Rocks

Igneous, Sedimentary, Metamorphic

What is a rock?

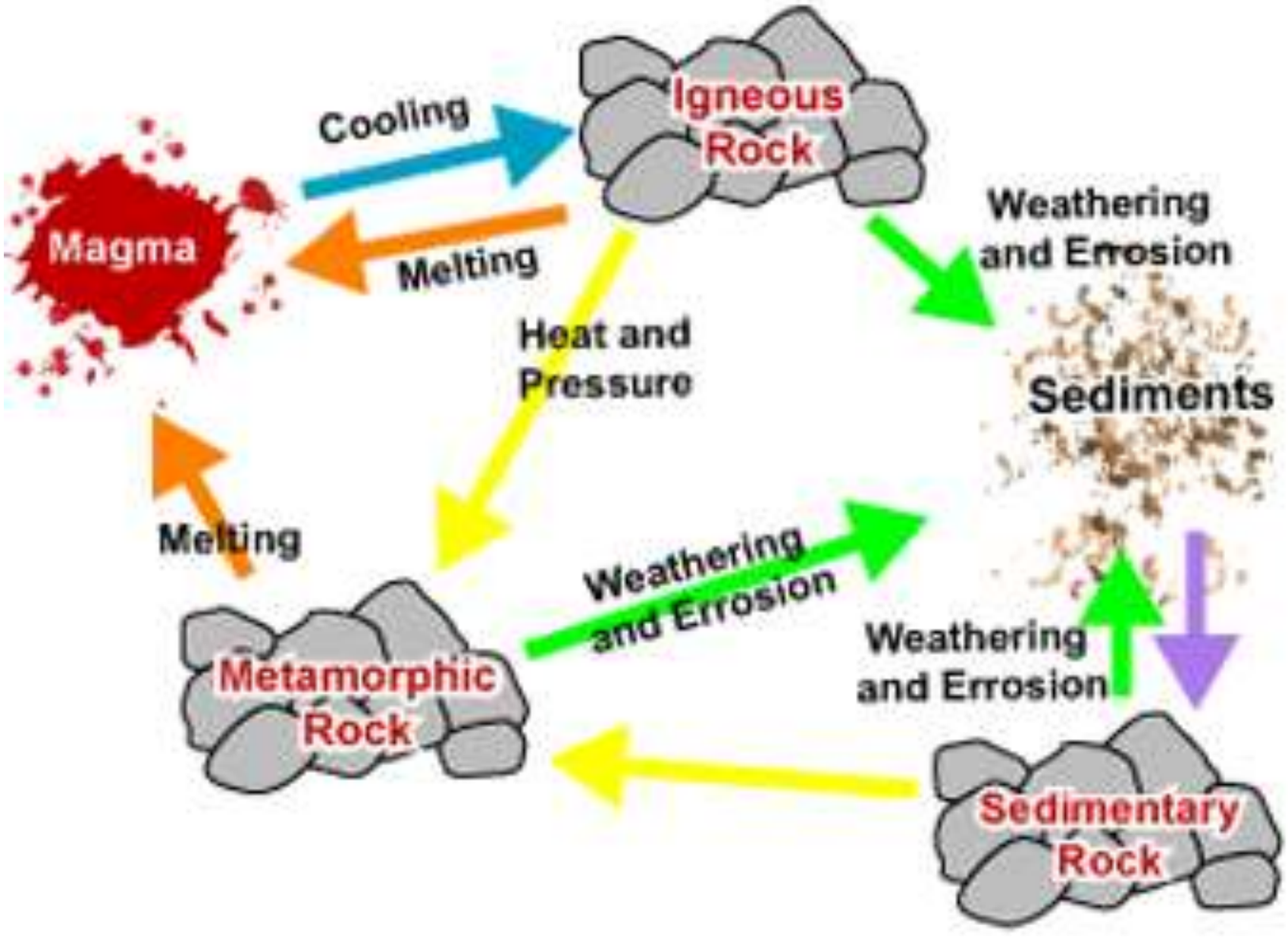
- Rocks are formed of groups of minerals.
- Rocks are constantly being recycled.
- Rocks are classified into three types.

There are three classes of rocks

- **Igneous** rocks
- **Sedimentary** rocks
- **Metamorphic** rocks

ROCK CYCLE

- Minerals cycle through the Earth, becoming rocks, sediment, and magma.



Monroe & Wicander 1992
Fig. 1-15
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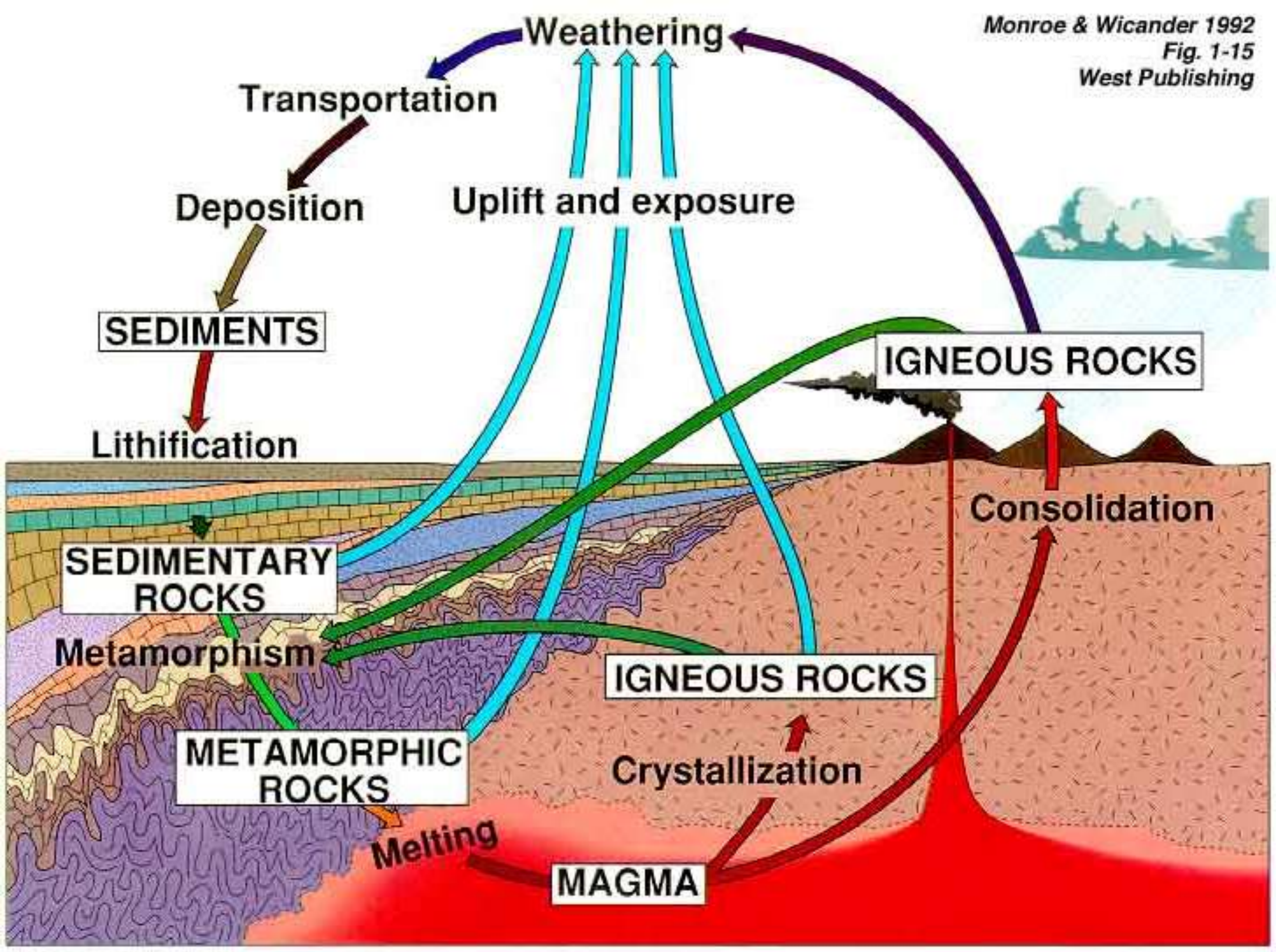
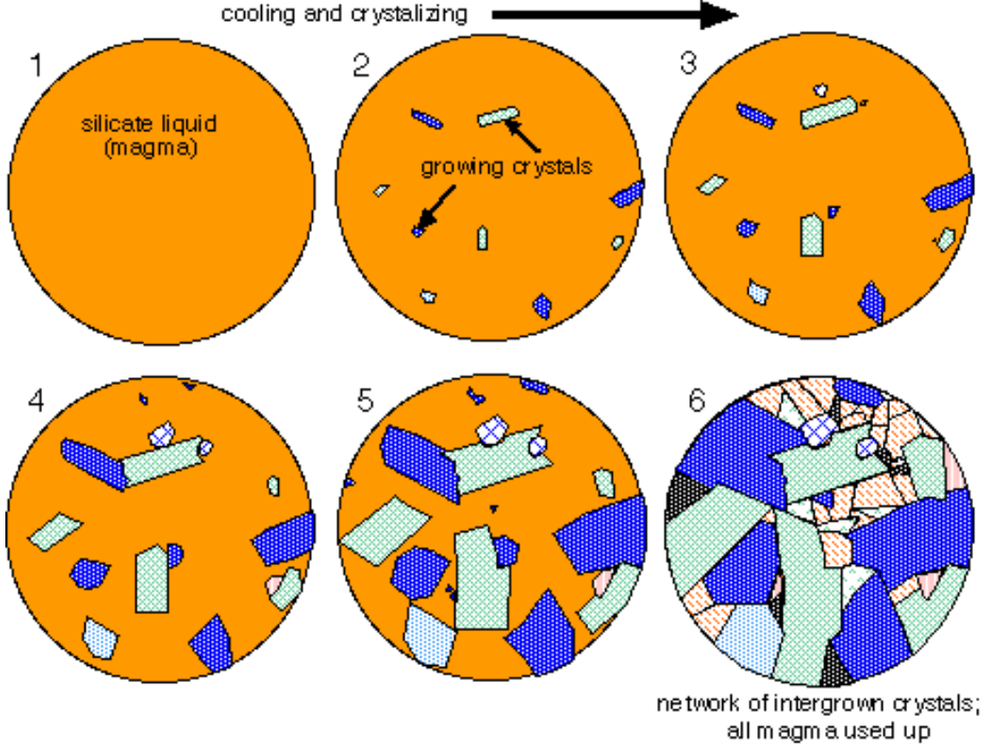
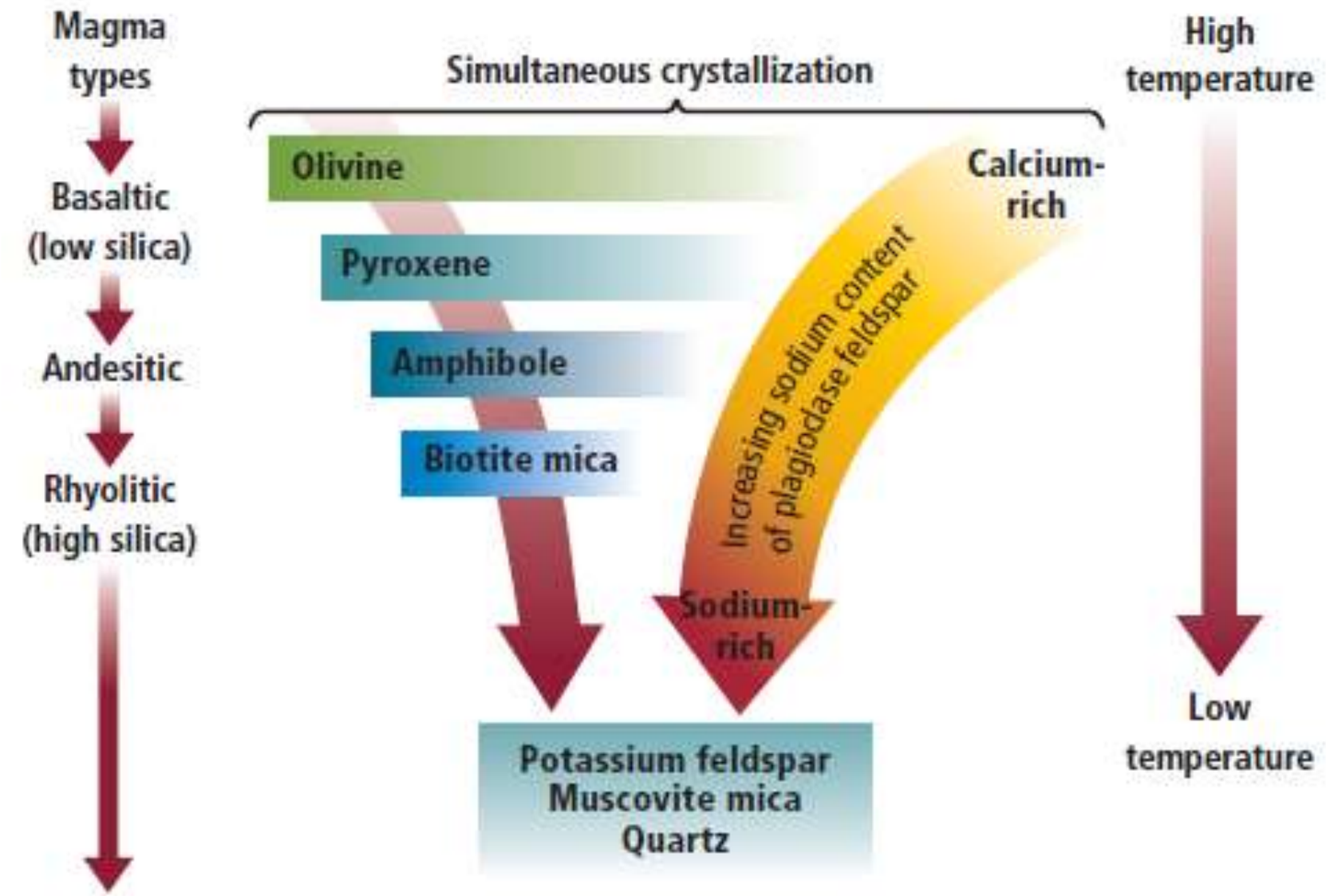


How rock crystallizes out of magma

Creating Igneous Rock



Bowen's Reaction Series



IGNEOUS ROCKS

- Igneous rock comes from crystallized **magma**.

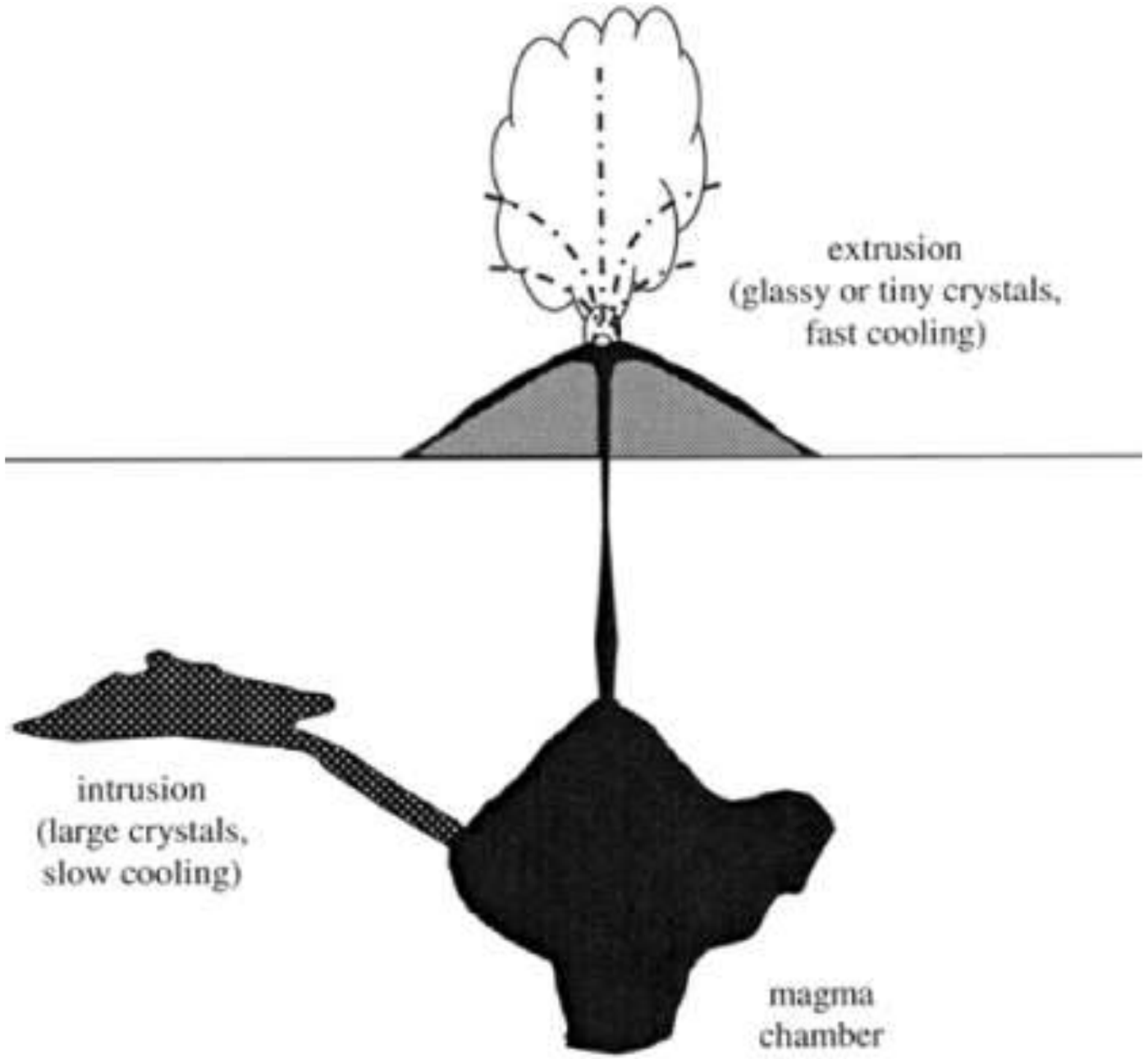
- Two types:

1. Intrusive

-Rocks crystallize **below** the ground

2. Extrusive

-Rocks crystallize **above** the ground

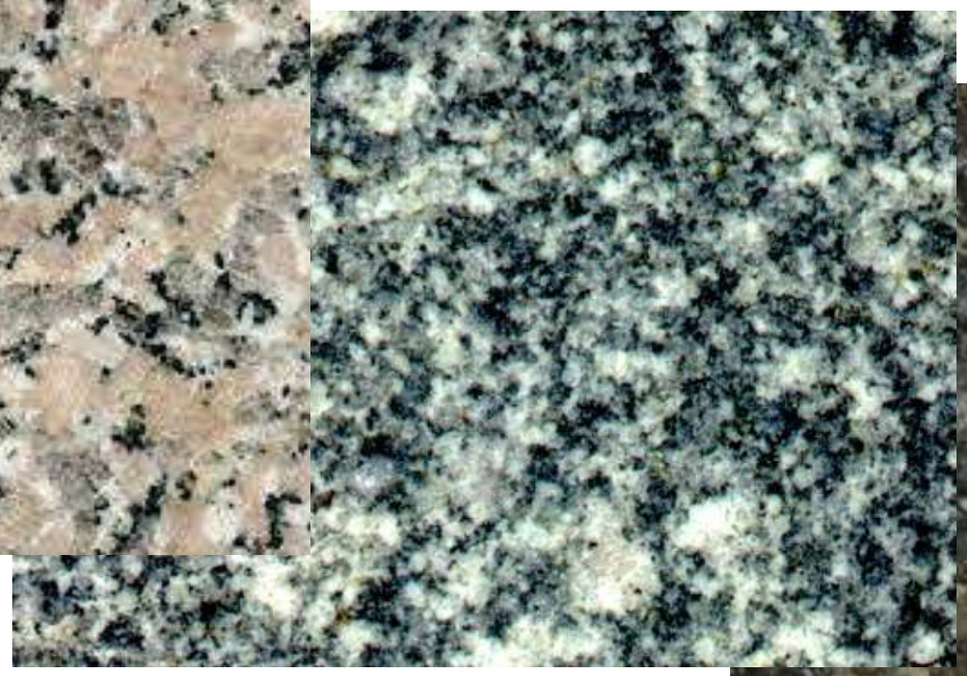


Coarse-Grained

Intrusive Igneous Rocks

<u>Large crystals</u> = slow cooling

Granite



Diorite

Gabbro

Peridotite

FELSIC

Magma
Chemical composition

MAFIC

Fine-Grained **Extrusive** Igneous Rocks

Small crystals = fast cooling

FELSIC ⟵ ⟶ MAFIC

Rhyolite

Andesite

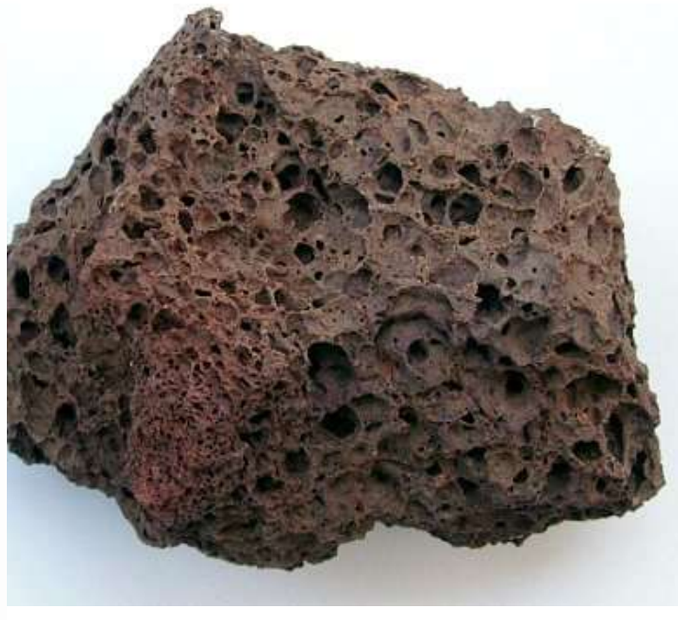
Basalt

Glassy

Obsidian

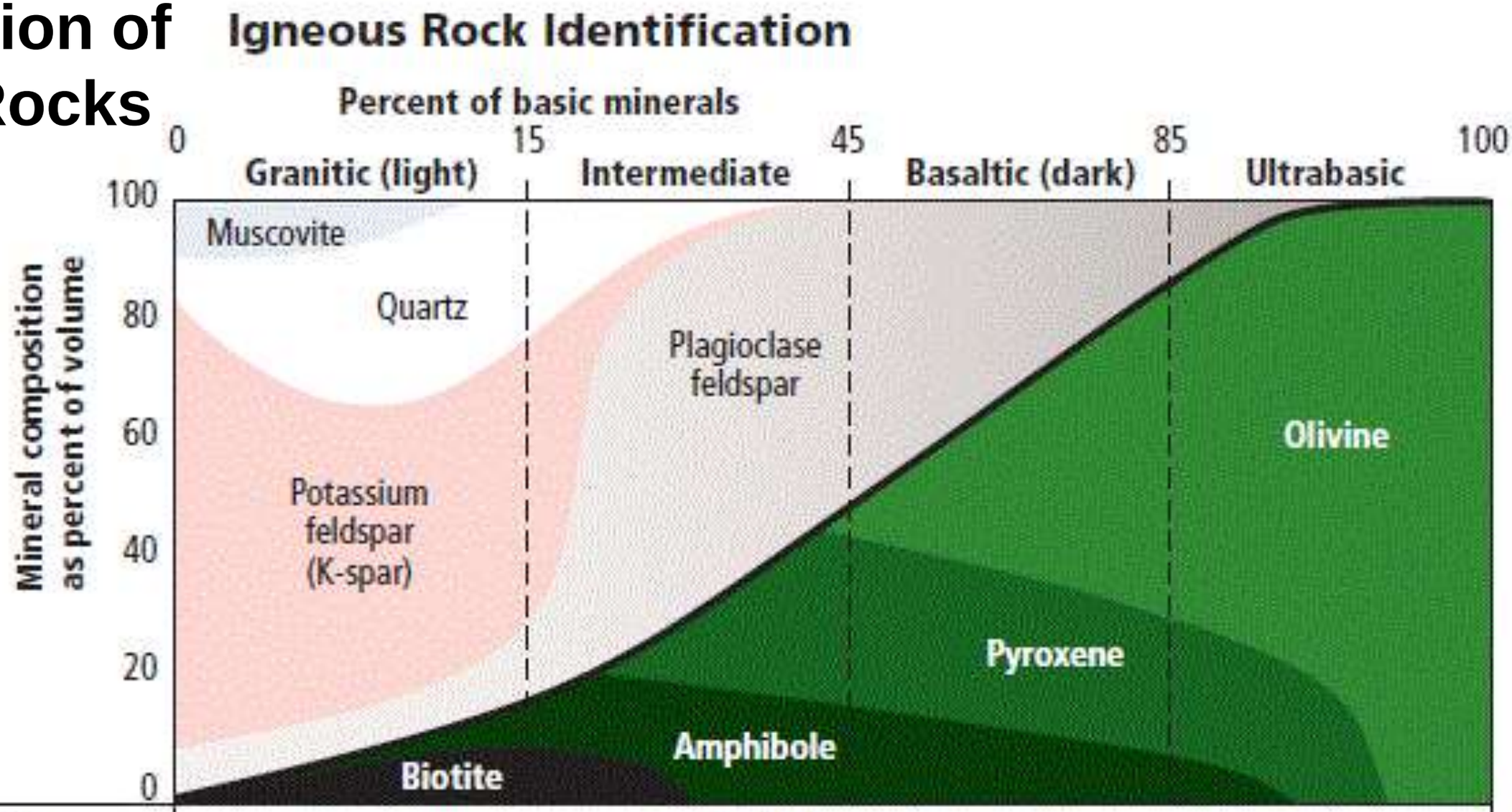
Vesicular

Pumice



Scoria

Classification of Igneous Rocks



Origin	Texture	Rock Names			
Intrusive	coarse-grained	granite	diorite	gabbro	peridotite
	porphyritic	porphyritic rhyolite or granite	porphyritic andesite or diorite	porphyritic basalt or gabbro	
Extrusive	fine-grained	rhyolite	andesite	basalt	
	glassy	obsidian			
	vesicular	pumice		scoria (vesicular basalt)	

Figure 5.9 Rock type can be determined by estimating the

SEDIMENTARY ROCKS

- Three classes:

1. Clastic

-made of weathered fragments of other rocks

2. Chemical

-made of deposits left over when water evaporates

3. Organic

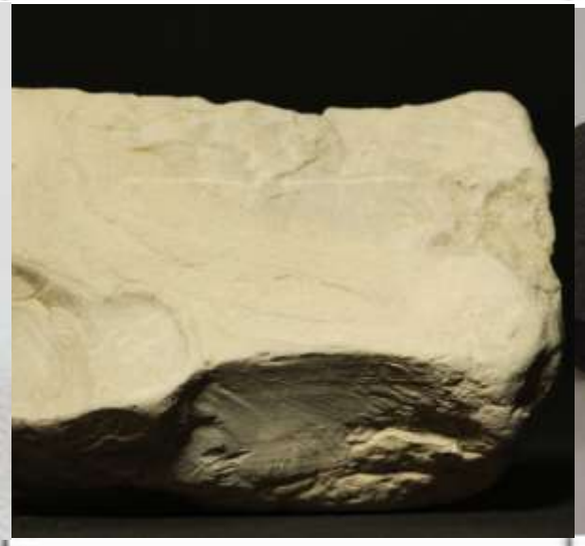
-made of organic material and shells

Clastic with Lithification!




Mechanical Origin:	>2mm	2 - 1/16 mm	1/16 - 1/256 mm	<1/256 mm
Loose / Uncemented	'gravel'	sand	silt	clay




	conglomerate *(rounded)* **breccia** *(angular)*	**sandstone**	**siltstone**	**mudstone** *(non-fissile)* **shale** *(fissile)*

Chemical and **Biological**

	ROCK		ENVIRONMENT
Shells and lime mud	Limestone		Warm shallow seas
$CaCO_3$ produced by marine plankton	Chalk		Deep sea
SiO_2 produced by marine plankton	Chert		Deep sea
Woody plant matter: Peat	Coal		Swamps
Salt	Rock salt		Lagoons or marginal seas

Fossils are formed ONLY in sedimentary rocks

METAMORPHIC ROCKS

- **Heat and pressure** cause igneous, sedimentary, and metamorphic rocks to chemically CHANGE!

- Two types:

1. Non-Foliated

-Minerals are granular, and not banded.

-**Marble** will react with acid

2. **Foliated**

-Minerals are aligned in banding and layering

Non-Foliated (Granular)

- **Translucent pale colors** → Fused quartz grains → **QUARTZITE**

- **Dark, dull, opaque colors;** → Dense, compact conchoidal fracture → **HORNFELS**

Reacts with HCl

- **Granular; translucent; many colors**
  - Reacts without powdering → **Limestone MARBLE**
  - Must be powdered to react → **Dolomitic MARBLE**

Foliated

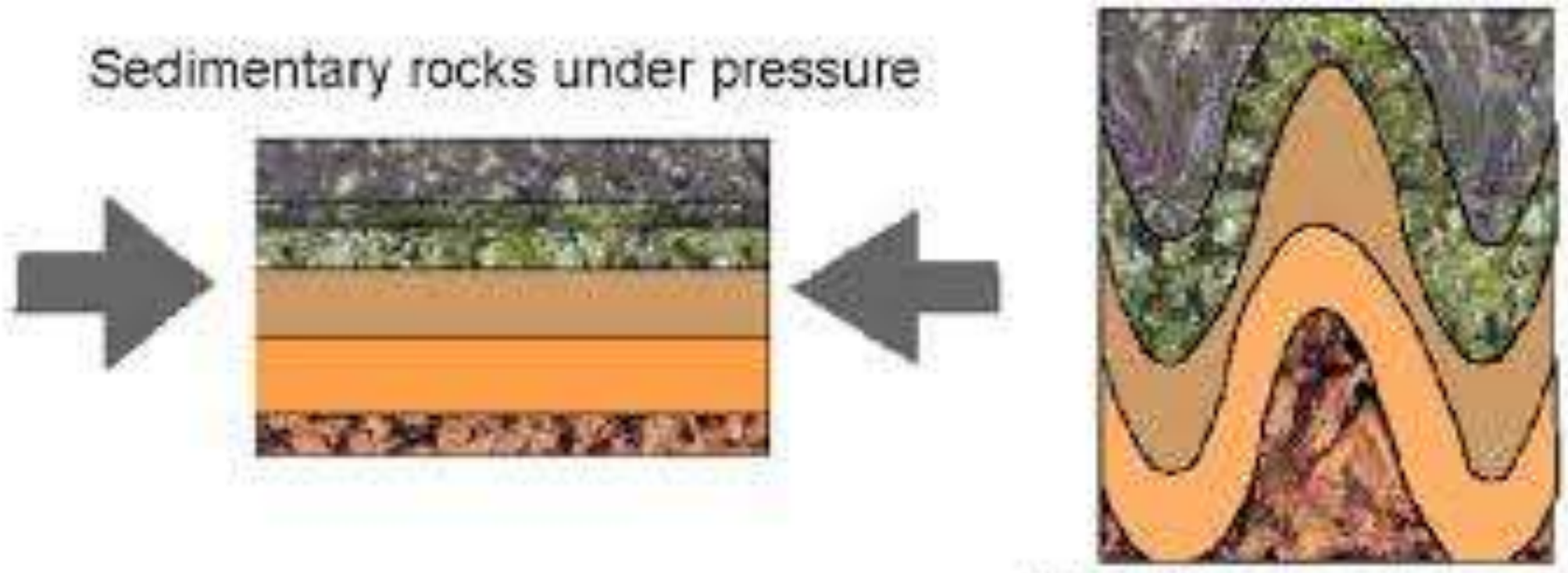
Crs. grained; schistose or banded

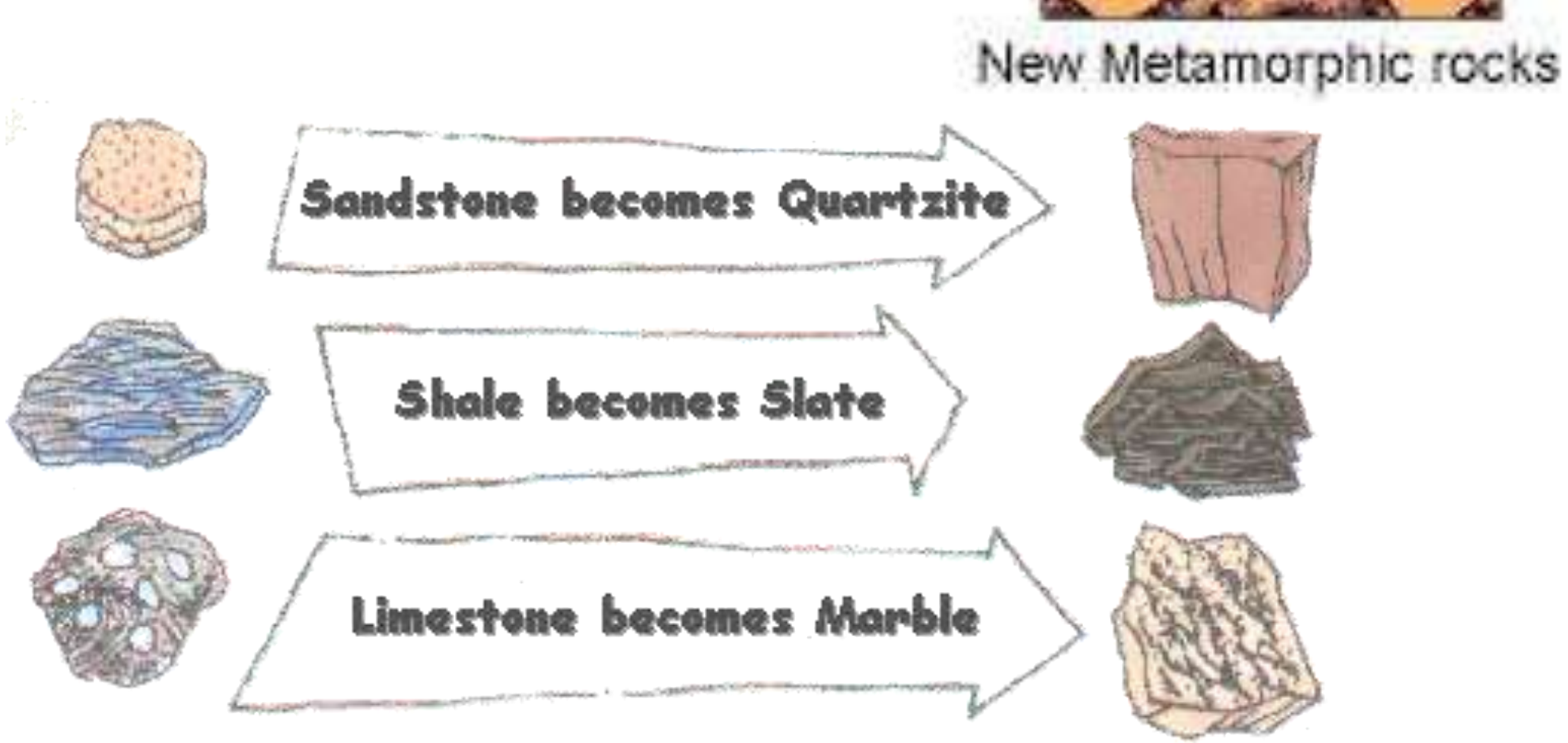
- Schistose; quartz/feldspar/mica completely intermixed → **SCHIST**
- Banded into light (quartz/feldspar) & dark (biotite/amphibole) layers → **GNEISS**

Fine grained; slatey cleavage

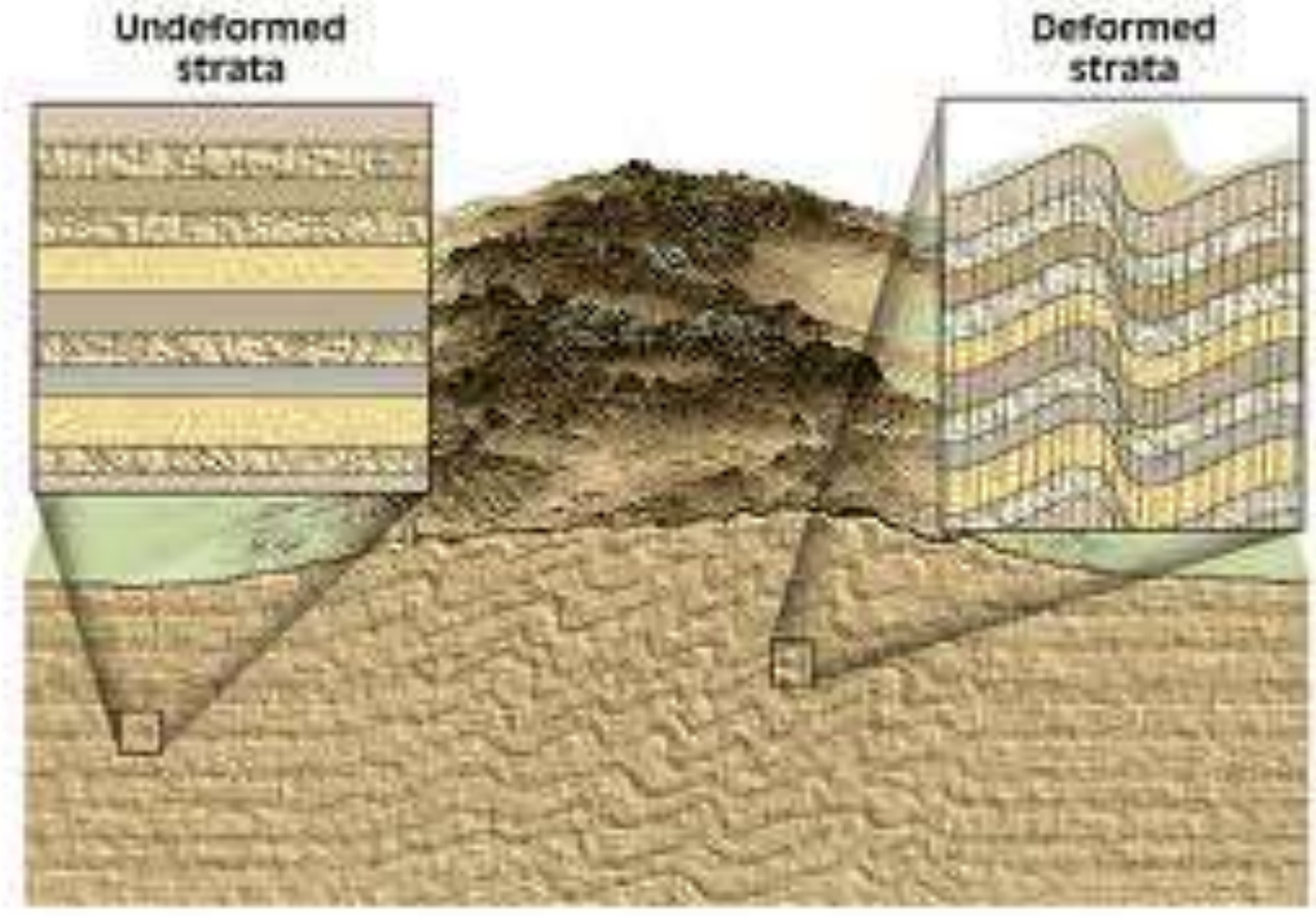
- Gray, black, green red; dull luster; often rings when struck → **SLATE**[1]
- Green; shiny luster; crystals may be visible → **PHYLLITE**[1]

Heat and Pressure create metamorphic rock



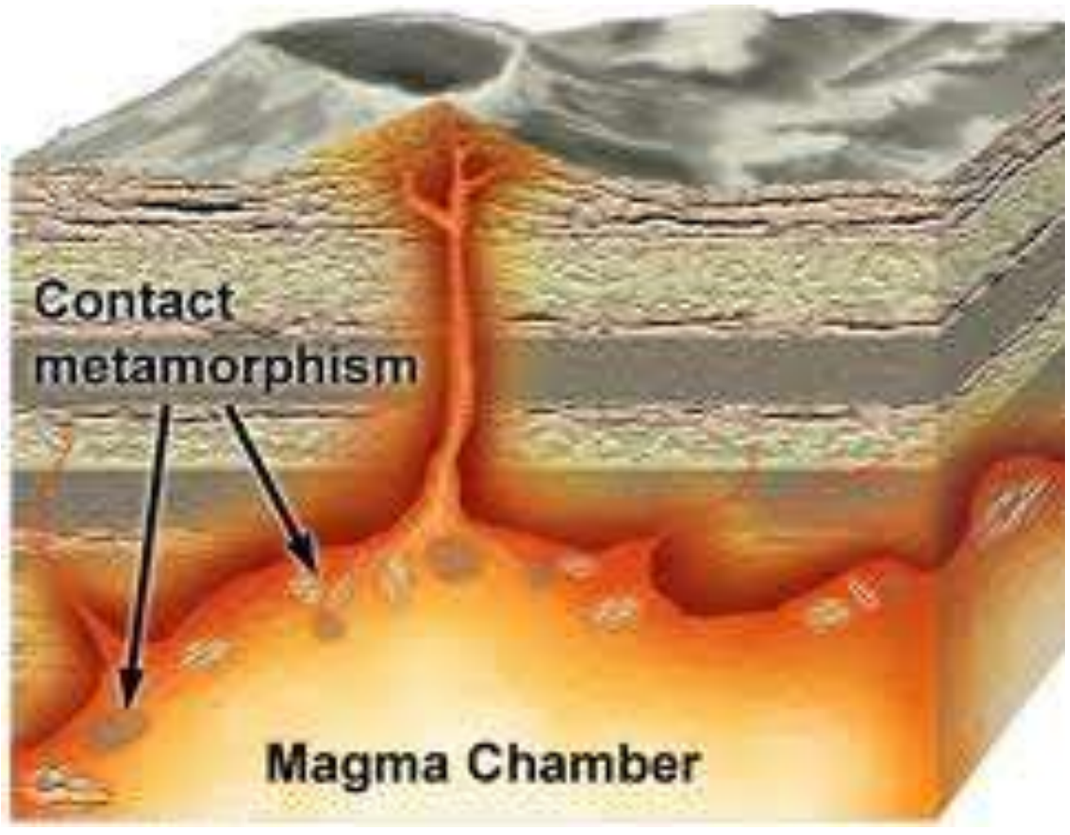


Regional metamorphism



Due to **continental plates** moving

Contact metamorphism



Due to heat from **magma**

Monroe & Wicander 1992
Fig. 1-15
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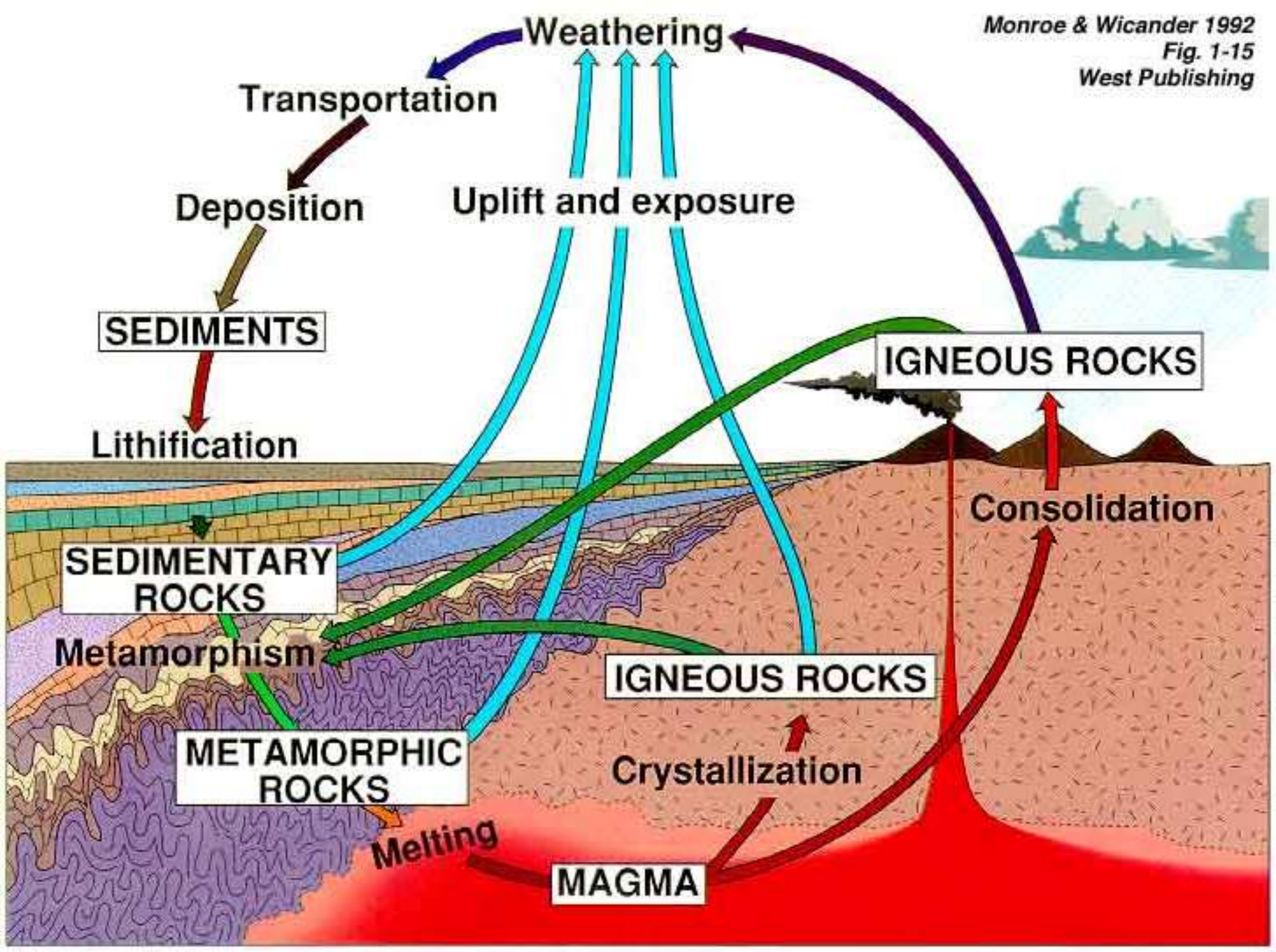
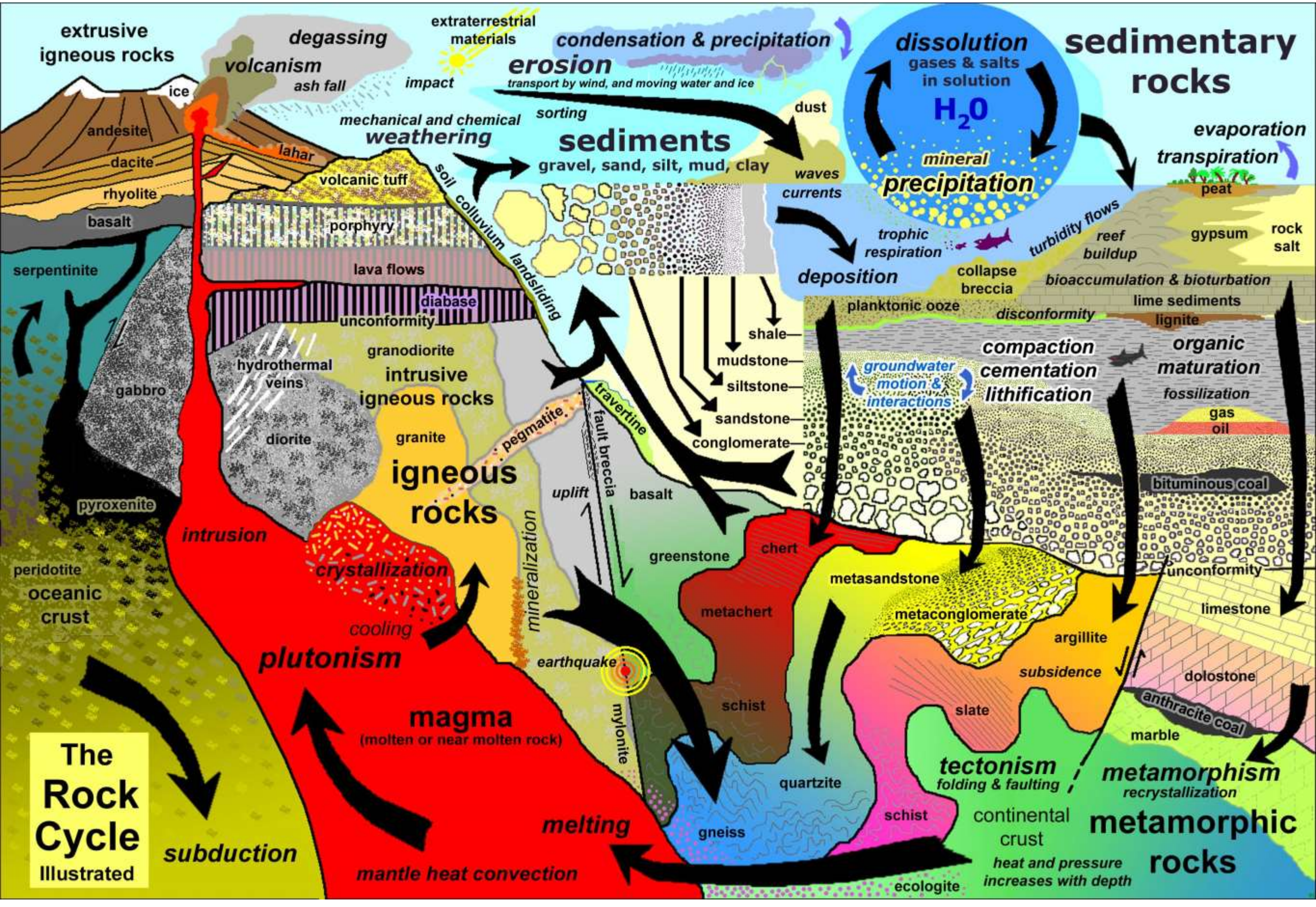



extrusive igneous rocks
degassing
volcanism
ash fall
extraterrestrial materials
impact
condensation & precipitation
erosion
transport by wind, and moving water and ice
dissolution
gases & salts in solution
H_2O
sedimentary rocks
ice
andesite
dacite
rhyolite
basalt
lahar
volcanic tuff
porphyry
mechanical and chemical weathering
sorting
sediments
gravel, sand, silt, mud, clay
dust
waves
currents
mineral precipitation
evaporation
transpiration
peat
soil
colluvium
landsliding
trophic respiration
turbidity flows
reef buildup
gypsum
rock salt
deposition
collapse breccia
bioaccumulation & bioturbation
lime sediments
lignite
planktonic ooze
disconformity
serpentinite
lava flows
diabase
unconformity
shale
mudstone
siltstone
sandstone
conglomerate
compaction
cementation
lithification
groundwater motion & interactions
organic maturation
fossilization
gas
oil
bituminous coal
hydrothermal veins
granodiorite
intrusive igneous rocks
travertine
gabbro
diorite
granite
pegmatite
fault breccia
uplift
basalt
greenstone
chert
metasandstone
metachert
metaconglomerate
argillite
subsidence
unconformity
limestone
dolostone
anthracite coal
marble
pyroxenite
intrusion
crystallization
cooling
plutonism
mineralization
earthquake
mylonite
schist
slate
peridotite
oceanic crust
magma
(molten or near molten rock)
quartzite
gneiss
tectonism
folding & faulting
metamorphism
recrystallization
continental crust
metamorphic rocks
heat and pressure increases with depth
ecologite
The Rock Cycle Illustrated
subduction
melting
mantle heat convection

The Rock Cycle

1. Draw 5 rock states

2. Add arrows:

-melting
-crystallization
-weathering & erosion
-heat & pressure
-lithification

Magma

Igneous Rocks

Sediment

Melting

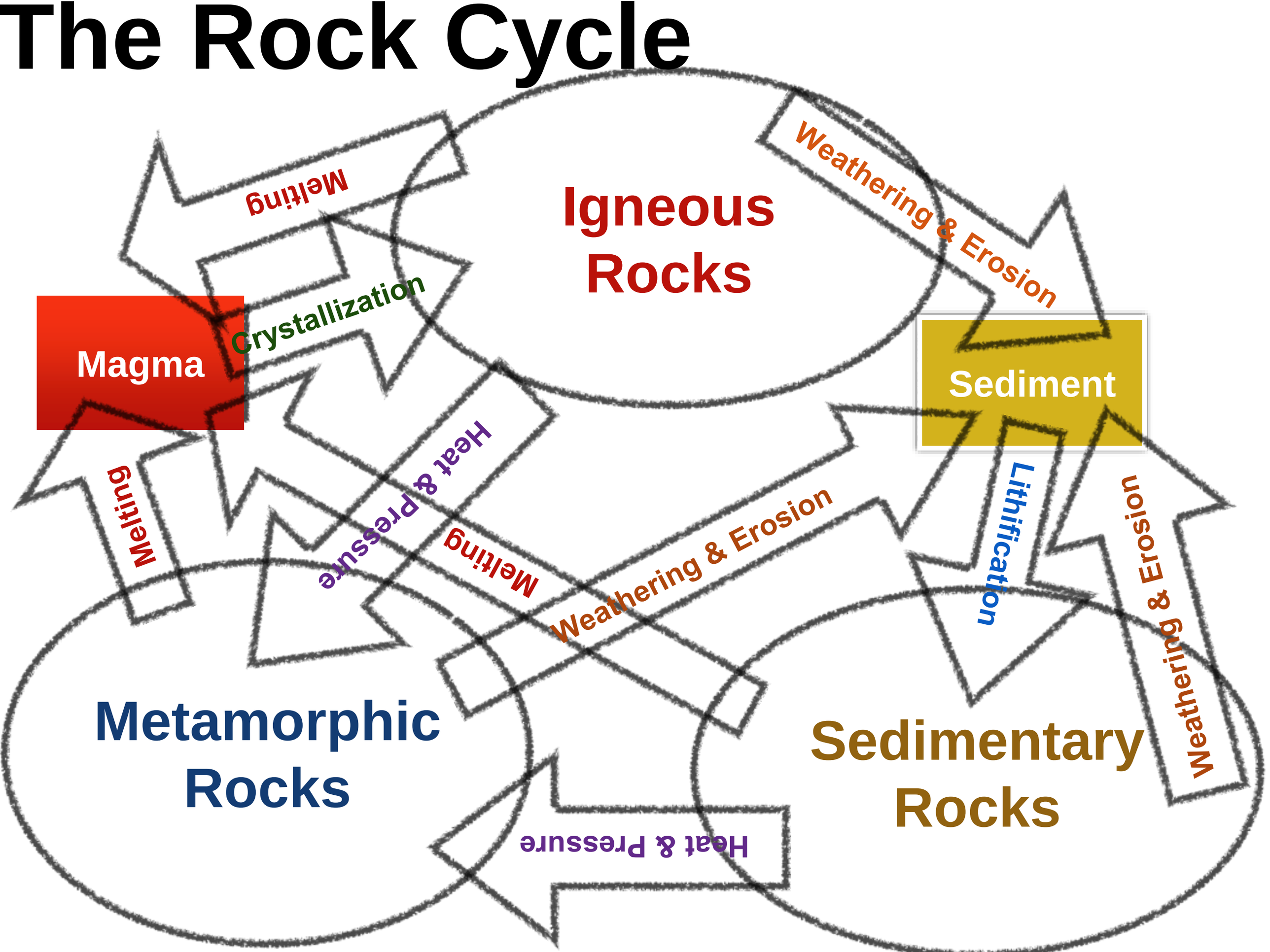
Melting

Melting

Metamorphic Rocks

Sedimentary Rocks

The Rock Cycle



Guess the type of rock!

Igneous, sedimentary, or metamorphic?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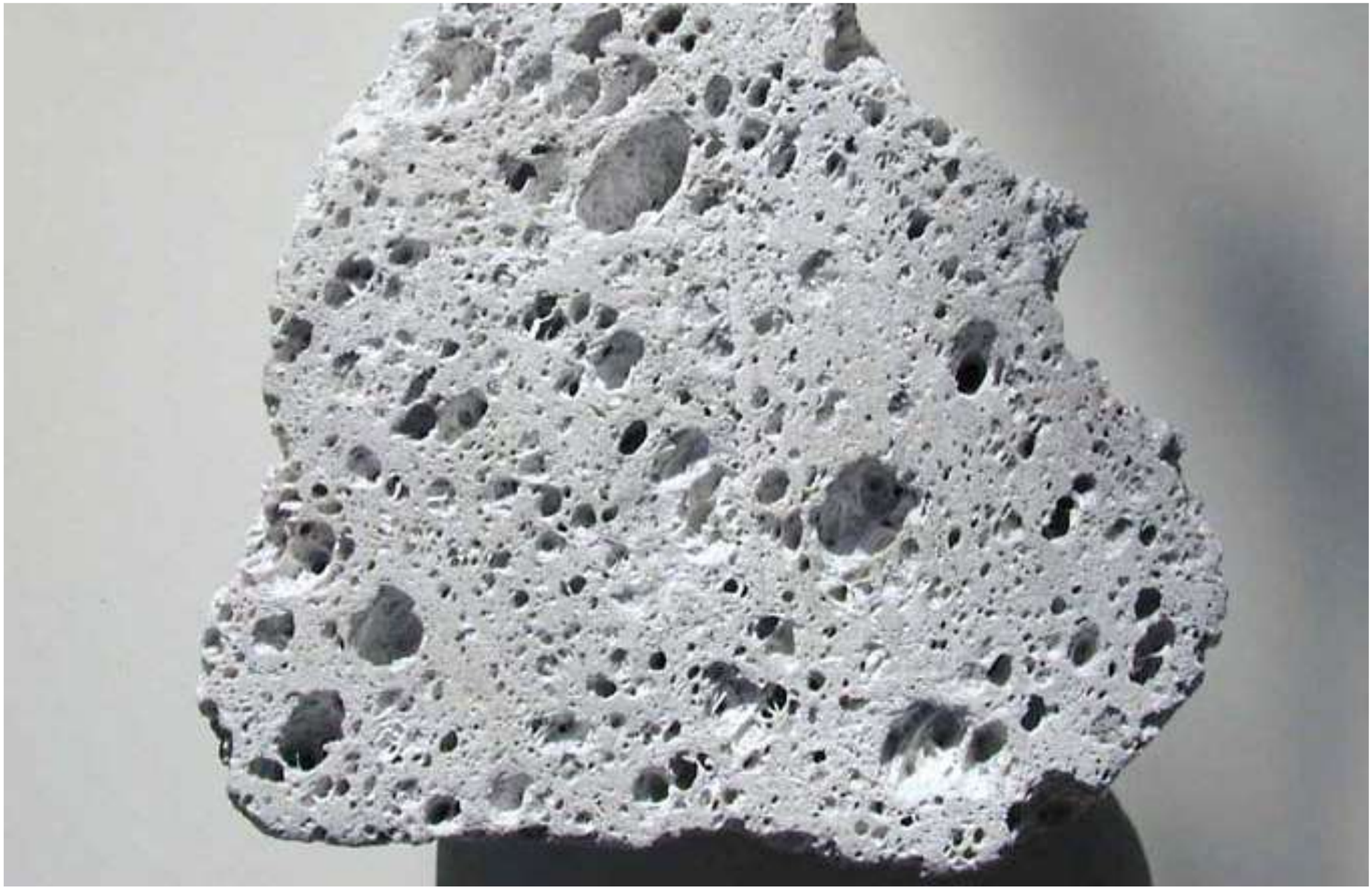

Rock Identification Lab

Fill in the **observe** the rocks, and on the sheet - **circle** the answers and choose the **rock name**!

Igneous Rocks Identification textbook p. 137

IGNEOUS ROCKS - INTRUSIVE -

Sample Number	Composition *(circle one)*	Texture *(circle one)*	Rock Name
14	Mafic Felsic	Coarse-grained Fine-grained Porphyritic Glassy Vesicular	
9	Mafic Felsic	Coarse-grained Fine-grained Porphyritic Glassy Vesicular	
3	Mafic Felsic	Coarse-grained Fine-grained Porphyritic Glassy Vesicular	
16	Mafic Felsic	Coarse-grained Fine-grained Porphyritic Glassy Vesicular	

IGNEOUS ROCKS - EXTRUSIVE -

Sample Number	Composition *(circle one)*	Texture *(circle one)*	Rock Name
6	Mafic Felsic	Coarse-grained Fine-grained Porphyritic Glassy Vesicular	
13	Mafic Felsic	Coarse-grained Fine-grained Porphyritic Glassy Vesicular	
	Mafic Felsic	Coarse-grained Fine-grained Porphyritic Glassy Vesicular	
	Mafic Felsic	Coarse-grained Fine-grained Porphyritic Glassy Vesicular	

Options: ***Granite, Diorite, Gabbro, Peridotite***

Rhyolite, Andesite, Basalt, Obsidian, Pumice, Scoria, Tuff