

The Geosphere

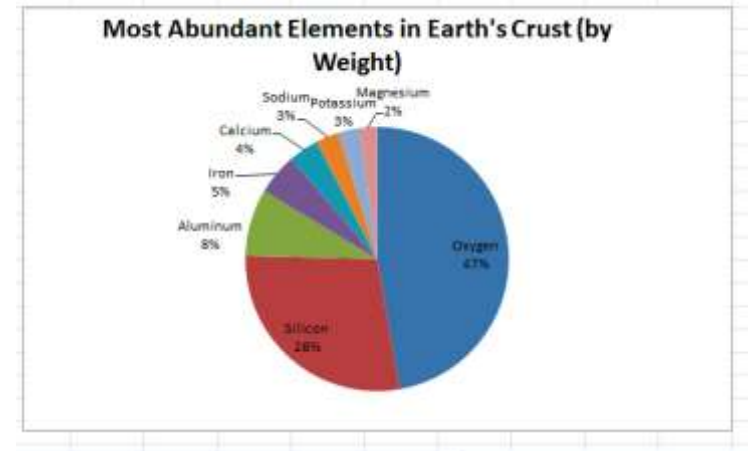
Morgan Kern



1. The Inner Structure of the Earth

There are two study methods to know what the inner structure of the Earth is like:

- Direct: Samples of rock are taken for physical and chemical analysis
 - Drilling underground and opencast mining
- Indirect: The study of Earth's interior without taking physical samples
 - Seismic method (most commonly)

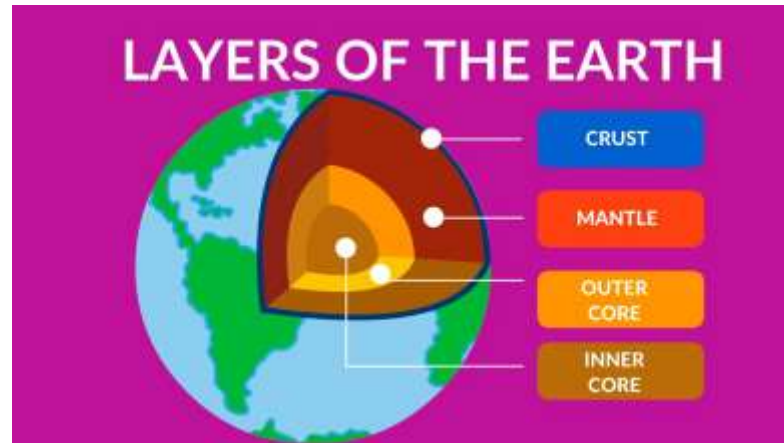




The Geosphere

The Rocky part of the planet that is composed of **three concentric layers**: The crust, the mantle and the core.

These layers have both **physical** and **chemical** properties.





2. Crust Materials

In the Earth's crust, we can find **natural resources** such as minerals. These materials are used for **construction**, for the supply of **raw materials** and for the production of the **energy** required for our daily activities.

All crust materials consist of different geochemical elements.

- **Minerals:** They are substances that have fixed structure and chemical composition.
- **Rocks:** They consist of one or more minerals. They don't have a fixed structure or composition.





3. Minerals

Minerals are natural, solid and inorganic substances. They have a fixed chemical composition and a crystalline inner structure.





Properties of Minerals

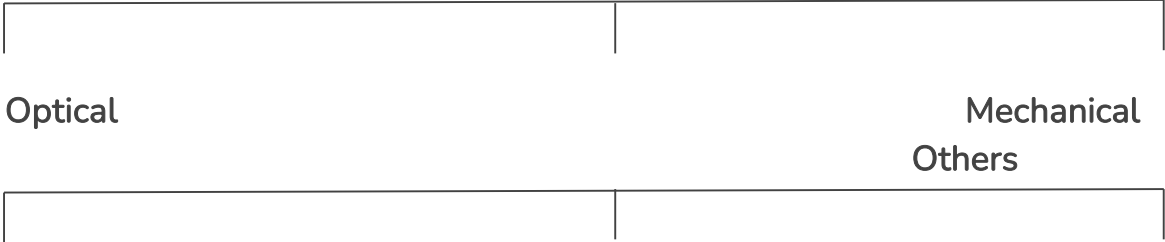
Optical properties:

- **Luster:** How a mineral looks when it reflects light. It may be **dull, metallic** or **nonmetallic**.
- **Color**
- **Streak:** The color of the mineral dust left when it is used to draw a line on a hard, white surface.
- **Habit:** The external appearance of the mineral (**crystalline, non-crystalline, twinned** or **massive**).
- **Transparency:** The property that lets light pass through the mineral (**transparent, translucent** or **opaque**).

Mechanical properties:

- **Hardness:** The degree of **resistance** of the surface of a mineral to being scratched by another mineral surface (Mohs hardness scale).
- **Tenacity:** The degree of resistance of a mineral to breaking or deforming (**fragile, malleable, ductile** or **flexible**).
- Other properties: **Density, magnetism, solubility**

Physical Properties of Minerals



Transparency



Metallic Luster



Nonmetallic Luster





Classification of Minerals

The most commonly used system to classify minerals is by their **chemical composition**. The most abundant is the **silicates group**, composed of silicon and oxygen.

Non-silicate minerals are classified according to their **major component**.

SILICATE OR NON-SILICATE?

<p>Silicates <i>Minerals that have silicon as a component</i></p> 		<p>Non-silicates <i>Do not have silicon</i></p> 
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Identification of Minerals

The physical properties of minerals can be classified within the table. To determine these properties, we must have specific **materials** and **instruments** in the geology laboratory.

Mohs Hardness Scale

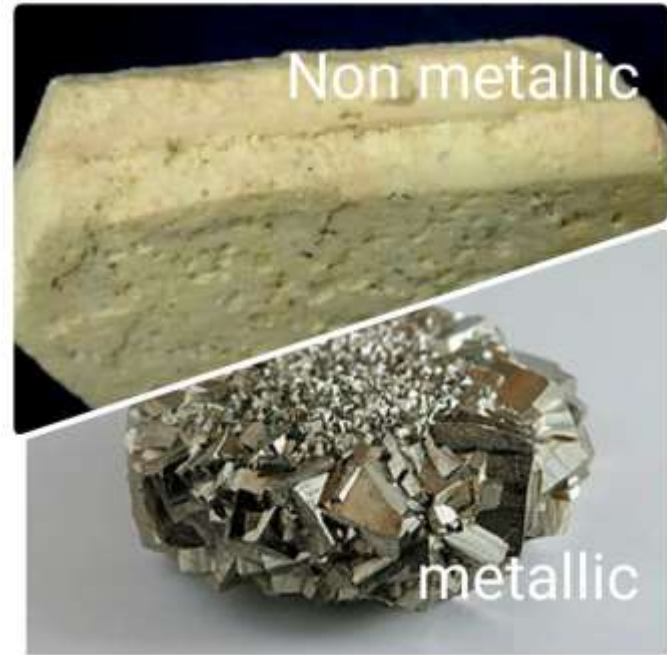
	Mineral Name	Scale Number	Common Object
↑ Increasing Hardness	 → Diamond	10	
	 → Corundum	9	 Masonry Drill Bit (8.5)
	 → Topaz	8	
	 → Quartz	7	 Steel Nail (6.5)
	 → Orthoclase	6	
	 → Apatite	5	 Knife/Glass Plate (5.5)
	 → Fluorite	4	
	 → Calcite	3	 Copper Penny (3.5)
	 → Gypsum	2	
	 → Talc	1	 Fingernail (2.5)



Uses of Minerals

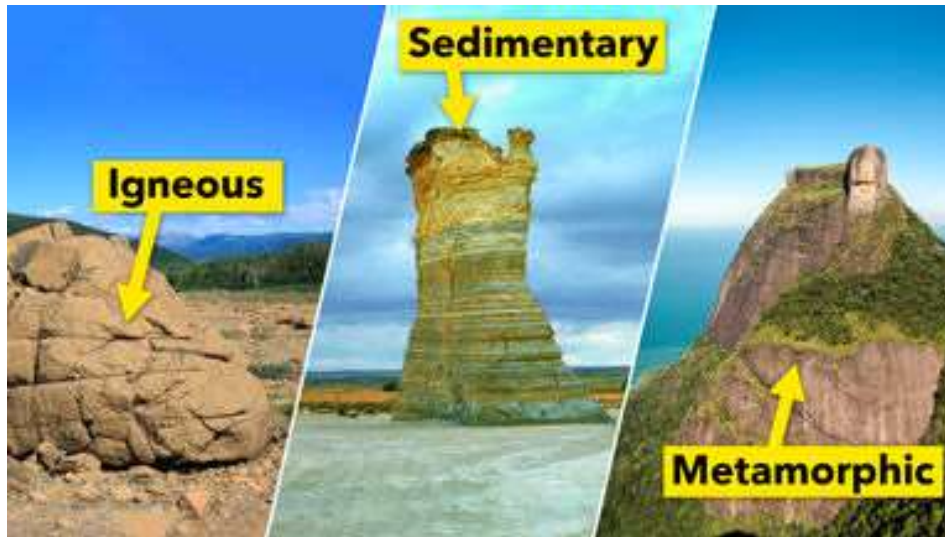
Mineral resources are classified into 2 groups:

- **Metallic minerals** are found in small amounts as part of the rock. **Ore** is the metal we can take from the rock. **Veinstone** is the rock that accompanies it.
- **Non-metallic minerals** come from sedimentary rocks.

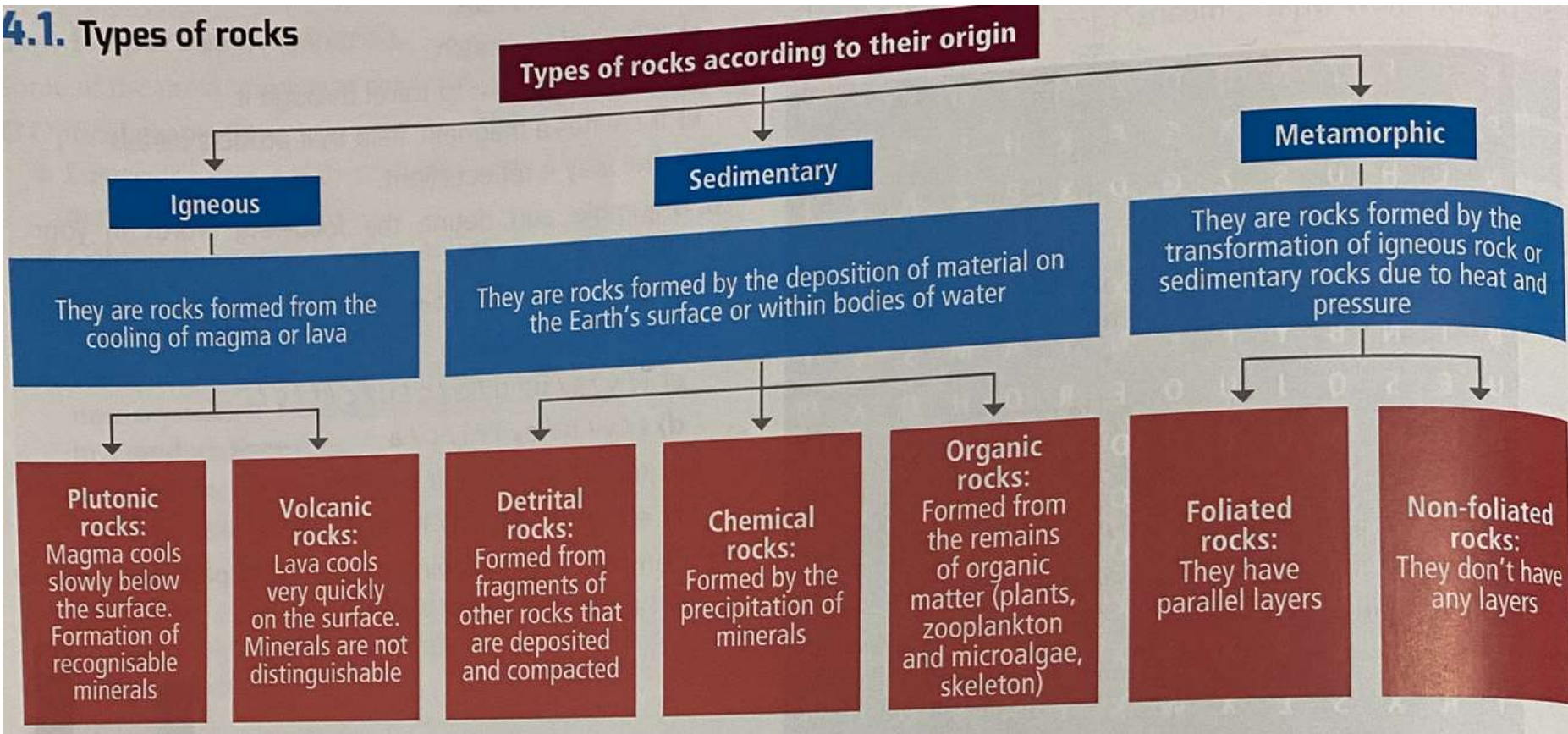


4. Rocks

Rocks are solid inorganic materials of natural origin that are composed of one or more minerals that joined together during the process of formation.



4.1. Types of rocks



Igneous rocks

Extrusive igneous rocks cool quickly and as a result these rocks are fine grained or has lack of crystal growth.



Intrusive igneous rocks are formed from magma that cools slowly and as a result these rocks are coarse grained.

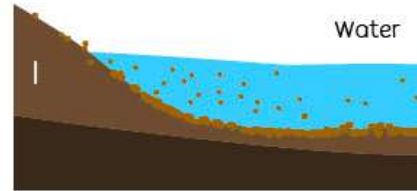


Magma chamber

Sedimentary Rocks

Eroded sediments end up in the water and begin to settle (sedimentation)

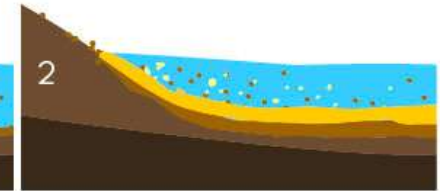
Land



Water

With time, more layers pile up and presses down the lower layers (Compaction)

2

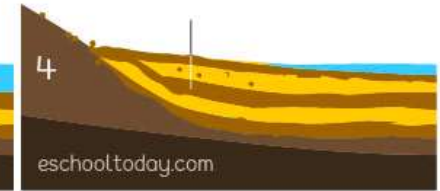


More layers (strata) and further compaction forces out water from the layers



Salt crystals glue the layers together (cementation)
Rock mass formed is sedimentary

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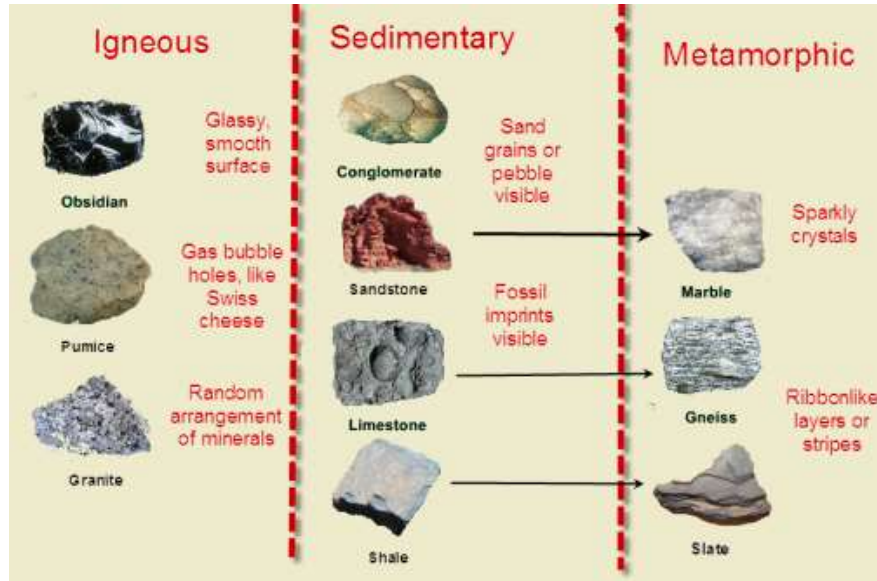
What Are Metamorphic Rocks?

Metamorphic rocks are rocks that have been changed (metamorphosed) by heat, pressure, fluids, and/or strain.

- Start out as a different type of rock (igneous or sedimentary)
- Often have a striped appearance as a result of stretching or squeezing
- Examples: marble, serpentinite, soapstone
- Wide range of color and luster

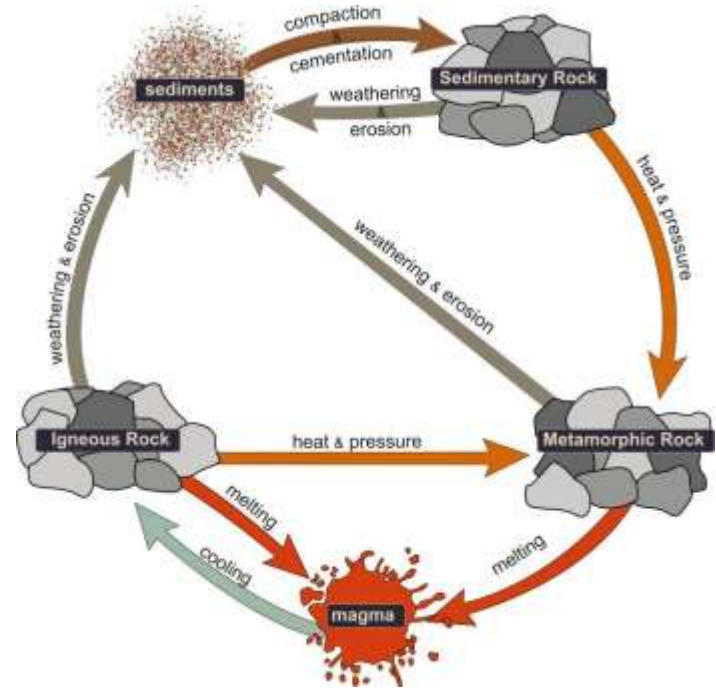
Identification of Rocks

The identification of rocks takes into account their **origins**. Within each group, there is a table of classification, which takes into consideration their **external appearance**.



Rock Cycle

Rocks are constantly being formed, destroyed or altered over a geologic time scale. This happens through a process known as the **rock cycle**.





Geological Resources

Geological resources are all the **natural resources** that come from the Earth's crust. They are exploited by humans; some examples are **soil, minerals, rocks** and even the **topography** (or relief) of the Earth's surface.





Mineral Deposits

Minerals are located in **deposits** where their concentration is higher than normal.

Surface mining or **strip mining** consist in removing minerals that are near the Earth's surface by scraping off the ground.

Some minerals are found very deep below the Earth's surface. To remove them we use **subsurface mining** where a long tunnel is created either horizontally or vertically.





Rock usage

Humans get many raw materials from rocks. We use them as:

- **Sources of energy:** For example, oil and natural gas.
- **Chemicals:** For example, fertilizers, pesticides and medicines.
- **Building materials:** For example, stone, cement, aggregates and ceramics.
- **Domestic and decorative uses:** Marble floors and sculptures.
- **Technological materials:** For example, silicon chips and solar panels.

