

IGNEOUS ROCKS – born from fire

Intrusive, Plutonic
Coarse grained

Gabbro

augite and
plagioclase



Extrusive, Volcanic
Fine grained groundmass

Basalt

olivine

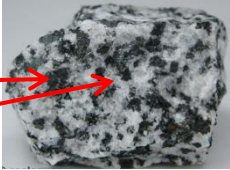


*Dark, high in mafics
(Fe, Mg)*

Extrusive rocks may
contain “floating crystals
called phenocrysts

Diorite

hornblende
plagioclase



may or may not contain quartz

Andesite

plagioclase



*Gray or mixed,
intermediate
composition*

Granite

Microcline
(pink) and
quartz, biotite



Rhyolite



*Light, pink or with
orthoclase/microcline*

Very coarse grained

Pegmatite

Quartz and
potassium
feldspar



Crystals often several cm in size

Glassy, quenched from lava

Obsidian



*Scoria and pumice solidify
from lava thrown into the
air, lots of gaseous
material is trapped and
resultant rock has very
low density, vugs/holes in
rock are gas vesicles*

Scoria



*Dark, basaltic, but
with very low density*

Pumice



*Light, rhyolite
composition, very low
density due to porosity*

KEY TO THE IDENTIFICATION OF BASIC SEDIMENTARY ROCKS

DO NOT React With Acid

Grains visible
or rock feels gritty

Grains > GRAVEL

Angular
Gravel Grains

BRECCIA

Rounded
Gravel Grains

CONGLOMERATE

Grains < but still visible

Grains distinct &
visible even under
a microscope

**SAND
STONE**

Scratch Glass

No grains, may feel
gritty or be glassy

Feels gritty but can't see
particles even with microscope;
scratches fingernail readily

**SILT
STONE**

Conchoidal fracture glassy;
dull luster; many colors

CHERT

Feels smooth; does not
scratch fingernail;
often layered

SHALE

Black, light weight
smudgy or shiney

COAL

White, pink, clear
crystalline, softer
than fingernail

Salty taste; three perfect
right angle cleavages;
clear, gray,

**ROCK SALT
(HALITE)**

Softer than finger nail; pink or
white; fibrous thick plates,
or dense

GYPSUM

Softer Than Glass

React With Dilute HCl

**Reacts with
dilute
hydrochloric
acid (HCl)**

**Abundant fossils
present, whole or
broken**

Fine grained matrix
(micrite) with many fossils
or fossil fragments

**FOSSIL
LIMESTONE**

Porous, light weight;
broken shell fragments;
tan to whitish

COQUINA

Miniature spheres about 1mm
in diameter, like tiny pearls;
white, gray, blue-gray common

**OOBITIC
LIMESTONE**

White, powdery
feels gritty; reacts vigorously
with acid

**CHALK
LIMESTONE**

Fine grained; smooth, dense;
often conchoidal fracture, or
irregular blocky

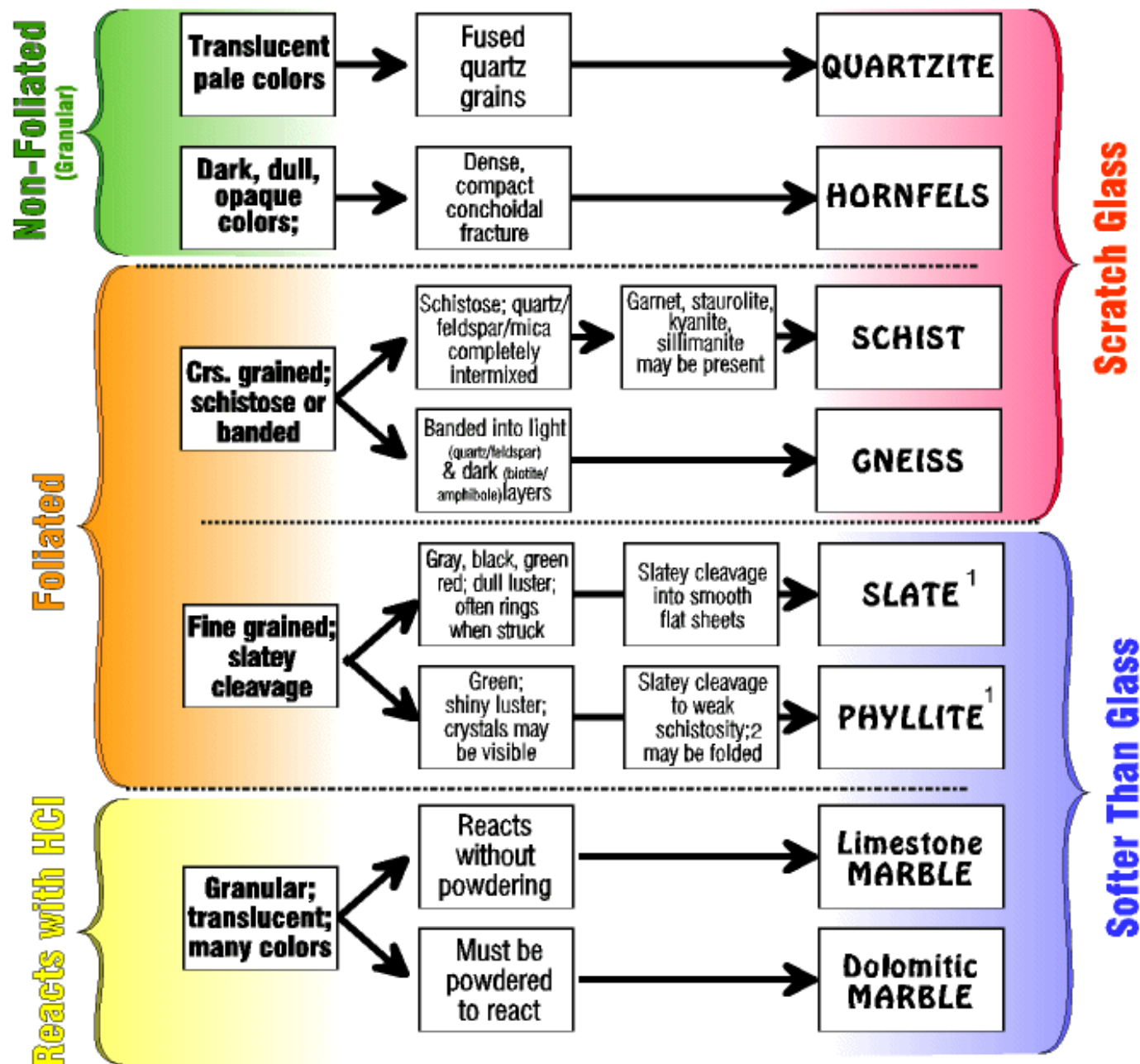
**MICRITE
LIMESTONE**

**Rock must be
powdered to react
with acid (HCl)**

Must be powdered to react
with acid; dull luster; gray, tan
white, plus many other colors

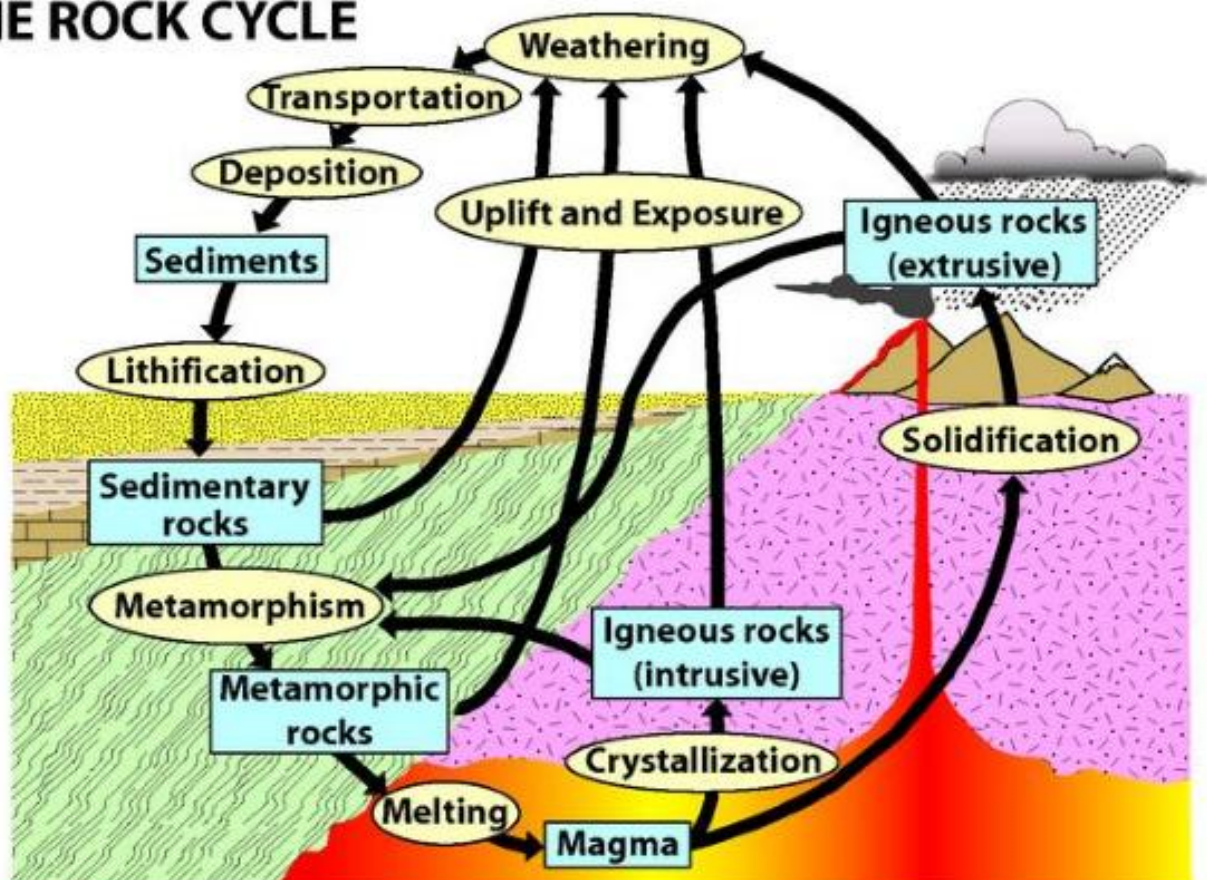
DOLOMITE

Metamorphic Rocks



¹ (Shale), slate, and phyllite complete intergrade with each other. Distinctions may be difficult.

THE ROCK CYCLE



Igneous Rocks -

Rocks that form from the cooling of molten rock (magma). Example: granite and basalt

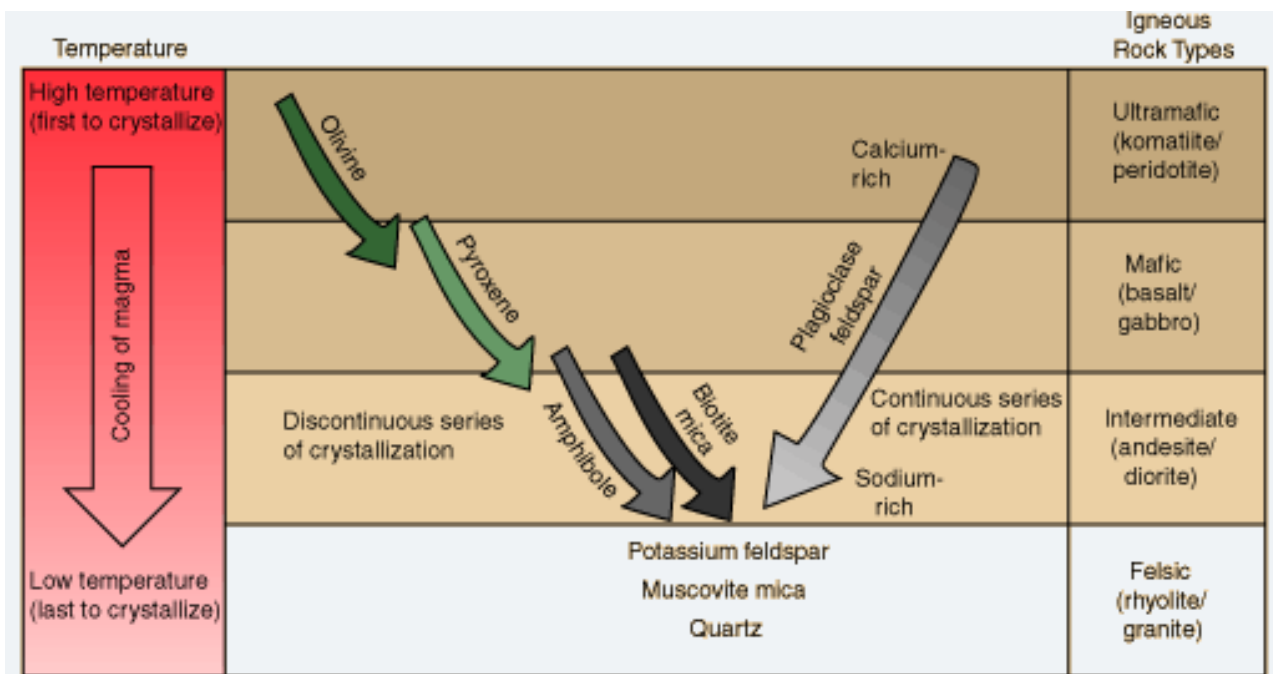
Sedimentary Rocks -

Rocks that are formed from pieces of other rocks. Example: sandstone, or that are deposited from the ocean by chemical processes. Example: limestone

Metamorphic Rocks -

Rocks that are changed by heat and pressure without melting. Example: gneiss

Bowen's Reaction Series



Bowen determined that specific minerals form at specific temperatures as a magma cools. At the higher temperatures associated with [mafic](#) and intermediate magmas, the general progression can be separated into two branches. The continuous branch describes the evolution of the [plagioclase feldspars](#) as they evolve from being calcium-rich to more sodium-rich. The discontinuous branch describes the formation of the mafic minerals olivine, pyroxene, amphibole, and biotite mica.

The weird thing that Bowen found concerned the discontinuous branch. At a certain temperature a magma might produce olivine, but if that same magma was allowed to cool further, the olivine would "react" with the residual magma, and change to the next mineral on the series (in this case pyroxene). Continue cooling and the pyroxene would convert to amphibole, and then to biotite. Mighty strange stuff, but if you consider that most silicate minerals are made from slightly different proportions of [the same 8 elements](#), all we're really doing here is adjusting the internal crystalline lattice to achieve stability at different temperatures.

At lower temperatures, the branches merge and we obtain the minerals common to the [felsic](#) rocks - [orthoclase feldspar](#), muscovite mica, and quartz