Where is the greatest risk to our mineral resource supplies?

February 21 2020, by Alex Demas

Bastnaesite (the reddish parts) in Carbonatite. Bastnaesite is an important ore for rare earth elements, one of the mineral commodities identified as most at-risk of supply disruption by the USGS in a new methodology. Credit: Scott Horvath, USGS

Policymakers and the U.S. manufacturing sector now have a powerful

tool to help them identify which mineral commodities they rely on that are most at risk to supply disruptions, thanks to a new methodology by the U.S. Geological Survey and its partners.

"This methodology is an important part of how we're meeting our goals in the President Trump's Strategy to ensure a reliable supply of critical minerals," said USGS director Jim Reilly. "It provides information supporting American manufacturers' planning and sound supply-chain management decisions."

The methodology evaluated the global supply of and U.S. demand for 52 mineral commodities for the years 2007 to 2016. It identified 23 mineral commodities, including some rare earth elements, cobalt, niobium and tungsten, as posing the greatest supply risk for the U.S. manufacturing sector. These commodities are vital for mobile devices, renewable energy, aerospace and defense applications, among others.

"Manufacturers of new and emerging technologies depend on mineral commodities that are currently sourced largely from other countries," said USGS scientist Nedal Nassar, lead author of the methodology. "It's important to understand which commodities pose the greatest risks for which industries within the manufacturing sector."

The supply risk of mineral commodities to U.S. manufacturers is greatest under the following three circumstances: U.S. manufacturers rely primarily on foreign countries for the commodities, the countries in question might be unable or unwilling to continue to supply U.S. manufacturers with the minerals; and U.S. manufacturers are less able to handle a price shock or from a disruption in supply.

2019 U.S. NET IMPORT RELIANCE[1]

Commodity	Percent	Major import sources (2015–18)[2]
ARSENIC (all forms)	100	China, Morocco, Belgium
ASBESTOS	100	Brazil, Russia
CESIUM	100	Canada
FLUORSPAR	100	Mexico, Vietnam, South Africa, China
GALLIUM	100	China, United Kingdom, Germany, Ukraine
GRAPHITE (natural)	100	China, Mexico, Canada, India
INDIUM	100	China, Canada, Republic of Korea, Taiwan
MANGANESE	100	South Africa, Gabon, Australia, Georgia
MICA, sheet (natural)	100	China, Brazil, Belgium, Austria
NEPHELINE SYENITE	100	Canada
NIOBIUM (columbium)	100	Brazil, Canada, Russia, Germany
RARE EARTHS[3] (compounds and metal)	100	China, Estonia, Japan, Malaysia
RUBIDIUM	100	Canada
SCANDIUM	100	Europe, China, Japan, Russia
STRONTIUM	100	Mexico, Germany, China
TANTALUM	100	Rwanda, Brazil, Australia, Congo (Kinshasa)
YTTRIUM	100	China, Estonia, Republic of Korea, Japan
GEMSTONES	99	India, Israel, Belgium, South Africa
BISMUTH	96	China, Belgium, Mexico, Republic of Korea
TELLURIUM	>95	Canada, China, Germany
VANADIUM	94	Austria, Canada, Russia, Republic of Korea
TITANIUM MINERAL CONCENTRATES	93	South Africa, Australia, Canada, Mozambique
POTASH	91	Canada, Russia, Belarus, Israel
DIAMOND (industrial stones)	88	India, South Africa, Botswana, Australia
BARITE	87	China, India, Morocco, Mexico
ZINC (refined)	87	Canada, Mexico, Australia, Peru
TITANIUM (sponge)	86	Japan, Kazakhstan, Ukraine, China, Russia
ANTIMONY (metal and oxide)	84	China, Thailand, Belgium, India
RHENIUM	82	Chile, Germany, Kazakhstan, Canada
STONE (dimension)	81	China, Brazil, Italy, Turkey
COBALT	78	Norway, Japan, China, Canada
TIN (refined)	77	Indonesia, Malaysia, Peru, Bolivia
ABRASIVES, fused Al oxide (crude)	>75	China, Hong Kong, France, Canada
BAUXITE	>75	Jamaica, Brazil, Guinea, Guyana
CHROMIUM	72	South Africa, Kazakhstan, Russia
PEAT	70	Canada
SILVER	68	Mexico, Canada, Peru, Poland
GARNET (industrial)	64	Australia, India, South Africa, China
PLATINUM	64	South Africa, Germany, Italy, Russia
ALUMINA	54	Brazil, Australia, Jamaica, Canada
MAGNESIUM COMPOUNDS	52	China, Canada, Australia, Hong Kong
ABRASIVES, silicon carbide (crude)	>50	China, South Africa, Netherlands, Hong Kong
GERMANIUM	>50	China, Belgium, Germany, Russia
IODINE	>50	Chile, Japan
IRON OXIDE PIGMENTS (natural and synthetic)	>50	China, Germany, Brazil, Canada
TUNGSTEN	>50	China, Bolivia, Germany, Spain
DIAMOND (industrial dust, grit, and powder)	50	China, Ireland, Republic of Korea, Russia
CADMIUM	<50	China, Australia, Canada, Peru
MAGNESIUM METAL	<50	Israel, Canada, Mexico, United Kingdom
NICKEL	47	Canada, Norway, Australia, Finland
SILICON (metal and ferrosilicon)	41	Russia, Brazil, Canada
MICA, scrap and flake (natural)	37	Canada, China, India, Finland
COPPER (refined)	35	Chile, Canada, Mexico
PALLADIUM	32	South Africa, Russia, Germany, Italy
LEAD (refined)	30	Canada, Mexico, Republic of Korea, India
SALT	29	Chile, Canada, Mexico, Egypt
PERLITE	28	Greece, China, Mexico
LITHIUM	>25	Argentina, Chile, China
BROMINE	<25	Israel, Jordan, China
SELENIUM	<25	China, Philippines, Mexico, Germany
ALUMINUM	22	Canada, Russia, United Arab Emirates, China
IRON and STEEL	21	Canada, Brazil, Republic of Korea

[1]Not all mineral commodities covered in this publication are listed here. Those not shown include mineral commodities for which the United States is a net exporter (abrasives, metallic; boron; clays; diatomite; gold; helium; iron and steel scrap; iron ore; kyanite; molybdenum concentrates; sand and gravel, industrial; soda ash; titanium dioxide pigment; wollastonite; zeolites; and zirconium mineral concentrates) or less than 21% import reliant (beryllium; cement; feldspar; gypsum; iron and steel slag; lime; nitrogen (fixed)–ammonia; phosphate rock; pumice; sand and gravel, construction; stone, crushed; sulfur; talc and pyrophyllite; and vermiculite.). For some mineral commodities (hafnium; mercury; quartz crystal, industrial; thallium; and thorium), not enough information is available to calculate the exact percentage of import reliance.

[2]In descending order of import share.

[3]Data include lanthanides.

A graph showing the net import reliance of the United States for more than 90

different mineral commodities. Credit: USGS

"Supply chains can be interrupted for any number of reasons," said Nassar. "International trade tensions and conflict are well-known reasons, but there are many other possibilities. Disease outbreaks, natural disasters, and even domestic civil strife can affect a country's mineral industry and its ability to export mineral commodities to the U.S."

Risk is not set in stone; it changes based on global market conditions that are specific to each individual mineral commodity and to the industries that use them. However, the analysis indicates that risk typically does not change drastically over short periods, but instead remains relatively constant or changes steadily.

"One thing that struck us as we were evaluating the results was how consistent the mineral commodities with the highest risk of supply disruption have been over the past decade," said Nassar. "This is important for policymakers and industries whose plans extend beyond year-to-year changes."

For instance, between 2007 and 2016, the risk for rare earth elements peaked in 2011 and 2012 when China halted exports during a dispute with Japan. However, the supply of rare earth elements consistently remained among the highest risk commodities throughout the entire study period.

In 2019, the U.S. Department of Commerce, in coordination with the Department of the Interior and other federal agencies, published the interagency report entitled "A Federal Strategy to Ensure a Reliable Supply of Critical Minerals," in response to President Trump's Executive Order 13817. Among other things, the strategy commits the U.S.

Department of the Interior to improve the geophysical, geologic, and topographic mapping of the U.S.; make the resulting data and metadata electronically accessible; support private mineral exploration of critical minerals; make recommendations to streamline permitting and review processes enhancing access to critical mineral resources.

The methodology is entitled "Evaluating the Mineral Commodity Supply Risk of the U.S. Manufacturing Sector," and is published in *Science Advances*.

More information: Evaluating the mineral commodity supply risk of the U.S. manufacturing sector, *Science Advances* 21 Feb 2020: Vol. 6, no. 8, eaay8647, DOI: 10.1126/sciadv.aay8647 , advances.sciencemag.org/content/6/8/eaay8647

Provided by United States Geological Survey