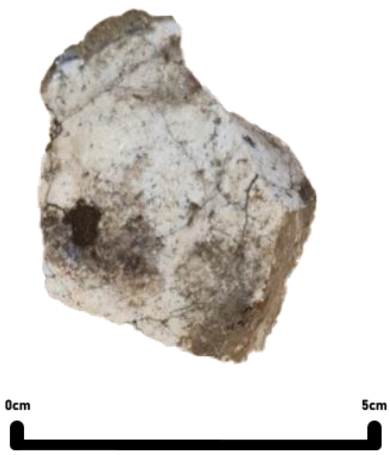

Figure 99. Chert core found between T11/1050 and T11/1014 during monitoring

4.4.2 Obsidian

The obsidian assemblage comprised flakes and was mostly recovered during monitoring, the exceptions being a few flakes derived from T11/1050 context 208. The flakes showed a range of flake debitage with the majority being micro-flakes 2-5mm in size, and occasional flakes had cortex present (Table 12, Figure 100–Figure 103).

The presence of the micro-flakes suggests that a fine flaking process was occurring due to use wear or percussion flaking (Figure 101). A few pieces of obsidian were unusual as some had more than 50% of cortex, suggesting they were flakes from the outside of an obsidian boulder (Figure 102). Lastly, several pieces of obsidian flakes had notching and micro-flake removal (Figure 103).

Two processes could result in this type of flake characteristic: natural processes once the piece is discarded, where erosion or stock trampling crush and remove parts of the flake; or human use wear, with attempts to sharpen and reuse a flake.

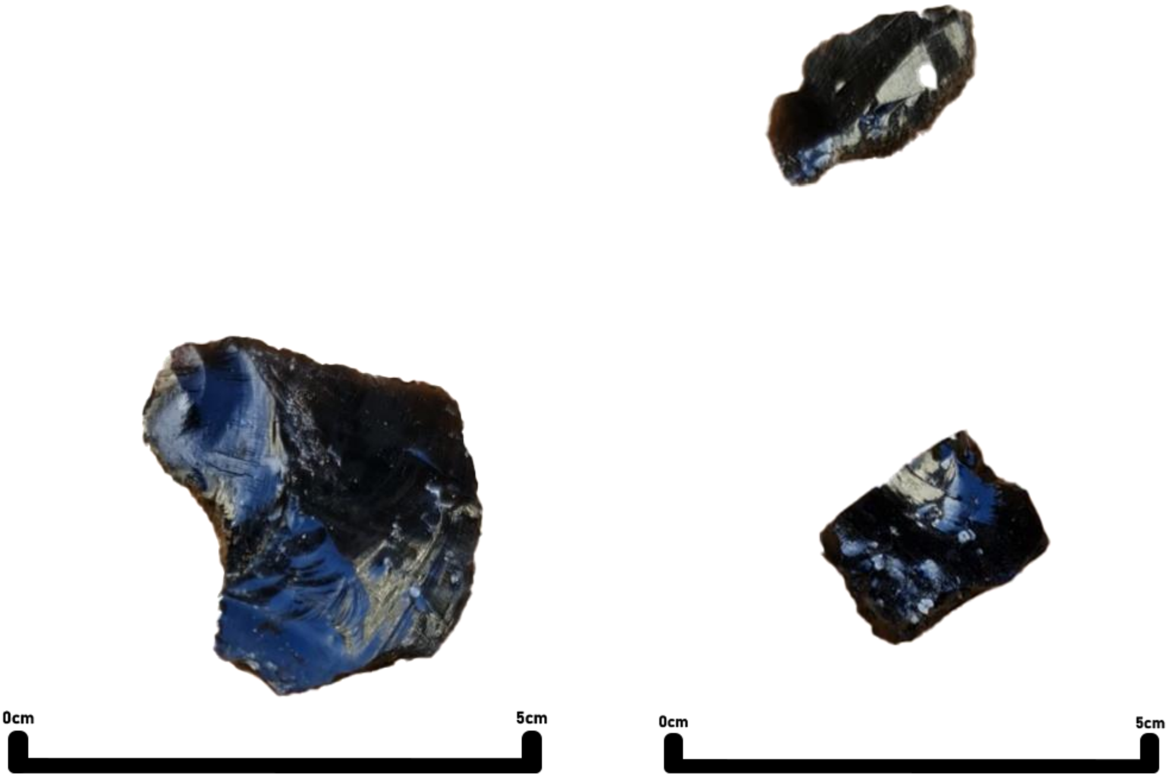

Figure 100. Obsidian flake and micro-flakes found in proximity to chert core, between sites T11/1050 and T11/1014

Figure 101. Micro-flakes of obsidian from T11/1050 context 208

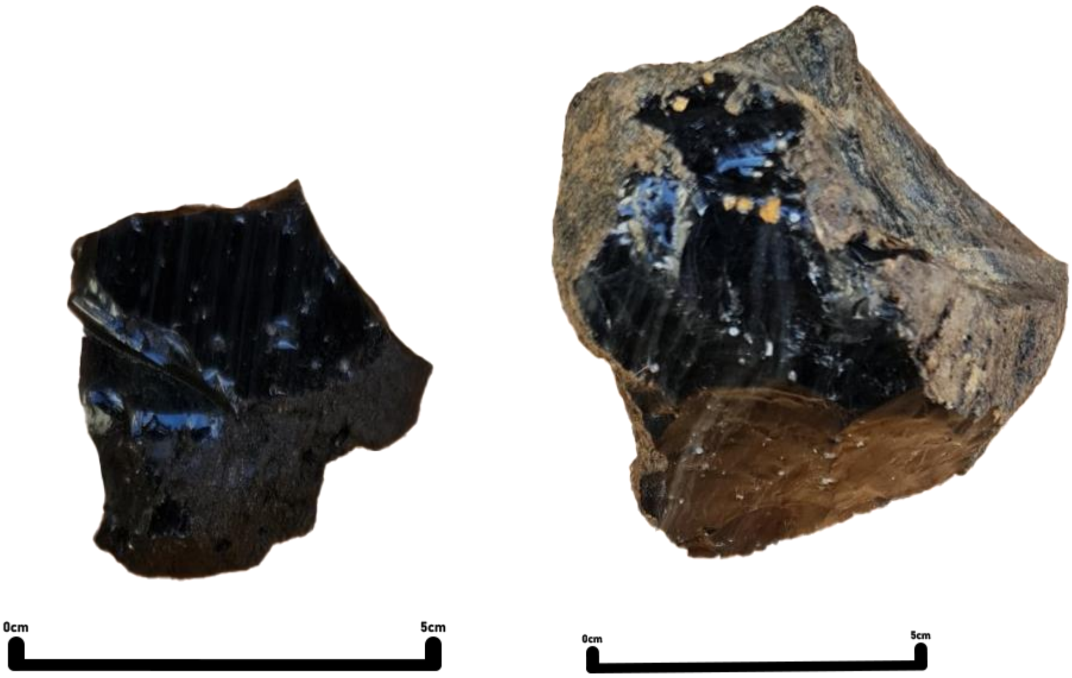

Figure 102. Obsidian with cortex from T11/2790

A) B)

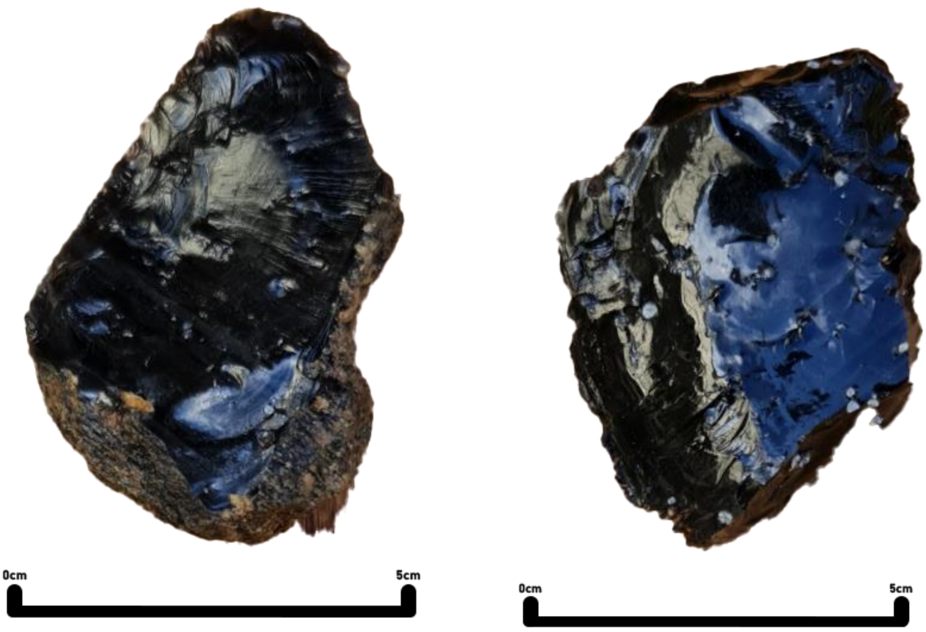

Figure 103. Obsidian flakes with notches and microflakes: A) context 26; B) site T11/1051

5 SUMMARY

5.1 Results

5.1.1 Occupation of T11/1050

The archaeological excavations and monitoring during the works have recovered data that can be applied to questions related to chronology and the nature of settlement in this area. Most of the works that were monitored did not expose intact archaeological features or midden deposits, though scatters of shell and obsidian and chert cores, flakes and nodules were noted. However, two pit features were identified near site T11/1014, and the excavation of T11/1050 revealed several midden deposits overlying garden soils, postholes related to shellfish processing (drying racks), and a terrace benched into the hill slope that had been used as shelter, with a drain and postholes in midden 210. The results included information comparable to Hoffman's (2017) work during the earlier stages on the project as well as some additional suggestions of habitation at site T11/1050.

The results across the lower parts of the property support the results reported by Hoffman (2017) with a range of smaller features associated with some areas of modified soils. The main difference was around T11/1050, which hinted at a more permanent structure, as evidenced by feature 227.

The interpretation of this as a possible whare created some debate. As discussed earlier, the evidence of the terracing into the slope was quite obvious during excavation along with the back drain and the row of postholes. On that evidence, the structure was probably something like a whare kai (cooking shelter). Figure 104 shows one possible reconstruction of feature 227 as a whare kai.

An alternative interpretation of the structure is that what was recovered was the back of a large whare (Figure 105). This is favoured by the authors because it was apparent that the eastern slopes of the hill had been heavily earthworked in the past and the length of the open area indicated by the drain and post hole locations would have made this structure very exposed. The excavated postholes were all very shallow, suggesting that at least 20-30cm of subsoil had previously been removed, and this was likely to be greater on the downslope so that postholes along the eastern side of the structure therefore may have been destroyed.

The peculiar 'kink' in the back wall based on the post holes suggested that there may have been limited supplies of suitable framing timber or that reconstruction had been necessary. Figure 106-Figure 108 show views of the feature reconstructed as a whare with nearby likely drying racks for seafood processing. It is also possible that some gardening activities were undertaken on the slope of the hill, associated with context 205, which may have been contemporary with the structure. Gardening was almost definitely occurring on the dunes below (Figure 108).

The structure itself may not have been that been that substantial and would still only represent one example of more long-term or colder seasonal occupation. Unfortunately, most of the top of the hill where the site was situated had been heavily modified during the 20th century and potential evidence destroyed. It remains plausible that this area was the better location for a more permanent settlement managing the seafood processing and gardening on the slopes and flat areas below.

Overall, it seems likely that the earliest parts of the occupation on the coastal flat described by Hoffman (2017) may have represented a relatively transient occupation. However, the evidence from T11/1050 points to the shift towards a more continuous occupation, perhaps seasonal, but not abandonment during the post-1650 AD period, as the radiocarbon date evidence now suggests the site was occupied during the period c.1650-1750 AD.

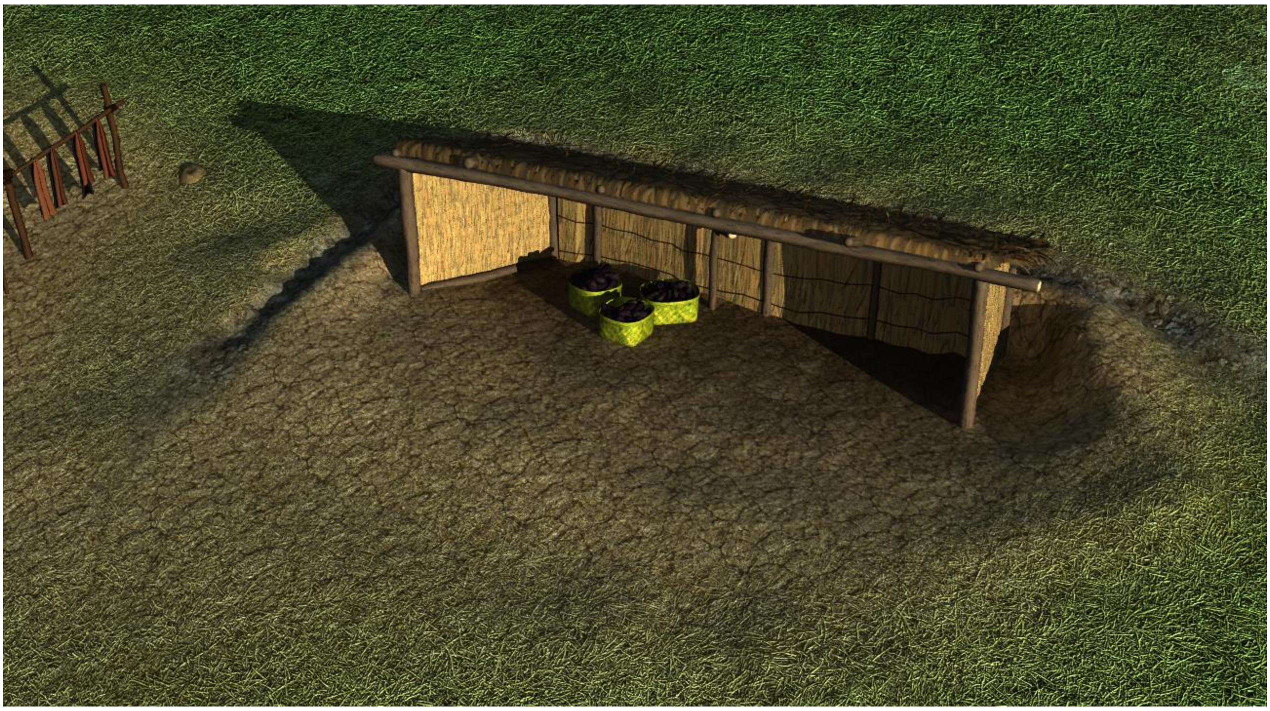

Figure 104. 3D reconstruction of 227 as a whare kai

Figure 105. Internal 3D reconstruction of 227 as a large whare

Figure 106. 3D reconstruction of 227 as a large whare with nearby activities associated with excavated contexts (looking approximately north and from different angles)

Figure 107. 3D reconstruction of site T11/1050 looking south

Figure 108. 3D reconstruction of site T11/1050 looking north showing nearby dunes

5.2 Chronology

The sites excavated during the Cooks Beach investigations described by Hoffman (2017) are one of the main reasons Maxwell et al. (2017) argued for a three-phase occupation and abandonment model for settlement at Cooks Beach. The results from T11/1050 are shown in comparison with that data in Figure 109. What becomes apparent is that the results from T11/1050 are later than most of the dates from Hoffman's (2017) work.

Interestingly, the dates from context 205 are largely identical with a cluster of dates from the Hoffman investigations (e.g., T11/2789 F44, 46, 48), with the slightly later date from the structure 227 contemporary with another group of dates (including for example T11/2789 F97).

Maxwell et al. (2017) had argued that the settlement of Cooks Beach represented a succession of occupation and abandonment of the landscape. A first phase of abandonment may relate to the transient nature of occupation in the area, targeting the main resources such as obsidian and chert; this was relatively intermittent, and no evidence of large-scale settlement has been identified. Following a period of abandonment during the 15th century AD, small scale occupation occurred with cultivation. Radiocarbon dates have suggested that the area may have fallen into disuse or been abandoned around 1650 AD (Maxwell et al. 2017:15; see Figure 8 and Table 1). Hoffman (2017) and Maxwell et al. (2017) discuss explanations for this abandonment, possibly the result of the local soils becoming less productive and/or the result of greater conflict in the region during that period. The abandonment of the area by the time of Captain Cook's visit in 1769 suggests that conditions had not changed following abandonment by 1650 AD.

The remaining dates from T11/1050, however, overlap with two other late dates from Hoffman's work that come from earlier projects nearby (T11/928). These later dates span a wider time range and are likely to include the reported post-abandonment period described by Maxwell et al. (2017). Taken together, it seems unlikely that the Cooks Beach area was abandoned at all, but rather settlement shifted to other locations, such as the hill at T11/1050, and away from the earlier dunes.

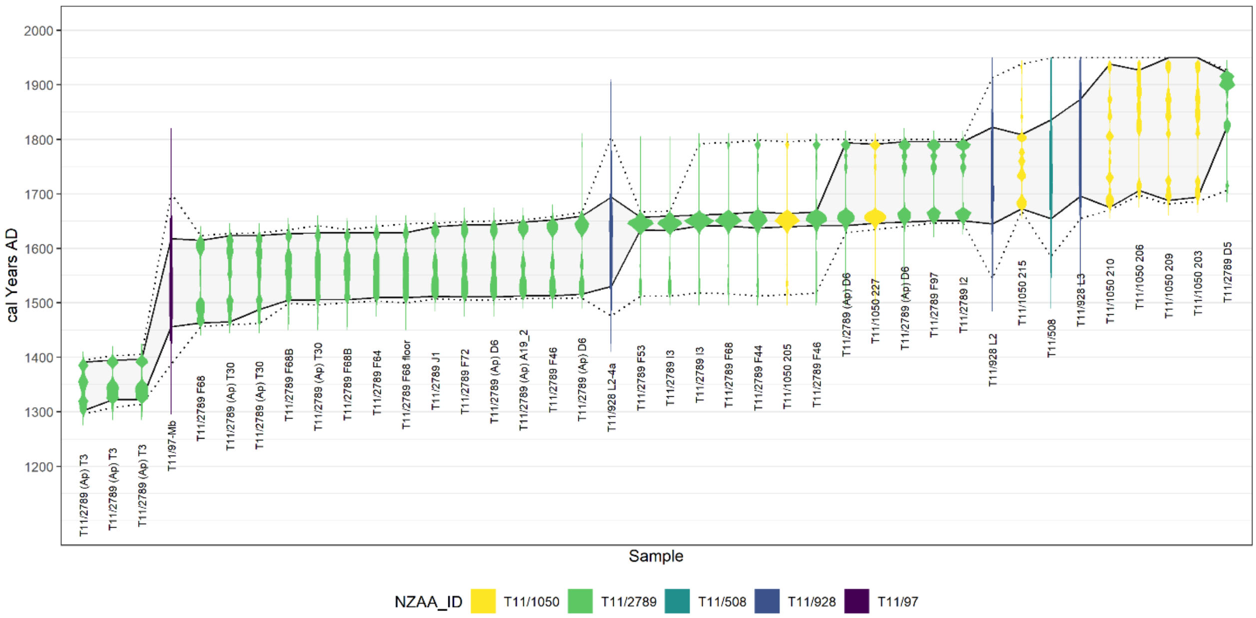

Figure 109. Dates from current project and Stage 1 results (Maxwell et al. 2017)

5.3 Horticulture at Cooks Beach

One of the main research objectives of the project was to establish additional information relating to horticultural practice at Cooks Beach. As discussed earlier, Hoffman (2017) had noted that while kumara agriculture is 'clear' from the range of storage and gardening features, and typically the crop is assumed to have been the prime target for cultivation at Cooks Beach, their results had provided almost no direct evidence of kumara agriculture. Starch residues were poorly preserved, which may be the explanation for this absence, except for a possible starch residue on one of the obsidian tools (CB-3), the evidence of kumara gardening was equivocal. The presence of storage pits identified in the area does not inherently imply the presence of kumara *cultivation* at the site. The pollen and palynological samples from the current evidence (Section 4.2) did suggest the kumara was being cultivated in the vicinity of the sites, with starch and pollen found in the two samples analysed.

Hoffman (2017) highlights that the best evidence to date relates to bracken and there is good evidence that this may have been fundamental to horticulture at Cooks Beach. Little new evidence was identified in the current project, although bracken was present in palynological samples analysed by Horrocks (see Section 4.2). Given that the bulk of excavation undertaken was focused on T11/1050 above the dunes the result is not that surprising and does not detract from the role bracken probably played in horticultural practice.

New evidence from the current project did come from evidence of taro in the palynological samples excavated at T11/1050 and the pit feature near T11/1014 discussed in the previous chapter (Section 4.2). There is little ethnographic information regarding Māori ritual and ceremony associated with taro, as by the 19th century it was not an important crop (see Furey 2006:9, 13ff for further discussion), but it seems likely that it was a valuable addition at Cooks Beach.

Matthews (2014) has undertaken substantial research on the history of taro in New Zealand based on botanical survey, historical research, and DNA. Matthews has been able to trace the arrival of the taro from other Pacific islands with Māori in pre-Contact times, although the reliable datable archaeological evidence on the ground is difficult to establish (Matthews 2014:80-81). However, taro also appears to have disappeared almost immediately with the arrival of European potatoes (Matthews 2014:59). Early descriptions by Colenso and Monkhouse (reported by Furey 2006:13) describe taro being planted on levelled areas with wind screens or in 'circular conclaves' near wet ground. Holes dug into sandy or gravelly soils appear to have been the preferred methodology (Best 1941:392) but there were no obvious excavated features at Cooks Beach that fitted this profile.

Cultivation of taro requires control and regular water flow to ensure the corms do not rot (see Barber 1982, 1989, 2004). The most likely area near T11/1050 is the now seasonal creek that runs down the major slopes south of the site, down the western side of the hill before turning east and emptying into the estuary. There were no clear indicators that this area was used, but modern landscaping around the water's edge is clear from the historical information and aerial imagery.

Recent work on Ahuahu/Great Mercury Island in the Coromandel included the reporting of evidence of taro cultivation from swamps by Prebble et al. (2019). They argue that the northern offshore islands were preferred for taro production by Māori in early settlement of Aotearoa. Barber (2020) has pointed out that there has been documented evidence of taro production around Aupouri, Northland and taro phytoliths have been recovered by Campbell et al. (2009) from excavations in the Bay of Plenty. Recent work at Weiti (Bickler et al. 2021) has also identified taro in constructed ditches at the back of a large beach flat.

While Prebble et al. (2020) maintain their preference for offshore island locations, it should be noted that they are arguing from a single example and from the perspective of comparison with other Polynesian islands. However, Auckland and Northland are more northerly than Ahuahu and offer an extensive and diverse range of habitats. Many of these would match any offshore locations and probably have more reliable climatic conditions (see e.g., Barber 1982, 1989, 2020). Weiti Bay may have been one of those locations.

The gardening activities have been built into the 3D model to better illustrate the results of the combined project work at Cooks Beach. The plants have been placed in the ditches as these would have provided the fast-moving water conditions that taro would have liked. Figure 110 shows the view from just north of T11/1050 showing the edge of the dunes with the ridges covered in bracken. A cleared area on the dune is planted with kumara in small puke, or mounds. It should be noted that no archaeological evidence of such mounds has been identified but it would likely to have been destroyed in this dynamic dune environment and by subsequent farming. However, it is plausible that bracken clearance provided organic material for kumara crops in the free-draining soils at least on a small scale.

Nearby, taro can be seen growing in the creek running down to the estuary (to the left of the image). Other wetland plants were also probably found in this zone and either planted or encouraged as supplements for the nearby habitation.

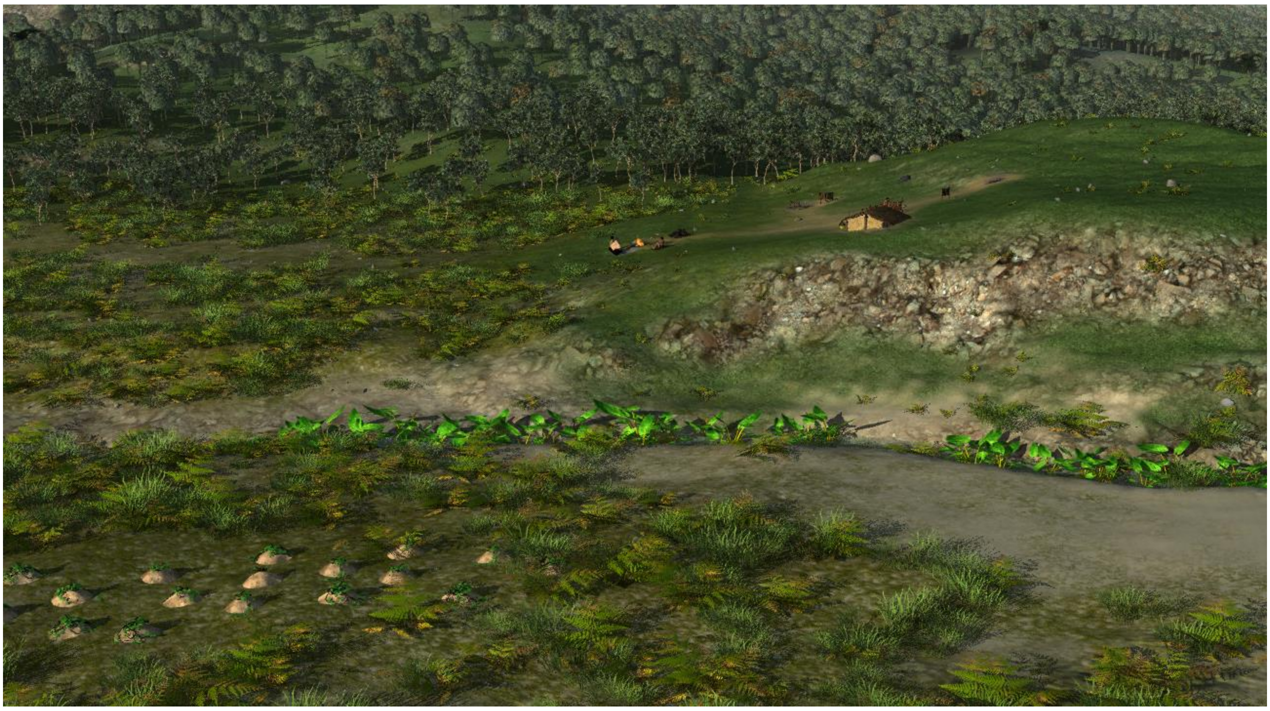

Figure 110. 3D reconstruction of horticulture looking across dunes towards T11/1050

Evidence of the combined swidden horticulture practiced at Weiti outlined in Section 1 (see also Bickler et al. 2021; Damon and Bickler 2017) can be observed. Bracken clearance provided organic material to enhance kumara gardens and a root crop to manage transition and fallow periods. Wetland plants were both cultivated and probably collected near to the settlements. These were then supplemented by the food gathering associated with the extensive seafood/kai moana remains found through the area.

5.4 Cooks Beach Landscape

Cooks Beach is relatively sheltered, crescent shaped, 3km long, and located on the southern shoreline of Mercury Bay. The beach faces the NNE and is oriented almost parallel to the long axis of Mercury Bay (Figure 111).

Figure 111. Cooks Beach showing the Purangi Estuary to the east. Note the ebb tidal delta

A small intertidal harbour, Purangi Estuary, is located at the eastern end of the beach. A large and predominantly intertidal bar formed at the entrance of this estuary (ebb tide delta), lies adjacent to the easternmost 500m of the beach. The beach has formed over the last 6,500 years as sands moved onshore from the continental shelf (Cooper et al. 2006). Shoreline advance over this period has formed a coastal dune plain, varying in width from 200m (western end) to 675m (eastern end). However, net seaward advance has progressively slowed over the last 2000-3000 years and has now effectively ceased. In other words, the beach has all the sand it is likely to get.

Fine sands on the beach face slopes result in a typical east coast beach. The headlands at the eastern and western ends contain the sediments, with no sand exchange with adjacent beaches. For example, Lonely Bay and Maramaratotara have much coarser beach sands.

The seaward edge of the beach systems lies about 15m offshore from the toe of the dune, at depths about 7m below the normal level and about 4m below lowest low tide. Further seaward, there is a major change in offshore gradient with the seabed flattening off into Mercury Bay. The marked sediment and morphological break suggest that there is little transfer of sediment to areas further offshore and this depth represents the common limit to offshore exchange.

The prevailing wave conditions of the north-eastern coast of New Zealand are north-easterly waves with common heights of 0.5m to 1.5m. The deep-water significant wave height is estimated at 1–1.4m, though storm waves associated with subtropical disturbances and local storms can generate deep water waves at 5–7m and higher. Cooks Beach is sheltered from easterly waves by a large headland at the eastern end and from the north by Kuaotunu Peninsula. However, the beach is exposed to waves from the northeast – with the most severe coastal erosion tending to be associated with waves from this direction. Tides at the beach are semidiurnal with a mean spring range about 1.6m. Water levels can also be elevated by storm surge effects.

The coastal geomorphology background is important to contextualise the archaeology within this dynamic system. The wave conditions, sediment supply, tides and storm surge frequency would affect the extent to which archaeology would be preserved within this environment. For example, it is considered that the frontal dunes of Cooks Beach are so dynamic that there are unlikely to be any remaining intact archaeological sites (Gumbley, pers. comm. cited in Cooper et al. 2006). The more sheltered areas such as the Council reserve adjacent to Purangi Estuary and inland dunes seem to account for most of the archaeology.

The LiDAR image in Figure 112 recorded the remaining inland dunes before they were developed in Stage 1. The extensive excavations by Hoffman occurred in this area. Questions arise as to the dynamic nature of these dunes. For example, sediment supply needed for the shoreline advance ceased around 2000 to 3000 years. This shoreline advance would have created these inland dunes unless they are supplied by tidal sediment within the ebb tide delta. The former is more likely.

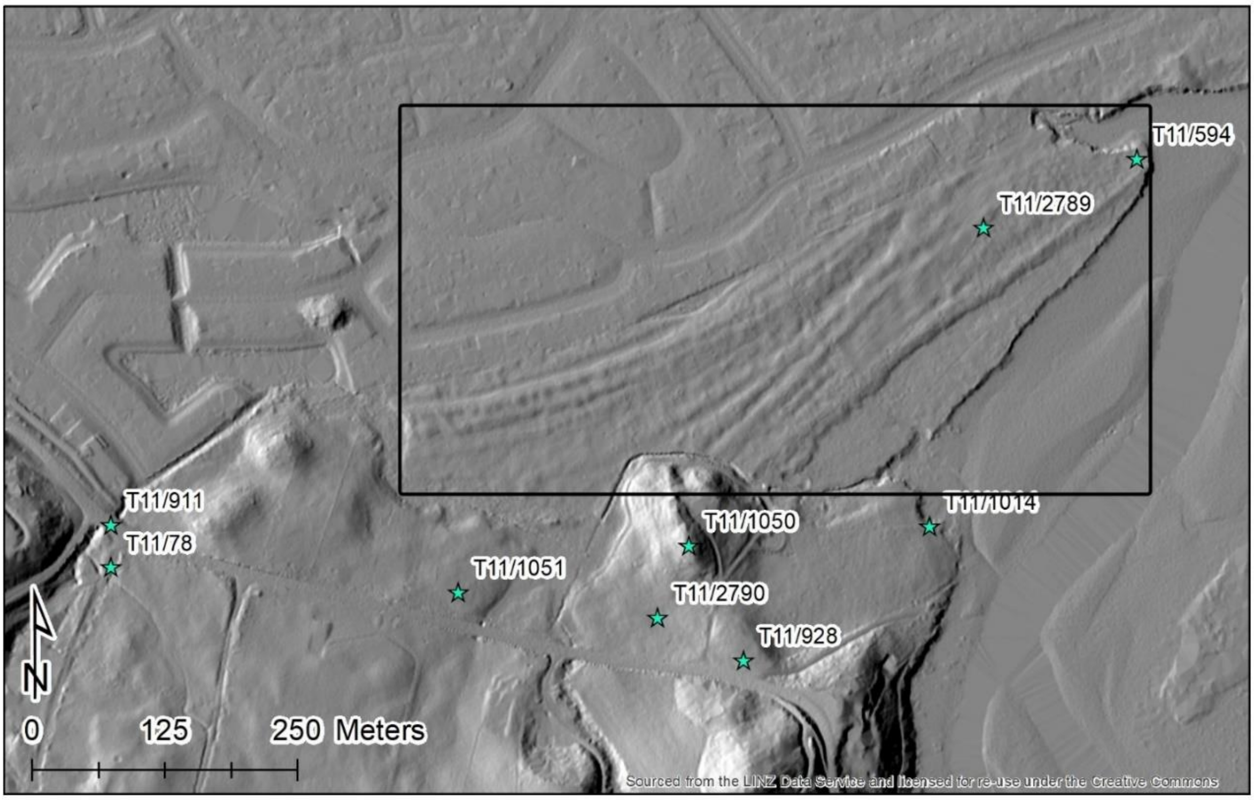

Figure 112. LiDAR image greyscale illustrating relict dune ridges visible from 2006 LiDAR capture (black box)

These inland dunes would have been welded against a basement layer. For example, geology within Stage 1 is composed of estuarine and beach deposits. Stages 2B, 4 and 5 are on pumice-rich ignimbrite with local pumice breccia and associated midden rhyolite tuff.

Hoffman's (2015) report provides a cross section of these inland dunes (Figure 113). The key stratigraphy is the O (organic matter), A (topsoil), and B horizon (substrate). Starting from the bottom the dunes are suggested to have a Bsm or Bs horizon where the substrate is reddish brown or yellowish red, then the A horizon less than 100m thick and bleached brown. The important characteristic is raised in relation to the Ab and Ap horizon. In a number of cases when dissecting the inland dunes through north–south trenches, Hoffman found evidence of the dune slopes containing evidence of an Ab-horizon. This horizon was described as less than 50mm thick, rich in charcoal pieces and was interpreted as the charred remains of a landscape clearing event.

Figure 113. Trench cut north–south dissecting the inland dune ridges showing the different horizons

When evidence of the Ap horizon was found this was used as example of where the organic material is intermixed and other horizons truncated, where podzols like E-horizons were missing from dune crests, either eroded or incorporated into the A-horizon. The E-Horizon defined is the parent soil or substrate below the O-horizon topsoil.

Referencing this back to the geomorphology and pre-Contact horticultural activity two scenarios exist. One, the intense bracken cultivation could have impacted the dune crests creating a thick A horizon with sections of Ap and Ab horizons. The Ap horizon represents gardening of the dune slopes mixing the organic layer through cropping or bracken cultivation. The Ab horizon represents burning events to add organic material into the O-horizon, which accumulates into a thicker A-horizon over time. Effectively, clearance of bracken and other vegetation would have enhanced that A-horizon which was gardened. Consequently, Hoffman's evidence and this report provide a key insight into how Māori were cultivating a relict dune system within an estuary coastal environment. Figure 114 provides a reconstructed image of the landscape. These 3D models, built by Thomas MacDiarmid with Simon Bickler, combine elevation information, vegetation models and the results of the archaeological investigations.

Figure 114. Looking southeast across the eastern side of the project area showing reconstructed dunes, archaeological settlements, gardens and forest

This underlying geology is important for two reasons:

1. The archaeology in Stages 2B, 4 and 5 is located on a different substrate.
2. The gardening recorded by Hoffman (2015) is on a relict inland dune system.

The effect of this is twofold:

1. If intensive Māori multi-cropping occurred, it would be expected that the inland dune morphology was heavily affected, especially the dune ridges (Figure 112, and Figure 114). However, the relict dune system seems relatively intact.
2. The gardening in profile in Stages 2B, 4 and 5 would be different as gardening would have occurred in a tuff rich soil profile.

The two scenarios add to Hoffman's (2015) results and link to the research strategy, as intensive bracken cultivation could have stabilised and preserved the inland dunes seen in Figure 112, while intensive multi-cropping may have occurred in Stages 2B, 4 and 5. Overall, the geomorphology and general environmental review contextualises the archaeological results for Stages 2B, 4 and 5 discussed below.

Evidence of occupation was identified by the midden and structural remains across the dunes and the hill at T11/1050. It is likely that occupation sites ranged in size. The structural remains excavated near T11/1014, which constituted only really two small pit structures (see contexts 21 and 26) thought to be food storage structures, were at the smaller end of the scale. It is likely this may have been within an area of gardening with small shelters for a small group or for temporary shelter while gardening (Figure 115).

Figure 115. 3D reconstruction of pit (context 26) and possible small shelter at edge of T11/1014 looking towards T11/1050

T11/1050 appears to have been the largest of the settlement occupation but even then, only one possible whare or large whare kai was found. However, there is every chance that more occupation around the hill was present from at least the mid-17th centuries onwards. The site is situated with good access to fresh water in the stream below, probably also a source of wetland crops (Figure 116, Figure 117). A gentle walk down the slope led to the estuary and probably a place where canoes could be left for easy access to fishing grounds.

To the south of the project area, the land rises up and was probably mostly covered by forest. Although shrub species dominated the charcoal analysis recovered from the midden at T11/1050, this probably represented a later phase of occupation with much of the local forest cleared in the immediate vicinity. Larger tree species probably provided building materials as well as some firewood. Birds were also probably a source of food but generally not found in the midden, with only one bird bone found (in midden 204), which suggests that the focus of the coastal settlements excavated was probably the shellfish and the gardening activities across the dune systems (Figure 117 and Figure 114).

Figure 116. View of T11/1050 and T11/1014 looking east

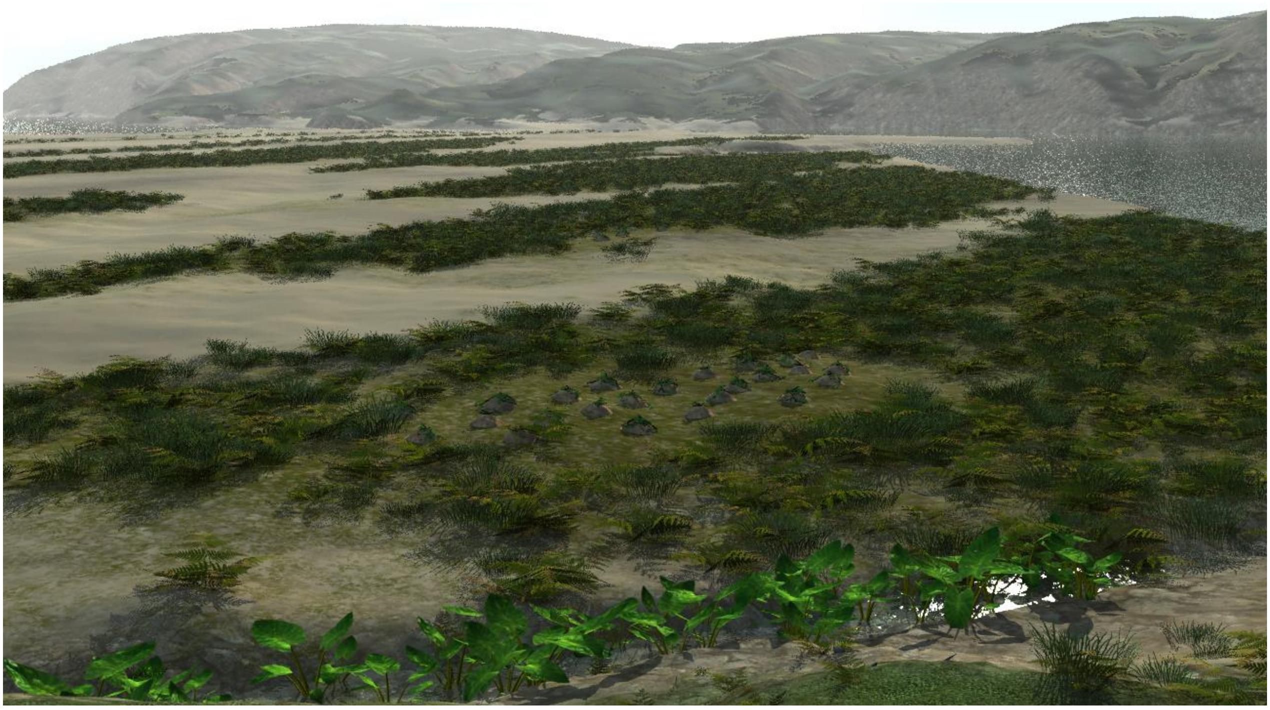

Figure 117. 3D view of taro (foreground) and kumara mounds (middle) in bracken on dunes north of T11/1050

5.5 Conclusions

The results from T11/1050 did not cover the earlier occupation of the area identified by Hoffman (2017) but clearly show that the proposed later ‘Abandonment’ of the area, from 1650 AD onwards suggested by Maxwell et al. (2017), was either relatively short-lived or did not occur. Dates from T11/1050 overlapped the end of the Maxwell et al. sequence and carried on through at least the 18th century and possibly the early 19th century.

The results do indicate a shift towards the higher elevation points for at least some activities, which may have occurred as part of increasing usage of the landscape and potentially additionally for early warning of groups arriving in the area during the 17th century. The structure, 227, did fit well with the end of the main use of the flatter dune areas described by Maxwell et al. (2017) and it is likely that other structures were located then and in later times around the hill but subsequently destroyed by the farmhouse and other landscaping.

As discussed in the research strategy in Chapter 1, the major periods of abandonment suggested by the dates from the sites on the dunes north of the current project area probably relate more to the complexity of the sampling of different parts of the broader landscape. Indeed, while there is probably usage of the dunes around the 14th century AD, there was a shift from the temporary occupation and resource extraction associated with seafood and bracken to more long-term habitation, with horticulture continuing across the area relatively continuously from 1500 AD on.

The dates from T11/1050 also indicated taro horticulture from the 17th century AD and this may have continued for some time. These gardens were most likely in the nearby stream that flows around the western and northern sides of the hill on which T11/1050 was located. Taro may have been suitable in faster-running waters above any brackish influx from the tidal outflow and planted on the edges of the stream.

Overall, the results from excavations combining Hoffman’s (2017) work and the current project present a valuable contribution to the archaeology of the Coromandel. The radiocarbon dates alone cover much of the occupation sequence known for the region (Figure 118) and substantially contribute to the understanding of the changing use of the landscape over the last several hundred years (Figure 119).

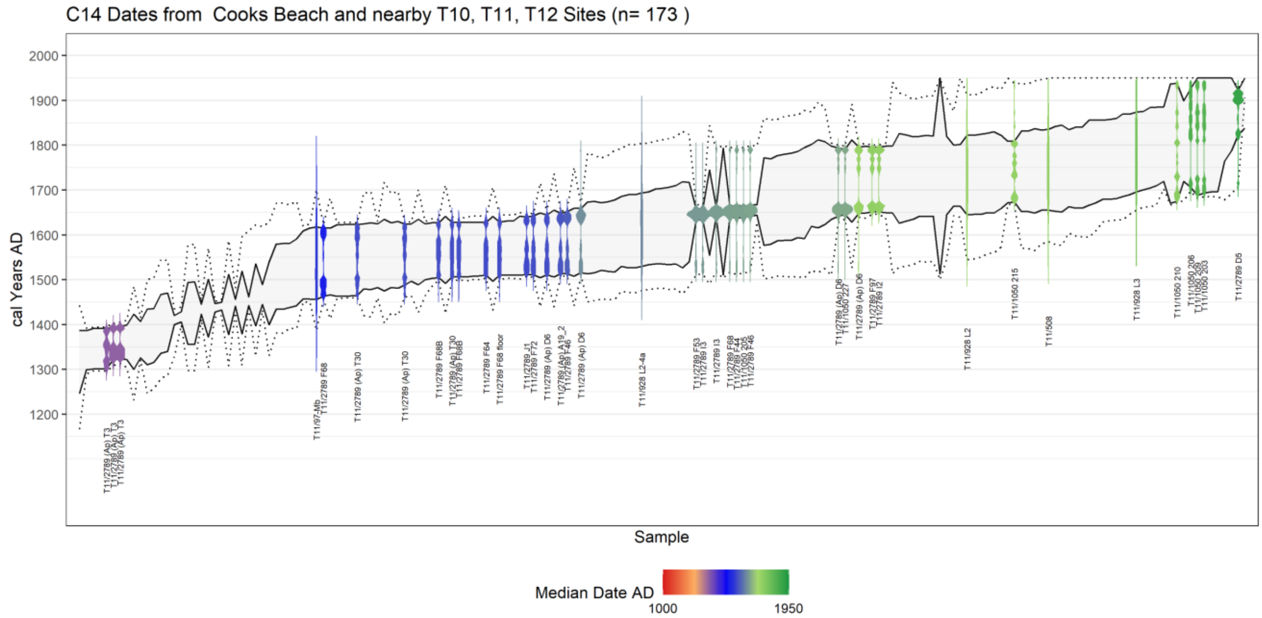

Figure 118. Dates from Cooks Beach work (including Stage 1: Maxwell et al. 2017) in black with background information from other sites in the Coromandel

The evidence from the project taken as a whole seems to support the model of swidden agriculture at Cooks Beach revolving primarily around bracken clearance and harvesting supplemented by seafood. A mosaic of small garden patches for dryland kumara grew in the dunes along with wetland cropping of taro, at least from the 17th century onwards.

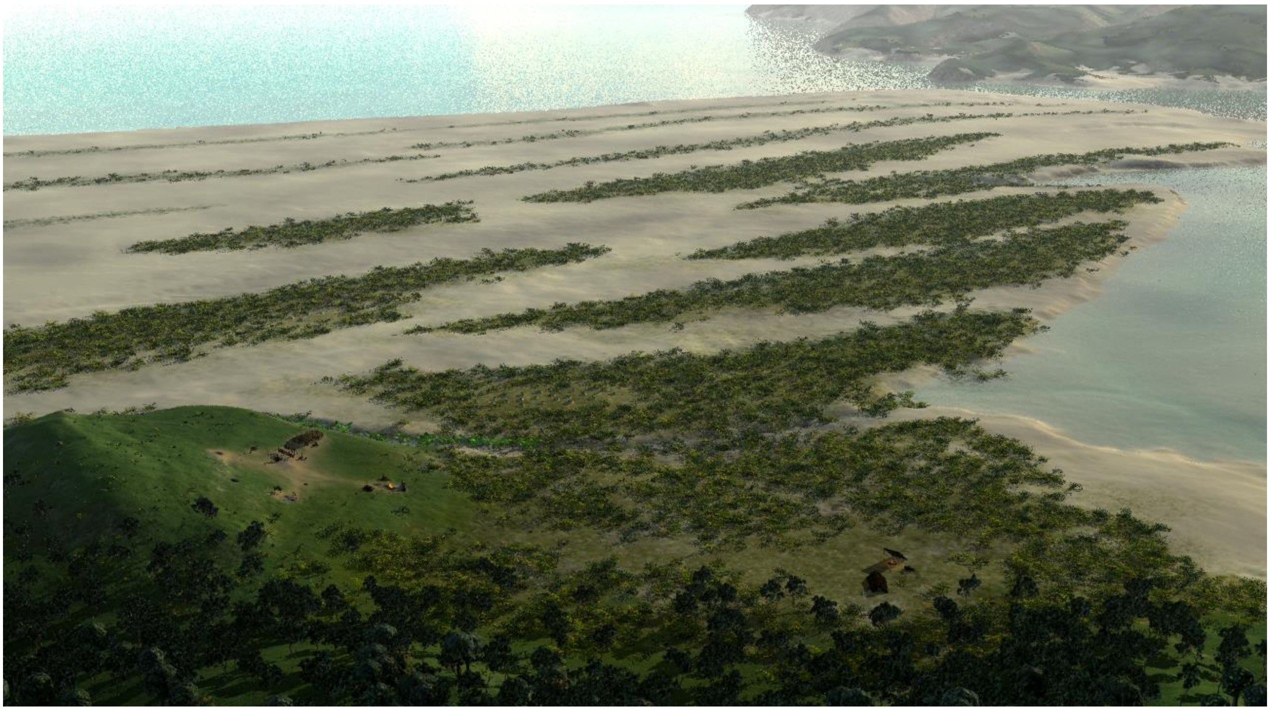

Figure 119. Overview of project area showing 3D reconstruction of landscape and archaeology

The project results, combined with those of Hoffman's (2017) work, provide one of the few detailed landscape-based archaeological projects in the Coromandel area and demonstrate the value of research derived from land development (see Bickler 2018: chapter 10). Combining detailed excavation of a range of sites in both the dunes and high areas, along with the analysis of the environmental and geomorphological data, has allowed for building a model of Māori settlement covering at least 600 years. Future work integrating the project results with oral traditions, mātauranga Māori and an understanding of the broader settlement will further the understanding of this dynamic history.

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APPENDIX 1 – CHARCOAL ANALYSIS

Charcoal Identification – Cooks Beach (Pit Terrace site R11/1050)

Rod Wallace
14th March 2021

Ten charcoal samples from deposits at Cooks Beach Coromandel Peninsula were submitted for identification and C14 dating sample selection. The results are as below.

Results

[1]	(101) <22> Bulk sample Midden in western half of property near silt pond.	
Manuka	6	C14 dating sample

[2]	(213) <13> Truncated by newer fire scoop on top (211)	
Tutu	3	
Hebe	5	C14 dating sample
Coprosma	1	
Manuka	2	
Ngaio	1	

[3]	(215) <11> Old fire scoop below 214 which is below 211	
Tutu	5	
Hebe	6	C14 dating sample
Coprosma	3	
Ngaio	11	

[4]	(214) <10> fire scoop under 211 and above 215.	
Tutu	1	
Hebe	7	C14 dating sample
Coprosma	4	
Manuka	3	

[5]	(274) <15> Raked out firescoop, whole shell, matrix with grey ashy sand bleached burnt cockle and pipi.	
Hebe	3	C14 dating sample
Manuka	8	
Mahoe	1	

[6]	(211) <9> fire scoop, haangi	
Tutu	4	
Hebe	8	C14 dating sample
Manuka	4	
Ngaio	1	

[7]	(205) garden soil?	
Tutu	1	
Hebe	2	C14 dating sample
Coprosma	1	

Manuka 4

[8] (210) <5> brown silty sand + degraded and bleached cockle and pipi.
Hebe 15 C14 dating sample

[9] (206) grey silty ashy sand with pipi and cockle and charcoal dense
Hebe 10 C14 dating sample
Coprosma 2
Ngaio 7

[10] (203) <7> grey Midden burnt and degraded trampled cockle pipi and occasional tuatua and whelk.
Tutu 2
Hebe 7 C14 dating sample
Coprosma 3
Manuka 5
Mangrove 3

Summary

Species	Type	# Pieces
Tutu	Shrubs	16
Hebe		63
Coprosma		14
Manuka		32
Ngaio		20
Mahoe	Tree	1
Mangrove	Eastuary	3
Total		146

Discussion

The charcoal samples almost exclusively contain pioneering shrub species. A single piece of mahoe is the only larger species but even this is more typical of secondary regrowth that intact forest.

All samples contain abundant material suitable for C14 dating.

APPENDIX 2 – RADIOCARBON DATES

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Private Bag 3105
Hamilton,
New Zealand.
Ph +64 7 838 4278
email c14@waikato.ac.nz

Radiocarbon Dating Laboratory

Thursday, 10 June 2021

Report on Radiocarbon Age Determination for Wk- 52803

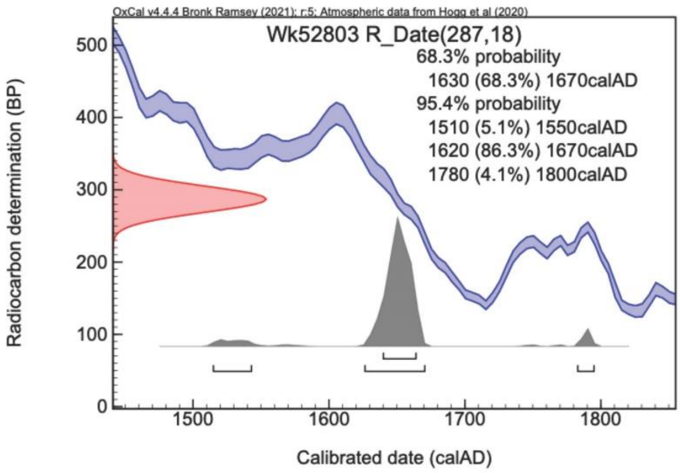
Submitter	Ben Jones
Submitter's Code	T11/1050 205
Site & Location	T11/1050, New Zealand
Sample Material	Charcoal - Manuka
Physical Pretreatment	Sample cleaned.
Chemical Pretreatment	Sample washed in hot HCl, rinsed and treated with multiple hot NaOH washes. The NaOH insoluble fraction was treated with hot HCl, filtered, rinsed and dried.

$D^{14}C$	-35.1 ± 2.1 ‰
$F^{14}C\%$	96.5 ± 0.2 %
Result	**287 ± 18 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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Te Whare Wānanga o Waikato

Private Bag 3105
Hamilton,
New Zealand.
Ph +64 7 838 4278
email c14@waikato.ac.nz

Radiocarbon Dating Laboratory

Thursday, 10 June 2021

Report on Radiocarbon Age Determination for Wk- 52804

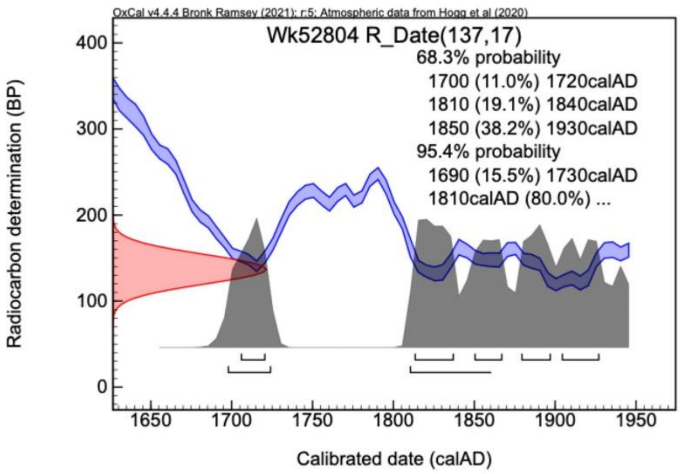
Submitter	Ben Jones
Submitter's Code	T11/1050 206
Site & Location	T11/1050, New Zealand
Sample Material	Charcoal - Hebe
Physical Pretreatment	Sample cleaned.
Chemical Pretreatment	Sample washed in hot HCl, rinsed and treated with multiple hot NaOH washes. The NaOH insoluble fraction was treated with hot HCl, filtered, rinsed and dried.

$D^{14}C$	-16.9 ±	2.1 ‰
$F^{14}C\%$	98.3 ±	0.2 %
Result	**137 ± 17 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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THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Private Bag 3105
Hamilton,
New Zealand.
Ph +64 7 838 4278
email c14@waikato.ac.nz

Radiocarbon Dating Laboratory

Thursday, 10 June 2021

Report on Radiocarbon Age Determination for Wk- 52805

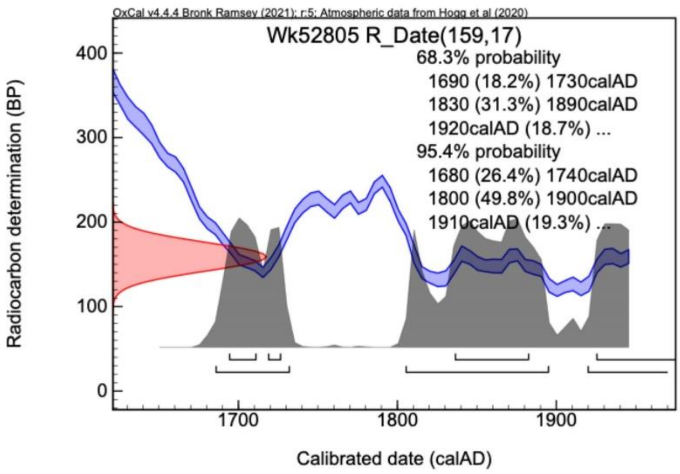
Submitter	Ben Jones
Submitter's Code	T11/1050 203
Site & Location	T11/1050, New Zealand
Sample Material	Charcoal - Tutu
Physical Pretreatment	Sample cleaned.
Chemical Pretreatment	Sample washed in hot HCl, rinsed and treated with multiple hot NaOH washes. The NaOH insoluble fraction was treated with hot HCl, filtered, rinsed and dried.

$D^{14}C$	-19.6 ±	2.1 ‰
$F^{14}C\%$	98.0 ±	0.2 %
Result	**159 ± 17 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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Private Bag 3105
Hamilton,
New Zealand.
Ph +64 7 838 4278
email c14@waikato.ac.nz

Radiocarbon Dating Laboratory

Thursday, 10 June 2021

Report on Radiocarbon Age Determination for Wk- 52806

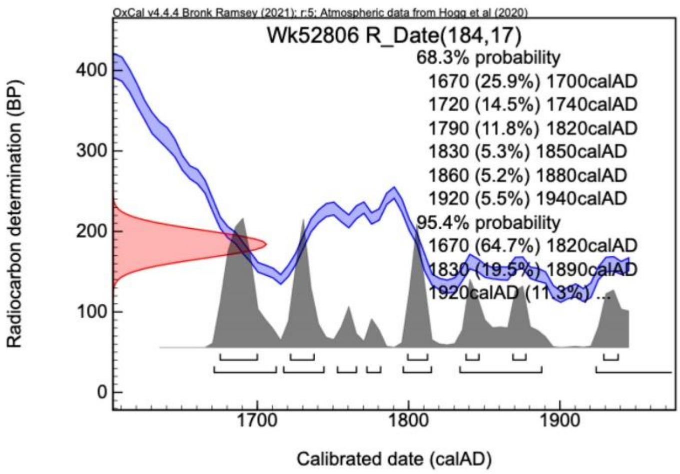
Submitter	Ben Jones
Submitter's Code	T11/1050 210
Site & Location	T11/1050, New Zealand
Sample Material	Charcoal - Hebe
Physical Pretreatment	Sample cleaned.
Chemical Pretreatment	Sample washed in hot HCl, rinsed and treated with multiple hot NaOH washes. The NaOH insoluble fraction was treated with hot HCl, filtered, rinsed and dried.

$D^{14}C$	-22.6 ± 2.0 ‰
$F^{14}C\%$	97.7 ± 0.2 %
Result	**184 ± 17 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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Private Bag 3105
Hamilton,
New Zealand.
Ph +64 7 838 4278
email c14@waikato.ac.nz

Radiocarbon Dating Laboratory

Thursday, 10 June 2021

Report on Radiocarbon Age Determination for Wk- 52807

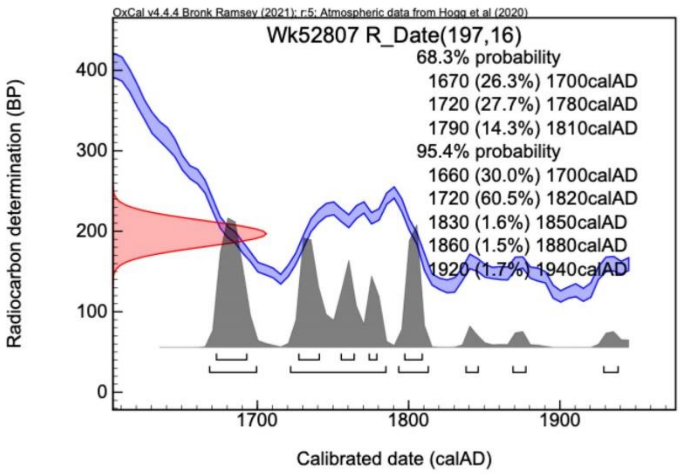
Submitter	Ben Jones
Submitter's Code	T11/1050 215
Site & Location	T11/1050, New Zealand
Sample Material	Charcoal - Hebe
Physical Pretreatment	Sample cleaned.
Chemical Pretreatment	Sample washed in hot HCl, rinsed and treated with multiple hot NaOH washes. The NaOH insoluble fraction was treated with hot HCl, filtered, rinsed and dried.

$D^{14}C$	-24.3 ± 2.0 ‰
$F^{14}C\%$	97.6 ± 0.2 %
Result	**197 ± 16 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)*.

THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

Private Bag 3105
Hamilton,
New Zealand.
Ph +64 7 838 4278
email c14@waikato.ac.nz

Radiocarbon Dating Laboratory

Wednesday, 28 July 2021

Report on Radiocarbon Age Determination for Wk- 52925

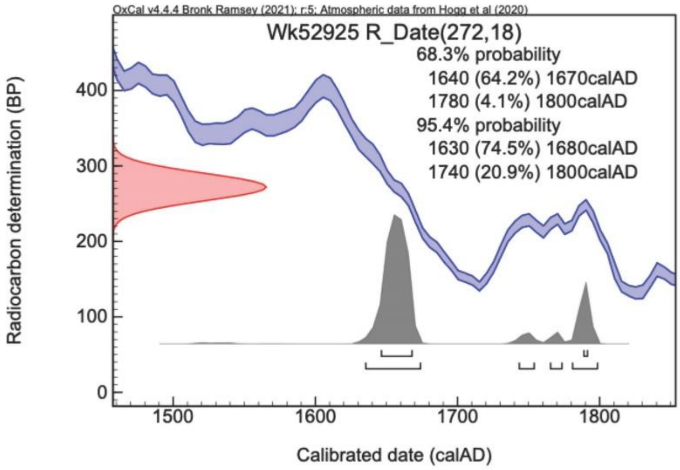
Submitter	Ben Jones
Submitter's Code	T11/1050/227
Site & Location	, New Zealand
Sample Material	Charcoal Tutu
Physical Pretreatment	Sample cleaned.
Chemical Pretreatment	Sample washed in hot HCl, rinsed and treated with multiple hot NaOH washes. The NaOH insoluble fraction was treated with hot HCl, filtered, rinsed and dried.

$D^{14}C$	-33.2 ± 2.2 ‰
$F^{14}C\%$	96.7 ± 0.2 %
Result	**272 ± 18 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)*.

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Private Bag 3105
Hamilton,
New Zealand.
Ph +64 7 838 4278
email c14@waikato.ac.nz

Radiocarbon Dating Laboratory

Wednesday, 28 July 2021

Report on Radiocarbon Age Determination for Wk- 52926

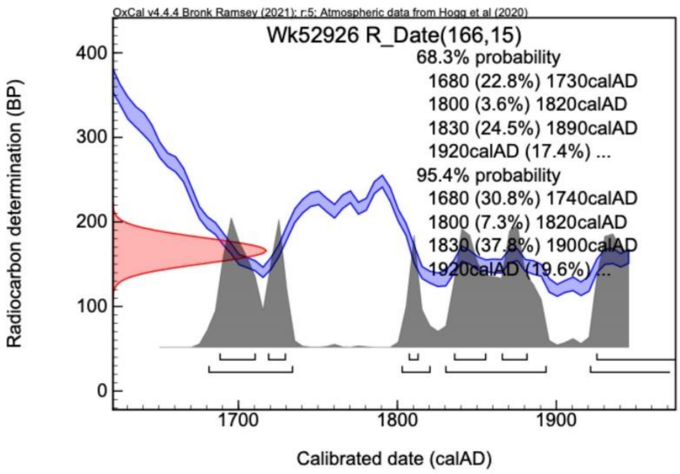
Submitter	Ben Jones
Submitter's Code	T11/1050/209
Site & Location	, New Zealand
Sample Material	Charcoal Manuka twig
Physical Pretreatment	Sample cleaned.
Chemical Pretreatment	Sample washed in hot HCl, rinsed and treated with multiple hot NaOH washes. The NaOH insoluble fraction was treated with hot HCl, filtered, rinsed and dried.

$D^{14}C$	-20.4 ±	1.9 ‰
$F^{14}C\%$	98.0 ±	0.2 %
Result	**166 ± 15 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)*.

APPENDIX 3 – CONTEXT LIST

Missing numbers were not used and are different from voids. Contexts 0-30 and 101 were recorded during monitoring. All other contexts relate to the T11/1050 investigation

Context Number	Type	Interpretation	Length (m)	Width (m)	Depth (m)	Orientation	Related Contexts	Above	Below	Description
0	Fill	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	General working shots
1	Layer	layer			10		2	2	N/A	Mid brown sandy topsoil. Thin, possibly ploughed
2	Layer	layer			N/A		1	3	1	Yellow brown sandy subsoil
3	Deposit	scatter	0.20	0.30	Un-ex	N/A	N/A	2	1	Thought to be midden but shell in very good condition and found in association with plastic and gravel mixed within shell material. Frequent pockets of redeposited fragmented shell, predominantly pipi and cockle. All in very good condition
4	Deposit	scatter	0.20	0.30	Un-ex	N/A	N/A	2	1	2 small shell scatters. Investigated, resolved to thin surface deposit
5	Deposit	scatter	0.20	0.30	Un-ex	N/A	N/A	2	1	As above
6	Deposit	scatter	0.20	0.30	Un-ex	N/A	N/A	2	1	Small shell deposit. Fragmented pipi, cockle and rock. In dark brown sandy silty matrix. Excavated and resolved to irregular elongated scoop
7	Deposit	scatter	0.20	0.30	Un-ex	N/A	N/A	2	1	Irregular pockets of shell located adjacent to 6. Likely shell material scattered during farm modification.
17	Cut	firescoop	0.7	0.4	0.05	N/A	N/A	2	1	Possible firescoop composed of moderately fragmented shell and some whole cockle, pipi and rare whelk. Assumed to be non-archaeological as no associated charcoal and much of the shell is mixed within very loosely compacted mid brown silt.
18	Deposit	scatter	6	2	0.2	N/A	N/A	2	1	Pockets of shell distributed over an area
20	Deposit	midden	4.3	3	0.05	N/A	N/A	2	1	Thin layer of midden. Composition largely cockle 3-4cm and small pipi 3-4cm. Some rare whelk and stone. Midden amorphous during excavation, kept disappearing
21	Cut	pit	0.9	0.65	0.15	ew	N/A	2	1	Half-sectioned and resolved to possible circular feature 60x60cm sloping to north. May have overcut.
22	Deposit	scatter	8	3	0.25	N/A	N/A	2	1	Amorphous pockets of shell mixed with topsoil
23	Cut	posthole	0.25	0.25	0.4	N/A	N/A	2	1	Posthole
25	Cut	drain	7	0.5	0.5	ew	N/A	2	1	Drain - modern
26	Cut	pit	1.7	1.2	0.40	ew	N/A	2	1	Triangular, pointed to east. Pit was half sectioned and turned out to be oval undercut pit with undulating base. Base of pit held central posthole

Context Number	Type	Interpretation	Length (m)	Width (m)	Depth (m)	Orientation	Related Contexts	Above	Below	Description
										surrounded by several small stakeholes each c.4x4c2cm deep.
27	Deposit (s)	posthole	0.25	0.25	0.4	N/A	N/A	2	1	4 surface finds in topsoil
28-29	Cut	posthole	0.25	0.25	0.4	N/A	N/A	2	1	Posthole
30	Cut	Posthole	0.25	0.25	0.4	N/A	N/A	2	1	Posthole
101	Layer	midden	7	6	0.15	ns	1,2	2	1	Loosely compacted downslope deposited shell midden material. Mid brown slightly ashy, very thin. frequent cockle, pipi, tuatua and whelk. Small fragments of fcr, burnt shell and charcoal. GPS s36 50 38.60 e175 45 11 23 11am 6 Jan north northeast facing slope. Up to 7cm pipi and tuatua, 5cm cockle and 4cm whelk
200	Layer	midden	12	10.5	0.27		201	201	1	Greyish brown sandy silt, loose compaction, frequent fragmented shell and burnt shell. Pipi tuatua, and cockle. Occasional charcoal and rock fragments
201	Layer	midden	5	5	0.2		200	202	200	Greyish brown sandy silt, moderate to loose. Frequent whole shell, cockle, tuatua and pipi. Occasional charcoal fragments
202	Layer	layer	5	5	0.14		200, 201	2	201	Dark grey brown sandy soil
203	Layer	midden	21	8	0.25		203 - 206	205	1	Moderate compaction with frequent fragmented and whole cockle pipi and occasional tuatua and whelk. Shell burnt and degraded. Trampled
204	Layer	midden	2	2	0.25		203 - 206	205	203	Grey black ash with frequent whole pipi and cockle shell. Occasional whelk charcoal and fcr. Burnt shell present
205	Layer	layer	22	10	0.4		203 - 206	2	203	Light grey brown firm compaction with occasional fragmented and whole pipi and cockle shell
206	Cut	deposition	2	1.8	0.3		203 - 206	203	1	Moderate dark grey silty sand with ashy matrix. Frequent pipi and cockle. Frequent charcoal dense
208	Layer	midden	13	10	0.4		208-209	205	1	Loose grey brown ashy silt with frequent cockle, pipi and whelk. Occasional charcoal and fcr. Shell is bleached and burnt
209	Layer	midden	4	4	0.35		208-209	205	1	Firm compaction grey ash sandy material intermixed with highly fragmented shell and occasional charcoal
210	Layer	midden	13	10	0.15	ns	208-209	2	1	Moderate compaction grey brown silty sand. Frequent cockle and pipi. Shell is degraded and bleached
211	Cut	firescoop	0.9	0.7	0.15	ns	1211	2	210	Oval in plan, steeply sloped sides and concave to flattish base
212	Cut	firescoop	0.92	0.8	0.18	ns	1212, 213	2	210	Sloping sides and concave base with another older? feature in the eastern side
213	Cut	firescoop	0.3	0.25	0.15	ns	1213, 212	2	212	Steeply sloped sides and concave base

Context Number	Type	Interpretation	Length (m)	Width (m)	Depth (m)	Orientation	Related Contexts	Above	Below	Description
214	Cut	firescoop	N/A	0.82	0.2			2	211	Possibly oval. Sloping sides and concave base truncated by newer firescoop on top (211)
215	Cut	firescoop	N/A	0.7	0.1		211, 214, 1215	2	214	Steeply sloped sides and concave base. Vertical truncation by (214)
216	Cut	firescoop	0.75	0.6	0.32	ns	1216, 217	2	210	Oval in plan sloping sides and concave base with 2 small depressions in the base. Truncated by posthole in southern side
217	Cut	posthole	0.35	0.3	0.38	ns	1217, 216	2	210	Circular vertical sides and concave base
218	Cut	rake-out	0.5	0.5	0.1		218-226	208	208	See 225
219	Layer	rake-out	3	3	0.04		218-226	224	208	Moderate compaction fine ash grey with occasional charcoal
220	Cut	ko marks	0.3	0.3	0.15		218-226	within205	208	Same as 221
221	Cut	ko marks	0.3	0.3	0.15		1221	within205	208	Short sloping sides and concave base
222	Cut	posthole	0.1	0.1	0.45		208, 203, 1222	205	1	Near vertical sides and concave base
223	Cut	posthole	0.15	0.15	0.3		209, 1223	205	209	Near vertical sides and concave base
224	Layer	firescoop	1.5	1.5	0.25		218-226	205	219	Firm whole shell, matrix with grey ashy sand with frequent bleached and burnt cockle and pipi. Occasional charcoal
225	Cut	rake-out	0.5	0.5	0.1		1225	208	1	Moderate compaction with frequent fragmented cockle shell
226	Cut	firescoop	0.5	0.5	0.3		218-226	209	1	Short sloping sides and concave base
227	Cut	whare	7.4	4.3	0.6	nne-ssw	264, 265, 266, 267, 268, 269, 270, 271, 1227, 2227, 3227	2	1	Oblong triangular. Near vertical benched slope gives way to flattish floor
228	Cut	posthole	0.22	0.2	0.2	ew	1228	2	203	Oval vertical sides and concave base
229	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void
230	Cut	posthole	0.3	0.22	0.13	ns	1230	2	203	Oval near vertical sides and concave base
231	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void
232	Cut	posthole	0.35	0.25	0.12	ne-sw	1232	2	203	Oval in plan near vertical sides and concave base
233	Cut	posthole	0.29	0.25	0.1	ns	1233	2	203	Oval in plan steep sides and concave base
234	Cut	posthole	0.25	0.21	0.11	ns	1234	2	203	Oval vertical sides and concave base
235	Cut	posthole	0.31	0.25	0.2	ew	1235	2	203	Oval vertical sides and concave base
236	Cut	posthole	0.22	0.2	0.18	ew	1236	2	203	Circular vertical sides and concave base
237	Cut	posthole	0.2	0.8	0.18		1237	2	203	Circular vertical sides and concave base.
238	Cut	posthole	0.2	0.2	0.1		1238	2	203	Circular near vertical sides and concave base
239	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void square hole
240	Cut	posthole	0.37	0.25	0.33	ns	240	2	203	Sub circular vertical sides and sloping base. Truncated on south by root
241	Cut	posthole	0.22	0.22	0.19		1241	2	203	Circular vertical sides and concave base
242	Cut	posthole	0.22	0.21	0.2	ns	1242	2	203	Oval vertical sides and concave base
243	Cut	posthole	0.4	0.3	0.27	ew	1243	2	203	Oval near vertical sides and concave base
244	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void
245	Cut	Posthole	0.2	0.2	0.08		1245	2	203	Circular near vertical sides and flattish base

Context Number	Type	Interpretation	Length (m)	Width (m)	Depth (m)	Orientation	Related Contexts	Above	Below	Description
246	Cut	drain	5.6	2.2	0.05	nne-ssw	1246	2	within 227	Linear short sloping side gives way to gradual slope and concave base
248	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void
249	Cut	posthole	0.37	0.28	0.16	ns	1249	2	210	Sub oval vertical sides and concave base
250	Cut	posthole	0.18	0.18	0.22		1250	2	210	Circular vertical sides concave base
251	Cut	posthole	0.17	0.17	0.16		1251	2	210	Circular vertical sides and concave base
252	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void
253	Cut	posthole	0.17	0.17	0.14		1253	2	210	Circular vertical sides and concave base
254	Cut	posthole	0.17	0.17	0.15			2	210	Circular vertical sides and flattish base
255	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void
256	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void
258	Cut	posthole	0.19	0.19	0.16			N/A	N/A	Circular vertical sides and concave base
259	Cut	posthole	0.22	0.2	0.19	ns	1259	2	210	Oval near vertical sides and concave base
260	Cut	posthole	0.27	0.2	0.22		1260	2	210	Oval near vertical sides and concave base
261	Cut	firescoop	0.13	0.9	0.9	ns	1261	2	210	Gently sloping sides and concave to flattish. Truncated on north by roots
262	Cut	posthole	0.08	0.08	0.1		261? 1262	2	210	Circular vertical sides and unknown base
263	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void
264	Cut	sump	0.4	0.23	0.12	ew	246, 1246, 1264	2	3227	Ovalish bulb at end of drain 246, sloping sides and concave base
265	Cut	posthole	0.17	0.17	0.06		1265	2	3227	Circular near vertical sides and flattish base
266	Cut	posthole	0.15	0.15	0.06		1266	2	3227	Circular near vertical sides and flattish
267	Cut	posthole	0.17	0.17	0.08		1267	2	3227	Circular near vertical sides and concave base
268	Cut	posthole	0.34	0.3	0.16	ew	1268	2	3227	Circular near vertical sides stepped flattish base
269	Cut	posthole	0.2	0.2	0.2		1269	2	3227	Circular sloping sides and concave base steps down one side
270	Cut	posthole	0.27	0.26	0.19	ew	1270	2	3227	circular sloping sides and concave base
271	Cut	posthole	0.19	0.19	0.06		1271	2	3227	circular sloping sides and concave base
272	Cut	posthole	0.9	1.1	0.18	EW		2	208	Sub oval scoop feature gently sloping sides with undulating base. Matrix of ashy grey material, loosely compacted, containing fragmented pipi, cockle, and rocks. Shell both burnt and bleached
273	Cut	posthole	0.45	0.49	0.9	ns		2	208	Shallow circular scoop feature with gradually sloping sides and flattish base. Loosely compacted grey brown ashy matrix with fragmented cockle and pipi shell. Shell burnt and bleached. Concentration of charcoal at centre of feature
274	Layer	midden	11.1	9.5	0.42	ew		1	2	Greyish brown silt moderate compaction. Frequent pipi and cockle. Occasional whelk rare mudsnail
275	Cut	posthole	0.55	0.55	0.13			1	208	Moderate to loose compaction, circular scoop feature with steep sides and flat base, filled with ashy grey matrix. Whole and fragmented pipi and cockle, rare mud snail and fcr
276	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Un-ex

Context Number	Type	Interpretation	Length (m)	Width (m)	Depth (m)	Orientation	Related Contexts	Above	Below	Description
277	Cut	firescoop	0.4	0.35	0.11	ns		1	208	Oval sloping sides and concave base
278	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void modern
279	Cut	posthole	0.15	0.15	0.1			1	2	Circular sloping sides and concave base
280	Cut	posthole	0.2	0.2	0.05			1	2	Circular sloping sides and concave base
281	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void
282	Cut	firescoop	0.8	0.8	0.15		1282, 2282	1	2	Circular near vertical sides and flattish base.
283	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void
284	Cut	posthole	0.4	0.37	0.14	ew	1284	1	2	Oval vertical sides and flattish base
285	Cut	firescoop	0.8	0.65	0.13	ns		1	2	Circular near vertical to sloping sides and concave base
286	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Modern disturbed midden under a tree
287	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void
288	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void
289	Cut	firescoop	0.4	0.3	0.05	se-nw	1289	1	2	Sub circular vertical sides and flattish base
290	Cut	firescoop	0.67	0.52	0.11	ne-sw	1290	1	2	Oval, gently sloping sides and a flat base
291	VOID	void	VOID	VOID	VOID	VOID		N/A	N/A	Void
292	Cut	firescoop	0.68	0.67	0.12		1292	1	2	Roughly circular, steeply sloped sides and irregular flat base
1211	Fill	fill	N/A	N/A	N/A	N/A	2211, 211	N/A	N/A	Grey sand loose compaction mostly composed of crushed shell and frequent charcoal. Pipi tuatua and cockle
1212	Fill	fill	N/A	N/A	N/A	N/A	212	N/A	N/A	Mid grey sand loose to moderate mostly fragmented shell. Frequent charcoal
1213	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Mid brown sand with frequent fragmented shell and occasional whole shell. Whelk cockle and pipi. Occasional charcoal
1214	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Mid grey sand, mix of whole and crushed shell, frequent rock inclusions. Cockle pipi tuatua
1215	Fill	fill	N/A	N/A	N/A	N/A	211, 214, 215	N/A	N/A	Mid brown sandy silt loose mostly crushed shell and frequent charcoal. Cockle pipi tuatua
1216	Fill	fill	N/A	N/A	N/A	N/A	216	N/A	N/A	Mid yellowish brown sand loose to moderate with frequent fragmented shell (mostly cockle) and charcoal inclusions
1217	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Mid yellowish brown sand loose compaction. Frequent whole and fragmented shell cockle. Occasional charcoal. A singular large piece of white rock mineral?
1218	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	See 1225
1220	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Same as 1221
1221	Fill	fill	N/A	N/A	N/A	N/A	221	N/A	N/A	Compacted grey brown silty sand with whole and fragmented cockle shell. Shell degraded. Ash visible in the matrix. Charcoal present
1222	Fill	fill	N/A	N/A	N/A	N/A	222	N/A	N/A	Loose compaction light brown silty clay with occasional fragmented shell

Context Number	Type	Interpretation	Length (m)	Width (m)	Depth (m)	Orientation	Related Contexts	Above	Below	Description
1223	Fill	fill	N/A	N/A	N/A	N/A	223	N/A	N/A	Loose grey brown silty sand with frequent whole cockle shell and occasional charcoal. Shell burnt
1225	Fill	fill	N/A	N/A	N/A	N/A	225	N/A	N/A	Modern
1226	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Loose grey brown silty ash matrix with fragmented shell
1227	Fill	fill	N/A	N/A	N/A	N/A	227	N/A	N/A	Loose brown grey well sorted silt with occasional charcoal flecks and obsidian pieces with fcr and fragmented cockle and pipi shell
1228	Fill	fill	N/A	N/A	N/A	N/A	228	N/A	N/A	Light brown loose compaction silt. Occasional fragmented pipi. Fragmented rock inclusions maybe packing stones. Possible supporting stake on nw 8x8x6
1230	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Mid and dark brown silty sand loose to moderate with fragmented pipi and cockle
1232	Fill	fill	N/A	N/A	N/A	N/A	232	N/A	N/A	Mid and dark brown sandy silt. Moderate to loose pipi and cockle
1233	Fill	fill	N/A	N/A	N/A	N/A	233	N/A	N/A	Mid yellowish brown silty sand moderate to loose compaction with occasional pipi, tuatua and cockle. Occasional shell fragments
1234	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Mid brown silty sand with occasional light brown mottling. Occasional fragmented shell with rare whole shell. Whelk pipi tuatua
1235	Fill	fill	N/A	N/A	N/A	N/A	235	N/A	N/A	Mid brown sand moderate to loose compaction. Occasional whole cockle pipi tuatua, rare charcoal. Burnt shell
1236	Fill	fill	N/A	N/A	N/A	N/A	236	N/A	N/A	Mid brown sand occasionally mottled with light brown. Moderate to loose compaction. Occasional whole shell and fragmented shell cockle pipi whelk. Rare burnt shell
1237	Fill	fill	N/A	N/A	N/A	N/A	237	N/A	N/A	Dark brown sand occasionally mottled with light brown. Moderate to loose compaction. Occasional whole shell whelk pipi cockle. Occasional burnt shell and fragmented shell
1238	Fill	fill	N/A	N/A	N/A	N/A	238	N/A	N/A	Mid brown sand mottled with light brown. Moderate to loose compaction. Occasional whelk pipi cockle. Rare rock
1240	Fill	fill	N/A	N/A	N/A	N/A	240	N/A	N/A	Dark brown silty sand with light brown mottling. Moderate to loose compaction. Fragmented shell cockle pipi whelk. Rare charcoal
1241	Fill	fill	N/A	N/A	N/A	N/A	241	N/A	N/A	Mid brown silty sand mottled with occasional light brown. Moderate to loose compaction. Occasional fragmented shell and charcoal flecks
1242	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Dark brown sand mottled with light brown. Moderate to loose compaction. Frequent

Context Number	Type	Interpretation	Length (m)	Width (m)	Depth (m)	Orientation	Related Contexts	Above	Below	Description
										fragmented shell occasional whole shell: whelk pipi tuatua cockle. Occasional charcoal and burnt shell
1243	Fill	fill	N/A	N/A	N/A	N/A	243	N/A	N/A	Dark brown sand mottled with light brown. Moderate to loose compaction. Occasional charcoal and shell. Fragmented and whole.
1245	Fill	fill	N/A	N/A	N/A	N/A	245	N/A	N/A	Mid to light brown silt. Moderate to loose compaction. Occasional fragmented shell
1246	Fill	fill	N/A	N/A	N/A	N/A	246	N/A	N/A	Mid brown white mottled silt. Marine shell cockle occasional fragmented. Charcoal present
1249	Fill	fill	N/A	N/A	N/A	N/A	249	N/A	N/A	Mid brown silt. Moderate to loose compaction. Frequent fragmented shell and whole shell. Whelk pipi cockle. Occasional charcoal
1250	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Mid brown moderate to loose compaction. Occasional shell fragments and rare charcoal
1251	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Mid brown silt moderate to loose compaction. Occasional whole and fragmented shell rare charcoal
1253	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Mid brown silt. moderate to loose compaction. Occasional fragmented shell
1254	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Mid brown silt. moderate to loose compaction. Occasional fragmented shell
1258	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Mid brown silt. moderate to loose compaction. Occasional fragmented shell and whole shell pipi cockle
1259	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Mid brown silt moderate to loose compaction. Occasional fragmented shell. Rare whole shell occasional charcoal
1260	Fill	fill	N/A	N/A	N/A	N/A	260	N/A	N/A	Mid brown silt moderate to loose compaction. Occasional fragmented shell and whole shell
1261	Fill	fill	N/A	N/A	N/A	N/A	261	N/A	N/A	Mid grayish brown silt loose to moderate compaction. Mostly fragmented shell with occasional whole shell, charcoal and fcr. Cockle pipi tuatua
1262	Fill	fill	N/A	N/A	N/A	N/A		N/A	N/A	Same as 261
1264	Fill	fill	N/A	N/A	N/A	N/A	264	N/A	N/A	Mid brown mottled with yellowish brown and white silt. Moderate to loose compaction. Rare fragmented shell and charcoal
1265	Fill	fill	N/A	N/A	N/A	N/A	265	N/A	N/A	Mottled white and yellow brown silt. moderate compaction. rare charcoal
1266	Fill	fill	N/A	N/A	N/A	N/A	266	N/A	N/A	Same as 1265
1267	Fill	fill	N/A	N/A	N/A	N/A	267	N/A	N/A	Mottled white and yellow brown silt. Moderate compaction. Rare charcoal
1268	Fill	fill	N/A	N/A	N/A	N/A	268	N/A	N/A	Mottled white and yellow brown silt and dark brown. Moderate compaction. Rare charcoal

Context Number	Type	Interpretation	Length (m)	Width (m)	Depth (m)	Orientation	Related Contexts	Above	Below	Description
1269	Fill	fill	N/A	N/A	N/A	N/A	269	N/A	N/A	Mottled white and yellow brown silt. Moderate compaction. Rare charcoal
1270	Fill	fill	N/A	N/A	N/A	N/A	270	N/A	N/A	Mottled white and yellow brown silt. Moderate compaction. Rare charcoal
1271	Fill	fill	N/A	N/A	N/A	N/A	271	N/A	N/A	Mottled white and yellow brown silt. Moderate compaction. Rare charcoal
1277	Fill	fill	N/A	N/A	N/A	N/A	277	N/A	N/A	Greyish brown ashy silt. Loose compaction. Frequent crushed shell and occasional charcoal
1279	Fill	fill	N/A	N/A	N/A	N/A	279	N/A	N/A	Mid brown silt moderate to loose compaction. Frequent pipi and cockle
1280	Fill	fill	N/A	N/A	N/A	N/A	280	N/A	N/A	Dark brown silt moderate compaction with occasional crushed shell and rare charcoal flecks
1282	Fill	fill	N/A	N/A	N/A	N/A	282	N/A	N/A	Light grey to grey loose compaction with common fragmented shell and charcoal and rare fcr in ashy matrix
1284	Fill	fill	N/A	N/A	N/A	N/A	284	N/A	N/A	Mid brown silt moderate compaction with rare fragmented shell and charcoal flecks
1285	Fill	fill	N/A	N/A	N/A	N/A	285	N/A	N/A	Mid brown silt moderate to loose compaction with frequent fragmented shell occasional whole shell and charcoal. Pipi and cockle
1289	Fill	fill	N/A	N/A	N/A	N/A	289	N/A	N/A	Grey ashy silt loose compaction with frequent whole and fragmented shell
1292	Fill	fill	N/A	N/A	N/A	N/A	292	N/A	N/A	Dark brown silty soil moderate compaction with frequent whole and fragmented shell and occasional charcoal
2227	Fill	fill	N/A	N/A	N/A	N/A	227	N/A	N/A	Yellowish brown mixed silt with frequent fragmented shell and charcoal. Firm compaction
2282	Fill	fill	N/A	N/A	N/A	N/A	282	N/A	N/A	Mid brown moderate compaction silty fine sand with occasional light yellow brown silt inclusions and common charcoal fragments, base of layer increased burnt material
3227	Fill	fill	N/A	N/A	N/A	N/A	227	N/A	N/A	Yellowish brown silty clay with occasional whole and fragmented cockle shell

APPENDIX 4 – PLANT MICROFOSSIL METHODS

Dr M. Horrocks

Pollen analysis

Pollen analysis includes pollen grains of seed plants and spores of ferns and other plants. It provides insight into past vegetation and environments, and in New Zealand allows the differentiation of sediments deposited in pre-settlement, early Māori, and European times (McGlone et al. 1993, Hayward et al. 2004). Pollen can also provide evidence from archaeological sites of Māori-introduced plants, for example bottle gourd, paper mulberry, and taro, and European-introduced crops such as maize (Horrocks 2004, Horrocks et al. 2008, Prebble et al. 2019). As well as at archaeological sites, taro pollen has also been identified in an offshore marine sediment core (Handley et al. 2020).

The samples were prepared for pollen analysis by the standard acetolysis method (Moore et al. 1991, Horrocks 2020). At least 150 pollen grains and spores were counted for each sample, and slides were scanned for pollen and spore types not found during the counts. Microscopic fragments of charcoal were also extracted during pollen preparation, providing evidence of fire. Starch and some other plant remains can sometimes be found in pollen preparations.

Phytolith analysis

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

The samples were prepared for phytolith analysis by density separation (Piperno 2006, Horrocks 2020). At least 150 phytoliths were counted for each sample, and slides were scanned for phytolith types not found during the counts. Other biosilicates, in this sponge spicule fragments, were not included in the count from which the phytolith percentages were calculated. These others are still, however, expressed as a proportion of the base count.

Analysis of starch and other plant material

This analysis includes starch grains and other plant material such as calcium oxalate crystals and xylem (Pearsall 2015). Starch is the main substance of food storage for plants and is mostly found in high concentrations of microscopic grains in underground stems (e.g., tubers and corms), roots, and seeds. The grains are synthesised and stored in amyloplasts; sub-cellular units specialised for this function. Calcium oxalate crystals, comprising raphides which are needle-like and druses which are compound, are found in both the aerial and underground parts of many plant taxa. Xylem is a vascular tissue comprising elongated cells through which most of the water and minerals of a plant are conducted. Starch analysis can provide evidence from archaeological sites for Māori-introduced starch crops, such as kumara, taro and yam, and European-introduced crops such as potato (Horrocks and Barber 2005, Horrocks and Weisler 2006, Horrocks et al. 2007, 2008). As well as at archaeological sites, kumara and taro starch and associated material have also been identified in an offshore marine sediment core (Handley et al. 2020).

Advances in this method include the use of Fourier Transform InfraRed spectroscopy to positively identify degraded starch, often uncertain due to loss of distinguishing features, and the discovery of non-starch taro microfossil types, namely shoot epidermal tissue and phenolic inclusions from the skin of the corm (Horrocks and Barber 2005, Horrocks et al. 2012a, b, 2014, 2016, 2017, Kahn et al. 2014).

Starch and other remains were prepared for analysis by density separation and presence/absence noted (Pearsall 2015, Horrocks 2020). These remains can sometimes be found in pollen preparations, despite the harsh chemicals used in that procedure.

References: refer to Bibliography above.