A U.S. Perspective on By-Products and Critical Materials

Roderick G. Eggert
Mineral and Energy Economics Program
Colorado School of Mines, and
Critical Materials Institute, an Energy Innovation Hub of the US Department of Energy

Joint Study Groups’ Seminar, “By-Products of Copper, Nickel, Lead and Zinc, Including Their Role as Critical Materials”
Lisbon, Portugal, October 2, 2013

Outline

- Observations about critical materials
- Observations about by-products
- US government activities
Critical materials today

- “The periodic table is under siege”
  - Early cell phone → Today’s smart phone
  - GE experience
- Potential explosion in demand for some elements used now in small quantities
- Seemingly fragile supply chains, small fragmented markets
  - Will supply be able to keep up with demand?
  - Will supplies be secure?
  - Implications for input costs?
- Mineral (un)availability as a potential constraint on development and diffusion of emerging technologies

Critical materials today (continued)

- A ‘critical’ element is both (a) important in use and (b) subject to supply risk (“something you really need but can’t always get”)
- Criticality is
  - ‘In the eye of the beholder’
  - Dynamic
- Many critical materials are produced primarily as by-products and co-products
Outline

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Observations about by-products

- Potentially lower-cost than main products because of cost sharing
- But often viewed as nuisances because of complex metallurgy & small revenues
- Supplies may be fragile:
  - Unresponsive to increased price of by-product (available quantities determined by production capacity of main product)
  - Very responsive to reduced price of main product
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- Observations about critical materials
- Observations about by-products
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US government activities

- No single, overarching policy . . . instead . . . rely on market forces to assure supplies and manage risks . . . and
- Undertake focused interventions
  - Encourage undistorted trade: WTO
  - Facilitate domestic production: more efficient permitting of new mines
  - Provide public goods:
    - Information (USGS, conflict minerals) & standards (NIST)
    - R&D (basic geoscience, materials science & engineering, Advanced Research Projects Agency-Energy, Department of Defense, EPA recycling, National Science Foundation, USGS)
- Critical Materials Institute (CMI), an Energy Innovation Hub of the US Department of Energy
CMI: Overview

- **What:** Science & engineering to assure supply chains for materials essential to clean-energy technologies; up to $120 million over 5 years; started June 2013
- **Why:** To remove impediments to technology development and deployment, to accelerate innovation
- **How:** Develop technologies to (a) increase & diversify supply and (b) reduce demand
- **Who:** A consortium of 18 institutions, led by the Ames Laboratory
The CMI Partnership

Initial CMI Focus

- 7 elements
- 4 technologies
  - magnets
  - phosphors
  - batteries
  - photovoltaic materials
“Produce more, use less”

- Research to:
  - Diversify global supply chains
  - Develop substitute materials
  - Enhance recycling, reuse and efficient use of materials
  - Support the activities above

...but not ALL of these in EVERY case!

CMI Today and in the Future

- Science and engineering to assure supply chains, enable energy technologies
- How?
  - Innovate to produce more, use less
  - Develop the next generation of scientists and technical experts
  - Anticipate rather than respond to material-supply crises
- Finally: develop mutually beneficial international collaborations
Thank You!

Questions?

Contact information:
Roderick G. Eggert
Division of Economics and Business
Colorado School of Mines
Golden, Colorado USA 80401
Phone: +1 303 273 3981
E-mail: reggert@mines.edu

CMI website:
cmi.ameslab.gov/