

LEVEL
2

Cracked Plates: Earthquake-Prone

from the GeoInquiries™ collection for Earth Science

Target audience – Earth science learners

Time required – 25 minutes

Activity	Explore the spatial distribution of earthquakes around the world and their effects on cities in one continent in particular.
Science Standards	NGSS: MS-ESS2-2. Earth's Systems: Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
Learning Outcomes	<ul style="list-style-type: none">Students will investigate the relationship between earthquakes and plate boundaries.Students will analyze the affected population of recent earthquakes.
Level 2 GeoInquiry Requirements	<ul style="list-style-type: none">A free school ArcGIS Online organization account. Instructors or students must be signed in to the account to complete this activity.Approximately 0.78 credits will be used per person in the completion of this activity as scripted.

Map URL: <http://esriurl.com/earthGeoInquiry6>

Engage

Where in the world do the most earthquakes occur?

- Click the link above to launch the map.
- In the upper-right corner, click Sign In. Use your ArcGIS Online organization account to sign in.
- With the Details button underlined, click the button, Content (Show Contents of Map).
- Check the box to the left of the layer, Global Quakes of Large Magnitude 5.8 or Greater.
- Hover the mouse on the layer name and click the button, Change Style.
- Select Heat Map to illustrate the distribution of the earthquakes. Click Done.
- ? Where in the world do the most earthquakes occur? [*The west Pacific Ocean and South America*]
- Turn off the layer, Global Quakes of Large Magnitude 5.8 or Greater.
- ? Which boundary type produces the most earthquakes? [*Convergent*]



Explore

What causes the earthquakes in South America?

- Turn on the layer, Global Quakes of Large Magnitude 5.8 or Greater.
- Click Bookmarks. Select South America.
- ? Looking at the distribution of earthquakes around South America, which coast is more geologically active and why? [*The Peru-Chile Trench sits just offshore of the West Coast, while the East Coast is a sizable distance from the Mid-Atlantic Ridge.*]
- Use the Measure tool to compare the distances of each coast to a plate boundary. [*West Coast < 100 miles from a trench. East Coast > 500 miles from Mid-Atlantic Ridge at its closest and > 1,500 miles at its farthest.*]
- ? Observing the map, which South American countries seem to experience the most earthquakes? [*Chile, Bolivia, Argentina, and Peru*]



Explain

Where do most of South America's population live?

- Turn on the layer, South American Cities.
- ? Where are most of the cities? [*More are near the coasts, especially north and west, than in the interior.*]
- Hover over the layer name, South American Cities. Click the button, Show Table.
- Click on the field header, Population. Choose Statistics.
- ? What is the total population of all South American cities? [*~129 million*]
- Close the statistics pop-up and table.
- Turn off the layer, South American Cities.

more ➔



Elaborate

Which cities are within 50 miles of a recent earthquake?

- Select the bookmark, South America. This confirms the proper map extent for analysis.
- See the Find Existing Locations ToolTip below.
- Click the button, Analysis. Expand the Find Locations group. Choose Find Existing Locations.
- In the Find Existing Locations pane, set the following parameters:
 - ① Choose South American Cities.
 - ② Click the green Add Expression button, and create the following expression: South American Cities Within A Distance Of **50** Miles From Global Quakes Of Large Magnitude 5.8 or Greater.
 - ③ Ensure that the Use Current Map Extent box is checked. Always click Show Credits to ensure acceptable credit usage (about 0.78 credits).
- Give the new layer a unique name to avoid conflicts. Click Run Analysis.
- Turn on the new layer.



Evaluate

Who lives in an earthquake zone?

- Open the new layer's table. (See ToolTip below for details.)
- ? How many cities were within 50 miles of an earthquake? *[42 but slight variation may arise from map extent]*
- Hover over the new layer name. Click the button, Change Style. Symbolize the new layer by Population.
- ? What is the total population of these cities? (Hint: Use table.) *[About 17 million]*
- ? Which city is the most populous? *[Santiago, Chile, with about 5 million people]*

VIEW AND SORT A TABLE

- Tables are only available for certain map layers.
- In the Contents pane, point to a layer and click the Show Table button that appears under the layer name.
- Click the field name and choose Sort Ascending or Sort Descending.

FIND EXISTING LOCATIONS

- This tool selects existing features in your study area that meet a series of criteria that you specify.
- These criteria can be based on attribute queries and spatial queries (for example, within 1 mile of a river).

Next Steps

Continue using an ArcGIS Online organizational account (www.esri.com/schools) to dig deeper into data using the analysis tools, and save your maps to your account.

THEN TRY THIS...

- Analyze cities near earthquake zones in the western Pacific.
- Explore the 2015 Nepal earthquakes with a story map at <http://esriurl.com/Geo519>.



TEXT REFERENCES

This GIS map has been cross-referenced to material in sections of chapters from these high school texts.

- Earth Science by Glencoe McGraw Hill — Chapter 5*
- Earth Science by McDougal Littell — Chapter 1*
- Earth Science by Prentice Hall — Chapter 7*
- Earth Science by Tarbuck and Lutgens — Chapter 7*