

Copyright is owned by the Author of the thesis. Permission is given for a copy to be downloaded by an individual for the purpose of research and private study only. The thesis may not be reproduced elsewhere without the permission of the Author.

STRUCTURAL, TECTONIC AND CLIMATIC CONTROL  
OF THE FLUVIAL GEOMORPHOLOGY OF THE MANAWATU RIVER  
WEST OF THE MANAWATU GORGE

A Thesis Presented in Partial Fulfilment of the  
Requirements for the Degree  
of Master of Science in Geography  
at Massey University

By

EILEEN ELEANOR FAIR  
Massey University  
1968

### ACKNOWLEDGEMENTS

I wish to express my gratitude to Mr R.G. Heerdegen, my supervisor, and to Mr B.G.R. Saunders, for constructive criticism in the preparation of this thesis. Thanks are also due to Professor Sir Charles Cotton for his encouragement and criticism of the manuscript.

I would also like to acknowledge the assistance given by the following people: Mr J.D. Cowie of the Soil Bureau, D.S.I.R., for his assistance in field work and use of unpublished material; Mr B.J. Allen for time devoted to drawing maps and diagrams; Miss Geraldine Byers for typing and cyclostyling; Miss Carol Mitchell of the Massey University Photographic Unit for her help in the preparation of diagrams and photographs in this thesis; and members of the staff of the Massey University Department of Geography for discussion and criticism.

Particular mention must be made to members of the Manawatu Catchment Board for their assistance and co-operation and the use of their maps and aerial photographs. Thanks must also be given to the Hydrological Survey of the Ministry of Works for the use of their aneroid barometer.

## CONTENTS

	<u>Page</u>	
CHAPTER I — INTRODUCTION		
Location .....	1	
Previous research .....	3	
Methods of research .....	4	
Aims of research .....	6	
CHAPTER II — ELEMENTS OF GEOLOGY AND STRUCTURE		
Main structural elements .....	7	
The New Zealand Geosyncline .....	8	
The Tararua-Ruahine horst and synclinal basins .....	9	
The development of the Manawatu Gorge .....	14	
The Tokomaru Marine Terrace formation .....	22	
The anticlines of the Wanganui Basin .....	26	
CHAPTER III — STRUCTURAL TECTONIC CONTROL		
The Pohangina Anticline .....	31	
The Himatangi and Levin Anticlines .....	31	
The Kairanga Trough .....	33	
The Structural Control of the Manawatu River .....	33	
CHAPTER IV — CLIMATIC CONTROL		
Climatic control on Pleistocene landforms .....	36	
Late Pleistocene conditions in the Manawatu .....	42	
The terraces of the Manawatu River .....	47	
The Forest Hill Terrace .....	49	
The Milson Terrace .....	49	
The Ashhurst Terrace .....	52	
The Raukawa Terrace .....	61	
Terrace deposits .....	64	
Loess deposits .....	66	
The Aokautere Ash band .....	69	
Conditions of terrace formation .....	71	
CHAPTER V — CONCLUSION .....		85
APPENDIX A .....		92
APPENDIX B .....		93
BIBLIOGRAPHY .....		95

LIST OF FIGURES

		<u>Page</u>
Figure 1.	Location .....	2
Figure 2a.	Synclinal Basins—The Petane Trough and Wanganui Basin .....	11
Figure 2b.	Geological cross section .....	11
Figure 3.	Paleographic maps of formation of the Manawatu Strait .....	18
Figure 4.	Manawatu Gorge and marine strand lines on the Tararua Range .....	19
Figure 5.	Plio-Pleistocene shorelines .....	21
Figure 6.	Geology .....	24
Figure 7.	Otiran ice-fields, solifluction and loess deposits .....	45
Figure 8.	The terraces of the Manawatu River valley .....	48
Figure 9.	Forest Hill Terrace .....	50
Figure 10.	Milson Terrace .....	53
Figure 11.	Ashhurst Terrace .....	57
Figure 12.	Raukawa Terrace .....	62
Figure 13.	Stratigraphic columns of terrace deposits .....	65
Figure 14.	Terrace scarps masked by colluvial deposits .....	70
Figure 15a.	Terrace profiles .....	72
Figure 15b.	Terrace cross section across the river valley .....	72
Figure 16.	Terraces—schematic cross sections of their formation .....	74
Figure 17.*	Field work base map 25" x 38"	

SOURCES: Figures 2a, 2b and 3 are reproduced without alteration from the originals. Figures 5, 6 and 7 are compiled from information contained in the references stated below.

- Figure 2a. Kingma, J.T., 1959: 17.
- Figure 2b. Shaw and Stevens, G.R., 1966: 776.
- Figure 3. Grant Taylor, T. and Hornibrook, N. de B., 1964: 306.
- Figure 5. Rich, C.C., 1959.
- Figure 6. Cowie, J.D., 1961; Fleming, C.A., 1953; Lillie, A.R., 1953; Oliver, W.R.B., 1948; Rich, C.C., 1959 and Te Punga, M.T., 1954 and 1957.
- Figure 7. Ice fields, Willett, R.W., 1950; Solifluction deposits, Cotton, C.A. and Te Punga, M.T., 1955, and Rich, C.C., 1959; Loess deposits, Cowie, J.D., 1964.

\* This map is lodged in the Department of Geography, Massey University.

LIST OF PLATES

	<u>Page</u>
Plate 1. Manawatu Gorge and marine strand lines on the Tararua Range .....	19
Plate 2. Marine cliffs and benches on the Tararua Range .....	21
Plate 3. Tokomaru Marine Terrace formation on the Pohangina Anticline .....	27
Plate 4. Forest Hill Terrace .....	51
Plate 5. Milson Terrace on west bank at Roberts Line .....	54
Plate 6. Milson Terrace on east bank at Centre Road .....	55
Plate 7. Ashhurst Terrace near Ashhurst Road Bridge .....	58
Plate 8. Ashhurst Terrace on west bank at James Line .....	59
Plate 9. Ashhurst Terrace on east bank .....	60
Plate 10. Raukawa Terrace .....	63
Plate 11. Milson Terrace scarp edge masked by colluvium .....	70
Plate 12. Lacustrine deposits .....	76
Plate 13. Lacustrine deposits exposed in quarry .....	78
Plate 14. Forest Hill terrace—a hanging terrace .....	79
Plate 15. Doming of the Tararua Range and terraces near Centre Road .....	90

All photographs were taken by the writer.