Global Plate Tectonics

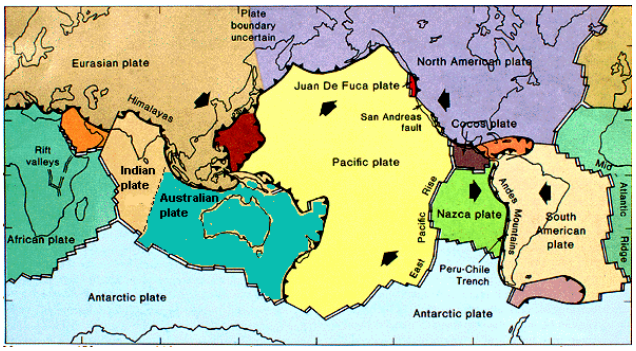
Go to this website to read this USGS online publication
http://pubs.usgs.gov/publications/text/dynamic.html

The "plate tectonics" postulate

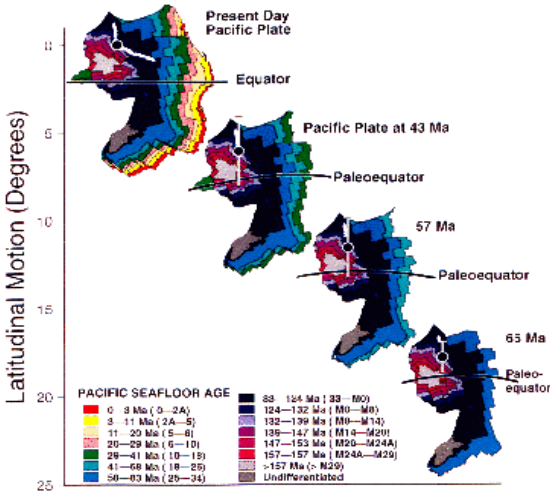
- unifies the earlier hypotheses of continental drift, sea-floor spread and mountain building into a single theme, and
- ascribes the evolution of earth's surface morphology to relative angular motions of rigid lithospheric plates, lithosphere being the Earth's ~150 km thick rigid outermost shell that includes the entire crust and the top part of the mantle.

The basic tenets

- Present ocean floor covers ~70% of earth's surface, and is ≤200 Ma old compared to up to >4 Ga age of continental rocks, but earth has not expanded appreciably during the past ~200 Ma.
- This is because every creation of new surface area as an ocean floor is balanced by the loss of an equal surface area elsewhere (e.g., in a folded mountain belt or a deep sea trench).



The map on the left shows the principal plates of the world.

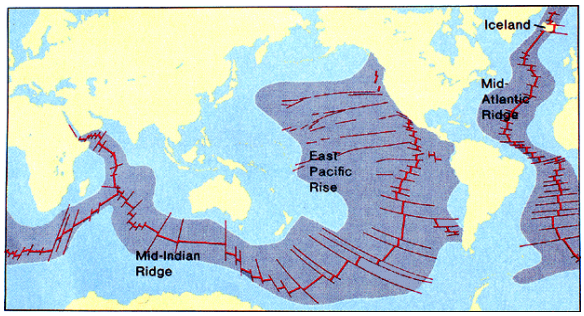


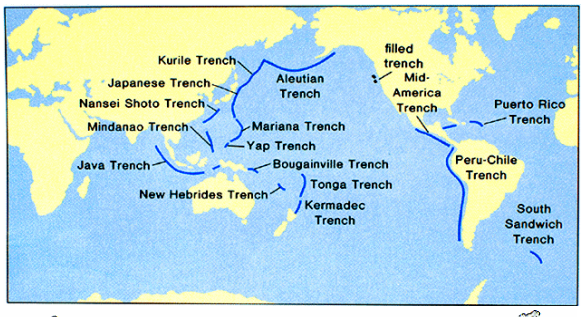
New data suggest that Earth's largest plate, the Pacific plate, moved about 1500 km northward over a 26 Ma period from Late Cretaceous to the late Eocene and another 500 km northward over a 39 Ma period since then (http://www.agu.org/sci_soc/action.html)

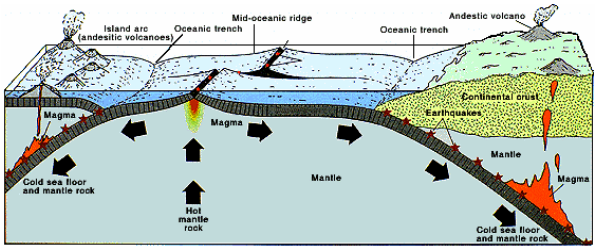
The plate boundaries

The map on the top right shows the distribution of spreading submarine ridges and the bottom map shows the distribution of deep-sea trenches.

- The boundaries of lithospheric (i.e., the crust and the uppermost mantle) plates are essentially "seismic" and can be active or passive
- Active plate boundaries are where lithosphere surface area changes, i.e., the surface is
  - either created, at the divergent or accreting boundaries (the spreading submarine ridges, e.g., Mid-Atlantic Ridge, East Pacific Rise etc.)
  - or destroyed, at the convergent or consuming boundaries (deep-sea trenches, e.g., Mariana trench, folded mountain belts, e.g., Alps and Himalayas, and at trench-mountain pairs, e.g., Peru-Chile trench and the Andes etc.)
- Passive plate boundaries are where lithosphere (or new surface) is neither created nor lost, e.g., San Andreas Fault.







Mantle convection offers a plausible mechanism for plate motions.

Plate tectonics postulate explains the Pacific "Ring of Fire" and the reason why earthquakes are so common in the deep sea trenches, folded mountain belts and similar tectonically active regions.