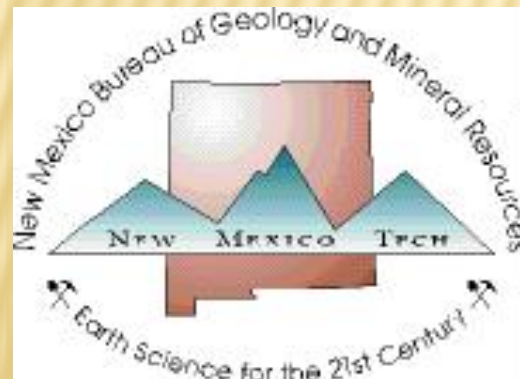


MINING HISTORY, GEOLOGY, AND POTENTIAL OF THE ROSEDALE MINING DISTRICT, SOCORRO COUNTY, NEW MEXICO

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New Mexico Tech, Socorro, NM*



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ACKNOWLEDGEMENTS

✕ Funding

- + Energy Minerals and Natural Resources Department (Abandoned Mine Lands Bureau), U.S. Department of the Interior, Office of Surface Mining and Reclamation (OSMRE)
- + New Mexico EPSCoR, National Science Foundation, NSF, award #IIA-1301346)
- + New Mexico Geological Society
- + Society of Mining, Metallurgy, and Exploration, Inc.
- + NMBGMR and NMIMT Mineral Engineering Department

✕ Two M.S. theses/independent studies--3rd in progress

✕ Professional staff and many students who worked on these projects



PM 12:01 MAR. 25. 2016

WHY STUDY MINING DISTRICTS?

- × History
- × Mineral collecting
 - + Minerals
- × Environmental issues
 - + Mineralogy and geochemistry
- × Mineral-resource potential
 - + Are there any minerals left to mine today or in the future?
- × **Understanding geologic processes**

PREVIEW

- Define the problem
- Purpose of NMBGMR AML mines program
- Sources of information on mine feature locations (pre-field inventory)
- Mining history and description of the Rosedale district
- Summary
- Lessons learned



Mill and cyanide plant at the Rosedale mine, looking north, about 1905 (NMBGMR historical photos #p-00970).

DEFINE THE PROBLEM



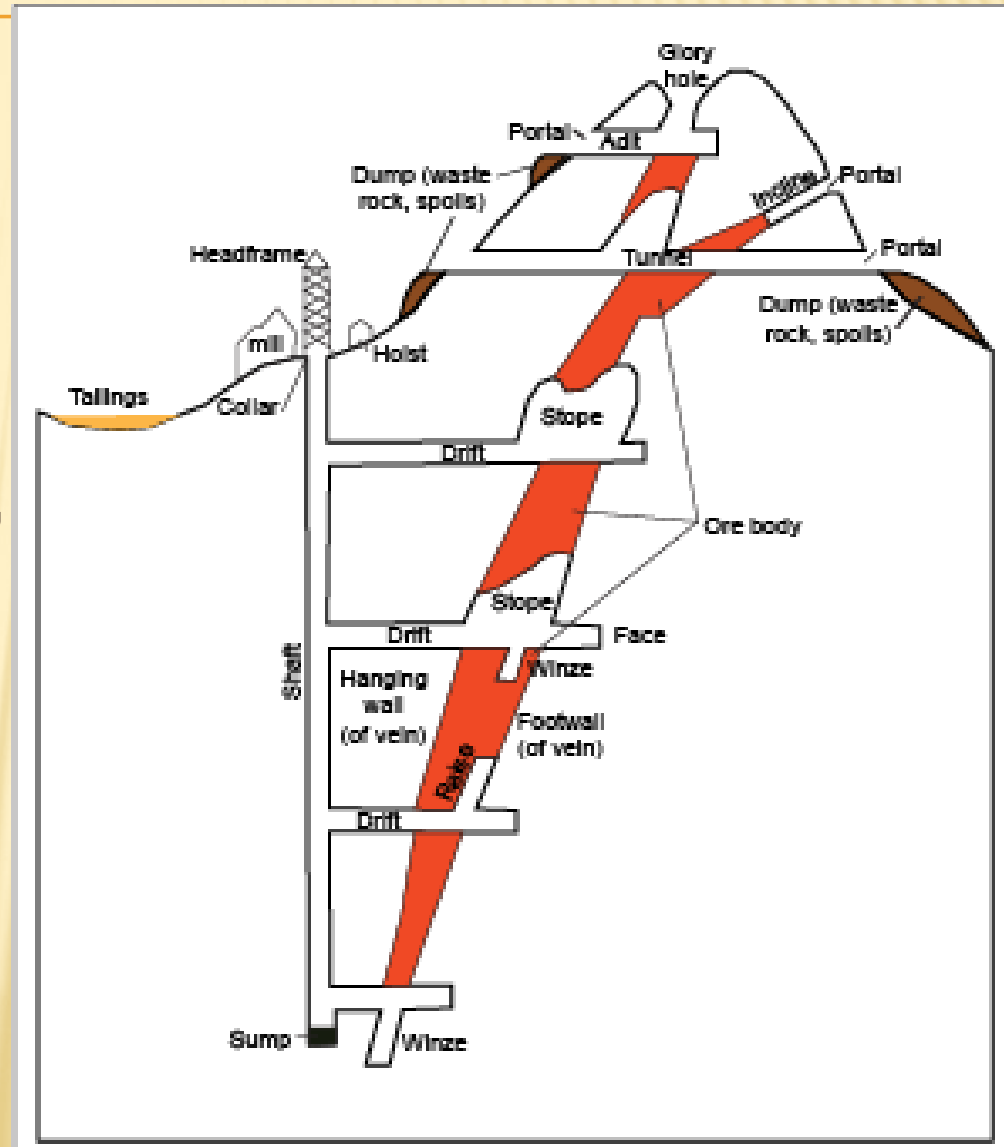
**NMSO0061_Bell Mine
Adit_1WZ**



**NMSO0601_
Bell Mine Shaft
1_WZ**

DEFINITION OF MINE

- ✖ any opening or excavation in the ground for extracting minerals, even if no actual production occurred, mine feature



DEFINITION OF AML (ABANDONED MINE LANDS)

- ✘ Lands that were excavated and left unreclaimed where no individual or company has reclamation responsibility and there is no closure plan in effect
- ✘ Excavations, either caved in or sealed, that have been deserted and where further mining is not intended in the near future, generally >10 yr old
- ✘ Includes mines and mine features left unreclaimed on Federal, State, private and Native American lands because the current owner was not legally responsible for reclamation at the time the mine was created
- ✘ Also called inactive, legacy, and orphaned mines

WHAT ARE POTENTIAL IMPACTS ASSOCIATED WITH LEGACY MINES?

- ✘ Mine workings, rock piles, tailings, and heap leach facilities—physical hazards
- ✘ Acid rock drainage and contamination by metals and other constituents is a problem at some sites in NM—potential water quality issues
- ✘ Since there is no complete inventory, we do not know the extent of any problems

PURPOSE OF NMBGMR AML PROGRAM



Rosedale mill launder,
now buried under cover
of the Longtail tailings
(from Sherman and
Sherman, 1975, p. 179)

Looking NE across
reclaimed Rosedale tailings,
2012.



PURPOSE OF NMBGMR AML PROGRAM

Provide data on districts, mines, and mills in New Mexico

- Help plan and assess reclamation procedures
- Determine background concentrations
- Understand geologic processes
- Compare trace-element concentrations in mined versus undisturbed areas
- Provide background data that can assist with the planning of future mining operations



Rosedale ruins
(~1930s?)

PURPOSE—CONTINUED

To make informed decisions about

- Economic impacts
- Resource development and management (mineral resource potential)
- Impacts on water supplies
- Impacts on land use
- Environmental impacts (including potential sources of AD [acid drainage] or other MIW [mine influenced waters])
- Physical hazard assessment and remediation



Foundations,
Rosedale

SOURCES OF INFORMATION ON MINE FEATURE LOCATIONS (PRE-FIELD INVENTORY)

The New Mexico Bureau of Geology and Mineral Resources (NMBGMR) has been collecting data on mining districts since it was created in 1927

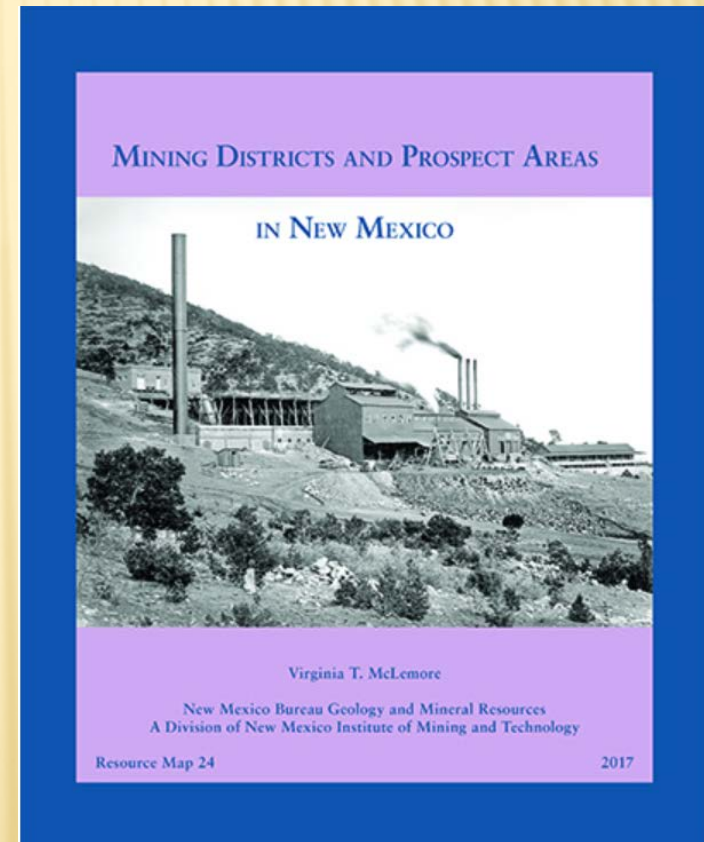
We are slowly converting these data into electronic form and import into ArcGIS

NMBGMR MINING ARCHIVES

- ✖ Organize, catalog and scan the mining archives
- ✖ NM Mine File Catalog (>16,000 mines) with links to more detailed location by section, township, range (>6,000 file cards)
- ✖ More than 2,000 mine plats scanned and cataloged
- ✖ Scan and catalog thousands of reports, both published and unpublished, accompanying mine maps, newspaper articles, assay reports, and historical mine photographs

GIS DATA

- ✗ Coal fields and Mining districts
- ✗ Coal mines and reserve data
- ✗ **Mines and mills**
- ✗ Geochemistry
- ✗ **Photographs**
 - + (both recent and historic)
- ✗ Bibliography
- ✗ **Mine maps**
- ✗ **Mine production**
- ✗ Mine reserves
- ✗ Drill data (Petroleum records)
- ✗ Well logs (Coal library and Petroleum records)



Mines Records by Location and Name (~20,000 records)

MX004

T~~6~~5, R~~5~~W, Sec. ⁶~~7~~, N. M. P. M.
District Rosedale County Securo
Property or claim name:
Great London Lode + mill site

Number of claims ?
Lode ☒ Placer _____ Other M.S.
Survey No. 1076-A & B
Year Patented ☒ Rejected _____
Owner's Name: Address: Date:

The W. H. Martin Co.

Operator: _____
Production: Total _____
From _____ To _____
Present Rate _____ per _____ Date _____

R5W. Sec 6+7 (See other side for general information)

R6W. " 1+12 24.479 acres

MS. on Sec 6

Location if Twp. and Range not given:

Classification:

Chief Mineral _____

Accessory Minerals _____

Status

Date

County Clerk's Record:


Book _____ Page _____

Source of Information:

* Locke, Augustus, short rept. on
the 'Rosedale' mine. Jan. 1, 1921

* T. Lindsley papers, Letter on the
Rosedale mine. Aug. 1913, U. Wyoming
* Bush, J. E., July 11th, 1910, Letter rept. on
Rosedale. Swarth Papers. Amer. zinc file #423
UNIMOD / ROLA

USGS MRDS, Mineral Commodity, topo mines data




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Mineral Resources Data

MRDS is a collection of reports describing geologic characteristics, production, reserve, and service provides a subset of the database available as well. Current status: As of 2017-12-01

Mineral Resources Online Spatial Data

Interactive maps and downloadable data for regional and global [Geology](#), [Geochemistry](#), [Geophysics](#), and [Mineral Resources](#)



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[ScienceBase Catalog](#) → [USGS Data Release Products](#) → [Prospect- and Mine-Related...](#)

Prospect- and Mine-Related Features from U.S. Geological Survey 7.5- and 15-Minute Topographic Quadrangle Maps of the United States

[View](#)

Dates

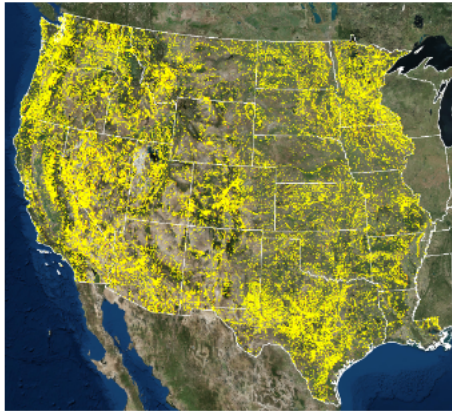
Publication Date :	2017-12-01
Start Date :	1888
End Date :	2006

Citation

Horton, J.D., and San Juan, C.A., 2017, Prospect- and Mine-Related Features from U.S. Geological Survey 7.5- and 15-Minute Topographic Quadrangle Maps of the United States: U.S. Geological Survey data release, <https://doi.org/10.5066/F78W3CHG>.

Summary

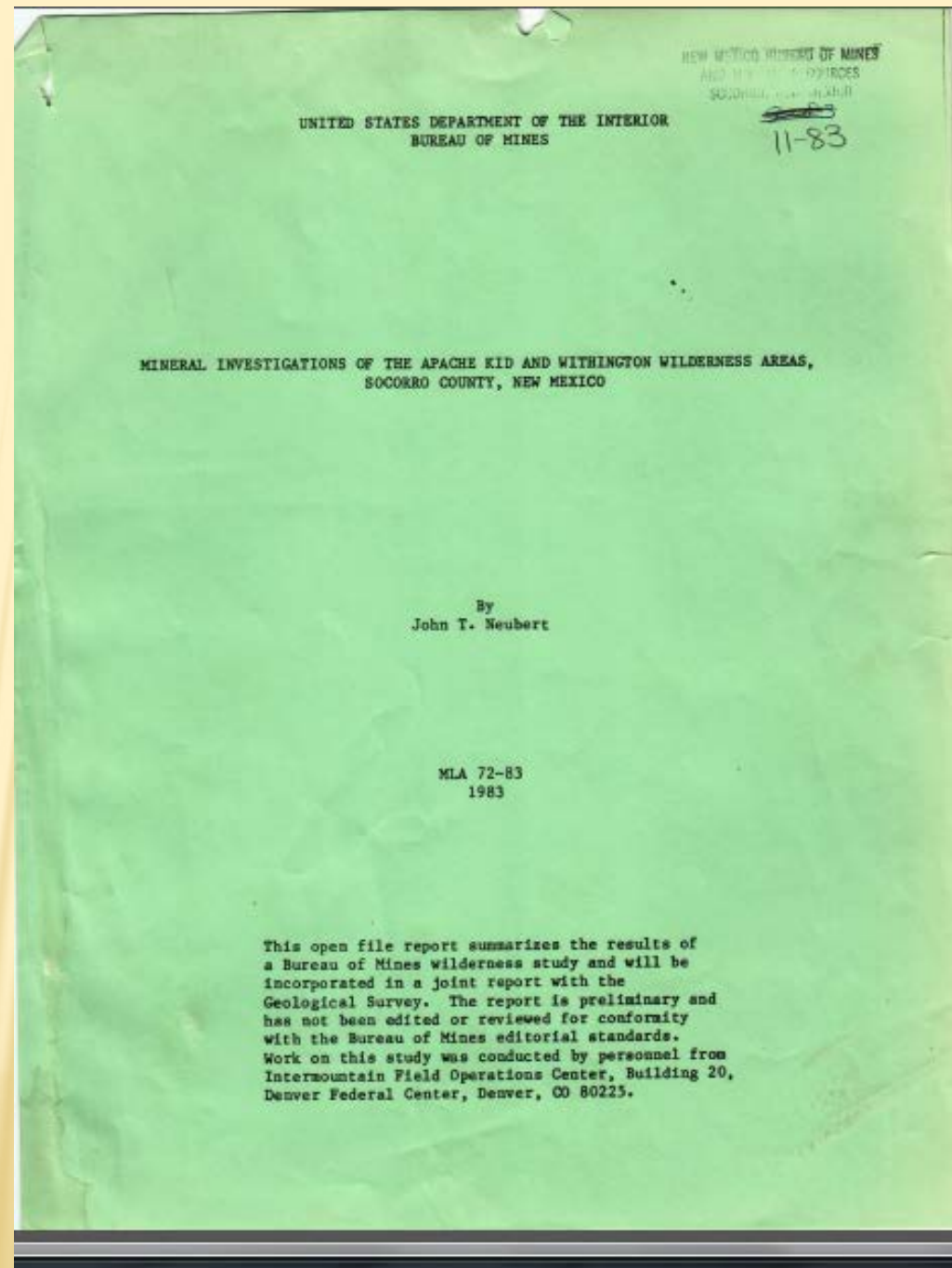
These data are part of a larger USGS project to develop an updated geospatial database of mines, mineral deposits and mineral regions in the United States. Mine and prospect-related symbols, such as those used to represent



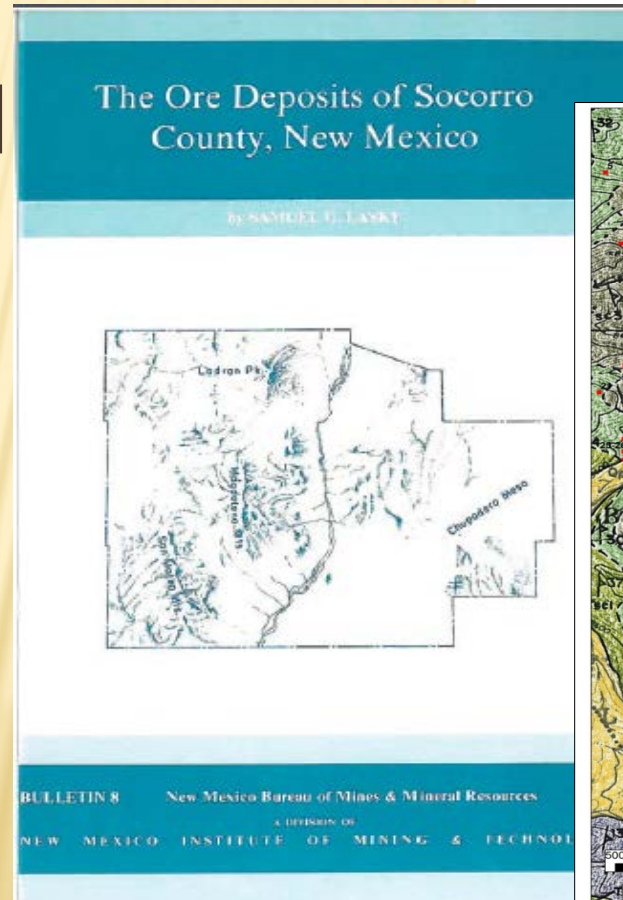
<https://mrdata.usgs.gov/>,

<https://www.sciencebase.gov/catalog/item/5a1492c3e4b09fc93dcfd574>

USBM and USGS mineral resource assessments



NMBGMR mapping projects, bulletins, and open file reports

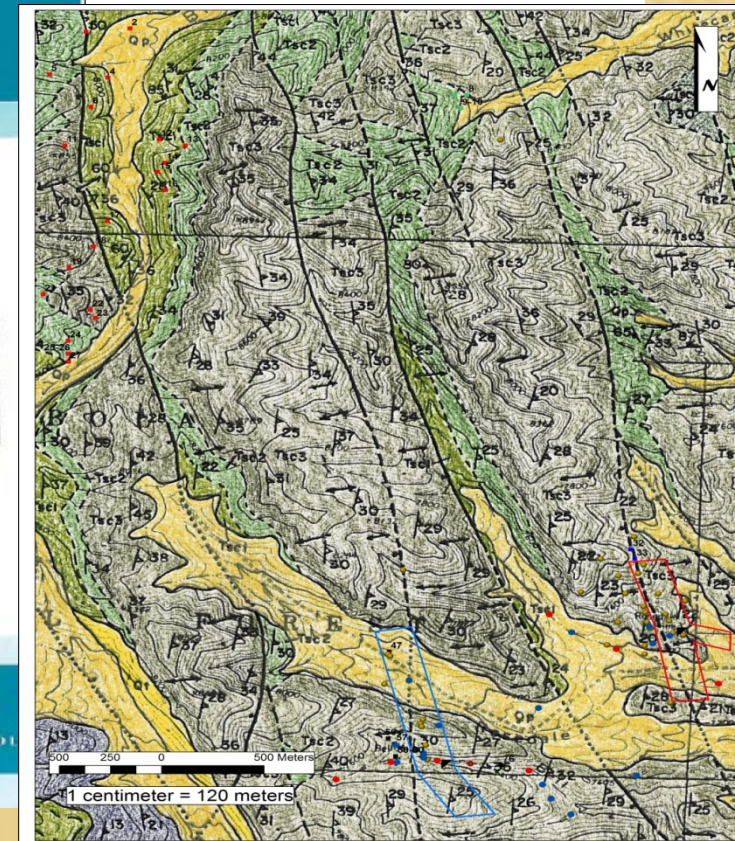


Geology of the Grassy Lookout 7.5' quadrangle, Socorro County, New Mexico

New Mexico Bureau of Mines and Mineral Resources
Open-file Report 366

by

Charles A. Ferguson
Department of Geology and Geophysics
University of Calgary



Other reports, company reports, newspaper articles, published and unpublished

THE MINES OF NEW MEXICO.

INEXHAUSTIBLE DEPOSITS OF

GOLD AND SILVER

COPPER, LEAD, IRON AND COAL.



A MINERAL AREA UNEQUALED IN ANY STATE OR TERRITORY
FOR THE EXTENT AND VALUE OF ITS MINES.

Issued by the New Mexico Bureau of Immigration,
Santa Fe, N. M., May, 1896.

SANTA FE, N. M.:
NEW MEXICAN PRINTING COMPANY.
1896.

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

PROFESSIONAL PAPER 68

THE ORE DEPOSITS OF
NEW MEXICO

BY

WALDEMAR LINDGREN, LOUIS C. GRATON
AND CHARLES H. GORDON



WASHINGTON
GOVERNMENT PRINTING OFFICE
1910

Historic Documentation, Archaeological
Monitoring, and Salvage Excavations
Undertaken at the Rosedale Gold Mine,
Mill, and Townsite, Cibola National Forest,
Magdalena Ranger District,
Socorro County, New Mexico



(A CERCLA Project)

Prepared By:
Michael S. Burney
and Angela M. Scarlata

Burney & Associates
P.O. Box 2329
Taos, New Mexico 87571

Barbara L. Scott, Final Eyes
Volume Editor

February 29, 2008

BLM mineral patents and mining claims records

The image shows a screenshot of the Bureau of Land Management (BLM) website. The top navigation bar includes links for "Search Documents", "Reference Center", "Support", and "Shopping Cart". Below this, there are three tabs: "Search Documents By Type", "Search Documents By Location", and "Search Documents By Identifier". The "Search Documents By Type" tab is selected, showing a sidebar with links for "Patents", "Surveys", "LSR", and "CDI". The "Patents" link is highlighted. The main content area displays a search form with a "Search" button and a "Clear Form" link. Below the search form, there is a section titled "To search for land patents:" with a "Location" input field. The bottom part of the image shows a separate page titled "Land & Mineral System Reports". This page has a sidebar with links for "LR2000 REPORTS", "ABOUT LR2000", "INSTRUCTIONS", "REFERENCE CODES", "CONTACT US", and "SUBMIT A HELPDESK TICKET". The main content area of this page is titled "Report Status and Updates" and contains a list of updates:

- The CR Serial Register Page (SRP) was updated to include the "Other Query Parameters".
- Reports that are still under construction are the CR Duration of Plans, and the ST Serial Register Pages - Other Query Parameters.
- The CR ROW Solar Energy Report is now available. The User Guide is in the process of being updated and will be posted as soon as possible.

Below the list, there is a paragraph explaining that the BLM administers more public land (over 245 million surface acres) than any other Federal agency in the United States. Most of this land is located in the 12 Western states, including Alaska. The BLM's Legacy Rehost System, called LR2000, provides reports on BLM land and mineral use authorizations for oil, gas, and geothermal leasing, rights-of-way, coal and other mineral development, land and mineral title, mining claims, withdrawals, classifications, and more on federal lands or on federal mineral estate. The LR2000 enables users to access the same information over the Internet as in the BLM State Office Information Access Centers.

LR2000 provides access to the following systems. To run reports you will need to know which of the following systems the information you are looking for is in:

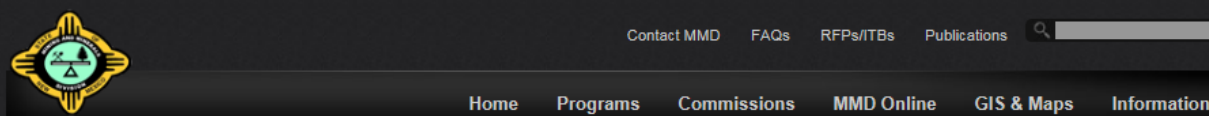
<https://glorerecords.blm.gov/search/default.aspx>;
<https://reports.blm.gov/reports.cfm?application=LR2000>

WARNING STATEMENT

This plat is the Bureau's Record of Title, and should be used only as a graphic display of the township survey data. Records hereon do not reflect title changes which may have been effected by lateral movements of rivers or other bodies of water. Refer to the cadastral surveys for official survey information.

BLM
master
title plat

NMMMD active mines and permits



MARP - Pending Permit Activities (Applications, Revisions, Modifications and Closeout Plans)

Follow the links below to review Mining Act Reclamation Program pending permit applications, modifications and revisions for exploration projects, minimal impact mines and regular mines, and approved and denied exploration applications. Permits are listed in each section by descending permit number.

NOTE: Approved, Denied, Withdrawn and Released sites older than approximately 6 months are removed from this website.

[Application and Annual Reporting Forms](#)
[Pending Permit Activities](#)
[Announcements, Public Notices, RFP/ITB](#)
[Guidance and Guidelines](#)
[FAQ - MARP](#)
[Annual Report to the Mining Commission](#)
[Rules and Regulations](#)

Pending Exploration Applications

[Minimal Impact](#)
[Regular Exploration](#)

Pending Mi

[Minimal Impact](#)
[Minimal Impact](#)
[Regular - New](#)
[Regular - Existing](#)



Contact MMD FAQs RFPs/ITBs Publications

Home Programs Commissions MMD Online GIS & Maps Information



GIS, MAPS AND MINE DATA

MMD uses a Geographic Information System (GIS) to locate and track its mining activities in the state. This is a computer system that can capture, store, analyze and display geographically referenced (location) information. The power of this system is its ability to draw conclusions about relationships between data that have a spatial component. GIS provides a method of displaying accurate mapping and database information to the staff and public.

<http://www.emnrd.state.nm.us/MMD/MARP/MARPPermitsRevModClose.html>;

<http://www.emnrd.state.nm.us/MMD/gismapminedata.html>

New Mexico Mines Database

Relational database in ACCESS that will ultimately be put on line with GIS capabilities

- ACCESS is commercial software and this design is compatible with other formats
- Metadata (supporting definitions of specific fields) can be inserted into the database
- ACCESS is flexible and data can be easily added to the design
- Easily imported into ArcGIS

MINING DISTRICTS AND COAL FIELDS

- ✖ 274 coal fields and mining districts in NM
 - + ~30 districts have had zero production
- ✖ Each district is classified by predominant commodity
- ✖ Each district can have more than 1 commodity type
- ✖ 28 coal fields
- ✖ 40 industrial minerals districts
- ✖ 173 metals districts
- ✖ 32 uranium districts



Chino copper mine



San Juan coal mine

GIS data for mining districts found at
<https://geoinfo.nmt.edu/repository/index.cfm?id=20170001>


MINES

- ✖ Each mine is classified by predominant commodity
- ✖ Each mine can have more than 1 commodity type
- ✖ 9000 mines in the database that include active, inactive, abandoned, and exploration sites
- ✖ Not all mines have workings
- ✖ Some mines have multiple workings




Questa mine, Taos County

NMBGMR AML WEBPAGE—ROSEDALE PORTFOLIO



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Geoscience > Geologic Hazards > Abandoned Mine Lands

ABANDONED MINE LANDS (AML) PROJECT

New Mexico's mineral wealth is among the richest of any state in the U.S. In 2015, New Mexico ranked 10th in coal production, 2nd in copper production, and 20th in total nonfuel minerals production (McLemore, 2017). Most of the



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- Search

Geoscience > Geologic Hazards > Abandoned Mine Lands

Resource Map 24, 65 p., scale 1:1,000,000.

McLemore, V.T., Hoffman, G., Smith, M., Mansell, M., and Wilks, M., 2005a, Mining districts of New Mexico: New Mexico Bureau of Mines and Mineral Resources, OF-494, CD-ROM.

McLemore, V.T., Krueger, C.B., Johnson, P., Raugust, J.S., Jones, G.E., Hoffman, G.K. and Wilks, M., 2005b, New Mexico Mines Database: Mining Engineering, February, p. 42-47.

OTHER RESOURCES

Historical mining records for [Rosedale](#) district

PHOTOS

<http://geoinfo.nmt.edu/geoscience/hazards/mines/aml/home.html>

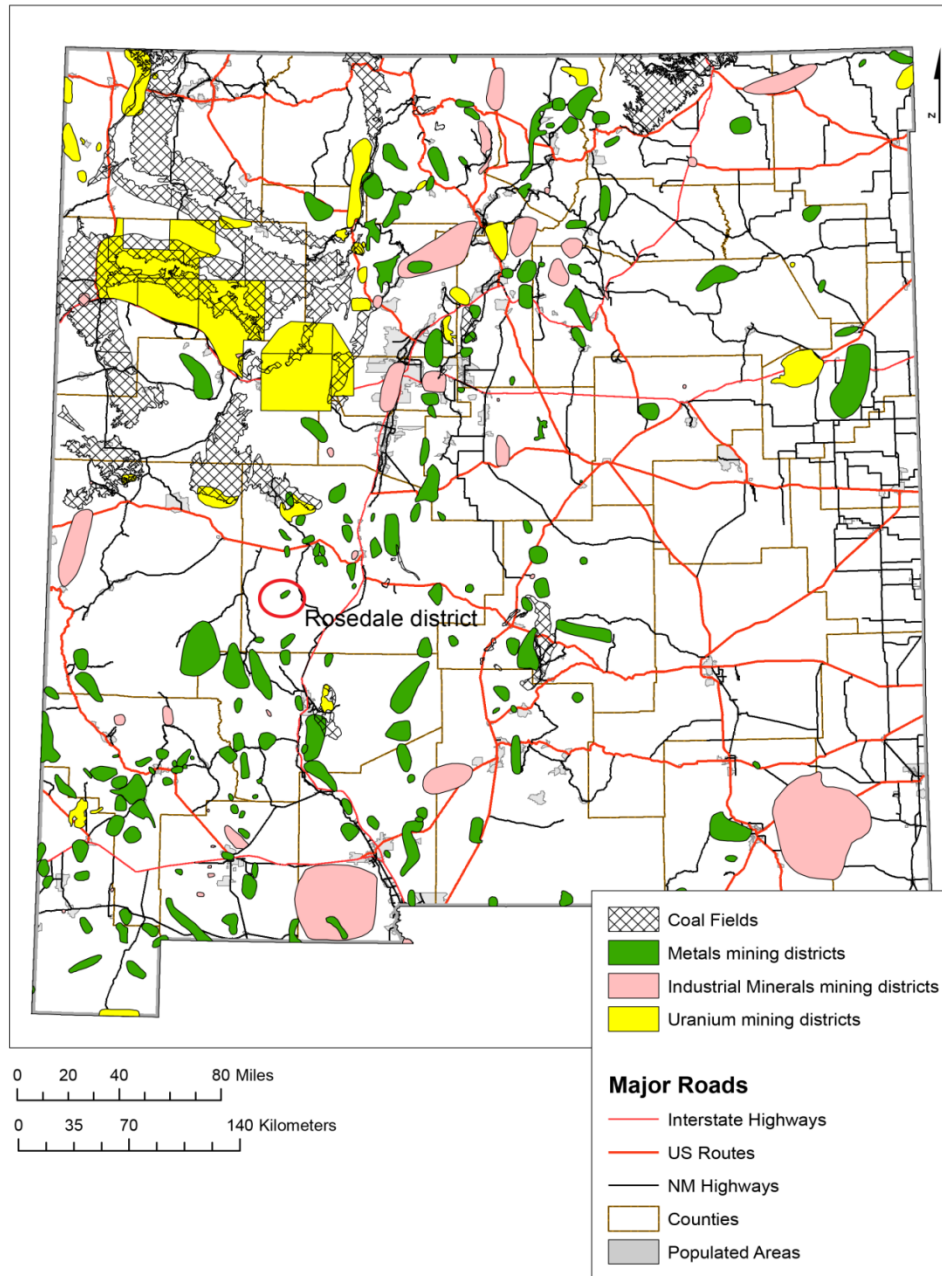
HISTORY AND DESCRIPTION OF THE ROSEDALE DISTRICT, SOCORRO COUNTY, NEW MEXICO



Looking E in White Cap Canyon
(Lane workings, 2017).



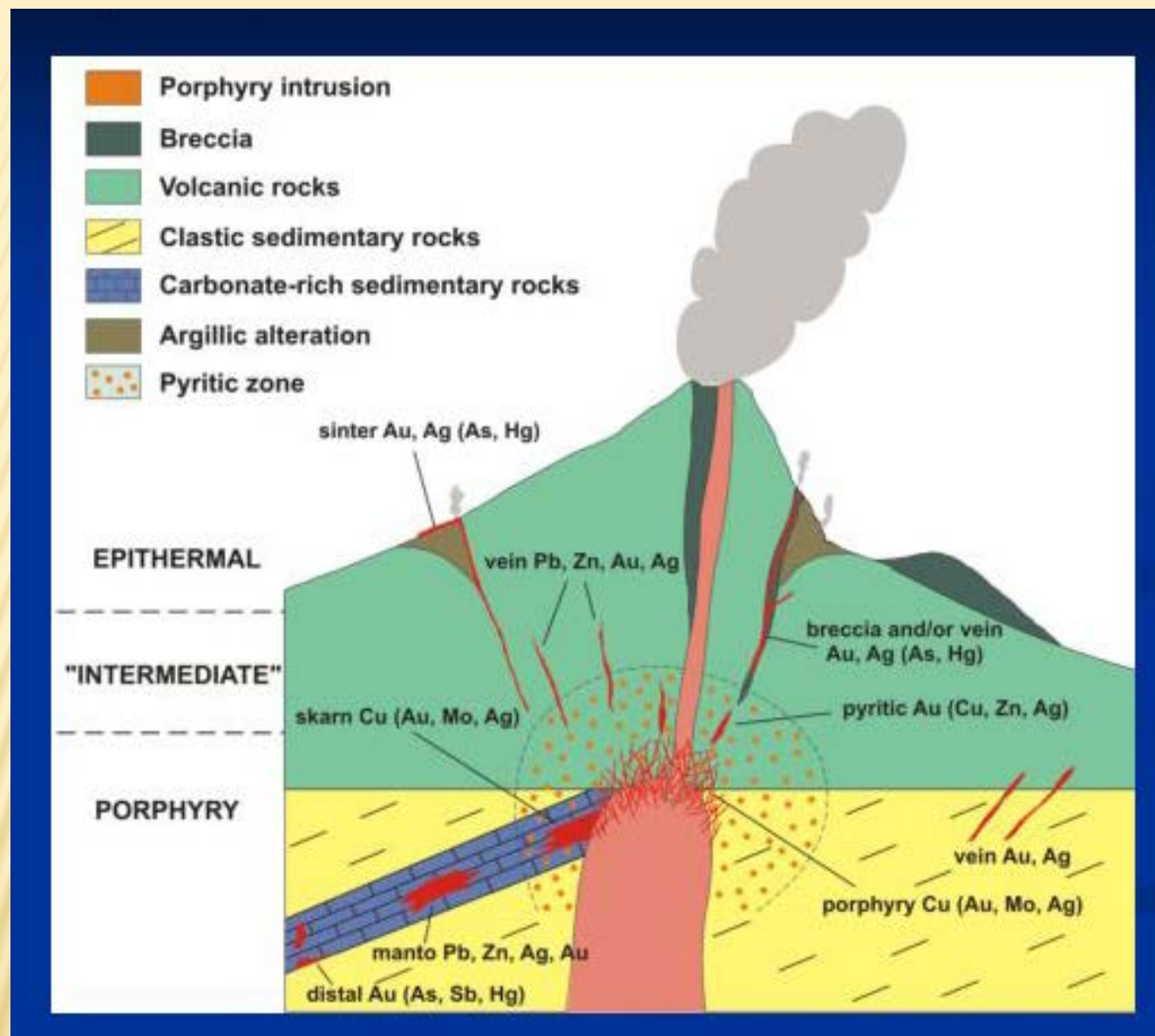
Looking N at Big Rosa
Canyon, 2017.



Rosedale
district is in
western
Socorro
County

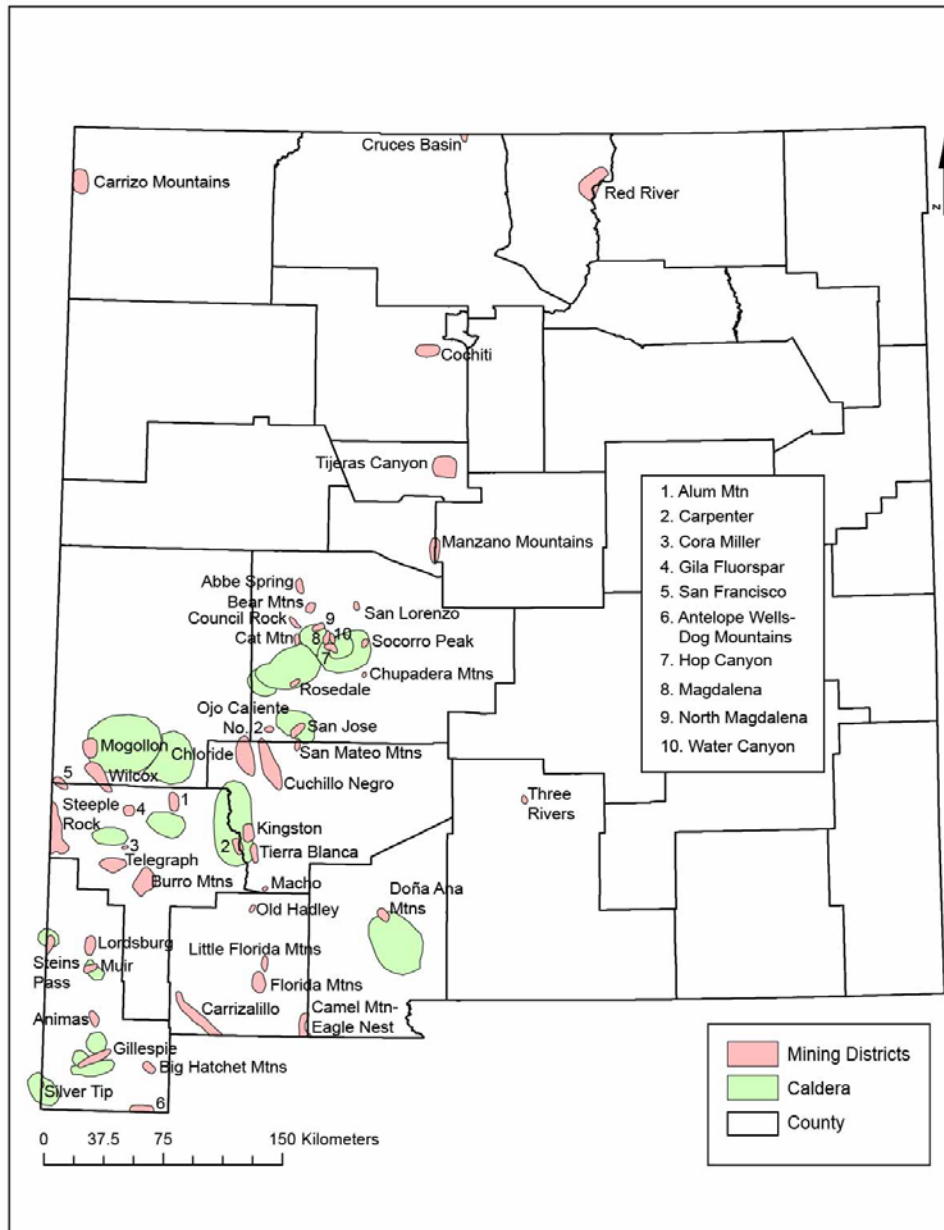


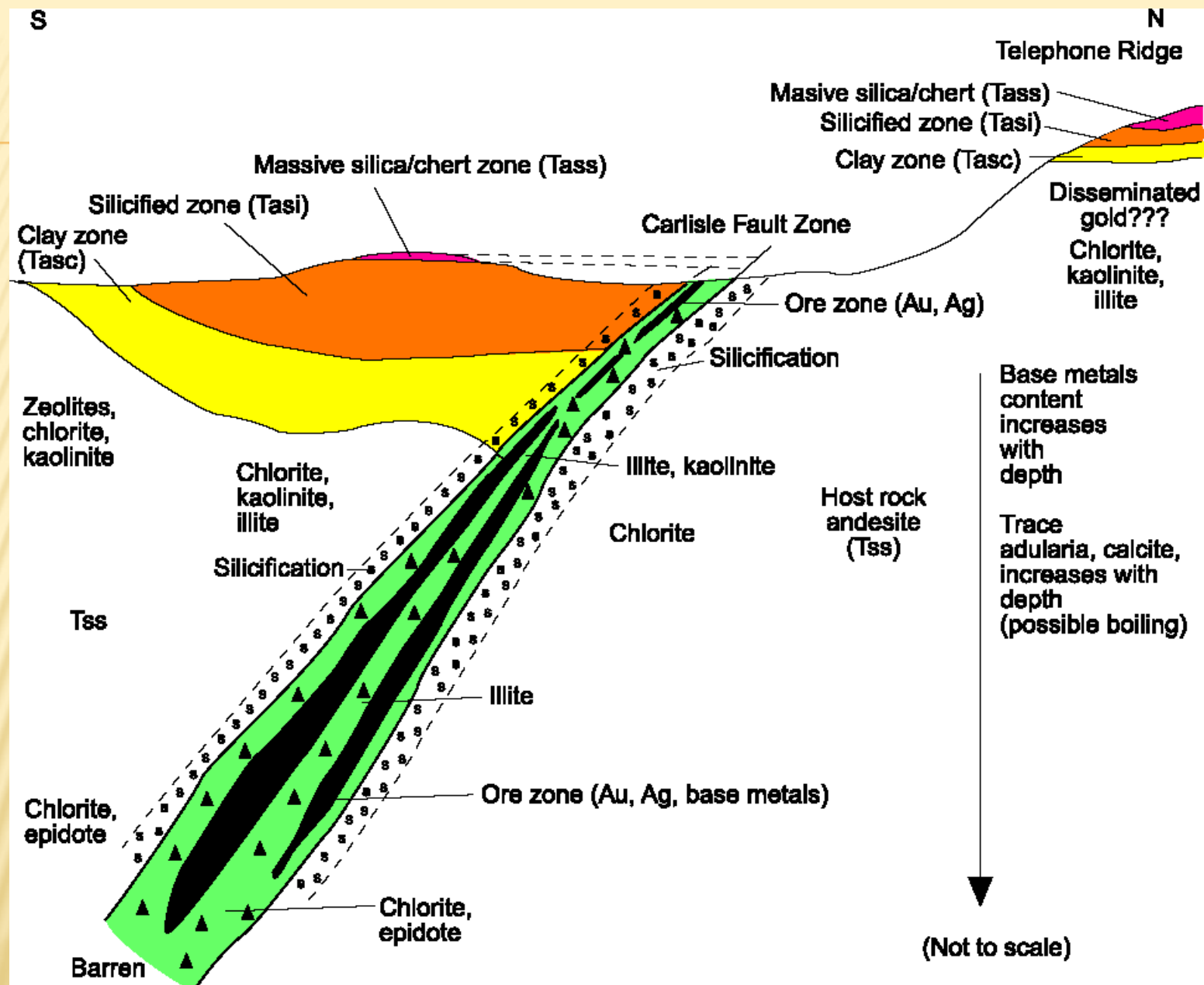
Rosedale district looking south



Schematic of formation of volcanic-epithermal districts—related to calderas and geothermal activity

Volcanic-epithermal districts in New Mexico





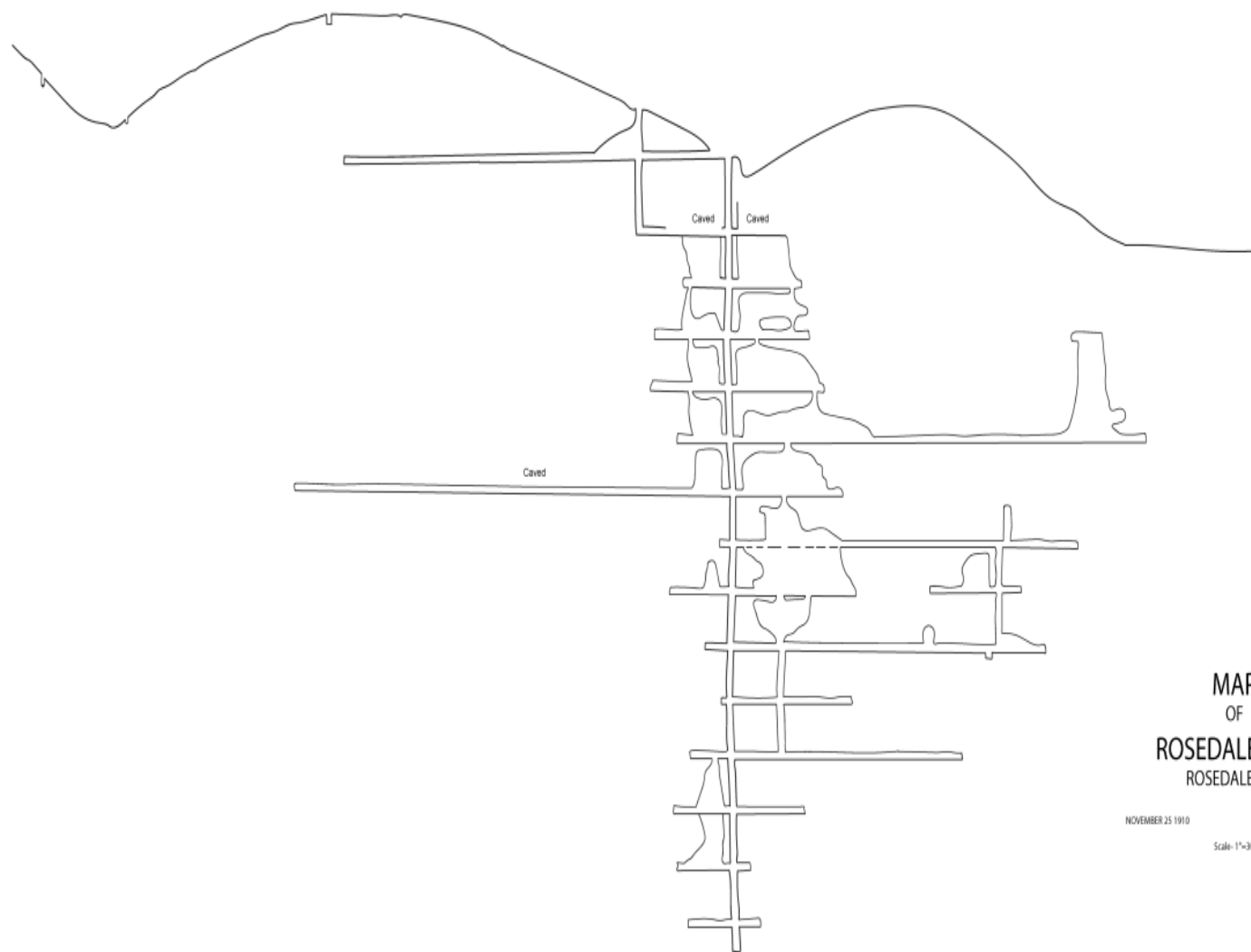
Cross section of the Carlisle mine, Steeple Rock district, Grant County

MINING HISTORY

- ✖ December 15, 1882, Jack W. Richardson discovers property
- ✖ July, 1891, 10-stamp mill completed, first ran in August
- ✖ February 1, 1899, Cyanide plant is completed
- ✖ March, 1901, assay office burns, mine and mill records lost
- ✖ July 27, 1901, 13 levels completed Rosedale mine
- ✖ November 2, 1901, Rosedale closes, Golden Bell finishing plans for a stamp mill
- ✖ September, 1903, Rosedale mill reopened

MINING HISTORY—CONTINUED

- ✖ August 12, 1910 20-stamp mill and cyanide plant burns
- ✖ 1913, Property reopens
- ✖ 1916, Fire destroys mill and surface plant
- ✖ 1942-1957, Inactive
- ✖ 1957-1961, minor production
- ✖ Final estimated production 1882-1981
 - + 28,000 oz Au
 - + 10,000 oz Ag



MAP
OF
ROSEDALE MINE
ROSEDALE, NM

NOVEMBER 25 1910

Jos M Batsholder, Jr. E.M.

Scale - 1"=30'

MINE INVENTORY



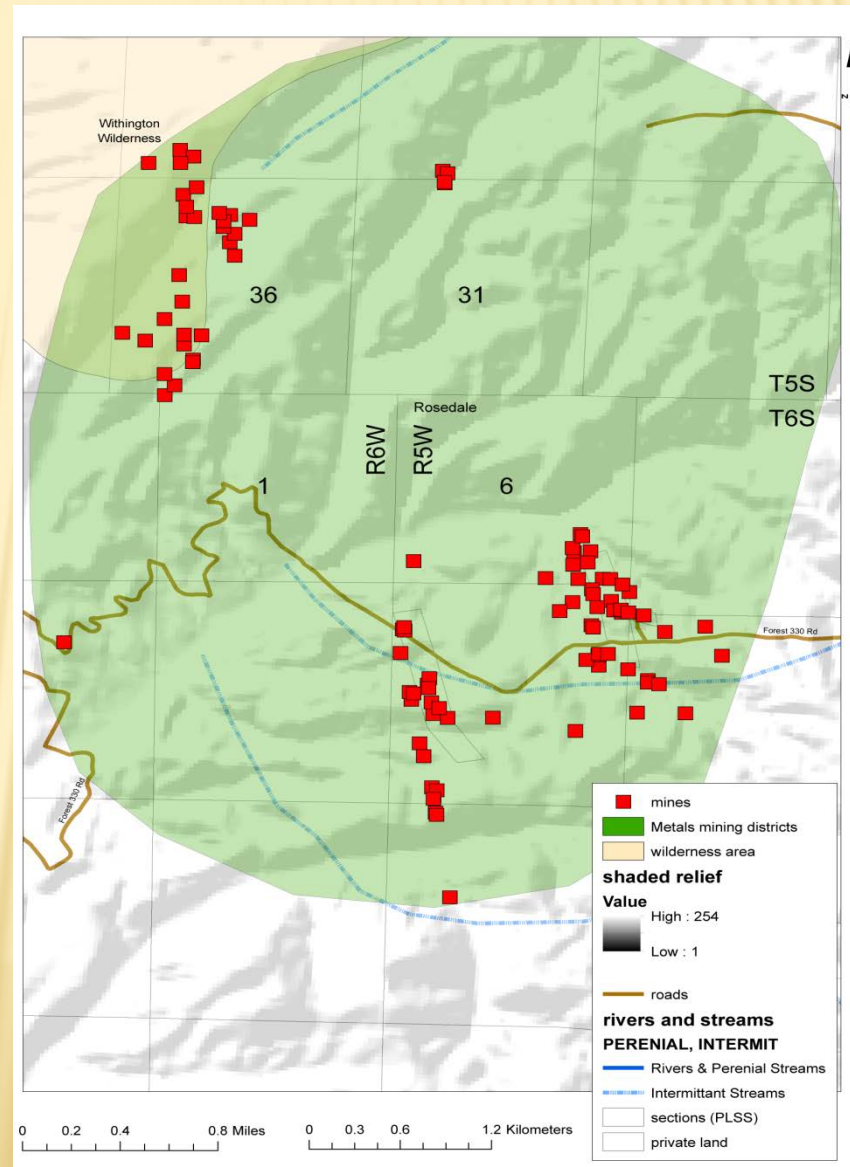
Rosedale tailings before reclamation

STEPS IN AML PROJECT

- ✘ Inventory the mines and mine features
 - + History of the site (production, commodities, mine methods, processing facilities)
- ✘ Preliminary characterization (for both environmental and resource potential)
 - + Paste pH, mineralogy, chemistry
- ✘ Prioritize mine features for further work and ultimately reclamation
- ✘ Detailed characterization
 - + Detailed mineralogy and chemistry
 - + ABA/NAG tests
 - + Particle size analyses
 - + Shear tests

MINES IN ROSEDALE DISTRICT

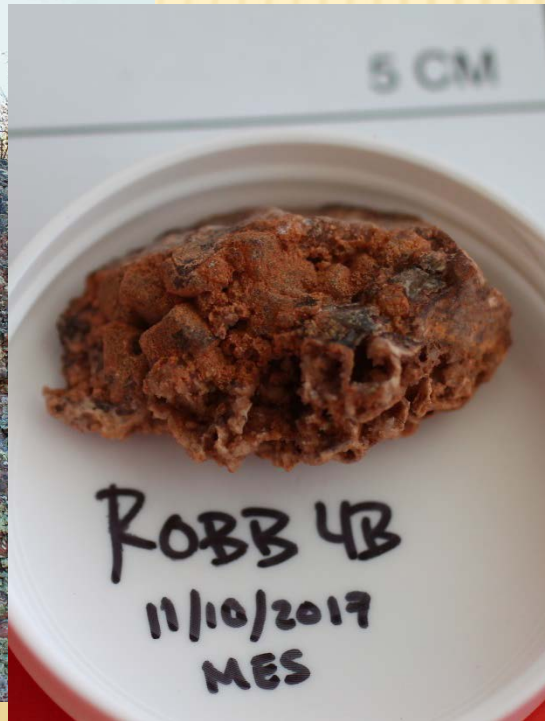
- ✖ When we started in October 2016, we had 26 mine features in the NM Mines Database
- ✖ When we finished our file search and field inventory, we had 103 mine features



Mine area	Number of Mine features	Mine Features	Depth of workings (ft)
Rosedale	28	Shafts (14 levels), pits, adit, tailings, mill foundations, trenches	2- ≥732
Bell	16	Tailings, shafts, adit, mill foundations, pits	2 - >50
Bell South	7	Adit, shafts, pits	3 - >10
Big Rosa Canyon	34	Shafts, adit, pits, trenches	2 - >30
Robb Prospect	10	Adit, shaft	3 - 20
Lane Prospect	5	Shafts, pits, trenches	2 - >30
Oak Spring	1	Drillholes	

Sampling Types

- Whole Rock: used to determine a baseline chemistry
- Rock Chips—"dump select" or outcrop: used to characterize in-situ mineralogy of the deposit
- Composite Dump: used to characterize chemistry of the waste rock and its potential for acid generation or as backfill material



MINERALOGY AND CHEMISTRY

- ✕ Petrography
- ✕ Whole rock geochemistry
- ✕ Paste pH
- ✕ Mineralogy
 - + XRD
 - + Electron microprobe
 - + Chemical analyses of minerals, esp. pyrite



- Volcanic-epithermal veins
- Hosted by rhyolite tuffs and intrusions
- Quartz veins typical of the Rosedale district

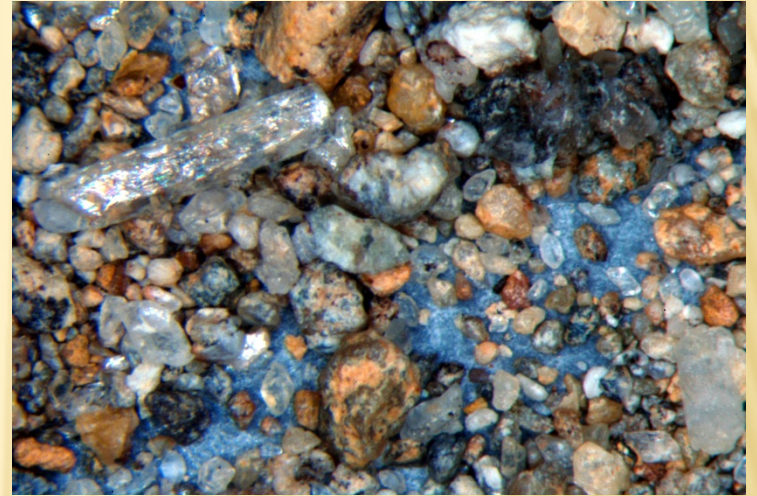


Unknown cubic mineral
(fluorite?)

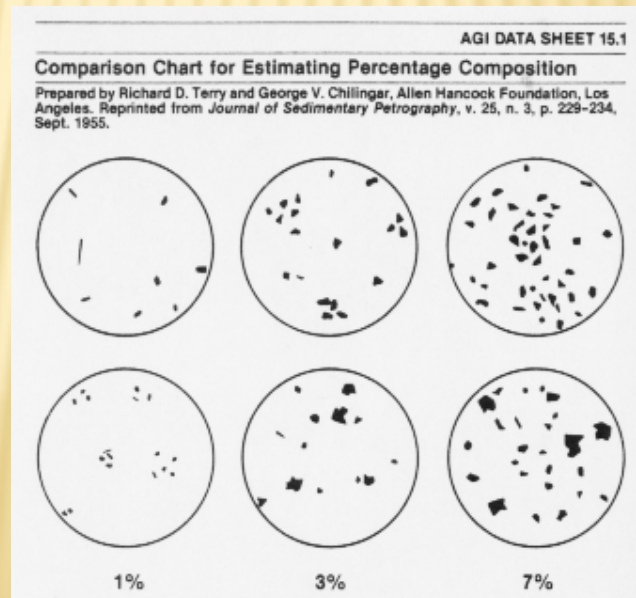


Massive silica

SOIL PETROGRAPHY—FIRST STEP IN DETERMINING MINERALOGY



2 mm

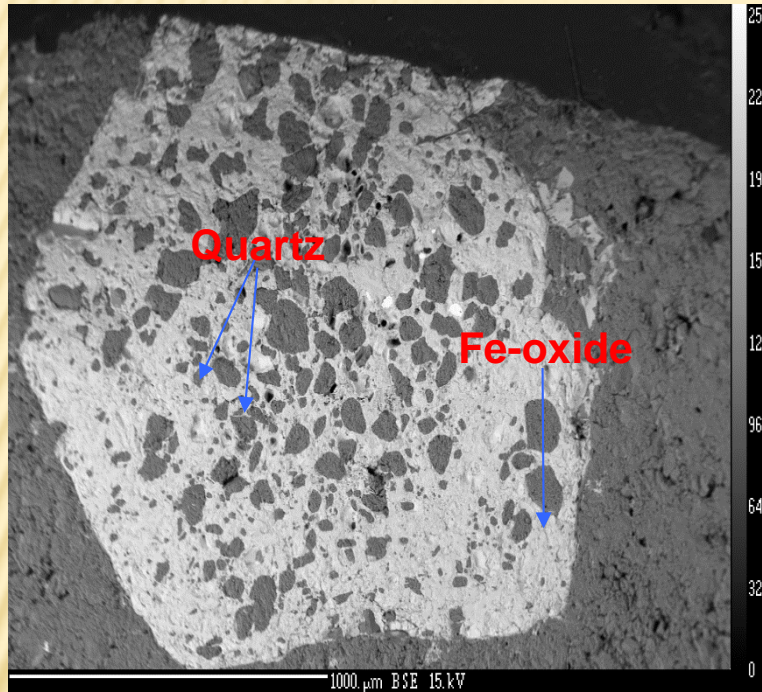


Pyrite characterization

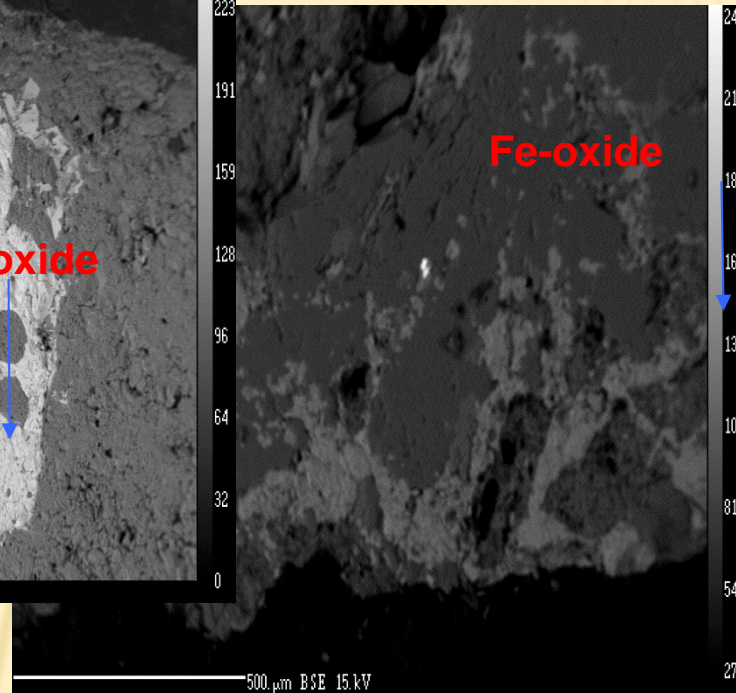
Evaluate the distribution, form, size, amount, surface area of pyrite in the rock piles



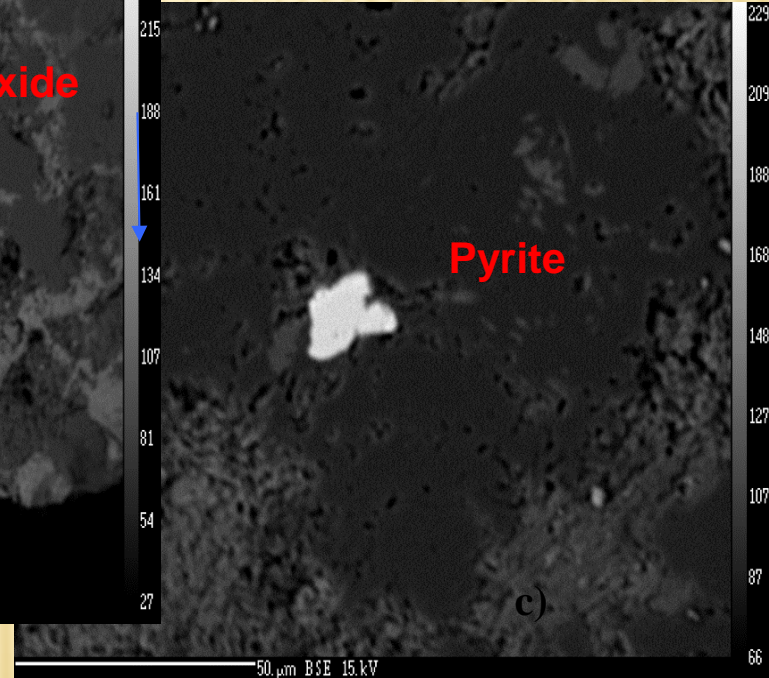
MICROPROBE ANALYSIS (BSE) IMAGES



a)

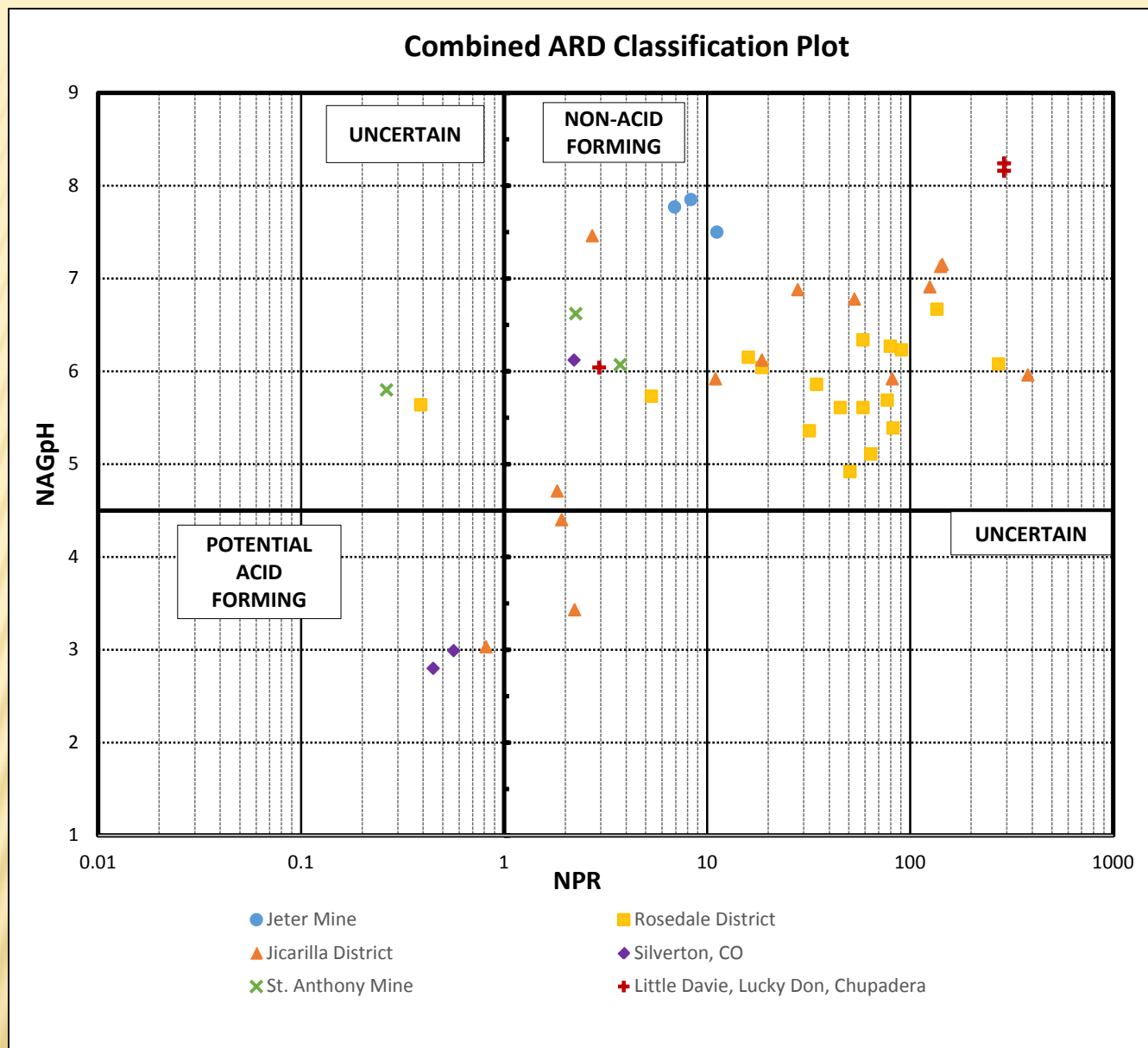


b)



c)

- a) Backscattered electron images of quartz grain replacing Fe-oxide in sample Jic410. This is likely supergene replacement.
- b) Backscattered electron images of Fe grain in sample Jic412. Note how altered and pitted the grain is.
- c) Backscattered electron images of pyrite grain in sample Jic412 c. Note how pristine the pyrite grain is.



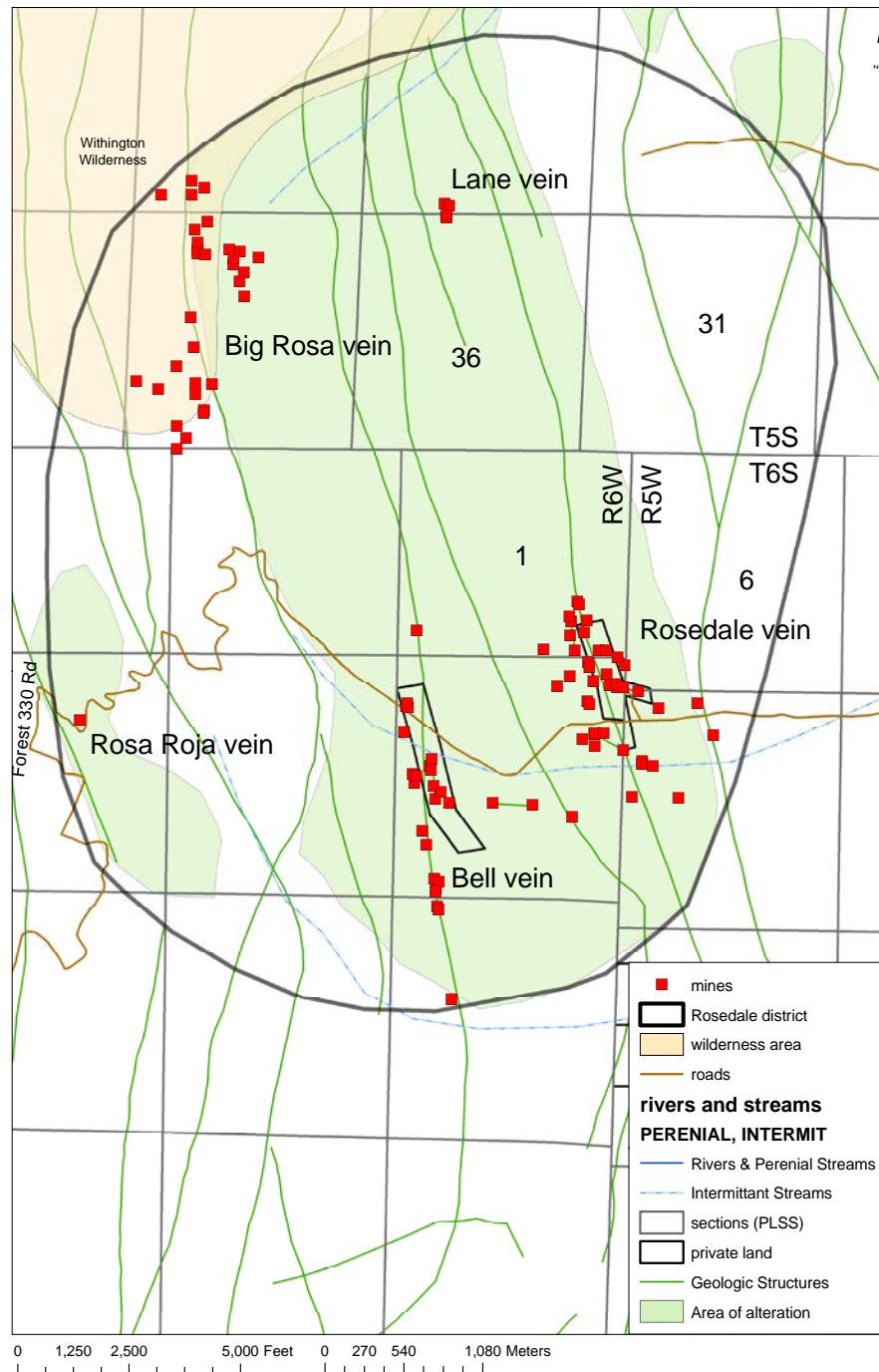
Acid Rock Drainage (ARD) plot of waste rock pile at mines examined during the NMBGMR AML project. NPR is a calculated ABA parameter

HAZARD RANKING

National Orphaned/Abandoned Mines, Canada,
http://www.noami.org/intro_e.php?language=English

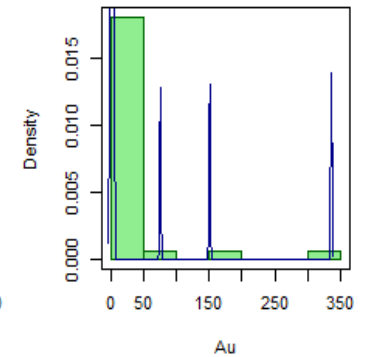
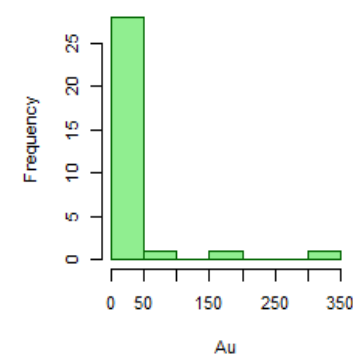
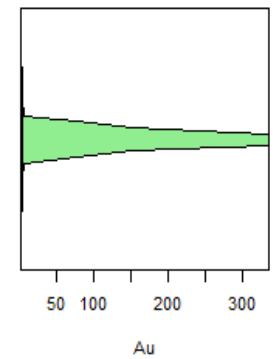
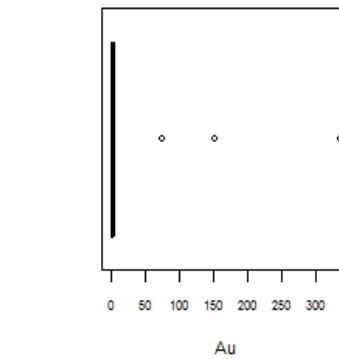
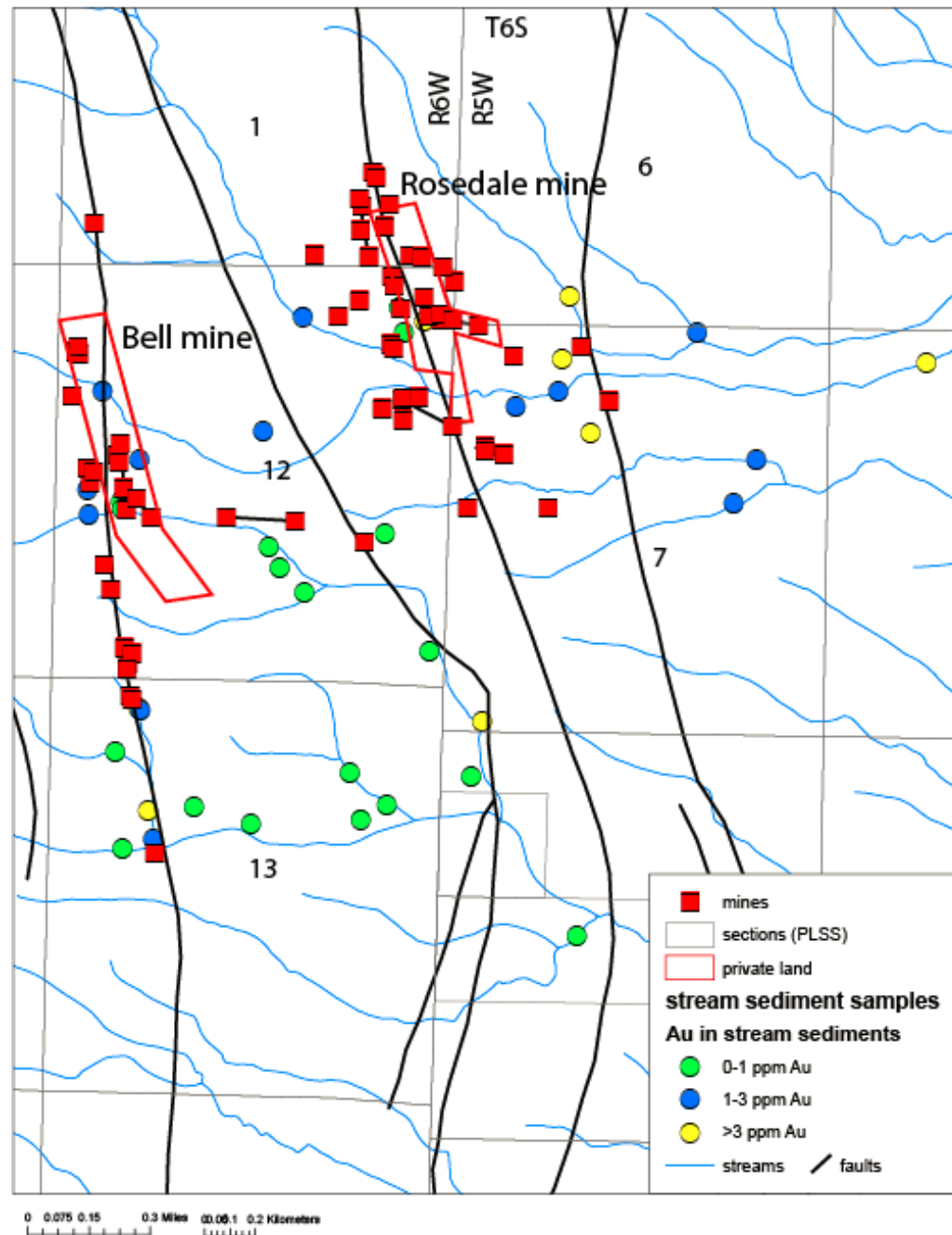
NOAMI Class	Description
A	A site with potential to cause environmental, public health and public safety concerns
B	A site with limited potential to cause environmental concerns but with potential for public health and safety concerns
C	A site with public safety concerns but little or no public health or environmental concerns
D	A site with no expected environmental, public health or public safety concerns
O	Information is not available
R	Remediated

MINERAL-RESOURCE POTENTIAL OF THE ROSEDALE DISTRICT

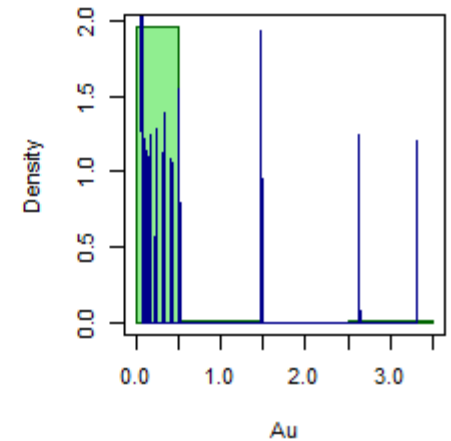
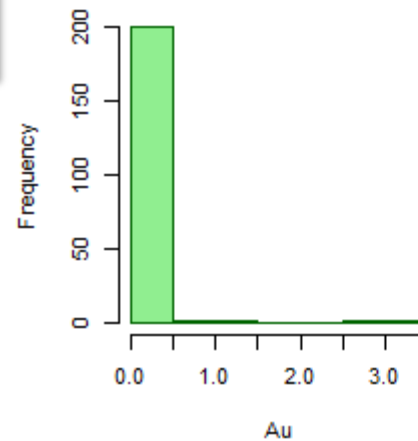
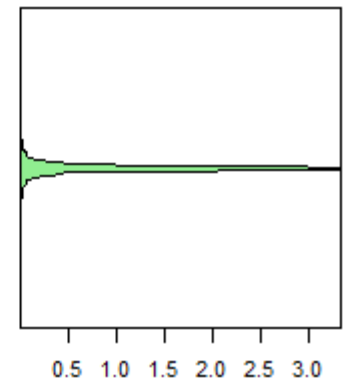
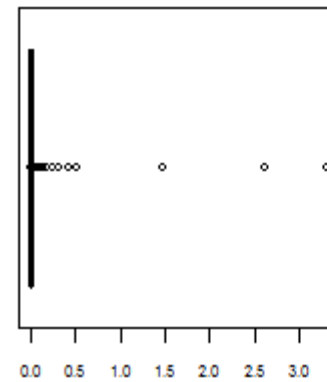
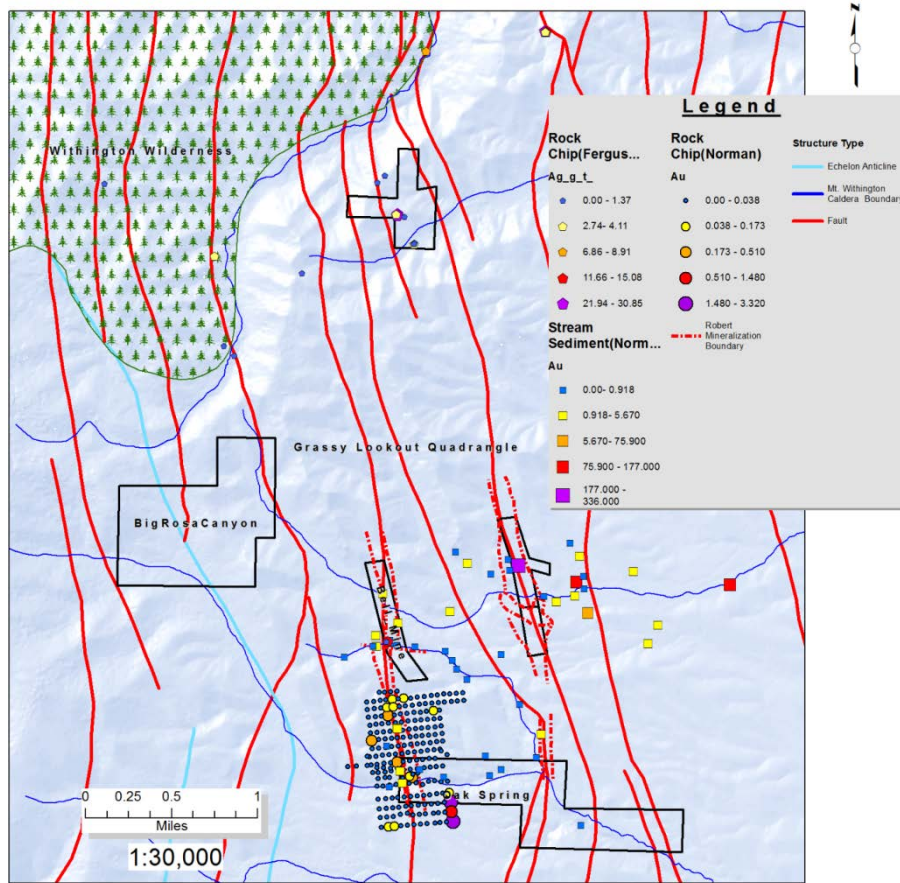


Mines in Rosedale district are found along structures related to the caldera or basin and range faulting

Stream sediment survey



Rock chip survey



SUMMARY—ENVIRONMENTAL ISSUES

- ✘ Hazard rating
 - + 22 mine features with a C rating
 - + 67 with a D rating
 - + 13 that are remediated (most by natural collapse)
- ✘ Mining-related disturbance is minor, except near the mines
- ✘ Only one sample from the Rosedale district plotted in the uncertain field on the ARD diagram
- ✘ The other samples plotted as non-acid forming
Rosedale samples contain low concentrations of all metals
- ✘ **Every site is different and must be specifically characterized**

SUMMARY—RESOURCE POTENTIAL

- ✘ Perry, Knox and Kaufman, Inc. estimated 1.5-2 million short tons of 0.3 oz/short ton (10 ppm) Au in the district
- ✘ High mineral-resource potential with a high level of certainty for gold>>silver as a low-sulfidation, quartz-dominant, low-base metal, volcanic-epithermal vein deposit
- ✘ Unknown mineral-resource potential with a low degree of certainty for base metals at depths below the present precious-metal workings
- ✘ **Drilling is required**

LESSONS LEARNED

- ✘ **Every site is different and must be specifically characterized**
- ✘ Examination of mining districts for AML inventory should include chemistry and full inventory of all mine features
- ✘ Results in evaluation of potential environmental issues and mineral-resource potential assessment
- ✘ Other commodities could be present

FOR MORE INFORMATION

- ✕ <http://geoinfo.nmt.edu/geoscience/hazards/mines/aml/home.html>
- ✕ <http://geoinfo.nmt.edu/staff/mclemore/projects/environment/home.html>