

**GEOL 1010-002**  
**Introduction to**  
**Physical Geology**

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**GEOL 1010-002**

- **Web Site:**  
<http://ruby.colorado.edu/~smyth/G1010syl.html>
- **Text:**
  - **Understanding Earth Fourth Edition**  
(Press, Siever, Grotzinger, Jordan) 2003

**GEOL 1010-003**

- **Test policy:**
- **Four hour-exams (last one optional)**
  - **Final Exam (comprehensive)**
  - **I will take the best four out of five scores.**

**Physical Geology**

- **Study of the Earth**
  - **How it Formed**
  - **How it evolved**
  - **How it works**
  - **How to preserve and utilize its resources**

**Physical Geology**

- **Field Science**
  - **Descriptive of the Earth**
  - **Observations and Hypotheses are based in Field**
- **Laboratory**
  - **Analysis of samples**
  - **Experiments to explore and test hypotheses**

**Earth Processes**

- **External Heat Engine**
  - **Thermonuclear Fusion in Sun**
  - **Drives most surface processes (atmosphere and ocean circulation, weathering, and sedimentation)**
- **Internal Heat Engine**
  - **Radioactive decay of U, Th, and K**
  - **Drives internal processes (volcanoes, earthquakes, plate movement, magnetic field)**

## **Course Outline**

- **Introduction**
- **Plate Tectonics**
- **Minerals**
- **Rocks**
- **Igneous Rocks**
- **Volcanism**
- **Weathering & Erosion**
- **Sedimentary Rocks**
- **Metamorphic Rocks**
- **Geologic Time**
- **Folds & Faults**
- **Mass Wasting**
- **Hydrology**
- **Streams & Rivers**
- **Wind & Deserts**
- **Glaciers**
- **Landscape Evolution**

## **Course Outline**

- **Oceans & Coasts**
- **Earthquakes**
- **Earth's Interior**
- **Plate Tectonics**
- **Continental Crust**
- **Energy and Mineral Resources**
- **Earth Systems and Human Impacts**

## **Scientific Method**

- **Observation (fact)**
  - This is a repeatable measurement or experiment
- **Hypothesis**
  - One or more possible explanations to link observations
- **Testing**
  - Further experiment or observation to test hypothesis
  - Non-testable hypotheses also rejected
- **Theory**
  - A grand or unifying hypothesis that has survived tests
  - Relativity, Evolution, Plate tectonics

## **Scientific Method: 1. Observation**

- **Observation (fact)**
  - **Measurement in Laboratory**
  - **Observation in field**
  - **Must be repeatable by independent investigator**
- **Example**
  - *The coastlines of Africa and South America are remarkably parallel*

## **Scientific Method: 2. Hypothesis**

- **Hypothesis**
  - **One or more possible explanations to link observations**
  - **Hypotheses must be testable**
  - **Hypotheses generally make predictions that will allow them to be tested.**
- **Example**
  - **The continents of Africa and South America were once joined and have since split and moved apart.**

## **Scientific Method: 3. Testing**

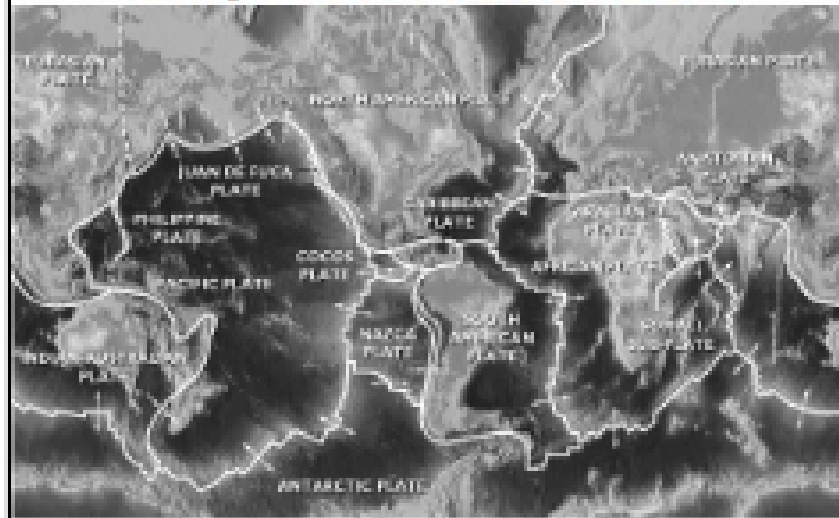
- **Testing**
  - **Further experiment or observation to test hypothesis**
  - **Non-testable hypotheses also rejected**
- **Example:**
  - **If Africa and South America were once joined there should be similar rock types in adjoining regions.**

### **Scientific Method: 4. Theory**

- **A Theory is a unifying hypothesis that has survived all the tests.**
  - Theories are never proven, only disproved
  - A theory is not someone's opinion.
  - There are no competing theories
- **Example**
  - Plate tectonics is the unifying theory of plate motion driven by convection.

**The Earth's surface is composed of about 12 large plates that move as rigid blocks**

### **The Earth's surface is composed of about 12**



### **Formation of the Planet**

- **'Big Bang' produces elements H and He**
- **Precursor large star formed heavier elements by thermonuclear fusion.**
- **Precursor star exploded (supernova).**
- **Solar system coalesced from remnants.**
- **Nebular ring condensed from gas**
- **Planets accreted from ring.**
- **Sun started up.**

### **Earth Formation**

- **Earth accreted (grew from smaller planetesimals).**
- **Earth melted and differentiated (iron metal core separated)**
- **Earth was impacted by a Mars-sized object.**
  - Fragments of this collision formed Moon
  - Tilted the Earth rotation axis 22°.

### **The Earth differentiated into rocky mantle and metal core**

