Project Overview and Critical Minerals in Alaska

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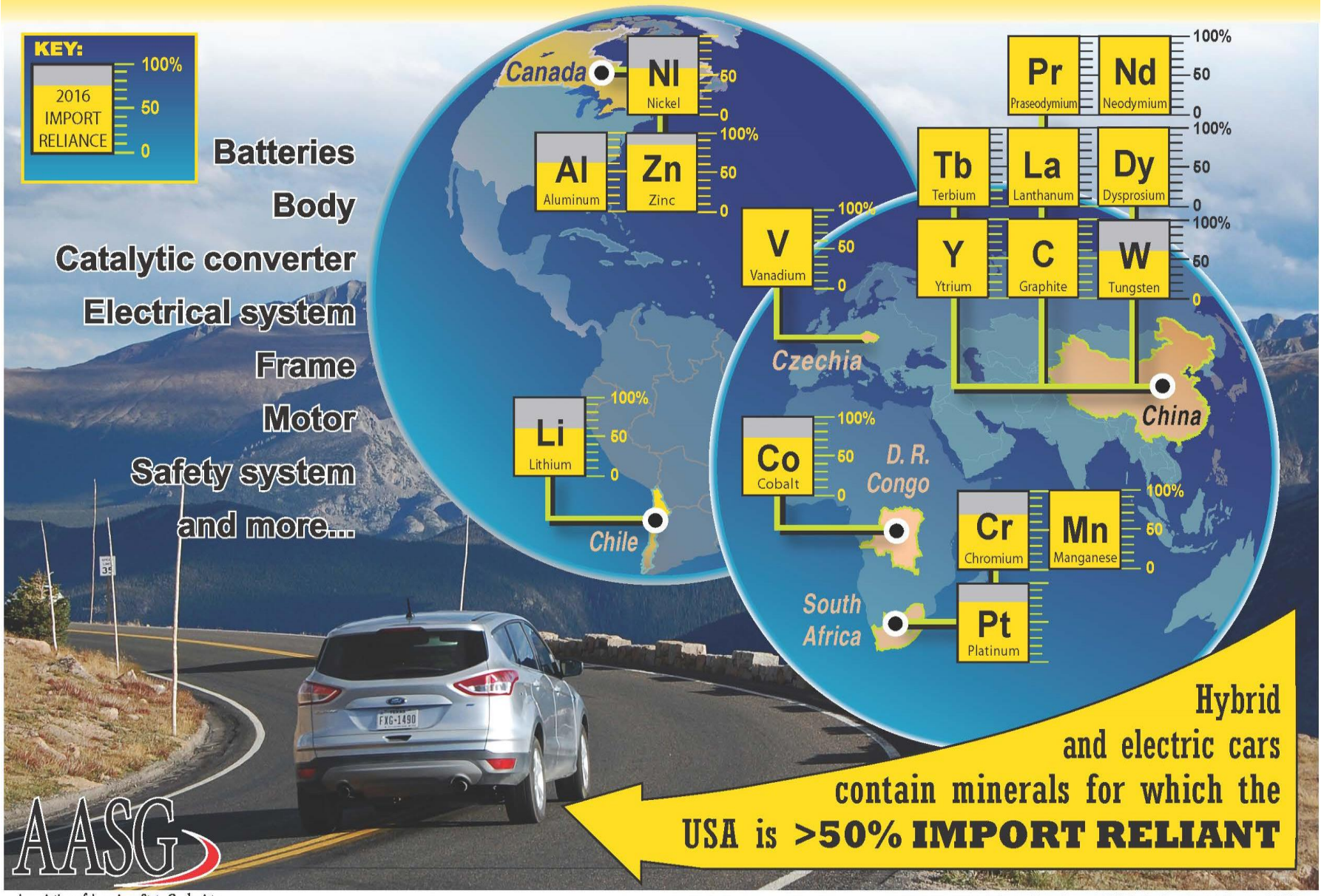
KEY MINERALS IN ELECTRIC & HYBRID CARS



AASG
Association of American State Geologists

Information from USGS Professional Paper 1802

Energy Transition Impact

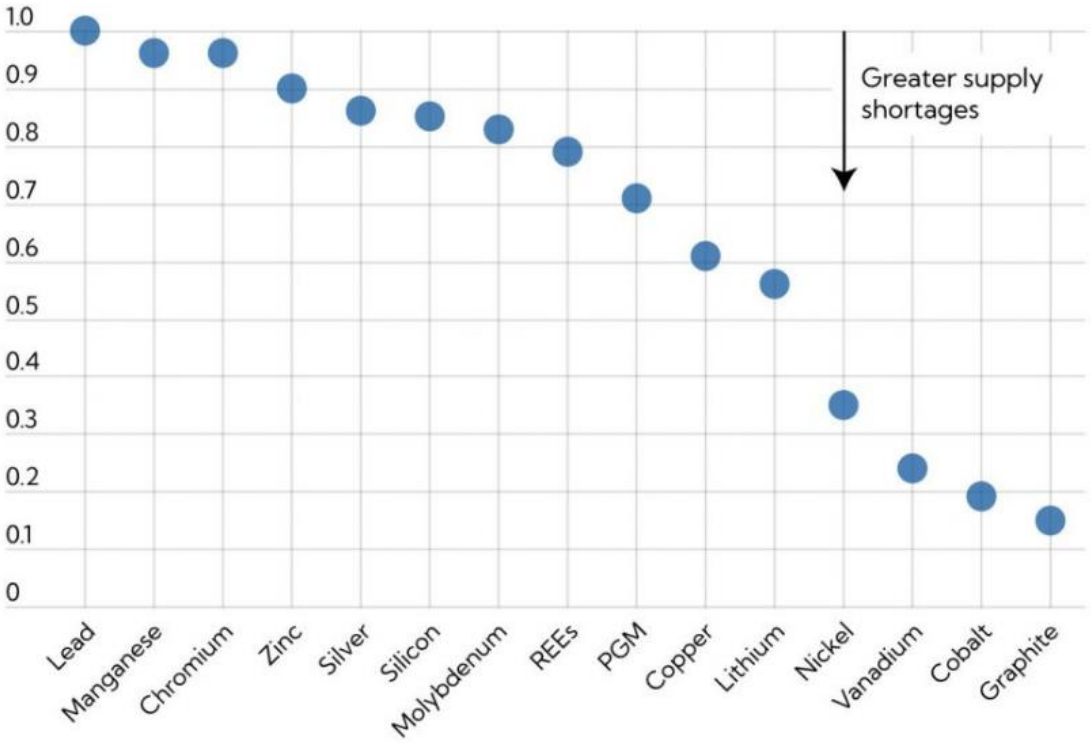
Metals Demand From Energy Transition May Top Current Global Supply

Projected Demand

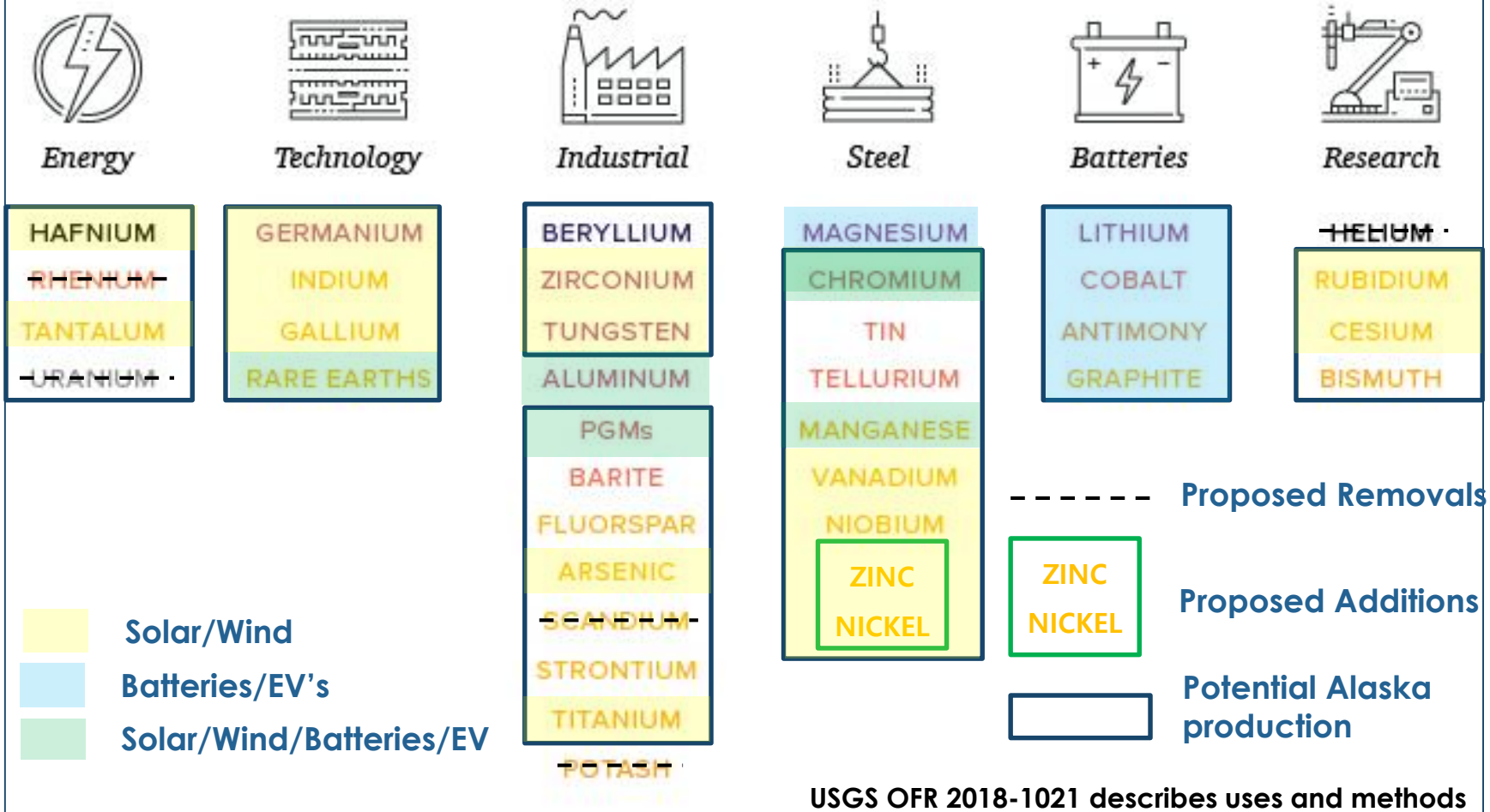
Metals in a net-zero scenario

Current production rates of some important metals, including copper, are likely to be inadequate to satisfy future demand.

(supply/demand ratio, energy and non-energy demand coverage)



Revised Critical Minerals



USGS OFR 2018-1021 describes uses and methods

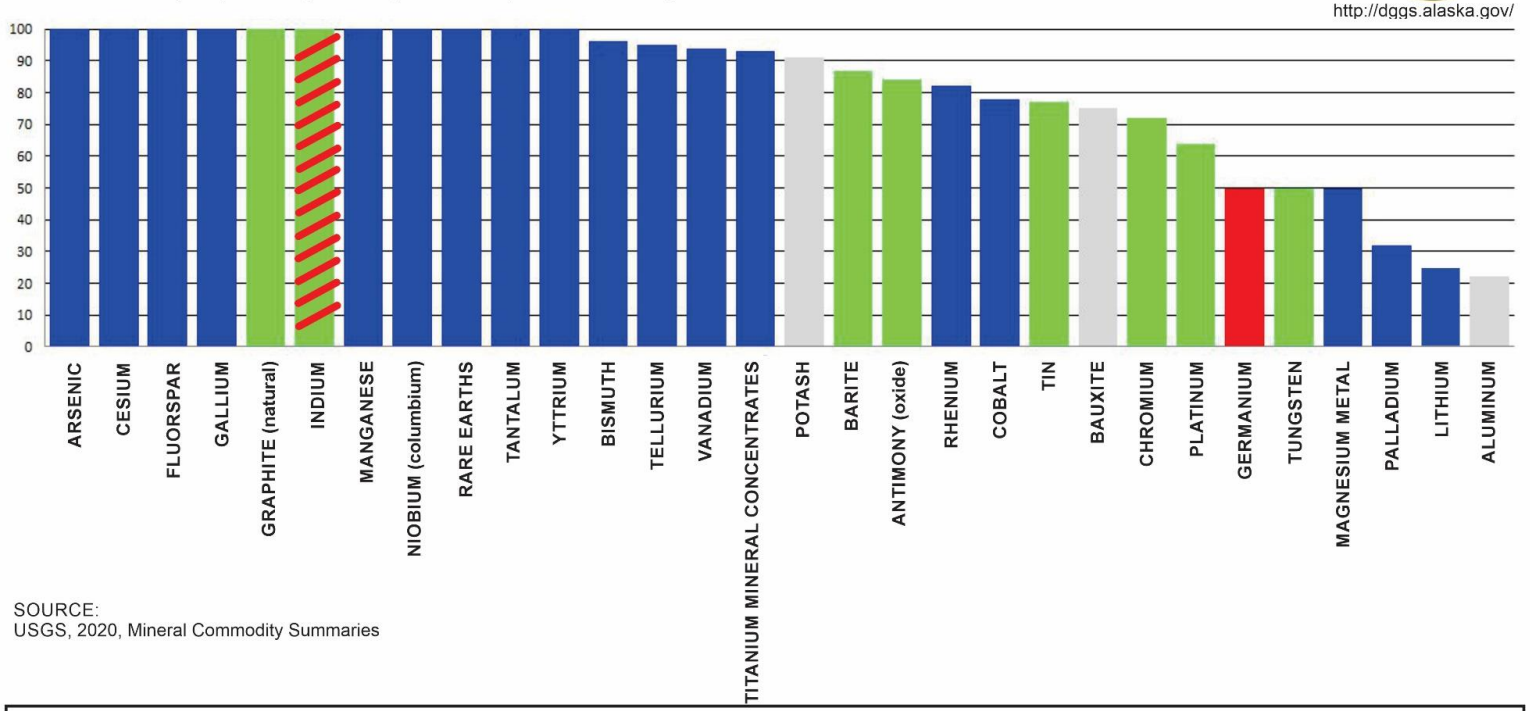
Meeting Increased Demand

1) Reduce Demand
2) Recycling
3) Substitution
~~4) Trading partners and supply chain stability~~
~~5) Stockpiling~~
6) Increase production:
    1) Brownfields production
        1) Recovery from waste streams
        2) Increase recovery from current production
    2) New mines

2019 U.S. Critical Minerals Import Reliance

NOTE:
Does not include beryllium, selenium, zirconium, and halfnium, as these commodity data are not available.

http://dggs.alaska.gov/



SOURCE:
USGS, 2020, Mineral Commodity Summaries

ALASKA

Current Production	Past & Potential Production	Potential Future Production	Low to Very Low Potential Production

CORE-CM

- Phase 1
  - Basin Assessment
- Phase 2
  - Planning and Initial Implementation
- Phase 3
  - Strategic Plan Implementation

Developing solutions for commercializing REE-CM mineral recovery from carbon ores and associated materials and waste streams

Phase 1

Basin Resources Assessment

- Carbon ore REE and critical mineral basin-focused critical mineral resource assessments
- Assessment of technology needs and initial testing
- Understand industrial and energy needs for development
- Develop strategy for integrating regions resources, infrastructure, needs and opportunities

Phase 2

Planning and Initial Implementation

- Build on Phase 1 CORE-CM basin-focused critical mineral resource assessments
- Technology development and field validation for production of REE's, CM's and high-value carbon-ore based resources

Phase 3

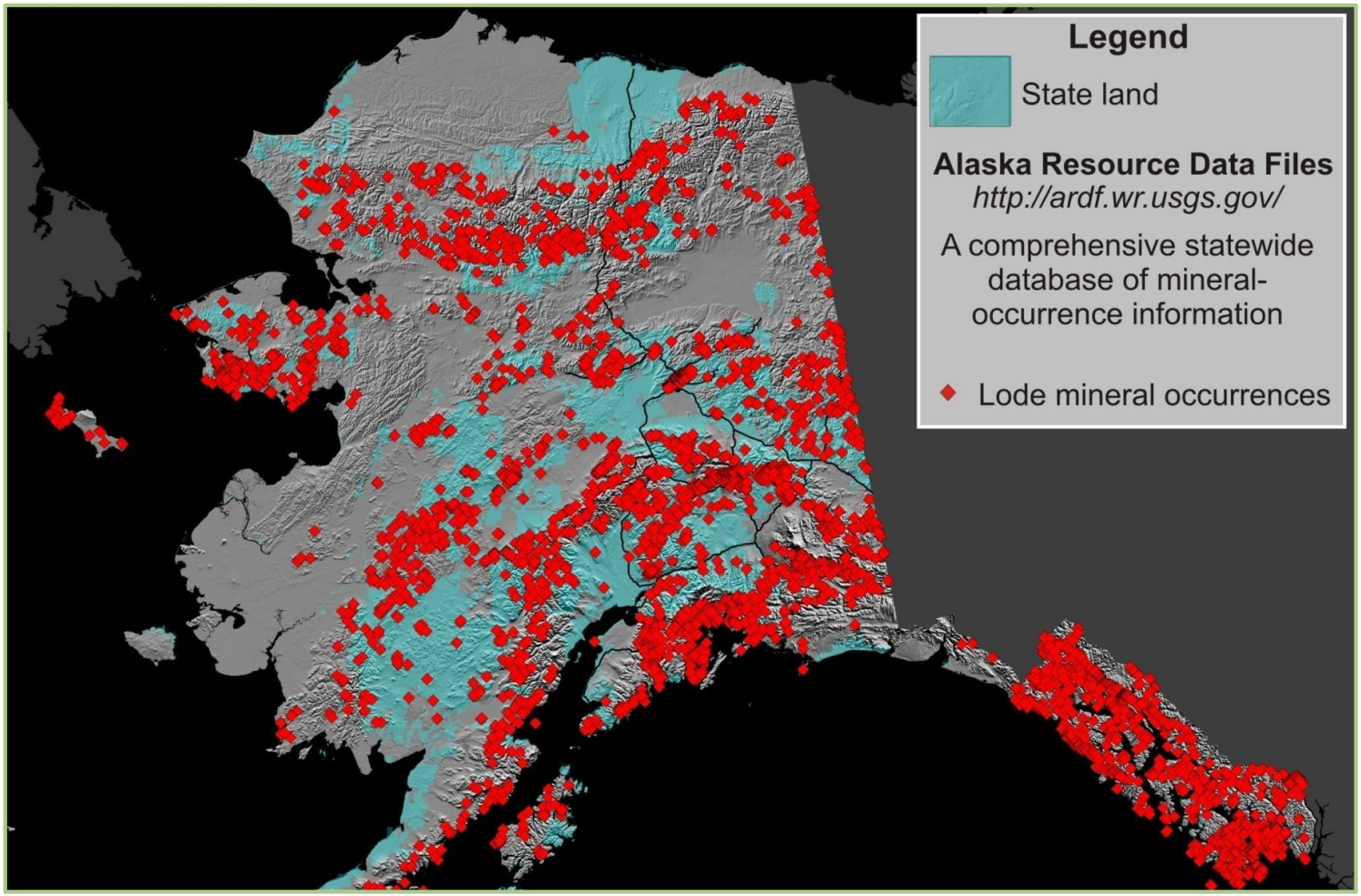
Strategic Plan Implementation

- Recovery technology development and field testing
- Execution of technical solutions and commercialization plans
- Programs for outreach, education and training

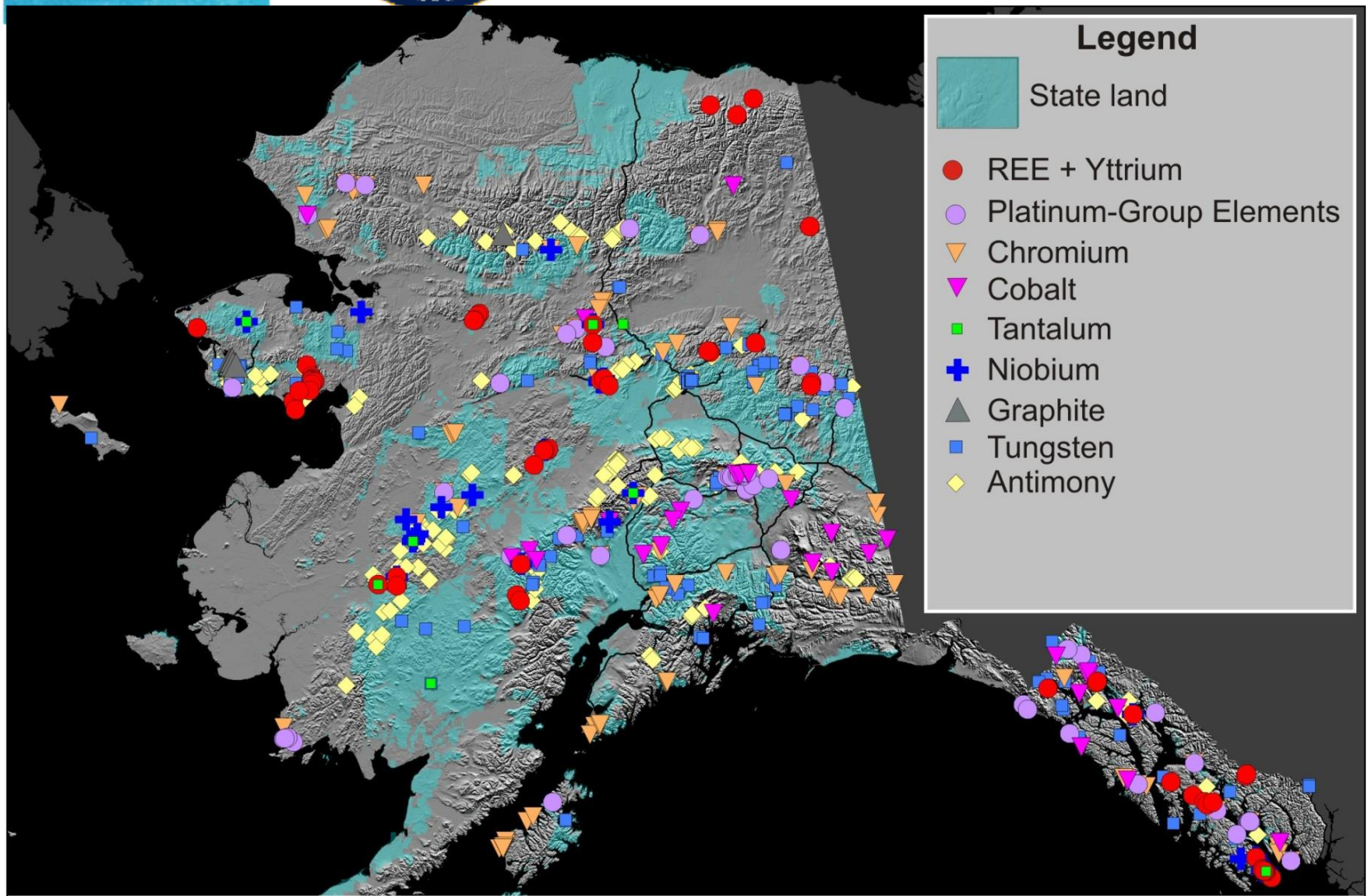
Phase 1 OVERVIEW

NETL Objective from the FOA		UAF/DGGS Task Equivalent
1. Basinal Assessment of CORE-CM Resources	=	Task 2: Basinal Assessments
2. Basinal Strategies for Reuse of Waste Streams	=	Task 3: Waste Stream Reuse
3. Basinal Strategies for Infrastructure, Industries and Businesses	=	Task 4: Strategies for Infrastructure, Industries and Businesses
4. Technology Assessment, Development and Field Testing	=	Task 5: Technology Assessment, Development and Field Testing
5. Technology Innovation Centers	=	Task 6: AK-TIC
6. Stakeholder Outreach and Education	=	Task 7: Stakeholder Outreach & Education

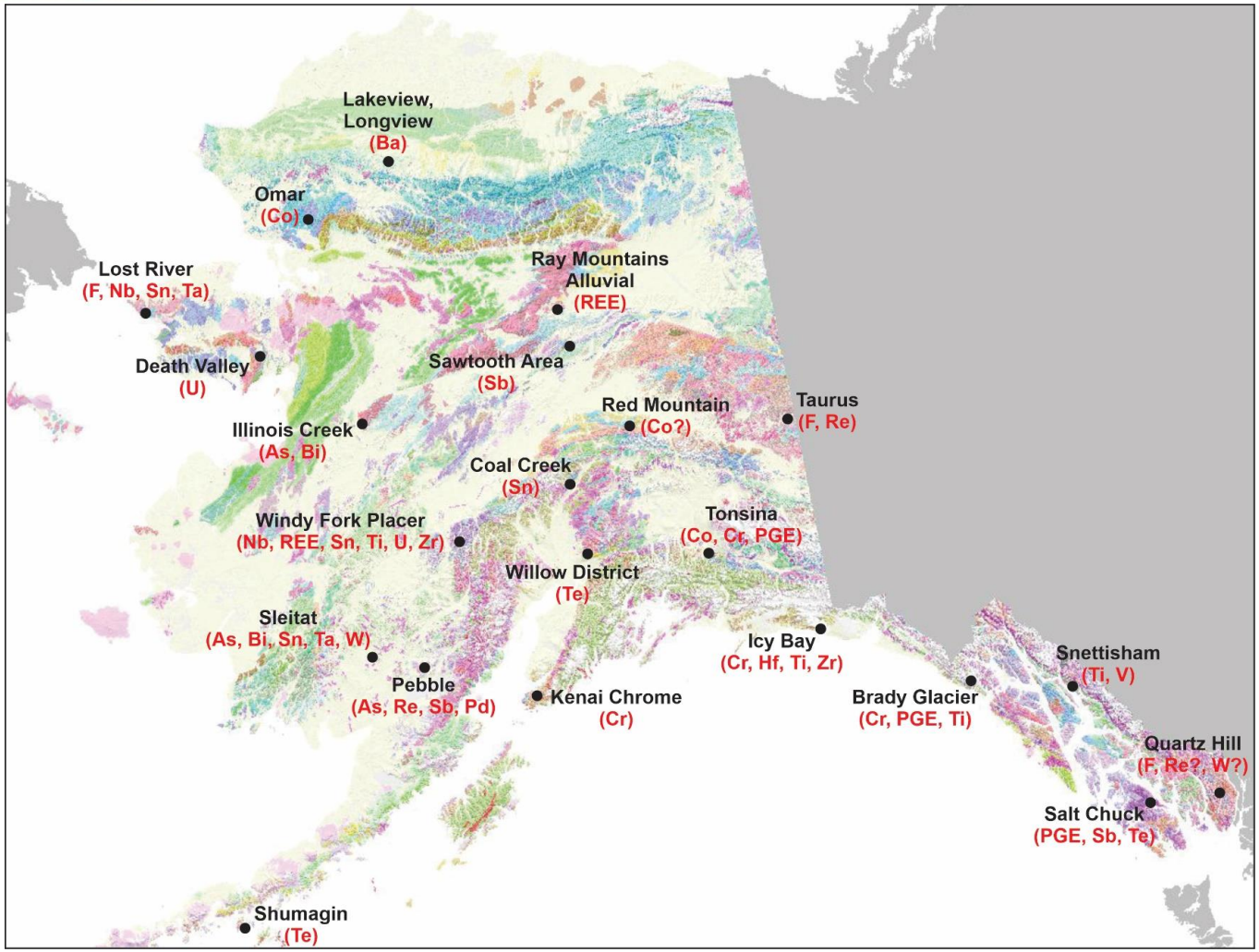
Mineral Occurrences



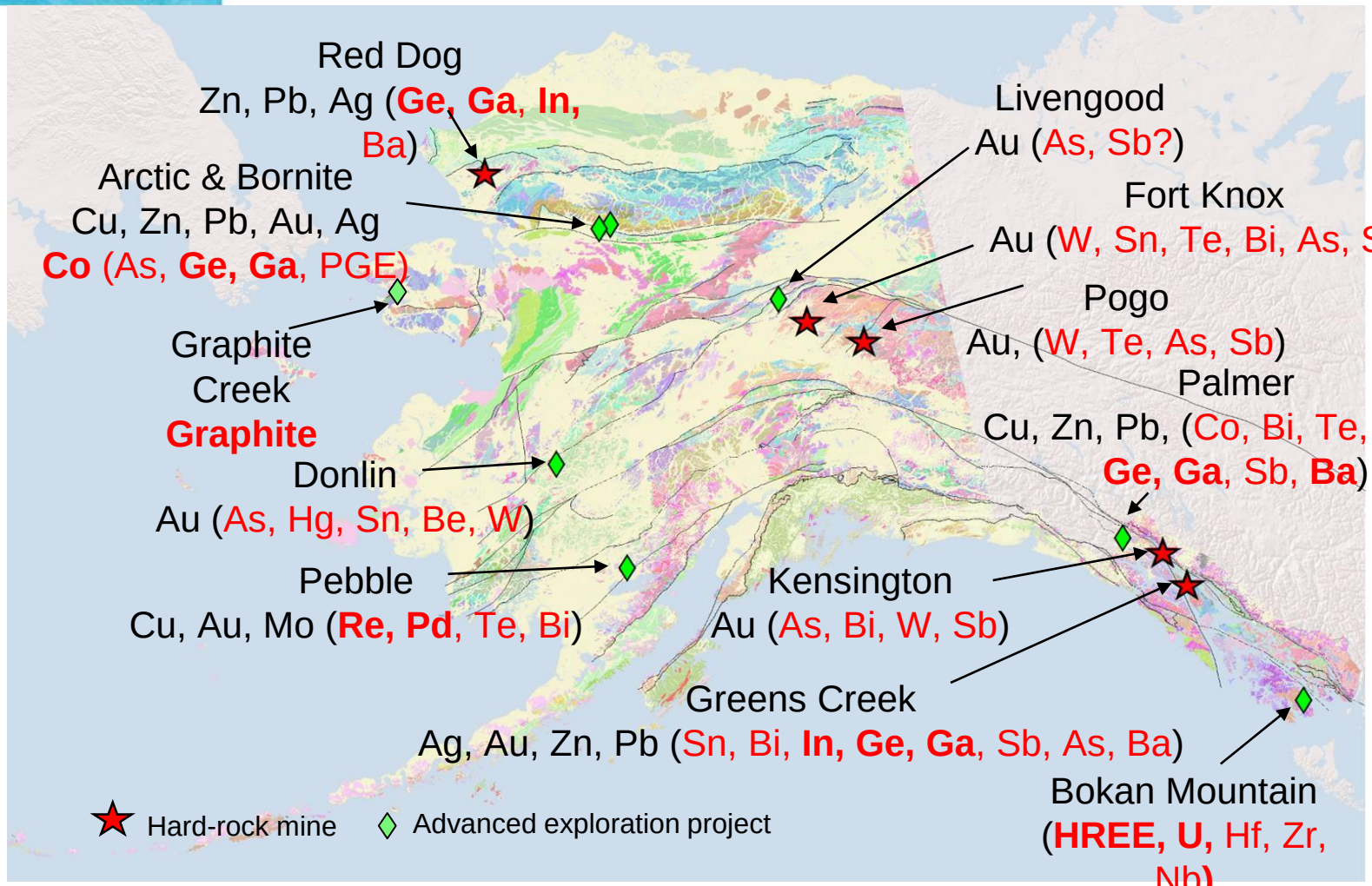
Critical Mineral Occurrences



Select Significant Critical Mineral Occurrences



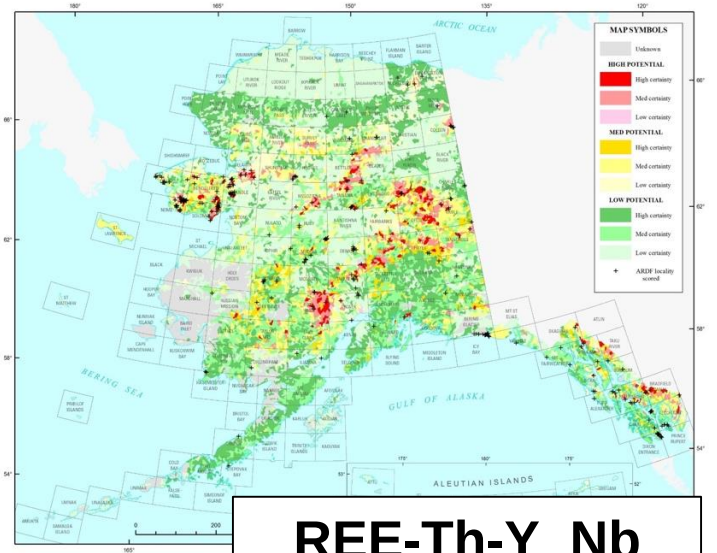
Mines and Advanced Projects - Brownfield Opportunities



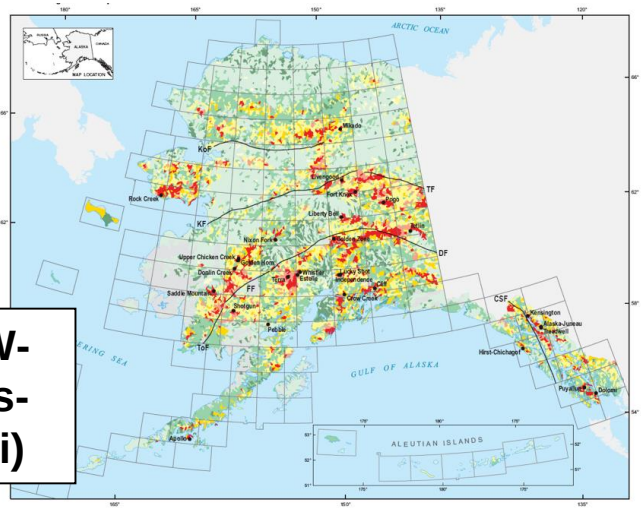
CM's in Alaska

Karl et al., 2016, USGS OFR 2016-1191

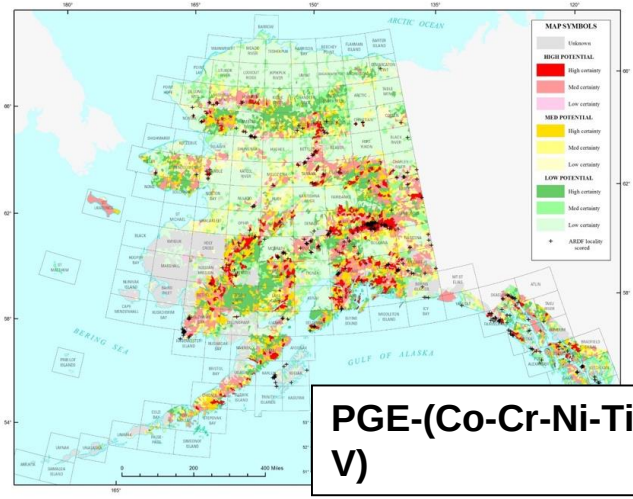
REE-Th-Y-Nb(-U-Zr)
PGE (-Co-Cr-Ni-Ti-V)
Placer/paleoplacer Au
Sn-W-Mo (-Ta-In-fluorspar)
Sandstone U (-V-Cu)
Cu (-Co-Ag-Ge-Ga) in carbonate



REE-Th-Y_Nb

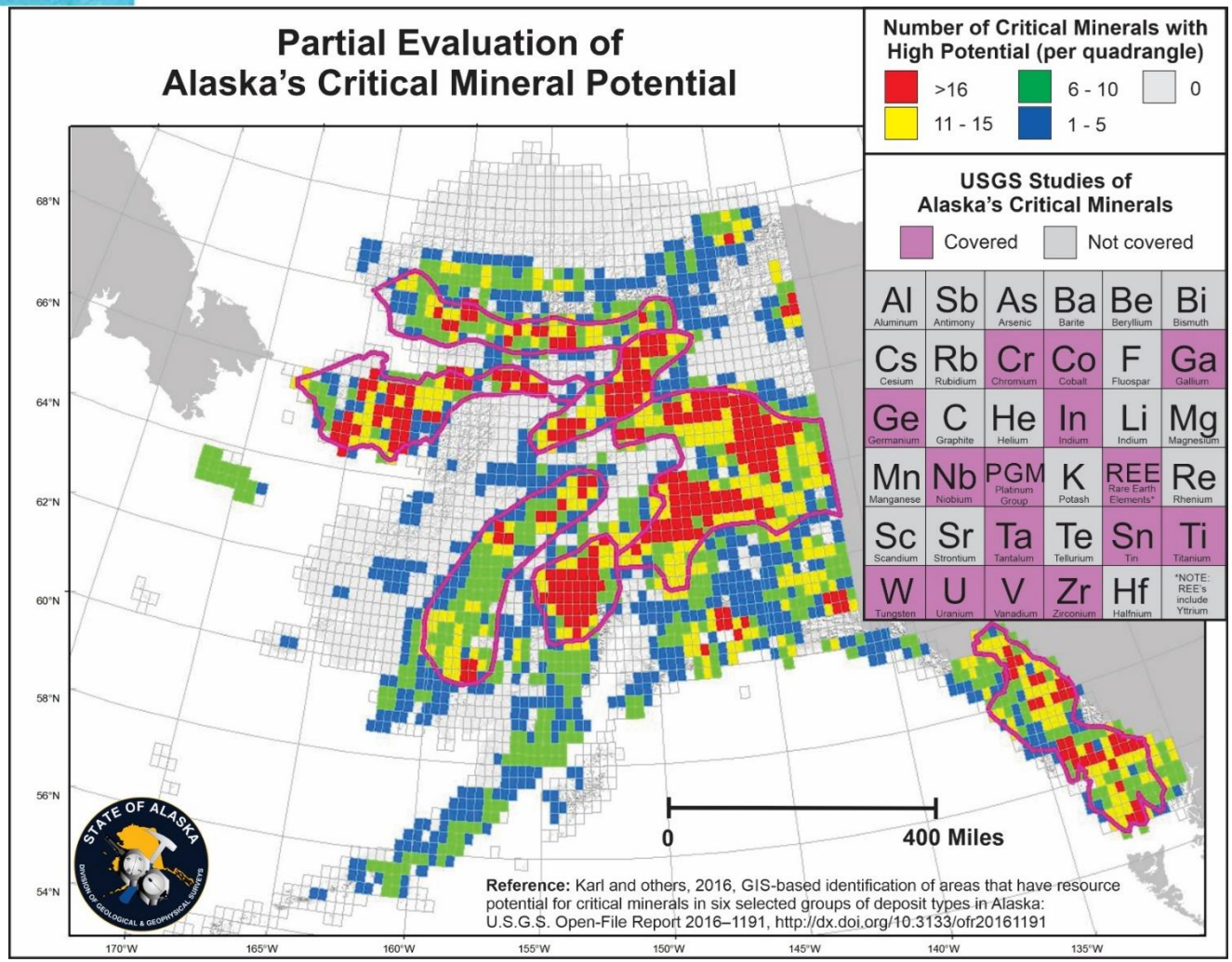


Au(-W-Sb-As-Hg-Bi)

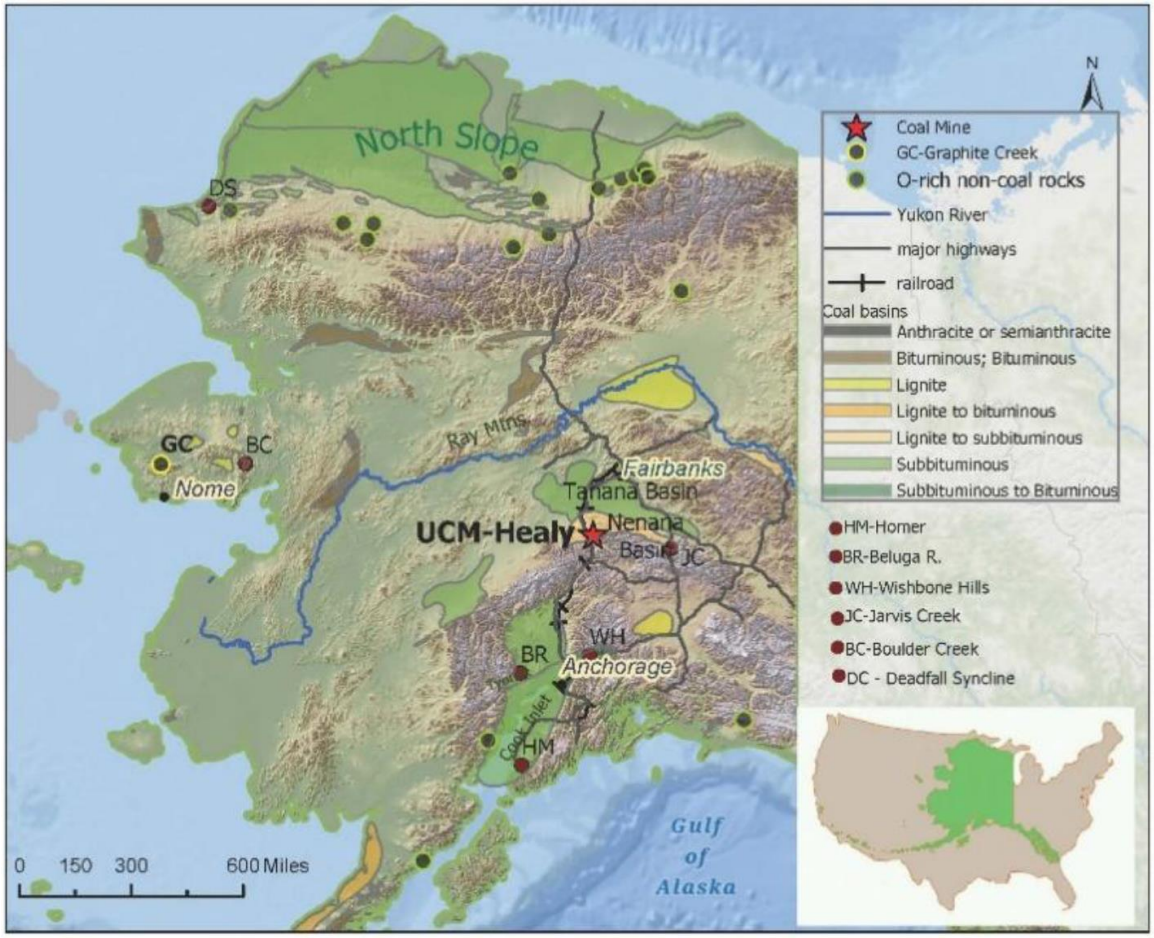


PGE-(Co-Cr-Ni-Ti-V)

CRITICAL MINERAL BELTS

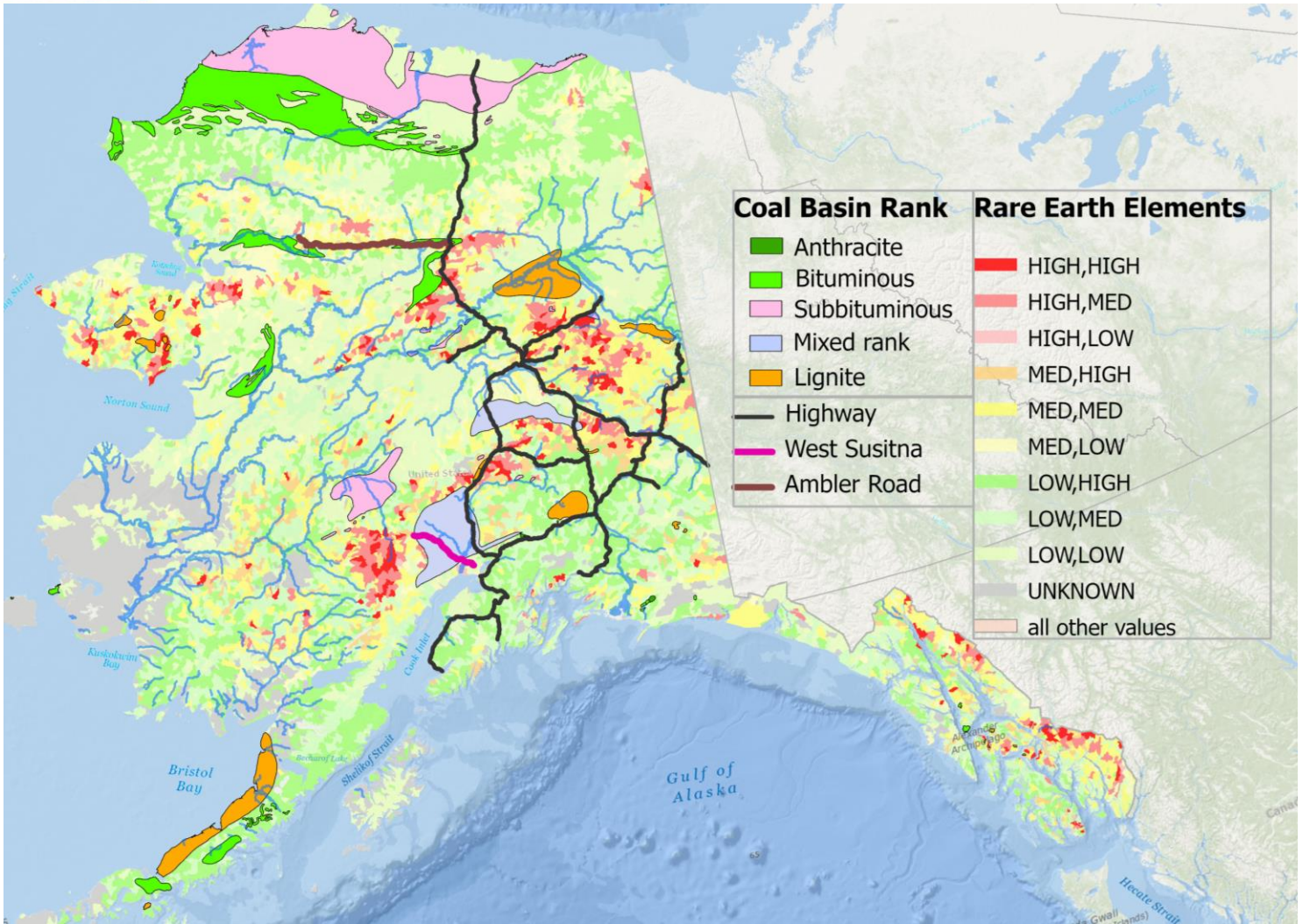


Carbon Ores in Alaska

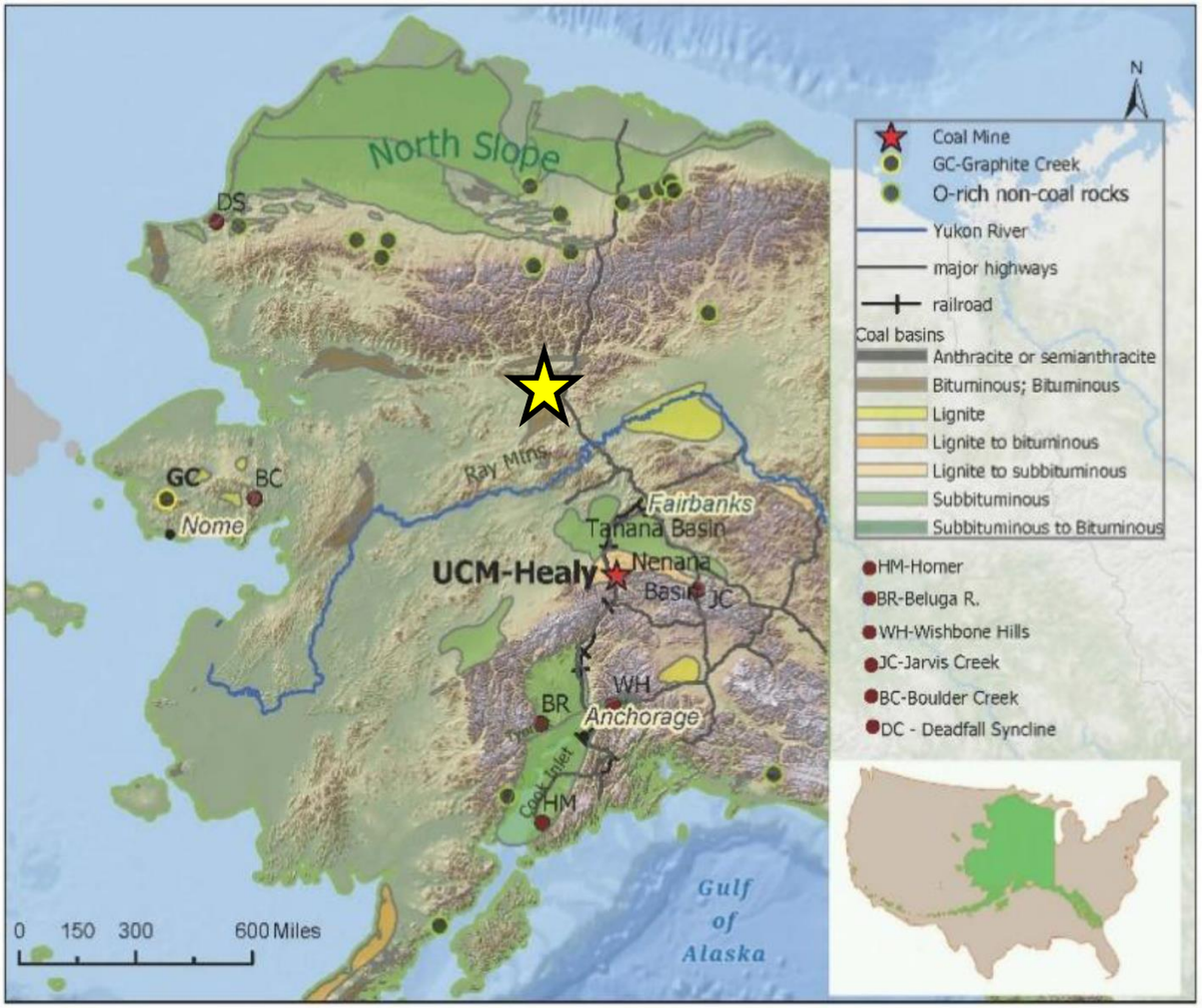


- Estimated to contain more than 5 trillion short tons of coal-over half the coal in North America
- 50+ coal fields deposited in a variety of tectonic settings
- Coarse graphite on the Seward Peninsula

REE & Coal Basins



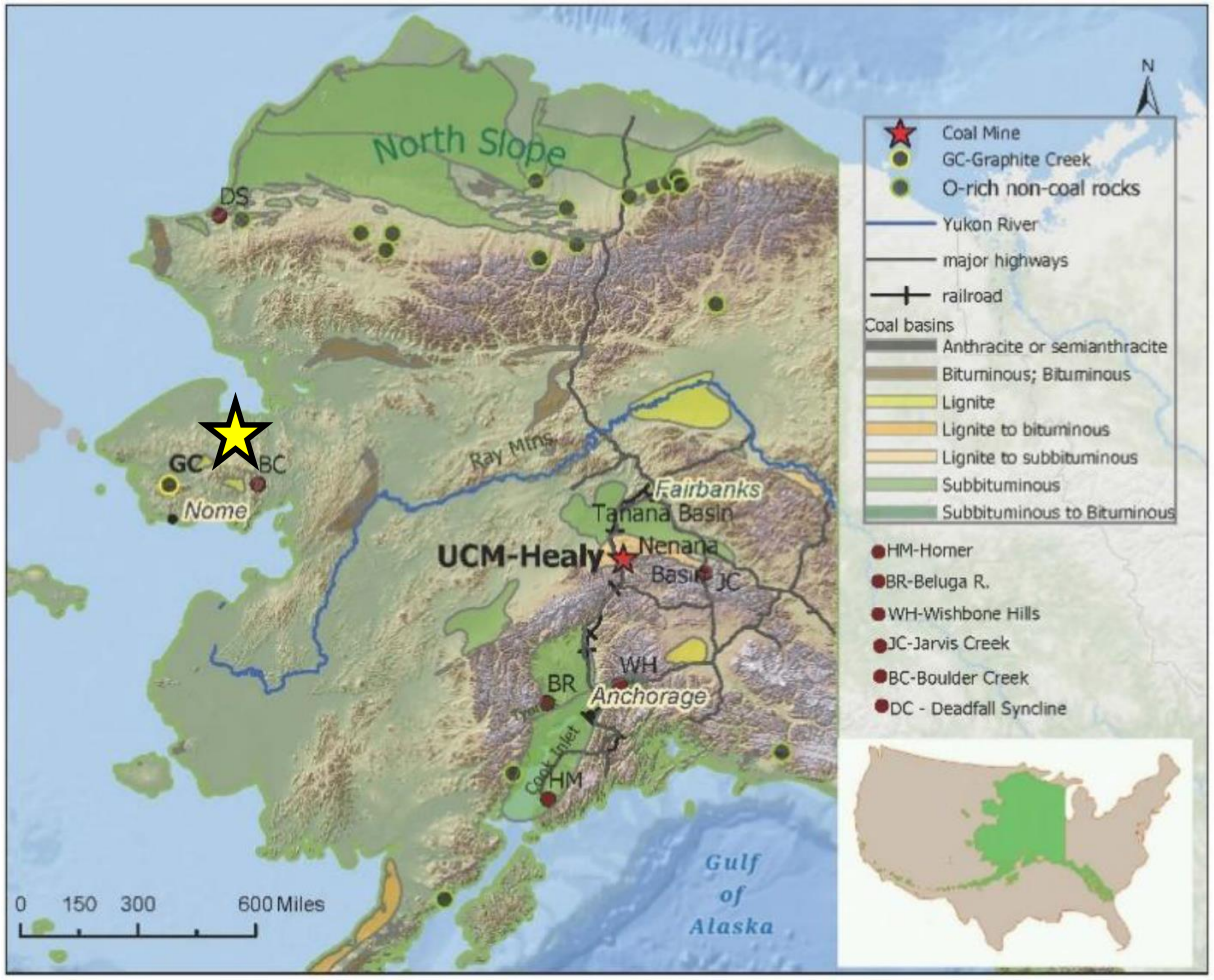
Ray Mountains



- Eocene Lignite - Subbituminous coal seams up to 18’ thick in fault bounded grabens
- Ge to 1 %
- Ga to 0.08%
- W to 2%
- REE’s to 0.16% in ash

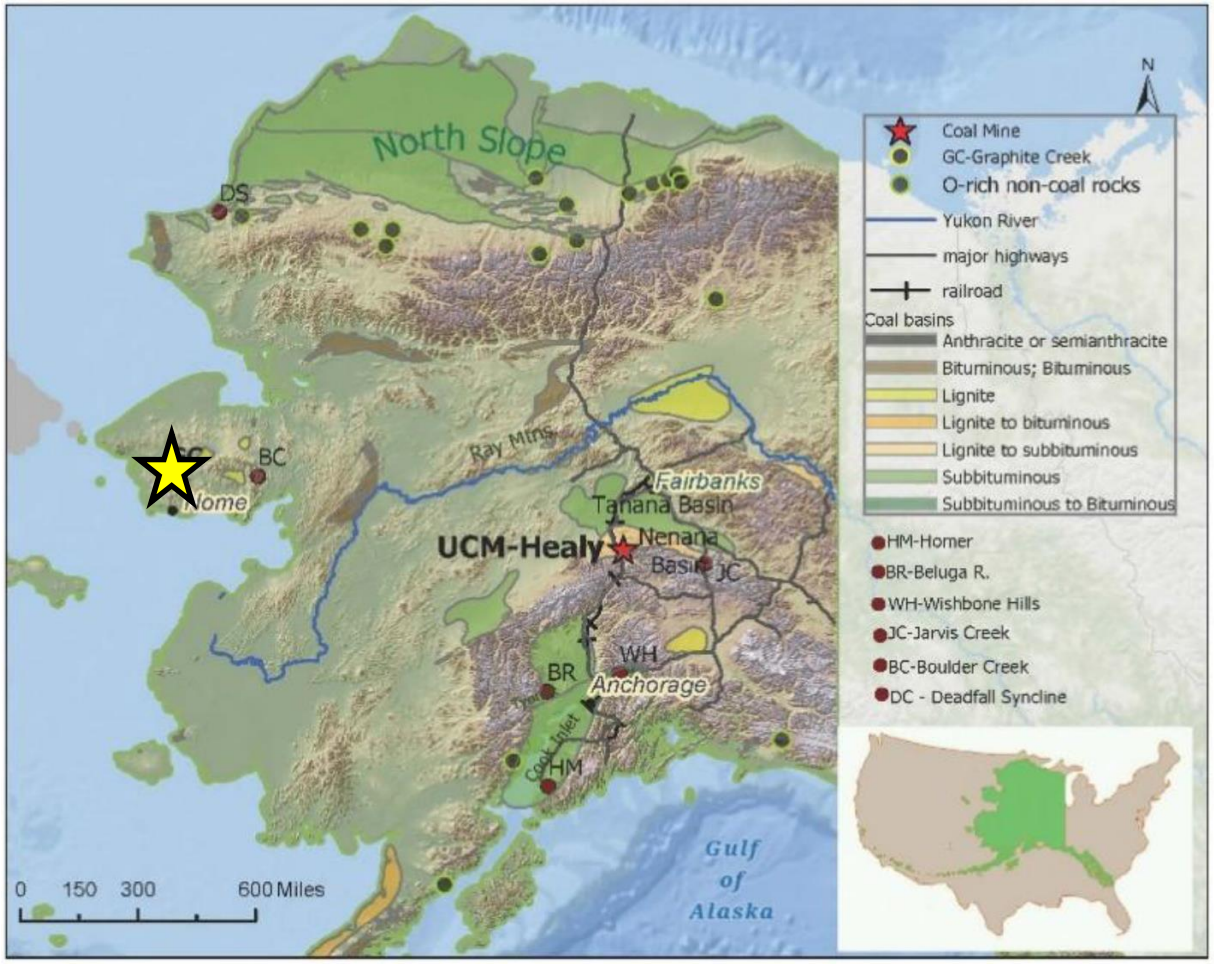
Barker, 2006
Dickinson et al., 1987
Clough et al., 1995

Boulder Creek



- Paleocene coals up to 175 feet thick occur in graben bounded by Kugruk fault and overlain by
- Associated sandstone has epigenetic and supergene U-mineralization averaging 0.27% and a calculated resource of 1,000,000 pounds of U_3O_8

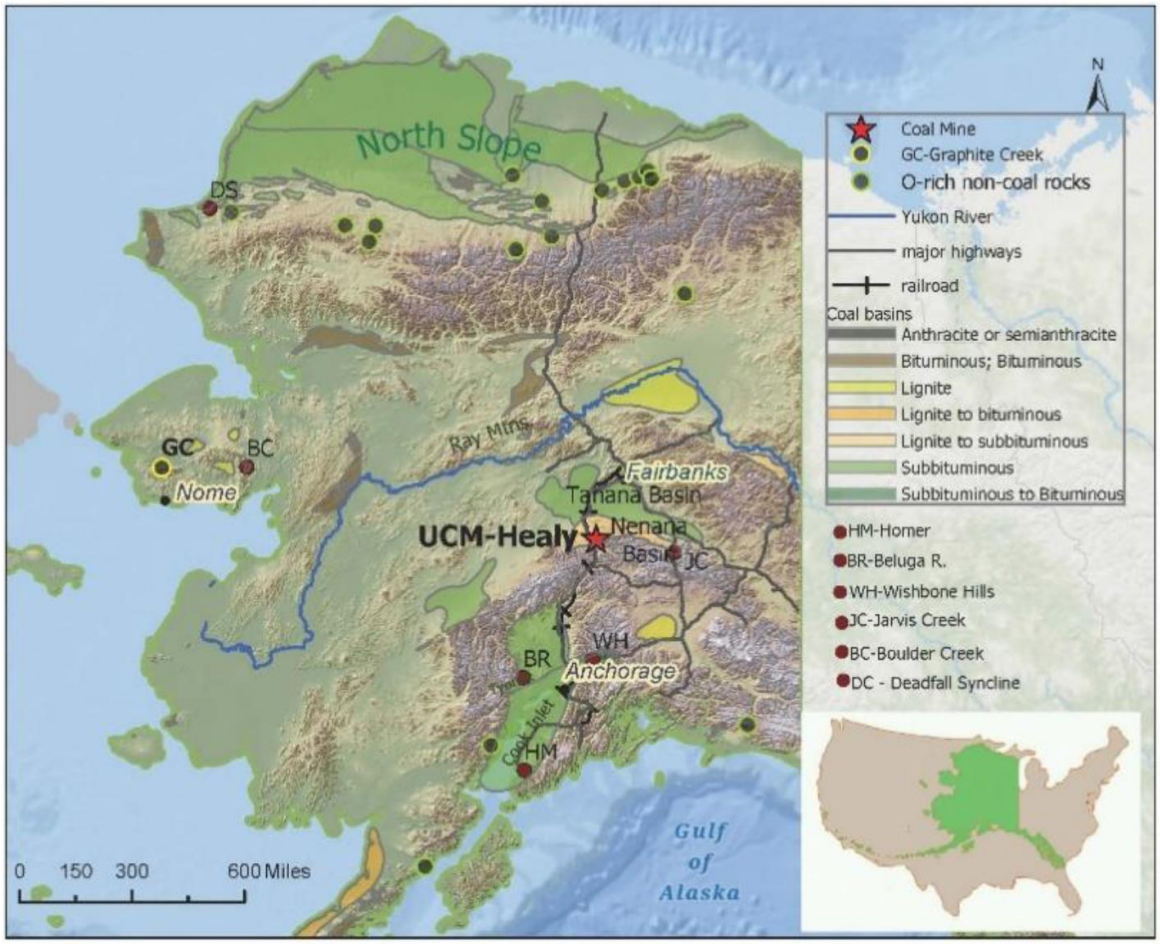
Graphite One



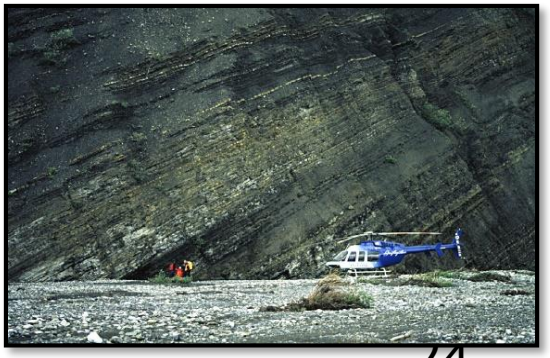
- North America's largest large-flake graphite deposit, located on Alaska's Seward Peninsula
- Minimum total resource of 10.95 million tonnes at 7.8% carbon as graphite.
- Small amounts of REEs were identified in residue from thermally processed graphite concentrate

Graphiteoneinc.com

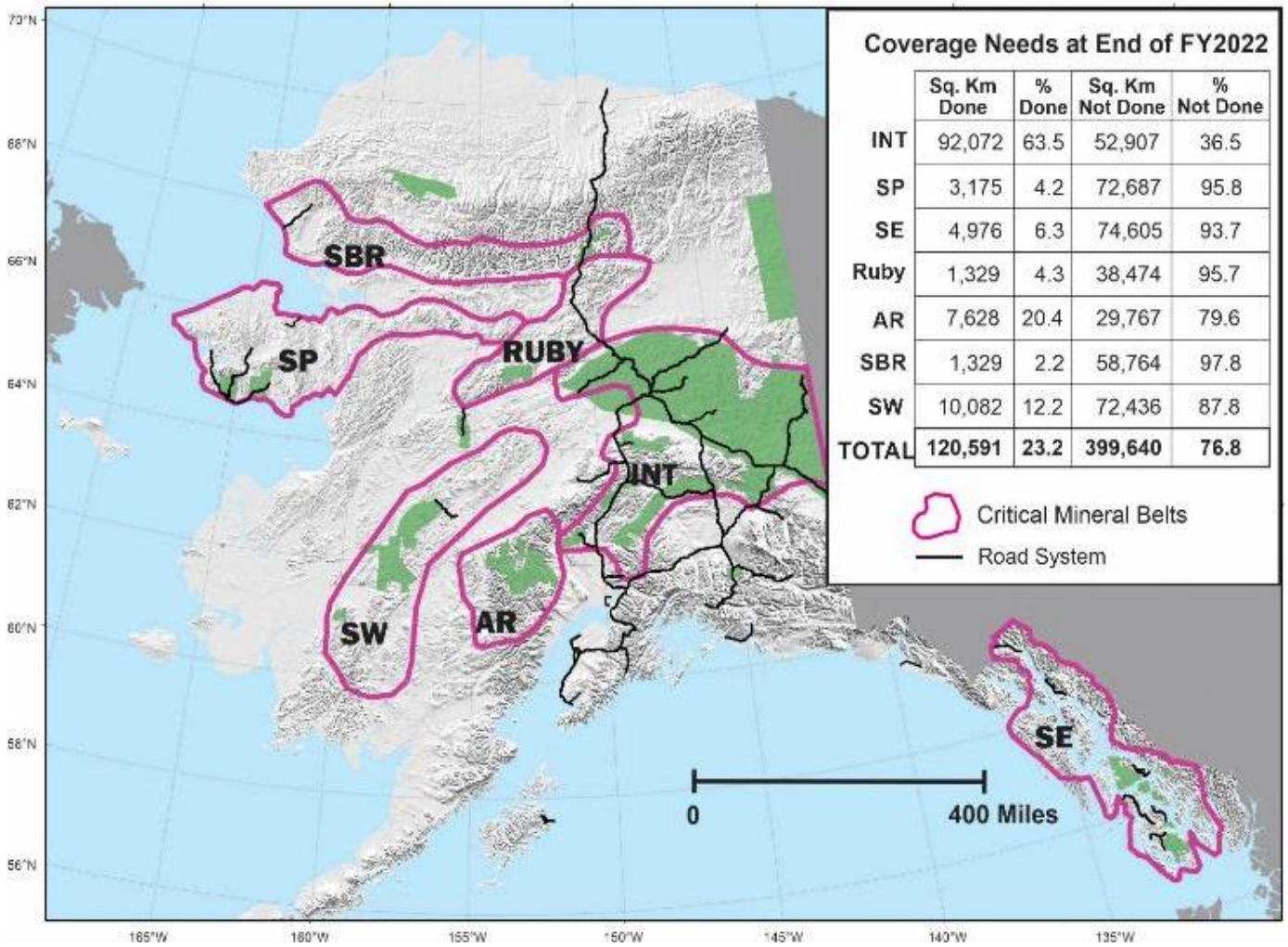
Carbon-rich rocks



- Mudstones with very high total organic carbon
- Isolated occurrences of tasmanite yield anomalous vanadium concentrations
- North Slope Triassic mudstone intervals host high phosphorous, fluorite, REE, V
- Many highly condensed shales are interbedded with abundant airfall volcanic material, potentially influencing their REE/CM content



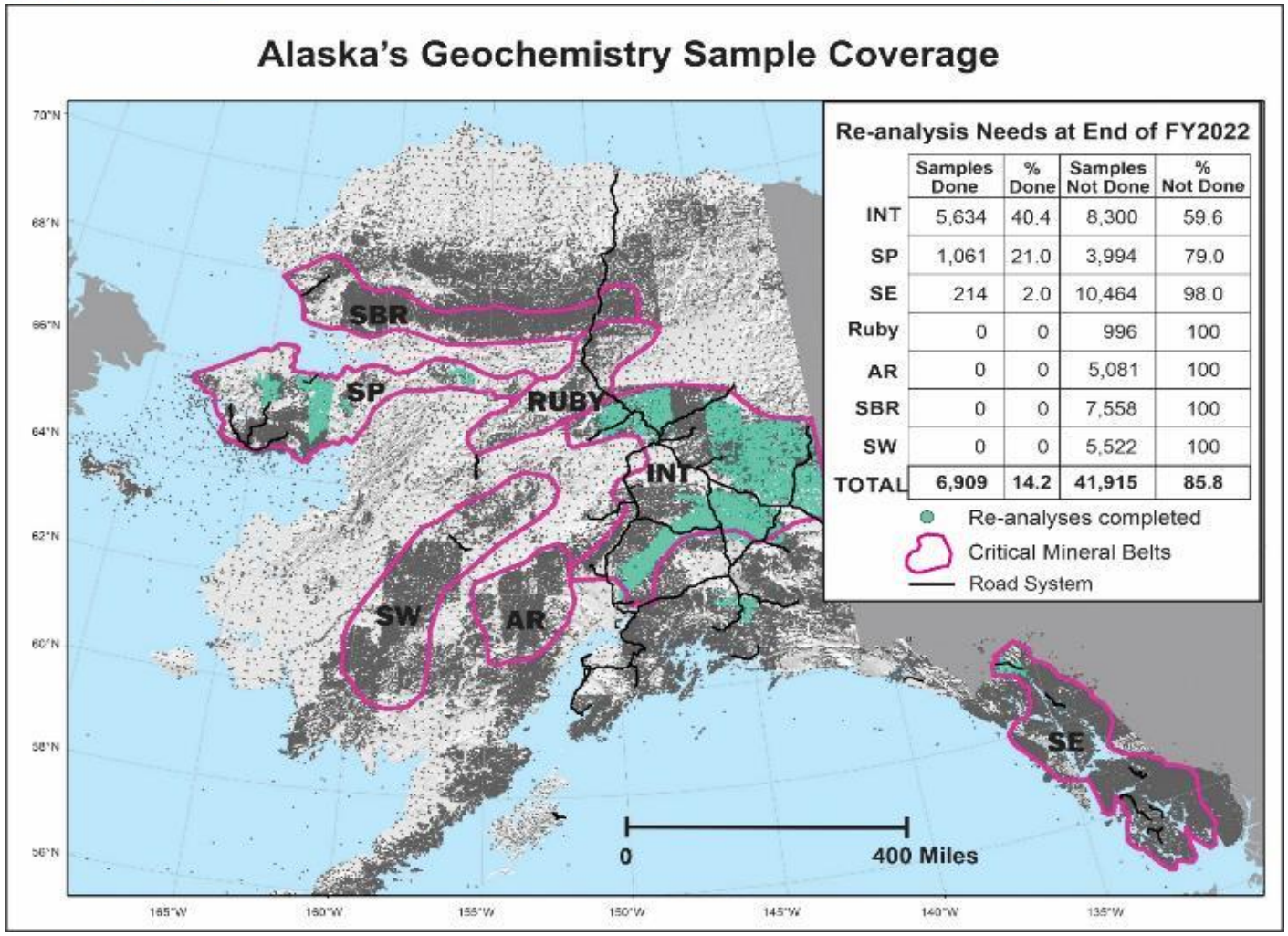
Airborne Geophysics



Coverage Needs at End of FY2022

	Sq. Km Done	% Done	Sq. Km Not Done	% Not Done
INT	92,072	63.5	52,907	36.5
SP	3,175	4.2	72,687	95.8
SE	4,976	6.3	74,605	93.7
Ruby	1,329	4.3	38,474	95.7
AR	7,628	20.4	29,767	79.6
SBR	1,329	2.2	58,764	97.8
SW	10,082	12.2	72,436	87.8
TOTAL	**120,591**	**23.2**	**399,640**	**76.8**

Geochemical Data



THANK YOU

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