Plate Tectonics

Chapter 2

Interactions at plate boundaries depend on the direction of relative plate motion and the type of crust.

Which kind of plate boundary is associated with Earthquake activity?

A. Divergent Boundary
B. Convergent Boundary
C. Transform-fault Boundary
D. All of the above

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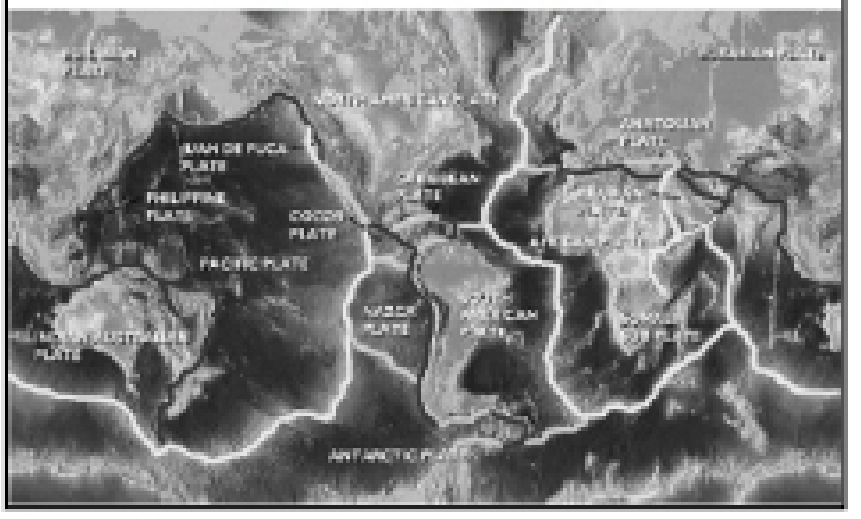
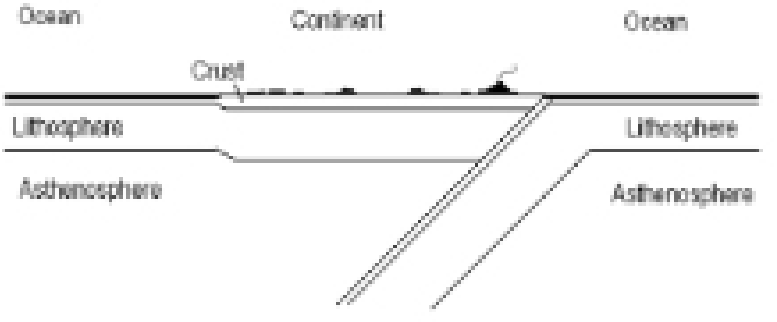
Plate Tectonics: Learning Goals

- ***Scientific Method***
  - ***Development of Plate Tectonics Theory***
- ***Lithosphere vs Asthenosphere***
- ***Crust vs Mantle***
- ***Plates contain continent and ocean***
- ***Plate boundaries (where the action is)***
  - ***Convergent Boundaries***
  - ***Divergent Boundaries***
  - ***Transform Boundaries***

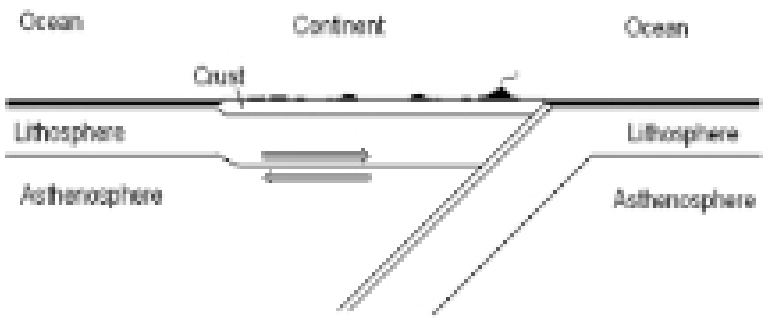
Divergent, Convergent and Transform plate boundaries



Crust and Mantle vs Lithosphere and Asthenosphere



Plates are lithosphere: Both continent and ocean crust



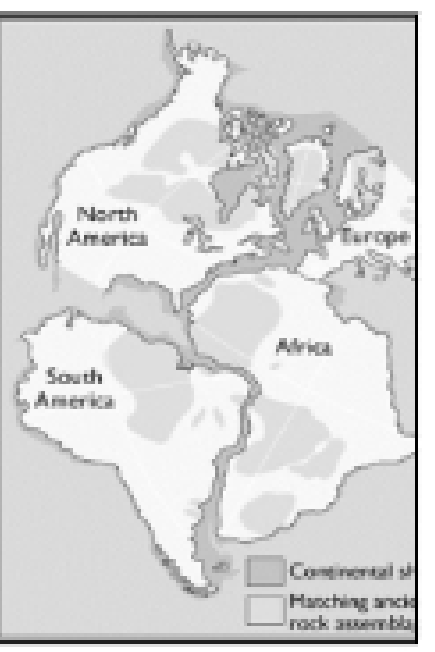
Scientific Method

- **1. Observation (fact)**
  - *This is a repeatable measurement or experiment*
- **2. Hypothesis**
  - *One or more possible explanations to link observations*
- **3. Testing**
  - *Further experiment or observation to test hypothesis*
  - *Non-testable hypotheses also rejected*
- **4. Theory**
  - *A grand or unifying hypothesis that has survived tests*
  - *Relativity, Evolution, Plate tectonics*

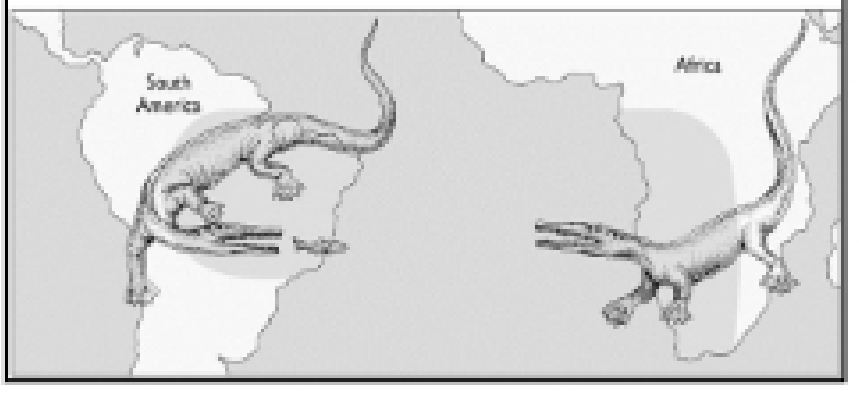
1. Observation: Early Evidence (Wegener)

- ***The geometric fit of the continents.***
- ***The similarity in rock age groups between adjoining regions.***
- ***The similarity in Paleozoic fossils between adjoining areas.***
- ***The distribution of Paleozoic glaciation in S.America, S.Africa, Australia, and India.***

The geometric fit of the continents.



Similarity of Paleozoic Fossils in adjoining regions.



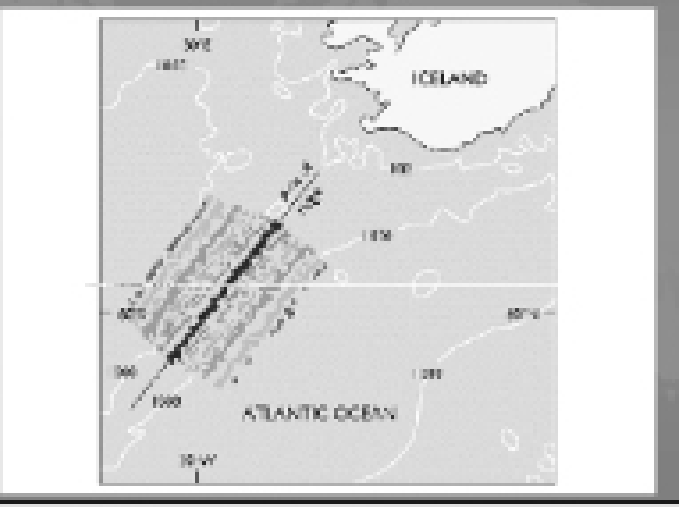
Early Objections

- *Mantle is solid*
  - *(Transmits Shear waves).*
- *How can continents move and remain intact?*
- *What is the driving force?*

1960s: Compelling New Evidence: Magnetic Anomalies

- *Magnetic minerals such as magnetite (Fe_3O_4) record Earth's magnetic field.*
- *They also perturb the field by a small amount.*
- *Perturbations are called magnetic anomalies.*
- *Anomalies can be mapped using magnetometers dragged behind aircraft or ships.*

Magnetic stripes on ocean floor



Magnetic Anomalies

- *Anomalies were first solid evidence of sea-floor spreading.*
- *Here was a credible hypothesis that demanded testing.*

2. The Hypothesis:

- *The continents have moved (drifted) over geologic time so that North and South America have separated from Europe and Africa.*