

Pacific Plate & The Ring of Fire Instructor's Notes

Overview

The kids take the locations of 25 major volcanos found around the rim of the Pacific Ocean and map them. This is the same kind of data that Alfred Wegener used to create his theory of continental drift so, in essence, they are retracing the footsteps of a great mind to see how the idea was generated. They will then compare their map with a record of all of the earthquakes for the past 50 years. And, like Wegener, the modern day data will support the original theory.

Content Correlations and Vocabulary

Geology

Volcanos
Earthquakes
Pangaea

Plate Tectonics

Plate Collisions
Plate Boundary
Trenches
Subduction Zone

Objectives

1. The student understands the structure of Earth, the rock cycle, and plate tectonics. The student is expected to identify the major tectonic plates including Eurasian, African, Indo-Australian, Pacific, North American, and South American.
2. The student can describe how plate tectonics causes major geological events, such as ocean basins, earthquakes, volcanic eruptions, and mountain building.

Time Line

30-35 Minutes

Lab Prep

Background on Alfred Wegener is nice

Answers to Questions

Will vary depending on the student. General tendencies are included in text.

Extension Ideas

Create a bulletin board and include the entire world. Place all of the tectonic plates in one color. Put the continents on top of them in another color and then draw in the locations of all of the major volcanoes and earthquakes to create a world-wide view.

Congruent Labs

Composite Volcano
Not My Fault
Pangaea to Present

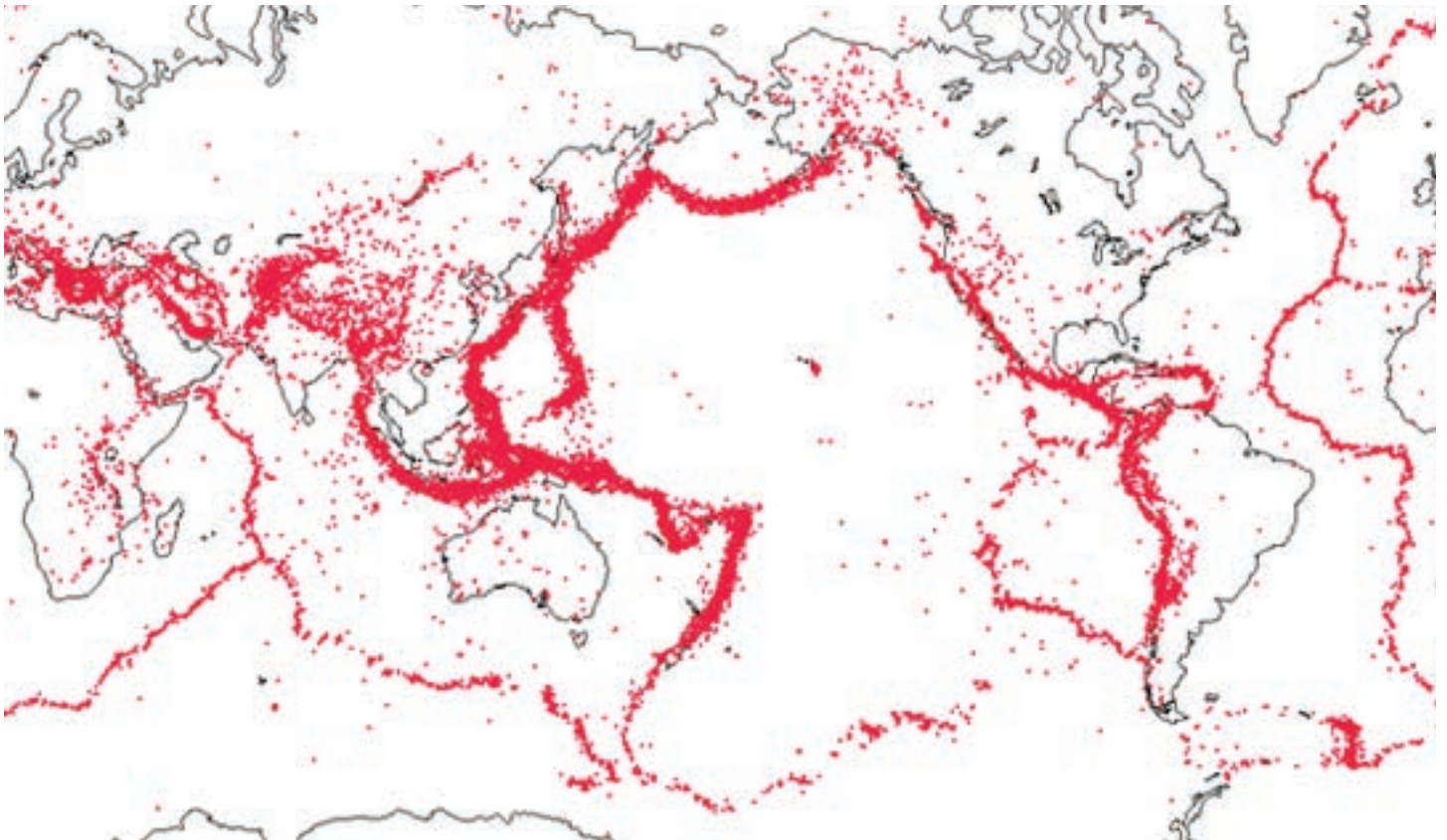
Fissure Fed Lava Plateaus
Graham Cracker Tectonics
Trenches, Subduction Zones, et al

Pacific Plate & The Ring of Fire Instructions

Why Are We Doing This Exercise?

To understand the history of the Earth. More specifically, the theory of plate tectonics, which, provides us with a comprehensive theory that explains “how the Earth works.” It originated with the theory of continental drift (Kontinentalverschiebung), introduced in 1915 by Alfred Wegener, a German scientist. He hypothesized that the continents were slowly drifting around the Earth. However, Wegener was unable to demonstrate a mechanism for continental drift, which, combined with his mostly circumstantial evidence, meant that his hypothesis was not accepted until the 1950s when a pile of new information came to light.

There are five main sets of data that support the current theory of plate tectonics; 1) studies on the nature and exploration of the ocean floor, 2) records of Earth’s ancient magnetism captured in lava flows, 3) the locations of volcanoes and record of earthquakes, 4) the observations of the flow of heat from Earth’s interior, and 5) the discoveries and correlations of the worldwide distribution of plant and animal fossils. This lab explores the volcanic and earthquake evidence.



Vocabulary

Earthquake: An earthquake is the result of the surface of the earth moving. Most of the time it is just a little bit, barely even noticeable to humans. However, the earth occasionally lets loose with a huge quake and there is wide scale devastation. The map above is a record of the epicenters (locations) of 340,000+ earthquakes that have been recorded since 1966. More importantly this map also creates a very clear outline of the tectonic plates that our continents rest upon.

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Volcano: A volcano is created when an opening, or rupture, in a planet's surface or crust, allows hot magma, ash and gases to escape from below the surface much like the picture of the volcano to the right, forming in the ocean, off the island of New Zealand. The ash and lava pile up and can produce small cones several hundreds of feet high or mountains that can soar to 22,000 feet in the air, like the Andes of South America.

Volcanoes are generally found where tectonic plates are either pulling away or running into one another, which makes them a great visible clue for inferring and locating the boundaries of tectonic plates.

A mid-oceanic ridge, for example the Mid-Atlantic Ridge, has examples of volcanoes caused by divergent tectonic plates pulling apart; the Pacific Ring of Fire has examples of volcanoes caused by convergent tectonic plates coming together which, curiously enough, is the focus the exercise today. This was the data that originally caused Wegener to develop his idea of continental drift, which was the grand daddy of modern plate tectonic theory.



Ring of Fire: The Pacific Ring of Fire is an area where large numbers of earthquakes and volcanic eruptions occur in the basin of the Pacific Ocean. In a 40,000 km horseshoe shape, it is associated with a nearly continuous series of oceanic trenches, volcanic arcs, and volcanic belts and/or plate movements. The Ring of Fire has over 450 volcanoes and is home to over 75% of the world's active and dormant volcanoes. It is also home to roughly 90% of the world's earthquakes. 80% of these being among the world's largest earthquakes, suggesting lots of movement.

You have a map of earthquake epicenters on the previous page and you will be asked to map 25 of the largest volcanos found in and around the Pacific Ocean on the next page. When you compare the two sets of data, earthquakes and volcanos, you can see the outline of the Pacific plate very clearly.

Plate Tectonics; The theory states that Earth's outermost layer, the lithosphere, is broken into 7 large, rigid chunks called plates: the African, North American, South American, Eurasian, Australian, Antarctic, and Pacific plates. Since the process isn't a pre-fabricated job, several minor plates also exist, including the Arabian, Nazca, and Philippines plates.

The plates are all moving in different directions and at different speeds (from 2 to 10 centimeters (1 to 3 inches for those of you stuck in English measurement mode) per year, which, for a point of reference, is about the speed your fingernails grow) in relationship to each other. The plates are moving around like cars in a slow motion demolition derby, which means they sometimes crash together, pull apart, or sideswipe each other. The place where the two plates crash, side-swipe and pull apart is called a plate boundary. Thinking about this in terms of slow moving cars, this is where you would expect to find almost all of your damage to the crust, producing the location for the volcanos and earthquakes.

Pacific Plate & The Ring of Fire Instructions

Materials

- 1 Box of Colored Pencils
- 1 Pencil, #2
- Data and map provided

Procedure

1. On the next page is an outline of the continents surrounding the Pacific Ocean. Using the latitude and longitude readings for the volcanos above, plot the approximate location of each volcano with a dot and write the corresponding number next to the dot. When you have completed locating all of the volcanos, connect the dots from one to twenty-five to reveal the Ring of Fire.

Volcano Name	Location	Latitude	Longitude
1. Ngauruhoe	New Zealand	38° S	178° E
2. Lamington	Papua, New Guinea	5° S	152° E
3. Rabaul	Bismark Archipelago	5° S	152° E
4. Soputan	Swlawesi	3° S	120° E
5. Apo	Philippines	7° N	125° E
6. Pinatubo	Philippines	7° N	125° E
7. Usu	Japan	43° N	143° E
8. Fuji	Japan	36° N	138° E
9. Kuril Islands	Russia	47° N	153° E
10. Klyuchevskoi	Russia	55° N	160° E
11. Mt. Katamai	USA (Alaska)	56° N	162° W
12. Mt. Spurr	USA (Alaska)	61° N	144° W
13. Nouarupta	USA (Alaska)	60° N	138° W
14. Mt. St. Helens	USA (WA)	46° N	122° W
15. Mt. Shasta	USA (CA)	41° N	122° W
16. Cerro de la Encantada	Mexico (Baja)	30° N	115° W
17. Colima	Mexico	20° N	103° W
18. San Cristobal	Nicaragua	18° N	87° W
19. Pacaya	Guatemala	14° N	92° W
20. Poas	Costa Rica	10° N	85° W
21. Cotopoxi	Ecuador	0°	78° W
22. El Misti	Peru	10° S	77° W
23. Carro Azulfe	Chile	27° S	69° W
24. Maipo	Argentina	34° S	70° W
25. Antuco	Chile	38° S	69° W

2. On the next page is an outline of the continents surrounding the Pacific Ocean. Using the latitude and longitude readings for the volcanos above, plot the approximate location of each volcano with a dot and write the corresponding number next to the dot. When you have completed locating all of the volcanos, connect the dots from one to twenty-five to reveal the Ring of Fire.

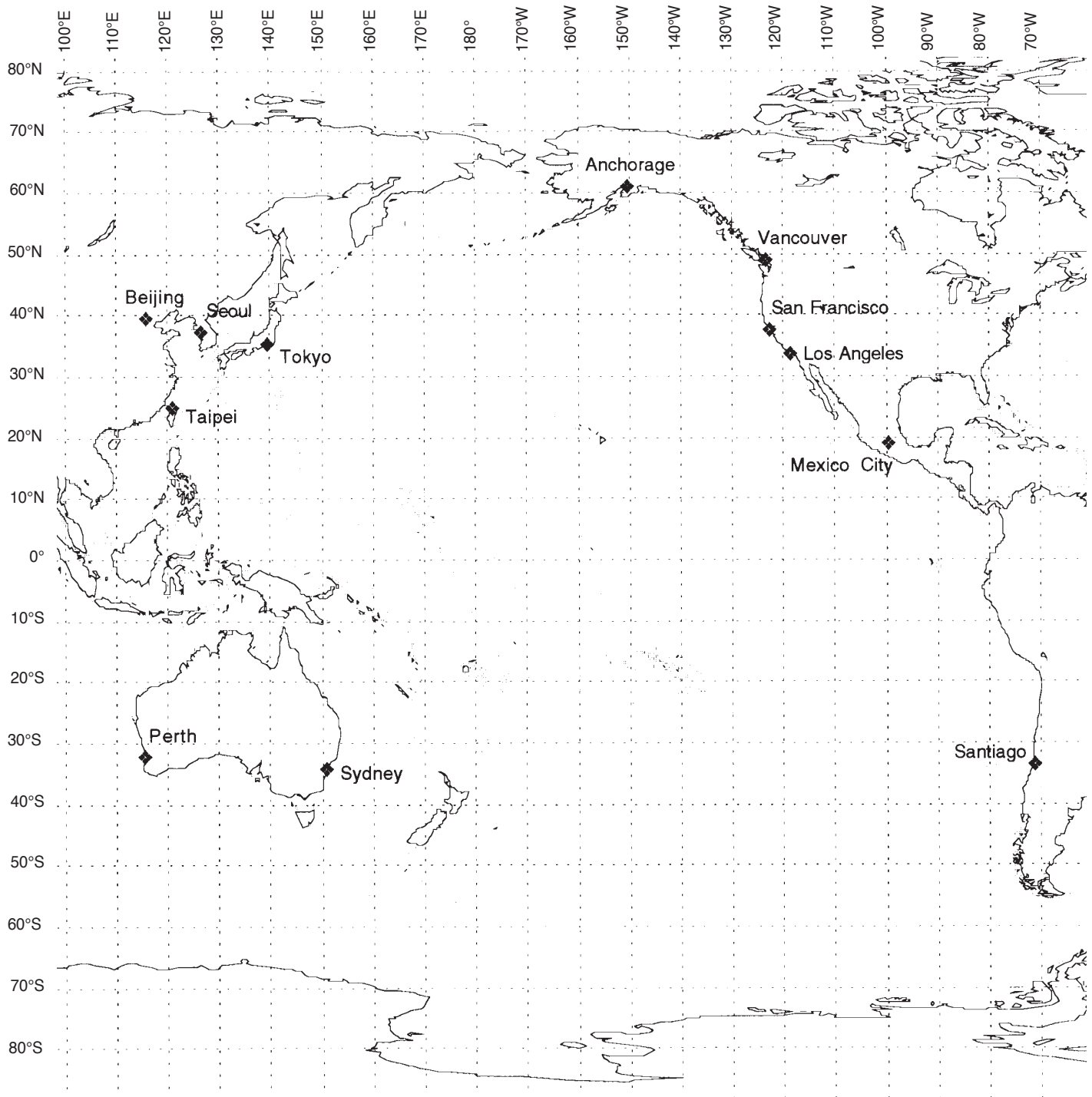
Pacific Plate & The Ring of Fire Data and Observations

Name : _____

Date: _____

Teacher: _____

Period: _____



Pacific Plate & The Ring of Fire Questions

2. When you are done plotting all of the volcano locations, take that same colored pencil and connect each dot representing a volcano in order from 1 to 25. When you are done, you will have just mapped "The Ring of Fire."

3. Once you have the Ring of Fire mapped, use the map of earthquake epicenter locations and copy it on to your map using a second colored pencil. Pacific plate.

4. Now that you have the locations of major volcanos around the Pacific Rim as well as a record of thousands of earthquake occurrences, draw an outline of where you think the boundary for the Pacific plate might lie.

5. Mapping the locations of volcanos and earthquakes is one clue to the plate tectonic puzzle. what are three other sets of data that has helped develop this theory.

A. _____

B. _____

C. _____

6. Match the word with the best definition.

- | | |
|--------------------|---|
| A. Volcano | i. The border between two tectonic plates |
| B. Tectonic Plate | ii. Two tectonic plates bumping into one another |
| C. Earthquake | iii. A fracture in the crust that produces magma, ash, dust |
| D. Plate Boundary | iv. A fracture in the crust that produces seismic readings |
| E. Plate Collision | v. Large chunk of the earth's crust. There are seven. |

7. Who was Alfred Wegener and why is he important in the study of geology?

8. The Ring of Fire is significant in that it is the location of _____% of all volcanos and home to _____% of all recorded earthquakes since 1966.