

Fundamentals of Earth Sciences
(ESO 213A)

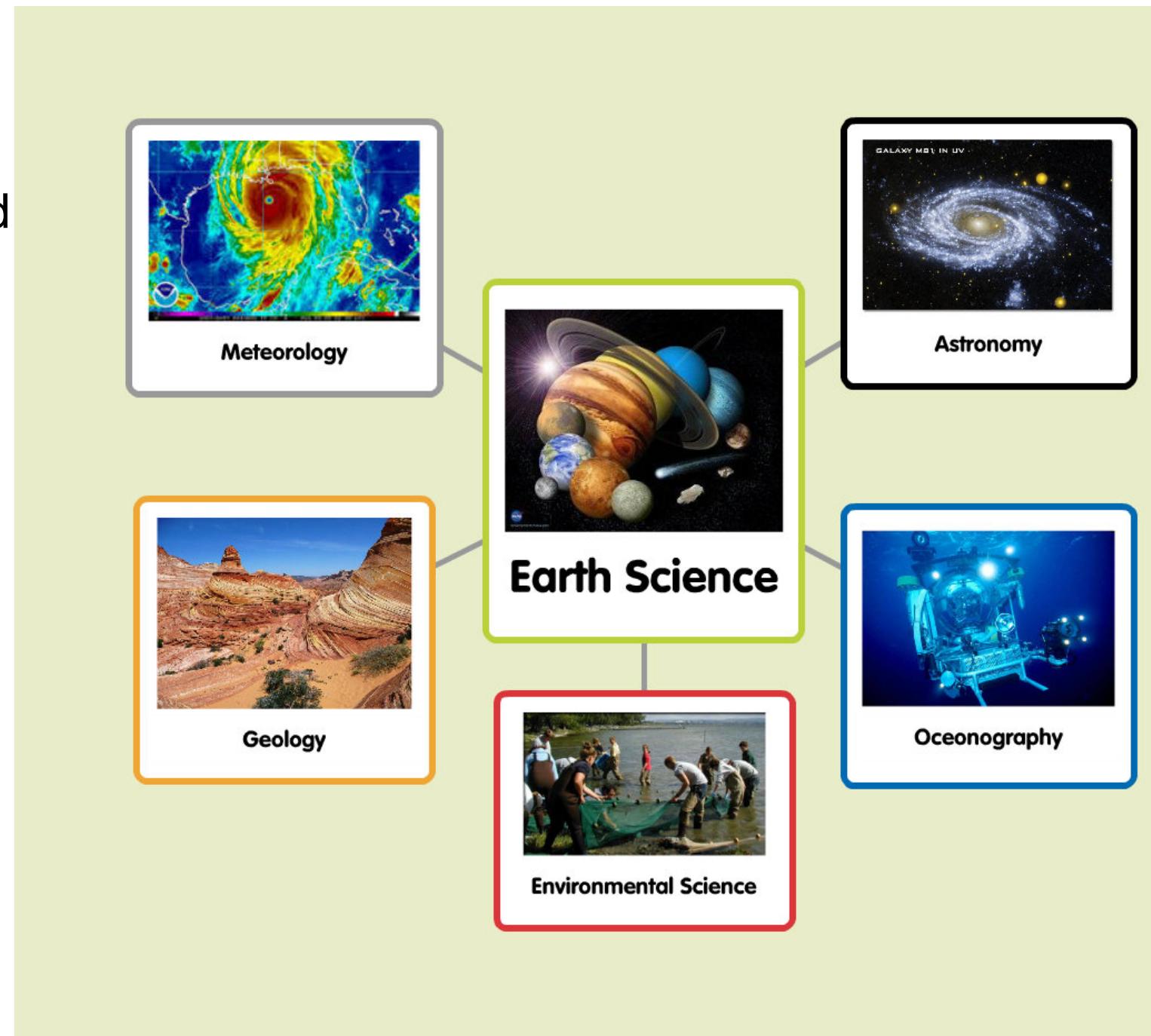
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Earth Science or Geoscience explains the physical, chemical, and biological processes associated with the planet Earth.

It has major 5 branches:

- Geology
- Meteorology
- Oceanography
- Astronomy
- Environmental Sciences

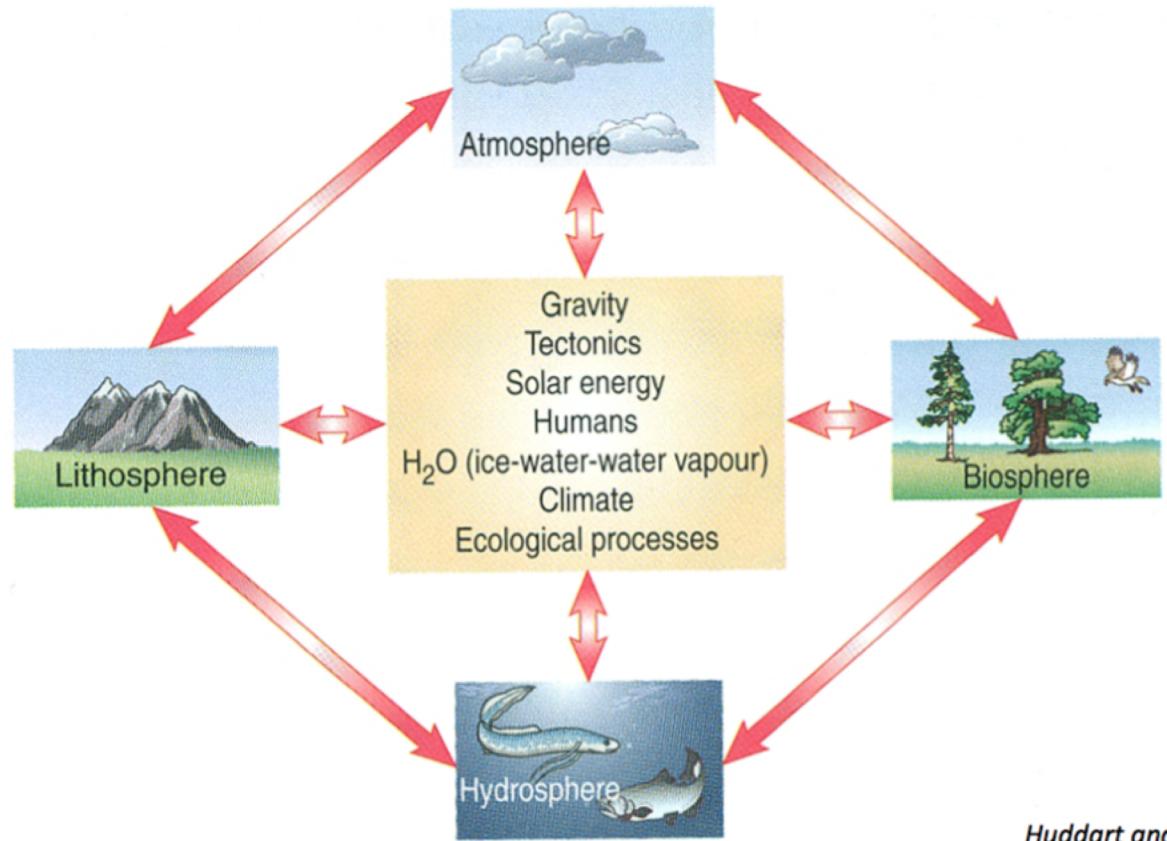
This subject establishes interaction among Geosphere, Biosphere, Atmosphere and Hydrosphere



Why study Earth Science?

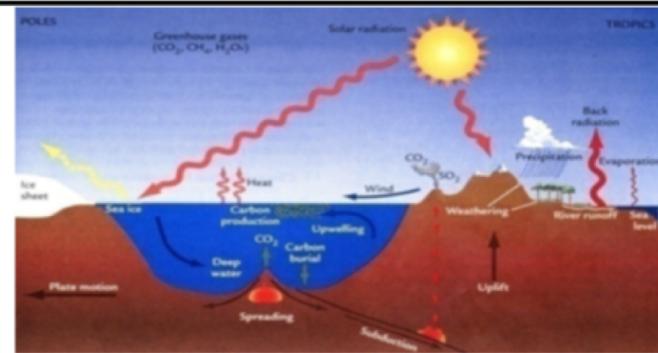
- Understand natural disaster (earthquake, tsunami, hurricane, volcanic eruption, flood.....)
- Understand the environment, particularly climate change and its consequences
- Understand, quantify, and predict occurrence of natural resources (precious metals, coal, petroleum, natural gas, ground water...)
- Investigate the strength of bedrock to support roads, dams, tunnels.

Components of the Earth's system



Huddart and Stott, 2010

Climate Forcing and Responses of Earth Systems

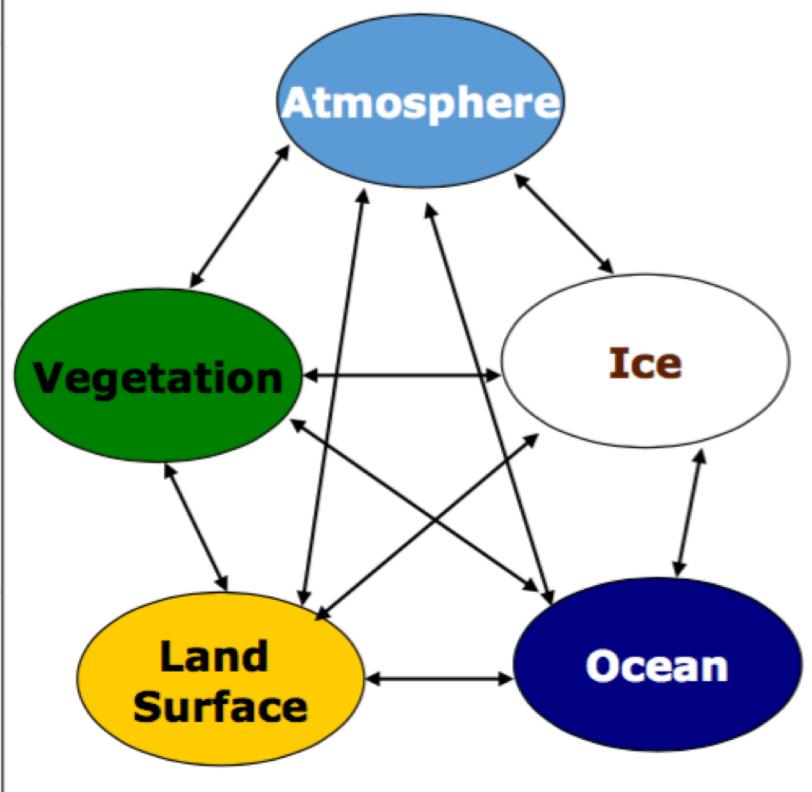


CAUSES (external forcing)

Changes in
Plate tectonics

Changes in
Earth's Orbit

Changes in
Sun's Strength



VARIATIONS (Internal responses)

Changes in
Atmosphere

Changes in
Ice

Changes in
vegetation

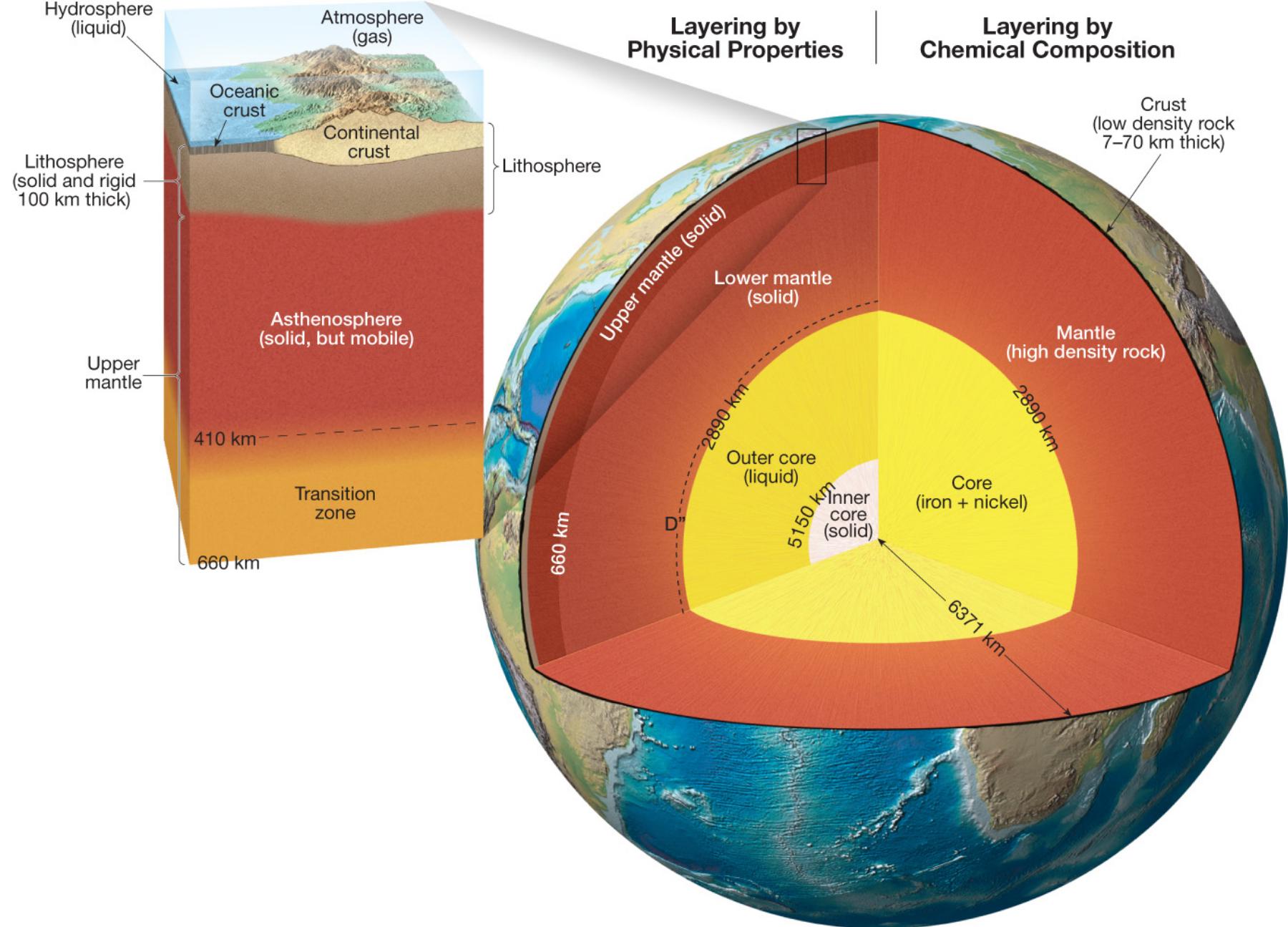
Changes in
Ocean

Changes in
Land
surface

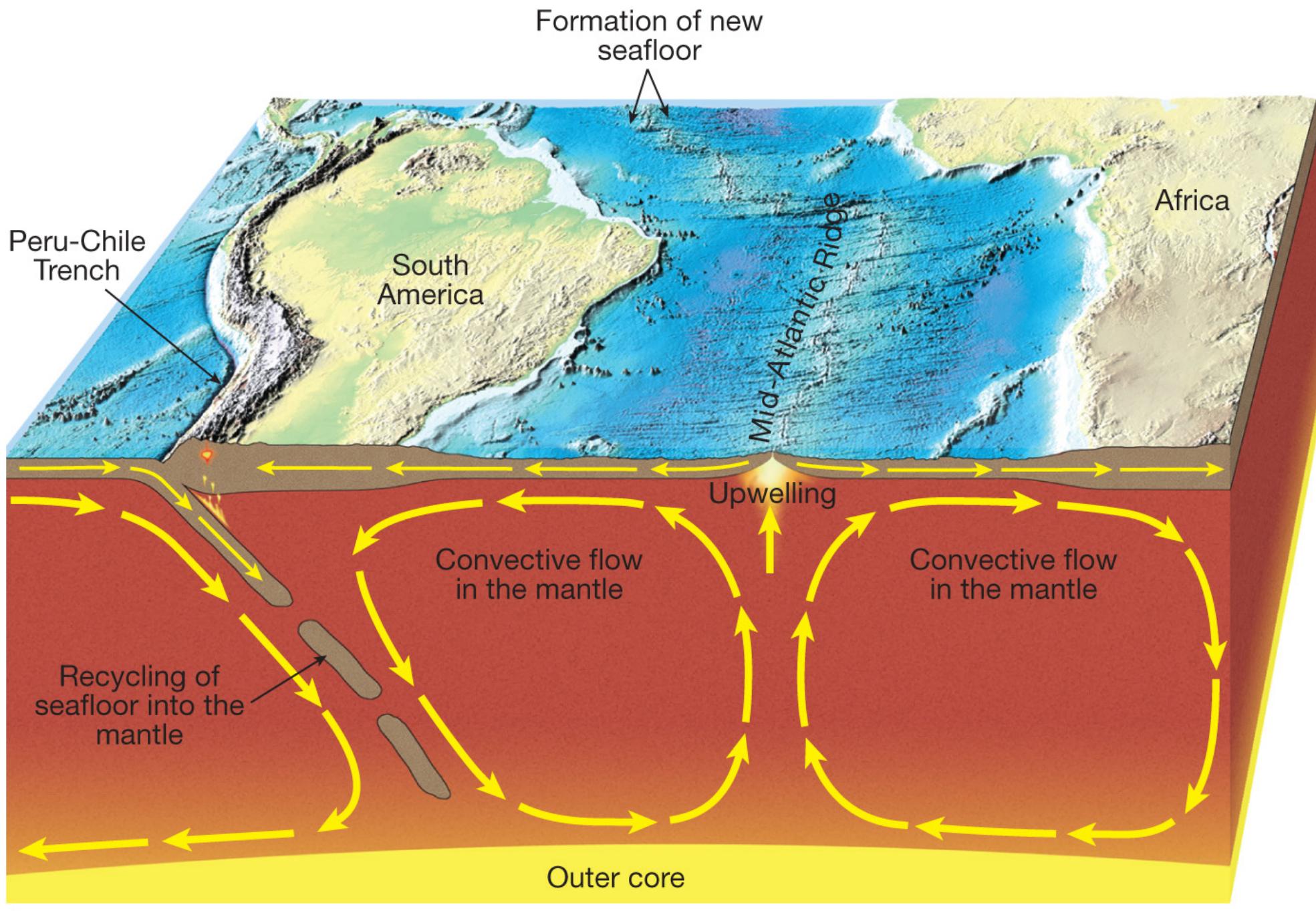
Ruddiman, 2008

Some Questions??

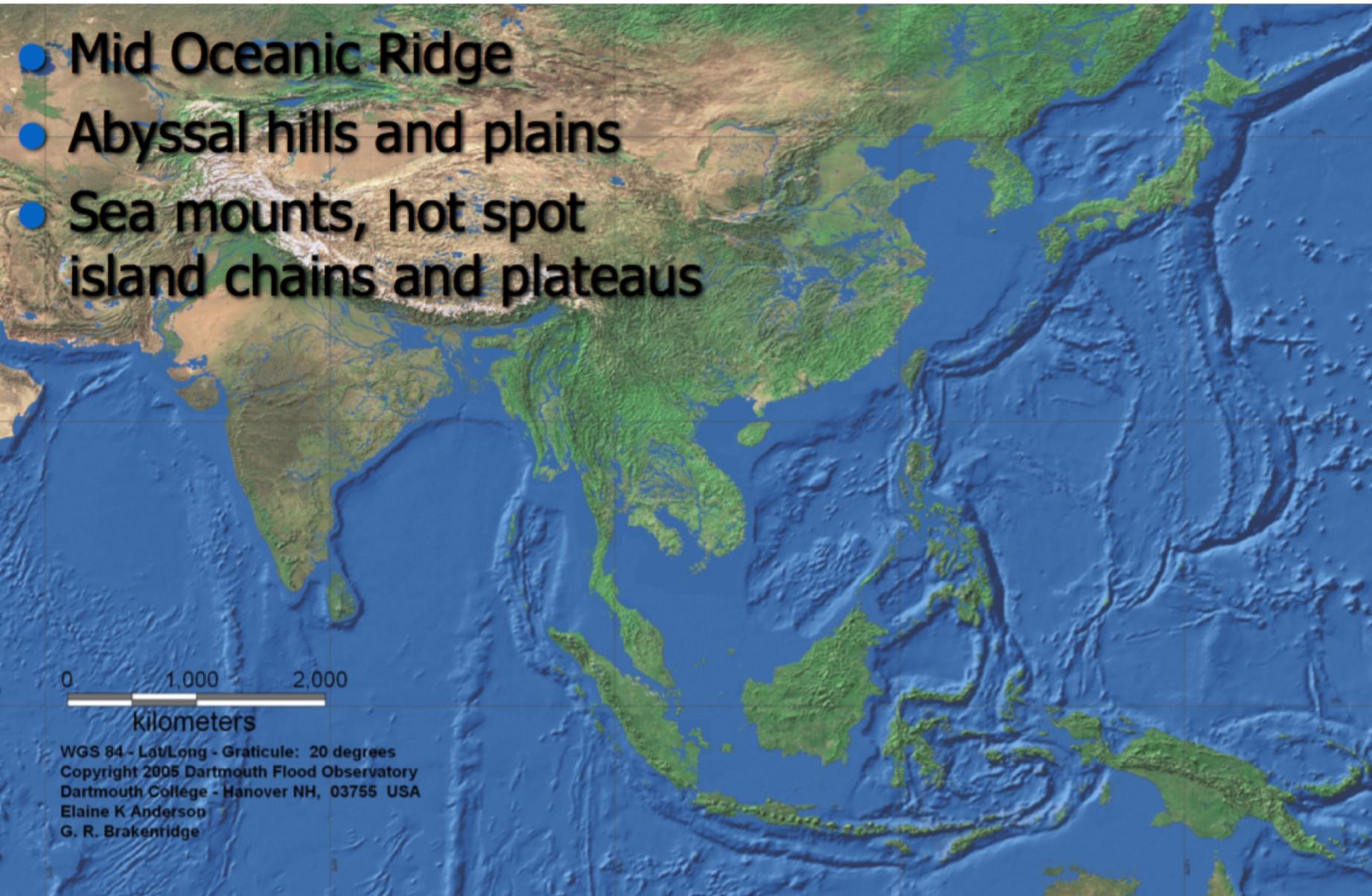
How does Earth's internal structure look like??



How do continents and ocean form ?



The sea floor is not flat



How did life evolve on Earth??



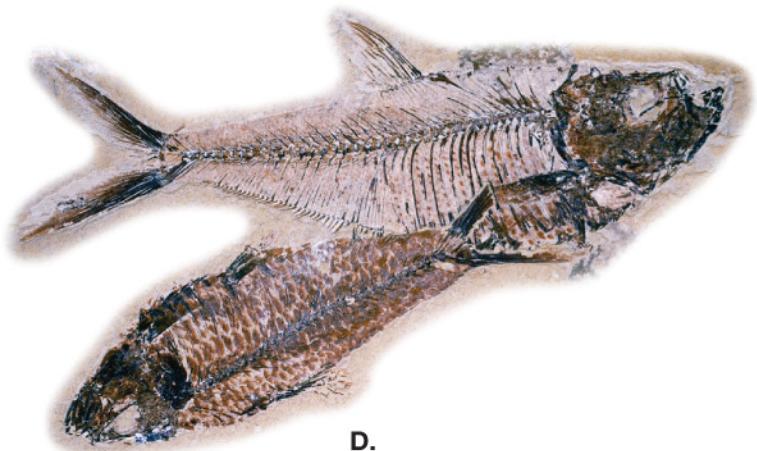
A.
Petrified wood



B.
Cast and mold



c.
Carbonization



D.
Impression



E.
Amber

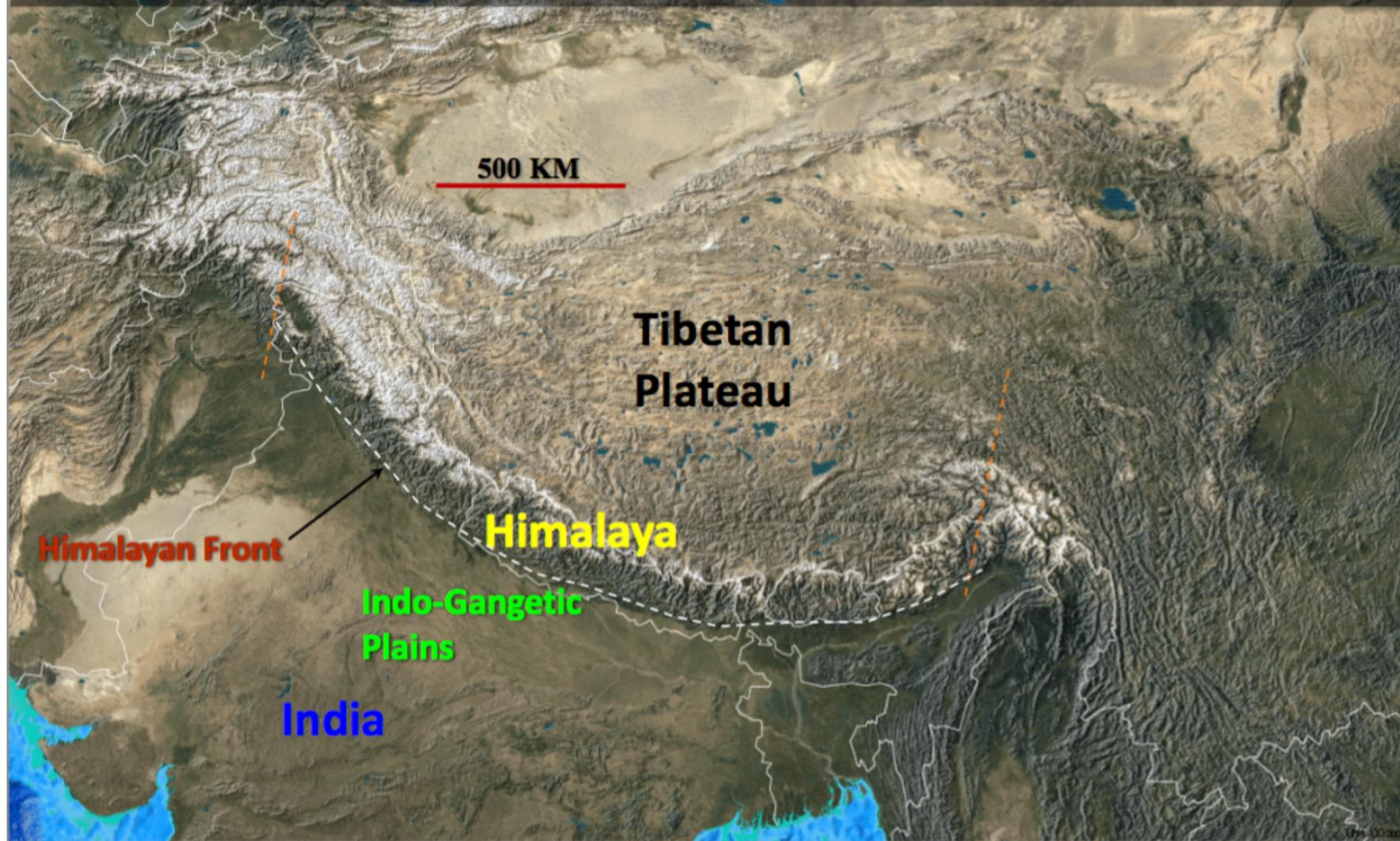


F.
Coproliite

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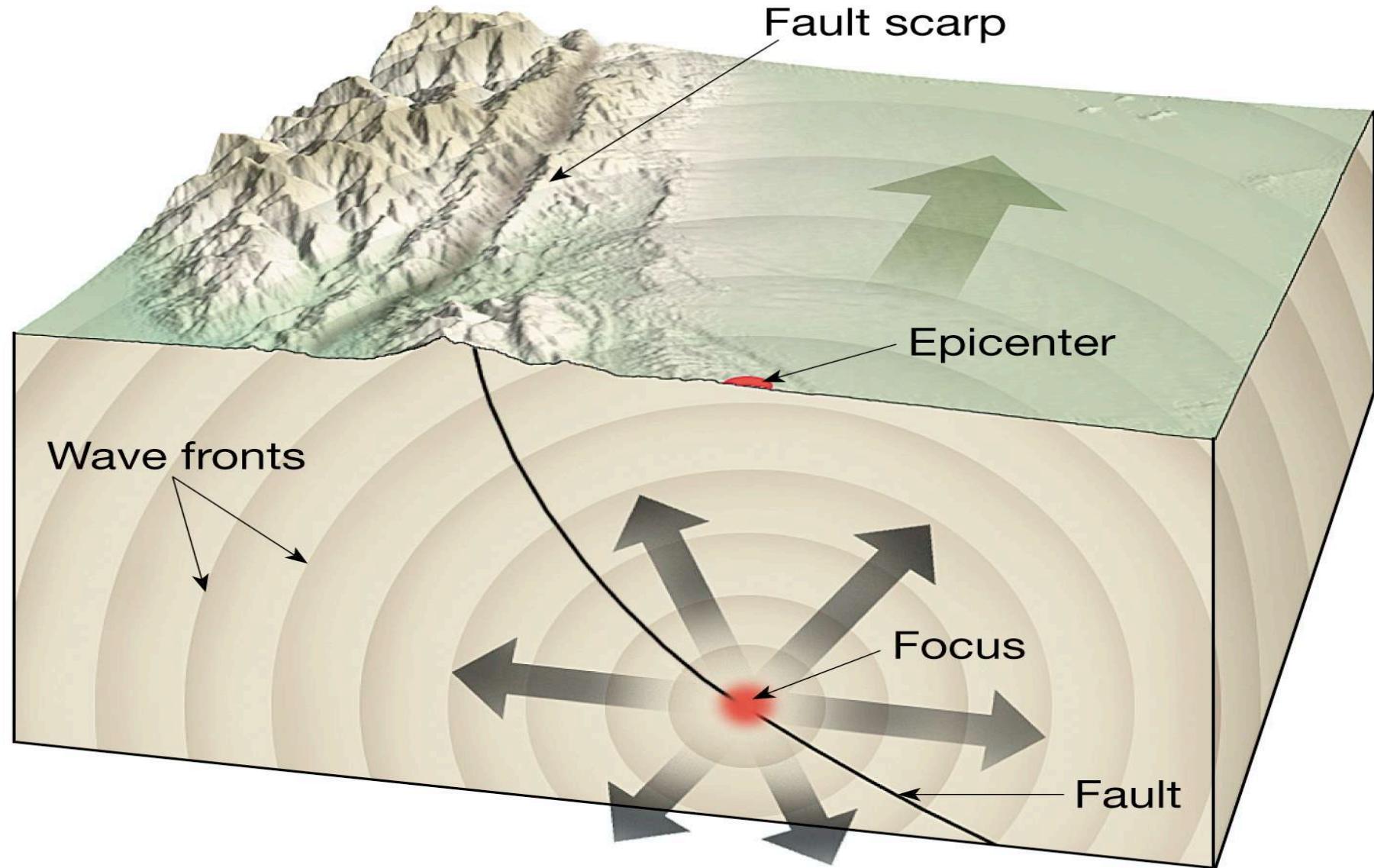
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What are the processes that result in first order relief of the Earth's surface?



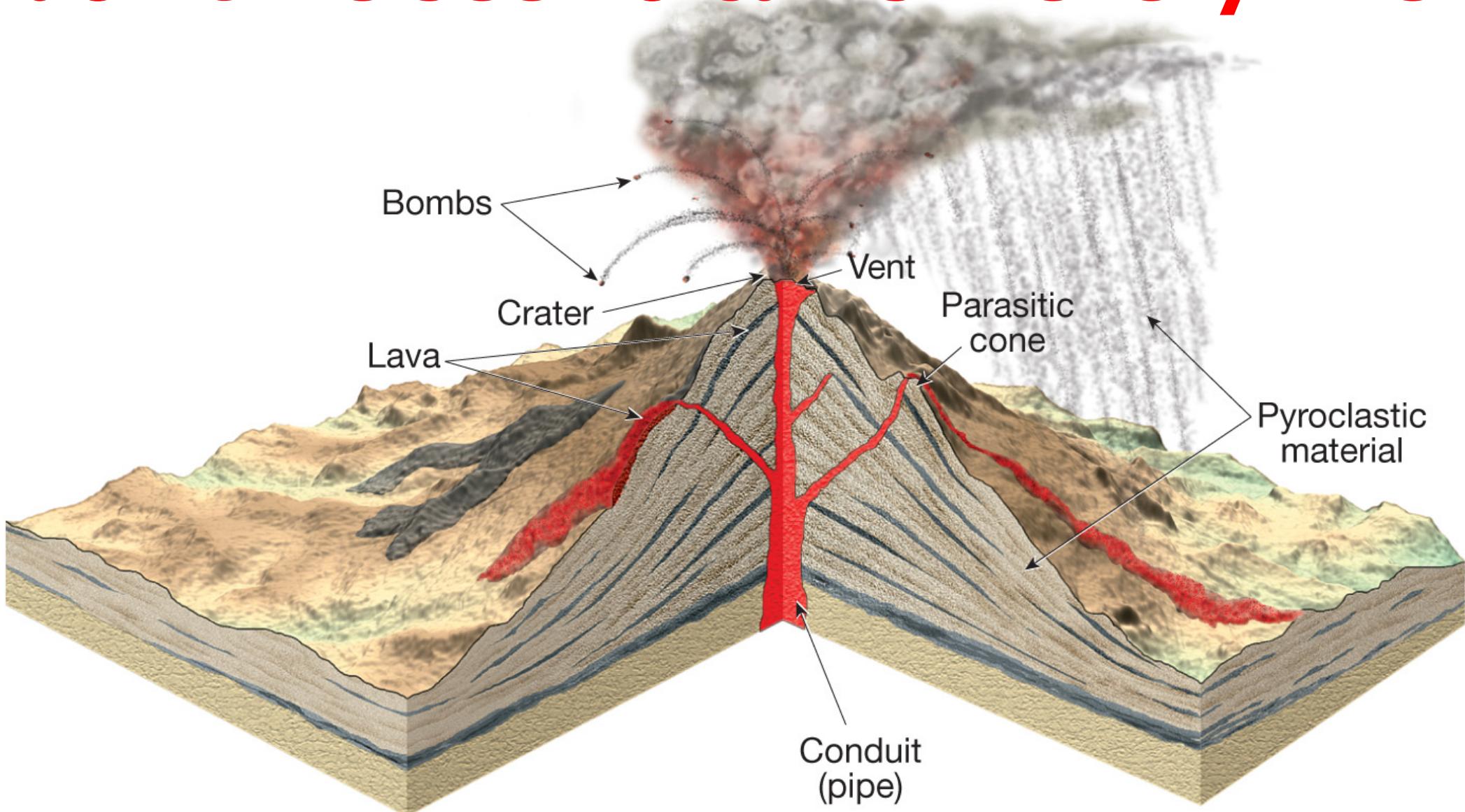
*What can cause
earthquakes??*

*Can we use the
earthquake
energy and
reveal buried
information?*



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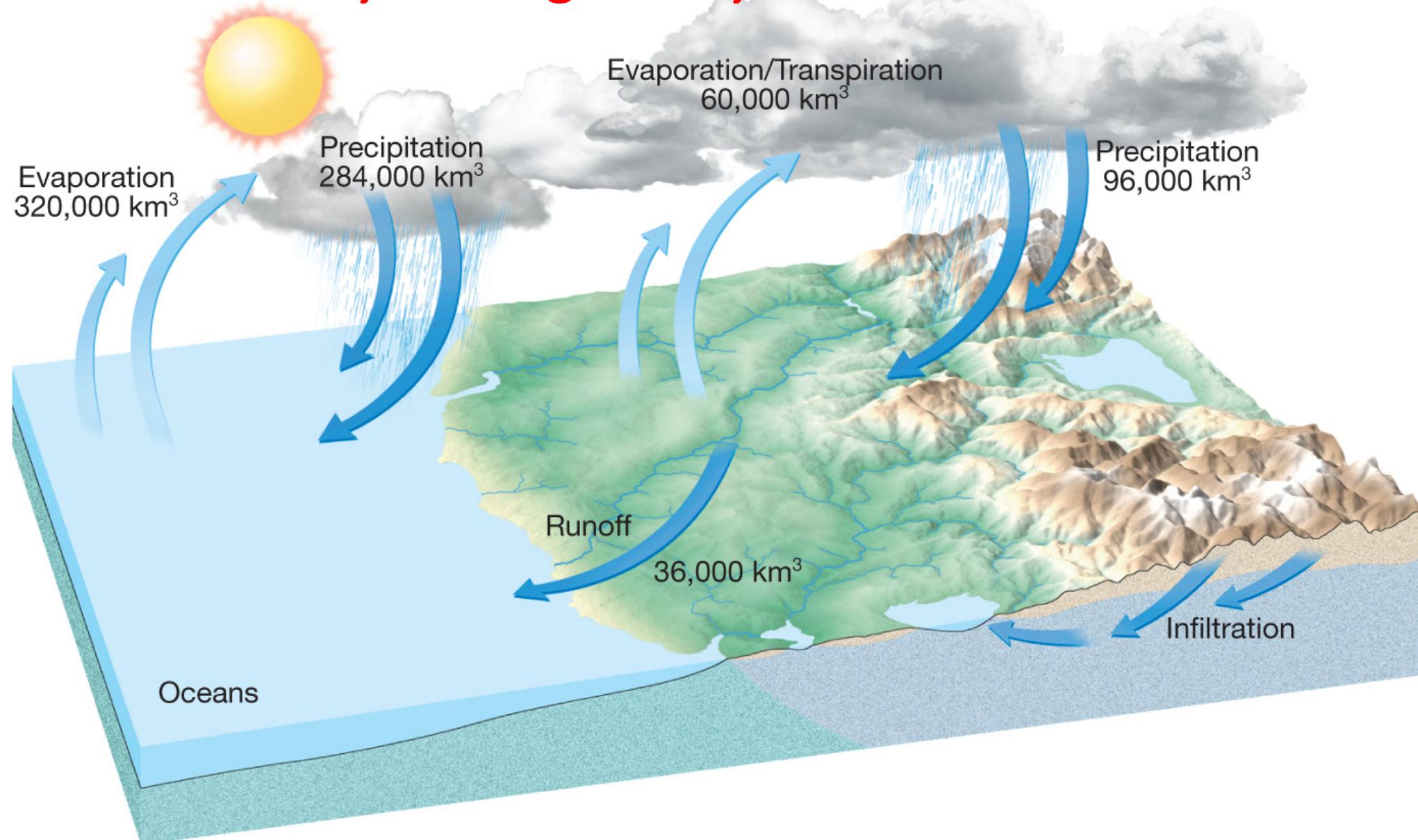
Are volcanoes important? Why don't we see volcanism everywhere ?



Why do we see different types of rocks? Do they originate from same process?

Texture	Composition		
Felsic (Granitic)	Intermediate (Andesitic)	Mafic (Basaltic)	
Phaneritic (course-grained)	 Granite	 Diorite	 Gabbro
Aphanitic (fine-grained)	 Rhyolite	 Andesite	 Basalt

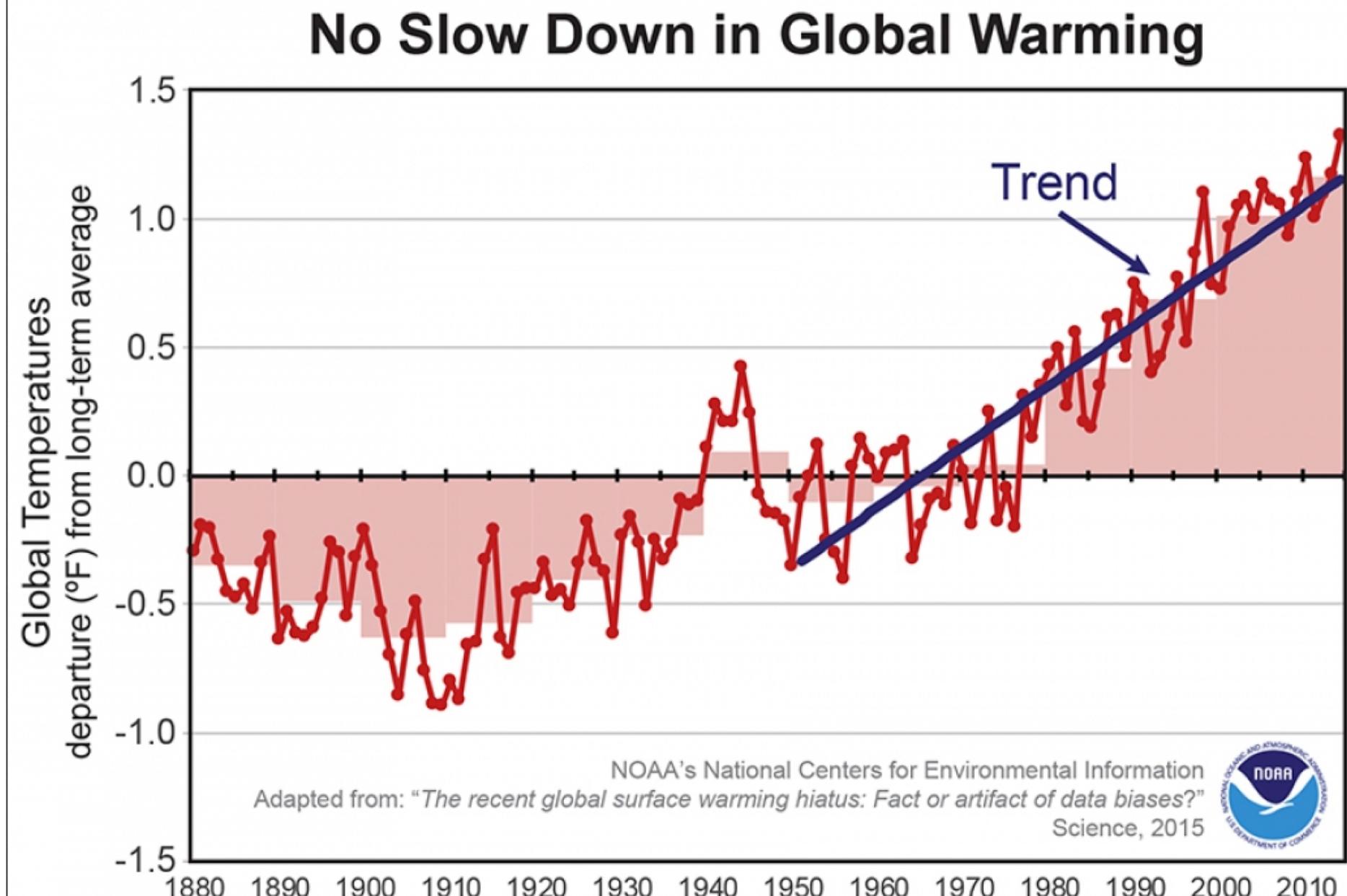
How does Earth's hydrological cycle work?



How do landscapes
influence and record
climate and
tectonics?



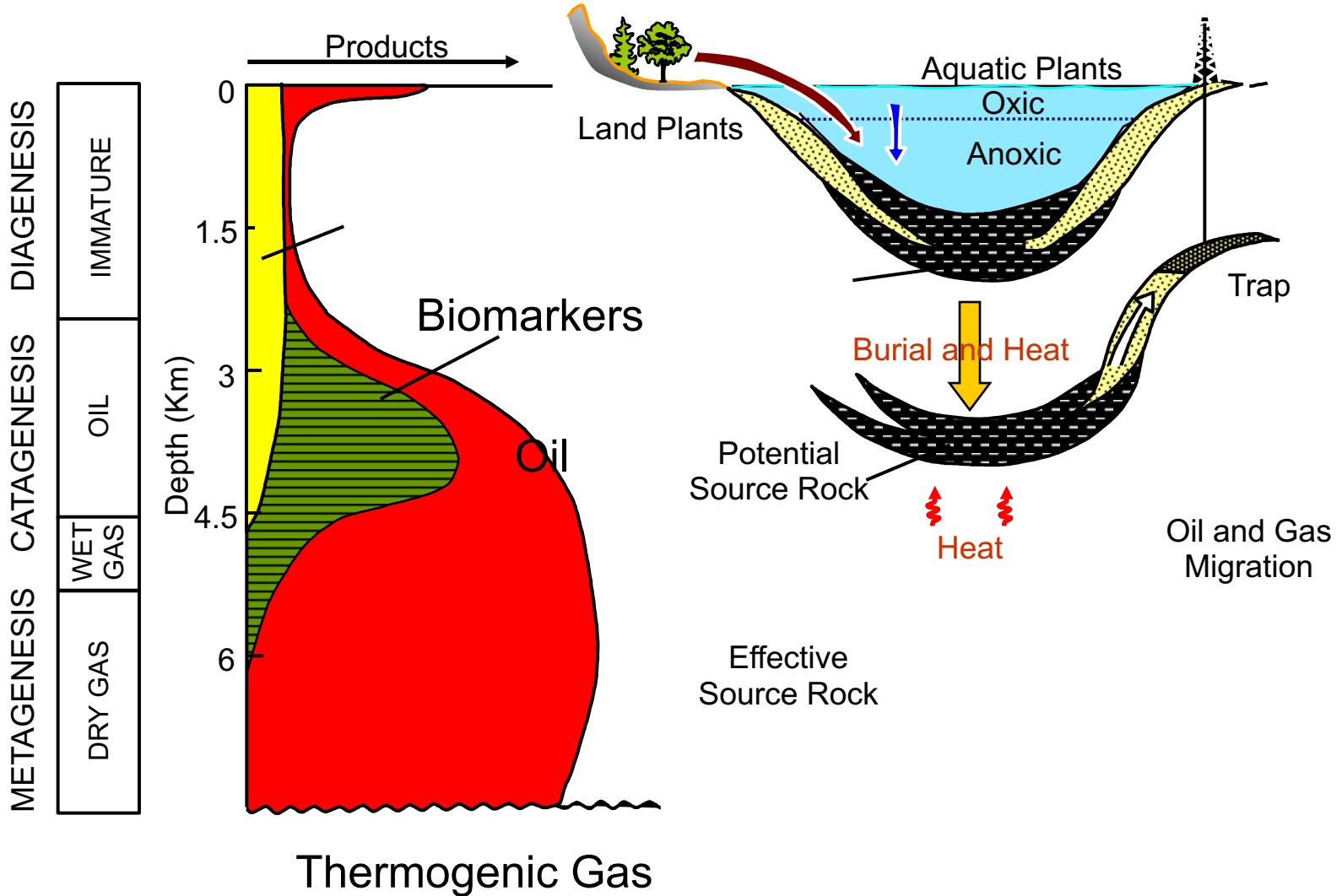
Is there any way to know about the paleoclimate and cycles of past global cooling and warming?



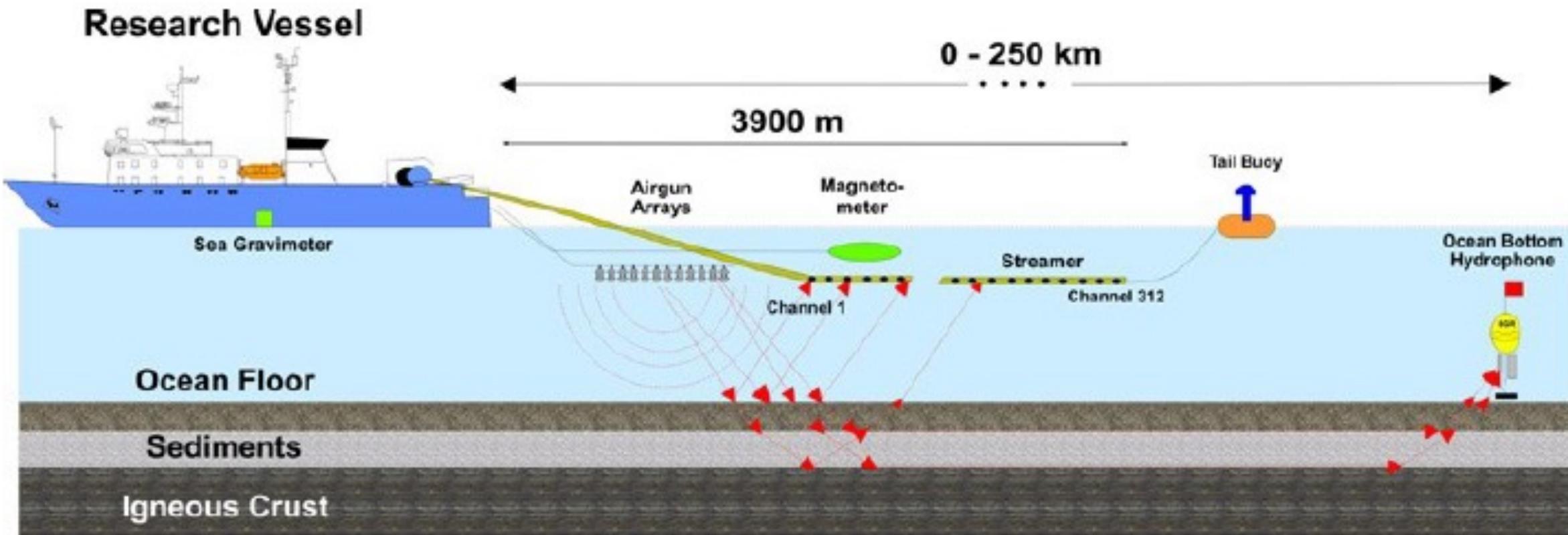
Contrary to much recent discussion, the latest corrected analysis shows that the rate of global warming has continued, and there has been no slow down.

How does a hydrocarbon reservoir look like? Is there any alternative to fossil fuel???

Biogenic Gas/Petroleum/Thermogenic Gas Formation



How can we explore buried structures????



In a nutshell, this subject offers you to *explore*:

mountains to rivers & lakes to Glacier,
Deserts, active volcanoes and deep
ocean and natural resources and many
more

I enjoy this
subject,
because I
love
travelling



JOIDES Resolution

Date	Day	Topics (tentative)	Content			
29-Jul	Fri	Introduction		26-Sep	Mon	Hydrological Cycles and Glacier
01-Aug	Mon	Universe and Solar System		28-Sep	Wed	Cryosphere
03-Aug	Wed	Origin of Earth, Moon and Atmosphere		30-Sep	Fri	Groundwater
		Internal structure of Earth				
05-Aug	Fri	Assignment 1: Watch the science fiction drama "The Core (2003)"				Mid semester Recess (No classes)
08-Aug	Mon	Internal structure of Earth continued		10-Oct	Mon	Rivers and Oceans
10-Aug	Wed	Plate Tectonics		12-Oct	Wed	Oceans continued
12-Aug	Fri	Divergent boundaries, Convergent and Transform Boundaries		14-Oct	Fri	Earth surface processes (Weathering and Soil)
15-Aug	Mon	National Holiday (No class)				Assignment 4: Watch "Dante's Peak (1997)"
17-Aug	Wed	Magma and Igneous Rocks		17-Oct	Mon	Desserts and winds
19-Aug	Fri	National Holiday (No class)		19-Oct	Wed	Climate system and Greenhouse effect
22-Aug	Mon	Intrusive Activities and Volcanoes		21-Oct	Fri	Fossil-Fuels
24-Aug	Wed	Metamorphic rocks		24-Oct	Mon	Restricted Holiday
26-Aug	Fri	Sedimentary rocks		26-Oct	Wed	Alternate energy
29-Aug	Mon	Earth's history and Geological Time Scale				Quiz2
31-Aug	Wed	Geologic time scale and Radioactive dating		28-Oct	Fri	Assignment 5: Watch "The day after tomorrow (2004)"
02-Sep	Fri	Quiz 1				
		Assignment 2: Watch "Jurassic Park (1993)"		31-Oct	Mon	Geophysical techniques: Imaging subsurface-1
05-Sep	Mon	Crustal Deformation		02-Nov	Wed	Geophysical techniques: Imaging subsurface-2
07-Sep	Wed	Earthquakes		04-Nov	Fri	Geophysical techniques: Imaging subsurface-3
09-Sep	Fri	Earthquakes continued		07-Nov	Mon	Geophysical techniques: Imaging subsurface-4
12-Sep	Mon	Landslide		09-Nov	Wed	Geophysical techniques: Imaging subsurface-5
14-Sep	Wed	Instrumentation		11-Nov	Fri	Geophysical techniques: Imaging subsurface-6
		Revision/Discussion		17-26 Nov		End Semester examination
16-Sep	Fri	Assignment 3: Watch "San Andreas (2015)"				Please read at your leisure 'Deception point by Dan Brown' and 'Journey to the centre of the Earth by Jule Verne'
19-23 Sep	Mid Semester week					

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EARTH SUGANDHI (earth@iitk.ac.in)

Textbook and reading:

Please follow the power point presentations and lecture notes from class. You can also consult the following books

- E. J. Tarbuck, F. K. Lutgens and D. G. Tasa. Earth: An Introduction to Physical Geology, 2013 (11th Ed.). Prentice Hall. 912 p.
- D. R. Prothero and R. H. Dott, Jr. Evolution of the Earth. 2010 (8th Ed.), McGraw Hill, 576 p.
- J. Grotzinger and T. Jordan, Understanding Earth, 2010 (6th Ed.). Freeman, 710 p.

GRADING POLICY

I will follow the system of Relative Grading. Marks will be distributed as per the table –

<i>Quiz (open notes/books/internet).</i>	30
<i>Mid Term</i>	30
<i>Final Term</i>	40

There will 2 announced quizzes of 30 marks. Don't miss your quizzes, as there will be no make up quizzes. Quizzes will be an open book; notes and you are free to use the Internet as well. Mid term and Final term will cover 70 marks in total. Remember both Mid term and final term will be closed book examination.

NO MARKS on ATTENDENCE