



### 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).

### SEDIMENTARY ROCK TYPES

A1<sub>1</sub>

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

A2<sub>1</sub>

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.

A2<sub>2</sub>

Alluvium: mud, sand and gravel with minor peat forming terrace deposits 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 terrace deposits 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.

GS<sub>1</sub>

CONGLOMERATE  
Conglomerate: gravel to boulder size angular to rounded fragments of basalt and andesite in a poorly sorted matrix, thickly bedded; moderately hard to hard. Weathered to moderately soft fragments in a soft brown silty clay to depths of 10 m.

LS<sub>1</sub>

LIMESTONE  
Crystalline limestone: medium grained crystalline calcium carbonate containing some sand grains, with minor greensand (S4<sub>1</sub>); thinly to medium bedded and widely fractured; moderately hard to hard. Weathered to brown clay to depths of 2 m.

LS<sub>2</sub>

Muddy limestone: grey, 50–75% calcium carbonate, closely fractured, in places interbedded with minor greensand and mudstone (M4<sub>1</sub>); moderately hard to hard. Weathered to brown very soft slightly calcareous clay to depths of 2 m.

M1

MUD AND MUDSTONE  
Intertidal mud: minor sand, unconsolidated.

M4<sub>1</sub>

Mudstone: grey, brown and green, thinly bedded and closely fractured, locally calcareous or siliceous, with minor muddy limestone (LS<sub>1</sub>) and greensand (S4<sub>1</sub>); moderately soft to moderately hard. Weathered to soft clay to depths of 10 m, unstable in places.

M4<sub>2</sub>

Mudstone with blocks: matrix of closely fractured mudstone containing variably sized (cm – km) blocks of calcareous, non-calcareous or siliceous lithologies (LS<sub>1</sub>, M4<sub>1</sub>, M5<sub>1</sub>, LS<sub>2</sub>, S4<sub>1</sub>, S4<sub>2</sub>, US<sub>1</sub>); matrix moderately soft, blocks of variable hardness. Weathered to soft clay to depths of 10 m, with weathering of blocks as given in individual descriptions; may be unstable, even on gentle slopes.

M4<sub>3</sub>

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<sub>4</sub>

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

M4<sub>5</sub>

Mudstone with chert: brown, calcareous mudstone, medium to thickly bedded and moderately fractured, with beds of grey and green chert; in places thinly interbedded with sandstone; moderately soft, chert beds hard. Weathered to soft clay to depths of 10 m.

MS

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.

MS4

Interbedded mudstone and sandstone: grey mudstone, thinly to medium interbedded with grey quartz-feldspar sandstone, moderately to widely fractured; both lithologies moderately soft to moderately hard. Weathered to soft, brown silty clay to depths of 20 m.

S1

SAND AND SANDSTONE  
Sand: quartzose with feldspar and minor shell fragments, forming intertidal and beach deposits; unconsolidated.

S2

Sand: quartzose, with some feldspar, forming active dunes; unconsolidated and unweathered.

S3

Sand: quartzose, with some feldspar, minor dark minerals 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.

S4

Sand: quartzose, with some feldspar, limonite cementation in places, forming damp intertidal areas, with minor swamp deposits; unconsolidated to very soft. Unweathered.

S4<sub>1</sub>

Clayey sand: quartzose, highly quartzose at Okahukura Peninsula and Girit, some feldspar and a clay content of up to 15%, forming high, dissected fixed dunes, very soft. Weathered to grey or brown stained, very soft clayey sand to depths of 5 m.

S4<sub>2</sub>

Glaucous 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<sub>1</sub>

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 10 m.

S5<sub>2</sub>

Micaceous sandstone: blue-grey, quartz-feldspar sandstone, with a mica content of up to 5%, in places calcareous, thinly to thickly bedded and moderately fractured, with minor interbedded mudstone (M4<sub>1</sub>); hard conglomerate and carbonaceous material in places, large calcareous concretions are present locally; moderately hard to hard. Weathered to soft, brown silty clay to depths of 10 m.

SM4<sub>1</sub>

Interbedded sandstone and mudstone: grey quartz-feldspar sandstone, thinly to thickly interbedded with grey mudstone, moderately to widely fractured and rare beds of medium to coarse grained volcanic breccia; moderately soft to moderately hard. Weathered to soft, yellowish brown silty clay to depths of 20 m.

SM5<sub>1</sub>

Interbedded sandstone and mudstone: grey-brown volcanic sandstone, thinly to thickly interbedded with volcanic mudstone, moderately to widely fractured, with minor beds of coarse grained tuff and basalt flows locally; moderately soft to moderately hard. Weathered to soft brown silty clay to depths of 20 m.

SM5<sub>2</sub>

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 (spilitic) beds (outcrops of chert or quartzite are marked on the map by 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.

US

IGNEOUS ROCK TYPES  
Breccia and tuff: breccia of medium to coarse grained, angular to sub-rounded fragments of very fine to medium grained crystalline andesite and basalt, in a poorly sorted, tuffaceous matrix, in places thickly interbedded with fine to medium grained tuff, moderately to widely fractured; breccia hard to very hard, tuff moderately hard. Weathered to soft reddish clay to depths of 20 m.

US<sub>1</sub>

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 30 m.

US<sub>2</sub>

Andesite, basalt and sandstone: flows of very fine to medium grained crystalline andesite and basalt and beds of fine to coarse grained tuff, thickly interbedded with volcanic sandstone and minor volcanic conglomerate, with minor limestone and lignite beds locally; lava flows hard to very hard, sandstone and tuff moderately hard. Weathered to soft reddish sandy or silty clay to depths of 20 m.

US<sub>3</sub>

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 20 m.

US<sub>4</sub>

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.

US<sub>5</sub>

Basalt and dolerite: very fine to medium grained crystalline basalt and dolerite, moderately fractured with some curved jointing; hard to very hard. Weathered to soft clay to depths of 30 m.

US<sub>6</sub>

INTRUSIVE ROCK  
Serpentine: bodies of greenish, very fine to medium grained serpentine (magnesian content up to 40%), commonly very closely fractured; moderately hard. Weathered to reddish clay to depths of 10 m.

US<sub>7</sub>

MAN MADE LAND  
Man made land: a variety of natural and processed material, forming reclaimed and filled land.

### 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 3 mm 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 excavator 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.  
‡Units such as gravel or scoria are unconsolidated as a mass but consist of fragments with individual hardnesses of up to 7.

### NEW ZEALAND LAND INVENTORY

SCALE 1 : 100 000

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

#### REFERENCE

WHANGAREI

Towns

Settlements

Homesteads

State highways

Other roads

Tracks

Railways

Rivers and streams

Trig stations

Vinyls (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.

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

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HEIGHTS ARE IN METRES ABOVE MEAN SEA LEVEL

AREAL SCALE  
500 hectares divided into units of 25 hectares

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.

### DEFINITION OF DESCRIPTIVE TERMS

GRAIN SIZE	CRYSTALLINE ROCK	UNCONSOLIDATED SEDIMENT	CONSOLIDATED SEDIMENT	FRAGMENTAL VOLCANIC DEBRIS
SIZE	glassy less than 2 microns 2 to 60 microns 60 microns to 2mm 2 to 60mm more than 60mm	clay silt mud sand gravel cobble and boulders	claystone siltstone sandstone conglomerate breccia (angular)	mudstone tuff volcanic breccia
BEDDING	The following terms denote bedding thickness ranges: thinly bedded medium bedded thickly bedded	less than 200mm 200–600mm more than 600mm		
FRACTURING	The following terms denote fracture spacing ranges: closely fractured moderately fractured widely fractured	less than 20mm 20–200mm more than 200mm		

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

COMPILATION METHODS  
This map was compiled by G.S. Markham and T.F. Crippen, N.Z. Geological Survey, Otago. All available lithologic information was first plotted onto a topographic base map (NZMS 1, scale 1:63 360). Rock type unit boundaries were delineated by use of the lithologic information supplemented 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 H.T. Ferrar (1921–25, field sheet scale 1:15 840), and B.N. Thompson and D. Kea (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).  
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RELIABILITY  
This is a small scale map, therefore rock type units and their boundaries are generalized. The data used in this compilation are, in any mapped area, variable in quality and quantity, in relation to the range of lithologies encountered, and their clarity of topographic expression. Small significant areas have been exaggerated.  
No general field checking of original data or boundaries has been carried out.  
For more detailed information on selected areas write to:  
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### SHEET INDEX

Area covered by "Rock Type" maps.

COMPILATION NOTE: The base map is compiled from the NZMS 1 series (1:63360) dated: 1968, 69, 71, 72, 73, 74.

EDITION 1 1981

NZMS 290 SHEET Q08/09

ROCK TYPES