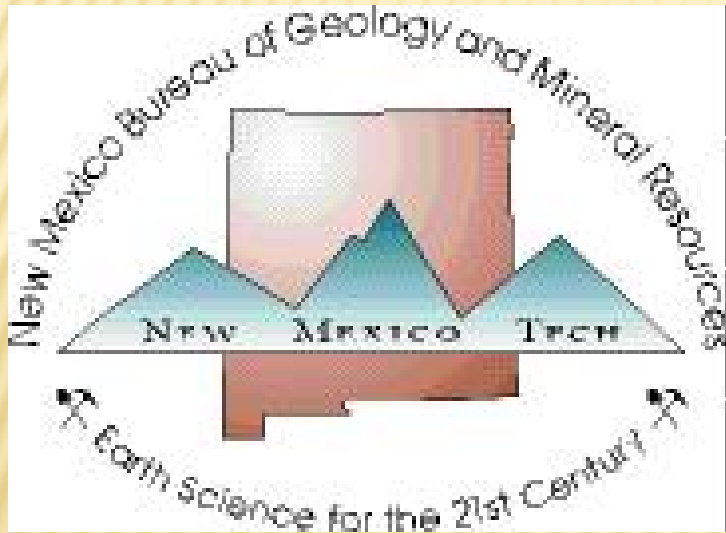


# MINING ISSUES FACING NEW MEXICO- 2015



***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 US Bureau of Mines, US Geological Survey, NM Energy, Minerals and Natural Resource Department (NM MMD), company annual reports
- ✖ New Mexico Mining Association

# OUTLINE

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- ✖ What are minerals?
- ✖ Why are they important?
- ✖ How are minerals formed?
- ✖ What, where, and how much minerals are produced in New Mexico?
- ✖ What are the Mining Issues Facing New Mexico?
- ✖ More Information



# WHAT ARE MINERALS?

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# **WHAT ARE MINERALS?**

Minerals refer to any rock, mineral, or other naturally occurring material of economic value, including metals, industrial minerals, energy minerals, gemstones, and aggregates

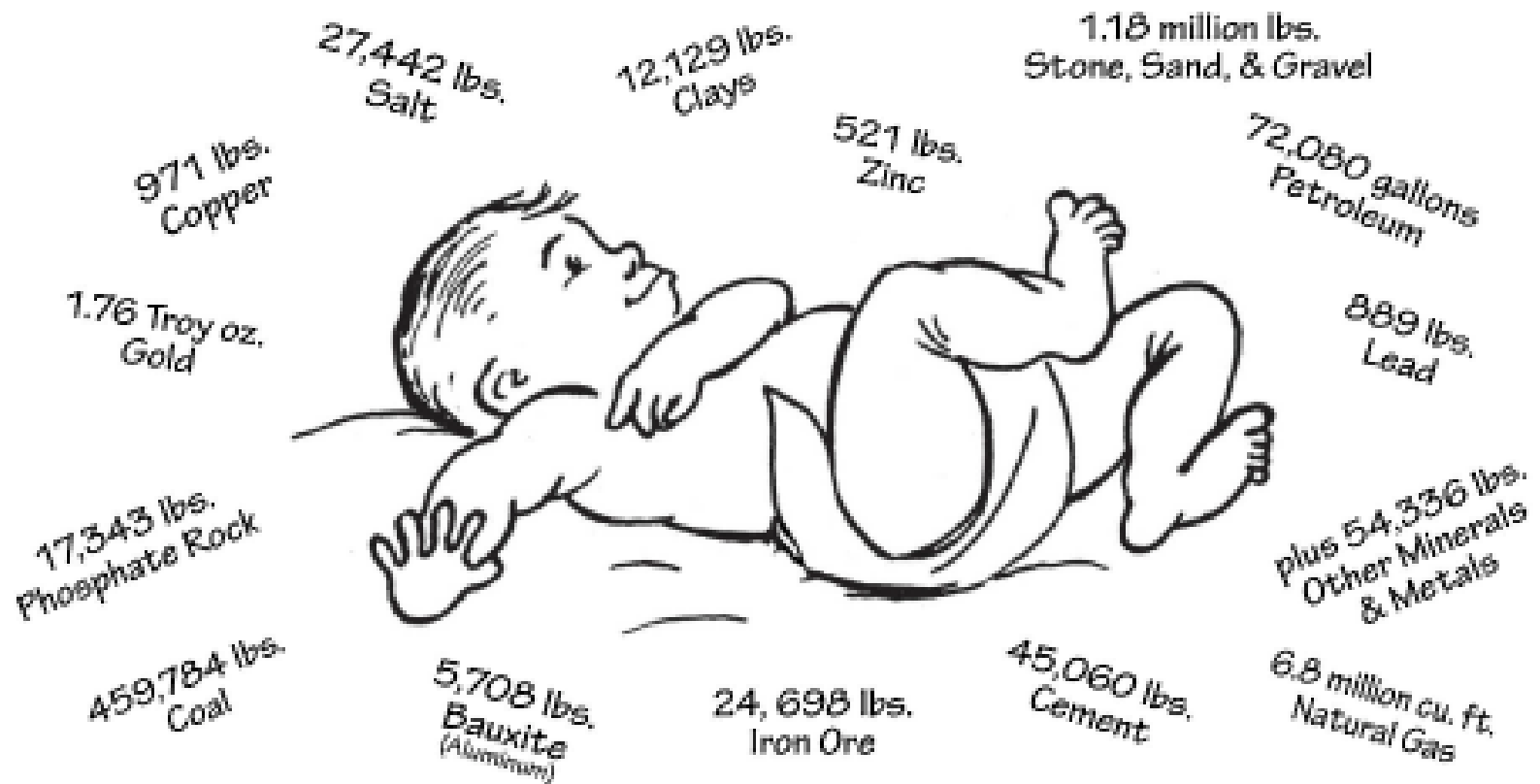
**WEALTH CREATOR**

# WHY ARE MINERALS IMPORTANT?

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# YOUR WORLD IS MADE FROM MINERALS

## Every American Born Will Need...



**3.03 million pounds of minerals, metals, and fuels in their lifetime**



## *Every Year*— 38,212 pounds of new minerals must be provided for every person in the United States to make the things we use every day



9,002 lbs. **Stone** used to make roads, buildings, bridges, landscaping, and for numerous chemical and construction uses



6,251 lbs. **Sand & Gravel** used to make concrete, asphalt, roads, blocks and bricks



556 lbs. **Cement** used to make roads, sidewalks, bridges, buildings, schools and houses



348 lbs. **Iron Ore** used to make steel— buildings; cars, trucks, planes, trains; other construction; containers



349 lbs. **Salt** used in various chemicals; highway deicing; food & agriculture



207 lbs. **Phosphate Rock** used to make fertilizers to grow food; and as animal feed supplements



152 lbs. **Clays** used to make floor & wall tile; dinnerware; kitty litter; bricks and cement; paper



78 lbs. **Aluminum (Bauxite)** used to make buildings, beverage containers, autos, and airplanes



12 lbs. **Copper** used in buildings; electrical and electronic parts; plumbing; transportation



11 lbs. **Lead** 87% used for batteries for transportation; also used in electrical, communications and TV screens



7 lbs. **Zinc** used to make metals rust resistant, various metals and alloys, paint, rubber, skin creams, health care and nutrition



35 lbs. **Soda Ash** used to make all kinds of glass; in powdered detergents; medicines; as a food additive; photography; water treatment



6 lbs. **Manganese** used to make almost all steels for construction, machinery and transportation



488 lbs. **Other Nonmetals** have numerous uses: glass, chemicals, soaps, paper, computers, cell phones



24 lbs. **Other Metals** have the same uses as nonmetals but also electronics, TV and video equipment, recreation equipment, and more

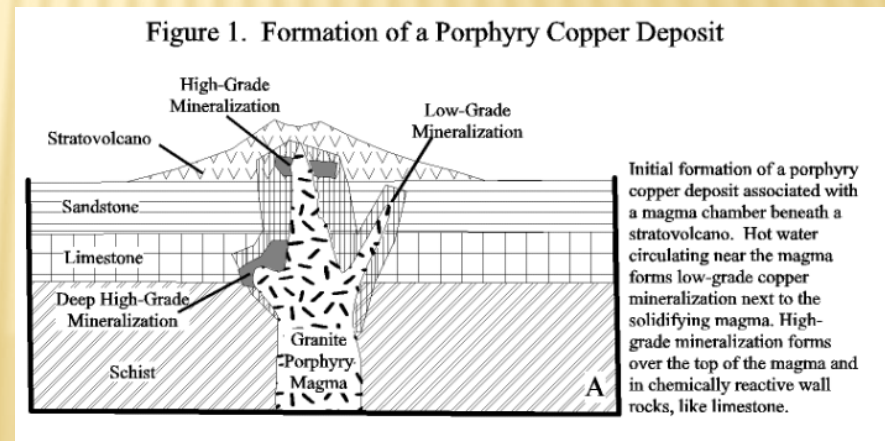
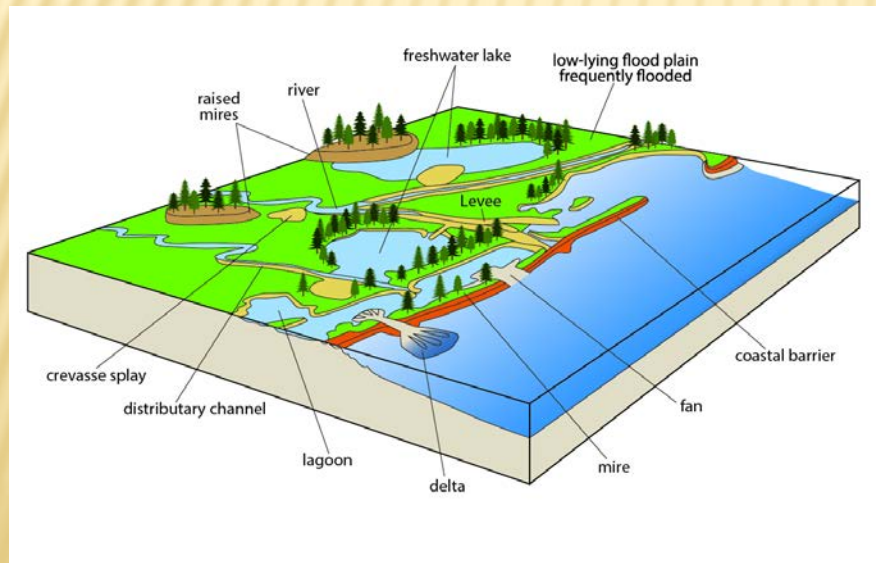
### *Including These Energy Fuels*

• 906 gallons of **Petroleum** • 5,666 lbs. of **Coal** • 84,348 cu. ft. of **Natural Gas** • 1/4 lb. of **Uranium**

*To generate the energy each person uses in one year—*

# HOW ARE MINERAL DEPOSITS FORMED?

- ✖ By natural geologic processes in specific places in the world
- ✖ Mineral deposits are not always found in the most convenient places in the world



**WHAT, WHERE, AND HOW  
MUCH MINERALS ARE  
PRODUCED IN NEW  
MEXICO?**



# SUMMARY

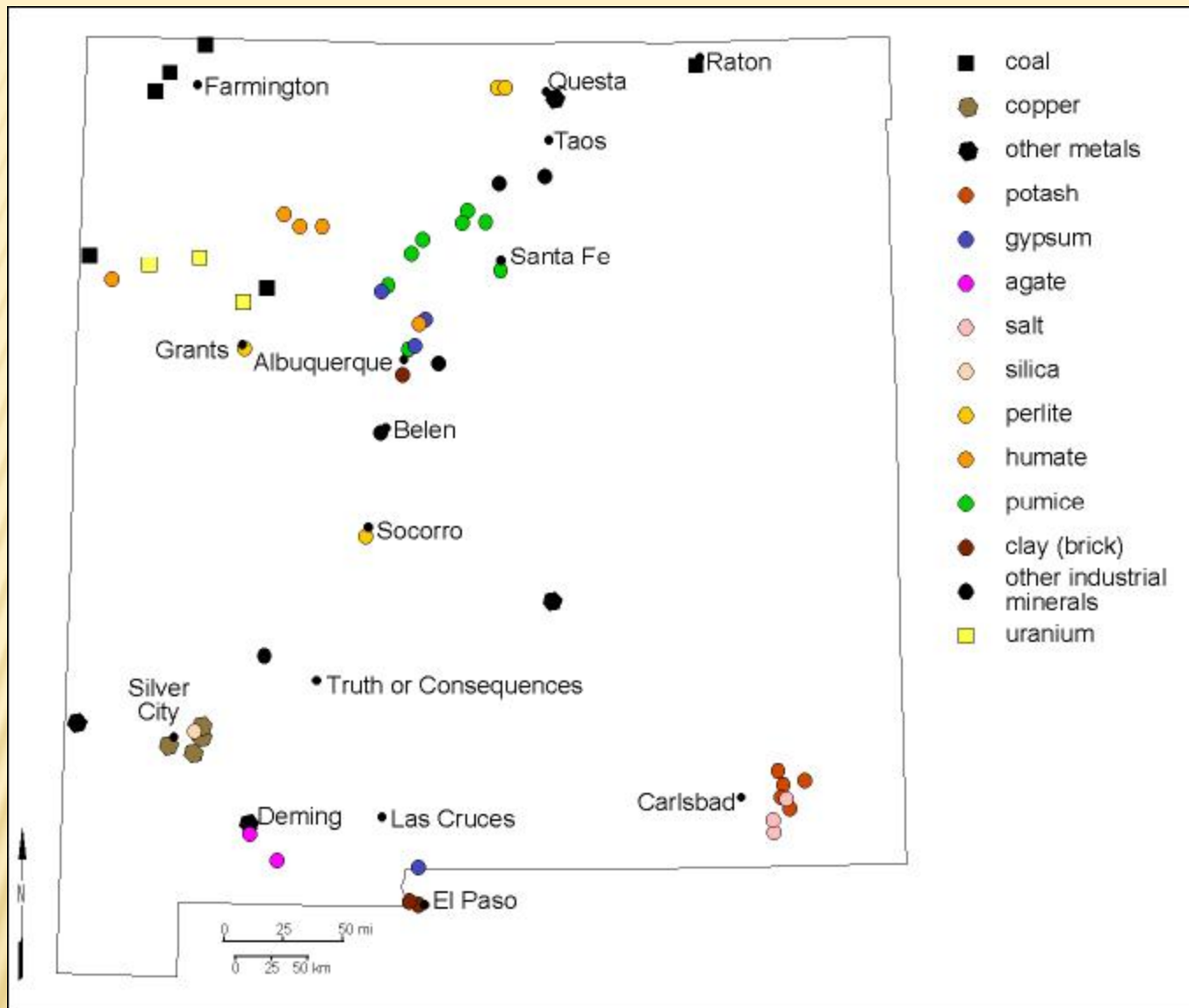
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- ✘ Value of mineral production in 2013 was \$2.8 billion (does not include oil and gas)—ranked 12<sup>th</sup> in the US
- ✘ Employment in the mining industry is 7,112
- ✘ Exploration for garnet, gypsum, limestone, nepheline syenite, agate, specimen fluorite, gold, silver, iron, beryllium, uranium, copper, potash, rare earth elements, humate, clays

**TABLE 1 New Mexico Summary of Commodity Production, Production Value, Employment, Payroll, Revenue and Ranking: 2013**

Mineral	Production <sup>1</sup>	Production Rank <sup>2</sup>	Production Value \$	Employment <sup>3</sup>	Reclamation Employment	Payroll \$ <sup>4</sup>	Revenue Generated \$ <sup>5</sup>	
							State	Federal
Coal	21,968,639	12	\$ 816,628,814	1,623	183	\$ 85,145,465	\$ 22,700,382	\$ 8,068,407
Copper	266,483,184	3	\$ 890,357,625	1,885	88	\$ 106,936,573	\$ 7,259,514	\$ -
Gold	2,943	-	\$ 3,994,109	59	-	\$ 2,392,294	\$ 58,068	\$ -
Industrial Minerals <sup>6</sup>	1,248,312	-	\$ 91,113,849	471	11	\$ 17,860,998	\$ 1,028,914	\$ 212,690
Aggregates <sup>7</sup>	9,393,307	-	\$ 81,505,531	937	101	\$ 14,264,197	\$ 2,498,063	\$ -
Other Metals	512,323	-	\$ 2,539,625	65	-	\$ 1,877,897	\$ 651,719	\$ -
Molybdenum	2,384,509	-	\$ 24,789,281	461	-	\$ 19,028,960	\$ -	\$ -
Potash <sup>8</sup>	2,188,874	1	\$ 914,659,051	1,600	15	\$ 95,988,330	\$ 5,254,275	\$ 11,369,170
Silver <sup>9</sup>	68,523	-	\$ 1,867,307	-	-	\$ -	\$ 13,886	\$ -
Uranium <sup>10</sup>	-	-	\$ -	11	18	\$ 1,164,144	\$ -	\$ -
<b>TOTAL</b>			<b>\$ 2,827,495,091</b>	<b>7,112</b>	<b>416</b>	<b>\$ 344,658,958</b>	<b>\$ 39,484,821</b>	<b>\$19,650,267</b>

Source: Mining and Minerals Division, unless otherwise noted.

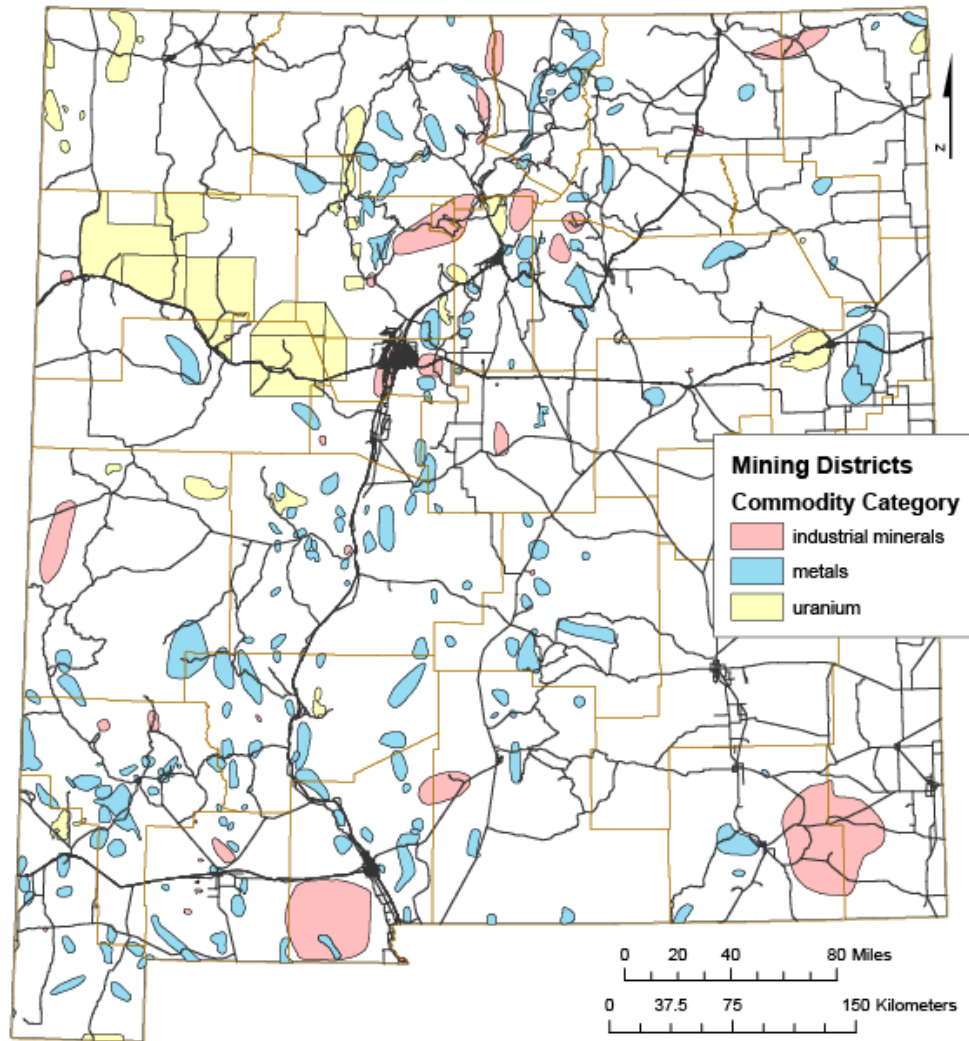


# ACTIVE MINES AND EXPLORATION IN NEW MEXICO 2000-2015 (EXCLUDING AGGREGATES)



# HISTORICAL PRODUCTION

# MINING DISTRICTS IN NEW MEXICO



# **ESTIMATED TOTAL PRODUCTION OF MAJOR COMMODITIES IN NEW MEXICO**

- ✘ More than \$68 billion worth of minerals have been produced from New Mexico since 1804



# ESTIMATED TOTAL PRODUCTION OF MAJOR COMMODITIES IN NEW MEXICO

Commodity	Years of production	Estimated quantity of production	Estimated cumulative value (\$)	Quantity of production in 2013* (natural gas and oil are in 2014)	Value in 2013 (\$)*	Ranking in U.S. in 2013
Coal	1882-2013	>1.06 billion short tons	>\$20.75 billion	21,968,639 short tons	\$816,628,814	12
Copper	1804-2013	>11.2 million tons	>\$19.6 billion	266,483,184 pounds	\$890,357,625	3
Potash	1951-2013	109,923,866 Short tons	>\$13 billion	2,188,874 short tons	\$914,659,051	1
Uranium	1948-2002	>347 million pounds	>\$4.7 billion	none		
Industrial minerals	1997-2013	39,076,946	>\$2.5 billion	1,248,312	\$91,113,849	
Aggregates	1951-2013	>654 short tons	>\$2.4 billion	9,393,307	\$81,505,531	
Molybdenum	1931-2013	>176 million pounds	>\$852 million	2,384,509 pounds	\$24,739,281	6
Gold	1848-2013	>3.2 million troy ounces	>\$452 million	2,943 ounces	\$3,994,109	9
Silver	1848-2013	>118.7 million troy ounces	>\$279 million	68,523 ounces	\$1,867,207	7

# ACTIVE MINES 2015

- ✖ ~240 active registered mines (NMMMD)
- ✖ 5 coal
- ✖ 3 potash, 5 potash plants
- ✖ 1 gold mine and mill (on standby)
- ✖ 2 copper open pits, 1 concentrator (mill), 2 solvent/electro-winning (SX-EW) plants
  - ✖ 2 additional mines in permitting stage
  - ✖ Several exploration
- ✖ 20 industrial minerals mines, 18 mills
- ✖ ~200 aggregate/stone

# COAL

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coal

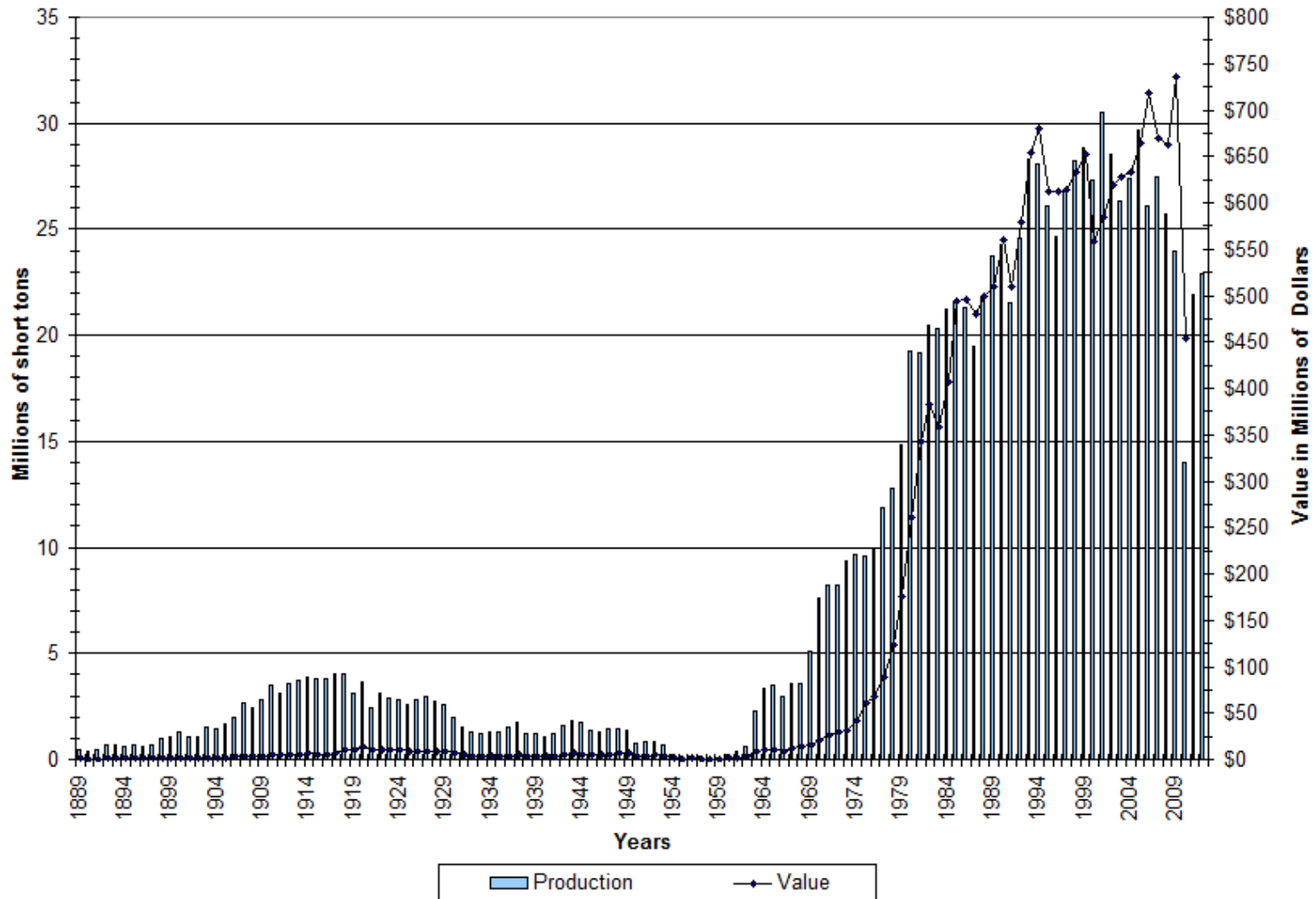


# COAL

- ✗ Fuels electrical generating plants
- ✗ 4 surface mines and 1 underground mine in San Juan Basin
- ✗ Resources at Raton, Carrizozo
- ✗ 12<sup>th</sup> in production in U.S. in 2013
- ✗ 11<sup>th</sup> in estimated recoverable coal reserves—7 billion tons of recoverable reserves (2005 figures)
- ✗ **Coal production is expected to decrease in the near future**



Coal Production and Value 1889-2012



1882-2013 >1.06 BILLION SHORT TONS  
COAL WORTH >\$20.75 BILLION

# METALS

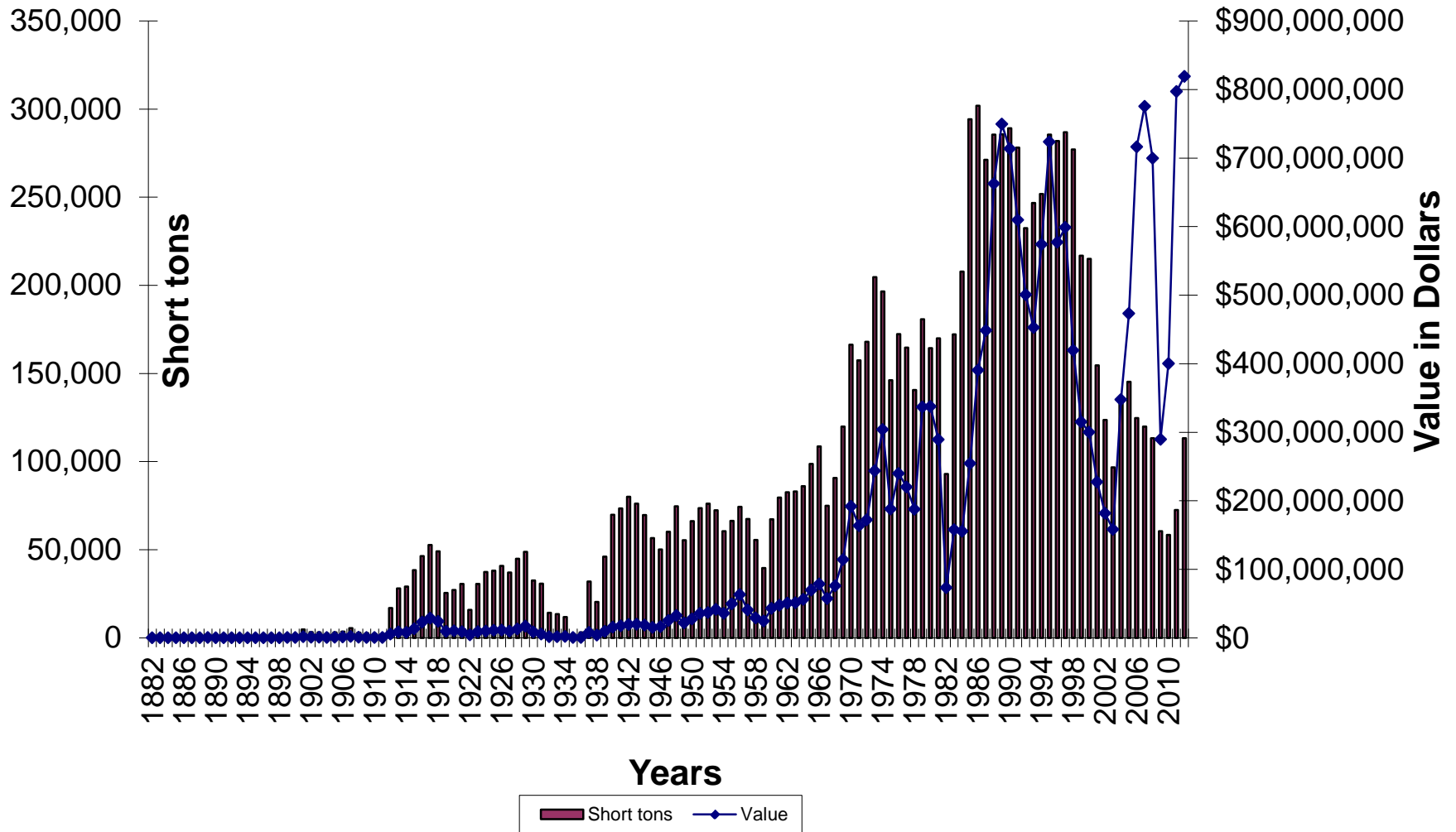
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3<sup>RD</sup> IN COPPER IN 2013 (CHINO,  
TYRONE)

## Copper Production 1882-2012



1804-2013 >11.2 MILLION SHORT TONS CU WORTH  
>\$19.6 BILLION

# COPPER RESERVES—2009

## ✖ Chino

- + milling reserves are 54 million tons of 0.66% copper, 0.03 g/t gold and 0.013% molybdenum
- + leaching reserves are 69 million tons of 0.41% Cu

## ✖ Tyrone

- + leaching reserves are estimated as 139 million tons of ore grading 0.32% Cu

## ✖ Cobre

- + leaching reserves are 71 million tons of 0.40% Cu

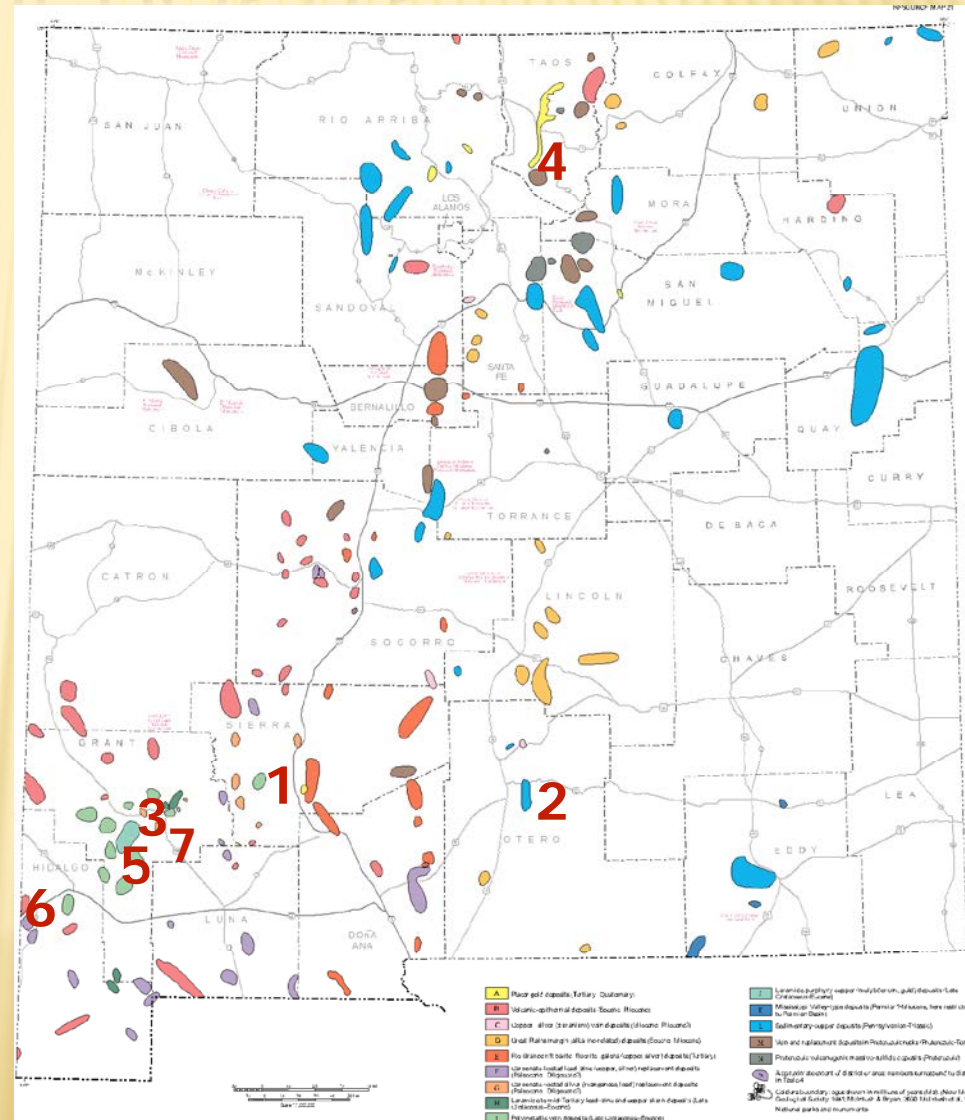
## ✖ Niagara deposit

- + contains 500 million tons of ore grading 0.29% Cu (leaching)



# POTENTIAL COPPER DEPOSITS

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, 102% 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 11 yrs

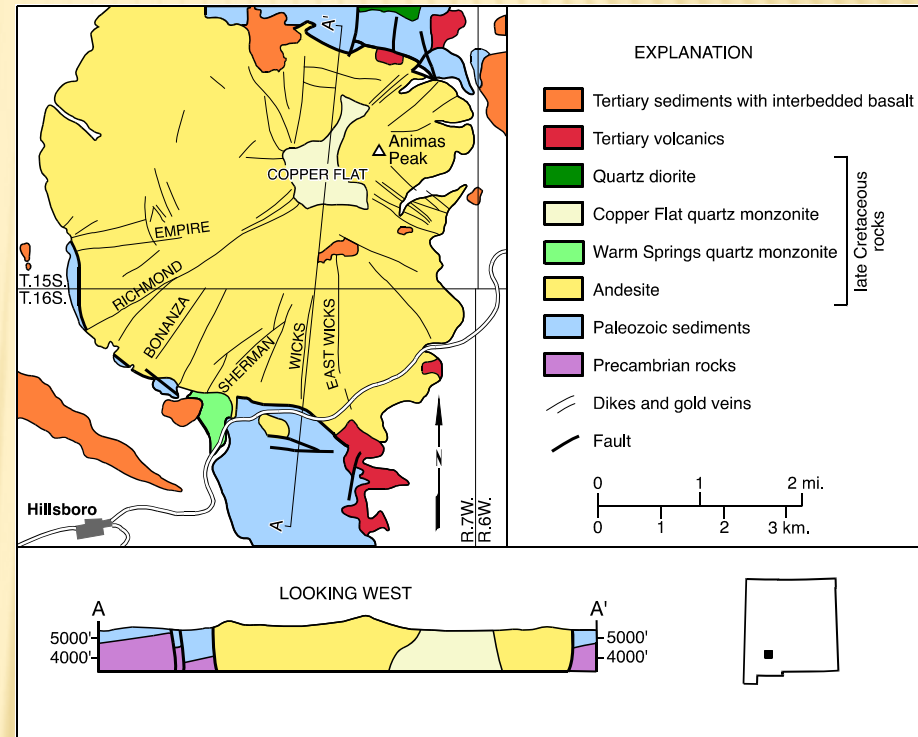
50.76 mill lbs Cu

1.01 mill lbs Mo

12,750 oz Au

455,390 oz Ag

Start in 2018?



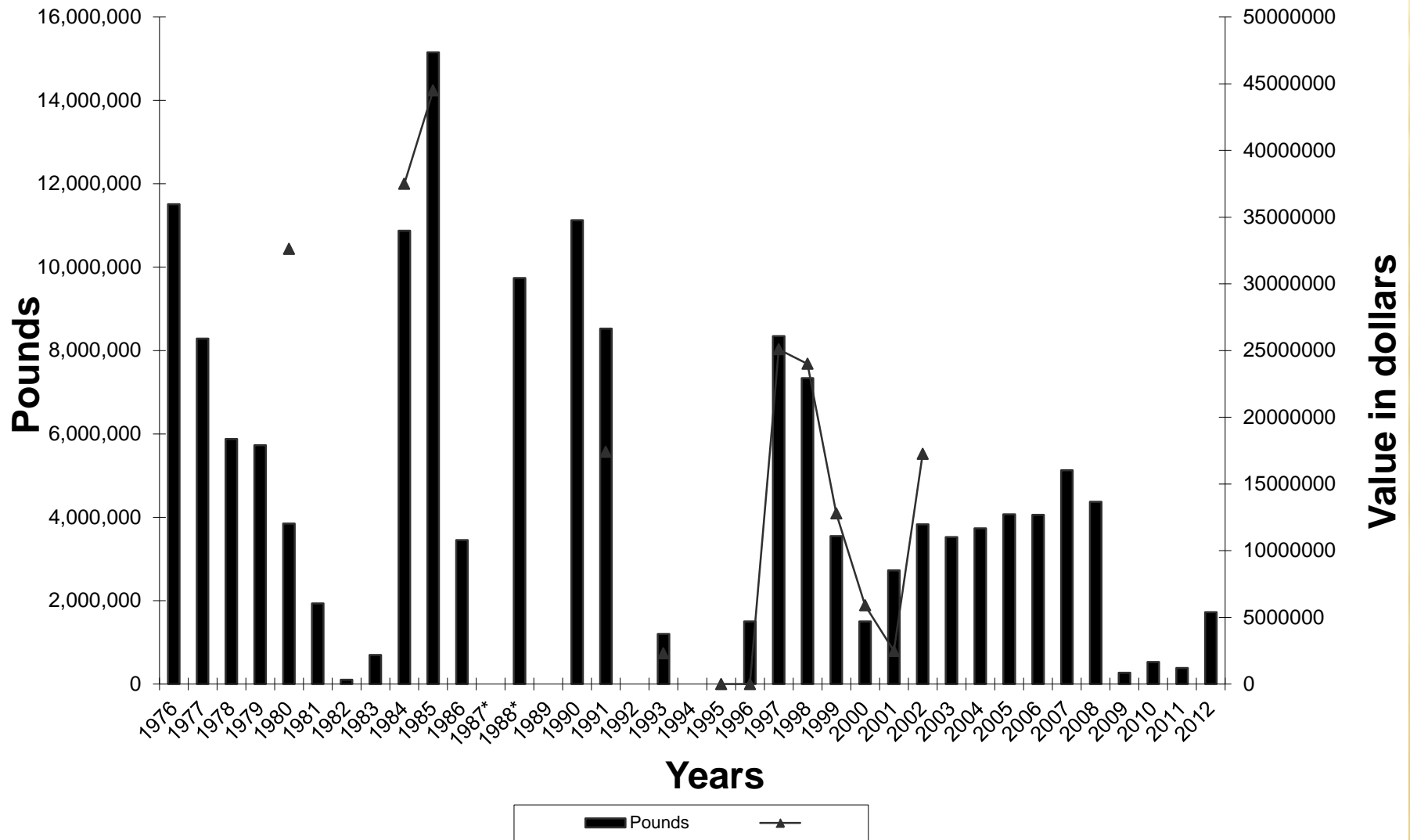




ONCE PRODUCED MOLYBDENUM  
(QUESTA)—CLOSED IN JUNE 2014



## Molybdenum Production 1976-2012



1931-2013 >176 MILLION POUNDS MO WORTH  
>\$852 MILLION

# MOLY RESERVES AT QUESTA CHEVRON MINING INC.

- ✖ Proven reserves
  - + 16,344,898 tons of 0.343% MoS<sub>2</sub> at a cutoff grade 0.25% MoS<sub>2</sub>
- ✖ Probable
  - + 47,198,409 tons of 0.315% MoS<sub>2</sub>
- ✖ Possible
  - + 3,223,000 tons of 0.369% MoS<sub>2</sub>

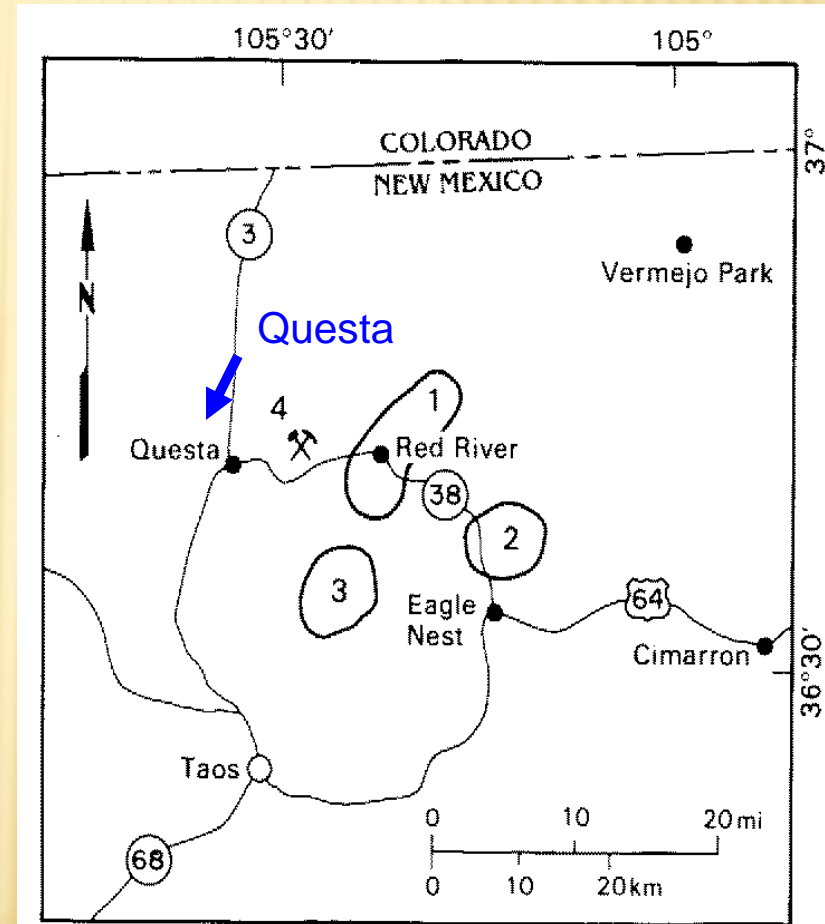


FIGURE 1. Location map of the Red River mining district. 1 = Red River district; 2 = Elizabethtown-Baldy district; 3 = Twining district; 4 = Molycorp Questa mine.



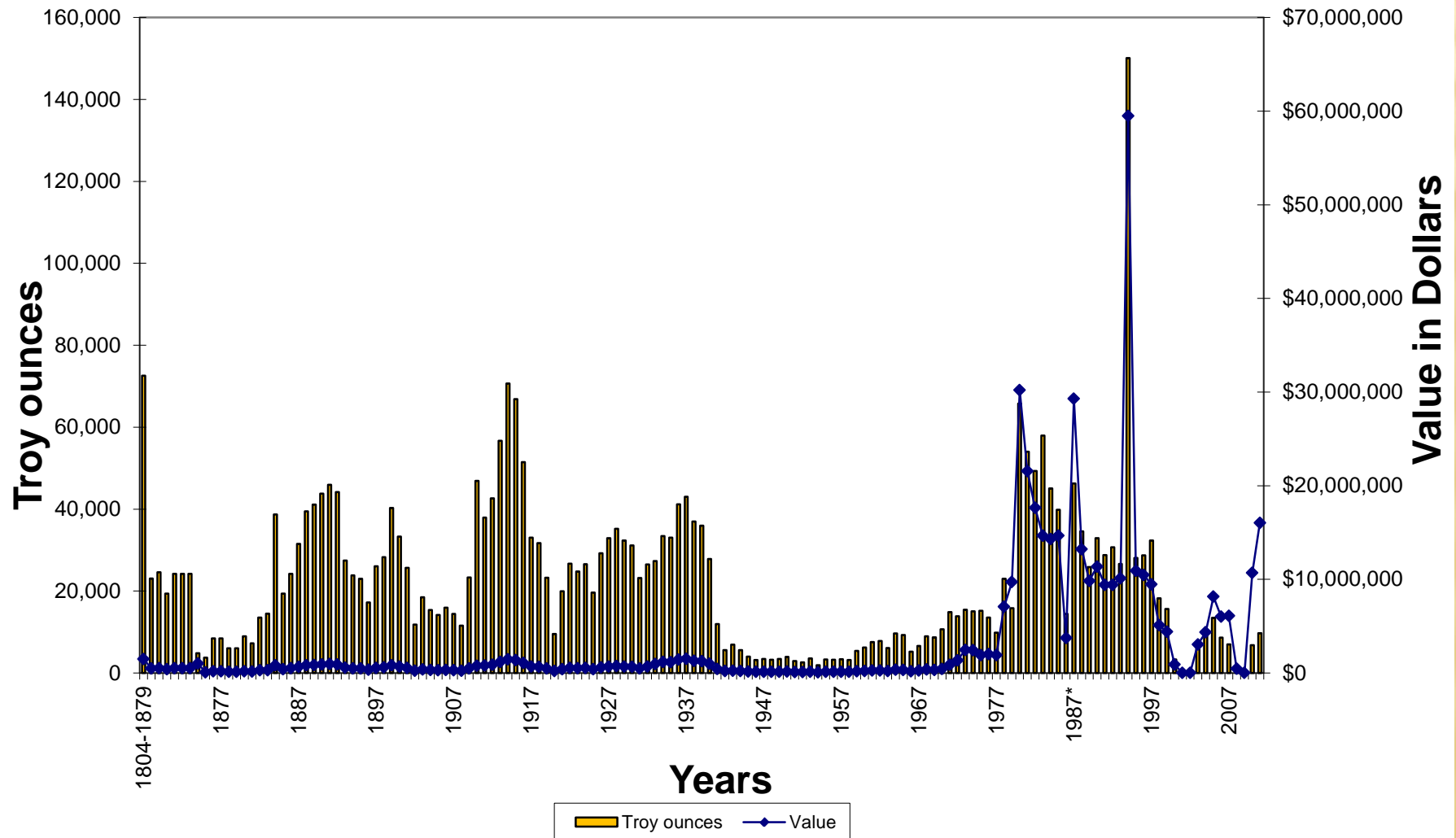


# **GOLD AND SILVER PRODUCTION IN 2004-2015 AS A BYPRODUCT OF COPPER PRODUCTION FROM THE IVANHOE CONCENTRATOR (FREEPORT-MCMORAN )**

**2009 SUMMIT MINE OPENED (CURRENTLY  
ON STANDBY)**

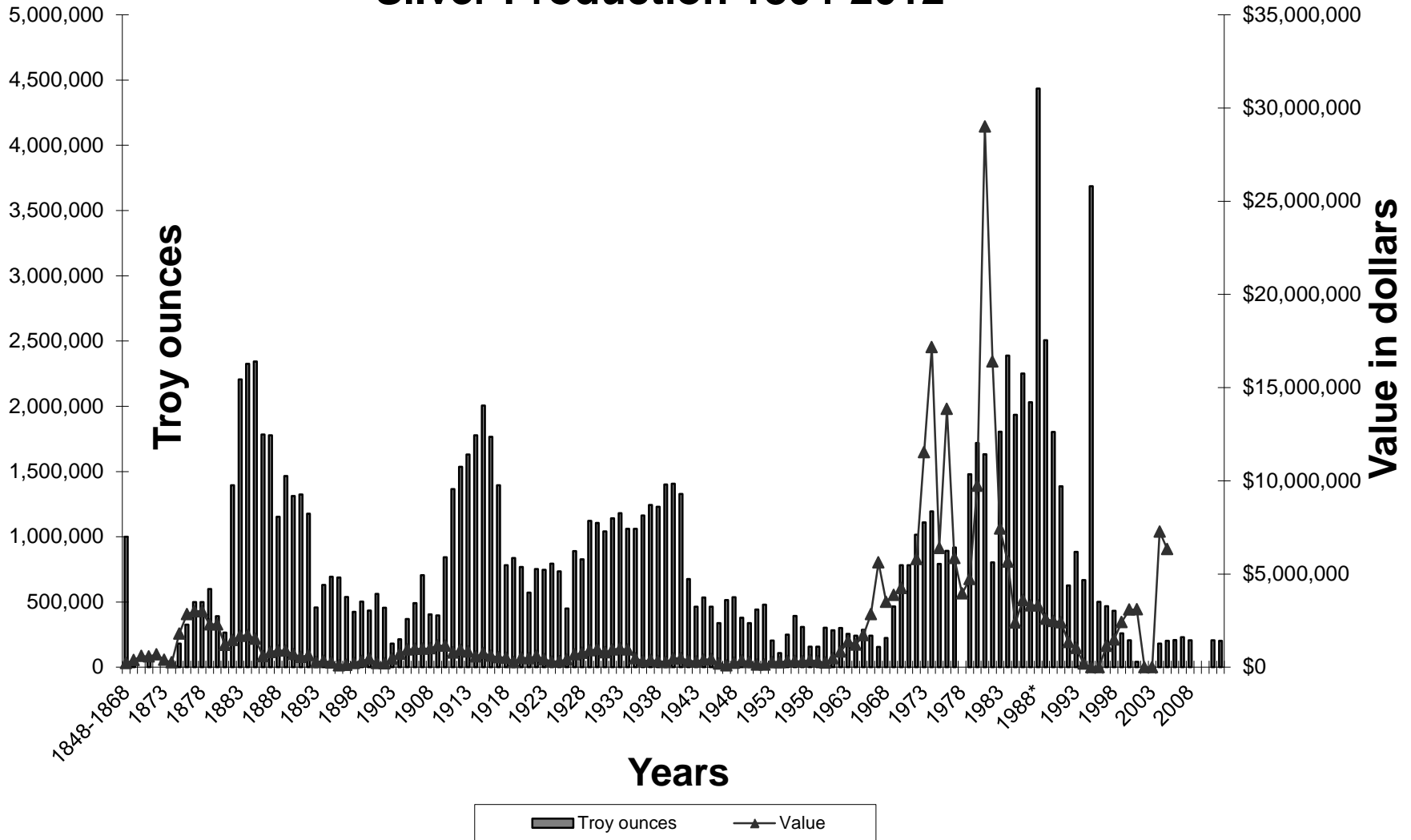
**9<sup>TH</sup> IN GOLD PRODUCTION  
10<sup>TH</sup> IN SILVER PRODUCTION**

## Gold Production 1804-2012



1804-2013 >3.2 MILLION TROY OUNCES AU  
WORTH >\$452 MILLION

# Silver Production 1804-2012

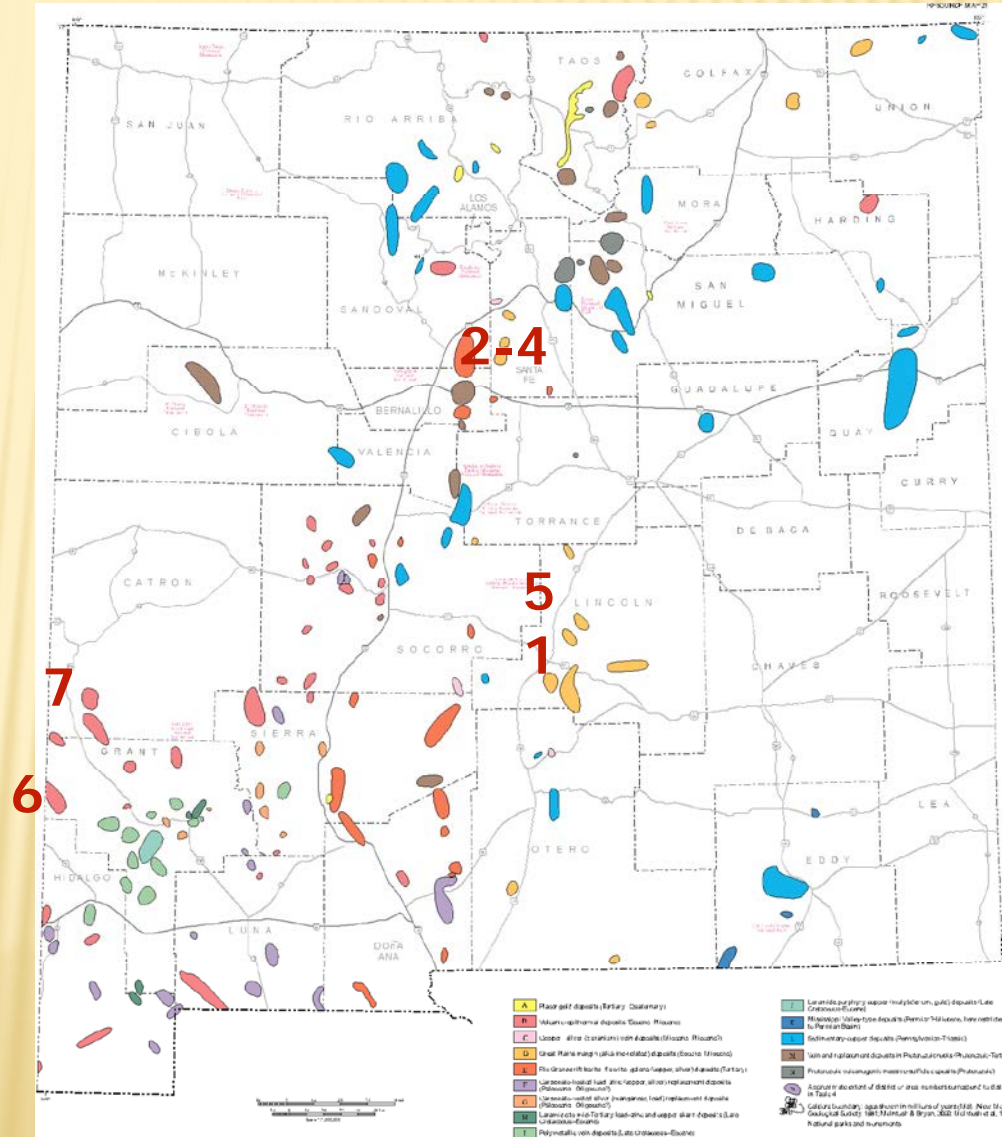


1848-2013 >118.7 MILLION TROY OUNCES AG  
WORTH >\$279 MILLION



# ГОЛОС НАШЕГО ВРЕМЕНИ

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





# SUMMIT GOLD MINE

An aerial photograph of the Summit Gold Mine site. The foreground shows a rocky, scrub-covered hillside. In the middle ground, there is a large, flat, sandy area where mining operations are taking place. Several pieces of heavy machinery, including excavators and trucks, are visible. A large pile of blue material, likely crushed ore or waste, is situated in the background. To the right, there are several small, light-colored buildings and a parking lot with several vehicles. The background features a steep, rocky hillside with sparse vegetation.

In 2009, Santa Fe Gold opened the Summit mine in the Steeple Rock district

The ore is milled at Lordsburg

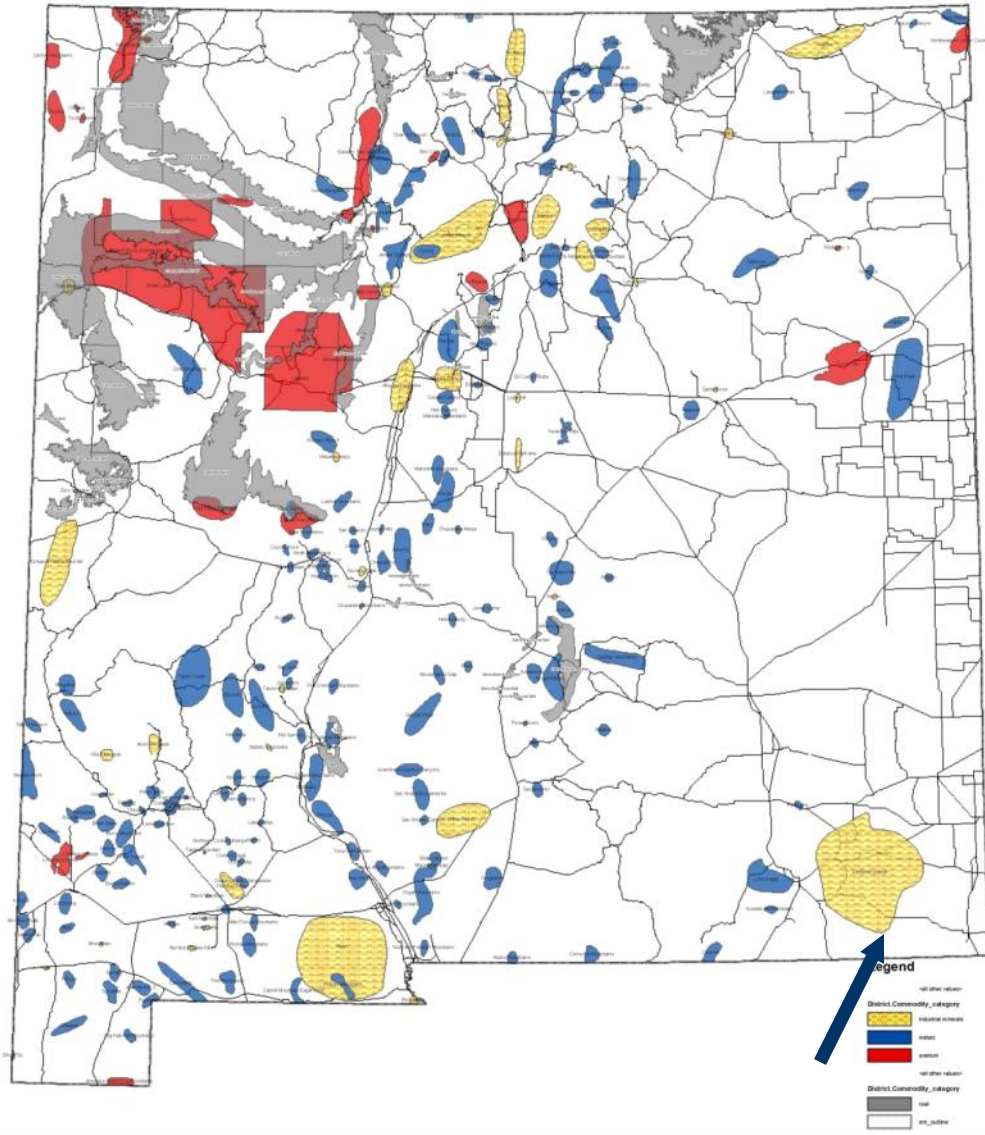


# INDUSTRIAL MINERALS

The background of the slide features a light beige color with a pattern of thin, parallel, wavy lines that create a sense of depth and movement. On the right side, there is a faint, stylized silhouette of a mountain range, adding a naturalistic element to the industrial theme.



## NM Mining Districts



## PRODUCTION

1951-2013 109  
million tons worth  
>\$13 billion

## RESERVES IN CARLSBAD DISTRICT

Potash (>553 million  
tons)

*Potash is used in  
fertilizers among  
other uses*



1<sup>ST</sup> IN POTASH IN 2013 (MOSAIC,  
INTREPID MINING)





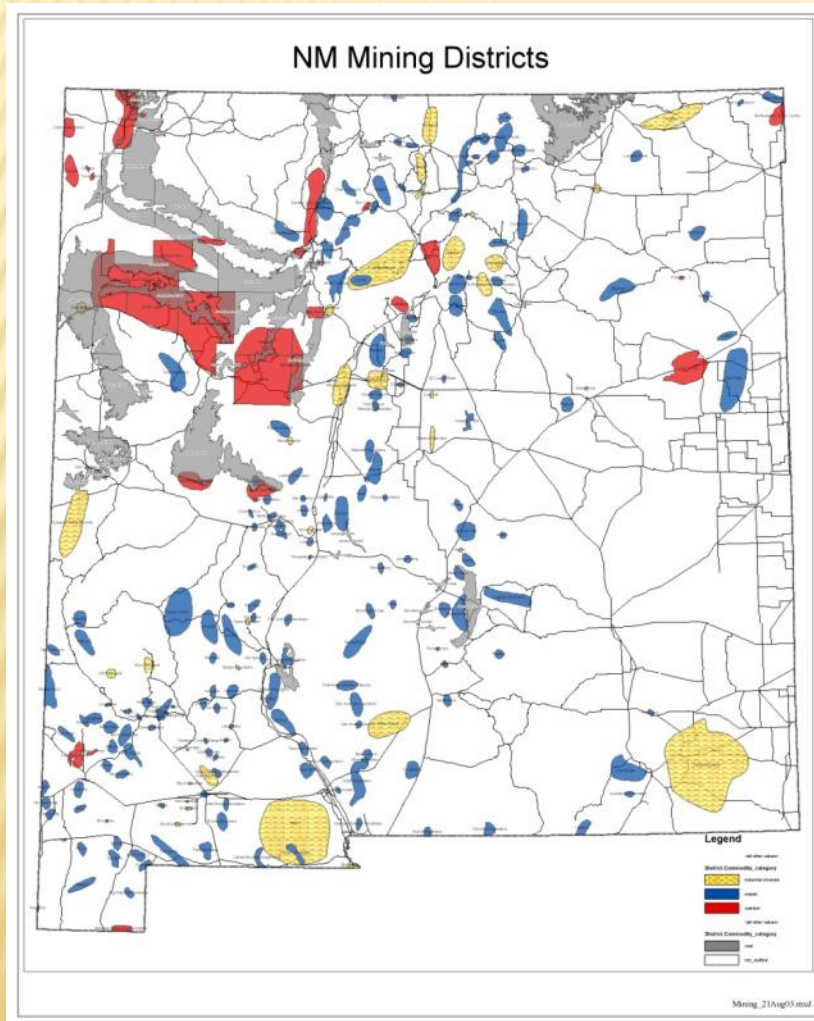
UNDERGROUND OPERATIONS AT  
MOSAIC POTASH MINE, CARLSBAD.



# NEW 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)

# INDUSTRIAL MINERALS ARE INCREASING IN IMPORTANCE IN NEW MEXICO



- ✗ 1<sup>st</sup> in zeolite (St. Cloud, Sierra County)
- ✗ 5<sup>th</sup> in pumice (6 operations)
- ✗ 1<sup>st</sup> in perlite (4 operations)
- ✗ 11<sup>th</sup> in salt (4 operations, Carlsbad)





STONE HOUSE ZEOLITE MINE, SIERRA COUNTY (18.3 MILLION TONS OF RESERVES).





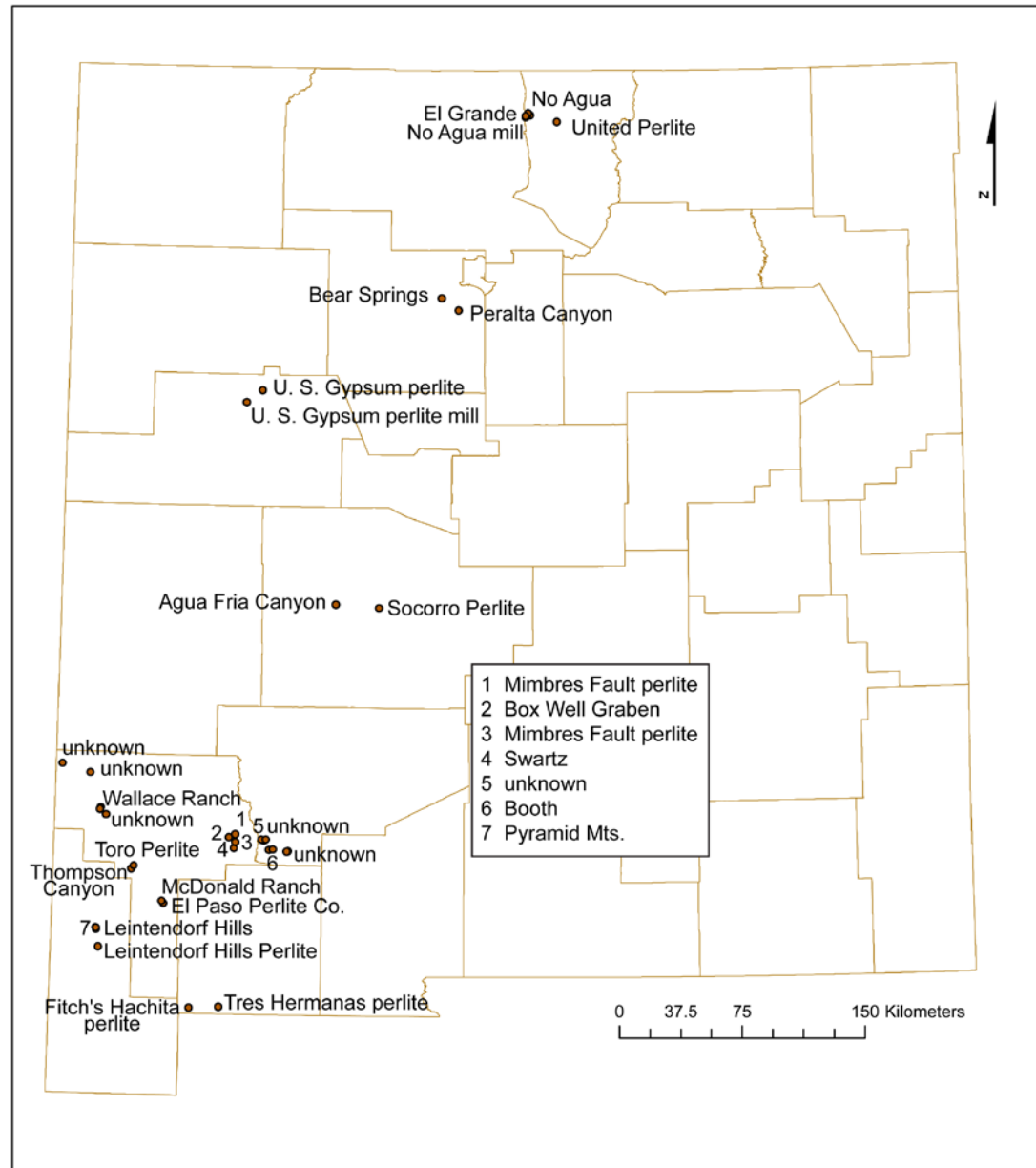
LAS CONCHAS PUMICE QUARRY,  
SANDOVAL COUNTY





SOCORRO PERLITE QUARRY

# PERLITE IN NEW MEXICO





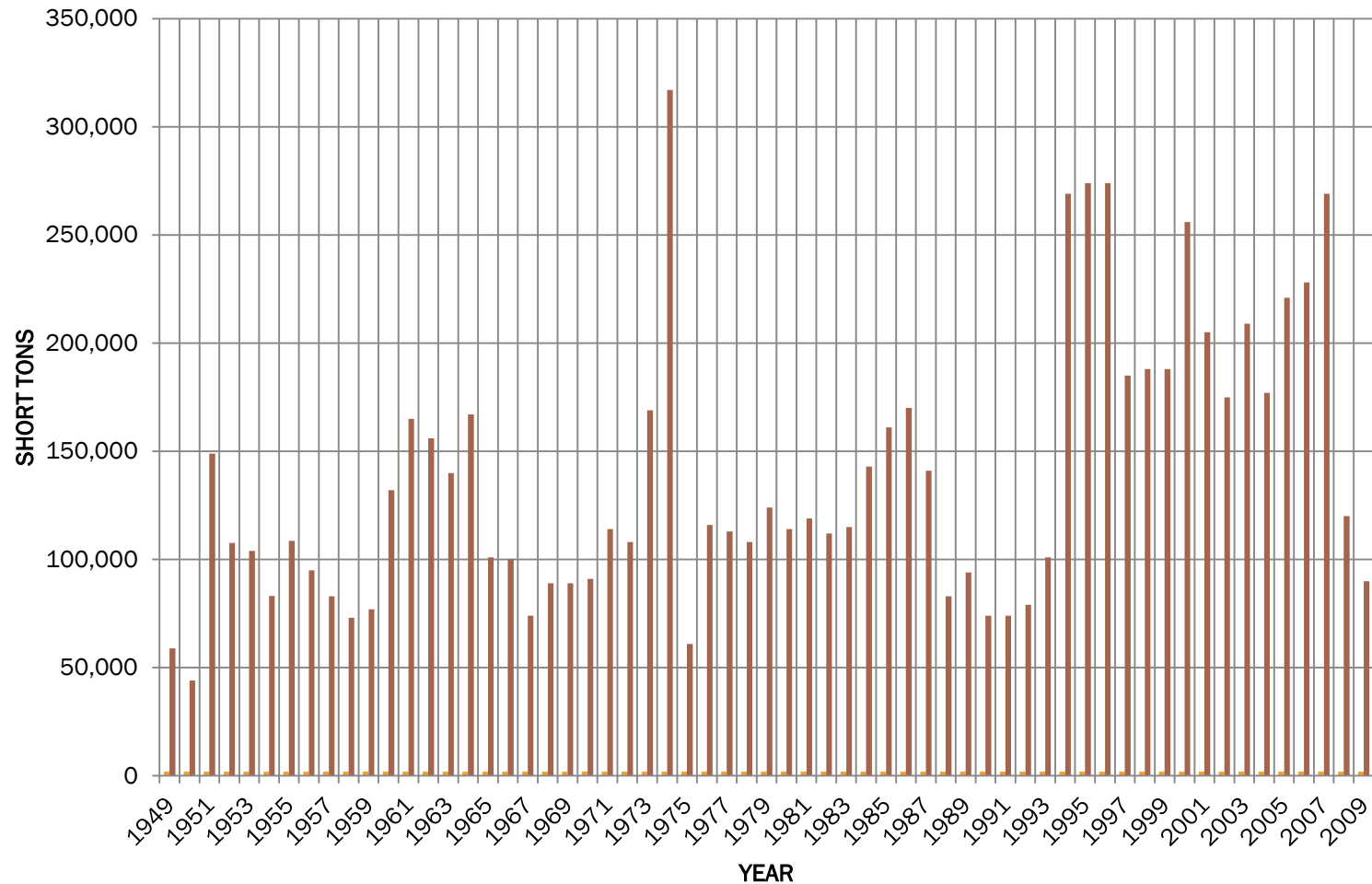


GYPSUM IS MINED AT WHITE MESA,  
SANDOVAL COUNTY (EAGLE MATERIALS,  
FORMERLY CENTEX AMERICAN GYPSUM)  
AND USED TO MANUFACTURE WALLBOARD.

# OTHER INDUSTRIAL MINERALS DEPOSITS

- ✕ Brick and clay in El Paso, Albuquerque areas
- ✕ Cement in Tijeras Canyon
- ✕ Humate in the San Juan Basin
- ✕ Travertine (dimension stone), Meso del Oro, west of Belen
  - + 477.6 million tons of travertine

## NEW MEXICO CLAY PRODUCTION 1949-2009



# CLAY PRODUCTION

>3 MILLION TONS WORTH >\$8 MILLION 1949-2013

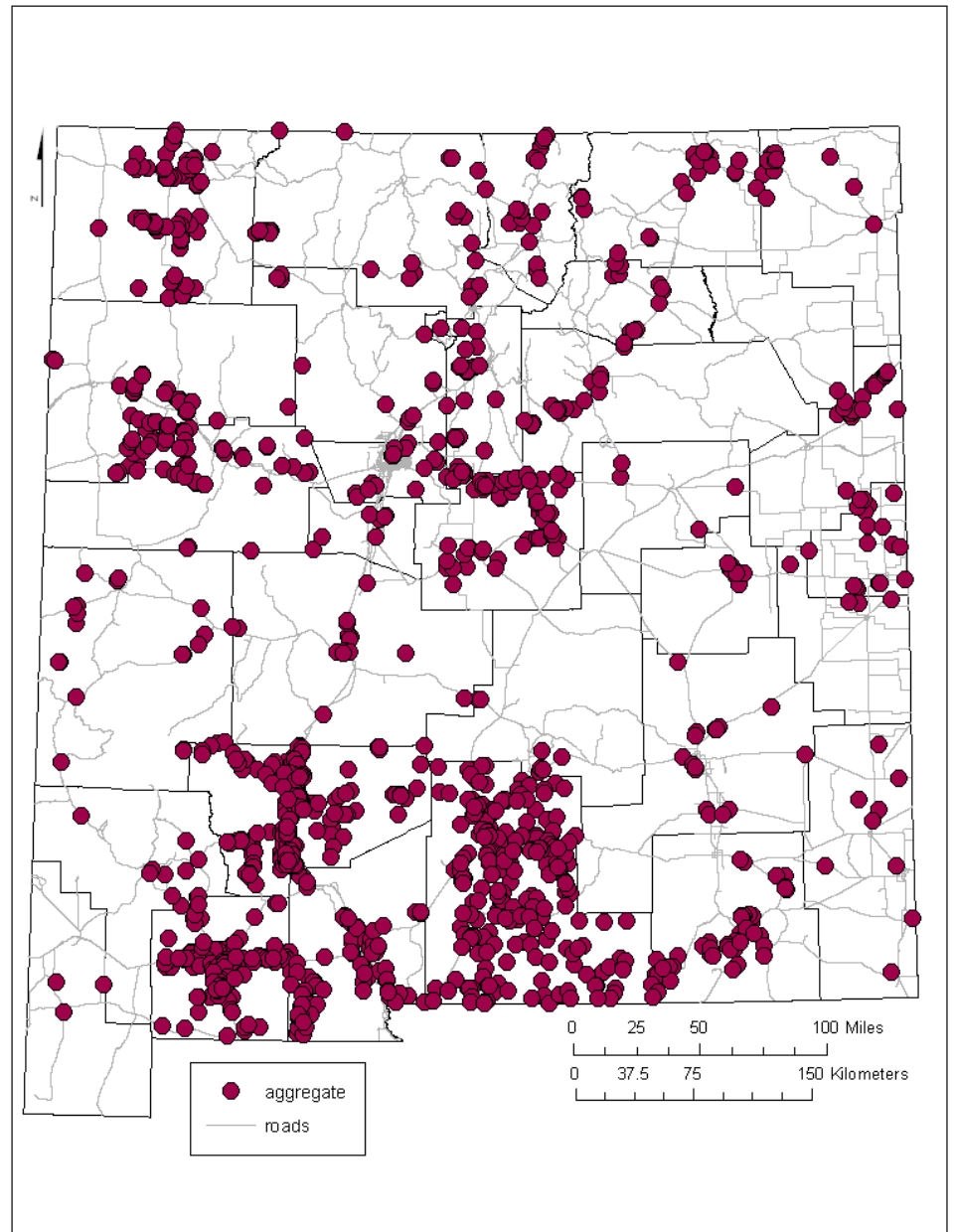


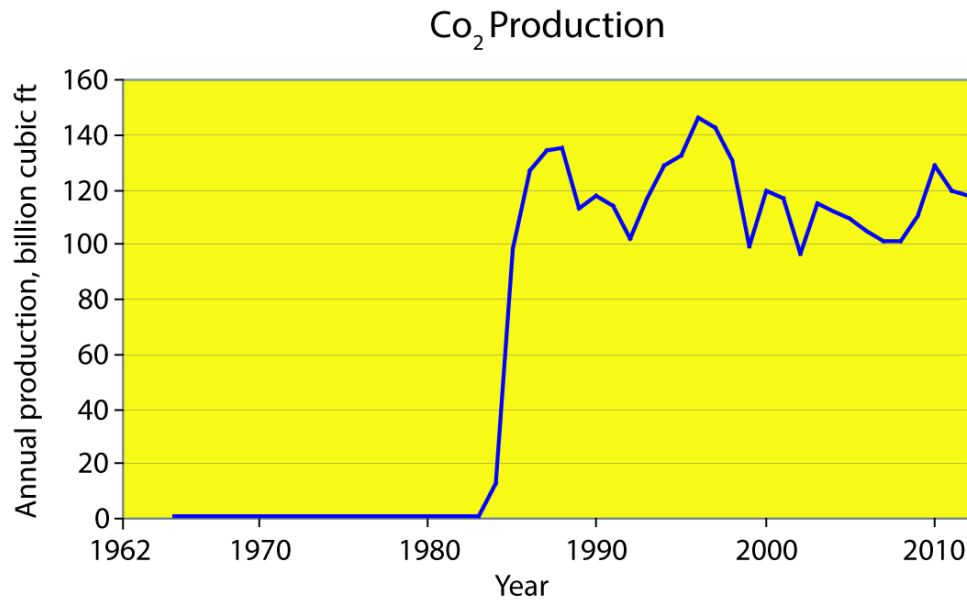
# AGGREGATES

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- ✖ ~200 active and standby aggregate mines in 2015
- ✖ highways, railroad, and home construction
- ✖ More aggregate operations are in rural areas
- ✖ A shortage of aggregate in urban areas is expected

# AGGREGATE MINES IN NEW MEXICO



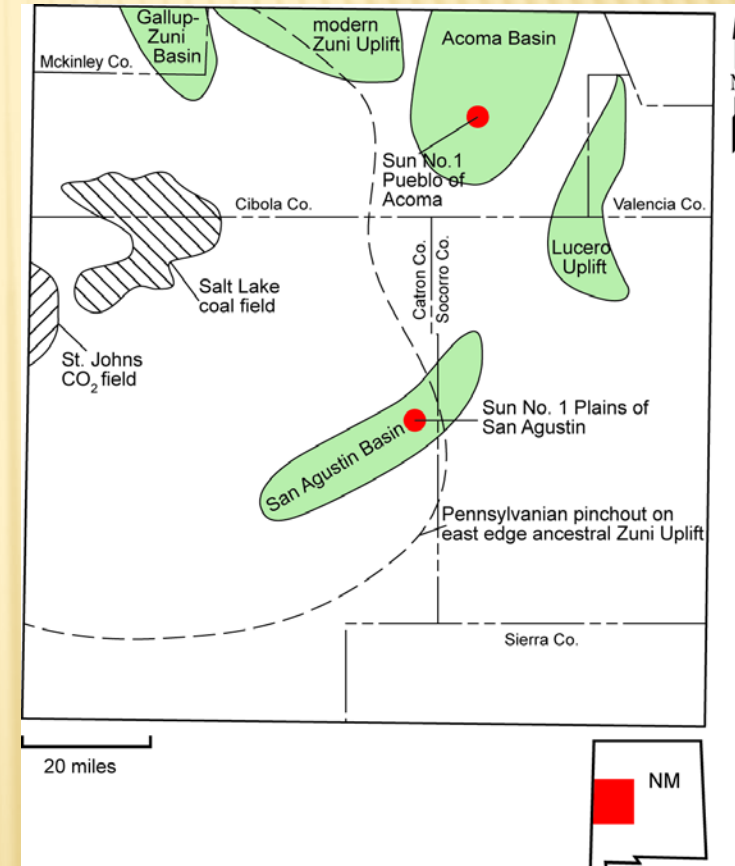
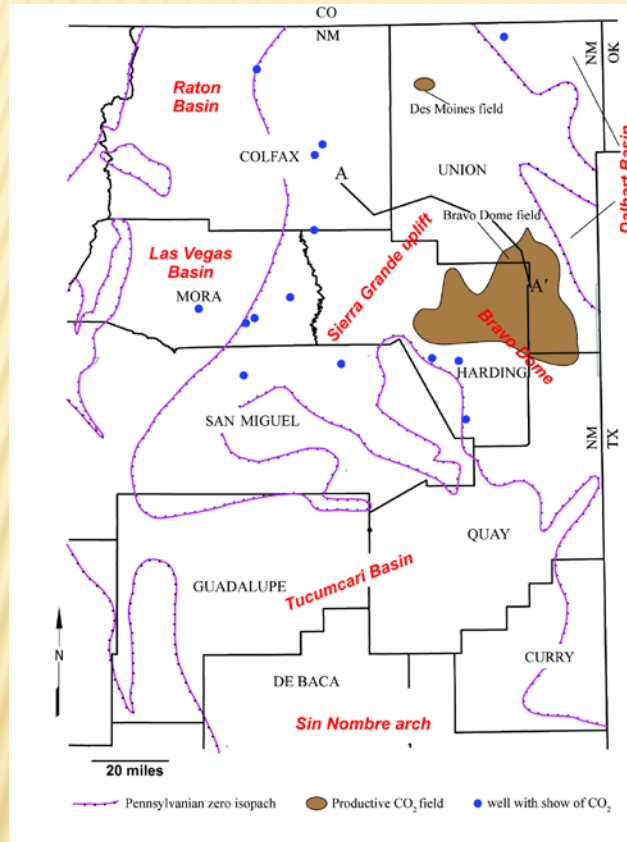


Annual volume of CO<sub>2</sub> gas produced from natural geological accumulations in New Mexico in billion ft<sup>3</sup> (BCF). Production data not available prior to 1965. Compiled by Ron Broadhead from data obtained from New Mexico Oil Conservation Division

**CARBON DIOXIDE**



# CARBON DIOXIDE FROM BRAVO DOME FIELD OF UNION AND HARDING COUNTIES, AND THE NOW ABANDONED DES MOINES FIELD OF UNION COUNTY AND THE TWO ESTANCIA FIELDS OF TORRANCE COUNTY



BRAVO DOME AND SIERRA GRAND UPLIFT  
INDICATING LOCATIONS OF THE BRAVO DOME  
AND DES MOINES CO<sub>2</sub> GAS FIELDS, WELLS THAT  
ENCOUNTERED CO<sub>2</sub> GAS SHOWS

WEST-CENTRAL NEW  
MEXICO SHOWING MAJOR  
TECTONIC ELEMENTS, THE  
ST. JOHNS CO<sub>2</sub> FIELD

# HELIUM

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- ✖ Helium-rich gases have been produced from small Devonian, Mississippian and Pennsylvanian reservoirs in western San Juan County since World War II

# SULFUR

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- ✖ New Mexico has produced sulfur, mostly as a by-product of natural gas plants, although there are geological occurrences of sulfur in New Mexico
- ✖ Sulfuric acid from copper mills



# URANIUM

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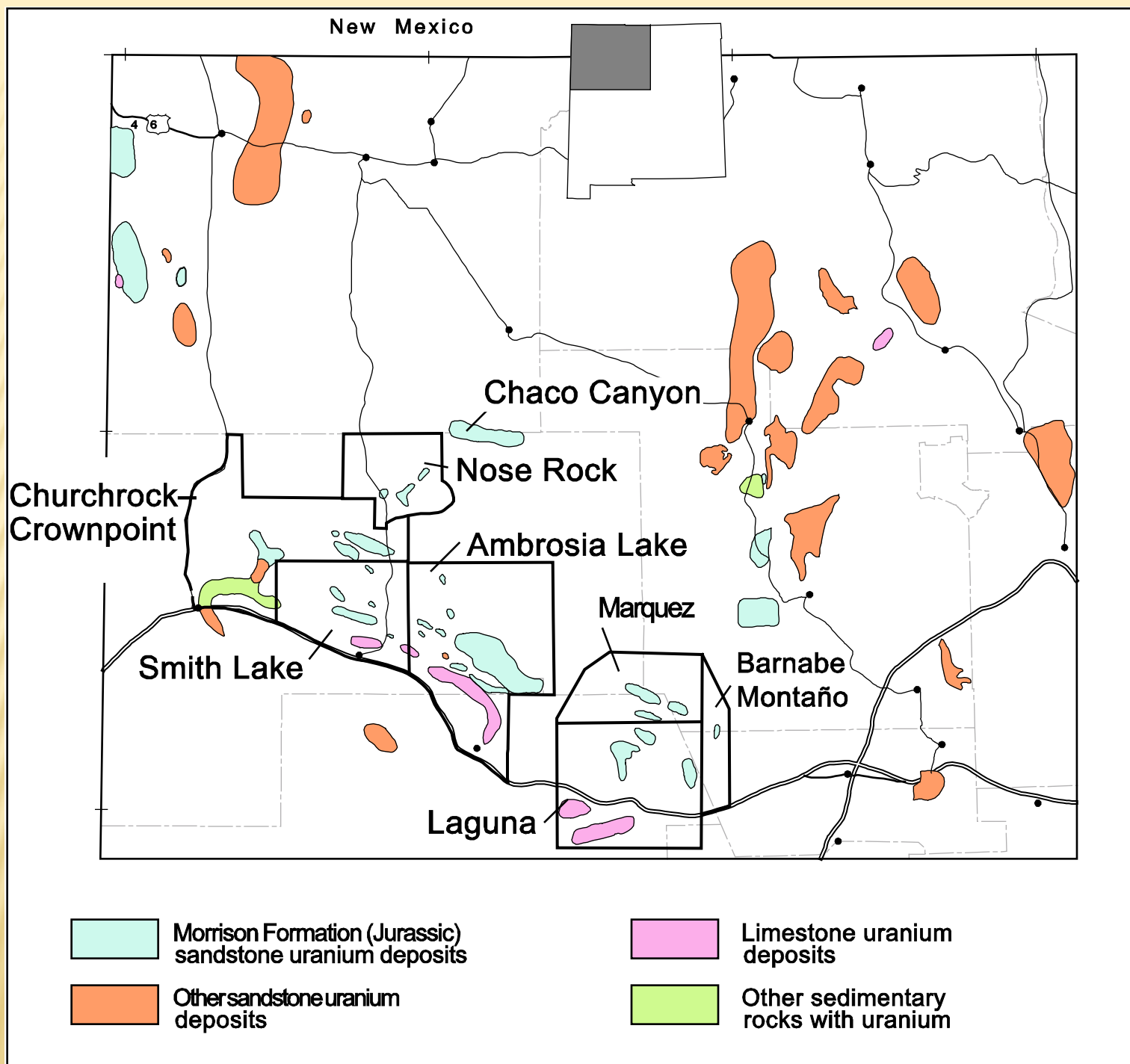
# URANIUM IN NEW MEXICO 2015

- ✖ 2<sup>nd</sup> in uranium resources 15 million tons ore at 0.277% U<sub>3</sub>O<sub>8</sub> (84 million lbs U<sub>3</sub>O<sub>8</sub>) 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

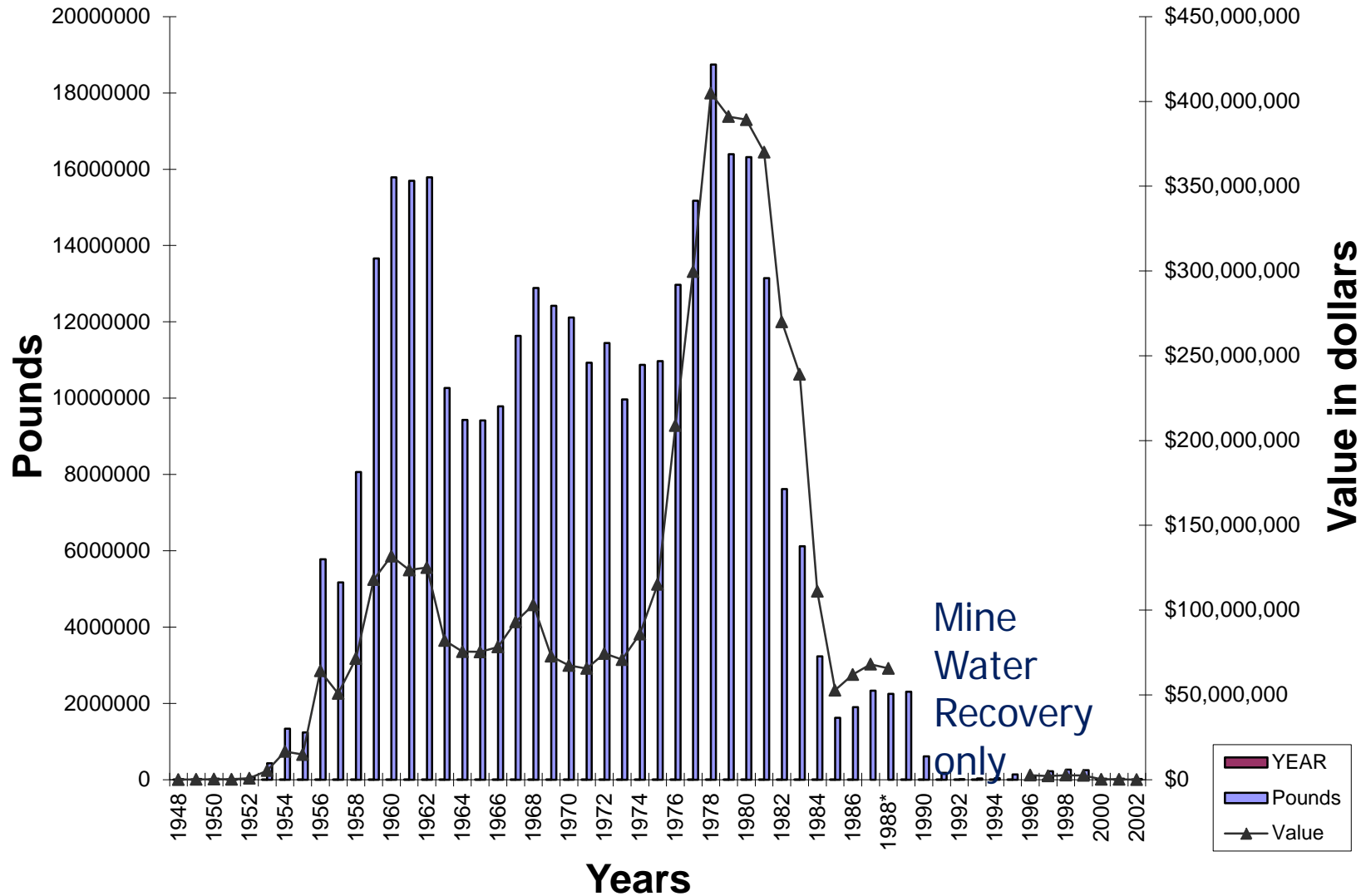
# URANIUM IN GRANTS DISTRICT

- ✗ World-class deposits
- ✗ 340 million lbs of  $U_3O_8$  from 1948-2002 produced
- ✗ 4<sup>th</sup> largest district in total uranium production in the world
- ✗ More than 30% of the total uranium production in the United States
- ✗ ~380 million pounds of resources identified by the companies in 1980s (McLemore, 2007, 2013)
- ✗ Probably another 300 million lbs of  $U_3O_8$  remaining to be discovered
- ✗ District total of 600-900 million lbs of  $U_3O_8$





# Uranium Production 1948-2002



1948-2002 >347 MILLION POUNDS U WORTH  
>\$4.7 BILLION



**MOUNT TAYLOR HEAD FRAME, 2006**







# **Importance of sandstone uranium deposits in the Grants district**

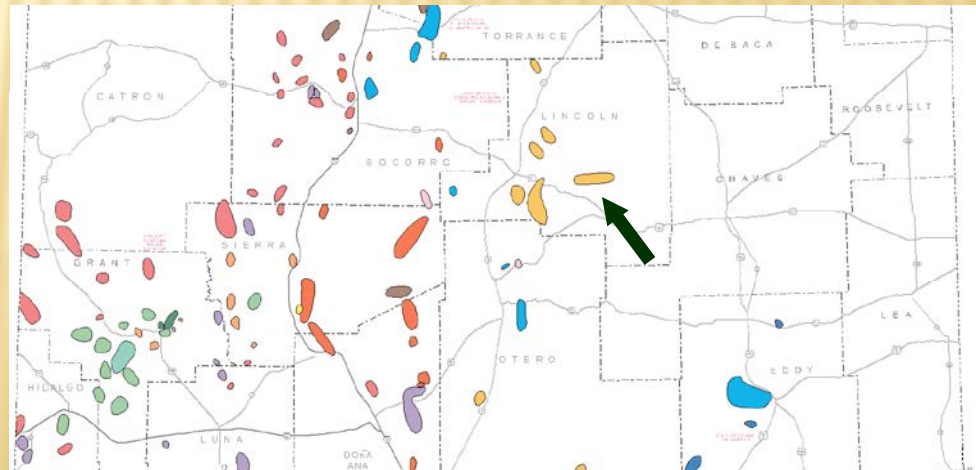
- ▶ Major mining companies abandoned the districts after the last cycle leaving advanced uranium projects.
- ▶ Inexpensive property acquisition costs includes \$\$ millions of exploration and development expenditures.
- ▶ Availability of data and technical expertise.
- ▶ Recent advances in in situ leaching makes sandstone uranium deposits attractive economically.

# OTHER POTENTIAL COMMODITIES

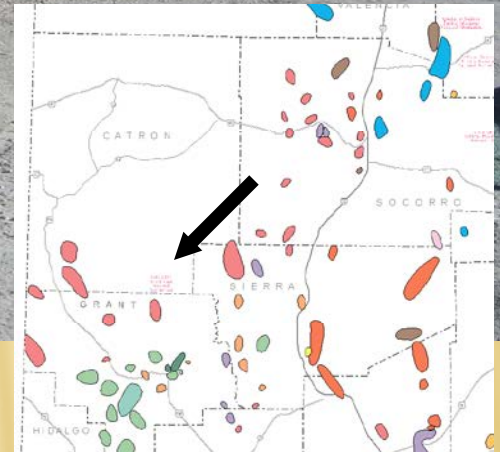


# IRON ORE FROM THE CAPITAN MTS

- ✖ Produced 250,000 mill tons Fe ore 1963-1988
- ✖ El Capitan Precious Metals Corp. claims a resource of 141,000 tons ore of 0.041 opt Au
- ✖ Drilling permit approved by MMD 11/26/07, but rejected by the USFS requesting additional work



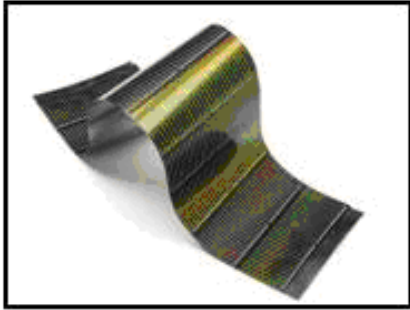




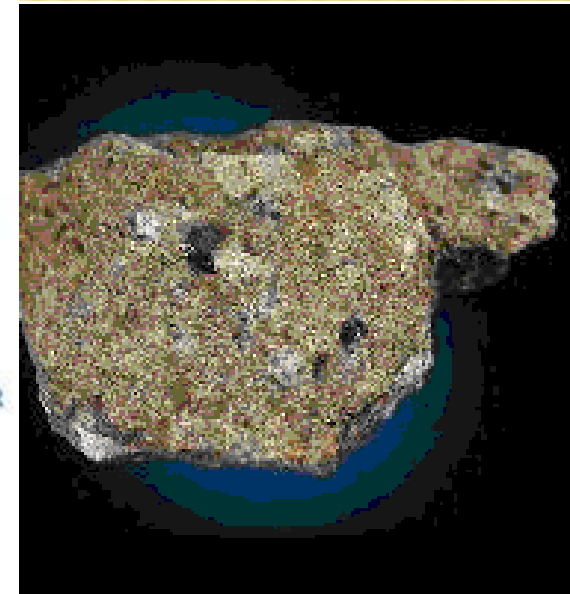
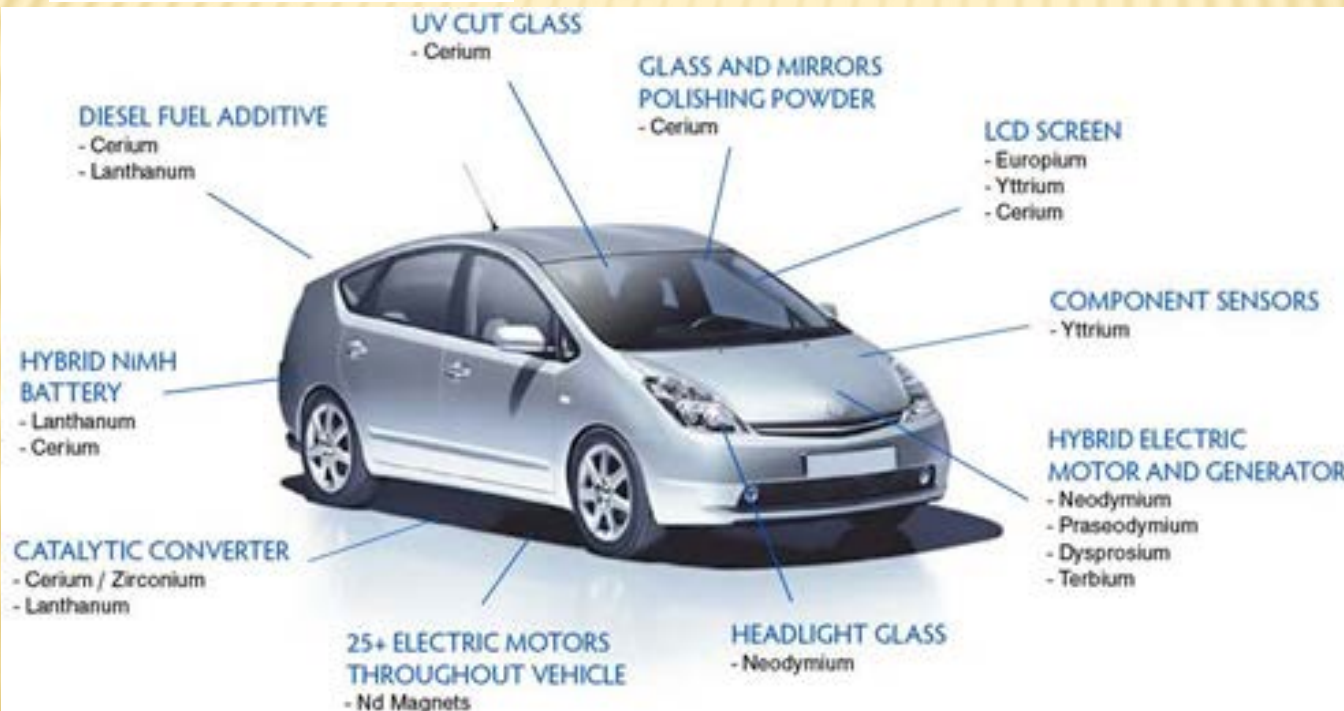
# KLINE MOUNTAIN KAOLIN DEPOSIT

# MINERALS NEEDED FOR EMERGING GREEN TECHNOLOGIES

Thin Film CIGS Solar



beryllium tuff  
(USGS OF 98-524)





- solar panels/photovoltaics
- wind turbines
- batteries
- magnets
- other

H	other																He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac															
			Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
			Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	

SOME OF THE MINERALS REQUIRED FOR THESE GREEN TECHNOLOGIES ARE FOUND IN NEW MEXICO

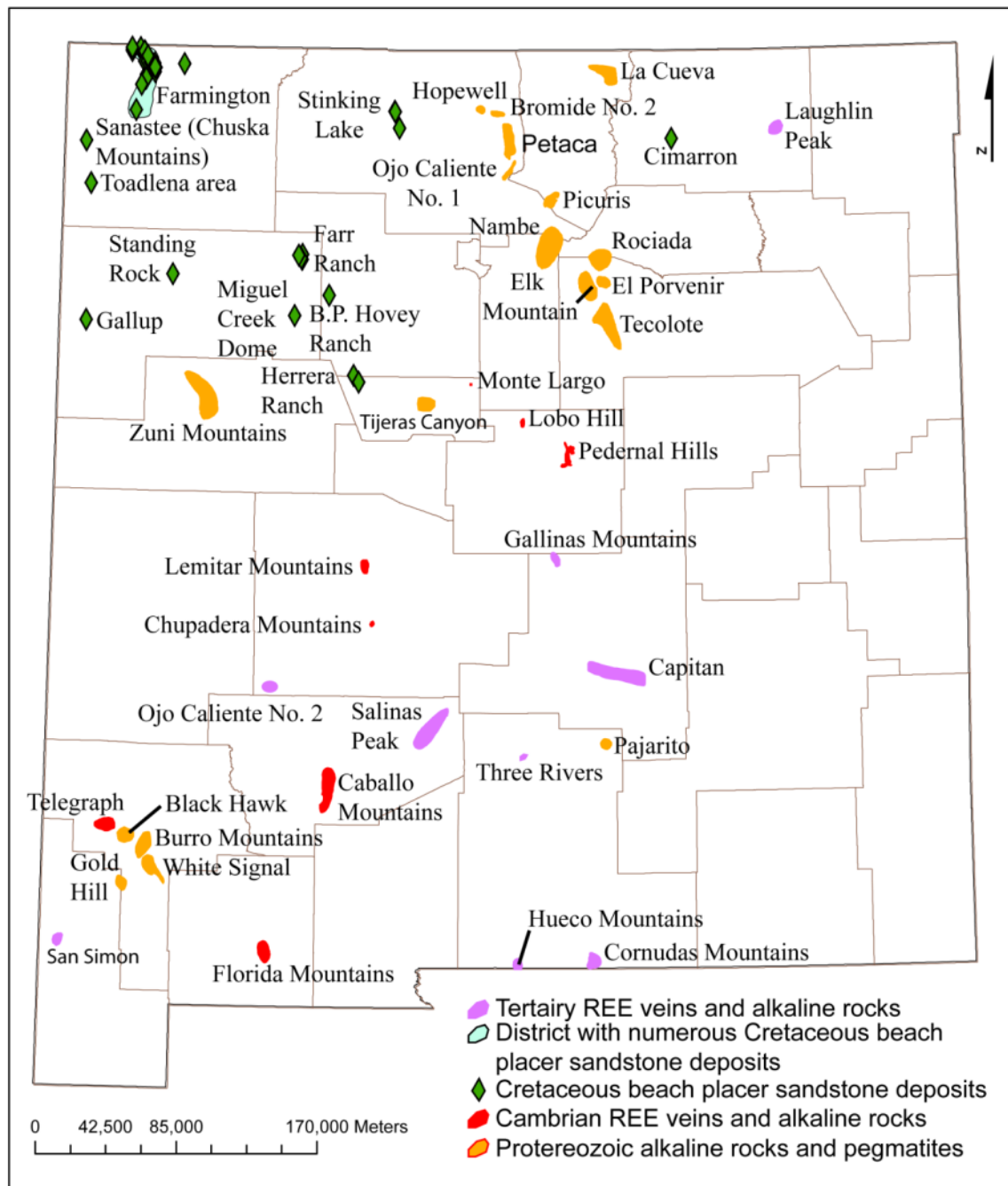
# Elements in Computer Chips (National Research Council, 2007)

■ elements needed in 1980s

 additional elements needed today

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac															
			Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	
			Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	

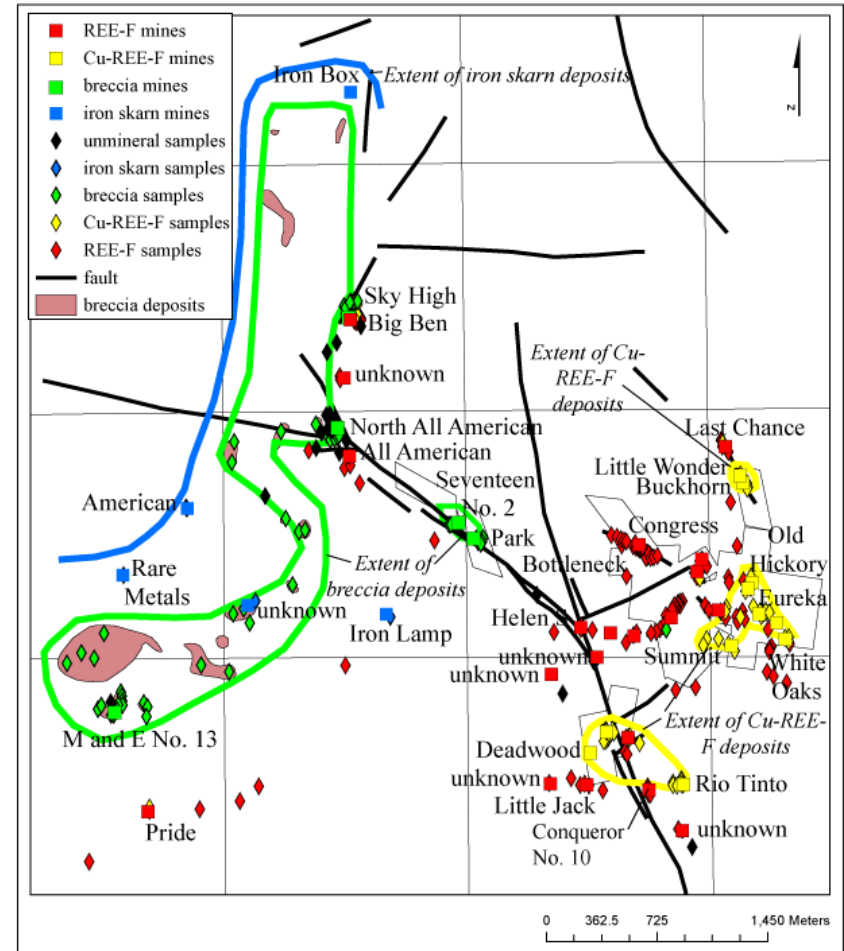
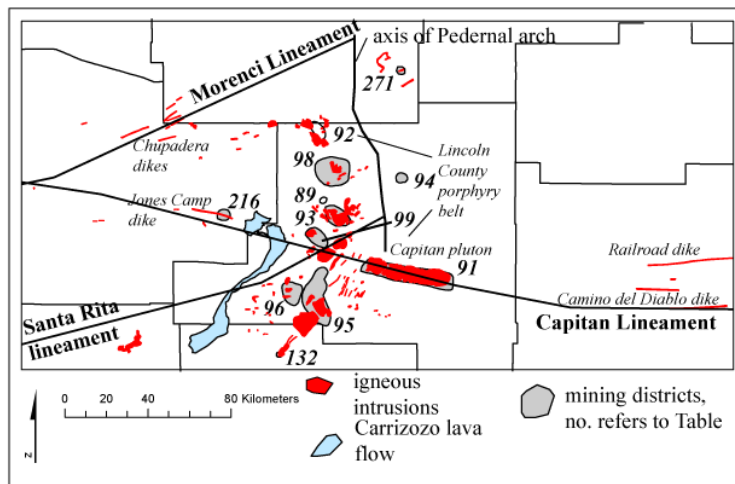
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr



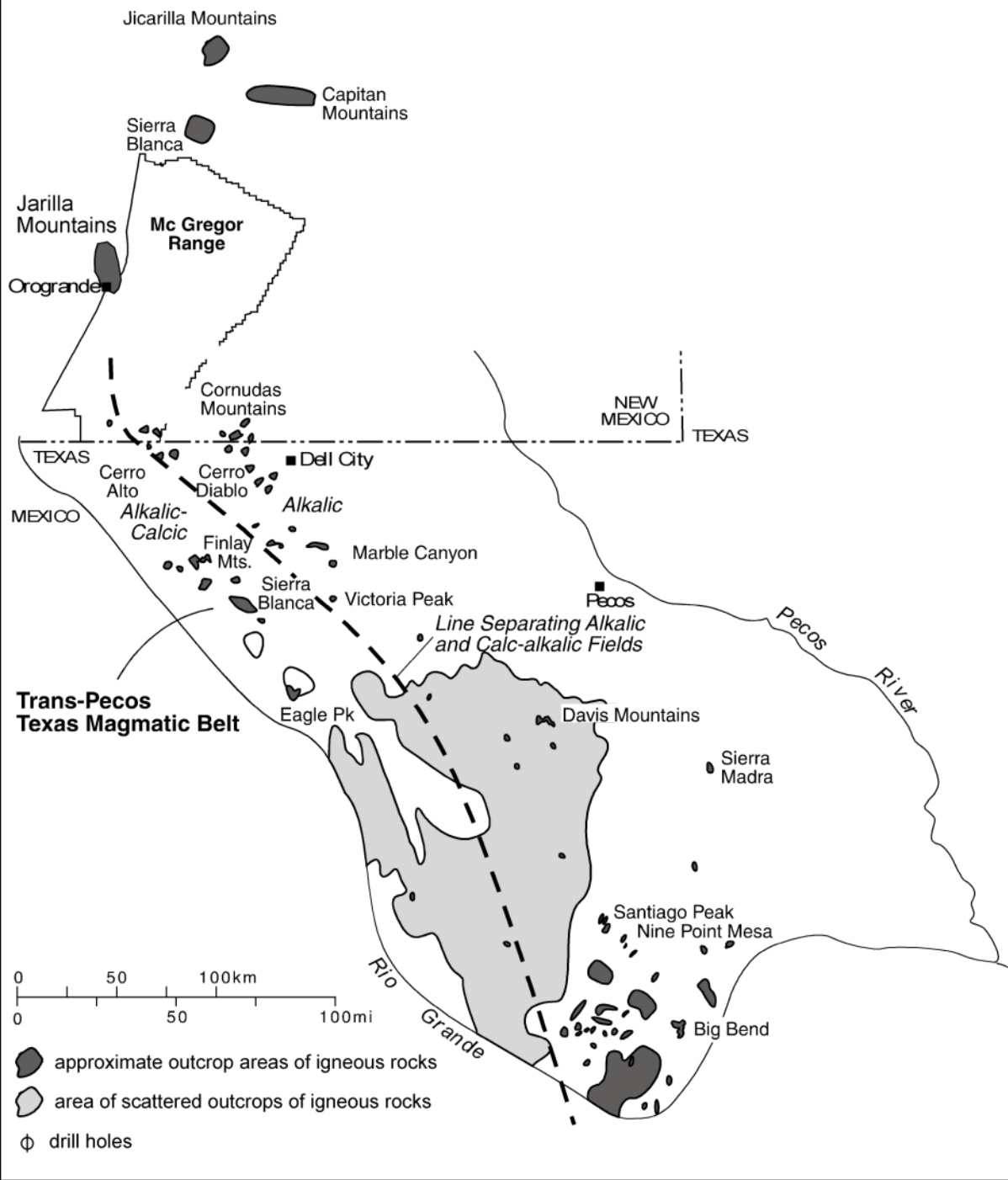
# OCCURRENCES OF RARE EARTH ELEMENTS (REE) IN NEW MEXICO

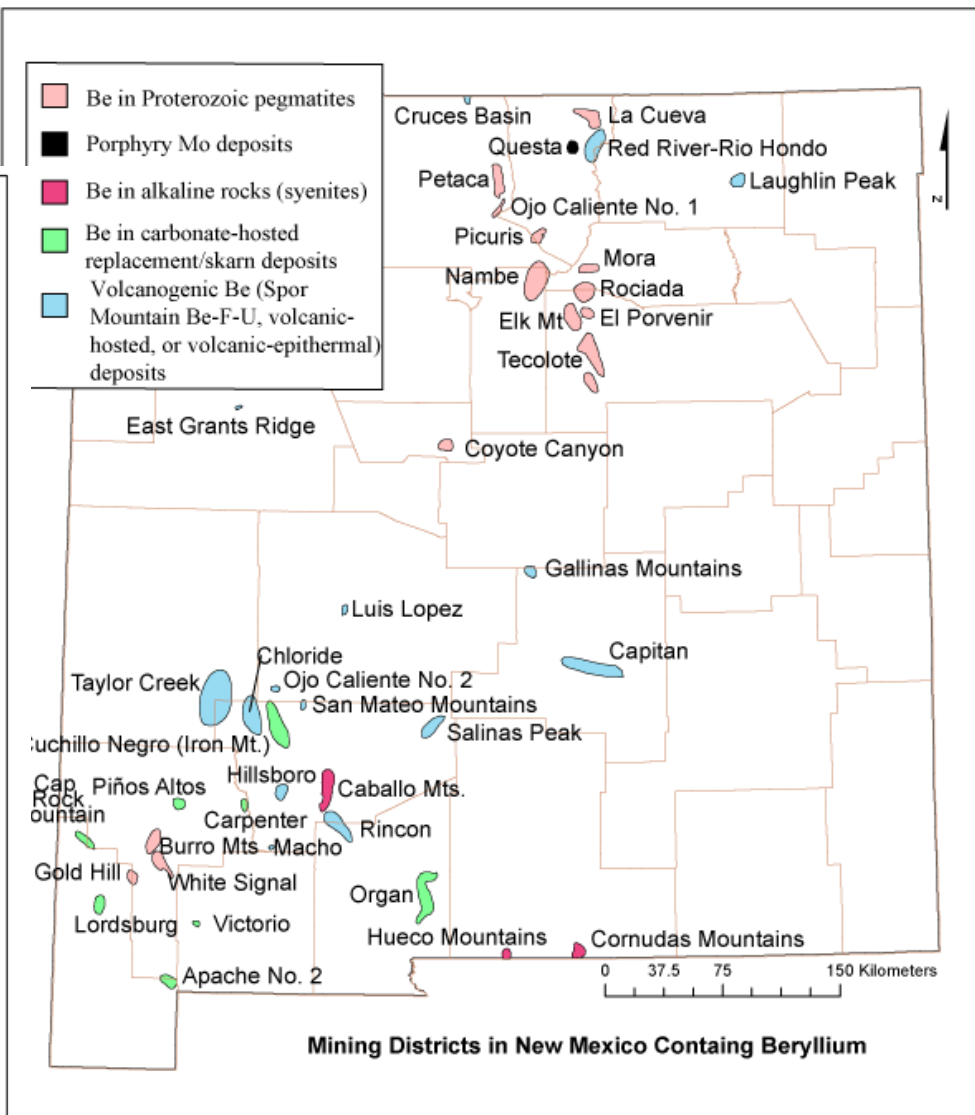
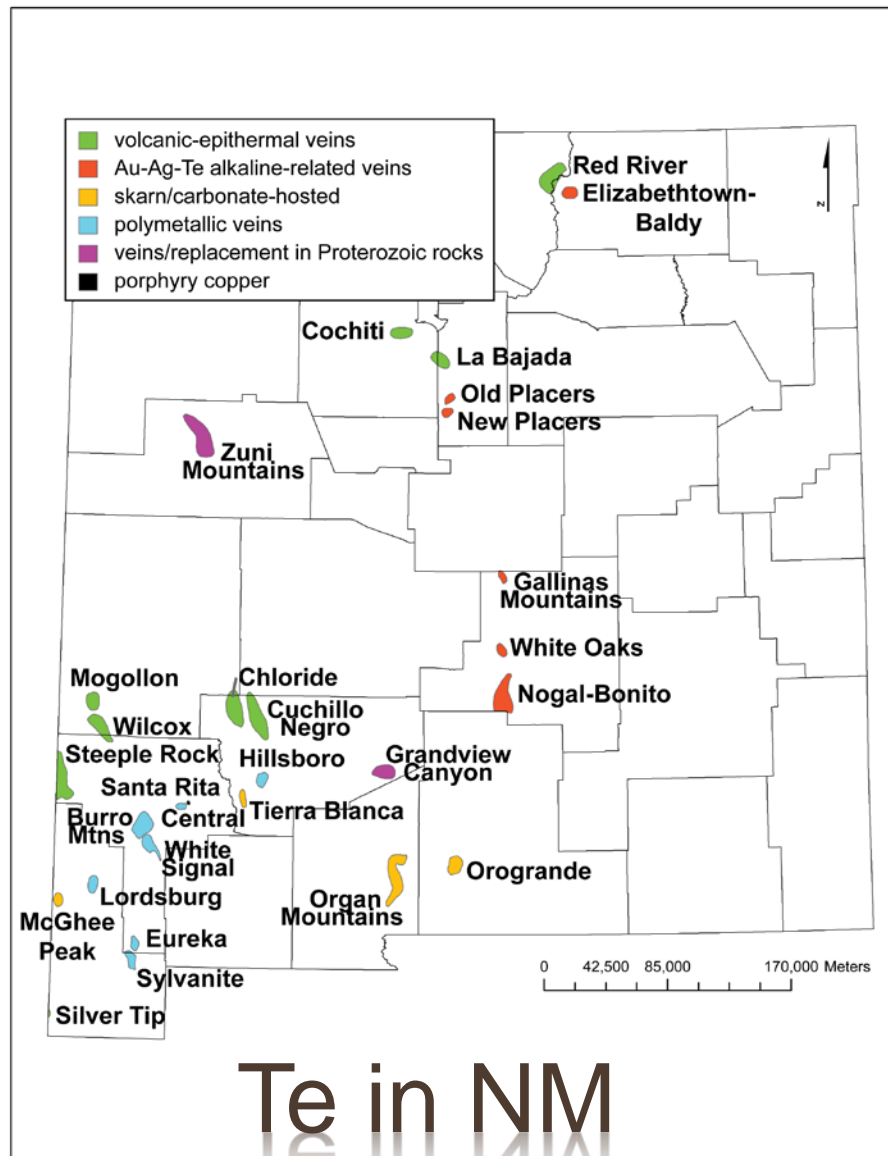


# REE in Gallinas Mountains, Lincoln County



# REE IN CORNUDAS MOUNTAINS, OTERO MESA







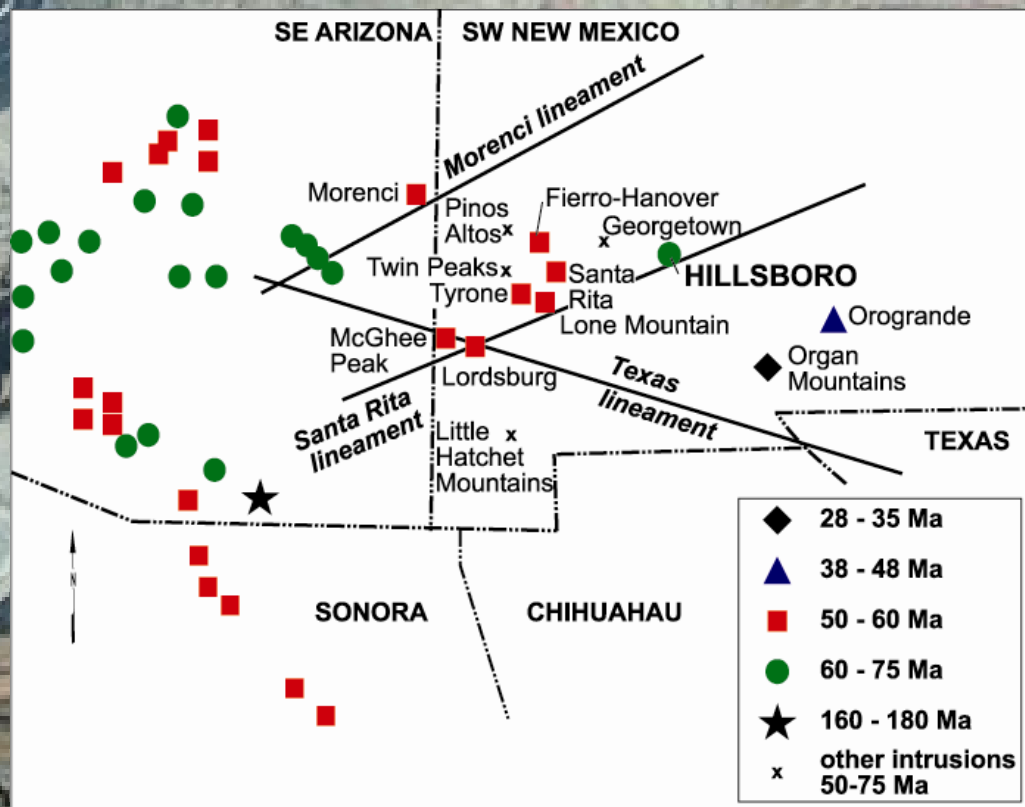
# Porphyry copper deposits

## ■ Current

- Gold
- Silver
- Molybdenum

## ■ Possible

- Tellurium
- Gallium
- Germanium
- Indium
- Others



# OTHER POTENTIAL COMMODITIES

- ✖ Nepheline syenite from Wind Mt, Cornudas Mts (200,000,000 tons)
- ✖ Garnet from Grant County, San Pedro, Orogrande
- ✖ Iron ore from Orogrande
- ✖ Titanium (Fe, REE, Th, Y, Zr) from Cretaceous black sandstone deposits in San Juan Basin
- ✖ Kaolin, tin in Taylor Creek
- ✖ Au, Ag Steeple Rock, Malone, Burro Mountains



# WHAT ARE THE MINING ISSUES FACING NEW MEXICO?



Gold King adit



Animas River after Gold king spill



# WHAT ARE THE MINING ISSUES FACING NEW MEXICO?

- ✗ Legacy issues of past mining activities form negative public perceptions of mining
- ✗ Many inactive mines that have the potential to contaminate the environment or present a hazard to health and safety
  - + Gold King spill
- ✗ Mining today is not performed in the same manner as 20 years ago

# WHAT ARE THE MINING ISSUES FACING NEW MEXICO?

- ✗ NMBGMR with other universities and state agencies are cooperating and forming a monitoring program of the Animas River watershed and the potential effects to New Mexico
- ✗ 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

# WHAT ARE THE 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



# SUMMARY

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# SUMMARY

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- ✘ Commodities are needed to maintain our standard of living, even for green technologies, like solar, wind
- ✘ Mineral deposits are controlled by geology
- ✘ New Mexico has a wealth of mineral resources

# SUMMARY

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- ✖ Exploration and permitting takes many years before a deposit can be mined
- ✖ Mining is important to rural New Mexico (create wealth)
- ✖ Mining disturbs the ground—there can be risks
- ✖ Legacy issues are being addressed
- ✖ Boom or bust—cyclic industry





**WE HAVE MOVED INTO OUR NEW BUILDING ON  
CAMPUS! COME AND VISIT!**





# MINERAL MUSEUM

AM 8:20 SEP. 9. 2015



# MORE INFORMATION

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- ✖ Mines and Minerals Division

<http://www.emnrd.state.nm.us/MMD/index.htm>

- ✖ Virginia McLemore web page

<http://geoinfo.nmt.edu/staff/mclemore/home.html>

- ✖ New Mexico Bureau of Geology and Mineral Resources

<http://geoinfo.nmt.edu/>



# SILVER AND GOLD IN NEW MEXICO



Virginia E. McLaughlin

Former, Virginia Bureau of Geology and Mineral Resources  
in cooperation with the New Mexico Bureau of Geology and Mineral Resources

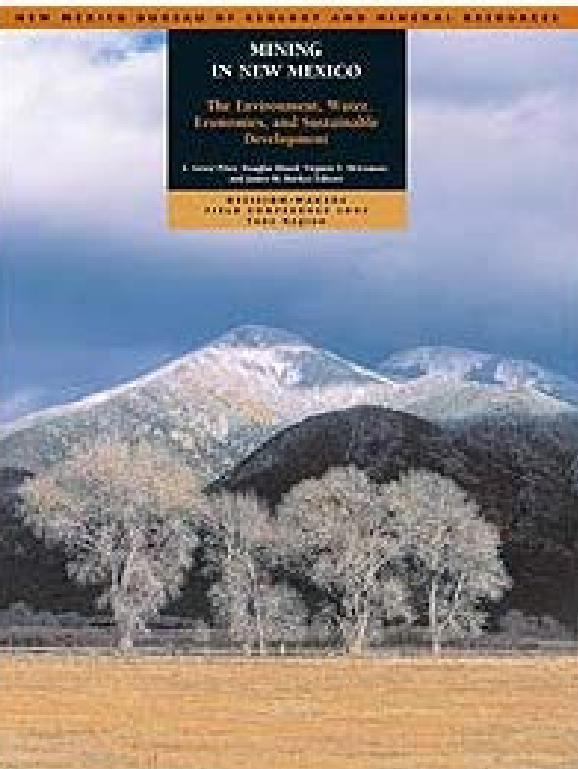
December 1999

## New Mexico GEOLOGY

August 2000  
Volume 32, Number 3



New Mexico Bureau of Geology and Mineral Resources / A Division of New Mexico Tech



2005 guidebook cover

## New Mexico EARTH MATTERS

volume 2008

### New Mexico Potash—Past, Present, and Future

Potash is the granddaddy of mineral and nonfuel commodities. It's a component of fertilizers and is used in a wide range of industries, including glass, ceramics, and food.

Potash is used widely in industry by companies that produce a wide range of products, from glass and ceramics to food and pharmaceuticals. It's also used in the production of potash products.



A photograph of a potash deposit.

Potash is a mineral that is used in a wide range of industries, including glass, ceramics, and food. It is also used in the production of potash products.

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## Lite Geology

### Geothermal Energy

FALL 2008 ISSUE 28

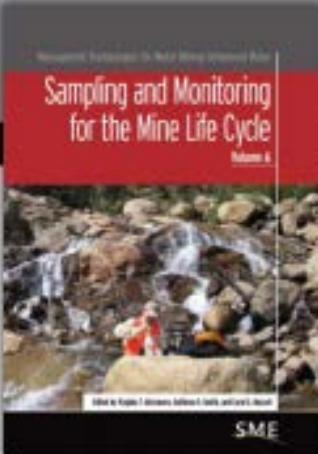


Flowers growing in a geothermal greenhouse at Mexican Springs Farm, New Mexico.

### In This Issue ...

- Geothermal Energy • How Do Geysers Work?
- Classroom Activity: Infrared Yellowstone Lesson Plans • Geothermal Crossword Puzzle
- Geothermal Applications in New Mexico
- Geothermal Greenhouse Heating at Mexican Springs, New Mexico
- Heating New Mexico Tech's Campus with Geothermal Energy
- Most Wanted Mineral: Opal • Through the Hand Lens
- New Mexico's Enchanting Geology • Short Items of Interest

NEW MEXICO BUREAU OF GEOLOGY & MINERAL RESOURCES, A DIVISION OF NEW MEXICO TECH



**Sampling and Monitoring for the Mine Life Cycle**  
Volume 1

Edited by Virginia T. McLennan, Kathleen S. Smith, and Carol C. Russell

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## Sampling and Monitoring for the Mine Life Cycle

Edited by Virginia T. McLennan, Kathleen S. Smith, and Carol C. Russell

**Sampling and Monitoring for the Mine Life Cycle** provides an overview of sampling for environmental purposes and monitoring of environmentally relevant variables at mining sites. It focuses on environmental sampling and monitoring of surface water, and also considers groundwater, process water streams, rock, soil and other media including air and biological organisms. The handbook includes an appendix of technical summaries written by subject matter experts that describe field measurements, collection methods, and analytical techniques and procedures relevant to environmental sampling and monitoring.


The sixth of a series of handbooks on technologies for management of metal mine and metallurgical process drainage, this handbook supplements and enhances current literature and provides an awareness of the critical components and complexities involved in environmental sampling and monitoring at the mine site. It differs from most information sources by providing an approach to address all types of mining influenced water and other sampling media throughout the mine life cycle.

**Sampling and Monitoring for the Mine Life Cycle** is organized into a main text and six appendices that are an integral part of the handbook. Sidebars and Illustrations are included to provide additional detail about important concepts, to present examples and brief case studies, and to suggest resources for further information. Extensive references are included.

**Contents**

- Introduction
- Sampling and Monitoring During the Mining Phases
- Sampling Considerations in the Mining Environment
- Decision Making, Risk, and Uncertainty
- The Planning Process
- Sampling and Monitoring Program Implementation
- Data Management, Assessment, and Analysis for Decision Making
- Additional Key Issues and Future Research Needs
- Selected Online Resources
- Summary of Selected ASTM Methods
- Summary of Field Sampling and Analytical Methods
- Examples of Sampling Plans and Quality Assurance Project Plans
- Case Studies of Sampling and Monitoring
- Applications and Examples of Geo-Environmental Models

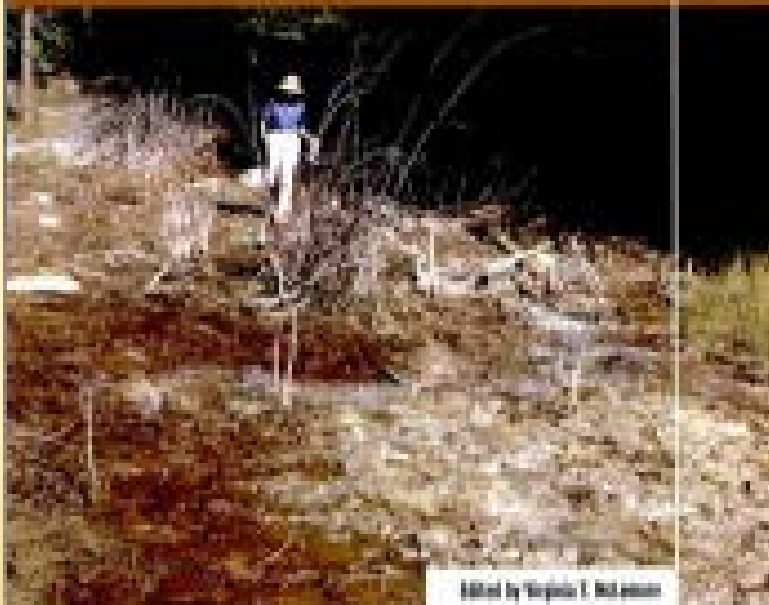
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Management Technologies for Metal Mining Influenced Water

# Basics of Metal Mining Influenced Water

Volume 1



Edited by Virginia T. McLennan



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