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Palynology and Tephrostratigraphy of Quaternary coverbed sequences of the Auckland area, New Zealand

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A Thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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ABSTRACT

This thesis presents the results of detailed palynological and tephrostratigraphic investigations of five sites around the Auckland Isthmus, which collectively contain a fragmented record spanning approximately the last 1.2 million years. A range of additional methods were applied including, radiometric dating, palaeomagnetism, identification of other palynomorphs and fossil wood, and calculation of deposition rates.

Study of two late Quaternary sites provided information on the Last Glacial Maximum (LGM) environment of the Auckland Isthmus. This suggested LGM forest was spatially restricted, dominated by beech forest with minor podocarp elements and contained within extensive shrub- and grassland. Late Quaternary sites were more easily studied than early to mid Quaternary sites because the depositional environment in which they were found provided greater palynological and tephrostratigraphic detail. Detailed published late Quaternary tephrostratigraphy also allowed for tight chronological control, accurate interpolation of ages of uncorrelated tephra and assessment of the accuracy of radiocarbon dates. Forty late Quaternary tephra layers were identified, adding to the record of eruptions sourced from the Auckland Volcanic Field, Taupo Volcanic Zone and Taranaki Volcano. Since c. 24 ka the frequency of Late Quaternary tephra-forming events of significant volume to be recorded in the sediments on the Auckland Isthmus is 1 every 600 years.

Study of early to mid Quaternary sites was hampered by lack of published tephrostratigraphic records for correlation. Last appearance data for four extinct taxa were tentatively extended. Significant depositional hiatuses were noted; the period between c. 1.0 Ma and c. 44 ka was particularly unsatisfactorily recorded. Three key tephra markers and nine previously undocumented tephra layers were documented. Spatial variation and alternating vegetation structure characterised cooler and warmer environments of the early to mid Quaternary record. Extensive high diversity conifer-angiosperm forest occurred during warmer periods while reduced diversity beech-dominated forest contained within extensive shrub/grassland characterised the cooler periods. Certain combinations of taxa occurred during glacial/stadial and interglacial/interstadial periods and an attempt was made to generalise these. It was apparent the extremes of the LGM were not reached during this time, and that climate oscillated between cool and warm periods sometimes characterised by vegetation assemblages without modern analogue.

Extensive depositional hiatuses at one site, deposition of extremely thick, reworked, homogenous marine silt at a second site, and dipping bedding planes at a third site suggest sea level variation and/or tectonism were influential in the Quaternary depositional history of the Auckland Isthmus. However, not enough evidence was present to quantify this.
Many people have assisted in the creation of this thesis, all of whom I wish to thank for their efforts. J. Ogden, R. Newnham, B. Alloway - supervisors; I am eternally grateful for their help and advice. M. Horrocks - initial training in pollen identification; P. Shane - initial glass chemistry identifications; B. Alloway - ITPFT dates and training to use the electron microprobe; B. Pillans - palaeomag data.

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This thesis is dedicated to the memory of

my grandpa, JAMES,

who would be proud to see there is another physical scientist in the family; and

DR KENN TORRANCE

who believed I could do it, even before I thought about it.
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