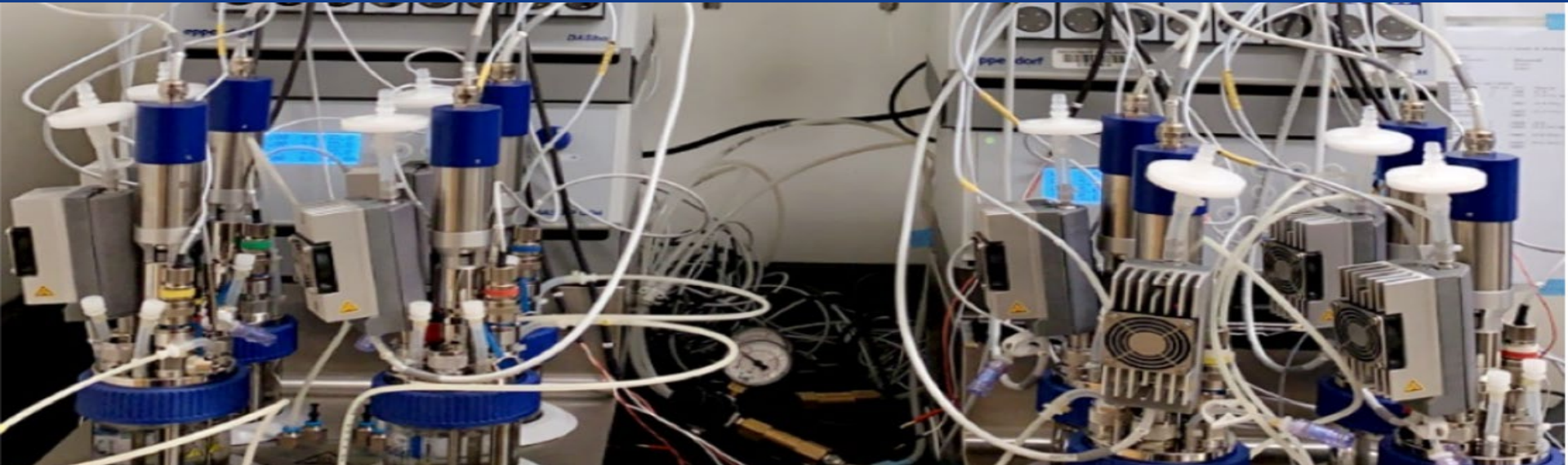




U.S. DEPARTMENT OF
ENERGY

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

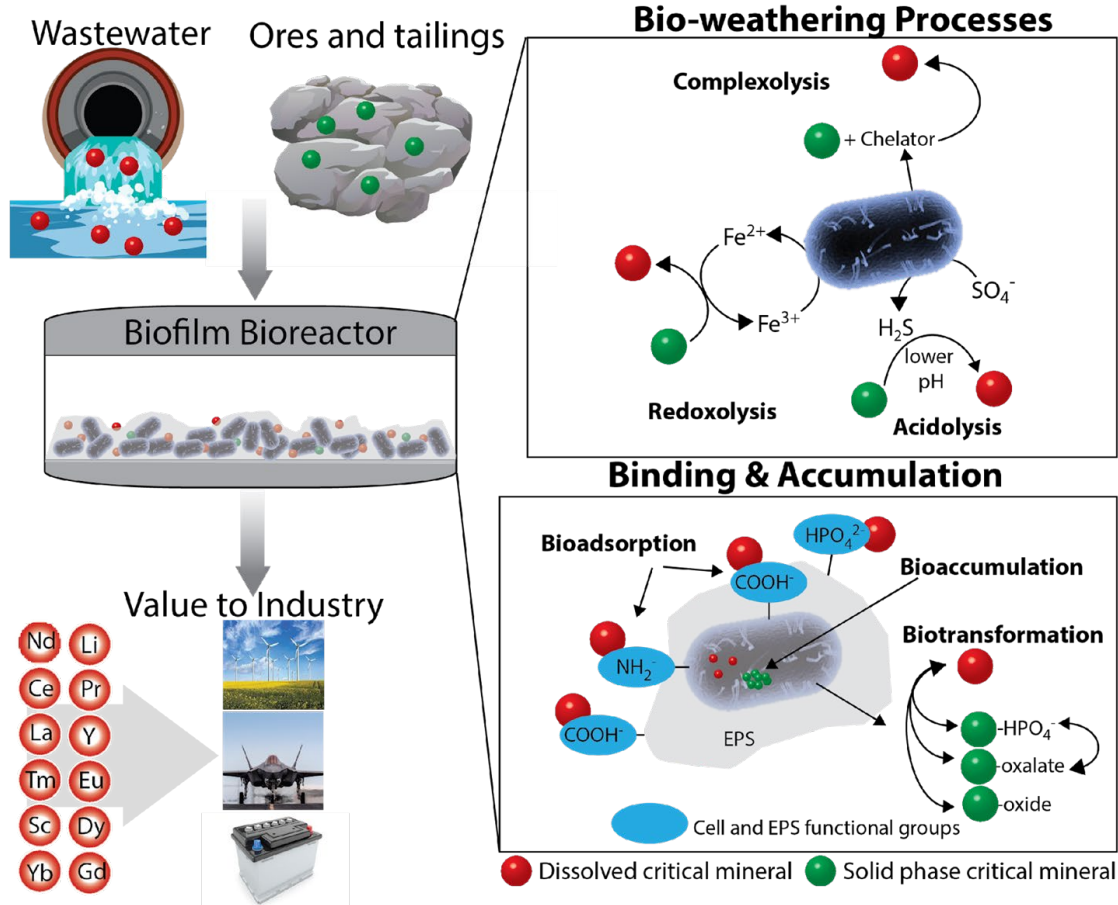
- Permanent magnets
- LED's
- Consumer Electronics



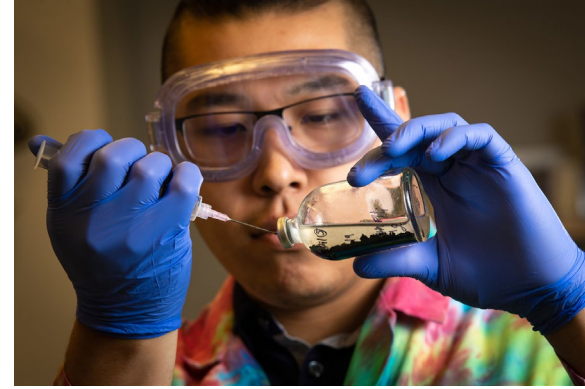
Concentrated acids & heat,
High energy demands



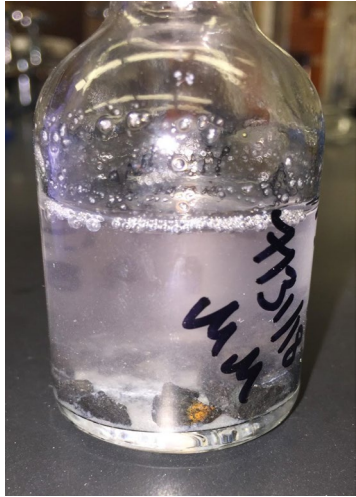
Bio-Hydrometallurgy



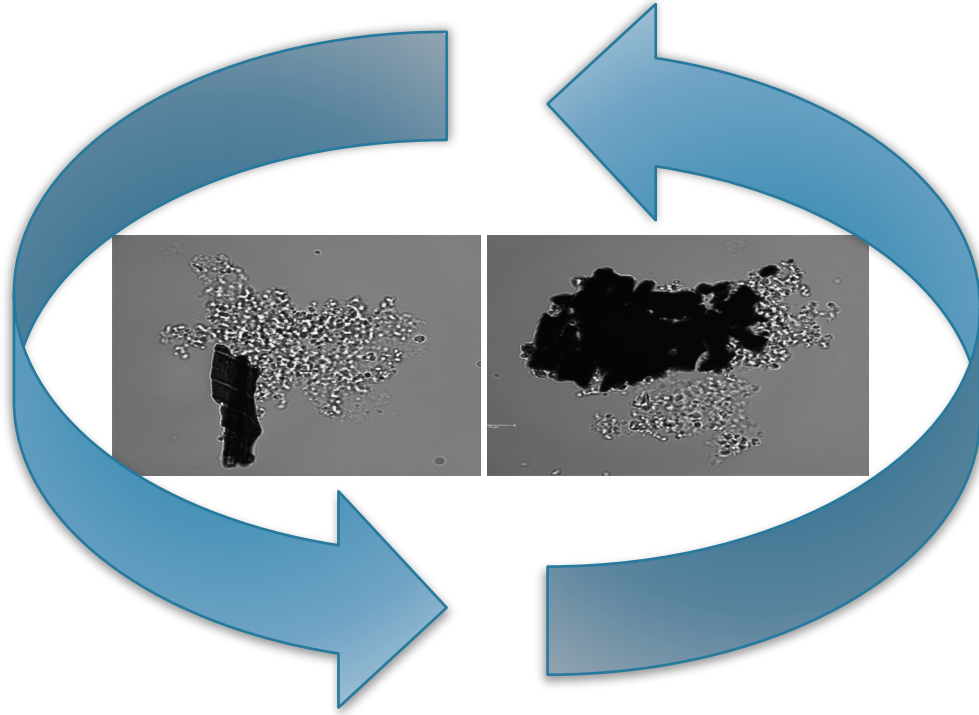
Hunt for Novel Microbes



Redox cycling

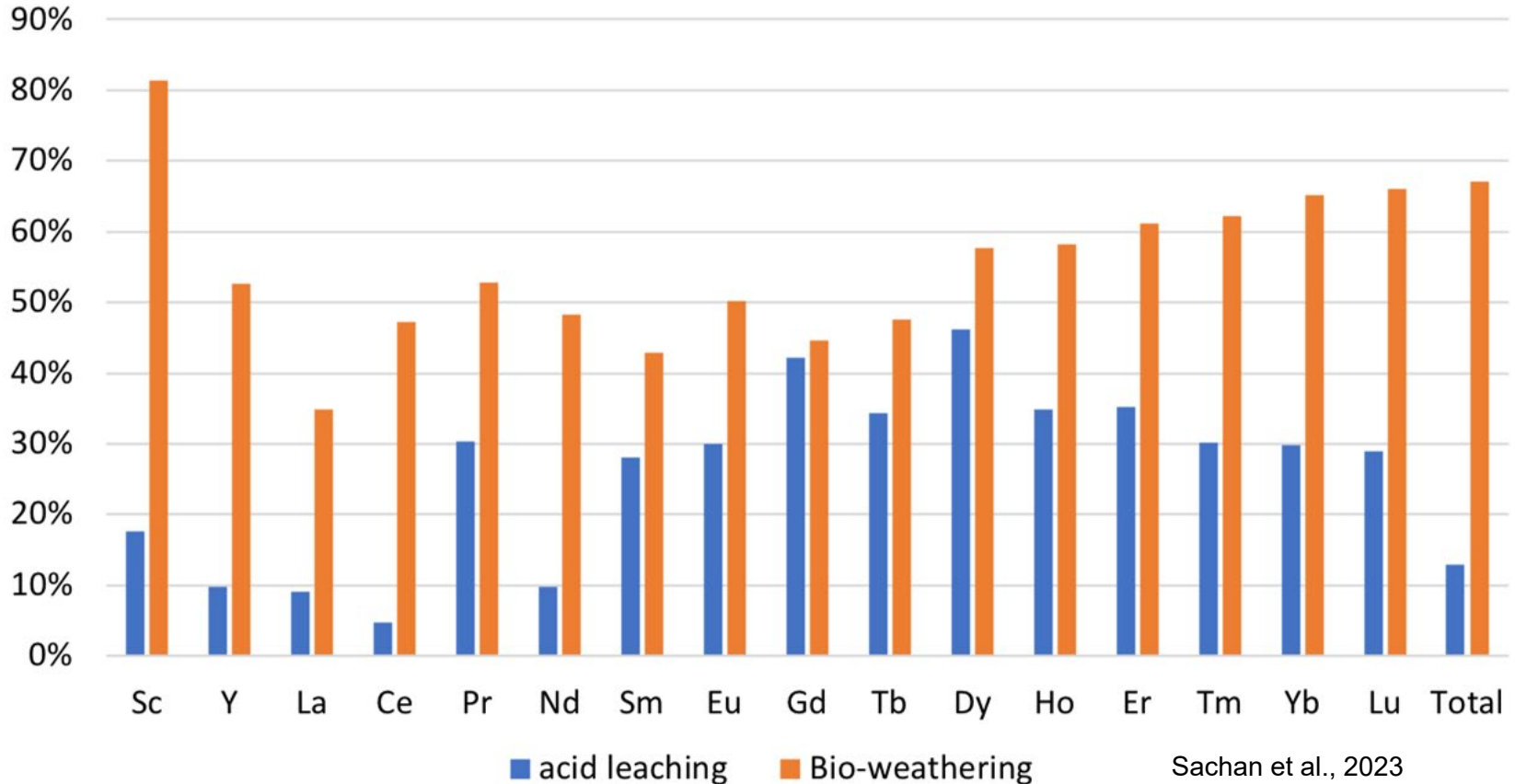


Oxic



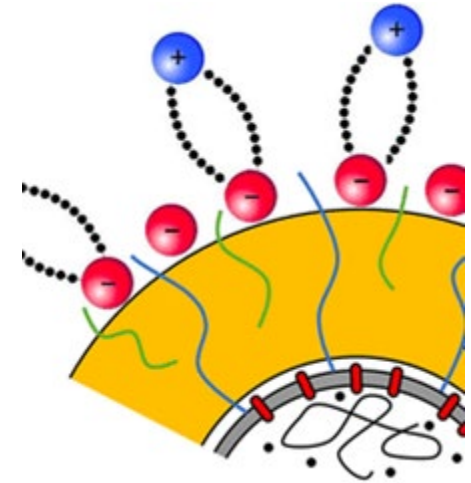
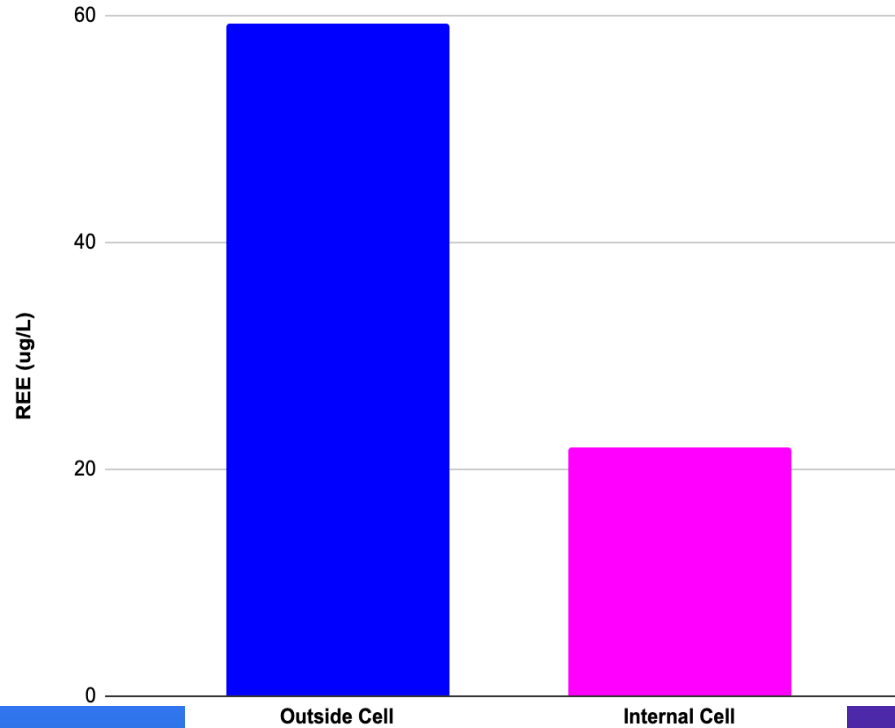
Anoxic

Healy Coal



Bacteria A: Adsorption-Desorption REE

REE Bacteria A: Cell Surface vs Internal

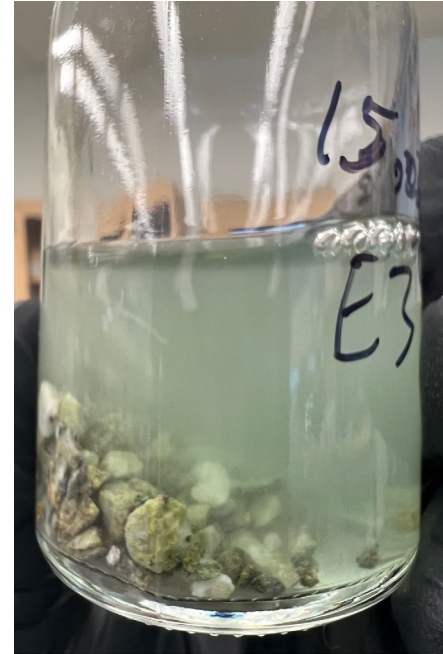


Seifan et al., 2018

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

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

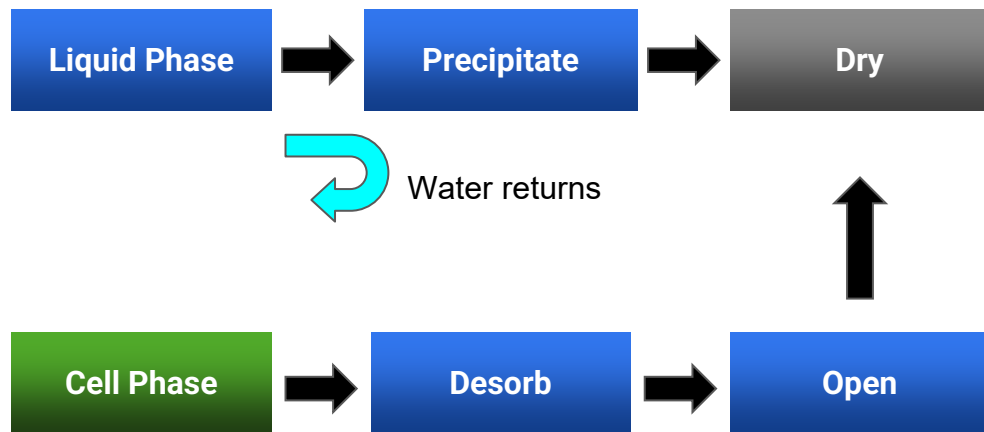
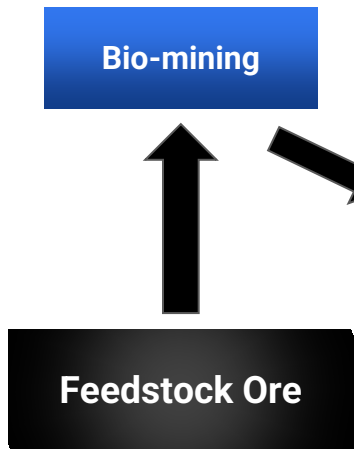
Bacteria B: CM Extraction from Hard Rocks



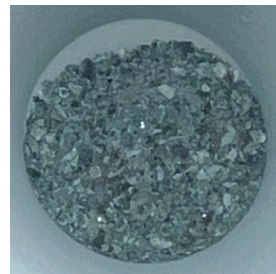
pH ~ 7

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



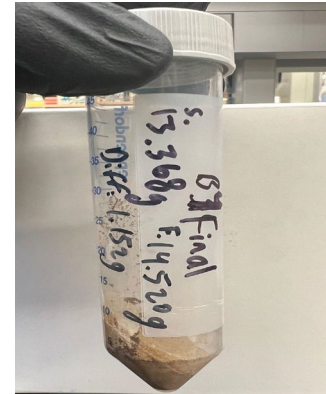
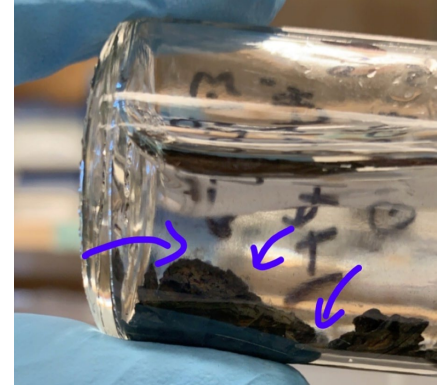
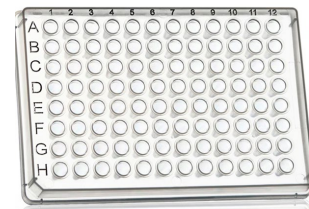
Powder



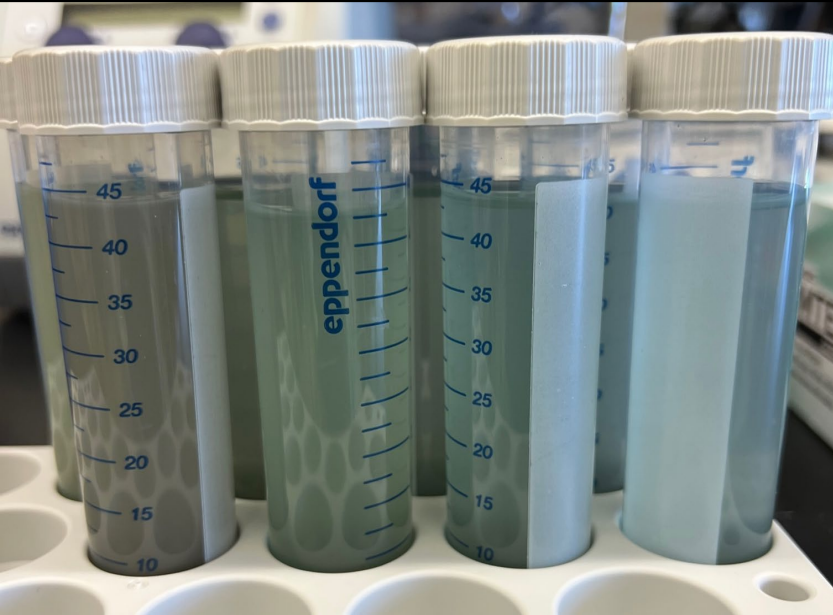
Bio-mining: Bacteria A, B or Both (TBD)

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

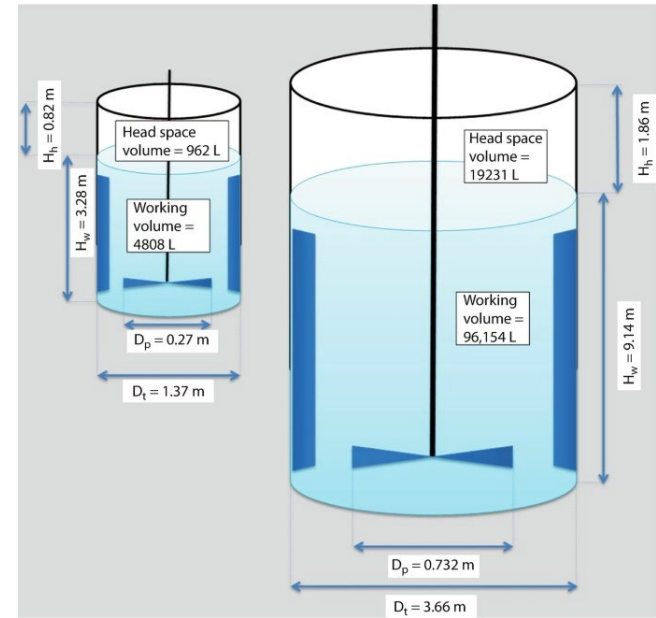
Bioreactors:

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

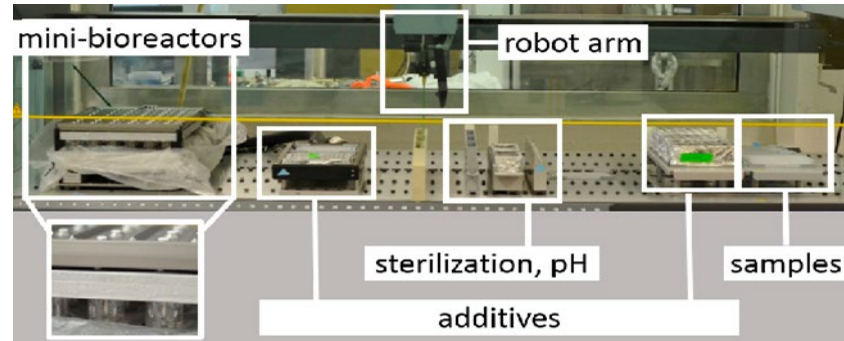
2024:

- 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

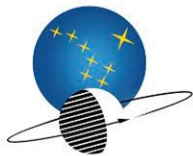


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NSF Innovation Corps

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- UAA Honors College
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- Alaska CORE-CM & Wyoming CORE-CM



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- University of Alaska Fairbanks
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