Critical and Strategic Minerals Importance to the U.S. Economy

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Issue

The availability of critical and strategic minerals and mineral materials are essential to industrialized nations like the United States and to the industrialization of developing nations for economic growth, national security, telecommunications, conventional and renewable energy technologies as well as the manufacturing and agricultural supply chain.

Background

Minerals that are needed for these technologies are deemed "critical and strategic" because of the key roles they play in the United States economy and because the U.S. is dependent on imports, mainly from China, for most of our domestic supply.

The U.S. has vast mineral resources, but is becoming increasingly dependent upon foreign sources for these mineral materials, as demonstrated by the following:

- China has become increasingly predatory in its pricing of some of these minerals in order to manipulate global supply.
- In 1995, the U.S. was dependent on foreign sources for 47 nonfuel mineral materials, 8 of which the U.S. imported 100 percent of the Nation's requirements, and for another 16 commodities the U.S. imported more than 50 percent of the Nation's needs. [1]
- By 2014 the U.S. import dependence for nonfuel mineral materials increased from 47 to 64 commodities, 19 of which the U.S. imported for 100 percent of the Nation's requirements, and an additional 24 of which the U.S. imported for more than 50 percent of the Nation's needs. [2]

Definition

Any mineral or element determined by another Federal agency to be strategic and critical to the defense or national security of the United States may be considered to be a critical mineral. Despite their importance to our everyday life, they face potential supply restrictions.

Uses [3]

Critical and Strategic minerals are part of virtually every product we use.

Energy Technologies: Indium, gallium, germanium, selenium, tellurium, neodymium, lanthanum, tantalum, vanadium, lithium, silicon, platinum, cobalt, nickel, arsenic and silver are key minerals for producing solar photovoltaic, thermal solar, wind power, electric and hybrid vehicles.

Aerospace, Communications and Defense: Vanadium, rhenium, cobalt, nickel, niobium, neodymium, samarium, cobalt, yttrium, terbium, europium and erbium.

Battery Technologies: Nickel-Metal hydride batteries require Rare Earth Elements lanthanum, cerium, neodymium and praseodymium plus nickel, cobalt and manganese. Lithium-ion batteries use lithium and cobalt.

Electronics /Lighting: Praseodymium, samarium, scandium, europium, gallium, indium, germanium, tin, cerium, lanthanum, zinc and selenium.

If the supply of any given mineral were to become restricted, consumers and sectors of the U.S. economy could be significantly affected. Risks to minerals supplies can include a sudden increase in demand or the possibility

that natural ores can be exhausted or become too difficult to extract. For example, mining permits currently take 7 to 10 years to obtain primarily due to duplicative and overlapping federal agency requirements and reviews. Minerals are more vulnerable to supply restrictions if they come from a limited number of mines, mining companies or nations, as do most minerals which can be considered critical and strategic. Baseline information on minerals is currently collected at the federal level, but no established methodology currently exists to identify potentially critical and strategic minerals.

Issue

Lack of secure supply chains for some minerals critical to clean energy technologies hinders U.S. manufacturing and energy security. These critical materials (a) provide essential and specialized properties to advanced engineered products or systems for which there are no easy substitutes and (b) are subject to supply risk. Rare Earth Elements, with essential roles in high-efficiency motors and advanced lighting, are the most prominent of the critical materials today.

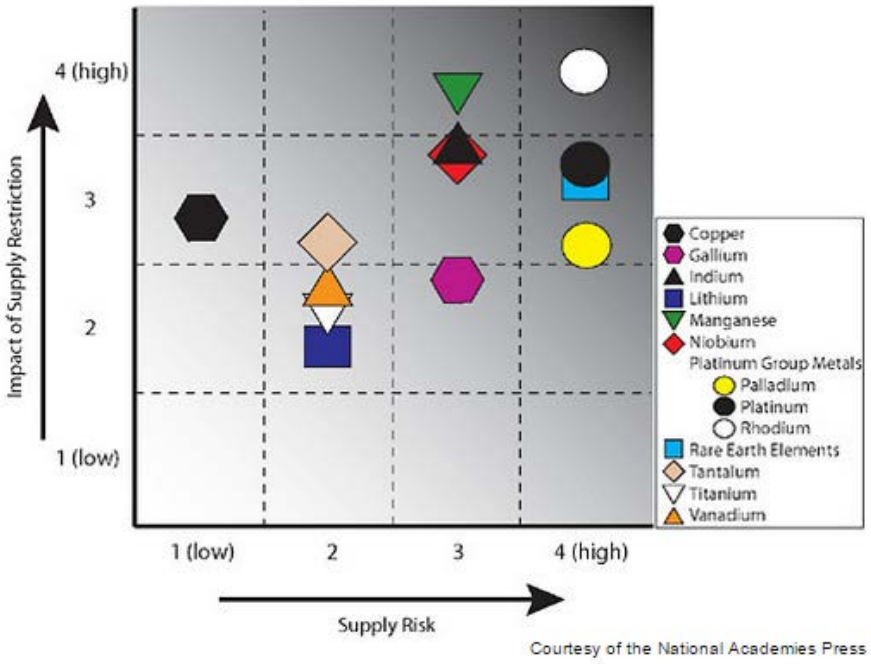

Figure 1. Criticality matrix for 11 mineral commodities evaluated in the NRC study, "Minerals, Critical Minerals and the U.S. Economy" (National Research Council, 2008).

The economic importance of critical and strategic minerals, increasing global competition for them by rapidly developing countries, and the potential for supply disruptions triggered a study by the National Research Council (NRC), "Minerals, Critical Minerals, and the U. S. Economy." [4] This report included the criticality evaluation matrix (Figure 1) that relates the importance and availability of a mineral. The matrix uses evaluations of the impacts of supply restrictions (the importance of the mineral) to the potential for supply disruptions. The greater both of these measures the more critical the mineral. [5]

A mineral commodity's importance can be characterized by factors such as the dollar value of its U. S. consumption, the ease with which other minerals can be substituted for it, and the outlook for emerging uses that can increase its demand. A way to evaluate the significance of these factors is to consider the impact that a lack of availability would have on them. How would the mineral's uses or price change if it were less available? A mineral's availability depends on several factors including how much has been discovered, how efficiently it can be produced, how environmentally and socially acceptable its production is, and how governments

influence its production and trade. Many of the technological, social and political factors have become increasingly important influences on mineral availability. For example, China produces most of the world's Rare Earth Elements. By curtailing export shipments of these technologically key elements in 2010, China drastically affected their global availability. [5]

SME Statement of Technical Position

- A streamlined U.S. permitting process, which eliminates duplicative federal agency oversight, (i.e. "one-stop shopping") would speed the responsible development of domestic critical and strategic mineral production.
- A methodology should be developed to identify potential critical minerals.
- A comprehensive inventory of critical and strategic mineral resources should be conducted.
- The U.S. government should consider a subsidy for domestic suppliers of certain strategic minerals including rare earth elements, in order to compete with countries, like China, that control the global flow of these minerals that are critical to national defense applications.

References

[1] United States Geological Survey, 1996, "Mineral Commodity Summaries 1996," USGS, Reston, VA.

[2] United States Geological Survey, 2015, "Mineral Commodity Summaries 2015," USGS, Reston, VA, 199 p.

[3] Colorado Geological Survey, "Critical and Strategic Minerals of Colorado," www.coloradogeologicalsurvey.org.

[4] American Geosciences Institute, 2010, "Critical Minerals," Earth Notes, AGI, Alexandria, VA, 1 p.

[5] National Research Council, 2008, "Minerals, Critical Minerals, and the U.S. Economy," National Academies Press, Washington, D.C., 245 p.