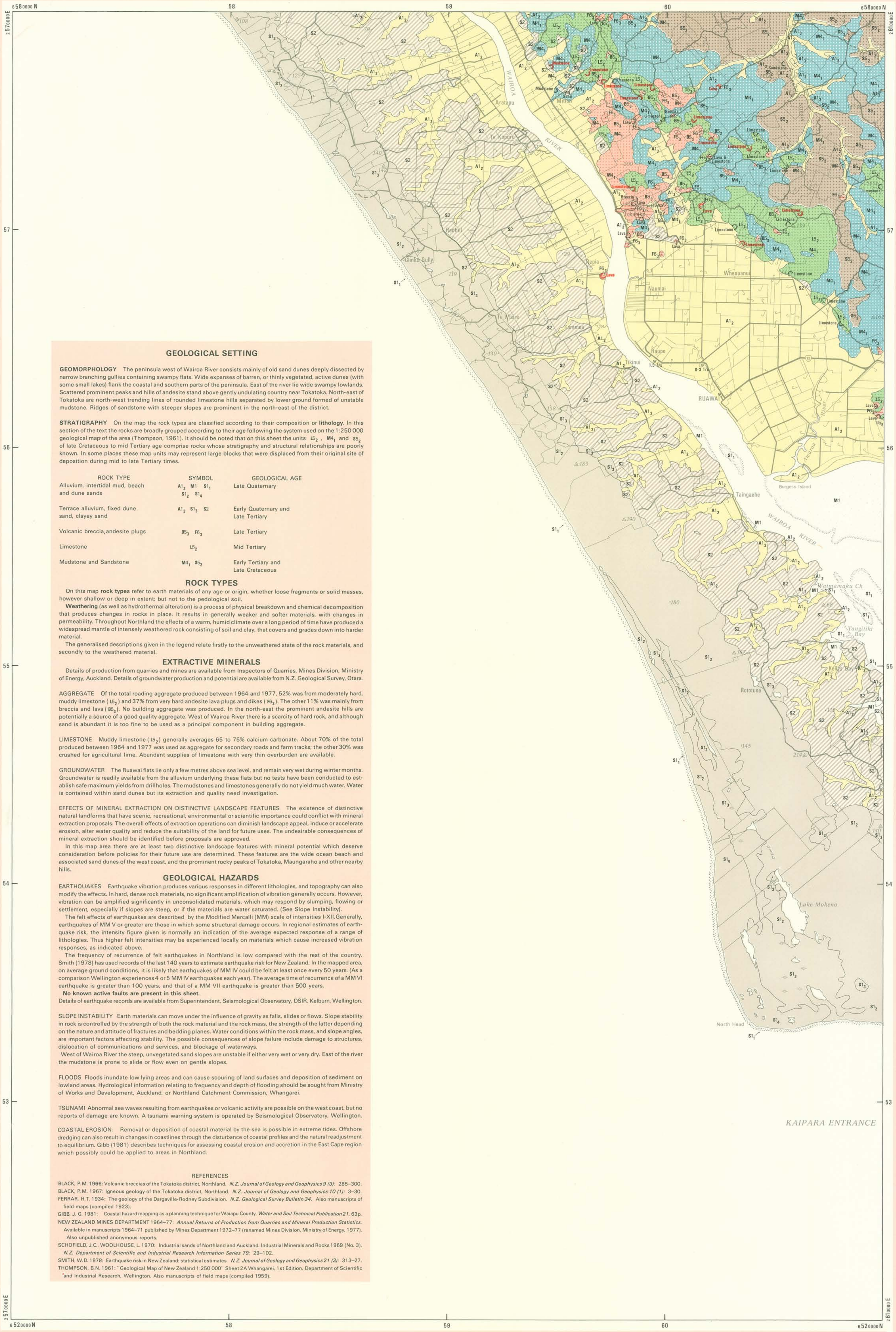
RUAWAI–ROTOTUNA



GEOLOGICAL SETTING

GEOMORPHOLOGY The peninsula west of Wairoa River consists mainly of old sand dunes deeply dissected by narrow branching gullies containing swampy flats. Wide expanses of barren, or thinly vegetated, active dunes (with some small lakes) flank the coastal and southern parts of the peninsula. East of the river lie wide swampy lowlands. Scattered prominent peaks and hills of andesite stand above gently undulating country near Tokatoka. North-east of Tokatoka are north-west trending lines of rounded limestone hills separated by lower ground formed of unstable mudstone. Ridges of sandstone with steeper slopes are prominent in the north-east of the district.

STRATIGRAPHY On the map the rock types are classified according to their composition or **lithology**. In this section of the text the rocks are broadly grouped according to their age following the system used on the 1:250 000 geological map of the area (Thompson, 1961). It should be noted that on this sheet the units $L5_2$, $M4_1$ and $S5_2$ of late Cretaceous to mid Tertiary age comprise rocks whose stratigraphy and structural relationships are poorly known. In some places these map units may represent large blocks that were displaced from their original site of deposition during mid to late Tertiary times.

ROCK TYPE	SYMBOL	GEOLOGICAL AGE
Alluvium, intertidal mud, beach and dune sands	$A1_2$ M1 $S1_1$ $S1_2$ $S1_4$	Late Quaternary
Terrace alluvium, fixed dune sand, clayey sand	$A1_3$ $S1_3$ S2	Early Quaternary and Late Tertiary
Volcanic breccia, andesite plugs	$B5_3$ $F6_3$	Late Tertiary
Limestone	$L5_2$	Mid Tertiary
Mudstone and Sandstone	$M4_1$ $S5_2$	Early Tertiary and Late Cretaceous

ROCK TYPES

On this map **rock types** refer to earth materials of any age or origin, whether loose fragments or solid masses, however shallow or deep in extent; but not to the pedological soil.

Weathering (as well as hydrothermal alteration) is a process of physical breakdown and chemical decomposition that produces changes in rocks in place. It results in generally weaker and softer materials, with changes in permeability. Throughout Northland the effects of a warm, humid climate over a long period of time have produced a widespread mantle of intensely weathered rock consisting of soil and clay, that covers and grades down into harder material.

The generalised descriptions given in the legend relate firstly to the unweathered state of the rock materials, and secondly to the weathered material.

EXTRACTIVE MINERALS

Details of production from quarries and mines are available from Inspectors of Quarries, Mines Division, Ministry of Energy, Auckland. Details of groundwater production and potential are available from N.Z. Geological Survey, Otara.

AGGREGATE Of the total roading aggregate produced between 1964 and 1977, 52% was from moderately hard, muddy limestone ($L5_2$) and 37% from very hard andesite lava plugs and dikes ($F6_3$). The other 11% was mainly from breccia and lava ($B5_3$). No building aggregate was produced. In the north-east the prominent andesite hills are potentially a source of a good quality aggregate. West of Wairoa River there is a scarcity of hard rock, and although sand is abundant it is too fine to be used as a principal component in building aggregate.

LIMESTONE Muddy limestone ($L5_2$) generally averages 65 to 75% calcium carbonate. About 70% of the total produced between 1964 and 1977 was used as aggregate for secondary roads and farm tracks; the other 30% was crushed for agricultural lime. Abundant supplies of limestone with very thin overburden are available.

GROUNDWATER The Ruawai flats lie only a few metres above sea level, and remain very wet during winter months. Groundwater is readily available from the alluvium underlying these flats but no tests have been conducted to establish safe maximum yields from drillholes. The mudstones and limestones generally do not yield much water. Water is contained within sand dunes but its extraction and quality need investigation.

EFFECTS OF MINERAL EXTRACTION ON DISTINCTIVE LANDSCAPE FEATURES The existence of distinctive natural landforms that have scenic, recreational, environmental or scientific importance could conflict with mineral extraction proposals. The overall effects of extraction operations can diminish landscape appeal, induce or accelerate erosion, alter water quality and reduce the suitability of the land for future uses. The undesirable consequences of mineral extraction should be identified before proposals are approved.

In this map area there are at least two distinctive landscape features with mineral potential which deserve consideration before policies for their future use are determined. These features are the wide ocean beach and associated sand dunes of the west coast, and the prominent rocky peaks of Tokatoka, Maungaraho and other nearby hills.

GEOLOGICAL HAZARDS

EARTHQUAKES Earthquake vibration produces various responses in different lithologies, and topography can also modify the effects. In hard, dense rock materials, no significant amplification of vibration generally occurs. However, vibration can be amplified significantly in unconsolidated materials, which may respond by slumping, flowing or settlement, especially if slopes are steep, or if the materials are water saturated. (See Slope Instability).

The felt effects of earthquakes are described by the Modified Mercalli (MM) scale of intensities I-XII. Generally, earthquakes of MM V or greater are those in which some structural damage occurs. In regional estimates of earthquake risk, the intensity figure given is normally an indication of the average expected response of a range of lithologies. Thus higher felt intensities may be experienced locally on materials which cause increased vibration responses, as indicated above.

The frequency of recurrence of felt earthquakes in Northland is low compared with the rest of the country. Smith (1978) has used records of the last 140 years to estimate earthquake risk for New Zealand. In the mapped area, on average ground conditions, it is likely that earthquakes of MM IV could be felt at least once every 50 years. (As a comparison Wellington experiences 4 or 5 MM IV earthquakes each year). The average time of recurrence of a MM VI earthquake is greater than 100 years, and that of a MM VII earthquake is greater than 500 years.

No known active faults are present in this sheet.

Details of earthquake records are available from Superintendent, Seismological Observatory, DSIR, Kelburn, Wellington.

SLOPE INSTABILITY Earth materials can move under the influence of gravity as falls, slides or flows. Slope stability in rock is controlled by the strength of both the rock material and the rock mass, the strength of the latter depending on the nature and attitude of fractures and bedding planes. Water conditions within the rock mass, and slope angles, are important factors affecting stability. The possible consequences of slope failure include damage to structures, dislocation of communications and services, and blockage of waterways.

West of Wairoa River the steep, unvegetated sand slopes are unstable if either very wet or very dry. East of the river the mudstone is prone to slide or flow even on gentle slopes.

FLOODS Floods inundate low lying areas and can cause scouring of land surfaces and deposition of sediment on lowland areas. Hydrological information relating to frequency and depth of flooding should be sought from Ministry of Works and Development, Auckland, or Northland Catchment Commission, Whangarei.

TSUNAMI Abnormal sea waves resulting from earthquakes or volcanic activity are possible on the west coast, but no reports of damage are known. A tsunami warning system is operated by Seismological Observatory, Wellington.

COASTAL EROSION: Removal or deposition of coastal material by the sea is possible in extreme tides. Offshore dredging can also result in changes in coastlines through the disturbance of coastal profiles and the natural readjustment to equilibrium. Gibb (1981) describes techniques for assessing coastal erosion and accretion in the East Cape region which possibly could be applied to areas in Northland.

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INTRODUCTION

Rock types maps are intended to help planners and land users to:
i) identify the characteristics of near surface rock types;
ii) recognise areas of existing and potential mineral resources;
iii) become aware of geological hazards.

ROCK TYPE DESCRIPTIONS (LITHOLOGIES)

The map unit symbols are listed alphabetically within the two major rock type categories - sedimentary and igneous. The first letter of each symbol indicates the major lithology, and the second letter (where present) a significant interbedded lithology. The numeral indicates the typical hardness (see Physical Characteristics table) of the unweathered rock material, and the subscript numeral indicates variation.

The description for each map unit may include common name, distinctive landform, colour, hardness, grain size, bedding, fracturing and chemical composition. Major and minor lithologies are described and also the weathered material in terms of changes in colour, hardness and grain size. Range of depth of the weathered mantle is also given. (See also "Definition of descriptive terms").

SEDIMENTARY ROCK TYPES

ALLUVIUM

$A1_2$ River bed and flood plain alluvium: mainly mud with some sand and peat. Unconsolidated to very soft. 100 m thick near Ruawai.

$A1_3$ Terrace alluvium: up to 10 m above stream or sea level, mainly mud and sand. Very soft. Weathered to cream-brown, very soft clay to depths of 2 m.

LIMESTONE

$L5_2$ Muddy limestone: grey, mud sized grains, containing 65–75% calcium carbonate; closely fractured; in places thinly interbedded with minor greensand. Moderately hard to hard. Includes small areas of igneous rocks ($F6_3$) near Tokatoka. Weathered to brown, soft clay to depths of 1 m.

MUD AND MUDSTONE

M1 Intertidal mud: with some sand. Unconsolidated.

$M4_1$ Mudstone: grey, brown and green, thinly bedded and closely fractured, in places calcareous or siliceous; minor muddy limestone ($L5_2$) and greensand Moderately soft to moderately hard. Weathered to soft clay to depths of 10 m. Unstable in places.

SAND AND SANDSTONE

$S1_1$ Beach sand: mostly quartz and feldspar, median grain size 100–250 microns. Unconsolidated.

$S1_2$ Active sand dunes: mostly quartz and feldspar, median grain size 100–250 microns. Unconsolidated. Unweathered.

$S1_3$ Fixed sand dunes: mostly quartz and feldspar, median grain size 100–250 microns, in places cross-bedded, minor swamp deposits. Unconsolidated to very soft. Weathered to brown stained, very soft, clayey sand.

$S1_4$ Damp sand areas: low lying; mostly quartz and feldspar, median grain size 100–250 microns, in places calcareous, minor swamp deposits. Unconsolidated to very soft. Unweathered.

S2 Clayey sand: white or brown, mostly quartz and feldspar, median grain size 100–250 microns, in places thickly bedded, some peaty or pumiceous layers. Very soft. Weathered to brown, soft sandy clay to depths of 10 m.

$S5_2$ Micaceous sandstone: blue-grey quartz-feldspar sandstone with a mica content up to 5%, in places calcareous, thinly to thickly bedded and widely fractured; with minor interbedded mudstone ($M4_1$), hard conglomerate and carbonaceous material in places and large calcareous concretions locally. Moderately hard to hard. Weathered to brown, soft, sandy clay to depths of 10 m.

IGNEOUS ROCK TYPES

VOLCANIC BRECCIA

$B5_3$ Breccia and lava flows: breccia of moderately hard to very hard, medium to coarse grained, angular to rounded fragments of andesite (minor basalt and dacite) in a moderately hard to hard, medium grained matrix; in places interbedded with hard to very hard, medium grained crystalline andesite lava flows. Minor areas and blocks of limestone and mudstone. Weathered to brown, moderately soft clay containing moderately hard fragments to depths of 20 m.

INTRUSIVE ROCKS

$F6_3$ Andesite plugs and dikes: Fine to medium grained crystalline andesite: (some basalt and dacite), moderately fractured. Hard to very hard. Weathered to brown, soft clay to depths of 10 m. (N.B. Labelled lava at quarry sites).

PHYSICAL CHARACTERISTICS OF UNWEATHERED ROCK TYPES, AND A GUIDE TO EXCAVATION METHODS

*TERM	NUMBER & PATTERN	*DIAGNOSTIC FEATURE	§GUIDE TO EXCAVATION METHODS
Very Hard	7	Not scratched with knife or hammer point.	Explosives generally required.
Hard	6	Scratched with knife or hammer point only with difficulty.	Heavy machinery generally required; explosives will be needed where rocks widely fractured.
Moderately Hard	5	Scratched with knife or hammer point.	
Moderately Soft	4	Grooved or gouged to depth of about 3mm by firm pressure on knife or hammer point.	Machinery required; explosives may be needed where rocks widely fractured.
Soft	3	Grooved or gouged readily with knife or hammer.	Machinery required.
Very Soft	2	Carved with knife or scratched with finger nail.	Can be dug with spade, light excavators suitable.
†Unconsolidated	1	Disaggregated by hand, or easily moulded.	Can be dug by hand.

*Refers to hand sized samples of fresh rock of the map unit.

§Fractures can have a significant effect on the ease of excavation; e.g. hard rocks if closely fractured, may be excavated as readily as softer material. (see table on fracture spacing).

†Units such as gravel or scoria are unconsolidated as a mass but consist of fragments with individual hardnesses of up to 7.

DEFINITION OF DESCRIPTIVE TERMS

GRAIN SIZE

SIZE	CRYSTALLINE ROCK	UNCONSOLIDATED SEDIMENT	CONSOLIDATED SEDIMENT	FRAGMENTAL VOLCANIC DEBRIS
	glassy			
less than 2 microns	very fine grained crystalline	clay } mud	claystone } mudstone	tuff
2 to 60 microns	fine grained crystalline	silt } mud	siltstone } mudstone	tuff
60 microns to 2mm	medium grained crystalline	sand	sandstone	tuff
2 to 60mm	coarse grained crystalline	gravel	scree (angular) } conglomerate } breccia (angular)	volcanic breccia
more than 60mm	very coarse grained crystalline	cobbles and boulders	scree (angular) } conglomerate } breccia (angular)	volcanic breccia

BEDDING

The following terms denote bedding thickness ranges:

thinly bedded	less than 200mm
medium bedded	200–600mm
thickly bedded	more than 600mm

FRACTURING

The following terms denote fracture spacing ranges:

closely fractured	less than 20mm
moderately fractured	20–200mm
widely fractured	more than 200mm

SYMBOLS

- Rock type boundary – known
- Rock type boundary – uncertain
- ×Mn Sample site or mineral outcrop with chemical symbol (N.B. Q = quartzite or chert)
- Quarry or pit (closed) / Quarry or pit (operating) — Quarried material indicated eg. Crystalline Limestone
- Underground mine (mined material indicated e.g. Silver)
- Spring (mineral composition indicated when known e.g. Soda)
- 1957 0.1 l/s Water bore (with sample pumping rate in litres per second (l/s), and date when known)

COMPILATION METHODS

This map was compiled by L.O. Kermode, New Zealand Geological Survey, D.S.I.R. Distinctive landforms were delineated from aerial photographs (scale 1:15 840), and then correlated with rock type information derived from records of outcrop sites (usually with incomplete descriptions). Information was obtained from manuscript maps (Ferrar, compiled 1923; Thompson, compiled 1959), notes from N.Z. Mines Department (compiled 1961–75), publications by Black (1966–1967) Schofield and Woolhouse (1970) and Mines Department (1966–77) and unpublished reports filed at N.Z. Geological Survey, Otara. Unit boundaries were accurately plotted onto 1:25 000 contoured photogrammetric plots (NZMS 270). The plots differ from the NZMS 290 topography (based on NZMS 1), particularly in regard to river courses, thus the distribution of some rock type units, e.g. alluvium, will not correspond exactly to the base.

RELIABILITY

This is a small scale map, therefore rock type units and their boundaries are generalised. The reliability of the content and position of unit boundaries is influenced by the lack of detailed field mapping, the uneven distribution of observation points (most of which are concentrated near Tokatoka), the variety of rock materials within some units, the degree of distinctiveness of the topography as seen on aerial photos, and the variability in the accuracy and completeness of the existing descriptions of the rock types.

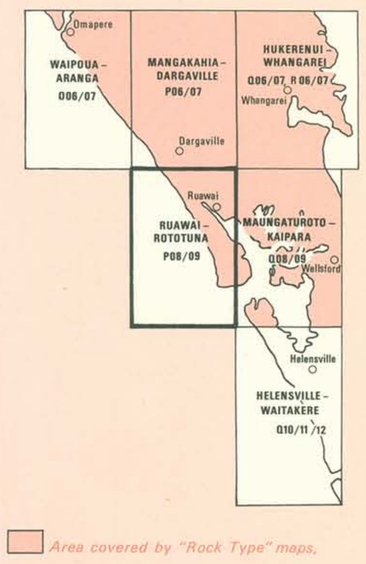
Although no systematic field checking was done, all boundaries are considered to be accurate for the scale of the map. Small significant areas have been exaggerated.

For more detailed information on selected areas write to:
The Director,
N.Z. Geological Survey, DSIR,
P.O. Box 30-368,
Lower Hutt.

Note: This map should not be used for planning major engineering projects, large scale quarrying operations, or detailed work, for which individual site investigations are required.

Refer to this map as:
Kermode, L. O. 1981: "Ruawai – Rototuna".
NZMS 290 Sheet P08/09, 1:100 000.
New Zealand Land Inventory, Rock Types.
Department of Lands and Survey, Wellington, New Zealand.

SHEET INDEX



Area covered by "Rock Type" maps.

COMPILATION NOTE:– The base map is compiled from the NZMS 1 series (1:63360) dated 1969, 72

EDITION 1 1981

NEW ZEALAND LAND INVENTORY

SCALE 1 : 100 000

Metres 1000 0 1 2 3 4 5 6 7 8 Kilometres

REFERENCE

WHANGAREI *Cities*	*Rivers and streams*
KAIKOHE *Towns*	*Trig stations*
Houhora *Settlements*	*Vincula (separate parcels under same ownership)*
State highways	*Land holding boundaries*
Other roads	*Sand and mud*
Tracks	*Wetlands*
Railways	

This map is one of a series. Themes mapped in this study are :– Land Tenure and Holding, Rock Types, Soils, Existing Land Use, Wildlife, Indigenous Forest.

HEIGHTS ARE IN METRES ABOVE MEAN SEA LEVEL

This map is drawn on the New Zealand Map Grid Projection, a minimum–error conformal projection. The grid is the New Zealand Map Grid, showing coordinates in metres in terms of the Geodetic Datum 1949, based on the International (Hayford) Spheroid.

The smallest area mapped is generally not less than 10 hectares. Calculation of areas from this map should be within the limitations of scale. For example, individual areas should be rounded to the nearest 5 hectares. Accumulated areas should be rounded to the nearest 50 hectares.

AREAL SCALE

500 hectares divided into units of 25 hectares

Compiled by L.O. Kermode,
New Zealand Geological Survey,
Department of Scientific and Industrial Research.

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