

GLY 102

Introduction to Geology II

2020/2021 Session

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and**

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Course Description

This Course makes use of the principles and techniques of geology to reconstruct and understand the geological history of Earth. It focuses on evolution of organism , their distribution, classification, occurrence and uses as fossil for relative dating of rocks.

The course also explains the use of stratigraphy, structural geology and paleontology to tell the sequence of rock formation and the timing of other events observed on rocks during different time periods in the geological timescale. Account of historical geologists will also be thought.

Learning Objectives

By the end of this Course and after answering tutorial questions and assignments, students should be able to understand:

- The historical development of the field of geology
- The development of the basic geologic principles employed by historical geologists.
- The evolution of the geologic time scale
- The history of the Earth from its inception to the present

Course Contents

WEEK	TOPIC
1	Principles of Historical Geology -Earth's History
2	Principles of Historical Geology -Earth's History
3	The Founders of Historical Geology
4	The Founders of Historical Geology
5	Global Dating of the Rock Record
6	Global Dating of the Rock Record
7	Global Dating of the Rock Record
8	First Continuous Assessment
9	Unconformity
10	Rock Cycle
11	Rock Cycle
12	Second Continuous Assessment
13	Water Cycle/Hydrologic Cycle
14	Water Cycle/Hydrologic Cycle
15	Revision
16	Examination
17	Examination

Additional Textbooks

- Understanding Earth Sixth Edition Edition by John Grotzinger (Author), Thomas H. Jordan
- Principles of Geology: (Classic Reprint) Paperback – June 15, 2012 by Charles Lyell.
- System History - Text 3RD EDITION by Steven M. Stanley. W.H. Freeman, 2009

Founders of Historical Geology

How Does the Study of Historical Geology Benefit Us?

- ❖ Survival of the human species depends on understanding how Earth's various subsystems work and interact
 - ✓ how we consume natural resources and interact with the environment determines our ability to pass on this standard of living to the next generation
 - ✓ our standard of living depends directly on our consumption of natural resources that formed millions and billions of years ago
- ❖ Study what has happened in the past, on a global scale, to try and determine how our actions might affect the balance of subsystems in the future

Founders of Historical Geology

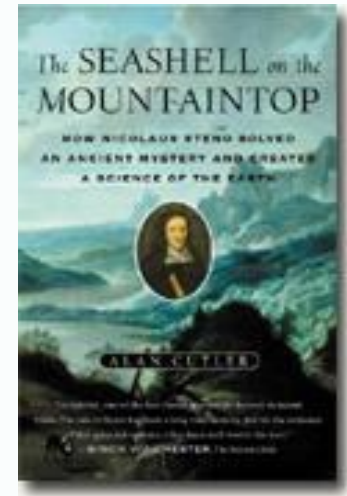
Can be traced back to classical Greece

Nicolaus Steno (Neils Stensen) 1638-1687

Originally a Danish physician, an expert in Anatomy (Public Dissections) Developed the fundamental principles of historical geology
Physician to the de Medici family in Florence.

Steno, in his Dissertation is prodromus of 1669 is credited with four of the defining principles of the science of stratigraphy. His words were:

- i. Law of superposition
- ii. Lateral continuity
- iii. Original horizontality
- iv. Cross-cutting relationship



Founders of Historical Geology

Nicolaus Steno (Neils Stensen) 1638-1687

In 1669, Steno wrote

De solido intra solidum naturaliter

contento dissertationis prodromus

Prodromus to a dissertation on Solids

Naturally Enclosed in Solids

only 78 pages long

Steno gave the first accurate observations on a type of **crystal** in his 1669 book.

This fundamental breakthrough formed the basis of all subsequent inquiries into crystal structure.



"STENO LIVED AT A TIME WHEN PEOPLE BELIEVED THAT FOSSILS GREW INSIDE ROCKS, WITCHES SKULKED EVERYWHERE, AND CRYSTALS AND UNICORN HORNS CURED DISEASE."

Founders of Historical Geology

John Strachey 1671-1743

Used superposition and original lateral continuity

Determined the stratigraphic succession of coals in England

Recognized what would later be termed unconformities

Performed local-scale observations.

Founders of Historical Geology

Giovanni Arduino

1714-1795

Had a broader global view of sedimentary layers

Developed the first classification of rocks and *relative ages*

Primary Mountains

crystalline rocks oldest rocks on Earth later became igneous/metamorph.

Secondary Mountains

layered fossiliferous rocks

later sedimentary rocks

Tertiary Mountains

unconsolidated sediments

lava flows

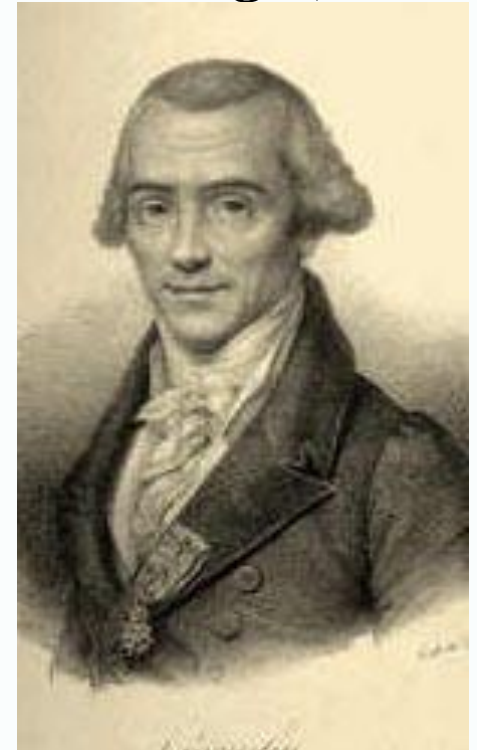


Founders of Historical Geology

Johann Lehmann 1719-1767

Georg Fuchsel 1722-1776

**Came up with classification similar to that of Arduino
Developed stratigraphic successions of rocks in Thuringia,
and the Hartz and Ertz Mountains.
Began to understand the events that lead
to mountain building**



Lehmann

Founders of Historical Geology

Peter Simon Pallas

1741-1811

Improved geologic history of the mountains of Europe

Developed the general geologic history of the Urals

Observed changes in rock assemblages going from margins to the core of mountains.



Reise
durch
verschiedene Theile
des
Russischen Reichs
im 1771sten Jahr.
—
Des Zwenten Theiles
Zwentes Buch.

*Reise durch
verschiedene Provinzen
des Russischen Reiches
1771-1776*

*Journey Through
Several Provinces
of the Russian Empire*

Founders of Historical Geology

Founders of Historical Geology

Abraham Gottlieb Werner

1749-1817

Most influential geologist of the late 18th century

Studied at the Freiburg Mining Academy

Taught mineralogy at Freiburg.

Developed the “Neptunian”
classification of rocks

All rocks of the crust were deposited
or precipitated from sea water

A universal ocean once covered the
Earth

Followers called “Neptunists”



Founders of Historical Geology

Founders of Historical Geology

Abraham Gottlieb Werner

1749-1817

Primitive Rocks

Deposited first

Came from hot, steamy fluid with many dissolved minerals

Coarse grained igneous and metamorphic

Transition Rocks

Ocean basins formed, waters cooled

Fossiliferous, stratified rocks

Deformed rocks

Ocean resembled modern oceans

In 1915, the German geologist and meteorologist Alfred Wegener first proposed the theory of continental drift, which states that parts of the Earth's crust slowly drift atop a liquid core. The fossil record supports and gives credence to the theories of continental drift and plate tectonics.

Founders of Historical Geology

Founders of Historical Geology

James Hutton 1726-1797

Father of Modern Geology

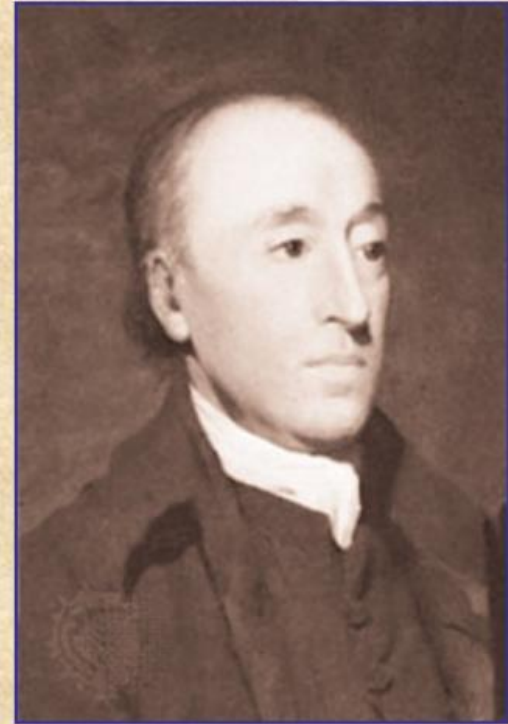
Edinburgh physician & geologist?
Opponent to Neptunism

Believed *fire* was the answer.

Recognized change on the Earth's
surface
(Surficial processes were active)

Developed cyclic view of Earth

“No vestige of a beginning, no
prospect of an end”.



Hutton (1726-1797): Native of Edinburgh, Scotland. Educated as a medical doctor in Leiden (1749). Passionate about scientific inquiry. Father of modern Geology. Published “Theory of the Earth” in 1785 in which he outlined that geological features and ancient rocks could be explained by present-day physical and chemical processes.

Founders of Historical Geology

Founders of Historical Geology

Laid foundation for *uniformitarianism*

“The past history of our globe must be explained by what can be seen to be happening now”.

By observing geologic processes in operation around him, Hutton could infer the origin of features observed in rocks.

“Present is the key to the past”.

Archibald Geike 1835-1924

James Hutton (1726–1797), a Scottish farmer and naturalist, is known as the founder of modern geology. He was a great observer of the world around him. More importantly, he made carefully reasoned geological arguments. The Scottish naturalist James Hutton (1726 - 1797) is known as the father of geology because of his attempts to formulate geological principles based on observations of rocks.

Founders of Historical Geology

Charles Lyell (1797-1875): Scotsman who attended Oxford University. Father was an avid naturalist. Rebelled against prevailing thought, which was rooted in Biblical interpretation and Catastrophism. Published “Principles of Geology,” which through succeeding editions came to address all the major geological processes recognized today. His main contribution was the development of Uniformitarianism (Actualism). He strongly supported an “old Earth” view. He was close friends with Charles Darwin. The present is the key to the past... Modern view holds that processes that operate today have shaped the Earth through Geological Time, but rates may not have always remained constant.

Founders of Historical Geology

In his Essay on the **Theory of the Earth (1813) Cuvier** was interpreted to have proposed that new species were created after periodic catastrophic floods. In this way, Cuvier became the most influential proponent of catastrophism in geology in the early 19th century.

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