Late Quaternary Evolution of Matakana Island, Bay of Plenty, New Zealand

A Thesis
submitted in partial fulfilment
of the requirements for the Degree of

Master of Science in Geography

at

Massey University

by

Harley David Betts

MASSEY
UNIVERSITY

1996

Frontispiece: Oblique aerial view of Matakana Island and Tauranga Harbour from above Mount Maunganui township.

Abstract

Matakana Island consists of two main parts - an area of mainly Pleistocene materials to the southwest and a *c*.24 km long Holocene barrier to the northeast. Together with the tombolo systems of Bowentown Heads and Mount Maunganui, Matakana Island encloses the *c*.200 km^2 Tauranga Harbour.

This study establishes the late Quaternary geomorphological history of Matakana Island, focussing primarily on the evolution of the Holocene barrier. The barrier consists largely of relict foredunes, with relict parabolic dunes, lakes/wetland areas, washover deposits and estuarine flats also present. A detailed geomorphological map provides a foundation for palaeoenvironmental reconstructions. The landform information is supplemented with details of the sedimentology, tephrochronology, pedology, archaeology and palynology of the barrier in order to identify and describe past environmental changes.

The Pleistocene part of the island contains remnants of at least three late Pleistocene terraces, mantled by thick beds of tephra and ignimbrite. The lowest terrace, which retains some coastal landforms, originated as a relict foredune plain which probably formed during the Last Interglacial maximum (*c*.125 000 years ago). The older, higher terraces are likely to have originated during earlier interglacial periods.

The barrier consists primarily of moderately well sorted to well sorted medium to fine sand. The dominance of quartz, feldspar and hypersthene indicate that much of the sediment was originally derived from the active Taupo Volcanic Zone. Following the end of the Postglacial Marine Transgression *c*.7 000 cal BP, deposits of these materials on the continental shelf were reworked and transported shoreward to form the Holocene barrier.

Barrier formation commenced by around *c*.6 000 cal BP. The barrier initially formed in at least two separate parts, separated by a tidal inlet at present-day Blue Gum Bay. The entrance migrated southeastward as the barrier prograded and was closed off *c*.3 750 cal BP. Following the closure of the entrance, foredunes became larger and more irregular, suggesting a major change to the coastal sediment budget.

Progradation rates, calculated from shoreline ages determined by airfall tephra deposits, radiocarbon ages and sea-rafted pumice deposits, generally decreased with time, from about 0.46 metres/year initially to about 0.18 metres/year over the last *c*.650 years. Significant erosion of the southeastern end of the barrier culminated shortly after the Kaharoa eruption (*c*.650 cal BP), at which time the barrier was approximately 83 percent of its present length. Subsequently, both ends of the barrier extended rapidly. The coarse texture of sand comprising the barrier ends and anomalously old radiocarbon ages of incorporated shells suggests that, as the entrances narrowed, sediment from adjacent ebb-tidal deltas was reworked to form the barrier ends. The barrier also underwent considerable change following the first arrival of humans on Matakana Island sometime after the Kaharoa eruption. Widespread vegetation clearance and soil disturbance are likely to have contributed to dune instability.

Matakana Island appears to have developed in a similar fashion to many Holocene barrier systems of southeastern Australia in terms of a predominant shelf sediment source, onshore sediment transport following the end of the Postglacial Marine Transgression and decreasing progradation rates through time.

Acknowledgements

I would like to take this opportunity to extend my heartfelt thanks to all those people who have supported me in innumerable ways during all stages of this thesis. My thanks to Dr Doug Sutton, for providing me with the initial opportunity to work on Matakana Island as part of the Department of Conservation-sponsored Archaeological Conservation Assessment of Matakana Island (Investigation 1480). The provision of Department of Conservation funds through the University of Auckland, and assistance in kind through Department of Conservation Science and Research Division Investigation 1771, led by Dr Bruce McFadgen, contributed significantly to the completion of this project. The Massey University Research Fund, Graduate Research Fund and the Department of Geography all provided essential support, in addition to funding gratefully received by means of a Massey Masterate Scholarship and a grant from the Royal Society of New Zealand Skinner Fund. All these sources are thanked for their invaluable financial support, without which this thesis could not have been undertaken.

To my supervisor Dr Mike Shepherd, who has encouraged me and assisted with fieldwork and many other aspects of this study, and from whom I have learned a great deal over the last three years, a very big thank you for all you have done. My sincere thanks too to Dr Bruce McFadgen for your enthusiasm and admirable patience when assisting me both in the field and "at the drawing board" throughout this study. Warm thanks also to the Te Kotukutuku Corporation, Tauranga Moana Trust and local residents of Matakana Island, who generously provided excellent accommodation on the island and allowed unrestricted access to their land. My thanks especially to Dave, Piri and Russell McCoubrie, and Enoka, Adelaide and Mark Ngatai, whose friendship and hospitality made every field trip to Matakana a truly memorable experience. Thank you to Dave McCoubrie, Russell McCoubrie, Mike Paama, Jimmy Peene, Waata Smith and many other local residents for assistance with field work, transport and equipment. For allowing access to the forests of the barrier, my thanks to ITT Rayonier Ltd., Earnslaw One Ltd., PF Olsen and Company Ltd. and FAR Forestry Ltd. I am also grateful to Air Maps (NZ) Ltd., Carter Holt Harvey Ltd., PF Olsen and Company Ltd. and New Zealand Aerial Mapping Ltd. for providing the many aerial photographs used in this research. Thank you too to the Tauranga Aero Club for flying Mike and I over Matakana Island for aerial photography.

I am indebted to Drs Alan Beu, Paul Froggatt and Mr Andrew Hammond for general advice and the identifications of sample materials. Dr Jeremy Gibb is also thanked for advice and assistance in the field, as is Dr Bill McLea who also identified pollen from buried soils on the barrier. GeoSystems Ltd. generously provided the GPS equipment used in this study, and the Civil Engineering Department of the University of Auckland provided the drilling rig. My thanks to the rig operator, Mr Graham Duske, for your time and effort. Thank you Bernd Striewski and Matai Power for assistance with peat coring, during what became an unforgettable field trip! Grateful thanks go to Karen Puklowski for your skill and patience in draughting many of the diagrams for this thesis; to Andrea Thom for assistance in the field and the laboratory and for support during the writeup; to Leighanne Empson for assistance with laboratory techniques, and to departmental secretaries Olive Harris and Glynis Walsh for your general assistance. To the rest of the Geography Department, for your friendship and support, my sincere thanks.

A special thank you goes to Brett Robinson for those hundreds of games of tennis (none of which I have managed to win even after three years), for those mountain bike trips, and for being a reliable companion in the search for those liquid refreshments. Finally, but certainly with no less meaning, I thank my family for all your love, patience and support and for seeing me through those swings from enthusiasm to apathy and back again. Thanks too for your financial support which has more than once saved me in the nick of time. Now you can relax and put away those cheque books!

Harley Betts
February 1996

Table of Contents

List of Figures

FOLDER AT REAR OF THESIS

CHAPTER 1

CHAPTER 2

CHAPTER 3

CHAPTER 4

CHAPTER 5

List of Tables