

Bringing Alaska's CORE-CM Potential into Perspective

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National Energy Technology Laboratory
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Project Overview

- **Objective:** Document Alaska's CORE-CM potential and work with industry, regulators, and concerned stakeholders to jointly establish a pathway whereby Alaska's CORE-CM resources can be developed
- **Funding:** \$1,908,642
 - DOE Share: \$1,526,908
 - Cost Share: \$381,734
- **Performance Period:**
Sept. 1, 2021 – Aug. 31, 2023



Project Participants



Background—Alaska's Critical Mineral Potential

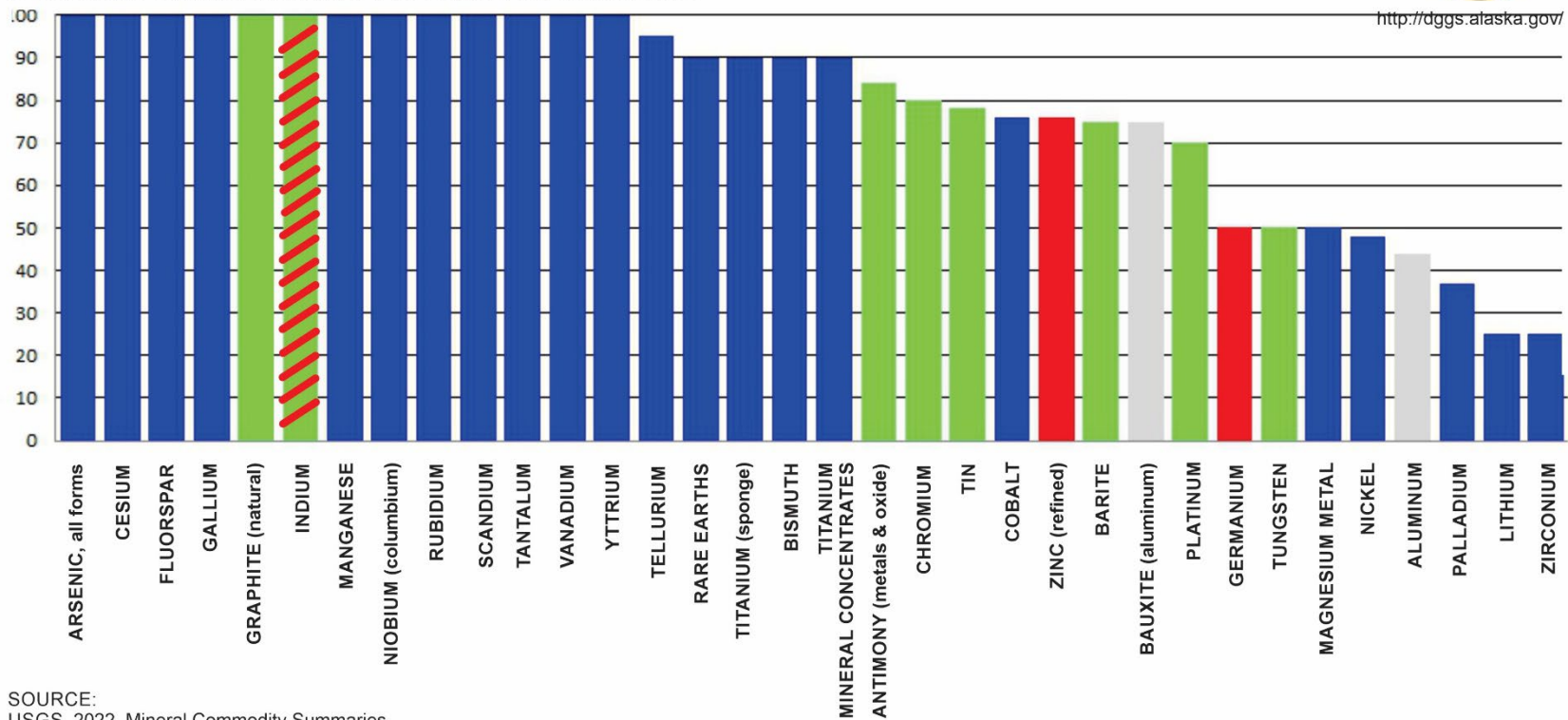
2021 U.S. Critical Minerals Import Reliance



<http://dgg.s.alaska.gov/>

NOTE:

Does not include beryllium and hafnium as these commodity data are not available.



SOURCE:

USGS, 2022, Mineral Commodity Summaries

ALASKA



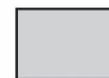
**Current
Production**



**Past & Potential
Production**



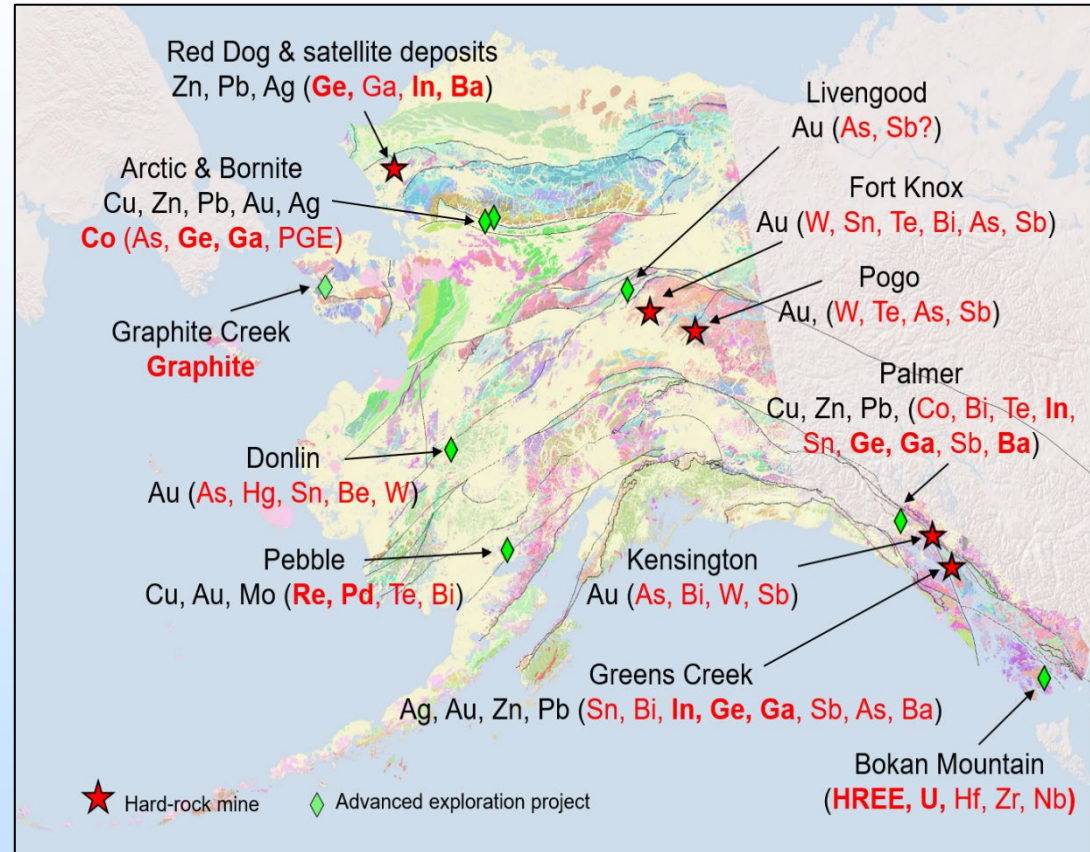
**Potential Future
Production**



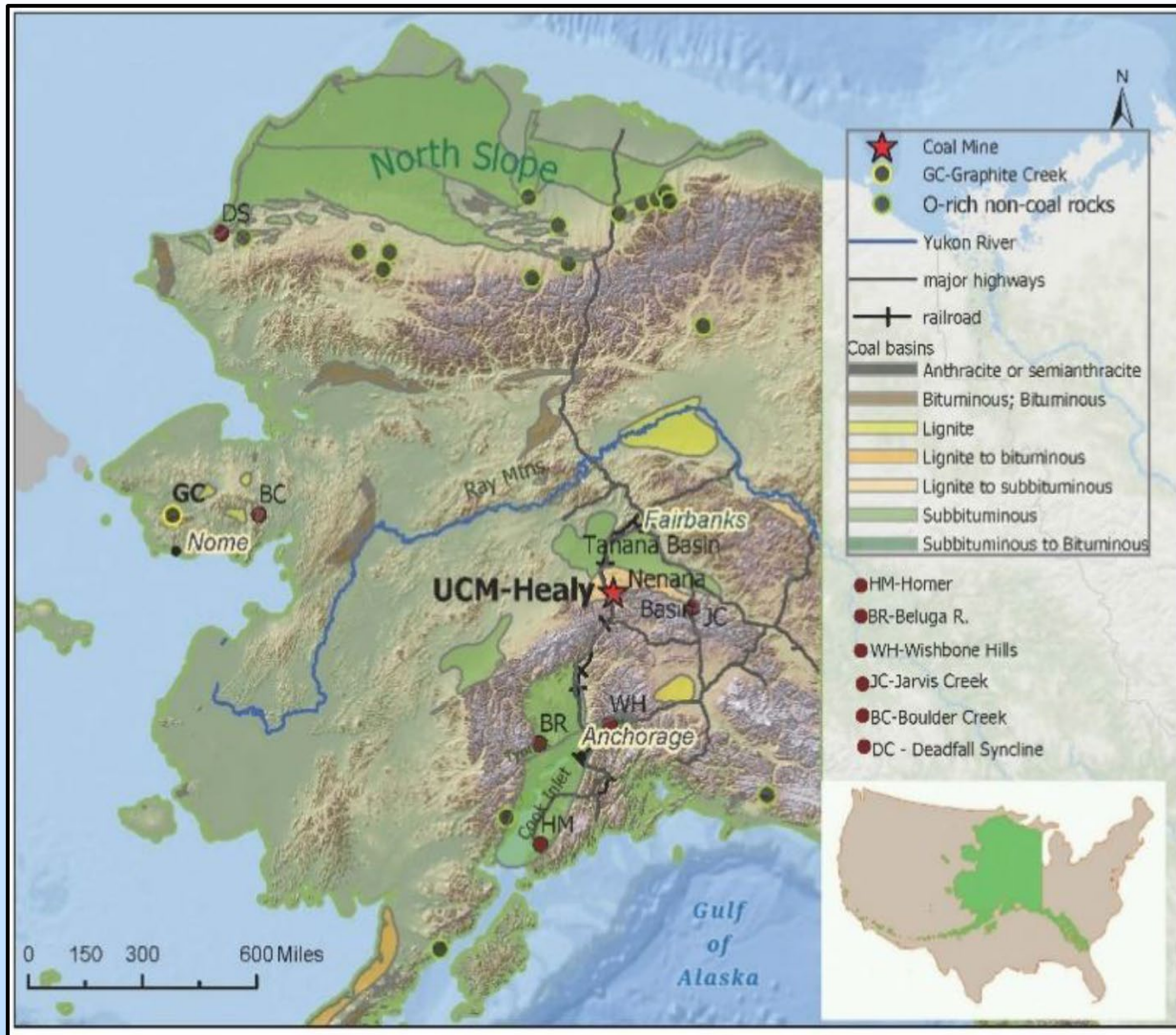
**Low to Very Low
Potential Production**

Background—Alaska's Critical Mineral Potential

- Operating hard rock mines either already produce, or have significant potential to produce critical minerals
- Several advanced exploration projects have demonstrated CM potential, including two of our project partners:
 - Graphite One
 - Ucore
- Opportunities are balanced by development challenges due to remoteness and lack of infrastructure in many parts of Alaska



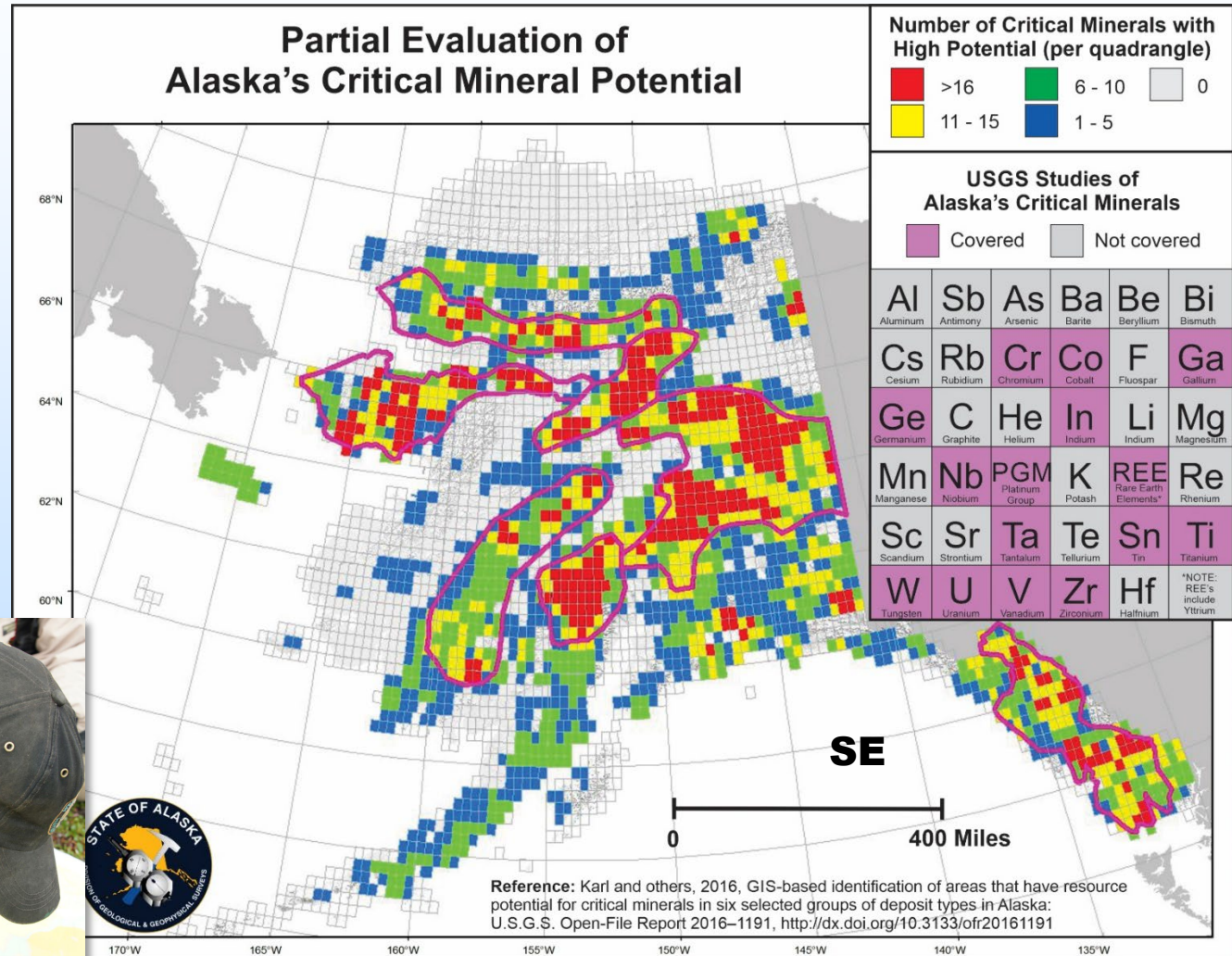
Background—Alaska's Carbon Ore Resource Base



- Alaska hosts an immense amount of carbon ore, including more than 5 trillion short tons of coal – more than half of the estimated coal resource in North America
- Unlike the continental U.S., characterization of carbon ores for their REE/CM content in Alaska's many basins is still in its infancy

Progress and Current Status

- Evaluated regional geology in the context of CM potential
- Considered coal basin geology to high grade assessment



Progress and Current Status

Three principal sources for Basinal Assessment

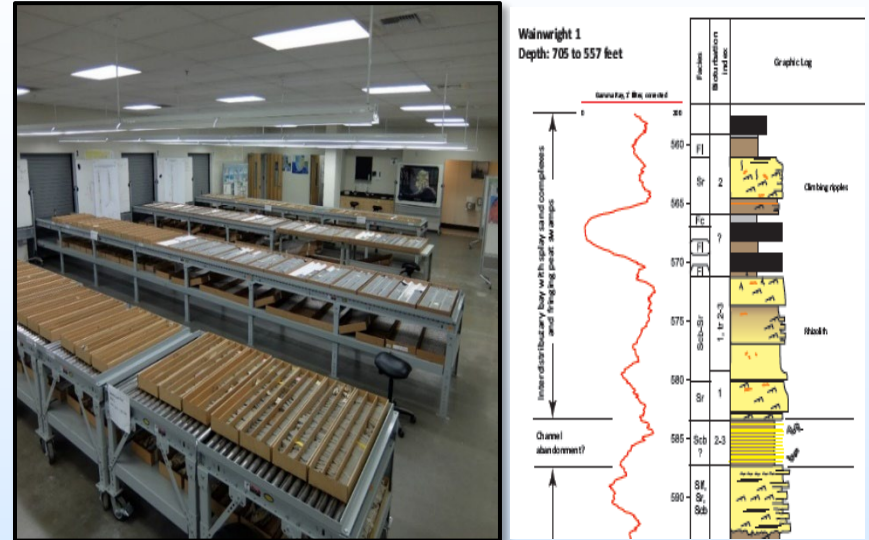
- 1) Existing published and unpublished data
 - Federal, State, Native and Industry
 - ✓ QA/QC of DGGs NCRDS data; generally limited due to vintage of geochemical techniques
- 2) New data from archived legacy samples
- 3) New data from recently acquired field samples



Progress and Current Status

Geologic Materials Center

- 3096 energy wells
- 26,500,000 feet of energy strata drilled
- 16,700,000 representative feet of energy core & cuttings
- 76,000 linear feet of energy core
- 22,000 Alaska minerals boreholes
- 766,000 feet of mineral rock drilled
- 617,000 representative feet of mineral core and cuttings
- 354,000 linear feet of mineral core
- 250,000 processed slides and thin sections
- 507,000 surface samples



Progress and Current Status

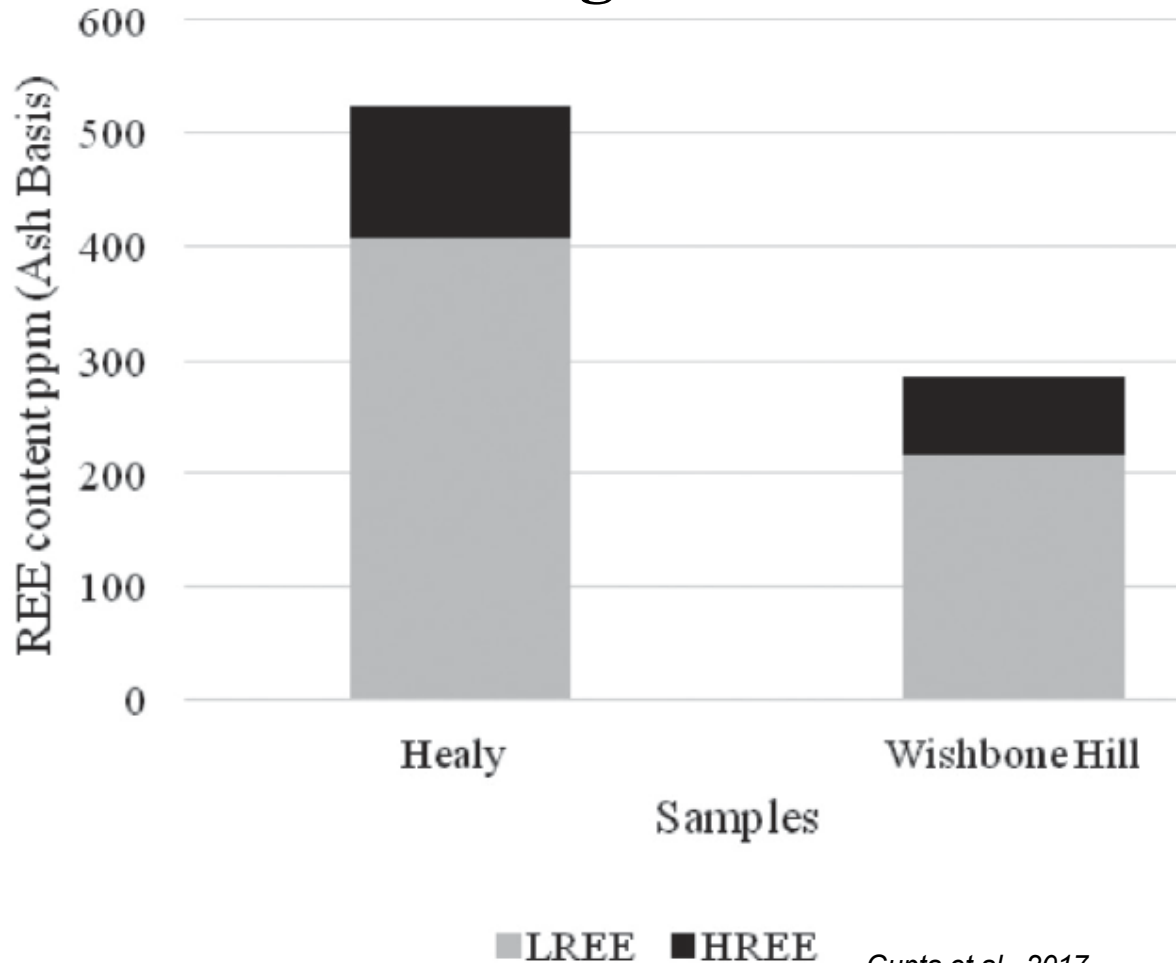


Screening Approach for New Data

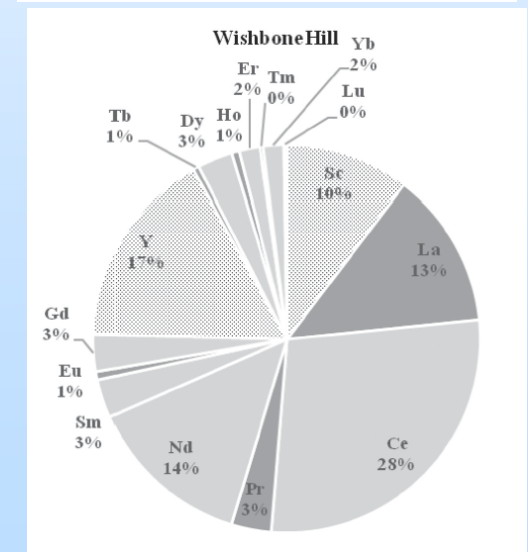
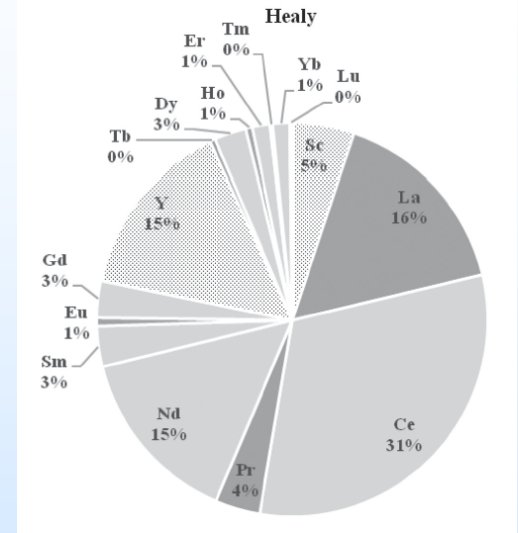
- Procured one of the first SciAps X-555 HH-XRF
 - 55 kV X-ray tube
 - Specifically developed for REE
 - Calibrated for Y, La, Ce, Pr, Nd, Sm, Eu and Gd
 - Excellent detection limits measured on whole rock hand samples (down to lower tens of ppm)
- Identified favorable core and samples at GMC to obtain rapid, qualitative elemental data
- Received training from SciAps
- Working to define “anomalous values” for follow up ICP-MS analysis

Progress and Current Status

Existing Data



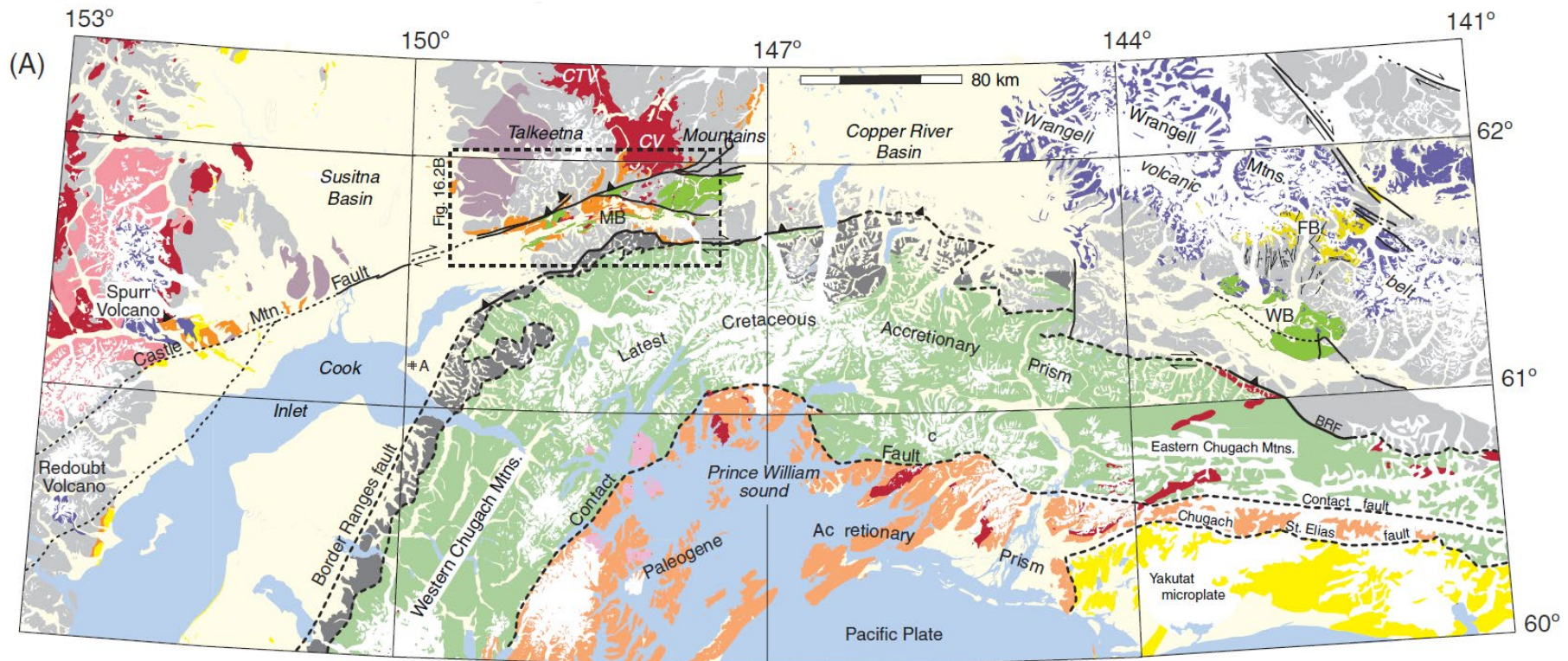
Gupta et al., 2017



Progress and Current Status

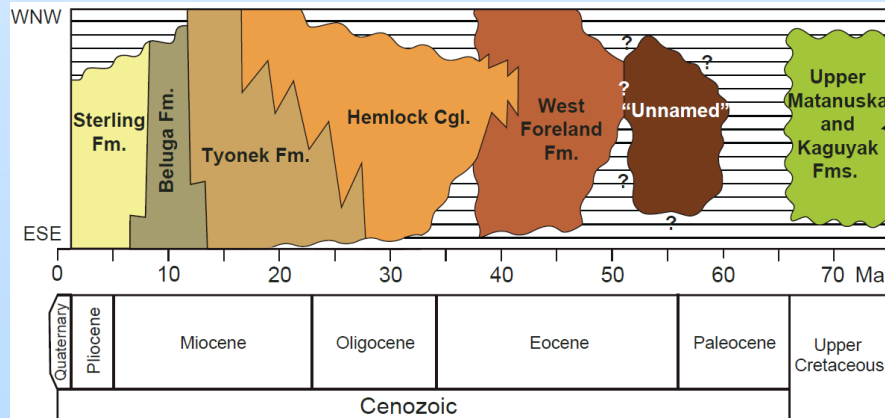
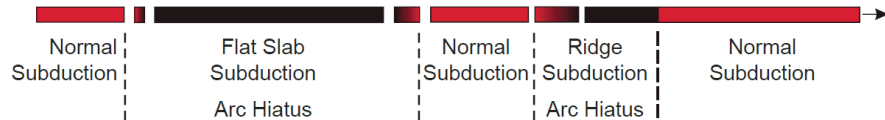
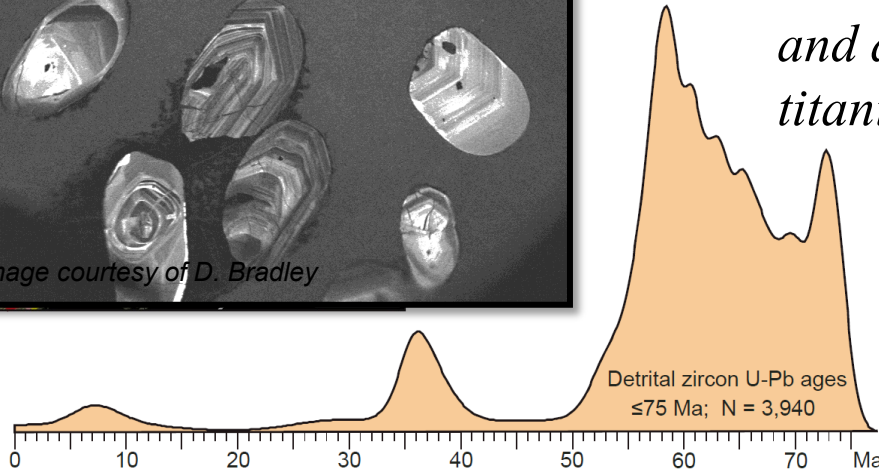
Helicopter Based Geological Field Work

- Collected Upper Cretaceous (Campanian) samples on North Slope
- Conducted reconnaissance work & sampling in the Cenozoic nonmarine basins in southern Alaska (western Susitna, northwestern Cook Inlet & Matanuska Valley)

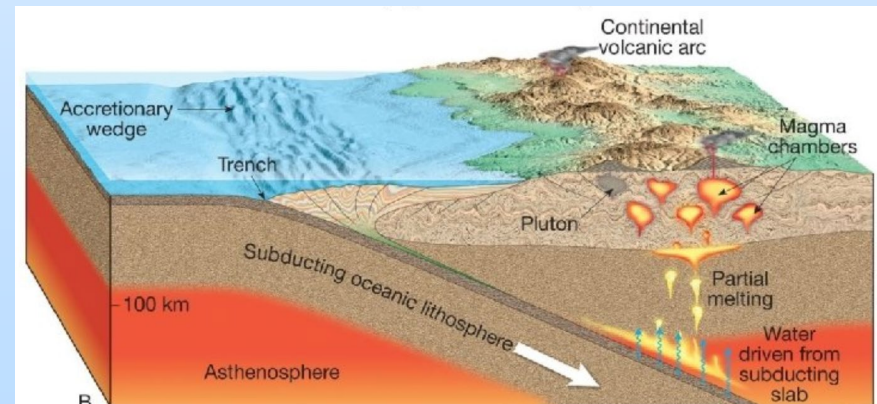


Progress and Current Status

Hypothesis: REE/CM detrital concentrations in coal reflect waxing and waning of arc volcanism and detrital contributions of monazite, apatite, titanite and zircon



Helmold et al., 2018



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Progress and Current Status

Usibelli Coal Mine

- Alaska's sole operating coal mine for last 50 years, producing 50+ million tons of coal
- Currently averaging 1-2 million tons/yr
- 7,570 - 9,430 Btu/lb on an as-received basis, 17.8% moisture, 3.5-13.2% ash yield and 0.1-0.3% sulfur



2022 Coring Program

- Drilled 13 holes totaling ~2,000 feet of total borehole depth
- 4" core collected through the mineable seams
- One core is a twin of a 2019 hole that yielded full thickness for targeted intervals to be sent to GMC for detailed analysis
- HH-XRF and ICP-MS data will be compared against available geochemistry

Progress and Current Status

Mine Waste Feedstock

- Expanded project scope to consider REE/CM from hard rock mine waste streams
- Hired experienced minerals geologist to negotiate access to data or min-sep processing splits



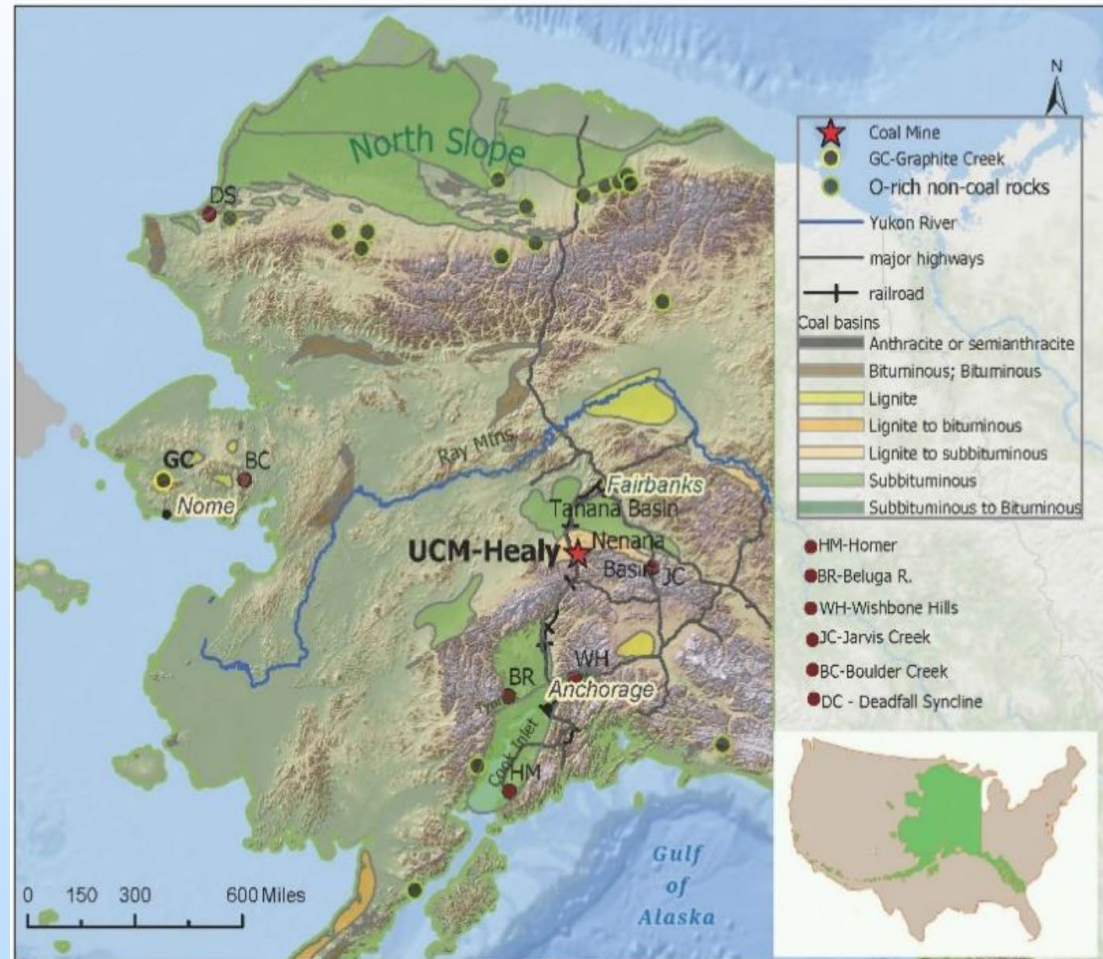
Mineral Separation R&D

- Continued research into microbial bioleaching to extract REE's from coal
- Ongoing experiments on hybrid graphene membrane solvent extraction of REE's



Site Selection Approach

- Alaska's basins ranked utilizing UAA's Institute of Social and Economic Research methodology that considers existing exploration permits and evaluates their progress toward possible development
- Alaska has only one operating coal mine, so we've partnered with them to develop a business plan to co-produce REE-CM
- Development scenarios will be created based on stakeholder inputs



Plans for future testing/development/ commercialization

- 1) Phase 1: Develop Phase 2 application around our private sector partners and help get them set up in Alaska
 - a. Usibelli Coal Mine
 - b. Ucore
 - c. CVMR
- 2) Phase 2: Address mine-site technology barriers
 - a. Mineral Phase Characterization
 - Mineral Phase Environment
 - Host Phase Environment
 - b. Mine Site Separation Technology
 - c. Infrastructure to support onsite concentration
 - d. Expand to placer mine operations (Alaska's Family Farms)

Plans for future testing/development/commercialization

The State of Alaska appropriated \$7.8 million to the University to support development of the Critical Minerals Industry in Alaska. These funds will be used to compliment the CORE-CM program:

- Head start on the TIC:
 - Hiring expertise & establishing a Separations Lab
 - Looking into initial on-site processing of ores
 - Working to provide assay and density separation services to our mining industry, including purchasing ICP/MS.
There is currently no in-state capacity for these services.
- Continuing work on biological mineral extraction and bio-film treatment of mining waste
- Work with partners to apply research findings for non-fuel uses of carbon



Outreach

- Sept 2021: UA Board of Regents Presentation
- Jan 5, 2022: Support Industry Alliance (≈ 75 participants)
- Jan 18, 2022: Initial Stakeholder Meeting (100+ participants)
- Jan 28, 2022: Alaska Miners Association (≈ 100 participants)
- Feb 4, 2022: Alaska House Finance Committee
- Feb 28, 2022: Alaska Chamber of Commerce Resources Committee
- March 5, 2022: Alaska Miners Association, DGGS (≈ 100 participants)
- Apr 6 & 19, 2022: Alaska Senate Finance Committee
- Apr 27, 2022: Briefing to Senators Sullivan & Murkowski staffers
- May 20, 2022: Alaska Miners Association Update (≈ 100 participants)
- May 27, 2022: DOE's Arctic-X Summit, *Carbon Management Panel*
- June 8, 2022: Participated with CVMR in Congressional Briefing
- Aug 22-23, 2022: University of Alaska Conference: Alaska Minerals—A Strategic National Imperative (≈ 200 participants)

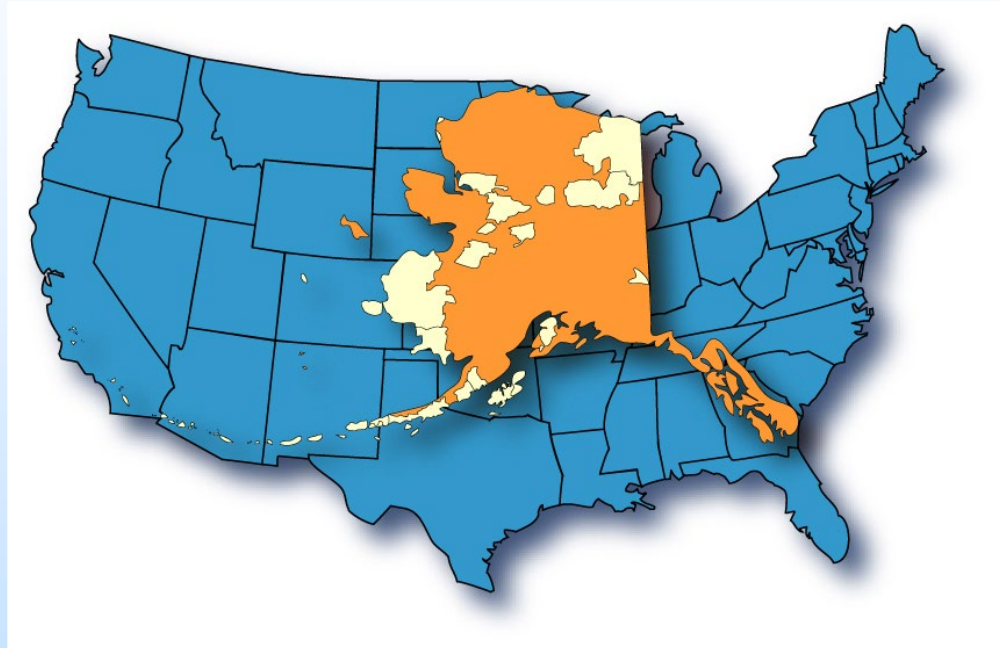
Workforce Development

- MOA between Ucore and University of Alaska Southeast being negotiated to provide workforce training specific to working in Ucore's planned facility
- University of Alaska Fairbanks developing self-paced, non-credit, online courses specific to CORE-CM
- Partnering with Alaska Resource Education to develop a REE/CM component to their curriculum



Summary

- Alaska is BIG and has enormous CORE-CM potential
- Usibelli Coal Mine is a promising target, but more detailed data is needed
- Exploration for these minerals will likely create the opportunity to leverage more abundant commodities (e.g. Au, Cu, Zn, etc.)
- Timeline for development will be determined by infrastructure development
- Continue outreach to maintain momentum started by the CORE-CM award & State investment

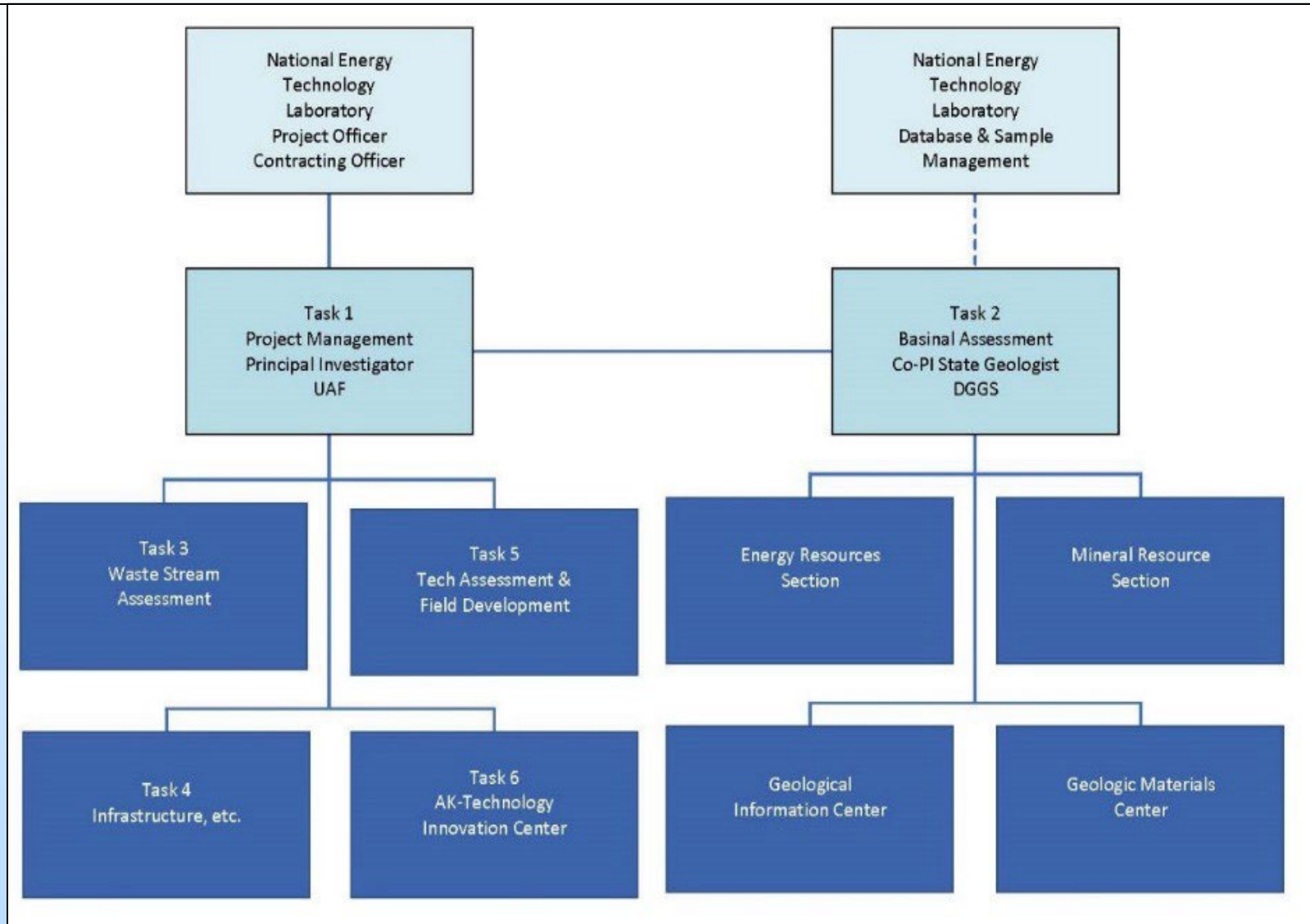


Thank You



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Organization Chart



Gantt Chart

