Rocks

Rock: a. Strictly, any naturally formed aggregate or mass of mineral matter, whether or not coherent, constituting an essential and appreciable part of the earth's crust.

Rock: b Ordinarily, any consolidated or coherent and relatively hard, naturally formed mass of mineral matter.

Rocks

1. **Igneous Rocks.** الصخور النارية
2. **Metamorphic Rocks.** الصخور المتحولة
3. **Sedimentary Rocks.** الصخور الرسوبية

جامعة المعقل الأهلية
Almaaqal Private University

الصخور النارية
Igneous Rocks

- **Igneous rocks form as molten rock cools and solidifies.**

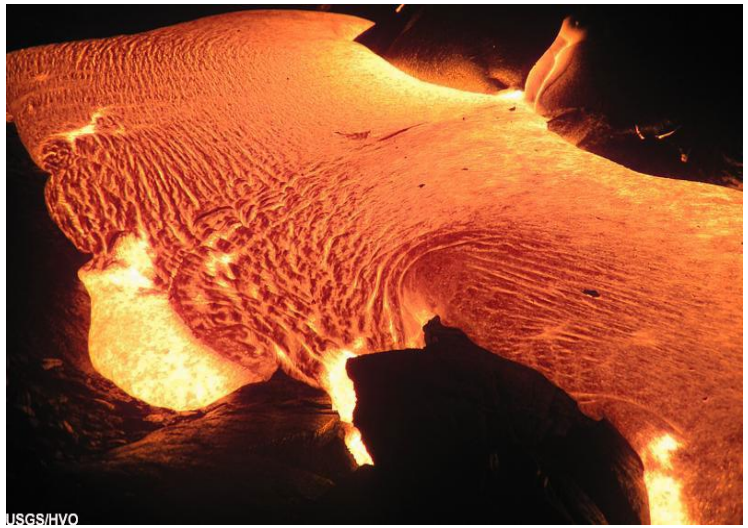
- **General characteristics of magma:**

    - **1. Parent material of igneous rocks.**
    - **2. Forms from partial melting of rocks.**
    - **3. Magma at Earth’s surface is called lava.**

General characteristic of magma

- **Rocks formed from lava = extrusive, or volcanic rocks.**

- **Rocks formed from magma at depth = intrusive, or plutonic rocks**


USGS/HVO

The nature of magma

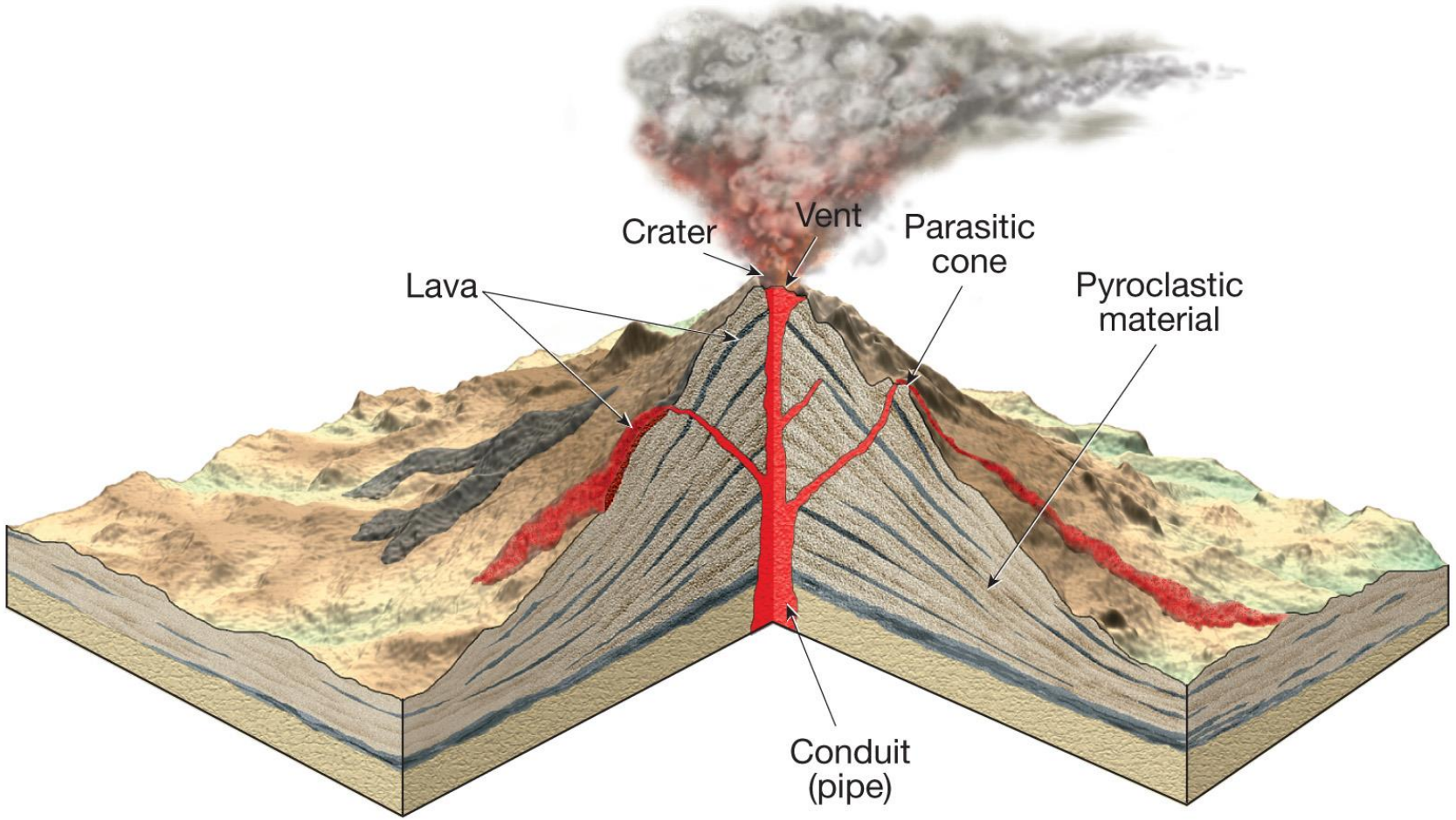
Consists of three components:

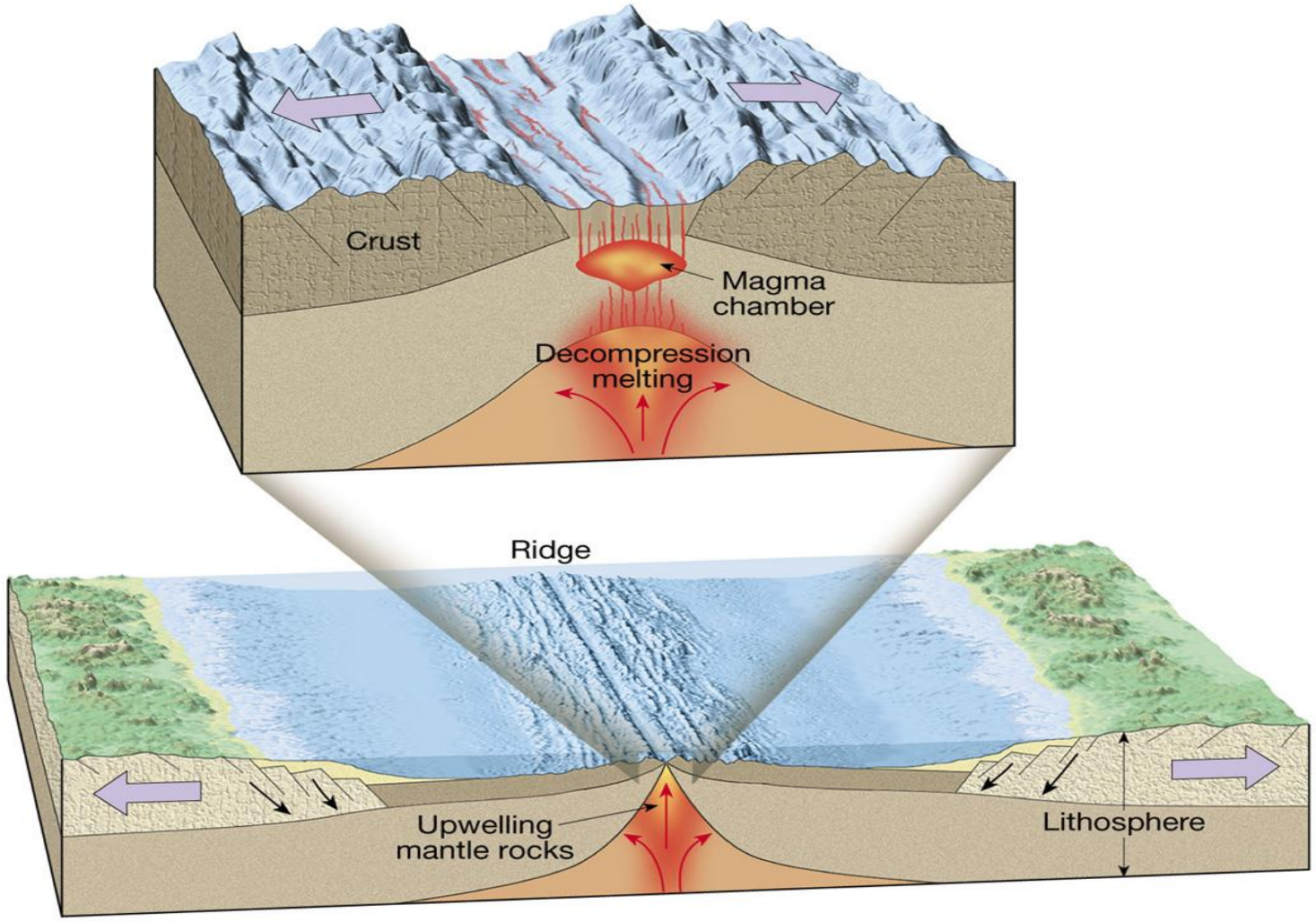
1. **Liquid portion = melt**

2. **Solids, if any, are silicate minerals**

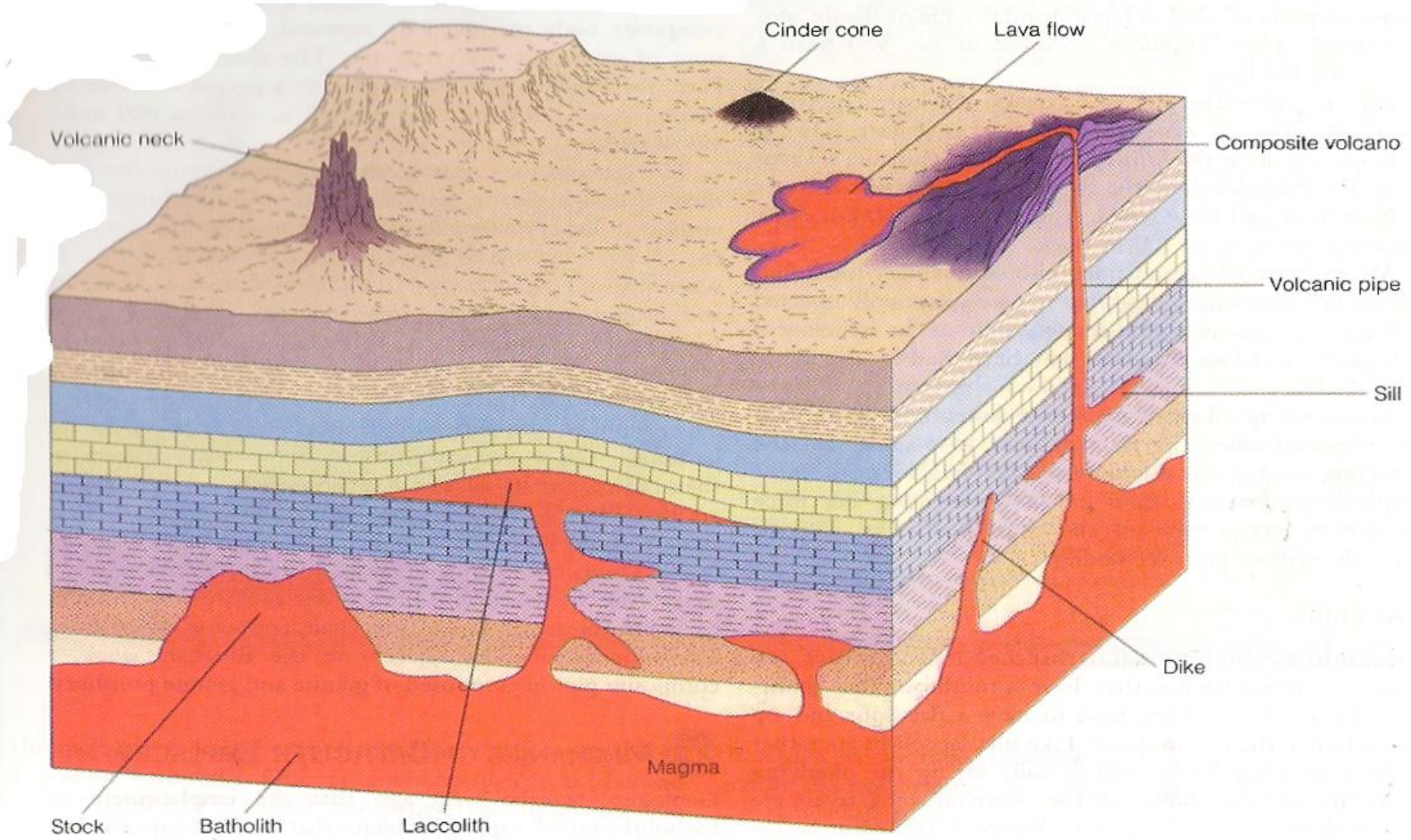
3. **Volatiles = dissolved gases in the melt, including water vapor (H_2O), carbon dioxide (CO_2), and sulfur dioxide (SO_2)**

A composite volcano

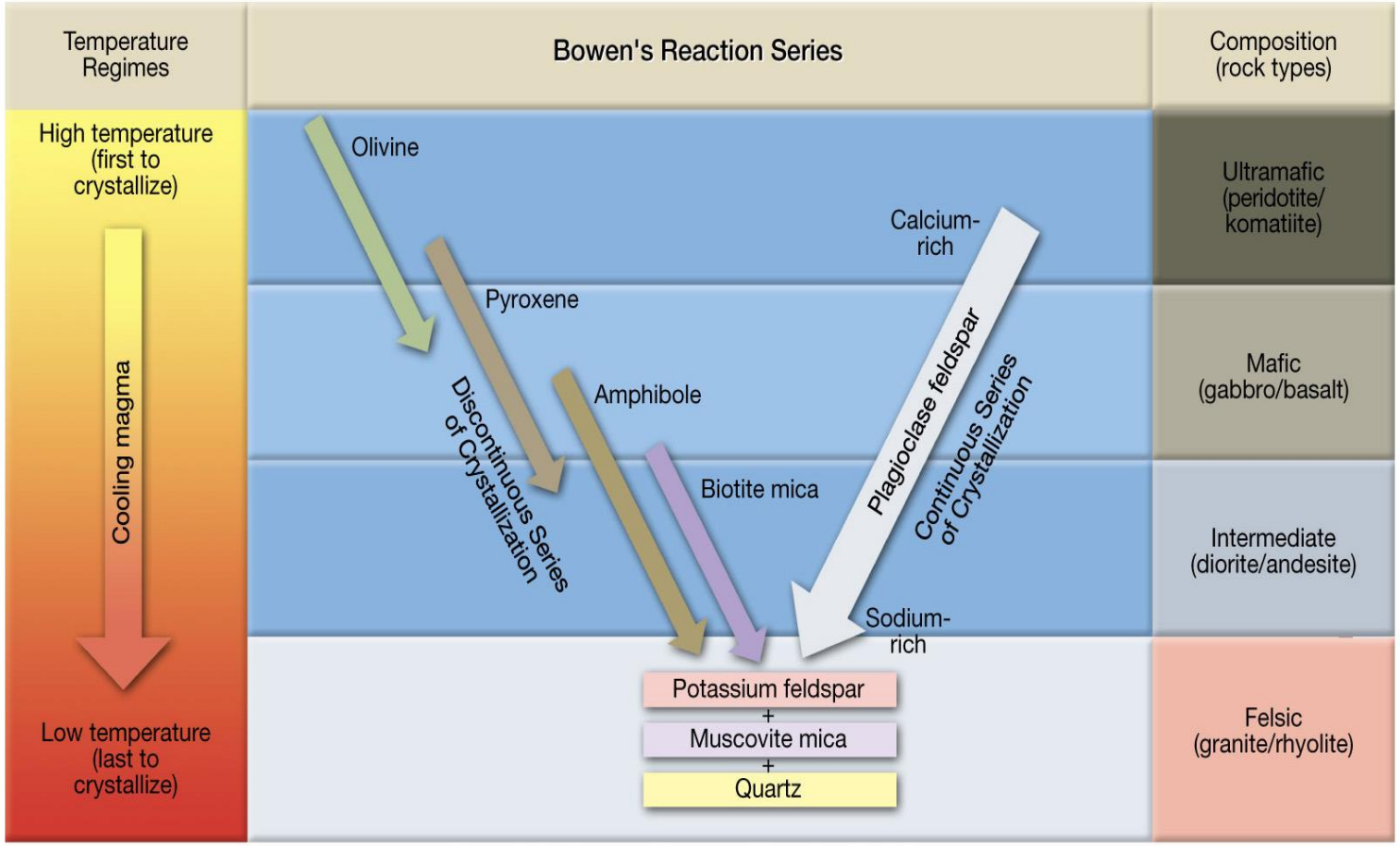




Decompression melting


Cinder cone
Lava flow
Volcanic neck
Composite volcano
Volcanic pipe
Sill
Dike
Magma
Stock
Batholith
Laccolith

Bowen's Reaction Series



General characteristics of magma

- **Igneous rocks form as molten rock cools and solidifies**
- **General characteristics of magma**
  - **Parent material of igneous rocks**
  - **Forms from partial melting of rocks**
  - **Magma at Earth's surface is called lava**

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General characteristics of magma

- **The nature of magma**
  - **Consists of three components:**
    - **Liquid portion = melt**
    - **Solids, if any, are silicate minerals**
    - **Volatiles = dissolved gases in the melt, including water vapor (H_2O), carbon dioxide (CO_2), and sulfur dioxide (SO_2)**
- **Crystallization of magma**
  - **Cooling of magma results in the systematic arrangement of ions into orderly patterns**
  - **Silicate minerals result from crystallization in a predictable order**
  - **Texture - size and arrangement of mineral grains**

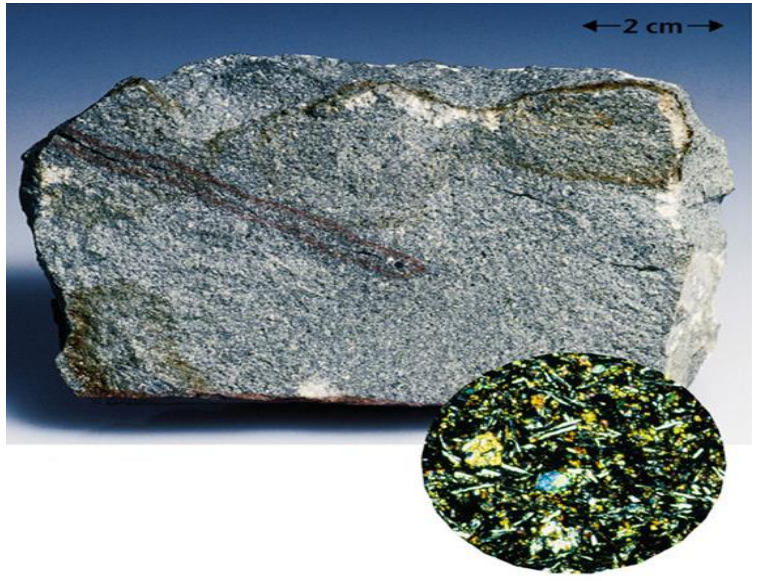
Igneous Textures

- **Texture - overall appearance of a rock based on the size, shape, and arrangement of interlocking minerals**
- **Factors affecting crystal size**
  - **Rate of cooling**
    - **Slow rate = fewer but larger crystals**
    - **Fast rate = many small crystals**
    - **Very fast rate forms glass**
  - **% of silica (SiO_2) present**
  - **Dissolved gases**

- **Types of igneous textures**

1. Aphanitic (fine-grained) texture.

- **Rapid rate of cooling.**
- **Microscopic crystals.**
- **May contain vesicles (holes from gas bubbles).**

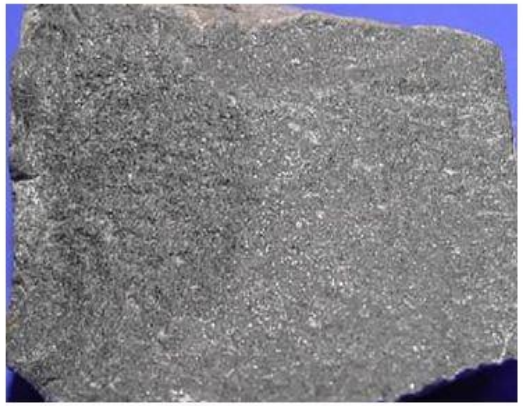


IGNEOUS ROCK TEXTURES

- Aphanitic Texture

Aphanitic texture consists of small crystals that cannot be seen by the eye with or hand lens. The entire rock is made up of small crystals, which are generally less than 1/2 mm in size.

Texture results from rapid cooling in volcanic or hypabyssal (shallow subsurface) environments.



2. Phaneritic (coarse-grained) texture

Slow cooling.

Large, visible crystals.

Phaneritic Texture

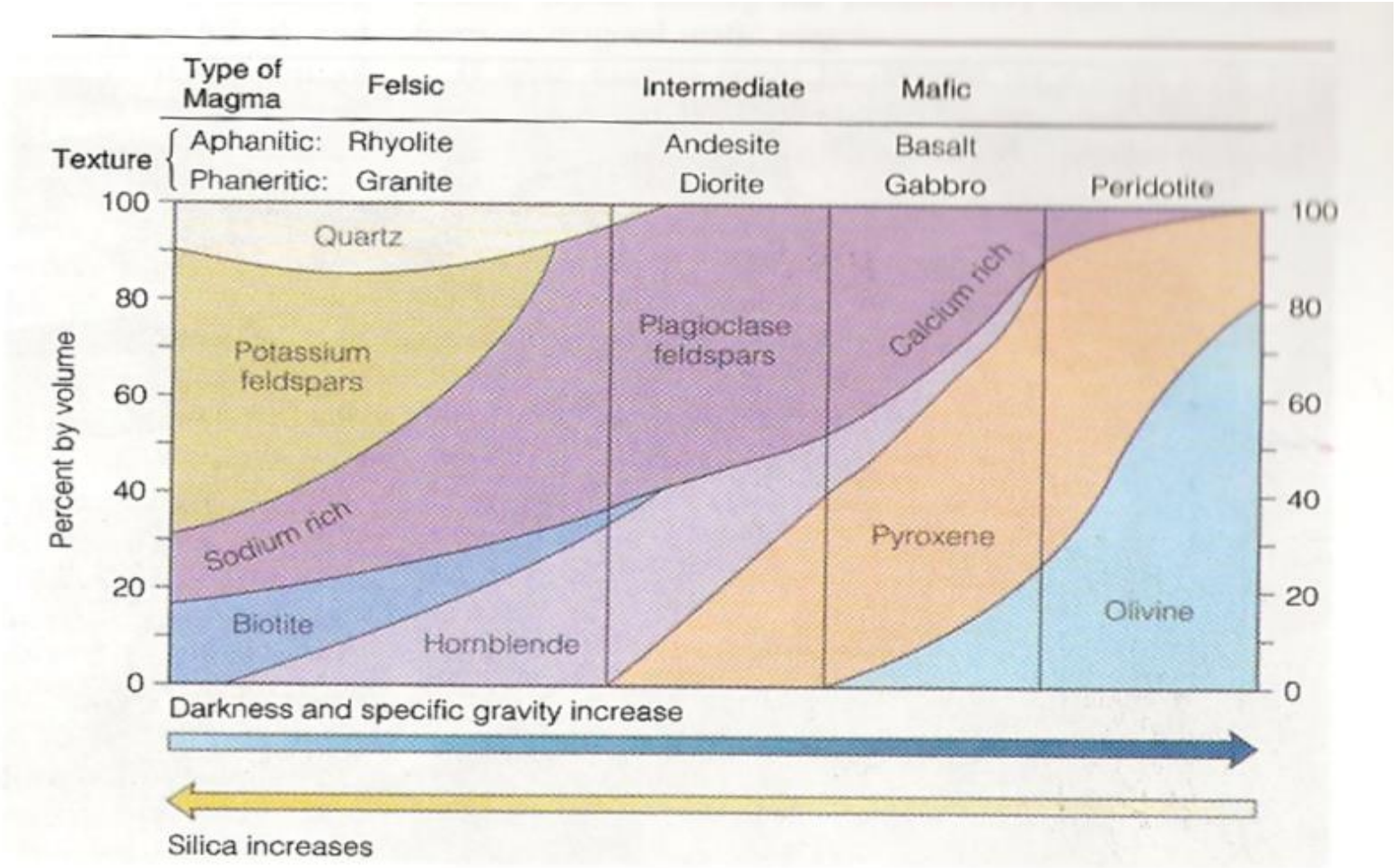
- Phaneritic ("FAN-a-RIT-ic") rocks
- Have mineral grains that are large enough to be seen with the naked eye or a hand lens
- like this **granite**

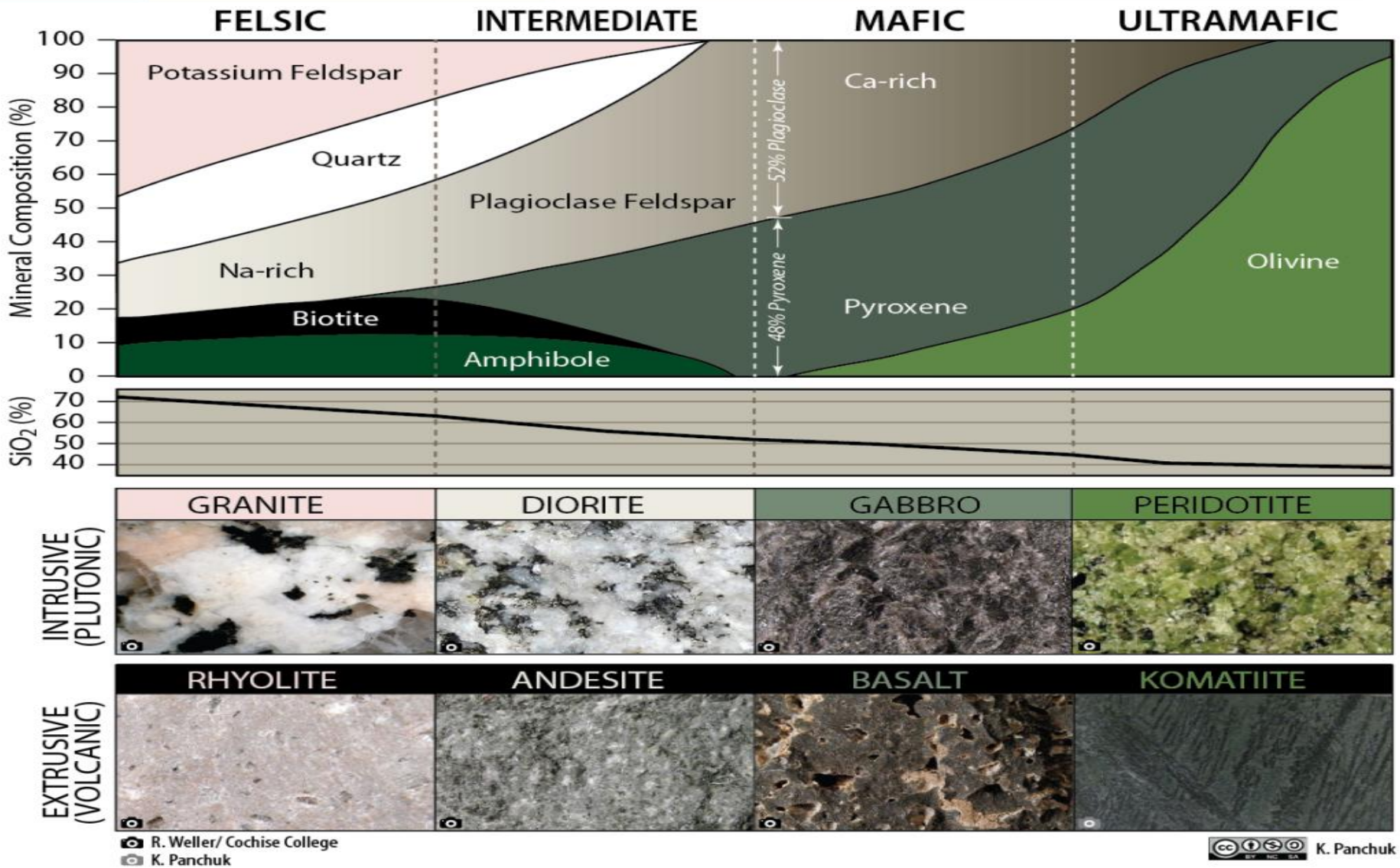
Classification of Igneous Rocks

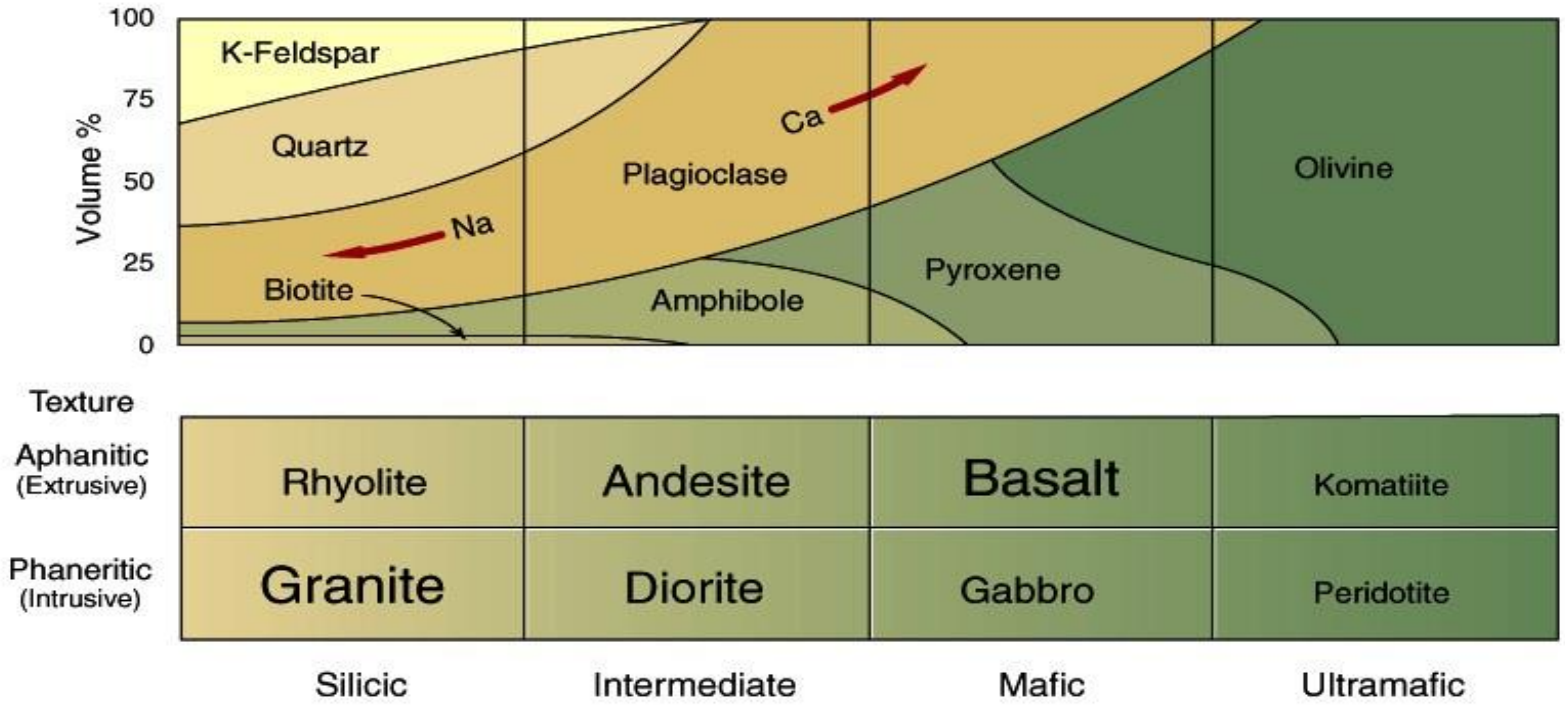
- **Texture**
  - Aphanitic
  - Phanaritic
- **Composition**
  - Silicic
  - Intermediate
  - Mafic
  - Ultramafic

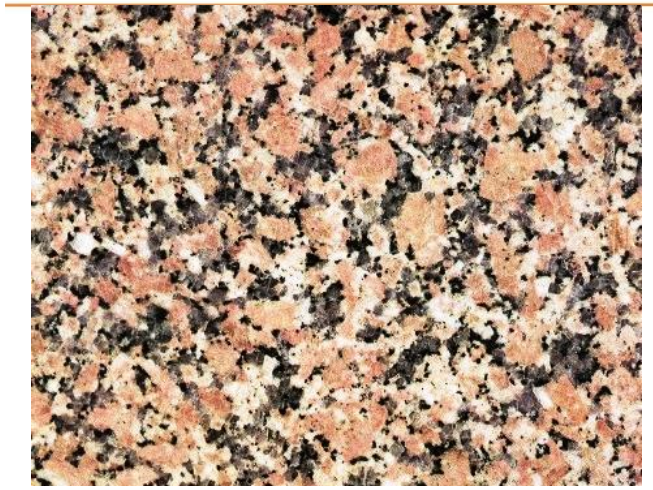
Combination of Texture and Composition produces rock name

Types of Igneous Rocks




FELSIC
INTERMEDIATE
MAFIC
ULTRAMAFIC
Mineral Composition (%)
100
90
80
70
60
50
40
30
20
10
0
Potassium Feldspar
Quartz
Na-rich
Biotite
Amphibole
Plagioclase Feldspar
52% Plagioclase
48% Pyroxene
Ca-rich
Pyroxene
Olivine
SiO2 (%)
70
60
50
40
INTRUSIVE (PLUTONIC)
GRANITE
DIORITE
GABBRO
PERIDOTITE
EXTRUSIVE (VOLCANIC)
RHYOLITE
ANDESITE
BASALT
KOMATIITE
R. Weller/ Cochise College
K. Panchuk
K. Panchuk


100
75
50
25
0
Volume %
K-Feldspar
Quartz
Plagioclase
Ca
Na
Biotite
Amphibole
Pyroxene
Olivine
Texture
Aphanitic
(Extrusive)
Phaneritic
(Intrusive)
Rhyolite
Andesite
Basalt
Komatiite
Granite
Diorite
Gabbro
Peridotite
Silicic
Intermediate
Mafic
Ultramafic



Granite

Diorite

Granodiorite

Gabbro

Andesite

Obsidian

Basalt

Ash

Rhyolite

Pumice