– NOTE –

New Radiocarbon Ages Clarify Chronology of Waimea Plains Māori Settlement and Dry Agronomy, Northern Te Waipounamu

Ian Barber[1]

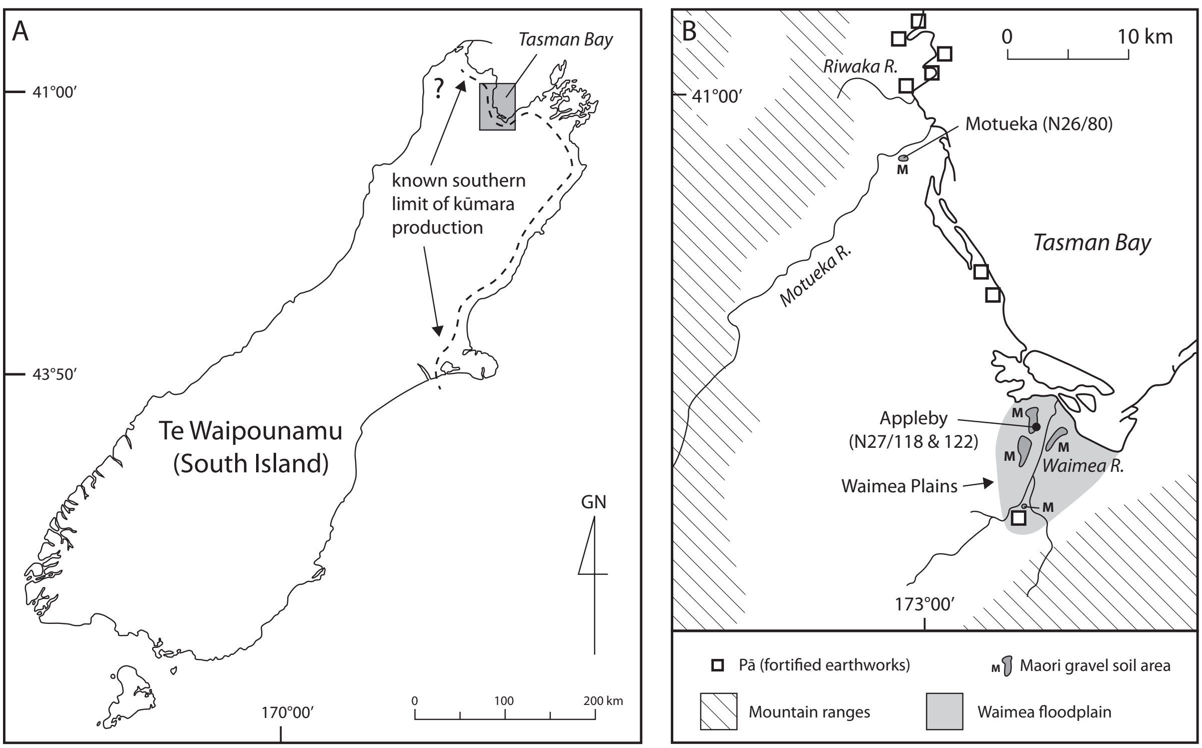

Figure 1. Maps for Te Waipounamu (A) and locations in southern Tasman Bay (B). Map B includes Māori gravel soil (M) distribution and all recorded pā sites for the area shown.

The Waimea Plains of northern Te Waipounamu (South Island) are notable in New Zealand archaeology for a discontinuous Māori gravel soil association extending over about 400 ha of the floodplain (Figures 1 and 2). It is assumed that these anthropic (Ap) soils were created for dry production of tuberous roots of kūmara (sweet potato), *Ipomoea batatas* (Barber 1994). The Ap profile is generally either a silt to sand loam up to ~200 mm thick below gravel sediments 60–120 mm thick or a gravelly sandy loam up to ~400 mm thick where the gravel and sand fractions at least were added (maximum gravel particle size <200 mm, e.g. Figure 3). These mineral additions variously improved soil temperature, texture and drainage qualities and may have been crucial for local cultivation success. The Waimea Māori gravel soil distribution is on the inland, temperate climate, southwestern margins of Pacific kūmara production (Figure 1; Barber 1994, 2004, 2010).

It can be difficult to date cultivation soils by radiocarbon (^{14}C). Soil mixing may destroy discrete events and relocate datable organic materials. From the Waimea Plains, *in situ* midden deposits that cap or bracket Māori gravel sediments and soils offer valid ^{14}C dating options around cultivation soil development. Examples have been excavated at open settlement site N27/118, Appleby (Fig-

1 Department of Anthropology and Archaeology, University of Otago, Dunedin, New Zealand
Email: ian.barber@otago.ac.nz
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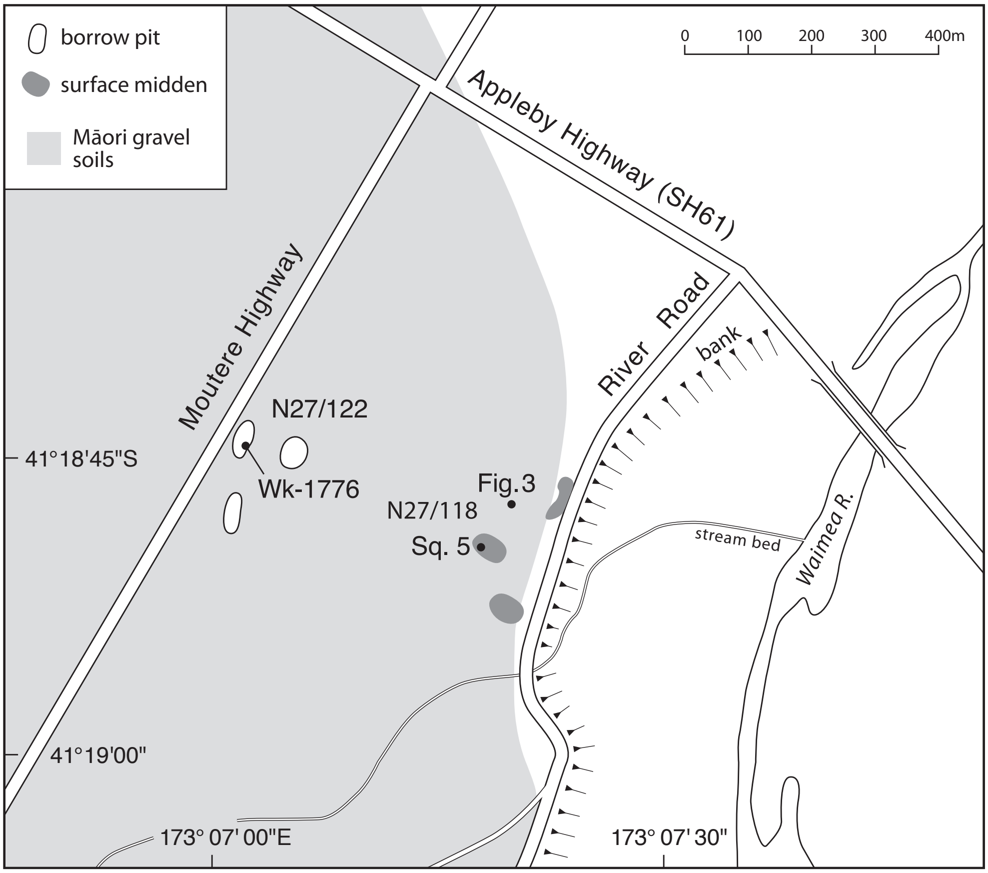

Figure 2. Archaeological sites, units and locations, Appleby, Waimea Plains.

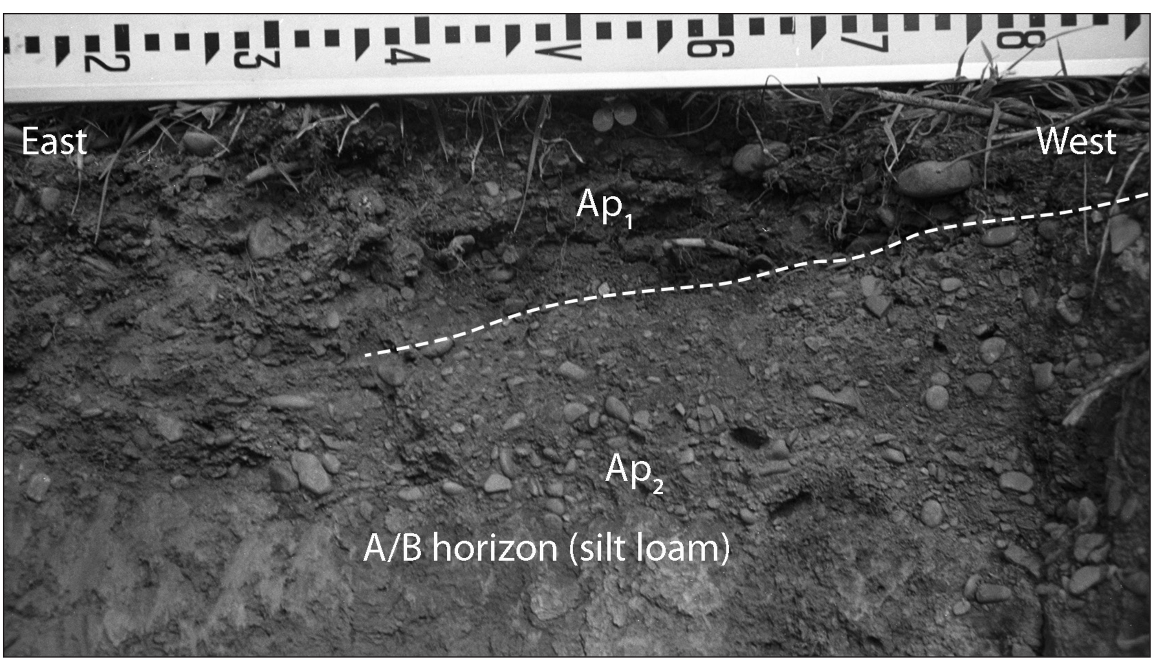

Figure 3. Māori gravel soil profile, western edge N27/118 (numbered scale increments 0.1 m, location at Fig. 2). The Ap2 unit (below broken line) is a mounded Māori gravelly sandy loam. Ap1 is a plough-disturbed topsoil including scattered cobbles and midden components (cf. Fig. 4). Photograph, Ian Barber.

ures 1, 2 and 4; Barber 1994). Biological components of N27/118 sediments and soils include mollusc valves (primarily *Austrovenus stutchburyi*), finfish, dog, rat, bird and occasional sea mammal remains and woody charcoal fragments (primarily gymnosperm matai, *Prumnopitys taxifolia*). Biogenic and stone ornaments and specialist metasomatised argillite adze and chisel tools are scattered throughout. Collectively these components characterise an inland village of some consequence, consistent with traditional references (Barber 1994).

Two marine radiocarbon (^{14}C) ages are published from upper and basal midden lenses of N27/118 excavation Square 5 on *A. stutchburyi* samples (Figure 4). Datable valves of this estuarine filter feeder from the non-calcareous Waimea Inlet are not affected obviously by ^{14}C depletion (including reservoir) difficulties (see Barber 1994 for environmental assessment). A ^{14}C determination is published also on carbonised matai bark (probably although not certainly representing shorter-life material) from the base of a borrow pit (N27/122) about 400 m west (Figures 1 and 4). Māori borrow pits of the Waimea Plains were created from the excavation of gravel and sand materials for field applications (Barber 1994, 2004, 2010). At 95% confidence intervals (CI) these three calibrated ages present plateaux-like probability distributions across three centuries (Figure 5).

New short-life (<10 years) AMS ^{14}C ages have been processed from N27/118 Sq. 5 on curated atmospheric plant charcoal. Each age represents a discrete, single entity angiosperm twig without obvious fungal or root contamination sampled by hand in field (Table 1). The curated parent samples are dominated numerically by matai fragments and identified generally in excavation records as charcoal concentrations within numbered Māori gravel soil level units (L hereafter, each ≤200 mm thick). It is likely that these samples represent primary discarded oven or hearth contents given their concentration *in situ* and the preservation of delicate twig morphology. Fragments of burnt vegetation in Waimea Māori gravel soil profiles elsewhere from assumed land clearance are usually isolated, highly comminuted from tillage mixing and not diagnostic (Barber 1994: 309–19). Even so, in the absence of exact provenance information one cannot eliminate the possibility of moderate disturbance effects on Sq. 5 charcoal nor assume superposition within a mixed soil otherwise (cf. Figures 3 and 4). In Sq. 5 the dated *in situ* midden below plough-disturbed topsoil L1 provides a *terminus ante quem* limit at least for lower samples (albeit on a single marine age). Samples from L3 have dating integrity for the area between extensive *in situ* mid-profile mineral lenses and the A/B horizon substrate (Figure 4).

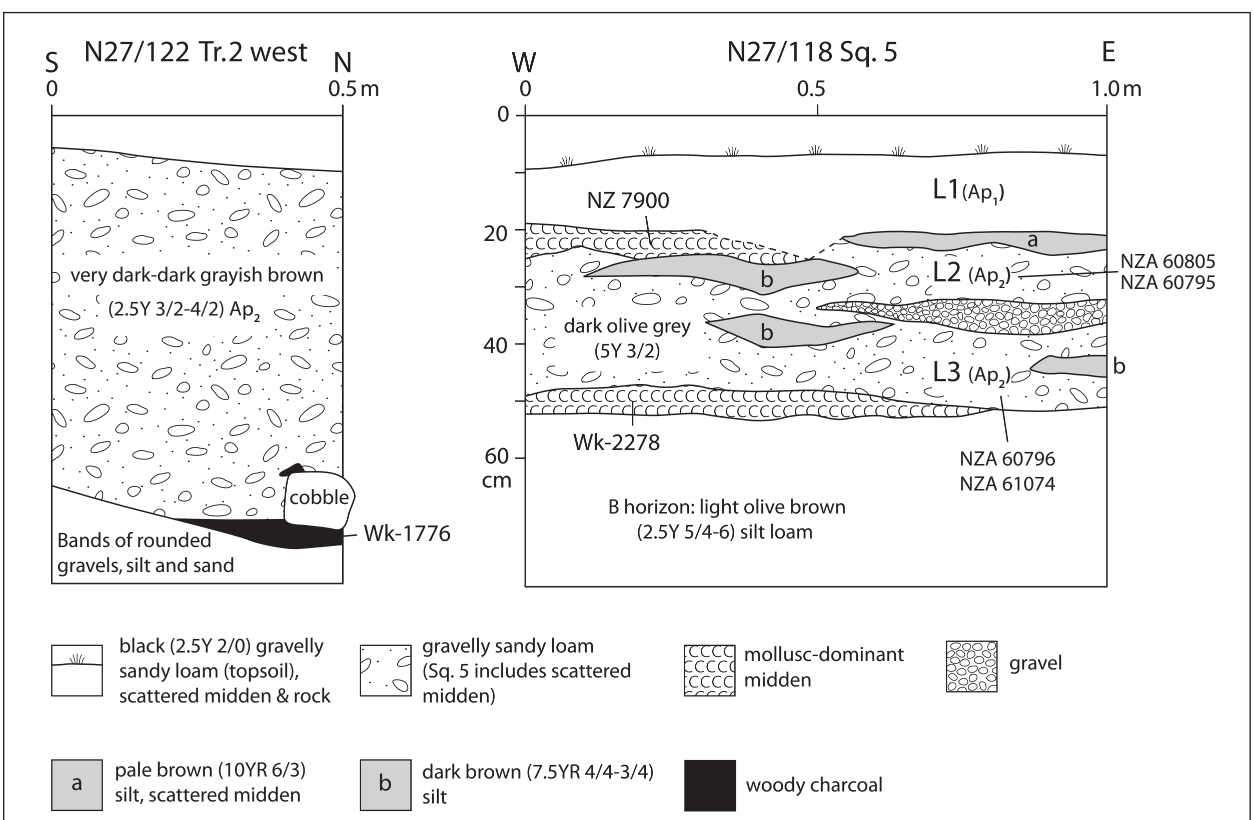

Figure 4. Provenance of ^{14}C ages in Appleby excavation profiles. See Barber (1994) for further details and Fig. 3 for comparable Ap1 and Ap2 units and descriptions.

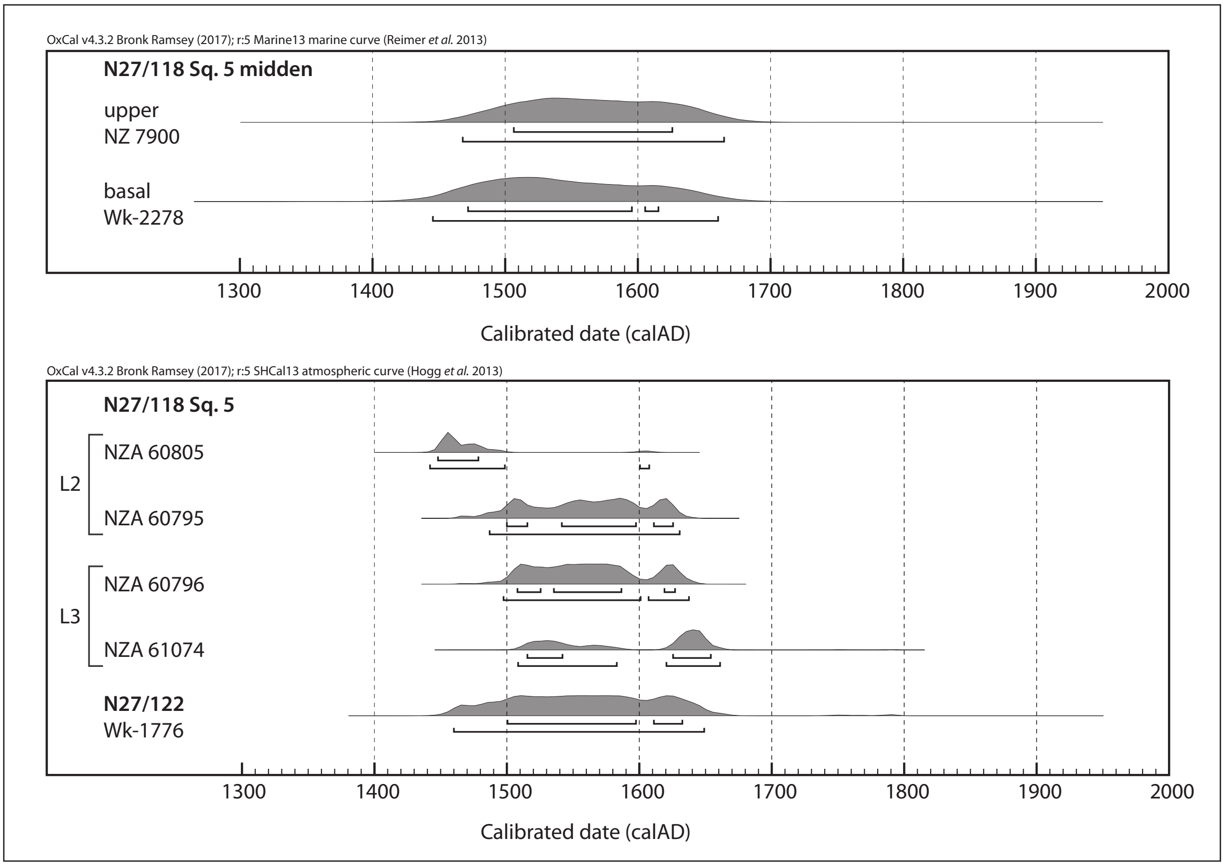

Figure 5. Probability distributions for Appleby ^{14}C ages in OxCal v. 4.3.2 from calibration curves SHCal13 (Reimer *et al*. 2013) and Marine13 (Hogg *et al*. 2013), the last by New Zealand ΔR average –7±45 as advised by Waikato Radiocarbon Dating Lab. Probability ranges below each distribution are 68% and 95% CI.

Table 1. *Appleby ^{14}C data including cal yr AD probability distributions (see Figure 5 caption for further details).*

Site code Unit/feature or layer	Lab no.	Reservoir *, type, taxa †	^{14}C Age (yrs BP)	δ13C‰ (IRMS)	cal yr AD 68% prob.	cal yr AD 95% prob.
N27/118 Sq. 5 upper midden	NZ 7900	M, mollusc valves, *A.stutchburyi* ‡	741±29	–0.5	1510–1630	1470–1670
N27/118 Sq. 5 basal midden	Wk-2278	M, mollusc valves, *A.stutchburyi* ‡	770±45	+0.2	1470–1620	1450–1660
N27/118 Sq. 5 L2	NZA 60805	A, twig charcoal, *Myrsine* sp.	451±19	–29.2±0.2	1450–1480	1440–1610
N27/118 Sq. 5 L2	NZA 60795	A, twig charcoal, *Hebe* sp.	370±19	–25.8±0.2	1500–1630	1490–1630
N27/118 Sq. 5 L3	NZA 60796	A, twig charcoal, *Olearia* sp.	357±19	–26.9±0.2	1510–1630	1500–1640
N27/118 Sq. 5 L3	NZA 61074	A, twig charcoal, *Olearia* sp.	310±23	–26.2±0.2	1515–1650	1510–1660
N27/122 Tr. 2 N., base pit	Wk-1776	A, bark charcoal, *P. taxifolia* ‡	360±50	–26.1	1500–1630	1460–1650

* A = Atmospheric, M = Marine.

† For type, all twigs dated by AMS were identified on intact morphology, including external surface nodes and (or), in transverse section, radial structures around prominent pith centres or cavities. Taxonomic identifications draw on botanical reference materials in the Archaeology Microscopy Laboratory, University of Otago. Lab records, including images, are held by and accessible from Ian Barber, Department of Anthropology and Archaeology, University of Otago.

‡ After details in Barber 1994.

Calibrated probability distributions of three N27/118 twig dates, including one from L2 and two from L3, all begin about or just after the turn of the 16th century and terminate in the 17th century AD at 68% and 95% CI. At 95% CI, >50% of the distributions of all three dates converge in the 16th century, while the N27/122 borrow pit distribution ranges between the mid-15th and mid-17th centuries (Wk-1776). The two Sq. 5 mollusc probability distributions corrected by a New Zealand average marine reservoir value (ΔR) bracket the 16th century also to terminate in the 17th century at 95% CI. At 68% CI the outlier of this Appleby group is NZA 60805 from N27/118 L2 with its entirely 15th century calibration range. However, a small mode of NZA 60805 is distributed from the turn of the 17th century at 95% CI (Table 1, Figure 5).

The new AMS dates reported here improve the descriptive chronology of first recorded crop production and settlement on the inland Waimea floodplain. Māori occupation before and otherwise in southern Tasman Bay was coastal in orientation (Barber 1994). The probability distributions of the two most secure N27/118 twig ages by stratigraphy (NZA 60796, NZA 61074 from L3) range between cal AD 1500–1660 at 95% CI. These agree with the indicative N27/118 Sq. 5 marine and N27/122 borrow pit ^{14}C chronologies to point to the ~16th century or (less statistically likely) earlier 17th century onset of innovative, modified dry soil agronomy and associated village floodplain settlement in southern Tasman Bay. This period is about or soon after the mid-part of the pre-acculturation Māori cultural sequence (~AD 1250–1769), and before the likely local advent of defended earthworks, or pā (Barber 1994, 2010). Consistently, the single pā of historical record on the Waimea floodplain was a ditched enclosure about 6 km inland (southwest) of Appleby that was occupied in the early 19th century (Figure 1; Barber 1994: 303–306).

Acknowledgements

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