

# Continental Drift and Plate Tectonics

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# Take-Away Points

1. How we know plate tectonics happens
2. Most earthquakes and volcanoes occur along plate boundaries
3. New ocean crust is created along mid-ocean ridges
4. Old ocean crust is recycled at subduction zones
5. Subduction zones are where mountain-building (orogeny) occurs
6. Small pieces of crust (terranes) are important in building up continents
7. Hot spots are long lived stationary magma sources

# Global Problems in Geology

Distribution of Continents

Mid-ocean Ridges

Trenches

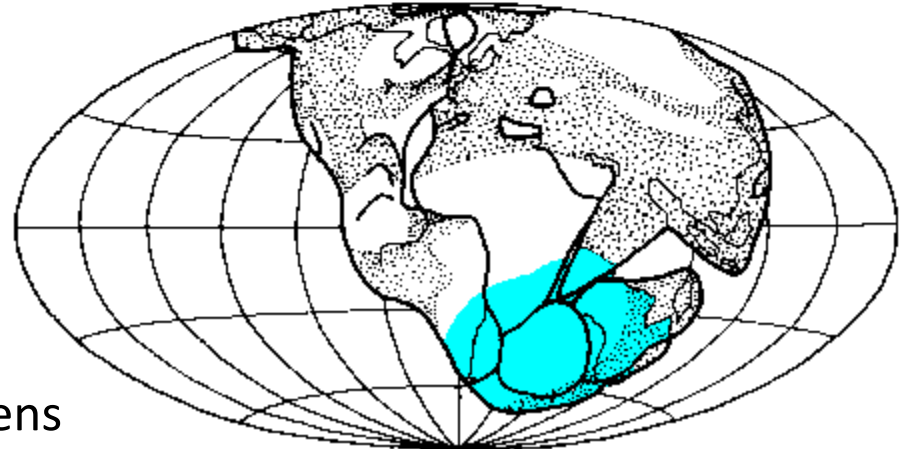
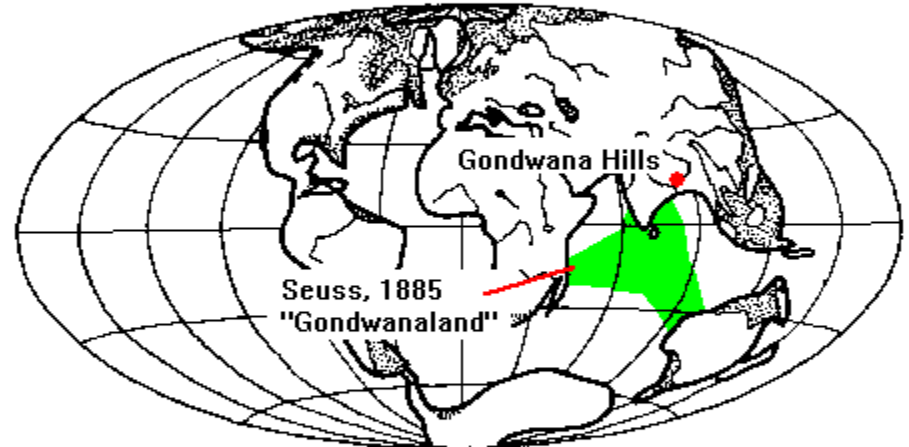
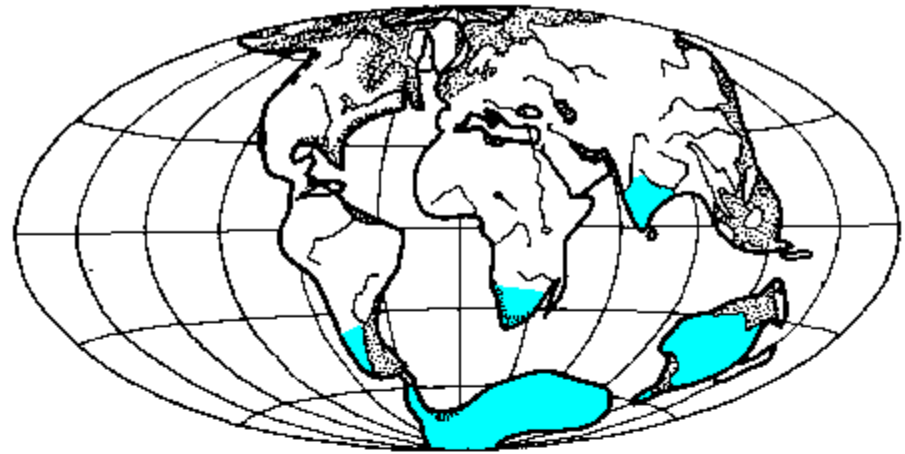
Orogenic Belts

- Deformation
- Metamorphism
- Volcanism
- Earthquakes

# Development of Continental Drift

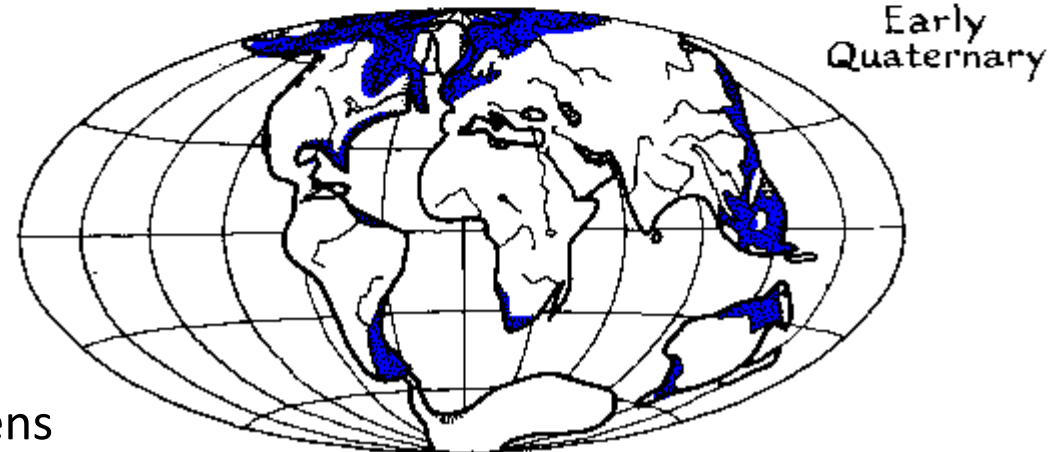
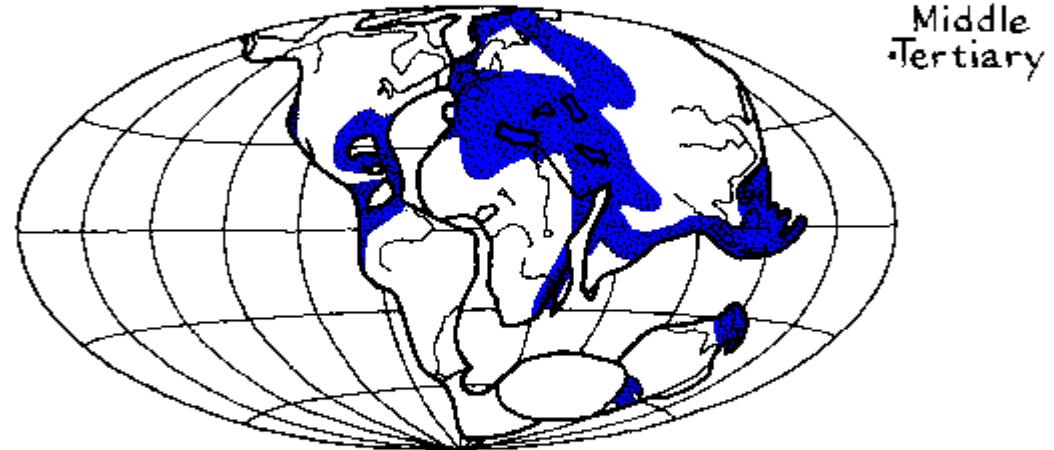
- Lots of people had noticed that the coastlines of Africa and South America are similar
- Frank Taylor (1910)
- Alfred Wegener (1912) *Die Entstehung Der Kontinente Und Ozeane*

# The Permian Ice Age Problem



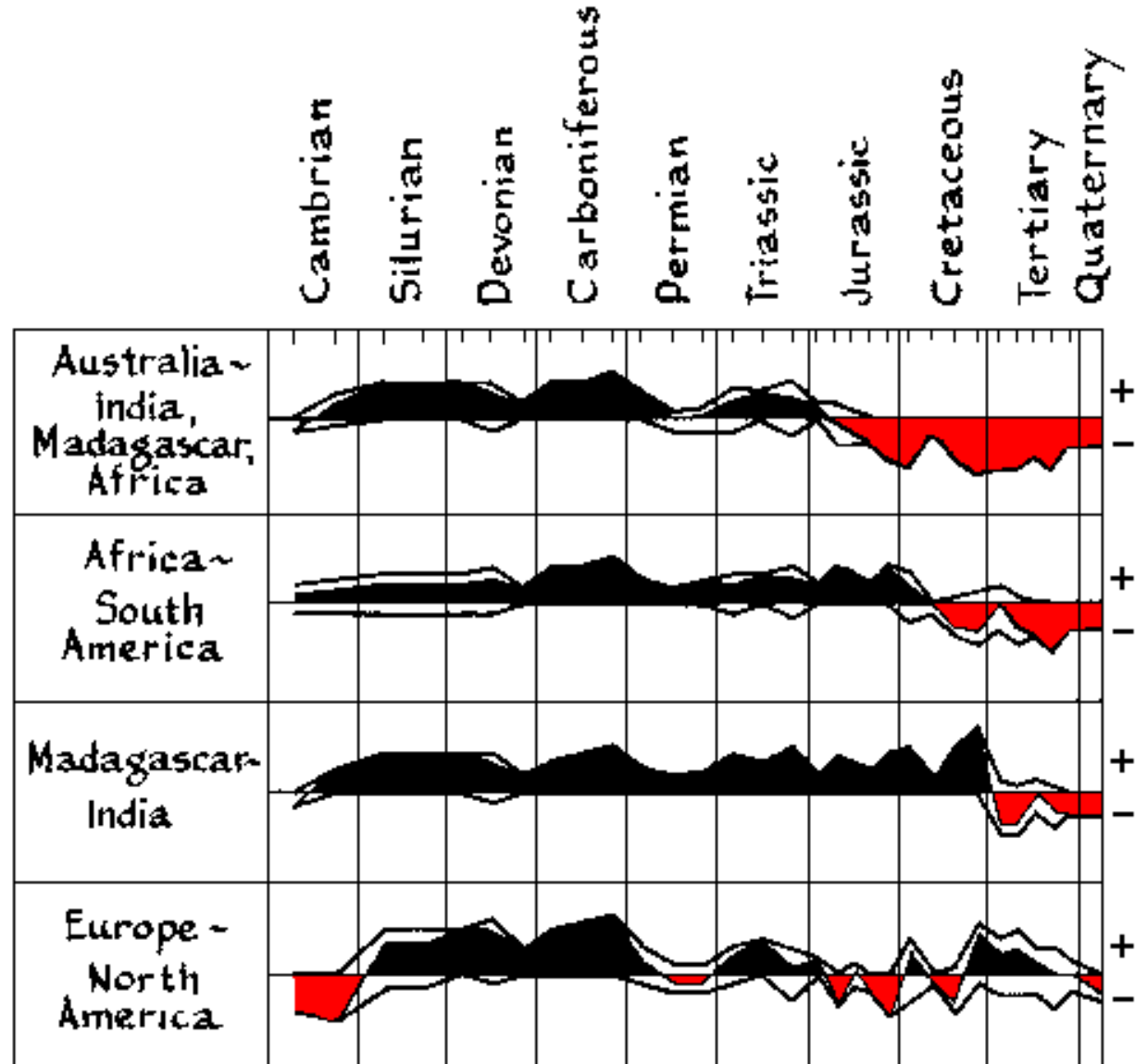
1. How we know plate tectonics happens

# Wegener's Theory



1. How we know plate tectonics happens

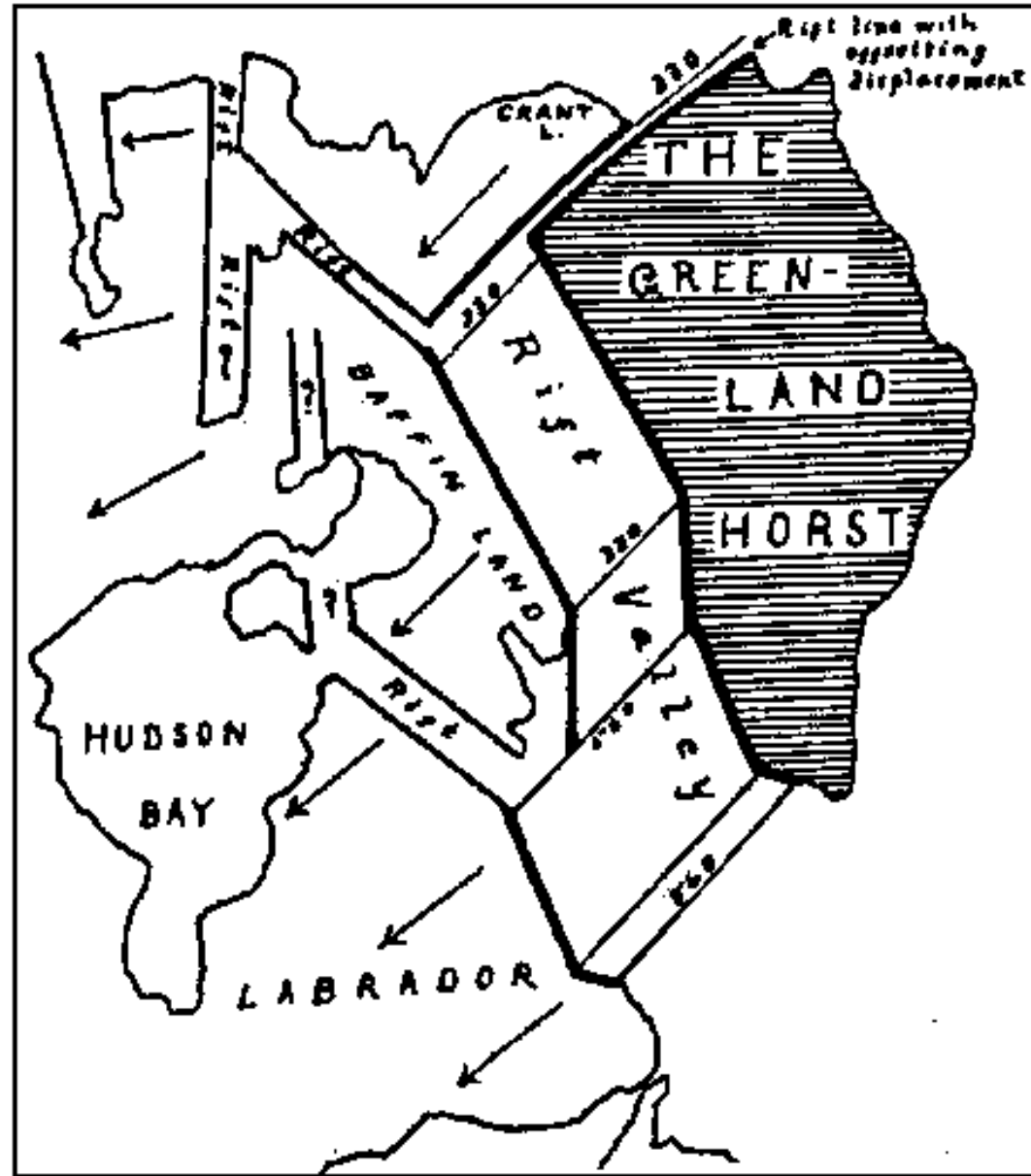
# Dating the Breakup



1. How we know plate tectonics happens

# Frank Taylor

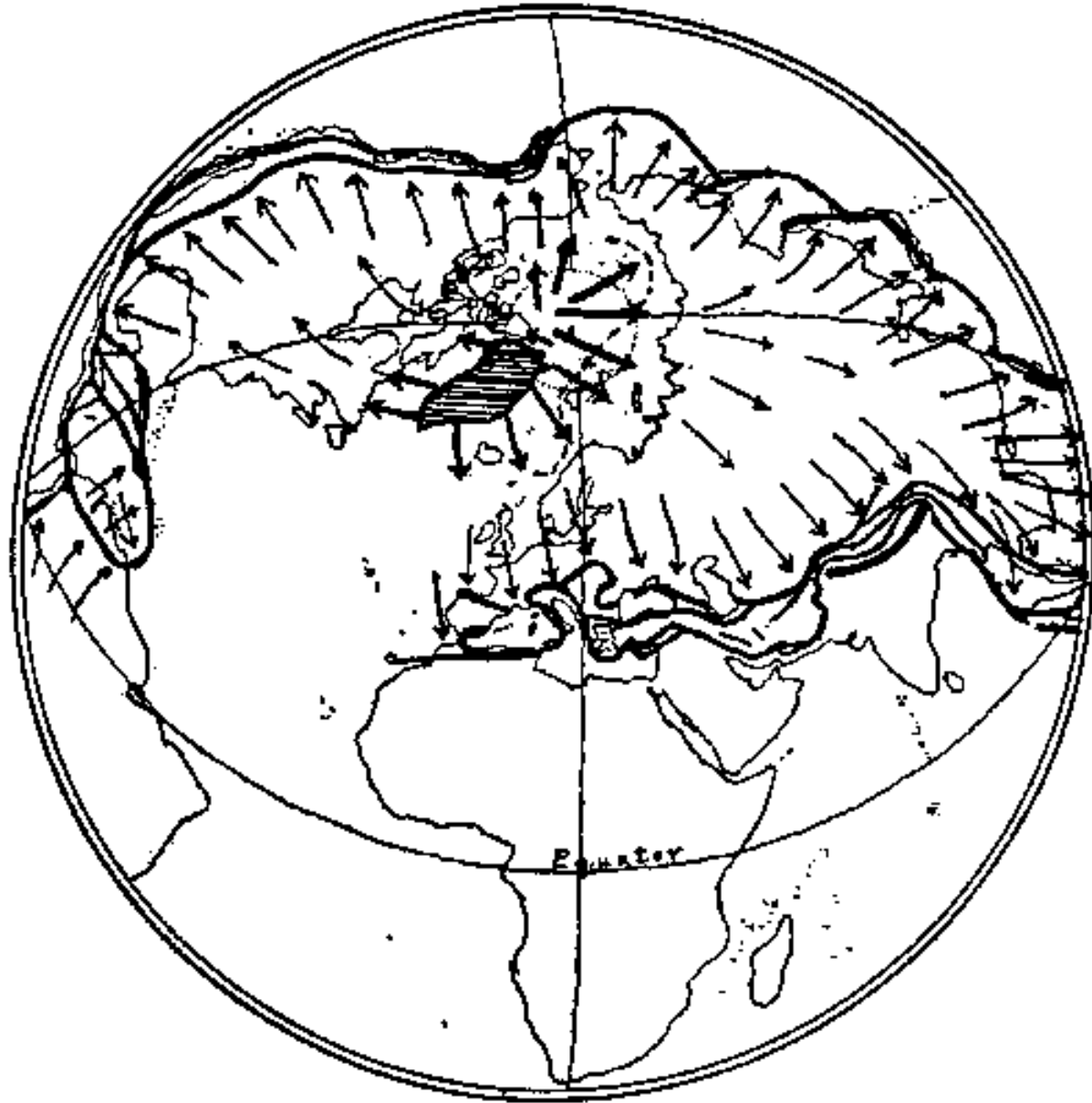
- In some respects, Taylor's ideas were more modern than Wegener's
- Taylor always thought Wegener had stolen credit from him





# Frank Taylor

- Recognized role of Mid-Atlantic Ridge
- Never reconstructed the continents like Wegener did

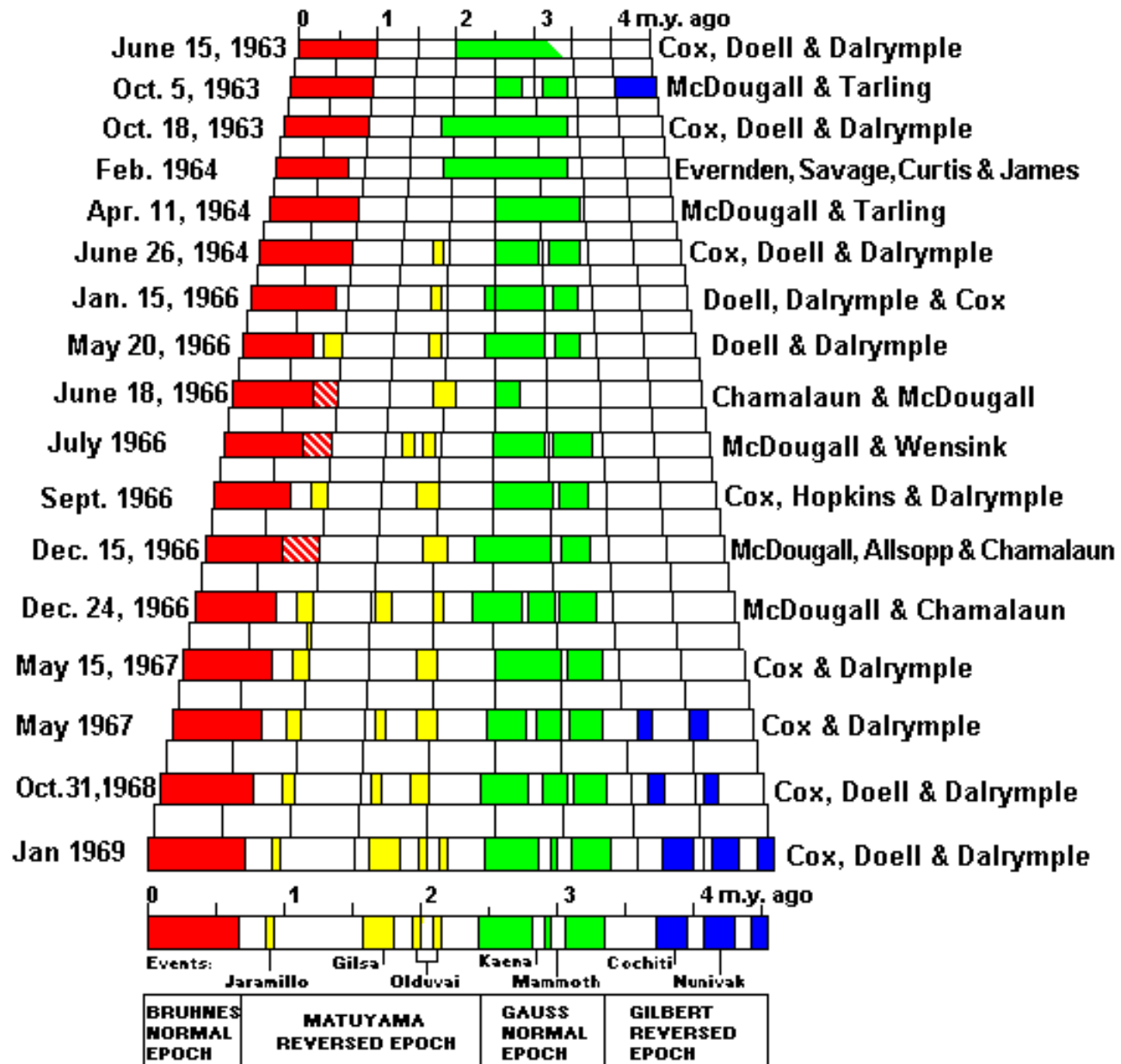


1. How we know plate tectonics happens

# Confirmation of Continental Drift

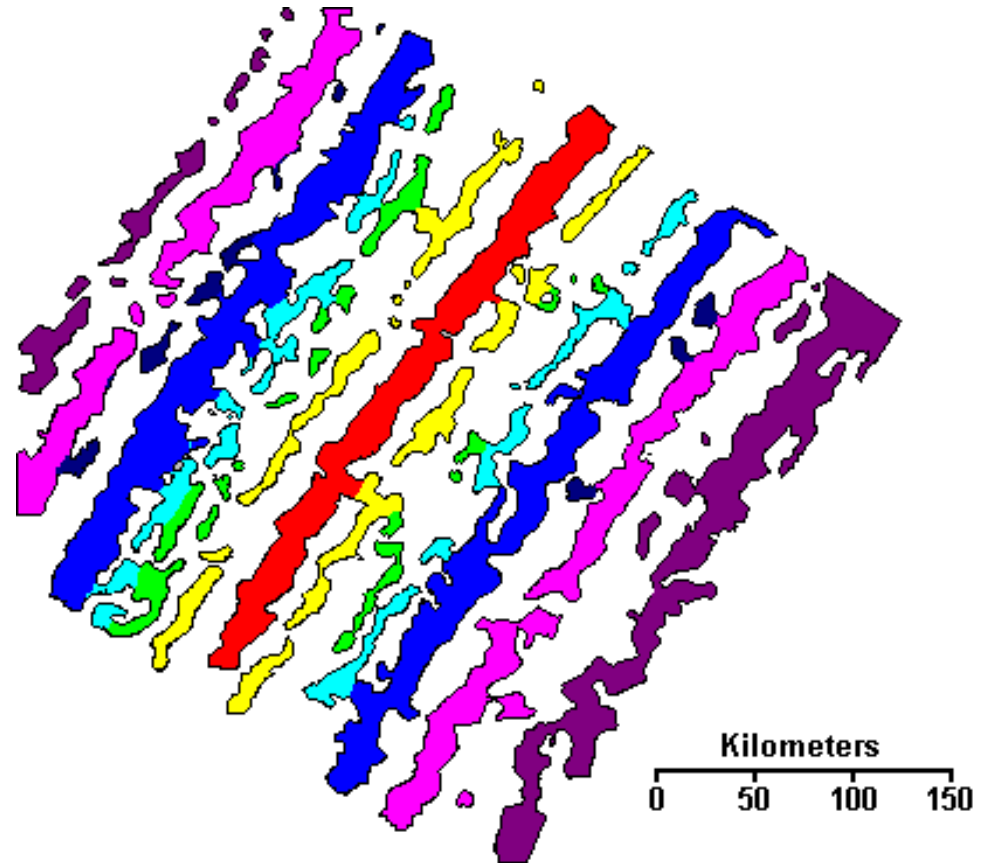
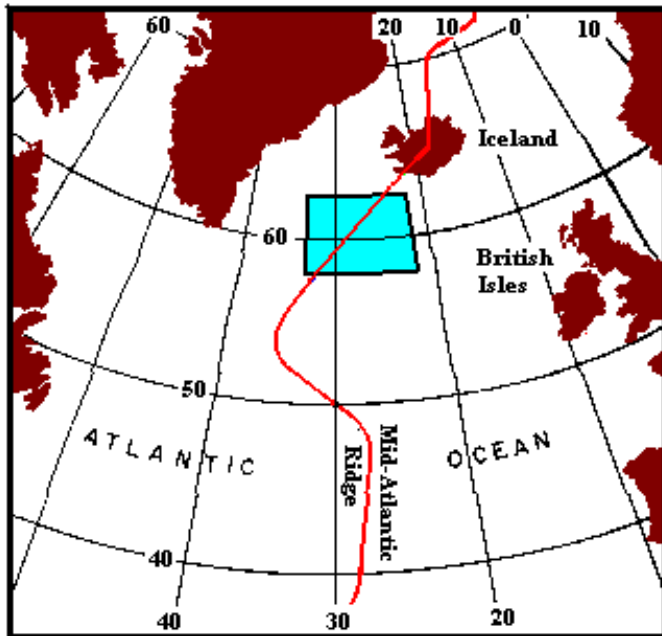
- World War II technology
- International Geophysical Year (IGY) 1957-58
- Worldwide Standardized Seismic Network 1963-

# The Geomagnetic Reversal Time Scale



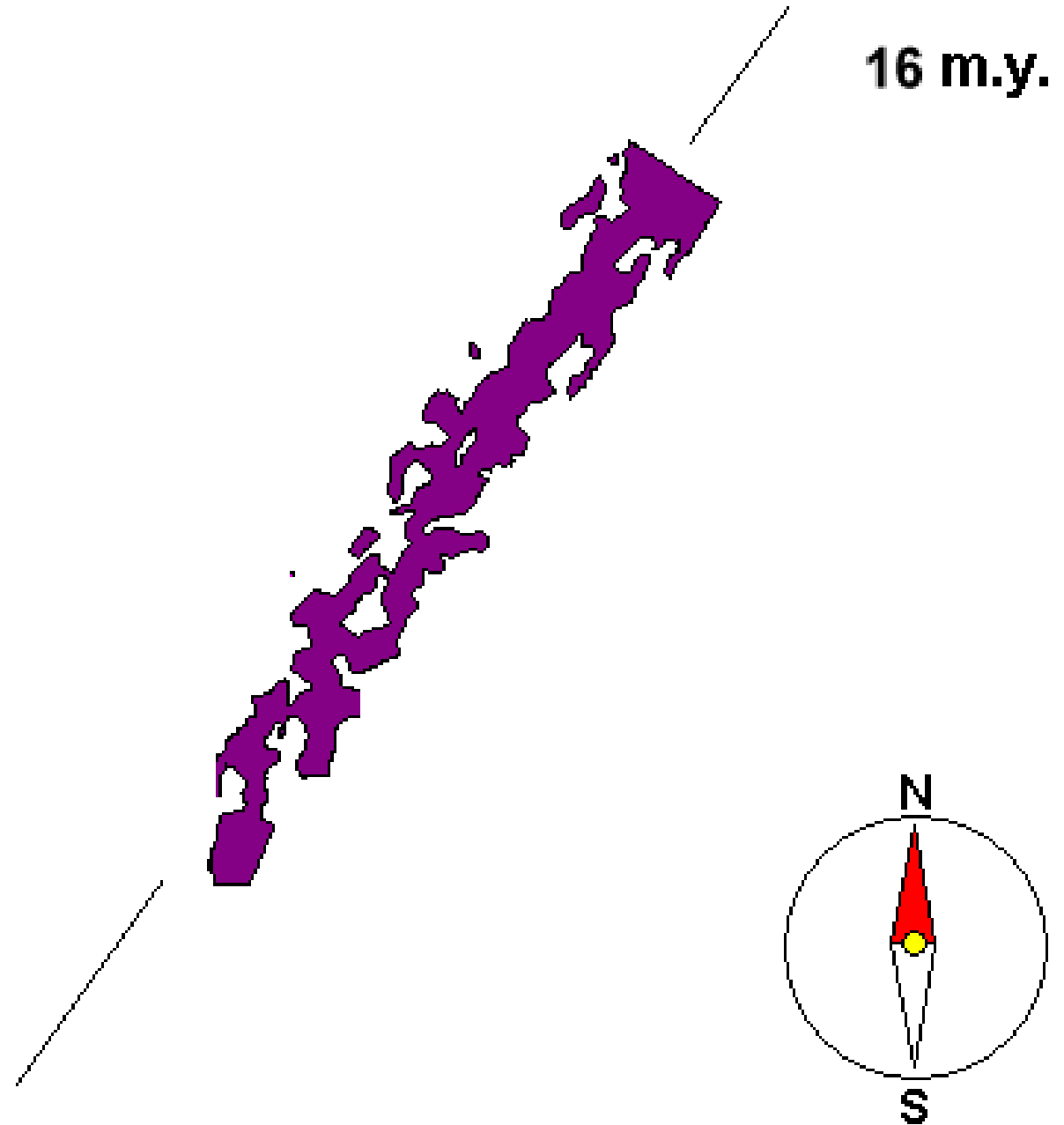
1. How we know plate tectonics happens

# Discovery of Sea-Floor Spreading



1. How we know plate tectonics happens

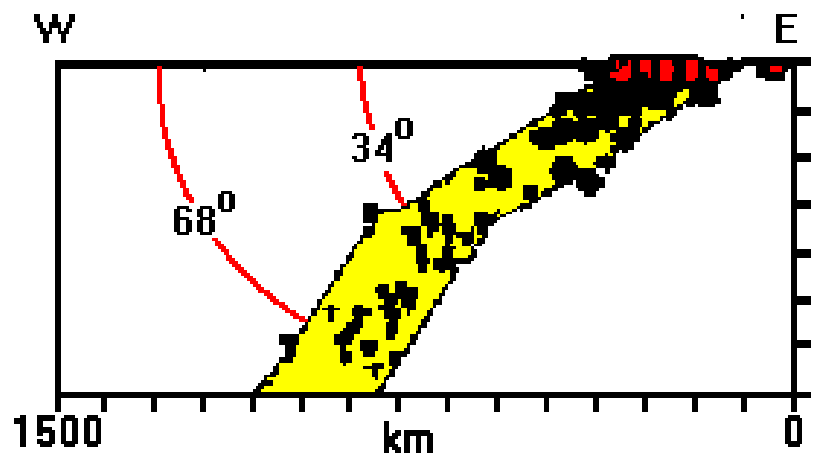
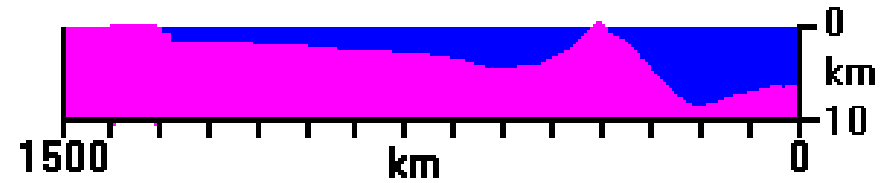
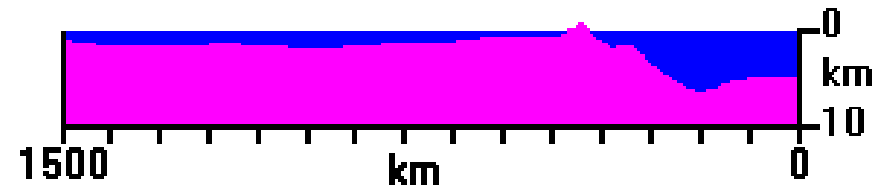
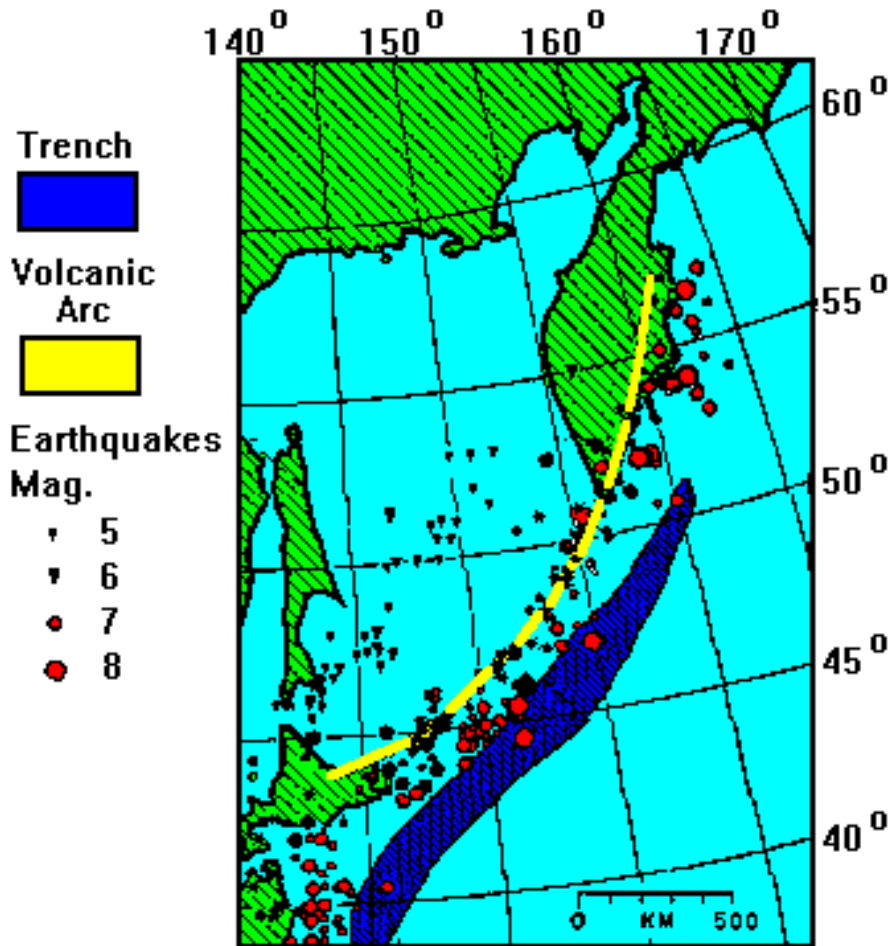
# Sea-Floor Spreading



1. How we know plate tectonics happens

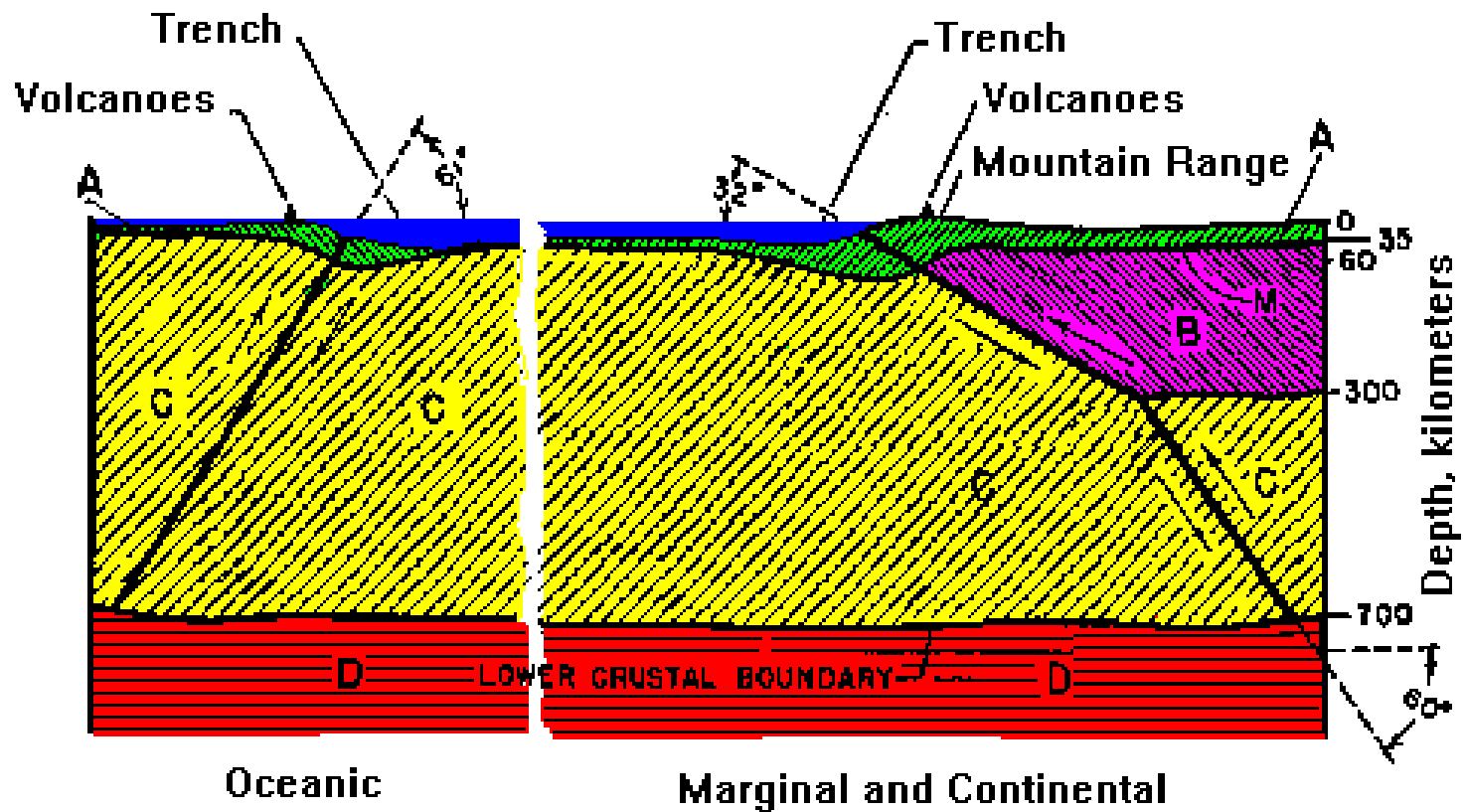
# Where Does Ocean Crust Go?

Hugo Benioff, 1954



1. How we know plate tectonics happens

# Benioff's Interpretation



1. How we know plate tectonics happens

# Benioff's Interpretation Updated



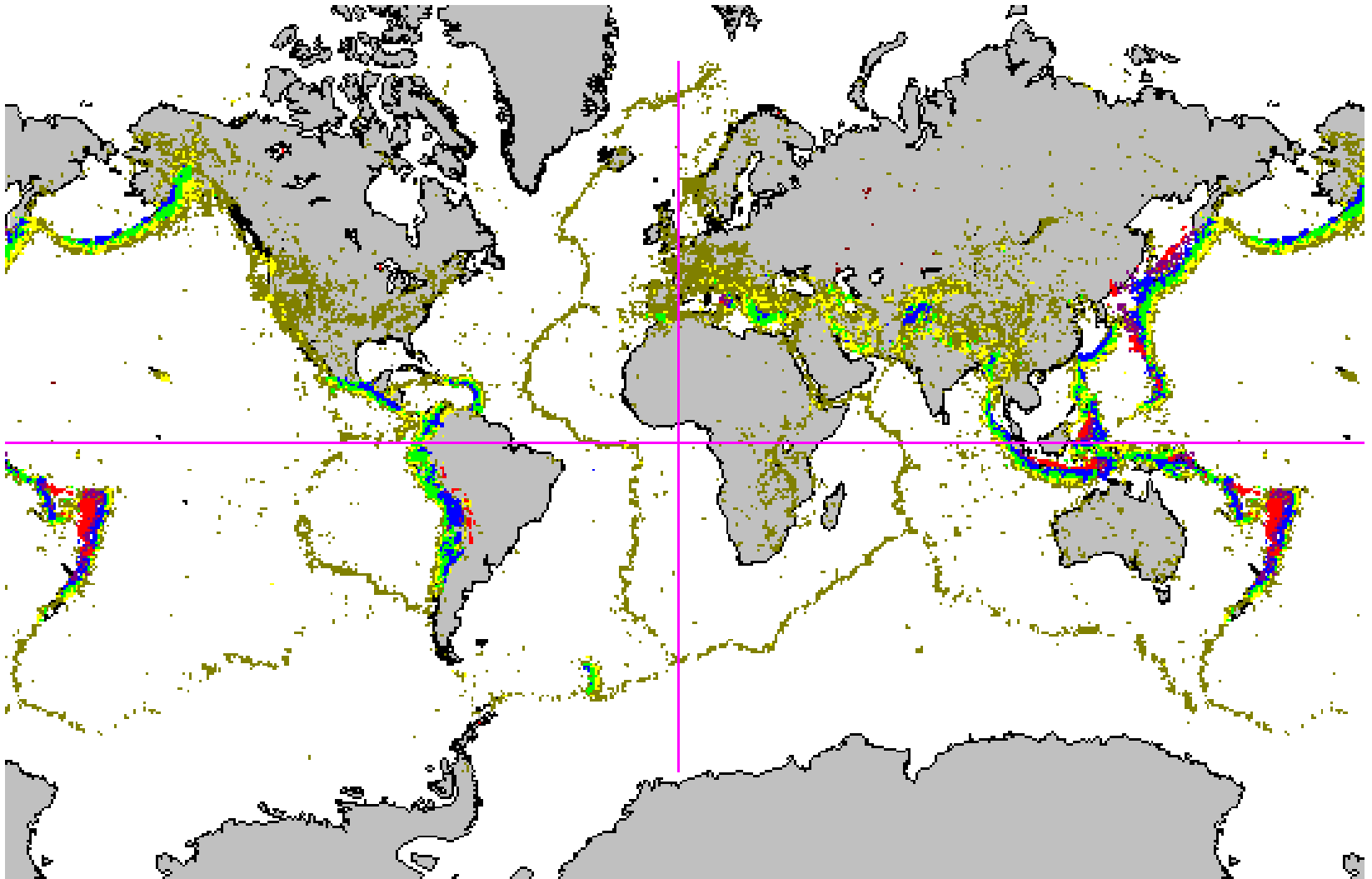
Oceanic

Marginal and Continental

1. How we know plate tectonics happens

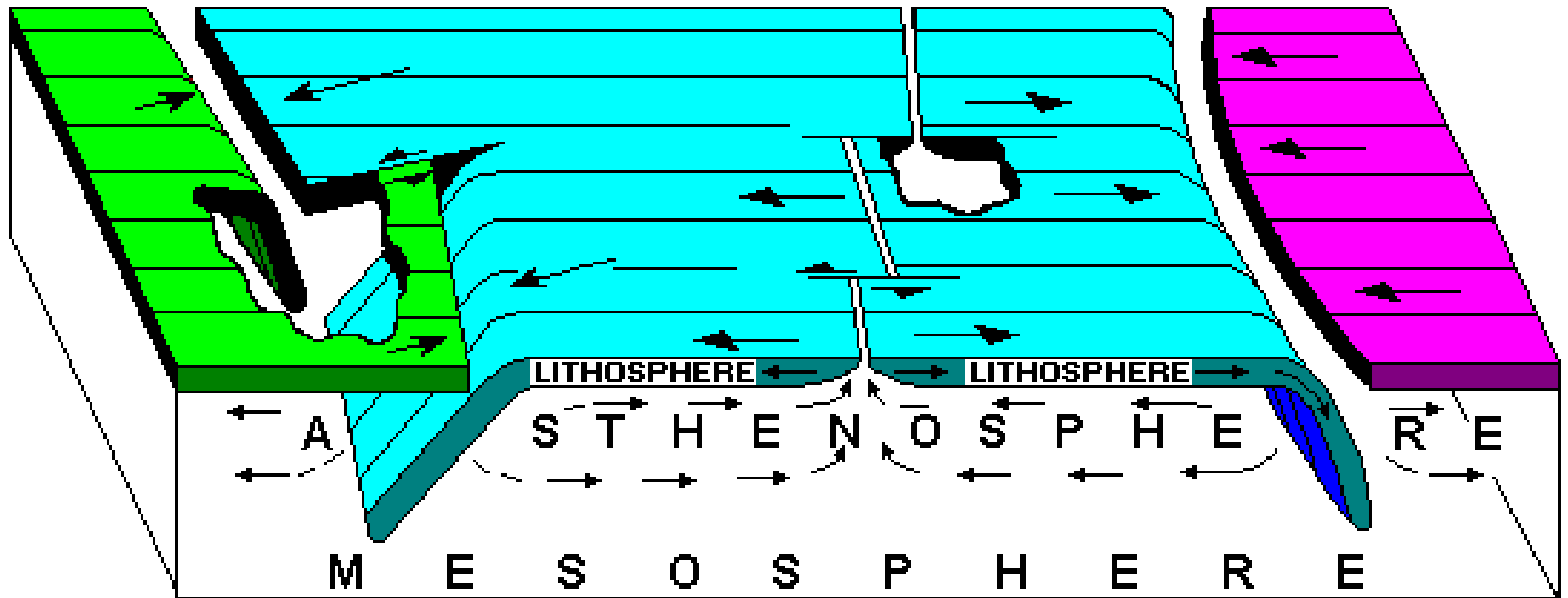


# Worldwide Standardized Seismic Network

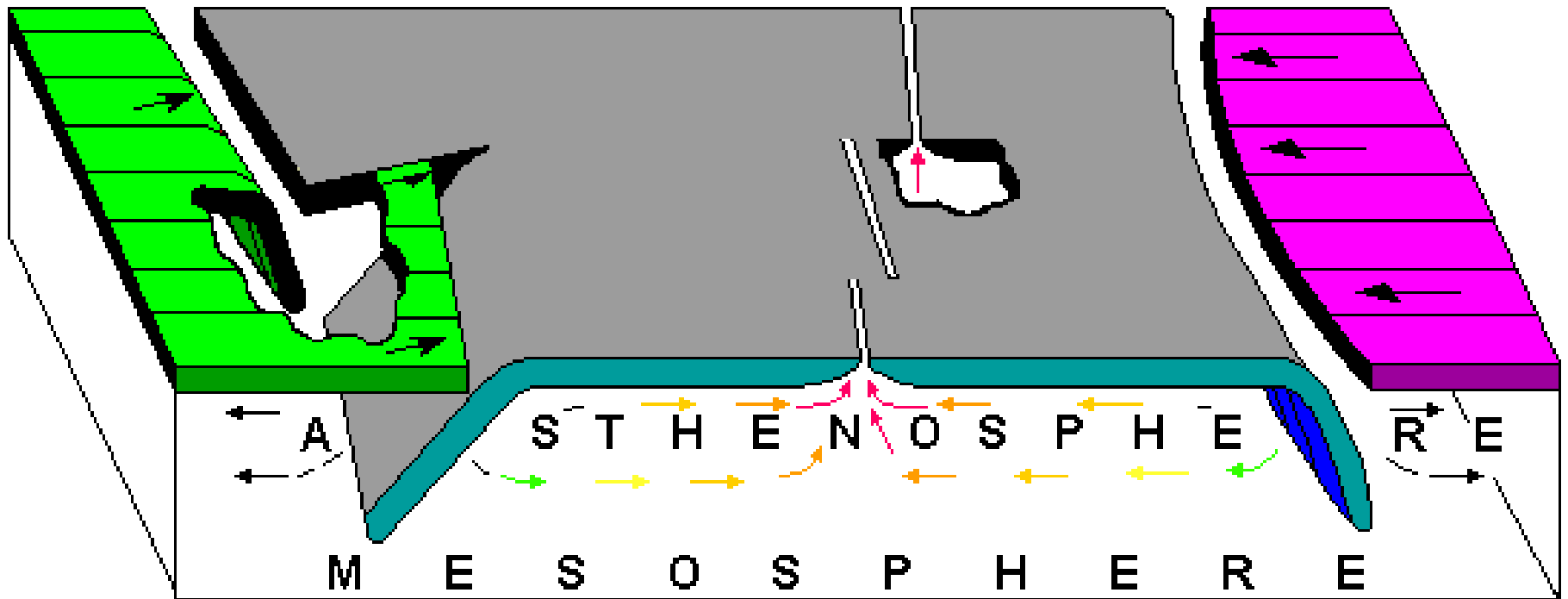


2. Most earthquakes and volcanoes occur along plate boundaries

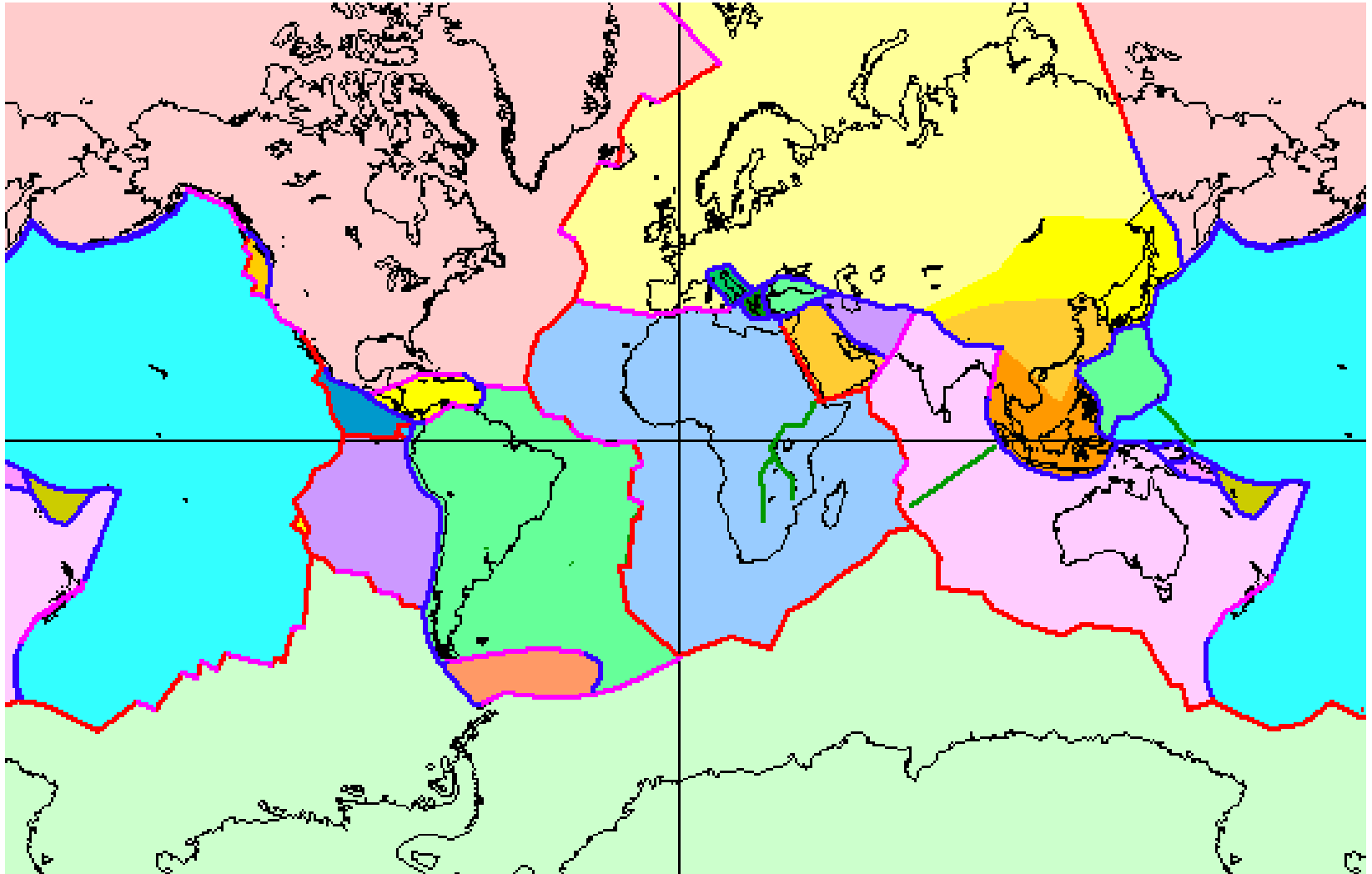
# The Plate Tectonics Model



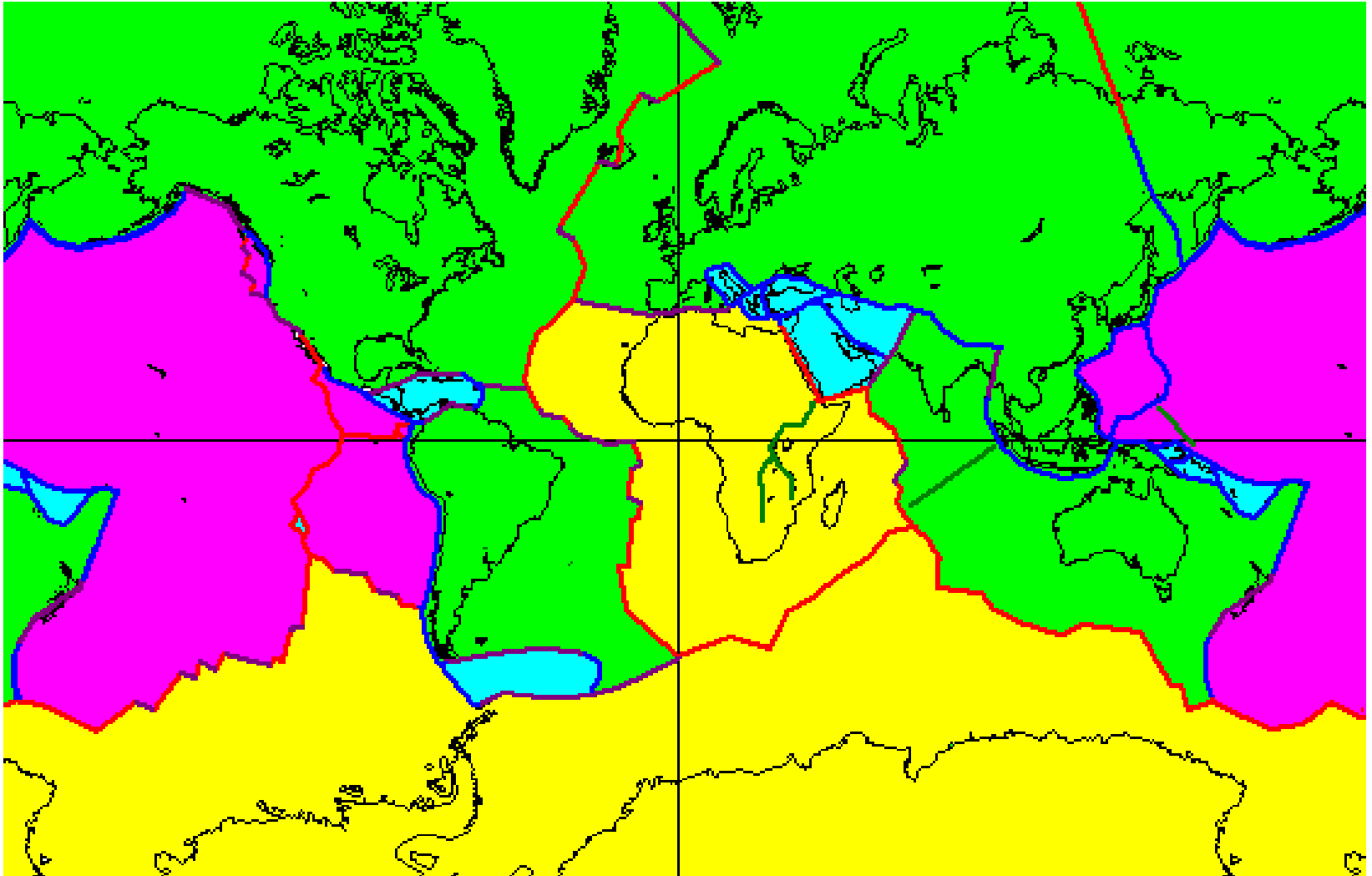
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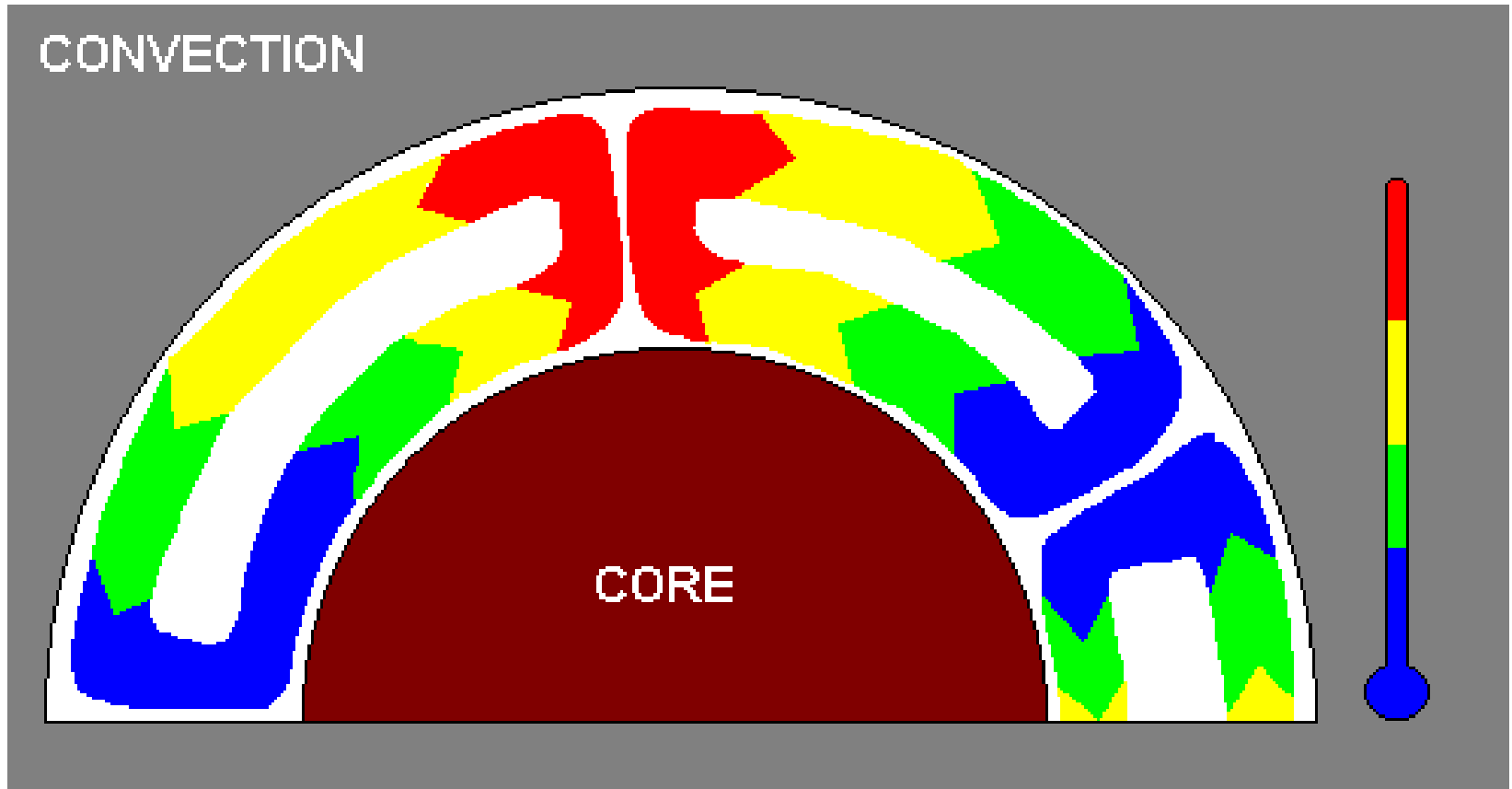
# The Earth's Plates



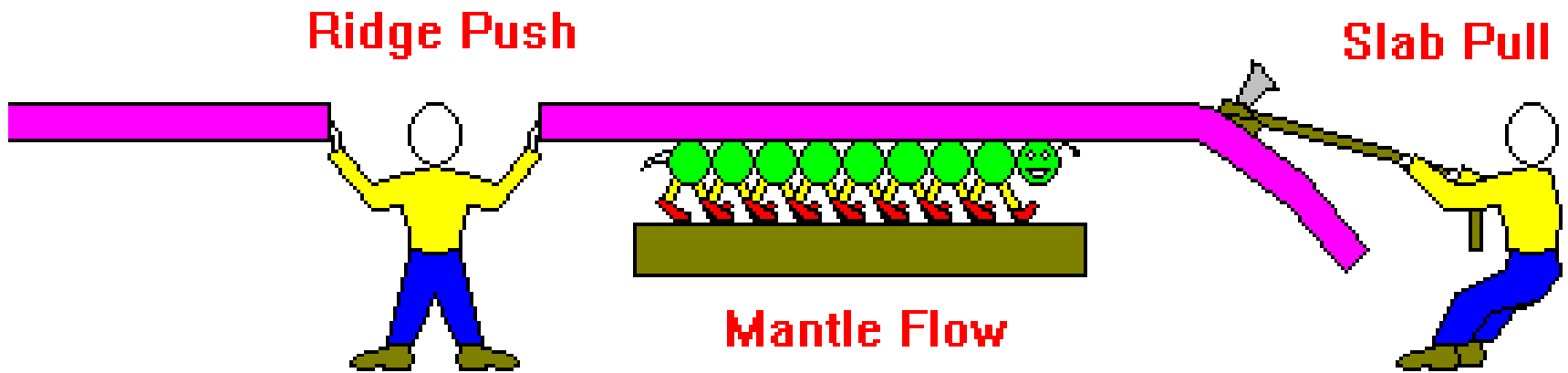
# Global Plate Motions



# What Drives It: Convection



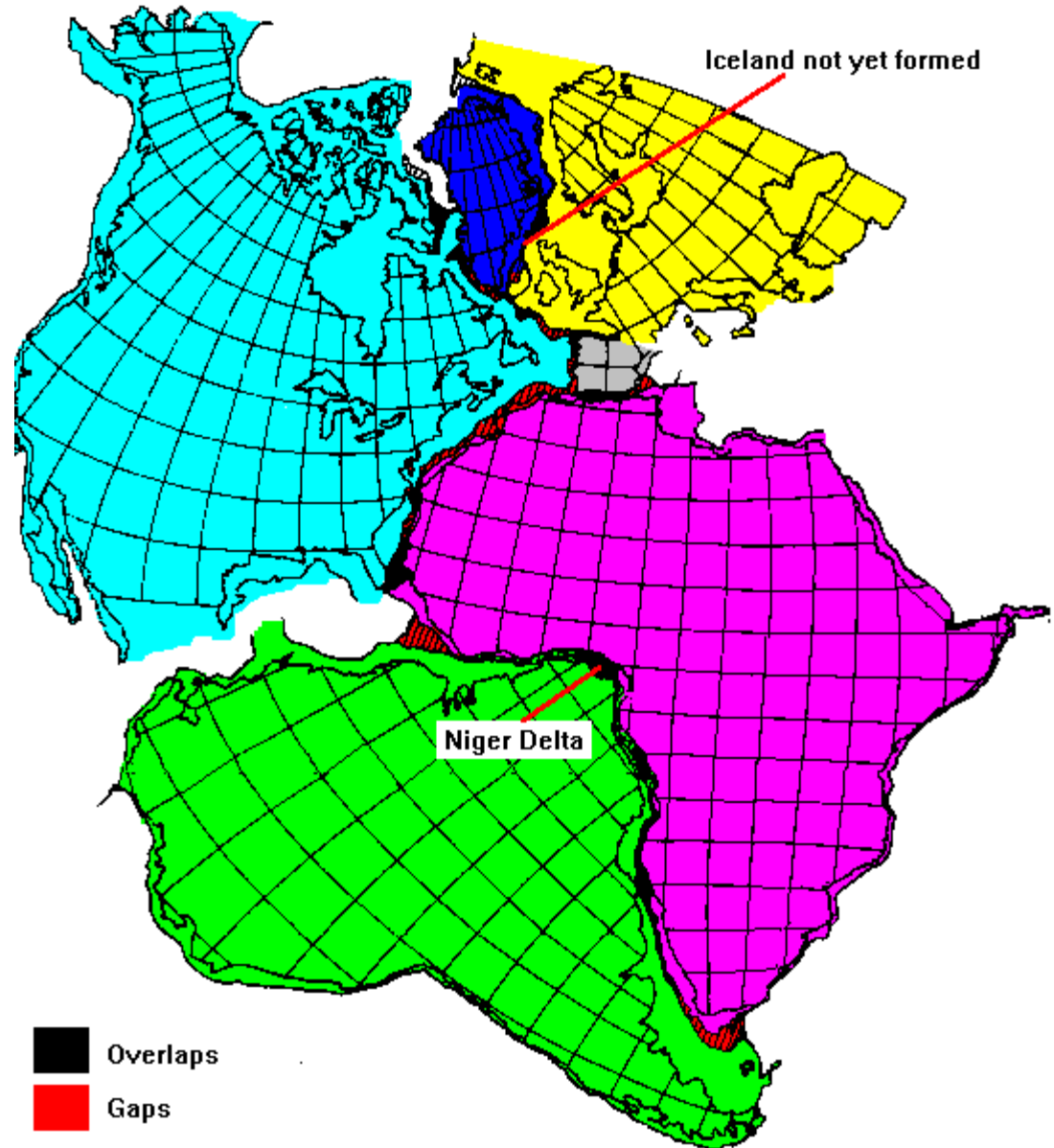
# How Plates Move



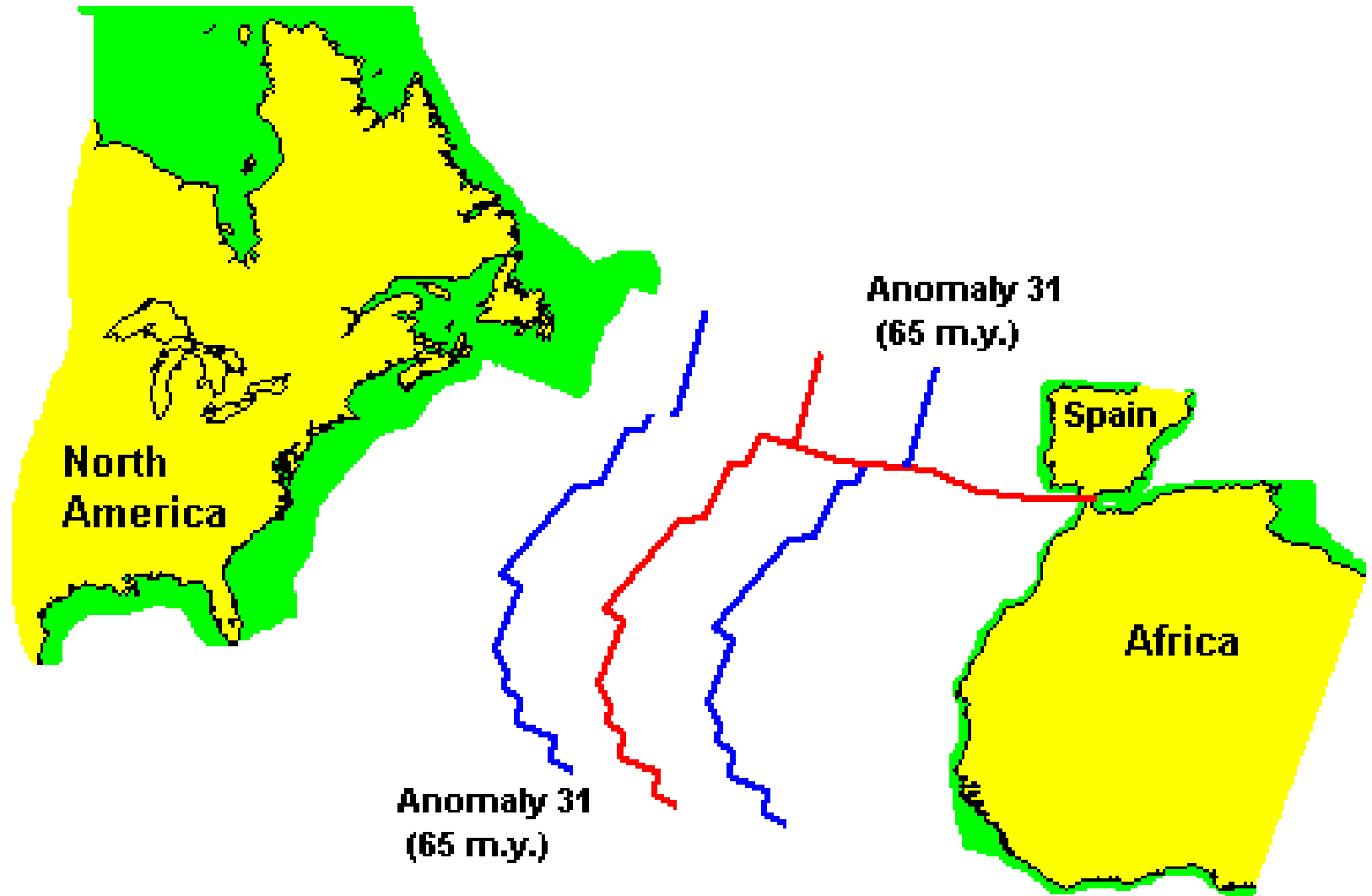
# Reconstructing Plate Movements



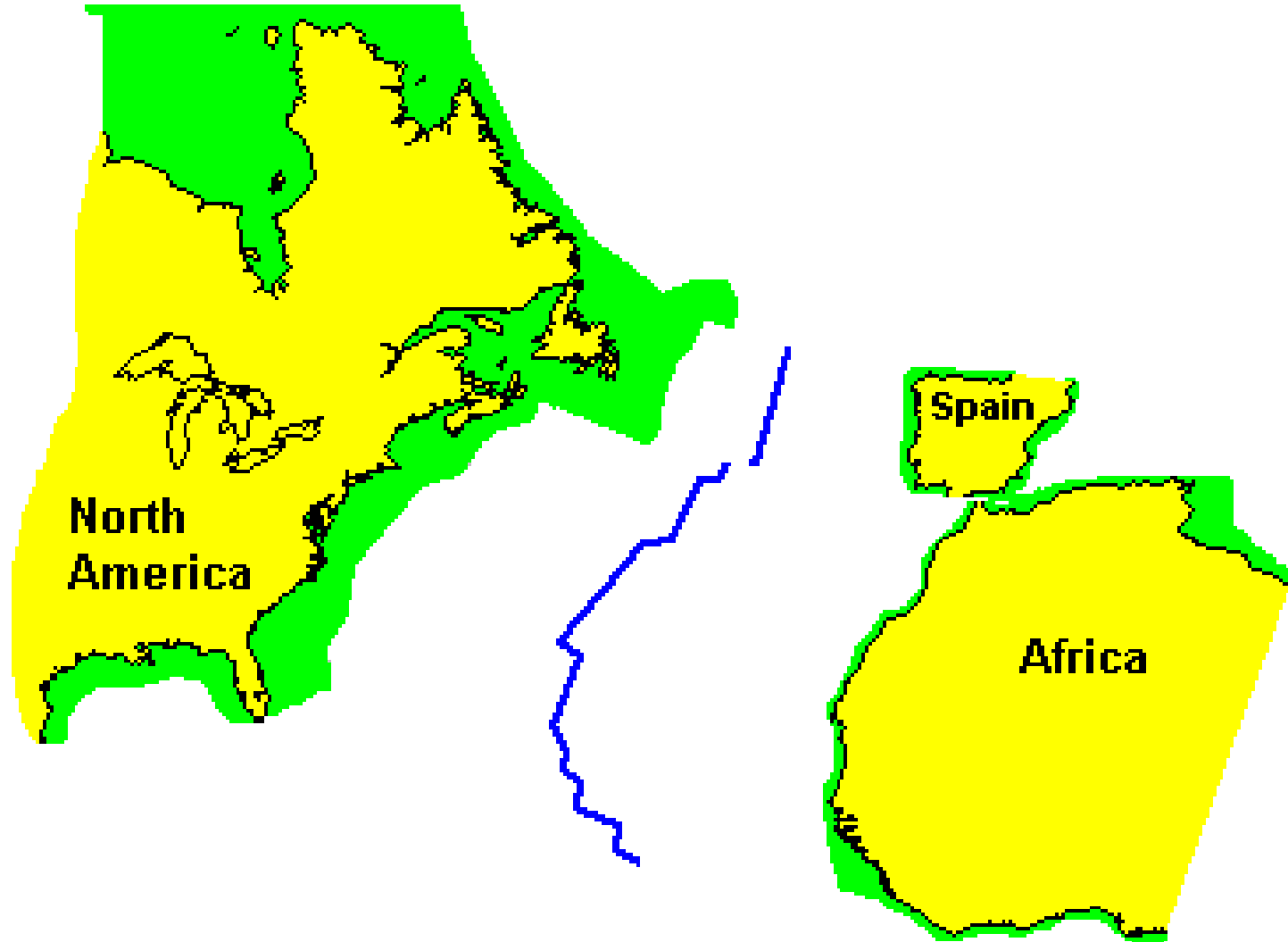
# Fit of Continents Across the Atlantic



# Present Day Atlantic

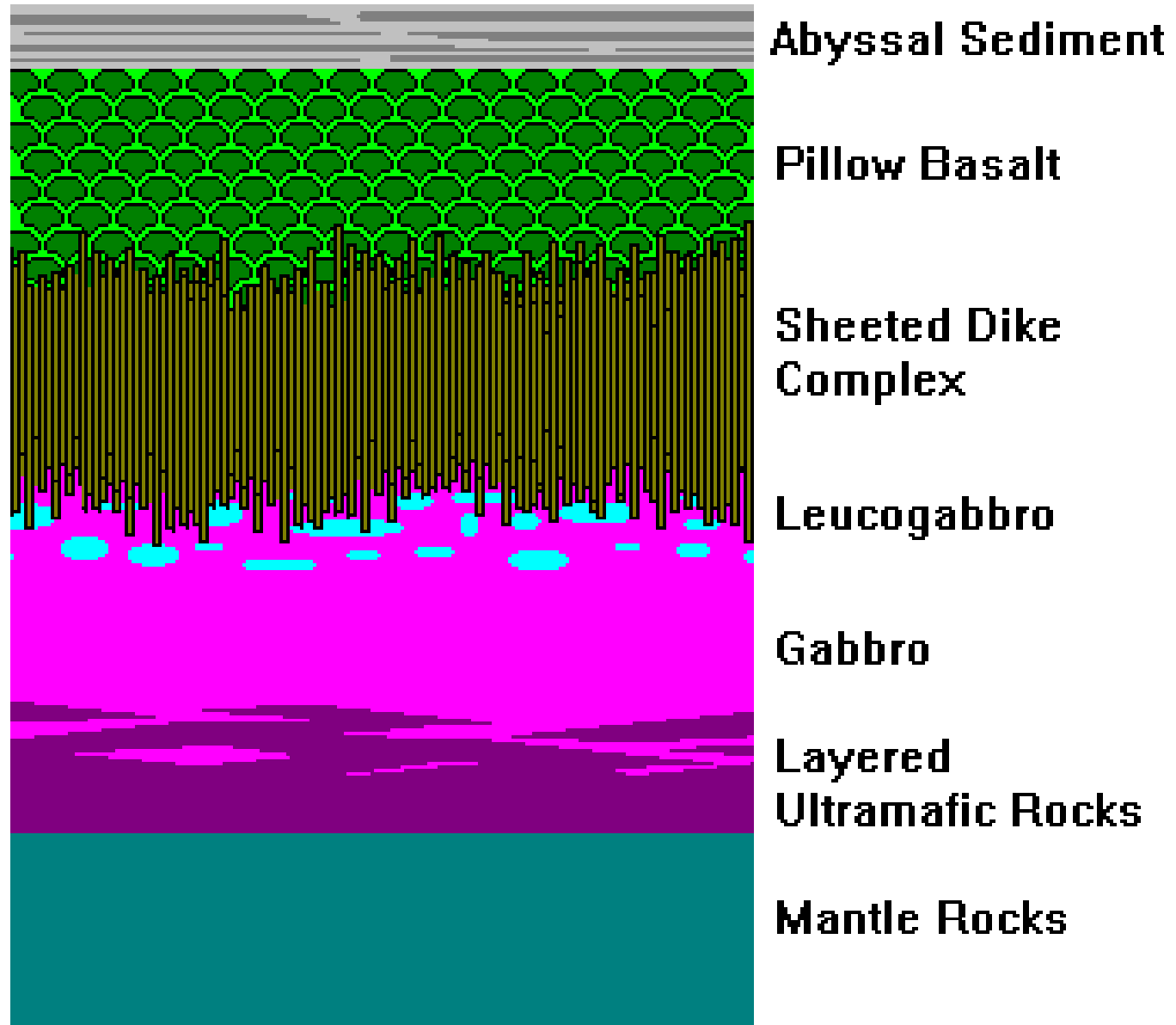


# Atlantic 65 m.y. ago

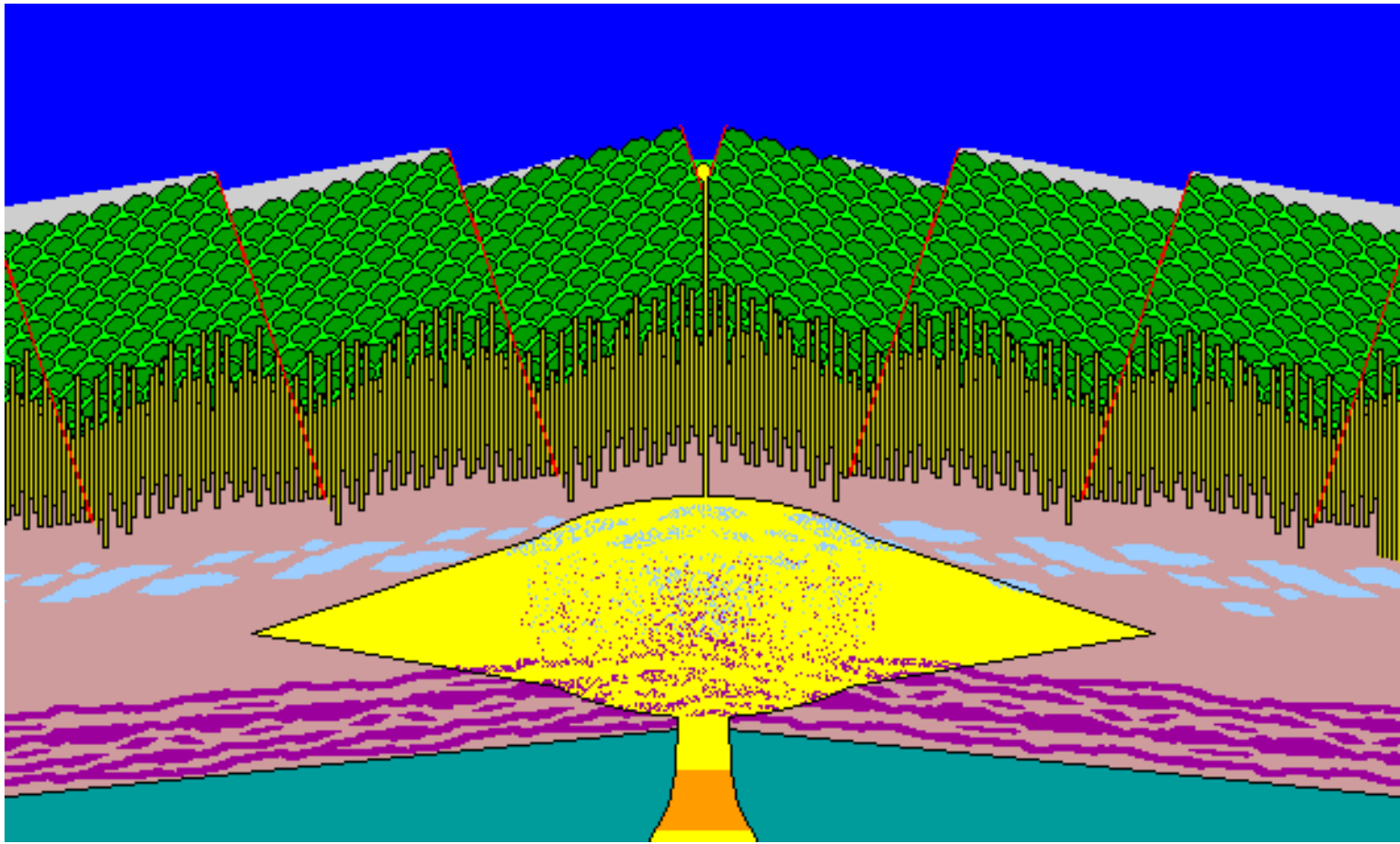


# Geology of Plate Margins

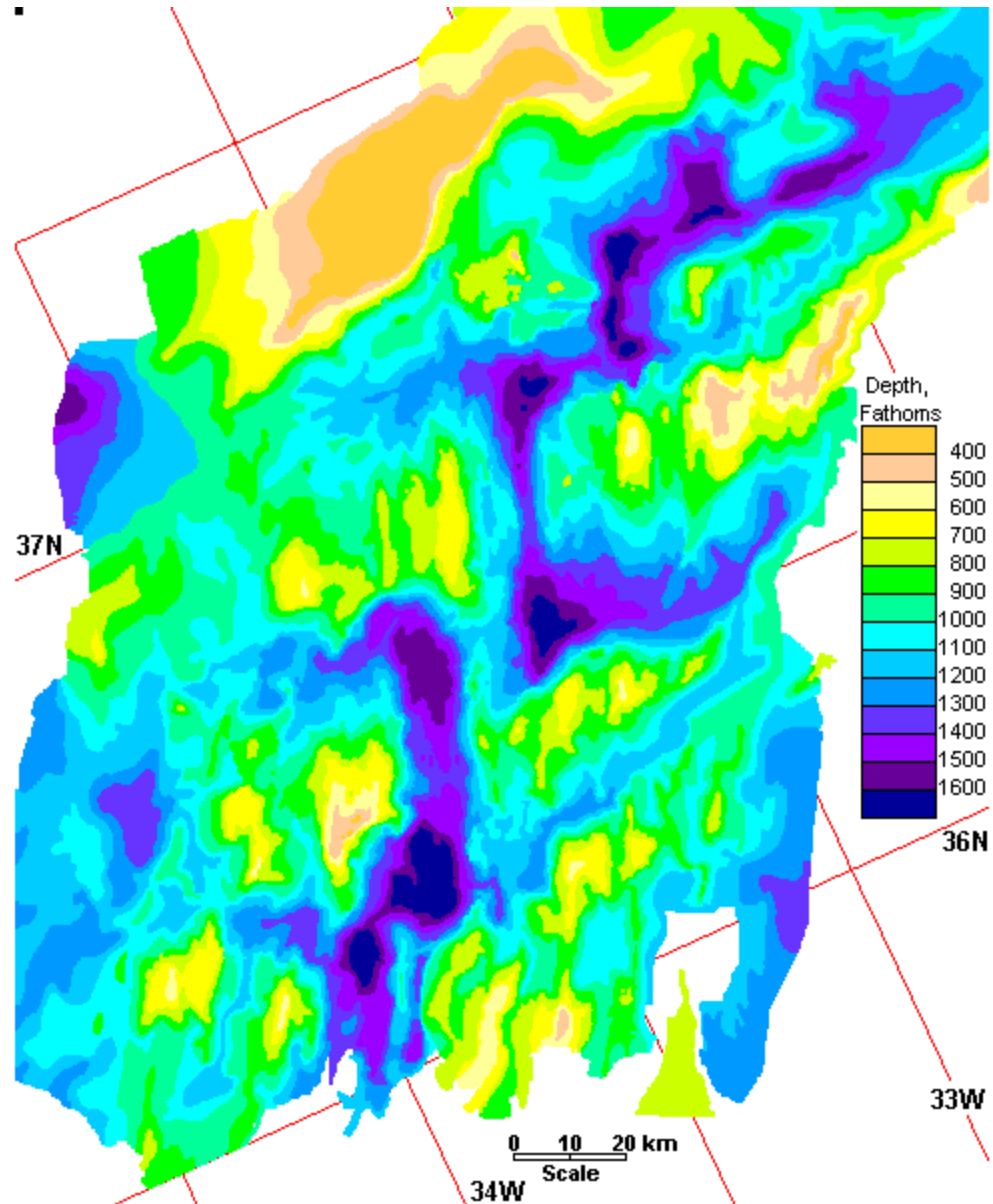
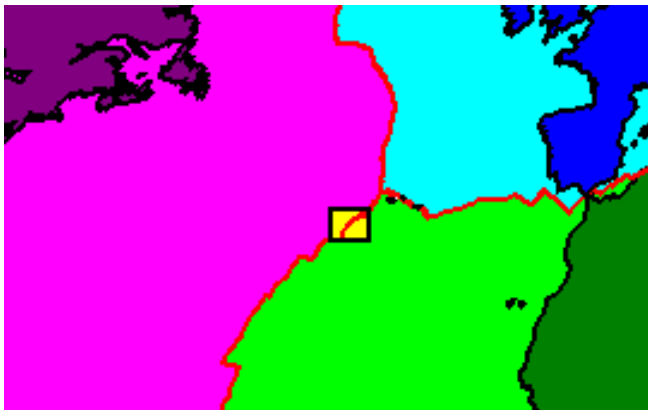
# Ophiolites: Oceanic Crust



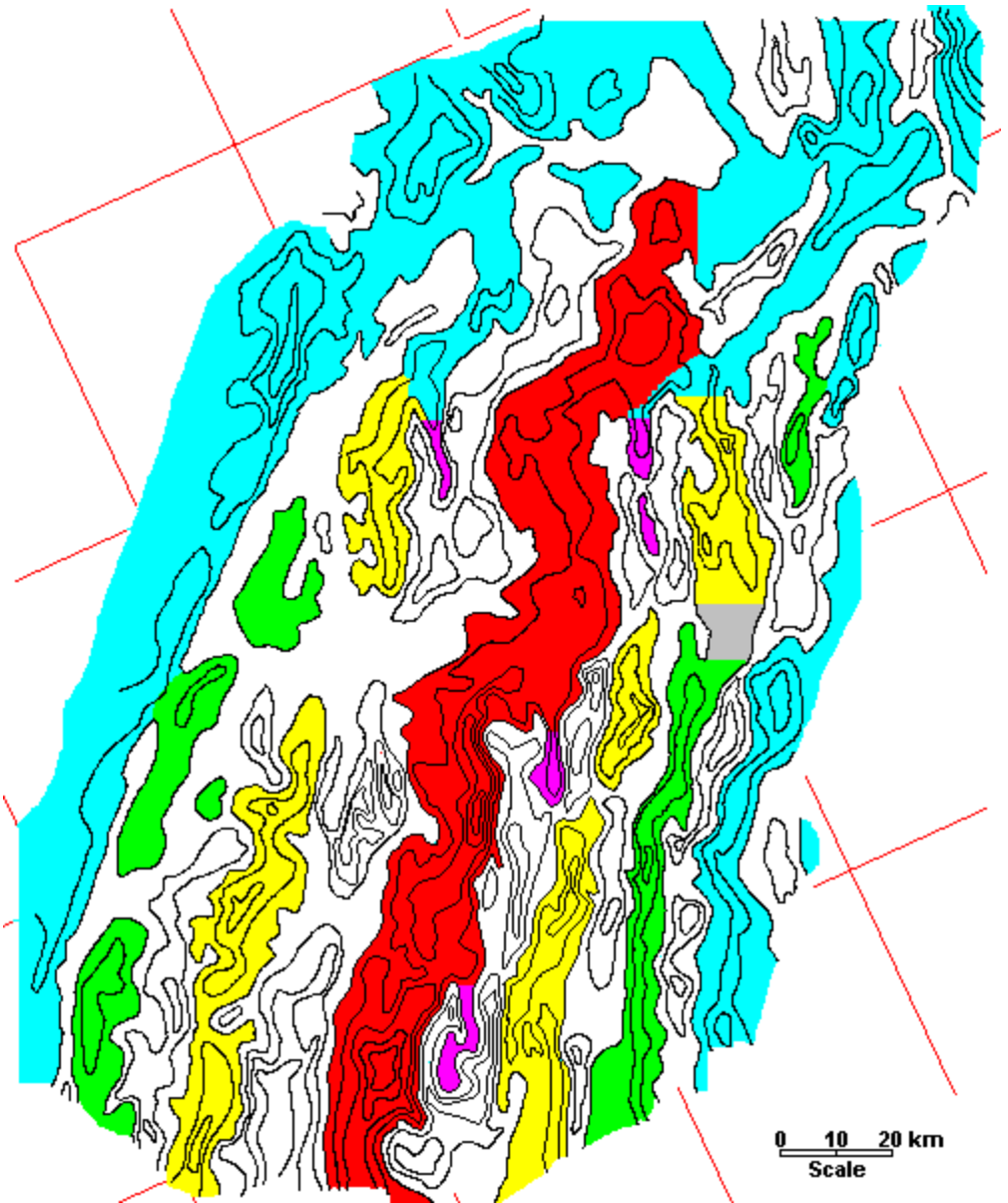
# Anatomy of a Mid-Ocean Ridge



# FAMOUS: Close-Up of the Mid- Atlantic Ridge

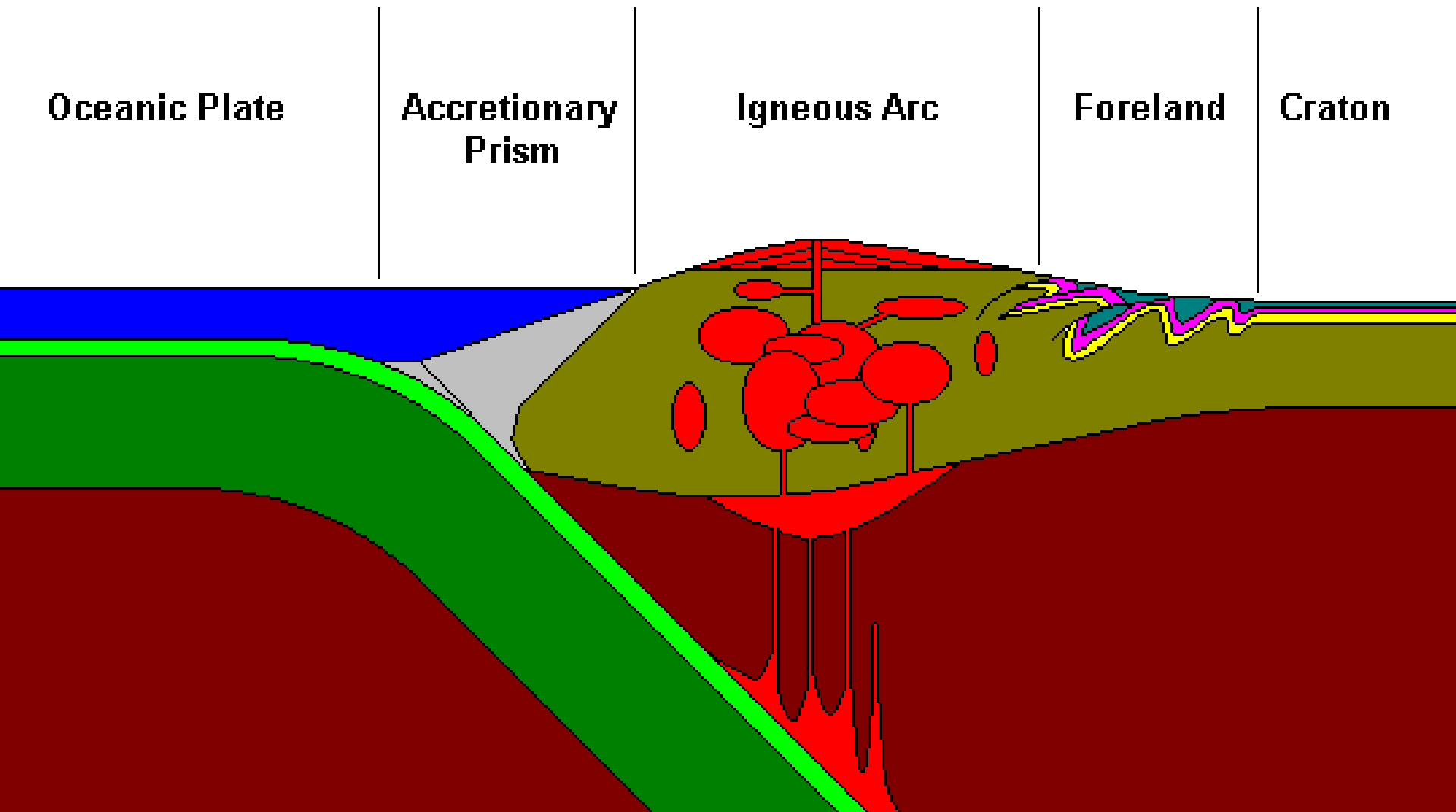


# Magnetic Stripes in the FAMOUS Area

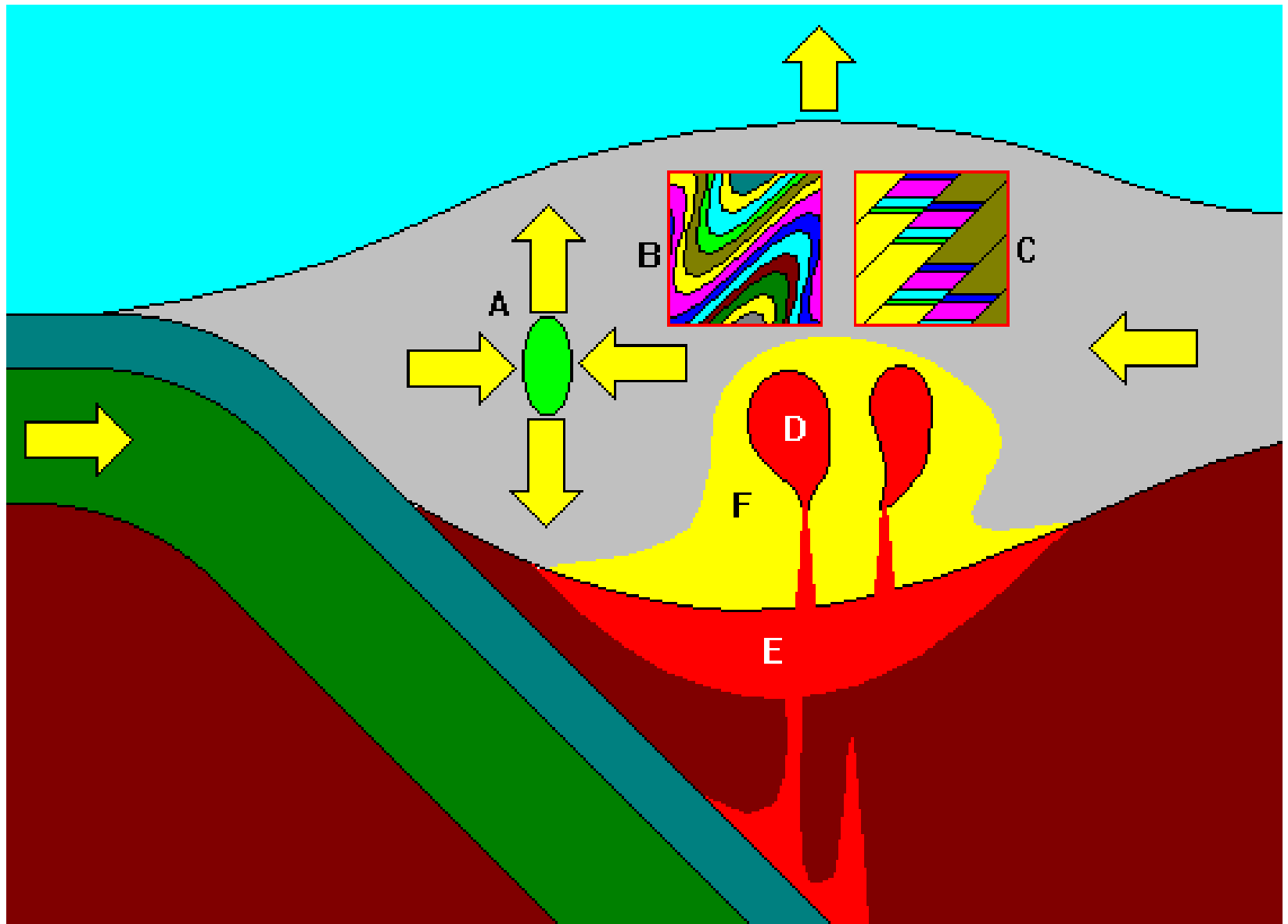




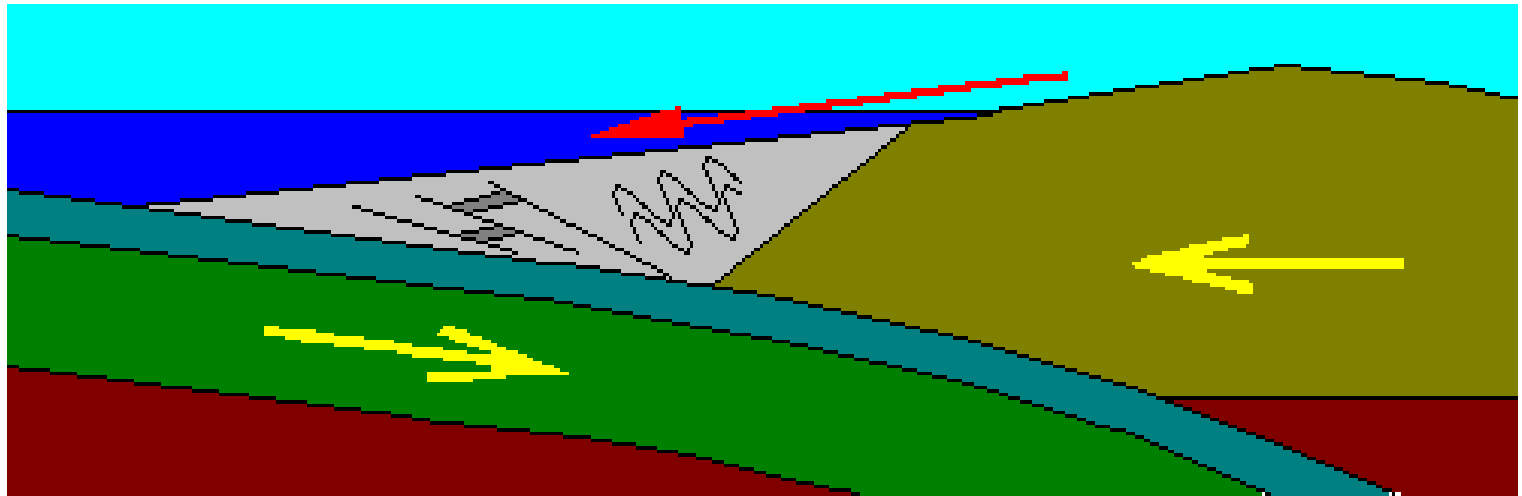
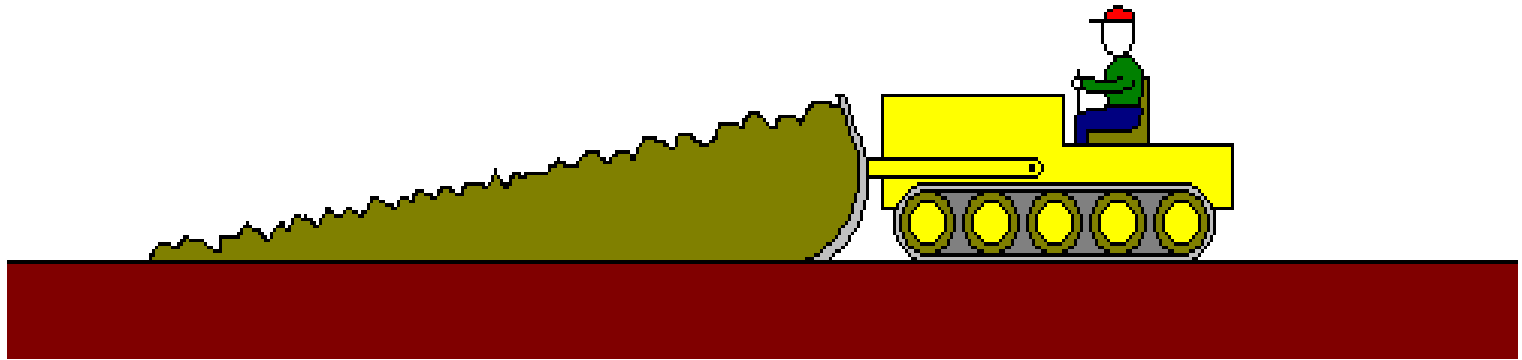
# A Subduction Zone



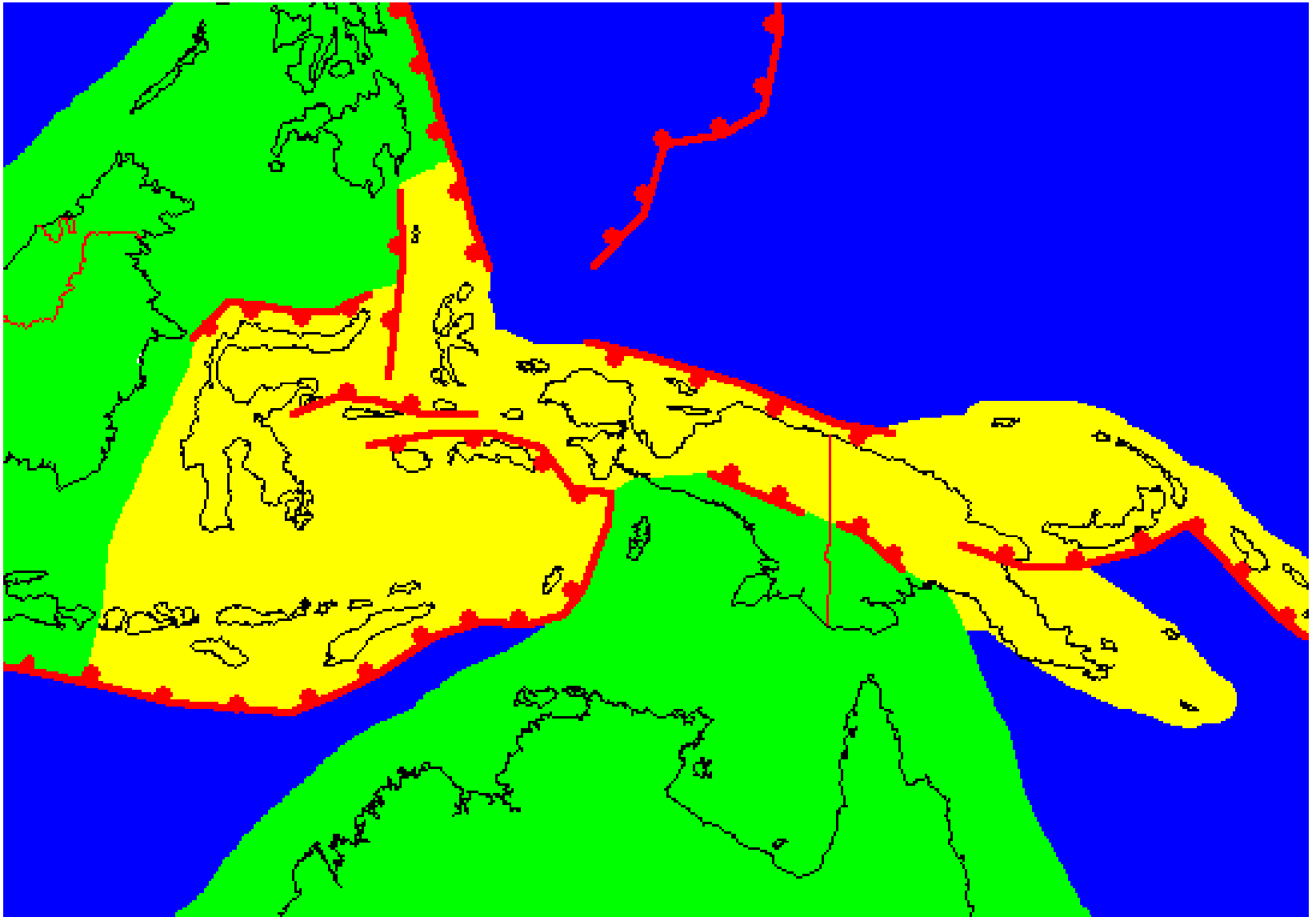
# Why Mountains are High



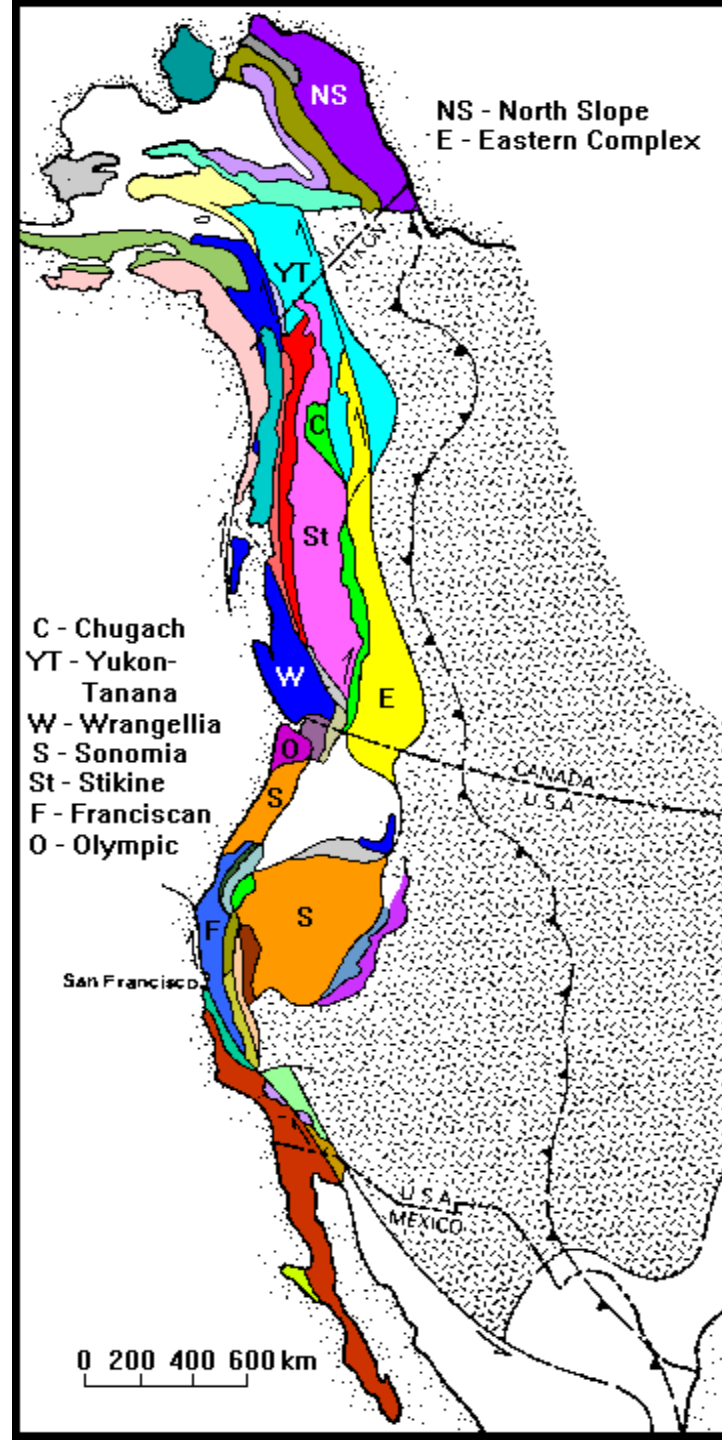
# Where the Plates Meet



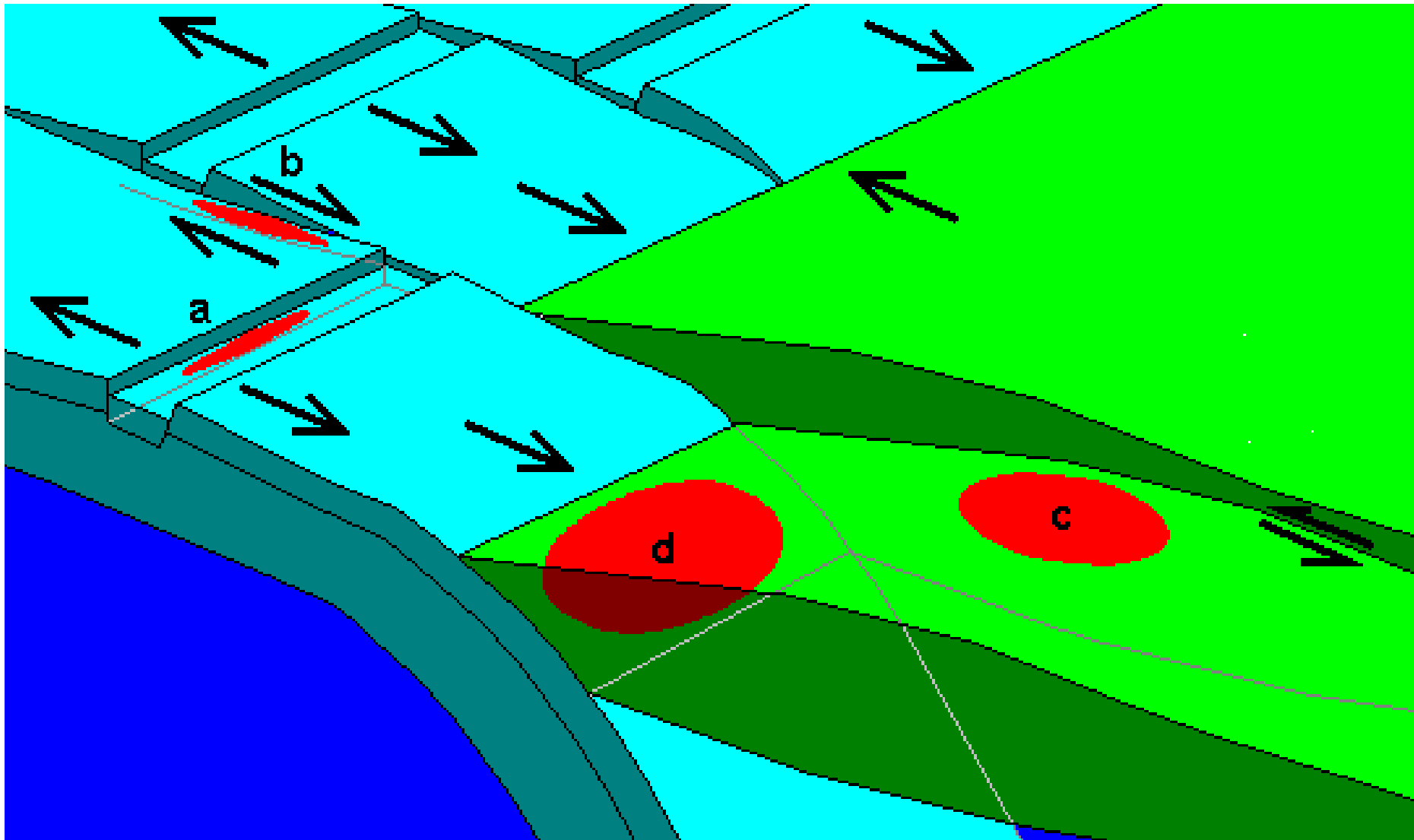
# Terrane Accretion



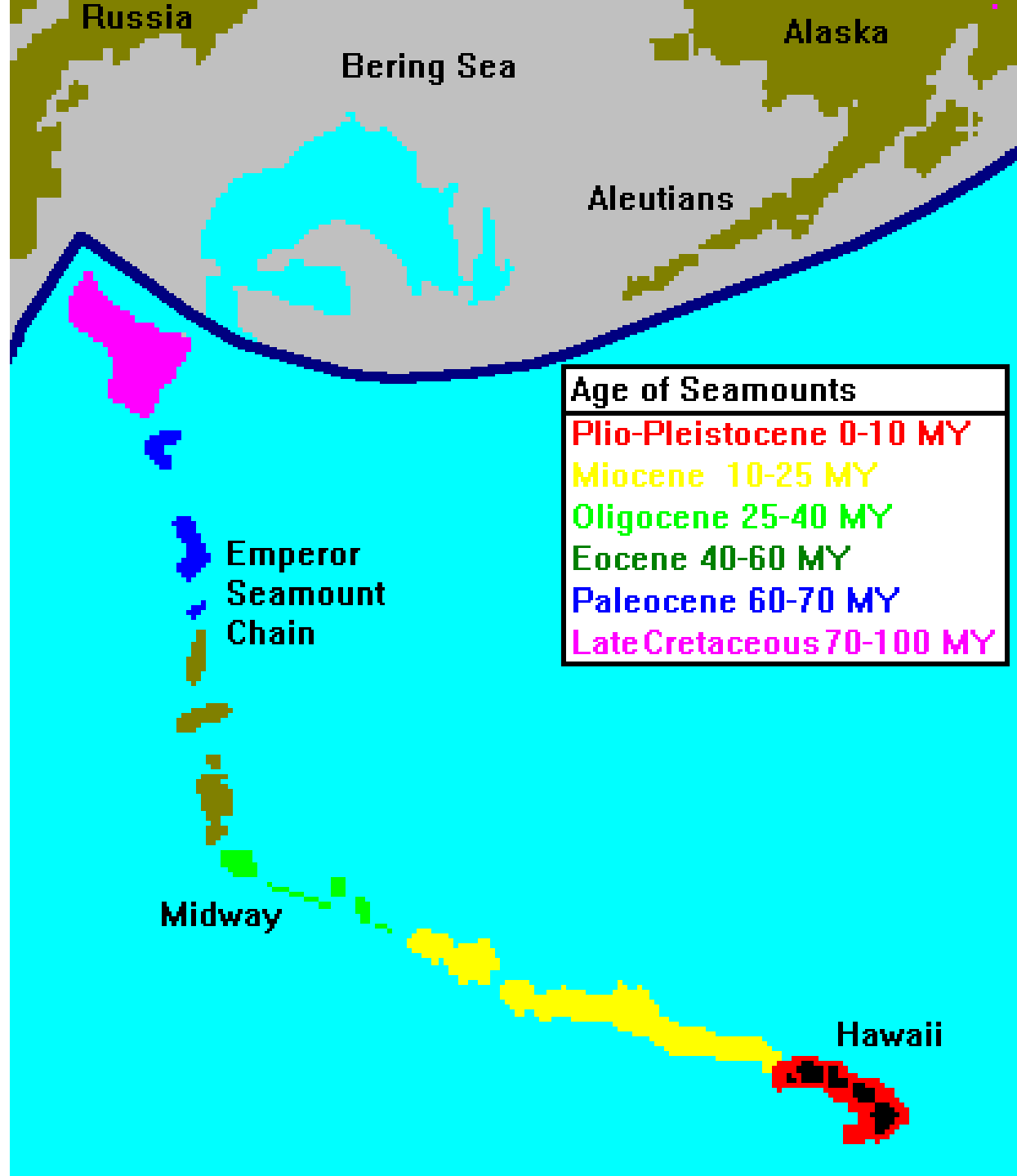
# Terranes in Western North America



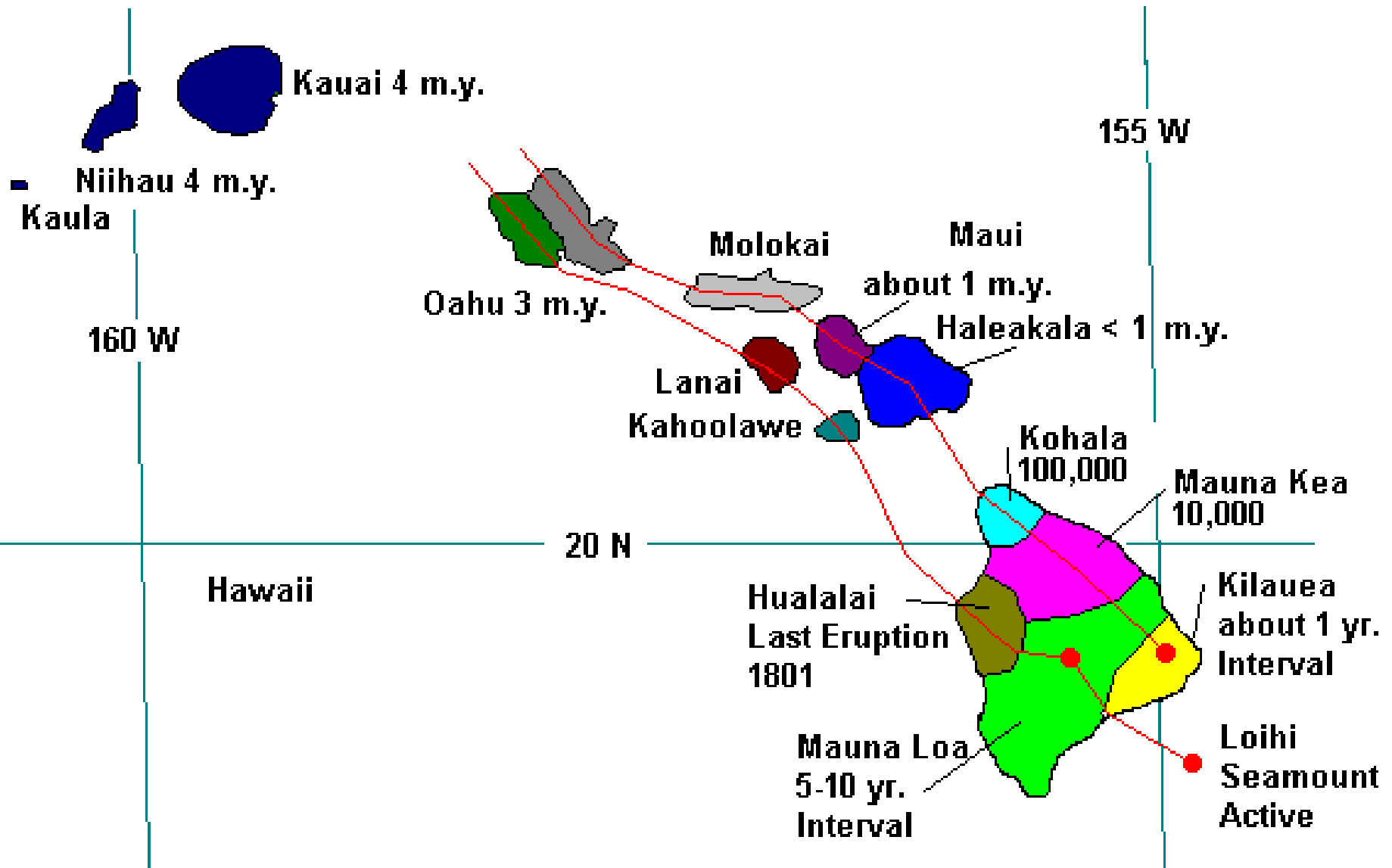
# Plate Boundaries and Earthquakes



# Hot Spots



# Hot Spots: Hawaii





# Pacific Hot Spot Tracks

