

Classification of Igneous Rocks

- Igneous rocks are further classified according to;
 - **Texture:** Describes the appearance of an igneous rock, based on the *size, shape* and *arrangement* of interlocking crystals
 - **Mineral Composition:** Is the mineral makeup of an igneous rock based on the *chemical composition* of the magma

Reference:

Tarbuck and Lutgens
Pages 62-69

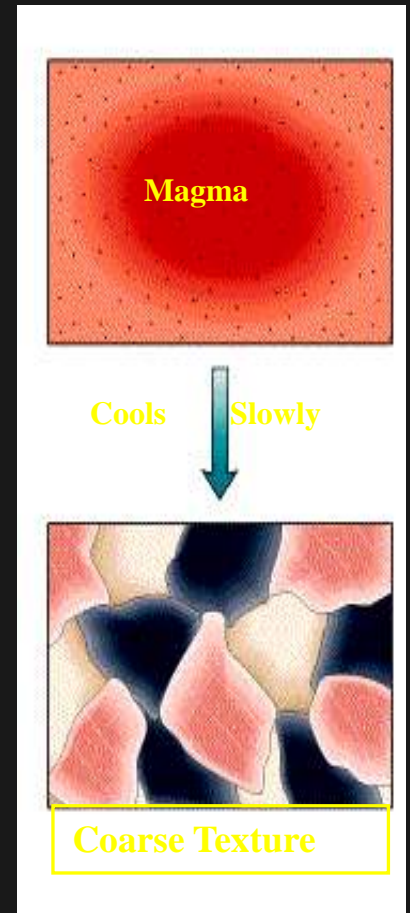
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Texture

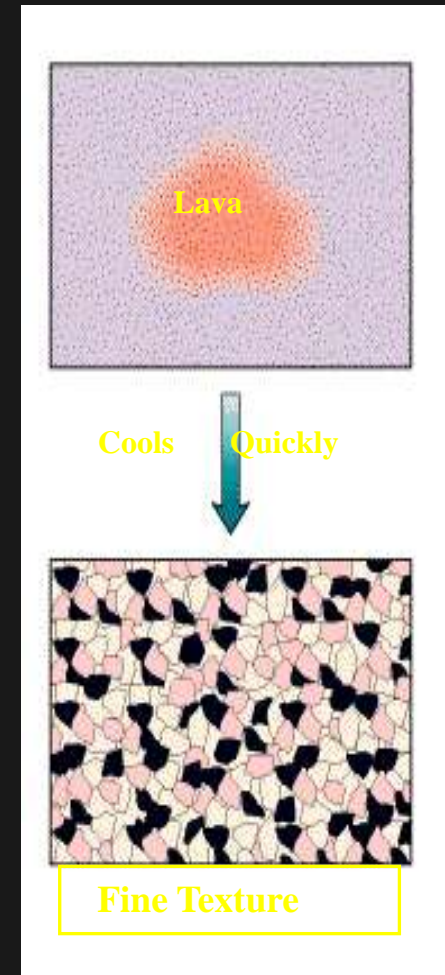
- The texture of an Igneous rock reveals a great deal about the environment in which the rock cooled and solidified.
- Crystal size is the most important factor affecting texture and the size of the crystals are determined by
 - 1) Cooling Rate
 - 2) Amount of Dissolved Gases

1) Cooling Rate

- Molten rock (magma) can cool
 ➤ **beneath Earth's surface.**
- Large crystals form deep within Earth where magmas may take up to tens of thousands of years to cool and crystallize.
- Therefore, the slower the molten rock cools, the larger the crystals



- Molten rock (lava) can **cool on Earth's surface.**
- • Fine crystals form on or near Earth's surface where lava cools quickly in the matter of minutes to hours.
- Therefore, the quicker the molten rock cools, the smaller the crystals.



2) Amount of Dissolved Gases

- Dissolved gases helps the ions in the molten rock to move around and helps crystals to form much faster.
- This can speed up the crystallization of both magma beneath Earth's surface and lava on or near earth's surface.

Texture Classification Chart



T E X T U R E	Coarse Grained	Granite	Diorite	Gabbro
	Fine Grained	Rhyolite 	Andesite	Basalt
	Glassy	Obsidian (compact glass) Pumice (frothy glass)		

Sample Problem

- Explain how texture could be used to classify igneous rocks.

Answer:

Texture:

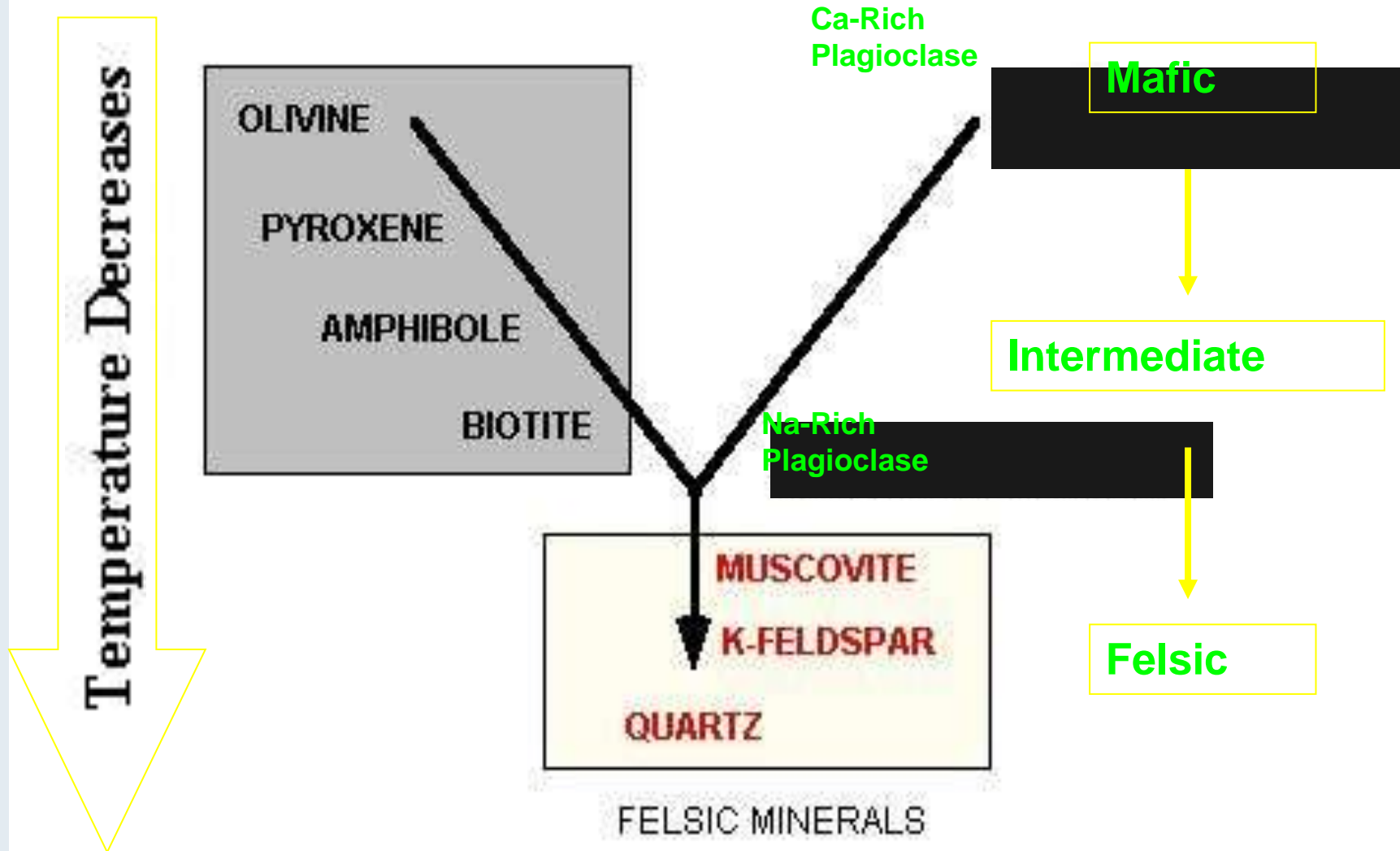
If the igneous rock has small crystals that is not visible to the eye, it is classified as a fine (aphanitic) texture and this rock would form in a volcanic environment.

If the igneous rock has large crystals that is visible to the eye, it is classified as a coarse (phaneritic) texture and this rock would form in a plutonic environment.

Mineral Composition

- The minerals that are present in any igneous rock depends on the chemical composition and the environment (temperature of the magma) from which the molten rock crystallizes.
- N. L. Bowen discovered that different minerals form at different temp.
- Bowen also noted that minerals will react with the magma to produce the next mineral in the reaction series, this is known as **Bowen's Reaction Series**.

BOWEN'S REACTION SERIES



- Olivine and Ca-rich plagioclase feldspar are the first to crystallize at very high temperatures and these minerals are often found in mafic igneous rocks.
- Orthoclase feldspar and quartz crystallize at lower temperatures and are found in felsic igneous rocks
- Therefore, igneous rocks are classified according to their mineral makeup as Mafic, Intermediate, or Felsic.

Mafic Composition

- contain magnesium and iron rich minerals
- form at high temperatures 1200EC
- found mainly in oceanic crust
- form most volcanic rocks (Basalt)
- low percentage of silica, very fluid magmas
- forms dark colored minerals, thus rocks are dark color
- minerals include; olivine, pyroxene, plagioclase feldspar

Felsic Composition

- contains orthoclase feldspar and quartz (silica rich)
- forms at lower temperatures, approximately 600EC
- found mainly in continental crust
- form mainly plutonic rocks (Granite)
- high percentage of silica, very viscous (thick) magmas
- forms light colored minerals, thus rocks are light colored
- minerals include; orthoclase and plagioclase feldspars, quartz, and muscovite mica

Mineral Composition Classification Chart

Composition	Felsic (Granitic)	Intermediate (Andesitic)	Mafic (Basaltic)
Major Minerals	Quartz Orthoclase Feldspar	Amphibole Feldspars	Pyroxene Plagioclase Feldspar
Color	Light	Medium	Dark
	Granite	Diorite	Gabbro
	Rhyolite	Andesite	Basalt

Sample Problem

Explain how mineral composition could be used to classify igneous rocks.

Answer:

Mineral Composition:

If the igneous rock is light color and consist of the minerals quartz and orthoclase feldspar, it is classified as felsic.

If the igneous rock is dark color and consist of the minerals pyroxene and plagioclase feldspar, it is classified as mafic.