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GEOLOGY AND LANDSLIDES
OF THE EASTERN TE AUTE DISTRICT,
SOUTHERN HAWKES BAY

JARG REIN PETTINGA

In fulfillment of the requirements for the
Degree of Doctor of Philosophy in Geology,
Department of Geology, University of Auckland

April 1980
'Clear and trustworthy sections are very rare in the sea cliffs, gigantic slips generally forming the coastline, the ground being disturbed in some cases as far as half a mile inland, the whole being, during wet weather, in constant movement. The best section of these rocks is seen along the shore from Waimirima Bluff to near the mouth of the Mokomokoura.'

From a 'Report on Country between Cape Kidnappers and Cape Turnagain'

by Alexander McKay (1875)
FRONTISPIECE

Aerial Oblique View southward from N141/250040 of the St Lawrence-Hawea Valley system. To east (left) lies the Silver Range; to west (right) the Makara Ridge comprising part of the Elsthorpe Anticline, western limb. Note entrenched meandering Hawea Stream (foreground to middle distance).

(Photograph by Noel Trustrum (MWD))
ABSTRACT

A succession of Upper Cretaceous to Quaternary sedimentary strata of the East Coast Deformed Belt is subdivided into 12 formations. Three unconformities and two stratigraphic breaks of uncertain character are recognised.

Upper Cretaceous sedimentation is typified by an influx of clastic detritus. A progressive fining upward sequence is represented by Paleocene and Eocene formations. Total stratigraphic thickness is small, reflecting a tectonically quiescent period and environment of deposition which was probably deepwater, continental slope.

The East Coast Deformed Belt, a tectonically active and structurally complex zone since Oligocene times is interpreted as the accretionary sediment prism in the arc-trench gap of the obliquely convergent plate margin. The Waimarama-Mangakuri Coastal High and Elsthorpe Anticline are located over a deep-seated thrust zone. Both are characterised by complexly folded and thrust-faulted Upper Cretaceous to Miocene sequences. Thrusts commonly are accompanied by mélange and crush zones. The 'coastal high' developed during Upper Oligocene and Miocene times. The Elsthorpe Anticline formed as an offshoot from this during Upper Pliocene-Lower Pleistocene times.

Deformation has occurred progressively since Oligocene times. A sporadically preserved early phase, recognised in east-west trending structures and inverted sequences, followed by imbricate thrust faulting along the dominant northeast-southwest structural grain are present within the 'coastal high'.

The narrow elongate thrust zones are separated by broad, shallow synclinal basins in which thick flysch sequences accumulated unconformably on older strata during Neogene times. These basin sequences have, in part, subsequently been incorporated into the imbricate accretionary margin. Little evidence exists to suggest that major transcurrent faulting has been important in coastal Southern Hawkes Bay.

Mount Kahuranaki, a limestone klippe, is located to the east of a change in axial trend of the Elsthorpe Anticline, and is genetically related to this. It formed as the result of a gravity glide from the anticlinal crest onto the eastern flank.
A large-scale Regional-Slump which developed during Quaternary time involves the progressive eastward downfaulting and rotation of large blocks of land extending over 20 km in length, incorporating much of the Waimarama-Mangakuri Coastal High. Only the head of the slump is exposed on land. Its extent offshore to the east is unknown. Large 'parasitic' landslides involve the crown of the western (main scarp) margin of the slump.

Soft rock lithologies encountered are typical of the Belt, and with bedrock structure are important controlling factors on slope failure. The main associations recognised between failure type, lithology and structure are:

a) Earthflows, debris-flow slides, mudflows, and creep on Upper Cretaceous and Lower Tertiary alternating sandstone and carbonaceous mudstone, glauconitic sandstone and bentonitic mudstone. Complex folding, intense fracturing, shearing and development of crush or mélangé zones on thrust faults has reduced much of the soft rock to 'soil'.

b) Rotational slide-earthflow, regolith slides, clayflows on massive mudstones and thinly bedded mudstones-sandstones of Middle Tertiary age. These sequences are tightly folded and thrust faulted.

c) Large planar slides (block and wedge glides) occur in a Middle to Upper Miocene flysch succession which is gently folded and moderately faulted. The slides occur on bedding planes in conjunction with steeply dipping primary fractures.

d) Sheet and regolith slides are widespread irrespective of lithology.

Important controls on precipitation and near-surface groundwater conditions are exerted by the moderate to steep relief and the limestone-capped Maraetotara Plateau. Permeability contrasts both within bedrock and soil masses are recognised as primary factors influencing slope failure.

Severe earthquakes and regional uplift are common and widespread in the tectonically active East Coast Deformed Belt (eg Napier, 1931). Lowering of base levels in conjunction with regional (tectonic) uplift is related to successive generations of slope failures. Landslides belong to an old (relict) or a new (rejuvenated) landscape, each of which is composed of several erosion surfaces.

Slope failure susceptibility is assessed in terms of bedrock and soil failures. Five critical control parameters (based on landform and bedrock characteristics) are given susceptibility ratings, which are related to a rating scale of slope failure susceptibility.
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ACKNOWLEDGEMENTS

Financial support for this research was received from two sources. I would like to thank The National Water and Soil Conservation Organisation and Soil Conservation and River Control Council, Water and Soil Division of Ministry of Works and Development, for providing a contract study bursary held from 1976 to 1978. Under this contract financial support was also received to provide field assistance and equipment, and other materials. A Post-Graduate Scholarship from the University Grants Committee was held from 1976 to 1979.

In particular, I would like to thank my supervisors, Mr Warwick Prebble and Dr Peter Ballance for their continued encouragement and guidance in seeing this project through to completion. I am grateful to Dr Bernhard Spörli for his enthusiastic assistance in unravelling the complex structure encountered. Also Dr Huko Kobe for elucidating the geology of Karamea (Red Island). The company of the foregoing staff in the field during inclement weather and the odd fine day was invaluable in gaining an insight into the geology of the area.

I wish to thank: Assoc-Prof. Jack Grant-Mackie for assisting with macro-fossil identification; Dr Graham Gibson who dated numerous micro-fossil samples; Assoc-Prof. Philippa Black for help with X-ray analyses; Professor Terry Sameshima for assisting with the bentonite analyses and Mr Tom Wilson for completing a number of whole rock analyses.

Discussions were held with the following NZ Geological Survey staff: Dr I Speden, Dr R Katz, Messrs T Grant-Taylor and P Moore. Dr G van der Lingen, Chief Sedimentologist, Christchurch, combined with the author in presenting data collected independently in Southern Hawkes Bay, at the 1979 ANZAAS Congress, Auckland. The paper prepared for this Congress is appended.

I am appreciative of the assistance given by staff officers of the Water and Soil Division, MWD. In particular, Messrs Graham Howard and Peter Walsh for arranging the preparation of base map transparencies. Valuable discussions were also held with Dr John Hawley and Messrs Peter Stephens and Noel Trustrum (Aokautere Science Centre, Palmerston North). A flight over part of the study area in conjunction with staff of the Catchment Condition Survey team, Aokautere, provided a number of the oblique aerial photos used.

Many of the technical staff of the Geology Department (Auckland University) provided assistance and advice. I wish to thank Roy Harris (photography and draughting), Anne Paton (Library), Barry Curham (grinding room), Dave Pryor (Sed. Lab/Pal. Store) and Nan Howett (petrology store, field equipment).

The technical services of Mr A Downing (for producing the majority of black and white photographs) and Ms L Leonard (for last-minute draughting) of the Geology Department (Canterbury University) are very much appreciated.

Special thanks to Messrs Noel Trustrum and Peter Stephens (Aokautere Science Centre) for assistance with colour photography.

For assistance and company in the field I thank Mark Barsdell, Chris Webb, Grant Cardno and Jock Mackintosh. I too, acknowledge the company and hours of discussion with Mark Barsdell, especially during the late evening and weekend hours in the Department.

xx
This project, being field-oriented, relied heavily on the permission for access to property, assistance and information. All this was freely given by the entire farming community and is gratefully acknowledged. In particular, I wish to thank: Garth and Anne Mackintosh ("Balvounie") for providing accommodation, hospitality, many meals and hours of non-geologic chatter; David Mackintosh for providing the opportunity to own a vehicle of remarkable tolerance and reliability; John and Betty McNeill ("Inverary") for accommodation at Waimarama and Maraetotara; Peter and Betty Sherning ("Waimoana") for accommodation; John Aitken ("Wairama") for accommodation and assistance; Jan Graham for accommodation at Waimarama Beach, assistance and the opportunity to take a flight over the coastal district; Frances and Peter Cronin at the Waimarama Store and Camping Ground for assistance, advice and meals; Messrs P Williams ("Waipoapoa Station"), C M and T M Gilray ("Karamea") and D Belcher ("Haumoana") for advice and assistance.

Staff at NZ Aerial Mapping, in particular Messrs Peach and Pearson for assistance with vertical aerial photo coverage, and the preparation of the coast half-tone transparencies used for base maps.

To all those friends, too numerous to mention, who helped in some way, please accept my thanks.

A special thanks to Margaret for typing the manuscript, for her patient help and advice, for proof-reading and colouring maps.

En tenslotte wil ik mijn Moeder bedanken voor haar onvermoeibaar aanmoediging en steun over al deze jaren. (Thanks Mam!)