INVESTIGATION 2

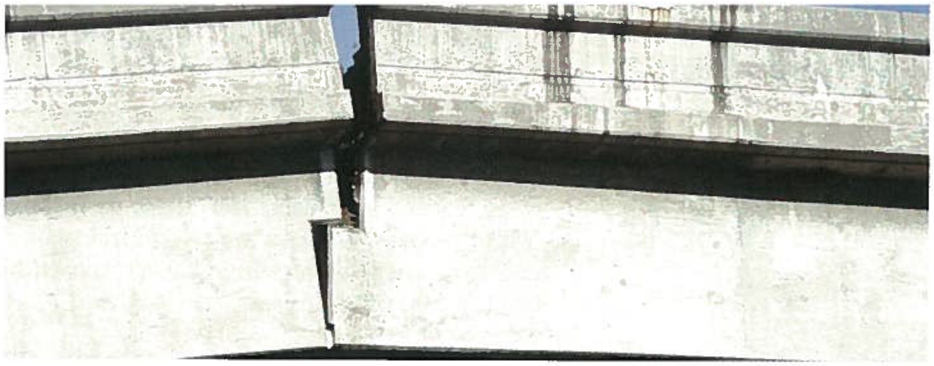


Plate Tectonics

Project

PURPOSE

- Plot key geologic events and correlate them to tectonic plate boundaries

INTRODUCTION

In the 1960s and 1970s it was becoming obvious that the map of Earth's continents has been continuously changing over a large portion of geologic history.

Fig. 2-1

Earth's Continents Over Last 225 Million Years

The theory of plate tectonics explains the drift of continents and related geological events.

Continental land masses crashed into and moved away from each other for over 2.0 billion years. These movements can be inferred from present-day geologic features resulting from these collisions and breakups. Rocks and fossils found in western Africa are also found in eastern South America. And scratches left on rocks by moving glaciers suggest how continents have moved over the last 300 million years.

The idea of drifting continents was first proposed in 1912 by Alfred Wegener, who observed that the continents seem to fit together like the pieces of a puzzle. Although the evidence suggested that Wegener was correct, he could not find a mechanism to explain how whole continents could move thousands of miles across the Earth's surface.

It is now believed that the continents move on pieces of the Earth's crust called **tectonic plates**. The surface of the Earth seems to be divided into seven or eight major plates and maybe a dozen smaller ones. The best explanation for the mechanism is that heat escaping from the planet's interior creates convection currents that move the plates into and away from each other. From a geological point of view, the most interesting places are the plate boundaries where the plates collide, separate, or slide past each other. Scientists infer the size, shape, and location of the plates by a process similar to the one you will undertake in this project.

In this investigation you will plot the locations of recent earthquakes, volcanic eruptions, and mountain ranges on a world map (see **Fig. 2-2**). These events are not evenly distributed over the Earth. You will be asked to look for patterns in the locations of these occurrences globally and discuss how they affect the planet and its inhabitants.

Procedure

Step 1 Go to the following Internet site:

http://neic.usgs.gov/neis/bulletin/

Using small circles as markers, mark on the world map the location of the 25 most recent earthquakes that are not in the same locale.

Step 2 Plot the location of the following volcanoes, using small triangles on the map.

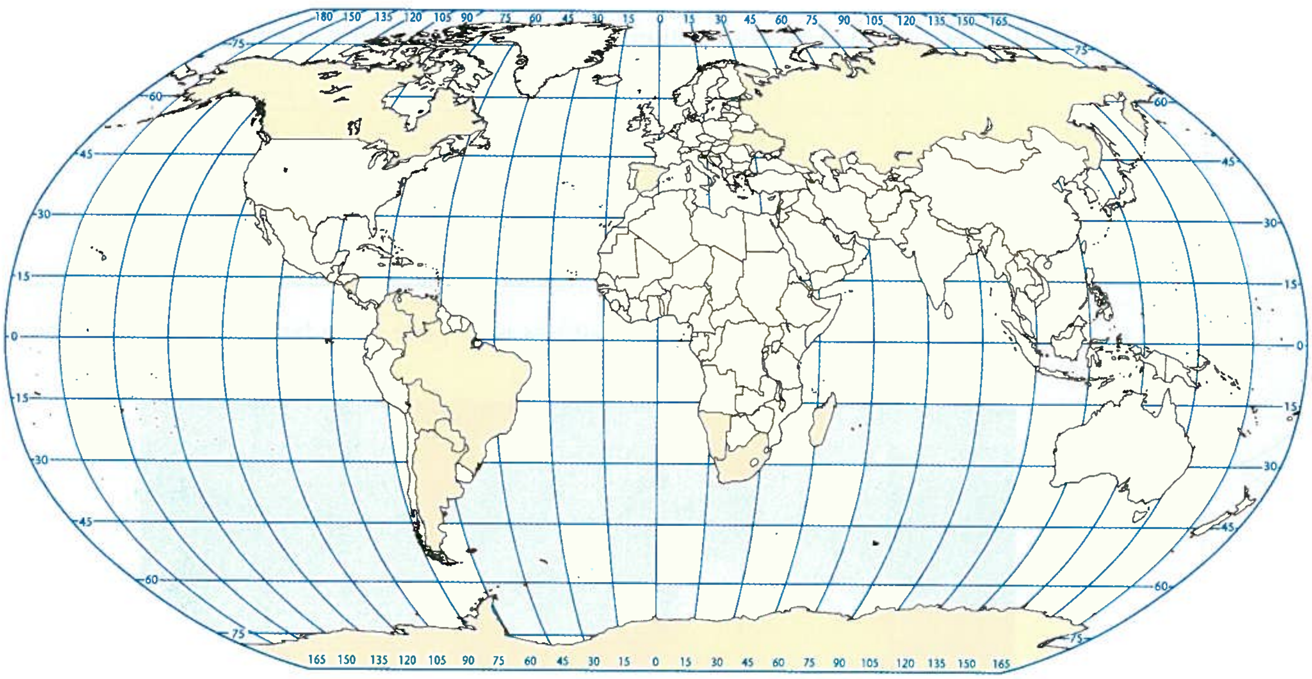
Mt. Etna, Italy - 37.73N, 15.00E
Ayelu, Ethiopia - 10.082N, 40.702E
Likaiu, Kenya - 2.17N, 36.36E
White Island, New Zealand - 37.52S, 177.18E
Santorini, Greece - 36.4N, 25.4E
Askja, Iceland - 65.03N, 16.75W
El Chichon, Mexico - 17.4N, 93.2W
Mt. Wrangell, USA - 62.66N, 144.12W
Redoubt, USA - 60.5N, 152.7W
Mount Rainier, USA - 46.58N, 121.75W
Lassen Peak, USA - 40.5N, 121.5W
Unimak Island, USA - 54.47N, 163.9W
Mt. Pelee, West Indies - 14.8N, 61.1W
Blup Blup, Papua New Guinea - 3.5S,144.6E
Pinatubo, Philippines - 15.13N, 120.35E
Tambora, Indonesia - 8.3S, 118.0E
Gamalama, Indonesia - 0.8N, 127.3E
Irazu, Costa Rica - 9.979N, 83.853W
Lascar, Chile - 23.32S, 67.44W
Nevado del Ruiz, Columbia - 4.9N, 75.3W
Krasheninnikov, Russia - 54.58N, 160.26E
Fuji, Japan - 35.4N, 138.7E
Chaine des Puys, France - 45.5N, 2.8E
Soufriere Hills, Montserrat - 16.7N, 62.2W
Ararat, Turkey - 39.70 N, 44.28 E
Savo, Solomon Islands - 9.1S, 159.8E

Step 3 Again, using the map, shade in locations for the following mountain ranges.

- Alps
- Andes
- Appalachians
- Atlas
- Balkin Mts.
- California Coast Ranges
- Carpathians
- Cascades
- Dolomites
- Himalaya
- Karakoram
- Mid Ocean Ridges
- Scandinavian Mts.
- Sierra Nevada
- Urals

Fig. 2-2

World Map



1a. What patterns do you observe in the locations of these earthquakes, volcanoes, and mountain ranges?

b. Why do these events seem common in some areas on Earth and rare in others?

c. Using **Fig. 2-3**, compare your plotted positions with plate boundary locations. Describe any correlations.

Fig. 2-3: Earth's Plate Boundaries

Questions

d. How does the theory of Plate Tectonics explain these similarities of location? Describe how the theory of Plate Tectonics is strengthened by these patterns.

2. What is meant by the term ***Ring of Fire***?

3a. How do the Ayelu and Likaiu volcanoes fit into the pattern you have observed?

b. What processes are going on in eastern Africa? Explain what is meant by a ***triple junction***.

Questions

c. About two hundred million years ago a similar process occurred. (Refer back to **Fig. 2-1**, historical maps of Earth's drifting continents.) Describe this process.

4a. What are ***hot spots***? Look at **Fig. 2-4**, showing a geological section of the Hawaiian Islands. What do hot spots tell us about plate movement?

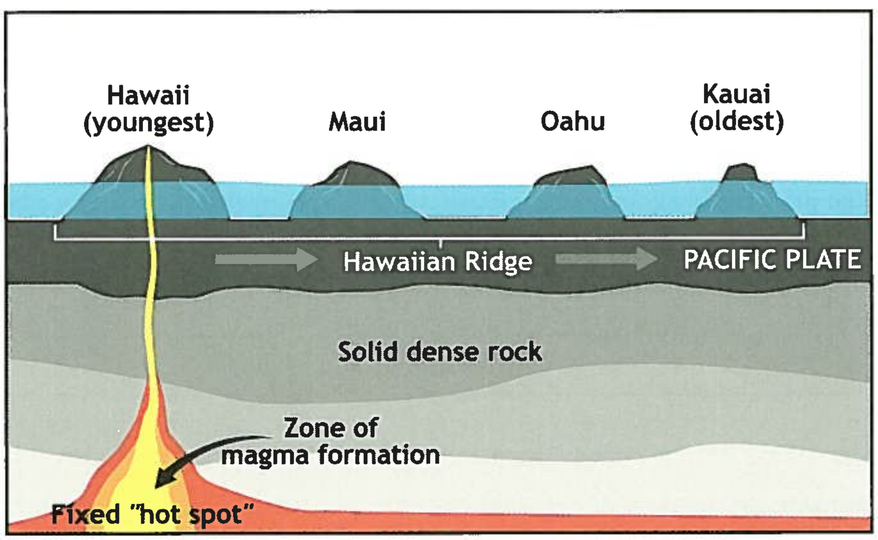


Fig. 2-4: Geological Map of the Hawaiian Islands

Questions

b. Refer to **Fig. 2-5**. How has the hot spot in the Yellowstone region given clues about the movement of the North American Plate? Yellowstone National Park is in the upper right-hand corner of the image.

Fig. 2-5: The Snake River Plain

c. Scientists have determined that plates move at different speeds. Some travel as slow as 2 cm/yr and others as fast as 15 cm/yr. Describe how hot spots could be used to determine the speed of plate movement.

Questions

d. What information and measurements would you need to calculate the rate of movement?

5a. How did the Himalaya and Karakoram mountain ranges form? Twenty-two mountains in these mountain ranges are 8,000 m (26,240 ft) or higher, with Mt. Everest being the tallest on Earth at 8,850 m (29,028 ft). Why are these ranges so high even though they are not near a coast line?

b. Compare the Urals, another range in the list that is not near a continental edge, to the Himalaya and Karakoram. The highest mountain in the Urals is Naroda Mountain at 1,895 m (6,215 ft). Why are the Himalaya and Karakoram so much higher than the Urals?