



# Mining the world's most used minerals

from the Esri GeoInquiries™ collection for Earth Science

Target audience – Earth Science learners

Time required – 15 minutes

**Activity** Students will analyze the quantities and origins of basic mineral resources.

**Science Standards** NGSS:MS-ESS2-1 – Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

**Learning Outcomes**

- Students will explore mineral resources used in their lives and learn the origins of these resources to better predict where they might be found.

Map URL: <http://esriurl.com/earthgeoinquiry3>



## Engage

### What earthy things do you surround yourself with?

- List some things around you that were manufactured from materials mined from the earth.
- Click the link above to launch the map.
- Click the link in the upper-right, Modify Map.
- With the Details button underlined, click the button, Show Contents of Map (Content).
- Click the button, Bookmarks. Select Bingham Canyon Mine.
  - This is the largest and deepest open pit mine in the world.
- Measure the opening of the mine from the west rim to the east rim.
- ? How far is it across the opening? *[It is approximately 2.7 miles across, .75 miles deep.]*
- ? How many major league football stadiums would fit in this hole? *[Using the 80,000-person capacity of the Dallas Cowboys' stadium, approximately 115 stadiums would fit in the hole.]*
- Click the button, Basemap. Select Imagery.



## Explore

### What amount of raw minerals do we need in our lives?

- Each mine is the largest of its kind in the world.
- Click the bookmarks for each mine, and then click each marker to view additional information.
- ? What does each mine produce? *[Among other things, the mines produce copper, salt, iron, and lithium.]*
- ? Based on the information you learned from the Bingham Canyon Mine, what is the total amount of mineral resources an average person uses? *[An average person uses 1600 pounds of mineral resources.]*



## Explain

### Why do more minerals gather in certain places?

- Click the Home button to see the full extent of the map.
- Turn on the two layers, Copper Mine Density and the Sources Of Minerals.
- Click the large box containing the word Copper to see how copper ore is formed.
- ? What are the top three areas that produce this metal for the world? *[Chile, China, and Peru are the top three areas.]*
- Explore the other three metals (iron, aluminum, and gold) in the same way.

## Elaborate

### At this rate, how long can we use resources?

- Click the marker near Lake Huron.
- Click the image in the popup, and explore the image and graph further.
- ? Which resource will we run out of soonest if we keep consuming it at today's rate? [*indium*]
- ? What product will we need to redesign after we run out of its associated mineral? [*We will need to redesign flat-screen televisions.*]

## Evaluate

### Will recycling help extend how long we have access to these minerals?

- ? If the recycling rate of chromium is doubled, what is the fraction of new material needed to make products that use chromium? [*It is .50, or 50 percent.*]
- The fraction of the percent of new material used currently, divided by how much new material there will be after recycling is increased, results in how much longer this resource will now be available.
- ? Calculate how much time the use of tin can be extended by doubling the amount of recycling from 75 percent new material to 50 percent new material. [ *$0.75/0.5 = 1.33$ , so tin will currently last 17 more years. By doubling the recycling, you will have  $1.33 \times 17 = 22.6$  years.*]

## MEASURE

- At the top of the map, click the Measure button.
- Hover and click the Distance button.
- Click and drag the mouse, and then double-click to end the measurement.

## 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 Online organization account and perform analysis on Metal Smelters And Refining Centers.
- Click Analyze Patterns, and choose Calculate Density to determine the density of the centers.

## TEXT REFERENCES

This GIS map has been cross-referenced to material in the minerals and mining 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*