AML Project: Inventory and Characterization of Inactive/Abandoned Mine Land Features in New Mexico

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Abstract

The New Mexico Bureau of Geology and Mineral Resources (NMBGMR) and Mineral Engineering Department at New Mexico Tech are conducting research on legacy mine features in New Mexico. The objective of our research is to develop a better procedure to inventory and characterize inactive or abandoned mine features in the state. This project will inventory mine features in three mining districts in New Mexico: the Jicarilla Mountains District in Lincoln County and the North Magdalena and Rosedale Districts in Socorro County. Samples are collected to determine whole-rock geochemistry, mineralogical, physical, and engineering properties, acid-base accounting, hydrologic conditions, particle size analyses, soil classification, and hazard ranking. Paste pH is used as a proxy for pH in leachate that might enter the water system after passing through mine waste piles. This allows us to determine if there is any potential for acid mine drainage. On several occasions water has been found in shafts, pits, and springs in mined areas. Once found, water is sampled in the field and tested for trace metals, stable isotopes, and general chemistry. By testing water found in and around mine features, we can assess whether AML features are influencing the watershed in which they are found. This allows us to prioritize which sites need remediation. These mine features are being mapped, evaluated for future mineral-resource potential, and evaluated for slope stability. The results of these studies will help the AML and other organizations better understand and remediate our state's legacy mining issues.

Project Goals and Procedures

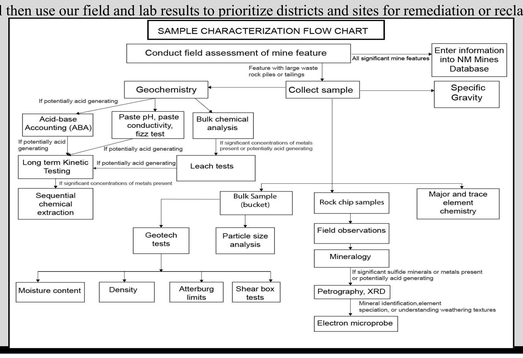
Abandoned Mine Lands (AML): Lands that were mined and left unreclaimed where no individual or company has reclamation responsibility. These may consist of excavations, either caved in or sealed, that have been deserted and where further mining is not intended. Also called inactive, legacy, and orphaned mines.
Source: https://geoinfo.nmt.edu/geoscience/hazards/mines/aml/home.html

Project Goals:

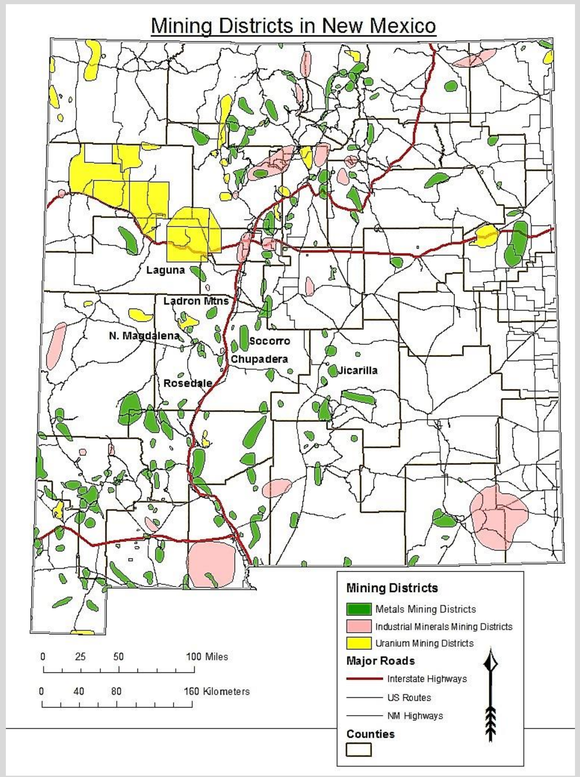
- To develop a relatively quick and inexpensive procedure to inventory and characterize AML/legacy mines in order to provide data on mining districts, mines, and mills in New Mexico.
- To characterize existing waste rock piles for backfill material, determine if there is potential for leaching metals or acid drainage (AD) from waste materials, and help plan and assess reclamation procedures.
- Understand geologic processes
- Provide background data that can assist with the planning of future mining operations
- To make informed decisions about economic impacts, resource development and management, impacts on water supplies, impacts on land use, and physical hazard assessment and remediation

Procedures:

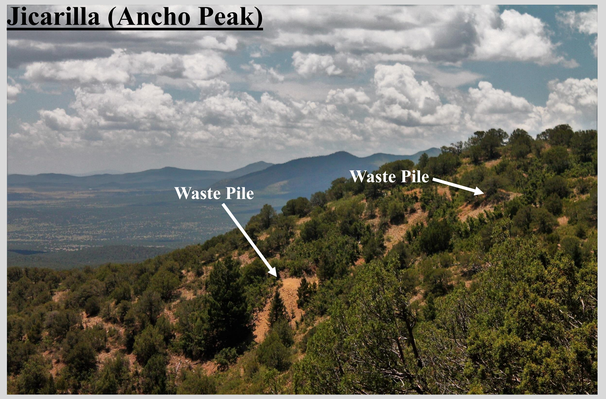
- Sites are located and mapped with GPS in the field. The location, geology, setting, and history of the sites are inventoried and later added to the database. Often, samples of rock or waste are collected and then prepared in-lab for various analyses.
- Paste pH is used as a proxy for determining potential AMD, particle size analyses are used to determine metal partitioning in mine waste, electron microprobe and XRD are used to classify mineralogy within samples and detect the presence of gold, fractions of soil samples are sent to ALS Reno for geochemical analysis, and laboratory petrographic analysis is performed on all waste rock samples collected in the field.
- The results from these tests are then used in the reports we write for the AML program that our work falls under.
- AML will then use our field and lab results to prioritize districts and sites for remediation or reclamation.



Current Mining Districts Under Evaluation



Jicarilla (Ancho Peak)



North Magdalena (shaft)

Rosedale (Big Rosa Canyon)

Rosedale (Bell Mine Adit)

Water Sampling

In conjunction with the Aquifer Mapping Program (AMP) we have collected water samples from select areas in the Rosedale Mining District.

- Water has been collected from 3 locations: the Robb Mine, at a spring in Big Rosa Canyon, and downstream of a waste rock pile from the creek sourced from that same spring.
- Samples are being tested for **general chemistry, trace metals,** and **stable isotopes.**
- Trace metals samples were filtered and acidified prior to lab analysis and all samples were kept cold after collection.
- Results are pending, so we have not drawn any conclusions at the time of this presentation though our results will hopefully help us understand how geology and different mining techniques affect water quality.

BRC Spring Sample 1

Robb Shaft (Rosedale)

Preliminary Conclusions

Jicarilla District:

- The Jicarilla District does, at some sites, contain sufficient pyrite to be potentially acid generating.
- Quantitative analyses of some samples indicate arsenic (As) percentages between 0.02-5%. Pitted textures observed in microprobe analyses are consistent with arsenic being leached from pyrite.

Rosedale District:

- It appears that sites in the Rosedale district do not contain pyrite based on current data and thus do not pose an environmental threat via AMD. We are still awaiting geochemical results that may show otherwise; however, it is unlikely due to the nature of the geologic setting.
- Water samples from Rosedale have only shown high Mn and Al levels, but more data is required from the surrounding watershed to draw any conclusions.

North Magdalena:

- We have only recently begun work on N. Magdalena, however what we have seen so far has been sites of copper production.
- N. Magdalena is known to have had vanadium, gold, silver, and other commodity production, so further fieldwork will reveal whether or not there is environmental risk from those sites.

Selected References & Acknowledgements

- This report is part of on-going studies of mineral resources in New Mexico, supported by the New Mexico Bureau of Geology and Mineral Resources (NMBGMR), Nelia Dunbar, Director and State Geologist.
- Funding for this project is from: New Mexico Bureau of Geology and Mineral Resources, Energy Minerals and Natural Resources Department and the U.S. Department of the Interior, Office of Surface Mining and Reclamation, Mineral Engineering Department of NMT, New Mexico Geological Society, New Mexico EPSCoR (funded by the National Science Foundation award #IIA-1301346).
- Furthermore: Bonnie Frey assisted with paste pH, water analysis, and EPSCoR funding. Stacy Timmons and Kitty Pokorny provided water sampling equipment and training. Kelsey McNamara assisted with the XRD analyses and Lynn Heizler assisted with the electron microprobe analyses. Mark Mansell set up the GIS project. Amy Trivitt provided database and mining archives support. William Zutah, Navid Mojtabai, Bonn Durica, John Durica, and Ashlynne Winton assisted in the field and with laboratory analyses. The Cameca SX-100 electron microprobe at NMIMT was partially funded by NSF Grant STI-9413900.
- Information on the AML project through New Mexico Tech can be found at: https://geoinfo.nmt.edu/geoscience/hazards/mines/aml/home.html
- McLemore, V.T., Silva, M., Asafo-Akowuah, J., and Shakelford, J., 2017, AML project: Inventory and characterization of inactive/abandoned mine (AML) features in New Mexico (abstr.): Environmental Conditions of the Animas and San Juan Watersheds with Emphasis on Gold King Mine and Other Mine Waste Issues, Farmington, May (WRRI)