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 (where present) indicates a variation.

The description for each map unit may include common name, distinctive landform, colour, hardness, grain size, bedding, fracturing and mineral composition. Major and minor lithologies are described and also the weathered material, in terms of changes in colour, hardness and grain size. The range of depths of the weathered mantle is also given. (See Definition of Descriptive Terms—on reverse of map.)

SEDIMENTARY ROCK TYPES

ALLUVIUM AND LANDSLIDE DEPOSITS

$A1_2$ Alluvium: mud, sand and gravel with minor peat, forming river bed and flood plain deposits up to 60 m thick: unconsolidated to very soft, unweathered.

$A1_3$ Alluvium: mud, sand and gravel with minor peat, forming terraces up to 10 m above stream or river beds, deposits up to 30 m thick; unconsolidated to very soft. Unweathered, or weathered to brown stained material to depths of 2 m.

$A2$ Alluvium: mud, sand and gravel with minor carbonaceous material and iron oxide cementation, or pans in places, forming dissected terraces more than 10 m above stream or river beds: deposits up to 30 m thick; very soft to moderately soft. Weathered to brown, very soft grains or fragments to depths of 10 m.

Landslide debris: unconsolidated chaotic mixture of fine to very coarse grained fragments of locally derived rock types in a matrix of weathered material; infilling steep valleys within massifs of basalt, dolerite, and breccia ($Hb_3 + Bb_2$).

GRAVEL AND CONGLOMERATE

$G2$ Gravel: gravel to boulder size subangular to rounded fragments of various rock types (mainly basalt and dolerite) in a poorly sorted finer matrix, iron oxide cementation in places, and minor beds of sand and mud, forming dissected terraces more than 10 m above stream or river beds, up to 30 m thick; fragments hard, deposits unconsolidated or cemented. Weathered to brown stained grains or fragments to depths of 10 m.

$G5_3$ Conglomerate: rounded gravel to cobble sized fragments of basalt and diorite in a matrix of tuffaceous sandstone, thickly interbedded with minor volcanic and carbonaceous sandstone, mudstone and lignite in places; widely fractured, moderately hard to very hard. Weathered to soft reddish brown clay containing harder cores to depths of 20 m.

$G5_4$ Conglomerate: rounded, gravel to boulder sized fragments of muddy limestone and basalt in a matrix of volcanic sandstone, thickly interbedded with brown sandstone in places; widely fractured, moderately hard to hard. Weathered to soft reddish brown clay containing harder cores to depths of 20 m.

LIMESTONE

$L5_3$ Crystalline limestone: medium grained crystalline calcium carbonate containing some sand grains, with minor greensand ($S4$): thinly to medium bedded and widely fractured; moderately hard to hard. Weathered to brown clay to depths of 2 m.

$L5_4$ Muddy limestone: grey, 50–75% calcium carbonate, closely fractured, in places interbedded with minor greensand ($S4$) and mudstone ($M4_1$); moderately hard to hard. Weathered to brown very soft slightly calcareous clay to depths of 2 m.

MUDSTONE

$M4_1$ Mudstone: grey, brown and green, thinly bedded and closely fractured, locally calcareous or siliceous, with minor muddy limestone ($L5_4$) and greensand ($S4$): moderately soft to moderately hard. Weathered to soft clay to depths of 10 m.

$M4_2$ Carbonaceous mudstone: brown, medium to thickly bedded, minor coal seams, sandstone and conglomerate beds: moderately soft. Weathered to very soft clay to depths of 10 m.

$M4_3$ Mudstone with sandstone: blue-grey, thinly to medium bedded mudstone, thinly to thickly interbedded with fine sandstone in places; both lithologies calcareous or carbonaceous in places; moderately fractured, moderately soft to moderately hard. Weathered to soft silty clay to depths of 10 m.

$M5$ Siliceous mudstone: dark grey and closely fractured with a silica content of up to 90%; moderately hard to hard. Weathered to light grey, soft clay containing harder cores to depths of 10 m.

SAND AND SANDSTONE

$S1_2$ Sand: quartzose with feldspar and minor shell fragments, forming intertidal and beach deposits, unconsolidated.

$S1_3$ Sand: quartzose, with minor feldspar, forming active dunes; unconsolidated and unweathered.

$S1_4$ Sand: quartzose, with minor feldspar and clay, forming fixed dunes, with minor swamp deposits: unconsolidated to very soft. Unweathered or weathered to brown-stained, very soft clayey sand to depths of 5 m.

$S1_5$ Sand: quartzose, with minor feldspar, calcareous cementation in places, forming damp interdunal areas, with swamp deposits: unconsolidated to very soft. Unweathered.

$S2$ Clayey sand: white, highly quartzose in places, with minor feldspar and a clay content of up to 20%, forming high, dissected, fixed dunes, very soft. Minor silt and lignite beds. Weathered to cream or brown, very soft clayey sand to depths of 10 m.

$S4$ Glauconitic sandstone (greensand): quartz-feldspar sandstone containing up to 5% glauconite, in places calcareous or carbonaceous, thickly bedded and widely fractured; moderately soft to moderately hard. Weathered to soft, brown, non-calcareous silty clay to depths of 10 m.

$S5_2$ Micaceous sandstone: blue-grey, quartz-feldspar sandstone, with a mica content of up to 2%, in places calcareous, thinly to thickly bedded and moderately fractured, with interbedded mudstone ($M4_1$); hard conglomerate and carbonaceous material in places, large calcareous concretions are also present locally; moderately hard to hard. Weathered to soft, brown silty clay to depths of 10 m.

$S5_3$ Laminated sandstone: blue-grey feldspathic sandstone with a mica content of up to 5%, thinly bedded and moderately fractured, with some thin carbonaceous beds, limestone and calcareous concretions in places; hard. Weathered to soft brown silty clay to depths of 20 m.

$SG5$ Interbedded sandstone and conglomerate: light grey sandstone, thinly to thickly interbedded with gravel sized angular to rounded fragments of basalt and dolerite: moderately to widely fractured; moderately hard to hard. Weathered to soft brown clay to depths of 10 m.

$SM6$ Interbedded sandstone and mudstone (greywacke and argillite): blue-grey quartz-feldspar greywacke sandstone, thinly to thickly interbedded with dark grey argillite mudstone, with minor chert, quartzite and volcanic (spilite) beds (outcrops of chert or quartzite are marked on the map Q): closely fractured and quartz veined, and locally very siliceous; hard to very hard. Weathered to soft, brown sandy clay with harder cores to depths of 30 m.

IGNEOUS ROCK TYPES

VOLCANIC BRECCIA

$B1$ Scoria: cones and mantles on lava flows, consisting of moderately soft to moderately hard, coarse to very coarse fragments of vesicular, very fine to fine grained crystalline basalt. Unconsolidated and unweathered.

Bb_2 Basalt and dolerite breccia: coarse angular fragments of very fine to medium grained crystalline basalt and dolerite, in a matrix of medium grained tuff, with minor blocks of sandstone ($S5_2$), mudstone ($M4_2$) and limestone ($L5_4$) in places, closely to widely fractured; moderately hard to hard. Weathered to soft clay with moderately soft fragments to depths of 20m.

Sx Rhyolitic tuff: cream, very fine to fine grained rhyolite tuff, thickly bedded and widely fractured; moderately soft. Weathered and hydrothermally altered to whitish clay to depths of 10 m.

EXTRUSIVE ROCK

Eb_2 Basalt flows: scoriac flows and cones of glassy and very fine to medium grained crystalline basalt, dense or vesicular, interbedded with scoria ($B1$) in places; moderately fractured; hard to very hard. Weathered to soft brown rubbly clay to depths of 10 m.

Eb_3 Basalt flows: flows and cones of glassy and very fine to medium grained crystalline basalt, dense and moderately fractured; hard to very hard. Weathered to soft brown clay to depths of 20 m.

Ea_4 Andesite: flows of very fine to medium grained crystalline andesite; moderately fractured; hard to very hard. Weathered to soft brown clay to depths of 20 m.

Eb_4 Basalt and dolerite: very fine to medium grained crystalline basalt and dolerite; rare blocks of $M4_2$, $S5_2$ and $L5_4$ in places; closely to widely fractured with some curved jointing; hard to very hard. Weathered to soft brown clay to depths of 30 m.

Eb_5 Basalt: massive flows of very fine to medium grained, crystalline, basalt, in places thickly interbedded with minor beds of tuff, scoria and breccia; moderately to widely fractured; hard to very hard. Weathered to soft reddish brown clay to depths of 30 m.

INTRUSIVE ROCK

Diorite and gabbro: bodies and dikes of medium to coarse grained crystalline diorite and gabbro: widely fractured; moderately hard to very hard. Weathered to soft clay to depths of 20 m.

Serpentinite: bodies of greenish, very fine to medium grained serpentine (magnesium content up to 40%) commonly very closely fractured; moderately hard. Weathered to soft clay to depths of 20 m.
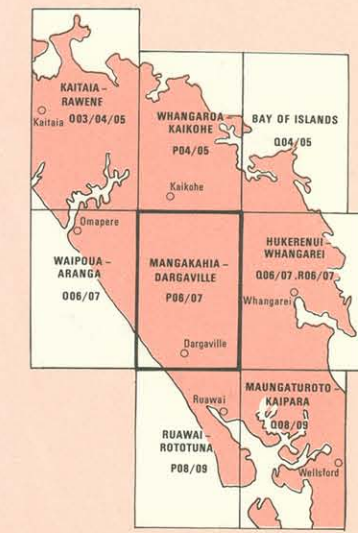
MAN MADE LAND

RZ Man made land: a variety of natural and processed material, forming reclaimed and filled land, particularly stopbanks along the Wairoa River.

RELIABILITY

This is a small scale map, therefore rock type units and their boundaries are generalised. The data and its compilation are, in any mapped area, variable in quantity and quality, in relation to the range of lithologies encountered, and their clarity of topographic expression. Small, significant areas have been understated.

No general field checking of original data or boundaries has been carried out.

NOTE: 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 investigations are required.

SYMBOLS

- Rock type boundary - known
- Rock type boundary - uncertain

$*Mg_1$ Sample site or mineral with chemical symbol (N.B. Q = quartzite or chert)

⚒ Quarry or pit (closed)   Quarried material indicated e.g.
> Quarry or pit (operating)   Oxidlike Limestone
× Underground mine (mined material indicated e.g. Silver)
⚬ Spring (mineral composition indicated when known e.g. Soda)
Water bore (with sample pumping rate in litres per second (l/s), and date when known)

NEW ZEALAND LAND INVENTORY

SCALE 1 : 100 000

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 1849, 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.

SHEET INDEX

AREAL SCALE
500 hectares divided into units of 25 hectares

REFERENCE

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

Area covered by "Rock Type" maps.

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

*TERM	NUMBER & PATTERN	*DIAGNOSTIC FEATURE	+GUIDE TO EXCAVATION METHODS
Very Hard		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 reduced.	Can be dug by hand.

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

+Structures 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.

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

COMPILATION METHODS

This map was compiled by G.S. Markham, N.Z. Geological Survey, Otara. All available lithological information was first plotted on to a topographic base map (scale 1:63 360). Rock type map unit boundaries were delineated by use of a topographic base map plus by stereoscopic air photo interpretation of landform patterns (air photo scales 1:15 840 and 1:16 700).

The main data sources were field records of R.F. Hay (1946–63: field sheet scale 1:15 840), H.T. Ferrar (1921–25: field sheet scale 1:15,840) and B.N. Thompson and D. Kear (1959–60: field sheet scale 1:63,360). Publications, theses in geology and unpublished N.Z.G.S reports were also referred to (see references).

*Now at Joint Centre for Environmental Sciences, Canterbury University, Christchurch.

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NOTE: Descriptive text, references and definition of descriptive terms are shown on the reverse side of this map.