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before the
House Committee on Natural Resources
Energy and Mineral Resources Subcommittee
on
December 12, 2017

Good morning Chairman Gosar, Ranking Member Lowenthal, and Members of the Subcommittee. Thank you for the opportunity to discuss critical minerals.

USGS has been examining domestic mineral resources since 1879. In 1973 the USGS published a professional paper entitled *Mineral Resources of the United States* that has remained one of the most widely disseminated USGS publications. Over four decades later, the mineral needs and environmental concerns of the country have changed dramatically.

For example, in the 1970s, rare-earth elements had few uses outside of some specialty fields, and were produced mostly in the United States. Today, rare-earth elements are integral to nearly all high-end electronics and are produced almost entirely in China. Many other mineral materials that we had little need for in the 1970s are also now essential to the Nation's economy, security and everyday life. Today, advanced technologies have increased the demand for and production of mineral commodities including nearly all elements in the periodic table. For instance, computer chip manufacturing utilized only 12 elements in the 1980's, but today uses more than 60[1].

What makes a mineral commodity "critical" to the nation's economic and national security? We use the definition that to be critical a mineral commodity must "have important uses and limited or no viable substitutes, yet face potential disruption of supply". A critical minerals screening tool[2] was developed by USGS and the Department of Energy to evaluate mineral commodity supply chains over time and identify potential emerging supply risks. The tool utilizes three criteria to determine criticality: 1) supply risk or the geopolitical concentration of a mineral supply; 2) the growth of importance of the mineral commodity which commonly is demonstrated in the growth of production of the mineral commodity; and 3) the market dynamics of the mineral commodity that is often reflected in its price volatility. Nearly all of the relevant data needed to carry out this modelling is collected on an annual basis by the USGS National Minerals Information Center with data extending back to the beginning of the 20th century. Rigorous analysis of these criteria allows for a quantitative score of criticality by the USGS. Mineral commodities that are critical can be identified and mineral commodities that may become critical can be forecast, thus providing an early warning of potential problems. Once identified, such mineral commodities are subjected to detailed study to evaluate risks to U.S.

[1] https://www.nap.edu/catalog/12034/minerals-critical-minerals-and-the-us-economy

[2]https://www.whitehouse.gov/sites/whitehouse.gov/files/images/CSMSC%20Assessment%20of%20Critical%20Minerals%20Report%202016-03-16%20FINAL.pdf

interests. This work is often done in conjunction with other U.S. Government agencies such as the Departments of Defense, Energy, State, and Commerce, as well as the intelligence agencies.

Criticality changes through time as technologies change and demand for different mineral commodities changes. Criticality also changes with geopolitics as different sources of mineral commodities become more or less stable or friendly to our Nation. Mineral commodities for which we don't have access to jurisdictionally friendly sources are ones we may worry about the most; we often term mineral commodities from such countries as "strategic."

A simple way to think about this is: critical means you need it, strategic means you don't have it.

The USGS Minerals Resources Program continues to conduct research that aids U.S. mineral independence. The *Mineral Commodity Summaries* are published annually, and provide estimates covering nonfuel mineral industry data. We are currently conducting research on other mineral commodities that are not now considered critical but may become critical for the country.

I would like to point out that our Nation's reliance on other nations for mineral commodities has risen dramatically over the past 60 years. For example, in 1954 the United States was 100 percent import reliant for the supply of only 8 nonfuel mineral commodities and by 1984 for 11 commodities. Today, the country is 100 percent net import reliant on 20 mineral commodities[3].

Since the 1973 report, not only has the USGS developed the methodology for quantifying and forecasting mineral criticality, our research scientists have also learned a great deal about the geologic and environmental issues related to discovery, production, and use of critical minerals. The United States remains a major mineral producer and our Nation contains many additional deposits of critical and strategic minerals. However, mineral exploration requires modern geological and geophysical data.

Currently less than one-third of the United States has complete topographic, geologic, and geophysical 3D mapping at fine enough scales to inform mineral resource management. For example, Alaska and large portions of the Midcontinent (IL, IN, IA, KS, MI, MN, MO, NE, OH, OK, and WI) represent some of the most prospective ground in the world for mineral discovery. However, the favorable rocks for critical mineral deposits in some of these areas are buried by younger rocks and are not visible at the Earth's surface. They must be imaged through geophysical surveys. Other countries such as Canada and Australia have undertaken such geological and geophysical surveys nationwide and have reported that investments of one dollar by the government have resulted in further investment of over five dollars by the private sector.

To ensure the Nation has the best possible data on critical minerals, USGS will continue research on mineral resources, continue to provide information on domestic and global mineral production and consumption, and continue to assess the critical mineral potential of the Nation. USGS's minerals research and assessment products are crucial to Federal, state, tribal, and industry decision-making on mineral resources management.

[3] https://minerals.usgs.gov/minerals/pubs/mcs/2017/mcs2017.pdf

Thank you for the opportunity to testify on the important subject of mineral resources. I would also like to thank the Subcommittee for their continuing support of the USGS and our Mineral Resources Program. I will be happy to answer any questions.