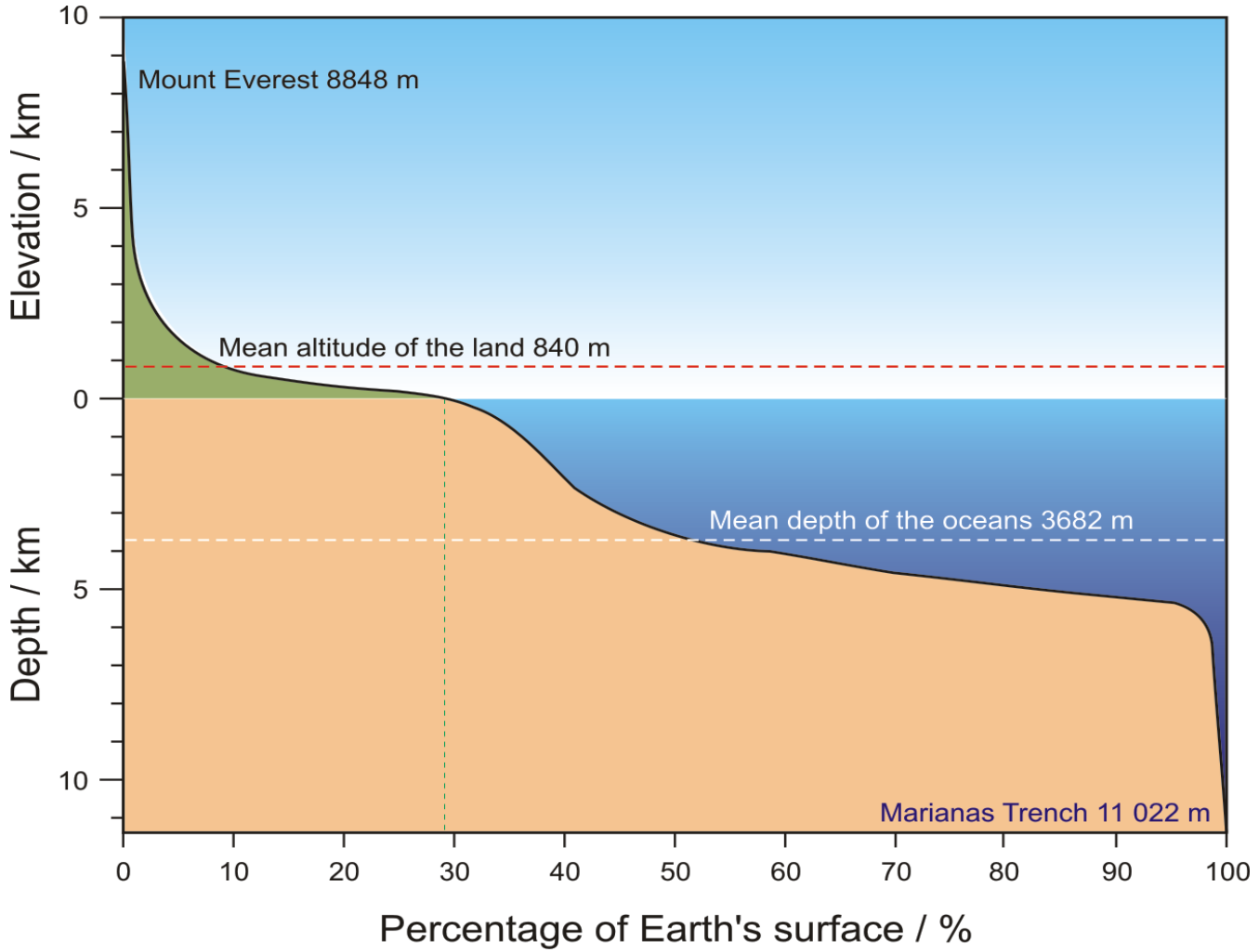
Oceans and Features on the Ocean Floor

- **The Earth's Oceans**
- **Seafloor Features**
  - Mid-Ocean Ridges
  - Fracture Zones
  - Abyssal plains
  - Continental Margins
  - Seamounts
  - Reefs

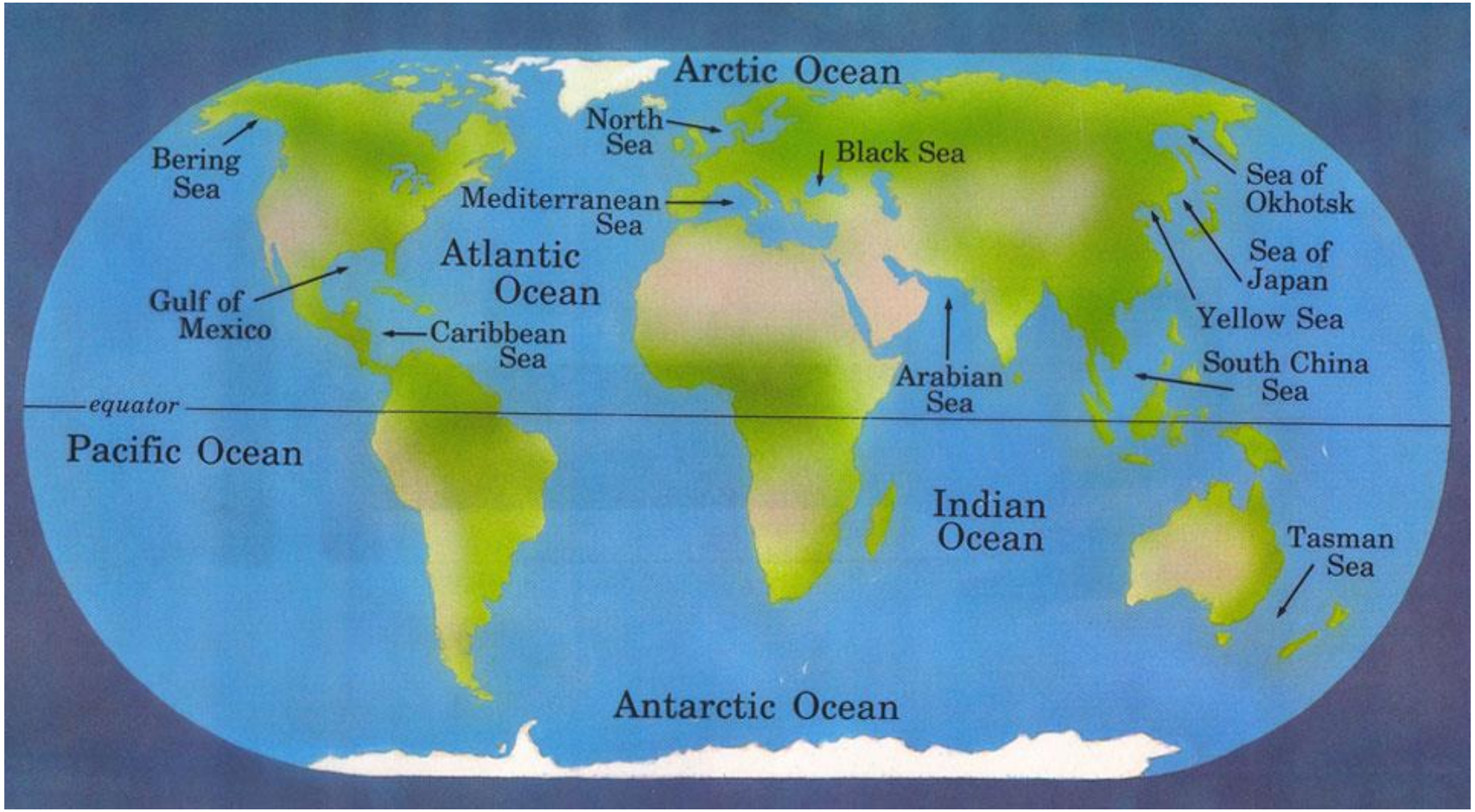
Oceans vs. Continents



Hypsographic Curve

Figure by E. Generalic, http://glossary.periodni.com/glossary.php?en=hypsometric+curve

The Earth's Oceans



How many oceans on the world?

Pacific Ocean

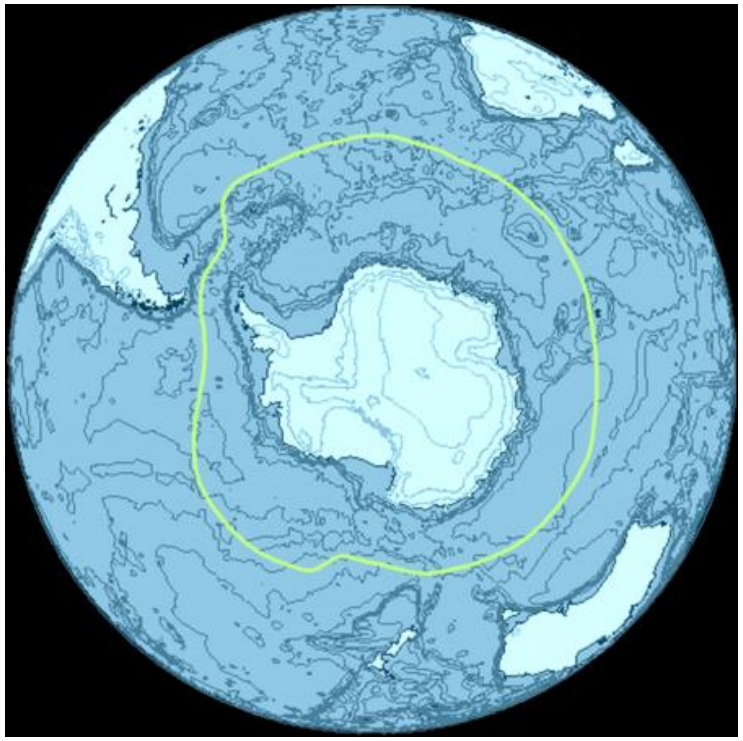
- World’s largest ocean.
- Accounts for more than half of Earth’s ocean space.
- World’s deepest ocean
- Earth’s largest geographic feature

Atlantic Ocean

Indian Ocean

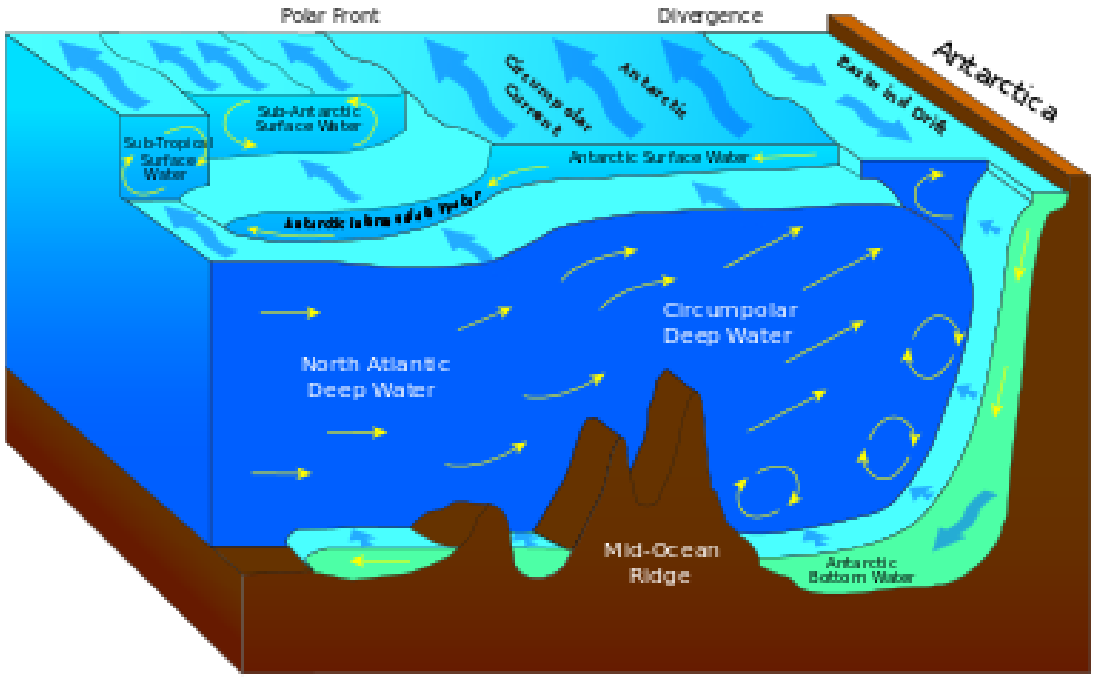
Arctic Ocean

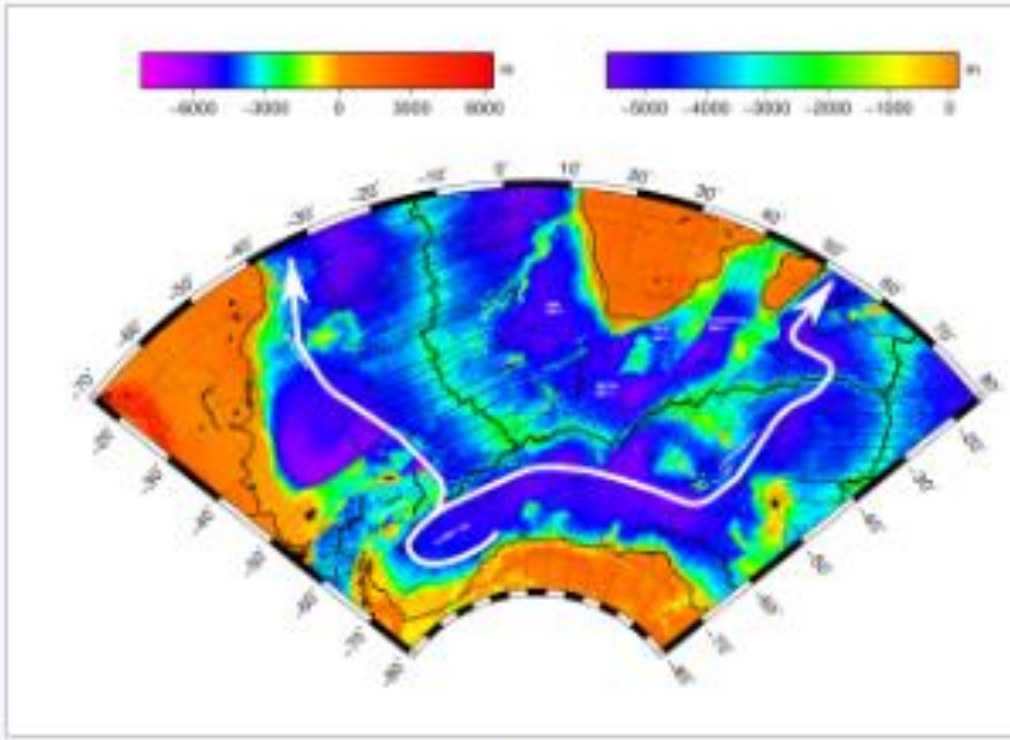
- Size ~ 7% of the Pacific Ocean.
- Shallowest world ocean.
- Permanent layer of sea ice a few meters thick



Antarctic (Southern) Ocean

- Circumnavigates Antarctica.
- Parts of the Pacific, Atlantic, and Indian Oceans that lie south of 60°S latitude





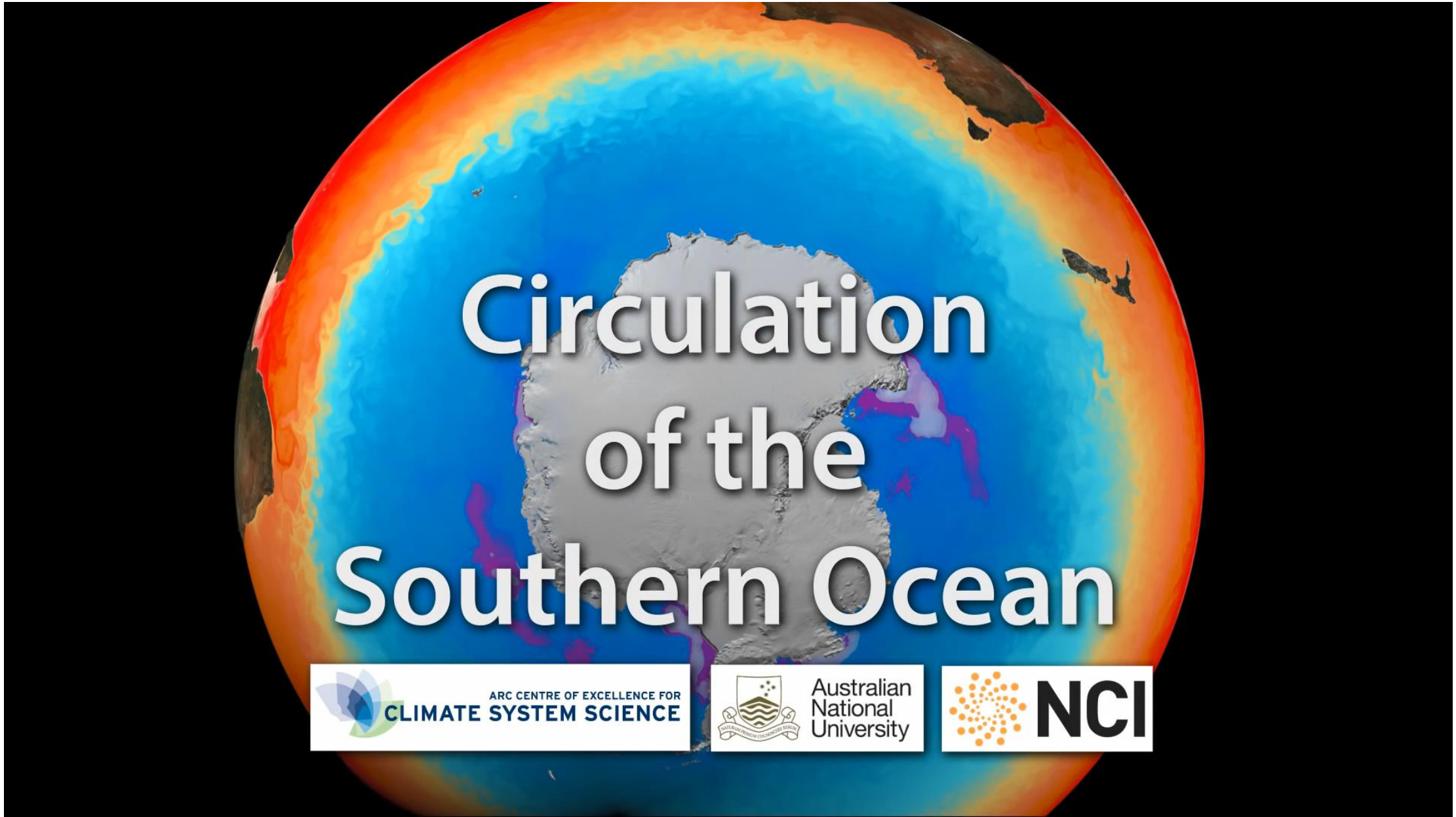
Pathways of AABW

Antarctic bottom water (AABW)

- Occupy the depth range below 4000 m of all ocean basins

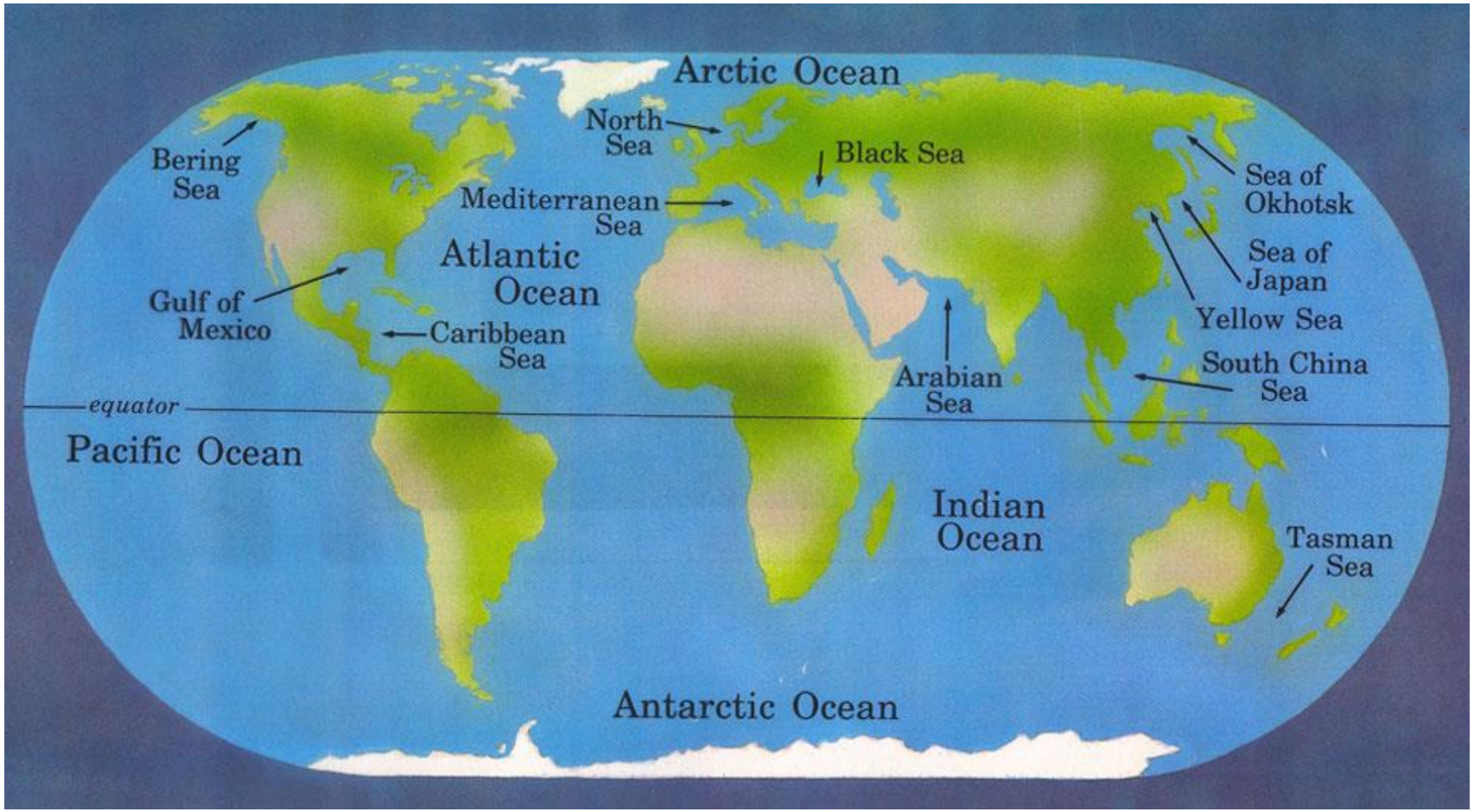
The southern ocean

Circulation of the southern ocean



The Earth's Oceans

5 Main Oceans + "Seven" Seas



Your feedback

	反馈
1	I fully understand
2	I can't understand at all
3	speak too fast
4	speak too slow
5	I can understand half
6	the content is too easy
7	the content is too difficult
8	Everything is OK

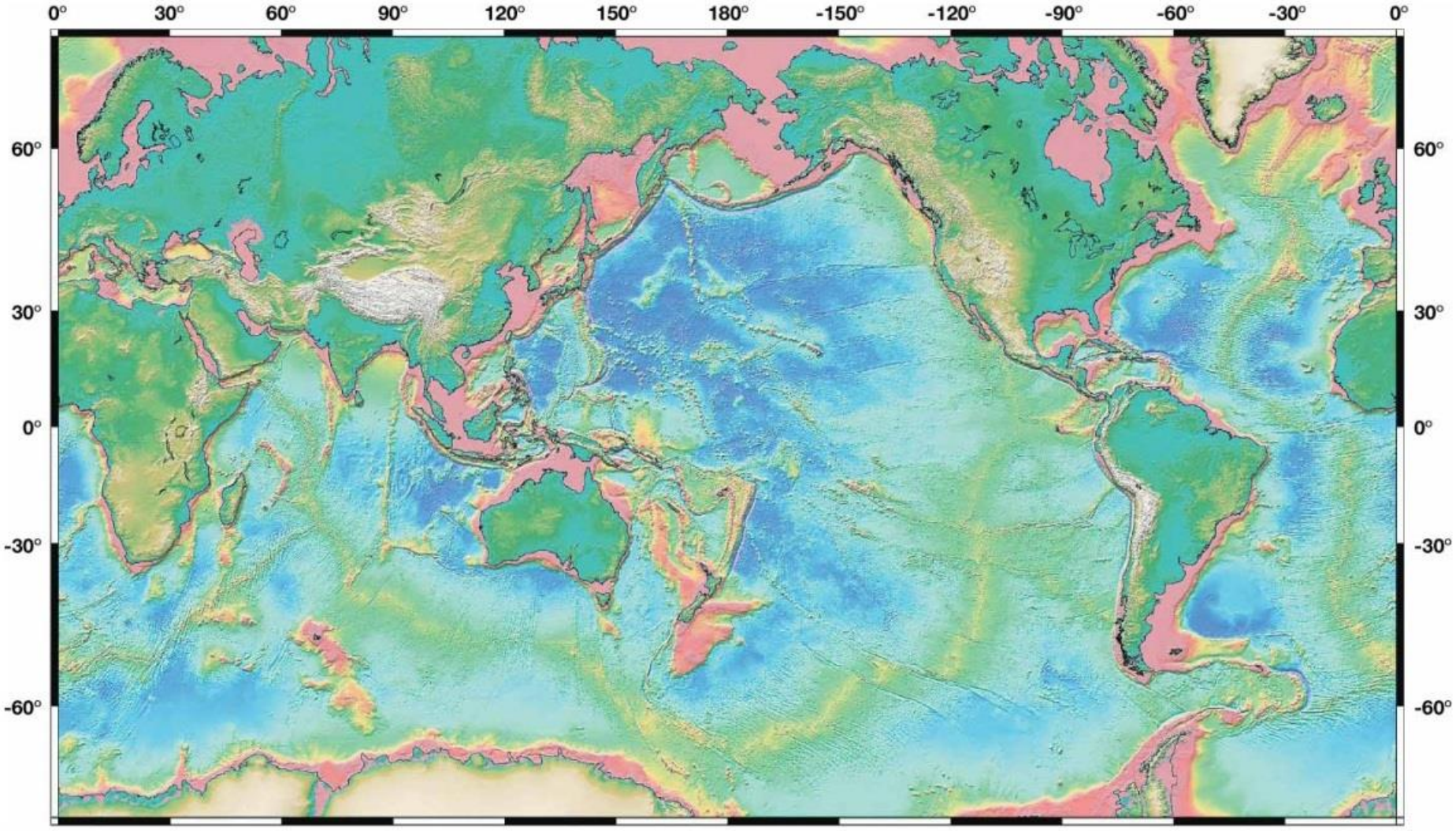
Results of pre-test

状态	成绩
已答	94
已答	68
已答	76
已答	54
未答	
已答	32
已答	50
未答	
未答	
未答	
已答	70
已答	90
已答	66
已答	40

	反馈	点赞数
1	I fully understand	7
2	Everything is OK	6
3	I can understand half	4
4	speak too fast	3
5	I suggest a simple and clear illustration and examples especially for those of us from the biological background. I look forward to enjoying the course. Thanks, Prof.	2
6	Lecture was very well delivered!	2
7	the content is too easy	1
8	the content is too difficult	1
9	Well delivered and clearly understood the lecture	1
10	I can't understand at all	0
11	speak too slow	0
12	专业背景有所了解，有些内容没怎么了解过听起来有点困难，听力感觉还可以	0
13	Professor i suggest you to take test after class instead of taking it during class and give atleast one day time so that everyone can finish it even if they are facing any netwo…	0

Features on Seafloor

Global Bathymetric Map from Satellite Data

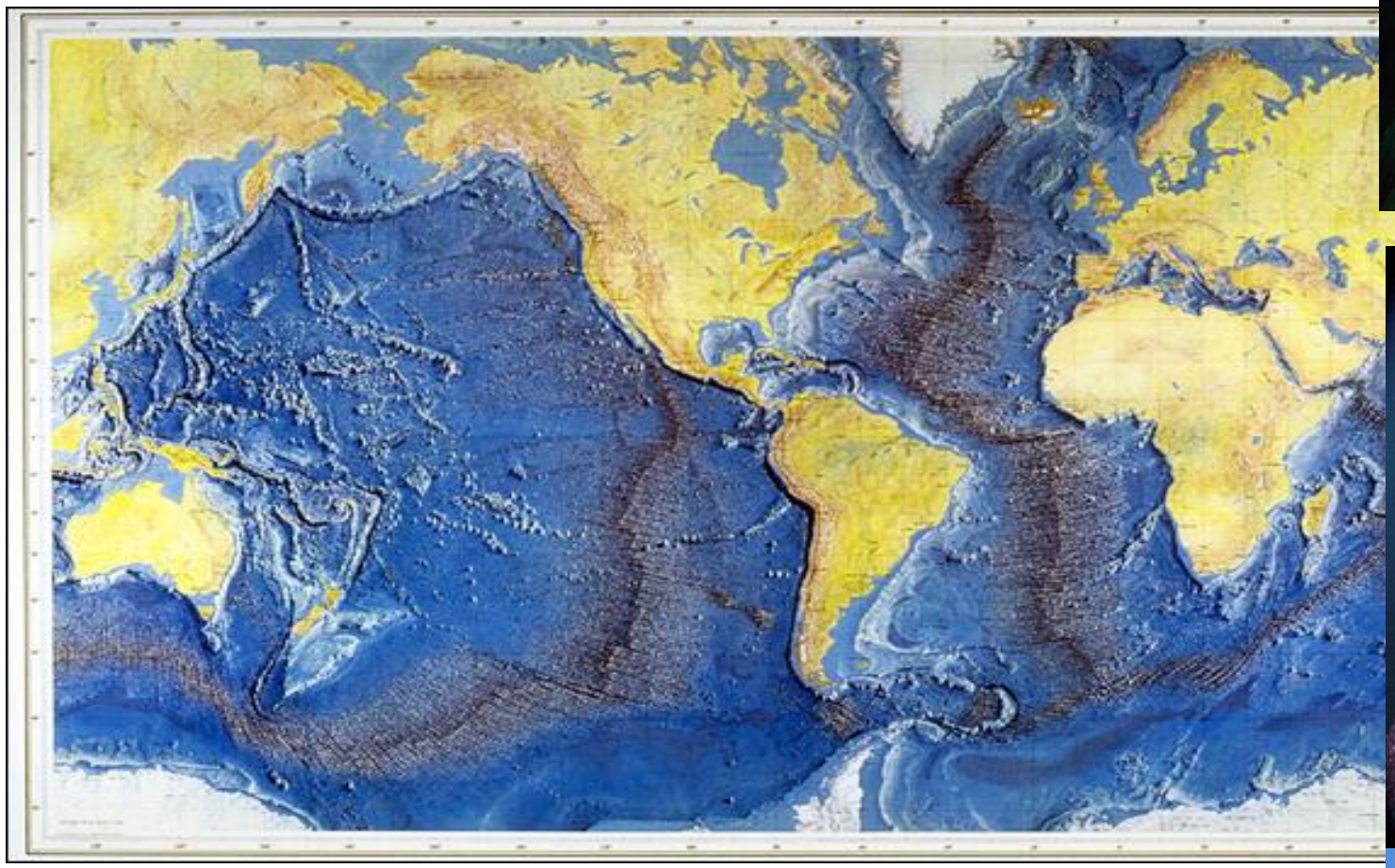


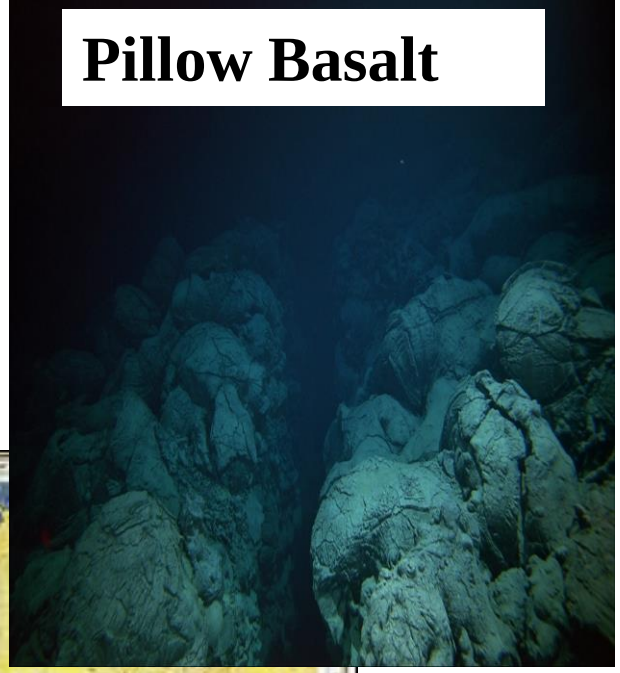
(Ocean- Dark blue: deep water; Light green & yellow: intermediate water depth; Pink: shallow water.)

(Land- Dark green: low elevations; White: high elevations)

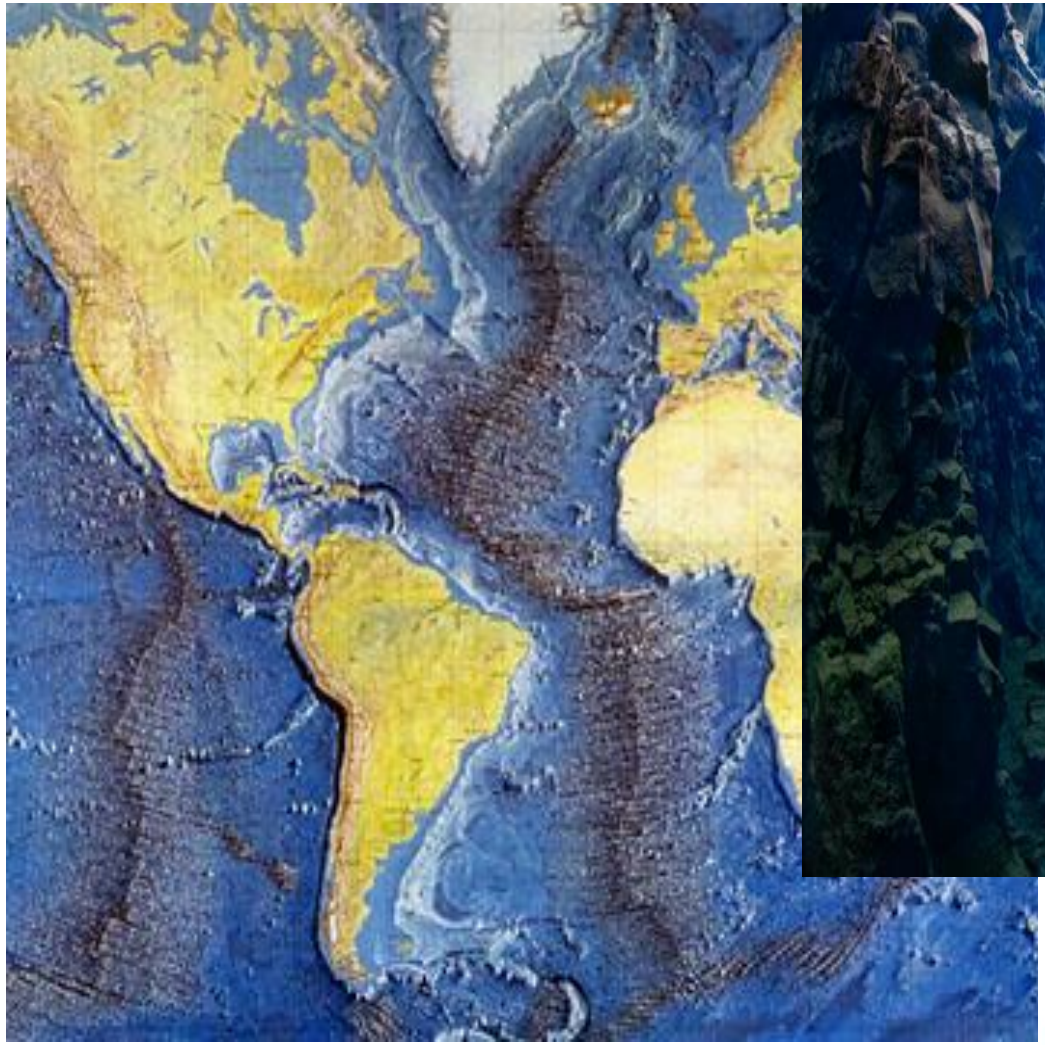
Mid-Ocean Ridges

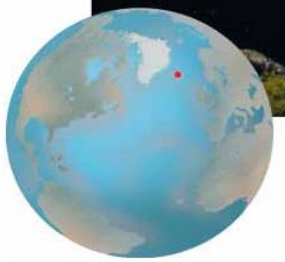
- Chains of undersea volcanoes
- Rises to 2 - 3 km above the ocean floor



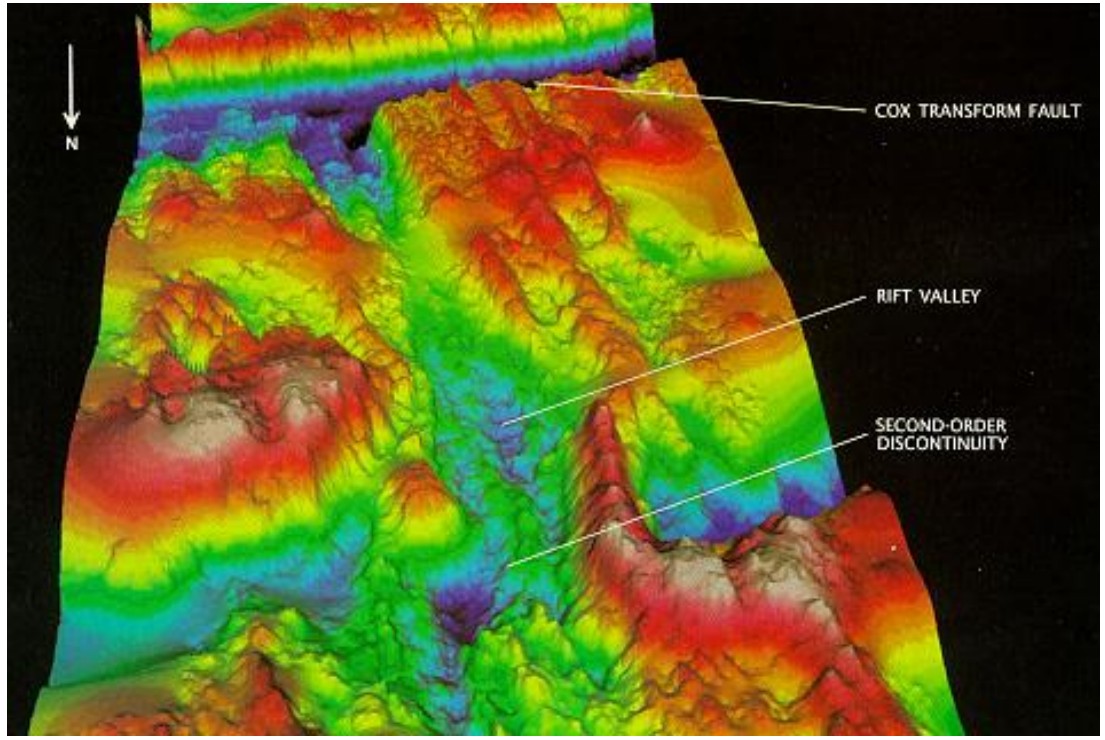


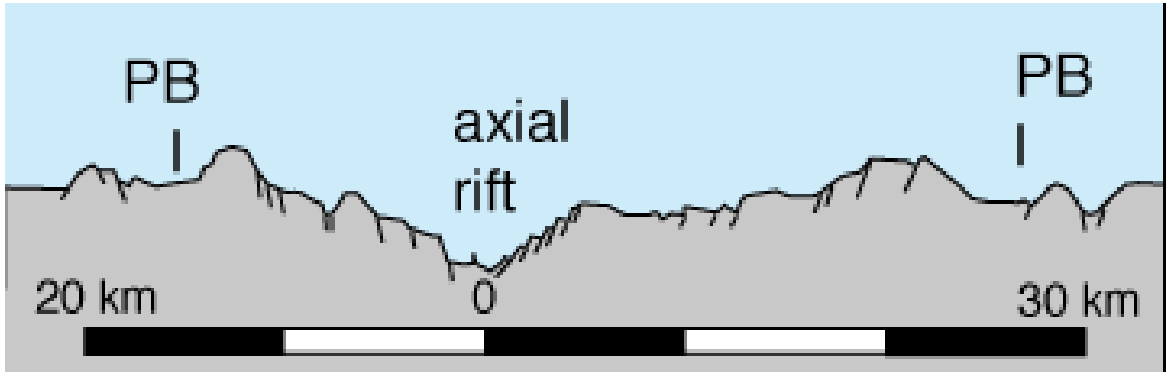
Hydrothermal vents





Iceland is one place where a **“mid-ocean ridge”** can be seen **on land and in shallow waters.**

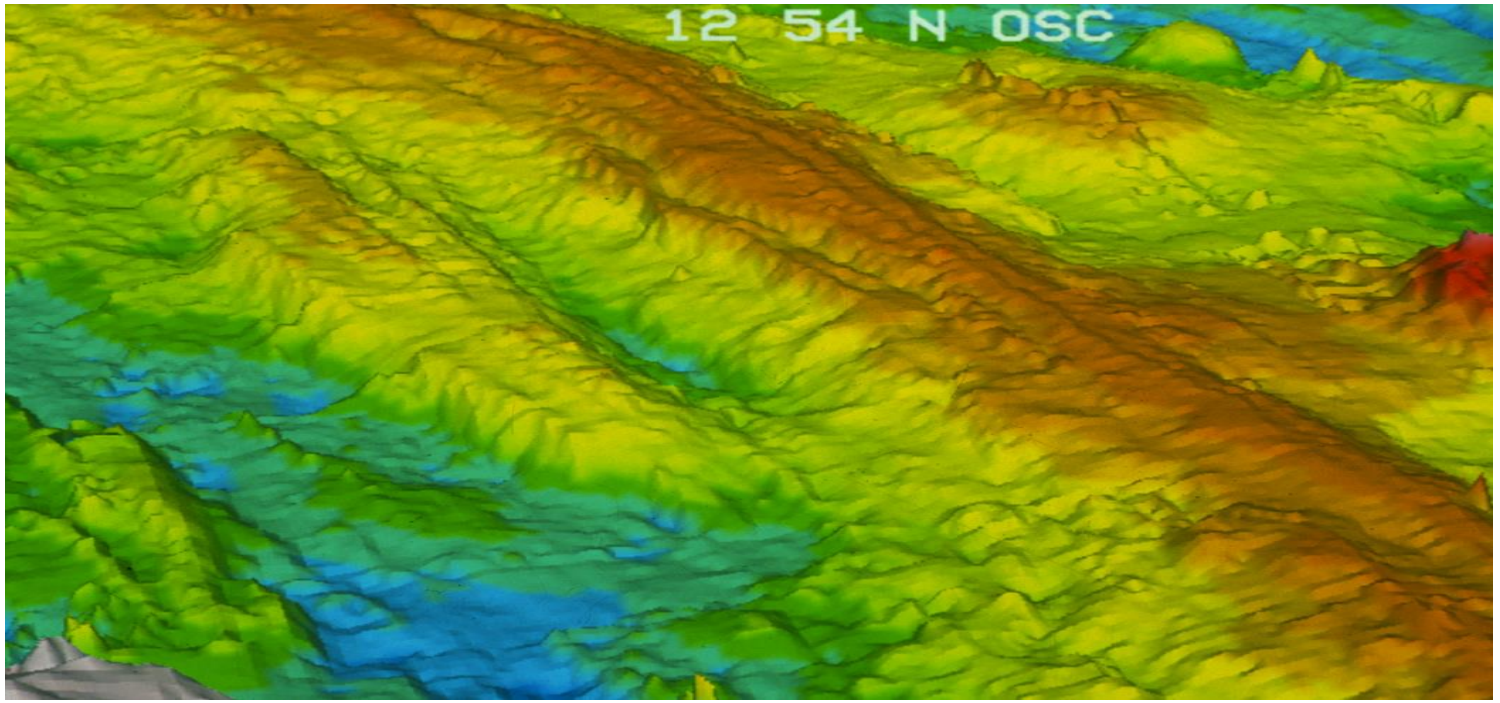




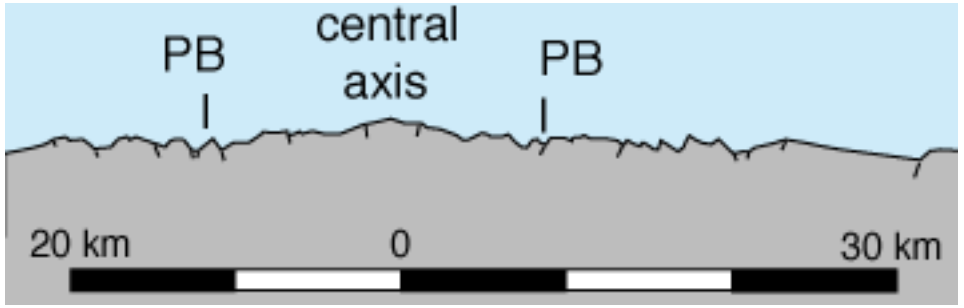
Rift Valley at Mid-Ocean Ridges

- **Mid-Atlantic Ridge**. A **rift valley** over **2 km deep** marks the axis of the ridge. Depths: from **1900** (**pink)** to **4200** meters (**dark blue**)

Mid-Ocean Ridge with Narrow or Absent Axial Rift

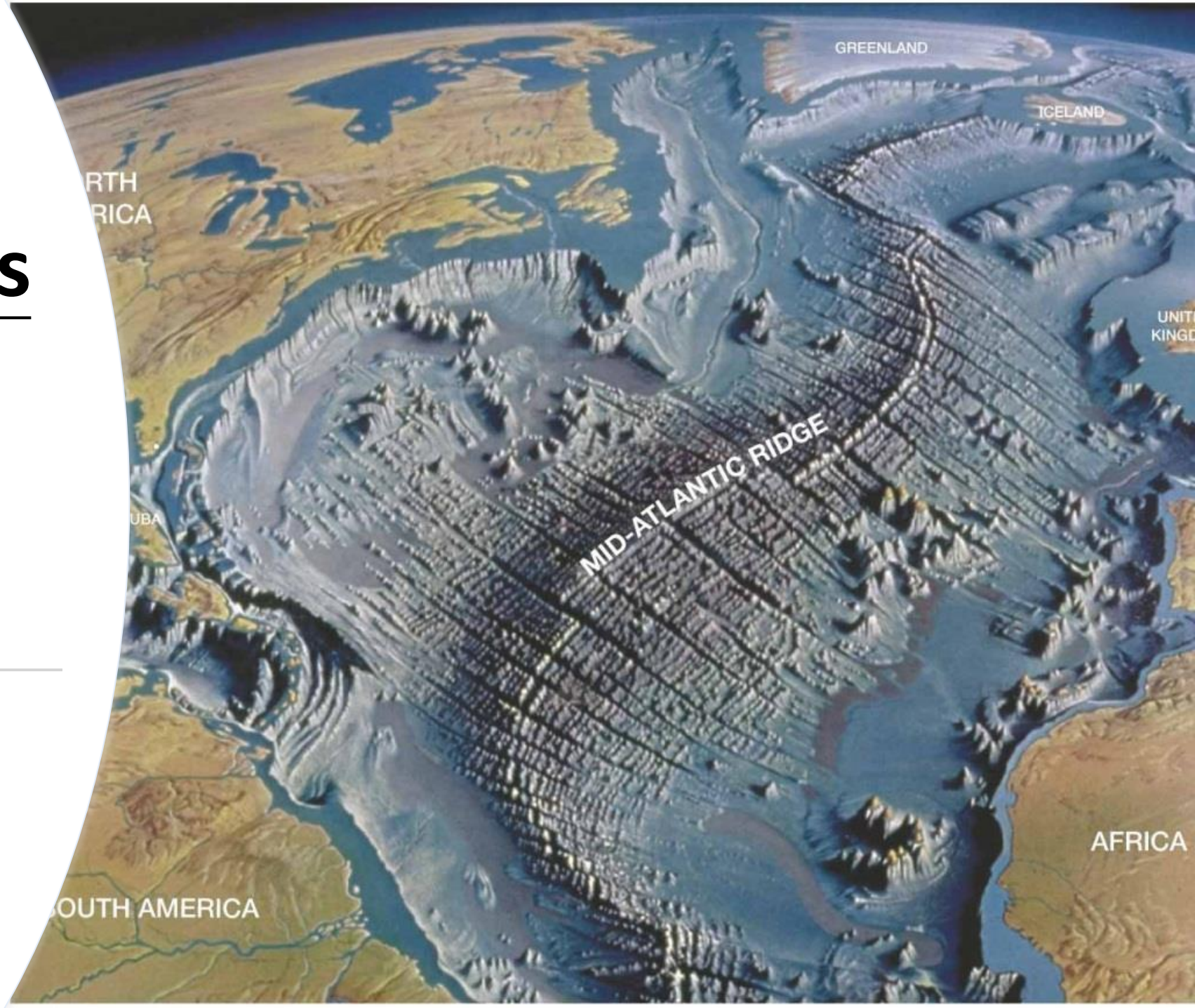


Bathymetric image of the **East Pacific Rise**

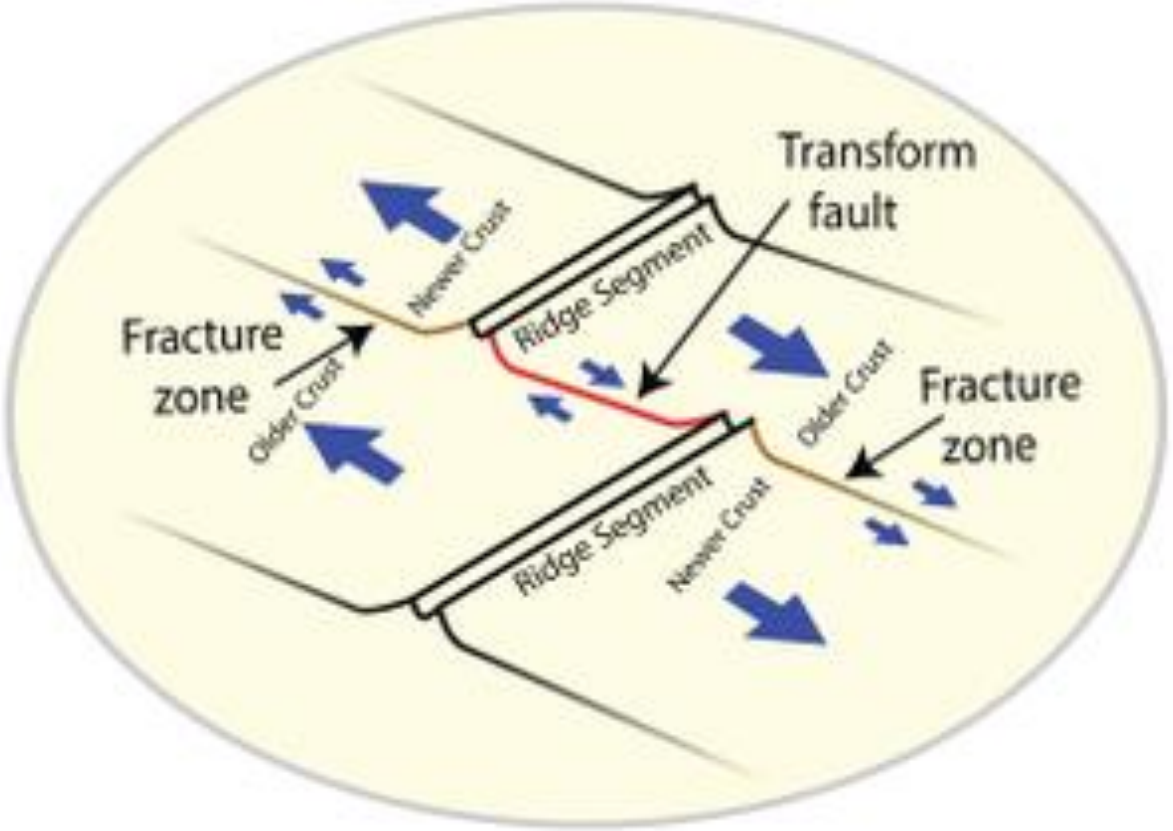


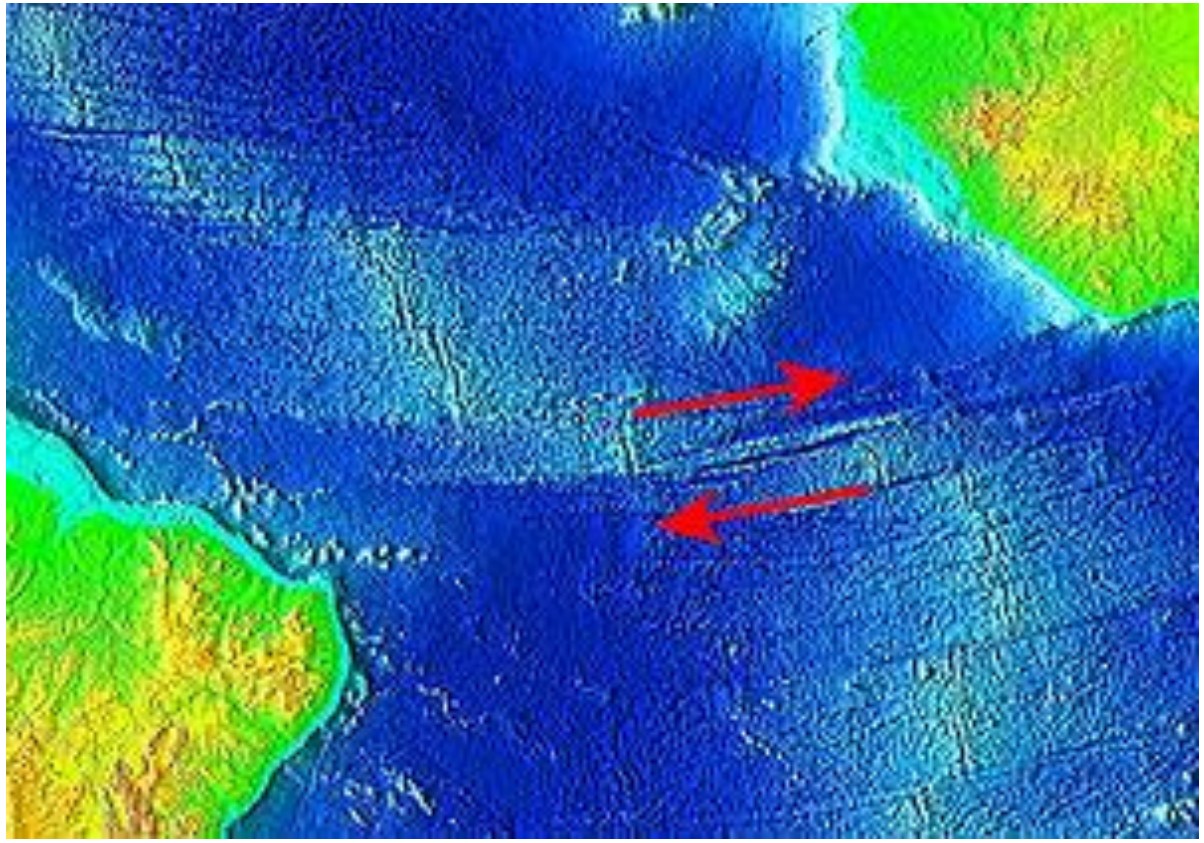
Fracture Zones

Offset mid-ocean ridge

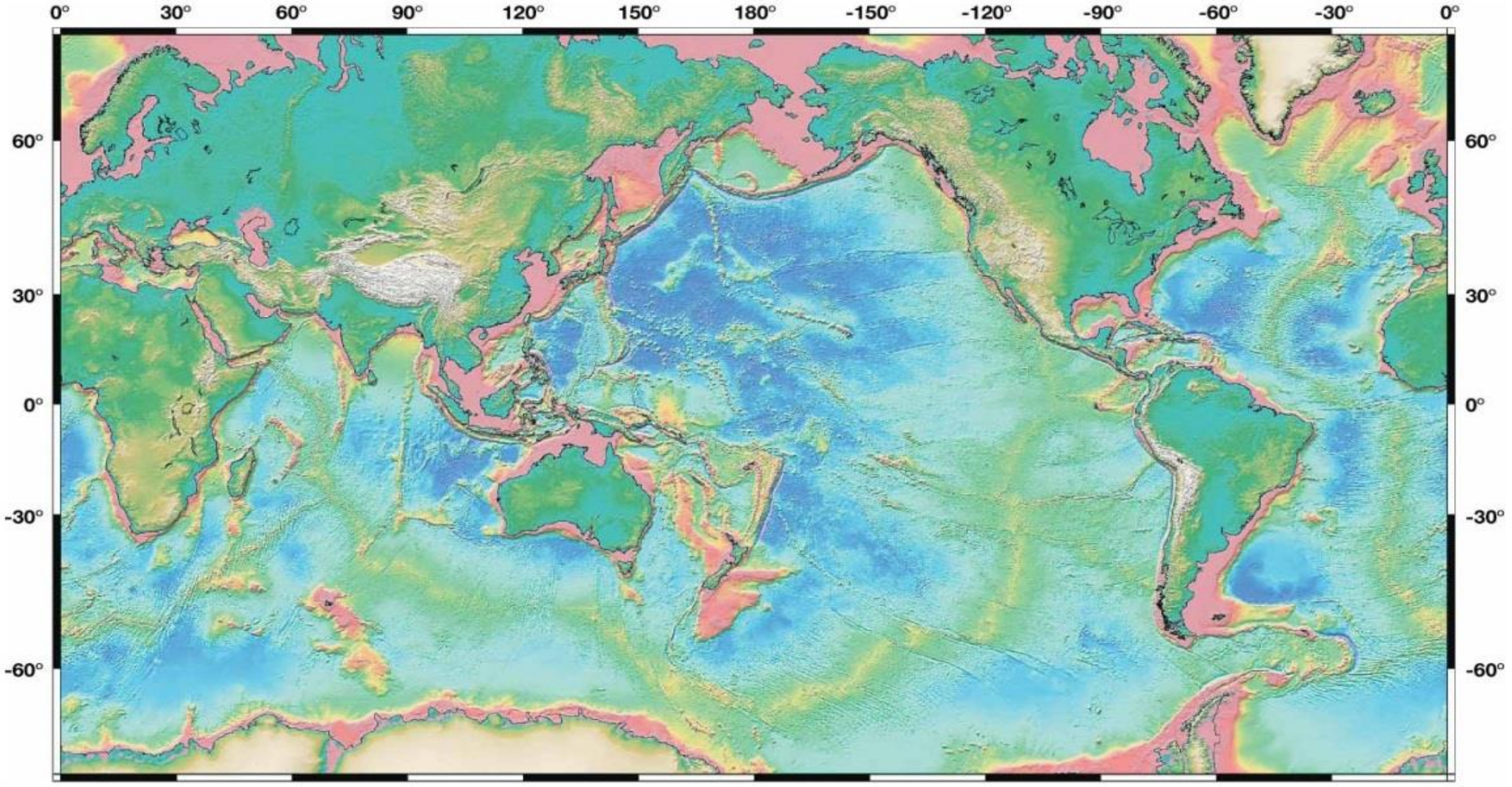


Fracture zones



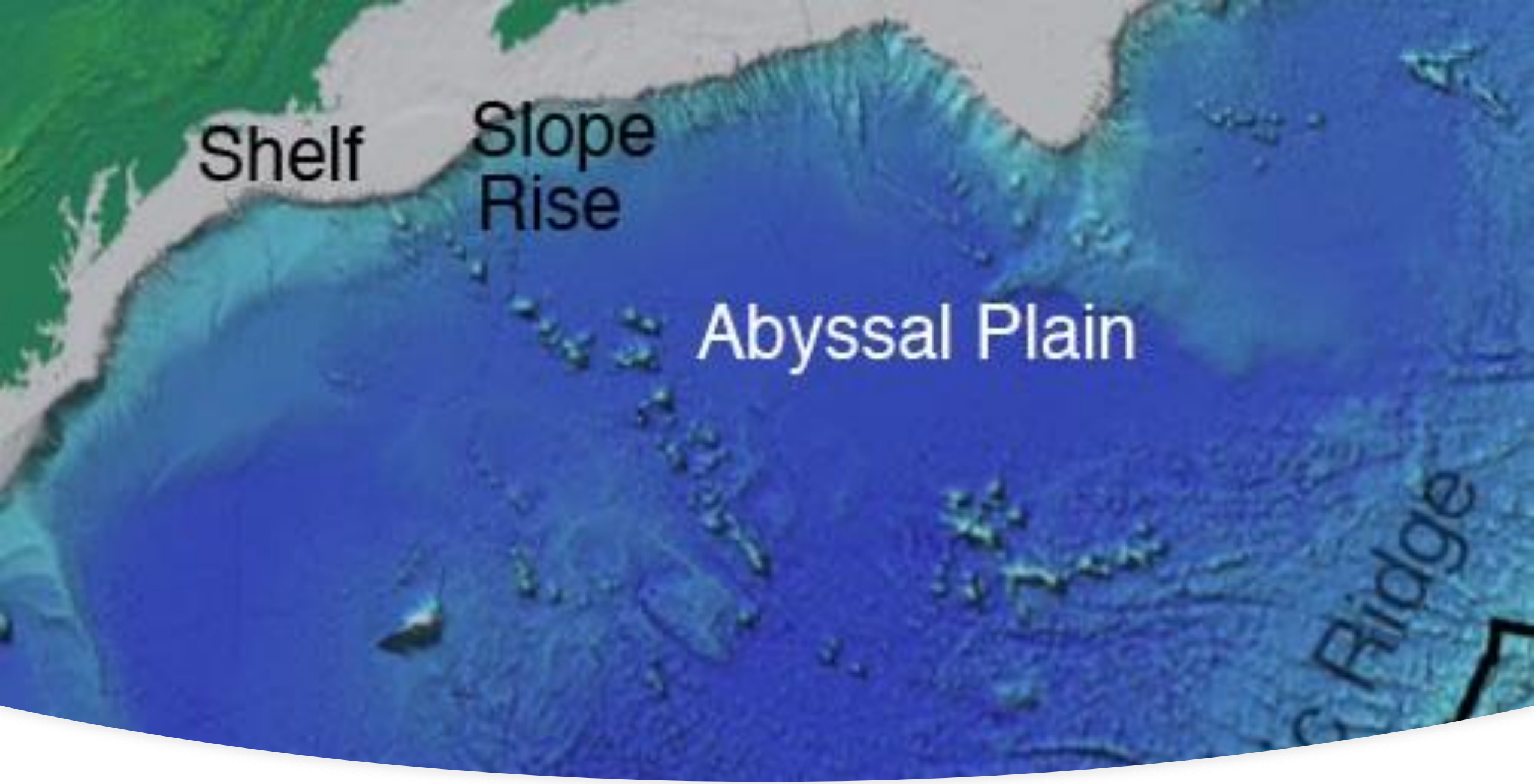


Global Bathymetric Map from Satellite Data

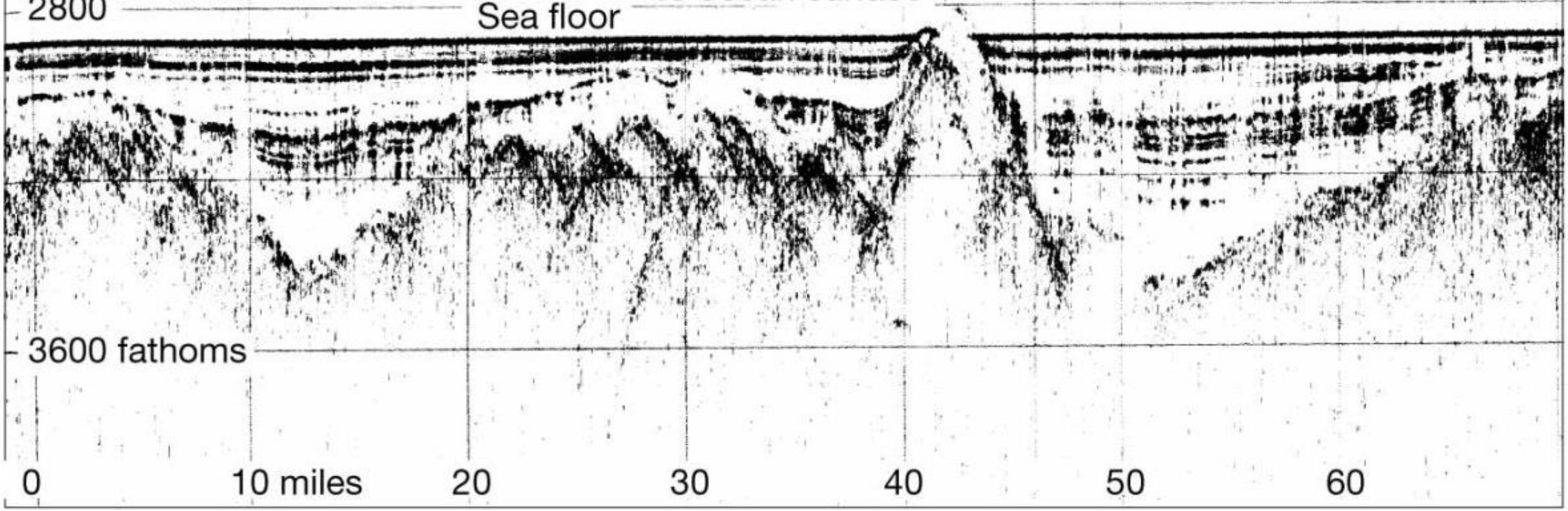


(Ocean- Dark blue: deep water; Light green & yellow: intermediate water depth; Pink: shallow water.)

(Land- Dark green: low elevations; White: high elevations)


Shelf
Slope
Rise
Abyssal Plain
Ridge


Continental margin
Ocean basin floor
Mid-ocean ridge
Ocean basin floor
Continental margin
A
B
NORTH AMERICA
EUROPE
AFRICA
SOUTH
See cross-section above
RIDGE
Abyssal plain



Abyssal Plains

Submarine Canyons- V-shaped valleys that run across continental shelves & slopes

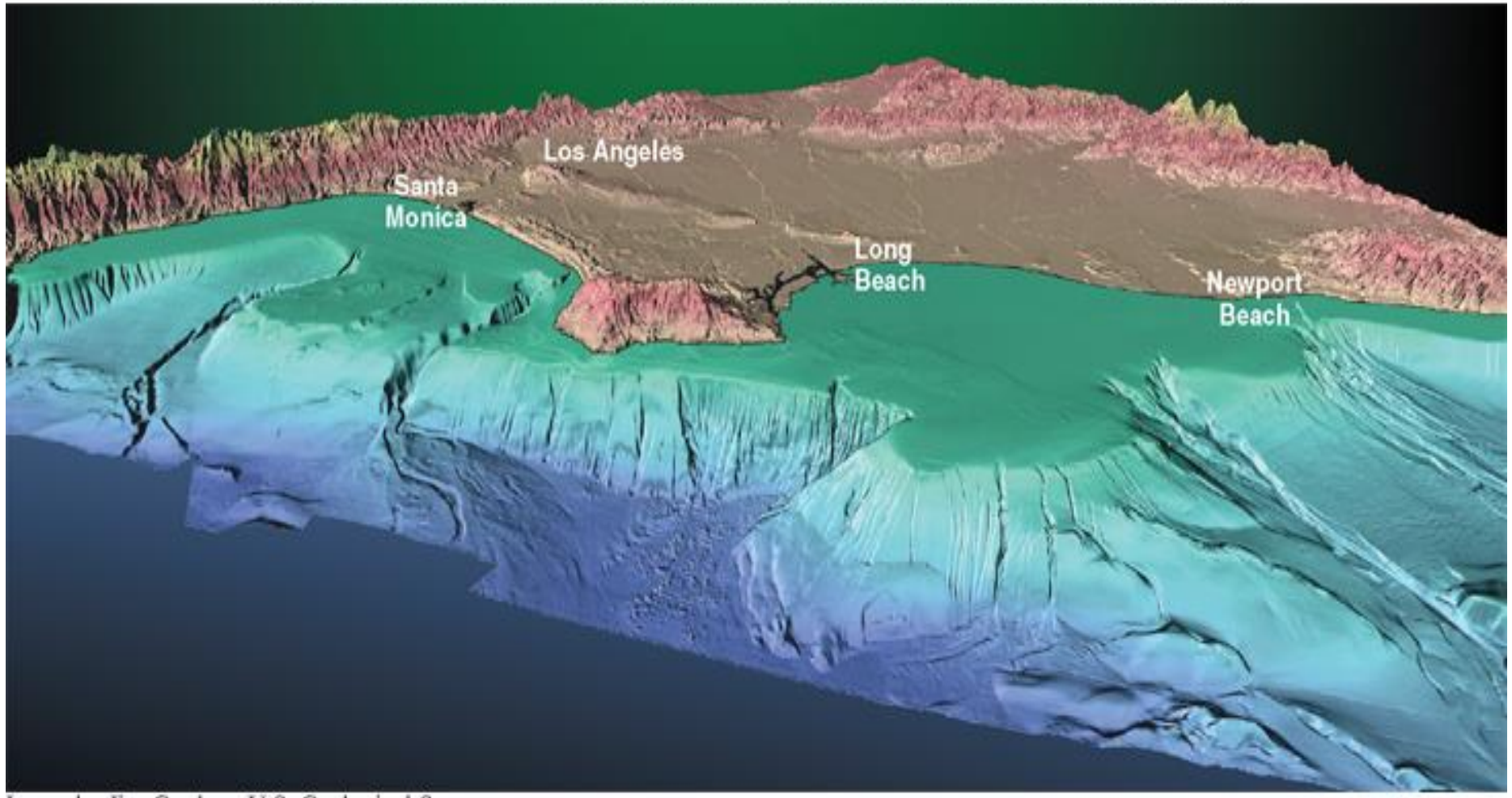
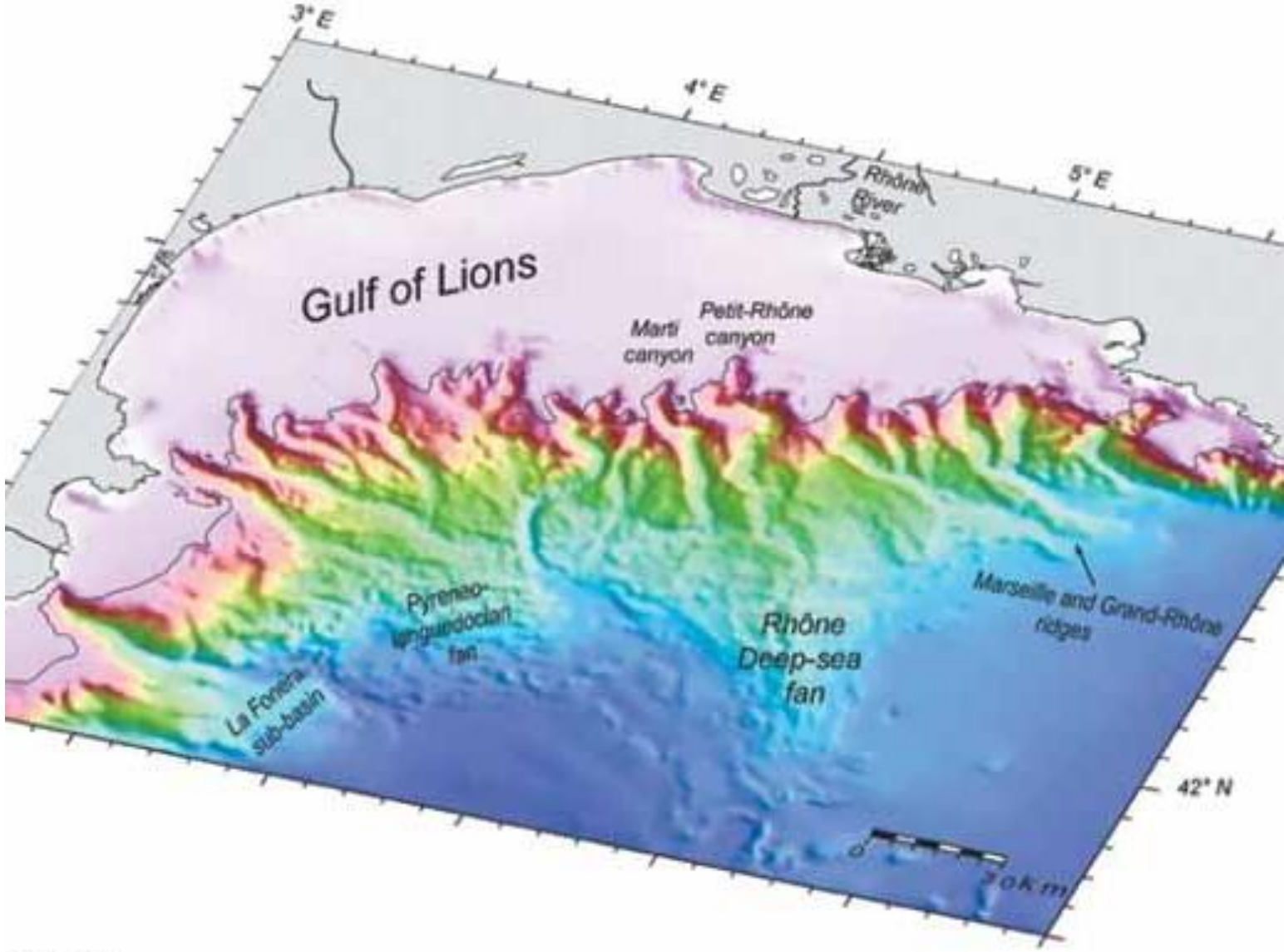


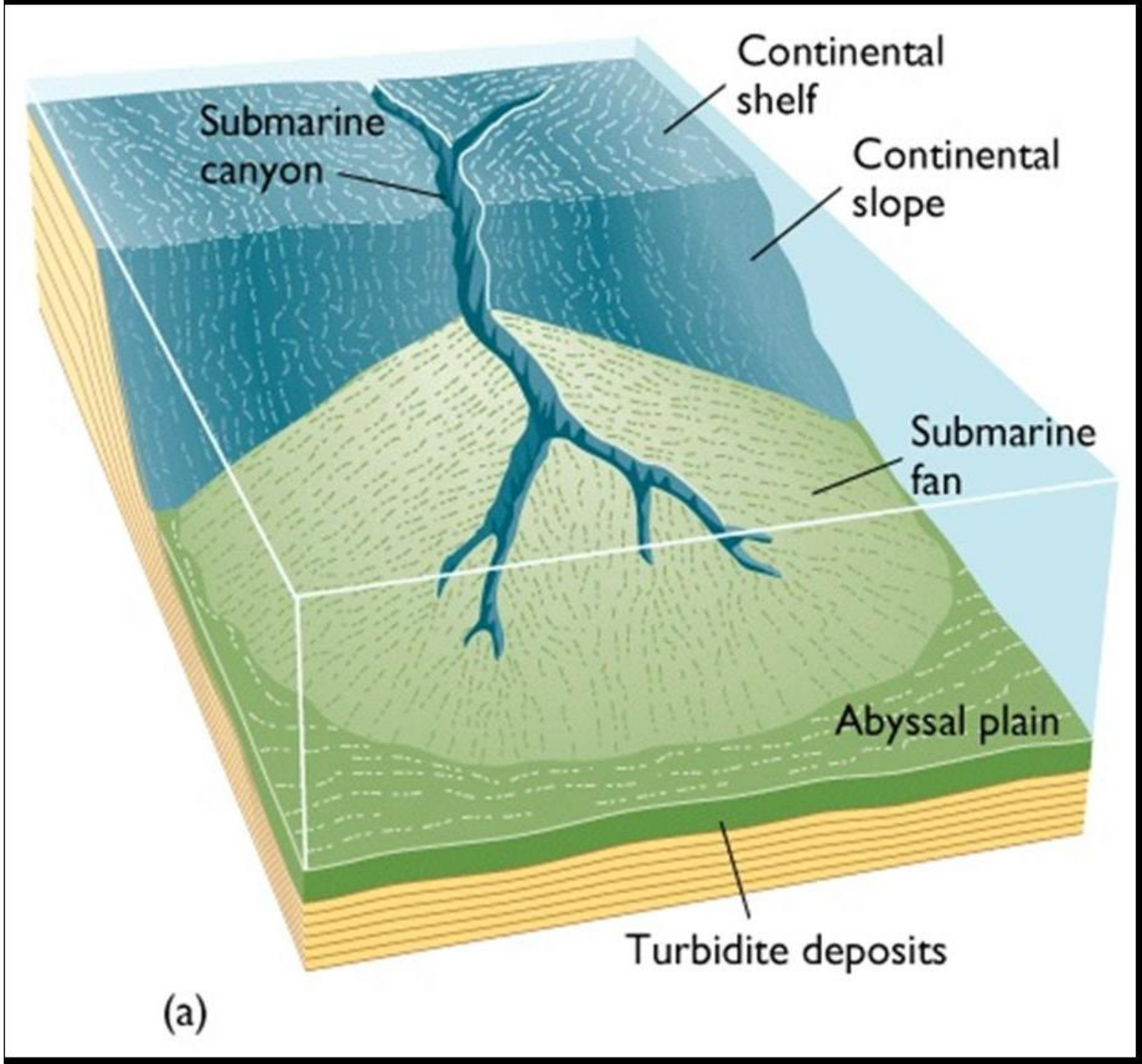
Image by Jim Gardner, U.S. Geological Survey

Abyssal (or submarine) fans

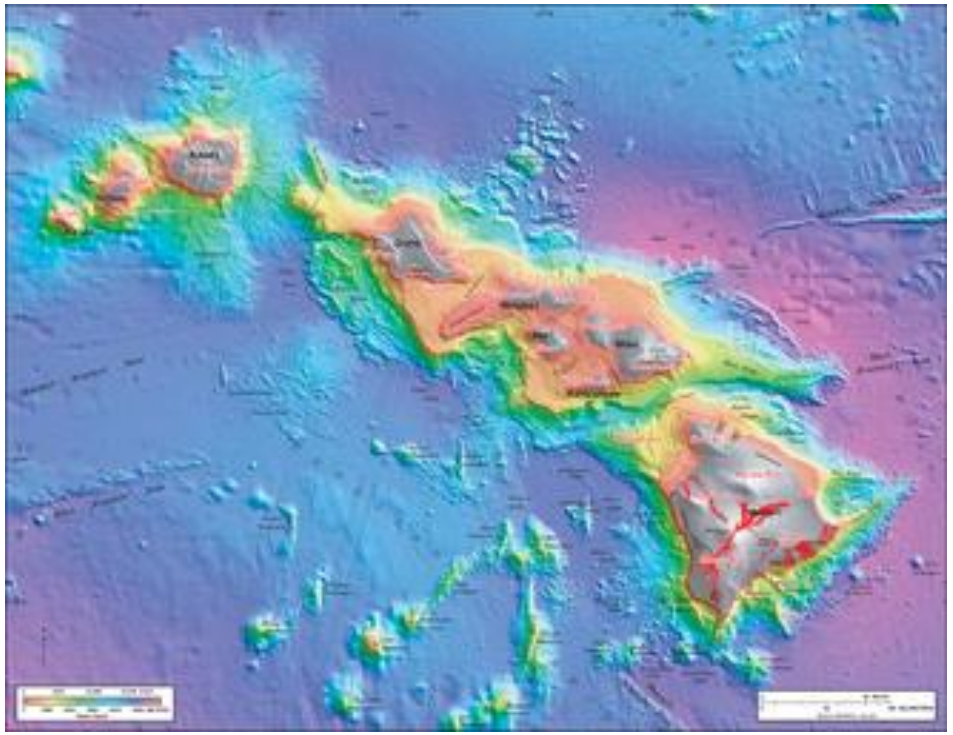


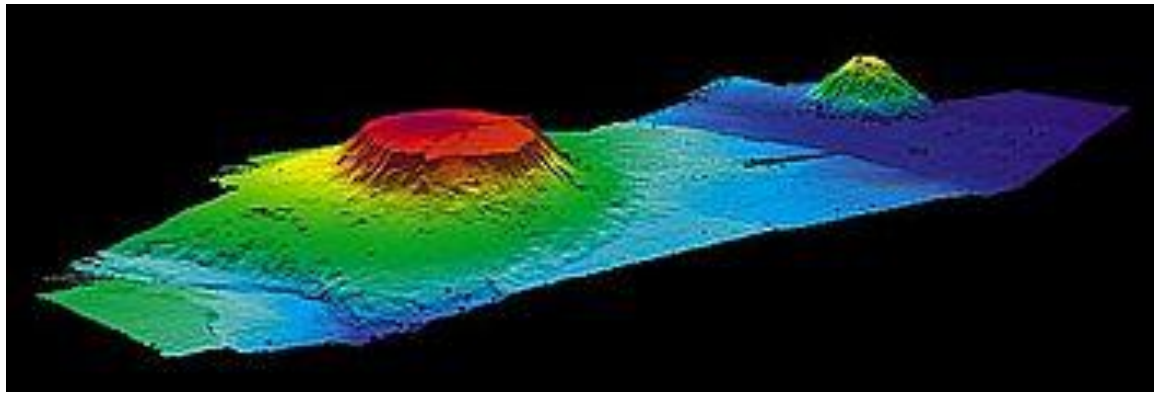
hymetric map illustrating the dense network of submarine canyons and the main Plio-Quaternary deep-water depositional
'REMER swath bathymetric data, France).

Abyssal (or submarine) fans (deposit at the base of continental slope)

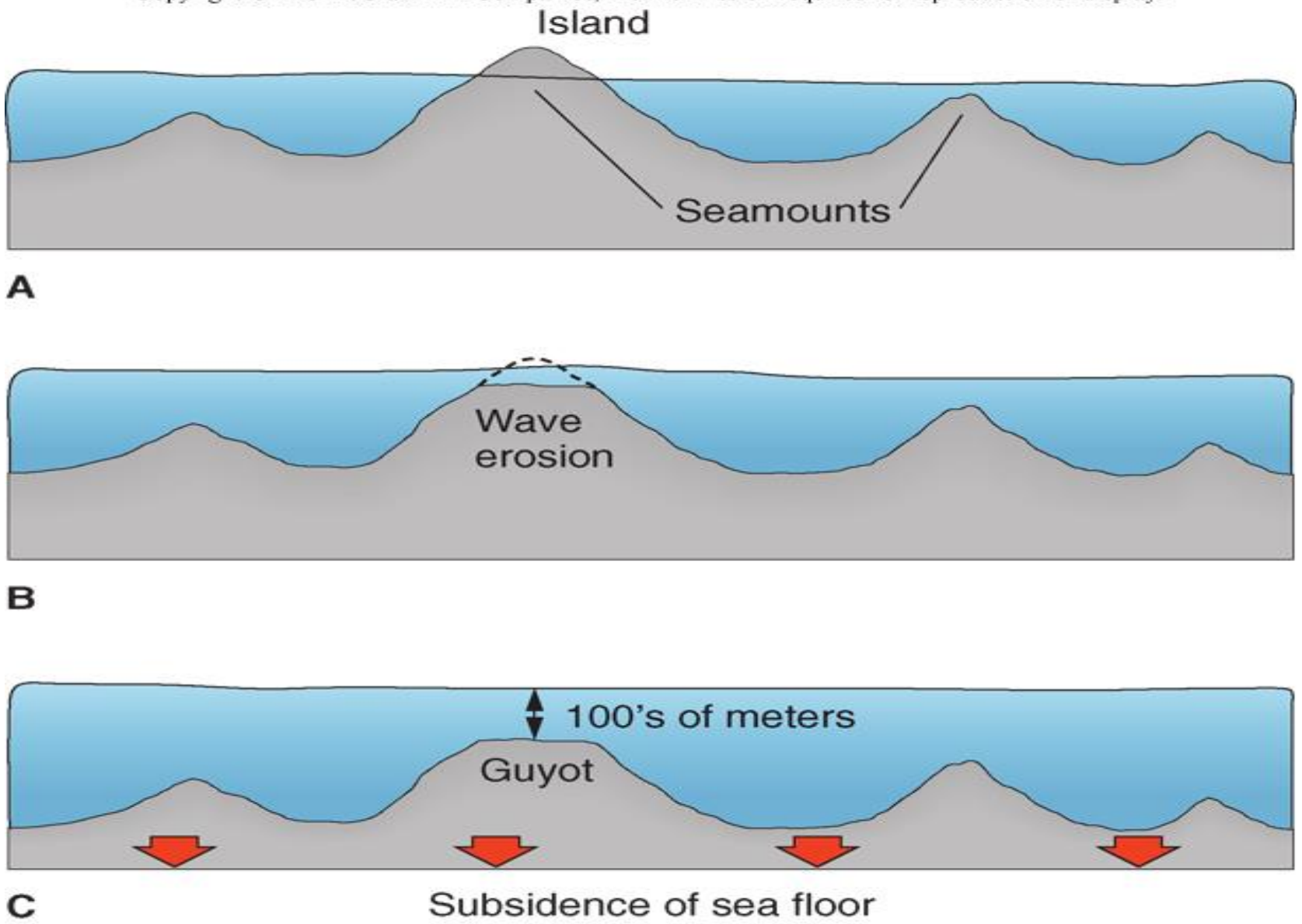


Islands/seamounts/guyots



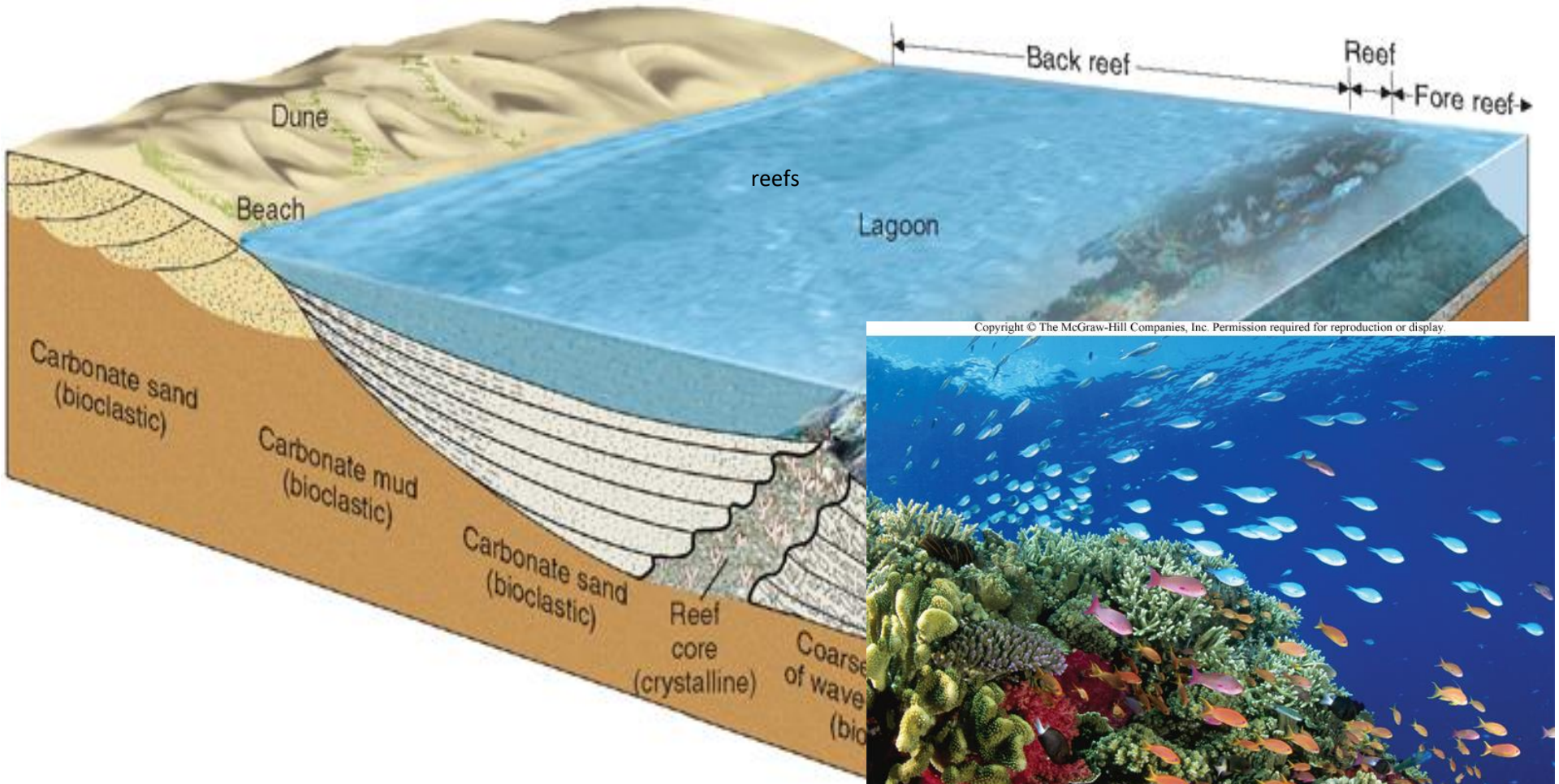


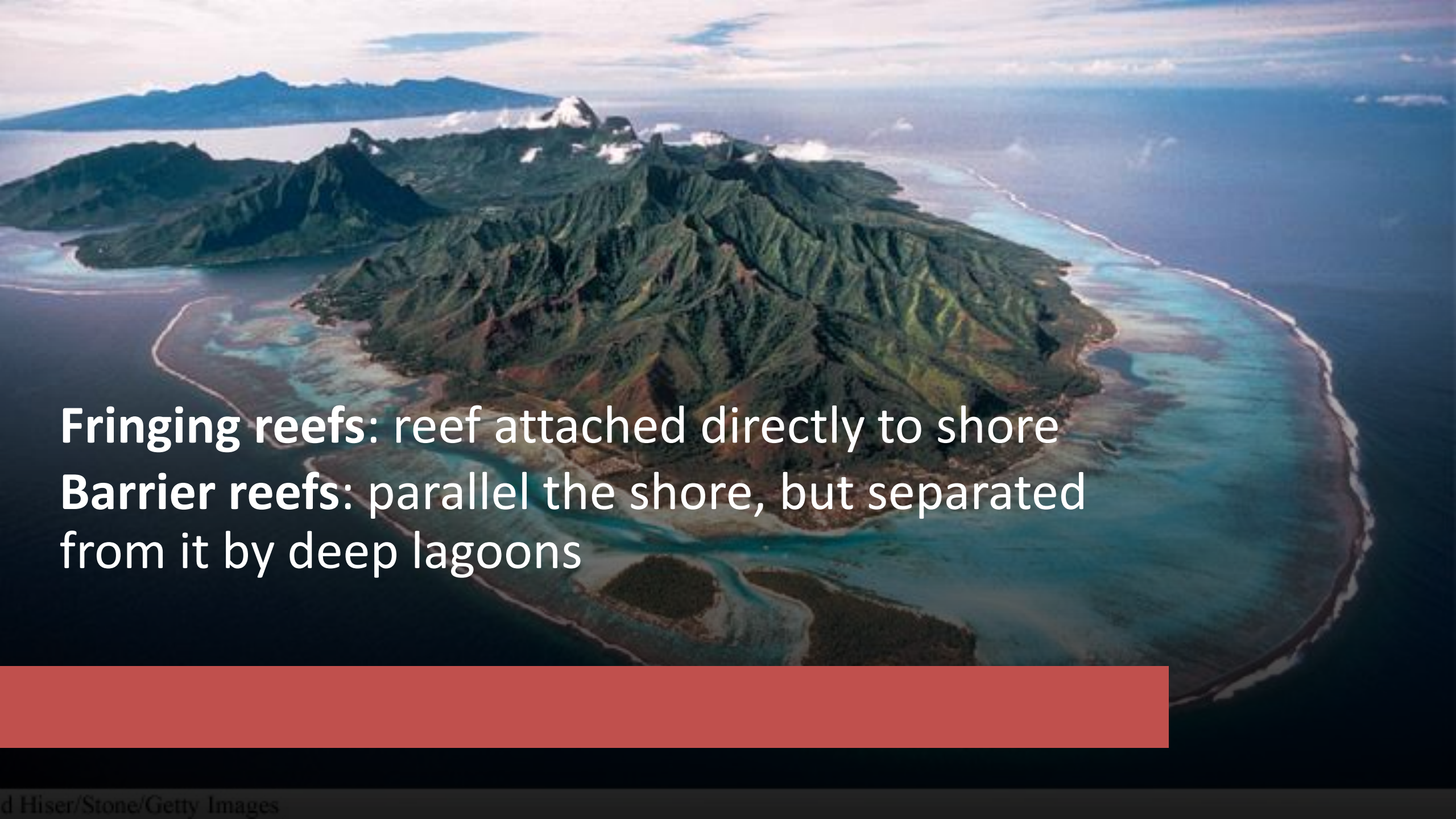
Islands/seamounts/guyots



Features on Seafloor

Coral Reefs: form in warm, shallow, sunlit water



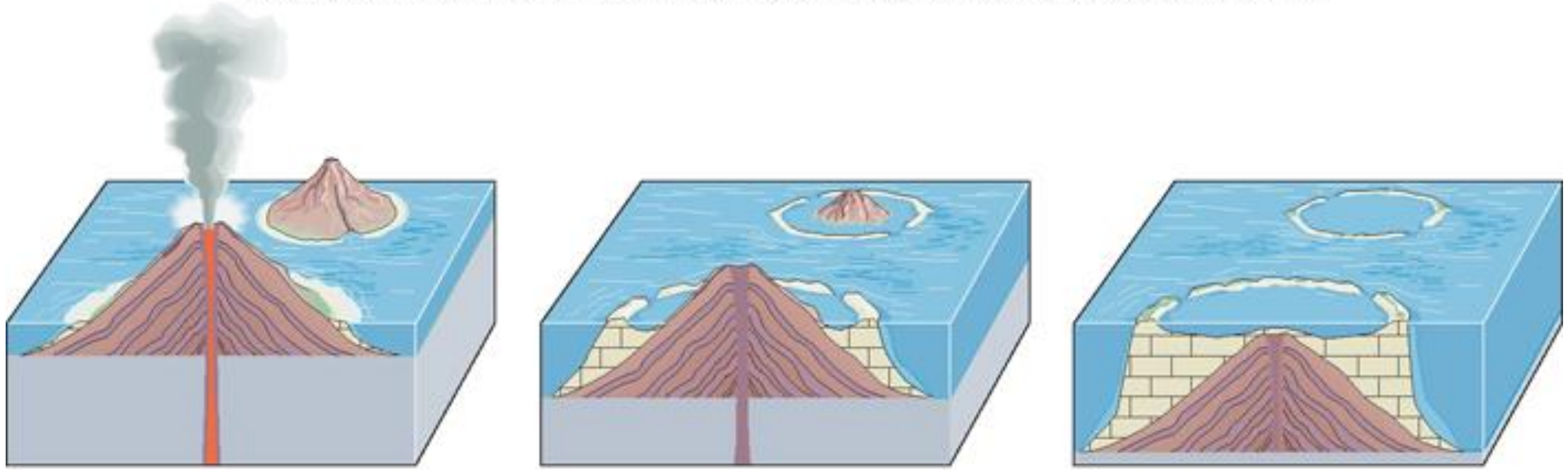


Fringing reefs: reef attached directly to shore
Barrier reefs: parallel the shore, but separated from it by deep lagoons

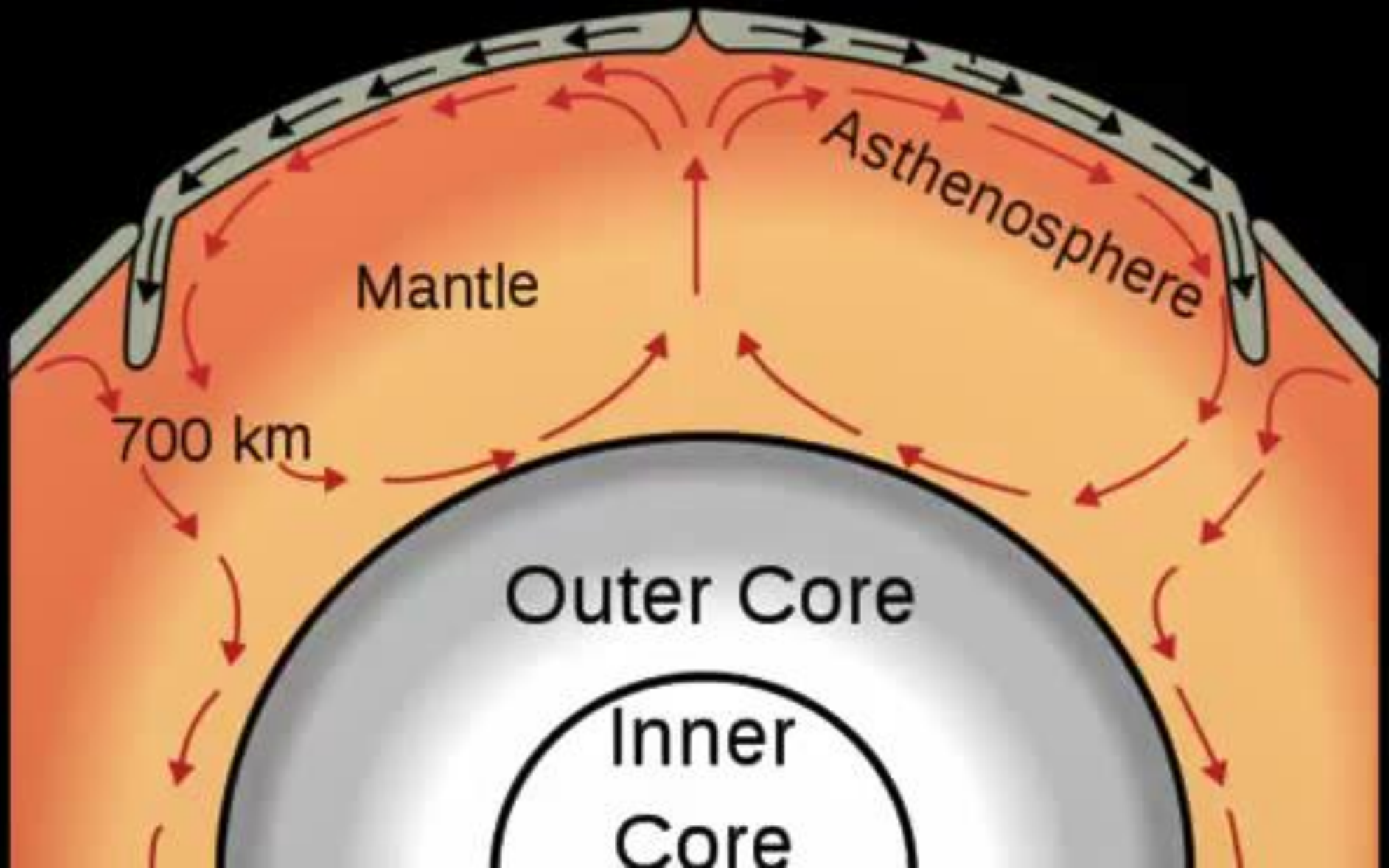
d Hiser/Stone/Getty Images

Atolls: circular reefs that rim lagoons, surround by deep water

Atolls of the Maldives



Fringing, barrier, & atoll reefs

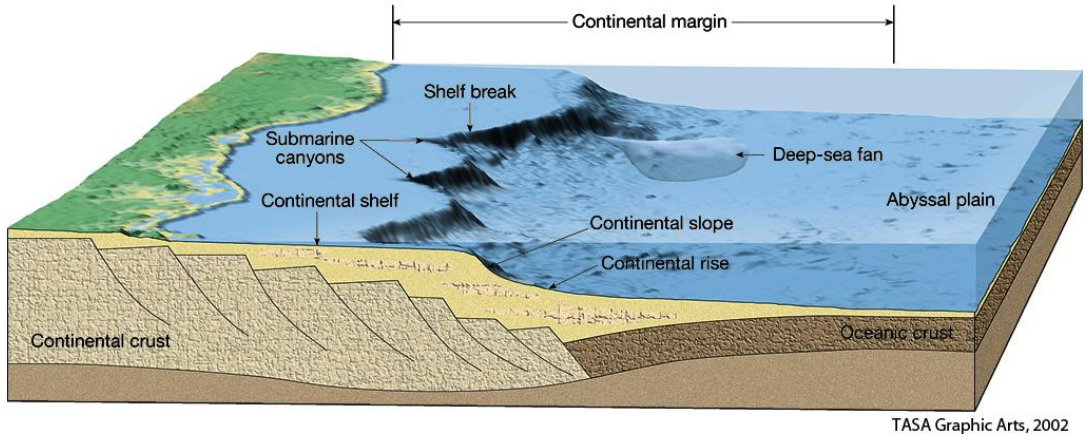

Asthenosphere
Mantle
700 km
Outer Core
Inner
Core


Birth of an Atoll
Living Oceans
Foundation

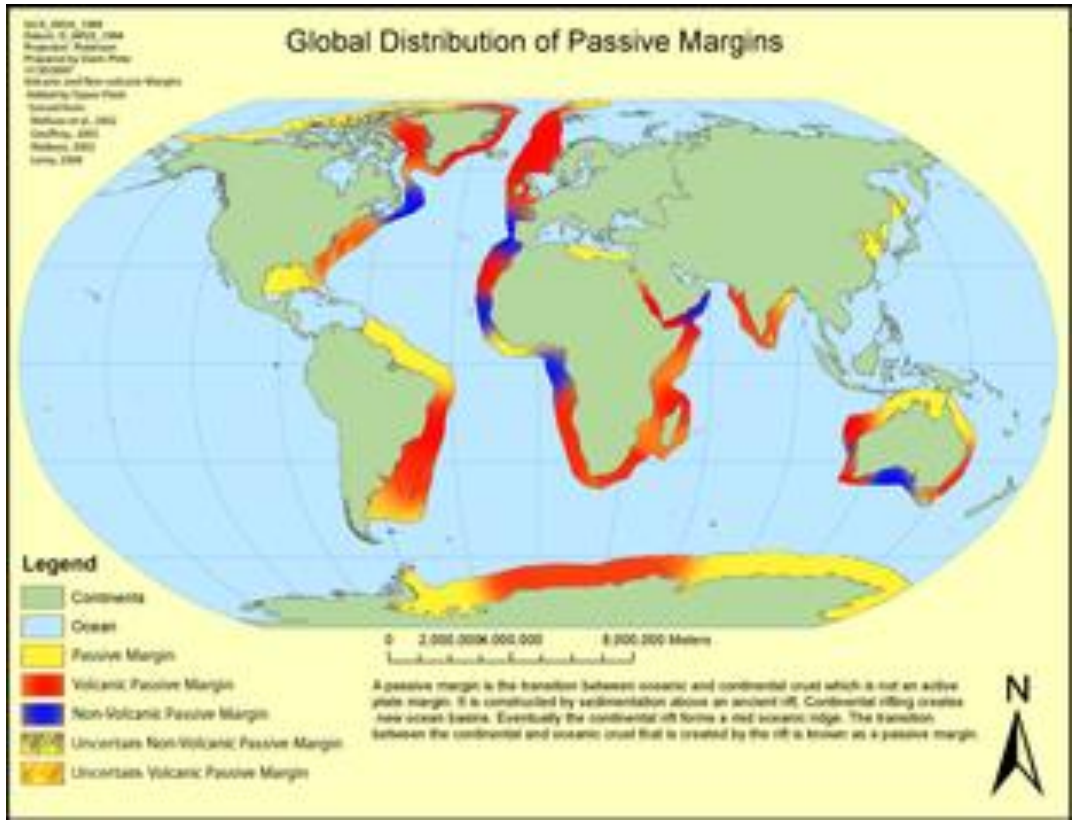
Continental Margins

(I) “Passive” Continental Margins

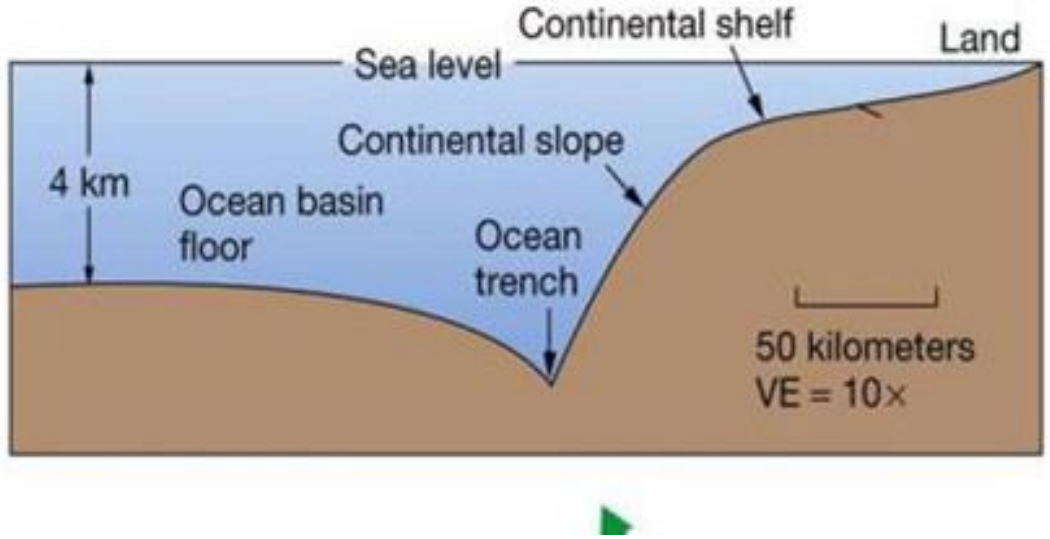
Continental shelf, Continental slope, Continental rise

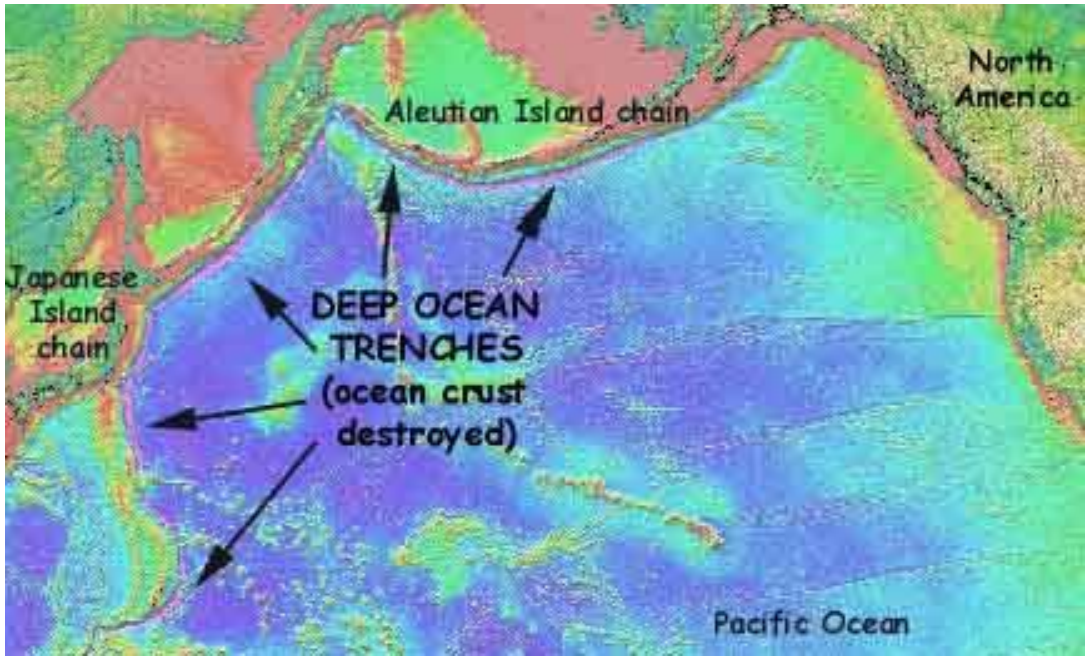


TASA Graphic Arts, 2002



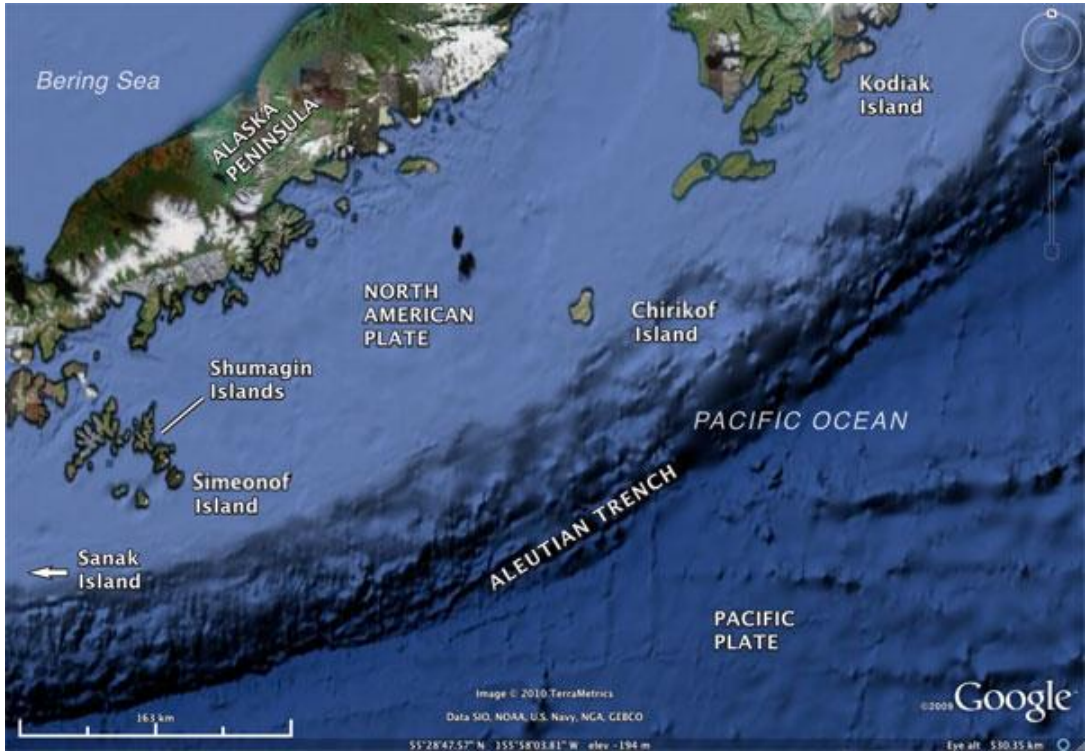
(II) “Active” Continental Margins
Continental shelf, Continental slope, Ocean trench

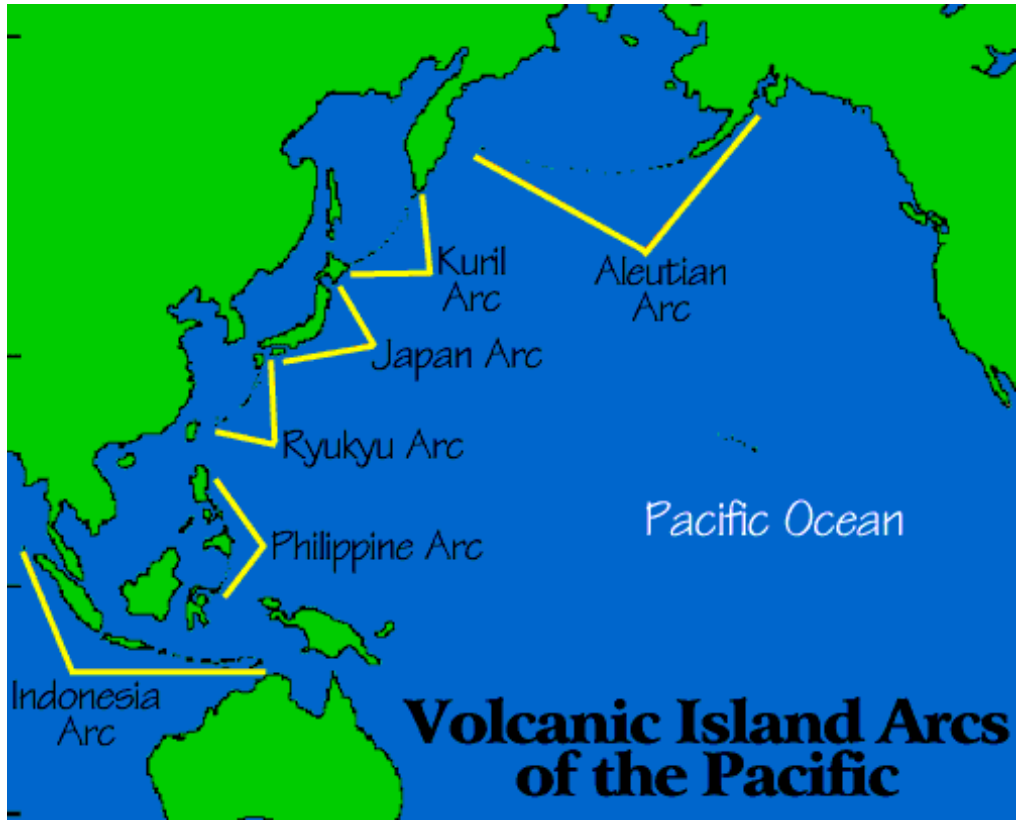




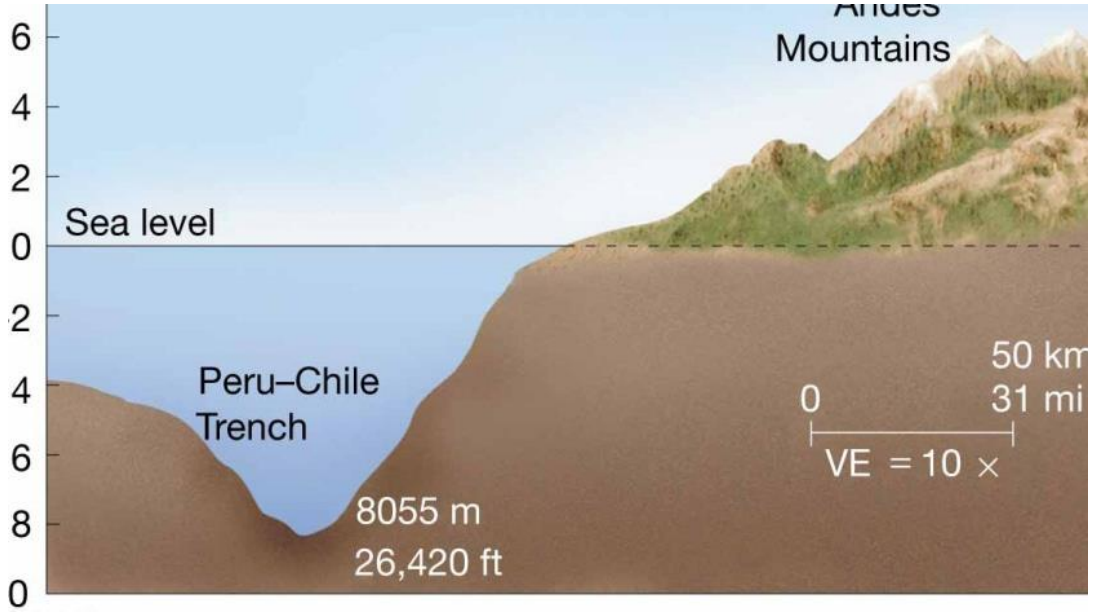

Kurile Trench
Aleutian Trench
North Pacific Ocean
Japan Trench
Ryukyu Trench
Izu Bonin Trench
Puerto Rico Trench
Philippine Trench
Marianas Trench
Middle America Trench
Bougainville Trench
Equator
Tonga Trench
Java (Sundal) Trench
South Pacific Ocean
Peru-Chile Trench
Kermadec Trench

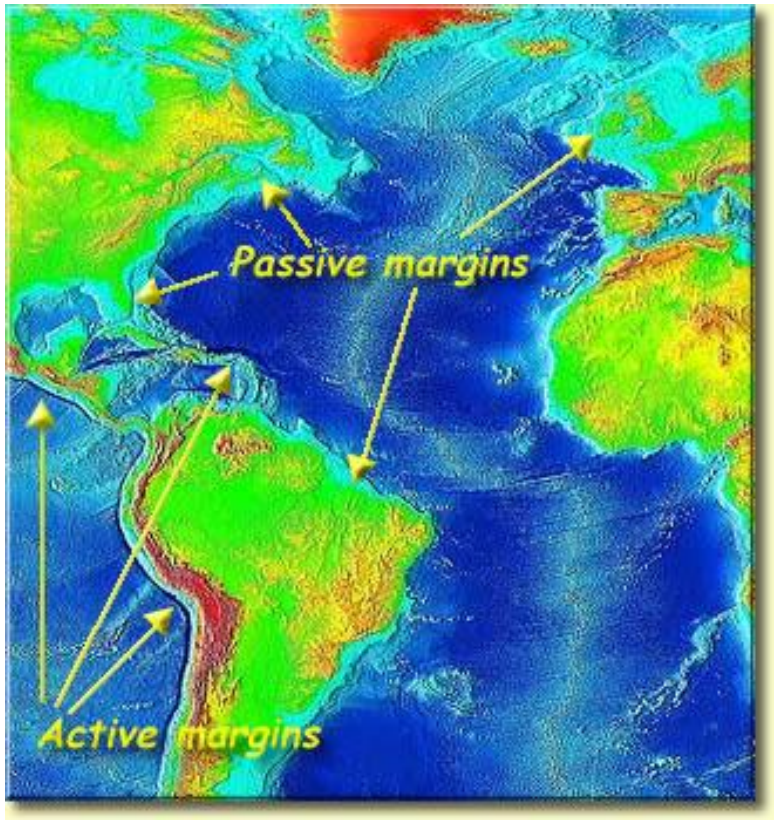
Volcanic island arcs near trenches

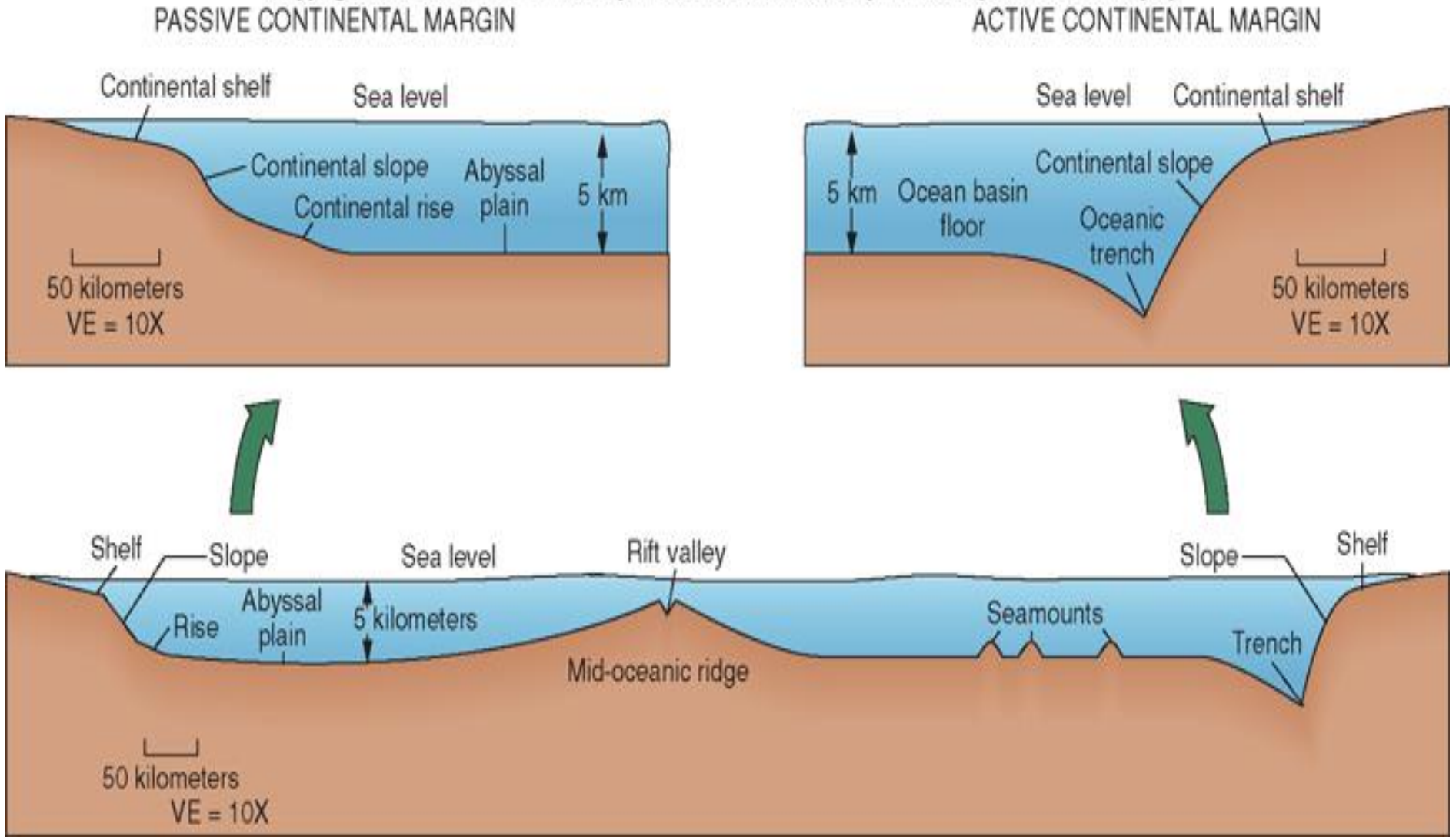




Continental Arcs
(Mountain range on the continent side beyond the trench)







VE: vertical exaggeration

苍海桑田 (cāng hǎi sāng tián) ??

- “The book of geology, all around me are interesting geology records. The book is open, and I read as I run.” John Powell