



Rock types tell stories

from the Esri GeoInquiries™ collection for Earth Science

Target audience – Earth Science learners

Time required – 15 minutes

Activity	Examine patterns of where rock types form and the relationship they have toward each other.
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.
Learning Outcomes	<ul style="list-style-type: none">• Students will differentiate rock types from their texture, color, and crystal size.• Students will explain the location relationships between areas of igneous, sedimentary, and metamorphic rocks using the rock cycle.

Map URL: <http://esriurl.com/earthgeo inquiry4>

Engage

Which came first: igneous, metamorphic, or sedimentary rock?

- ? What does the word “metamorphic” mean? *[It means changed from its original form.]*
 - ? What does this imply about when it could have formed, compared with other rock types? *[Metamorphic rock had to be a different rock type first.]*
 - ? What is sediment? *[It is small pieces of broken rock that have fallen to the bottom of moving streams.]*
 - ? Could the earth’s original surface have been composed of sedimentary rocks? *[Perhaps, but only as the planet formed. As these smaller pieces of space matter accumulated into the planet, all of these materials melted and combined into the earth’s original sphere.]*
 - ? Considering that smaller pieces of space dust melted to form the earth, which rock type seems most likely to have formed first? *[Igneous or hot melted rock probably formed first.]*
- Click the link above to launch the map.

Explore

In what way is the earth forged in fire?

- Click an Igneous Plutonic area of the map.
- Click an Igneous Volcanic area of the map to see several of the rocks formed from lava.
- ? How do Plutonic rocks compare to Volcanic rocks? *[Plutonic rocks have much larger crystals. While this aspect is unrelated, students may notice that darker rocks are from ocean crust or basalt. Continental crust is less dense and generally lighter in color.]*
- ? Which rocks in the images are formed from continental crust? *[The lighter white, gray, and light pink rocks, as well as the rhyolite, white pumice, and white and gray ignimbrite, are formed from continental crust.]*

Explain

In people, skin wrinkles over time; is this true for the earth’s skin?

- With the Details button underlined, click the button, Show Contents of Map (Content).
- Turn off the layer, NA Rock Types. Look at the ruggedness of the country.
- ? Which area has the newest, most recently crumpled surface? *[West coastal mountain ranges seem newest.]*
- Compare other igneous areas on the map.
- (Turn NA Rock Types on and off to see different rock types.)
- ? What mountains appear older, lower, and more eroded? *[The Appalachian (with Smokey and Blue Ridge) Mountains, the Adirondack Mountains, and the Ouachita/Ozarks of Arkansas and Oklahoma]*

Elaborate

Why is it important for rocks to erode?

- Turn on the layer, Sedimentary Rocks.
- ? In what different ways can sedimentary rocks form? *[They can form from weathering, plants, animals, evaporating water.]*
- ? Summarize which weathered material rocks you could find if you went from the base of the mountains (where they first broke off) to the sea (where their sediments came to a final resting place). *[You could find breccia, conglomerate, sandstone, and shale.]*
- ? How can you tell different types of coal apart? *[Lignite is brown and soft, bituminous is flat black and hard, and anthracite is hard and has shiny surfaces.]*
- ? What are some ways we currently use sedimentary rocks? *[Sand, gravel, and limestone make concrete. Gypsum makes drywall. Coal and oil helps produce energy. Salt is used for melting ice or seasoning food.]*

Evaluate

Where do all these eroded materials go?

- ? Where are the materials that used to be the mountains of the Canadian Shield? *[They have either eroded out to sea and the continental edge, or continental glaciers in the ice ages pushed them inward.]*
- ? If coal is formed from dead plants, from what is oil formed? *[Oil is formed from small dead sea animals (zooplankton, shelled invertebrates) settled in with the fine clays that form shale on sea floors.]*
- ? Where are the oil deposits in North America? *[They are located throughout the sedimentary regions in Texas, North Dakota, Colorado, the Front Range of Canada, and the Gulf.]*
- ? In which type of rock does oil form? *[Oil forms in shale.]*
- ? Which rock type fills most of the volume between the Rockies and Appalachians? *[Students will most likely say sedimentary rock, but this is only at the surface of the continent. After the first couple of hundred feet maximum, one would reach the earth's original igneous crust. In some cases, it is metamorphic rock, particularly nearer to the Hudson Bay.]*

MEASURE

- At the top of the map, click the Measure button.
- Hover and click the Distance button.
- Click continuously along what you want to measure.
- Double-click to finish.

BOOKMARK

- At the top of the map, click the Bookmarks button.
- Choose your bookmark.
- The map will take you there.

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.
- Browse Esri map layers, and search for **energy, oil, coal, gas, shale, or pipelines**.
- Explore the rock types from which our energy resources form. *[They form from sedimentary rock.]*

TEXT REFERENCES

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

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