

# Critical Minerals at the University of Alaska

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# ALASKA'S MINERALS

A Strategic National Imperative | Summary and Next Steps



## PRIORITY AREA

### Outreach/Communication

Publish/publicize research outcomes for broad public consumption in addition to academic or industry audiences

### Promote Constructive/Inclusive Dialogue

Develop broad sustained partnerships through identification of shared goals, community engagement, co-production of knowledge and facilitated communication

### Implement Statewide Strategic Plan

Envision and implement a broadly-supported strategic plan for inclusive development of Alaska's critical mineral resources

### Promote Efficient/Effective Permitting

Industry and agencies work to reduce time required for permitting decisions, while maintaining oversight function

### Social/Environmental/Permitting

Current and projected linkages between mine sites and hydrologic and social/ecological systems

### Separation/Processing/Metallurgy

Enhanced recovering from active streams, waste streams and tailings.

### Promote Geochemical Analysis

Develop additional testing facilities and promote geochemical analysis of geologic samples

### Resource Assessment/Mapping

Continued efforts and technological advances characterizing Alaska's resource potential

### Infrastructure/Access/Climate

Transportation, power and geotechnical issues associated with remote sites and changing landscape

### Develop Support Infrastructure

Construct transportation corridors and provide energy alternatives to remote regions

### Economics/Market Analysis

Economic drivers upon, and impacts resulting from, critical minerals value chain

### Workforce Development

Incorporate mentoring programs, alternative employment models, paid trade programs and/or accelerate education tracks for regulators

*“Envision and implement a broadly-supported strategic plan for inclusive development of Alaska’s critical mineral resources”*

# UAF Alaska Critical Minerals Collaborative (ACMC)

## ***Vision***

Be a globally recognized research and educational organization to support a stable and sustainable critical minerals supply.

## ***Mission***

Advance interdisciplinary critical minerals research and workforce development throughout the supply chain in Alaska and beyond.

Leverage expertise and analytical facilities to answer current and emerging research questions in mineral development.

Advance existing and develop new technologies to discover and produce critical minerals resources.

Coordinate University of Alaska research to support industry and agency mineral research needs.



# Alaska Critical Minerals Collaborative

- A collaborative organization of university researchers and labs focused on critical minerals research
- Formed to expand current faculty and analytical capacities
- Will be branded and socialized with industry, federal and state agencies, and other research universities
- Will conduct research pertinent to industry and agencies
- Aims to increase production of critical minerals from Alaska mines
- Financial support from the Geophysical Institute (GI) and the Institute for Northern Engineering (INE)
- Initially located in the Geophysical Institute



# ACMC Goals

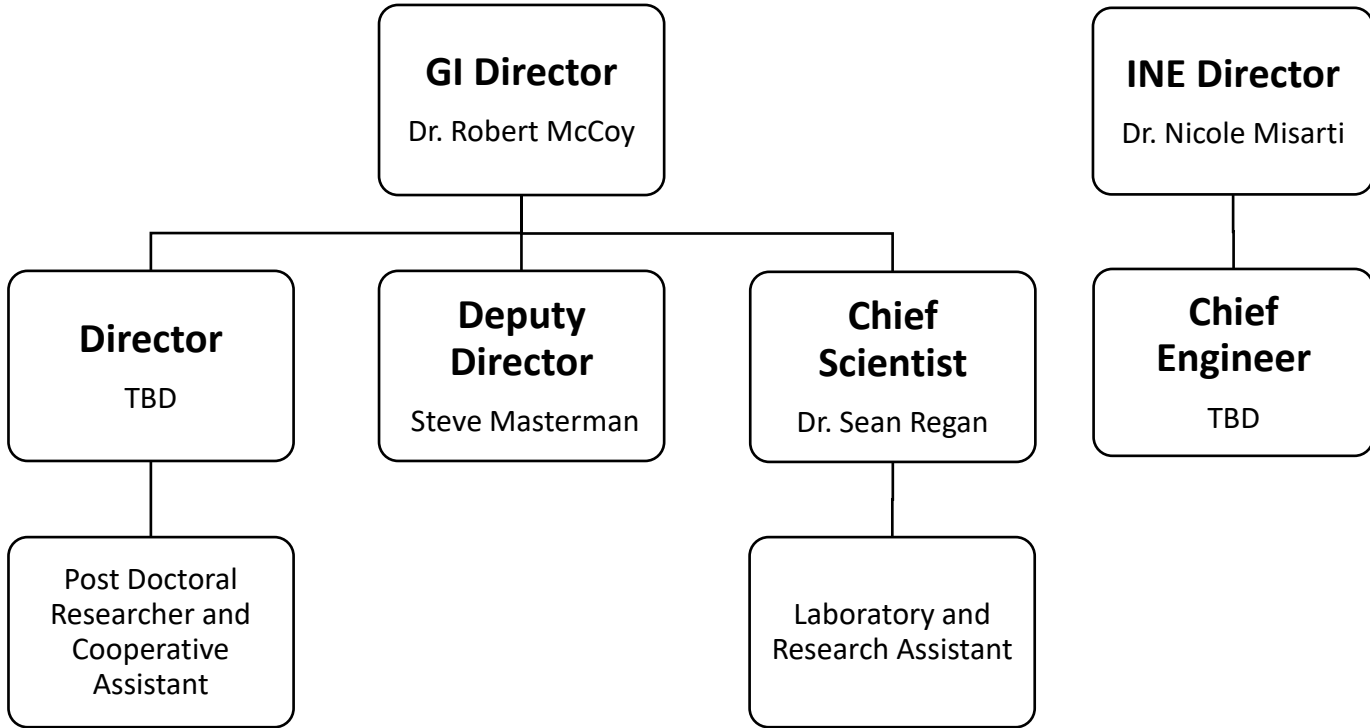
- Conduct research on Alaska mineral deposits to aid their development
- Be the go-to research organization for the Alaska minerals industry
- Be the partner of choice for federal and state agencies seeking minerals research
- Improve current, and develop new mineral exploration techniques
- Expand research in key areas (data science, remote sensing, metallurgy...)
- Expand analytical capacities within the University of Alaska
- Help re-invigorate the Mineral Industry Research Laboratory
- Obtain recurring funding to allow directed research on topics relevant to industry



# Alaska Critical Mineral Collaborative Structure

## External Collaborators

- Minerals/Mining Industry
- DGGS
- USGS
- DOD
- DOE
- State of Alaska
- Universities



## Internal Collaborators

- UAF  
CNSM, CFOS, ACEP, CCRC
- UAA  
CAS, CoE, ISER
- University Labs  
INE – MIRL, WERC, LA-ICP-MS  
GI – GEOCHRON, MICROSCOPY,  
ADVANCED INSTRUMENTATION  
UAA – ASET,  
HYDROGEOCHEMISTRY,  
BIOSEPARATION

# UAF and UAA Critical Mineral Laboratories

## Characterization

### Geoscience

-Geochronology and Mineralogy Lab - UAF

-Advanced Instrumentation Lab - UAF

### Environmental

-AK Hydrogeochemistry Lab - UAA

-Applied Science Engineering and Technology Lab - UAA

### Remediation

-WERC - UAF

-Remediation Lab - UAA

## Exploration

### Geoscience

-Geochronology and Mineralogy Lab - UAF

-AK Hydrogeochemistry Lab - UAA

### Remote Sensing

Hyperspectral Imaging Lab - UAF

### Data Science

AK Hydrogeochemistry Lab - Data Science Division - UAA

### Processing

-Mineral Industry Research Lab - UAF

## Recovery

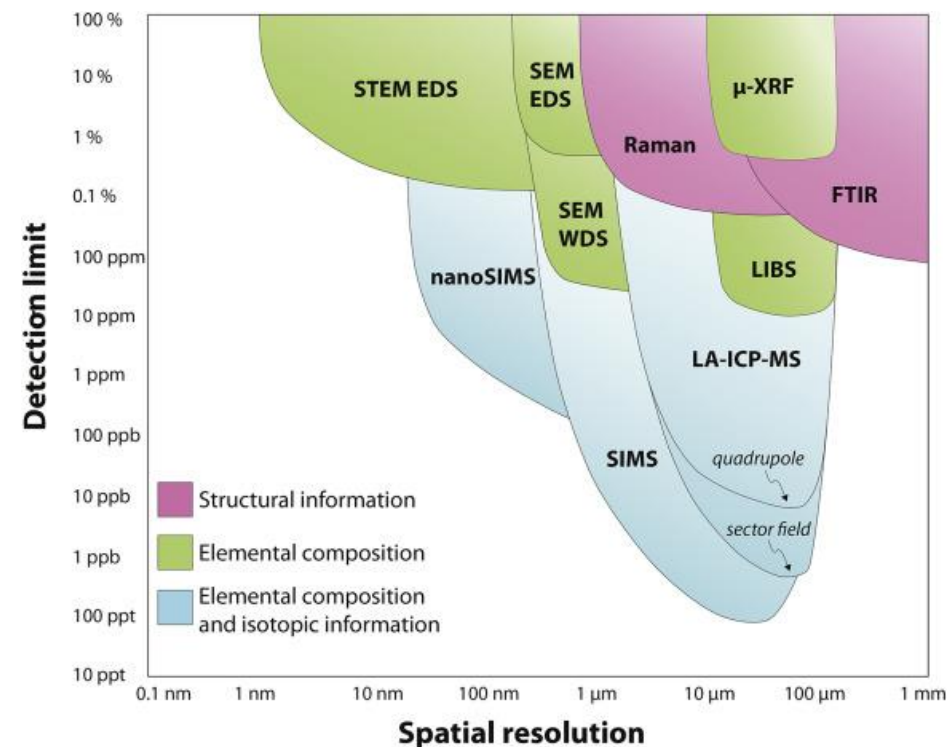
### Separations

-Mineral Industry Research Lab - UAF

-AIMS Core Facility - UAA

# Institute of Northern Engineering (INE), UAF

- New ICP-MS Laser Ablation system and Microwave-assisted digestion system are expected to be installed by Spring 2024.
  - U-Pb age dating will be available once the equipment is operational
- INE is actively recruiting and reviewing candidates to manage the instrumentation and new lab space.
- Separations lab renovation is nearly complete



# MIRL – Dr. Tagathaga Ghosh, UAF INE

- Mineral Processing
- Mine Design
- Mine Automation
- Ventilation Systems
- Rock Mechanics
- District Studies
- Wants industry input



# Geophysical Institute Labs, UAF

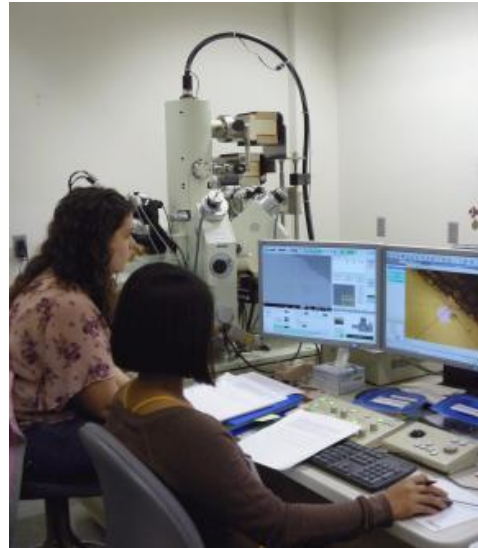
*Mineral characterization Lab*



*Spatially resolved LIBS analysis for real-time chemical analysis in atmosphere*

*Fluid Inclusion microscope  
Petrographic microscopes  
Rock Prep facility*

*AIL*



*EPMA, SEM, XRD, XRF*

*Geochronology Lab*



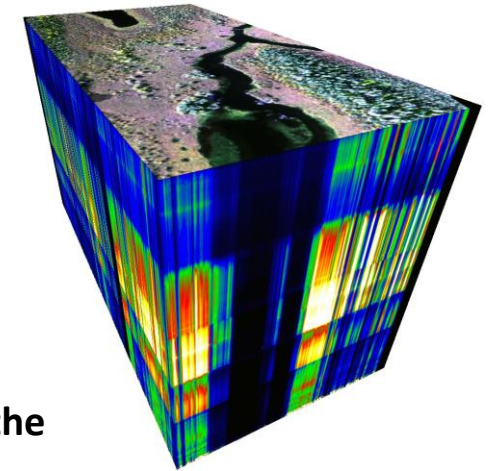
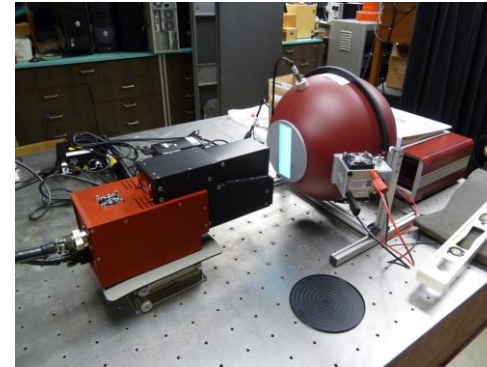
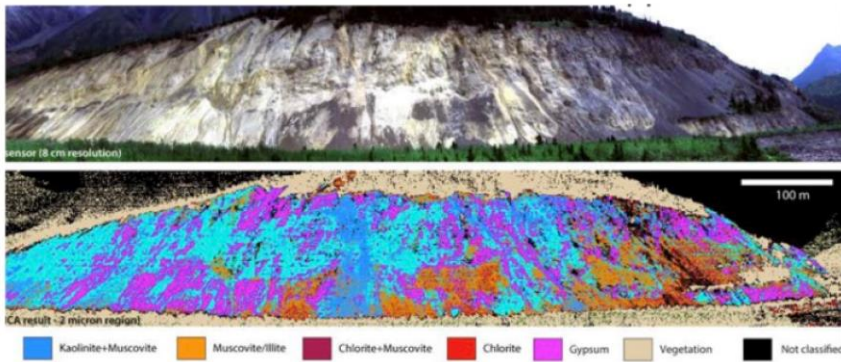
*New Noble Gas Mass Spectrometer  
Sample Preparation facilities*

*Existing Expertise: Chemical and isotopic analysis of rocks/minerals, Petrology, Mineralogy, Geochronology, Structure, Field Mapping, Experimental Petrology*



# Remote Sensing / Hyperspectral

## Dr. Martin Stuefer, UAF GI



### MOTIVATION

- Hyperspectral imaging is a **powerful remote sensing tool** to obtain accurate information on minerals exposed to the surface.
- Extract **Critical Mineral Compositional information from airborne measurements.**
- **Quantify or constrain** physical and chemical properties such as element chemistry or mineral abundances.

### FACILITIES

- **HyLab** deploys laboratory and field spectrometers for obtaining spectral signatures.
- **Aircraft equipped with visible and near infrared** as well as thermal imaging sensors.
- Ability to map targets from micrometer to kilometer scales.
- Resources to **calibrate** sensors.
- Expertise to generate **value-added data products.**

### SERVING ALASKA

- UAF's HyLab helps to cross the **practical, logistical, and financial barriers** that the State of Alaska and DGGs has faced in using this important technique for a variety of applications such as critical minerals exploration, and to serve the needs of Alaskan communities.

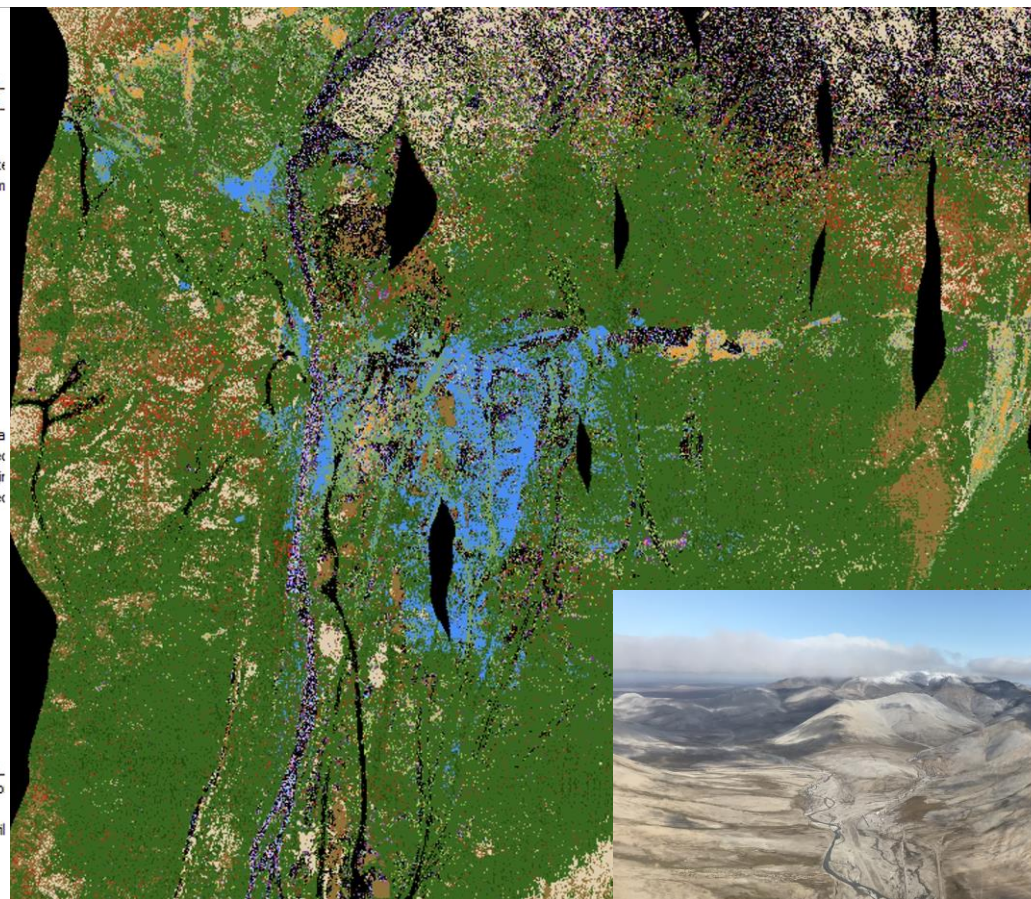


# Hyperspectral Survey – Lost River

## September 8, 2023



- 1: calcite\_abundant
- 2: calcite
- 3: calcite.7+muscovite.3
- 4: calcite.8+montmorillonite\_
- 5: calcite.8+montmorillonite\_
- 6: carbonate\_Fe\_bearing
- 7: dolomite
- 8: dolomite.5+montmorillonite
- 9: dolomite.25+calcite.25+m
- 10: epidote
- 11: chlorite\_lowFe
- 12: chlorite+muscovite
- 13: muscovite\_lowAl
- 14: muscovite\_medAl
- 15: muscovite\_medhighAl
- 16: muscovite\_Fe-rich
- 17: illite
- 18: illite\_gds4
- 19: kaolinite\_wd
- 20: kaolinite\_px
- 21: kaolin+clay\_mica\_or\_ha
- 22: kaolin.5+muscovite\_mex
- 23: kaolin+muscovite\_mix\_ir
- 24: kaolin.5+muscovite\_mex
- 25: kaolin.5+smectite.5
- 26: kaolin.2+calcite.8
- 27: montmorillonite\_Na
- 28: montmorillonite\_Ca
- 29: alunite\_Na\_450c
- 30: alunite\_K\_250c
- 31: alunite.5+kaolinite.5
- 32: alunite.25+kaolinite.75
- 33: pyrophyllite
- 34: pyrophyllite.5+alunite.5
- 35: jarosite\_Na
- 36: jarosite\_K
- 37: jarosite+muscovite\_mix\_
- 38: kaol\_possible\_alunite\_o
- 39: buddingtonite
- 40: buddingtonite+montmoril
- 41: serpentine1
- 42: serpentine2
- 43: serpentine3



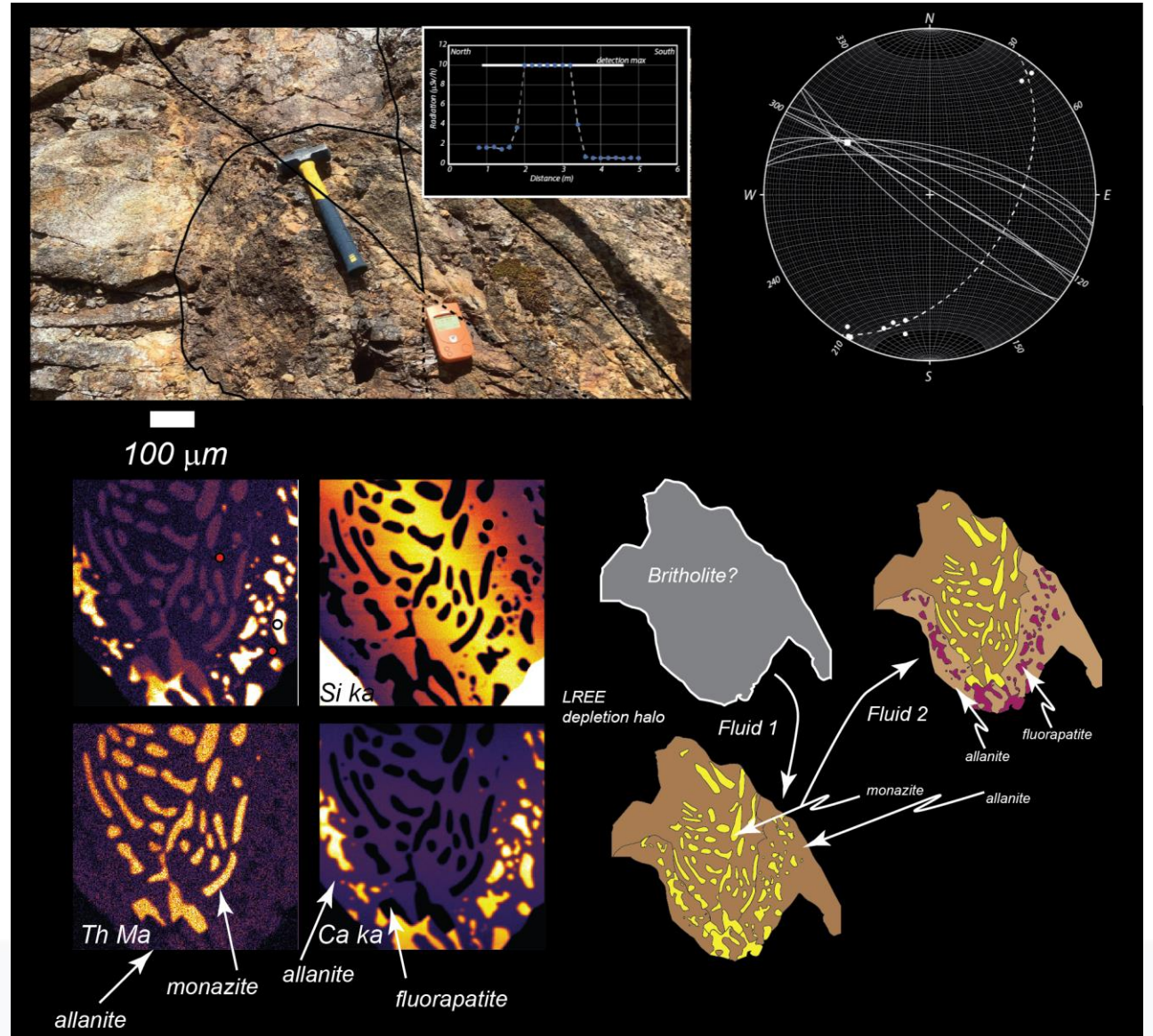
Mosaic of the HYSPEX VNIR

Spectral feature-based mineral analysis map

The Lost River Mining Complex (Sept. 8, 2023),  
Photo Source: Martin Stuefer

# Economic Geology – Dr. Sean Regan CNSM UAF

- Integrated multiphase chemical analysis and imaging to understand petrogenesis of graphite, Li, REEs, and more
- Petrochronology to test genetic models for the formation of CM resources
- Experimental studies focused on CM mobilization and deposition
- Map-scale structural and petrologic analysis aimed at incorporating geometric information and predictive geology
- Process focused program aimed at identifying and exploring important knowledge gaps.



# Economic Geology – Dr. Marisa Acosta, UAF CNSM



- New Economic Geology assistant professor at UAF 😊
- PhD from University of Oregon 2020
- Postdoc at University of Lausanne 2020-2023

## Research Interests:

- Crystal growth, dissolution, and deformation in ore-forming environments
- Integrating observations from deposit-scale to micro-scale



# Geochemistry - Dr. Lee Ann Munk UAA CM

## Hydrogeochemistry Laboratory

- Globally renowned interdisciplinary research team in lithium resources and environment (North and South America)
  - Closed-basin brines
  - Oil field brines
  - Volcano-sedimentary clay deposits
  - Industry supported research
- REE collaborative research at Bokan Mountain, Alaska
  - Origin of the ore deposit as well as its environmental signature
  - New \$2M DoE ARP Ae macroalgae biomining project collaborative with UAF CFOS and UAA Geochemistry, ADF&G, and biomining industry
- Environmental and exploration geochemistry of metals in mined and unmined terrains across Alaska
  - Red Dog
  - Pebble
  - Industry supported research




# Economics - Dr.'s Bob Loeffler & Brett Watson,

UAA ISER

- Comparing Alaska's environmental standards with those of the leading oil and gas and mineral producing countries around the world
- Distributing a survey for major companies, consulting firms, NGOs with appropriate technical experts, and mining and oil and gas experts
- Results will indicate where Alaska stands on various environmental measures; it will also identify leading practices and leading jurisdictions around the world



# CORE-CM - Brent Sheets UAF INE

- Phase 1 completed
  - UAF-DGGS resource characterization
- Phase 2 NOI issued 

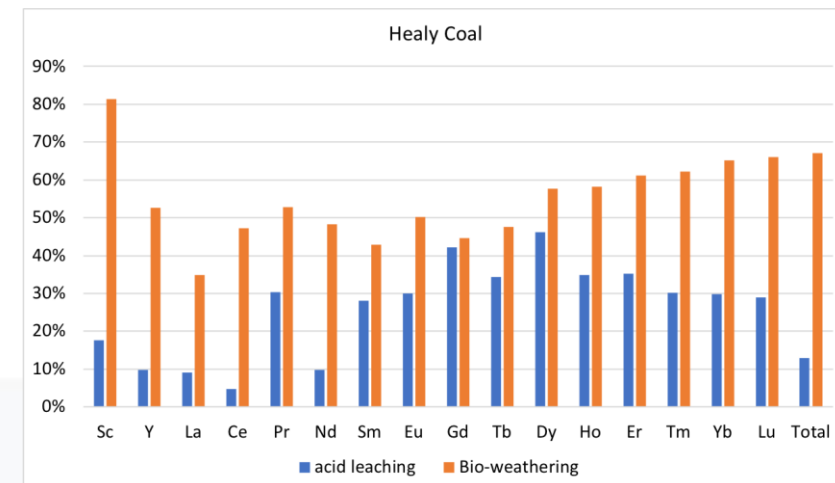
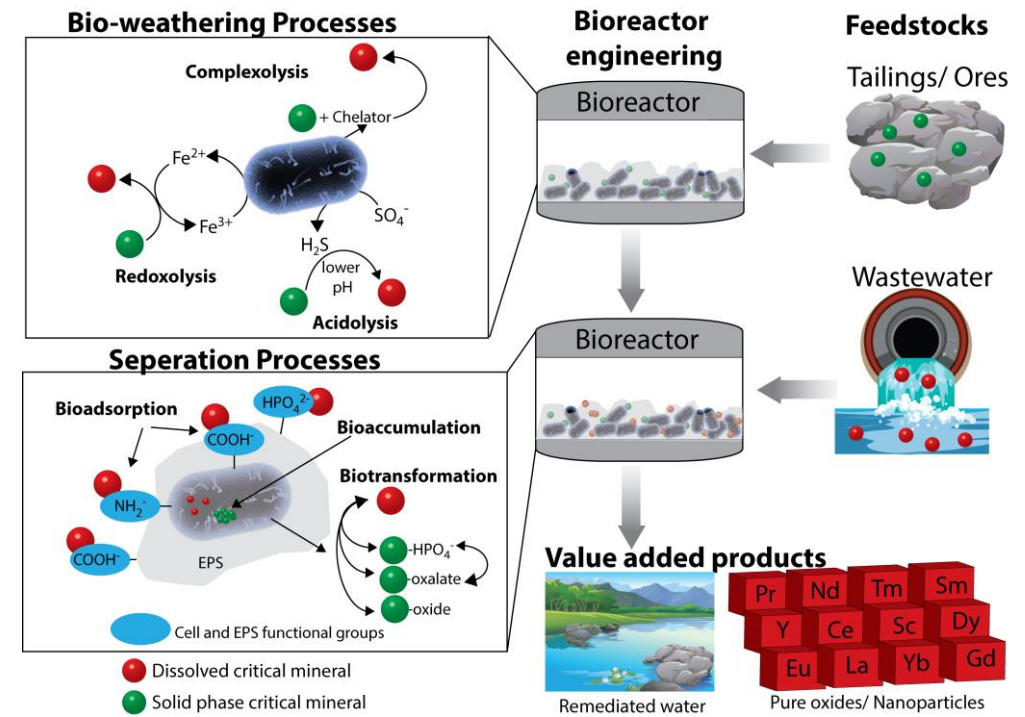
1. Completing CORE-CM regional assessments to understand CMM resource potential.
2. Formulate and implement strategies to leverage regional infrastructure, and formulate strategies that address regional infrastructure needs, economic challenges, and supply chain gaps.
3. Formulate and implement research strategies to fill technology gaps, including extraction and separations technologies.
4. Develop and implement plans for stakeholder outreach and education.
5. Prepare and start implementing a workforce development plan for the training of the next generation.
6. Develop and start implementing plans for technology innovation centers that will be operated by regional-specific public-private partnerships.
7. Collaborate on working groups and with adjacent regions.
8. Contribute to a U.S. nationwide prospectus on critical minerals from unconventional resources.

CORE-CM U.S.  
Regions of Interest



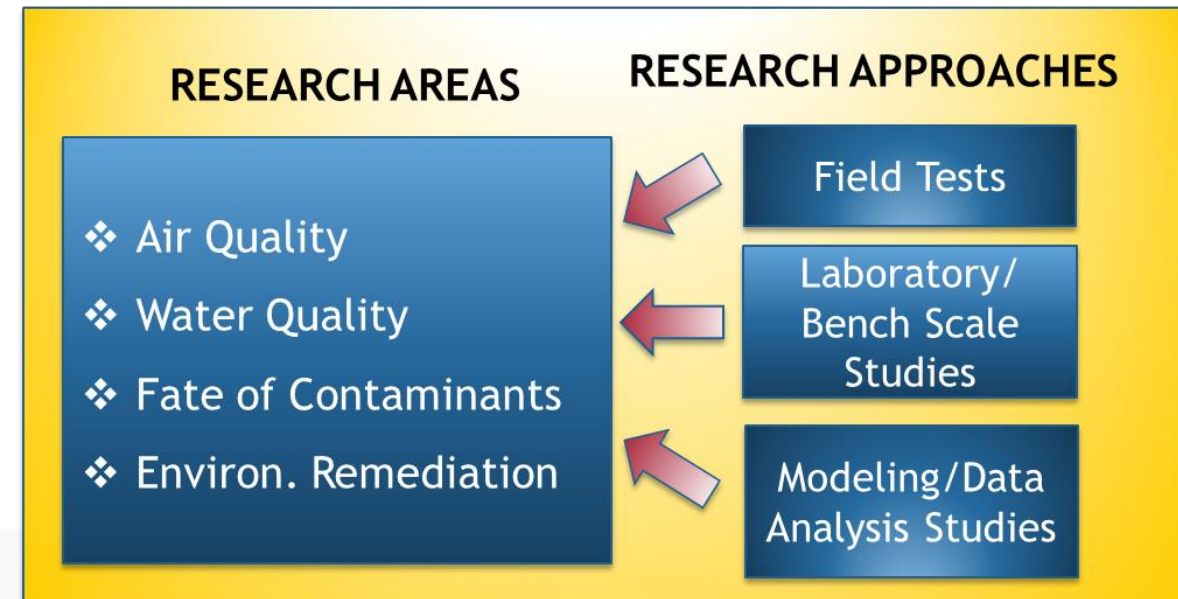
# Bioseparation – Dr. Brandon Briggs, UAA CAS

- Bioseparation research on rare earth elements (REE) extraction and separation
- Manuscript on REE extraction from Usibelli coal using sustainable biotechnology accepted for publication
- Improved recoveries over acid leaching
- Launched research on separating individual REEs
- Ongoing research, development and design for a stainless steel bioreactor for REE recovery



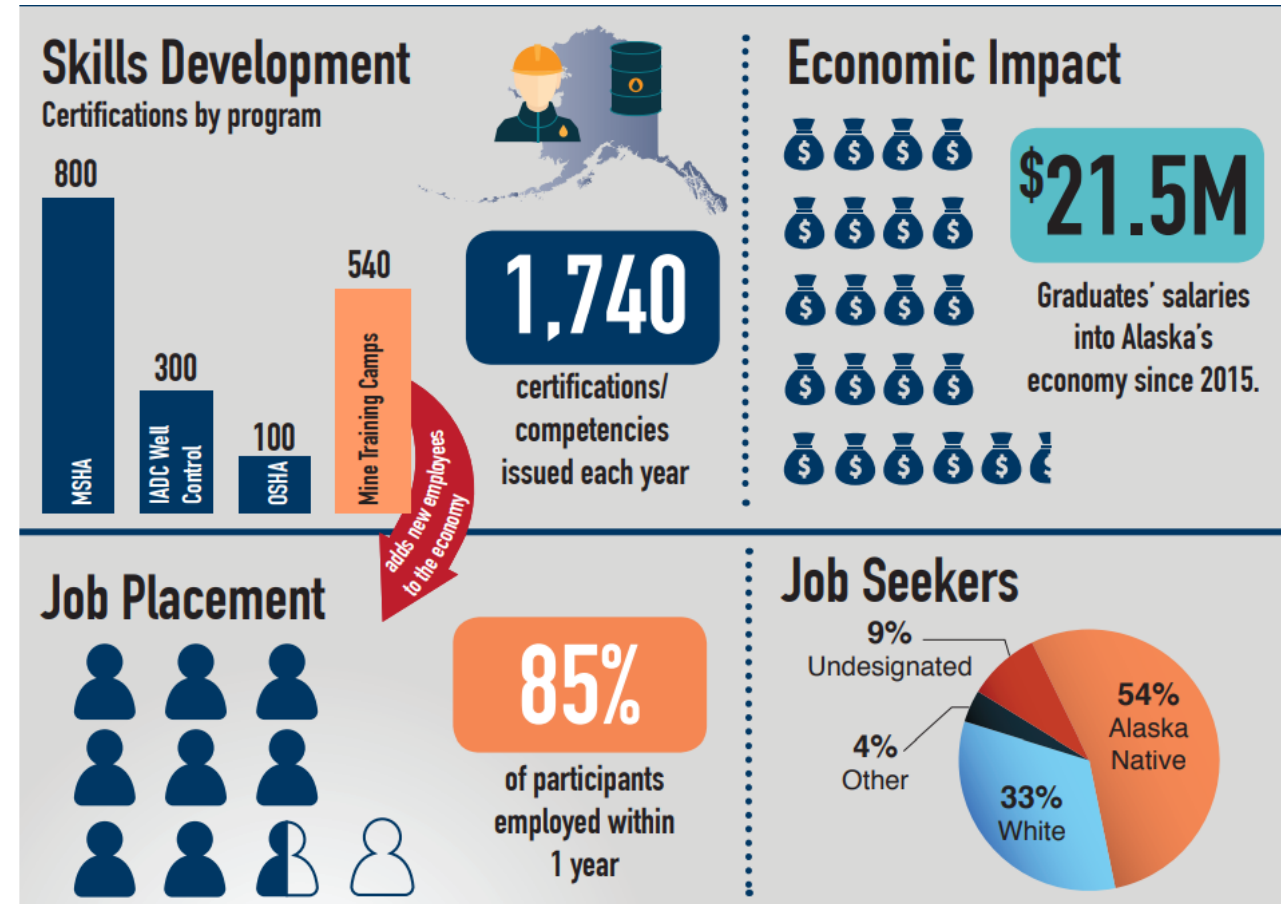
# Remediation - Dr. Srijan Aggarwal WERC, INE UAF

- Biofilms in environmental systems
- Developing biological approaches for waste remediation and resource recovery
- Drinking water quality, novel water treatment approaches
- Environmental fate and impacts of oil spill response chemicals
- Arctic water and sanitation issues

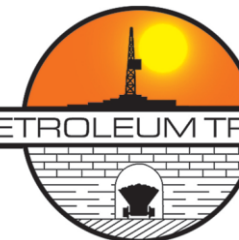


# Workforce Development – MAPTS UAF

- Underground mine training (280 hours)
- Surface mine training (140 hours)
- Purchased a specialized underground mine truck for the mine training center in Delta -



MINING AND PETROLEUM TRAINING SERVICE



# Workforce Development - UAS

- Hired a mine training coordinator
- Buying a tracked piece of equipment for the diesel program
- Plans to acquire a new, portable mine training simulator by the end of 2024
- Successfully conducted intensive welding and hydraulic training sessions
- Planning additional training for the 2024 calendar year and collaborating with the Juneau School District to revitalize a career pathway for students interested in mining occupations
- Contact – Cory Ortiz - [cortiz10@alaska.edu](mailto:cortiz10@alaska.edu)



To contact the collaborative email -  
[akminerals@alaska.edu](mailto:akminerals@alaska.edu)

Questions?

