Mineral Potential in New Mexico

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Panel: Mining Innovations and Challenges

New Mexico Bureau of Geology and Mineral Resources
New Mexico Tech
Earth Science for the 21st Century

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Mining Innovations and Challenges in New Mexico—INTRODUCTIONS

- **Virginia McLemore**—Principal Senior Economic Geologist New Mexico Bureau of Geology and Mineral Resources
- **David (DJ) Ennis**—Program Manager, State of New Mexico Mining Act Reclamation Program, EMNRD
- **Bob Newcomer**—Principal, Toltec Mesa Resources, LLC.
- **Tom Shelley**—Senior Engineer, Telesto Solutions, Inc.
- **Brent Goehring**—Deputy group leader for the Climate, Ecology, and Environment Group, LANL
- **Nelia Dunbar**—Emerita NMBGMR Director and State Geologist, NMT

This panel is designed to promote open discussion, facilitating collaborative research and education on mining as it effects energy evolution in New Mexico

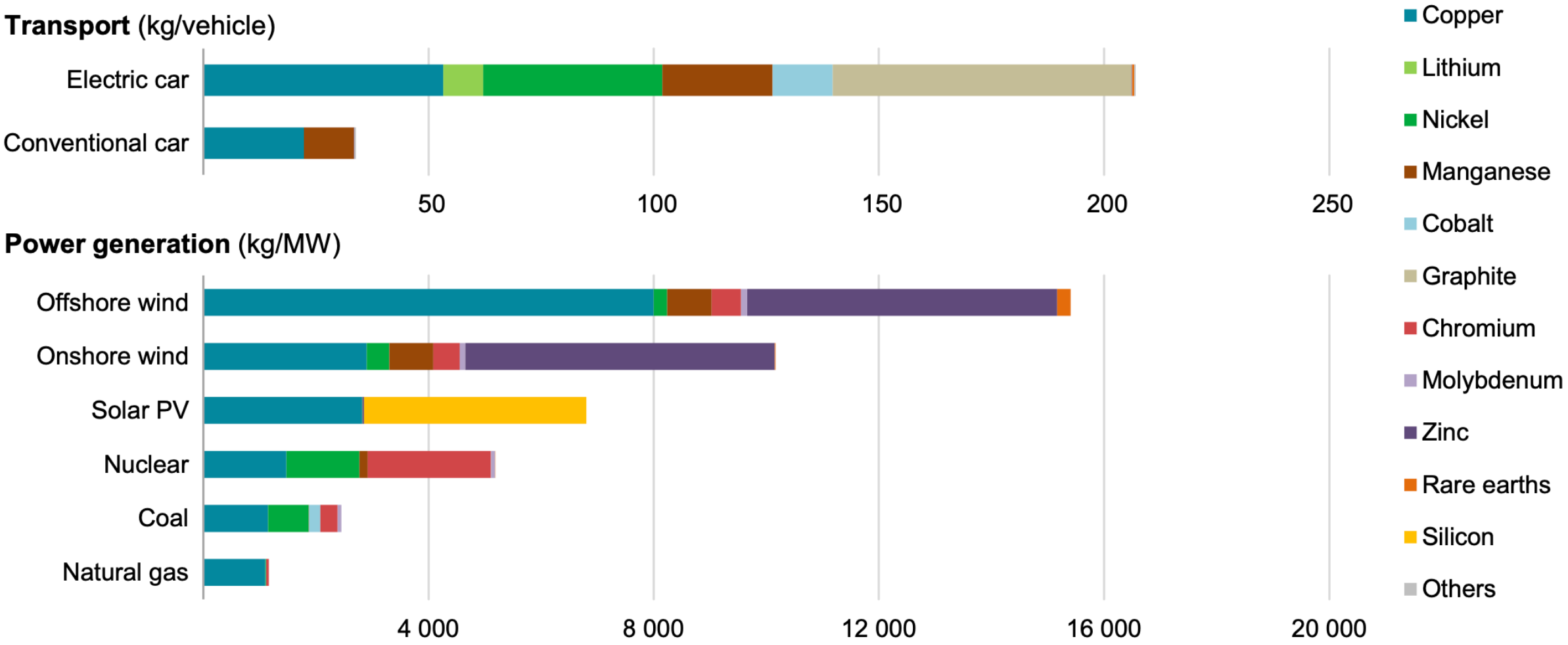
- We plan to discuss:
  - Mineral resources in New Mexico
  - Permitting
  - Challenges operators faces to bring a project online
  - Capital investments
  - Different permitting ideas
  - Diversify supply and develop alternate sources (reuse) until mining comes online
  - New technologies in mining—Mine of the Future
  - Educating the workforce
  - Federal focus on critical minerals

Importance of minerals

A ***mineral*** is defined by the 1872 U.S. Mining Law as any rock, mineral, or other naturally occurring material of economic value and sold as a commodity

- The current energy evolution (i.e. transition) will put new, greater pressures on the global mining industry, triggering demands for enhanced mineral supply chain security
  - **New energy devices, from cars to turbines, need a greater proportion of minerals than the technology they are replacing**
  - The production of minerals such as graphite, lithium and cobalt could increase by nearly 500% by 2050 to meet the growing demand for clean energy technologies (World Economic Forum, 2021)
  - **To achieve 100% renewable energy would mean mining over the next 20 years the same amount of copper that we have mined since the history of mankind**
  - With new forms of energy so reliant on mining and minerals, supply chains will have to be more robust than ever
- **How can New Mexico mining industry play a role in the energy evolution?**

Minerals used in selected energy technologies



- Electric cars require 6 times the amount of minerals as conventional cars
- Onshore wind farms require 9 times the amount of minerals as natural gas plants for the same power output

Source: IEA.org

Mining has to conducted in a sustainable manner with a social license to operate

Reclaimed mill tailings
Georgetown, Grant County

Mineral Resources in New Mexico for Energy Evolution

Introduction

- New Mexico has some of the oldest mining areas in the United States
- Native Americans mined turquoise from Cerrillos Hills district more than 500 years before the Spanish settled in the 1600s
- One of the earliest gold rushes in the West was in the Ortiz Mountains (Old Placers district) in 1828, 21 years before the California Gold Rush in 1849

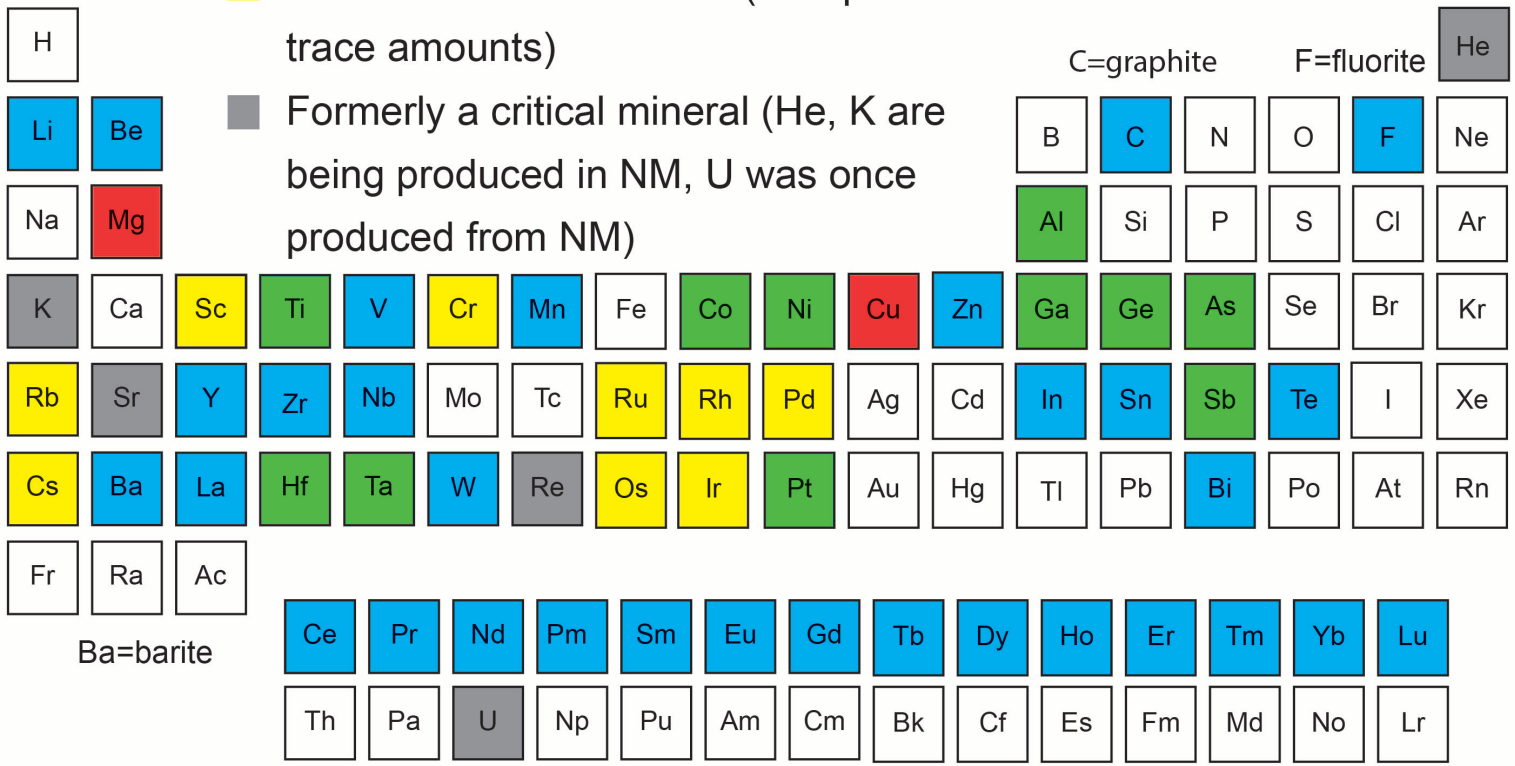
One of the turquoise mines in the Cerrillos Hills district, Santa Fe County

- Economic vulnerability
  - Essential to economic, strategic or national defense
- High risk of supply disruption
  - Difficulty of permitting new mines
- Trade exposure
  - Dependency on foreign supplies (including refining)
  - Net import reliance of >50%

Critical Minerals in New Mexico in 2024

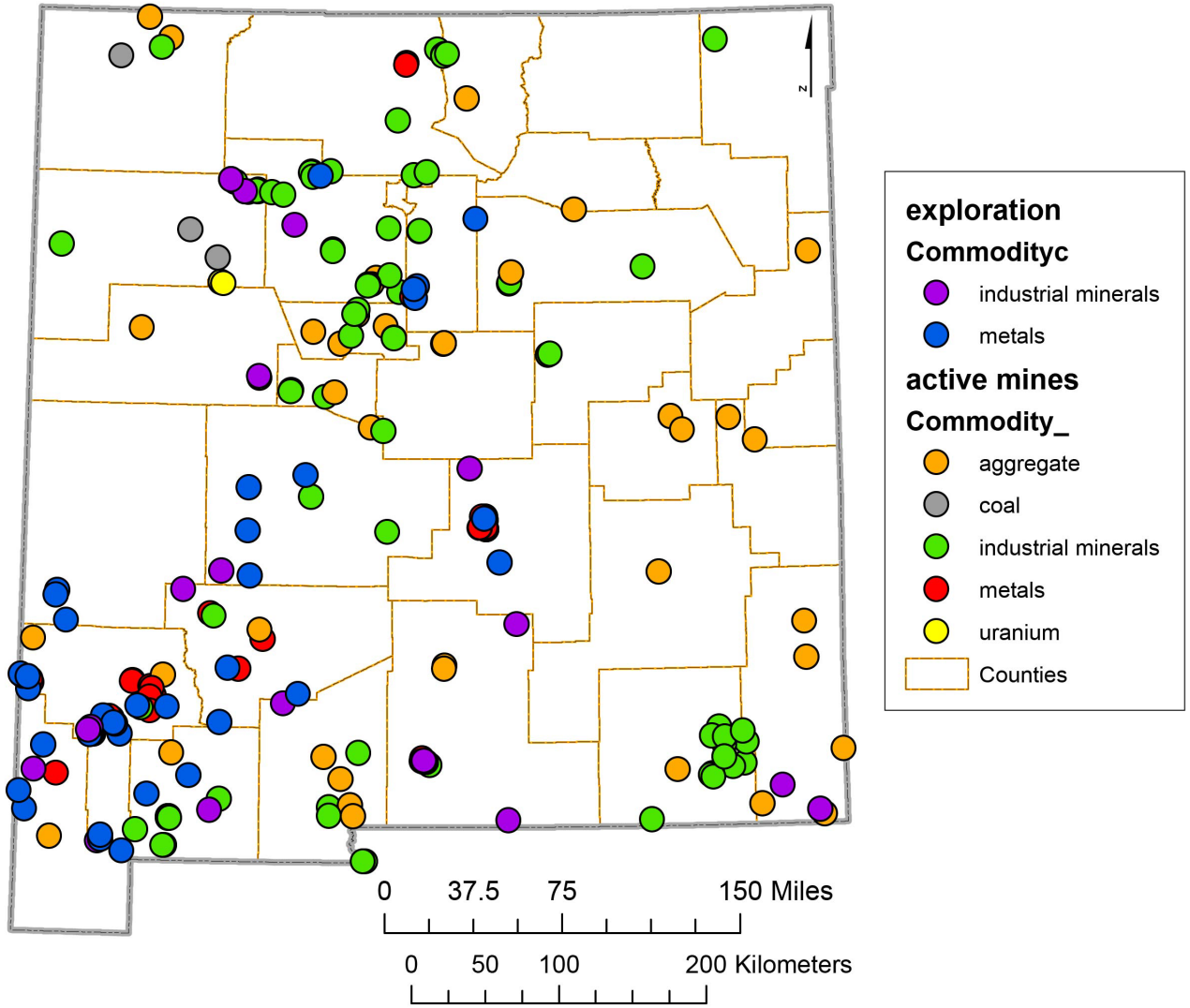
- Element currently producing in NM
- Element once produced from NM
- Element found in NM
- Element not found in NM (except in trace amounts)
- Formerly a critical mineral (He, K are being produced in NM, U was once produced from NM)

Graphite, fluorite, and barite are listed as critical minerals instead of the element because of their specific industrial uses.



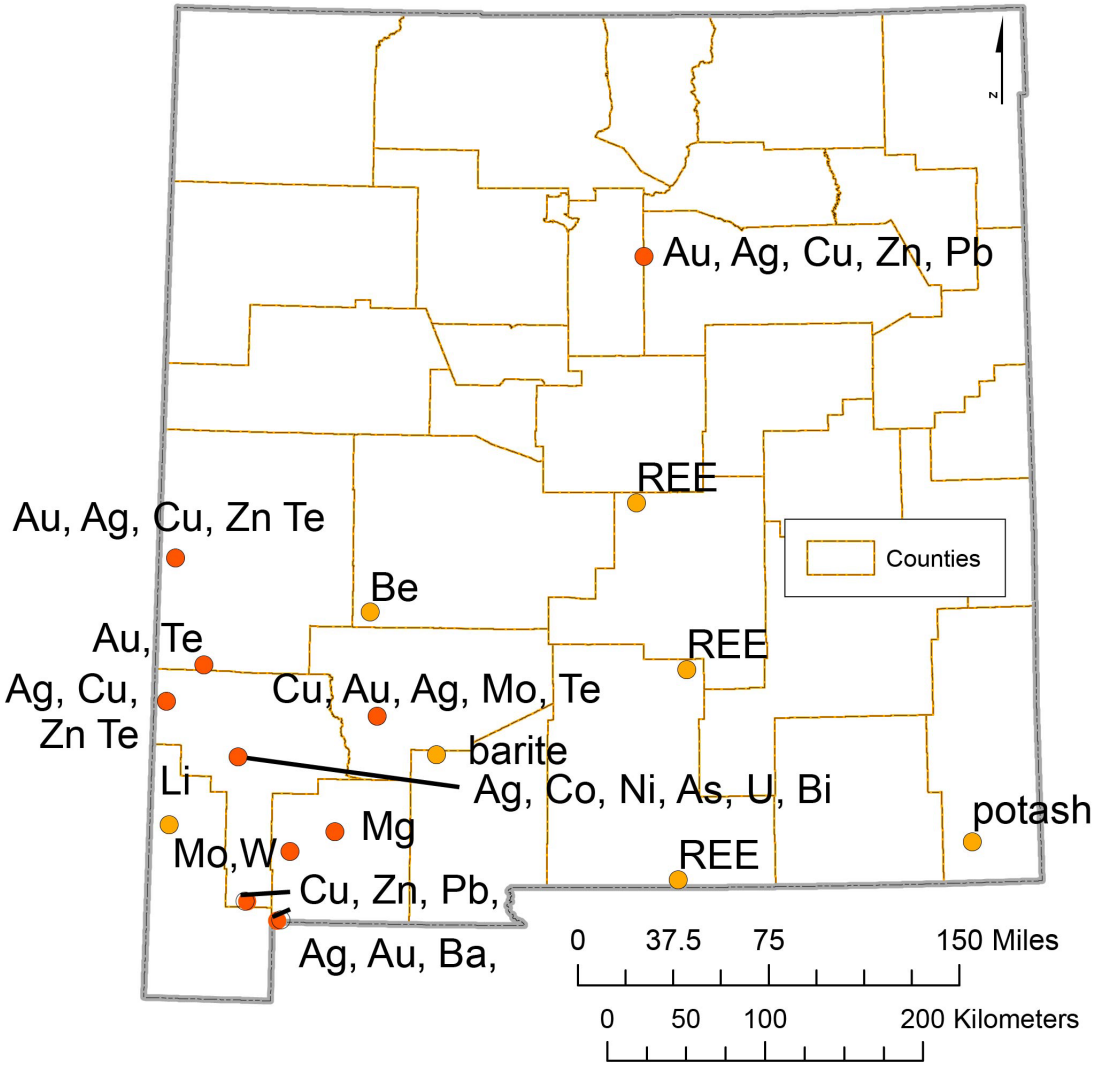
Note that any element or commodity can be considered critical in the future depending upon use and availability. Coal can contain several of these critical elements.

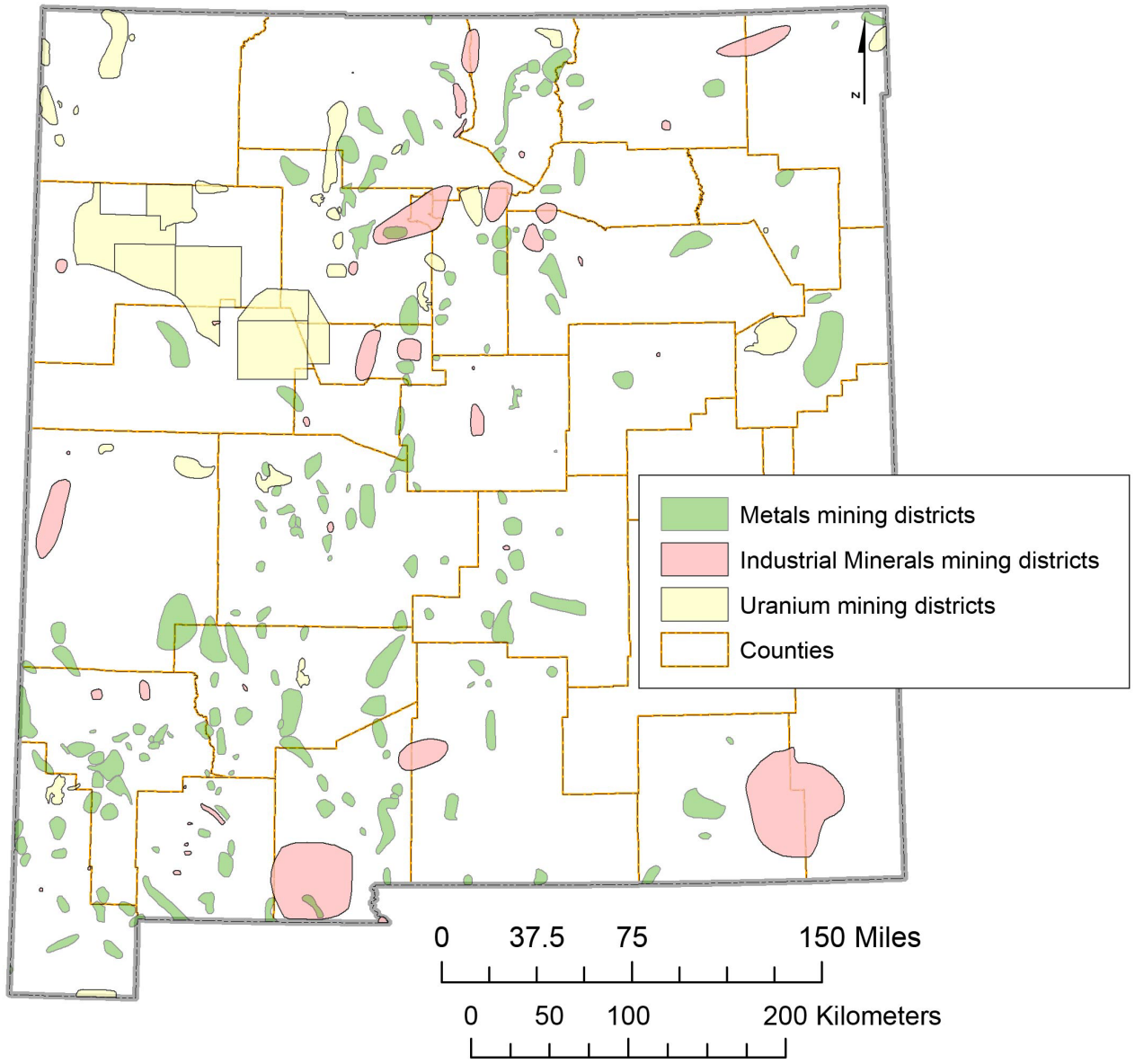
U, Re, He, Sr, and K (potash) were removed from the critical minerals list in 2022 and Zn and Ni were added. In 2023, the Department of Energy added Cu to the critical materials list.



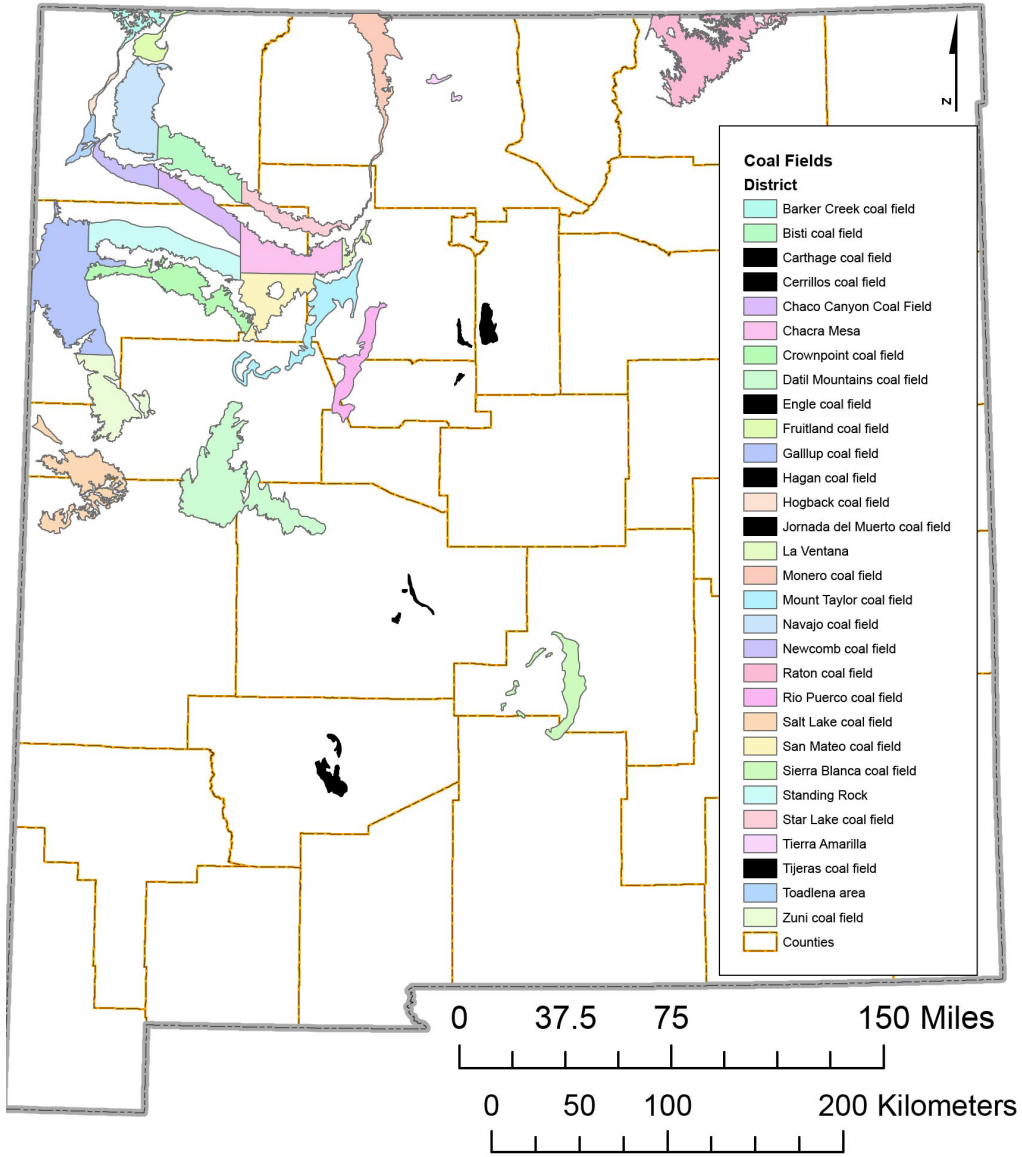
Active mines and exploration sites in New Mexico 2024

Active exploration sites of critical minerals in New Mexico 2024

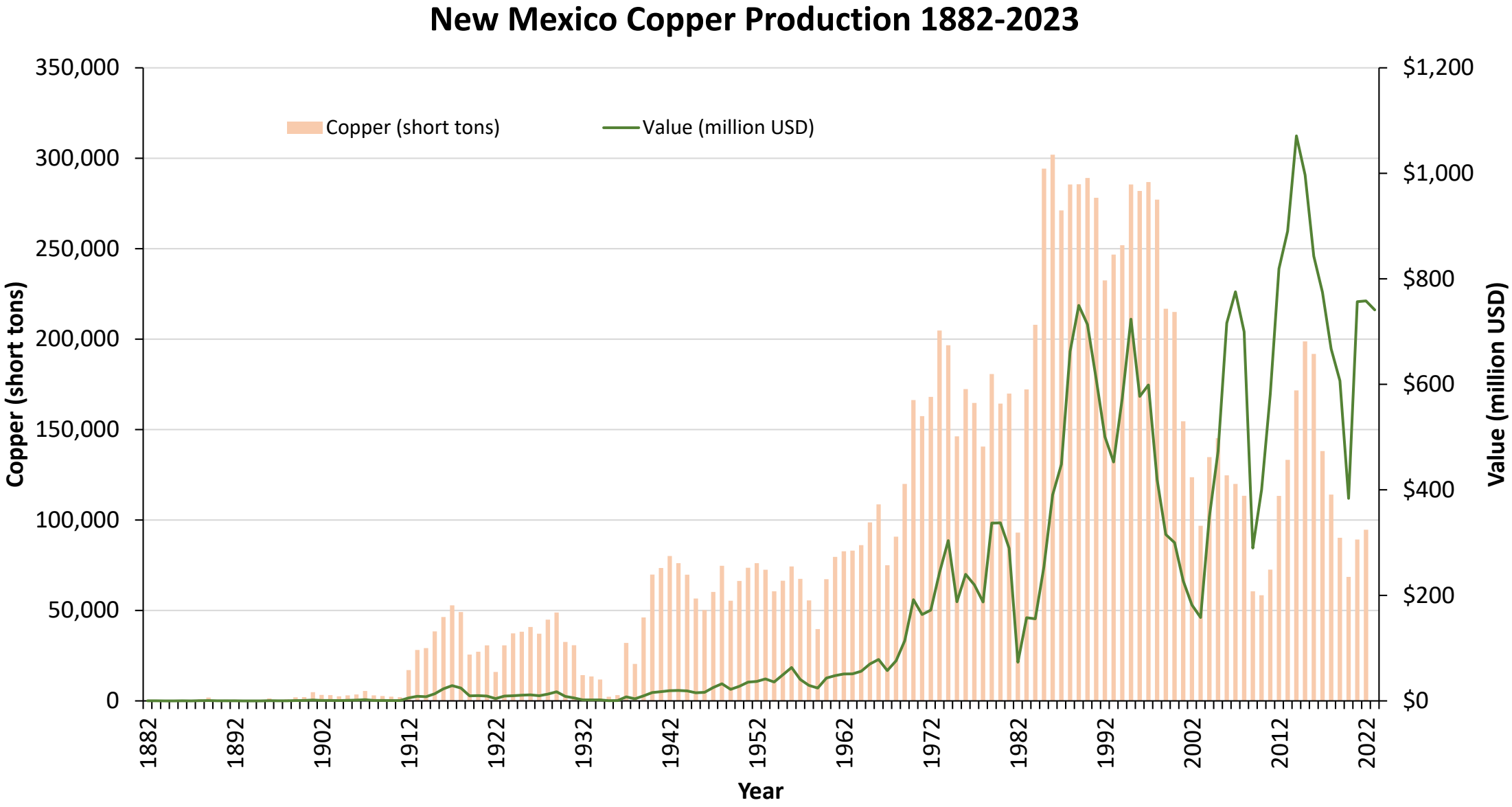




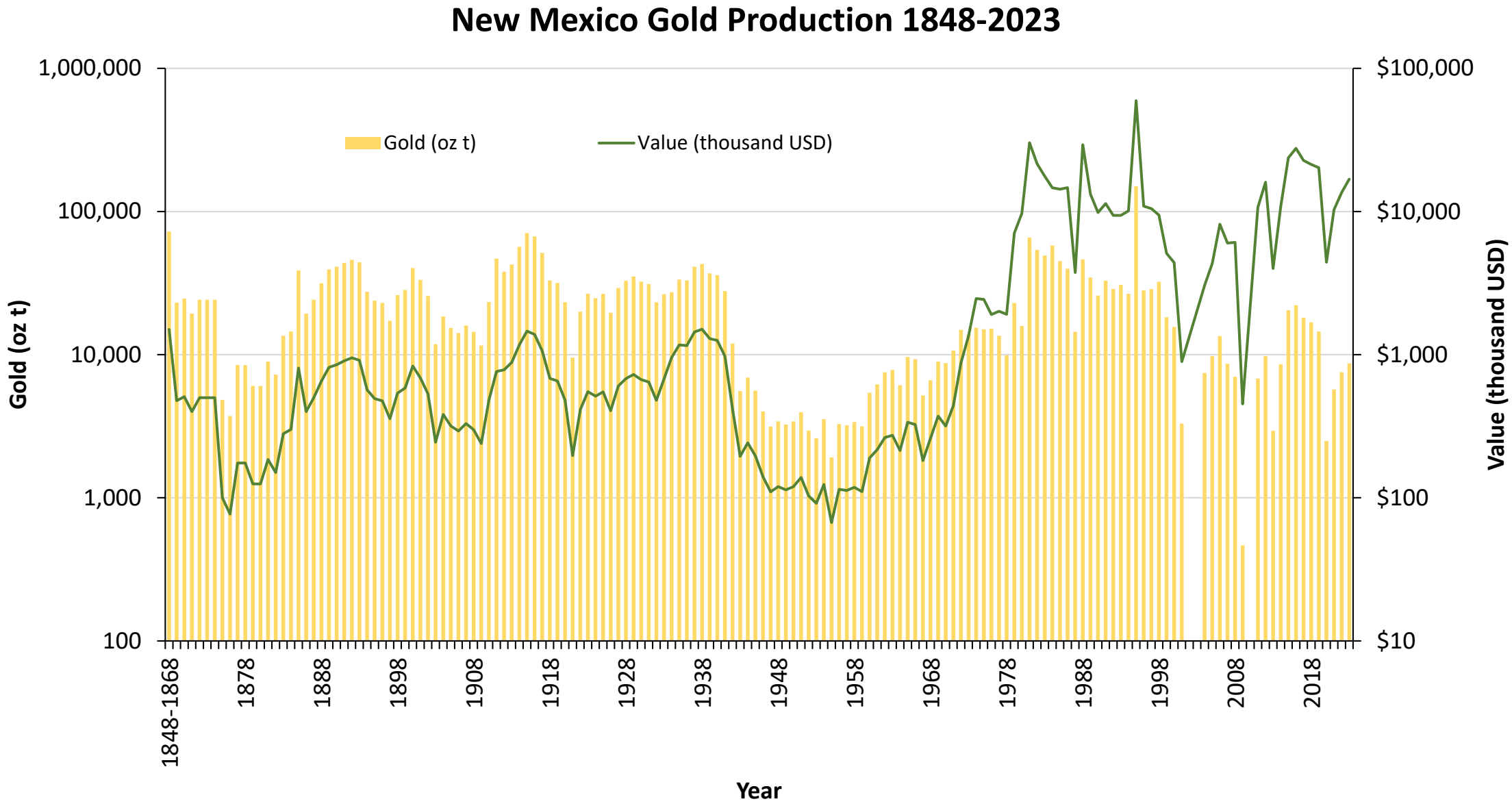
Mining districts and prospect areas in New Mexico



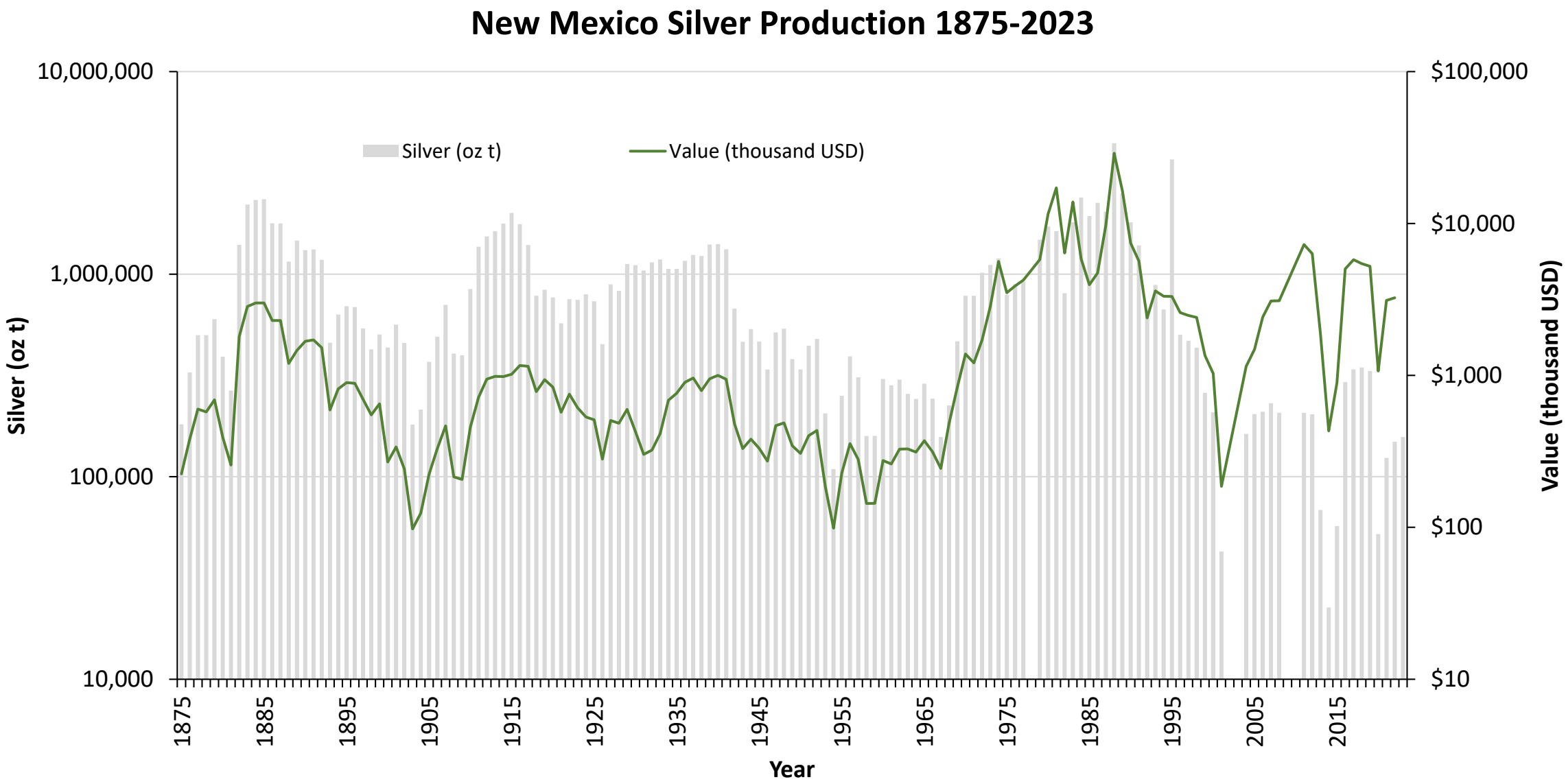
Coal fields in New Mexico



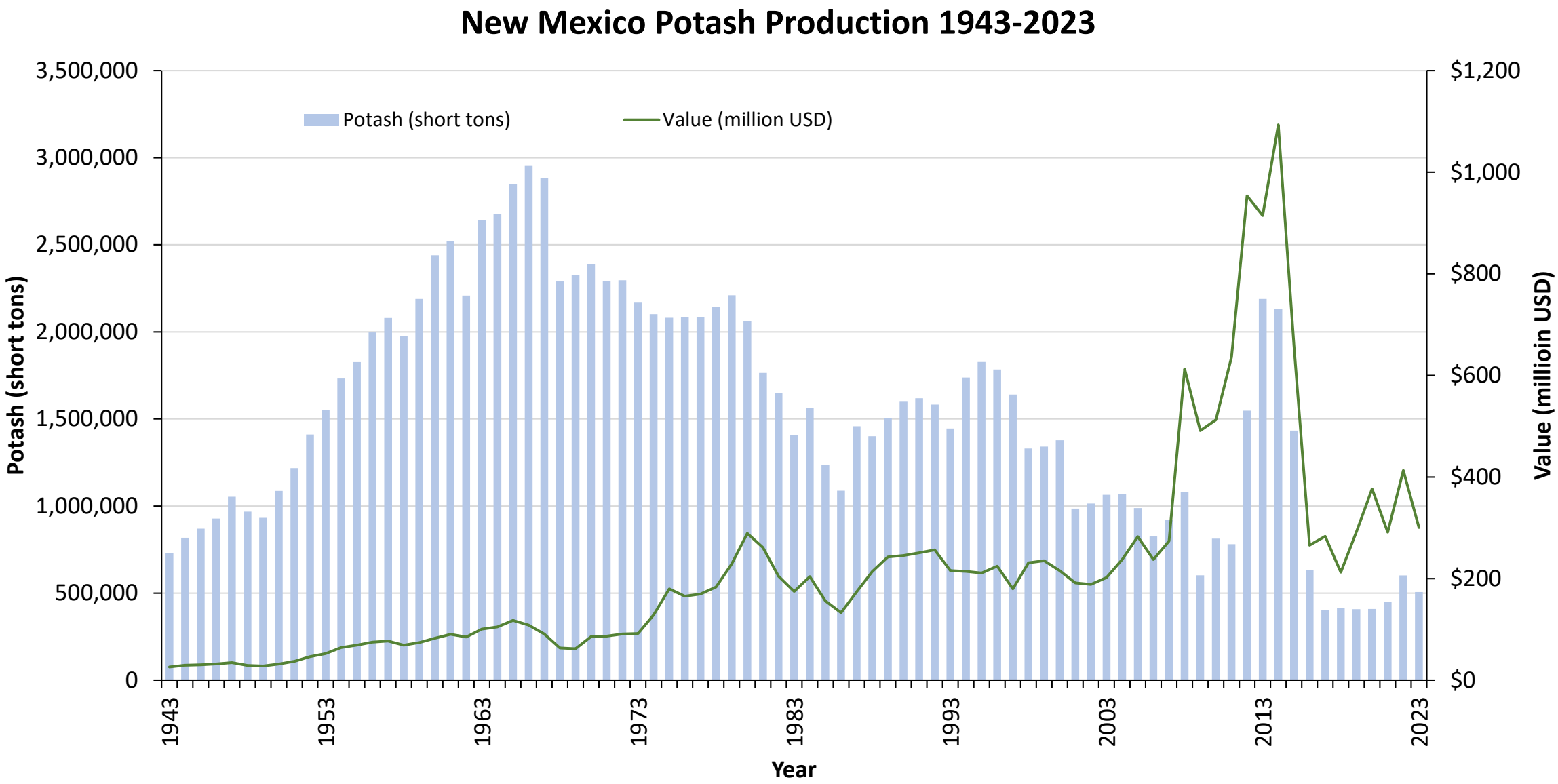
Copper production compiled by year from USGS and USBM Mineral Yearbooks, NM Energy and Minerals Dept., USGS (1965), Lindgren et al. (1910), and Anderson (1957)



Gold production compiled by year from USGS and USBM Mineral Yearbooks, NM Energy and Minerals Dept., USGS (1965), Lindgren et al. (1910), and Anderson (1957)

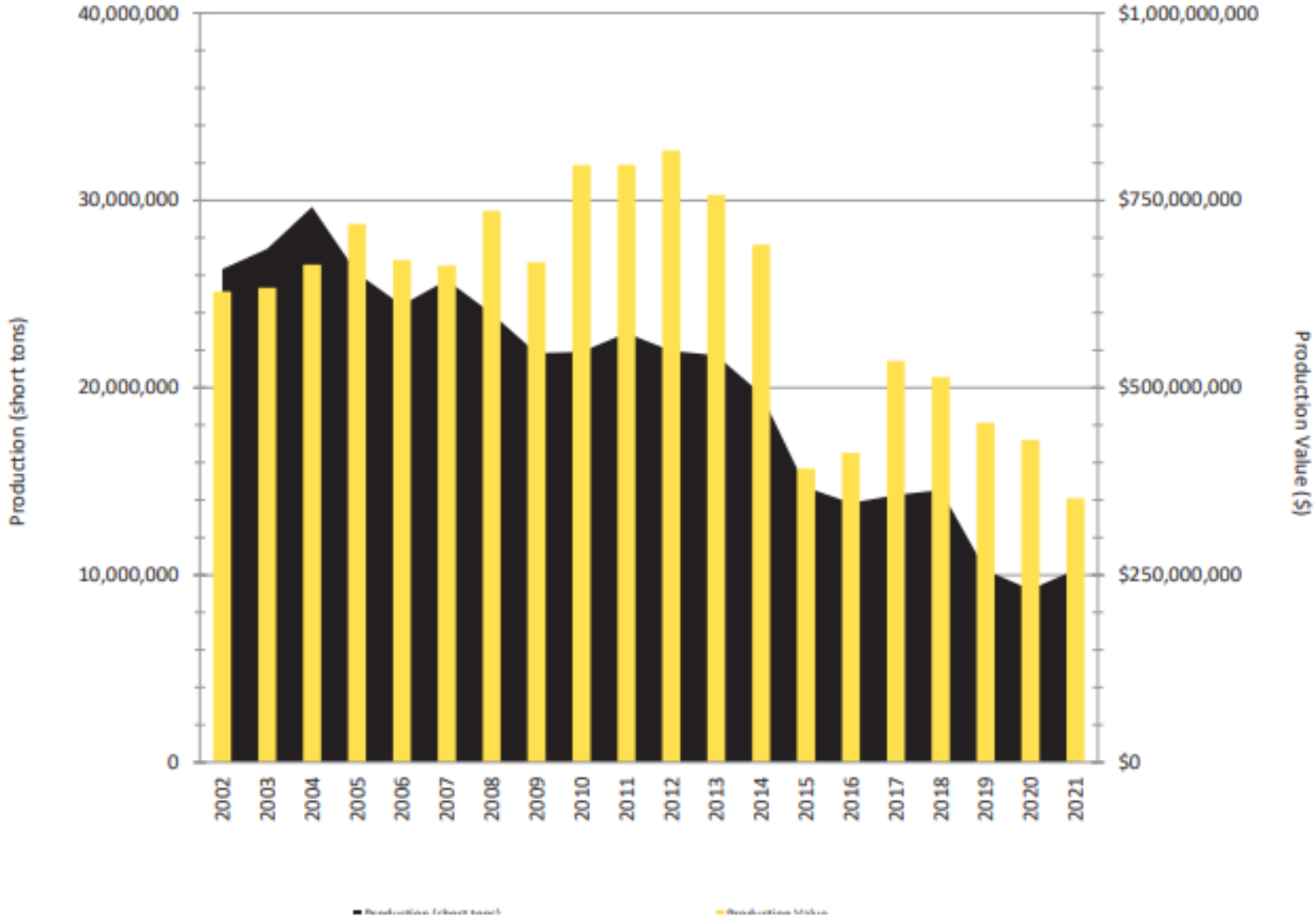


Silver production compiled by year from USGS and USBM Mineral Yearbooks, NM Energy and Minerals Dept., USGS (1965), Lindgren et al. (1910), and Anderson (1957)

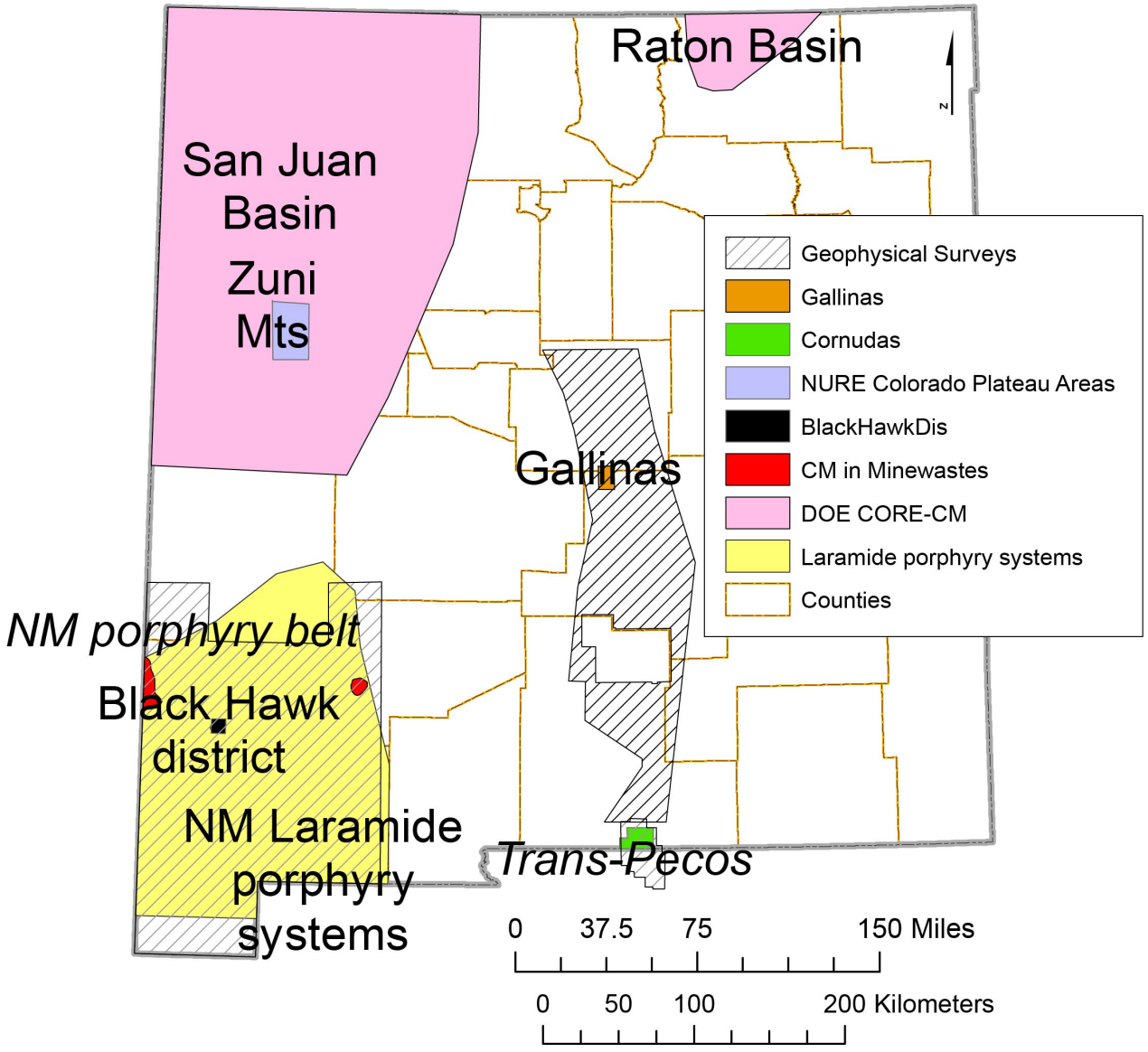


Potash production compiled by year from USGS and USBM Mineral Yearbooks and NM Energy and Minerals Dept.

FIGURE 6 New Mexico Coal Production and Value: 2003-2022

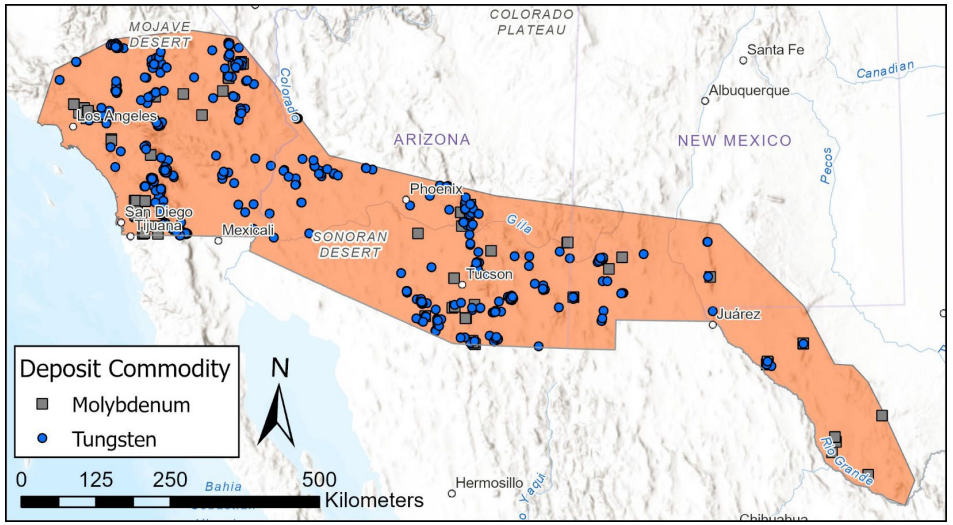


Coal production compiled by year from NM Energy and Minerals Dept.



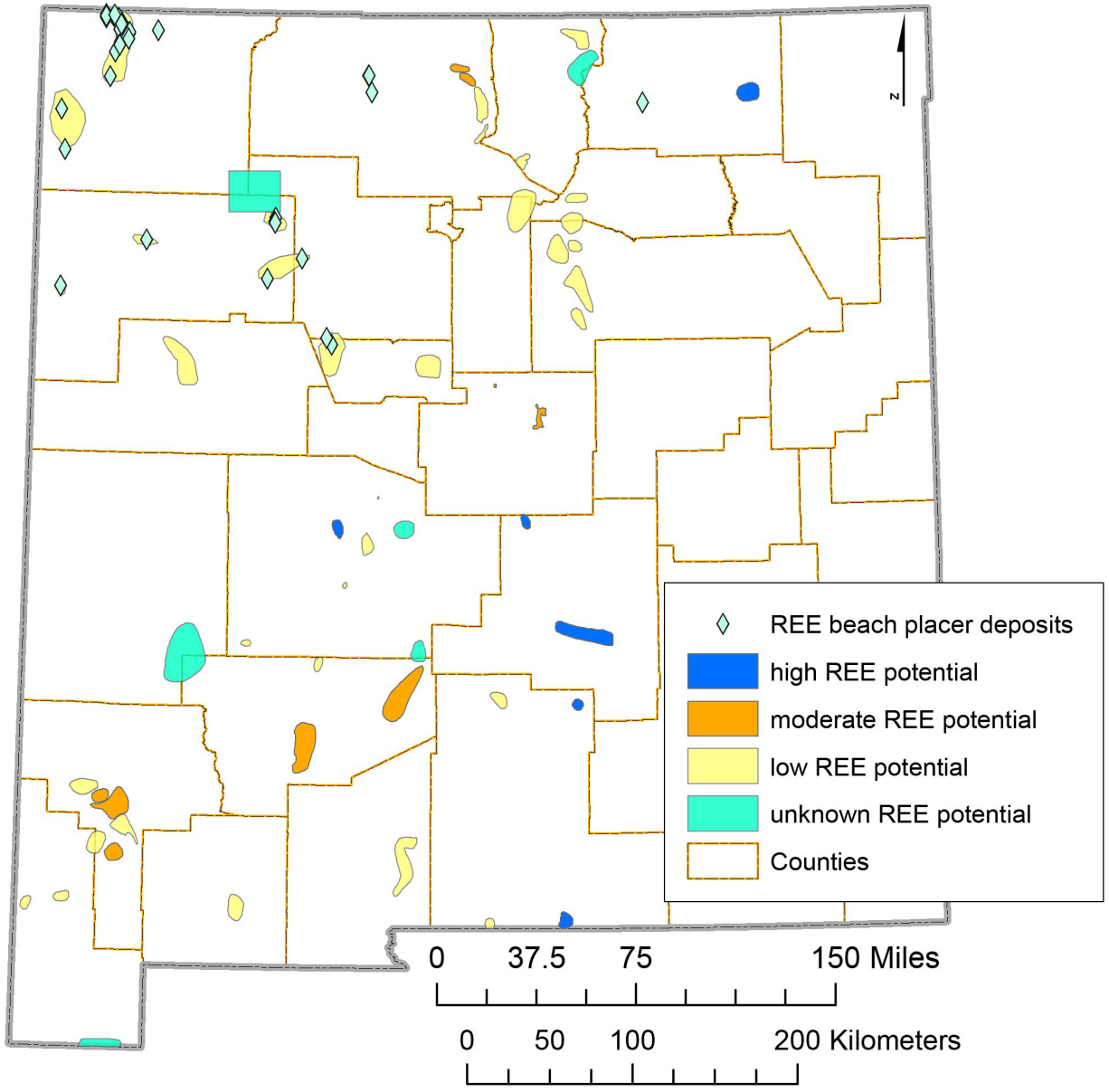
USGS Earth MRI and DOE CORE-CM projects in New Mexico

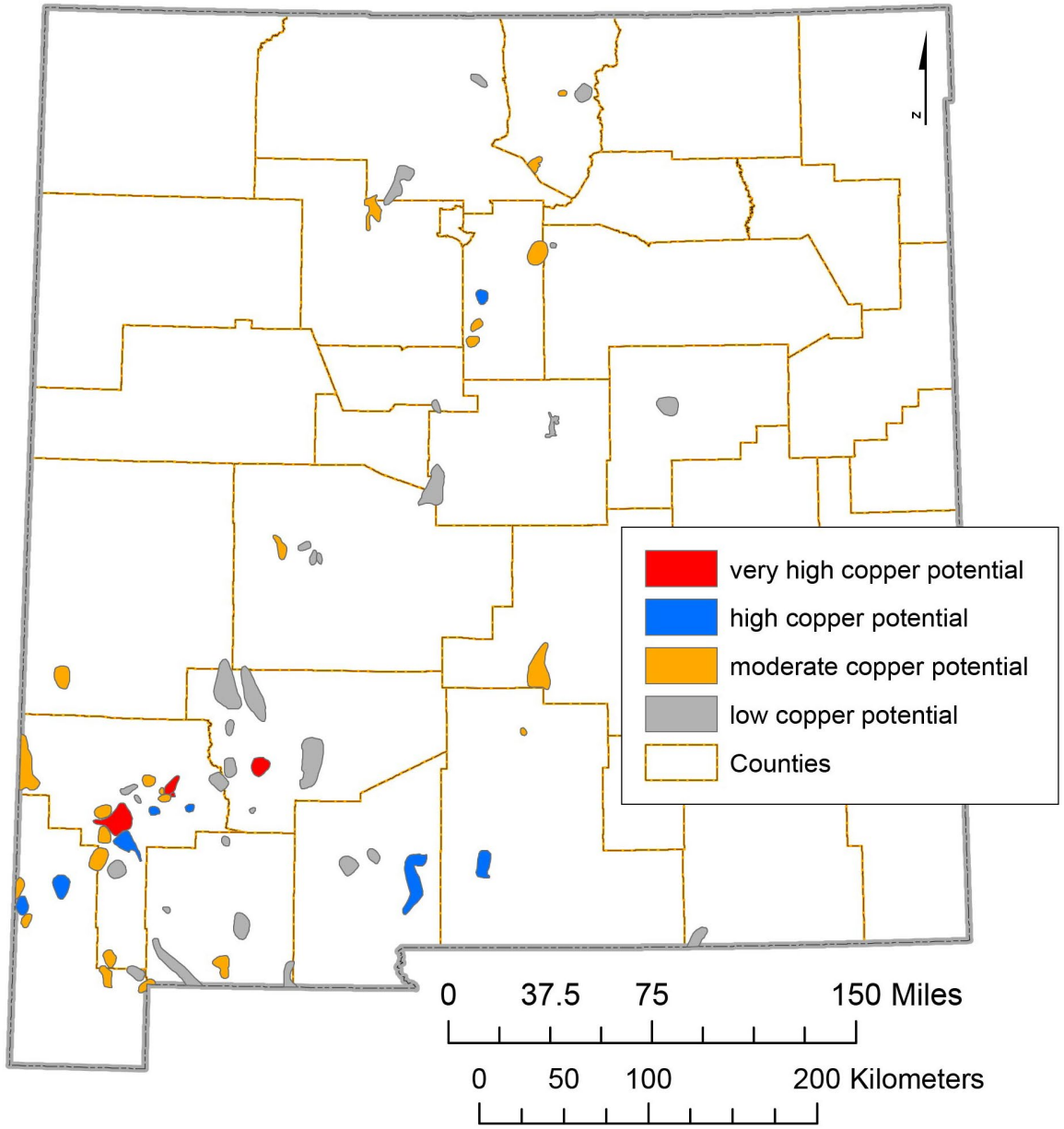
Geochemical reconnaissance of Southwest U.S. Mo-W deposits in southwest Texas, New Mexico, Arizona, and California (August 2024-July 2027) *(in cooperation with Arizona, California, and Texas Geological Surveys)*



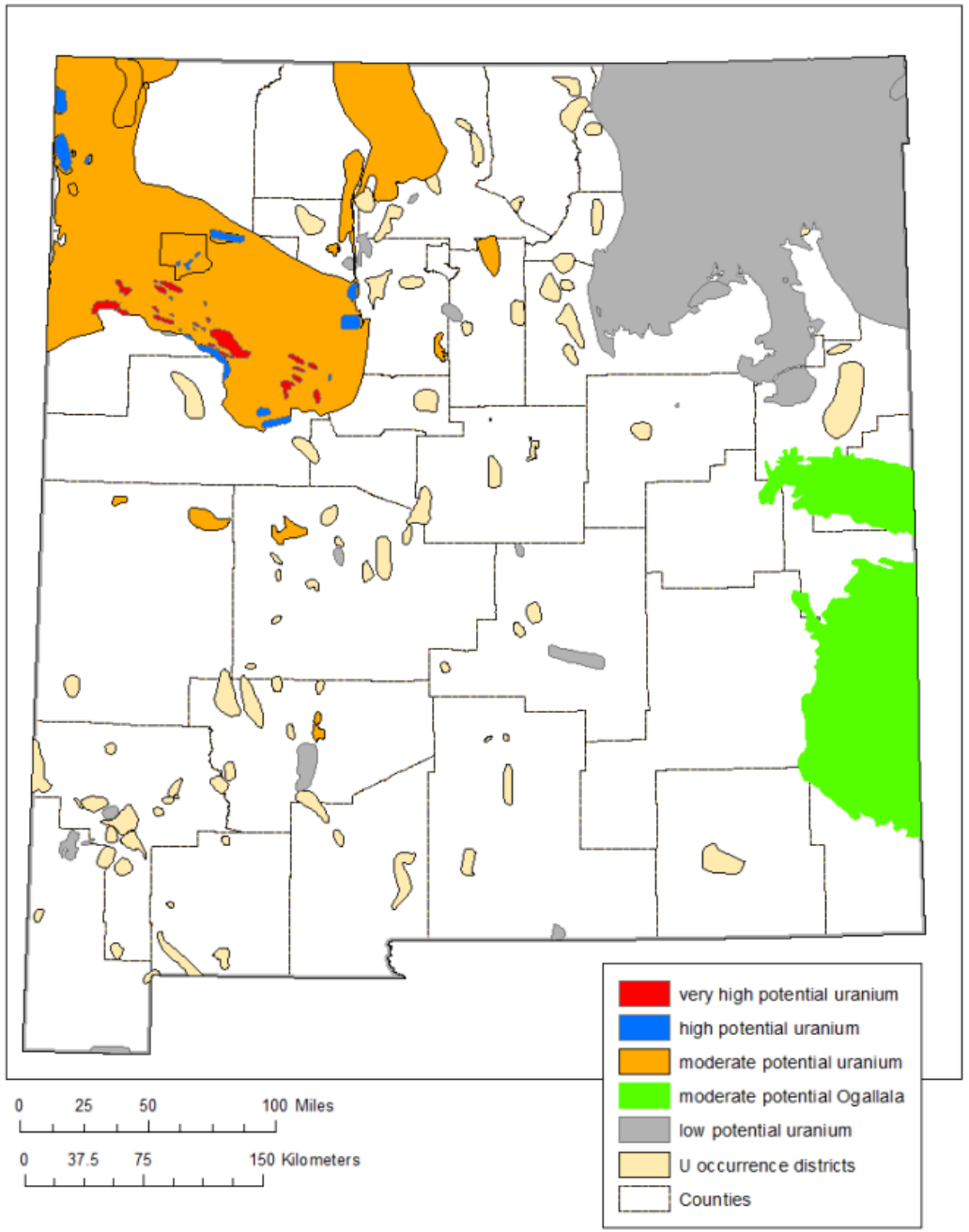
More than 24 students employed and trained on these projects. Many of these students have internships and final jobs with mining companies! A few students actually are employed in New Mexico!

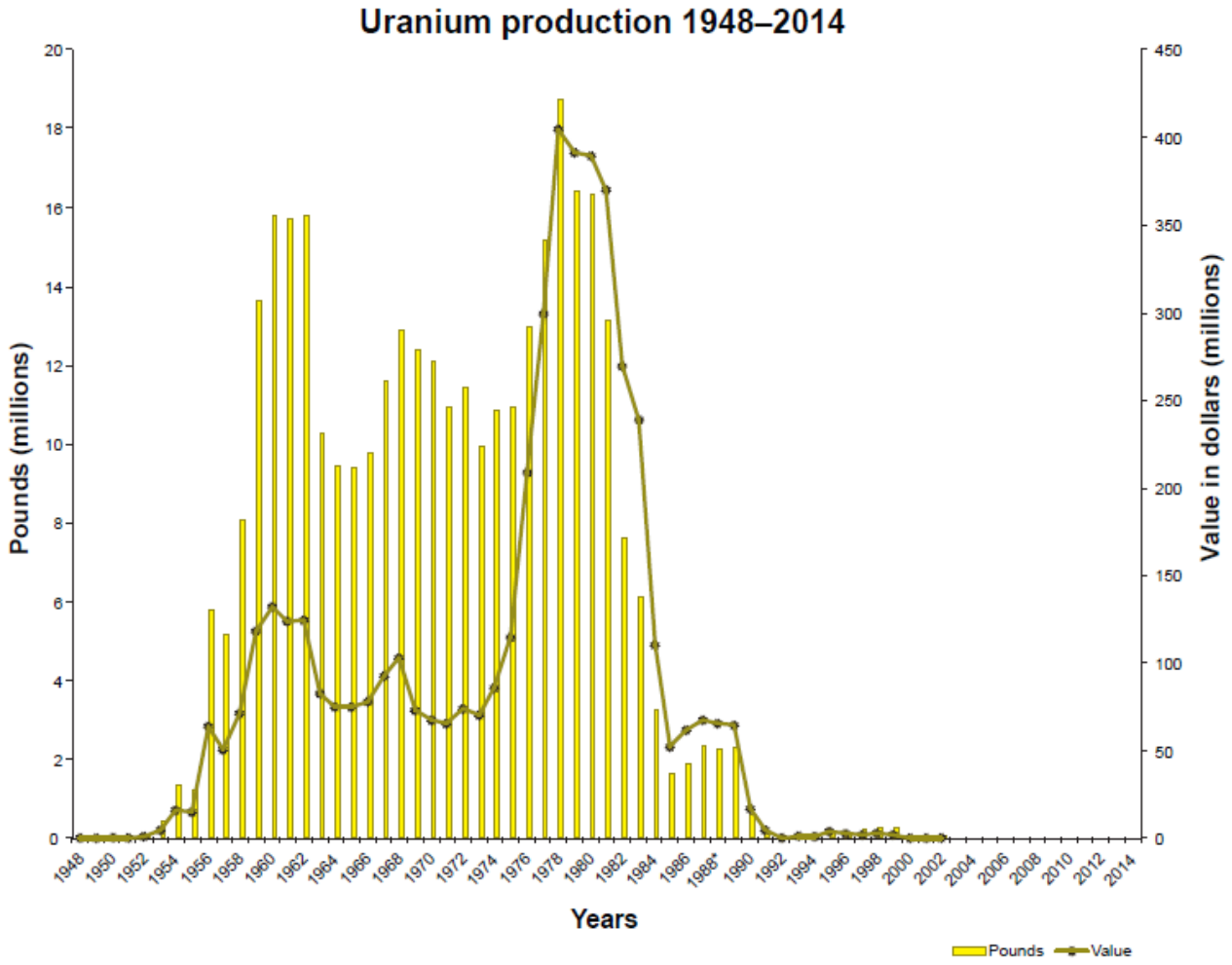
Collaboration with mining companies, other state surveys, Sandia and Los Alamos National Labs!!!





Mineral resource potential maps of New Mexico for REE and copper

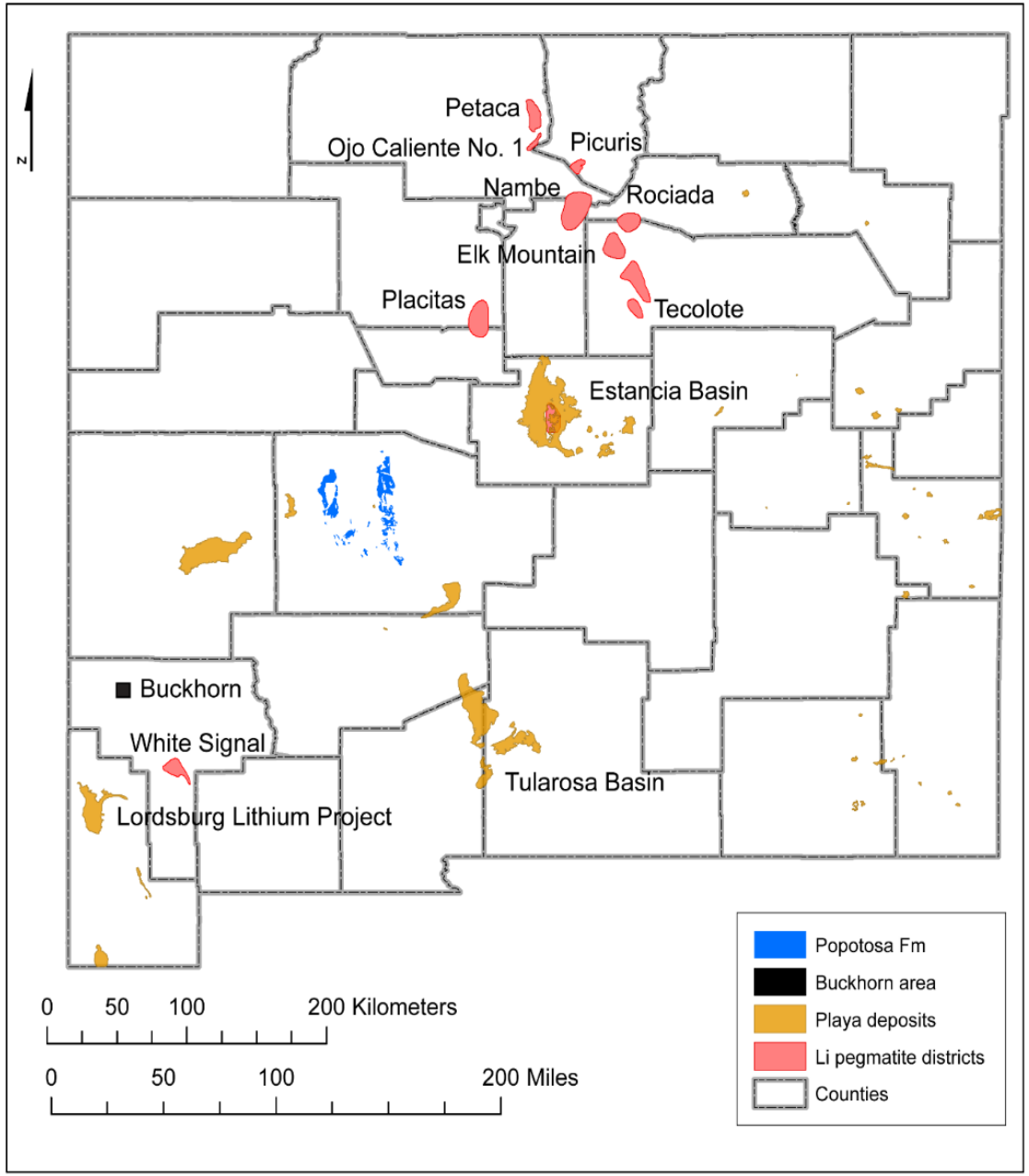




Sandstone uranium deposits also have potential for vanadium, molybdenum, REE (rare earth elements), and other minerals

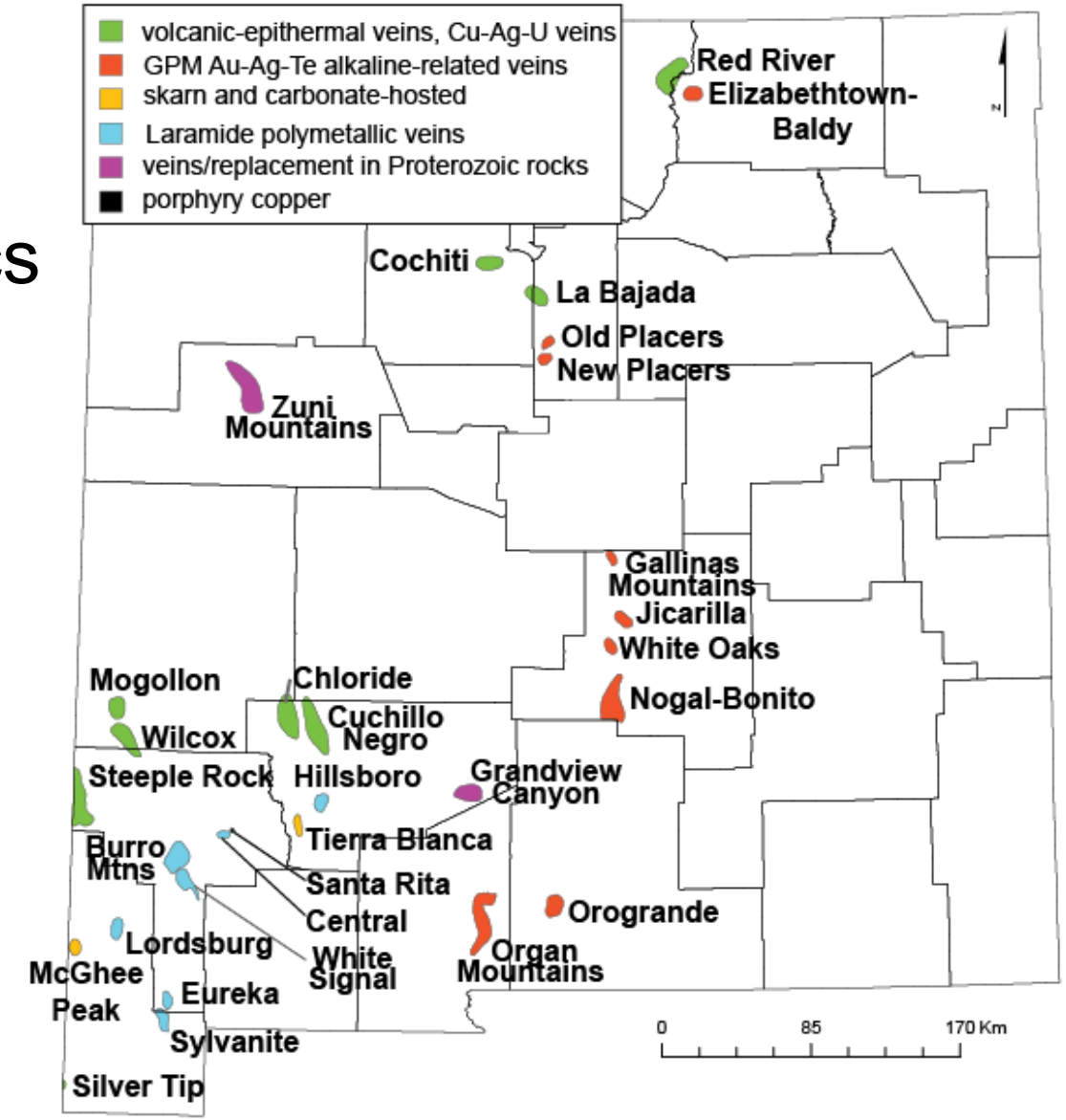
Lithium in New Mexico

- More than 13,000 short tons of lepidolite ore and several hundred short tons of spodumene ore have been produced from pegmatites in New Mexico in 1920-1950
- Lithium in brine, hydrothermal (geothermal), and playa deposits derived from weathering of lithium-enriched rhyolite and other volcanic rocks
- Lithium is used in batteries, lubricants, pharmaceuticals, glass, chemical industry
- Brine, hydrothermal (geothermal), and playa deposits best potential in NM



Tellurium in New Mexico

- 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**



Mining districts in New Mexico with tellurium minerals or chemical assays >20 ppm Te

Mine of the future

Mine of the future

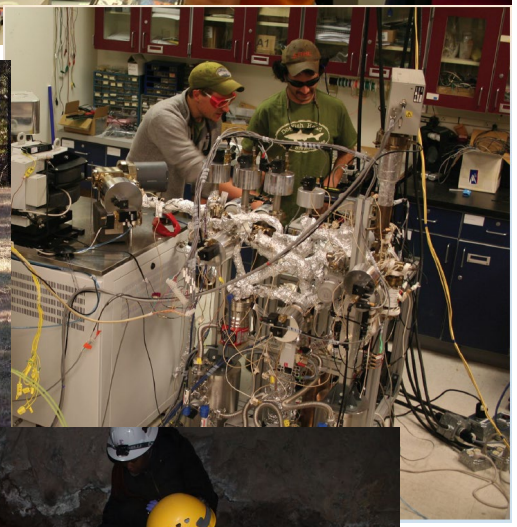
Challenge—We need to mine mineral resources differently

- In situ mining—targeted mining—noninvasive mining—laparoscopic mining (Dr. Webb SNL introduced topic)
  - Technologies available for U and Cu
  - Using drilling and production technology used in petroleum industry to target other deposit types
  - Can they be developed for noninvasive mining
  - Can we partner with carbon sequestration to “fill the voids after mining minerals in the subsurface”
- Smaller deposits
- Reduce footprint of mining
- No underground miners—safer
- Robotics in mining
- IT WILL TAKE TIME
- CHALLENGE—HOW DO WE GET THE MINING INDUSTRY ON BOARD SOONER

Importance of Mining REE and Critical Minerals in New Mexico

- Future mining of REE and critical minerals will directly benefit the economy of New Mexico and the U.S.
- Mineral resources must be identified before land use decisions are made by government officials
- Crucial to re-establish a domestic source of REE and critical minerals minerals in the U.S. to help secure the nation's clean energy future, reducing the vulnerability of the U.S. to material shortages related to national defense, and to maintain our global technical and economic competitiveness
- Training of the future workforce because students at New Mexico Tech, Navajo Tech, and San Juan College have been hired to work on this project and outreach activities train high and middle school students as well as their teachers
- We must rethink how we mine mineral resources

NMBGMR ECONOMIC GEOLOGY GROUP RESEARCH



Questions?

- What do you see as deficiencies or things that students need to learn before coming into industry? What should we be teaching to help students succeed in industry?
- How to increase mineral production in New Mexico?
  - Does it start with combatting nimbyism and education of the public and policymakers that modern mining doesn't lead to the legacy issues past generations have dealt with?
- How to obtain sustainable funding to continue training geologists and engineers for the mineral extraction industries?
- What new technologies can be developed to increase sustainability of mining and exploration?
- How will permitting have to change to accommodate new techniques of mining?
- What is the role of uranium in the future of low carbon energy production for New Mexico (and the U.S.)?
  - Importance of base load to accompany intermittent sources (solar & wind)
  - How can legacy uranium mining issues be effectively addressed?