Indian Institute of Technology, Kanpur

Department of Earth Sciences

ES0213: Fundamentals of Earth Sciences

Lecture 02. Subject Introduction

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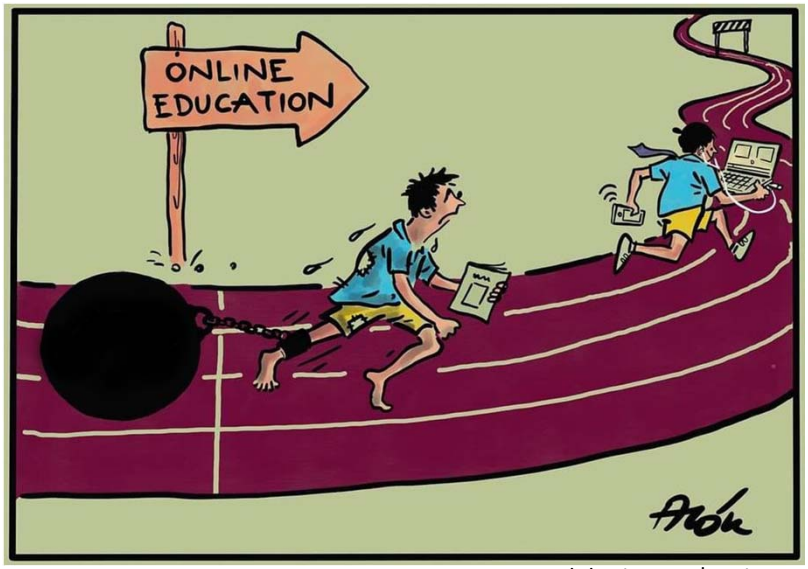
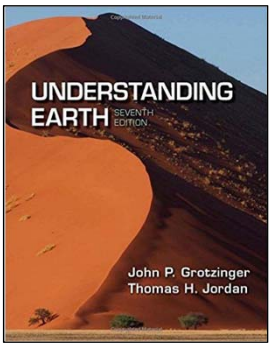
IITK Experimental Rock Deformation Laboratory

ONLINE CLASSES

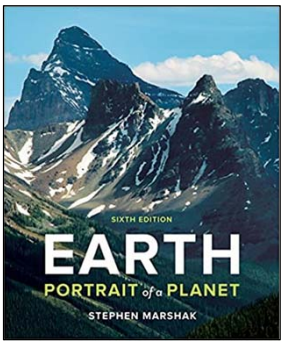


Alok Nirantar | Twitter

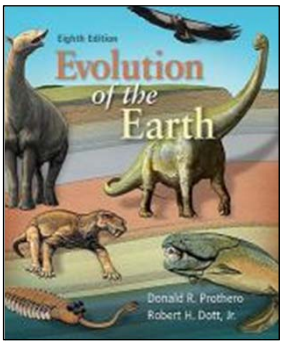
Study Materials



J. Grotzinger and T. Jordan, Understanding Earth, 2010 (7th Ed.), W.H. Freeman & Company: ISBN-13: 978-1-4641-3874-4



Stephen Marshak, Earth: Portrait of a Planet, 2015 (5th Ed.), W. W. Norton & Company: ISBN-13: 978-0393937503.



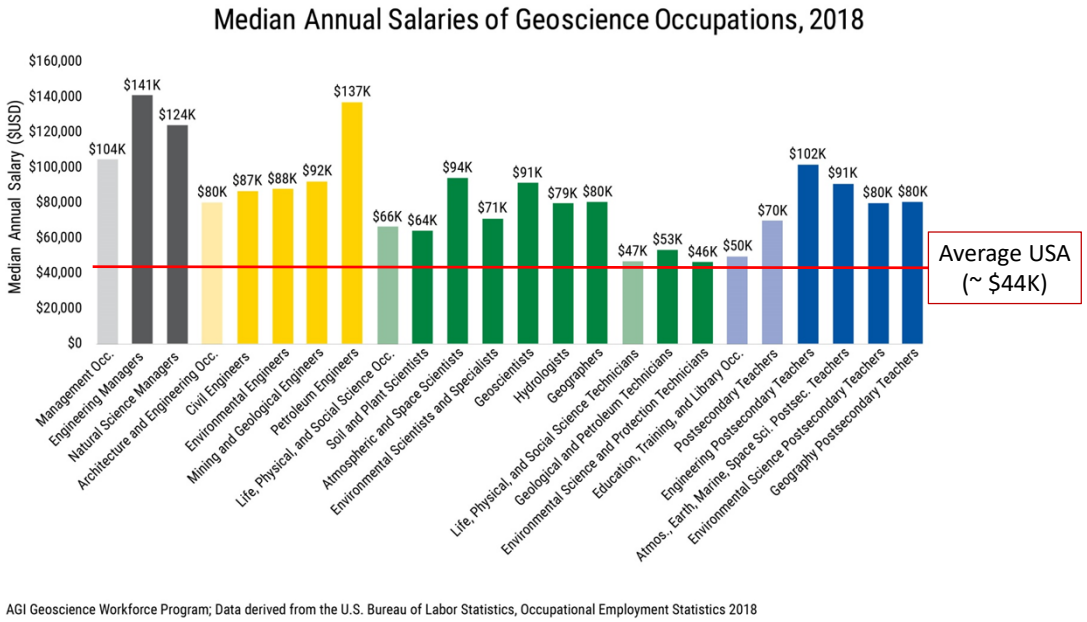
D. R. Prothero and R. H. Dott, Jr. Evolution of the Earth. 2010 (8th Ed.), McGraw Hill, 576 p.

Most of the materials of this course are from these books; also from my own collections and from different teaching sites and blogs.

Earth Sciences… what is that?

- Earth Science is a strongly interdisciplinary subject with several links to fundamental science pillars like Physics, Chemistry, Mathematics and Biology.
- The subject links important resources such as minerals, energy, and water, as well as to hazards and environmental management.
- Over the years, this discipline has developed into a major knowledge domain of science and technology due to the advent of modern space observation systems, new exploration technologies for probing earth's surface and sub-surface for resources, and the development of sophisticated geochemical analytical methods.
- In addition, several important issues such as climate change, natural hazards, environmental degradation and resource depletion have made this science highly relevant to the society.

Earth Sciences… what about the job market?



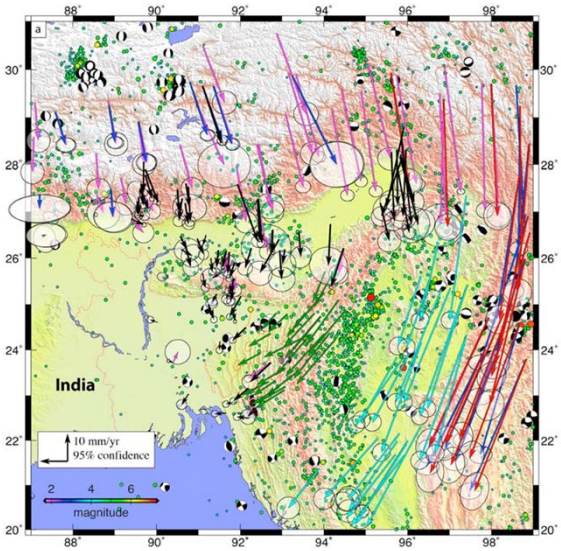
AGI Geoscience Workforce Program; Data derived from the U.S. Bureau of Labor Statistics, Occupational Employment Statistics 2018

Some basic concepts and ideas in Earth Sciences

- Earth scientists (Geologists) use observations and testable ideas to understand and explain our planet. This is the basic of practicing SCIENCE.
- Earth is ~4.6 billion years old. That's 4,600,000,000 years!
- Earth is a complex system of interacting rock, water, air, and life.
- Earth is continuously changing; Life evolves on a dynamic Earth and continuously modifies the Earth.
- The changes in earth are extremely slow; sometimes very fast.
- Earth is magnetic and has a geodynamo system.
- Earth is a water planet.
- Humans significantly alter the Earth.

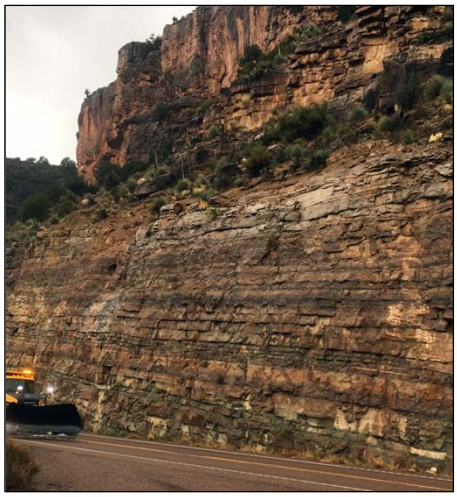
Some basic concepts and ideas in Earth Sciences

Geologists use observations and testable ideas to understand and explain our planet.



Some basic concepts and ideas in Earth Sciences

Earth is ~4.6 billion years old. That's 4,600,000,000 years!



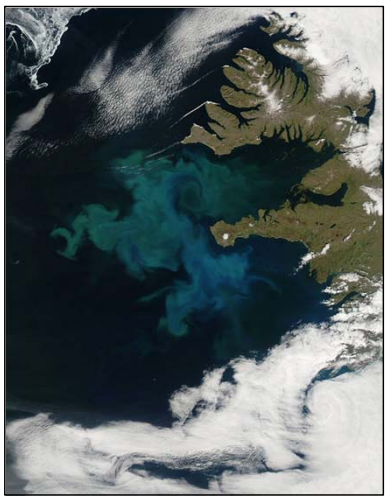
Lunar Sample (67215)	: 4.46 billion years
Jack Hills (Australia)	: 4.38 billion years
Greenstone Belt (Canada)	: 4.28 billion years
Alan Hills (Antarctica)	: 4.09 billion years

Oldest rock in India: 4.24 billion years old (Kendujhar, Odisha)

Some basic concepts and ideas in Earth Sciences

Earth is a complex system of interacting rock, water, air, and life.

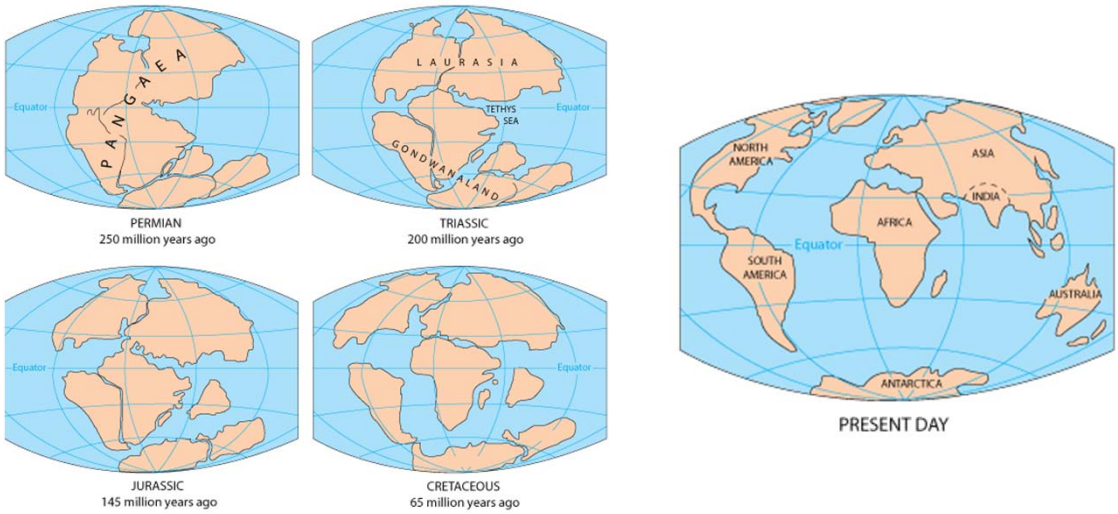
Dust plumes from Iran, Afghanistan and Pakistan blow southward over the Arabian Sea, Dec. 28, 2012. Credit: NASA / Goddard / MODIS Land Rapid Response.



North Atlantic phytoplankton bloom off the coast of Iceland, June 24, 2010. Credit: NASA's Earth Observatory.

Some basic concepts and ideas in Earth Sciences

Earth is continuously changing; so the LIFE on Earth



Some basic concepts and ideas in Earth Sciences

The changes in earth are extremely slow; sometimes very fast.

The most recent layer of sediment is about 250 million years old.

The rocks at the bottom of the Grand Canyon are 1.7–2.0 billion years old.

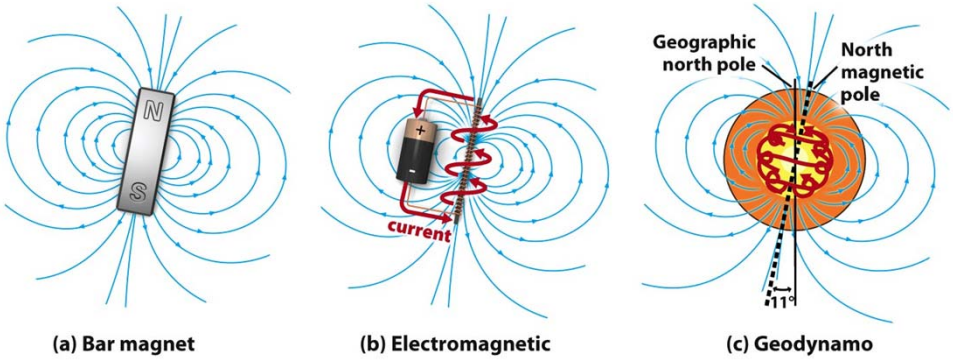
The explosive impact of a meteorite created this 1.2-km-wide crater in just a few seconds.

Earthquake, Landslide, Avalanches, Volcanoes….

Some basic concepts and ideas in Earth Sciences

Earth is magnetic and has a geodynamo system

Rapid motion of the liquid outer core stirs up electrical flow in the solid (iron) inner core, causing Earth's magnetic field.



(a) Bar magnet (b) Electromagnetic (c) Geodynamo

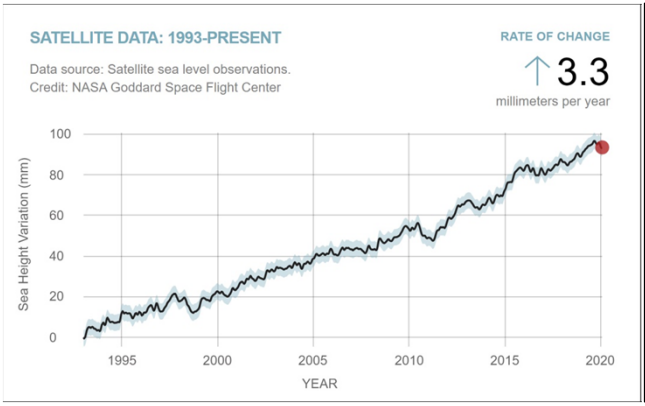
Some basic concepts and ideas in Earth Sciences

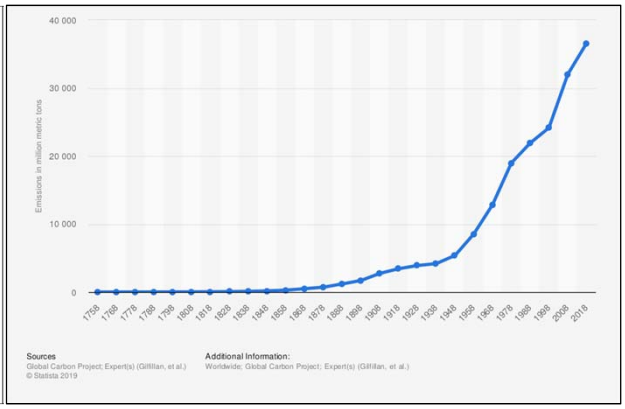
Earth is the water planet

About 71% of the Earth's surface is water-covered, and the oceans hold about 96.5 % of all Earth's water. Water also exists in the air as water vapour, in rivers and lakes, in icecaps and glaciers, in the ground as soil moisture and in aquifers, and even in us.

Some basic concepts and ideas in Earth Sciences

Humans significantly alter the Earth





Assignment – 01 (graded)

- Do we also have water inside the earth? If yes, how and in which form?
- Suggest three major human activities which are (has been) altering the earth.
- Suggest three slow and three fast natural processes that can affect the Earth's dynamics.
- Not every planet has a geodynamo, why? Earth did not have a magnetic field, what might be different about our planet?

Summary of this lecture

Understanding the Earth and its different processes are important. In this course, we'll learn the basics of how to look at the system.

Next lectures

Origin of the Universe and the Solar System