January 8, 2015
GEOL 1010-002 (Notes)

Lecture 0 – Intro to the Course

What is Geology?

- "The Study of the Earth"

What Geology Covers

- Natural Resources
- Environmental Issues
- Natural Disasters
- Climate Change
- Engineering, Construction, & Development

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Lecture 1 – What Is Science

What Is Science?

- One method to understand world around us (Not only way to view world)
- Use facts and principles
  - ① Facts – Repeatedly demonstrated to be true
  - ② Principles – Statements that were a revolutionary break-through → Treated like a fact (reinvented) → idea proven true over long periods

Scientific Method

- Step 0 – Observation
- Step 1 – Question
- Step 2 – * Hypothesis (Are not opinions)
  - ① Educated Guess (Observation + Background Info)
    - ↳ Answer Q
  - ② Testable & Predictive
  - ③ Pass "If-Then" Test
  - ④ Develop from past & future events
    - Can't observe in real time
  - ⑤ Difficult vs. easy to test (Some take years to test)

- *If Data supports Hypo, get more data/replicate results
- *If Data doesn't support Hypo, use new data to make a new Hypo

- Step 3- Data
  - ① What most ppl envision (Get facts)
  - ② Tests hypothesis
- Step 4- Evaluation
  - ① Correct vs. Incorrect (Hypothesis) → 9/10 wrong
  - ② Science is a trial & error process

If Hypothesis Correct (Scientific Method)

upgraded too

- Theory- Has a lot of evidence/testing (experiments) to back up (Strongly Supported)
- Law- Retested and has so much evidence that it's irrefutable
- Theories and Laws are tested and revised too (through S.M.)
- You must have scientific data to challenge scientific ideas
  - ① Facts, not beliefs

What is Geology?

- Greek → "Study of the Earth"
- Early 19th century
- Catastrophism → (Early Method of how Earth Formed) ↳ 1700s
  - ① All features of Earth could be explained by 6 Major Catastrophes close to one another (Last One Flood of Noah)

History of Geology

- James Hutton (1795, Scotland) → Naturalist
- Book "Theory of Earth"
  - ① How Earth Formed Principle
    - Basis of Geology
  - ② Principle of Uniformitarianism ↳ Day to Day Basis
    - Processes in nature always the same (Past + Present)
    - Small incremental changes add up over long period of time

Ex. Water flows → gradually wears away dirt, can carve out canyons given enough time

(Explain how Earth Formed)

√√ - Opposite of Catastrophism → (Dismissed)

√√ History of Geology

↳ √√• Actualism

Ex. Glaciers (Ice Age) acted the same as glaciers today, but in Ice Age, more glaciers + bigger

√√ ① Reshaped from Uniformitarianism (Processes work same but at diff. rates)

√√ ② Time to time, there will be a big catastrophic event that shapes Earth

√ = Ex Meteories enter Earth's atmosphere at up to 40 km/s

√√ Meteorite } Catastrophic Event

√√• 30 m (~100 ft) diameter meteorite @ 15 km/s impacts w/ energy = 4 million tons of TNT

√√ ① Ex. Meteor Crater, AZ

√How Did Earth Form?

bya = billions of years ago

√√• > 6 bya: No Solar system, just a nebula of H atoms

√• Nebula - Big cloud of gas (purple-reddish haziness)

√√ ① Contains H clouds

Forming the Solar System

√√• Nebular Hypothesis - See Steps Below

√√• Step A - Gravity (Affecting Nebula) → (takes 100k years)

√√ ① Draws H atoms closer towards center of cloud (condensed) → Leads to rise in temp. in core

√√• Step B - Solar Disk Model

√√ ① Cloud flattens and rotates (Like a frisbee) / Spins in space when condensing occurs

√√• Step C - Protostar (6 Ga) *Ga = billions of years ago

"Early Sun" √√ ① Prototype Star (Forms at center of Nebula) → Not Enough Hot

√√ ② Not hot enough to be a star

√√• Step D - Fusion (Long Time)

√√ ① Jacks up temperature of star → Leads to fusion occurs, which forms a star (billions of °C) → "Sun"

↳ distinct atoms bind together to form new atoms (Ex H + H = He atom)

↳ - follows trend on periodic table H + He = Li