ACKNOWLEDGEMENTS

- New Mexico Energy, Minerals and Natural Resource Department
- Company annual reports
- Personal visits to mines
- Students at NM Tech
- New Mexico Mining Association
Minerals

In the mining industry, *minerals* refer to any rock, mineral, or other naturally occurring material of economic value, including metals, industrial minerals, energy minerals, gemstones, aggregates, and synthetic materials sold as commodities.
Industrial minerals

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

• One of the nonmetallics

• Includes aggregates
Every American Born Will Need...

30,190 lbs. Salt
14,337 lbs. Phosphate Rock
75,327 gallons Petroleum
53,071 lbs. Cement
980 lbs. Copper
20,127 lbs. Iron Ore
12,182 lbs. Clays
7.70 million cu. ft. Natural Gas
1.54 Troy oz. Gold
1.36 million lbs. Stone, Sand, & Gravel
953 lbs. Lead
330,573 lbs. Coal
2,066 lbs. Bauxite (Aluminum)

3.19 million pounds of minerals, metals, and fuels in their lifetime

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Minerals are essential to our way of life

OUTLINE

• What, where, and how much minerals are produced in New Mexico?
• What are the Mining Issues Facing New Mexico?
• How are we responding?
  • Research
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
MINING DISTRICTS IN NEW MEXICO
PRODUCTION SUMMARY—2020

• Value of mineral production in 2018 was <$1.7 billion (does not include oil and gas)—ranked 28th in the US

• 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

• MINERALS PRODUCTION IS DECREASING, ESPECIALLY COAL
MINERALS PRODUCTION IN NEW MEXICO 2000-2018
ACTIVE MINES 2020

- ~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 AND EXPLORATION SITES IN NEW MEXICO 2000-2020
COAL

• Fuels electrical generating plants
• 3 surface mines and 1 underground mine in San Juan Basin
• Resources at Raton, Carrizozo
• 14th in production in U.S. in 2018
• 11th in estimated recoverable coal reserves—7 billion tons of recoverable reserves (2005 figures)
• Coal production is expected to decrease in the near future
Figure 4. Coal production and value 1899-2014.
METALS—3RD IN COPPER PRODUCTION IN 2019 (CHINO, TYRONE)
COPPER RESERVES—2019

- **Chino (including Cobre)**
  - milling reserves are 224 million metric tons of 0.51% copper, 0.05 g/t gold, 0.91 g/t silver and 0.01% molybdenum
  - leaching reserves are 100 million tons of 0.32% Cu

- **Tyrone (incl. Little Rock)**
  - leaching reserves are estimated as 49 million metric tons of ore grading 0.25% Cu
  - Expected to close 2020s

- **Cobre**
  - Included with Chino mine
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 mill st reserves at 0.38% Cu)

4. Copper Hill, Picuris district (46.5 mill st of ore at 0.42% Cu)

5. Lone Mountain (7.5 mill st at 2-3% Cu, 1.2% Pb, 4-5% Zn, 203 opt Ag, .01-.02 opt Au)

6. McGhee Peak, Pelloncillo Mountains

7. Mimbres
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
Gold Production 1804-2018

Troy ounces

Years

GOLD Troy ounces

Value in Dollars

Troy ounces

Value

Years

1804-1879

1877

1887

1897

1907 1917

1927

1937

1947

1957

1967

1977

1987*

1997

2007

2017

$0

$10,000,000

$20,000,000

$30,000,000

$40,000,000

$50,000,000

$60,000,000

$70,000,000

$0

$10,000,000

$20,000,000

$30,000,000

$40,000,000

$50,000,000

$60,000,000

$70,000,000
In 2009, Santa Fe Gold opened the Summit mine in the Steeple Rock district. The ore was milled at Lordsburg and sold as silica flux.
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
INDUSTRIAL MINERALS

Any rock, mineral, or other naturally occurring material of economic value, excluding metals, energy minerals, and gemstones, generally nonmetallics
POTASH PRODUCTION
1951-2018 115 million tons worth >$16 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)
PERLITE IN NEW MEXICO

Competition from Greece
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
Panel Rey is building a wallboard plant in Ciudad Juarez, Chihuahua, Mexico which could impact the New Mexico gypsum industry

URANIUM IN NEW MEXICO 2020

• 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 (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.
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
- 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 can 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 (superfund sites)
  • Gold King spill
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

• Global competition is closing some of our mines

• 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
  • Water

• 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
HOW IS THE STATE RESPONDING?
HOW IS THE STATE RESPONDING?

- NMBGMR is evaluating the mineral-resource potential of commodities in NM
HOW IS THE STATE RESPONDING?

Modifications to the 1993 NM Mining Act

NMMMD and the NM Mining Commission increased the minimum acreage for a minimal impact mine from 10 acres to 40 acres for five industrial minerals (humate, garnet, perlite, dolomite, zeolites), except in Bernalillo, Dona Ana, and Santa Fe Counties.
HOW IS NMBG/NMT RESPONDING?

NMED, NMBGMR with other universities and state agencies are cooperating and monitoring the Animas River watershed and the potential effects to New Mexico.
HOW IS NMBGMR/NMT RESPONDING?

NMBGMR and NM Tech is working with the state and federal AML (abandoned mine land) programs to evaluate other areas in New Mexico for potential environmental concerns.

AML project
http://geoinfo.nmt.edu/geoscience/hazards/mines/aml/home.html
HOW IS NMBG/NMT RESPONDING?

• NMBGMR, NMT, UNM, and other universities are examining environmental issues with uranium mines in NM
• New Mexico's Experimental Program to Stimulate Competitive Research (NM EPSCoR)
HOW IS NMBG/NMT RESPONDING?

• NMBGMR, NMT, UNM, and other universities conducted a workshop on Making AML wastes profitable

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, 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, fluor spar, barite, graphite)
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.
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
SUMMARY

• New Mexico has a wealth of mineral resources
  • Geologic processes control the location of mineral deposits and many of these same processes form the scenic views we treasure
• Minerals are critical in providing our way of life—everything we use has to be grown or mined
• Mining creates jobs and revenues in the community
SUMMARY

• New Mexico has a wealth of mineral resources
  • Geologic processes control the location of mineral deposits and many of these same processes form the scenic views we treasure
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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/
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