GY 112: Earth History

Lecture 3: Rock Suites

Instructor: Dr. Douglas W. Haywick
1. Formation of the solar system
2. Formation and differentiation of the Earth
   (Hot and Cold Accretion)
3. Formation of the moon (4 hypotheses)

(Web Lecture 2)
The Eagle Nebula
The Solar System

Pluto is no longer a planet

You are here!

Source: http://www.solarviews.com/eng/solarsys.htm
The Earth

Age: 4.6 Ga
Composition: rock/metal
Planet Diameter: 12,756 km
Mass: 6x10^{24} kg
Distance from Sun: 150 million km

Source:
http://www.solarviews.com/cap/earth/earthfg2.htm

Astronomy picture of the day (http://antwrp.gsfc.nasa.gov/apod)
The Earth-Moon System

4 Moon Formation Hypotheses:
1) Fission
2) Capture
3) Double Planet
4) “Glancing Blow”

“Astronomy picture of the day (http://antwrp.gsfc.nasa.gov/apod)

“Glancing blow” impact sometime before 4.1 GA
Today’s Agenda

1. **Rocks** *(GY 111 may help here)*
2. **The rock cycle**
3. **Sedimentary rocks and rock suites**

*(Web Lecture 3)*
Rocks are naturally occurring solids containing one or more minerals.

They come in many, many, many different “flavors”

e.g., Granite
Rocks are naturally occurring solids containing one or more minerals.

They come in many, many, many different “flavors”

e.g., sandstone
Rocks are naturally occurring solids containing one or more minerals. They come in many, many, many different “flavors” e.g., gneiss
Rocks

We recognize 3 major rock groups:

1) **Igneous** ("born of fire"); originally molten
Rocks

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1) Igneous (“born of fire”); originally molten
2) Sedimentary; originally particulate material or produced from precipitation out of water
Rocks

We recognize 3 major rock groups:

1) Igneous ("born of fire"); originally molten
2) Sedimentary; originally particulate material or produced from precipitation out of water
3) Metamorphic; pre-existing rocks modified by pressure or temperature
The Rock Cycle

**IGNEOUS**
- **BASALT**

**SEDIMENTARY**
- SANDSTONE

**METAMORPHIC**
- MARBLE

1. **SEDIMENTARY** rock is buried by ground
2. Over time, pressure and heat turn it into **METAMORPHIC** rock
3. **SEDIMENT** on the surface of a body of water is turned into **SEDIMENTARY** rock
4. **SEDIMENTARY** rock is heated and pressed into **METAMORPHIC** rock
5. **METAMORPHIC** rock is melted into **igneous** rock
6. **SEDIMENT** and water become **SEDIMENTARY** rock
7. **SEDIMENTARY** rock and heat become **METAMORPHIC** rock
8. **METAMORPHIC** rock and heat become igneous rock

The Rock Cycle

- Metamorphic Rock
  - pressure/heat
- Sedimentary Rock
  - transport
- Melting
- Magma
  - Cooling
- Igneous Rock
  - Erosion
  - Heat pressure
Sedimentary Rocks

We recognize 4 major classes of sedimentary rocks:
Sedimentary Rocks

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1) **Siliciclastic**: composed of broken bits of silicate minerals;

Alluvial fan
Sedimentary Rocks

We recognize 4 major classes of sedimentary rocks:

1) Siliciclastic: composed of broken bits of silicate minerals
2) Biochemical: mostly composed of the remains of calcium carbonate-secreting beasties
Sedimentary Rocks

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1) Siliciclastic: composed of broken bits of silicate minerals
2) Biochemical: mostly composed of the remains of calcium carbonate-secreting beasties
3) Chemical: formed through chemical precipitation alteration
Sedimentary Rocks

We recognize 4 major classes of sedimentary rocks:

1) Siliciclastic: composed of broken bits of silicate minerals
2) Biochemical: mostly composed of the remains of calcium carbonate-secreting beasties
3) Chemical; formed through chemical precipitation alteration
4) Organic; formed from plant material

Peat bog
Sedimentary Rocks

Are the most important rocks as far as Earth history is concerned because they contain the remains of particulate material* deposited in the past

* Including the remains of “beasties” (AKA fossil life forms)
Sedimentary Rocks

Are the most important rocks as far as Earth history is concerned because they contain the remains of particulate material deposited in the past.

- Determine the depositional environment at the time the sediment was laid down (e.g., beach, alluvial fan, reef)

Paleoenvironment
Sedimentary Rocks

Are the most important rocks as far as Earth history is concerned because they contain the remains of particulate material deposited in the past

- Determine the climate at the time the sediment was laid down (e.g., tropical, arid, wet)

Paleoclimate
Sedimentary Rocks

Are the most important rocks as far as Earth history is concerned because they contain the remains of particulate material deposited in the past.

- Determine the flow direction of currents at the time the sediment was laid down (e.g., north, south, etc.)

Paleocurrents
Sedimentary Rocks

• Determine the flow direction of currents at the time the sediment was laid down (e.g., north, south, etc.)

Paleocurrents
Sedimentary Rocks

In some cases, a single rock can tell you a lot about paleoenvironments, paleoclimate and/or paleocurrents.
Sedimentary Rocks

In some cases, a single rock can tell you a lot about paleoenvironments and paleoclimate.

e.g., halite:
Sedimentary Rocks

In some cases, a single rock can tell you a lot about paleoenvironments and paleoclimate.

e.g., halite:

- **Paleoenvironment**: evaporite basin
- **Paleoclimate**: hot and dry
Sedimentary Rocks

But most times, you need a collection of identically aged rocks that were all obtained from the same location.

= rock suites
Rock Suites

But most times, you need a collection of identically aged rocks that were all obtained from the same location.

= paleotectonic setting

Breccia + Red shale + Granite = Composite volcanoes on land (continental convergent plate boundary)
Rock Suites

But most times, you need a collection of identically aged rocks that were all obtained from the same location.

= paleotectonic setting

Breccia + Andesite = 
Composite volcanoes on land (oceanic convergent plate boundary)
Rock Suites

Three main types of paleotectonic setting:
1. Divergent plate boundary (oceanic, continental)
Rock Suites

Three main types of paleotectonic setting:

1. Divergent plate boundary (oceanic, continental)
2. Convergent plate boundary (oceanic, continental)
Rock Suites

Three main types of paleotectonic setting:

1. Divergent plate boundary (oceanic, continental)
2. Convergent plate boundary (oceanic, continental)
3. Passive continental margin
Today’s Homework

1. Download and read web notes 3
2. Think about grading options (Wednesday)

Next Time

Lecture: Nothing Monday; MLK Holiday
GY 112: Earth History

Lecture 3: Rocks and Rock Suites

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