

INTRODUCTION

Rock type 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. The range of depths of the weathered mantle is also given. (See 'Definition of descriptive terms').

SEDIMENTARY ROCK TYPES

ALLUVIUM

Undifferentiated intertidal deposits: mud, sand, gravel and shell; unconsolidated.

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

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

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

PEAT

Peat: dark brown, fibrous carbonaceous deposits, usually less than 5m thick; unconsolidated.

CONGLOMERATE

Conglomerate: angular to rounded, gravel to cobble sized, greywacke fragments in a matrix of calcareous mudstone or sandstone, medium to thickly bedded; includes minor crystalline limestone (LS<sub>1</sub>) and greenand (GS<sub>1</sub>); moderately hard to hard. Weathered to moderately soft fragments in a slightly calcareous matrix to depths of 10m.

LIMESTONE

Crystalline Limestone: medium grained crystalline calcium carbonate containing some sand grains, with minor greenand (GS<sub>1</sub>); thin to medium bedded and widely fractured; moderately hard to hard. Weathered to brown clay soil to depths of 2m.

Muddy Limestone: grey, 50-75% calcium carbonate, closely fractured, in places interbedded with minor greenand and mudstone (MS<sub>1</sub>); moderately hard to hard. Weathered to brown, very soft slightly calcareous clay to depths of 2m.

MUD AND MUDSTONE

Mudstone: grey, brown and green, thinly bedded and closely fractured, in places calcareous or siliceous; minor muddy limestone (LS<sub>2</sub>) and greenand (GS<sub>1</sub>); moderately soft to moderately hard. Weathered to soft clay to depths of 10m. Unstable in places.

Mudstone with Blocks: matrix of closely fractured mudstone containing variably sized (cm-km) blocks of calcareous, non-calcareous or siliceous lithologies (MS<sub>1</sub>, MS<sub>2</sub>, LS<sub>2</sub>, GS<sub>1</sub>, GS<sub>2</sub>); moderately soft. Weathered to soft clay to depths of 10m, with weathering of blocks as given in descriptions. Unstable in places, even on gentle slopes.

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

Mudstone with Sandstone: blue-grey, medium to thickly bedded and moderately fractured mudstone, medium to thickly interbedded with fine sandstone in places; both lithologies calcareous in places; moderately soft to moderately hard. Weathered to soft sandy clay to depths of 10m.

Siliceous Mudstone: dark grey and closely fractured with a silica content of up to 80%; moderately hard to hard. Weathered to light grey soft clay containing harder cones to depths of 10m.

SAND AND SANDSTONE

Sand: feldspathic, with quartz and minor shell fragments, forming intertidal and beach deposits; unconsolidated.

Sand: feldspathic with some quartz, forming active dunes; unconsolidated and unweathered.

Sand: feldspathic with some quartz, minor dark minerals and clay, forming fixed dunes; minor swamp deposits; unconsolidated to very soft. Unweathered or weathered to brown-stained, very soft clayey sand to depths of 5m.

Glaucous Sandstone (Greenand): 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 10m.

Calcareous Sandstone: grey quartz-feldspar sandstone with a calcium carbonate content up to 20%, thickly bedded and moderately fractured with minor interbedded grey mudstone; moderately hard. Weathered to soft, brown, non-calcareous silty clay to depths of 10m.

Micaceous Sandstone: blue-grey quartz-feldspar sandstone, with a mica content of up to 5%, in places calcareous; thinly to thickly bedded and moderately widely fractured, with minor interbedded mudstone (MS<sub>1</sub>), hard conglomerate and carbonaceous material in places, and large calcareous concretions locally; moderately hard to hard. Weathered to soft brown silty clay to depths of 10m.

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

IGNEOUS ROCK TYPES

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.

Andesite Breccia: coarse to very coarse angular fragments of fine to medium grained crystalline andesite in a matrix of medium grained tuff, interbedded with minor lava flows (FS<sub>1</sub>); widely fractured; moderately hard to hard. Weathered to soft clay with moderately soft fragments to depths of 10m.

Basalt and Dolomite Breccia: coarse angular fragments of very fine to medium grained crystalline basalt and dolomite, in a matrix of medium grained tuff, with minor blocks of sandstone (SS<sub>1</sub>), mudstone (MS<sub>1</sub>) and limestone (LS<sub>1</sub>) in places; widely fractured; moderately hard to hard. Weathered to soft clay with moderately soft fragments to depths of 20m.

EXTRUSIVE ROCK

Rhyolite and Dacite: flows and domes of glassy and very fine to medium grained crystalline rhyolite and dacite; moderately fractured; moderately hard to very hard. Weathered and hydrothermally altered to soft white or brown halloysitic clay to depths of 30m.

Basalt with Scoria: flows and cones of glassy and very fine to medium grained crystalline basalt, dense or vesicular, interbedded with scoria (B<sub>1</sub>) in places, moderately fractured; hard to very hard. Weathered to soft brown clay to depths of 10m.

Basalt: flows, cones, plugs, and dikes 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 20m.

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

Basalt and Dolomite: very fine to medium grained crystalline basalt and dolomite, with minor blocks of (SS<sub>1</sub>), (MS<sub>1</sub>) and (LS<sub>1</sub>) in places; moderately fractured with curved joints; hard to very hard. Weathered to soft clay to depths of 30m.

INTRUSIVE ROCK

Granodiorite and Gabbro Intrusions: bodies of medium grained crystalline granodiorite and gabbro, widely fractured; moderately hard to very hard. Weathered to soft clay to depths of 20m.

MAN MADE LAND

Man Made Land: a variety of natural and processed materials, forming reclaimed and filled land.

SYMBOLS

- Rock type boundary - known
- Rock type boundary - uncertain
- Sample site or mineral outcrop with chemical symbol (N.B. Q = quartzite or chert)
- Quarry or pit (closed)
- Quarried material indicated e.g. Crystalline Limestone
- Quarry or pit (operating)
- 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)

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

SHEET INDEX

NEW ZEALAND LAND INVENTORY

SCALE 1 : 100 000

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

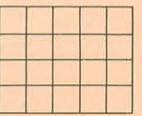


REFERENCE

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

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.



Compiled by G.S. Markham, New Zealand Geological Survey, Department of Scientific and Industrial Research.



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RELIABILITY

This is a small scale map, therefore rock type units and their boundaries are generalised. The data used in this compilation are, in many mapped areas, variable in quality and quantity, in relation to the range of lithologies encountered, and the quality of topographic expression. No general field checking of original data or boundaries has been carried out. Small significant areas have been exaggerated.

For more detailed information on selected areas write to:

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.

DEFINITION OF DESCRIPTIVE TERMS

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

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

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

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

COMPILATION METHODS

This map was compiled by G.S. Markham, N.Z. Geological Survey, DSIR. All available lithologic information present in the map was plotted onto a topographic base map (scale 1:63 360). Rock type map unit boundaries were delineated by use of the lithologic information supplemented by stereoscopic or photo interpretation of landform patterns (see photo scale 1:15 840). The main data sources were field records of H.T. Ferris (1919-25; field sheet scale 1:15 840) and B.N. Thompson and D. Kear (1959-60; field sheet scale 1:63 360). Publications, these 1:15 840 and unpublished NZGS reports were also referred to (see references).