

## Mineral Resource Science—

# • *Supporting Informed Decisionmaking*

The United States is one of the world's largest users of mineral resources. We use minerals to build our homes and cities, fertilize our food crops, and create wealth that allows us to buy goods and services. Individuals rarely use nonfuel mineral resources in their natural state—we buy light bulbs, not the silica used to create the glass bulb; we buy cell phones, not the rare earth elements used in tiny magnets for speakers and vibration; we buy cars, not the steel used to build the chassis.

The USGS Mineral Resources Program (MRP) delivers unbiased science and information to increase understanding of mineral resource potential, production, and consumption, and how mineral resources interact with the environment. The MRP is the Federal Government's sole source for this mineral resource science and information.

### *Program Goals*

- 1 Increase Understanding of Mineral Resource Formation
- 2 Provide Mineral Resource Inventories and Assessments
- 3 Broaden Knowledge of the Effects of Mineral Resources on the Environment and Society
- 4 Provide Analysis on the Availability and Reliability of Mineral Supplies



Specimen of stibnite, an ore mineral of antimony. Antimony compounds help to prevent skin burns, increase battery life, and refine the glass used in cell-phone screens.

Folded, faulted, and altered sedimentary rocks in the western Alaska Range, where mineral resource potential is being evaluated.





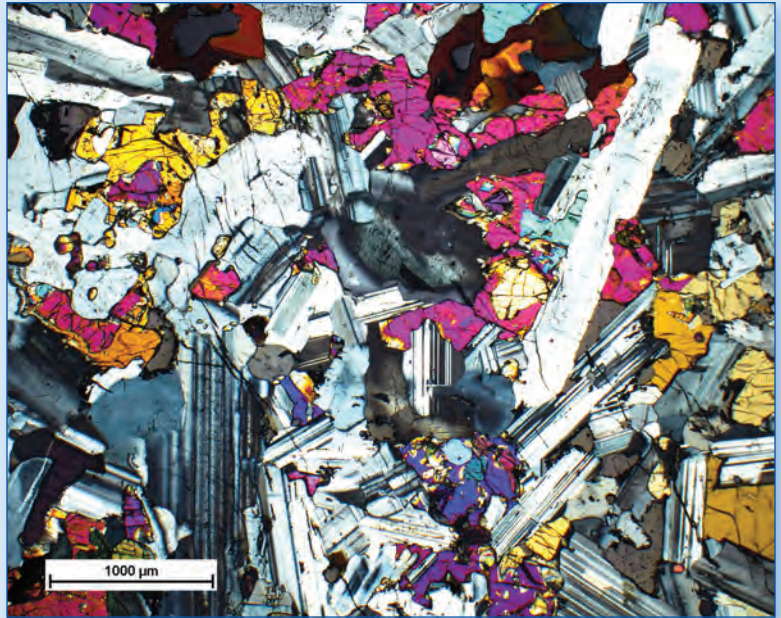
## Increase Understanding of Mineral Resource Formation

The MRP supports research on how and where mineral deposits form, as well as research on methods to predict the location and estimate the amount of potential mineral resources (also known as undiscovered mineral resources). Such research decreases uncertainty in assessments of undiscovered mineral resources.

Most undiscovered mineral resources are not exposed at the Earth's surface. Instead, they are concealed by dense vegetation or are buried by unmineralized rocks and sediments. The MRP is continually developing and applying geophysical tools and techniques to allow us to see geologic units and structures on and beneath the Earth's surface and build three-dimensional models of an area to understand how mineral resources are distributed.

The MRP is also developing and applying innovative remote sensing and geochemical tools and methods to identify Earth surface signatures of undiscovered mineral resources.

MRP scientists study mineral resources at all scales—from continental scale, to understand which regional geologic processes are controlling the distribution of mineralizing systems—to microscopic scale, to understand more local controls and mineral-to-mineral associations.

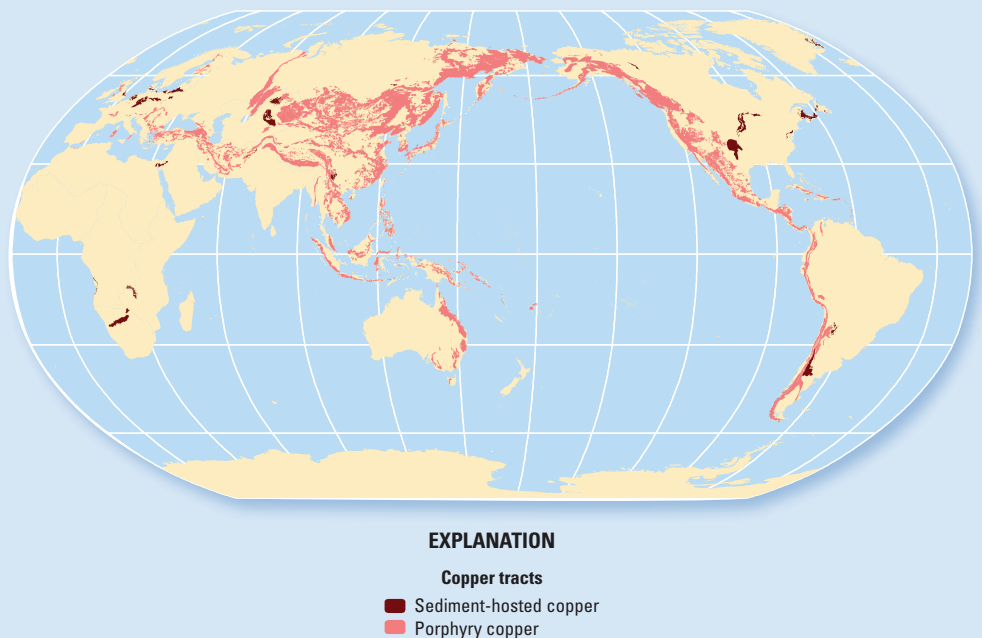


One way scientists study mineral resource formation is through microscopic images. The image above is a photomicrograph of a thin section of hornfels through which polarized light transmits in a microscope to show diagnostic optical properties of individual minerals like plagioclase (white, and gray and white stripes), olivine (pink, yellow, and purple), amphibole (brown-red [at top of image]), and sulfides (dark-gray pockets surrounded by amphibole). The width of the field of view is 4.7 millimeters.

## Provide Mineral Resource Inventories and Assessments

Before we can produce sound, objective, geologically based mineral resource assessments for undiscovered mineral resources, we must develop an inventory of known mineral resources and an understanding of the geologic controls on their distribution.

MRP scientists conduct research to understand the geologic history and characteristics of the assessment region, define what processes formed the known mineral deposits, and identify criteria for predicting the likelihood of undiscovered deposits. Teams of experts analyze available information, identify signatures that suggest the presence of undiscovered mineral deposits, outline mineral potential areas for specific deposit types, and estimate the quality and quantity of undiscovered mineral deposits in the mineral potential area. Federal, State, Tribal, and local government agencies use mineral resource assessments to advise mineral policy and land management decisionmaking.



Map from first-ever global assessment of undiscovered copper resources, conducted by the U.S. Geological Survey. Areas shown are likely to contain different types of undiscovered copper deposits that will feed future global copper supply.

## Broaden Knowledge of the Effects of Mineral Resources on the Environment and Society

The MRP supports research to understand what happens when mineral deposits weather naturally or are mined. MRP scientists use this information to establish baseline conditions prior to mineral resource development and to anticipate environmental challenges associated with developing new mineral deposits, such as the potential release of contaminants that could impact human and ecosystem health.

Understanding baseline conditions in a pre-development setting is essential to making informed policy and resource management decisions. Understanding potential environmental impacts and mitigating processes promotes sustainable development of the mineral materials that society needs and promotes responsible stewardship of our natural resources.

Stream affected by runoff from mineralized areas and abandoned-mine drainage, Animas River watershed, Colorado.

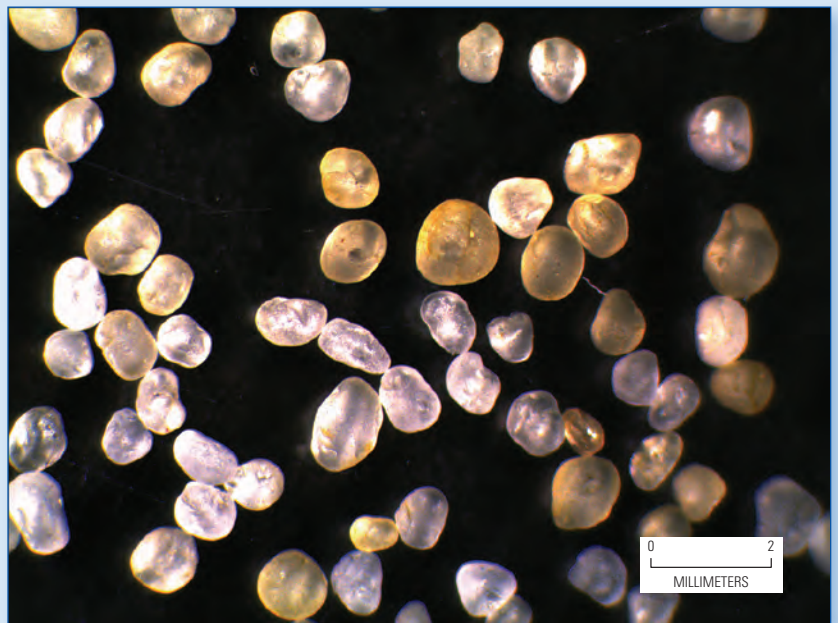


## Provide Analysis on the Availability and Reliability of Mineral Supplies

Information on domestic and international supplies and uses of mineral commodities is essential to the U.S. economy and to national security. Public and private organizations rely on this current, objective information to understand the importance of mineral materials to the economy, make informed decisions, and forecast future mineral supply and demand.

The MRP collects data on mineral production, consumption, recycling, inventory, and shipments from the U.S. mining and mineral processing industry. In addition, the MRP compiles and analyzes production data, trade data, and other information for more than 100 mineral commodities from about 180 countries. MRP specialists then use this information to assess national and global mineral materials flow through supply-chain analysis.

Supply-chain analysis characterizes the complexity of mineral commodity supply chains and documents vulnerabilities that could lead to supply-chain disruption. This information is essential in planning for and mitigating the impacts of potential disruptions to mineral commodity supply, whether caused by natural hazards or by human activities.



“Frac sand” is essential in the hydraulic fracturing process that has revolutionized oil and natural gas production in the United States. This pure quartz sand is found only in certain areas of the U.S. and must be mined and transported to areas of oil and gas production, which is one example of how materials must flow from source to use through a network of supply chains.



## Current Major Areas of Study



Excavator image by  
<http://www.freevectorarchive.com>



### Critical Mineral Resources

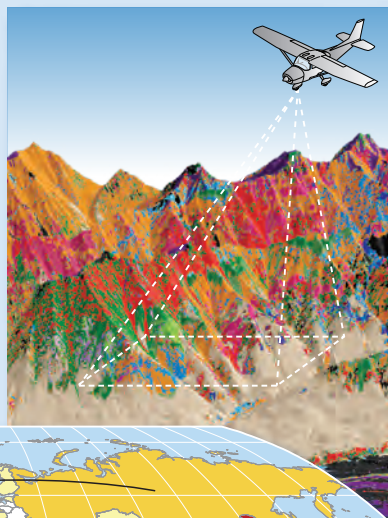
Research to better understand the genesis and regional controls on the distribution of mineralized systems containing critical mineral resources. Smartphones and other high-tech devices are made with many critical minerals.

### Alaska as a Mineral Resource Frontier

Geologic investigations as a foundation for documenting mineral resource potential.

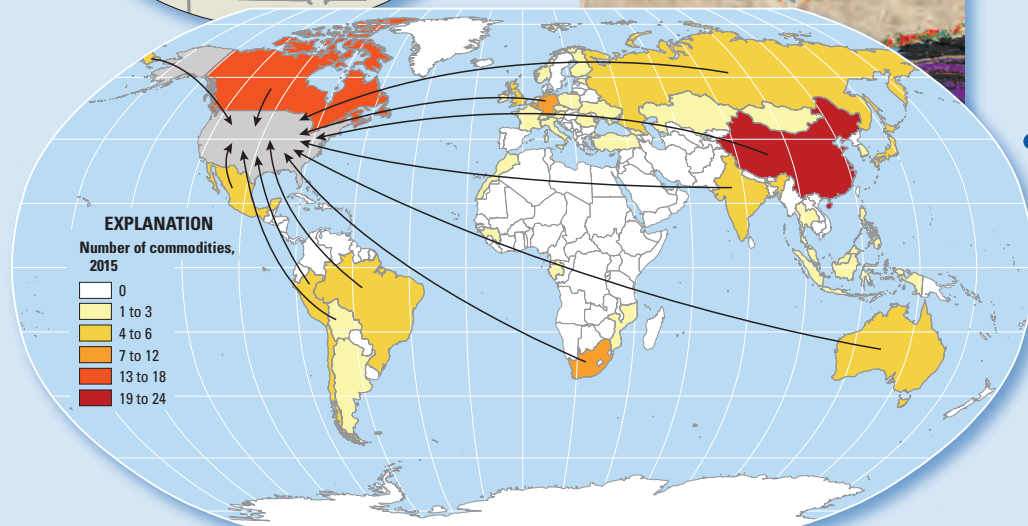
### The Midcontinent Rift of the United States

Multidisciplinary studies to image and characterize the mineral resource potential of this significant crustal feature (dark-green areas on map).



### Hyperspectral Imaging and Other Geophysical Investigations

State-of-the-art tools used for mineral resource and mineral environmental investigations. Different colors in the illustration represent individual mineral types.



### Materials Flow Studies

Investigations to address supply-chain analysis (including risk analysis) and sustainable mineral supplies. Map shows major import sources of nonfuel mineral commodities for which the United States was greater than 50 percent net import reliant in 2015.

#### For more information, contact:

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