THE CHARACTERIZATION OF ABANDONED URANIUM MINES IN NEW MEXICO

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OUTLINE

- Background
- Problem Identification
- Objectives
- Study Area
- Methodology
- Observations
- Conclusions

BACKGROUND

- 1948 – 2002, >347 million pounds of U was produced in NM cumulatively amounting >$ 4.7 billion
- Aftereffects of Mining and Exploration in NM has resulted in >300 legacy Abandoned Uranium Mines (AUM)
- >1000 uranium prospects and occurrences in NM (>100 ppm U)
- These mines/prospects typically include two or more actual mine features

BACKGROUND—continued

- Many of these AUM pose little or no environmental or stability threat to the public and environment, but field examination is required to be certain
- New Mexico Mining and Minerals Division (NMMMD) has assessed approximately 57 AUM
- Most larger uranium mines have been or are being reclaimed by the former operating companies

PROBLEM IDENTIFICATION

- Reclamation efforts have not examined the long-term chemical effects from these mines
- There is still potential for environmental effects long after remediation of the physical hazards, as found in several areas in NM including Jackpile mine, Laguna subdistrict
- Some of these observations only come from detailed electron microprobe studies
- Many more legacy mines in NM, which either have not been safely remediated or closed or their status is unknown

OBJECTIVES

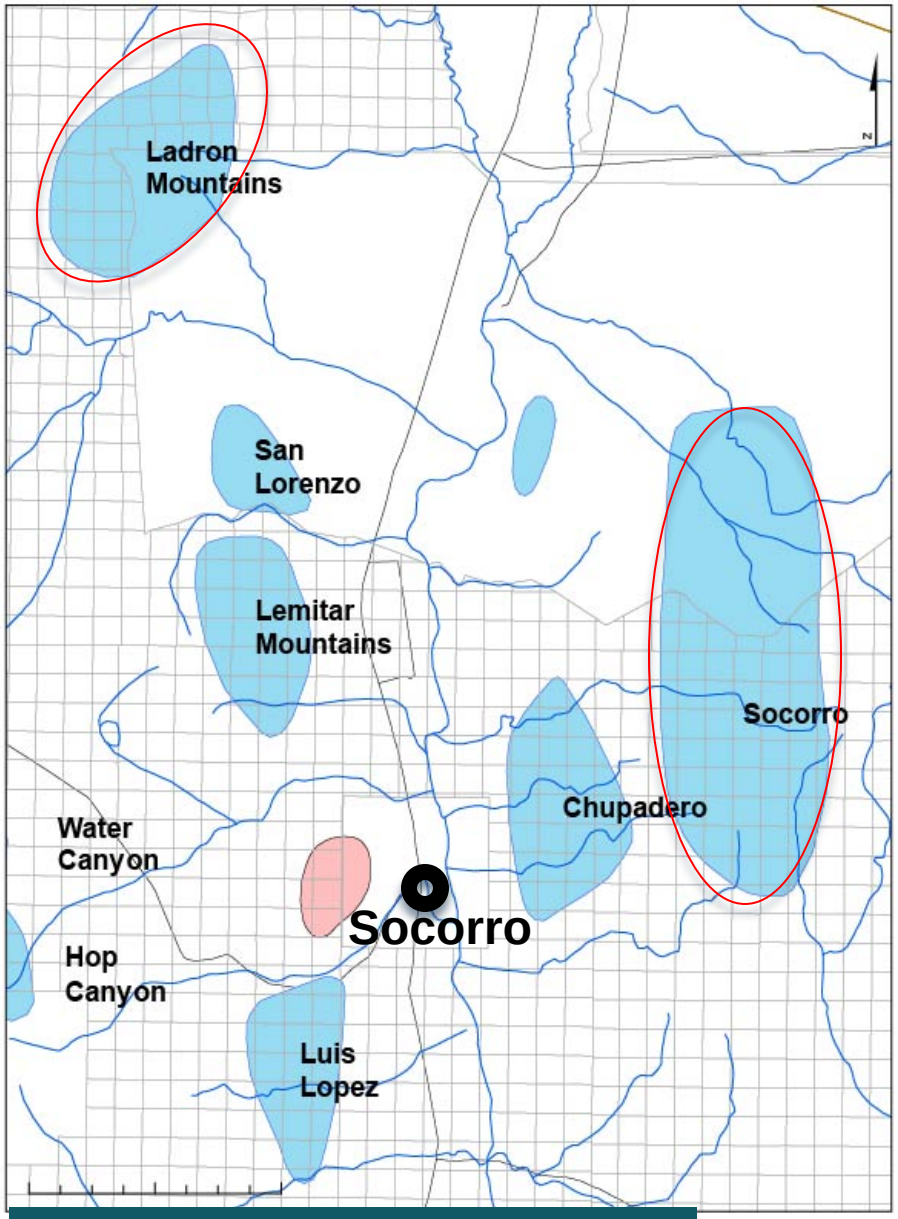
- **To develop a relatively quick and inexpensive procedure to inventory and characterize legacy uranium mines**

  - Determination of criteria for use of existing rock piles for backfill material
  - Location of additional sources of backfill material if available
  - Estimates of how local weather would affect the remediation
  - Determine if there is potential for leaching U, V from waste materials

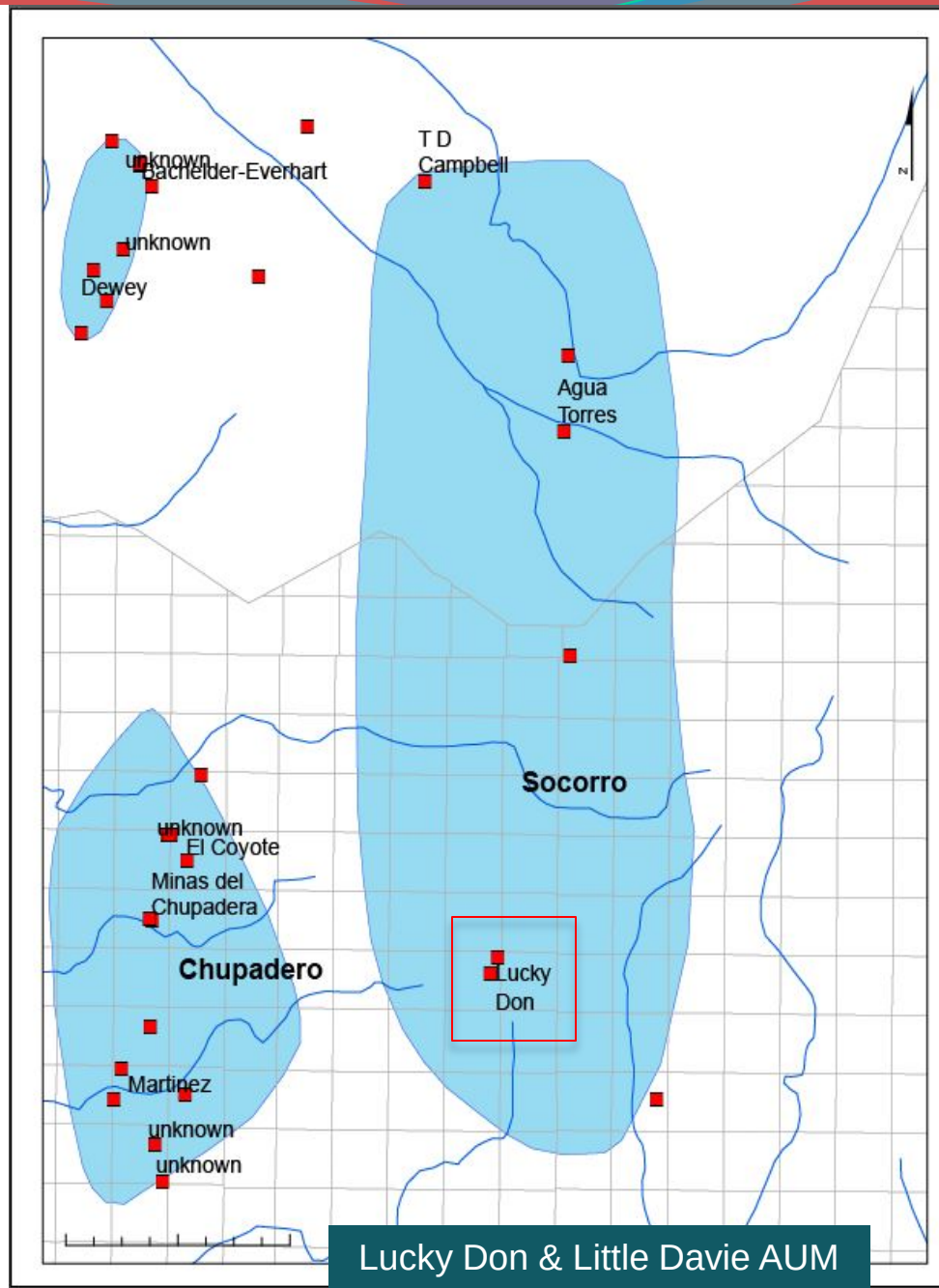
STUDY AREA

- **Lucky Don and Little Davie uranium mines**
  - ✓ Rio Grande Rift Cu-Ag (U) vein deposit type along faults in the Permian San Andres Formation
  - ✓ Lucky Don produced 1955–1963 U, V from limestone by surface and underground methods
  - ✓ Little Davie: U, V mined from limestone by surface and underground methods in 1955
  - ✓ Estimated value of U produced by Lucky Don and Little Davie $70,000

MAP OF STUDY AREA



Mining districts within Socorro County



Lucky Don & Little Davie AUM

Examples of Legacy mine features

Loading bin, Lucky Don

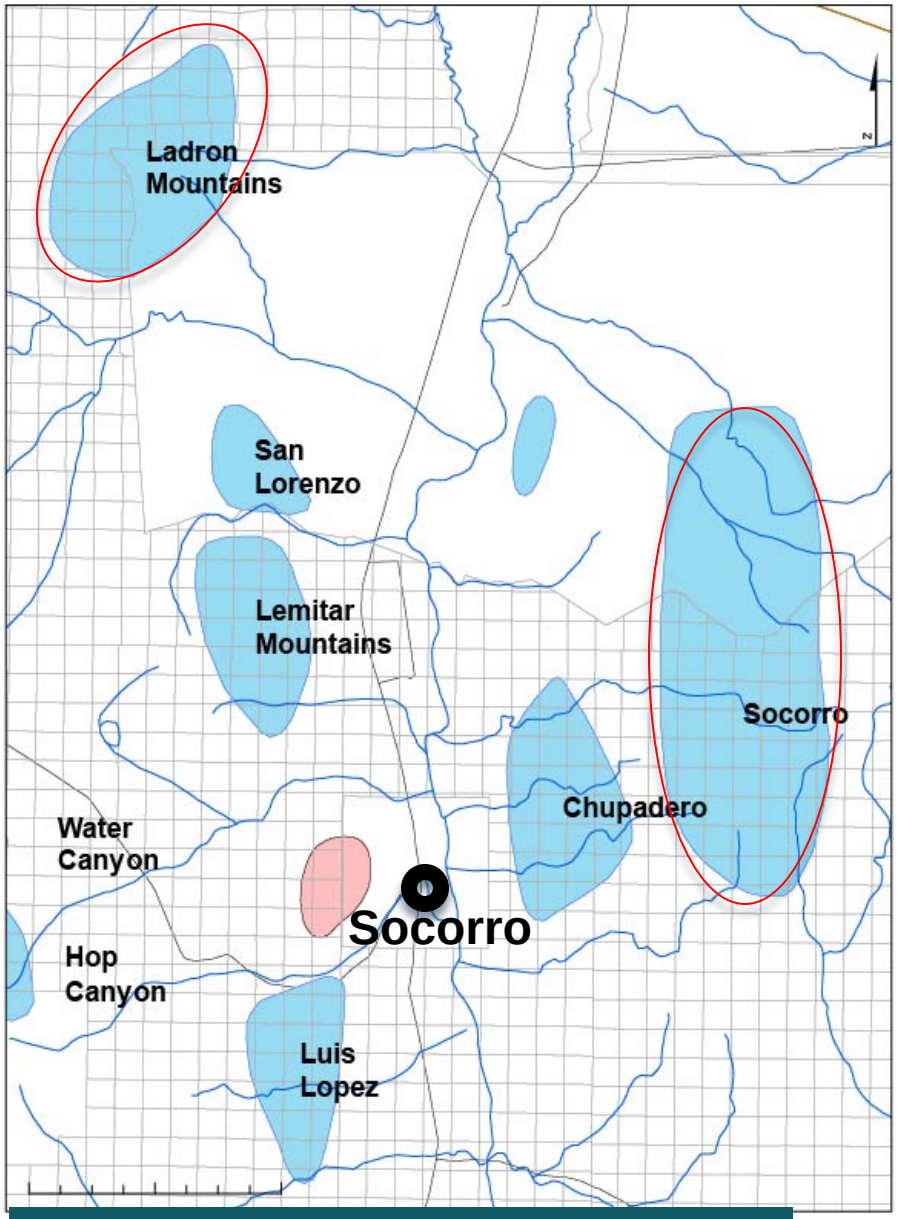
Waste pile

Mine face

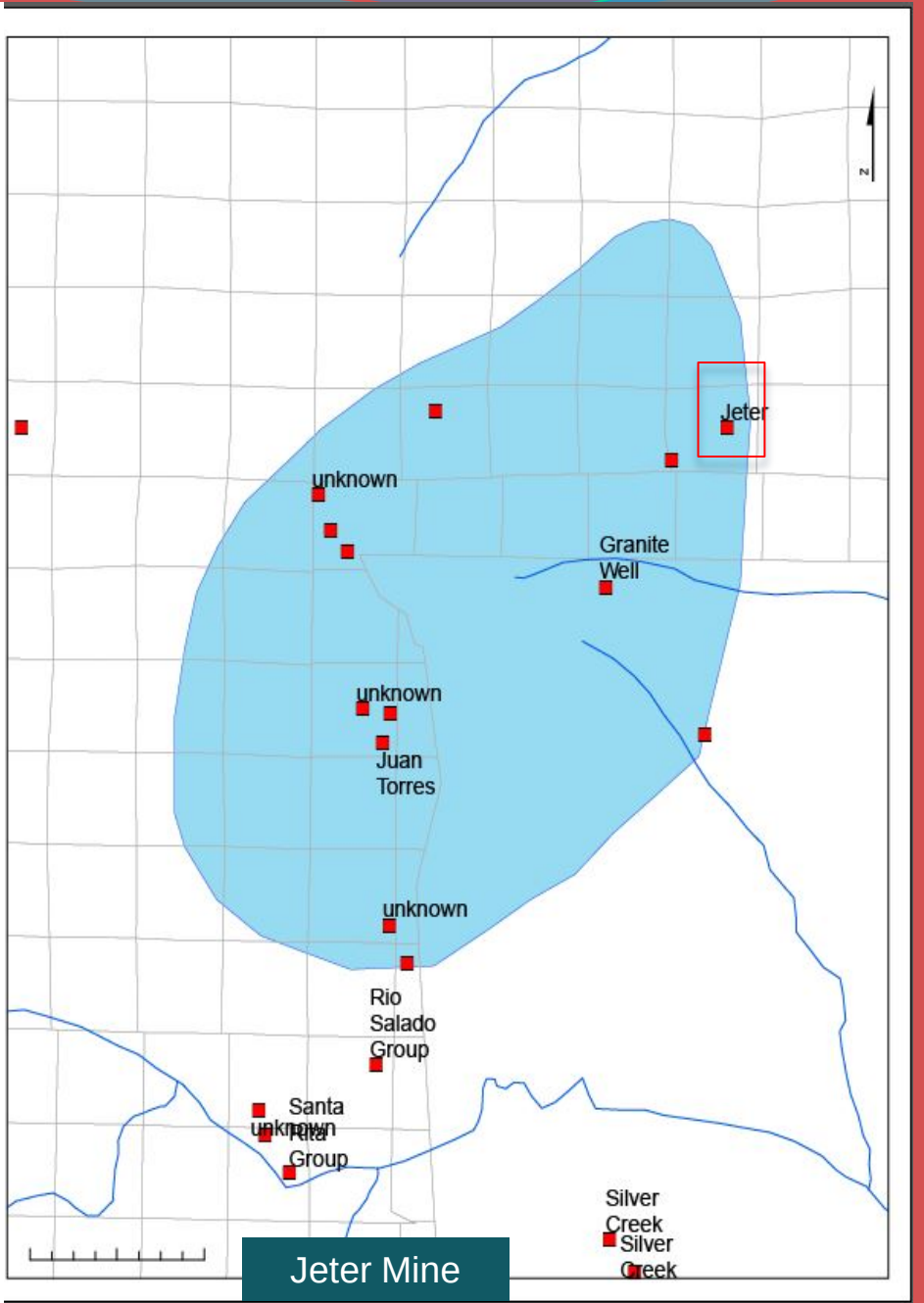
STUDY AREA

- **Jeter mine**
  - ✓ Rio Grande Rift Cu-Ag (U) vein deposit type along a fault between Proterozoic Capirote granite and the Miocene(?) sediments
  - ✓ 1954–1958 U, V were mined from the clay zone in fault gouge along the Jeter fault by surface and underground mining methods
  - ✓ Total U produced from Jeter mine amounts to 58,562 pounds worth $500,000

MAP OF STUDY AREA

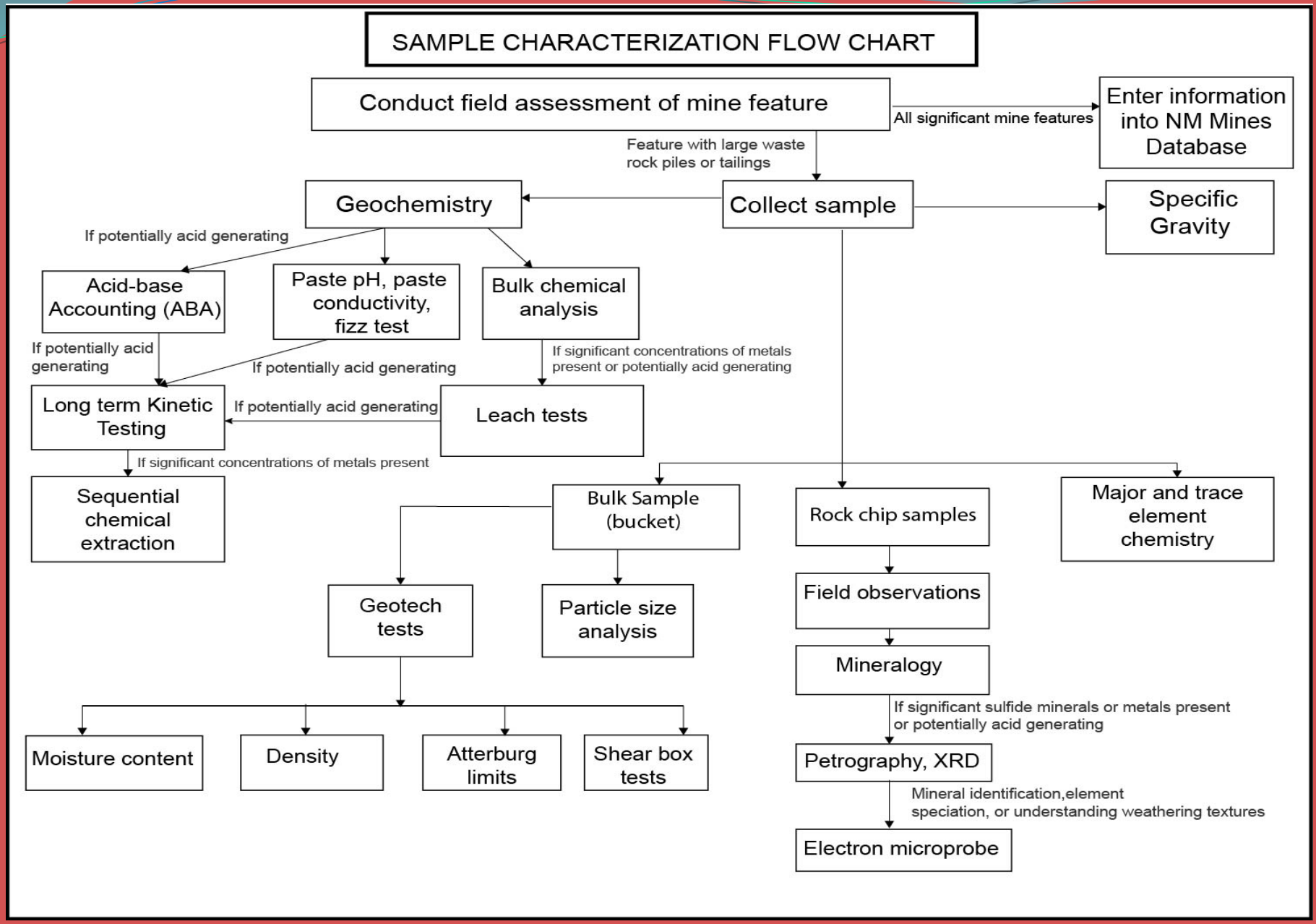


Mining districts within Socorro County



Jeter Mine

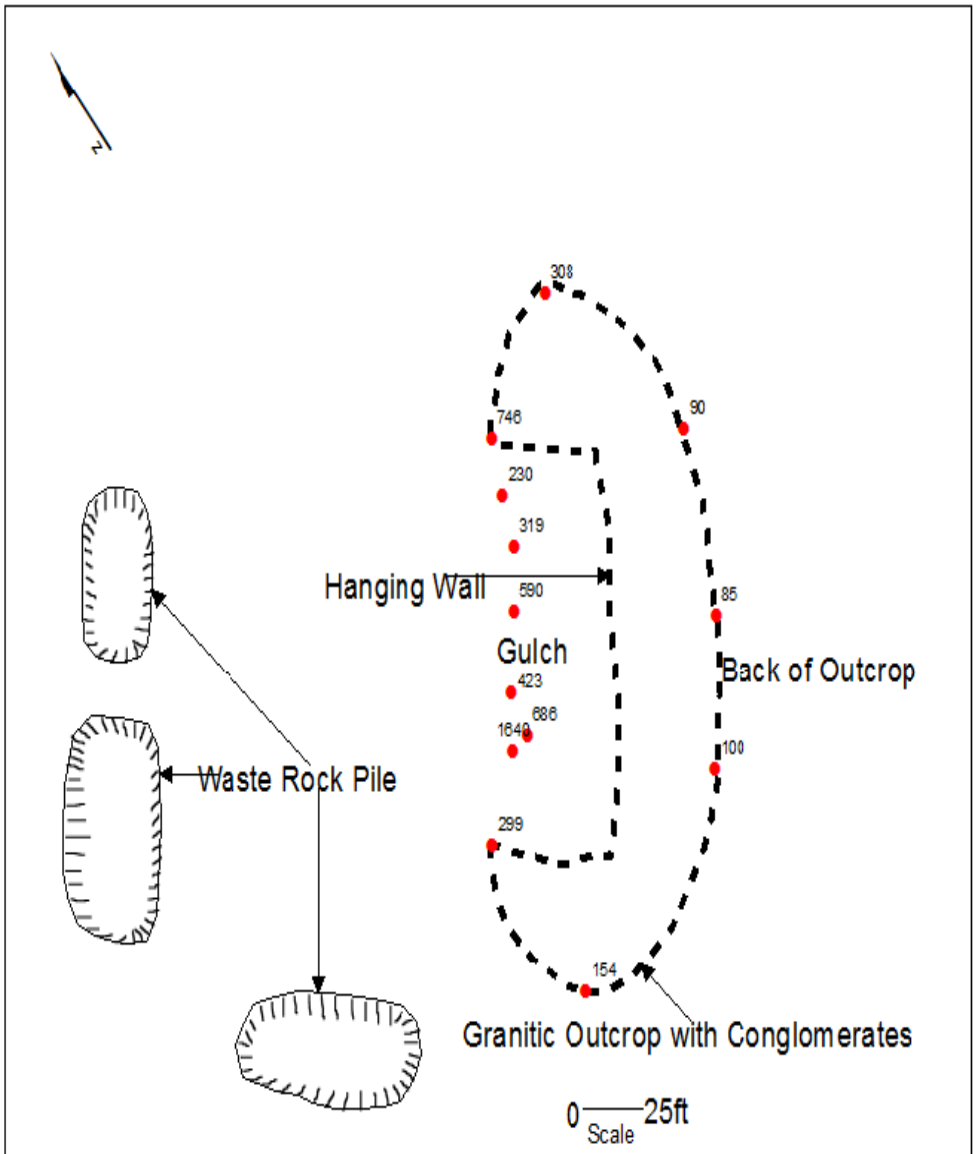
OUR APPROACH



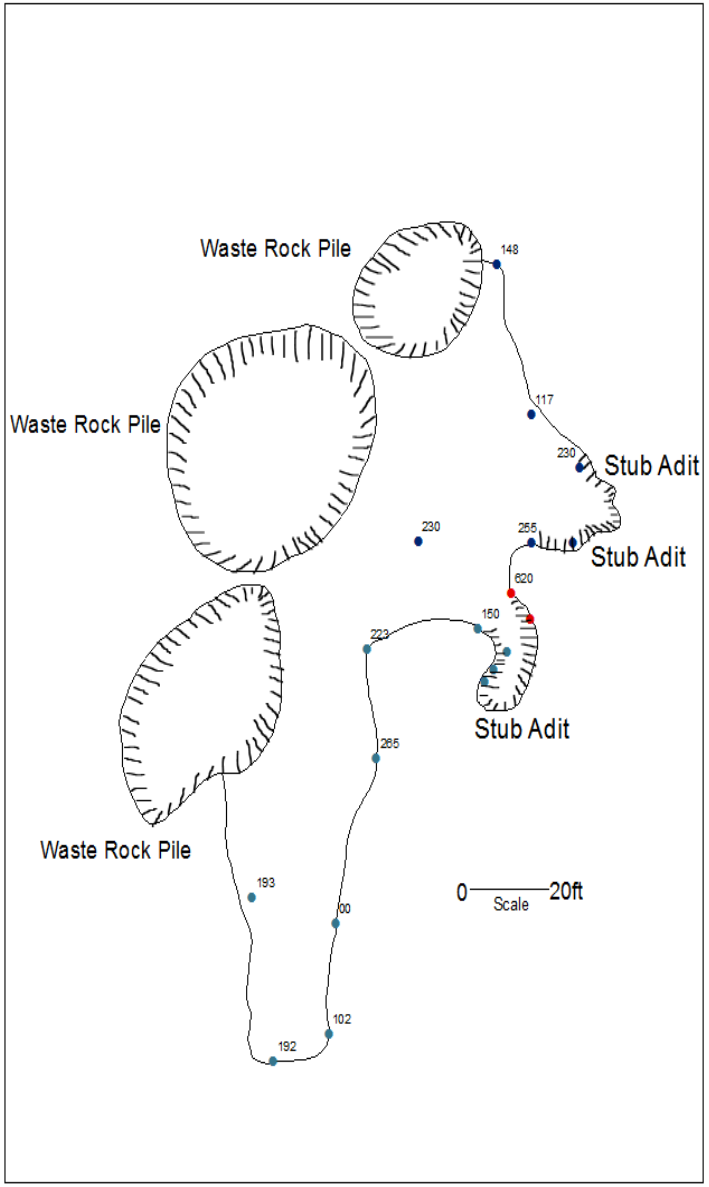
METHODOLOGY

- GPS/scintillometer map
- Waste rock pile sampling

SKETCH OF JETER MINE



SKETCH OF STUB ADITS AND WASTE ROCK PILES



OBSERVATIONS (Scintillometer Readings)

Uranium Mine	Background Radiation (cps)	Min Radiation (cps)	Max Radiation (cps)
Lucky Don	20-50	100	4,435
Little Davie	20-50	120	771
Jeter	10-30	80	1,640

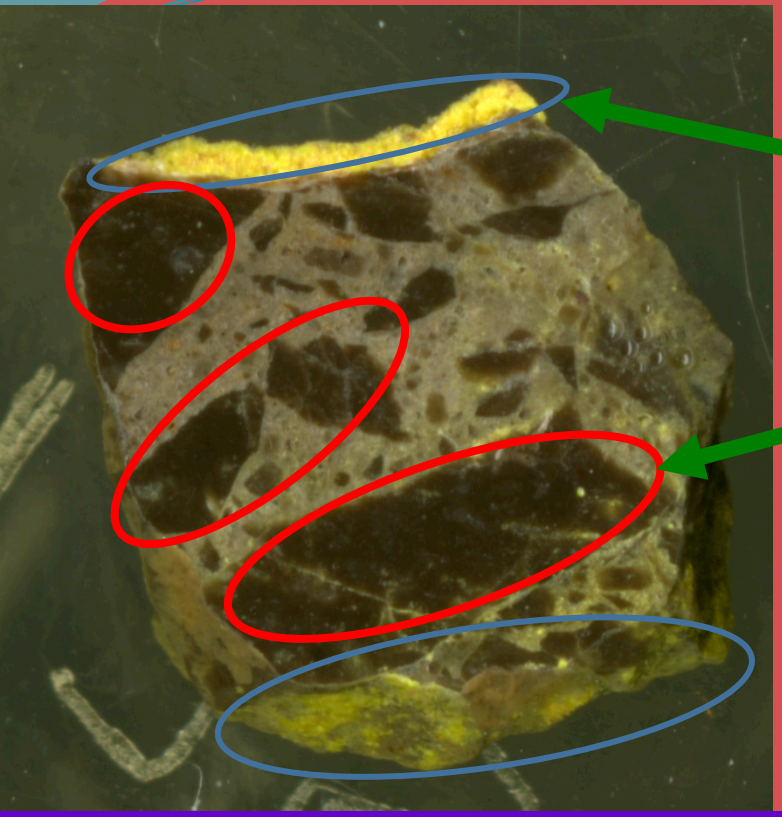
FIELD OBSERVATIONS

Uranium Mine	Mine Feature	Depth of Workings (ft)
Lucky Don	6 stub adits, loading bin, waste/ rock pile	0–40
Little Davie	Pit, short adit, waste/ rock pile	5–10
Jeter	Concrete platform, 3 waste pile	300

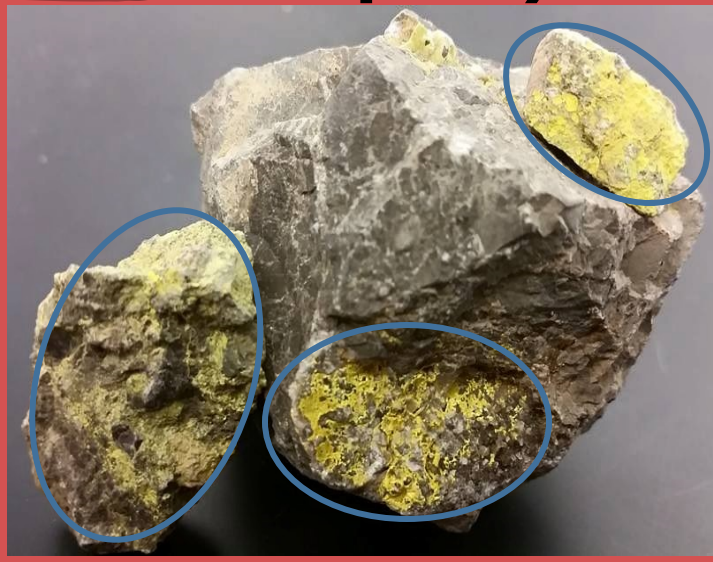
OBSERVATIONS (Ore minerals & Paste pH)

Uranium Mine	Ore Minerals	Paste pH	Field evidence of potential acid drainage
Lucky Don	tyuyamunite, carnotite, uraninite, Cu minerals, uranophane	**~8.16**	**No**
Little Davie	tyuyamunite, carnotite, uraninite, Cu minerals, uranophane	**~8.24**	**No**
Jeter	carnotite, tyuyamunite alunite, pitchblende, malachite, Fe-Mn oxides, clay, azuritite, barite, calcite	**~7.70**	**No**

OBSERVATIONS (Mineralized samples)



A mineralized sample of host rock from Lucky Don mine (4,435 cps)



Samples of waste pile rocks with disseminated carnotite from Lucky Don

A mineralized sample of host rock from Little Davie mine (771 cps)

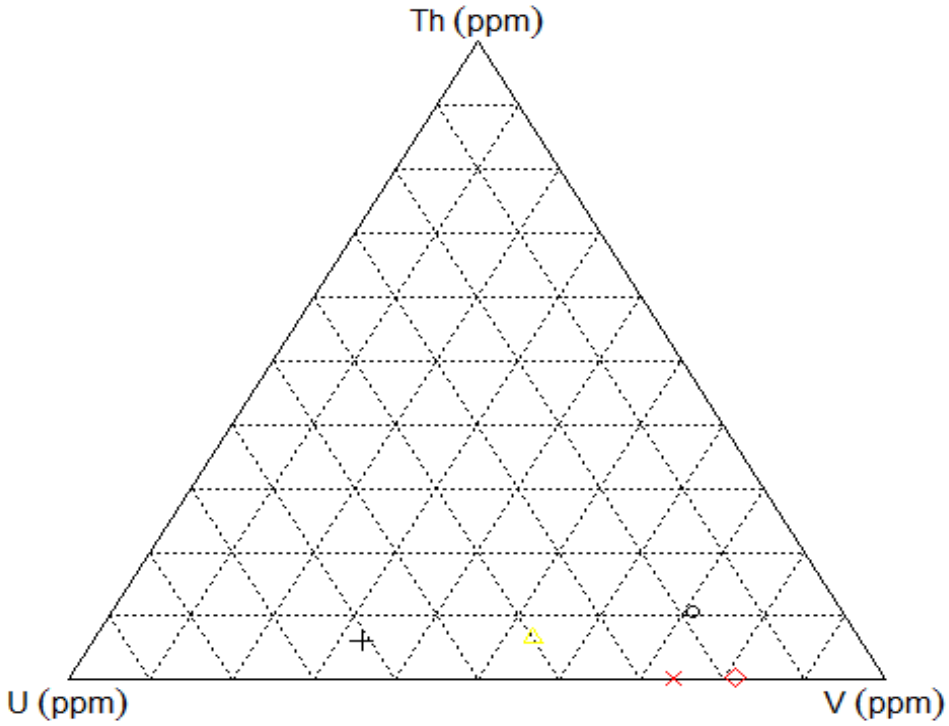
OBSERVATIONS (Chemistry)

Represent U,V >100
Represent U, V >400

Elevated U and V values (>100ppm)

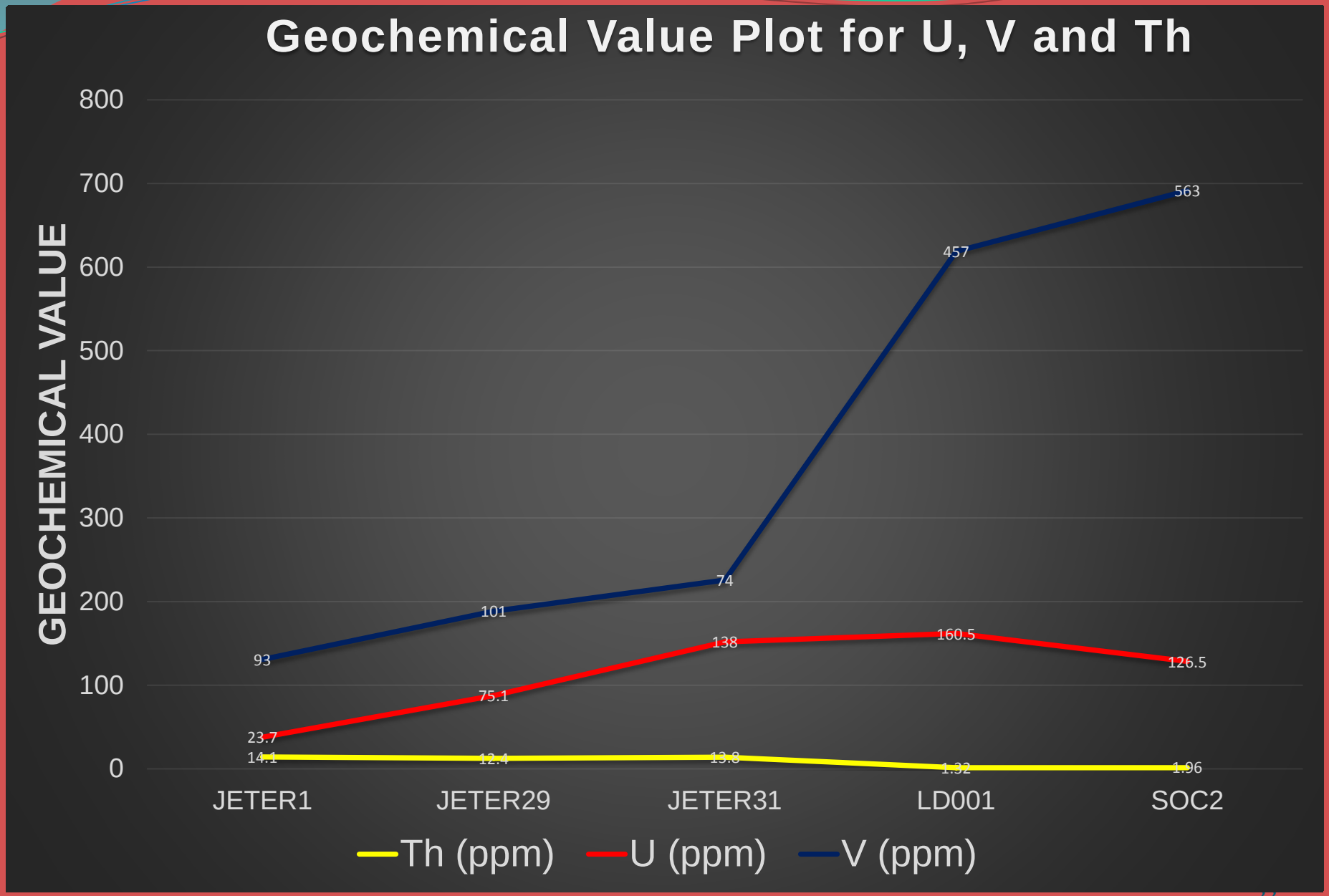
Waste Rock Pile	Uranium (ppm)	Vanadium (ppm)	Thorium (ppm)
Jeter 1	23.7	93	14.1
Jeter 29	75.1	101	12.4
Jeter 31	138	74	13.8
Little Davie	160.5	457	1.32
Lucky Don	126.5	563	1.96

OBSERVATIONS (Ternary plot for U, Th & V)

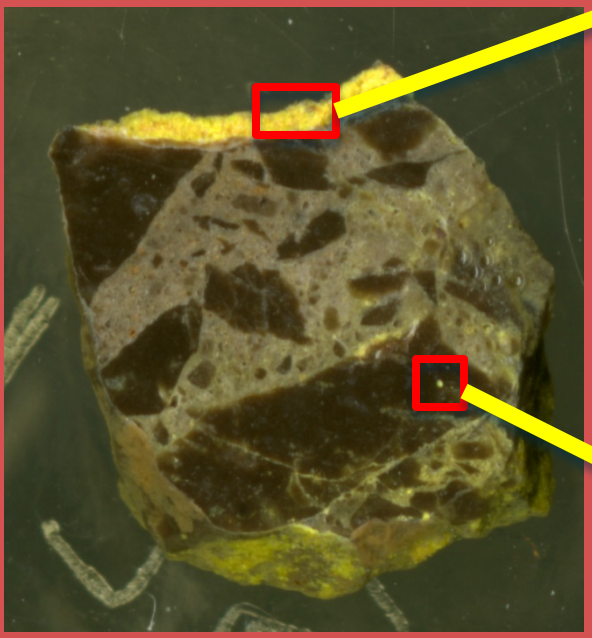


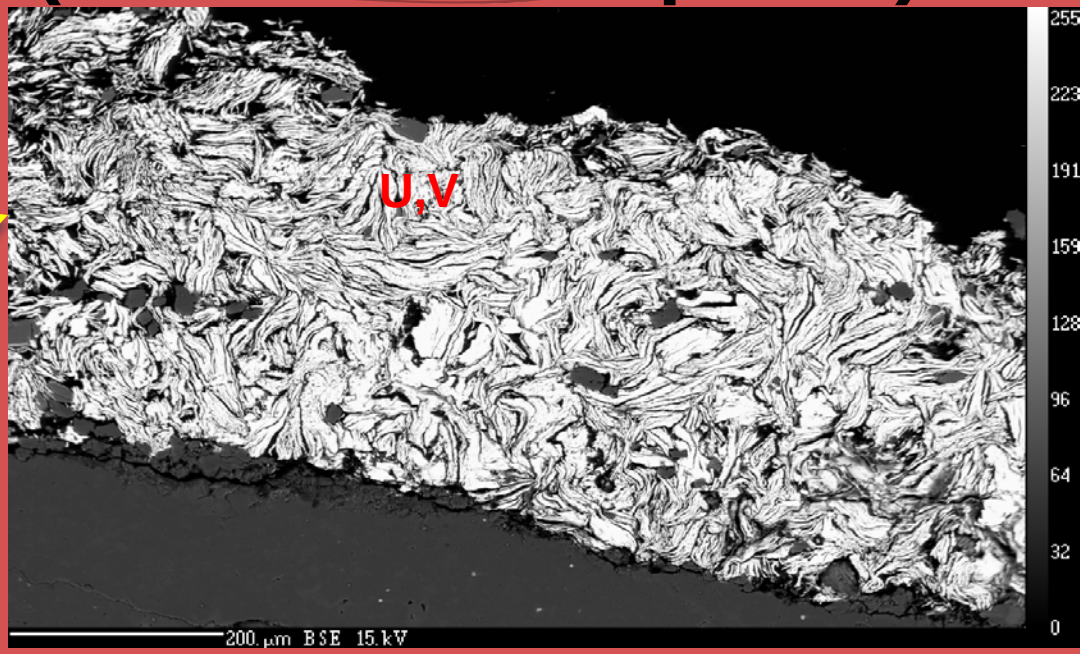
Samples have more V concentrations than U and Th

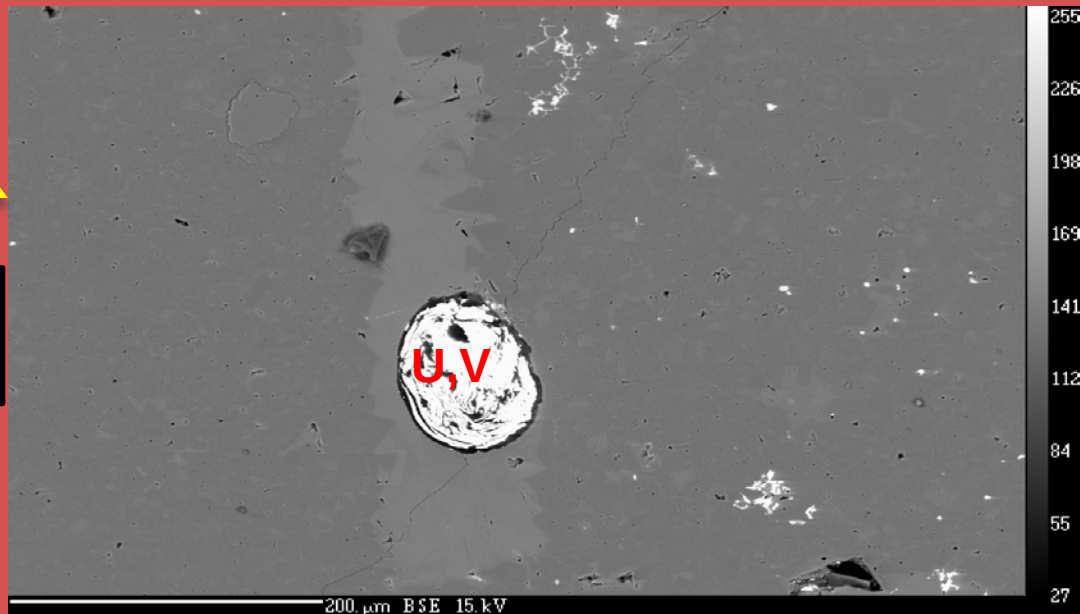
OBSERVATIONS (Geochemical value plot for U, Th & V)



OBSERVATIONS (Electron microprobe)

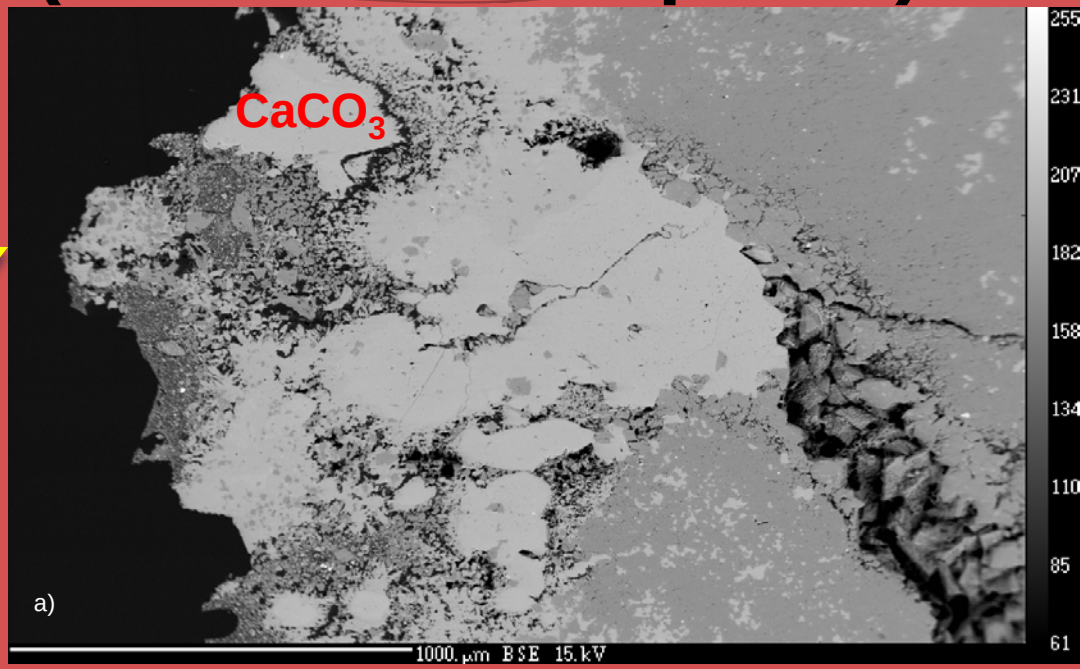


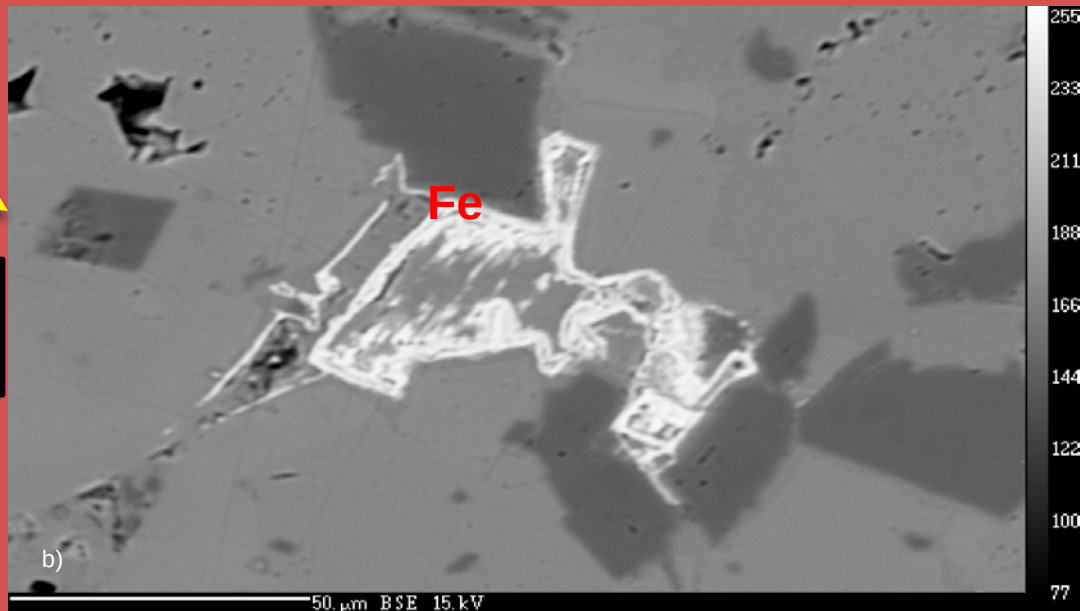




Backscattered electron (BSE) image of U and V grains

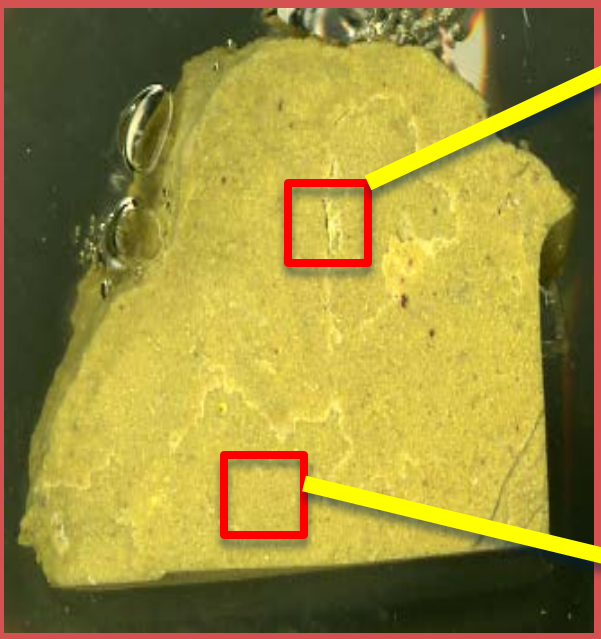
OBSERVATIONS (Electron microprobe)

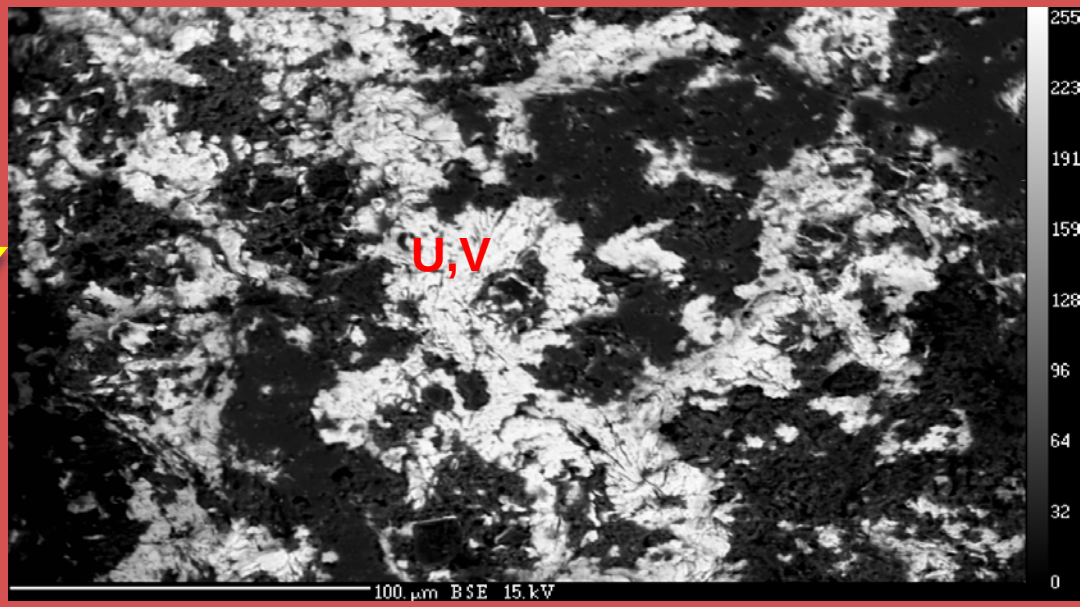


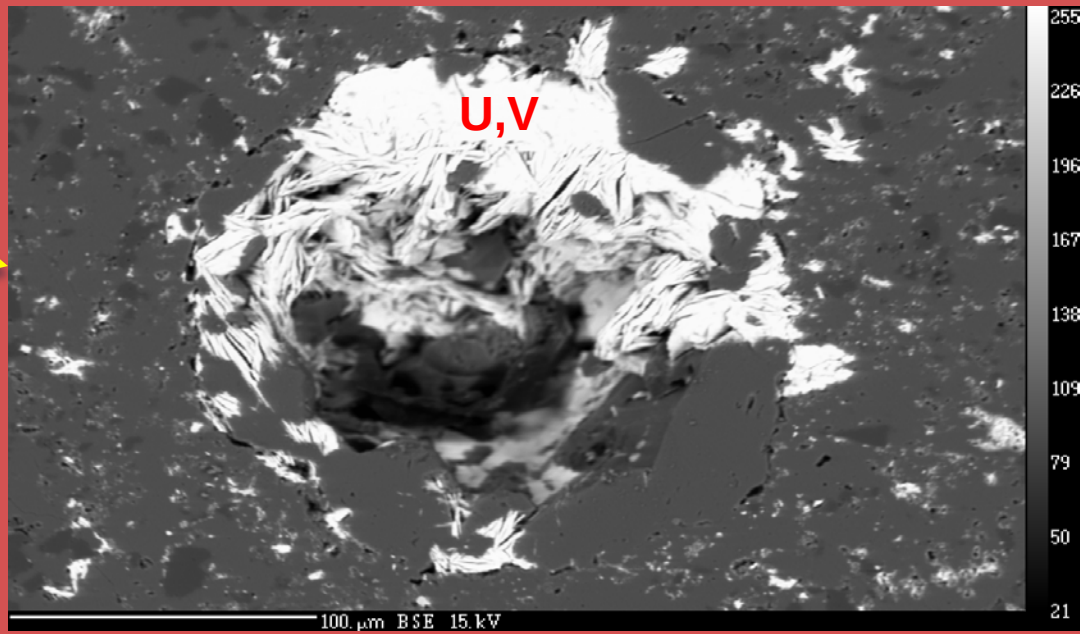


Backscattered electron (BSE) image of a) $CaCO_3$ grain b) Fe-oxide grains

OBSERVATIONS (Electron microprobe)







Backscattered electron (BSE) image of U and V grains

PRELIMINARY CONCLUSIONS

- No evidence of potential acid drainage from field observations
- No pyrite observed in XRD and electron microprobe analysis
- No acid drainage potential from paste pH measurements (pH>5)
- Elevated radioactivity (scintillometer mapping) and U and V values (>100 ppm) from chemical analyses in some waste rock piles
- Waste piles with high radioactivity from scintillometer should be covered

FUTURE WORK

- Proper evaluations for reclamation will be performed after all laboratory analyses data have been completed

- Further field studies needed to determine the mineral potential of area

THANK YOU

QUESTIONS