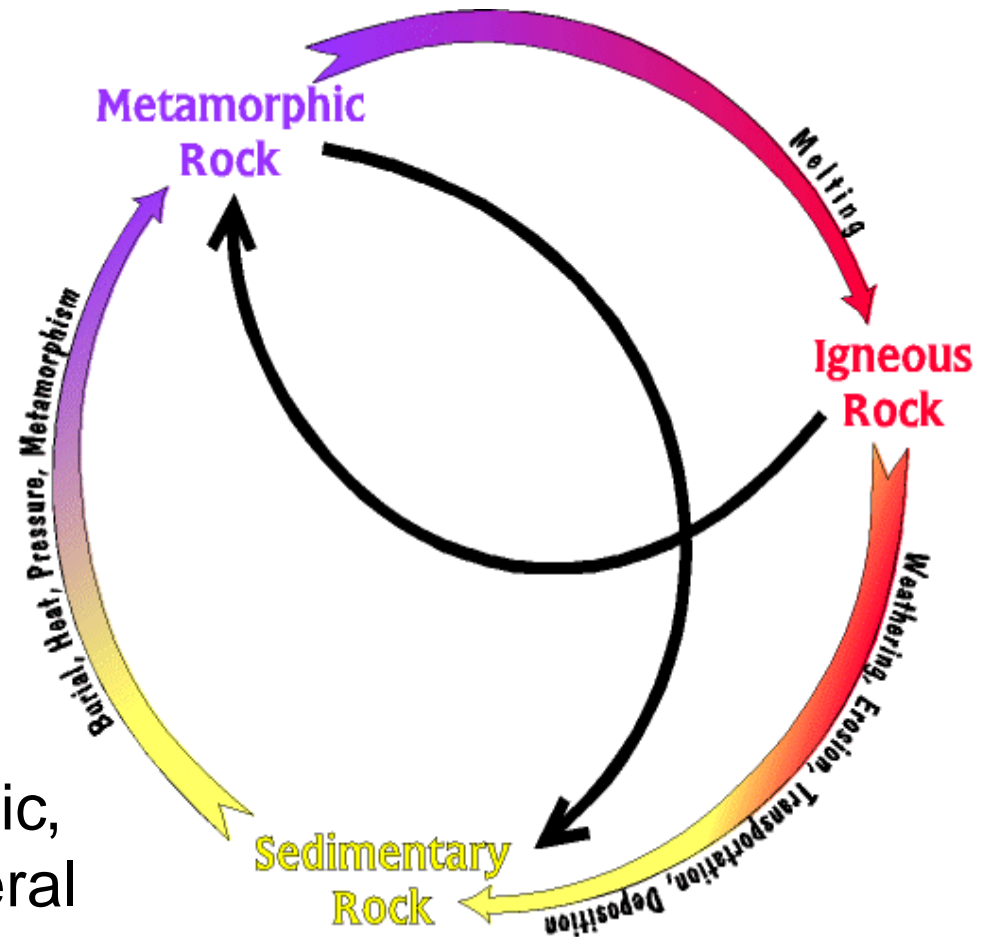


Igneous Rocks

Objectives

1. Contrast magma and lava.
2. Describe how the rate of cooling influences the size of crystals in igneous rocks.
3. Identify igneous rock textures (aphanitic, phaneritic, porphyritic, vesicular, glass) and their mineral composition.



Origin

"fire-formed rocks"

Crystallize from molten material:

- **Magma** - below the Earth's surface
- **Lava** - erupts onto the Earth's surface through a volcano or crack (fissure)

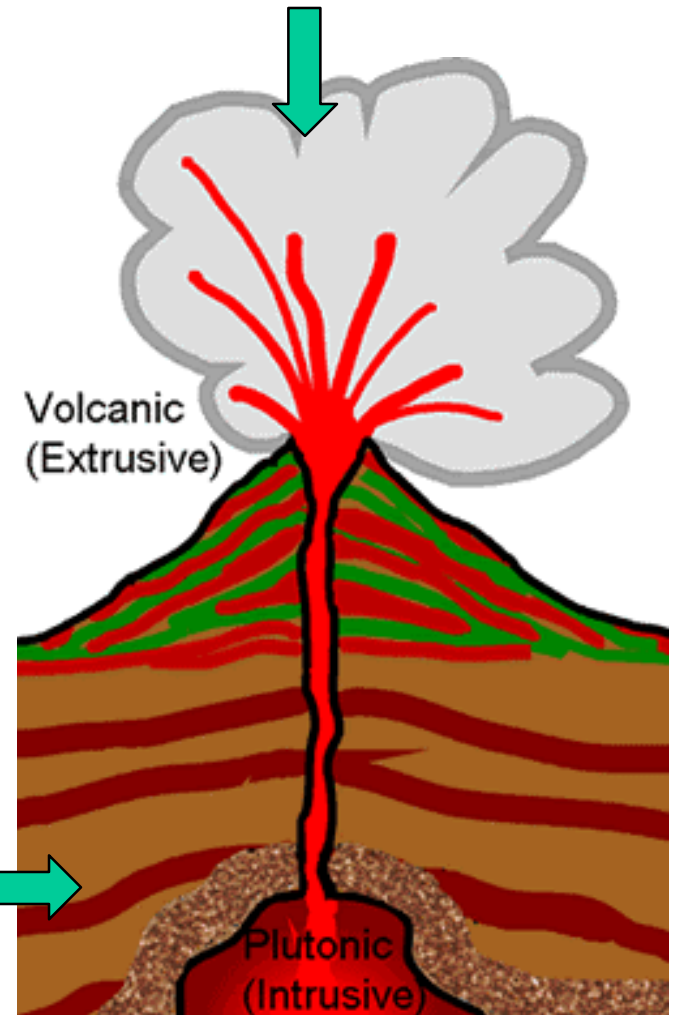
Lava cools more quickly because it is on the surface.

- **Slow cooling = coarse grains** →

Cooling Rates

Cooling rates influence the texture of the igneous rock:

- **Quick cooling = fine grains**



Igneous rocks are classified based on their:

-texture

-composition

Igneous textures

1. Glassy - instantaneous cooling

e.g. Obsidian = volcanic glass



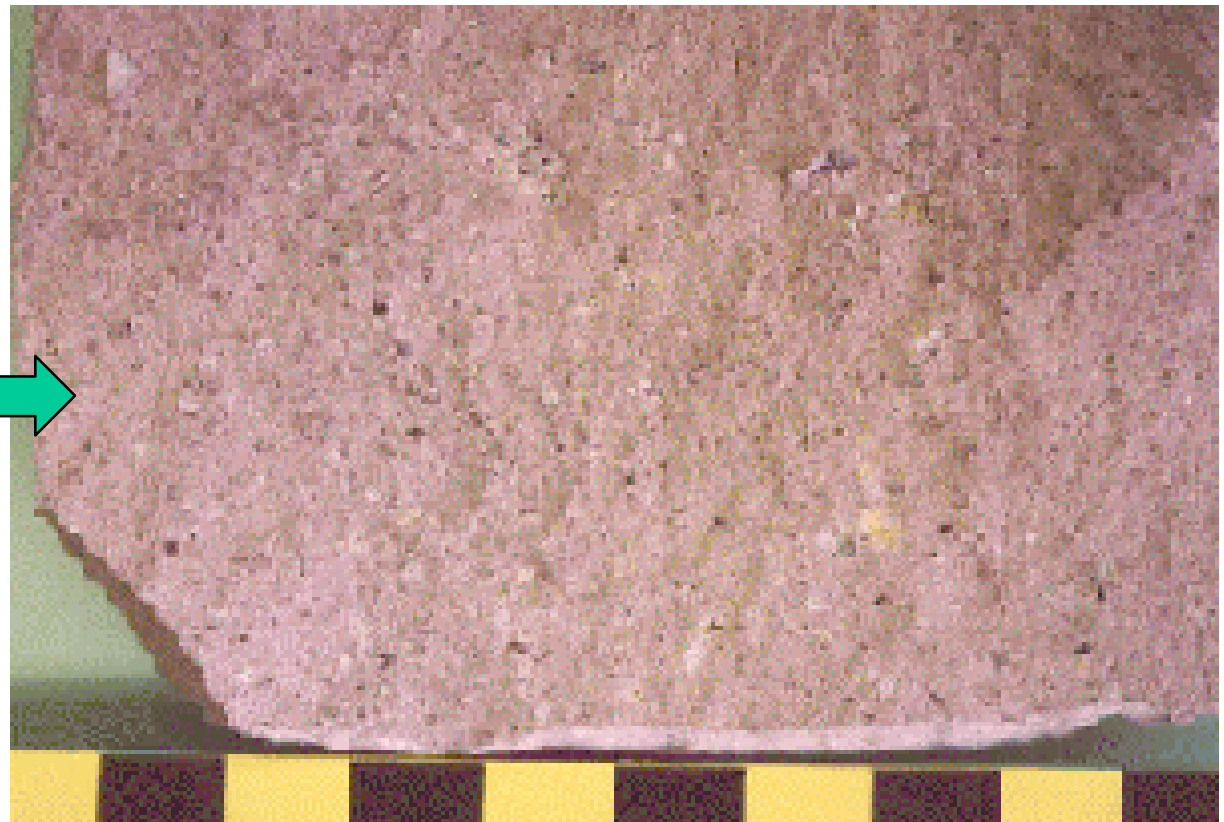
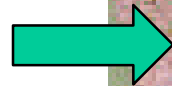
Igneous textures

2. **Aphanitic** -fine grain size (< 1 mm); result of quick cooling

e.g. Basalt

Andesite

Rhyolite



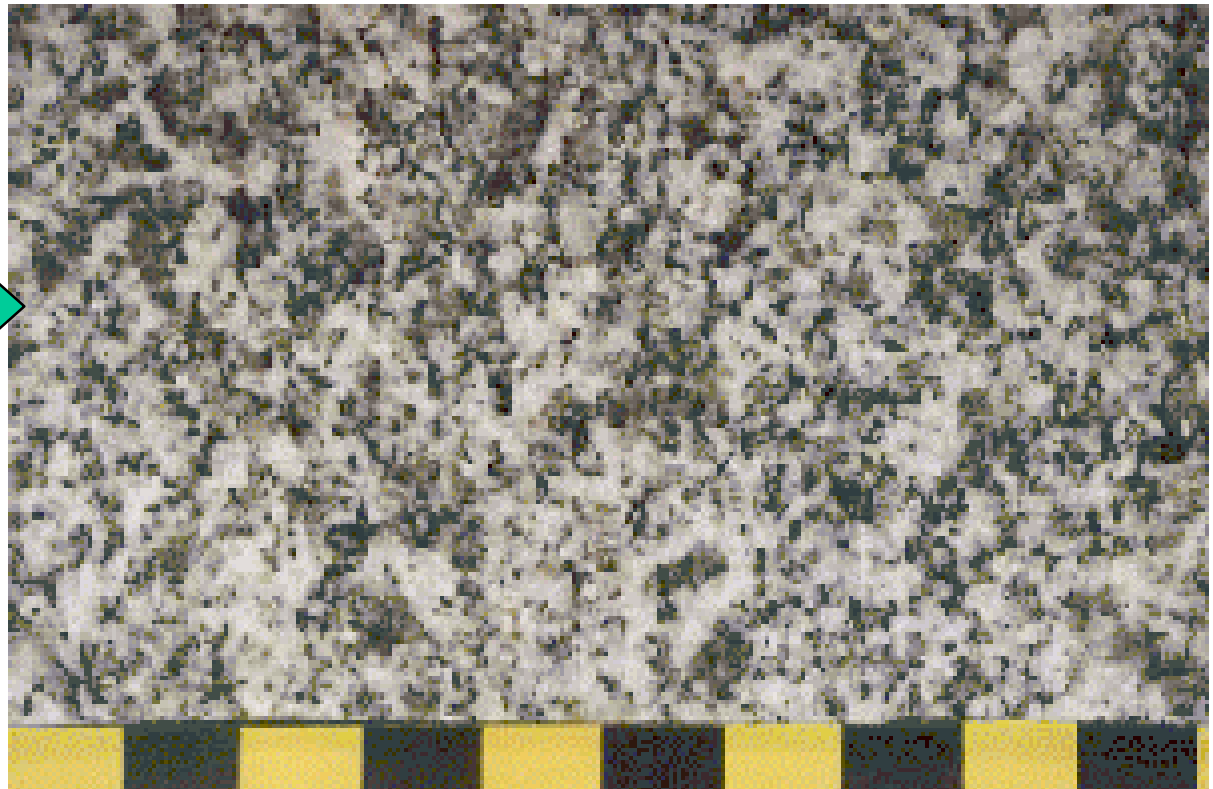
Igneous textures

3. Phaneritic - coarse grain size; visible grains (1-10 mm);
result of slow cooling

e.g. Granite

Gabbro

Diorite →

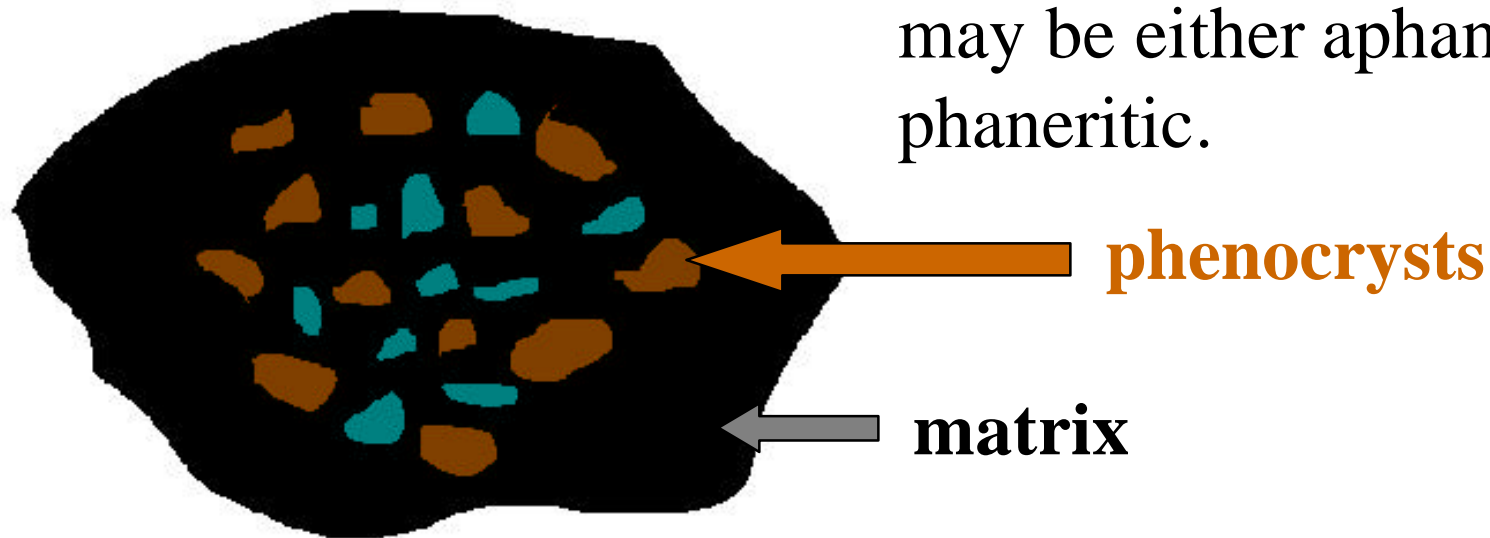


Igneous textures

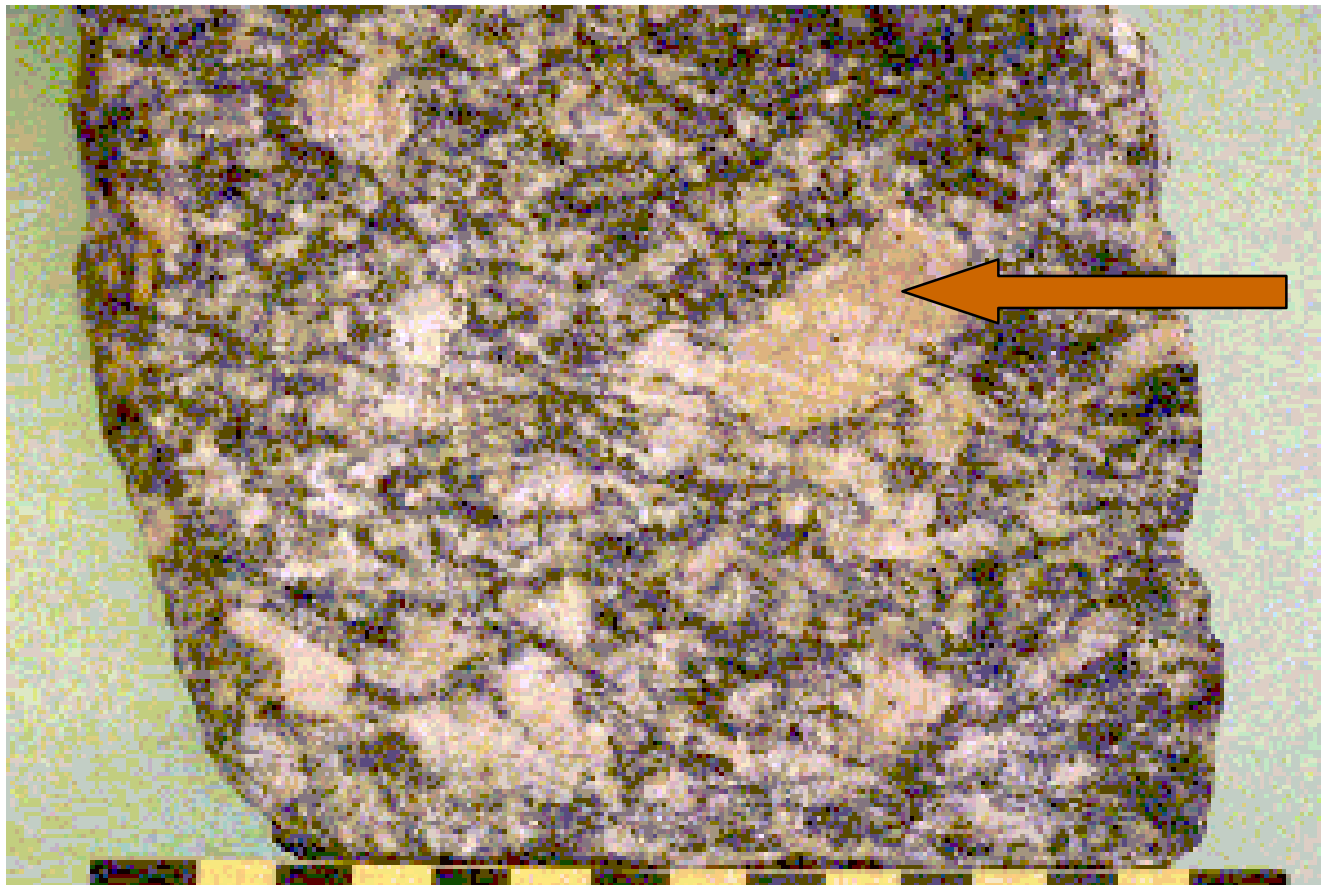
4. Porphyritic - Mixture of grain sizes caused by mixed cooling history; slow cooling first, followed by a period of somewhat faster cooling.

Terms used for the textural components:

- **Phenocrysts** - the large crystals
- **Groundmass or matrix** - the finer crystals surrounding the large crystals. Groundmass may be either aphanitic or phaneritic.

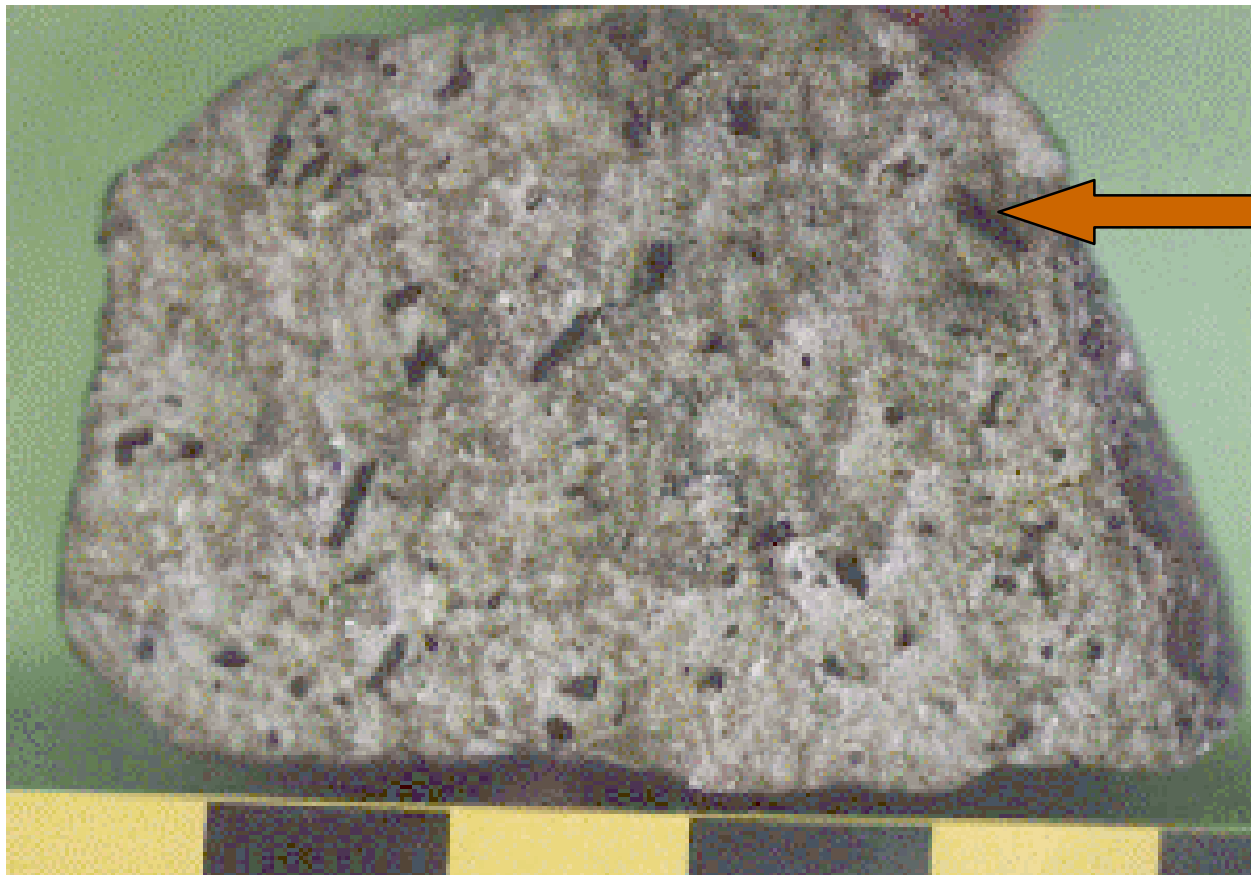


e.g. porphyritic granite - phenocrysts usually potassium feldspar



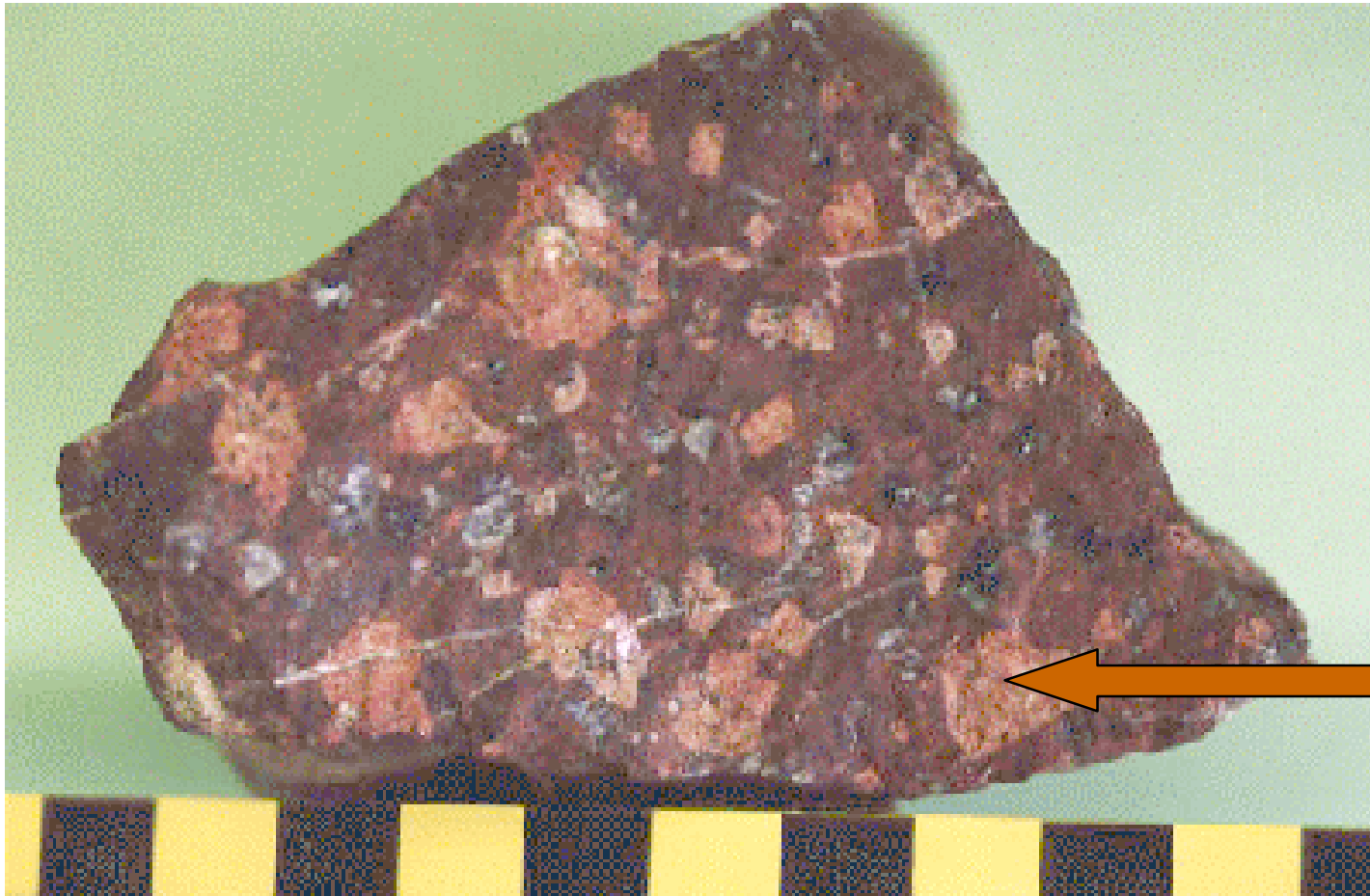
phenocrysts

e.g. porphyritic andesite - phenocrysts usually
hornblende (amphibole)



phenocrysts

e.g. porphyritic rhyolite



phenocrysts

- 5. Vesicular** - contains tiny holes called **vesicles** which formed due to gas bubbles in the lava or magma.
- Very porous (may resemble a sponge)
 - Commonly low density; may float on water
 - e.g. pumice, scoria*

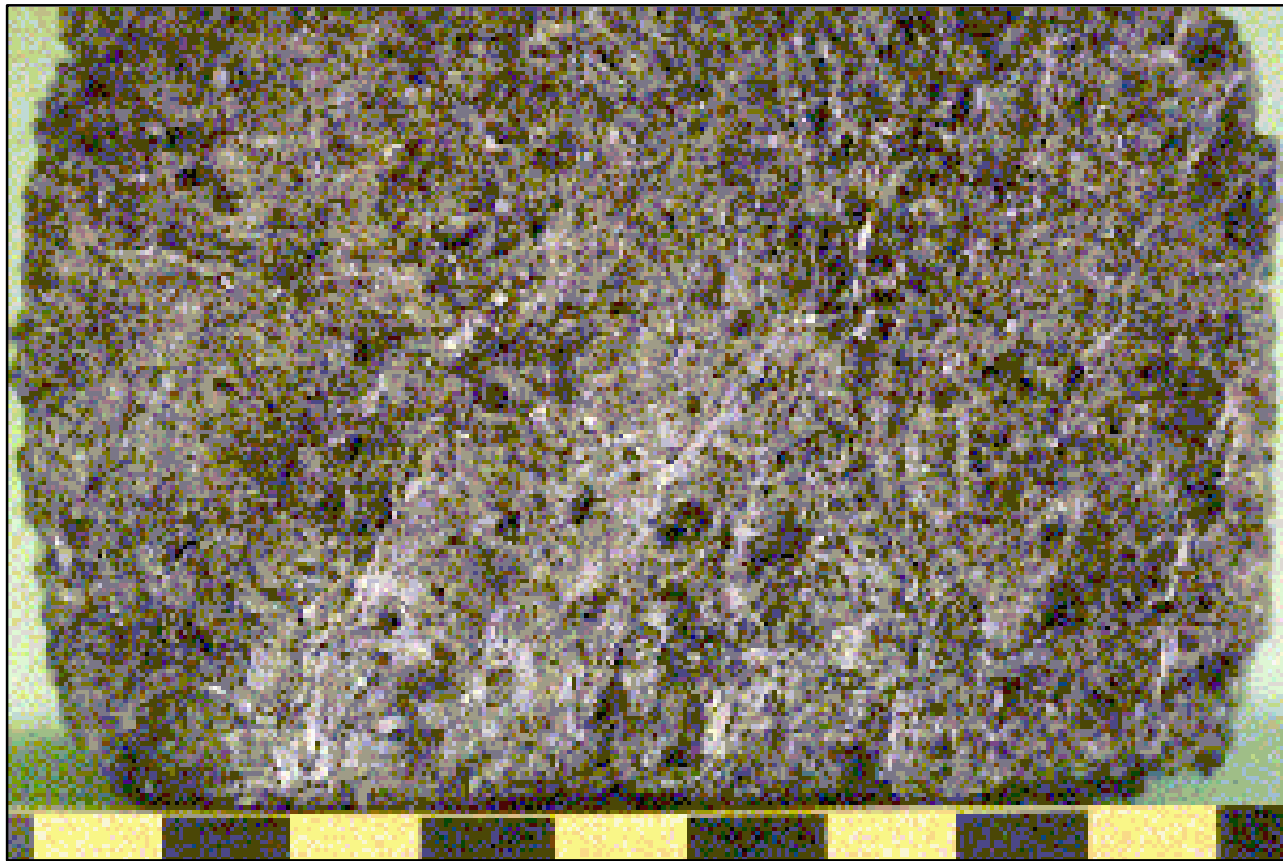
Pumice -light in color; white to gray; may be glassy or dull

-Fully riddled with holes. Very sponge-like. Floats

-Used as an abrasive. (Pumice stone, Lava Soap)



- Scoria* - dark in color; brown, black, or dark red
- fully riddled with holes to form a spongy mass
(may find in barbecue grills as lava rock)



Composition of Igneous Rocks

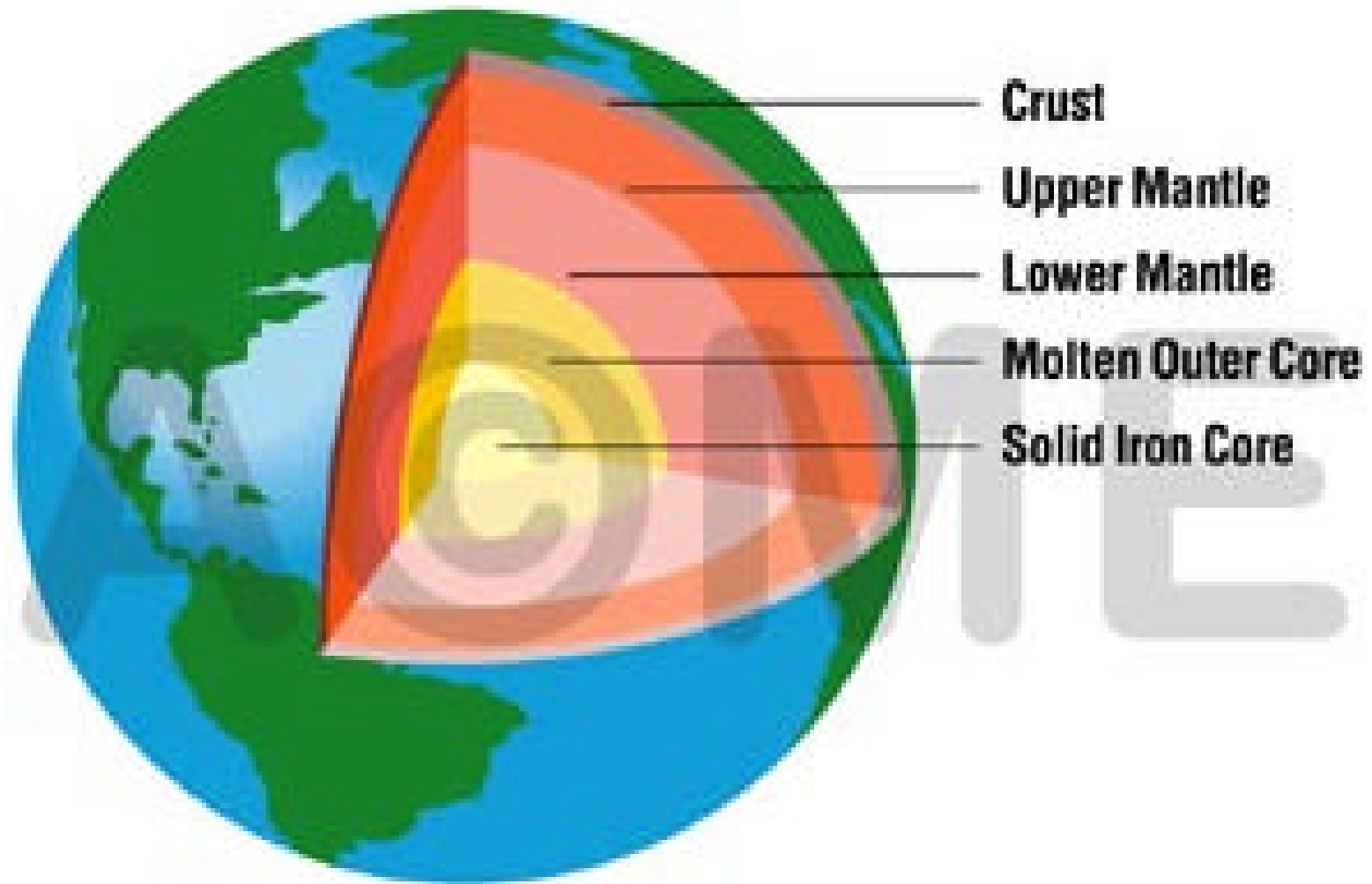
Igneous rocks can be placed into four groups based on their chemical compositions:

1. felsic
2. Intermediate
3. Mafic
4. Ultramafic

1. Felsic

-Usually light in color

-Characteristic of continental crust

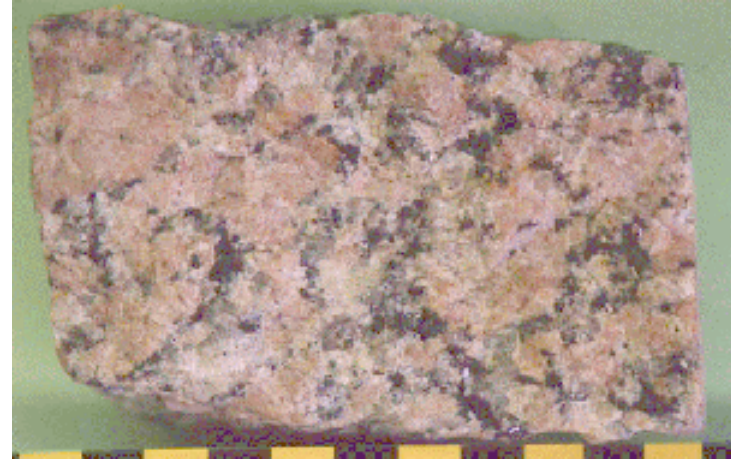


-Rock types include:

Rhyolite



Granite



-Common minerals:

- potassium feldspar (generally pink or white)
- Na-plagioclase feldspar (generally white)
- quartz (generally gray or colorless)
- biotite

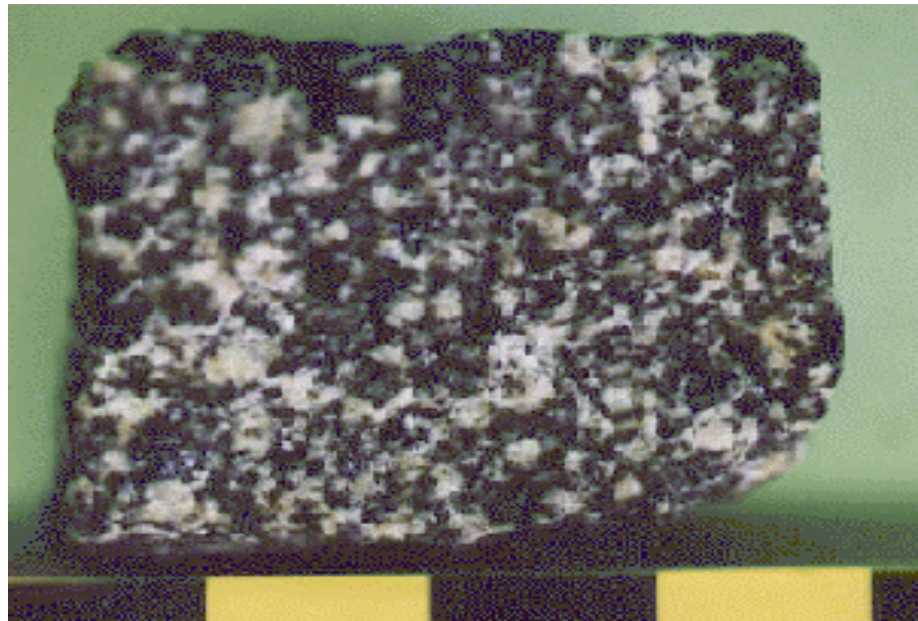
2. Intermediate

-Mixture of both light (felsic) and dark (mafic) minerals

-Rock types include *Andesite* (aphanitic)

-Minerals commonly present include: *Diorite* (phaneritic)

- plagioclase feldspar
- amphibole
- pyroxene
- biotite
- quartz



3. Mafic

- Usually dark in color (dark gray to black)
- Characteristic of Earth's oceanic crust, Hawaiian volcanoes
- Also found on the Moon, Mars, and Venus
- Rock types include: *Gabbro* (phaneritic)
- Minerals commonly present include:
 - Ca-plagioclase feldspar
 - pyroxene
 - olivine
 - amphibole



4. Ultramafic

- Rarely observed on the Earth's surface
- Believed to be major constituent of Earth's mantle
- Rock types include:

Peridotite (phaneritic)

-dominated by olivine -
the birthstone is *Peridot*,
which gives its name to
Peridotite

