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?

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

Research Methods in Earth Science
CC 3.32, Lecture 2
How does a scientist approach a research problem?

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

Continental Drift: A Case Study in Methods of Earth Science

How does an earth scientist approach a research problem?

- Scientific Method
- Experiments
- Field observations
- Modeling/Simulation
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
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
- Experiments indicated that oceanic rock is stronger than continental rock, and so oceans would have cut through the continents

Wegener proposed that the moving continents plowed through the oceans like an icebreaker

Continental Drift was a Model without a Mechanism!

Symmetry of Both Topography and Age

Tests of the New Hypothesis:

Paleoclimate Patterns Should be Consistent with Rock and Fossil Patterns

Mapping the Ocean Floor:
A Vital Set of Field Data (Post 1950)
The Plate Tectonic Model: Field Data Supported by Experiment and Simulation

New Methods in the Computer Age: Geophysical Modeling