#8 Plate Tectonics

Plate Tectonics theory: outer portion of Earth consists of number of thick slabs of rock (tectonic plates) that slowly move around globe; In map view, tectonic plate can consist entirely of oceanic crust or both oceanic + continental crust.

In cross-section, tectonic plate = lithosphere - "cool, outer rigid layer where rocks can break, ~100 km thick, includes entire crust + outer part of mantle; below lithosphere is asthenosphere - layer of "hot, weak rock that flows, from ~100 - ~300 km in depth, only mantle rock.

Plate Tectonic Boundaries

Three types of plate boundaries: Divergent, Convergent, Transform

I) Divergent boundary - where plates move apart. Defined by oceanic ridge - undersea volcanic mountain range of non-explosive volcanoes where oceanic crust (basalt) is produced due to rising molten rock (which generates minor EQ's only); cooled rock moves laterally away from ridge.
**Plate Tectonic Boundaries - Divergent**

Divergent boundary/oceanic ridge wraps around globe

Oceanic ridge shown in red

**Plate Tectonic Boundaries - Divergent**

Examples = Mid-Atlantic ridge, Iceland

**Plate Tectonic Boundaries**

II) Convergent boundary - where plates come together; defined by subduction zone, where old ocean lithosphere is subducted (descends back into mantle + melts) + destroyed

Oceanic trench (deep linear trough) = where subduction begins. As crust + mantle melt, produces explosive volcanic eruptions + volcanic mountains

**Plate Tectonic Boundaries - Convergent**

Many earthquakes (EQs, major and minor) as rocks grind past each other

**Plate Tectonic Boundaries - Convergent**

Examples = Andes mountains (ocean/continent convergence), Japan (ocean/ocean convergence)
Plate Tectonic Boundaries - Convergent
Margin of Pacific Ocean = "Ring of Fire" (lots of EQs + volcanoes), there is convergent boundary at most locations

Plate Tectonic Boundaries - Convergent
When all ocean lithosphere is subducted, there is continent/continent collision; continents can't subduct (~low density), creating tremendous mountain range (and major + minor EQs) but no volcanoes (e.g., Himalayas).

Plate Tectonic Boundaries - Convergent
Continent/Continent Collision Zone
Example = Himalayas

Plate Tectonic Boundaries - Transform
Where two plates grind past each other with horizontal motion; defined by major fault (transform fault); not creating new crust or destroying old crust (no rock melts), so no mountains or volcanoes; grinding two blocks of crust past each other, so lots of EQ's (major + minor).

Plate Tectonic Motion - Speed
Plates move at speeds of 2 - 10 cm/yr (measured by age of ocean crust and by accurate positions of locations on Earth from laser-satellite data).
Plate Tectonic Motion - Over Geologic Time

Plates move at speeds of 2 - 10 cm/yr; Over geologic time, Earth’s surface is constantly changing place.

Plate Tectonic Motion - Future Projections

Continent positions 50 m.y. in future.

Plate Tectonic Theory - Future Projections

California

Plate Tectonic Theory - Importance

Why is Plate Tectonics theory relevant to Natural Disasters?