



INTRODUCTION

Rock types maps are intended to help planners and land users to:

- identify the characteristics of near surface rock types;
- recognise areas of existing and potential mineral resources;
- 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 a 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 depth of the weathered mantle is also given. (See 'Definition of Descriptive Terms')

SEDIMENTARY ROCK TYPES

- A1₁** ALLUVIUM
Undifferentiated intertidal deposits: mud, sand (usually fine), gravel and shell, unconsolidated.
- A1₂** Alluvium: mainly sand and mud with some gravel and peat, forming river bed, flood plain and intertidal deposits up to 20 m thick; unconsolidated to very soft, unweathered.
- A1₃** Alluvium: mainly sand and mud with some gravel, forming terrace deposits up to 10 m above stream level and as much as 30 m thick; unconsolidated to very soft. Moderately to slightly weathered to very soft clay to depths of 2 m.
- A2₁** Alluvium: mainly sand, mud and gravel with iron oxide pans in places, some carbonaceous sandstone and lignite beds, forming terrace deposits 10 to 150 m above stream or sea level; very soft to moderately soft. Weathered to brown very soft clay (with some rock fragments) to depths of 10 m.
- A2₂** Alluvium: mud, sand and gravel with iron oxide pans in places, forming terrace surfaces more than 150 m above sea level; very soft to moderately soft. Weathered to multi-coloured clay (with some rock fragments) to depths of 10 m.
- C1** PEAT
Peat: dark brown, fibrous, carbonaceous deposits, some mud and sand, usually less than 4 m thick but some as much as 11 m thick; very soft to soft.
- GS₁** CONGLOMERATE
Conglomerate: gravel to cobble size rounded fragments of andesite in a hard muddy matrix, thickly bedded; moderately hard to hard. Weathered to soft sand-sized fragments in a soft brown silty clay to depths of 10 m.
- GS₂** Conglomerate: fine to medium gravel size pebbles of mixed rock types with interbedded coarse sandstone, up to about 200 m thick, with some minor carbonaceous and laminated sandstone; moderately hard to hard. Weathered to soft, sand-sized fragments in a soft brown silty clay to depths of 10 m.
- L3** LIMESTONE
Shelly limestone: shells weakly cemented with calcite, iron stained; soft. Partially weathered to sand and shell.
- LS₂** Muddy limestone: grey, 50–75% calcium carbonate, closely fractured, in places interbedded with minor greensand and mudstone; moderately hard to hard. Weathered to brown very soft slightly calcareous clay to depths of 1 m.
- MS₁** MUDSTONE
Siliceous mudstone: dark grey, thinly bedded 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.
- MS₂** Mudstone: blue-grey, slightly sandy, non-bedded, up to about 20 m thick, fossiliferous; moderately hard to hard. Weathered to light grey-brown, soft clay to 10 m.
- S1₁** SAND AND SANDSTONE
Sand: quartz, with feldspar and minor shell fragments, forming intertidal and beach deposits; unconsolidated.
- S1₂** Sand: quartz, with minor feldspar; forming moving and partially fixed dunes; unconsolidated and unweathered.
- S1₃** Sand: quartz, with minor feldspar and clay, forming fixed dunes; unconsolidated to very soft. Unweathered or weathered to brown-stained, very soft clayey sand to depths of 2 m.
- S1₄** Sand: mostly quartz and feldspar forming low dunes interspersed with low lying flat areas at water table level (Coastal Deflation Zone); unconsolidated to very soft. Unweathered.
- SMS₁** Interbedded sandstone and mudstone: grey quartz-feldspar sandstone, thinly to thickly interbedded with grey mudstone, some calcareous beds and minor conglomerates; rare basal beds of medium to coarse grained calcareous breccia; moderately hard. Weathered to soft, brown silty clay to depths of 10 m.
- SMS₂** Interbedded sandstone and mudstone (greywacke and argillite): blue-grey, quartz-feldspar greywacke sandstone, thinly to thickly interbedded with dark grey argillite mudstone, closely fractured and quartz veined; and minor lenses of chert and quartzite; both lithologies hard to very hard. Weathered to soft brown sandy clay with harder cores to depths of 30 m.

IGNEOUS ROCK TYPES

- IR₁** INTRUSIVE ROCK
Diorite and gabbro: fine to medium grained crystalline diorite and gabbro, widely fractured; hard to very hard. Weathered to brown soft clay (laterite) to depths of 20 m.
- IR₂** Granite and diorite: medium to coarse grained crystalline granite, tonalite and diorite intruding thinly bedded mudstone and sandstone, locally interbedded with keratophyre and dacite; closely to widely fractured; hard to very hard. Weathered or hydrothermally altered to soft clay to depths of 10 m.
- IR₃** Serpentine: green-grey, very fine to medium grained crystalline serpentinite (magnesium rich), commonly sheared and polished; moderately hard. Weathered to reddish clay to depths of 5 m.
- ER₁** EXTRUSIVE ROCK
Basalt and dolerite: flows (commonly pillow form) of fine to medium grained crystalline basalt and dolerite with minor mudstone, intruded by numerous medium-grained dikes, closely to moderately fractured; hard to very hard. Altered and weathered to soft brown clay to depths of 30 m.
- ER₂** Keratophyre and spilitic: flows (commonly pillow form) of fine grained keratophyre and spilitic, with minor sandstone, intruded by very fine grained granophyre and medium grained dolerite, moderately fractured; hard to very hard. Altered and weathered to soft brown clay to depths of 30 m.

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

COMPILATION METHODS

This map was compiled by D. R. Petty, NZ Geological Survey, from existing information. Alluvial areas and distinctive land forms were determined from aerial photos (scale 1:15 840), and rock type boundaries and descriptive materials data were derived from maps and manuscripts by Bennett (1976), Hay (1981, in prep.), Letch (1970), N.Z. Mines Department (1965–77), Petty (1974, 1975, 1978), Schofield & Woolhouse (1970) and Smith (1978). Additional data have been included from various unpublished reports filed at the Otago District Office, N.Z. Geological Survey, and these in geology.

Refer to this map as:
 Petty, D.R. 1982: "North Cape-Houhora"
 NZMS 290 Sheet NO2/03 Part Sheet M02,
 1:50000, New Zealand Land Inventory, Rock Types,
 Department of Lands and Survey, Wellington, New Zealand.

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, 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. No general field checking of original data or boundaries has been done. Small significant areas have been exaggerated.

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

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

SHEET INDEX



COMPILATION NOTE:—The base map is compiled from the NZMS 1 series (1:63360) dated 1967, 70, 71

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.

NEW ZEALAND LAND INVENTORY

SCALE 1 : 100 000

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

REFERENCE

WHANGAREI Cities
 KAIOHŌ Towns
 HUSBARA 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
 Rocks

AREAL SCALE
 500 hectares divided into units of 25 hectares

Compiled by D.R. Petty, New Zealand Geological Survey, Department of Scientific and Industrial Research.
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