

How Do Geologists Know?

Research Methods in Earth Science

CC 3.32, Lecture 2

How does a historian approach
a research problem?

How does a historian approach
a research problem?

- Analysis of written accounts
- Analysis of official records
- Analysis of film, photos, paintings
- Interviews

How does a scientist approach
a research problem?

How does a scientist approach a research problem?

- "Scientific Method"
- Experiments
- Field observations
- Modeling/Simulation

How does an earth scientist approach a research problem?

How does an earth scientist approach a research problem?

- "Scientific Method"
- Experiments
- Field observations
- Modeling/Simulation

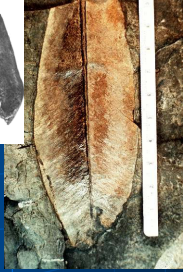
Continental Drift:
A Case Study in Methods of Earth Science



Alfred Wegener (1880-1930)

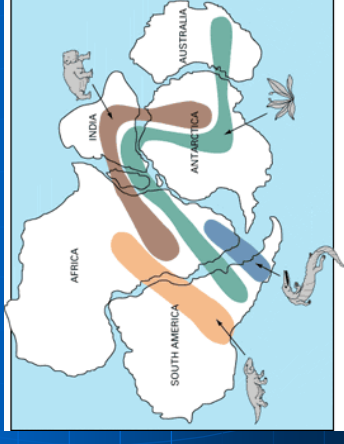


- An accomplished meteorologist and hot air balloonist (*a man who liked maps!*)
- Browsing maps in the library of the University of Marburg in 1911
- Noted the occurrence of identical fossils on landmasses that are separated by oceans

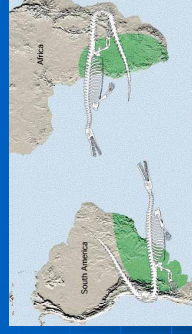


New Hypothesis:

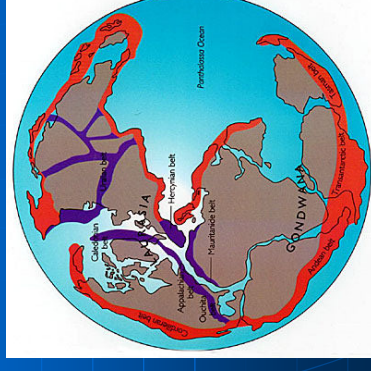
The Oceans Had Not Existed and the Continents Were Once Connected



Conventional Wisdom: Animals Migrated Across Land Bridges



Tests of the New Hypothesis:
Distinct Rock Units Should Connect in a
Pattern Similar to that of the Fossils



Tests of the New Hypothesis: Paleoclimate Patterns Should be Consistent with Rock and Fossil Patterns

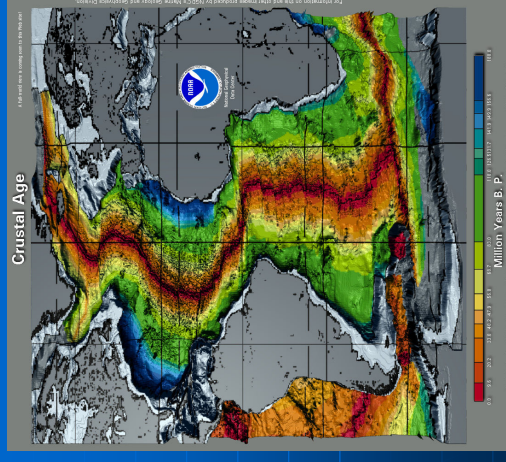


Patterns Fit, But Is It Possible?

- Tremendous amount of energy needed to move continents around the globe
- Wegener proposed that centrifugal force on the spinning Earth pushed continents from the south pole to the equator
- Modeling/simulation indicated that this would be insufficient
- Wegener proposed that the moving continents plowed through the oceans like an icebreaker
- Experiments indicated that oceanic rock is stronger than continental rock, and so oceans would have cut through the continents

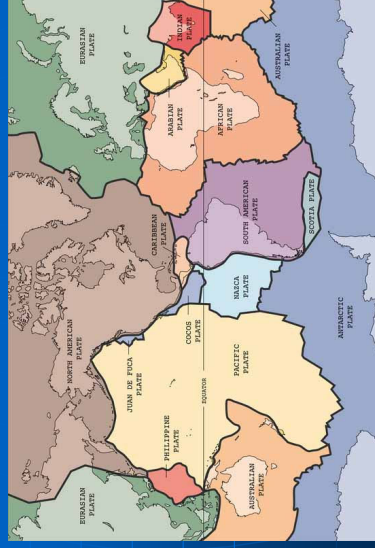
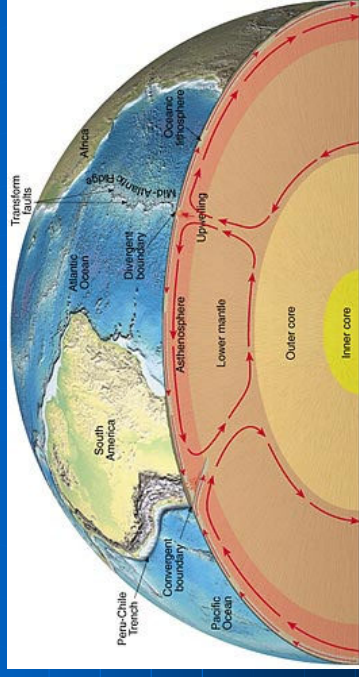
Continental Drift was a Model without a Mechanism!

Mapping the Ocean Floor: A Vital Set of Field Data (Post 1950)



Symmetry of Both Topography and Age

The Plate Tectonic Model: Field Data Supported by Experiment and Simulation



New Methods in the Computer Age: Geophysical Modeling

