APPENDIX 1:
ESSENTIAL ANALYSIS TOOLS AND TECHNIQUES FOR FIELD GEOLOGY

FIELD DESCRIPTION OF ROCKS

Field description of rocks is an essential component of geological fieldwork. Geologists must be able to use hand-specimens and outcrop-scale observations to derive a thorough and accurate description of any rock they encounter in the field. Following are some brief outlines to help you remember the steps involved in basic rock description. These are not meant to be comprehensive, but are intended to remind beginning geologists what to look for and what kinds of questions to ask themselves when they are examining rocks in the field.

Sedimentary Rocks

1 General Rock Type (conglomerate, sandstone, shale, mudstone, etc.)
2 Color (fresh and weathered)
3 Texture
  3.1 clastic
    3.1.1 % grains
      • grain size: coarse (> 2 mm), medium (2 - 1/16 mm), fine (< 1/16 mm)
      • sorting (well, moderate, poorly)
      • surface texture (e.g., polished, frosted, etc.)
      • roundness
    3.1.2 carbonate allochems
      • % intraclasts
      • % ooids
      • fossil and fossil fragments (identify when possible)
    3.1.3 % detrital matrix
      • sand or mud?
      • micrite (i.e. microcrystalline calcite mud)
    3.1.4 cement
      • composition
      • degree of cementation
  3.2 crystalline
    3.2.1 sizes: coarse (> 2 mm), medium (2 - 1/16 mm), fine (< 1/16 mm)
    3.2.2 crystal shapes: euhedral, subhedral, anhedral, etc.
4 Mineral Composition
  (%) quartz, feldspar, muscovite, biotite, chert, calcite, dolomite, rock fragments, etc.
5 Sedimentary Structures
  5.1 bedding
  5.2 nodules, concretions, geodes
  5.3 sole marks
7 Rock Name

Igneous Rocks

1. Color (fresh and weathered)
2. Texture
  2.1 aphanitic, phaneritic, glassy, pyroclastic
  2.2 porphyritic or non-porphyritic
  2.3 grain sizes (if large enough to see)
  2.4 fabric

2.4.1 panidiomorphic-, hypidiomorphic-, allotriomorphic-granular
2.4.2 ophitic, diabasic, trachytic, etc.

3 Structures
- 3.1 flow features
- 3.2 gas features
- 3.3 devitrification features
- 3.4 schlieren, augen, orbicules
- 3.5 inclusions (kind, size, shape, quantity)

4 Mineralogy (identify types, colors, shapes, sizes and quantities of each)
- 4.1 essential
- 4.2 varietal
- 4.3 accessory
- 4.4 alteration/secondary
- 4.5 ratio of alkali feldspar to total feldspar

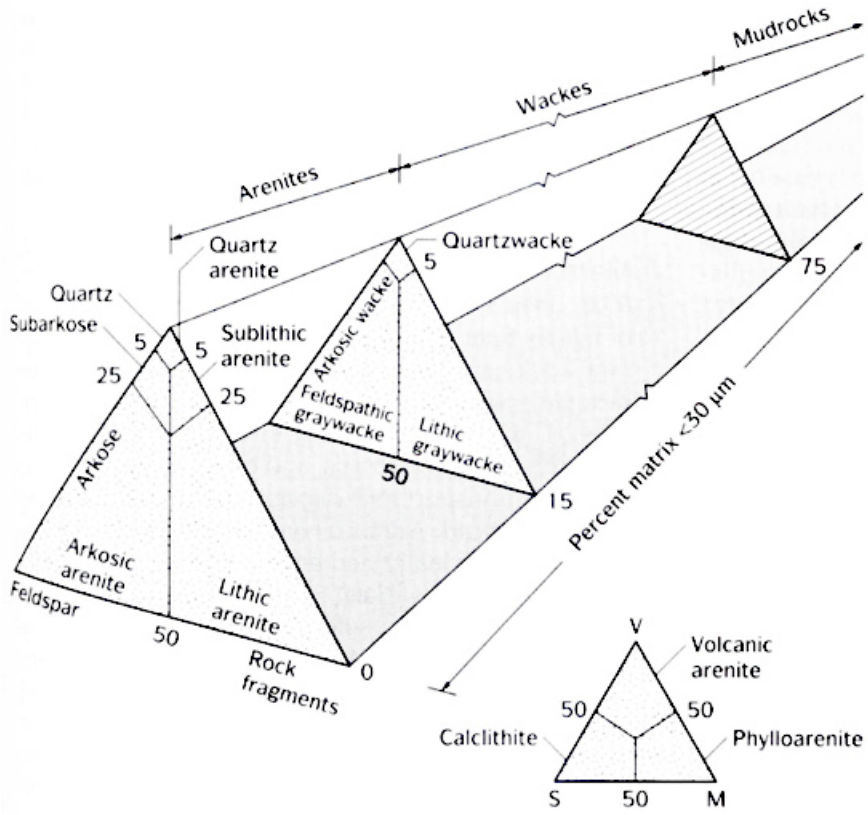
5 Rock Name

Metamorphic Rocks

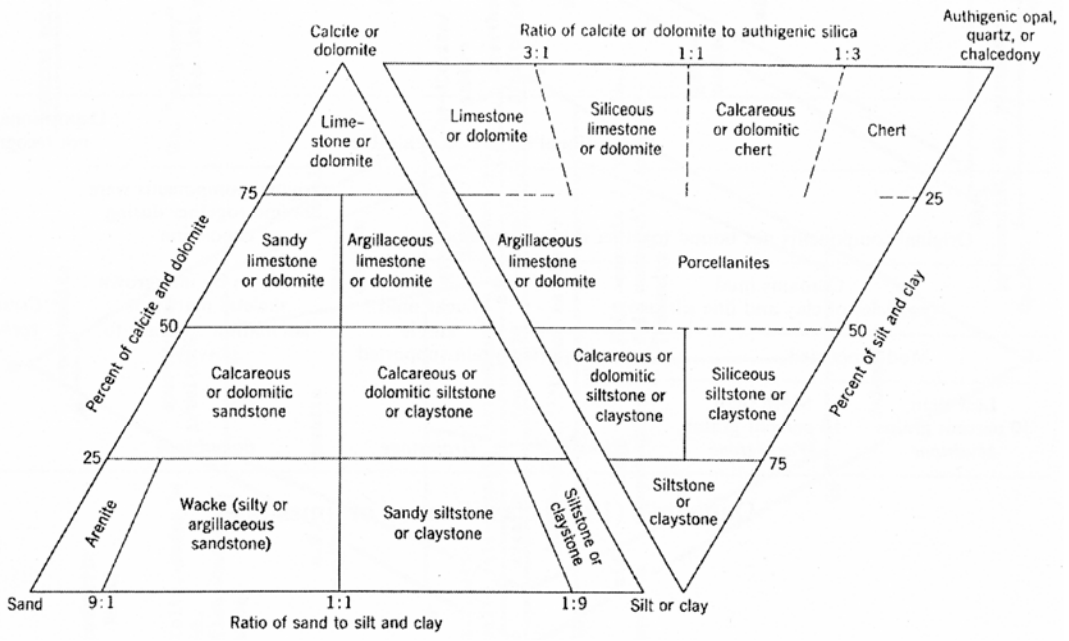
1 Color (fresh and weathered)
2 Type of Metamorphism
3 Texture
- 3.1 foliated
  - 3.1.1 slaty cleavage
  - 3.1.2 phyllitic
  - 3.1.3 schistosity
  - 3.1.4 gneissic banding
- 3.2 non-foliated
  - 3.2.1 granoblastic
  - 3.2.2 hornfelsic
- 3.3 lineated
  - 3.3.1 discrete or constructed?
  - 3.3.2
- 3.4 porphyroblastic (give sizes of matrix grains and porphyroblasts)

4 Mineralogy
- 4.1 mineral types
- 4.2 sizes
- 4.3 shapes
- 4.4 color
- 4.5 quantity

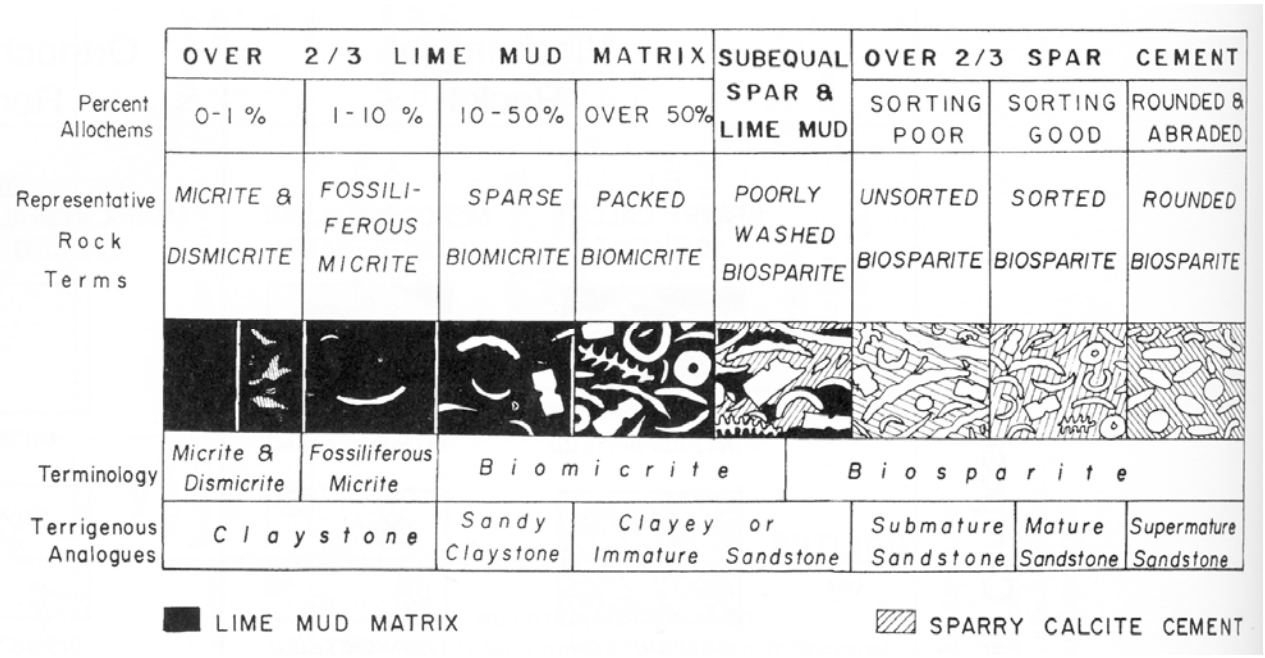
5 Rock Name
6 Metamorphic Facies



Dott's (1964) Classification of Sandstones.



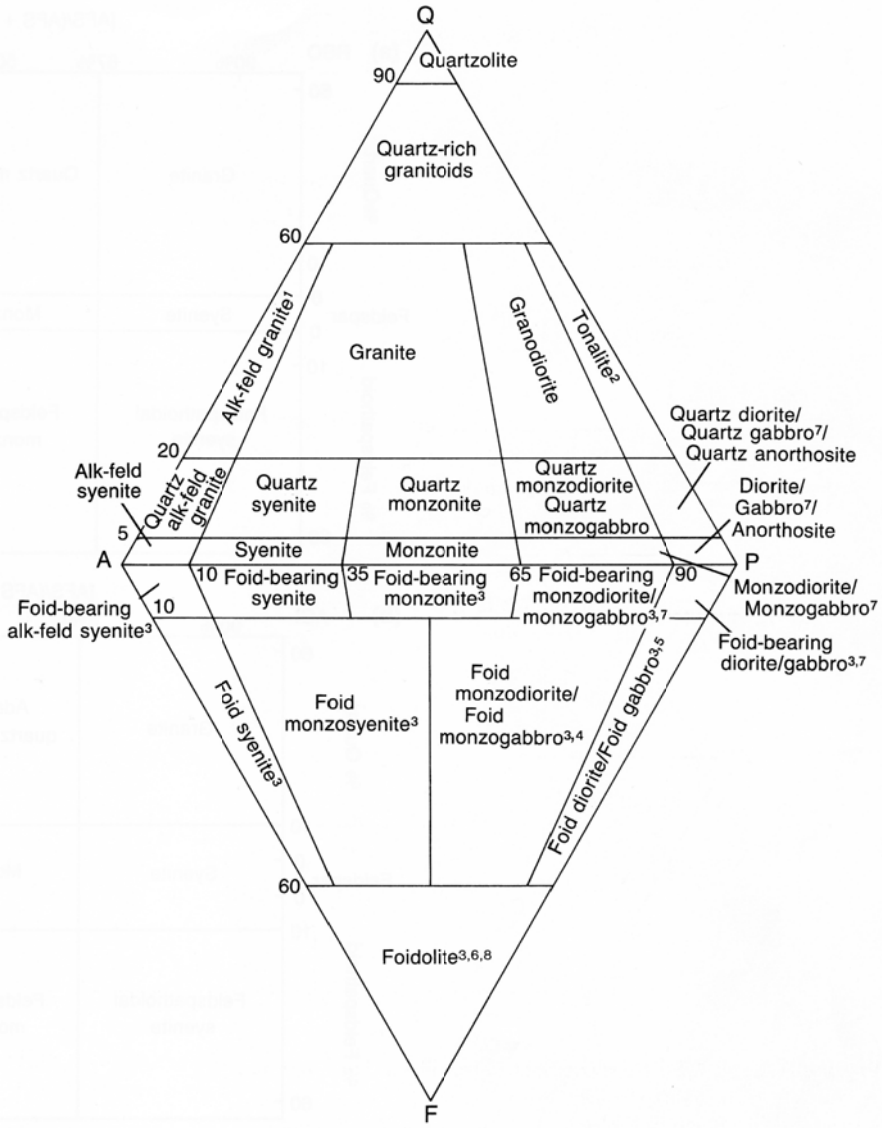
Rock names for various sedimentary components. Note that sand, silt, and clay do not include detrital grains of calcite or dolomite. Modified after Williams et al. (1954).

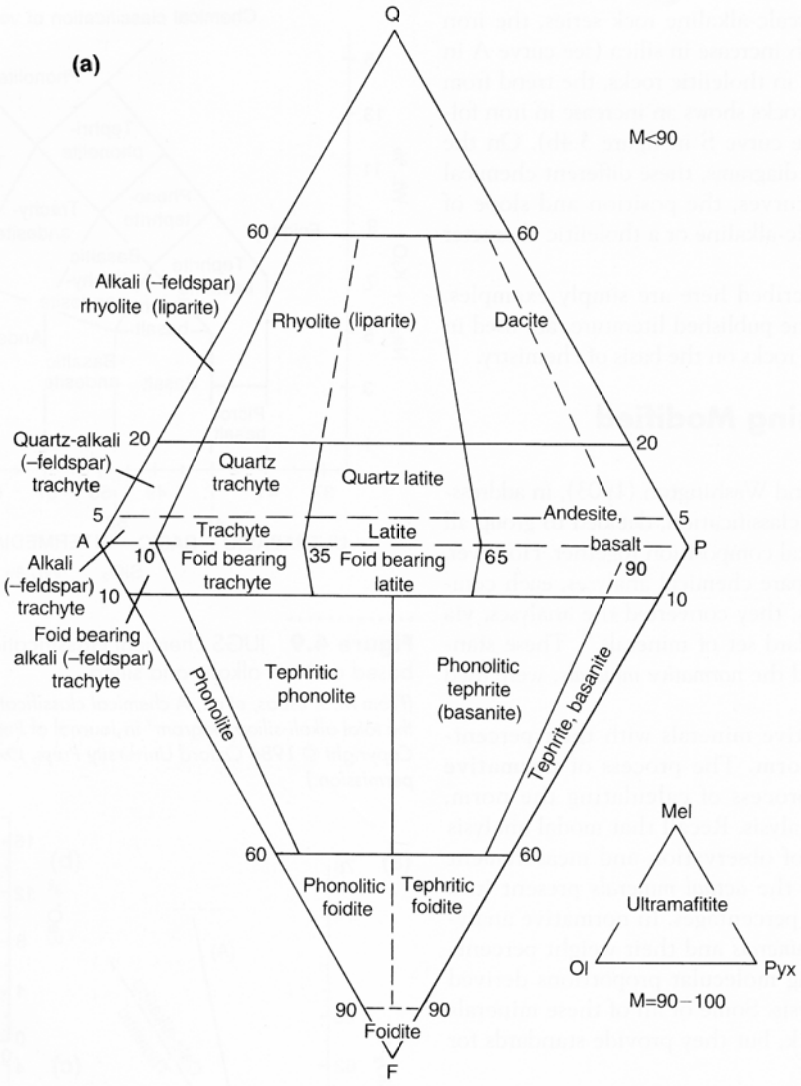


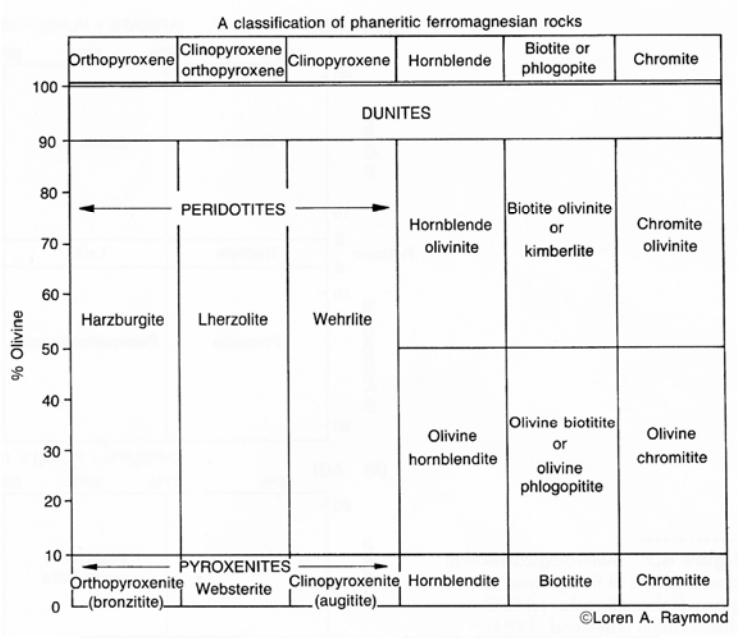
Folk's (1962) classification of limestones.

A	DEPOSITIONAL TEXTURE RECOGNIZABLE				DEPOSITIONAL TEXTURE NOT RECOGNIZABLE
Original components not bound together during deposition				Original components were bound together during deposition . . . as shown by intergrown skeletal matter, lamination contrary to gravity, or sediment-floored cavities are roofed over by organic or questionably organic matter and are too large to be interstices.	CRYSTALLINE CARBONATE
Contains mud (particles of clay and fine silt size)			Lacks mud and is grain-supported		
Mud-supported		Grain-supported			
Less than 10% grains	More than 10% grains				(Subdivide according to classifications designed to bear on physical texture or diagenesis.)
MUDSTONE	WACKESTONE	PACKSTONE	GRAINSTONE	BOUNDSTONE	

Dunham's (1962) classification of limestones.


Q
90
Quartzolite
Quartz-rich granitoids
60
Alk-feld granite[1]
Granite
Granodiorite
Tonalite[2]
Quartz diorite/ Quartz gabbro[7]/ Quartz anorthosite
20
Alk-feld syenite
Quartz alk-feld granite
Quartz syenite
Quartz monzonite
Quartz monzodiorite Quartz monzogabbro
Diorite/ Gabbro[7]/ Anorthosite
5
A
Syenite
Monzonite
P
10
Foid-bearing syenite
35
Foid-bearing monzonite[3]
65
Foid-bearing monzodiorite/ monzogabbro[3,7]
90
Monzodiorite/ Monzogabbro[7]
Foid-bearing alk-feld syenite[3]
10
Foid-bearing diorite/gabbro[3,7]
Foid syenite[3]
Foid monzosyenite[3]
Foid monzodiorite/ Foid monzogabbro[3,4]
Foid diorite/Foid gabbro[3,5]
60
Foidolite[3,6,8]
F


(a)
Q
M<90
60
60
Alkali (–feldspar) rhyolite (liparite)
Rhyolite (liparite)
Dacite
Quartz-alkali (–feldspar) trachyte
20
20
Quartz trachyte
Quartz latite
5
Andesite, basalt
5
A
Trachyte
Latite
P
10
Foid bearing trachyte
35
Foid bearing latite
65
90
Alkali (–feldspar) trachyte
10
10
Foid bearing alkali (–feldspar) trachyte
Phonolite
Tephritic phonolite
Phonolitic tephrite (basanite)
Tephrite, basanite
Mel
60
60
Phonolitic foidite
Tephritic foidite
Ultramafitite
Ol
Pyx
M=90–100
90
90
Foidite
F


A classification of phaneritic ferromagnesian rocks
Orthopyroxene
Clinopyroxene orthopyroxene
Clinopyroxene
Hornblende
Biotite or phlogopite
Chromite
DUNITES
PERIDOTITES
Harzburgite
Lherzolite
Wehrlite
Hornblende olivinite
Biotite olivinite or kimberlite
Chromite olivinite
Olivine hornblendite
Olivine biotitite or olivine phlogopitite
Olivine chromitite
PYROXENITES
Orthopyroxenite (bronzitite)
Websterite
Clinopyroxenite (augitite)
Hornblendite
Biotitite
Chromitite
% Olivine
100
90
80
70
60
50
40
30
20
10
0
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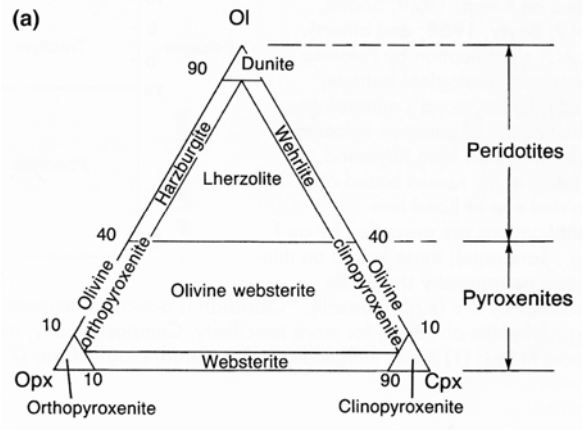
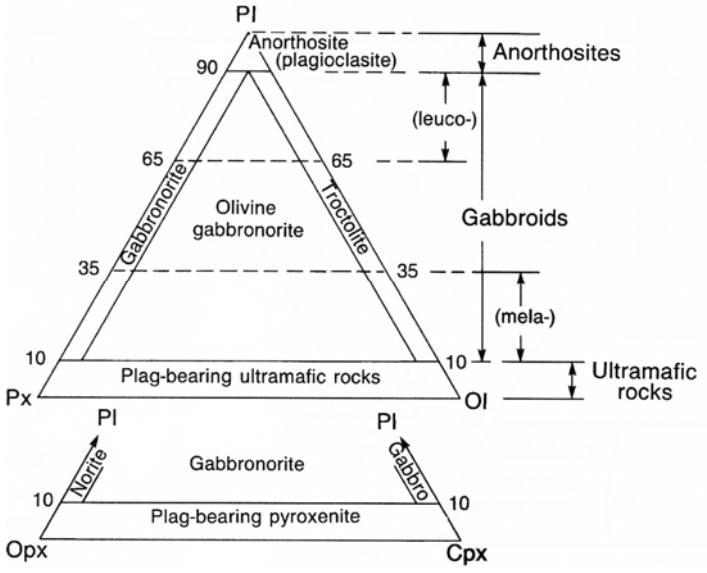
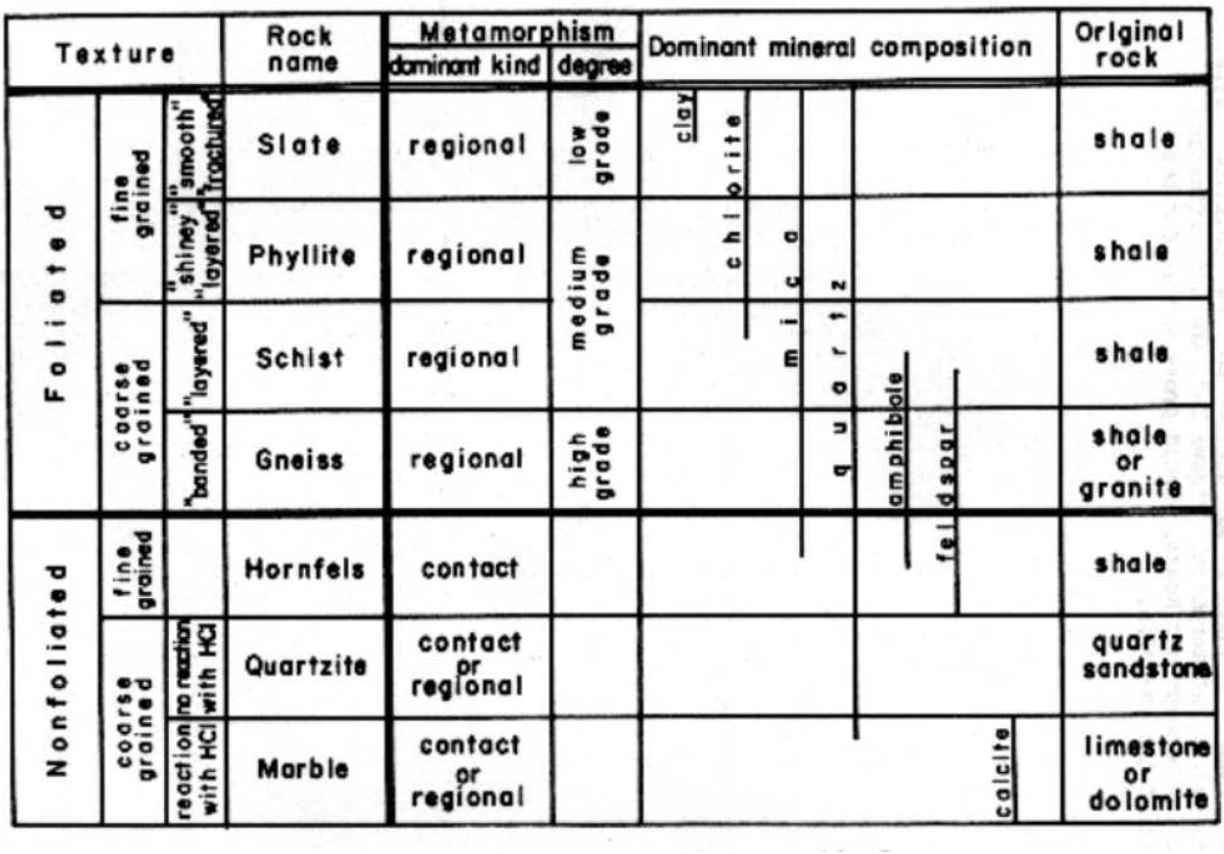

(a)
Ol
90
Dunite
Harzburgite
Wehrlite
Lherzolite
Peridotites
40
40
Olivine orthopyroxenite
clinopyroxenite Olivine
Olivine websterite
Pyroxenites
10
10
Websterite
Opx
10
90
Cpx
Orthopyroxenite
Clinopyroxenite


Pl
Anorthosite (plagioclasite)
Anorthosites
90
(leuco-)
65
65
Gabbronorite
Troctolite
Olivine gabbronorite
Gabbroids
35
35
(mela-)
10
10
Plag-bearing ultramafic rocks
Ultramafic rocks
Px
Ol
Pl
Pl
Norite
Gabbronorite
Gabbro
10
10
Plag-bearing pyroxenite
Opx
Cpx



Generic classification scheme for metamorphic rocks.