Mineralogy and Chemistry of Abandoned Mine Lands

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Overview

• We aim to characterize the in-situ mineralogy in 3 historic mining districts in NM
  • North Magdalena, Jicarilla, Rosedale
• This will then be compared to mineralogy of waste rock piles to observe effects of weathering on the surrounding environment
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
North Magdalena

- North Magdalena commodities:
  - Copper, gold, silver, vanadium, barium, manganese
- Mining methods:
  - Underground (adits, shafts)
  - Small surface pits, cuts, and trenches
Chrysocolla is abundant at many of the mine features inventoried at North Magdalena.

Barite, $\text{BaSO}_4$, has been observed at some locations within the district.
• Hydrothermal breccias suggest a possible origin for some of these deposits.

• Green secondary copper minerals are associated with veins of silica
Jicarilla

- Jicarilla district commodities:
  - Gold, silver, copper, iron

- Mining methods:
  - Underground and surface
  - Placer gold pits
• Iron skarns are common throughout this district

• Primarily magnetite and hematite

• Some copper minerals are associated with these deposits

• More work is needed
Aragonite

Chrysocolla (+ other Cu Minerals?)
Rosedale

Commodities:
• Au, Ag

Mining Methods:
• Underground and surface

Deposit Type:
• Volcanic-Epithermal
Unknown cubic mineral (fluorite?)

Massive silica
Examining chemistry to determine acid generating potential and suitability for backfill material

Paste pH and acid base accounting allow us to plot waste rock on an ARD Potential Diagram

Most AML sites are non-acid forming or uncertain

Example: Silverton Colorado (not part of AML order) plotted in the potentially acid forming range based on NAGpH and NPR.

Acid generating mineralogy: pyrite, FeS$_2$, is usually the culprit.

Sulfide oxidation by precipitation and surface weathering yields yellow jarosite, KFe$_3$(SO$_4$)(OH)$_6$, and sulfuric acid, H$_2$SO$_4$. 
Next Steps…

- Mineralogical analysis: X-Ray Diffraction, Electron Microprobe, Petrography
- Characterize and document mineralogy in the rock and in the waste piles
- Perform more chemical analyses to determine potential for environmental impacts
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