Critical Minerals: The USGS – National Minerals Information Center Perspective

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Washington, DC
March 30, 2016
National Minerals Information Center (NMIC)

- **Mission**
  - To collect, analyze, and disseminate information on the domestic and international supply of and demand for non-fuel minerals and materials essential to the U.S. economy and national security.

- **Objective**
  - Provide decision makers with the information required to ensure that the U.S. has an adequate supply of minerals and materials to meet U.S. needs, at an acceptable cost with regard to environmental, energy, and economic factors.
Mineral Critciality Studies Are Impossible Without Data

Broad Mineral Commodity Coverage (>85 Commodities)

- Mineral Commodity Summaries
- Minerals Yearbook
- Mineral Industry Surveys
- Metal Industry Indicators
- Nonmetallic Mineral Industry Indexes
- Special publications
- Data Series
- Fact Sheets

- > 700 Publications Annually
- Monthly, quarterly, annual work product cycles

http://minerals.usgs.gov/minerals/
Critical Minerals – Some Observations

- Numerous evaluations of mineral criticality have been conducted, resulting in a variety of lists, indexes, and methodological refinements.

- Criticality really depends on who is asking the question; an industry analysis is likely to come to a different conclusion and “list” depending on the application and market sector; an analysis by a government agency will likewise reach a different conclusion depending on mission and application:
  - Example: USGS Shakeout Scenario analysis of magnitude 7.8 earthquake in Southern California....critical minerals = aggregates (construction sand & gravel, concrete, asphalt)
  - Example: Oil & gas exploration and production....critical minerals = barite or frac sand
  - None of these fit the “classical” definition of a critical mineral

- Department of Energy focus is on green energy

- Department of Defense (Defense Logistics Agency) focus is on minerals for the strategic stockpile

- Criticality is not static but changes over time as the availability of mineral commodities changes and as new technologies result in increased consumption and new applications

- Mineral criticality studies require reliable, regularly updated, mineral production and consumption data for a broad spectrum of applications and stakeholder needs
Critical Minerals – Working Definition

  - A mineral can be considered critical if:
    - Performs an essential function for which few if any substitutes exist
    - An assessment indicates a high probability of supply being disrupted resulting in physical unavailability or significantly higher price
  - Defined two axes:
    - Impact of supply disruption
    - Supply risk
  - Questions
    - How to measure these?
    - What data are required?
    - What are important attributes of the data?
DLA-SM Definition of Strategic & Critical Materials

DLA Strategic Materials is the operational arm of *The Strategic and Critical Materials Stockpiling Act (50 U.S.C. 98 et seq.)*.

- The term “strategic and critical” (S&C) materials is defined by this Act:

  “…means materials that
  
  **(A)** would be needed to supply the military, industrial, and essential civilian needs of the United States during a national emergency, and

  **(B)** are not found or produced in the United States in sufficient quantities to meet such need.”

Net Import Reliance

- Country Specific
- Updated Annually
- Broad coverage
- Timely

## Supply Risk: Production – Country Concentration

### World Production Tables
- Quantitative
- Country Specific
- Updated Annually
- Timely (MCS)
- Authoritative (MYB)
- Time Series

<table>
<thead>
<tr>
<th>Rank</th>
<th>Commodity</th>
<th>2013</th>
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<tbody>
<tr>
<td>1</td>
<td>Yttrium</td>
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<tr>
<td>2</td>
<td>Ruthenium</td>
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<tr>
<td>3</td>
<td>Beryllium</td>
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<td>4</td>
<td>Niobium</td>
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<tr>
<td>5</td>
<td>Ferroniobium</td>
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<tr>
<td>6</td>
<td>Bismuth-mine</td>
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<td>7</td>
<td>Bismuth-refinery</td>
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### Herfindahl-Hirshman Index
Herfindahl-Hirshmann Index: Sum of the squares of country share of production of a commodity:

2000-2006 production dominated by Australia and Brazil
2009-2014 production dominated by DRC+ and other African countries
Shift from industrial to artisanal mining
Shift to countries with higher governance risk and less transparent trade flows
Criticality is dynamic, need to use time series to analyze for emerging risks
Combine with governance risk e.g. World Governance Indicators (World Bank)
Summary: Components & Characteristics of the USGS – National Minerals Information Center Approach to Mineral Criticality

- Broad coverage
- Global
- Country specific
- Flexibility
- Authoritative
- Dynamic
- Trends, not lists
- Metrics:
  - Rigor
  - Data availability
- Examples of data types used
  - Net import reliance
  - Production country concentration
  - Growth in world production
  - Price volatility
  - World governance indicators
- Ultimate Goal:
  - Practical, simple, early warning screening tool
  - Identify candidates for deep-dive analysis

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