

Do We Take Minerals for Granted?

Did you know that the average automobile contains more than a ton of iron and steel, 240 lbs of aluminum, 50 lbs of carbon, 42 lbs of copper, 41 lbs of silicon, 22 lbs of zinc, and more than thirty other mineral commodities, including titanium, platinum, and gold? Do you know the cost of a pound of copper or an ounce of platinum? Though you are constantly reminded of the importance of gasoline, and its cost, to keep the car running, do you ever think about the importance and cost of the mineral materials that make up the car? Do we take minerals for granted?



When the power goes out, few of us give a second thought about the copper and aluminum needed to carry electricity from the power plant to our homes or offices. When the battery dies, you do not automatically think about the lead, nickel, cadmium, or lithium used to make the batteries that store power for our cell phones, MP3 players, or hybrid cars, because you do not buy minerals, you buy products that have been manufactured using mineral materials. But without these nonfuel mineral commodities, many things that we take for granted would not work.



Minerals in the environment and products manufactured from mineral materials are all around us and we use and encounter them every day. They impact our way of life and the health of all that lives. Minerals are critical to the Nation's economy and knowing where future mineral resources will come from is important for sustaining the Nation's economy and national security.

The USGS Mineral Resources Program (MRP) supports science used to understand:

- How and where nonfuel mineral resources form and are concentrated in the Earth's crust,
- Where mineral resources might be found in the future,
- How mineral materials interact with the environment to affect human and ecosystem health, and
- The usage and production of about 100 different mineral commodities in the U.S. and nearly 180 countries throughout the world.

Why is it important to understand the science of mineral resources and materials? Because we are increasingly dependent on mineral materials to create products that support our way of life, our health, and the global economy.



Minerals Everywhere and Everyday



Our homes and office buildings contain many mineral materials:

- Drywall is made from gypsum,
- Concrete in the foundation is made with limestone and aggregate reinforced with steel rebar,
- Bricks are made from clay,
- Titanium oxide is used to make paint,
- Silica is used to make windows,
- Electrical wiring is made from copper,
- Iron and copper are used to make pipes for plumbing, and
- Faucets contain various combinations of iron, chromium, nickel, and molybdenum combined to make stainless steel.

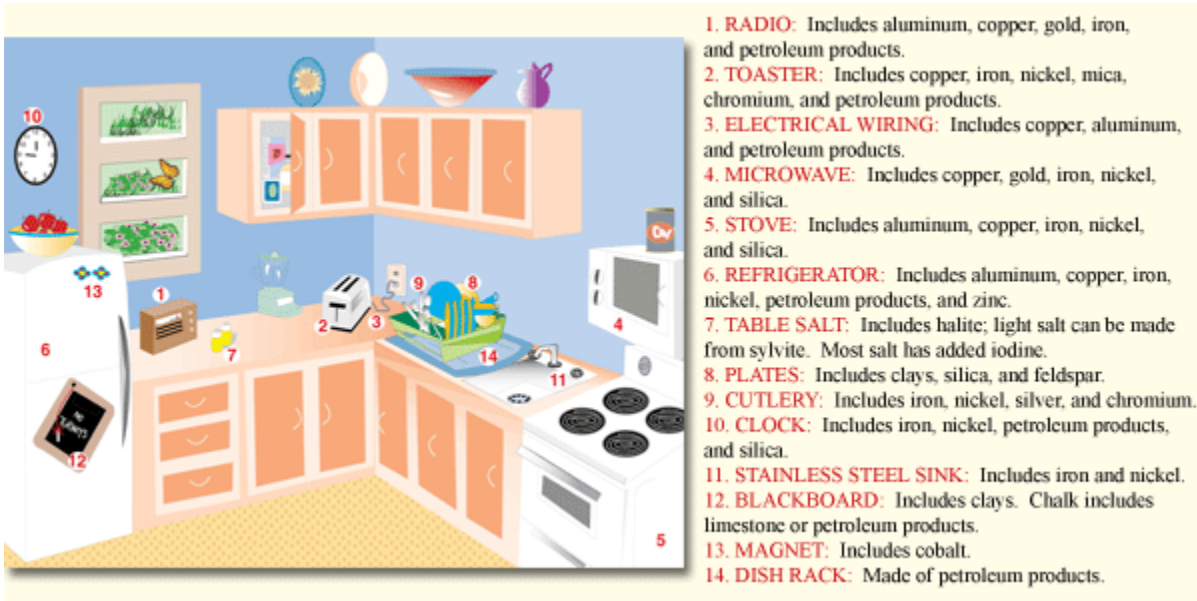
Some things we use for our [favorite hobbies and recreation](#) also rely on mineral materials to make them stronger, lighter, and more flexible. Advances in materials science have allowed bicycles, once largely made of steel, to incorporate parts made of aluminum, carbon fiber, magnesium, and titanium that make them lighter and more durable. Aluminum, fiberglass, graphite, titanium, zirconium, beryllium, copper, tungsten, and steel have replaced wood in baseball bats, tennis racquets, and golf clubs to make them lighter and stronger. Race tracks, as well as playing surfaces for baseball and tennis, are a prescribed mixture of clay, sand, and silt. Calcined clay (a clay that has been heated) readily absorbs water to dry wet spots on fields and it is used to reduce soil compaction. It is also used on infield areas of baseball diamonds and on fields and tracks because it does not stick to cleats or hooves.

The USGS MRP studies these and many more commodities to provide the critical mineral resource information required by policy makers, industry and the public to make informed decisions regarding minerals issues important to the Nation. The range of MRP research is described in USGS [Circular 1289](#). The MRP also compiles information on known mineral resources and makes these data and information available to



the public. To find out where various mineral materials occur in the U.S. and around the world, visit the [MRP Spatial Data site](#).

We use minerals every day to grow, prepare, and eat our food. Much of our food is grown using fertilizers made from [phosphate](#) and potash. Meat and poultry come from animals that eat fodder grown with mineral-based fertilizers that may be supplemented with selenium, phosphorus, or zinc. Modern tools for safe food storage and preparation (such as, refrigerators and stoves) are made from many mineral commodities and rely on copper wires for electric power or copper pipe for natural gas. At the table, salt is used for seasoning, cutlery is made from stainless steel or may be silver plated, plates are made from clays, and glassware is made from silica (or perhaps on special occasions it is lead crystal).



Minerals and the Environment

Many of the minerals that our bodies require for good health, such as calcium, magnesium, iron, potassium, and zinc, we get from food. And while we need an adequate supply of many different minerals, there are negative health consequences resulting from exposure to some mineral materials or elevated levels of otherwise good minerals. Some of these minerals come from our everyday contact with the air, water, and ground in our surroundings. Some of them we are exposed to by man-made disturbances to the natural environment or as a result of a wide range of natural disasters.

Whether it is research on

- Asbestos in California [soils](#),
- Dust from [black shale landscapes](#) in Colorado and Utah,
- Mercury from abandoned mines in [Big Bend National Park, Texas](#),
- Mud deposited during flooding in New Orleans after [Hurricanes Katrina and Rita](#),
- Dust from the collapse of the [World Trade Center in New York](#), or
- Effects of recent wild fires on soils and runoff waters in [southern California](#).



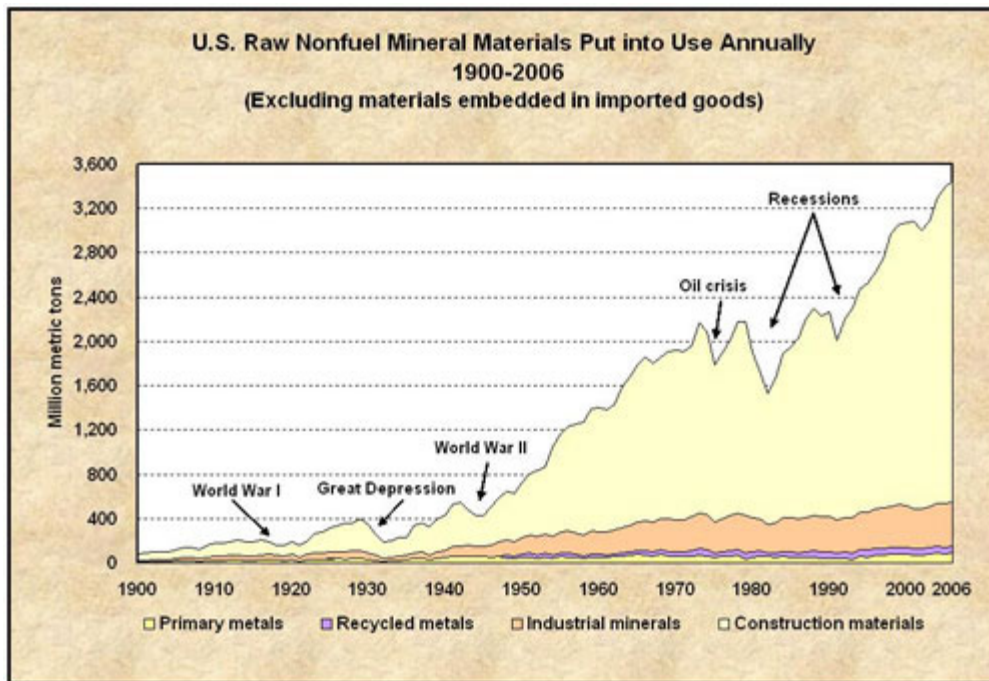
MRP science helps local, State, and Federal agencies develop land management plans to minimize effects of mineral-borne contaminants on human and ecosystem health.

The MRP supports research to better understand the environmental impact of abandoned mines, which reduces the cost of cleanup. For example, studies of old mining areas in the Animas River watershed in southwestern Colorado helped other agencies plan and carry out effective reclamation activities. The USGS MRP is a leader in the investigation and analysis of:

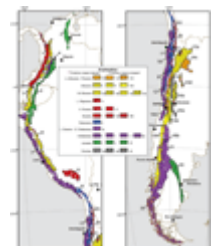
- Natural background levels of minerals in the environment,
- Mechanisms of mineral breakdown, and
- Transport of mineral components that may be sources of contaminants.

Future Mineral Supplies

As standards of living rise around the world, there is greater demand for durable goods and products manufactured from mineral materials. As [large emerging economies](#), such as China and India, increase their participation in the global economy, demand for critical mineral resources is increasing at a rapid rate. That means that we are depleting our known mineral deposits at an increasing rate, requiring that new deposits be found and put into production.



Every year, each person in the U.S requires more than 25,000 pounds of new nonfuel minerals to make the items we use every day. Where are the world's future supplies of important mineral resources located? The USGS MRP assessment of [Global Mineral Resources](#) and a new assessment of U.S. mineral resources will help answer this question. Recently MRP completed an assessment of copper resources in the Andes of South America. The study found that there likely is more copper (approx. 690 million tons) remaining in undiscovered deposits than has been produced and currently exists in known deposits in the Andes (590 million tons).

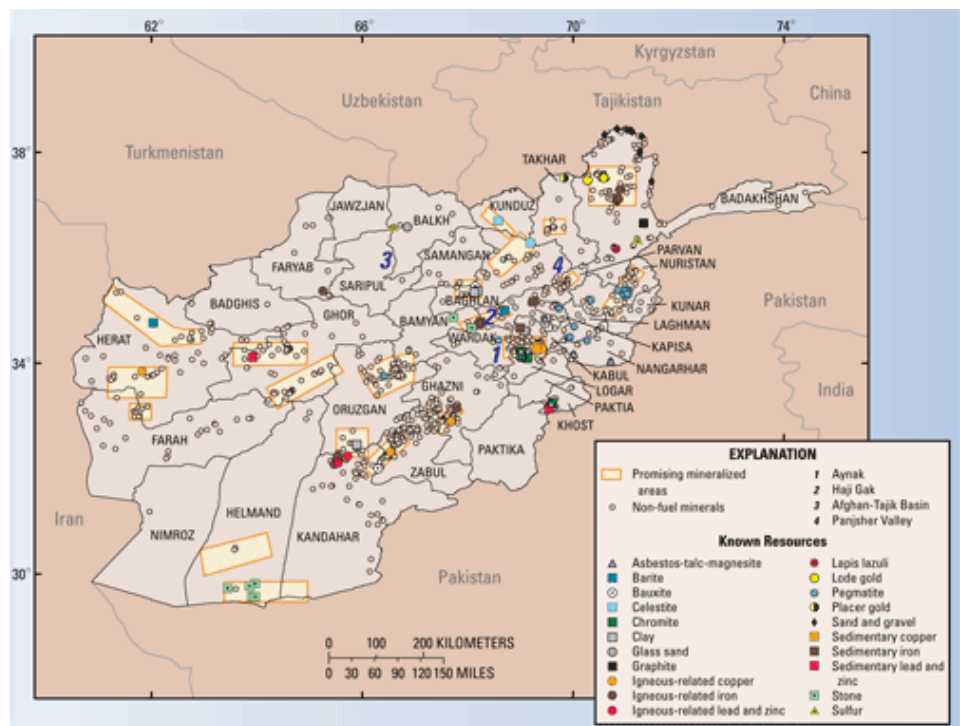


Every American born in 2008 is estimated to use the following amounts of nonfuel mineral commodities in their lifetime for their necessities, lifestyles, and health.	
Mineral commodity	Amount required over a lifetime
Aluminum (bauxite)	5,677 pounds
Cement	65,480 pounds
Clays	19,245 pounds
Copper	1,309 pounds
Gold	1,576 ounces
Iron ore	29,608 pounds
Lead	928 pounds
Phosphate rock	19,815 pounds
Stone, sand, and gravel	1.61 million pounds
Zinc	671 pounds
Data from U.S. Geological Survey and U.S. Energy Information Administration; statistical analysis by National Mining Association. Source of information: http://www.mii.org/pdfs/CalculationofmiiBaby.pdf .	

MRP is currently preparing for a new national assessment of mineral resources of the United States. Assessments of undiscovered resources require state-of-the-art methodologies and up-to-date background information. In preparation for the new assessment MRP is currently:

- Identifying mineral materials that will be important for emerging technologies and the future U.S. and global economy,
- Refine techniques to decrease uncertainty of new estimates of the location, quantity, and quality of undiscovered mineral resources,
- Refine ways to identify resources not directly exposed at the Earth’s surface, and
- Enhancing our ability to identify potential environmental consequences of developing mineral resources.

MRP expertise in mineral resource and mineral environmental assessments is recognized by the international community and by U.S. governmental agencies that provide assistance to developing countries. Mineral resource assessments of Afghanistan and Madagascar are examples of USGS mineral resource science aiding economic development of countries around the world. The MRP has also provided expertise to assist with the identification of possible mine-related environmental issues in the Philippines.



Minerals and the Economy

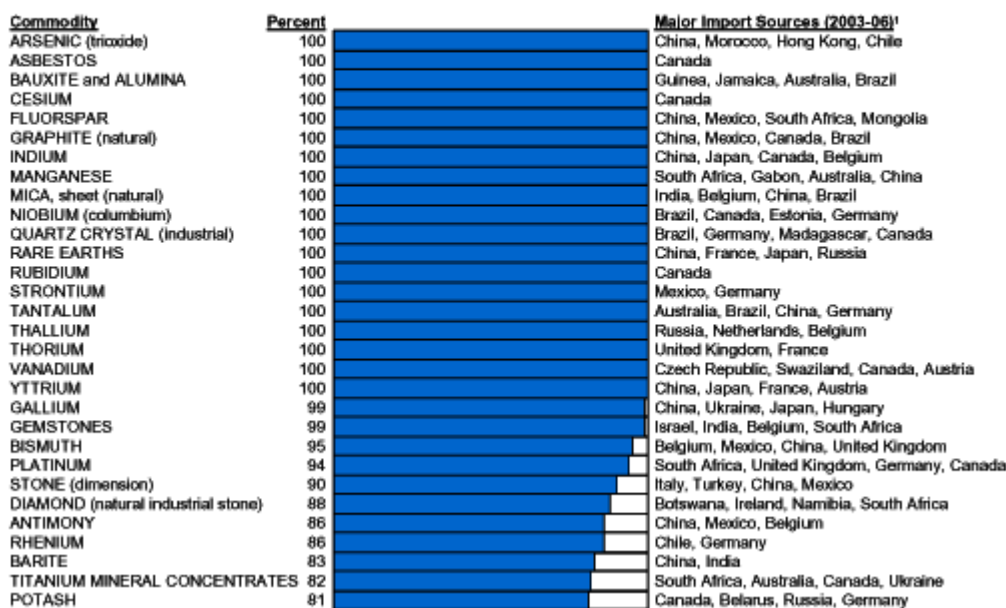
A recent study by the National Research Council (NRC) of the National Academies highlights the importance of minerals to the U.S. economy and provides a means to characterize how critical a **mineral commodity might be** by asking:

- How important is a particular commodity to our economy?
- What is the risk that the supply of an important commodity might be interrupted?

Commodities identified as being among the most critical included platinum-group metals and rare-earths. Platinum-group metals are essential components of pollution control systems (catalytic converters) in both gasoline- and diesel-powered vehicles, where they facilitate reduction in carbon monoxide, hydrocarbon, and nitrogen oxide emissions. Rare-earths are used in the manufacture of high-strength magnets, lasers, high-temperature metal alloys, and refractory ceramics which are strategic to the defense industry. The USGS MRP conducts research on these commodities to better understand how they occur and to decrease uncertainty in estimates of future resources both in the U.S. and around the globe.

As with petroleum resources, the U.S. increasingly relies on foreign sources for many mineral commodities that are important to the economy. The NRC report concludes that “decision makers in both the public and private sectors need continuous, unbiased, and thorough mineral information provided through a federally funded system of information collection and dissemination” and recommends that “Federal agencies, ...including the USGS...should develop and fund activities, including basic science,... to encourage U.S innovation in the areas of critical minerals and materials and to enhance understanding of global mineral availability.”

2007 U.S. NET IMPORT RELIANCE FOR SELECTED NONFUEL MINERAL MATERIALS

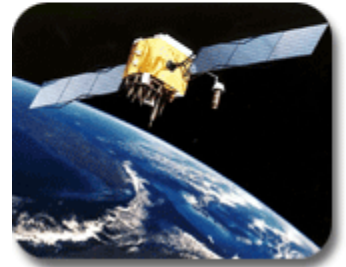


The Mineral Commodity Summaries report, published annually, is the earliest Government publication to furnish estimates covering nonfuel mineral industry data.

The USGS MRP is the sole Federal provider of objective mineral resource science and information. The MRP's unbiased research on mineral resource potential and mineral environmental issues and the collection, analysis, and dissemination of domestic and international mineral commodity information on production and consumption represent **one-stop access** for public and private users of mineral resource science and information.



As the global economy grows and evolves in the 21st century, emerging technologies will require mineral commodities on a greater scale and in a larger number of applications than ever before. Advances in alternative energy technologies, nanotechnology, telecommunications, and in the aerospace and defense industries have all been made possible by incorporating new applications of mineral materials. Some mineral commodities used in emerging technologies are rare and their known resources limited. The USGS MRP is conducting research to better understand the character of known resources for these **rare and scarce commodities** and is developing criteria to assess the possibility of undiscovered resources required to sustain emerging technology industries.



Minerals—Want to Learn More?

The next time you pick up that stainless steel fork, use your cell phone, replace the batteries in your remote control, or use your keys to start the car or open a locked door, take a moment to think about how important minerals are to your way of life. Then visit the **USGS MRP Web site** to learn more about what our Federal government is doing to ensure we have the mineral resources we need. The USGS Mineral Resources Program provides objective science and unbiased information at local to global scales so that the general public, government agencies, and industry can make informed decisions on minerals issues in land-use planning, national security, and economic policy, because mineral resources are vital to our nation.



<http://minerals.usgs.gov/granted.html>