

GLY 102

Introduction to Geology II
2020/2021 Session

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Course Description

This Course makes use of the principles and techniques of geology to reconstruct and understand the geological history of Earth. It focuses on evolution of organism , their distribution, classification, occurrence and uses as fossil for relative dating of rocks.

The course also explains the use of stratigraphy, structural geology and paleontology to tell the sequence of rock formation and the timing of other events observed on rocks during different time periods in the geological timescale. Account of historical geologists will also be thought.

Learning Objectives

By the end of this Course and after answering tutorial questions and assignments, students should be able to understand:

- The historical development of the field of geology
- The development of the basic geologic principles employed by historical geologists.
- The evolution of the geologic time scale
- The history of the Earth from its inception to the present
- The three types of rock and how they are related

Course Contents

WEEK	TOPIC
1	Principles of Historical Geology -Earth's History
2	Principles of Historical Geology -Earth's History
3	The Founders of Historical Geology
4	The Founders of Historical Geology
5	Global Dating of the Rock Record
6	Global Dating of the Rock Record
7	Global Dating of the Rock Record
8	First Continuous Assessment
9	Unconformity
10	Rock Cycle
11	Rock Cycle
12	Second Continuous Assessment
13	Water Cycle/Hydrologic Cycle
14	Water Cycle/Hydrologic Cycle
15	Revision
16	Examination
17	Examination

Additional Textbooks

- **Understanding Earth Sixth Edition Edition by John Grotzinger (Author), Thomas H. Jordan**

Rocks and the Rock Cycle

Types of Rocks

- Rocks are classified by how they form
 - **Igneous**
 - **Sedimentary**
 - **Metamorphic**
 - Rocks can change from one type to another over time

Schist

Rock Classification

- **Rocks are classified by:**
 - How they form
 - Texture
 - Grain size
 - Mineral composition



Conglomerate Sedimentary Rock

Types of Rocks

How they form

- **Igneous**-formed from the cooling and crystallization of magma
- **Sedimentary**-formed by the compacting and cementation of layers of sediment
- **Metamorphic**-formed by structural/chemical change due to heat and pressure

Igneous Rocks

How they form

- ❖ Forms when molten rock (magma) cools and hardens
- ❖ Classified by Where they form and their Crystal (grain) size

Igneous Rocks

Intrusive Igneous Rock

- ❖ Cooling takes place slowly
beneath Earth's surface

granite



Extrusive Igneous Rock

- ❖ Cooling takes place rapidly on
Earth's surface



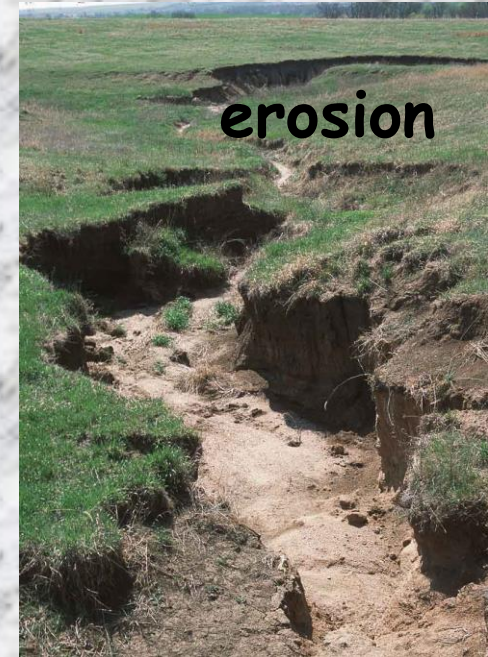
Pumice

Sedimentary Rock

- ❖ Forms from the compaction and/or cementation of **sediments**
- ❖ This process is called **lithification**
- ❖ **Sediments** are:
 - ✓ Rock pieces
 - ✓ Mineral grains
 - ✓ Shell fragments

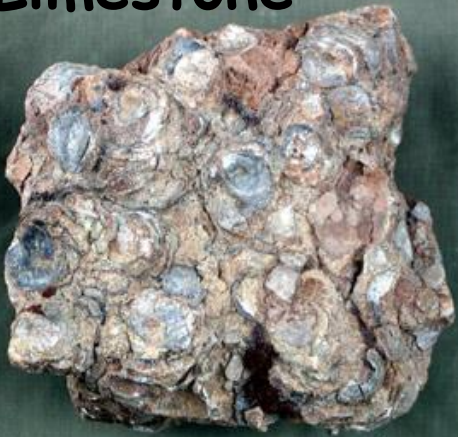
How do sediments form?

- ❖ Sediments form through the processes of weathering and erosion of rocks exposed at Earth's surface.
- ❖ Sedimentary rock can also form from the chemical depositing of materials that were once dissolved in water
- ❖ When water **evaporates**, minerals are left behind and form rock



Sedimentary Rock

Limestone



gypsum



0 1 2 cm
0 1 2 1Inch

Metamorphic Rock

- **Metamorphic rock**: forms when any rock type is changed into a different kind of rock
- Changes due to great heat and/or pressure



Gneiss

Metamorphic Rock

- ❖ “meta” = to change
- ❖ “morph” = form
- ❖ Metamorphic rocks are formed from Parent rocks (pre-existing rocks) or Protolith
- ❖ Parent rocks can be Igneous, sedimentary, or other metamorphic rocks.
- ❖ Metamorphism → The process through which a rock’s structure is changed by heat and pressure

Metamorphic Rock

Textures

1. Foliated Rock → Bands of minerals in parallel layers



2. Non-foliated Rock → Without bands



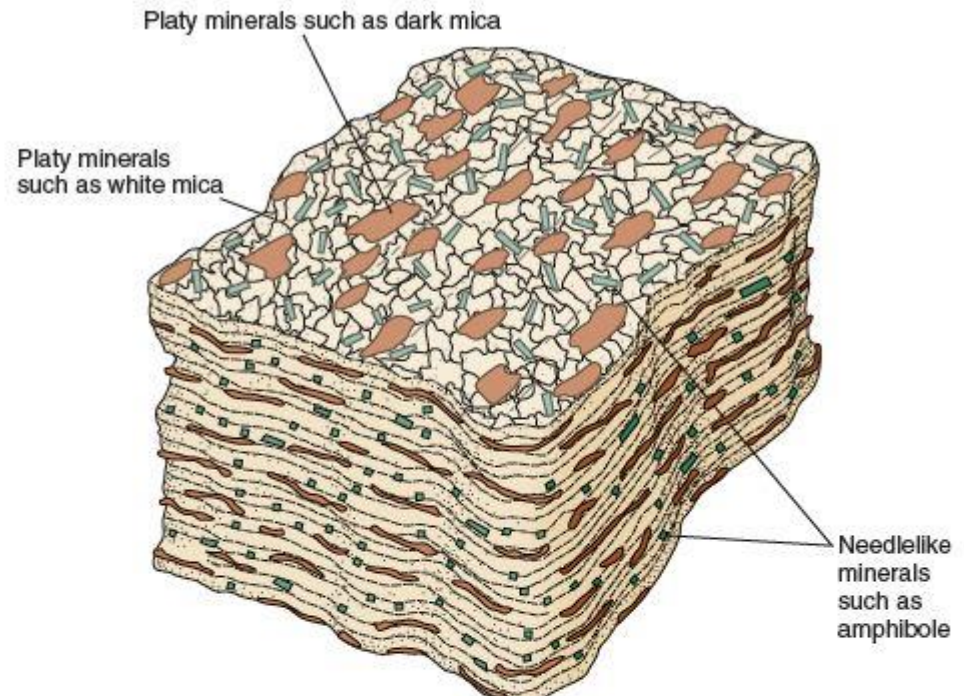
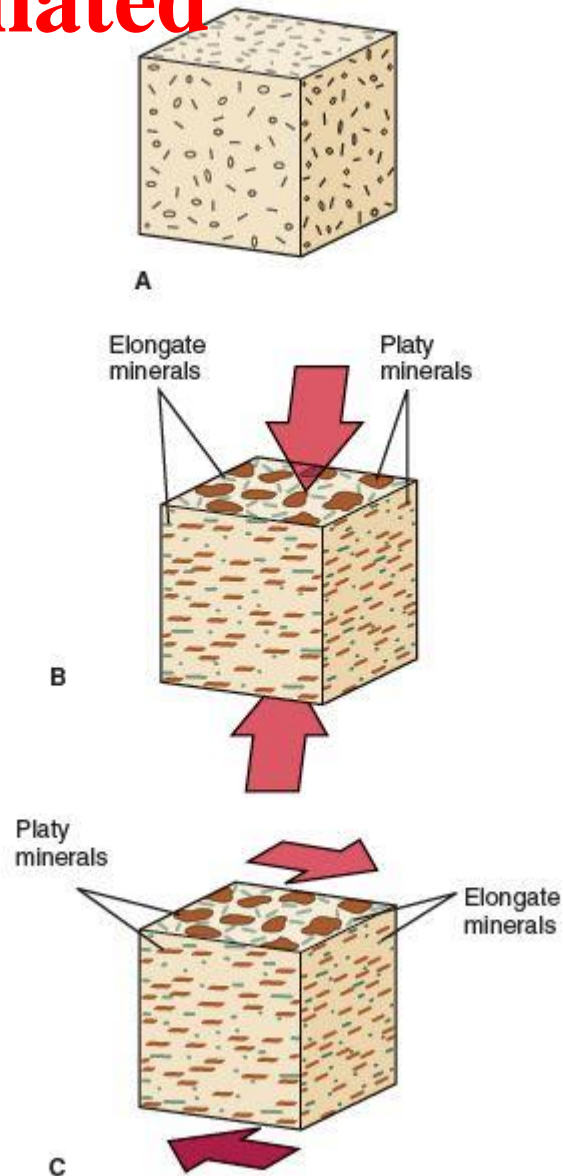
Metamorphic Rock

Foliated

1. If the rock splits easily along nearly flat and parallel planes, indicating that preexisting, microscopic, platy minerals were realigned during metamorphism, we say the rock is slaty, or that it possesses **slaty cleavage**.
2. If visible minerals that are platy or needle-shaped have grown essentially parallel to a plane due to differential stress, the rock is **schistose**.
3. If the rock became very ductile and the new minerals separated into distinct (light and dark) layers or lenses, the rock has a layered or **gneissic texture**,

Metamorphic Rock

Foliated



Orientation of platy and elongate minerals in metamorphic rock. (A) Platy minerals randomly oriented (e.g., clay minerals before metamorphism). No differential stress involved. (B) Platy minerals (e.g., mica) and elongate minerals (e.g., amphibole) have crystallized under the influence of compressive stress. (C) Platy and elongate minerals developed with shearing as the dominant stress.

Metamorphic Rock

Non-Foliated

Marble →



Quartzite →



Metamorphic Rock



Schist

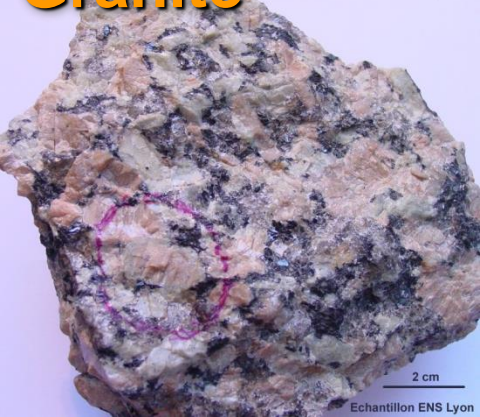


Gneiss

Parent Rocks to Metamorphic Rocks

▪ **Parent Rock** → The original rock material that forms metamorphic rock

Granite



Gneiss

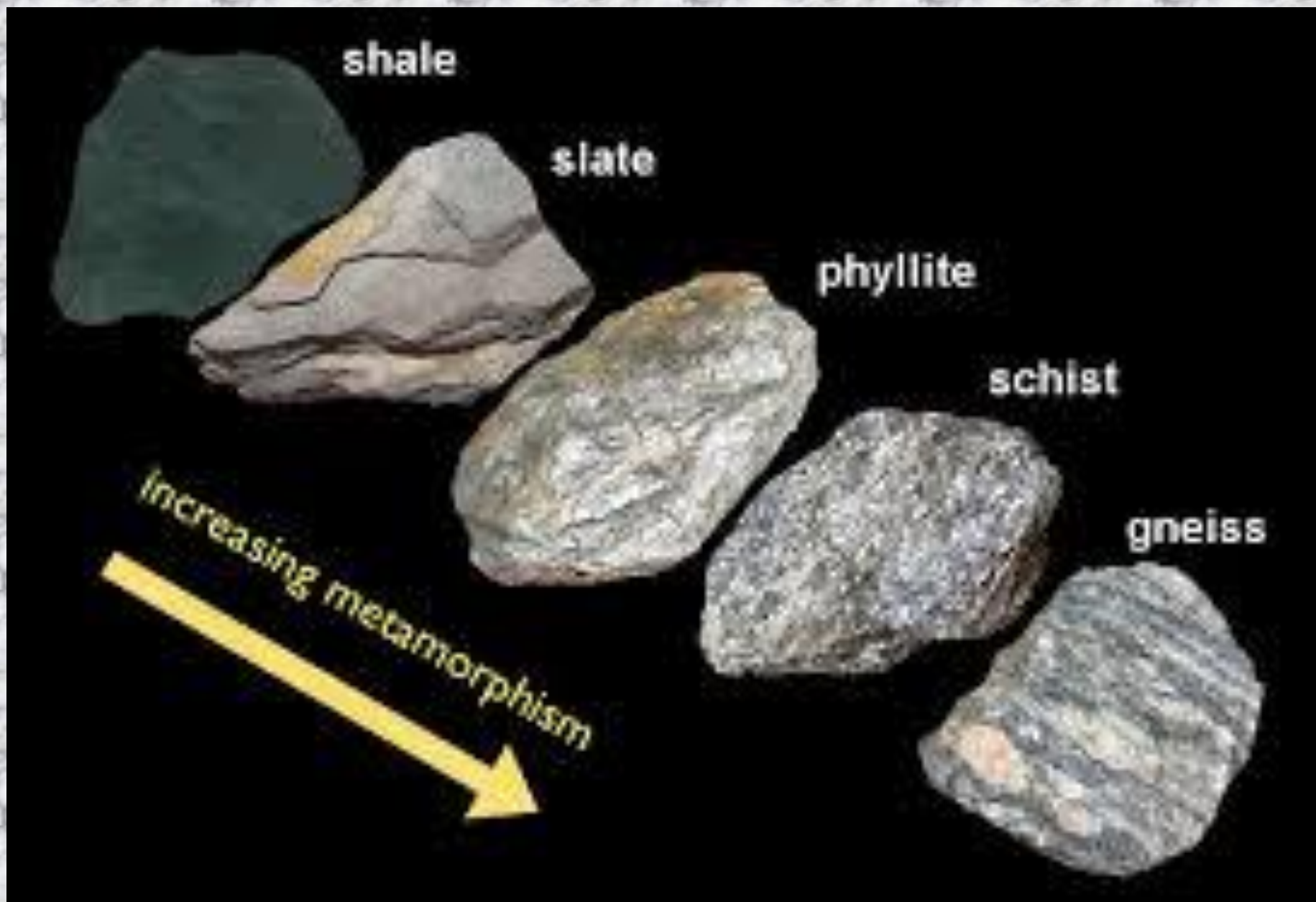


Shale



Slate





Parent rock of Marble

Limestone



Marble



Quartzite

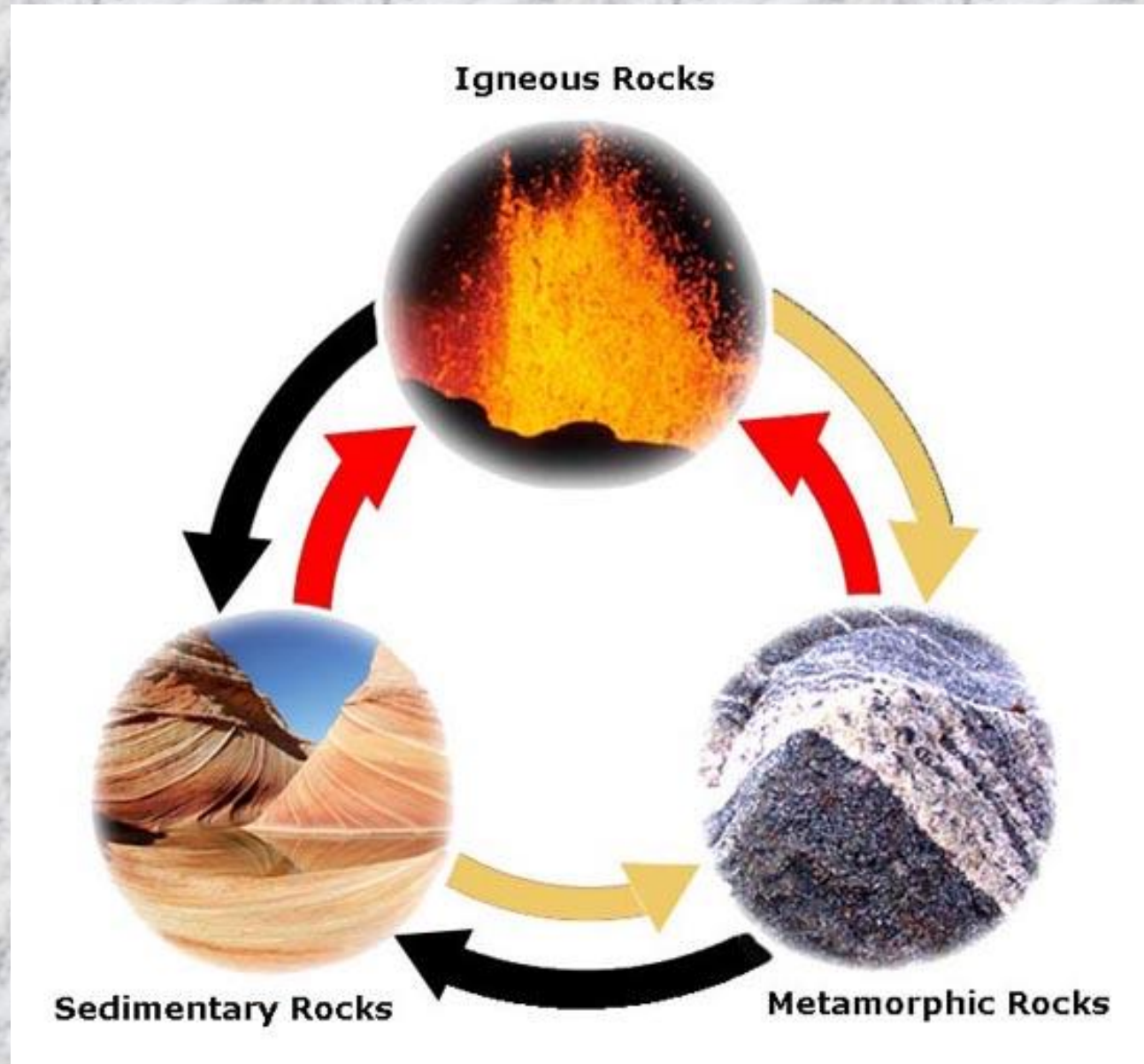
quartzite

sandstone

Sandstone

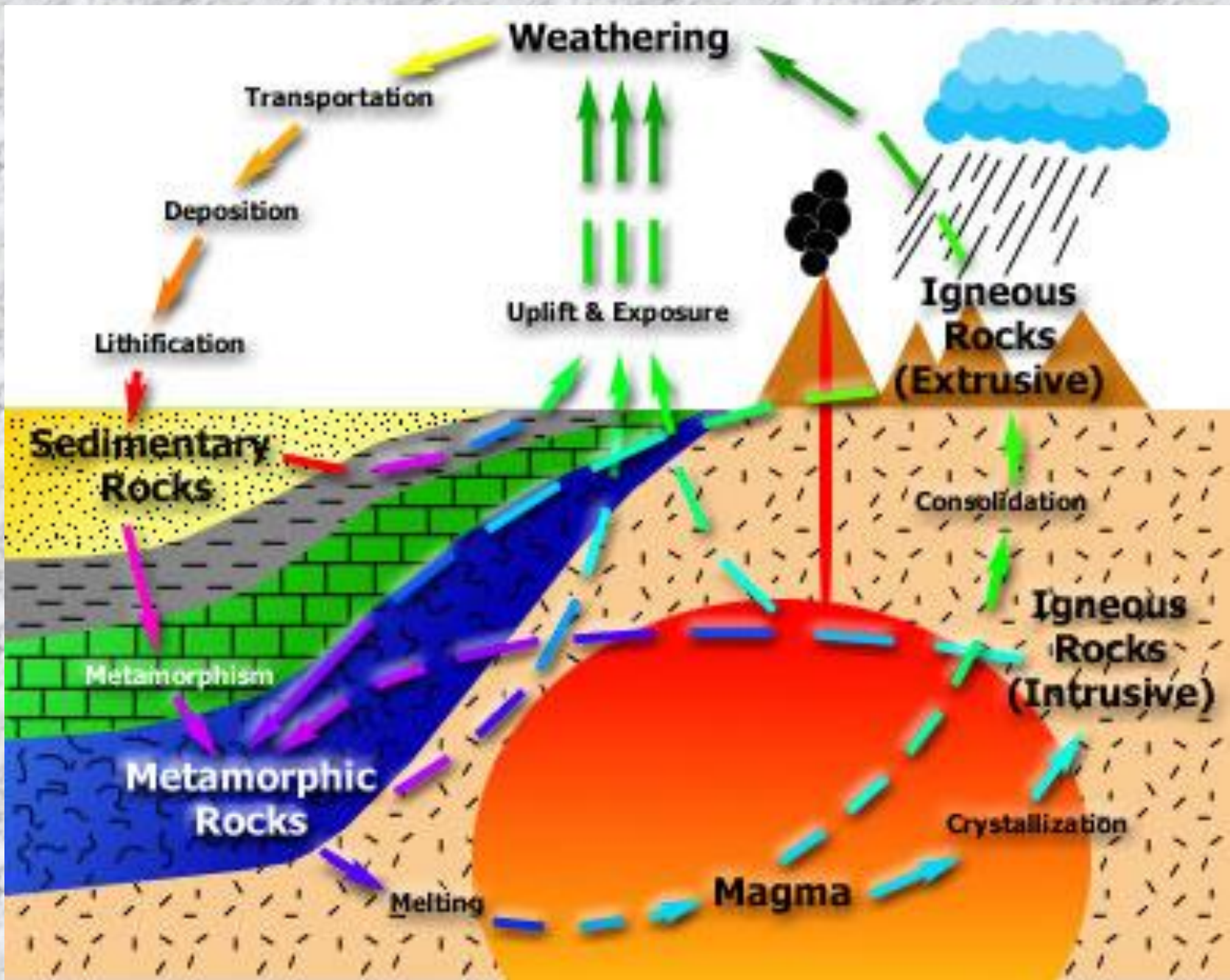


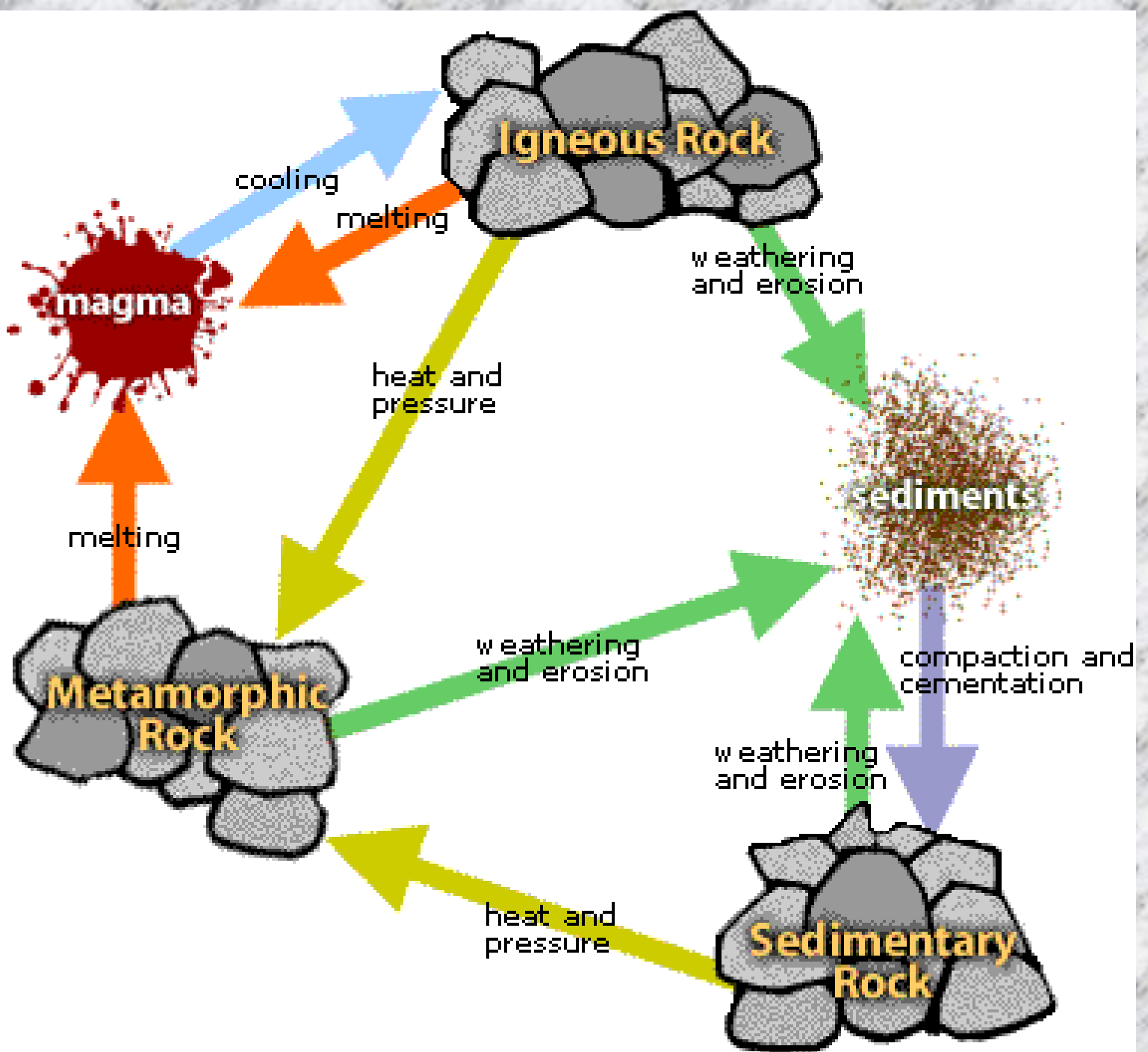
The Rock Cycle



The Rock Cycle

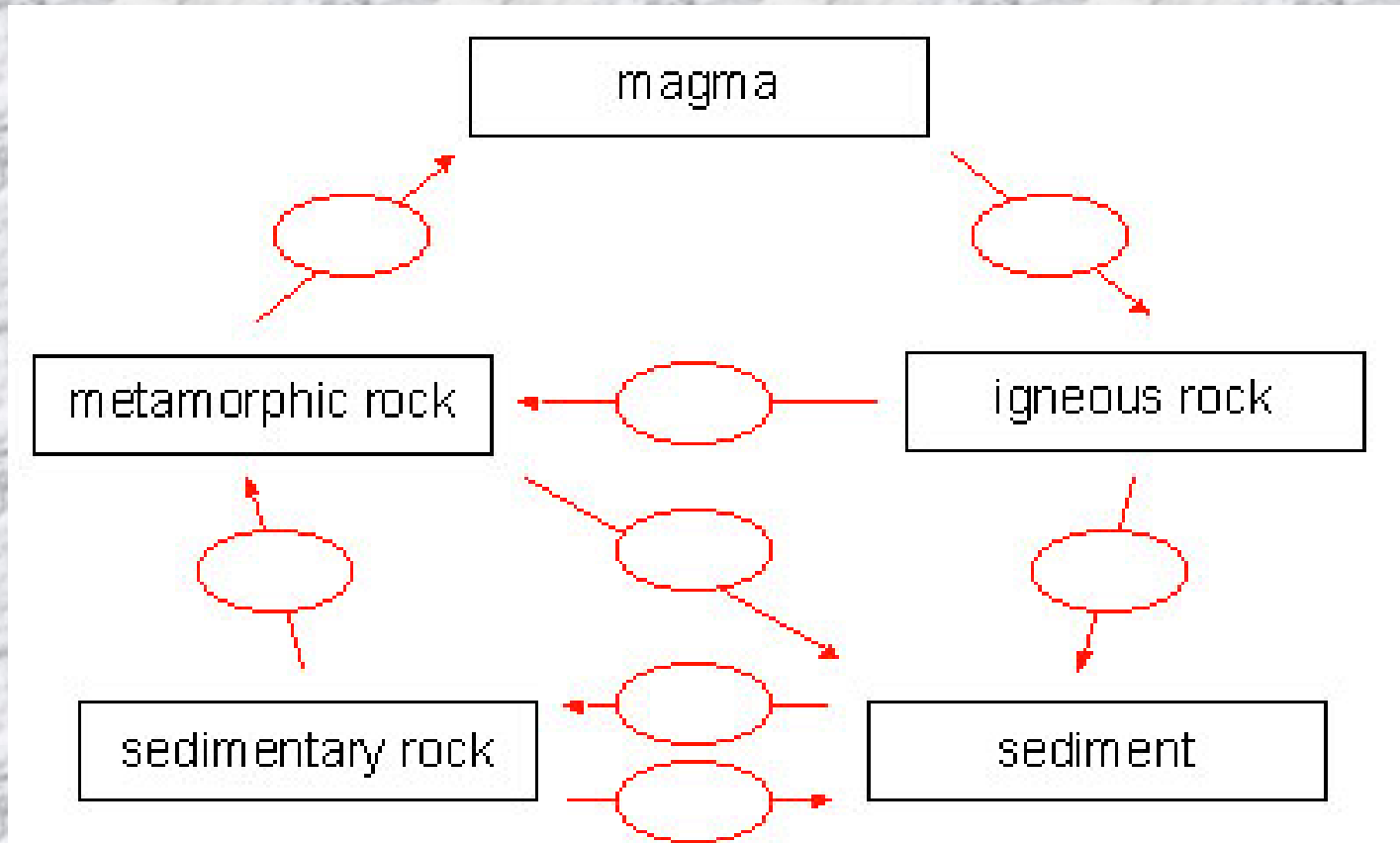
- ❖ The rock cycle is an ongoing series of processes inside Earth and on the surface
- ❖ Slowly changes rocks from one kind to another
- ❖ Any type of rock can change into another type



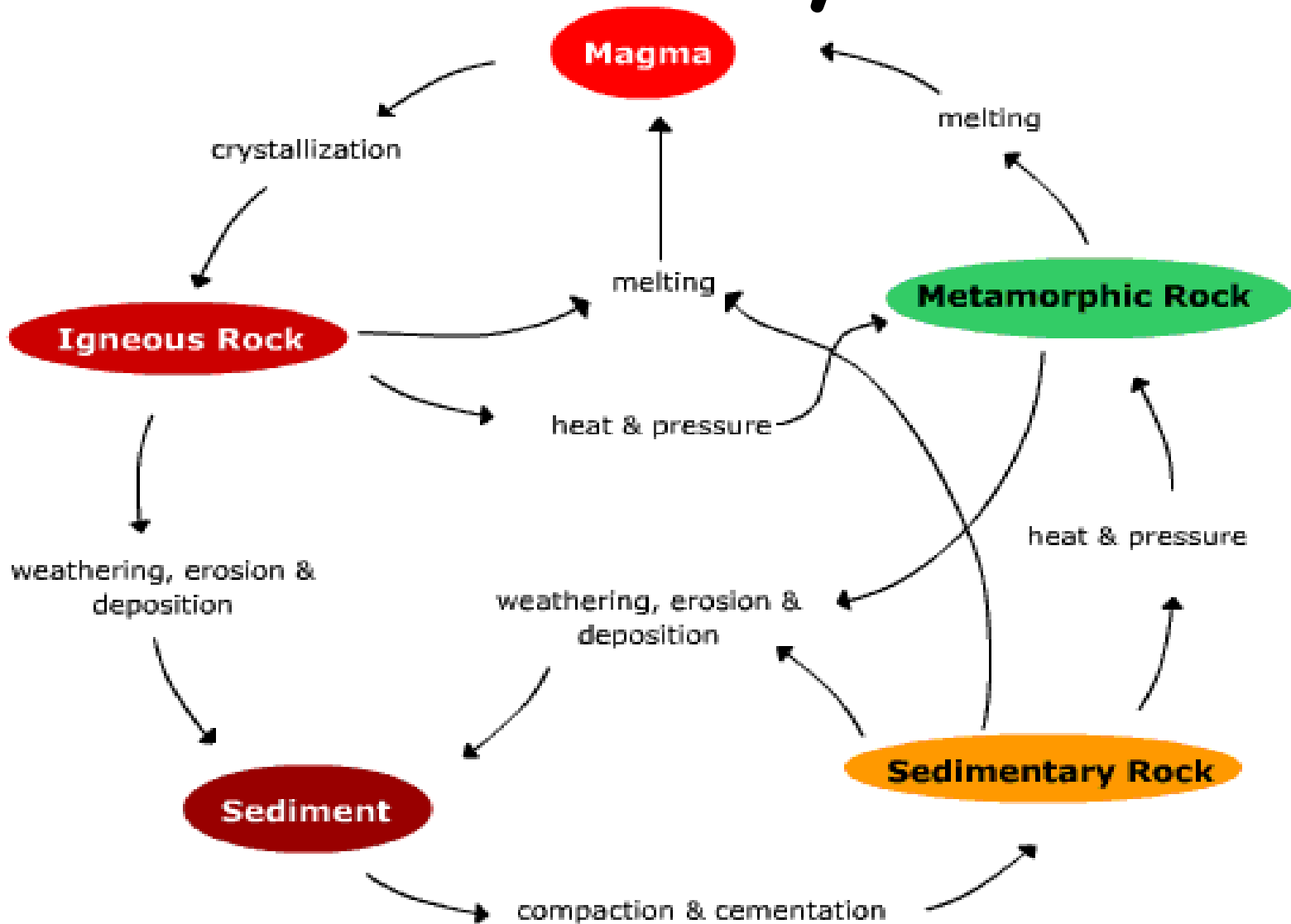


The Rock Cycle

- a. Cementation and compaction (lithification)
- b. Heat and pressure
- c. Weathering, transportation(erosion), and deposition
- d. Cooling and solidification
- e. Melting



The Rock Cycle

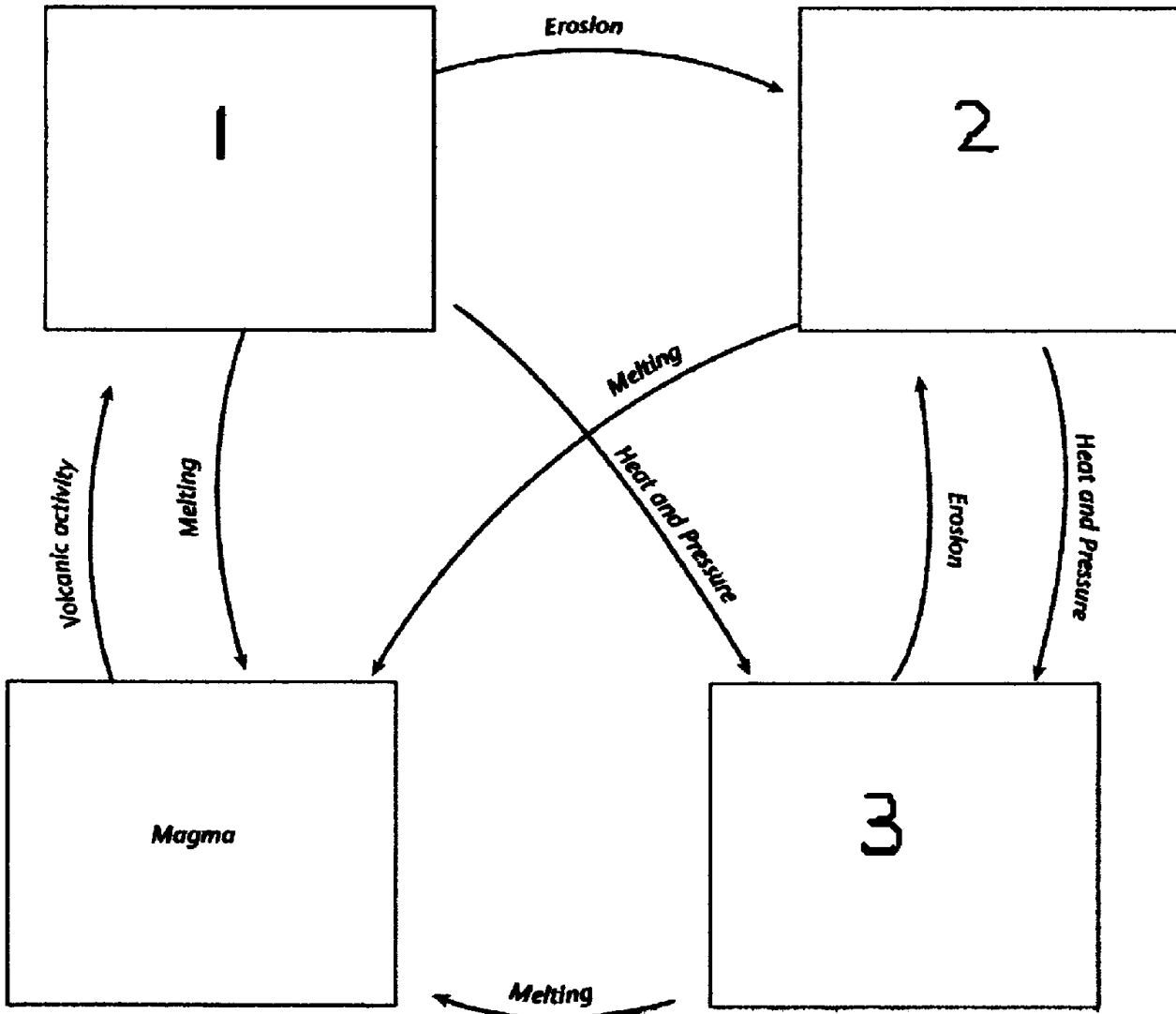


Give names to these materials



The Rock Cycle

The Rock Cycle



Based on the processes shown in the diagram, which type of rock is formed at #1?

- A. Sedimentary
- B. Igneous
- C. Metamorphic
- D. Clastic

Because heat and pressure are needed to form #3, it must be what type of rock?

- A. Sedimentary
- B. Igneous
- C. Metamorphic
- D. Clastic

