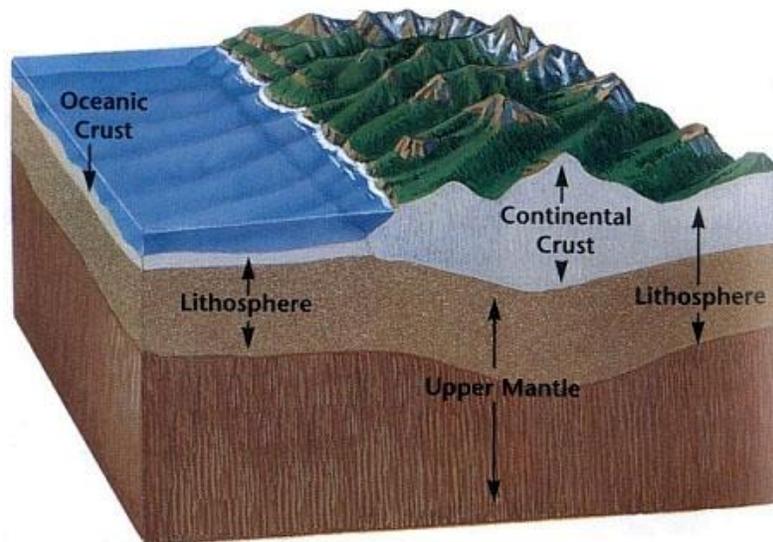


Chapter 5: Deformation of the Crust

5.1 How the Crust is Deformed

- **deformation** – the bending, tilting, and breaking of the earth's crust
 - o Major Cause? _____ (the movement of earth's lithospheric plates)

- Isostatic Adjustment:
 - o The _____ of the crust – how far it extends out of the mantle - changes depending on the _____ of the crust.



- o When parts of the crust become thicker and heavier, they will _____ more deeply into the mantle. If the crust becomes thinner and lighter, it will _____.

- o The balancing of these two forces (the mantle pushing up and the crust pushing down) is called _____ and the individual up and down movements are called **isostatic adjustments**.

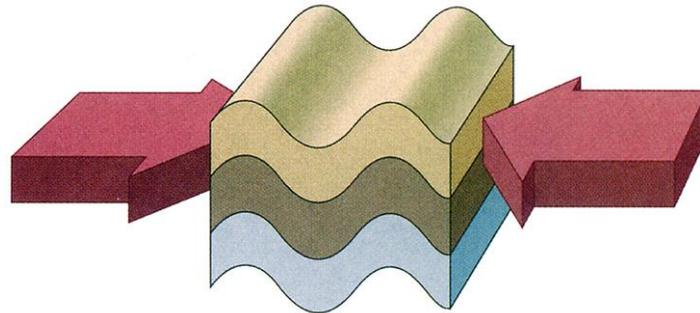
- o Example: As a mountain range wears down with _____, the crust becomes lighter, which causes the region to rise.

- o Example: Sediment deposits from the _____ River settle in the Gulf of Mexico causing the area to become heavier and sink.

- Example: Areas that used to be covered by _____ are now rising (in response to the reduced weight).

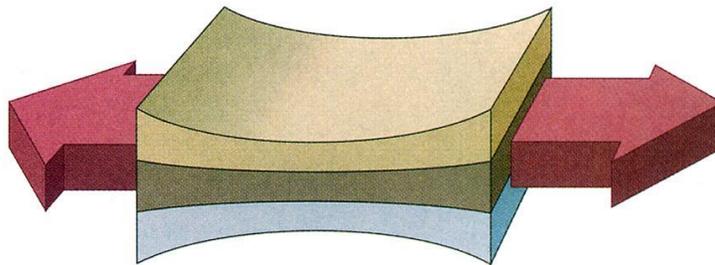
– Stress:

- Isostatic adjustment and plate movement cause _____ (or additional force) on the rocks that make up the earth's crust.
- 3 types of stress:
 - (1) **compression** – force that _____ rocks together
 - Tends to push rocks up higher or deeper down into the crust



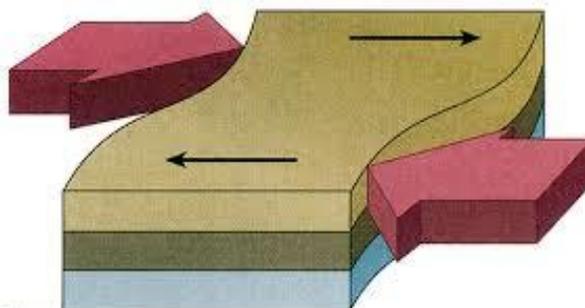
A. Compression

- (2) **tension** – force that _____ rocks apart
 - Tends to make the crust thinner



B. Tension

- (3) **shearing** – force that pushes rocks in _____ horizontal directions
 - Sheared rocks bend, twist, or break apart as they slide past each other.



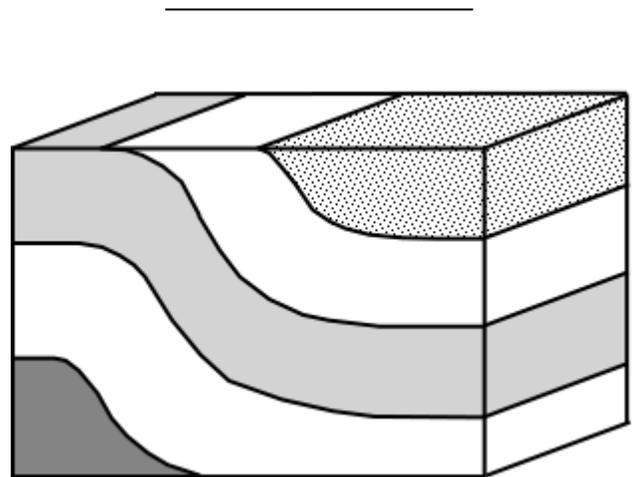
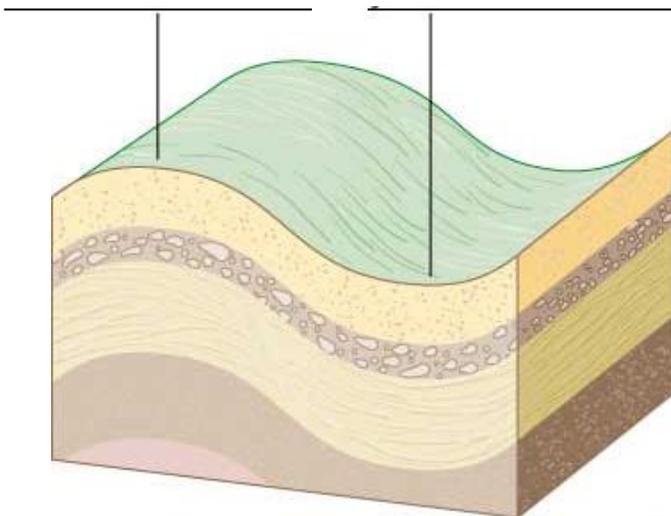
C. Shear

5.2 The Results of Stress

- **Folding** - when rock responds to stress by becoming permanently deformed without

-
- o Folds appear as wavelike structures in rock layers and vary greatly in _____
 - o 3 Types of Folds:
 - (1) **anticline** – an up-curved fold in which the oldest layer is in the center of the fold
 - Wherever large folds occur, an anticline will usually form a ridge.
 - (2) **syncline** – a down-curved fold in which the youngest layer is in the center
 - Wherever large folds occur, a syncline will usually form a valley.
 - (3) **monocline** – a fold in which both limbs remain horizontal

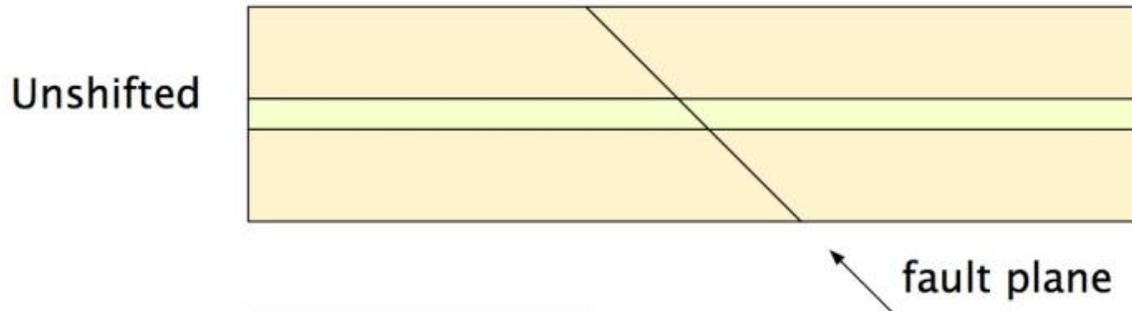
Label the following pictures based on the fold type:



- Rock does not always respond to stress by folding. _____ temperatures and _____ pressure near the earth's surface often cause rock to respond to stress by breaking.
 - o Breaks in rocks are divided into two categories:
 1. When there is no _____ in the rocks along either side of a break, it is called a **fracture**.

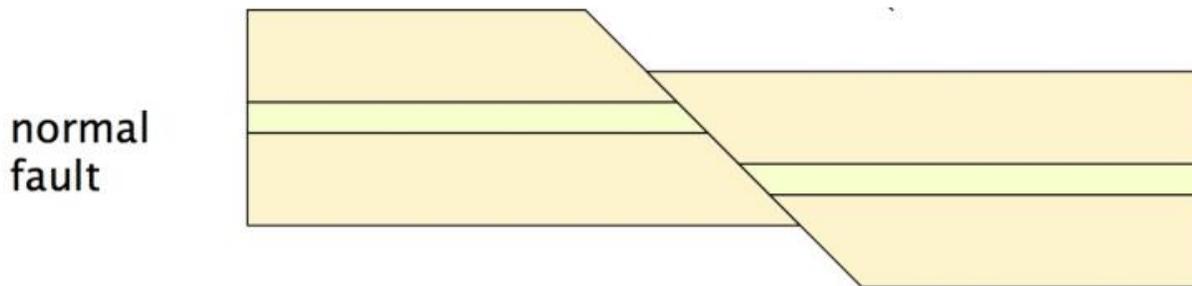
2. When the rocks do move, it is called a _____.

- The **fault plane** is the surface of a fault along which any _____ occurs.



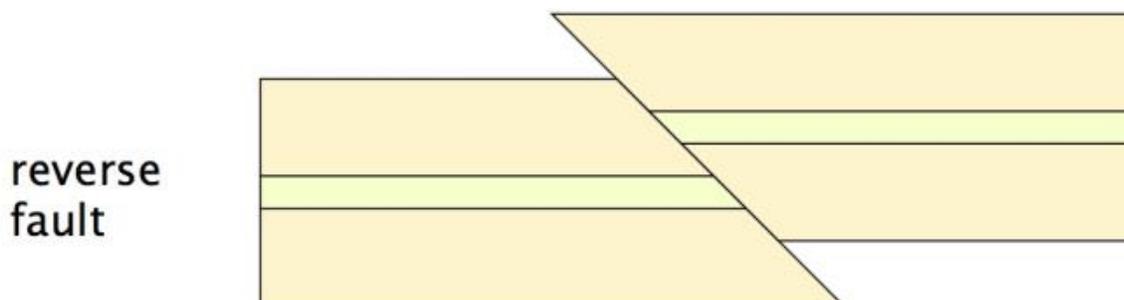
- In a nonvertical fault, the **hanging wall** is the rock _____ the fault plane and the **footwall** is the rock _____ the fault plane.
- A **normal fault** is a fault in which the hanging wall moves _____ relative to the footwall.
 - These form along _____ boundaries.
 - Usually form in a series of parallel fault lines.
 - Example: Great Rift Valley of East _____

Label the hanging wall and footwall of this normal fault:

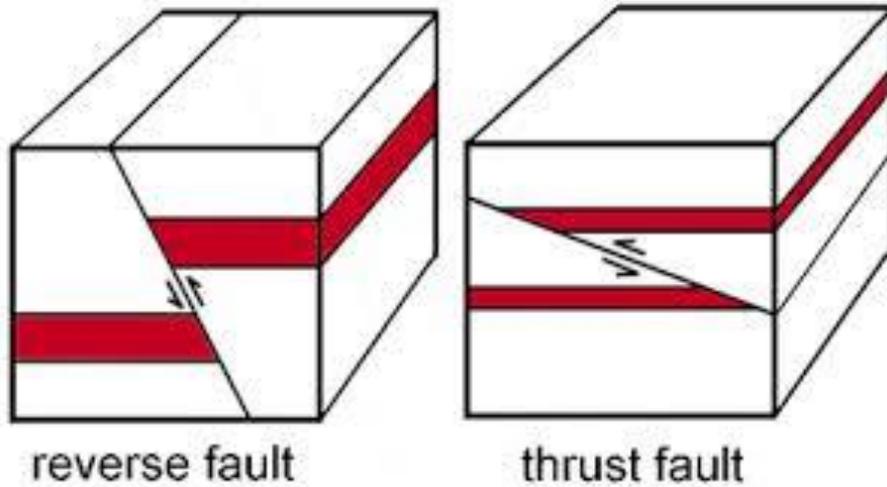


- A **reverse fault** forms when compression causes the hanging wall to move up relative to the footwall.

Label the hanging wall and footwall of this reverse fault:

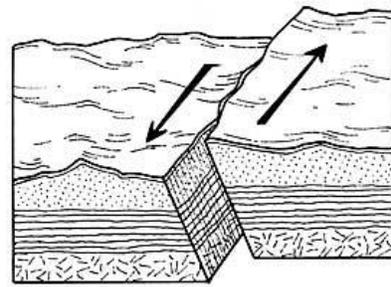
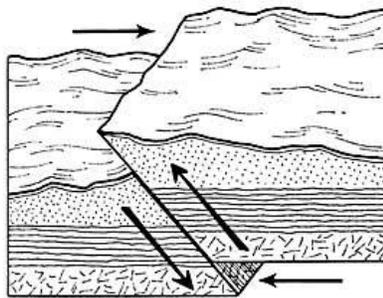
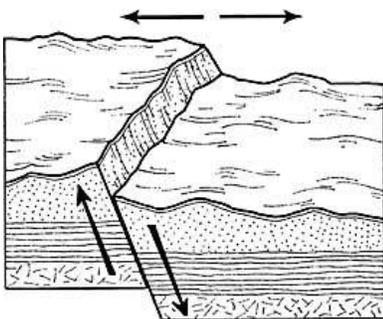


- A **thrust fault** is a special type of reverse fault. The angle of the fault plane is very low (almost horizontal).



- Both reverse and thrust faults are common in the Rockies and Alps.
- Along a **strike-slip fault**, the rock on either side of the fault plane slides horizontally.
 - Occurs often at transform boundaries
 - Example: San Andreas Fault

Label the following fault types:



Laurel Cook Lhowe

5.3 Mountain Formation

- **Mountain range** – a group of adjacent mountains with the same general _____ and structure
 - o Example: The Great _____ Range and The Cascade Range

- **Mountain _____** – a group of adjacent mountain ranges
 - o Example: The Great Smoky, the Blue Ridge, the Cumberland, and the Green mountain ranges all make up the _____ mountain system in the eastern United States

- **Mountain _____** – groups of mountain systems
 - o The two major mountain belts on earth are:
 1. _____ - _____ belt (which forms a ring around the Pacific Ocean)
 2. Eurasian-Melanesian belt (which runs from the Pacific islands, through Asia and southern Europe and into northwestern Africa). Also referred to as the _____ belt, Alpine-Himalayan Belt, or Tethyan Belt.

- Most mountains form when lithospheric plates _____ (as is evidence by the two major mountain belts).
 - o Continental-Oceanic Collisions
 - Mountain formation from colliding plates and subduction
 - Terranes also contribute to mountain formation
 - Higher likelihood of volcanic mountains
 - Example: Cascade Range and Mount Saint _____ in the Pacific Northwest

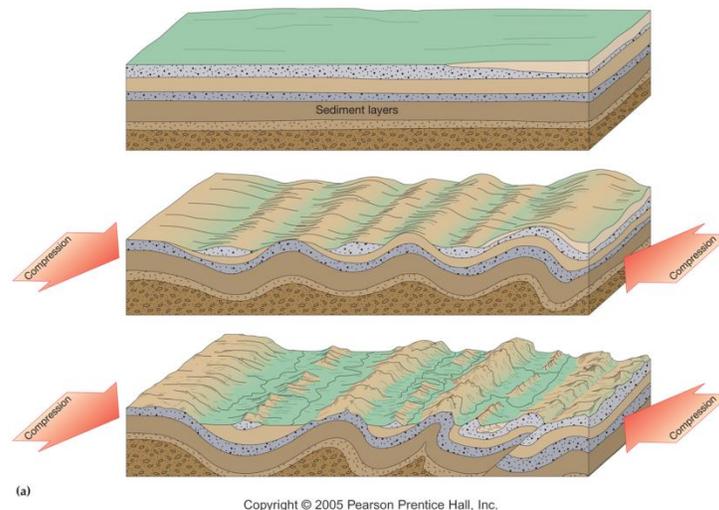
 - o Oceanic-Oceanic Collisions
 - An arc of volcanic mountains will sometimes form where two oceanic plates collide.
 - Example: The _____ Islands in the North Pacific Ocean.

- Continental-Continental Collisions

- Example: The _____ are a result of the Indian plate colliding with the Eurasian plate

- Types of Mountains

- The highest mountain ranges in the world are made up of _____ **mountains** and are commonly found where continents have _____.



- In folded mountains, tectonic movements have _____ rock layers together like an accordion.
- Parts of the _____, the Himalayas, the Appalachians, and Russia's _____ Mountains consist of very large and complex folds.
- **Plateaus** are large areas of _____-topped rocks high above sea level.
 - Most plateaus are formed when thick, horizontal layers of rock are _____uplifted. The area is pushed up gently enough so that the layers remain _____ rather than faulting or folding.
 - Most plateaus are found next to _____ ranges.
 - Example: Tibetan Plateau next to the Himalayan Mountains
 - Example: Colorado Plateau next to the _____
 - Plateaus may also form when layers of _____rock harden and pile up over time.
 - Example: Columbia Plateau

- _____ **-block mountain** – mountain formed where faulting breaks the earth’s crust into large blocks that become _____, causing some blocks to drop down relative to other blocks.
 - Example: Sierra Nevada Range of _____
 - Example: Wasatch Range, Utah

- **Grabens** – long, narrow _____ formed by faulting and downward slippage of a crustal block
 - Example: Death Valley, California

- _____ **mountains** – mountains that form when molten rock erupts onto the earth’s surface
 - Example: Nishinoshima, Japan
 - Example: Mount Hood, Oregon
 - Example: Mount Adams, Washington
 - Example: _____

- _____ **spots** – pockets of magma beneath the earth’s crust that erupt onto the surface, often forming large volcanic mountains
 - Example: _____ Islands

- _____ **mountains** – landform created when molten rock pushes up rock layers on the earth’s surface and the layers then are worn away in places, leaving separate high peaks
 - Example: _____ _____ of South Dakota
 - Example: _____ Mountains of New York State