# USGS projects that assess critical mineral resource potential in Alaska

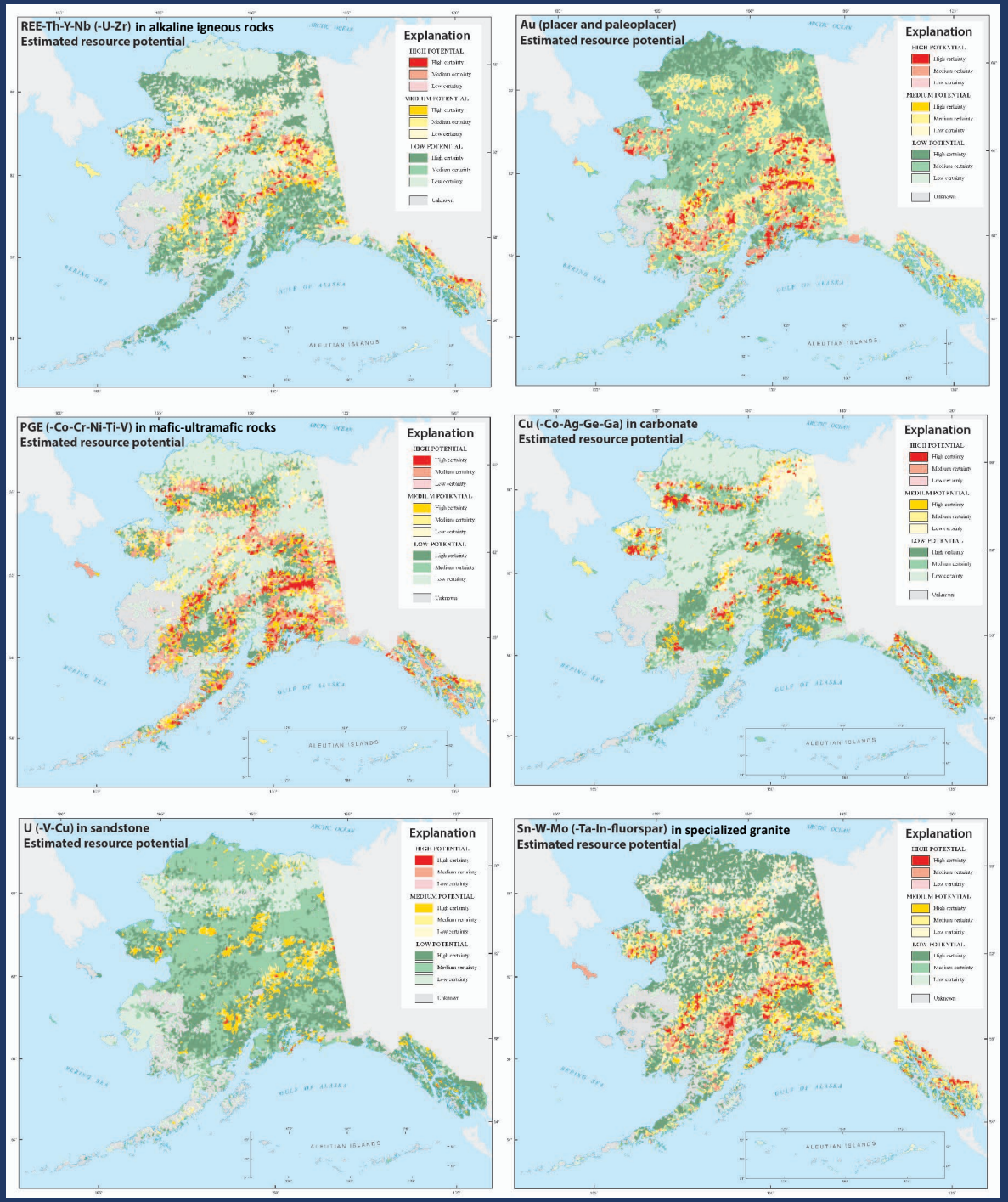
**How are they distributed**
**Where and why are they concentrated**

Sue Karl, Jamey Jones, Tim Hayes, Jeanine Schmidt, Melanie Werdon, Karen Kelley, Doug Kreiner, George Case, Erin Todd, Jeff Mauk, Matt Granitto, Eric Anderson, Keith Labay, Bronwen Wang, Isabelle Harris, Erik Spiller, Fred Transburg

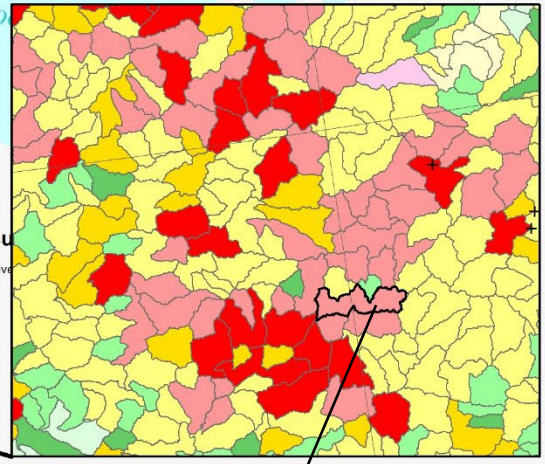
# Geospatial data-driven prospectivity analyses for critical elements in different mineral systems

Drainage basins, ~100 km$^2$, are scored and ranked for potential (red, yellow, green) and certainty (light, medium, dark shades) based on data they contain from geological, geochemical, geophysical, and mineral occurrence datasets.

Prospectivity analyses available online:
http://dx.doi.org/10.3133/ofr20161191
https://doi.org/10.3133/ofr20201147
https://doi.org/10.3133/ofr20211041

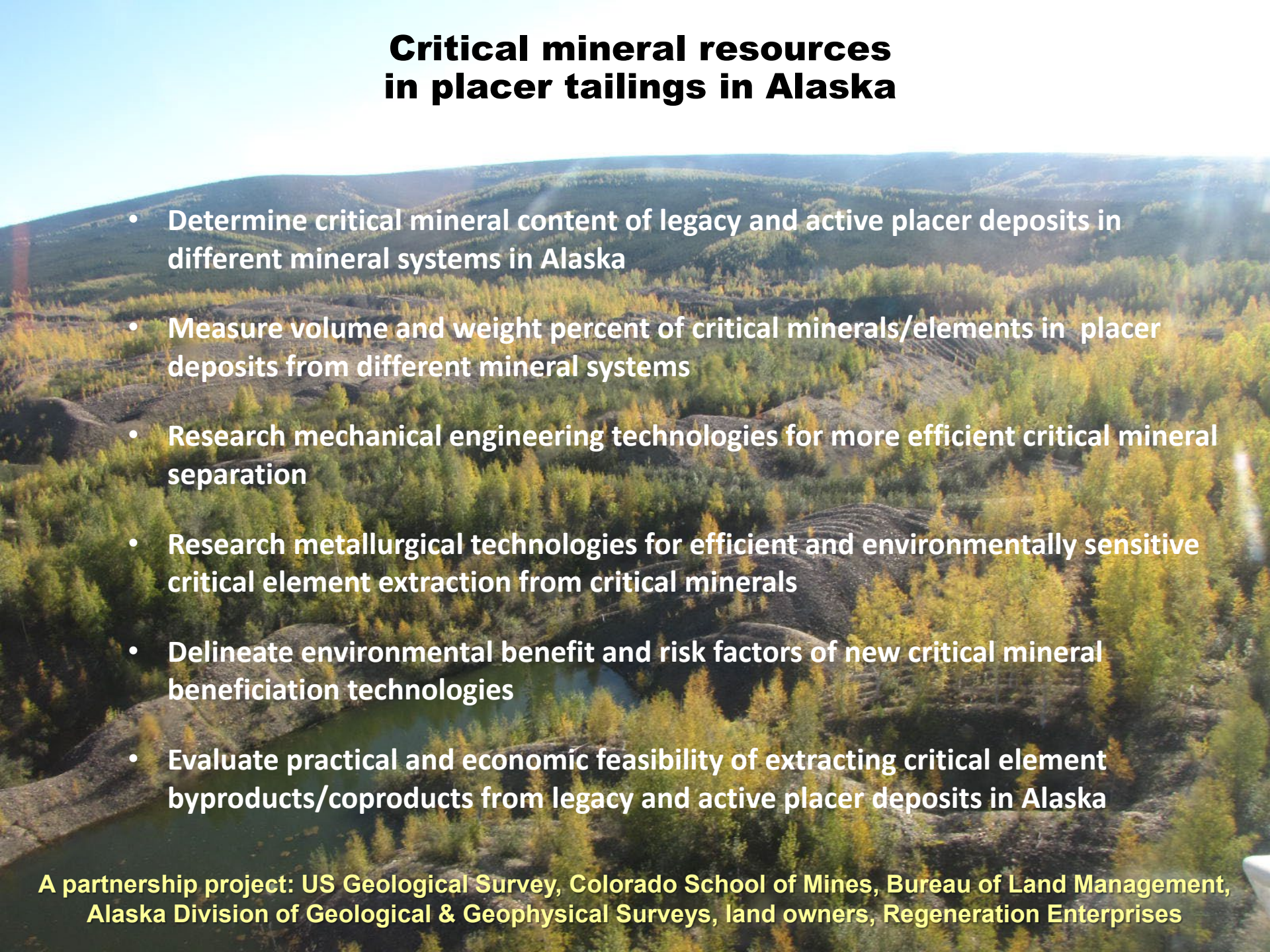


# Data-driven prospectivity maps for critical minerals in Alaska: REE example



Geospatial analysis of geologic, geochemical, geophysical, and mineral occurrence datasets identifies known areas prospective for REE, as well as new areas of interest that lack known occurrences.

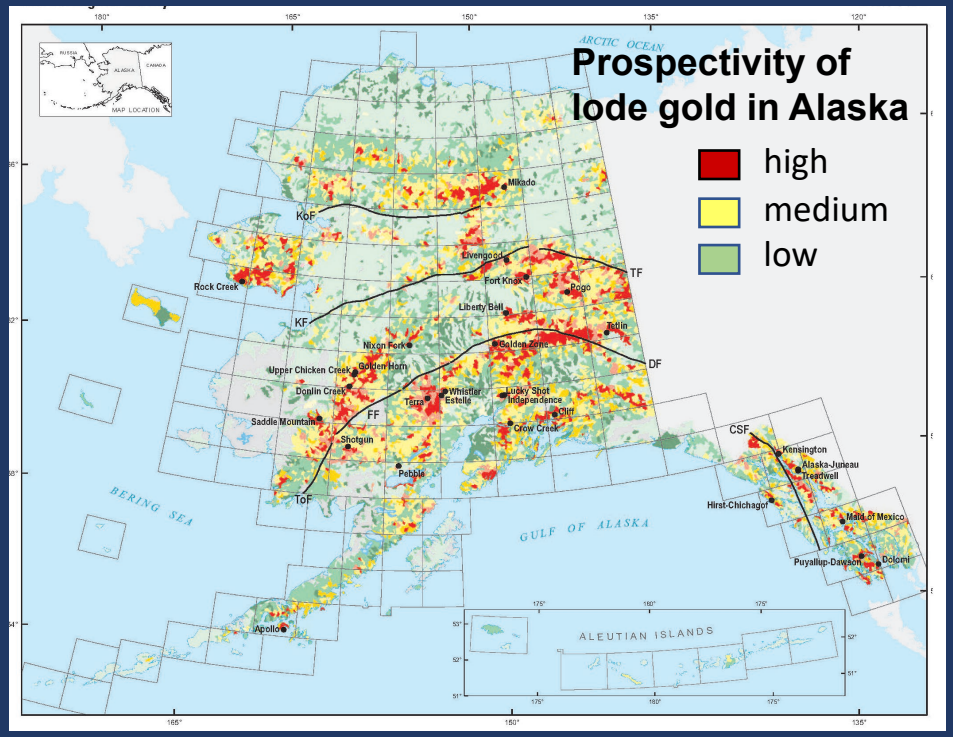
# Critical mineral resources in placer tailings in Alaska

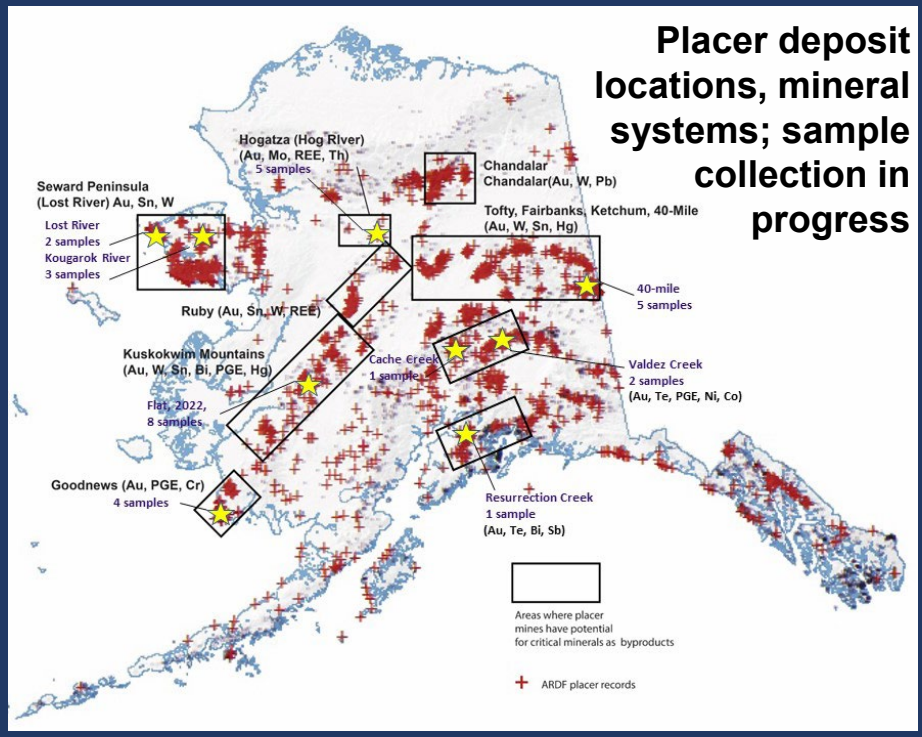


- Determine critical mineral content of legacy and active placer deposits in different mineral systems in Alaska
- Measure volume and weight percent of critical minerals/elements in placer deposits from different mineral systems
- Research mechanical engineering technologies for more efficient critical mineral separation
- Research metallurgical technologies for efficient and environmentally sensitive critical element extraction from critical minerals
- Delineate environmental benefit and risk factors of new critical mineral beneficiation technologies
- Evaluate practical and economic feasibility of extracting critical element byproducts/coproducts from legacy and active placer deposits in Alaska

A partnership project: US Geological Survey, Colorado School of Mines, Bureau of Land Management, Alaska Division of Geological & Geophysical Surveys, land owners, Regeneration Enterprises

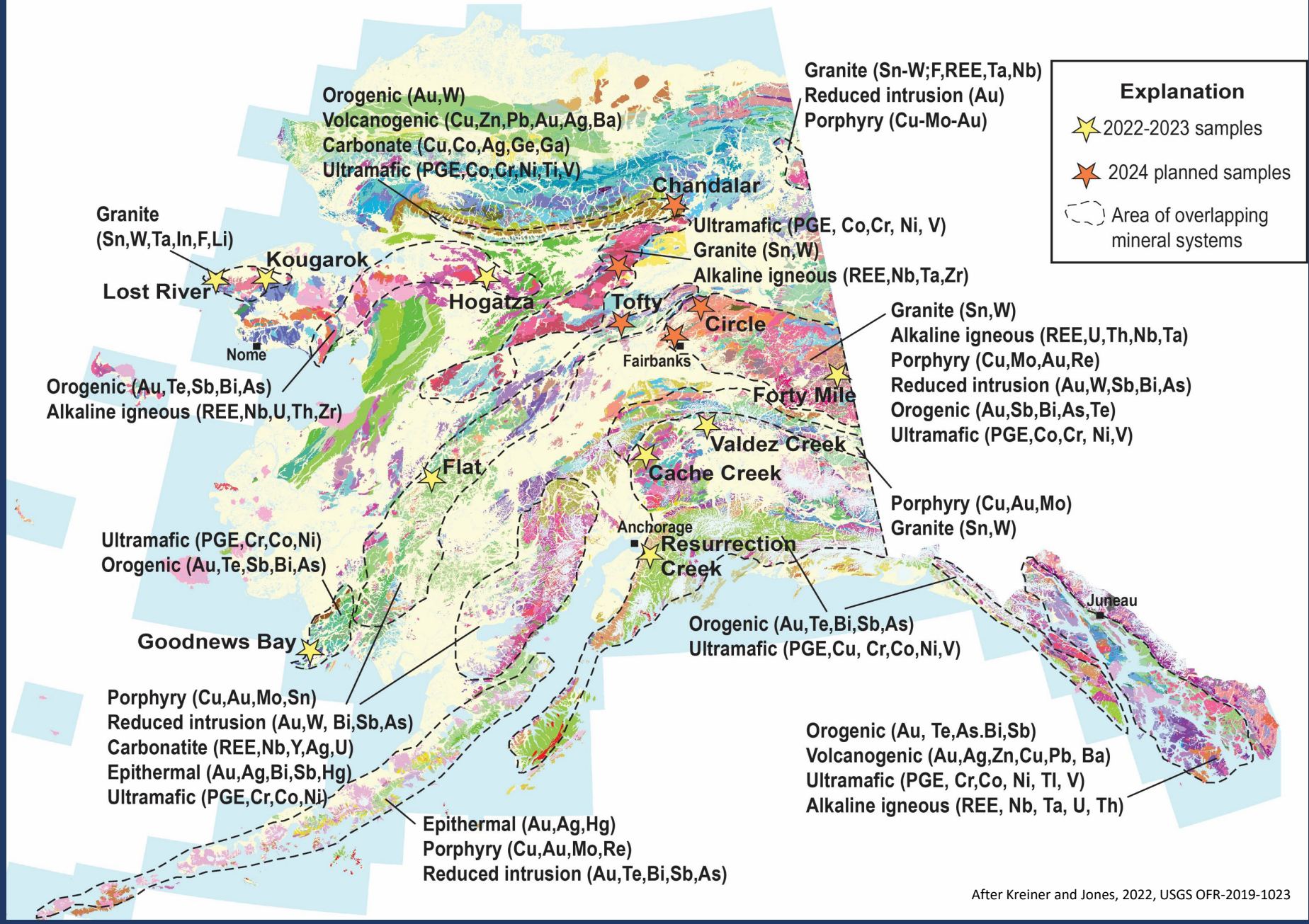
# Selection factors for placer tailings sample sites for critical element contents




- Regional-scale mineral systems for different critical element suites
- High contents of a variety of critical minerals
- High gold contents to aid economic feasibility
- High volume of placer tailings for economy of scale

# Alaska placer deposit sample sites selected for potential critical mineral contents




After Kreiner and Jones, 2022, USGS OFR-2019-1023

## Preliminary results for a pilot study:

**Flat, Alaska (1914)**

**Flat was the site of the last great gold rush in Alaska; gold was discovered in 1908**

**The district was the 3rd largest placer gold producer in Alaska**

**Flat Creek produced > 650,000 oz gold**

**The Flat area produced >1.6 Moz Au and >30,865 oz Ag**

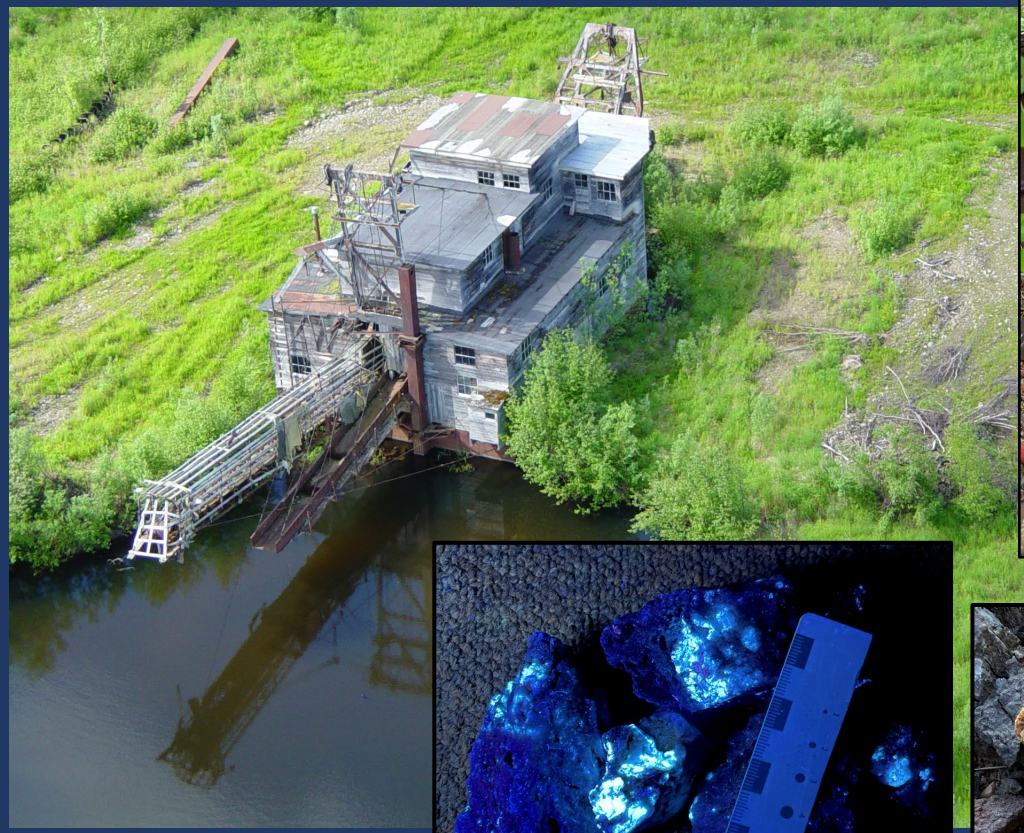
**The last dredges shut down in 1966**

**Claims remain active today**


GOLDMINING SCENE IN THE IDITAROD, ALASKA.

OTTER CREEK & Discovery City

# Flat placer tailings: critical and hazardous elements

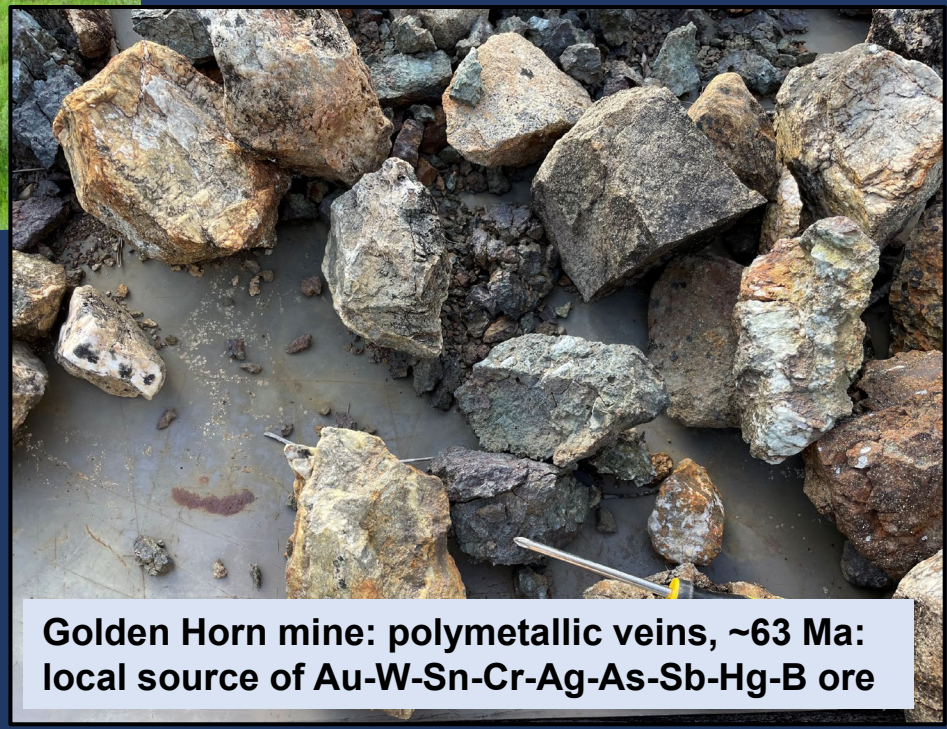


Mercury retort from gold production in the 1900s

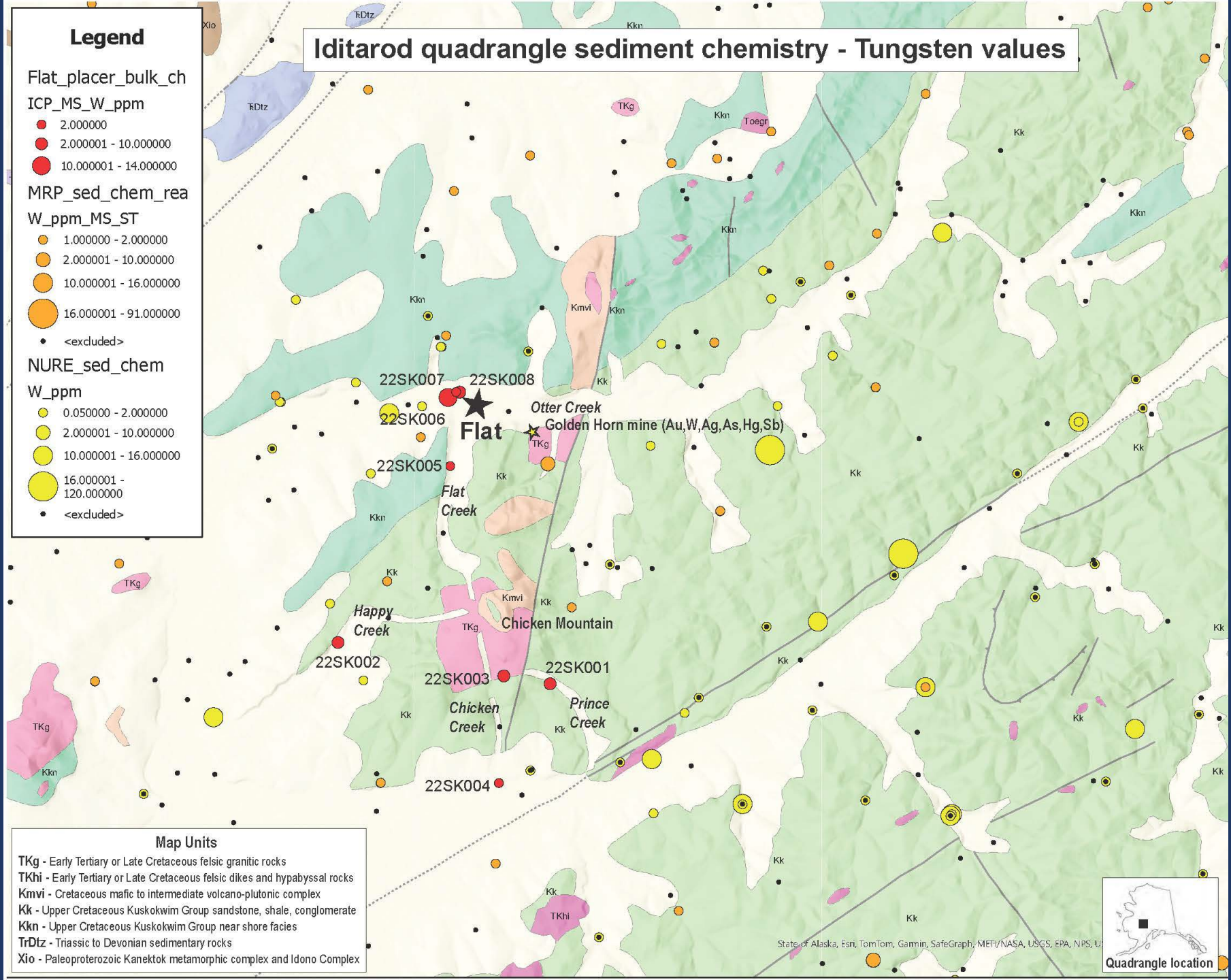


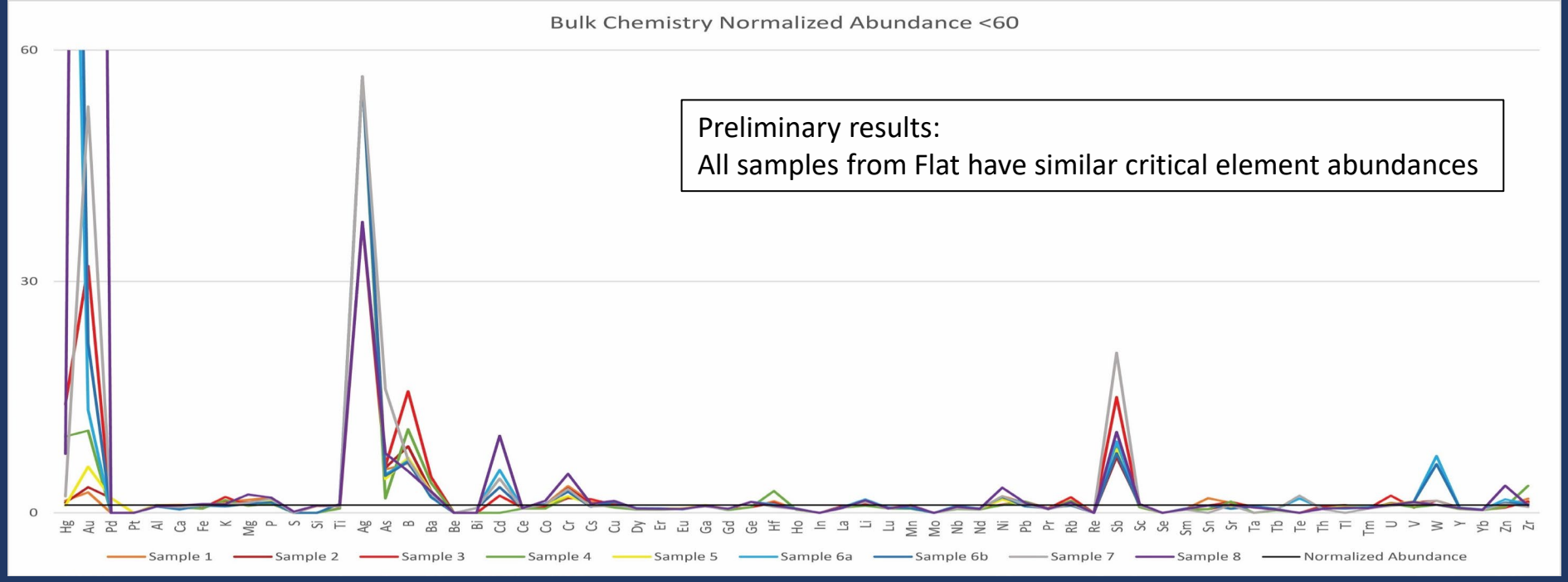
UV light – scheelite, $CaWO_4$

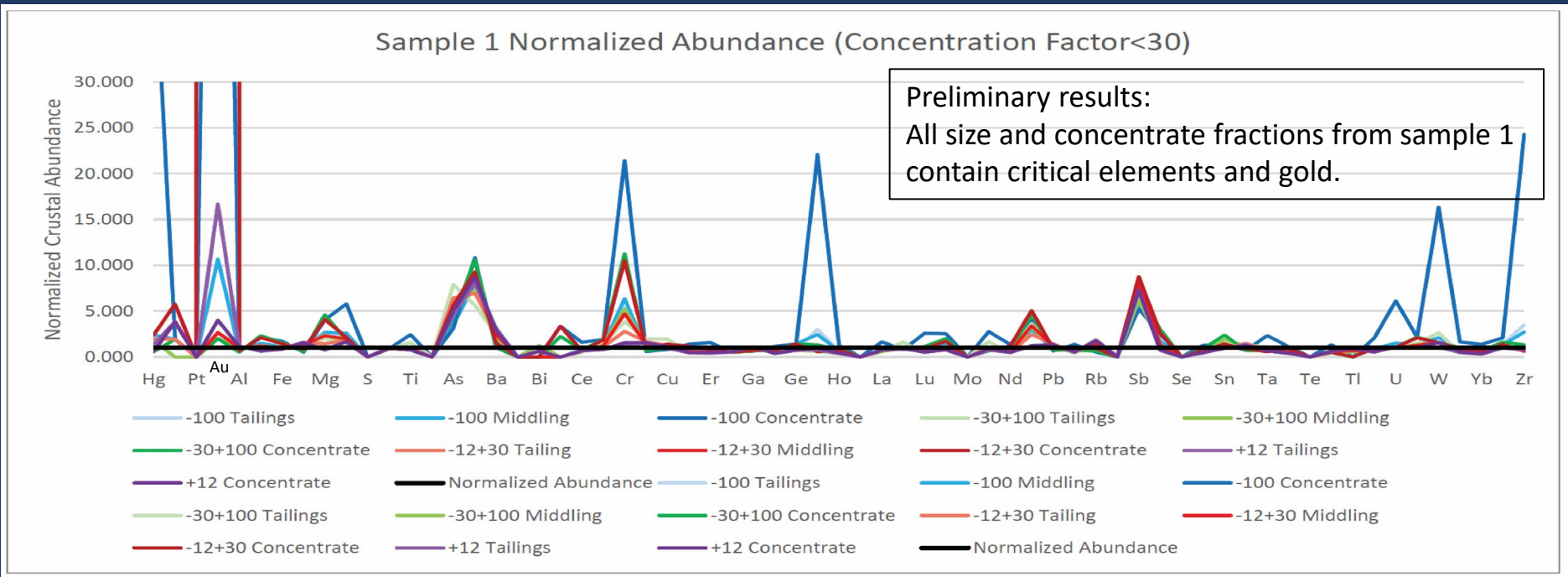
Quartz-scheelite vein rock from Golden Horn mine



Golden Horn mine: polymetallic veins, ~63 Ma: local source of Au-W-Sn-Cr-Ag-As-Sb-Hg-B ore


Iditarod quadrangle sediment chemistry - Tungsten values
Legend
Flat_placer_bulk_ch
ICP_MS_W_ppm
2.000000
2.000001 - 10.000000
10.000001 - 14.000000
MRP_sed_chem_rea
W_ppm_MS_ST
1.000000 - 2.000000
2.000001 - 10.000000
10.000001 - 16.000000
16.000001 - 91.000000
<excluded>
NURE_sed_chem
W_ppm
0.050000 - 2.000000
2.000001 - 10.000000
10.000001 - 16.000000
16.000001 - 120.000000
<excluded>
22SK007
22SK008
22SK006
Flat
Otter Creek
Golden Horn mine (Au,W,Ag,As,Hg,Sb)
22SK005
Flat Creek
Happy Creek
Chicken Mountain
22SK002
22SK003
22SK001
Chicken Creek
Prince Creek
22SK004
Map Units
TKg - Early Tertiary or Late Cretaceous felsic granitic rocks
TKhi - Early Tertiary or Late Cretaceous felsic dikes and hypabyssal rocks
Kmvi - Cretaceous mafic to intermediate volcano-plutonic complex
Kk - Upper Cretaceous Kuskokwim Group sandstone, shale, conglomerate
Kkn - Upper Cretaceous Kuskokwim Group near shore facies
TrDtz - Triassic to Devonian sedimentary rocks
Xio - Paleoproterozoic Kanektok metamorphic complex and Idono Complex
Quadrangle location


Bulk Chemistry Normalized Abundance <60
60
30
0
Preliminary results:
All samples from Flat have similar critical element abundances
Hg Au Pd Pt Al Ca Fe K Mg P S Si Ti Ag As B Ba Be Bi Cd Ce Co Cr Cs Cu Dy Er Eu Ga Gd Ge Hf Ho In La Li Lu Mn Mo Nb Nd Ni Pb Pr Rb Re Sb Sc Se Sm Sn Sr Ta Tb Te Th Tl Tm U V W Y Yb Zn Zr
Sample 1
Sample 2
Sample 3
Sample 4
Sample 5
Sample 6a
Sample 6b
Sample 7
Sample 8
Normalized Abundance


Sample 1 Normalized Abundance (Concentration Factor<30)
Normalized Crustal Abundance
30.000
25.000
20.000
15.000
10.000
5.000
0.000
Preliminary results:
All size and concentrate fractions from sample 1 contain critical elements and gold.
Hg Pt Au Al Fe Mg S Ti As Ba Bi Ce Cr Cu Er Ga Ge Ho La Lu Mo Nd Pb Rb Sb Se Sn Ta Te Tl U W Yb Zr
-100 Tailings
-100 Middling
-100 Concentrate
-30+100 Tailings
-30+100 Middling
-30+100 Concentrate
-12+30 Tailing
-12+30 Middling
-12+30 Concentrate
+12 Tailings
+12 Concentrate
Normalized Abundance
-100 Tailings
-100 Middling
-100 Concentrate
-30+100 Tailings
-30+100 Middling
-30+100 Concentrate
-12+30 Tailing
-12+30 Middling
-12+30 Concentrate
+12 Tailings
+12 Concentrate
Normalized Abundance

**Thank you**