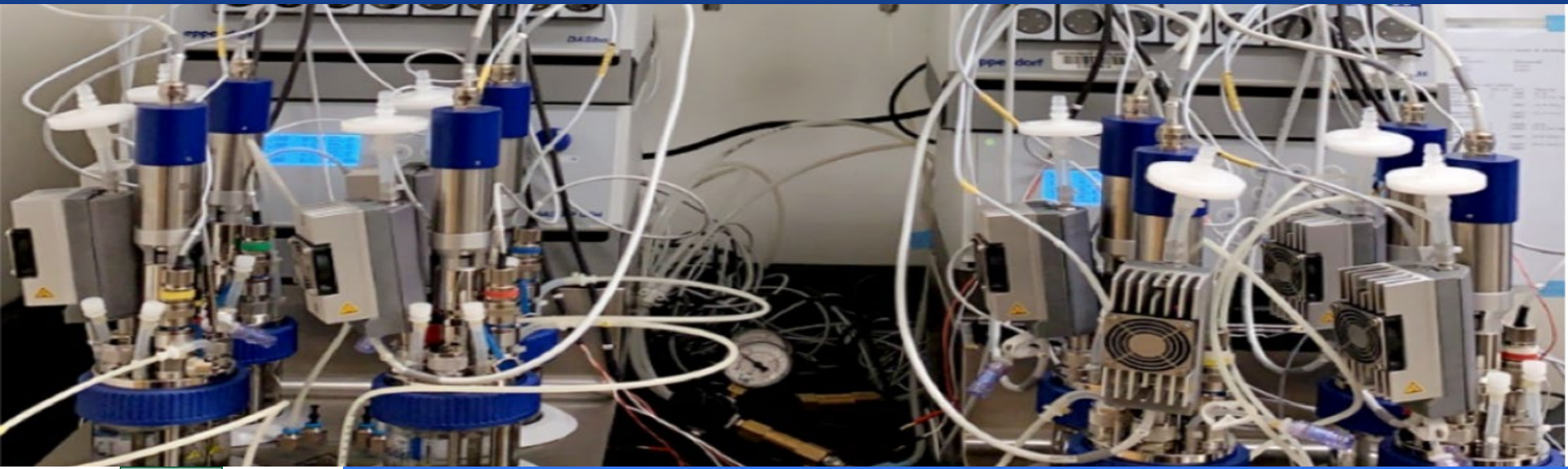
Alaska CORE-CM: REE & CM Bio-mining



UNIVERSITY of ALASKA ANCHORAGE

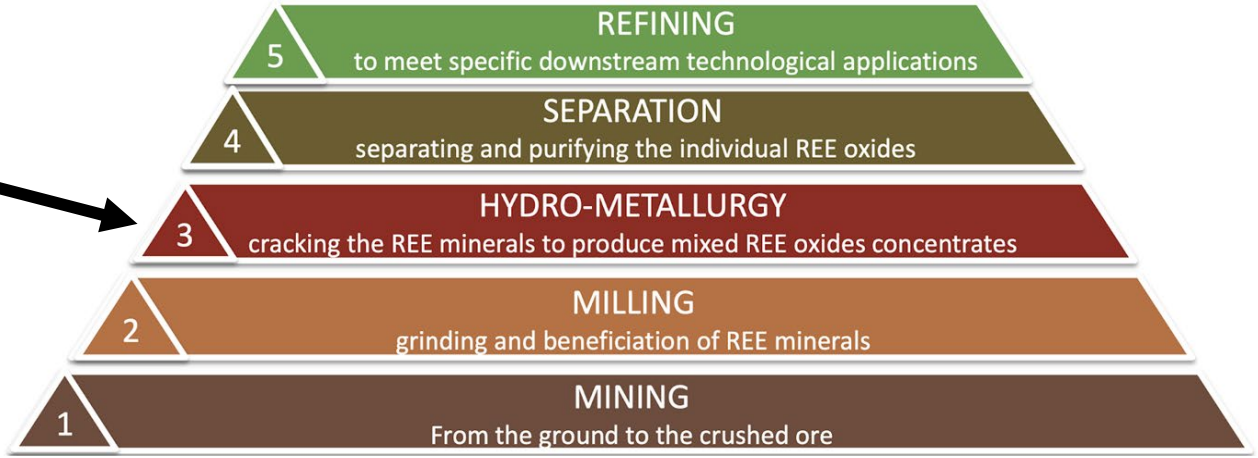
Michael A. Martinez, Chemistry PhD student UAF/UAA
Brandon Briggs, PhD

Mine to Market

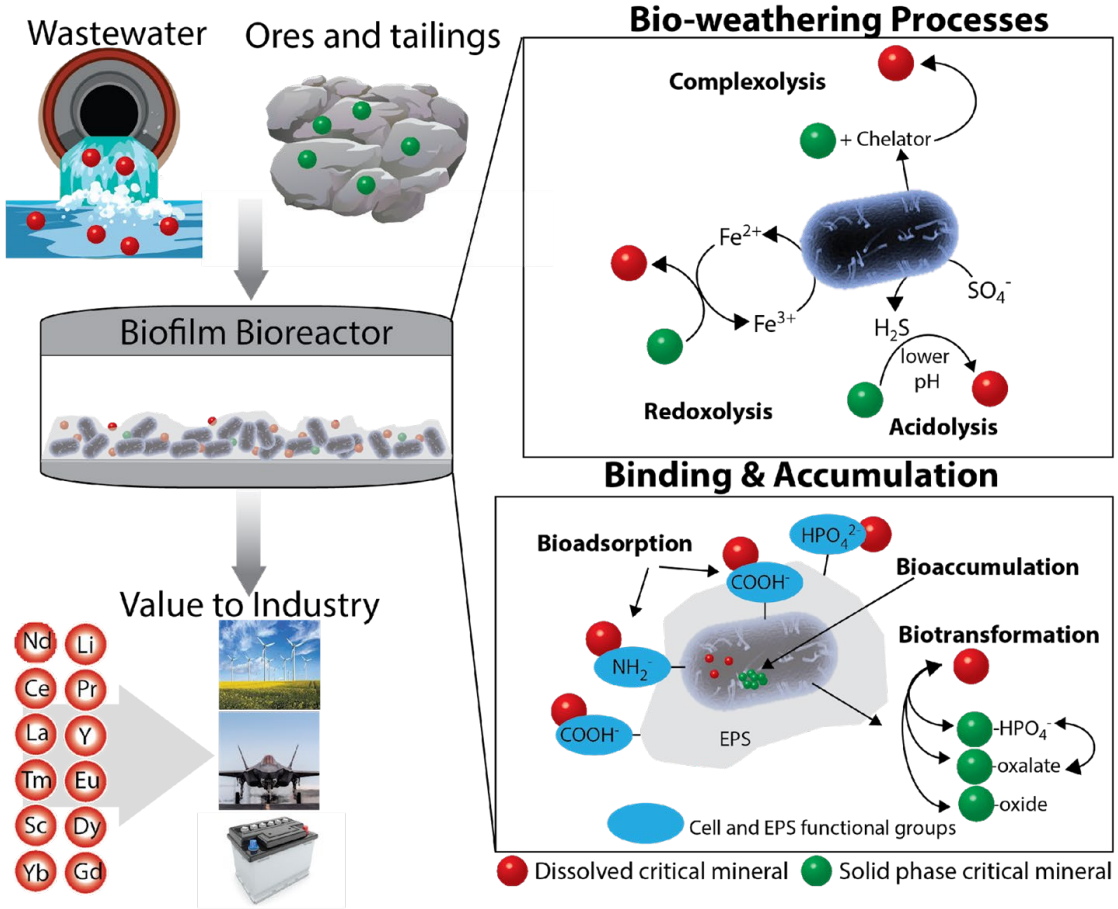
Products

- Permanent magnets
- LED's
- Consumer Electronics

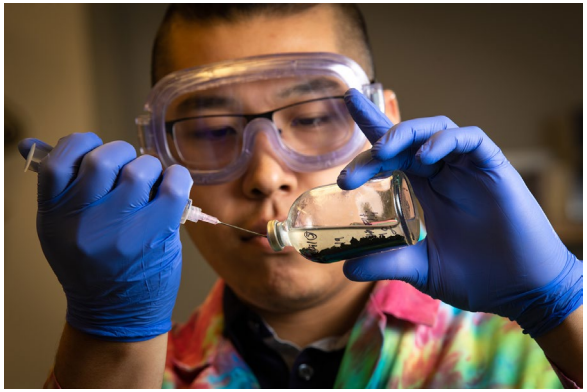
Concentrated acids & heat, High energy demands



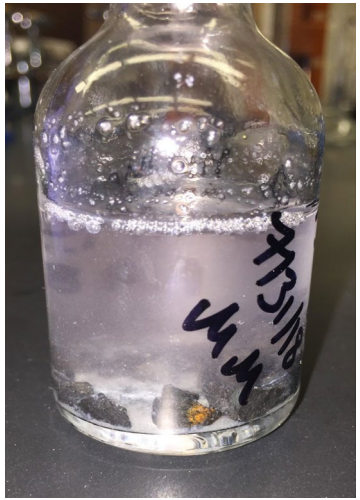
Bio-Hydrometallurgy



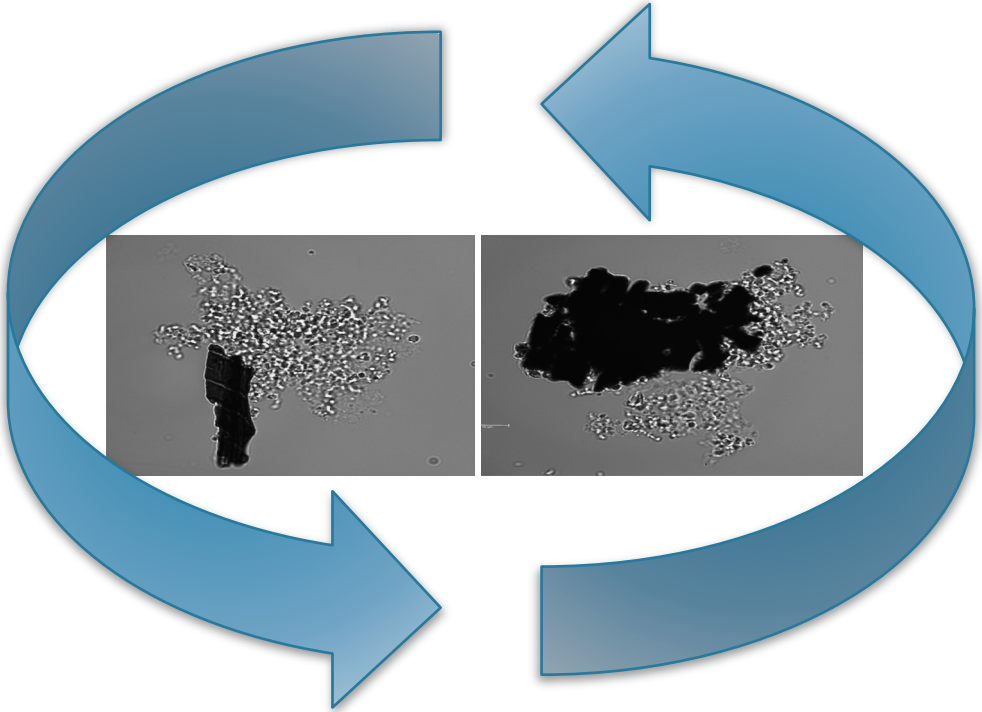
Hunt for Novel Microbes

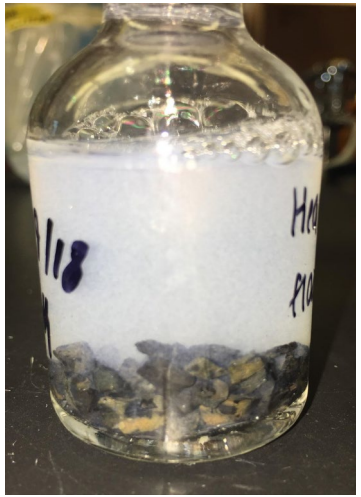


Redox cycling



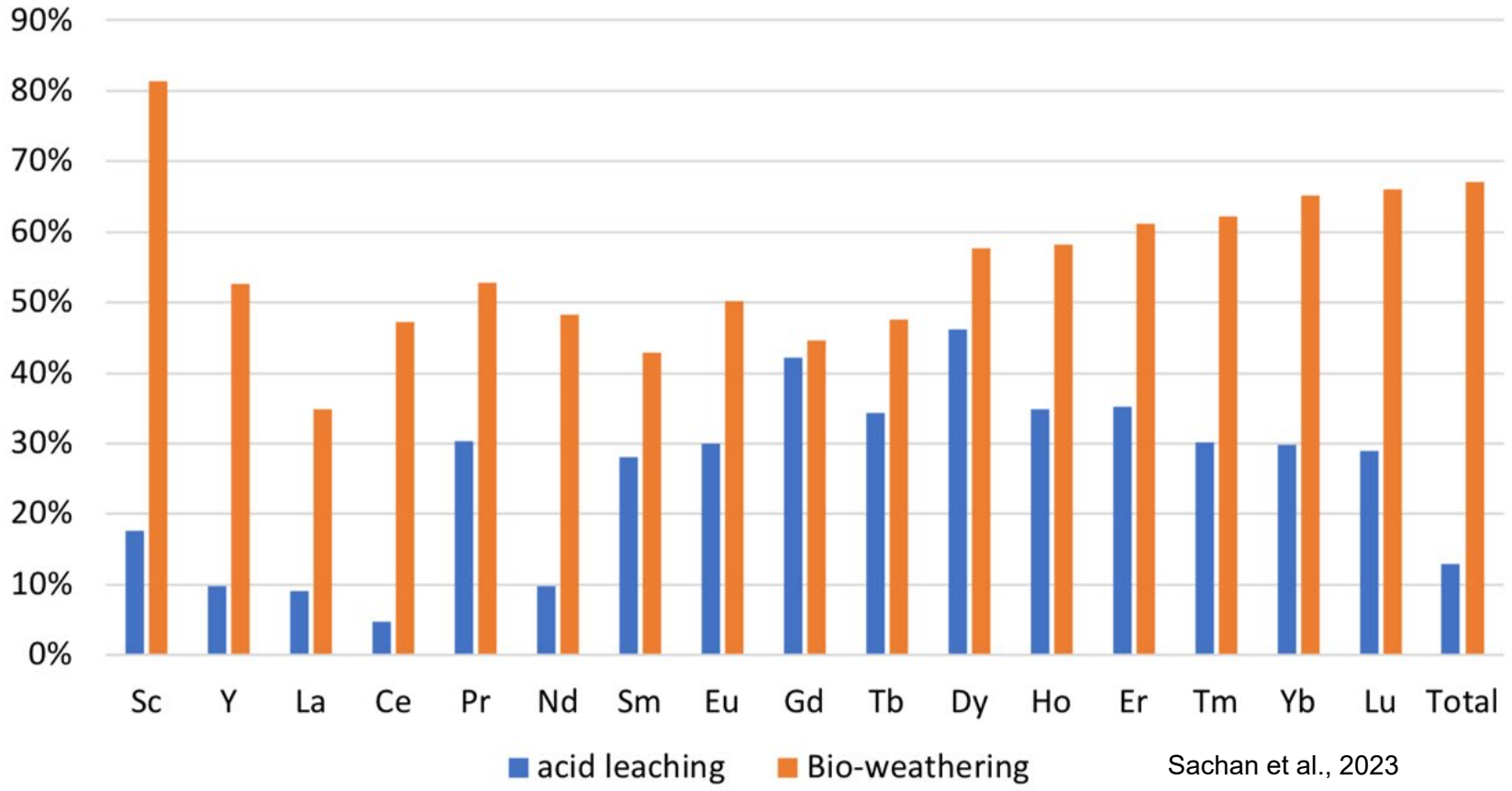
Oxic





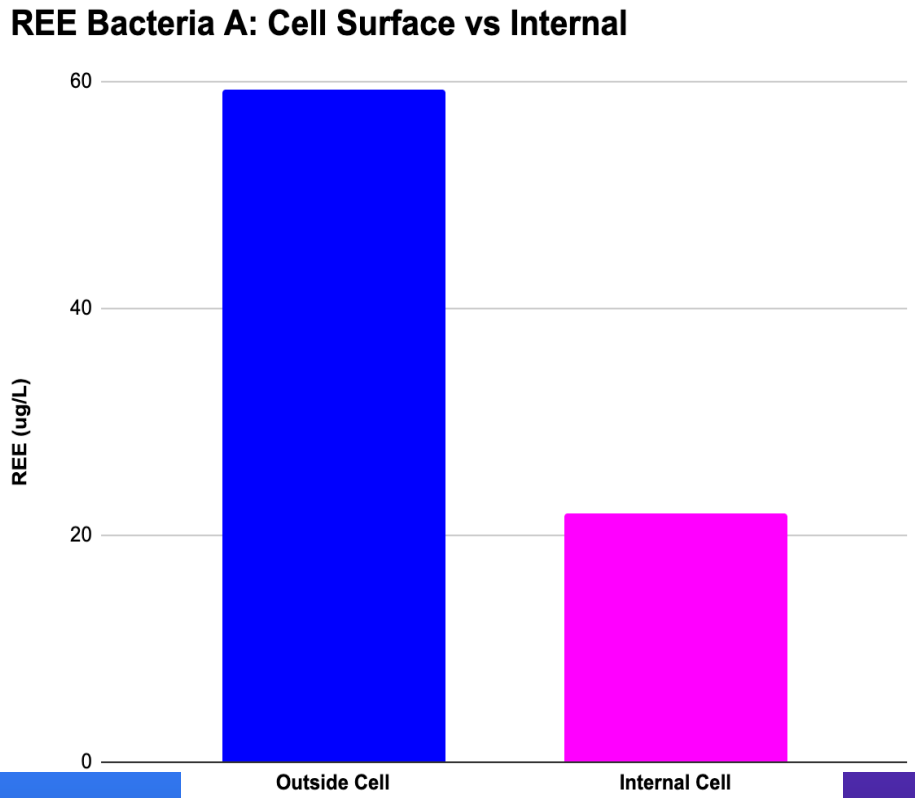
Anoxic

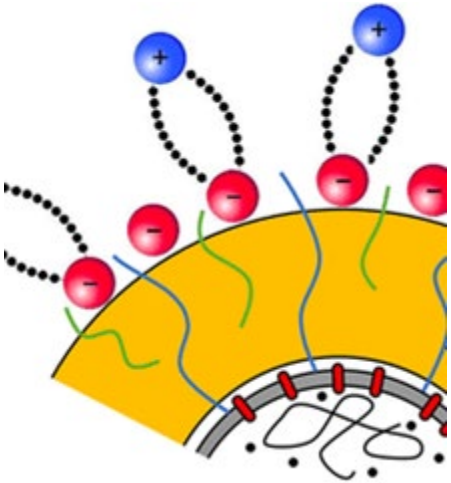
Healy Coal



Sachan et al., 2023

Bacteria A: Adsorption-Desorption REE



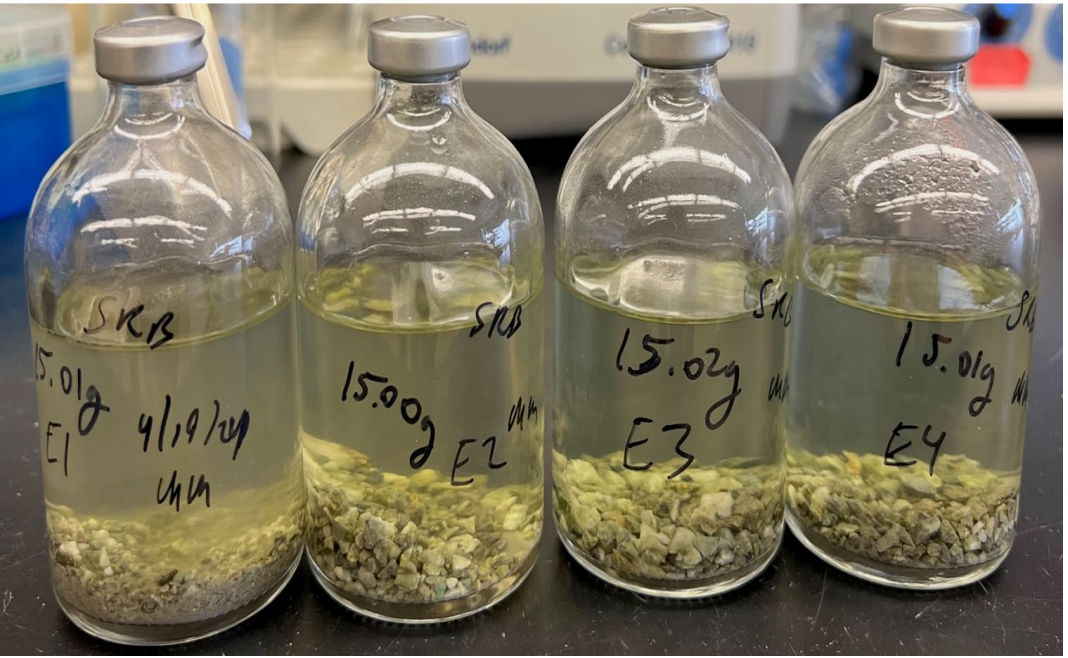


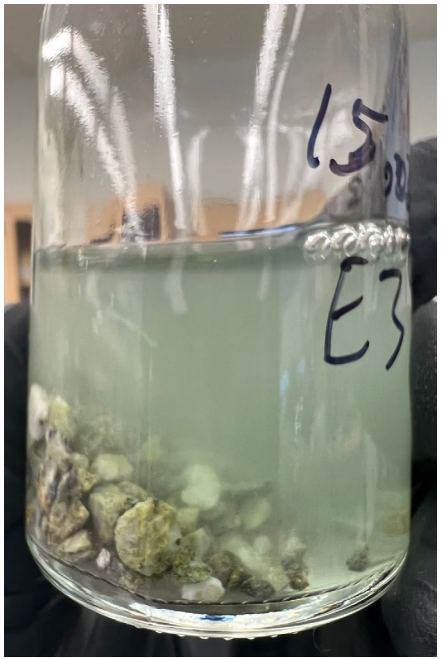
Seifan et al., 2018

Top Surface Captured:
Lu, Yb, Tm, Eu, Sm, Dy

Top Internal Captured:
Lu, Yb, Tm,Eu, Er, Dy

Bacteria B: CM Extraction from Hard Rocks

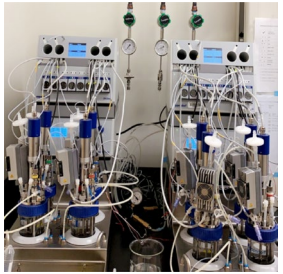




pH ~ 7

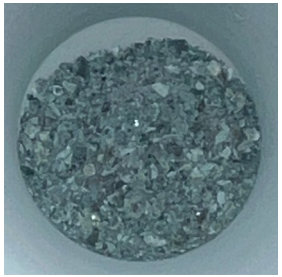
Prelim (ug/L) : Cu (27,377.91), Fe (11,552.16), Al (7,648.32), Mn (212.77), Zn (53.37), V (15.98)

Bio-mining Process



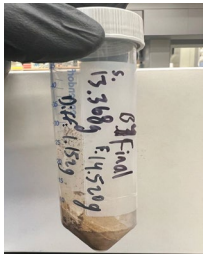
Bio-mining

Liquid Phase → Precipitate → Dry → Powder



Water returns

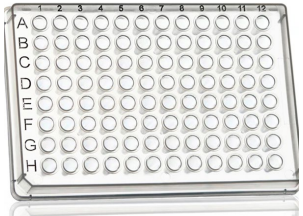
Cell Phase → Desorb → Open

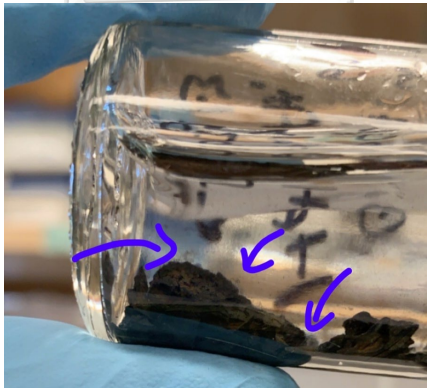


Feedstock Ore

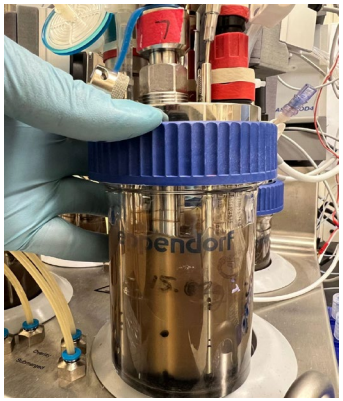
Bio-mining: Bacteria A, B or Both (TBD)

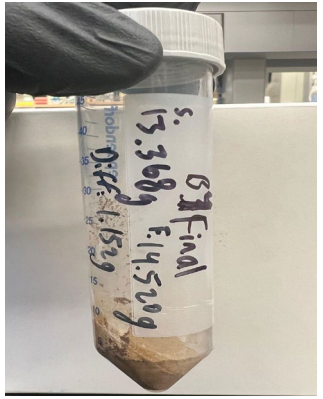
2018-2024 Bio-Mining REE



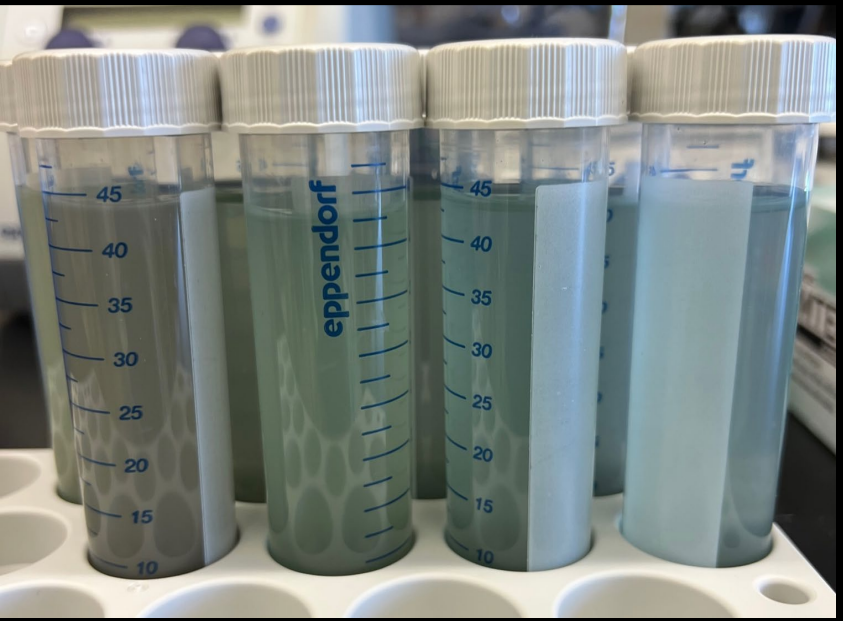


- 2018: 96 well plates, 100uL samples for Fe (III)
- 2019: 20mL bottles and medias
- 2020: UV mutations, 80mL bottles
- 2021: 80mL, Coal, and Hard rocks
- 2022: 250mL bioreactors
- 2023: **1st 1g Dry Powders**, adsorptions and gas conditions
- 2024: Scale Up 5 Gallon Tanks





Recent April Test: U.S. Hard rocks 10ug/L - 27 mg/L C.M.



April 2024: 80 mL, 7 days with Bacteria B

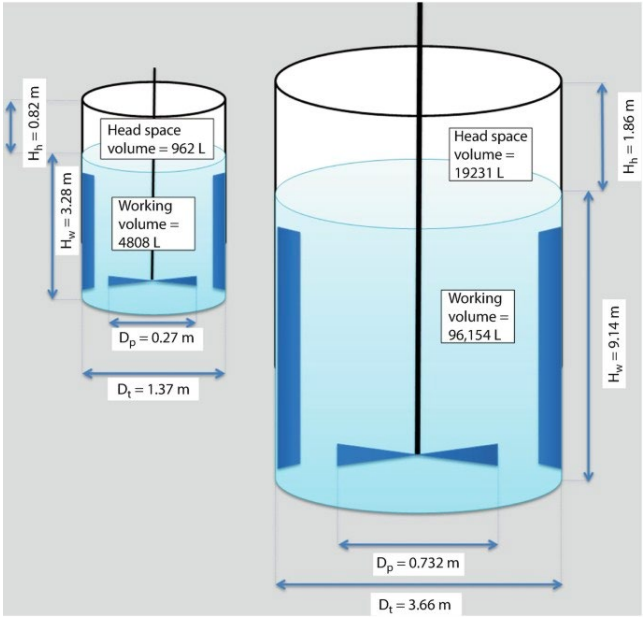
REE Updates

Bioreactors:

250mL , 15 grams = 1 g dry powder

5 Gal= 18.9 L

15g/0.25L ; x/18.9 L: need 1,134 g for 1 Vessel



10 Kg per Week: 4.5 Kg Dry Powder

- **~10 Days: 4.5 Kg Dry Mixed Powder**
- **0.1 Kg REE & CM Grouped**
- **Recycling Bacteria, Water Process**

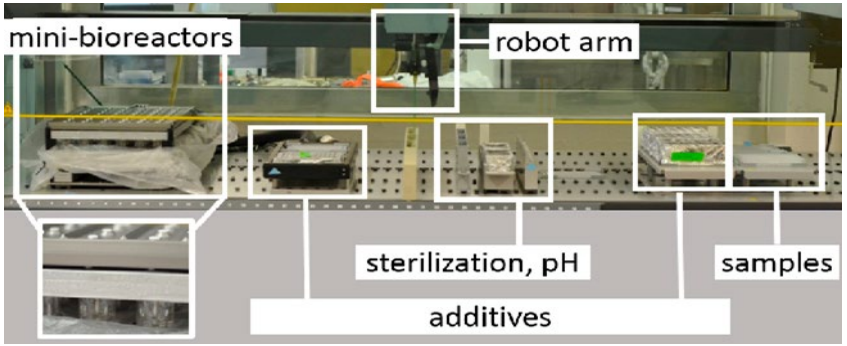
2024 and 2025 Goals

2024:

- 10 Bioreactor Tanks
- Advance Bacteria B
- Cycle parameters
- Precipitation

2025:

- Test outside and Conex
- Precipitation, isolations
- Water Recycle
- Automation, robotics



Alaska Potential: REE Processing Conex Goal

- Skilled labor: Chemistry, Robotics, Geology, Biotech, Microbiology, Genetic Eng., Mechanical Eng.
- Mobile and steps for Powder
- Mine Ore Partner; secure 5-10 year feedstock source
- Grants, Funding, Letters of Support

Acknowledgements

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- University of Alaska Anchorage
- University of Alaska Fairbanks
- University of Wyoming
- AIMS Core Facility
- ASET Lab