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Geotechnical investigation and testing — Identification and classification of rock —

Part 1: Identification and description

Recherches et essais géotechniques — Dénomination et classification des roches —

Partie 1: Dénomination et description

Reference number
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Foreword

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ISO 14689-1 was prepared by Technical Committee ISO/TC 182, *Geotechnics*, Subcommittee SC 1, *Geotechnical investigation and testing*.

ISO 14689 consists of the following parts, under the general title *Geotechnical investigation and testing — Identification and classification of rock*:

— *Part 1: Identification and description*

— *Part 2: Electronic exchange of data on identification and description of rock.*

Introduction

This part of ISO 14689 covers areas in the international field that were never previously standardized. It is intended that this document presents broad good practice throughout the world and significant differences with national documents are not anticipated. A more detailed description of rock and related to the site and project is likely to be appropriate.

This document is based on international practice (see the Bibliography).

Geotechnical investigation and testing — Identification and classification of rock —

Part 1: Identification and description

1 Scope

This part of ISO 14689 relates to the identification and description of rock material and mass on the basis of mineralogical composition, genetic aspects, structure, grain size, discontinuities and other parameters. It also provides rules for the description of other characteristics as well as for their designation.

This part of ISO 14689 applies to the description of rock for geotechnics and engineering geology in civil engineering. The description is carried out on cores and other samples of natural rock and on rock masses.

Rock mass classification systems using one or more descriptive parameters to suggest likely rock mass behaviour are beyond the scope of this part of ISO 14689 (see Bibliography).

Identification and classification of soil for engineering purposes is covered in ISO 14688-1 and ISO 14688-2.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 710-1, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 1: General rules of representation*

ISO 710-2, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 2: Representation of sedimentary rocks*

ISO 710-3, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 3: Representation of magmatic rocks*

ISO 710-4, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 4: Representation of metamorphic rocks*

ISO 710-5, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 5: Representation of minerals*

ISO 710-6, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 6: Representation of contact rocks and rocks which have undergone metasomatic, pneumatolytic or hydrothermal transformation or transformation by weathering*

ISO 710-7, *Graphical symbols for use on detailed maps, plans and geological cross-sections — Part 7: Tectonic symbols*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE Additional terms and definitions are given in EN 12670.

3.1
rock
a naturally occurring assemblage of minerals, consolidated, cemented, or otherwise bonded together, so as to form material of generally greater strength or stiffness than soils

3.2
rock mass
the rock together with its discontinuities and weathering profile

3.3
rock material
the rock within the framework of the discontinuities

3.4
rock type
a name in relation to a defined petrological composition, predominant grain size and genetic origin, including relevant structure and texture

NOTE Common examples are given in Table A.1.

3.5
matrix
fine grained, glassy or amorphous groundmass of a rock containing larger mineral grains or rock particles

3.6
texture
size, shape and arrangement of the grains for sedimentary rocks and crystals for igneous and metamorphic rocks

3.7
fabric
spatial arrangement of the constituents (grains) in the rock

NOTE In sedimentary rocks, fabric is the orientation (or lack of it) in space of the elements (discrete particles, crystals, cement) comprising the rock. The term is used in igneous and other crystalline rocks for the patterns produced by non-uniform arrangements of grains, crystals and matrix.

3.8
foliation
planar arrangements of components like minerals in any type of rock, especially the planar structure that results from flattening, segregation and other processes undergone by the grains in a metamorphic rock

3.9
discontinuity
surface which breaks the rock material continuity within the rock mass and that is open or may become open under the stress applied by the engineering work

EXAMPLES Bedding plane, joint, fissure, cleavage and fault in rock mass.

3.10
structure
pattern of discontinuities in rock masses, which subdivide the mass into individual rock blocks

4 Identification and description of rock

4.1 Rock identification

The identification of rocks is based on the determination of the following:

a) genetic group:

- sedimentary: clastic, chemical, organic;
- metamorphic;
- igneous: plutonic, volcanic;

b) structure:

- bedded, foliated or massive (without sharp genetic discontinuities);

c) grain size:

- descriptive terms (for various sizes) are given in Table A.1 in correlation to rock types;

d) mineralogical composition:

- quartz, feldspars and related silicate minerals;
- dark coloured minerals (e.g. biotite, amphibole, pyroxene);
- clay minerals;
- carbonate minerals (e.g. calcite and dolomite);
- siliceous amorphous material (e.g. glass);
- carbonaceous material (e.g. coal and graphite);
- salts (e.g. halite [rock salt]), gypsum);
- swelling minerals (e.g. anhydrite and clay minerals)
- sulfide minerals (e.g. pyrite);

e) void content:

- primary voids (e.g. gas bubbles in volcanic rocks);
- secondary voids (e.g. solution voids).

NOTE Lithological identification of rock is necessary to appreciate the geology of an area, to correlate geological profiles seen in boreholes or to distinguish boulders from bedrock. It is also important when rock material is required for construction purposes. Engineering properties can only partially be inferred from the identification of rock type.

The names of the more common rock types are given in Table A.1, which presents an aid to rock identification for engineering purposes.

Rock names are given particular combinations of features in this subclause and correct naming requires recognition of the attributes listed. The rock shall be correctly identified within geological science.

Geological maps related to the project shall be used for the designation of rocks.

4.2 Description of rock material

4.2.1 Colour

Rock material colour may be described using Colour Charts of an approved type. As an alternative, the following simple system should be used, which serves to limit the subjectivity of an estimation. One term is selected as required from each column (see Table 1) and combined as a colour assessment.

Examples of use are: yellow, light yellowish brown, dark reddish brown, dark brown, etc. If necessary, colour differences can be emphasised separately by the use of terms such as spotted, dappled, mottled, streaked; for example, light yellowish brown spotted with dark brown.

A colour chart provides a useful aid, particularly to improve the consistency between descriptions by different persons.

Table 1 — Terms for lightness, chroma and hue which may be used in combination for colour description (examples)

Lightness Tertiary descriptor	Chroma Secondary descriptor	Hue Primary descriptor
Light Dark	Pinkish Reddish Yellowish Brownish Greenish Bluish Greyish	Pink Red Yellow Brown Green Blue White Grey Black

4.2.2 Grain size

A descriptive scheme is given in Table A.1. Grain size refers to the average dimension of the predominant mineral or rock fragments comprising the rock material. It is usually sufficient to estimate the size by eye, which may be aided by a hand lens in the assessment of fine-grained or amorphous rocks, but separate descriptions of the grains and the matrix may be appropriate.

4.2.3 Matrix

The particle size and the mineralogical composition of the matrix shall be determined. Mineralogical composition shall be described using the terms given in Table A.1 (siliceous, calcareous, carbonaceous, etc.) but may be amplified, as appropriate, with such standard geological terms as ferruginous, argillaceous (containing clay minerals), quartzose and others.

4.2.4 Weathering and alteration effects

The results of weathering/alteration of rock material are given in Table 2. Any or all of the descriptive terms can be used to describe weathering/alteration

Table 2 — Terms to describe weathering/alteration of rock materials

Term	Description
Fresh	No visible sign of weathering/alteration of the rock material
Discoloured	The colour of the original fresh rock material is changed and is evidence of weathering/alteration. The degree of change from the original colour should be indicated. If the colour change is confined to particular mineral constituents, this should be mentioned.
Disintegrated	The rock material is broken up by physical weathering, so that bonding between grains is lost and the rock is weathered/altered towards the condition of a soil in which the original material fabric is still intact. The rock material is friable but the mineral grains are not decomposed.
Decomposed	The rock material is weathered by the chemical alteration of the mineral grains to the condition of a soil in which the original material fabric is still intact; some or all of the mineral grains are decomposed.

The weathering terms given in Table 2 may be subdivided using qualifying terms, for example "partially discoloured", "wholly discoloured" and "slightly discoloured", as this will aid the description of the material being examined. The last three terms may be used in combination, for example, "wholly discoloured and slightly decomposed".

4.2.5 Carbonate content

The carbonate content is determined by the application of droplets of dilute hydrochloric acid (HCl) (3:1 or 10 %). The following characteristics could be distinguished:

a) **carbonate-free (O)** if the addition of HCl produces no effervescence;

b) **calcareous (+)** if the addition of HCl produces clear, but not sustained, effervescence;

c) **highly calcareous (++)** if the addition of HCl produces strong and sustained effervescence.

It should be noted that, in wet or moist rocks, the effervescence usually occurs with some delay.

4.2.6 Stability of rock material

The degradation of rock material when it is exposed to a new water or atmospheric environment should be assessed where the relevant conditions shall be determined (see Table 3).

Table 3 — Stability of rock material

Term	Description
Stable	No changes
Fairly stable	Specimen surface crumbles, slakes
Unstable	Specimen disintegrates

Its behaviour when exposed to water should be described using the terms in Table 4, together with a description of the test undertaken. Some weak rocks do not show disintegration in water straight away, but only after being dried.

Table 4 — Rock material stability in water

Term	Description (after 24 h in water)	Grade
Stable	No changes	1
Fairly stable	A few fissures are formed, or specimen surface crumbles sligthly	2
	Many fissures are formed and broken into small lumps, or specimen surface crumbles highly	3
Unstable	Specimen disintegrates, or nearly the whole specimen surface crumbles	4
	The whole specimen becomes muddy, or disintegrates into sand	5

4.2.7 Unconfined compressive strength

The unconfined compressive strength of rock material can be estimated according to Table 5.

Table 5 — Field identification of the unconfined compressive strength

Term	Field Identification	Unconfined compressive strength MPa
Extremely weak[a]	Indented by thumbnail	less than 1
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	1 to 5
Weak	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	5 to 25
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	25 to 50
Strong	Specimen requires more than one blow of geological hammer to fracture it	50 to 100
Very strong	Specimen requires many blows of geological hammer to fracture it	100 to 250
Extremely strong	Specimen can only be chipped with geological hammer	greater than 250
[a] Some extremely weak rocks will behave as soils and should be described as soils according to ISO 14688-1.		

NOTE Unconfined compressive strength cannot always be defined in the field, thus point load tests are often used as indices for strength of rock material.

Any report describing compressive strength tests shall mention the specimen size, the test procedure, the anisotropy of the specimen and its water content.

4.3 Rock mass

4.3.1 General

The description of rock mass shall include:

a) types of rocks;

b) structure;

c) discontinuities;

d) weathering;

e) groundwater.

4.3.2 Structure

The structure of the rock mass should be described with relation to the larger scale interrelations of geological features and the associations between rock types in the mass.

Examples of common terms which may be used and which are defined in standard geological practice are as follows (see Table 6).

Table 6 — Examples of terms which may be used in the description of rock mass structure

Sedimentary	Metamorphic	Igneous
Bedded	Cleaved	Massive
Interbedded	Foliated	Flowbanded
Laminated	Schistose	Folded
Folded	Banded	Lineated
Massive	Lineated	
Graded	Gneissose	
	Folded	

4.3.3 Discontinuities

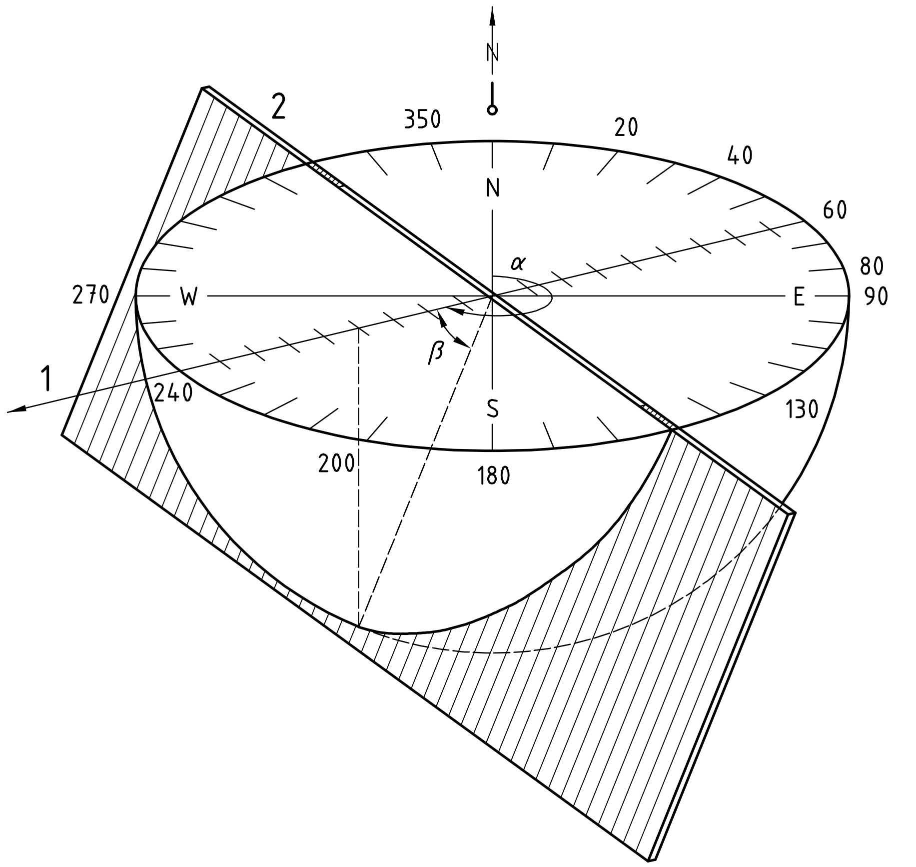
4.3.3.1 Introduction

The tensile or shear strength across or along the surface is lower than that of the intact rock material. They have many modes of origin, for example, bedding planes, joints, shears, faults, cleavages or foliations and may occur locally in sets of relatively uniform characteristics or individually.

In addition to describing the type of discontinuities, their orientations, spacing, persistence, roughness, aperture and filling, and seepage characteristics, the number of sets and the rock block size resulting from their combination should be recorded. It may often be necessary to describe large or important discontinuities individually. Full information on rock mass discontinuities can only be obtained from suitable exposures of the rock mass.

4.3.3.2 Measurement of dip and dip direction

The maximum declination (dip) of the mean plane of the discontinuity is measured with the clinometer, and should be expressed in degrees as a two digit number, e.g. 50 (00 to 90). The azimuth of the dip (dip direction) is measured in degrees counted clockwise from true north, and expressed as a three digit number, e.g. 240 (000 to 360). The dip direction and dip should be recorded in that order, with the three digit and two digit numbers separated by a slash, e.g. 240/50. The pair of numbers represents the dip vector. The relationship between dip, strike and dip direction is given in Figure 1.



Key

1 dip direction

2 strike

α dip direction (dip azimuth) = 240°

β dip (dip angle) = 50°

plane of discontinuity 240/50

Figure 1 — Diagram indicating, dip, dip direction and strike

4.3.3.3 Discontinuity spacing and block shape

The term “spacing” refers to the mean or modal spacing of a set of discontinuities and is the perpendicular distance between adjacent discontinuities. The terms to be used to describe bedding thickness are given in Table 7 and discontinuity spacing in Table 8.

Table 7 — Terms to describe bedding thickness

Term	**Spacing** mm
Very thick	greater than 2 000
Thick	2 000 to 600
Medium	600 to 200
Thin	200 to 60
Very thin	60 to 20
Thickly laminated	20 to 6
Thinly laminated	less than 6

Table 8 — Terms to describe discontinuity spacing

Term	Spacing mm
Very wide	greater than 2 000
Wide	2 000 to 600
Medium	600 to 200
Close	200 to 60
Very close	60 to 20
Extremely close	less than 20

In drilled cores, it is usually difficult to measure the true discontinuity spacing: measurements are commonly made along the core axis. The method of measurement shall be reported.

Discontinuity spacing in three dimensions should be described with reference to the size and shape of rock blocks bounded by the discontinuities. For the rock block size, the following scheme should be used (see Table 9).

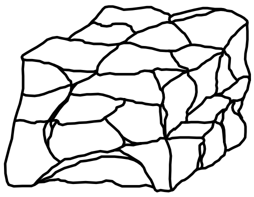
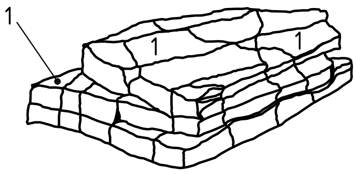
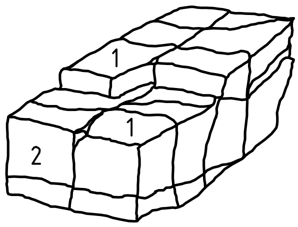
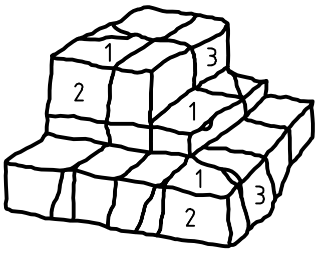
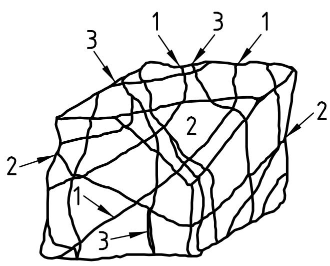
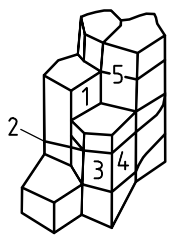
Table 9 — Dimensions of rock blocks

Term	Average length of block sides mm
Very large	greater than 2 000
Large	600 to 2 000
Medium	200 to 600
Small	60 to 200
Very small	less than 60

The rock block shape should be described according to the terms in Table 10.

The rock block shape shall be correlated to the spacing of discontinuities.

Table 10 — Terms to describe the main rock mass structures and block shapes

Term	Figure	Description
a) Polyhedral blocks		Irregular discontinuities without arrangement into distinct sets, and of small persistence.
b) Tabular blocks		One dominant set of parallel discontinuities (1), for example bedding planes, with other non-continuous joints; thickness of blocks much less than length or width.
c) Prismatic blocks		Two dominant sets of discontinuities (1 and 2), approximately orthogonal and parallel, with a third irregular set; thickness of blocks much less than length or width.
d) Equidimensional blocks		Three dominant sets of discontinuities (1, 2 and 3), approximately orthogonal, with occasional irregular joints, giving equidimensional blocks.
e) Rhomboidal blocks		Three (ore more) dominant, mutually oblique, sets of joints (1, 2 and 3), giving oblique-shaped, equidimensional blocks.
f) Columnar blocks		Several, usually more than three, sets of continuous, parallel joints (1, 2, 3, 4, 5) usually crossed by irregular joints; length much greater than other dimensions.

4.3.3.4 Persistence of discontinuities

The linear extent of discontinuities from their inception to their termination in solid rock mass or against other discontinuities has to be measured in metres. The size of the exposure shall be recorded and, if possible and appropriate, measurements should be made in two or preferably three orthogonal directions.

4.3.3.5 Roughness

The surface of discontinuities has to be described on the basis of three scales of observation:

a) small scale (several millimetres) — rough or smooth;

b) medium scale (several centimetres) — planar, stepped or undulating;

c) large scale (several metres) — wavy, curved or straight;

and using terms as indicated in Figure 2. A discontinuity surface could thus be described combining large or medium and small scale terms to give descriptions such as “stepped smooth” or “planar rough”. For total clarity of description, it may be necessary to give wavelength and amplitude measurements of the larger scale features. Note that all “smooth” discontinuities may be slickensided. Slickensides are striations on a discontinuity surface as a consequence of movement and pressure. Slickensided surfaces may be polished and reflect light.

“Slickensided” should only be used with clear evidence of shear displacement along the discontinuity. The vertical and horizontal scales are equal.

	Rough (irregular)	Smooth
Stepped	1 	2 
Undulating	3 	4 
Planar	5	6

Key

1 stepped rough surface

2 stepped smooth surface

3 undulating rough surface

4 undulating smooth surface

5 planar rough surface

6 planar smooth surface

Figure 2 — Terms for discontinuity roughness (not to scale)

4.3.3.6 Aperture

The perpendicular distance between the two surfaces of a discontinuity is referred to as the aperture. The origin of the exposure, such as natural outcrop, artificial excavated surface, etc., shall be reported. The separation has to be described using the terms in Table 11.

Table 11 — Terms for the description of discontinuity aperture

Aperture size term	Aperture
Very tight	less than 0,1 mm
Tight	0,1 to 0,25 mm
Partly open	0,25 to 0,5 mm
Open	0,5 to 2,5 mm
Moderately wide	2,5 to 10 mm
Wide	1 to 10 cm
Very wide	10 to 100 cm
Extremely wide	greater than 1 m

4.3.3.7 Infilling

The infilling material between discontinuity surfaces shall be identified and described (e. g. soil, minerals such as calcite quartz, epidote, chlorite clay gouge or breccia). The shear strength of infilling and the potential for infilling to swell shall be described, when relevant.

4.3.3.8 Seepage

Free moisture or water flow visible at individual spots or from discontinuities should be described using the terms “moisture on rock surface” and “dripping water” respectively. If the rate of flow can be estimated or measured then the rate of flow may be described using the terms given in Table 12.

Table 12 — Terms to describe seepage rates from discontinuities

Descriptive term	Rate of flow
Small	0,05 to 0,5 l/s
Medium	0,5 to 5 l/s
Large	Greater than 5 l/s

4.3.4 Weathering of the rock mass

The weathering of the rock mass should be described in terms of the distribution and relative proportions of fresh rock and discoloured, decomposed or disintegrated rock, and the effects of weathering on discontinuities.

Weathering eventually converts rock to a soil and the weathering profile shall be described in terms of three basic units: rock, rock-and-soil, soil.

To subdivide the different weathering units, a scale with six distinct grades applicable to a profile in rock is given in Table 13.

Table 13 — Scale of weathering stages of rock mass

Term	Description	Grades
Fresh	No visible sign of rock material weathering; perhaps slight discoloration on major discontinuity surfaces.	0
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces.	1
Moderately weathered	Less than half of the rock material is decomposed or disintegrated. Fresh or discoloured rock is present either as a continuous framework or as core stones.	2
Highly weathered	More than half of the rock material is decomposed or disintegrated. Fresh or discoloured rock is present either as a discontinuous framework or as core stones.	3
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.	4
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.	5

Table 13 gives a typical classification which is unlikely to apply to all rock types. More specific local classifications may be available and can be used where they are useful and unambiguous.

In logging cores, the distribution of weathering grades of rock material may be recorded; distribution of weathering grades of the rock mass from which the cores were obtained has to be inferred from this type of evidence.

Distribution of weathering grades in a rock mass may be determined by mapping natural and artificial exposures. It should be borne in mind, however, that isolated natural exposures of rock and excavations of limited extent are not necessarily representative of the whole rock mass.

4.3.5 Rock mass permeability

The rock mass permeability shall be measured by appropriate tests (e.g. pump test, Lugeon test).

5 Report

Symbols according to ISO 710-1 to ISO 710-7 shall be used to represent rocks on borehole legends or on engineering geological maps.

It has to be clearly stated that the descriptions are based on visual and manual identification.

The description of any rock shall at least contain:

— author's name;

— date of description;

— details of origin of collection and handling of samples (see ISO 22475);

— details on data collection in the field;

— identification and description of rock according to this part of ISO 14689;

— key of symbols and terms used.

If investigation results are recorded electronically, data should be transferred using open data transfer systems, such as XML (extensible mark-up language).

Annex A
(informative)

Aid to identification of rock types on the basis of geological features for engineering purposes

The purpose of Table A.1 is to provide the engineer, with limited geological knowledge, a means of assigning a rock a name, which may not be strictly correct geologically, but should place the rock within a rock family and thus aid the identification of engineering problems associated with that family. Rock names are mainly selected from those used in non-specialist geological text books, and are not used strictly but as a general term for a wide group of related rock types.

The rock to be identified is best seen in outcrop or as a large fragment showing broken surfaces. In using Table A.1, the first step is to decide whether the rock is igneous, sedimentary or metamorphic. Igneous and metamorphic rocks are crystalline; crystal surfaces reflect light, some crystals show geometric forms. Usually igneous rocks show no sharp layer boundaries and are massive. Metamorphic rock usually show layering, often bounded by wavy surfaces and are described as “foliated”. Clastic or detrital sedimentary rocks are, mostly composed of mineral grains cemented together and show “bedding planes” marking the boundaries between sediment layers. Pores between grains may be filled with cement or may be open; in which case the rock is porous. Some sedimentary rocks, such as the evaporites and some limestones, may be crystalline. However, the evaporites such as gypsum and rock salt are easily scratched with a fingernail, while the mineral calcite, of which most limestones are formed, can be scratched with a knife and gives off gas bubbles if dilute hydrochloric acid is applied to it. Sedimentary rocks may contain fossils.

Once a rock has been placed into one of the three main categories then predominant grain size will help determine the name. The 63 mm boundary between coarse and very coarse grain size, and the 2 mm boundary between medium and coarse grain size are easily recognized by eye. The grains in rocks of less than 0,063 mm grain size cannot be seen clearly even with the aid of a normal hand lens. Distinctions between igneous rocks are partly based on quartz and feldspar content. Quartz- and feldspar-rich rocks tend to be light in colour while quartz- and feldspar-poor rocks are dark.

Some distinctions are difficult. The names “mudstone” and “shale” in the fine grained clastic sedimentary rocks are used in Table A.1 to distinguish between rocks with bedding planes at more than about 6 mm spacing (mudstone) and less than about 6 mm spacing (shale). Bedding planes in shale may divide the rock into lenticular shaped pieces. Slate is also fine grained but the slate used for roofing has very closely spaced parallel foliation planes. Slate is usually a strong, tough rock. Both shales and slates may give severe engineering problems because they split easily and are very anisotropic.

Table A.1 — Aid to rock identification for engineering purposes

GENETIC GROUP	IGNEOUS — PYRO-CLASTIC*	IGNEOUS — IGNEOUS				SEDIMENTARY — CLASTIC SEDIMENTARY			SEDIMENTARY — CHEMICAL/ ORGANIC	METAMORPHIC		GENETIC GROUP
Usual Structure	MASSIVE	MASSIVE				BEDDED			BEDDED	FOLIATED	MASSIVE	Usual Structure
Composition	At least 50% of grains are of igneous rock	Quartz, feldspars, micas, dark minerals		Feldspars, dark minerals	Dark minerals	Grains of rock, quartz, feldspars and clay minerals		At least 50% of grains are of carbonate	Salts, carbonates, silica, carbonaceous	Quartz, feldspars, micas, dark minerals	Quartz, feldspars, micas, dark minerals, carbonates	Composition
		Acid	Inter-mediate	Basic	Ultrabasic							
Predominant grain size (mm): Very coarse-grained	Rounded grains: **AGGLOMERATE**	**PEGMATITE**	**PEGMATITE**	**PEGMATITE**	**PYROXENITE** **PERIDOTITE**	Rudaceous	Grains are of rock fragments. Rounded grains: **CONGLOMERATE**	**CALCIRUDITE**	Saline rocks **HALITE** **ANHYDRITE** **GYPSUM**	**TECTONIC BRECCIA**	**TECTONIC BRECCIA**	Very coarse-grained
63												63
Coarse-grained	Angular grains: **VOLCANIC BRECCIA**	**GRANITE**	**DIORITE**	**GABBRO**	**PYROXENITE** **PERIDOTITE**	Rudaceous	Angular grains: **BRECCIA**	**CALCIRUDITE**	Saline rocks **HALITE** **ANHYDRITE** **GYPSUM**	**MIGMATITE** **GNEISS**	**HORNFELS** **MARBLE** **GRANULITE** **QUARTZITE**	Coarse-grained
2												2
Medium-grained	**TUFF**	**GRANITE**	**DIORITE**	**DOLERITE**		Arenaceous	Grains are mainly mineral fragments: **SANDSTONE**	**CALCARENITE**	Calcareous rocks LIMESTONE DOLOMITE	**SCHIST**	**AMPHIBOLITE**	Medium-grained
0,063												0,063
Fine-grained	Fine-grained **TUFF**	**RHYOLITE**	**ANDESITE**	**BASALT**		Argillaceous or Lutaceous	**MUDSTONE** **SHALE**: fissile mudstone; **SILTSTONE**: 50% fine-grained particles; **MARLSTONE**	**CALCISILTITE**	Calcareous rocks LIMESTONE DOLOMITE	**PHYLLITE** **SLATE**		Fine-grained
0,002								**CHALK**				0,002
Very fine-grained	Very fine-grained **TUFF**	**RHYOLITE**	**ANDESITE**	**BASALT**		Argillaceous or Lutaceous	**MUDSTONE** **SHALE**: fissile mudstone; **CLAYSTONE**: 50% very fine-grained particles; **MARLSTONE**	**CALCILUTITE**	Siliceous rocks **CHERT** **FLINT**	**MYLONITE**	**MYLONITE**	Very fine-grained
Glassy / Amorphous		**VOLCANIC GLASSES**	**VOLCANIC GLASSES**	**VOLCANIC GLASSES**					Carbonaceous rocks **LIGNITE** **COAL**			Glassy / Amorphous

In the carbonate column, **LIMESTONE** (undifferentiated) spans all grain sizes from very coarse to very fine.

* Pyroclastic rocks are often classified as sedimentary rocks.

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