



Mountain building

from the Esri GeoInquiries™ collection for Earth Science

Target audience – Earth Science learners

Time required – 15 minutes

Activity

Discover how global mountain ranges are formed related to plate motions.

Science Standards

NGSS:MS-ESS2-3 – Analyze and interpret data on the distribution of fossils, rocks, continental shapes, & seafloor structures to provide evidence of past plate motions.
NGSS:MS-ESS2.B – Plate Tectonics and Large-Scale System Interactions

Learning Outcomes

- Students will describe forces at work in mountain building.
- Students will distinguish constructive from destructive forces in landscape development.

Map URL: <http://esriurl.com/earthgeoinquiry9>



Engage

Does North or South America have the biggest mountain range?

- ? How many mountain ranges can you name? How many do you think there are?
- Click the map URL link above to start the map.
- With the Details button underlined, click the button, Show Contents of Map (Content).
- Click the button, Bookmarks. Select Rocky Mountains.
- Select the bookmark, Andes Mountains.
- ? Compare and contrast the Andes and Rocky Mountains (e.g. Where are the mountains on each continent? How wide or long is each range? Where are the nearest tectonic plates?)



Explore

Where do mountains form?

- Check the box to the left of the layer name, Tectonic Boundaries.
- Select the bookmark, All Mountains.
- Mountains are “built up” through pressures on the earth’s crust when plates collide.
- ? Where do mountain ranges occur in relationship to tectonic plates? *[Most form at the plate boundary edges because of collisions.]*



Explain

Do some plate boundaries produce mountains better?

- ? Count the number of mountain ranges that occur near each boundary type. Based on this information, from which type of boundary are mountains more likely to occur? *[Convergent produces about 25, divergent produces about 6, and transform produces about 8.]*
- ? Why would this plate boundary type be better at creating mountains? *[The greater relative velocity of converging plate crashes provides more energy for piling up mountains.]*
- Turn off the layer, World Mountain Ranges.

more ►

Elaborate

Are there exceptions to this rule?

- Turn on the layer, Ranges Away From Boundaries.
- Explore the mountain ranges that do not appear to be located near plate boundaries.
- ? From what you are learning about how mountains form, which plate would North America have had to collide with to form the Appalachian mountains? [*Europe—even the shape of how the continents appear to fit together hints at it.*]
- ? Is there evidence in Europe of this collision? Which range is it? [*The Scandinavian range was formed at the same time as the Appalachians. South America (Brazilian Highlands) also has a matching mountain range in Africa (Bie Plateau).*]
- ? Why do some mountain ranges appear not to be located near plate boundaries? [*Many of these ranges formed from old plate boundaries that are no longer active.*]

Evaluate

What influences the height of the mountains?

- Turn on the two layers, Plate Motions (mm/year) and World Mountain Ranges.
- Consider how mountain heights might compare to the speeds of the colliding plates.
- ? Rank the mountains with the highest peaks: Himalayas, Andes, or Rocky Mountains. [*Himalayas = 29,000 ft., Rocky Mountains = 14,400 ft., Andes Mountains = 22,800 ft.*]
- ? What is the relationship between the speed of plates and height of mountain ranges? [*The faster the plates are moving, the higher the mountain ranges.*]

MEASURE

- Click the button, Measure.
- Click the Distance button. Select units of measurement.
- Click once on the map to start the measurement; click again to change direction and double click to stop measuring.

BOOKMARK

- Click the button, Bookmarks.
- Choose the desired bookmark.
- The map will change location and scale.

Next Steps

DID YOU KNOW? ArcGIS Online is a mapping platform freely available to public, private, and home schools. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at <http://www.esri.com/schools>.

THEN TRY THIS...

- Log in to your ArcGIS organization account and perform analysis on World Mountain Ranges.
- Use the Find Existing Location tool to manually find mountain ranges located within 100 miles of any plate boundary.
- Create an expression to find World Mountain Ranges **Within A Distance Of 100 Miles** From Tectonic Boundaries.

TEXT REFERENCES

This GIS map has been cross-referenced to material in the mountain building sections of chapters from middle-school texts.

- *Earth Science by Glencoe McGraw Hill – Chapter 6*
- *Earth Science by McDougal Littell – Chapter 3*
- *Earth Science by Prentice Hall – Chapter 7*
- *Earth Science by Tarbuck and Lutgens – Chapter 9*