



Science Objectives

- Students will plot recent earthquakes and volcanoes in the Pacific Ocean on a map to discover the relationship between these events and the plate boundaries.
- Students will use their maps of earthquakes and volcanoes to predict the types of boundaries in the “Ring of Fire”.



Vocabulary

- plate boundary
- tectonic plate
- volcano
- earthquake
- continent

About the Lesson

- This lesson allows students to plot actual earthquake and volcano data in order to map the boundaries of the Pacific plate. As a result, students will:
 - Understand the physical characteristics and spatial patterns on the Earth’s surface related to plate tectonics.
 - Describe what may happen when plate boundaries meet (e.g., earthquakes, volcanoes, faults, mountain building)



TI-Nspire™ Navigator™

- Send out the .tns file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies: TI-Nspire™ CX Handhelds, TI-Nspire™ Apps for iPad®, TI-Nspire™ Software

Tech Tips:

- This activity includes screen captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>

Lesson Files:

Student Activity

- Ring_of_Fire_Student.doc
- Ring_of_Fire_Student.pdf

TI-Nspire document

- Ring_of_Fire.tns



Discussion Points and Possible Answers

Have students read the background information stated on their activity sheet.

Move to pages 1.2 – 1.3.

Have students answer questions 1 and 2 in the .tns file, the activity sheet, or both.


Q1. **Volcanoes** and **earthquakes** can be found in the same locations.

Answer: Sometimes

Q2. The edge of a **continent** is the same thing as a **plate boundary**.

Answer: False



Move to pages 1.4 – 1.5.

1. After reading the explanation on page 1.4, students should then read the directions overlaying the map on page 1.5 and close the directions box by selecting .

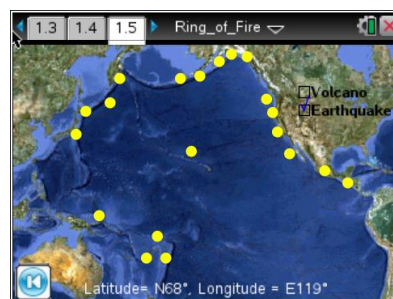
2. Have students select **MENU > Ring of Fire** to explore the options available in this simulation:

- 1: Volcano
- 2: Earthquake
- 3: Clear Pins
- 4: Directions
- 5: About



Tech Tip: To explore the options available, students should select  **> Ring of Fire**. Then select Volcano, Earthquake, Clear Pins, Directions, or About. Students may need to back-out to the main Tools Menu  to see the desired menu option.


Students should take a few minutes to practice moving the cursor and dropping both earthquake and volcano pins on page 1.5. Earthquake pins will be yellow and Volcano pins will be red.





Tech Tip: To drop the pins, students should select the box for Volcano or Earthquake at the top right of the screen. Then they should move the cursor around until the coordinates at the bottom of the map match the desired Latitude and Longitude. They can select that location to drop a pin. (They don't have to be exact. Just have them plot volcanoes or earthquakes in the approximate locations.)



Tech Tip: To drop the pins, students should select the box for Volcano or Earthquake at the top right of the screen. They can also access the options available, by selecting  > **Ring of Fire**. Then they should place a finger on the screen and drag it until the coordinates show the desired Latitude and Longitude. They can lift their finger from the screen to drop the pin. *Note- If Tools options are not visible, refresh page by moving to another page, and then back to 1.5.*

Before they begin plotting the earthquake data, make sure students have correctly answered questions 3-5 on their student activity sheet (these questions are not in their .tns file).

Q3. For a pin on California, what compass directions would you use (i.e.: NW, NE, SW, or SE)?

Answer: North and West

Q4. For a pin on Australia, what compass directions would you use?

Answer: South and East



Q5. Where on the map does W turn to E? Where on the map does N turn to S?

Answer: East 179°, West 180° (in the Pacific Ocean), North 1°, South 0° (also in Pacific Ocean)

Notice that students are not able to clear an individual pin. "Clear pins" removes all the pins that have been placed!

After practicing, be sure students clear all pins before they begin to plot the 19 Earthquake Coordinates from the table on their activity sheet. To clear pins, select **MENU > Ring of Fire > Clear Pins**.



Tech Tip: To clear pins, select  > **Ring of Fire > Clear Pins**. Students may need to back-out to the main Tools Menu  to see the desired menu option.



TI-Nspire Navigator Opportunities

Use the Live Presenter feature of TI-Navigator and have students plot the coordinates for questions 3-5.



Earthquake Coordinates:

If you accidentally drop a wrong pin, leave the pin and make a note to ignore it. You cannot remove individual pins. If you select MENU > Clear pins, you will remove all pins! Remember: It's okay if you are a few degrees off in any direction.

REMEMBER: Earthquake pins are YELLOW.

Location	Latitude	Longitude
56km NNE of Isangel, Vanuatu	19°S	169°E
South of the Fiji Islands	24°S	179°W
264km E of Vostok, Russia	49°N	153°E
40km E of Akutan, Alaska	54°N	165°W
11km W of Cobb, California	39°N	123°W
12km W of Progreso, Mexico	33°N	116°W
6km SW of Xochistlahuaca, Mexico	16°N	98°W
84km WSW of Sardinal, Costa Rica	10°N	86°W
51km NE of Wewak, Papua New Guinea	3°S	144°E
116km ENE of Lambasa, Fiji	15°S	180°W
131km E of Mivako, Japan	40°N	143°E
198km SSE of False Pass, Alaska	53°N	162°E
56km SW of Amukta Island, Alaska	52°N	172°W
65km SW of Redoubt Volcano, Alaska	60°N	153°W
4km NW of Okanogan, Washington	48°N	120°W
8km WSW of Volcano, Hawaii	19°N	155°W
196km NNE of Chichi-shima, Japan	29°N	143°E
234km SW of Hachijo-jima, Japan	31°N	138°E
60km SW of Tok, Alaska	63°N	144°W

Move to pages 1.7 – 1.8.

Have students answer questions 6 and 7 on the device, the activity sheet, or both.

Q6. Describe the pattern of earthquakes on the map.

Sample Answer: Student answers will vary. Answers should include the idea that “The earthquakes are basically making a ring around the Pacific Ocean with the exception of one earthquake near Hawaii.”



Q7. Did the earthquakes occur on the edges of continents?

Answer: Sometimes

Move to page 1.9.

3. After reading the directions on page 1.9, students will go back to page 1.5. Students should change the pin color to red (1: Volcano), then use the table of Volcano Coordinates found on their activity sheet to plot 20 volcanoes.

CAUTION: IF THE STUDENTS ACCIDENTLY SELECT “Clear pins” THEY WILL LOSE THE EARTHQUAKE DATA THEY HAVE ENTERED!



Tech Tip: Students may forget to change the drop pins setting to VOLCANO. Remind them to select the box for Volcano at the top right of the screen, which will change the pin color to RED.



TI-Nspire Navigator Opportunities

Use the Class Capture feature of TI-Navigator to display students' maps and compare earthquake plots before mapping the volcanoes.

Volcano Coordinates:

If you accidentally drop a wrong pin, leave the pin and make a note to ignore it. You cannot remove individual pins. If you select MENU > Clear pins, you will remove all pins! Remember: It is okay if you are a few degrees off in any direction.

REMEMBER: Volcano pins should be RED.



Volcano	Latitude	Longitude
Mt. Adams, WA	46°N	121°W
Alamagan, Mariana Islands	18°N	146°E
Aniakchak, Alaska	57°N	158°W
Gareloi, Aleutian Islands	52°N	179°W
Aoba, Ambae Island, Vanuatu	15°S	168°E
Biliran, Philippines	12°N	125°E
La Madera, Nicaragua	11°N	86°W
Cleveland Volcano, Alaska	53°N	170°W
Daisetsu, Hokkaido, Japan	44°N	143°E
Pisgah, California	35°N	116°W
Redoubt, Cook Inlet, Alaska	61°N	153°W
Newberry Volcano, Oregon	44°N	122°W
Pavlof, Alaska	55°N	162°W
Papandayan, Java, Indonesia	7°S	108°E
Gamchen, Kamchatka	55°N	161°E
Paricutin, Mexico	20°N	102°W
Ngauruhoe, New Zealand	39°S	176°E
Rumble, New Zealand	35°S	179°E
Fuss Peak, Kurile Islands	50°N	155°E

Move to pages 1.10 – 1.11.

Have students answer questions 8 and 9 on the device, the activity sheet, or both.

Q8. Did the volcanoes occur in the same locations as the earthquakes?

Answer: Sometimes

Q9. Which of the following is true based on the data points you plotted? (Select all that apply.)

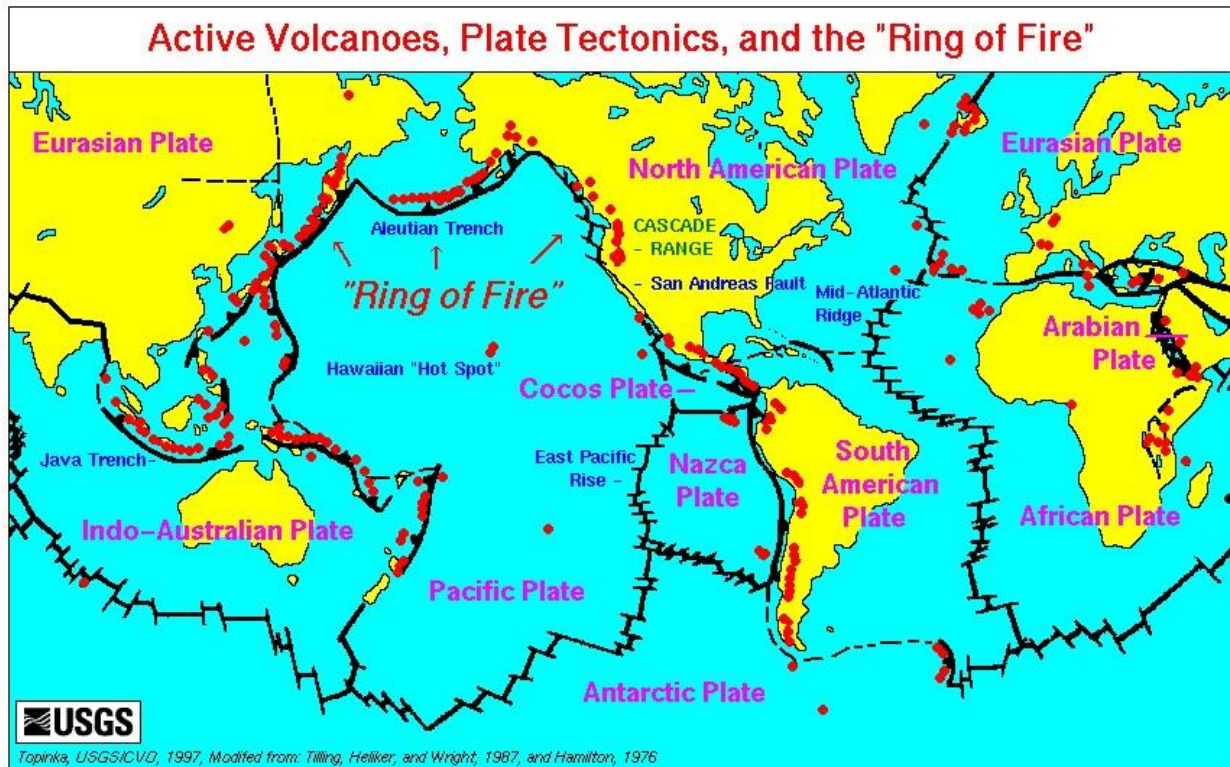
Answers: B. Volcanoes can form in the ocean.

D. Volcanoes and earthquakes occur in similar locations on earth.

Move to pages 1.12 – 1.17.

Have students answer questions 10 - 13 on the device, the activity sheet, or both.

4. After reading the information on page 1.12, students will view a diagram of the “Ring of Fire” on page 1.13. Using the map they created on page 1.5 and this diagram, they will answer the questions that follow.



Q10. Compare the map you created on page 1.5 to the diagram on page 1.13. What crustal plate does your earthquake and volcano data identify?

Answer: Pacific Plate

Q11. Do the plate boundaries always fall on the continent edges? Yes or No?

Answer: No

Q12. Tectonic plates don't quite match the continents and oceans on the Earth's surface. True or False?

Answer: True

Q13. What other surface features occur near plate boundaries? (Select all that apply.)

Answer: Mountains, Trenches, Rift valleys, Volcanoes



Move to pages 1.18 - 1.23

Have students answer questions 14 - 16 on the device, the activity sheet, or both.

5. After reading the information on pages 1.18 – 1.20, students will use their map of earthquakes and volcanoes on page 1.5 to answer the questions on pages 1.21 – 1.23.

Q14. What type of plate boundary is near Alaska?

Answer: A. Convergent

Q15. What type of plate boundary is near Japan?

Answer: A. Convergent

Q16. What type of plate boundary is near California?

Answer: C. Transform



TI-Nspire Navigator Opportunities

Make a student a Live Presenter to illustrate show how to change the drop pins. Throughout the activity, monitor student progress.



TI-Nspire Navigator Opportunities

Use Navigator to capture screen shots of student progress and to retrieve the file from each student at the end of the class period. The student questions can be electronically graded and added to the student portfolio.



Wrap Up

When students are finished with the activity, pull back the .tns file using TI-Nspire Navigator. Save grades to Portfolio. Discuss activity questions using Slide Show.

Assessment

- Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved. The Slide Show will be utilized to give students immediate feedback on their assessment.
- Summative assessment could consist of questions/problems on the chapter test or a performance assessment involving mapping and labeling plate boundaries.