CRITICAL MINERALS IN NEW MEXICO

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Definition of Critical Minerals

is a mineral

(1) identified to be a nonfuel mineral or mineral material essential to the economic and national security of the United States,

(2) from a supply chain that is vulnerable to disruption, and

(3) that serves an essential function in the manufacturing of a product, the absence of which would have substantial consequences for the U.S. economy or national security
Critical Minerals

• President Trump signed an executive order (Presidential Executive Order (EO) No. 13817) that requires the Departments of Interior and Defense to develop a list of critical minerals

• May 18, 2018 U.S. Department of Interior published the final list of critical minerals
Critical Minerals

• 35 critical minerals were identified
• New Mexico has many of these critical minerals
  – Potash is currently being produced in Carlsbad
  – Porphyry copper deposits in Grant County contain rhenium, indium, and germanium
  – Uranium deposits in the Grants district
  – Exploration for other critical minerals include REE, tellurium, lithium, beryllium, cobalt
  – Other critical minerals were once produced from New Mexico (tin, vanadium, manganese, fluorspar, barite, graphite, REE, tellurium, beryllium)
Critical Minerals in New Mexico

- **Element currently producing in NM**
- **Element once produced from NM**
- **Element found in NM**
- **Element not found in NM**

Note that any element or commodity can be considered critical in the future depending upon use and availability. Coal contains several of these critical elements.
Potash

- Uses—fertilizers, chemical industry
- New Mexico is the leading state in the U.S. for potash production and reserves (other state is Utah)
- U.S. imports 90% of potash used, 85% from Canada
POTASH PRODUCTION
1951-2015 109 million tons worth >$15 billion

Reserves in Carlsbad District
Potash (>553 million tons)
*Potash is used in fertilizers among other uses*
Intrepid closed one mine

Competition from Canadian deposits
Recent developments in potash

• Intercontinental Potash Corp. (IPC) plans to mine polyhalite at the Ochoa deposit SE of the district

• Intrepid Mining NM LLC is using solution mining techniques at the HB Solar Solution mine (old potash workings)
Uranium

- Uses—defense, 99 nuclear energy power reactors (20% electricity in U.S.), fuel for space missions
- 2nd in uranium resources 15 million tons ore at 0.277% U₃O₈ (84 million lbs U₃O₈) at $30/lb (DOE estimates in 2002)
- Numerous companies have acquired properties (Strathmore, Energy Minerals, Laramide Resources, among others)
Uranium potential in New Mexico
Deposits with uranium resources in New Mexico (McLemore and Chenoweth, 2017). Only major mines and deposits are included here.
Uses of Tellurium

- Alloying additive in steel to improve machining characteristics
- Processing of rubber
- As a component of catalysts for synthetic fiber production
- As pigments to produce various colors in glass and ceramics
- **Thermal imaging devices**
- Thermoelectric cooling devices, such as summertime beverage coolers
- Thermoelectronics
- **Solar panels/cells**
Tellurium

- Production—byproduct of copper refining (refinery in Texas)
- Lone Pine produced 5 tons of Te from Au-Te volcanic-epithermal veins
Mining districts in New Mexico with tellurium minerals or chemical assays >20 ppm Te
Lone Pine, Wilcox district, Catron County—volcanic epithermal vein
Occurrences of Rare Earth Elements (REE) in New Mexico
REE in Gallinas Mountains, Lincoln County

- REE-F mines
- Cu-REE-F mines
- breccia mines
- unmineral samples
- iron skarn samples
- breccia samples
- Cu-REE-F samples
- REE-F samples

- fault
- breccia deposits
Carbonatites and Episyenites (or metasomatic rocks) in New Mexico and Colorado
Episyenite is used to describe altered rocks that were desilicated and metasomatized by alkali-rich fluids solutions.

Episyenites in Longbottom Canyon, Caballo Mountains
Geologic map of the Caballo Mountains, New Mexico
South Apache Hills, Caballo Mountains, New Mexico
HIGH $K_2O$

Zuni Mountains

Burro Mountains
Some episyenites are HREE-enriched
As much as 133 ppm Yb, 179 ppm Dy

They are interpreted to be related to carbonatite or alkaline fluids altering the host granite, similar to fenitization
Complex mineralogy

- Synchysite (63 wt.% LREE)
- Aeschynite (9 wt.% HREE)
- Xenotime (16 wt.% HREE)
- Thorite
- Uranophane
- Bastnaesite

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<td>Calcite</td>
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Paragenesis South Red Hills
Backscatter electron image (electron microprobe) of an episyenite sample

**Synchysite**  
$\text{Ca(LREE)(CO}_3\text{)}_2\text{F}$

**Thorite**  
$(\text{Th, U})\text{SiO}_4$

**Xenotime**  
$\text{YPO}_4$
Age between deposition of the Bliss and emplacement of the 1.4 Ga granites and subsequently altered at ~200-400 Ma and younger.
Summary

• New Mexico is currently producing potash
• New Mexico has produced many of the critical minerals and has potential for future production
  • Uranium—2nd in the US in resources
• Exploration for several critical minerals ongoing in NM
  • REE, Te, Co, Li, Be
• Coal deposits in NM could have potential for critical minerals