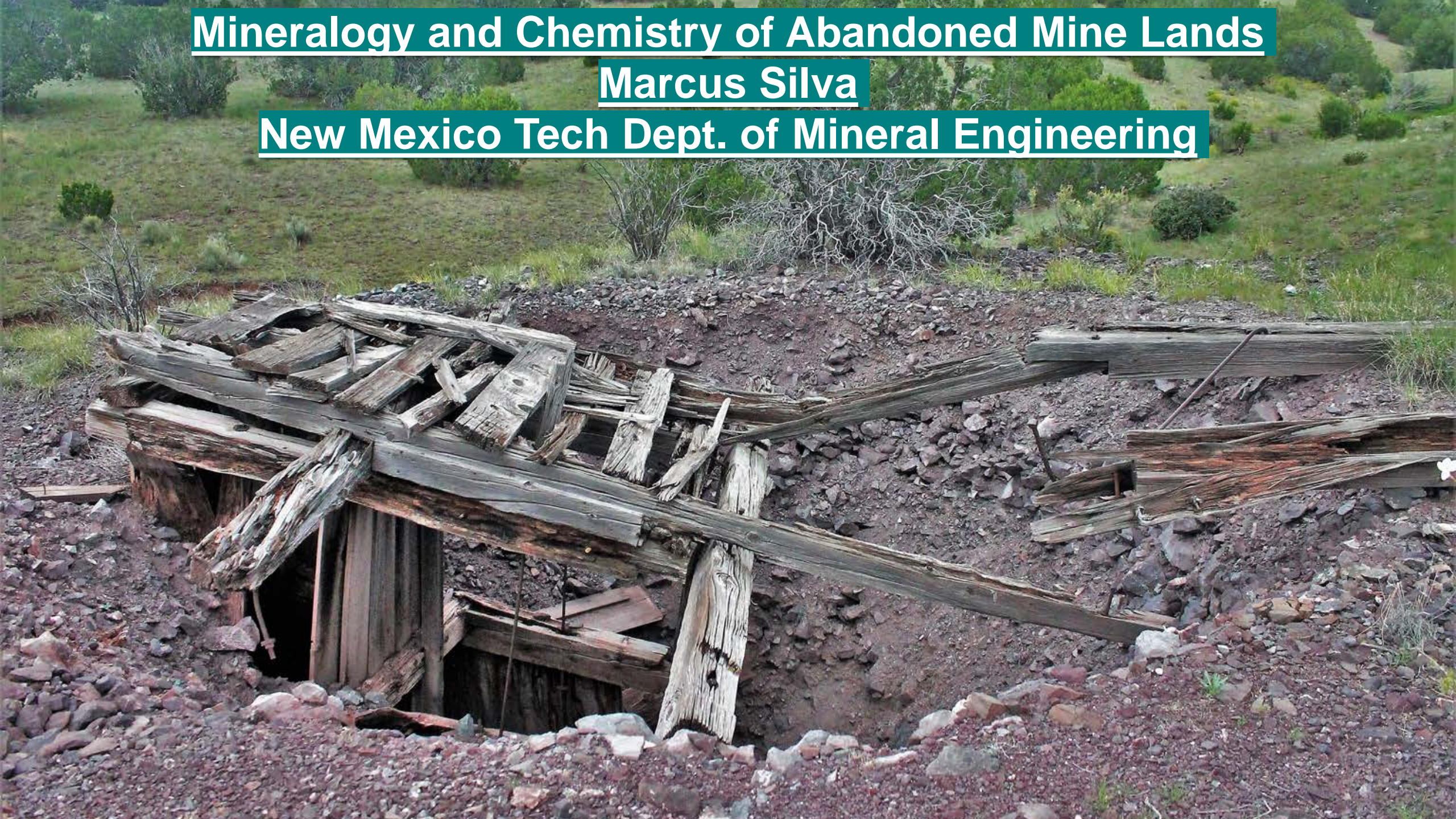


Mineralogy and Chemistry of Abandoned Mine Lands

Marcus Silva

New Mexico Tech Dept. of Mineral Engineering

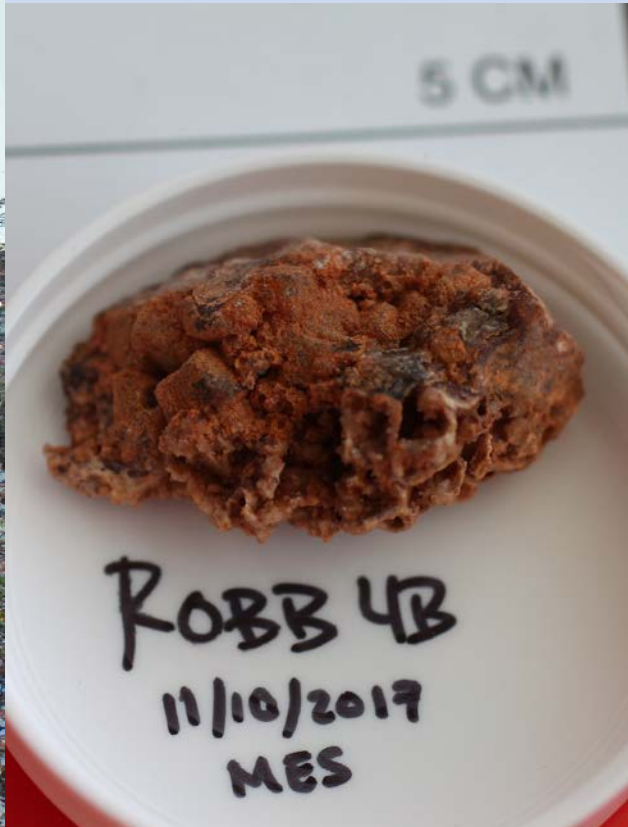


Overview

- 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

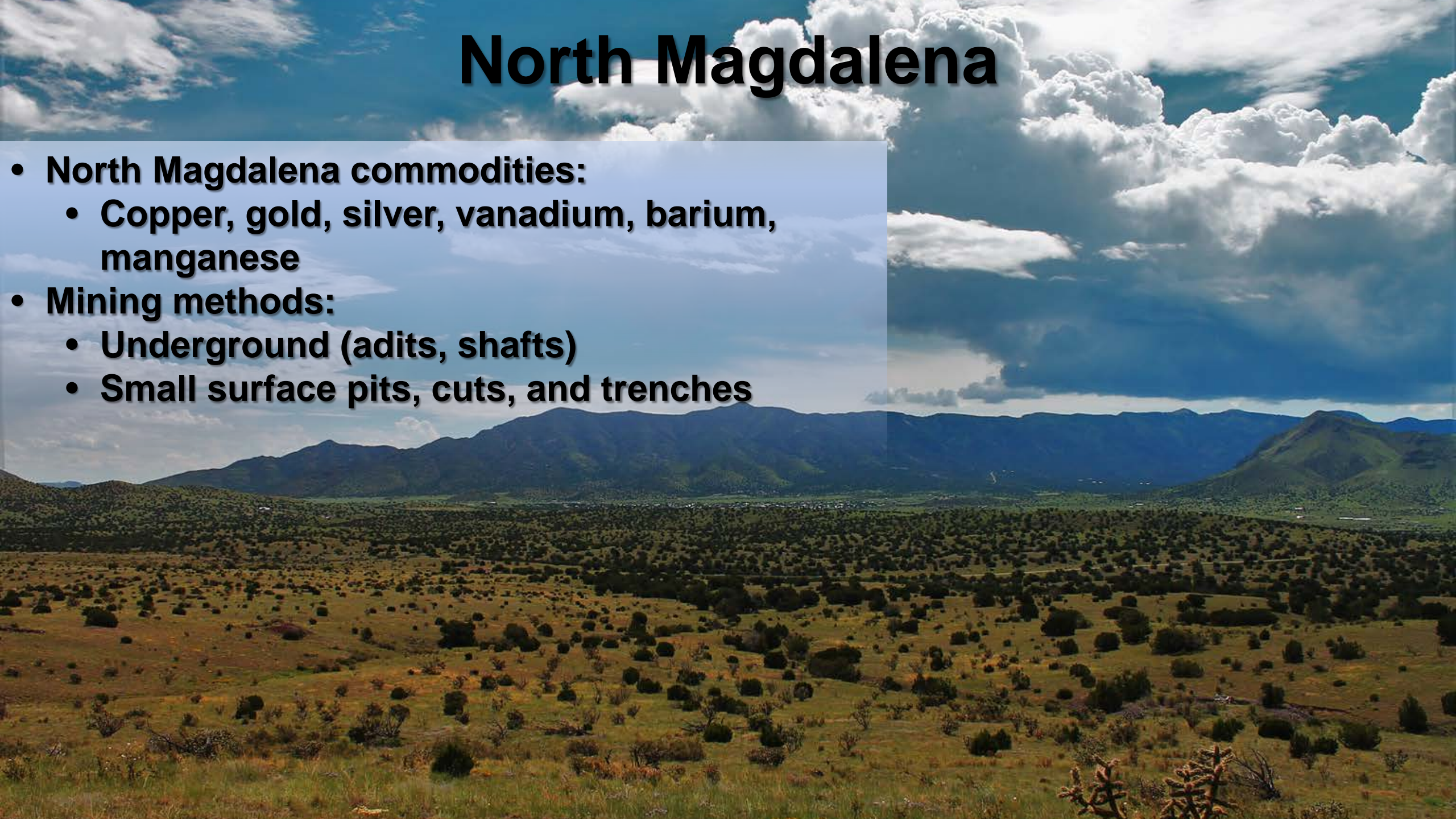
Sampling Types:

- **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



**Barite, BaSO_4 , has been
observed at some locations
within the district**



**Chrysocolla is abundant at many of
the mine features inventoried at
North Magdalena**



- **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**



Chrysocolla (+ other Cu Minerals?)



Aragonite

Rosedale

Commodities:

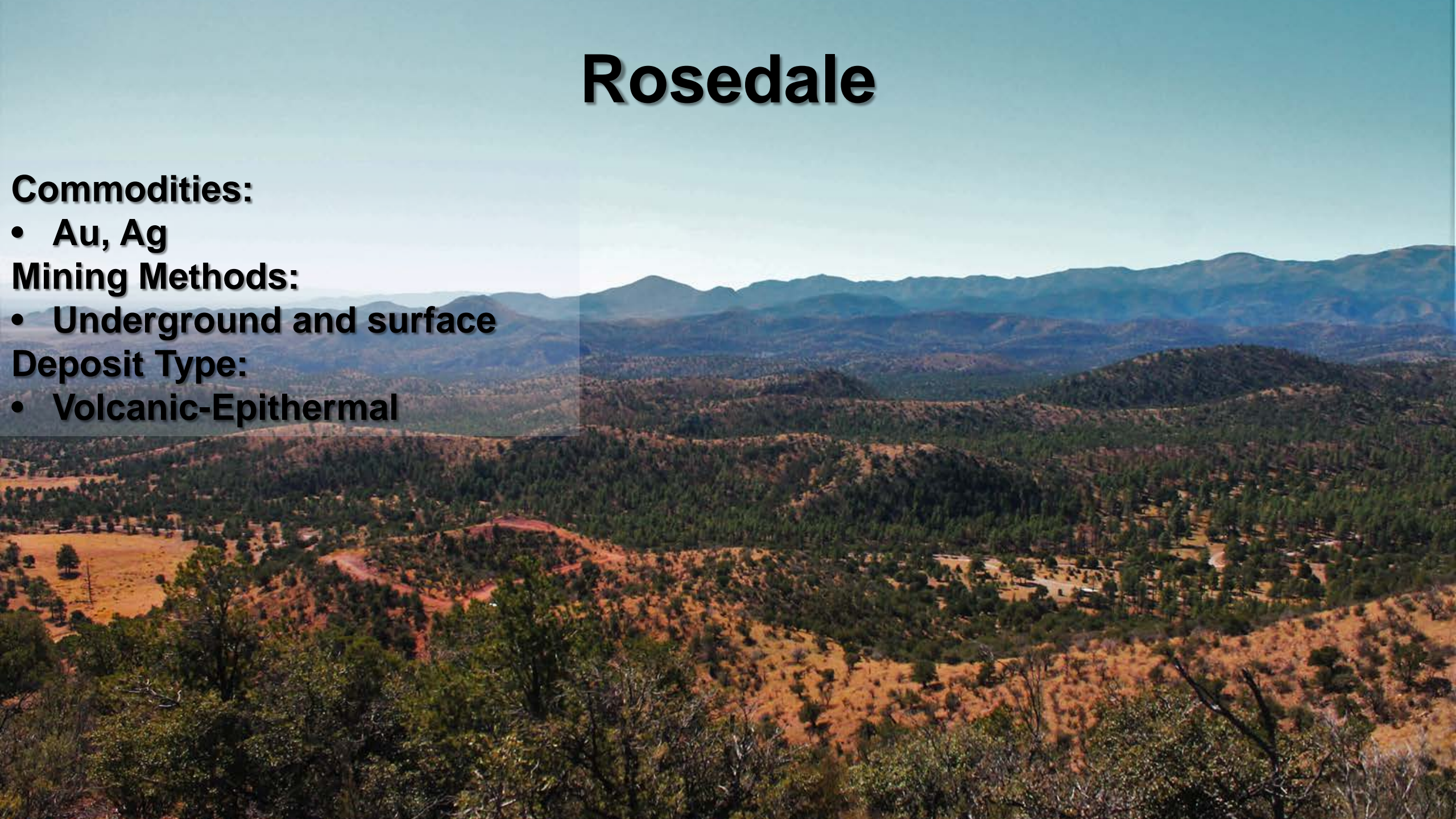
- Au, Ag

Mining Methods:

- Underground and surface

Deposit Type:

- Volcanic-Epithermal





**Unknown cubic mineral
(fluorite?)**



Massive silica

Chemistry

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

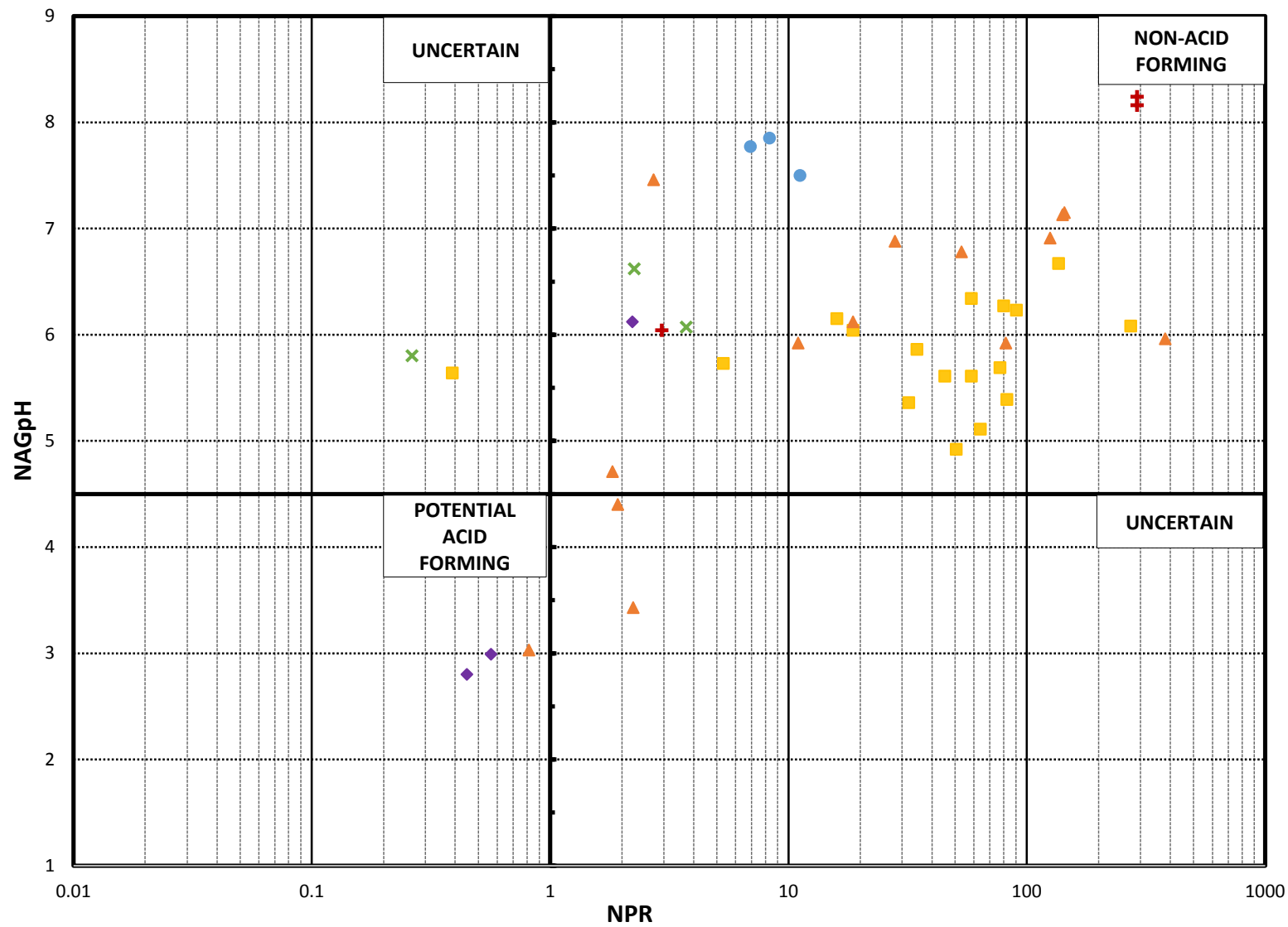
Example: Silverton Colorado (not part of AML order) plotted in the potentially acid forming range based on NAGpH and NPR.

Acid generating mineralogy: pyrite, FeS_2 , is usually the culprit.

Sulfide oxidation by precipitation and surface weathering yields yellow jarosite, $\text{KFe}_3(\text{SO}_4)(\text{OH})_6$, and sulfuric acid, H_2SO_4



Combined ARD Classification Plot



● Jeter Mine ■ Rosedale District ▲ Jicarilla District ◆ Silverton, CO ✕ St. Anthony Mine + Little Davie, Lucky Don, Chupadera



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**

Special Thanks To:

- **Virginia McLemore**
- **Navid Mojtabai**
- **Joseph Blais**
- **Bon and John Durica**
- **William Zutah**
- **Bonnie Frey**

Questions?

