

## Exploring Mining the Lower 48 States

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Before you begin using this module, you will need to know about using a Web-based GIS viewer. You can do this by watching the tutorial video or working through the tutorial. The tutorial video, student activity, and Web-based GIS Tutorial Viewer can be found at <http://gis.lanecollege.edu> → “Modules” tab → “Tutorial” link. The activity works best with a high speed Internet connection.

**Prior Skills:** For this activity, you will need to know how to turn on and off layers, make layers active and visible, use the zoom tool, toggle between the legend menu and the layers menu, and use the ID tool.

**Objectives:** In this activity you will:

- Describe geologic patterns of igneous, metamorphic and sedimentary rock and sediments in the lower 48 states.
- Understand the influence geology and atmospheric particles have on the environment.
- Identify associations between specific mineral and geologic type
- Use GIS technology to explore physical relationships and to collect and analyze data to identify solutions and/or make informed decisions.
- Collect, organize, and display sufficient data to facilitate scientific analysis and interpretation.
- Understand the properties and limited availability of the materials which make up the Earth.

Lesson adapted from 1998 ESRI Canada - Where should we Mine? Schools and Libraries Program, 12 Concorde Place, Suite 900 Toronto, Ontario, M3C 3R8 Tel: (416) 441-6035 Fax: (416) 441-6838

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For the following activity you are going to act as a consultant for a mining company that has operations in many states in the U.S. (Excluding Alaska and Hawaii). You will need to evaluate new sites for future development. To do this, you will use data derived from a continental (small-scale) geologic map.

### Geologic Maps and Generalization

“A geologic map uses a combination of lines, symbols, and colors to show the composition and structure of earth materials and their distribution across and beneath the Earth's surface. Several map layers are used to comprise the Generalized Geologic Map of the United States, including geology and faults. The Generalized Geologic Map of the United States map layers show the geology of the bedrock that lies at or near the land surface, but not the distribution of surficial materials such as soils, alluvium, and glacial deposits. This kind of general geologic information is used to find natural resources such as water, minerals, oil, and gas; evaluate potential hazards such as earthquakes, landslides, floods, and volcanic eruptions; and to describe a fundamental part of the environment that controls the distribution of plants and animals. These map layers were compiled by the U.S. Geological Survey (USGS)” (National Atlas 2009). Once a preliminary study is done using

a small-scale map, final analysis is done using a more detailed large-scale geologic map.

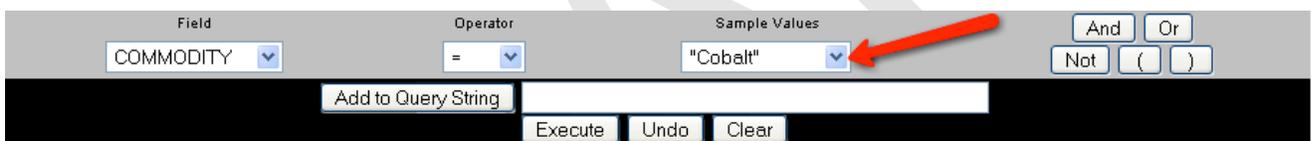
Before you begin read the background information sheet to refresh your knowledge of rocks and minerals and to familiarize yourself common mineral uses. In this activity, you will explore the location of non-ferrous and ferrous mines and then prioritize sites for coal development.

**Remember**, computer steps are indicated by a ► symbol and questions you need to answer are numbered.

- Open the Web-based GIS at <http://gis.lanecc.edu> → Modules → Mining
- Click the link to the Web-based map or type in the URL <http://arcgis.lanecc.edu/website/mines/viewer.htm>

1. Describe the distribution of ferrous and non-ferrous mines. Where are they in the U.S.? Are they evenly spaced, or are they clustered in specific areas?

- Make Ferrous Mines Active   Ferrous Mines and Refresh Map.
- Choose the Query Tool  → Click the dropdown for Sample Values



2. List the five ferrous commodities in this data set.

- Make Non-Ferrous Mines Active and Refresh the Map.
3. Use the query method above and list the four non-ferrous commodities.
- Set the query to search for Gold Mines. → Execute the query



4. How many gold mines are selected? In general, where are they in the U.S.? There are 12 non-ferrous mines in this dataset. What percent are gold mines?

- Turn on “Geologic Age.”
5. In general, which geologic ages are associated with gold mines?

▶ You will need to turn on the legend to see the age categories. 

▶ Turn off “Geologic Age” and turn on “Geologic Type.”

6. What type of geology is associated with gold mines? Does this fit what you know about the occurrence of gold? Why or why not?

The Web-based GIS map is a small-scale very generalized map. Typically, the larger the land area shown on a map the less accurate and precise the data can be and therefore more generalized it is.

▶ Turn off the mines and Refresh the Map.

7. Where do you find mainly igneous rock? Where do you find metamorphic rock?

8. According to the map, what region or areas appear to be made up mainly of sedimentary rock?

▶ Turn on the “Coal” and “Karst” layers. Karst describes a type of landform characterized by caves, sinkholes, underground rivers, and tubes formed in limestone.

9. For this map, karst is used as proxy data for limestone. Which geologic type is associated with coal and limestone? Describe the spatial occurrence of coal and limestone.

▶ Turn off the geology layers → Turn on the mines, the processing plants and Railroads → Refresh the Map.

10. Describe the association between mines and railroads.

### **Coal Mining and Production Site Analysis**

Your task is to propose sites in the U.S. for coal exploration. First locate all the known deposits of Bituminous Coal using the query tool.

- ▶ Make Coal Visible and Active → Refresh the Map → Click the Query tool

Field: TYPE Operator: = value: TYPE = "Bituminous" Get Samples

Add to Query String Execute Undo Clear

And Or Not ( )

11. How many bituminous sites are there? Describe their location.

- ▶ Narrow the search and find only those with an area > 1 square mile  
Add the following to the query string "TYPE = "Bituminous" AND AREA > 1"

12. How many known coal fields are bituminous with an area over 1 square mile? Describe their location.

13. How many of these are identified as having mining potential?

14. Your client needs to find suitable sites of Medium and High Volatile Bituminous coal that have mining potential. You will base your recommendation on several factors.

- Because bituminous coal is high in sulfur; the mines and associate processing plants are down wind from cities and towns. Sulfur is a component of acid precipitation and can create environmental damage to vegetation, and aquatic life, especially in area with granitic soils.
- The closer the mine is to a processing plant, the less transportation will be.
- You may be able to refit or use an existing plant or build near an existing plant and share infrastructure costs.
- You will need a workforce and proximity to a town is important
- Proximity to a town with a mining history will provide n experienced workforce.

Evaluate each of the sites with respect to - Water, Rail, Small town workforce, Existing processing facility - in the table provided on the following page.

COALFDP050	Water	Rail	Highway	City	Processing	Other
1.						
2.						
3.						
4.						
5.						

15. Discuss other factors that would affect your recommendation?

16. List your recommended sites in order from most desirable to least desirable and amplify your recommendations.

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