Sedimentary Rocks

Most common SURFACE rock

Formation of Sedimentary Rocks

(Sediments are pressed & cemented together)

- Weathering, Erosion, and Deposition

- **Erosion** involves the weathering and the removal of rock.
  -Chemical weathering (acid rain, rusting)- change comp
  -Mechanical/Physical (waves, frost wedge, roots)
  -Erosion is the transport of the sediment that has been weathered (wind, water, gravity, glaciers)
    -Longer distance= round and smooth rock

- **Deposition** occurs when an agent of erosion—water, wind, ice, or gravity—loses energy and drops sediments.

Sedimentary Rocks

Formation of Sedimentary Rocks -Usually form in water

- Compaction and Cementation (Lithification)

- **Burial** & **Compaction** is a process that squeezes, or compacts, sediments.
- **Cementation** takes place when dissolved minerals are deposited in the tiny spaces among the sediments. Also called lithification.

Sedimentary Rocks

Classification of Sedimentary Rocks

- Two Main Groups

1. **Clastic sedimentary rocks** are composed of weathered bits of rocks and minerals.
   - Classified by particle size (coarse, med, fine)
   - Common rocks include
     - Shale (most abundant)
     - Sandstone
     - Conglomerate

Shale with Plant Fossils

Conglomerate

Sedimentary Rocks

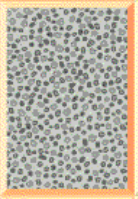
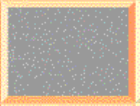
Classification of Sedimentary Rocks

- Two Main Groups
  2. **Chemical sedimentary rocks** form when dissolved substances precipitate, or separate, from water.
     - Common rocks include
       - limestone—most abundant chemical rock
       - microcrystalline quartz known as chert, flint, jasper, or agate
       - evaporites such as rock salt or gypsum
       - coal

Fossiliferous Limestone

Classification of Sedimentary Rocks

Clastic Sedimentary Rocks

Texture (grain size)		Sediment Name	Rock Name
Coarse (over 2 mm)		Gravel (rounded fragments)	**Conglomerate**
		Gravel (angular fragments)	**Breccia**
Medium (1/16 to 2 mm)		Sand	**Sandstone**
Fine (1/16 to 1/256 mm)		Mud	**Siltstone**
Very fine (less than 1/256 mm)		Mud	**Shale**

Chemical Sedimentary Rocks

Composition	Texture (grain size)	Rock Name	
Calcite, $CaCO_3$	Fine to coarse crystalline	**Crystalline Limestone**	
		Travertine	
	Visible shells and shell fragments loosely cemented	**Coquina**	**Biochemical Limestone**
	Various size shells and shell fragments cemented with calcite cement	**Fossiliferous Limestone**	
	Microscopic shells and clay	**Chalk**	
Quartz, SiO_2	Very fine crystalline	**Chert (light colored) Flint (dark colored)**	
Gypsum $CaSO_4 \cdot 2H_2O$	Fine to coarse crystalline	**Rock Gypsum**	
Halite, NaCl	Fine to coarse crystalline	**Rock Salt**	
Altered plant fragments	Fine-grained organic matter	**Bituminous Coal**	

Sedimentary Rocks

Features of Some Sedimentary Rocks

- Features of sedimentary rocks are clues to how and where the rocks are formed
- Fossils may be present…only in sedimentary rocks
- Uses of sedimentary rocks
  - Energy
    - Coal
    - Reservoir for oil & natural gas when porosity (open space) is present
  - Limestone to make cement.

Metamorphic Rocks

Formation of Metamorphic Rocks

- ***Metamorphism*** means “to change form.”
- Most metamorphic changes occur at elevated temperatures and pressures.
- Conditions for formation are found a few kilometers below the Earth’s surface and extend into the upper mantle.

Metamorphic Rocks

Formation of Metamorphic Rocks

- **Contact metamorphism** occurs when magma moves into rock.
  - Occurs near a body of magma
  - Changes are driven by a rise in temperature.

Metamorphic Rocks

Formation of Metamorphic Rocks

- **Regional metamorphism** results in large-scale deformation and high-grade metamorphism.
  - Directed pressures and high temperatures occur during mountain building.
  - Produces the greatest volume of metamorphic rock

Metamorphic Rocks

Agents of Metamorphism

- Heat
  - Provides the energy needed to drive chemical reactions
- Pressure
  - Causes a more compact rock with greater density

Metamorphic Rocks

Agents of Metamorphism

- **Hydrothermal Solutions**
  - Hot water-based solutions escaping from the mass of magma
  - Promote recrystallization by dissolving original minerals and then depositing new ones

Metamorphic Rocks

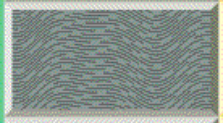
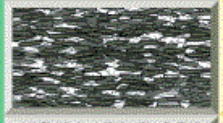
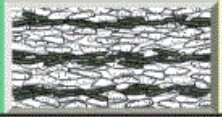
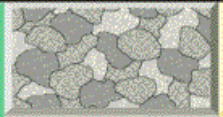
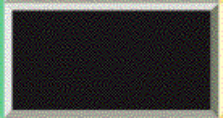
Classification of Metamorphic Rocks

- Two main categories

1. **Foliated Metamorphic Rock- From Pressure**
    - Has a banded or layered appearance
    - Minerals in granite squeezed into layers (granite to gneiss)
2. **Nonfoliated Metamorphic Rock- From Heat**
    - Does not have a banded texture
    - Limestone to Marble

Classification of Metamorphic Rocks

Table 3 Classification of Major Metamorphic Rocks

Rock Name	Texture	Grain Size	Comments	Parent Rock
Slate	Foliated 	Very fine	Smooth dull surfaces	Shale, mudstone, or siltstone
Phyllite		Fine	Breaks along wavy surfaces, glossy sheen	Slate
Schist		Medium to Coarse	Micaceous minerals dominate	Phyllite
Gneiss		Medium to Coarse	Banding of minerals	Schist, granite, or volcanic rocks
Marble	Nonfoliated 	Medium to coarse	Interlocking calcite or dolomite grains	Limestone, dolostone
Quartzite		Medium to coarse	Fused quartz grains, massive, very hard	Quartz sandstone
Anthracite		Fine	Shiny black organic rock that fractures	Bituminous coal

Increasing Metamorphism

Gneiss Typically Displays a Banded Appearance

Marble—A Nonfoliated Metamorphic Rock

The Rock Cycle

Rocks

- **Rocks** are any solid mass of mineral or mineral-like matter occurring naturally as part of our planet.
- Types of Rocks
  1. **Igneous rock** is formed by the crystallization of molten magma.

The Rock Cycle

Rocks

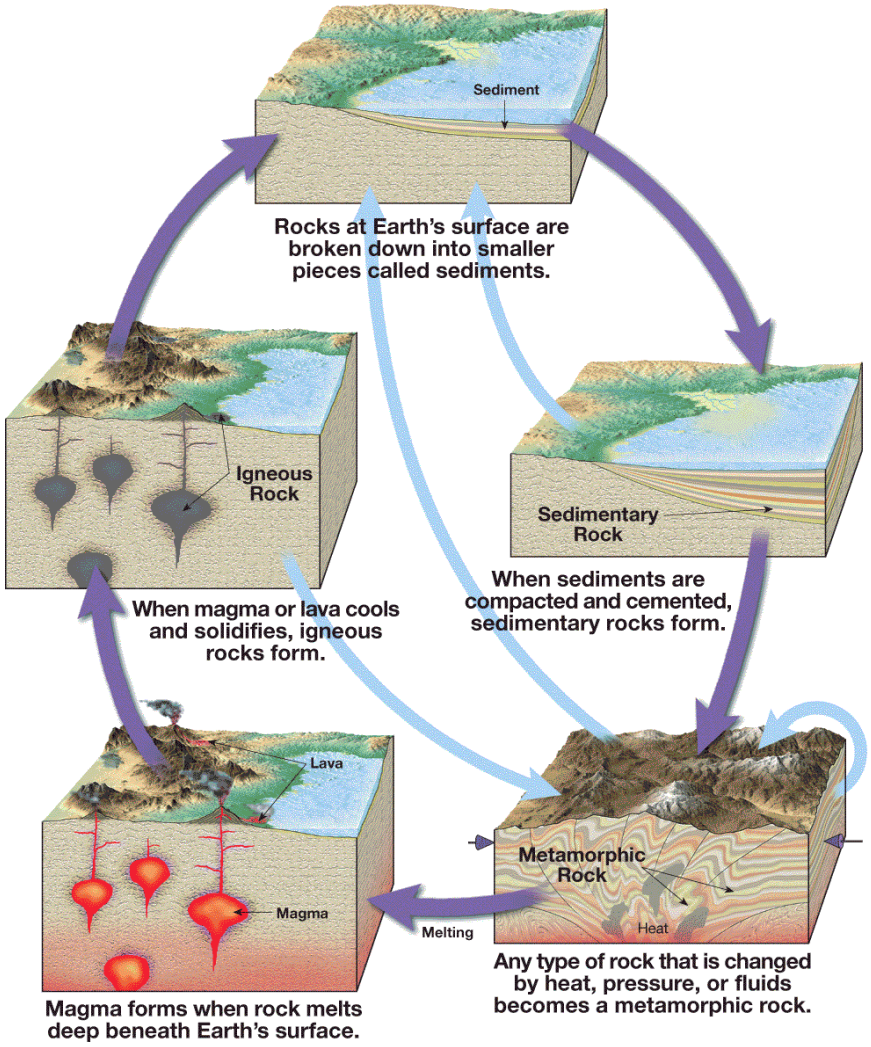
- Types of Rocks
  2. **Sedimentary rock** is formed from the weathered products of preexisting rocks that have been transported, deposited, compacted, and cemented.
  3. **Metamorphic rock** is formed by the alteration of pre-existing rock deep within Earth (but still in the solid state) by heat, pressure, and/or chemically active fluids.

The Rock Cycle

The Rock Cycle

- Shows the interrelationships among the three rock types (igneous, sedimentary, and metamorphic)
- **Magma** is molten material that forms deep beneath the Earth's surface.
- **Lava** is magma that reaches the surface.
- **Weathering** is a process in which rocks are broken down by water, air, and living things.
- **Sediment** is weathered pieces of Earth elements.

The Rock Cycle



The Rock Cycle

Energy That Drives the Rock Cycle

- Processes driven by heat from the Earth's interior are responsible for forming both igneous rock and metamorphic rock.
- Weathering and the movement of weathered materials are external processes powered by energy from the sun.
- External processes produce sedimentary rocks.