STATUS OF THE MINING INDUSTRY IN NEW MEXICO—2019

Virginia T. McLemore
New Mexico Bureau of Geology and Mineral Resources, New Mexico Tech, Socorro, NM
ACKNOWLEDGEMENTS

• New Mexico Energy, Minerals and Natural Resource Department
• Company annual reports
• Personal visits to mines
• Historical production statistics from U.S. Bureau of Mines, U.S. Geological Survey, N.M. Energy, Minerals and Natural Resource Department (NM MMD), company annual reports
• Students at NM Tech
OUTLINE

• What, where, and how much minerals are produced in New Mexico?
  • Where are potential future resources?
• Are there critical minerals in New Mexico?
• What are the Mining Issues Facing New Mexico?
WHAT, WHERE, AND HOW MUCH MINERALS ARE PRODUCED IN NEW MEXICO?
INTRODUCTION

- NM has some of the oldest mining areas in the United States
- Native Americans mined turquoise from Cerrillos Hills district more than 500 yrs 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 yrs before the California Gold Rush in 1849

One of the turquoise mines in the Cerrillos Hills district
MINING DISTRICTS IN NEW MEXICO
PRODUCTION SUMMARY—2018

• Value of mineral production in 2018 was $1.77 billion (same as 2017) (does not include oil and gas)—ranked 23rd in the US (18th in 2017)

• Employment in the mining industry is 5,000

• Exploration for garnet, gypsum, limestone, nepheline syenite, agate, specimen fluorite, gold, silver, iron, beryllium, uranium, copper, potash, rare earth elements, humate, clays, lithium

• MINERALS PRODUCTION REMAINS THE SAME OR DECREASING, ESPECIALLY COAL
VALUE OF MINERAL PRODUCTION IN NEW MEXICO 2000-2017 (MMD)
ACTIVE MINES 2019

- ~282 active registered mines (NMMMD)
- 4 coal
- 3 potash, 4 potash plants
- 2 copper open pits, 1 concentrator (mill), 2 solvent/electro-winning (SX-EW) plants
  - 2 additional mines in permitting stage
  - Several exploration
- 1 gold mine and 1 mill (on standby)
- 2 iron mines
- 32 industrial minerals mines, 18 mills
- ~236 aggregate/stone
ACTIVE MINES IN NEW MEXICO 2016-2019

From NM Mining and Minerals Div. database

Not all aggregate mines are shown
SELECTED ACTIVE EXPLORATION SITES IN NEW MEXICO 2016-2019 (EXCLUDING U)

From NM Mining and Minerals Div. and NMBGMR databases, company web sites
Most of these exploration sites have been known for >20 yrs

Industrial minerals deposits sometimes can be permitted within a few yrs but not metal mines
• Fuels 3 electrical generating plants
• 3 surface mines and 1 underground mine in San Juan Basin
• Resources at Raton, Carrizozo
• 12th in production in U.S. in 2018
• 11th in estimated recoverable coal reserves—7 billion tons of recoverable reserves (2005 figures)
• San Juan generating station in the Farmington is scheduled to close in the near future
• **Coal production is expected to decrease in the near future**
COAL PRODUCTION IN NEW MEXICO
1998-2017

METALS—3RD IN COPPER PRODUCTION IN 2018 (CHINO, TYRONE)
COPPER RESERVES—2018

• Grades are decreasing

• Chino (incl. Hanover, Cobre)
  • milling reserves are 274 million metric tons of 0.54% copper, 0.04 g/t gold, 0.93 g/t silver and 0.01% molybdenum
  • leaching reserves are 121 million tons of 0.29% Cu

• Tyrone (incl. Little Rock)
  • leaching reserves are estimated as 55 million metric tons of ore grading 0.25% Cu
  • Was expected to close 2020s, but may develop a new pit (Emma project)
1. Copper Flat (98.1 million short tons at 0.31% Cu, 0.009% Mo, 0.003 oz/short ton Au, and 0.07 oz/ short ton Ag)
2. Orogrande
3. Hanover Mountain (80 million short tons reserves at 0.38% Cu)
4. Copper Hill, Picuris district (46.5 million short tons of ore at 0.42% Cu)
5. Lone Mountain (7.5 million short tons at 2-3% Cu, 1.2% Pb, 4-5% Zn, 203 opt Ag, .01-.02 opt Au)
6. McGhee Peak, Pelloncillo Mountains
7. Mimbres, Grant Co
8. Oak Grove, Grant Co
Copper Flat, Themax Resources
Planned production per year for ~15 yrs
50.76 mill lbs Cu
1.01 mill lbs Mo
12,750 oz Au
455,390 oz Ag
Start in 2020s?
GOLD AND SILVER PRODUCTION

- In 2004-2018 as a byproduct of copper production from the Ivanhoe concentrator (Freeport-McMoRan)
- 2009 Summit mine opened (currently on standby)
- 9th in gold production
- 10th in silver production
1. Vera Cruz, Lincoln Co
2. Carache Canyon, Santa Fe Co
3. Lukas Canyon, Santa Fe Co
4. San Lazarus, Santa Fe Co
5. Jicarilla Au placers
6. Steeple Rock district
7. Mogollon, Catron Co
8. Magdalena, Socorro Co
9. Rosedale, Socorro Co
10. Terrero, Santa Fe
INDUSTRIAL MINERALS

Any rock, mineral, or other naturally occurring material of economic value, excluding metals, energy minerals, and gemstones, generally nonmetallic

Many critical minerals are considered industrial minerals
POTASH PRODUCTION
1951-2018 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
1ST IN POTASH IN 2018 (MOSAIC, INTREPID MINING)
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)
ADDITIONAL INDUSTRIAL MINERALS IN NEW MEXICO

- 1st in zeolite (St. Cloud, Sierra County)
- 5th in pumice (6 operations)
- 1st in perlite (4 operations)
- 11th in salt (4 operations, Carlsbad)
- Humate is important and expanding
OTHER INDUSTRIAL MINERALS DEPOSITS

- Aggregates
- Gypsum for wallboard
- Brick and clay in El Paso, Albuquerque areas
- Cement in Tijeras Canyon
- Humate in the San Juan Basin
- Sulfur, helium, carbon dioxide
- Travertine (dimension stone), Meso del Oro, west of Belen
  - 477.6 million tons of travertine
URANIUM IN NEW MEXICO 2016

- 2nd in uranium resources 15 million tons ore at 0.277% U$_3$O$_8$ (84 million lbs U$_3$O$_8$) at $30/lb (DOE estimates in 2002)
- Numerous companies have acquired properties (Strathmore, Energy Minerals, Laramide Resources, among others)
- Energy Fuels acquired Strathmore in 2013 and is now permitting the Roca Honda mine
- HRI, Inc. awaiting permits for in situ leach in Church Rock, Ambrosia Lake areas
- Several exploration permits approved or in progress
Deposits with uranium resources in New Mexico (McLemore and Chenoweth, 2017). Only major mines and deposits are included here.
CRITICAL MINERALS IN NEW MEXICO
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

• 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
CRITICAL MINERALS

- 35 critical minerals were identified
- New Mexico has many of these critical minerals
  - Potash is currently being produced in Carlsbad
  - Copper deposits in Grant County contain rhenium, indium, gallium, and germanium
  - Uranium deposits in the Grants district contain Se, REE, V, Mo
  - 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)
Critical Minerals in New Mexico

- **Red**: Element currently producing in NM
- **Blue**: Element once produced from NM
- **Green**: Element found in NM
- **Yellow**: 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.
SELECTED EXPLORATION SITES OF CRITICAL MINERALS IN NEW MEXICO 2016-2019

From NM Mining and Minerals Div. and NMBGMR databases, company web sites
CRITICAL MINERALS ASSOCIATED WITH URANIUM DEPOSITS

- Vanadium and molybdenum were produced with uranium in the past and could resume by-product production in the future.
- Uranium deposits contain anomalously high rare earth elements (REE) in ore—companies should examine their deposits and determine if a Ce circuit is feasible and economic.
TELLURIUM IN MAGMATIC SYSTEMS NEW MEXICO
Uses of Te

- 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
Lone Pine, Wilcox district, Catron County—volcanic epithermal vein
OCCURRENCES OF RARE EARTH ELEMENTS (REE) IN NEW MEXICO
REE in Gallinas Mountains, Lincoln County
WHAT ARE THE MINING ISSUES FACING NEW MEXICO?

Gold King adit

Animas River after Gold King spill
MINING ISSUES FACING NEW MEXICO

• Some current mines are reaching the end of their life and will close over the next decade = decreasing minerals production
• There are not many new mines to replace them
• Results in unemployment and decrease in revenues
  • Affects rural economies
  • Affects state revenues
MINING ISSUES FACING NEW MEXICO

- Mining requires water and their environmental effects must not impact water supplies
- Legacy issues of past mining activities form negative public perceptions of mining
  - Abandoned or legacy mines, especially Grants uranium district and Questa mine
  - Gold King spill
  - Not in my backyard!!!!!!
Mining is viewed as favorable by only 27% of New Mexicans.
MINING ISSUES FACING NEW MEXICO

- Many inactive mines still have the potential to contaminate the environment or present a hazard to health and safety
  - Gold King spill
  - AML sites (Abandoned mine lands)
  - Grants uranium district
MINING ISSUES FACING NEW MEXICO

• Global competition is closing some of our mines
• Exploration for new deposits often results in drill targets based upon regulatory minimal impact regulations rather than optimum geological criteria
• Permitting for exploration can take longer than exploration funds are available
• Lower prices = closed mines, little exploration
MINING ISSUES FACING NEW MEXICO

• In some areas conflicts arise between mining and other activities
  • Grants uranium district
  • Otero Mesa
  • Pecos/Tererro mine
  • Water, don’t want a mine in their backyard

• Shortage of young geologists and engineers to explore for, develop, mine, permit these commodities and evaluate their effect on the environment—math, science skills critical
Number of thesis and dissertations on non-energy economic geology has decreased.

SUMMARY

• New Mexico has a wealth of mineral resources
• Exploration and permitting takes many years before a deposit can be mined, >10 yrs
• Legacy issues are being addressed
• Negative public perceptions are major issue as is funding
• Global competition is a major threat
• NMBG/NMT research is addressing some of these issues, as well as training future geologists and engineers
RESEARCH
MORE INFORMATION

- NM Mines and Minerals Division
  http://www.emnrd.state.nm.us/MMD/

  Virginia McLemore web page
  http://geoinfo.nmt.edu/staff/mclemore/home.html

- New Mexico Bureau of Geology and Mineral Resources
  http://geoinfo.nmt.edu/
QUESTIONS?