Plate tectonics

- Remarkable fit of Atlantic coastline of Brazil and Africa.
• Remarkable fit of East South America with West Africa
Mesosaurus: Argentina and Namibia

Alfred Wegener

1912 – first ideas

1915: *Die Entstehung der Kontinente und Ozeane* (*The Origin of Continents and Oceans*)

Lacked a convincing mechanism (proposed Coriolis force acting differentially on higher continents versus lower ocean basins)
Paleomagnetism

1600 – Sir William Gilbert demonstrates the Earth behaves as a magnet.

1895 Pierre Curie discovers “Curie Point” at which substances lose magnetism

All minerals have CP’s <800 C, reached at only 30-35kms into crust – so core cannot be magnetite!

Dynamo theory – conductive liquid iron-rich core flows in presence of weak magnetic field = current = feedback to increase magnetic field.
Magnetic Reversals
Movement of magnetic poles, 1590 - 2010

Curie Point: < 800 C
Curie Point: < 800 C
Lava > Curie point, so unmagnetized
As lava cools through ~ 800 C, it acquires a remnant magnetism aligned with current magnetic field
Old rocks retain the magnetic signature (pole direction) prevailing at the time they solidified
Vine and Matthews  1963

Mid-ocean ridges
Vine and Matthews – sea floor spreading
Problem: If the ocean floor is growing, and the Earth isn’t getting bigger...?

Subduction Zone

![Subduction Zone Diagram]
Subduction – angle of descent

Seismicity maps
Mid-Ocean Volcanism

Mauna Loa
13,679 feet (4,169 m)
17 km (~56,000 ft) above ocean floor

BASALT lava; $\text{SiO}_2$ 45-55 wt%; temperature ~ 1000-1200 C,
Low gas content, low viscosity, non-explosive eruptions.
Lava tube, Hawaii

Subduction Zone volcanism

Andesitic lava; SiO$_2$ 55-65 wt%, 800 – 1000 C, high viscosity, high gas content
Pyroclastic flow, Mt Mayon, Phillipines

Redoubt Volcano, Aleutians, Alaska: pyroclastic eruption, April 21, 1990
Subduction zone volcanism
Mid-ocean volcanism (hotspots and sea floor spreading)
Continental volcanism

Costa Rica Geology

North America
South America
Volcanic Impacts on Tropical Ecology

Soils
Local extinctions

Krakatoa 1883

August 27, 1883, generated a 30 meter tsunami in the Sunda Strait which killed about 36,000 people. (contours = travel times in hours)