Unit 7 – Plate Tectonics

Key Terms

- **Plate tectonics**: it explains the structure of the earth's crust as it is broken into individual plates and how they shift and move
- **Continental crust**: less dense/thicker crust that rises above oceanic crust.
- **Oceanic crust**: more dense/thinner crust that sinks below continental crust.
- **Divergent boundary**: where two tectonic plates move away from each other.
- **Convergent boundary**: where two tectonic plates move toward each other
- **Subduction**: The process at a plate boundary in which the denser, oceanic crust sinks down below the less dense continental crust.
- **Ocean trench**: A deep "V" shaped ocean floor feature created where subduction takes place.
- **Transform fault boundary**: where two tectonic plate boundaries move past each other.
- **Pacific Ring of Fire**: the line of tectonic plate boundaries along the perimeter of the Pacific Ocean where a lot of volcanic activity occurs.
- **Island arc**: volcanic islands created in an oceanic to oceanic convergent boundary
- **Hot Spot**: an area in the upper mantle from which heat is rising

Unit 107 Chapter 1 – Plate Tectonics

Tectonic Theory and Plate Boundaries

Plate·Boundaries·Graphic·Organizer¶

¶

Name _____ Date _____ Class _____

PLATE TECTONICS

Plate Boundaries

Four diagrams are shown in the table below. These diagrams represent the various movements at crustal plate boundaries. Complete the table by providing the missing information. The completed table will help you organize the main ideas about plate tectonics.

Table 14–1

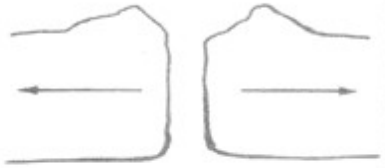
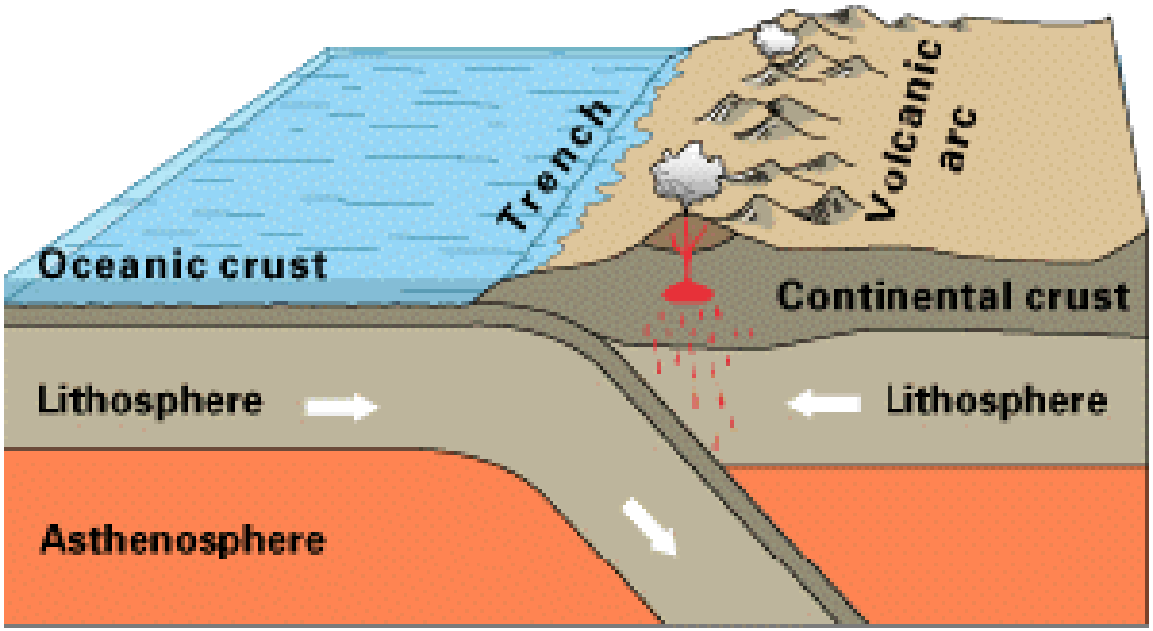
Diagram	Type of boundary and motion at boundary	Feature formed	Example
 Cross Section	Divergent	¶	¶
	¶	¶	Japanese Islands Aleutian Islands Andes Mountains Cascade Range

Plate Tectonics

- **Became a theory in the 1960's**
  - After Wegner (Cont. Drift, 1912) and Hess (Seafloor Spreading, 1950's)
- Describes **plate movements** AND explains **why they move**

Plate Tectonics

- **Two types of crust:**
- Oceanic and Continental
- Oceanic is more dense



Oceanic-continental convergence

- **Plates**: Chunks of lithosphere "floating" around on top of the asthenosphere
- Usually made of both types of crust

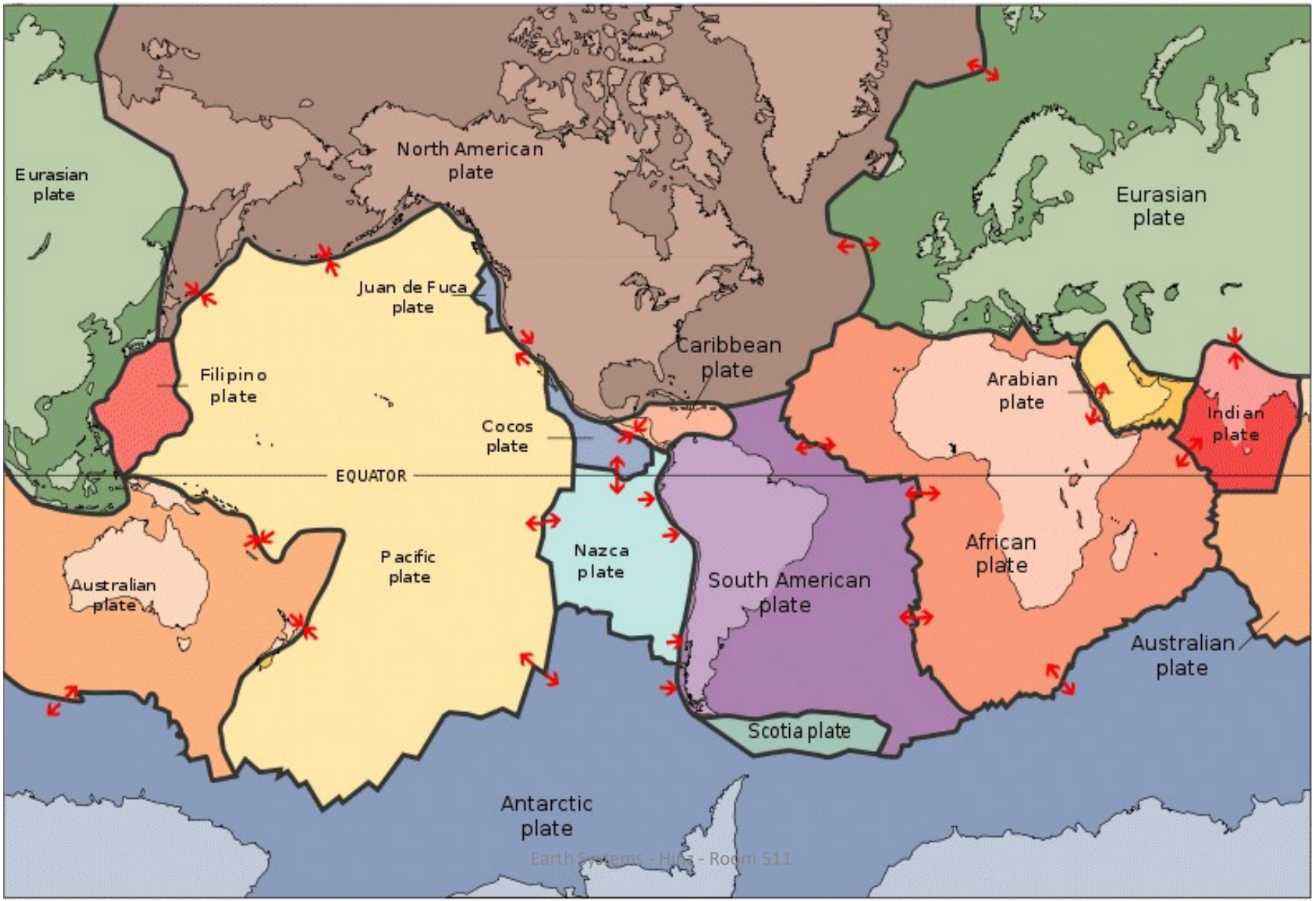
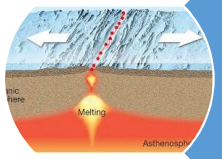
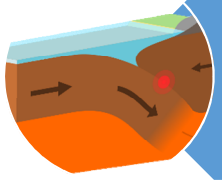

Eurasian plate
North American plate
Eurasian plate
Juan de Fuca plate
Caribbean plate
Filipino plate
Arabian plate
Indian plate
Cocos plate
EQUATOR
Pacific plate
Nazca plate
African plate
South American plate
Australian plate
Australian plate
Scotia plate
Antarctic plate

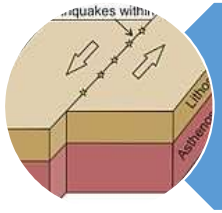
Plate Boundaries: 3 Types



Divergent



Convergent

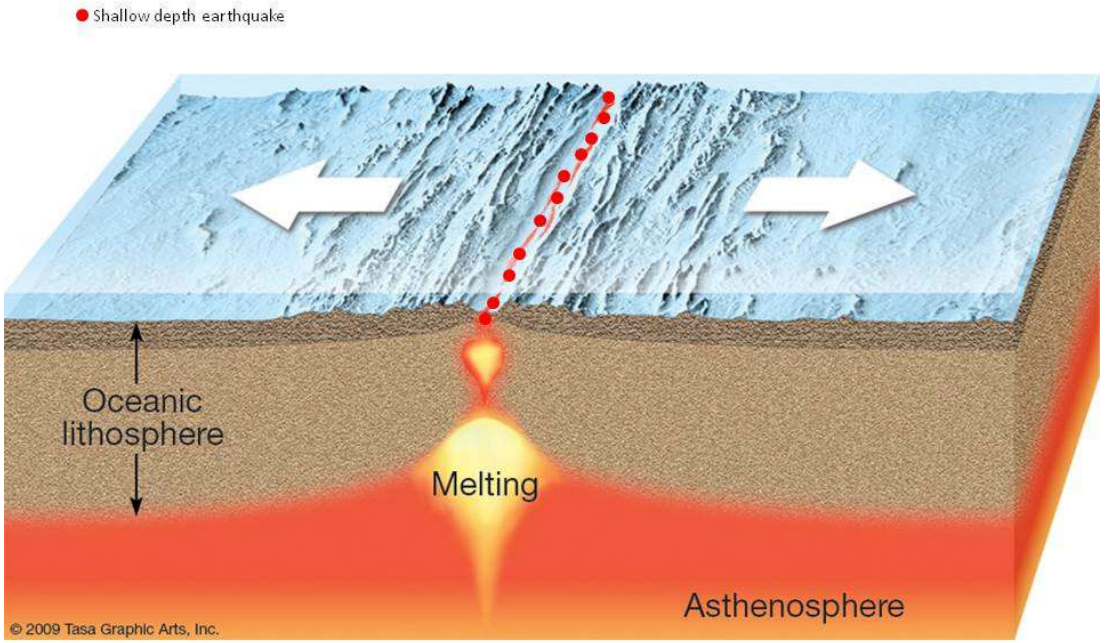


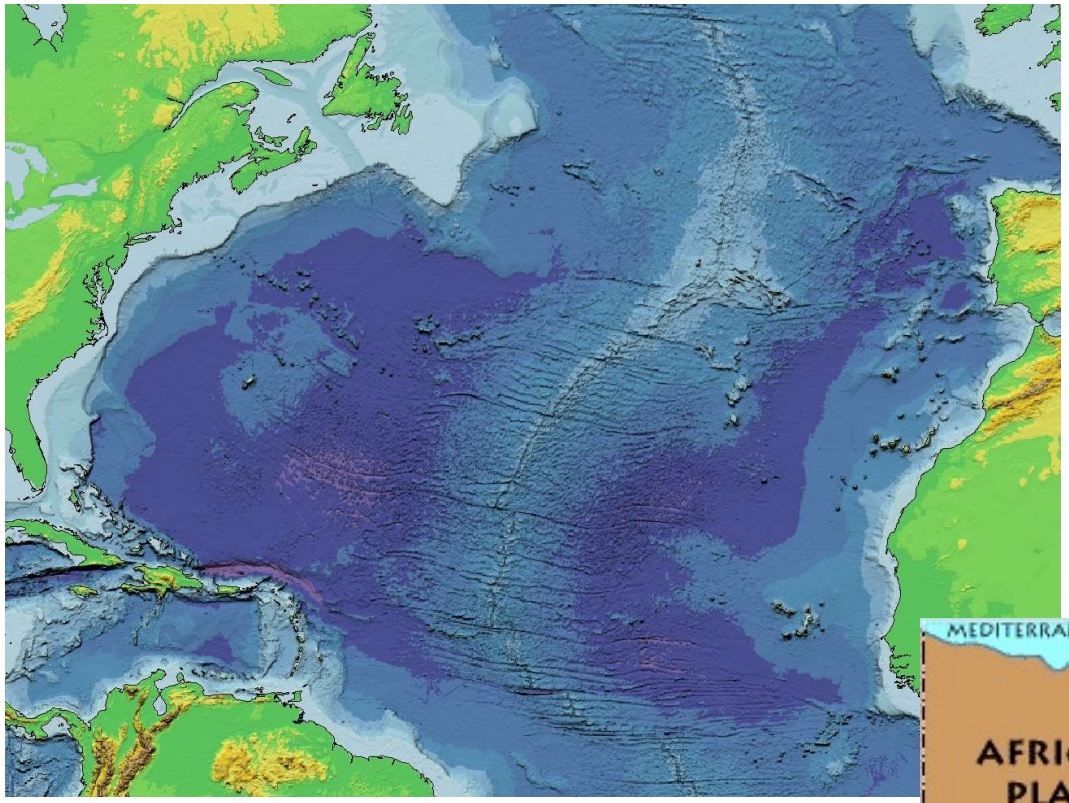
Transform

Plate Boundaries

Divergent Boundaries: two plates moving away from each other

- Plates move apart, molten rock from asthenosphere fills gap
- Most found on ocean floor (mid-ocean ridges)
- **Rift valley:** valley in the center of the mid-ocean ridge





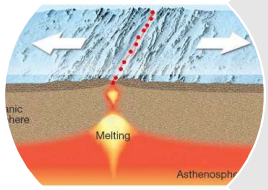

MEDITERRANEAN SEA
AFRICAN PLATE (NUBIAN)
NILE RIVER
RED SEA
ARABIAN PLATE
PERSIAN GULF

Plate Boundaries

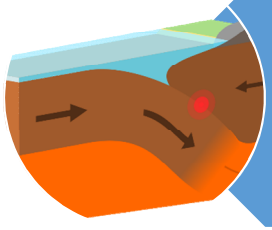
- **Convergent Boundaries:**
- **Two plates colliding**
  - **Ocean crust is denser**
  - **Subducted: forced under the continental crust**

Three Types:

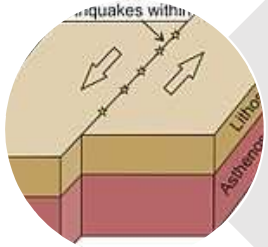
1. **Oceanic – Continental**
2. **Continental – Continental**
3. **Oceanic – Oceanic**



Divergent



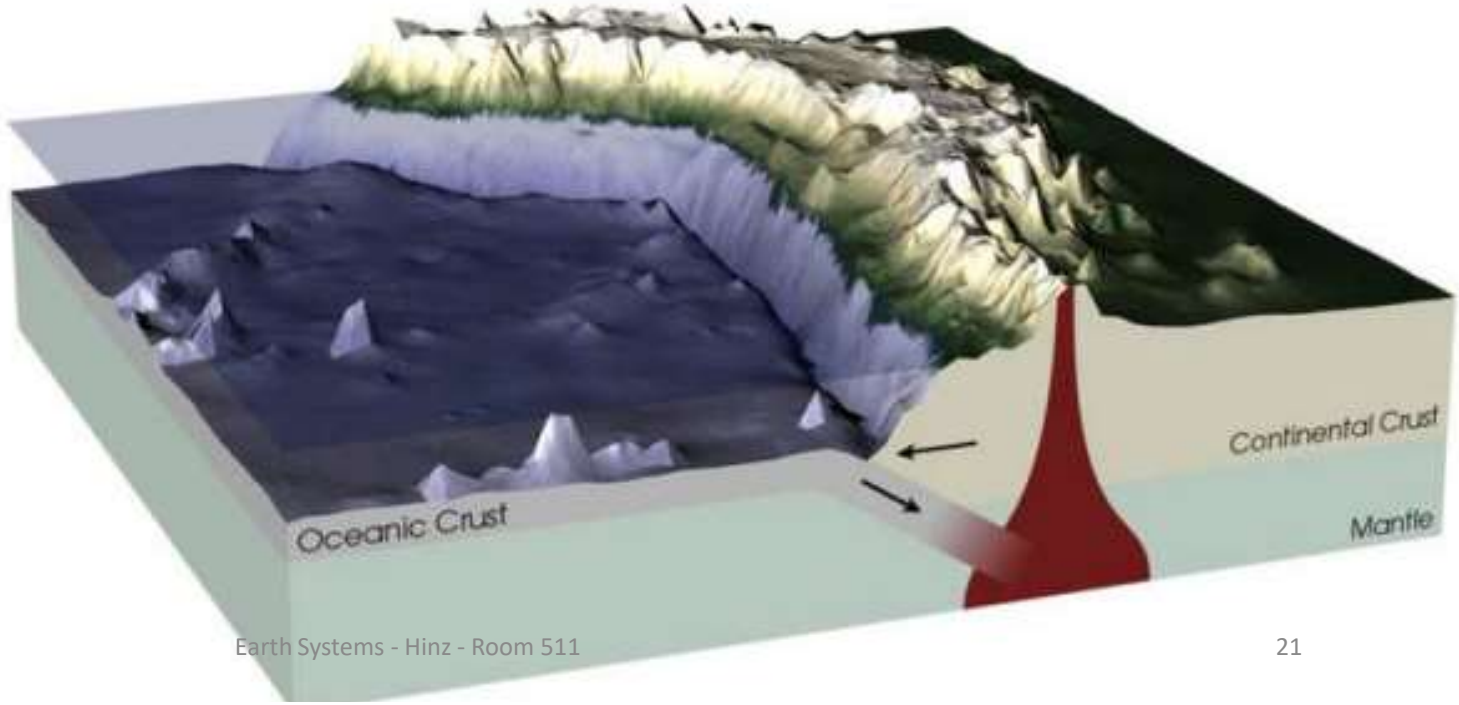
Convergent



Transform

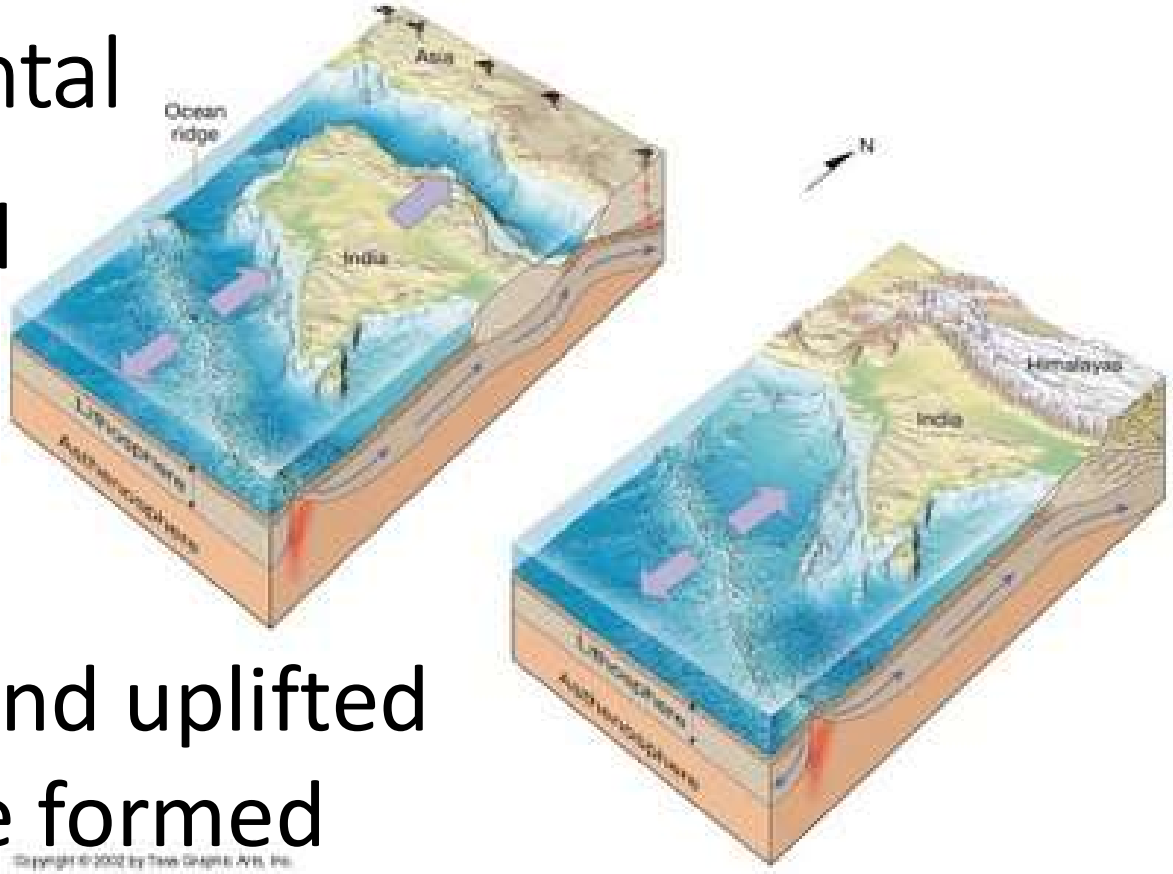
Oceanic – Continental Convergent

- Ocean crust is denser; Subduction occurs and its forced under
- Ocean trench forms
- Ocean crust melts; some rises to form volcanic mountains



Continental-Continental

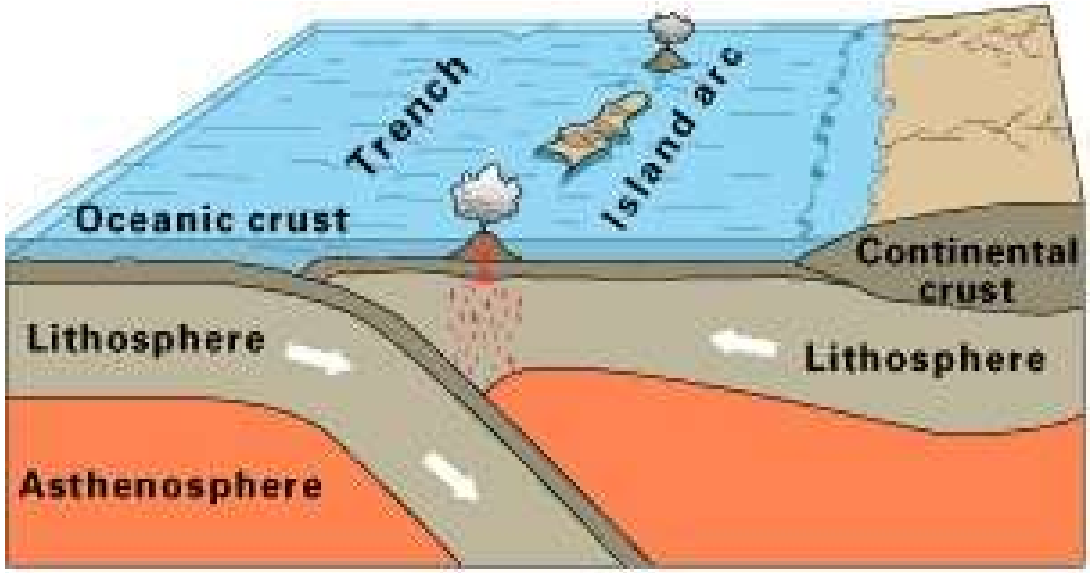
- Neither is subducted



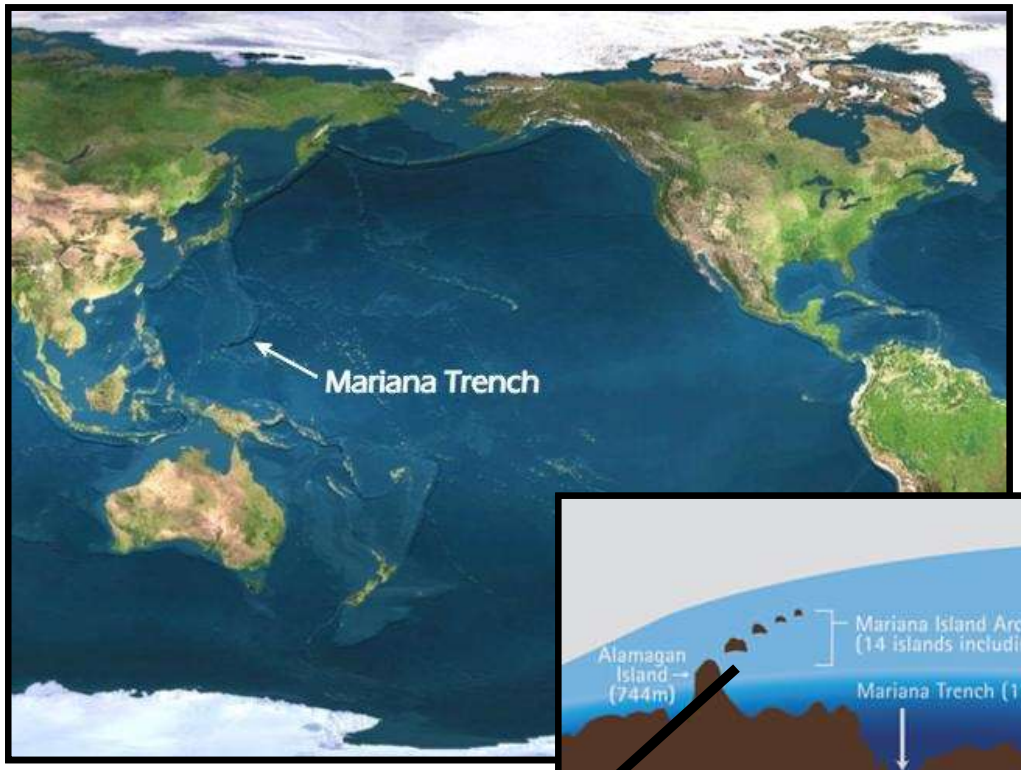
- Both are crumpled and uplifted
- Mountain ranges are formed

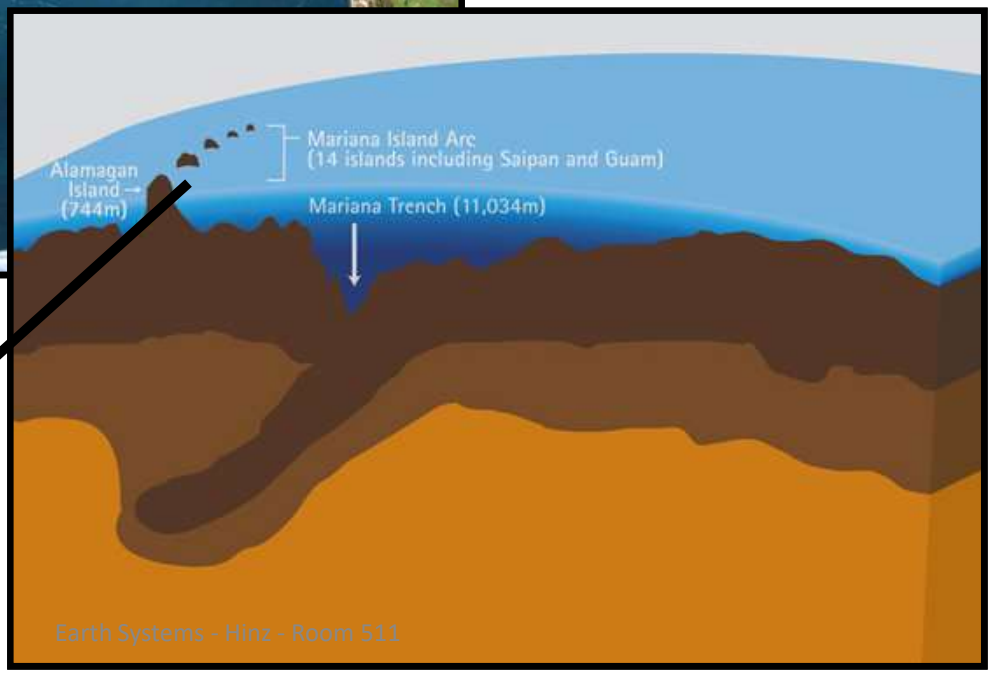
Convergent Boundaries

- **Oceanic-Oceanic:**
  - one plate gets subducted
  - Forms an ocean trench
  - Melting crust rises to form a volcanic **<u>island arc</u>**



Oceanic-oceanic convergence


Mariana Trench


Mariana Island Arc
(14 islands including Saipan and Guam)
Alamagan
Island
(744m)
Mariana Trench (11,034m)

ISLAND ARCS

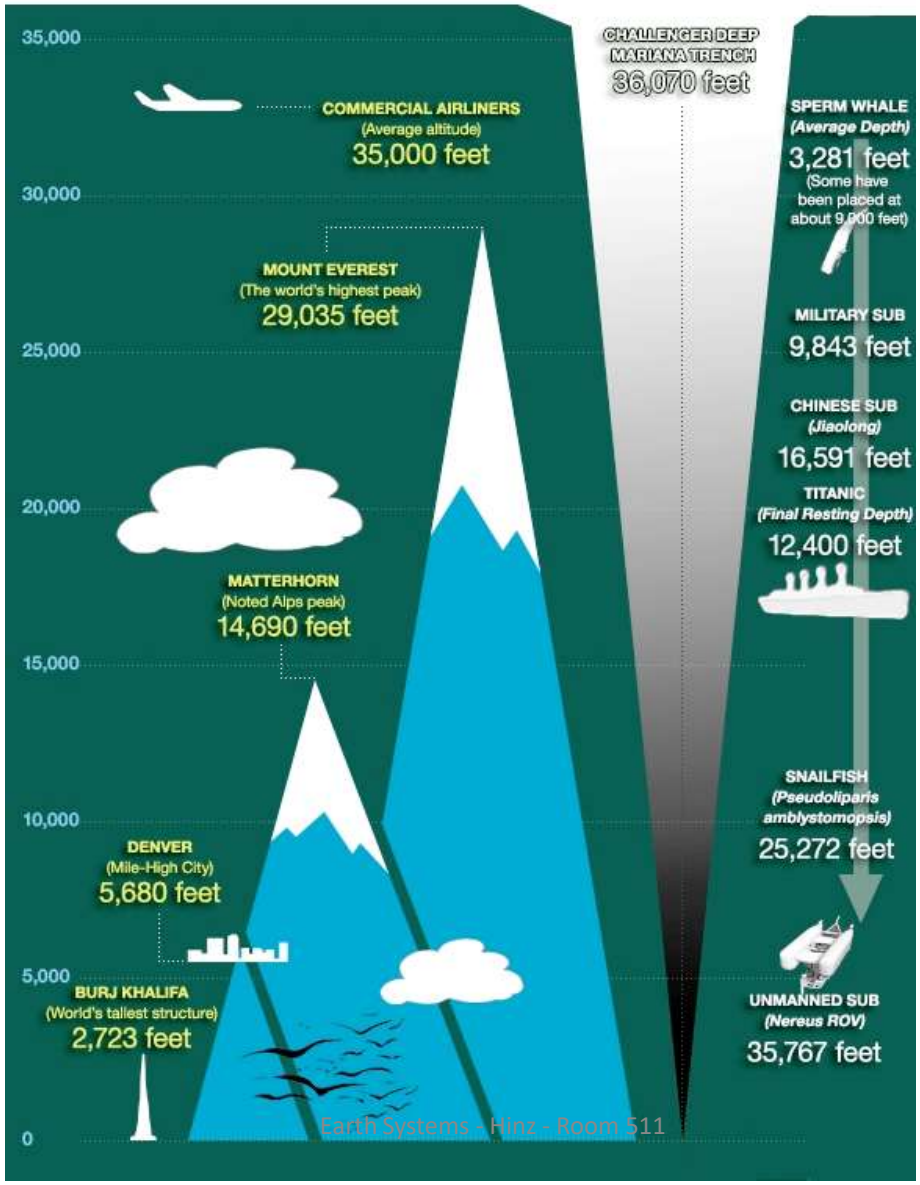
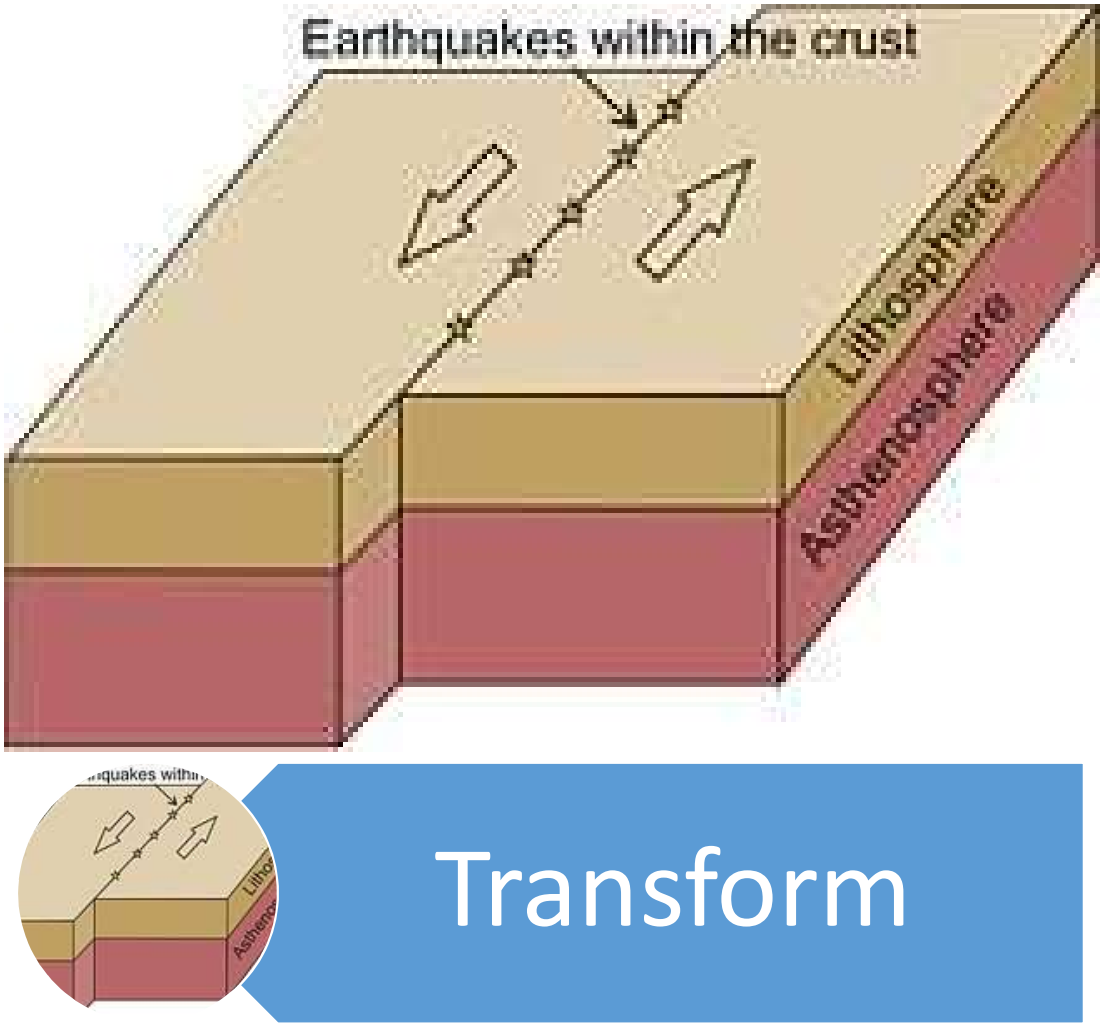

35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
COMMERCIAL AIRLINERS
(Average altitude)
35,000 feet
MOUNT EVEREST
(The world's highest peak)
29,035 feet
MATTERHORN
(Noted Alps peak)
14,690 feet
DENVER
(Mile-High City)
5,680 feet
BURJ KHALIFA
(World's tallest structure)
2,723 feet
CHALLENGER DEEP
MARIANA TRENCH
36,070 feet
SPERM WHALE
(Average Depth)
3,281 feet
(Some have been placed at about 9,900 feet)
MILITARY SUB
9,843 feet
CHINESE SUB
(Jiaolong)
16,591 feet
TITANIC
(Final Resting Depth)
12,400 feet
SNAILFISH
(Pseudoliparis amblystomopsis)
25,272 feet
UNMANNED SUB
(Nereus ROV)
35,767 feet

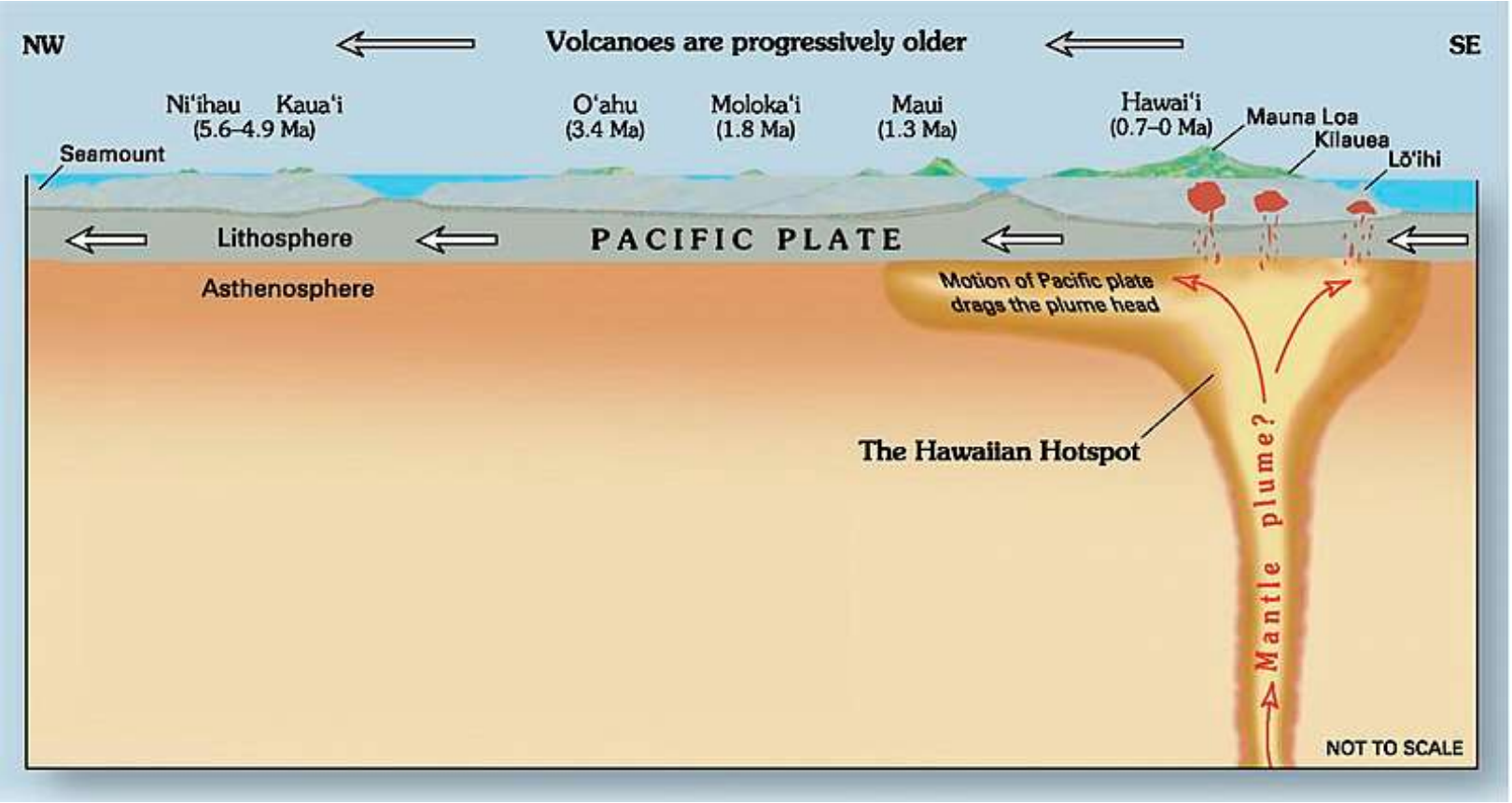
Plate Boundaries

- **Transform Fault Boundaries:**
  - Sliding and grinding past each other
  - Does not move smoothly – spurts of movement between periods of no motion

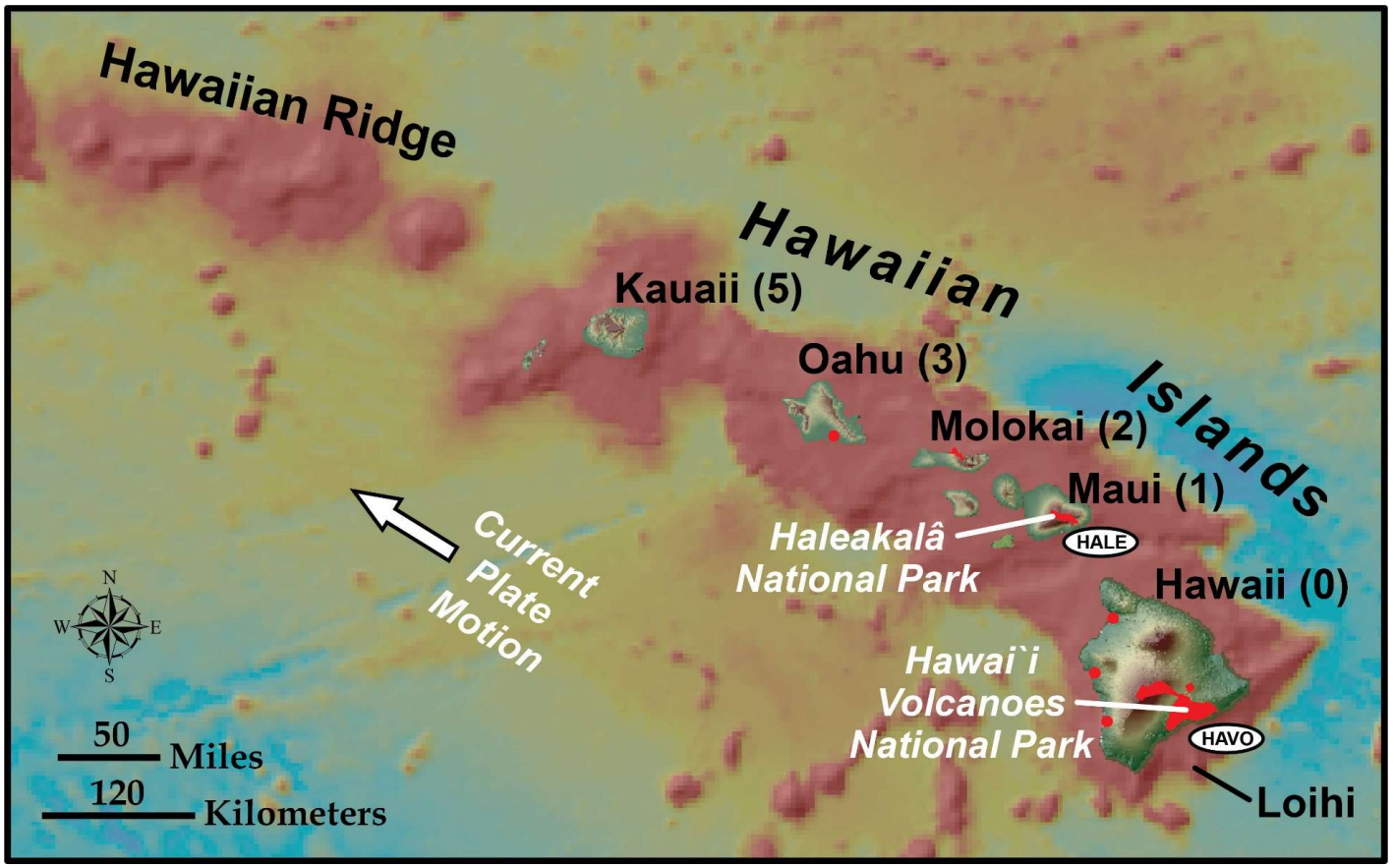



California's
San Andreas Fault
Crescent City
Eureka
Garberville
Point Delgada
Point Arena
Ukiah
Santa Rosa
Point Reyes
San Francisco
Daly City
San Jose
Santa Cruz
Hollister
San Juan Bautista
Monterey
Parkfield
San Luis Obispo
Simmler
Carrizo Plain
Soda Lake Rd
Frazier Park
Palmdale
Santa Barbara
San Bernardino
Desert Hot Springs
Los Angeles
Palm Springs
Brawley
San Diego
San Andreas Fault
Map copyright © 2006 David K. Lynch

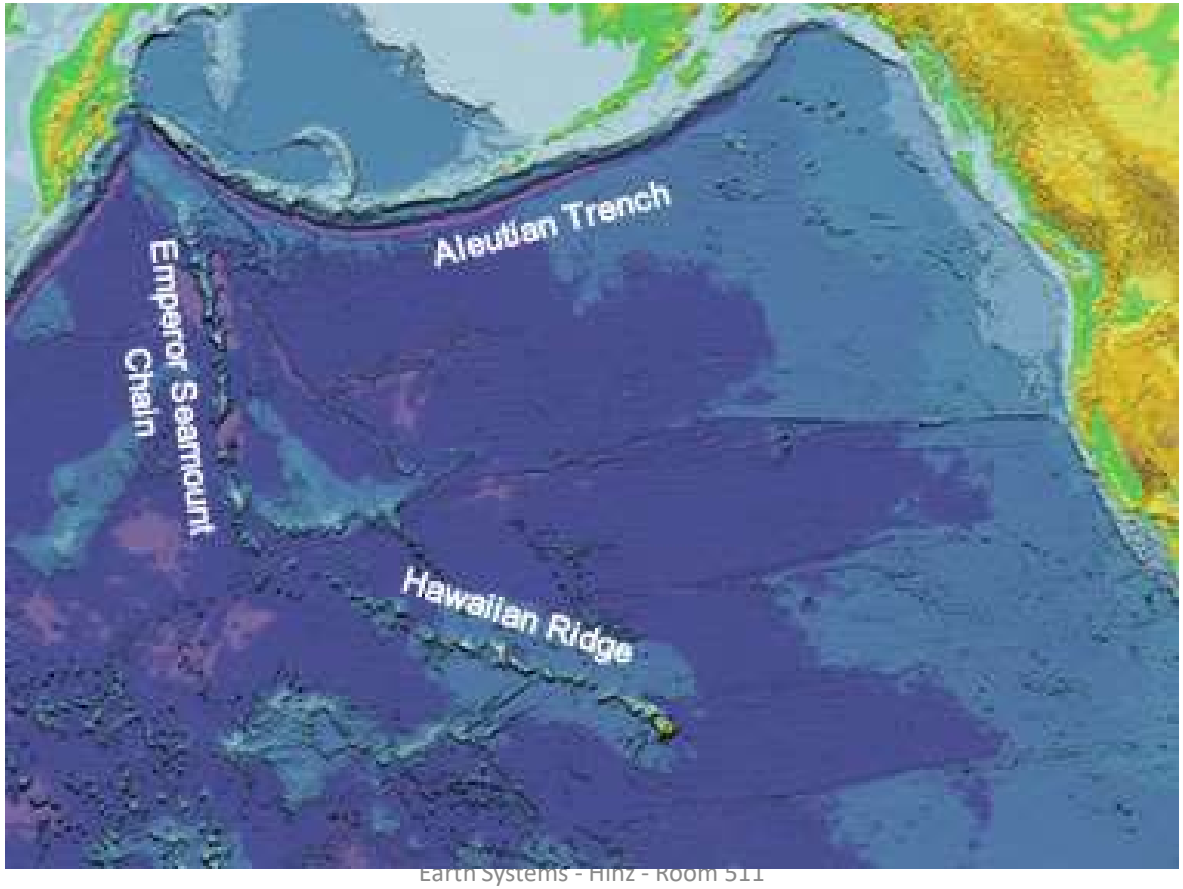
Hot Spots - Ocean



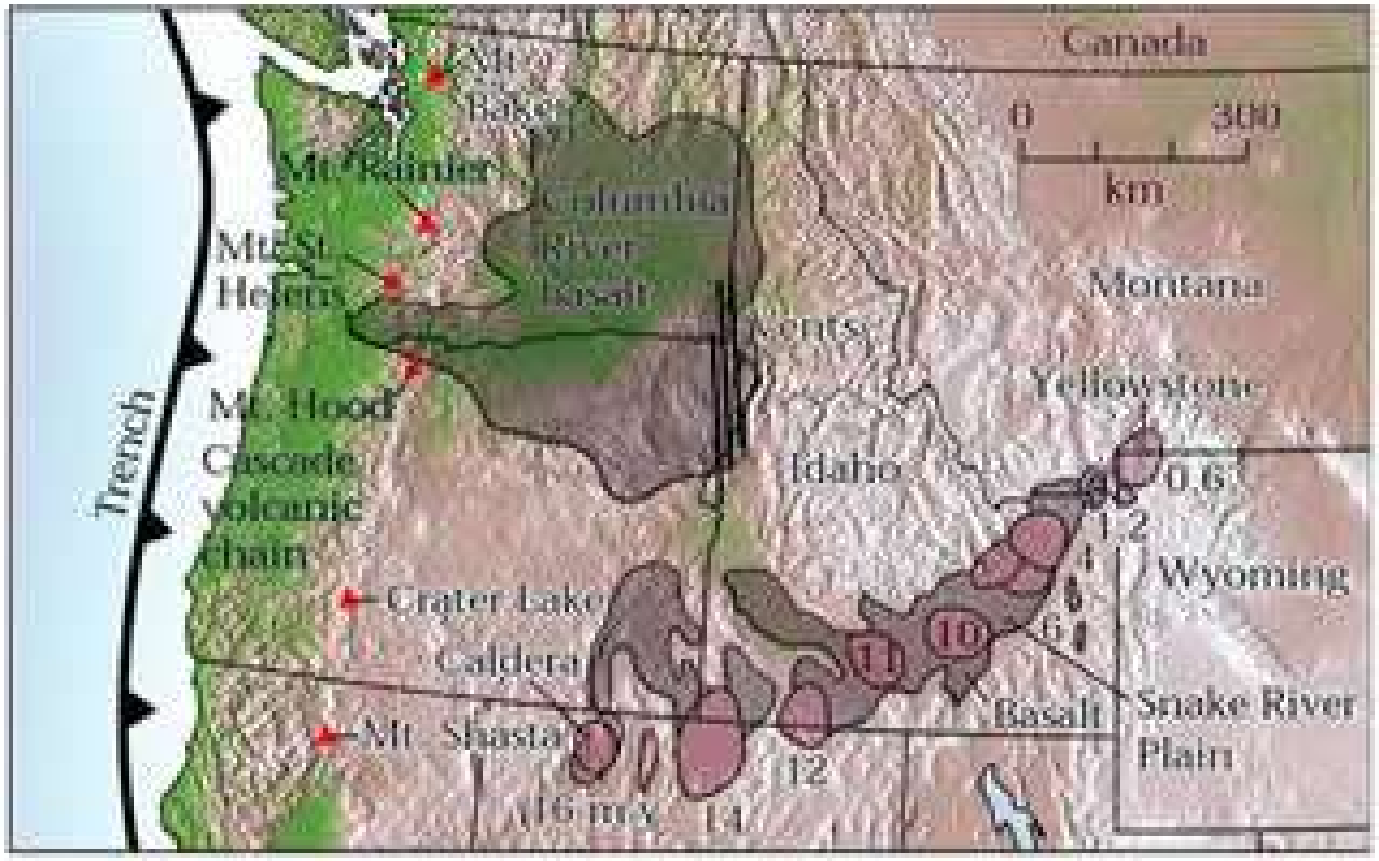
Hot Spots - Ocean

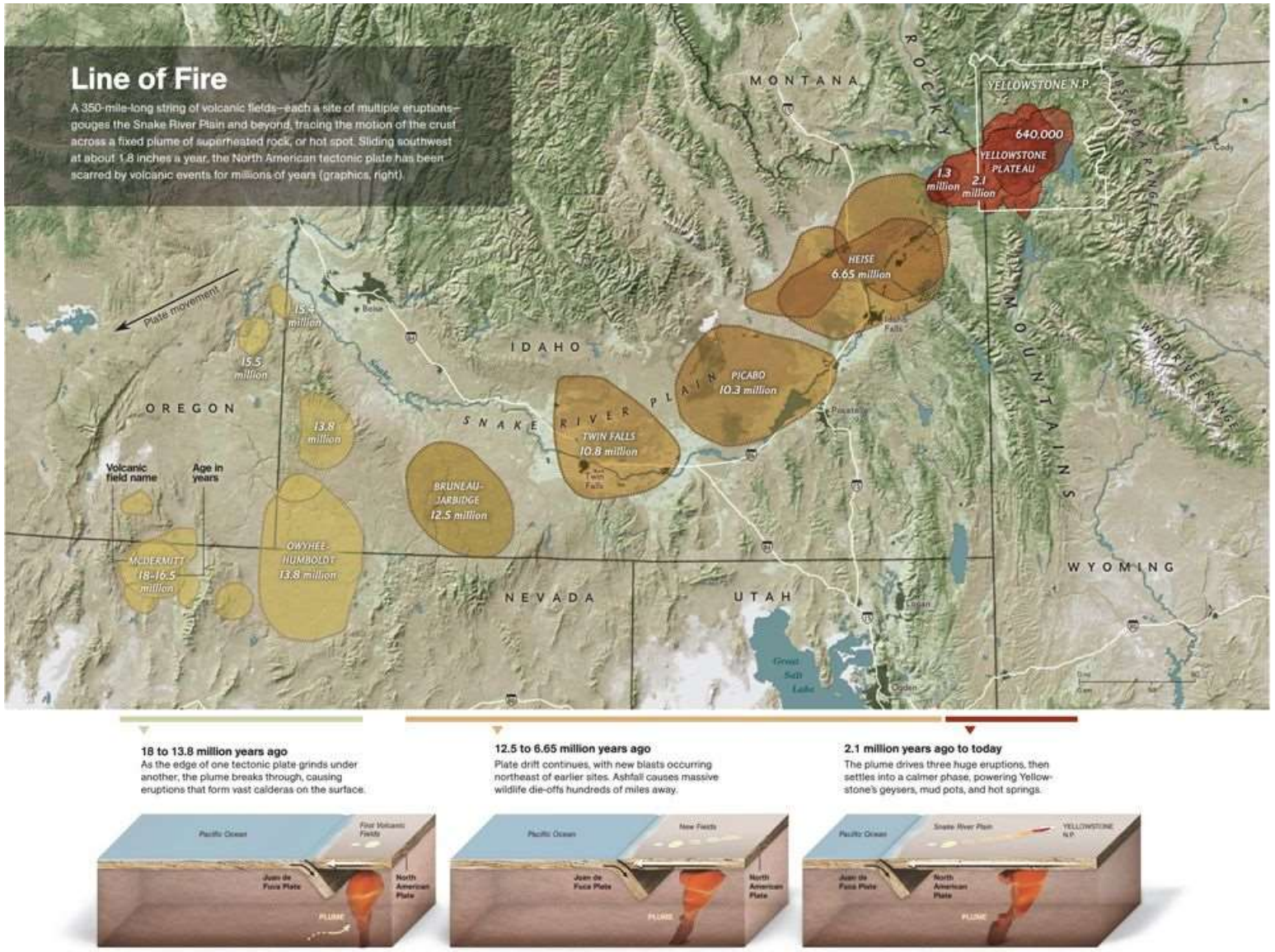


Hot Spots - Ocean



Hot Spots - Continental




Line of Fire
A 350-mile-long string of volcanic fields—each a site of multiple eruptions—gouges the Snake River Plain and beyond, tracing the motion of the crust across a fixed plume of superheated rock, or hot spot. Sliding southwest at about 1.8 inches a year, the North American tectonic plate has been scarred by volcanic events for millions of years (graphics, right).
Plate movement
Volcanic field name
Age in years
MONTANA
IDAHO
OREGON
NEVADA
UTAH
WYOMING
ROCKY MOUNTAINS
YELLOWSTONE N.P.
640,000
YELLOWSTONE PLATEAU
2.1 million
1.3 million
HEISE
6.65 million
PICABO
10.3 million
TWIN FALLS
10.8 million
BRUNEAU-JARBIDGE
12.5 million
OWYHEE-HUMBOLDT
13.8 million
13.8 million
15.5 million
15.4 million
MCDERMITT
18-16.5 million
SNAKE RIVER PLAIN
Boise
Idaho Falls
Twin Falls
Pocatello
Logan
Ogden
Great Salt Lake
Cody
18 to 13.8 million years ago
As the edge of one tectonic plate grinds under another, the plume breaks through, causing eruptions that form vast calderas on the surface.
12.5 to 6.65 million years ago
Plate drift continues, with new blasts occurring northeast of earlier sites. Ashfall causes massive wildlife die-offs hundreds of miles away.
2.1 million years ago to today
The plume drives three huge eruptions, then settles into a calmer phase, powering Yellowstone's geysers, mud pots, and hot springs.
Pacific Ocean
Juan de Fuca Plate
North American Plate
PLUME
Snake River Plain
YELLOWSTONE N.P.

Unit 7 Chapter 2 – Plate Tectonics

Signs of Tectonic Deformation

KEY TERM ORGANIZER

resource 1

Name: _____ TOPIC: _____

Key Term	Definition	Definition in your own words	Sketch of Key Term

Key Terms (Unit 7 Chapter 2)

- **Stress:**
- **Faults:**
- **Fault line:**
- **Hanging wall:**
- **Foot wall:**
- **Normal Fault:**
- **Reverse Fault:**
- **Strike-Slip Fault:**
- **Folds:**
- **Anticline:**
- **Monocline:**
- **Syncline:**
- **Deformation:**
- **Isostasy:**
- **Isostatic Adjustment:**

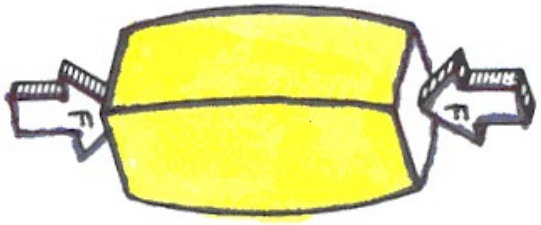
Deformation

- **Deformation:** the bending or reshaping of a rock due to the stress applied to it

Stress

- A force that causes pressure in the rocks of the Earth's lithosphere
- 3 Types:
  1. Compression: Rocks squeezed
  2. Tension: Rocks pulled apart
  3. Shearing: Rocks twisted or bent

1



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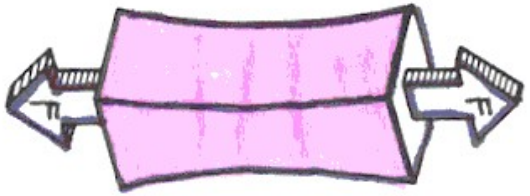
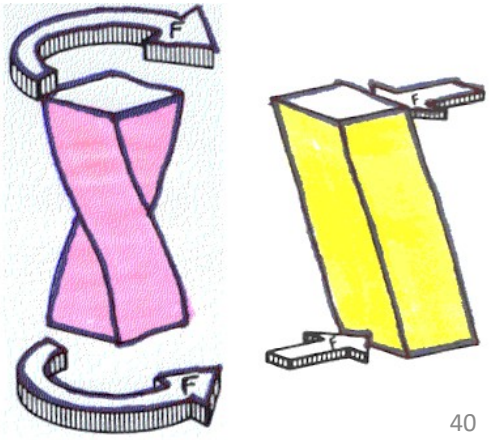


3



Faulting

- Rocks break under stress (lower temperatures and higher pressures)

- **Fracture:** rock breaks, but there is no movement to either side of the break

- **Fault:** rock breaks and move past one another

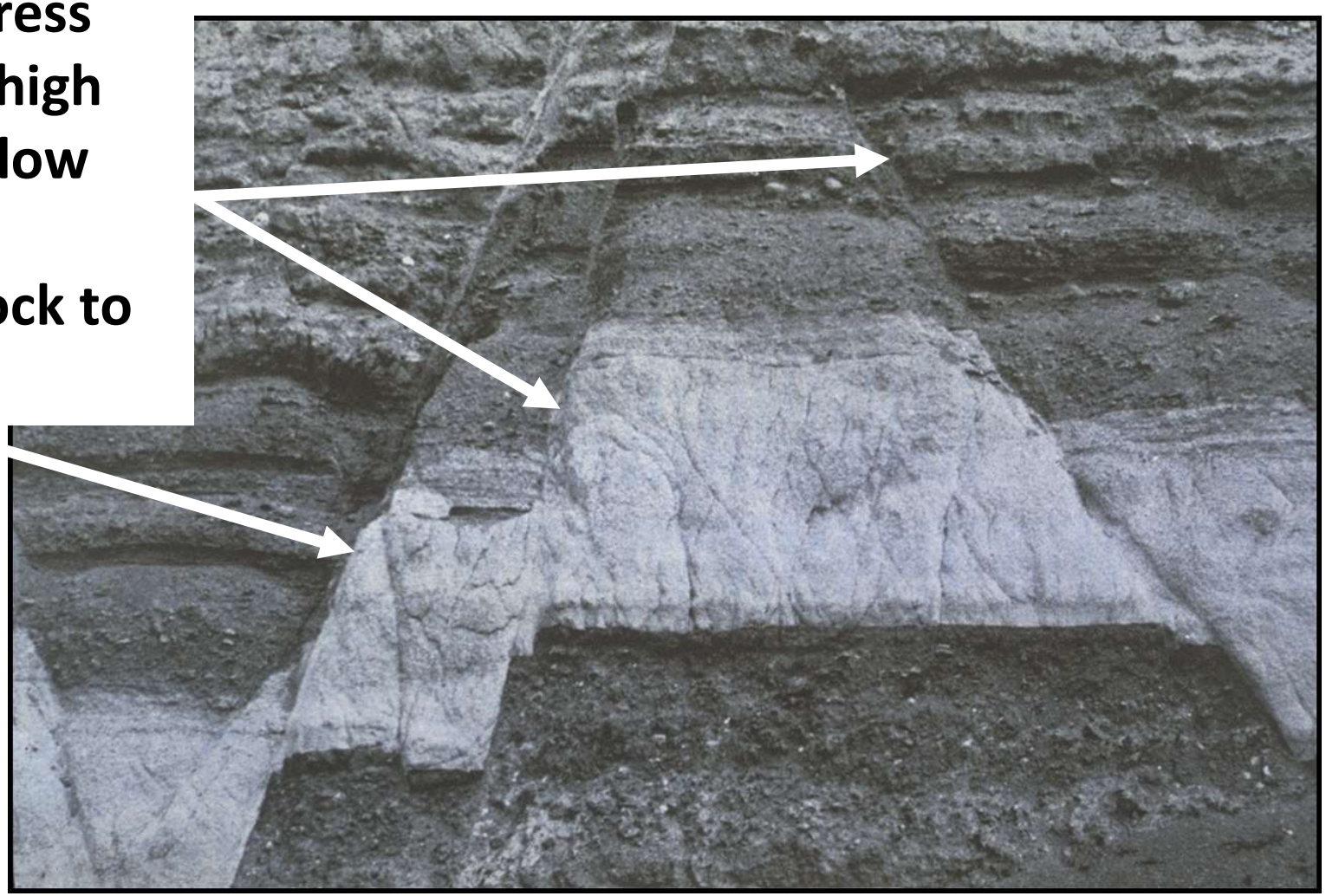
Faulting

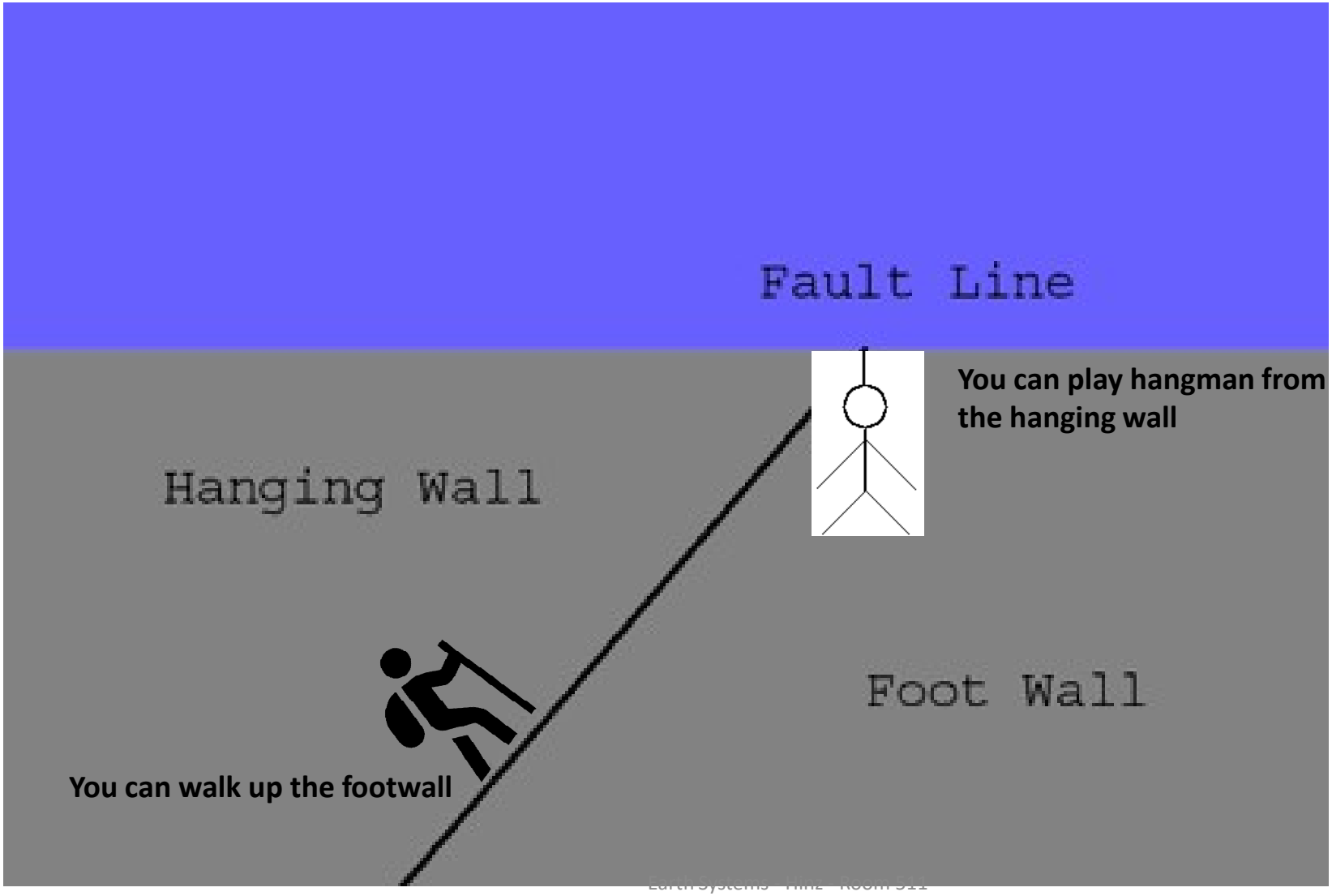
- **Fault line:** the line of fracture where the rock breaks

- **Hanging wall:** the rocks above the fault line

- **Footwall:** the rocks below the fault line

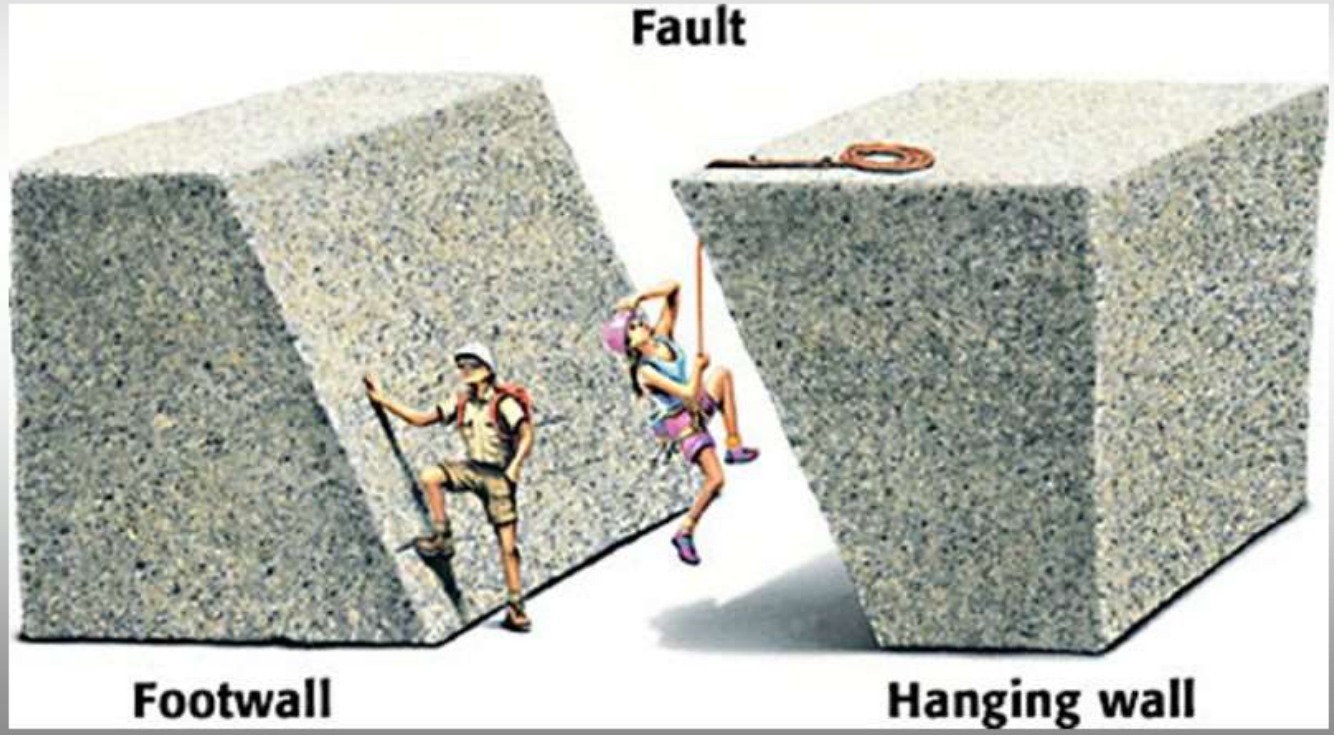
<u>Fault line</u> – stress built up with high pressure and low temperatures causing the rock to fracture.




Fault Line
You can play hangman from the hanging wall
Hanging Wall
Foot Wall
You can walk up the footwall

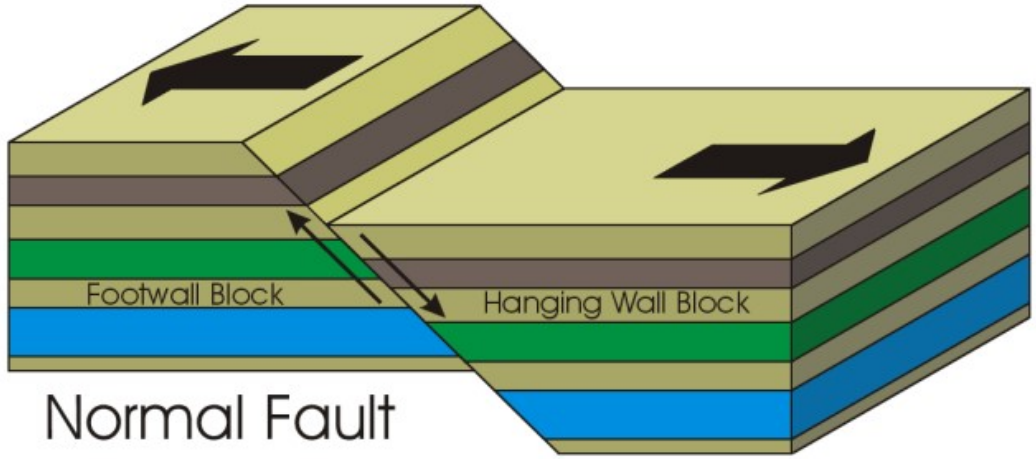
Hanging Wall and Footwall

How can I remember which is which???



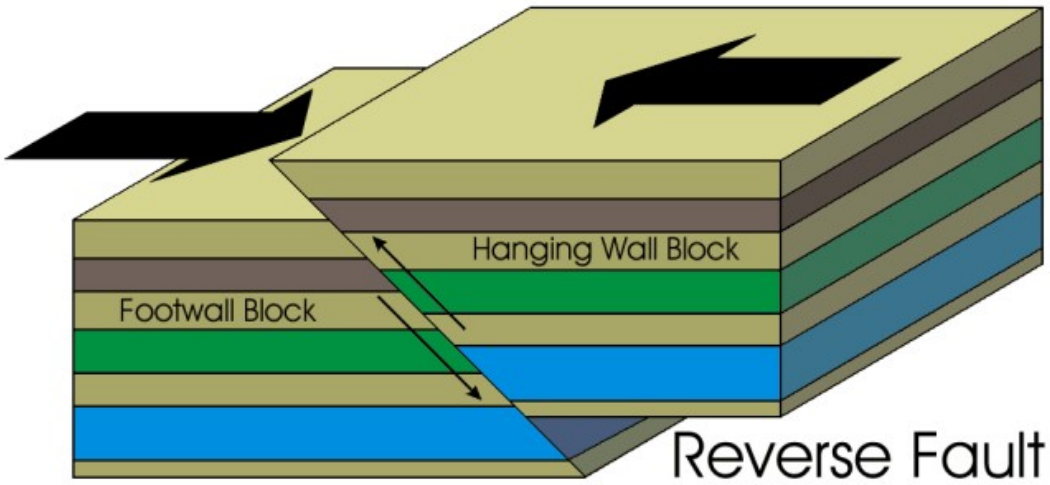
Types of Faults

- **Normal Fault:** The fault plane is steep/vertical, the hanging wall moves down relative to the footwall
  - Divergent boundaries



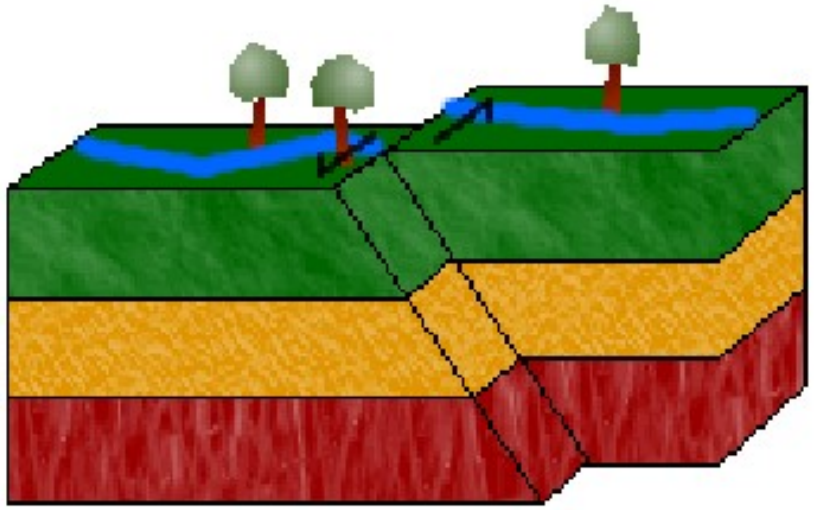
Types of Faults

- **Reverse Fault:** Steep/vertical fault plane, hanging wall moves up relative to footwall
  - Convergent boundaries



Types of Faults

- **Strike-Slip Fault:** The rock on either side of the fault plane moves horizontally
  - Transform fault boundaries



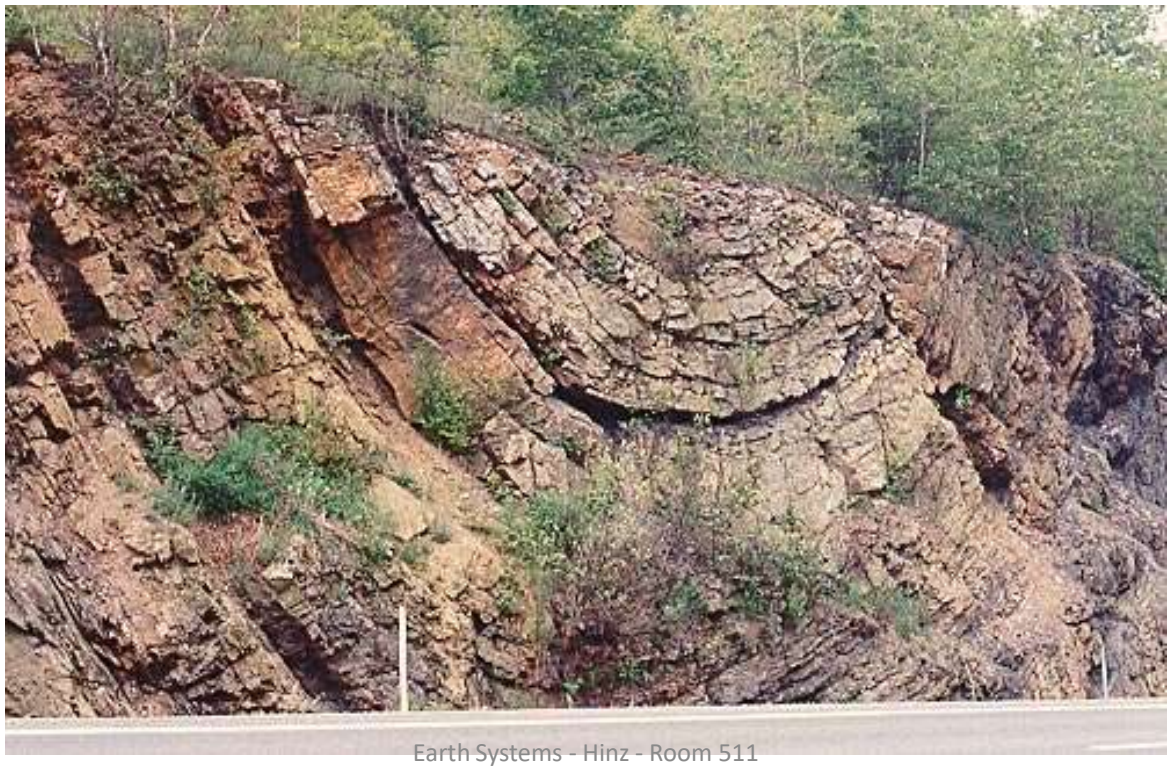
- **Folds:** a bend in rock layers due to high pressure and high heat

Three Types of Folds:

- **Anticline**: up-curved fold

Three Types of Folds

- **Syncline**: Down-curved fold

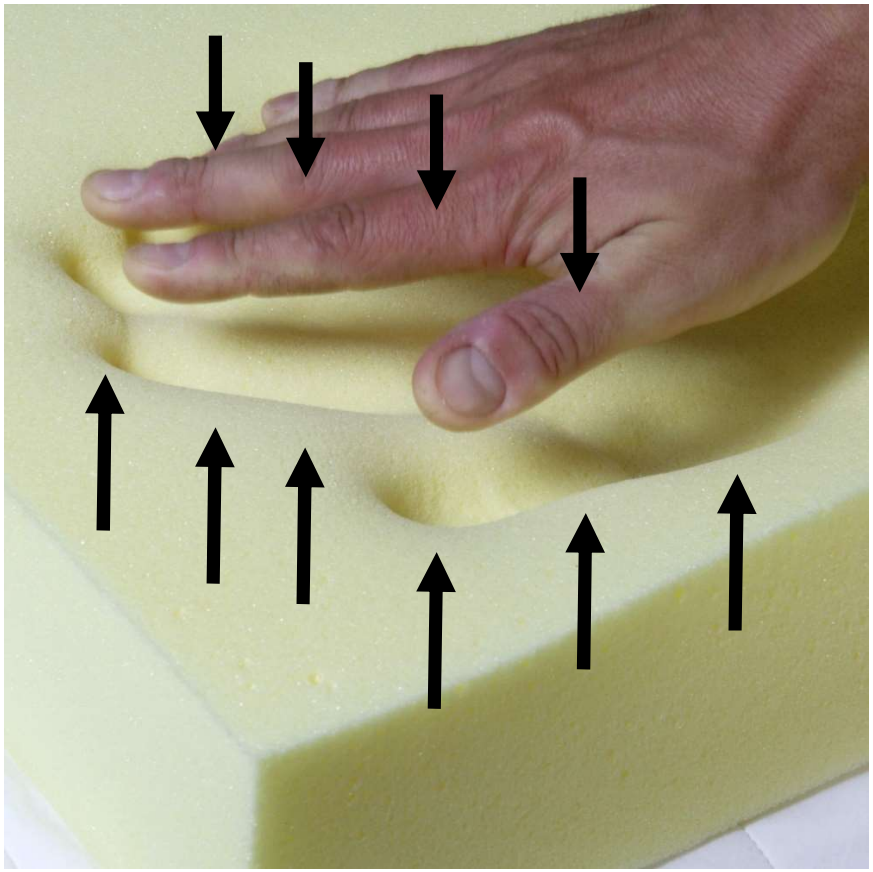


Three Types of Folds

- **Monocline**: gently dipping bends

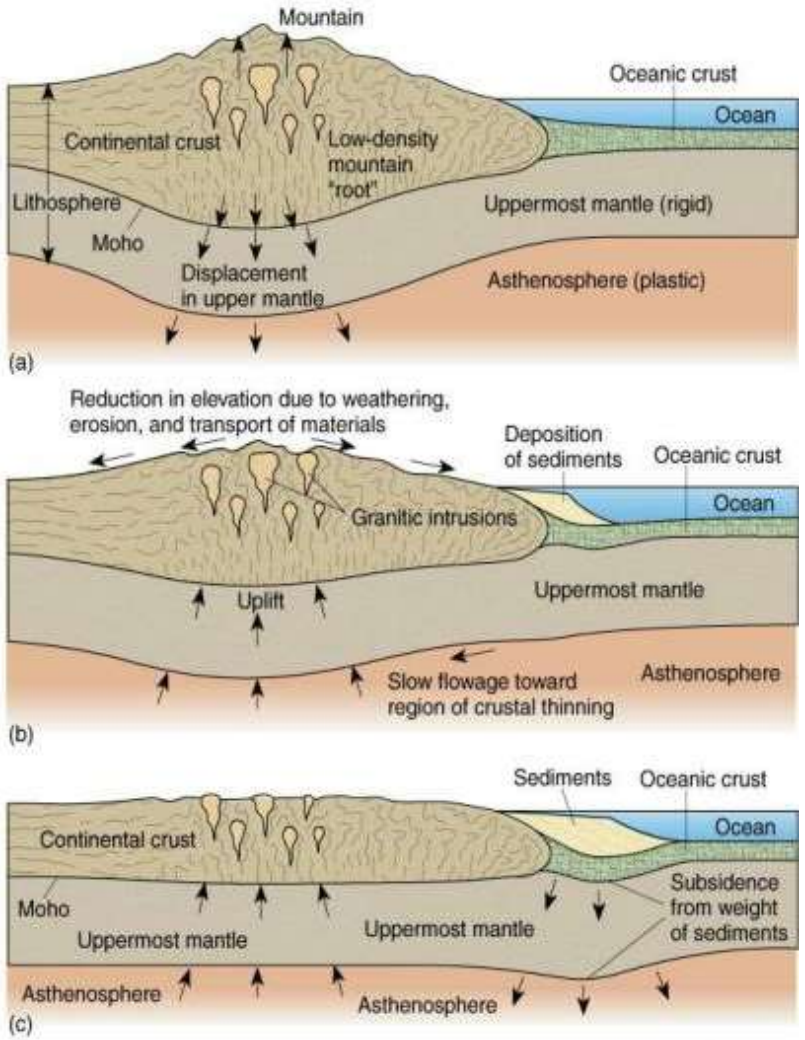
Isostasy

- **<u>Isostasy:</u>** The balance between these two forces
- Lithosphere presses down, Asthenosphere presses up

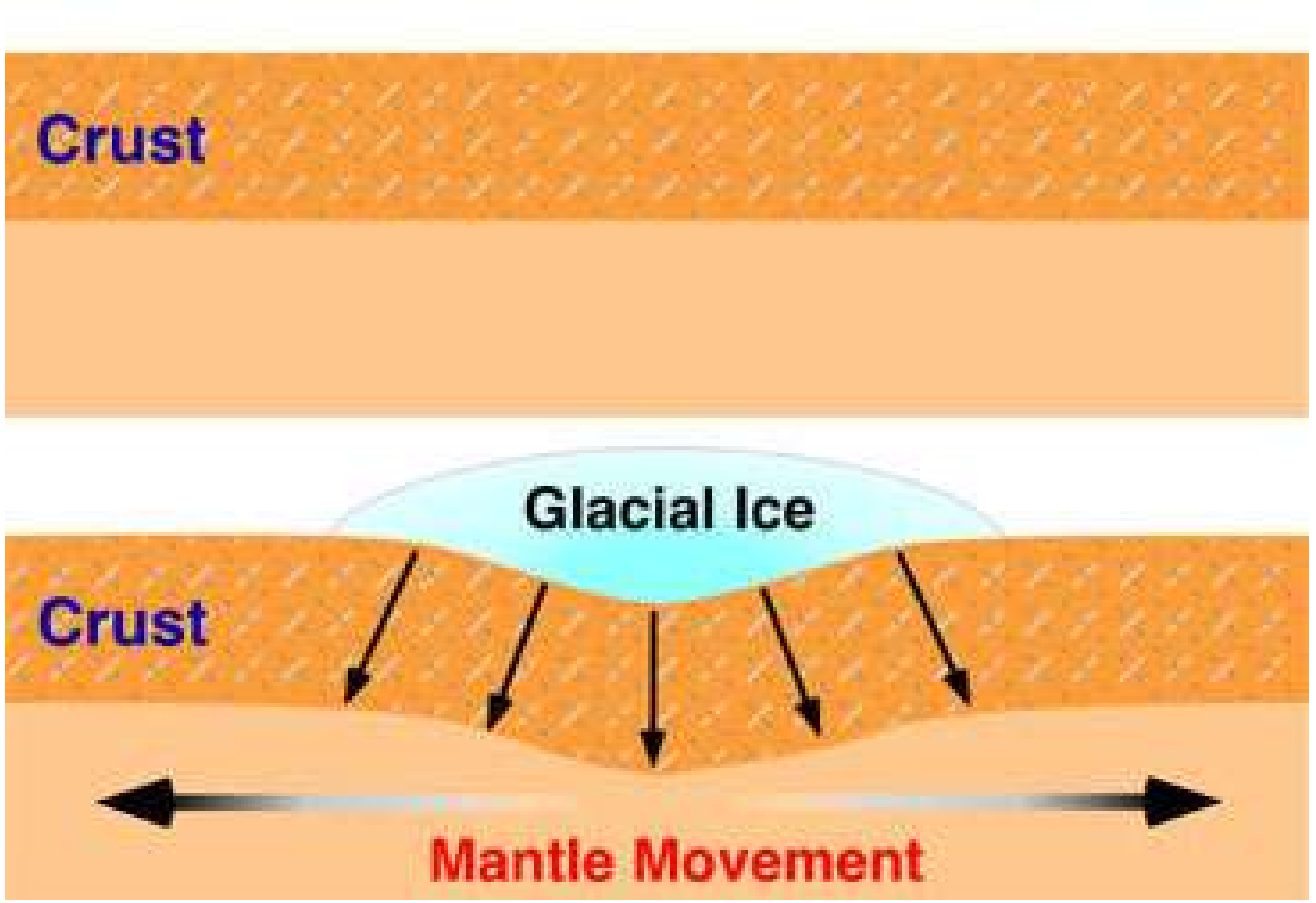


Isostatic Adjustment

- **Up-and-down movements of the crust to reach isostasy. This deforms the crust.**
- The lithosphere rides on the asthenosphere
- When the lithosphere is thick and heavy, it sinks deeper
- When it is thin and lighter, it rises higher



Glacial Isostatic Adjustment



Great Lakes Formation

STEP-BY-STEP Process:

1.) Glaciers covered the Great Lake region during the last ice age

2.) Glaciers carved out large basins as they advanced southward

3.) Glaciers retreated as the ice age ended

4.) Melt water from the glaciers filled in the basins created the Great lakes

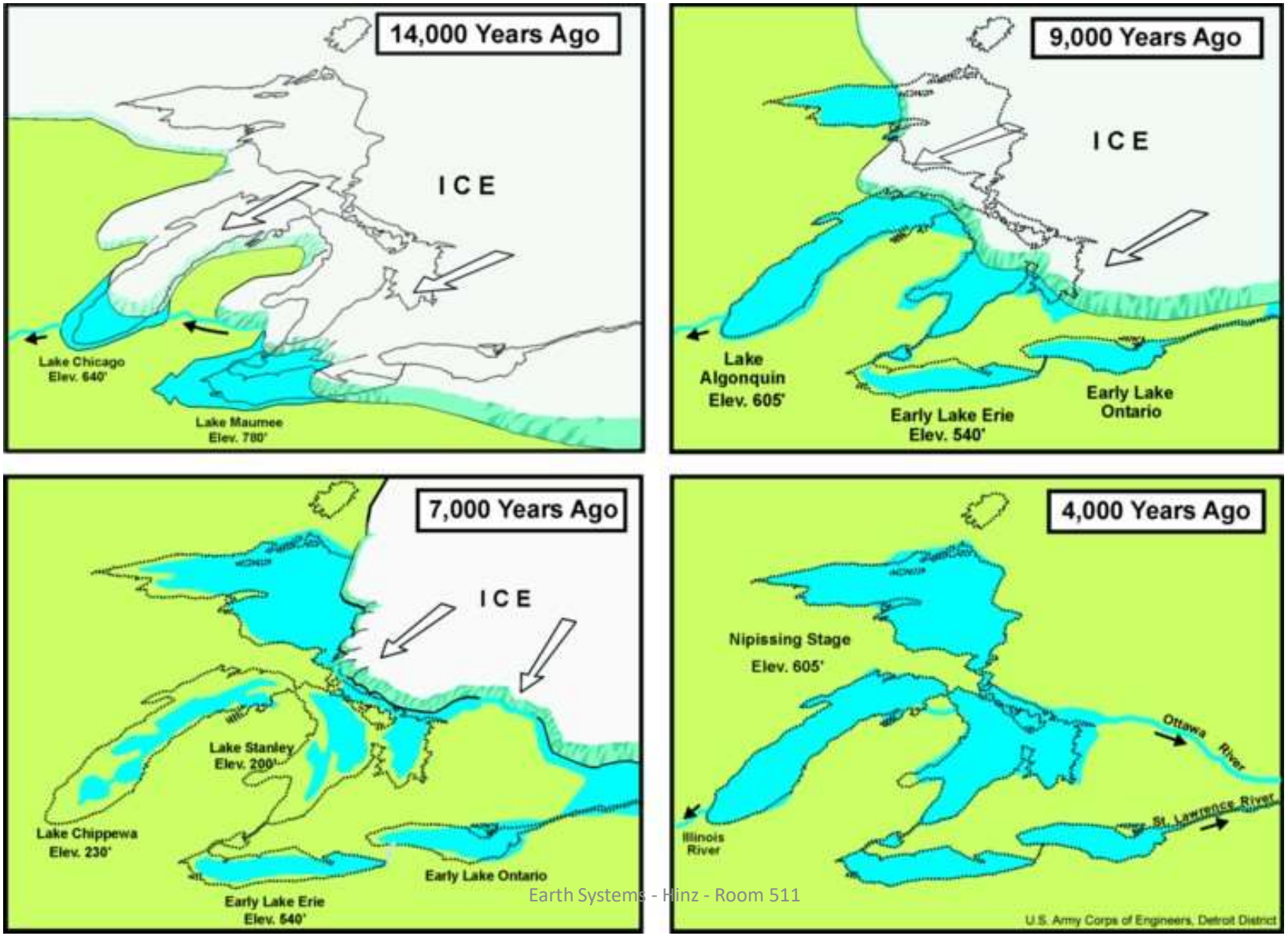
H: Huron

O: Ontario

M: Michigan

E: Erie

S: Superior


14,000 Years Ago
ICE
Lake Chicago
Elev. 640'
Lake Maumee
Elev. 780'
9,000 Years Ago
ICE
Lake
Algonquin
Elev. 605'
Early Lake Erie
Elev. 540'
Early Lake
Ontario
7,000 Years Ago
ICE
Lake Stanley
Elev. 200'
Lake Chippewa
Elev. 230'
Early Lake Ontario
Early Lake Erie
Elev. 540'
4,000 Years Ago
Nipissing Stage
Elev. 605'
Ottawa River
St. Lawrence River
Illinois
River
U.S. Army Corps of Engineers, Detroit District


Lake Superior
Minnesota
Ontario
Québec
St. Lawrence River
Lake Huron
Lake Michigan
Wisconsin
Ontario
Lake Ontario
New York
Michigan
Lake Erie
Pennsylvania
Illinois
Indiana
Ohio