ABSTRACTS

ALASKA MINERS ASSOCIATION

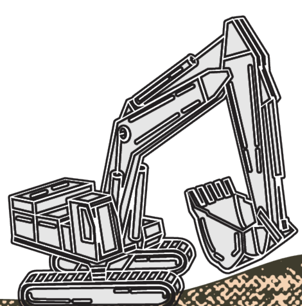
2024 ANNUAL CONVENTION & TRADE SHOW

CRITICAL MINING FOR THESE CRITICAL TIMES

NOVEMBER 4-7, 2024

DENA'INA CIVIC AND CONVENTION CENTER

ANCHORAGE, ALASKA



Alaska Miners Association

121 W. Fireweed Suite 120

Anchorage, Alaska 99503

907-563-9229

ama@alaskaminers.org

alaskaminers.org

ALASKA MINERS ASSOCIATION
2024 ANNUAL CONVENTION & TRADE SHOW

TRACK ONE

GEOSCIENCE INVESTIGATIONS

Multi-scale structural and petrochronologic applications to better refine mechanism and timing of mineral systems, Alaska

Authors: S.P. Regan, L. Munk, and M. Miller, University of Alaska Fairbanks

The physical mechanisms and conditions of precious metal and critical mineral deposits provide essential constraints informing exploration and production strategies. The Alaska Critical Mineral Collaborative (ACMC) is a UAF-lead effort integrating various scientific expertise to provide a streamlined multidisciplinary approach to resolve long-standing knowledge-gaps. Herein, we will focus on a series of examples integrating field-based structural analysis with microstructural and textural constraints with in-situ petrochronologic approaches to constrain the timing, physical mechanisms, and geometry of various precious metal and critical mineral deposits. Work to be highlighted is detailed in-situ monazite petrochronology on inverted metamorphic belts throughout central and southeast Alaska and their relationship to regional orogenic-gold mineralization, constraining the physical mechanisms for graphite mineralization in the Kigluaik Mountains, and evidence for progressive localization during gold mineralization at POGO. In addition, we will highlight some preliminary in-situ zircon petrochronologic work at Bokan Mountain in southeast Alaska, informing the timing and physical controls on U,Th, and HREE mineralization. These examples will be used as a spring board to introduce the ACMC and the new faces and philosophies of the growing Critical Minerals effort at the Geophysical Institute, University of Alaska Fairbanks.

Bi mechanisms of Au enrichment in hydrothermal ore deposits

Author: Marisa D. Acosta, University of Alaska Fairbanks

Gold deposits in the Tintina Au belt frequently display a strong Au-Bi association alongside a Au-As trend. In telluride-rich systems, Bi mineralization correlates with both Au and Te, the latter being a critical element (Bi is also classified as such by the US government). This research explores the role of molten bismuth in high-grade gold deposit formation across various deposit types, focusing on developing criteria to distinguish between two main paradigms: 1) simultaneous precipitation of Au and Bi from hydrothermal fluids due to changes in fluid conditions, and 2) precipitation of molten Bi from Au-undersaturated fluids, subsequently scavenging up to 20 wt.% Au.

Polymetallic melt inclusions provide direct evidence of metallic melts during ore deposit formation, observed in skarns, cassiterite-quartz veins, and ironstone Au-Cu-Bi deposits. Deposits exhibit zoning with respect to Bi mineral assemblages, allowing for the identification and tracing of changes in temperature, pressure, and fluid composition throughout the hydrothermal system's lifetime. Ongoing research at the University of Alaska Fairbanks' Ore Geology Research (OGRe) group is focused on the experimental quantification of Bi mineral solubility in ore-forming aqueous fluids, equilibrium thermodynamic modeling of fluid-rock interactions using CHIM-XPT, and characterizing deposit-scale spatial and temporal changes in mineral assemblage zonations. Understanding the role of molten bismuth in high-grade gold deposit formation has significant implications for exploration and recovery strategies, potentially leading to the identification of new target systems and optimization of extraction processes based on varying Au mineral assemblages.

Updates on the resource assessment of orogenic graphite mineral systems on the Seward Peninsula, Alaska

Authors: George N.D. Case, U.S. Geological Survey Alaska Science Center, Susan M. Karl, U.S. Geological Survey Alaska Science Center, Patricia MacQueen, U.S. Geological Survey Geology, Geophysics, and Geochemistry Science Center, Paul Bedrosian, and Jim Crowley, Department of Geosciences, Boise State University

The U.S. Geological Survey is assessing domestic graphite resource potential to help meet future demand for energy storage materials. Recent research has focused on the genesis of the Graphite Creek deposit, Seward Peninsula, Alaska, as an analog for undiscovered orogenic flake graphite mineralization that may be present in the region. The western Seward Peninsula is composed mainly of Neoproterozoic to Paleozoic metasedimentary and lesser metavolcanic rocks of the Nome Complex and York Terrane. These rocks achieved up to greenschist facies around the Nome hills and York mountains and amphibolite to granulite facies in parts of the Kigluaik, Bendeleben, and Darby mountains. Flake graphite ore at Graphite Creek is hosted primarily in sillimanite-bearing incipient metatexite (SIM). Graphite is either disseminated in the groundmass or in 0.1 – 1 m lenses containing up to 50 wt% graphitic carbon (Cg). The SIM is intercalated with quartz biotite gneiss (QBS) that locally contains up to 3-4 wt% graphite, a similar amount of pyrrhotite, and sporadic leucosome and melanosome; < 1m calc-silicate-rich layers are common. Structurally overlying these units is a mixed package of marble, QBS and quartzite. Protoliths to the SIM and QBS were likely pelitic and psammitic, respectively. Anatexis of SIM and melt loss during ca. 90 Ma granulite-facies metamorphism probably enhanced graphite grade. Consequently, key assessment factors for flake graphite on the Seward Peninsula are protolith age, composition, total organic content (TOC), and metamorphic grade. _

New uranium-lead (U/Pb) laser ablation inductively coupled plasma mass spectrometry analyses of detrital zircon from SIM and QBS at Graphite Creek yield Middle to Late Devonian maximum depositional ages (MDAs). These MDAs correspond to the youngest age populations known in the Nome Complex. An aerial electromagnetic (AEM) survey, funded by the Earth Mapping Resources Initiative (EMRI), was recently flown over most of the Kigluaik and Bendeleben Mountains to delineate graphitic lithologies and elucidate the structural geology of the high metamorphic grade domains. Field work in August 2024 to follow up on the survey revealed several insights about the regional graphite potential and sources of AEM anomalies. First, conductivity highs in both areas broadly correspond to carbonaceous and/or graphitic rocks, including the SIM and QBS units that host Graphite Creek. However, the most extensive conductivity highs correspond to approximately greenschist facies or lower microcrystalline graphite-bearing rocks on the southern flanks of the mountains, possibly due to more shallowly dipping foliation. Second, pyrite and pyrrhotite may account for some moderate conductivity anomalies. Third, the SIM is only documented in the granulite facies zone of the Kigluaik mountains gneiss dome, on its north flank and in the structurally lowest areas of the dome. Other graphitic rocks in the region did not achieve sufficient metamorphic grade or anatexis to generate flake graphite mineralization. Additional U/Pb dating is required to determine if the lower metamorphic grade rocks are stratigraphically equivalent to the Graphite Creek protoliths. Finally, little evidence was found for folding of SIM that would lead to repetition of the graphite orebody in the vicinity of Graphite Creek, but more geochronology data are needed to resolve pre-Cretaceous structure. The AEM survey and field observations provide important constraints on the regional extent of flake graphite mineralization and can inform models of orogenic graphite genesis.

Exhumation and thermal history of the Pogo Au deposit and Goodpaster district, eastern AK

Authors: Robert G. McDermott, U.S. Geological Survey Alaska Science Center, Douglas C. Kreiner, U.S. Geological Survey Alaska Science Center, and Jonathan Saul Caine, U.S. Geological Survey Geology, Geochemistry, and Geophysics Science Center

Exhumation of mineralized crust is key to the formation of economically viable ore deposits. The Goodpaster district in eastern AK is host to the middle Cretaceous, ~8 Moz Pogo Au-Bi-Te(-As,Sb) deposit and several other prospects distributed along an ~50-km-long trend. Recent reevaluation of models for Pogo metallogenesis highlight ambiguity in mineralization paleodepth and Au paragenesis, motivating development new constraints on the post-mineralization exhumation and thermal history of mineralized rocks. Here, we apply zircon (U-Th)/He (zircon He) and apatite (U-Th)/He (apatite He) thermochronometry, sensitive to rock cooling through temperatures of ~160–220 °C and 30–90 °C, respectively, to assess the thermal history and exhumation of the Pogo deposit and broader Goodpaster district.

Zircon He and apatite He dates from seventeen samples collected along ridgetop exposures and along the trend of mineralization define two broad spatial groups. Samples from across the study area yield mean zircon He and apatite He dates of ~90–75 Ma and ~65–43 Ma, respectively. In contrast, samples within ~10 km of Pogo have mean zircon He and apatite He dates of ~ 65 Ma and ~40 Ma, respectively. Modeling of thermal histories with these inputs suggest two phases of rapid cooling. The regionally distributed sample set captures rapid cooling (≥10 °C/Myr) from temperatures of ≥160 °C to <60 °C from ~75–65 Ma, with relatively slow cooling thereafter (<1°C/Myr). Samples near Pogo show an episode of rapid cooling over a similar temperature range, but at ~40 Ma and at rates ≥100 °C/Myr.

We interpret mechanisms of episodic rock cooling within the context of local and regional geological constraints. Eocene (~55 Ma) volcanic rocks demarcate the paleosurface at lower elevations than our sample locations, which we leverage with coeval paleotemperatures from thermochronometry samples, topographic swath profiles, and models of topographically-influenced thermal structure to infer ~0.6 to <1 km of relief reduction and exhumation since this time. Total post-mineralization exhumation at Pogo is likely ≤2 km based on evidence for boiling in syn-mineralization veins. We interpret that ~75 to 65 Ma rapid cooling, contemporaneous with both deformation along regional NE-trending fault systems and magmatism, is primarily attributable to the post-magmatic thermal relaxation, with no more than ~1.5 km of exhumation over this cooling phase. At Pogo, consideration of these district-scale constraints on cooling and exhumation, high cooling rates (≥100 °C/Myr) preferred by thermal history models, and a lack of large structures to accommodate substantial differential exhumation, suggests that ca. 40 Ma rapid cooling is best explained by reheating during transient hydrothermal fluid flow along local fault systems. Thermochronometric and geological data ultimately support limited post-mineralization exhumation of the Pogo deposit and Goodpaster district, punctuated by additional reheating events.

DGGS Earth MRI geologic mapping and geophysics program update

Authors: Wes Buchanan, Evan Twelker, Abraham Emond, Logan Fusso, Rainer Newberry, Travis Naibert, David Szumigala, Jamshid Moshrefzadeh, Conner Truskowski, Michael Barrera, and Lily Norwood, Alaska Division of Geological & Geophysical Surveys

The Alaska Division of Geological & Geophysical Surveys (DGGS) is engaged in major data collection efforts in Interior Alaska and the Seward Peninsula, funded through the U.S. Geological Survey's (USGS) Earth Mapping Resources Initiative (Earth MRI) and the State of Alaska. The goal of these programs is to improve our understanding of the Nation's geologic framework and to identify areas that have potential for discovery of critical mineral resources. The program is regional in scope and focuses on geophysical surveys, geologic mapping, geochronology, and geochemical sampling. Geophysical survey collection occurs in areas several years ahead of planned geologic mapping campaigns to inform the geologic mapping.

DGGS geologists continued a multi-year effort to update and improve the geologic maps of the Yukon Tanana Upland in eastern Interior Alaska, as well as further investigating and understanding mineral occurrences in the region. DGGS's ~400 person-day 2024 field season began investigation of an area of roughly 9,635 km^2 (3,720 mi^2) (Figure 1) as a part of the Steese project. The field area encompasses the Fairbanks and Circle historic mining districts. Other current operations and prospects in the field area include gold (± W, Te, Bi, Sb, As) mineralization at the Fort Knox mine and Golden Summit, U, Th, REE, and F mineralization at Roy Creek, and granite-related Sn-W prospects at Lime Peak-Cache Mountain, Table Mountain, and Mount Prindle. This regional mapping program blends new fieldwork, geochronology, geochemistry, and geophysical interpretation with compilation of existing maps, industry data, and re-examination of archived USGS and DGGS rock samples. Emphasis is on building a more detailed understanding of Cretaceous-Cenozoic plutonic rocks, the deformation conditions and timing of metamorphism of Paleozoic metaigneous and metasedimentary rocks, and orientation and relationship of fault systems. Geochemical sampling targeted both known and previously undocumented mineral occurrences, and we are employing lithogeochemistry and geochronology to understand suites of mineralizing and barren intrusive rocks.

The 2024 Earth MRI geophysical program focused on magnetic and radiometric data collection in the central Kuskokwim Mineral Belt and northern Kaiyuh Mountains, which hosts numerous gold, tin, rare-earth-element, tungsten, and antimony deposits. The USGS Funded Seward Peninsula Graphite electromagnetic survey was completed this year. The State of Alaska funded an Electromagnetic survey in the northern Kaiyuh Mountains and a high-resolution magnetic survey focused on the Tofty Carbonatite trend. Tofty, Kaiyuh Mountains (EM and magnetic/radiometric), and Seward Peninsula surveys were completed and have planned publication and data release through the DGGS website and associated services. The larger central Kuskokwim region surveys will wait for completion in 2025 before being published.

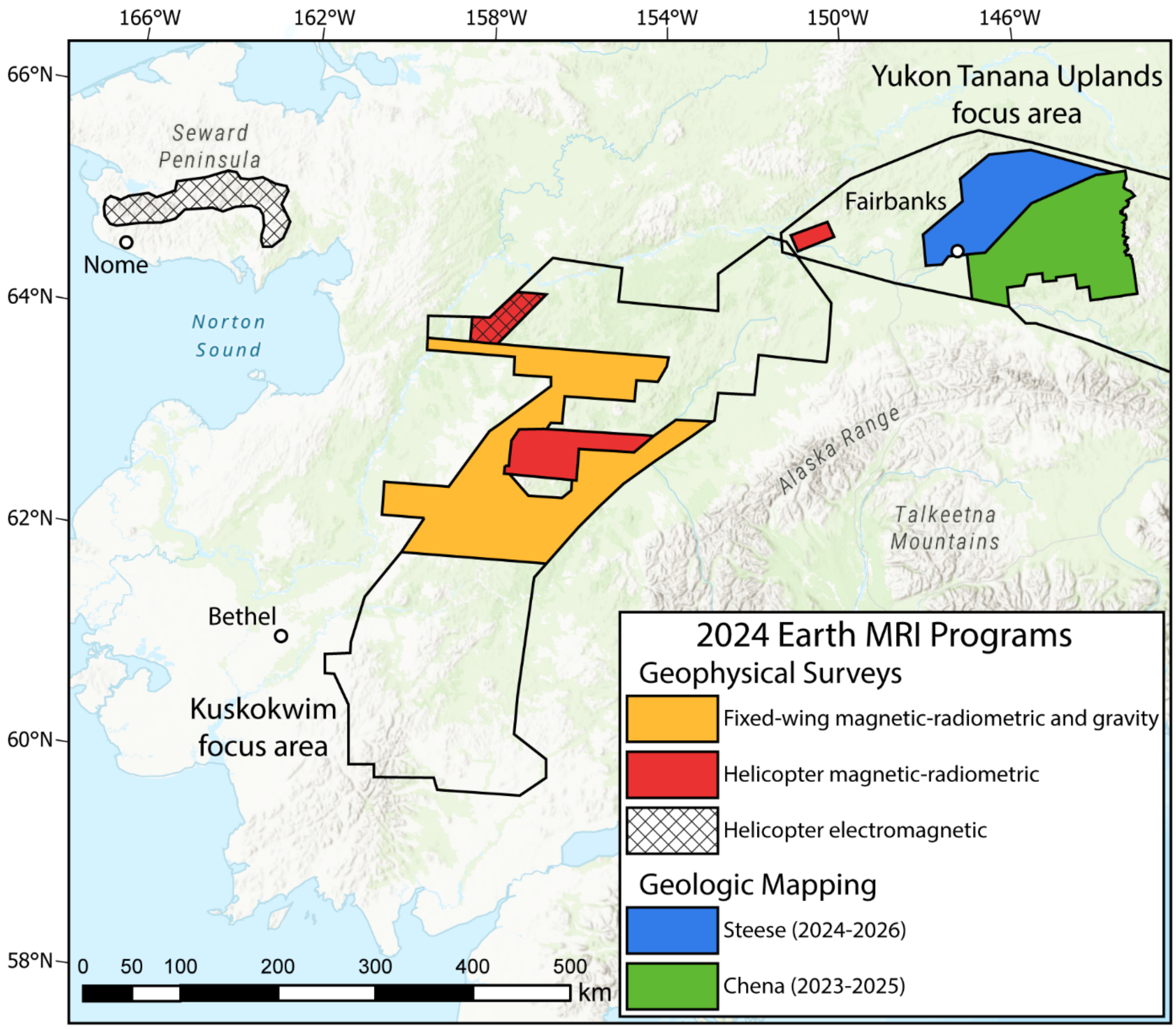


Figure 1. Location of geological mapping areas that were investigated during the summer 2024 field season, and the location of geophysical survey areas that were flown during the 2024 season.

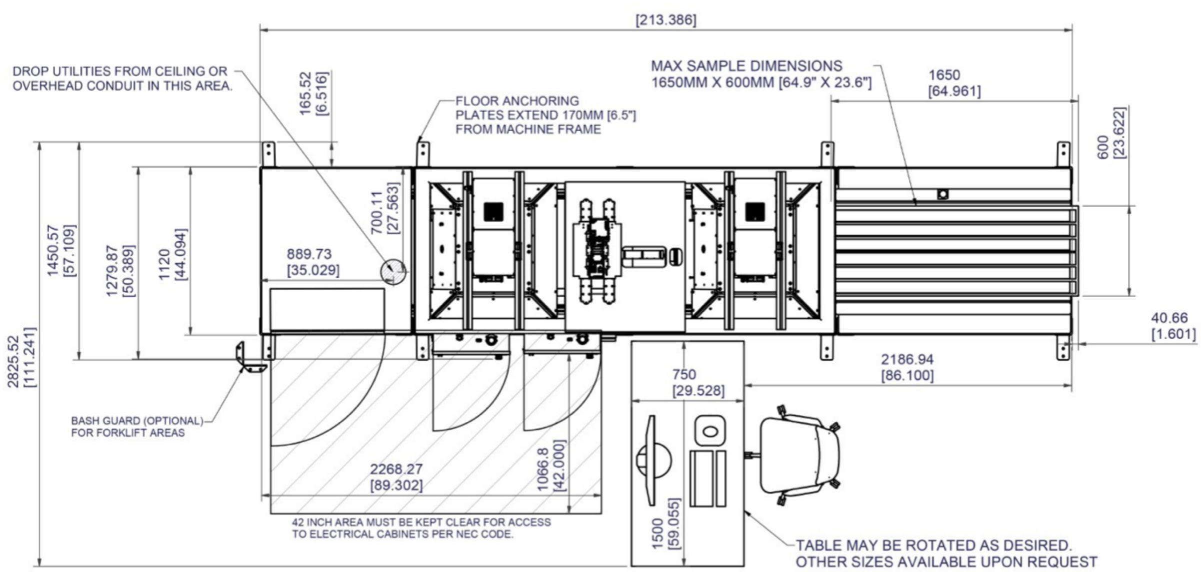
EXPLORATION PROJECT HIGHLIGHTS

A Hyper-spectacular Occurrence with Fall to Earth (Building a Hyperspectral Savvy Community in Alaska)

Author: Kurt Johnson, Curator, Alaska Geologic Materials Center, Div. of Geological & Geophysical Surveys

An advanced hyperspectral scanning instrument (HSI) is slated for delivery and operation at the Alaska Geological Materials Center (GMC) during April 2025. The HSI program is funded through a partnership between the State of Alaska and the USGS National Geological and Geophysical Data Preservation Program (NGGDPP). Main talk topics will briefly cover facility and IT preparation, HSI overview, and community support and participation opportunities.

The State of Alaska is spearheading a first-in-the-nation geologic repository hyperspectral scanning program at the Geologic Materials Center (GMC) in Anchorage. The program will focus on the analysis of samples from the extensive core collection housed at the GMC to advance the understanding of the state's complex geology and associated resources.



In the spring of 2025, the GMC will receive a new HySpex hyperspectral core scanning system to digitally record the legacy rock core collections. The system will combine HySpex VNIR-1800 and SWIR-640 cameras with HyperCam Mini MWIR and LWIR cameras from Telops, covering a wide spectral range of 400–12,500 nm. A 3D laser profiler will enable precise spatial alignment of all sensors, while a high-resolution RGB camera ensures accurate imaging of even fine-grained cores.

The Breeze Geo software by Prediktera will streamline data acquisition and analysis and guide mineralogical output with an expert system from the US Geological Survey.

Building an Alaskan geological community to take full advantage of spectral datasets takes both time and planning. GMC staff will begin utilizing proximal infrared sensing to analyze legacy core collections for mineralogical, chemical, and spatial features. Moving more than 80,000 core boxes through the HSI may take three or more years. Minerals community input and feedback can guide prioritization of prospects to scan, assist metadata research on GMC legacy boreholes, define interoperable data formats, delineate consistent published indices, review GMC client fees, delimit private industry use of the instrument, and other future developments. As rock scanning timelines build out, hyperspectral and other digitally captured data can combine and enhance understanding of deposit types, mineral regions, and Alaskan geological systems.

Cook Inlet Regional, Inc. (CIRI) Farewell Mineral Exploration

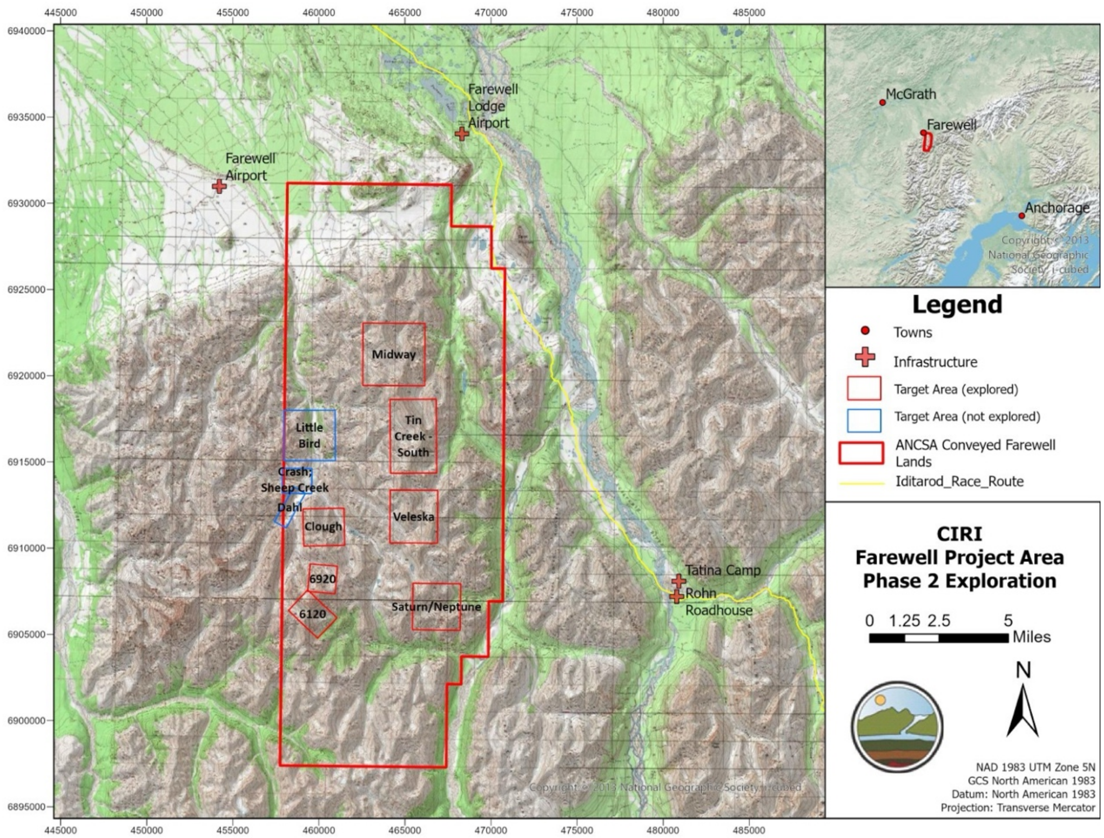
Author: Brendan McCrum, Exploration Geologist, Alaska Earth Sciences

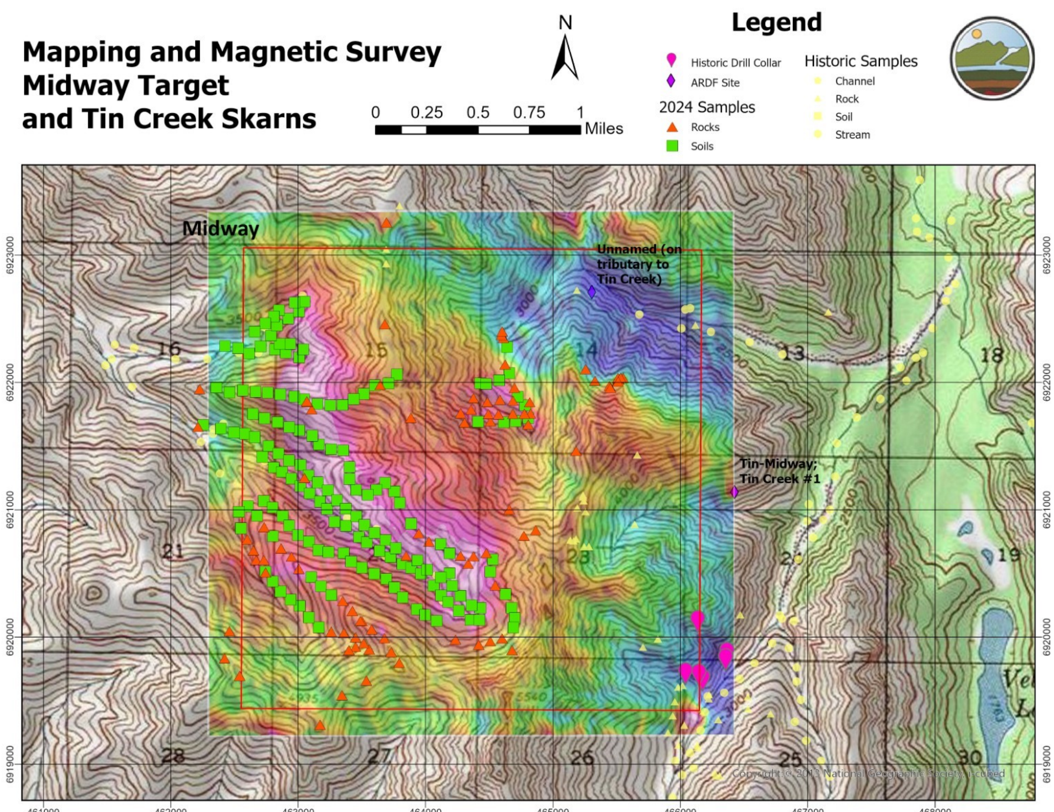
The Farewell Mineral Exploration Program, conducted on CIRI lands selected under its Alaska Native Claims Settlement Act (ANCSA) conveyances in the northern Alaska Range, built upon a 2021 Phase 1 desktop study and focused on advancing the identification of zinc-copper-silver skarn and manto-style mineralization targets. Previous exploration efforts by Anaconda (1980s), North Pacific Mining Corp. (1990s), and Talon Gold (mid-2000s) were compared with more recent geophysical surveys and updated geological deposit models to develop a list of prioritized targets across Farewell lands. The Phase 2 program explored mineral potential across various targets, with an emphasis on copper porphyry potential. The 30-day field campaign, based out of Tatina Camp along the South Fork Kuskokwim River, integrated geophysical surveys, geochemical sampling, and geological mapping to refine historically explored mineralization.

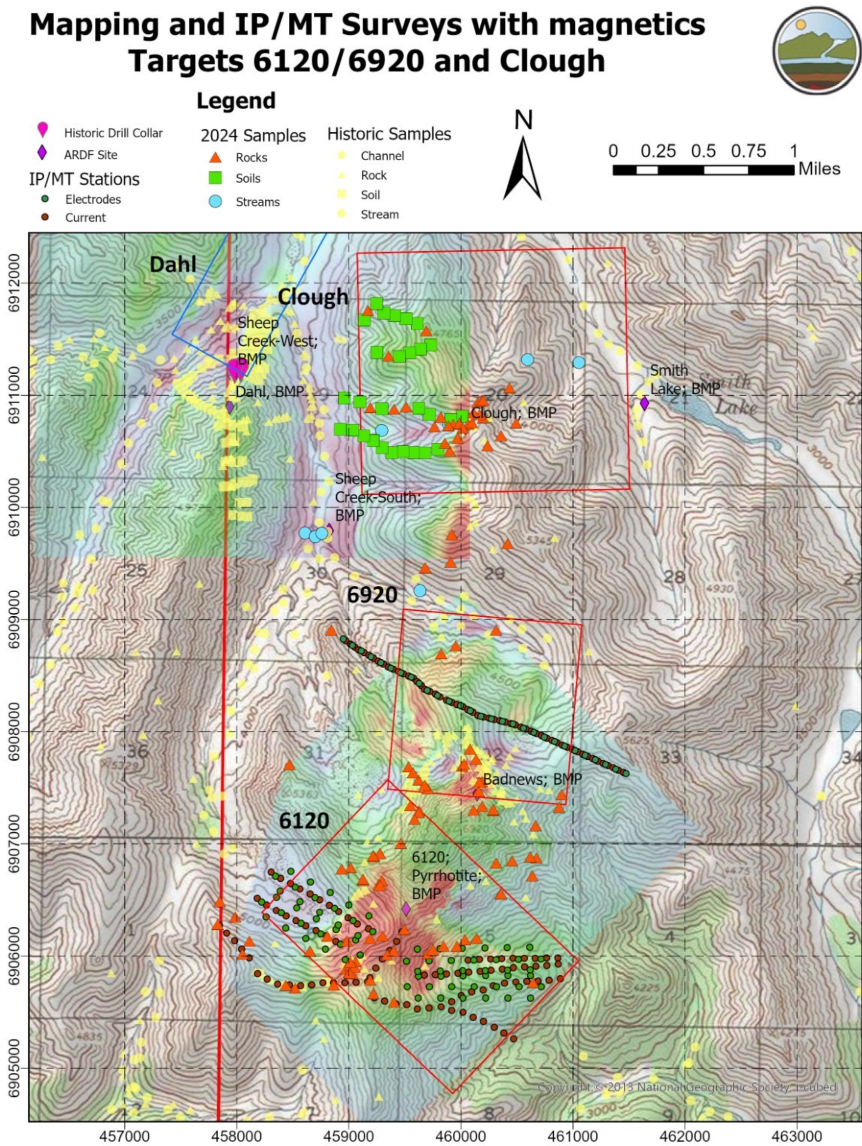
Geological mapping and sampling were concentrated on the Midway, 6120, and 6920 prospects, where the potential for significant mineralization is highest. These areas were prioritized for both geological exploration and geophysical surveys. The exploration program aimed to expand known mineralization and investigate new areas, filling data gaps across all targets. Close to 500 samples, including rock, soil, and stream sediments, were collected from the various targets throughout Farewell, some untouched since the early 1980s. Field observations identified significant copper mineralization, with visible copper occurrences observed from the helicopter and numerous samples assaying at ore-grade copper levels. An increase in the abundance of outcropping mineralized porphyritic dikes was observed, with several notable samples displaying B-type veining and visible sulfides, including chalcopyrite and, less commonly, molybdenite.

Following a 2008 detailed DIGHEM survey (50-meter flight line spacing), ground-based Induced Polarization (IP) and Magnetotelluric (MT) surveys were conducted at the 6120 and 6920 targets. These surveys identified trends of highly chargeable bodies and conductive material beneath known skarn and manto-style surface mineralization, surrounding a buried magnetic anomaly theorized to be the potential source of mineralization. In addition, a detailed airborne magnetic and radiometric survey (50-meter flight line spacing) at the Midway target further refined a buried magnetic anomaly previously identified through a 2014 regional DGGS DIGHEM survey (400-meter flight line spacing). The magnetic and radiometric data, including a 3D model, provided insights into the geometry of the anomaly and surrounding structures and alteration zones, indicating strong potential for a buried magmatic hydrothermal system.

The expansion of known mineralization and the abundance of copper-rich samples confirm the potential for a buried copper porphyry deposit. Several high-priority targets have been identified for future exploration, including numerous drill targets. Efforts are currently focused on further interpreting the data collected and advancing the various targets within the Farewell lands.


Farewell Lodge Airport
Farewell Airport
Midway
Little Bird
Tin Creek - South
Crash; Sheep Creek
Dahl
Clough
Veleska
6920
6120
Saturn/Neptune
Tatina Camp
Rohn Roadhouse
McGrath
Farewell
Anchorage
Legend
Towns
Infrastructure
Target Area (explored)
Target Area (not explored)
ANCSA Conveyed Farewell Lands
Iditarod_Race_Route
CIRI
Farewell Project Area
Phase 2 Exploration
0 1.25 2.5 5 Miles
N
NAD 1983 UTM Zone 5N
GCS North American 1983
Datum: North American 1983
Projection: Transverse Mercator


Mapping and Magnetic Survey
Midway Target
and Tin Creek Skarns
N
0 0.25 0.5 0.75 1 Miles
Legend
Historic Drill Collar
ARDF Site
2024 Samples
Rocks
Soils
Historic Samples
Channel
Rock
Soil
Stream
Midway
Unnamed (on tributary to Tin Creek)
Tin-Midway; Tin Creek #1



Mapping and IP/MT Surveys with magnetics
Targets 6120/6920 and Clough
Legend
Historic Drill Collar
ARDF Site
IP/MT Stations
Electrodes
Current
2024 Samples
Rocks
Soils
Streams
Historic Samples
Channel
Rock
Soil
Stream
N
0 0.25 0.5 0.75 1
Miles
Dahl
Clough
Sheep Creek-West; BMP
Dahl, BMP
Clough; BMP
Smith Lake; BMP
Sheep Creek-South; BMP
6920
Badnews; BMP
6120
6120; Pyrrhotite; BMP
457000
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6912000

Filling in the Blanks: In-region Exploration for Doyon Limited

Author: Matthew Hanson, Doyon Limited

In the 2024 exploration season, Doyon conducted two soil sampling programs and partnered with the state of Alaska to have a geophysical survey flown over a third property.

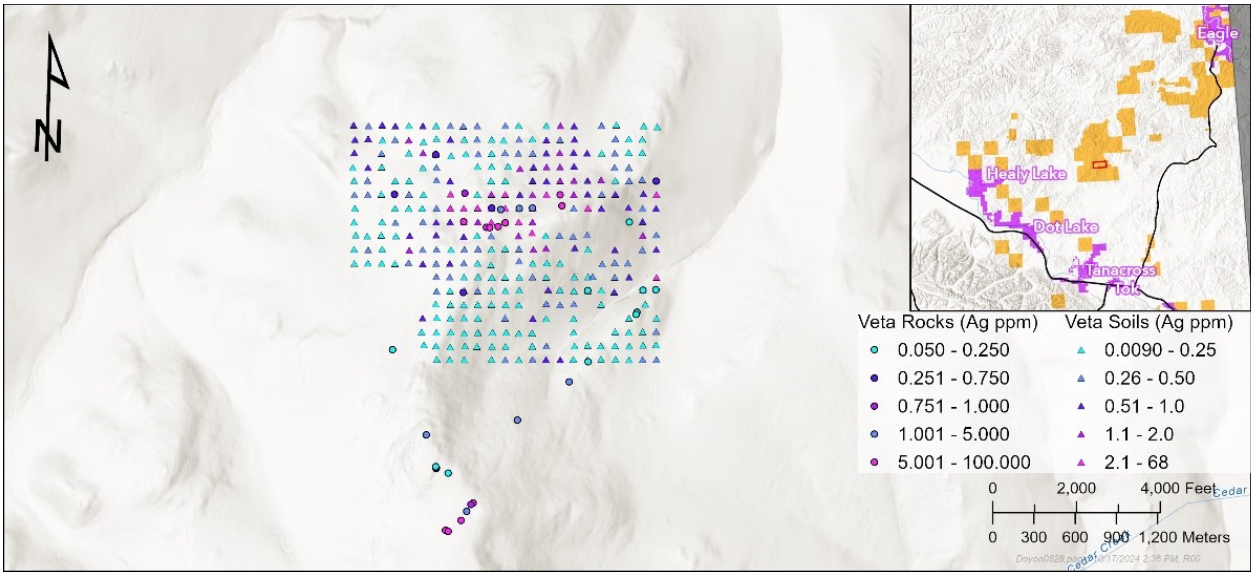
Doyon Limited is the Regional Native Corporation for the interior of Alaska comprising a total land package of almost 12 million acres. In this, 3 million acres were selected for their mineral potential. Over the last 51 years over 180,000 surface and drill samples have been taken on Doyon, or Doyon selected lands. Even with the large number of samples collected, entire townships still remain underexplored and unsampled.

In 2024, Doyon contracted Piton Exploration to sample two soil grids on the Mitchell and Veta Creek prospects within the Veta block north of Tok. A total of 664 samples were collected.

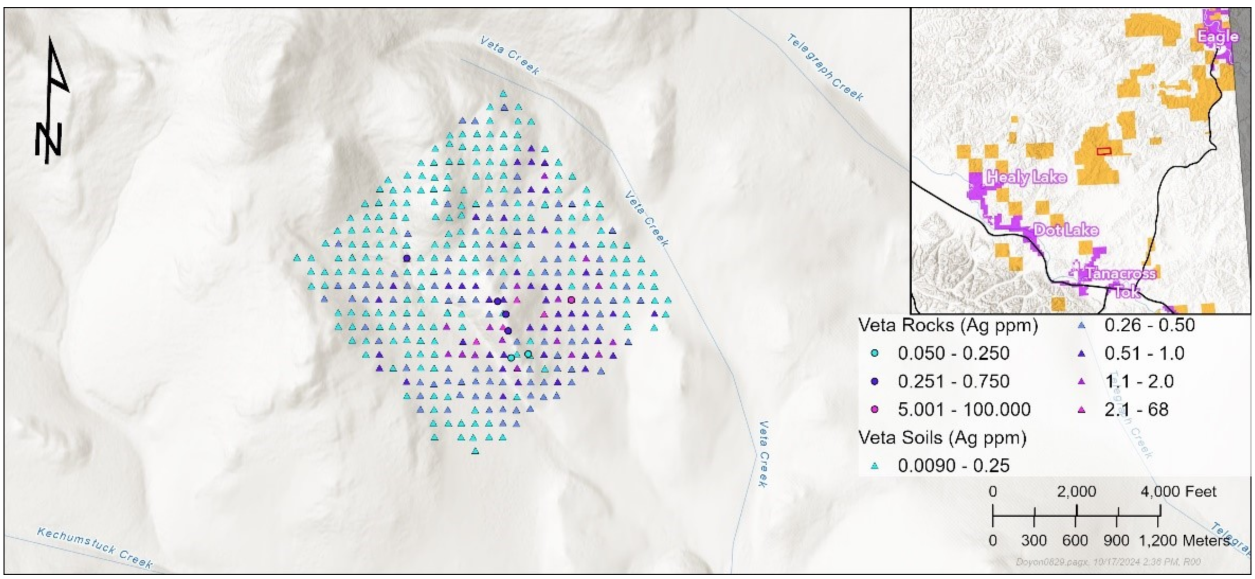
The Mitchell prospect was first discovered in 1955 and is comprised of a copper and silver skarn overlying Triassic hornblende rich granodiorite. Hand samples of 14.8 % Cu and 1135 ppm Ag have been collected from historic trenching. Due to its relatively small size as a roof pendant, limited work had been done on the prospect. Looking at the underlying intrusive, a hornblende rich granodiorite, and grades in the skarn, it was decided to investigate the possibility of a porphyry system underlying or adjacent to the pendant. A total of 292 soil samples were collected over the meta sediment pendant and surrounding granodiorite. A 900 meter by 400 meter copper anomaly of <300 ppm Cu, and a 1100 meter by 500 meter silver anomaly of <2ppm Ag was found. High grade hand samples were also collected confirming previous sampling.

The Veta Creek prospect is an epithermal system that initially had been assayed for Cu, Mo, Ag, Pb, and Zn, but only select samples were also assayed for Au. Elevated Ag, Pb and Zn values show that that exposure is distal in the system; a soil grid was centered on the discovery ridge to see if areas more proximal to the system were present at surface. A <1 ppm Ag anomaly of approximately 500 meter by 500 meter was identified, and remains open to the southeast

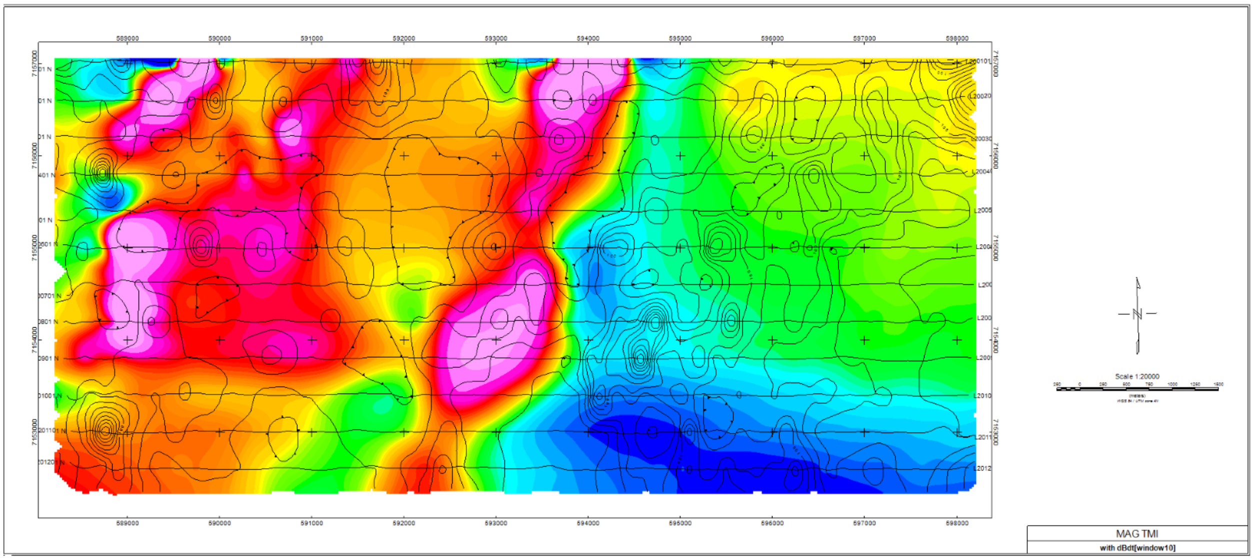
Perseverance was a small, past producing silver and lead mine on the north end of the Kaiyuh mountains. Hand samples of the vein returned values of up to 60% Pb and 3500 ppm Ag. However, soil sampling in 2023 did not return significant values. DGGS had selected this region for airborne geophysics and Doyon partnered with the state to infill over the Perseverance area. Preliminary results show promising highly conductive zones to the north and east of the mine. Future work will focus on these areas.



Mitchell Ag in soils and rocks



Veta Cr. Ag in soils and rocks



Preliminary Perseverance Mag and EM

Thermal (Long-wave) InfraRed Remote Sensing for Porphyry Exploration at the Oreo Mountain Cu-Mo-Ag-Au Prospect, East-Central Alaska

Author: David Hedderly-Smith, Ph.D., PG, QP — D.A. Hedderly-Smith & Associates

The Oreo Mountain prospect is a Cu-Mo-Ag-Au porphyry system located in east-central Alaska, approximately 40 miles east of Tok, Alaska, and 15 miles north of the Alaska Highway. Work to date has identified a large (5-mile by 2-mile), strong copper, molybdenum, lead and silver soil anomaly corresponding to an aeromagnetic high surrounding a sharp aeromagnetic low associated with resistivity lows. Six short drill holes in 2019 identified porphyry-type mineralization and alteration in calc-alkaline intrusive rocks. Since that work, the Alaska Division of Geological and Geophysical Surveys has published a 1:100,00-scale reconnaissance geologic map of the area, greatly enhancing the area's geologic understanding.

The traditional role of satellite remote sensing in mineral exploration has been to map regional geological structures through the synoptic view provided by the satellite, initially focused on identification of linears and structures. The arrival of multispectral imagery and the spectral unmixing interpretation paradigm has allowed quantitative estimates to be made of the various minerals in the scene.

In 2024 a remote sensing study of much of the eastern two-thirds of the Tanacross 1:250,000-scale Quadrangle, including the Oreo Mountain area, was commissioned utilizing visible/near infrared (VNIR), short-wave infrared (SWIR), long-wave or thermal infrared (LWIR or TIR) and synthetic aperture radar (SAR) data collected by three satellite systems: Sentinel-2, ASTER and ALOS-1. The study focused for the most part on the remote sensing systems with penetrative ability, the ASTER TIR bands.

The ASTER thermal (TIR) or long-wave (LWIR) infrared survey and interpretation of high-resolution hyperspectral satellite imagery over the Oreo Mountain property and surrounding area returned some very interesting results. The algorithm that developed one of the images — named TargetC — was designed to target pixels in the ASTER scene with spectral signatures in the five TIR bands that corresponded to the signatures of the pixels over high-copper soil sample locations on a 370+ sample grid of soil samples over the Oreo Mountain prospect collected by Kennecott Exploration in 2018 (Figure 1). The resulting image successfully highlighted the known area of copper-enriched soils at Oreo, and added addition areas of interest for adjacent areas outside of the existing soil grid and claim block warranting follow up. The survey identified Contango ORE's Triple Z prospect and Cities Service's historic Alcan prospect to the west of Oreo Mountain, and Doyon's Northway prospect to the south, as well as other prospects and areas of soil anomalies identified in other, earlier reconnaissance efforts.

Notably, however, the TargetC image did not identify several other known porphyry occurrences in the northern half of the scene, including both Taurus and Bluff, recently explored by Kenorland Minerals, Freeport-McMoRan and Antofagasta Minerals. (Figure 2). Nonetheless, while the science behind this is not yet thoroughly understood, the apparent identification of the copper-rich portion of the Oreo Mountain prospect and other prospects in the southern half of the ASTER scene suggests good potential for utilization of thermal infrared band data in mineral exploration in Alaska and the Canadian north.

The analysis of the TIR bands detected something likely associated with the copper mineralization at Oreo Mountain. It could be longwave infrared radiation from the copper (or associated metal) minerals themselves or derivatives of those minerals, or perhaps some alteration of the spectral signature of the local vegetation caused by metals absorbed from the soils, or something else.

From a prospect-level standpoint, the Oreo Mountain hyperspectral analysis developed complimentary data that should be valuable in the further exploration and development of the prospect and adjacent area at a relatively minimal cost.

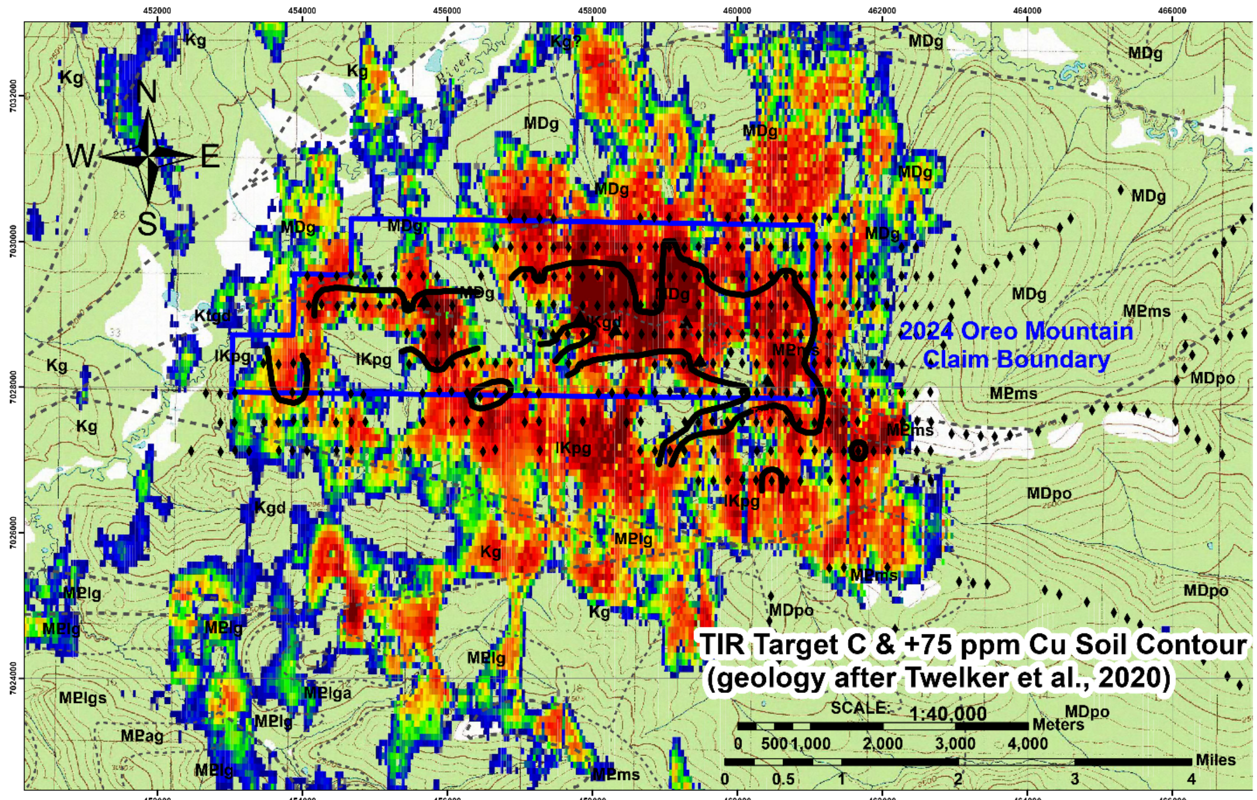


Figure 1. 2024 ASTER thermal infrared (TIR) TargetC analysis overlain on the +75 ppm Cu contour from 2018 Kennecott Exploration soil grid and geology from Alaska DGGS. Small black diamonds indicate Kennecott soil sample locations.

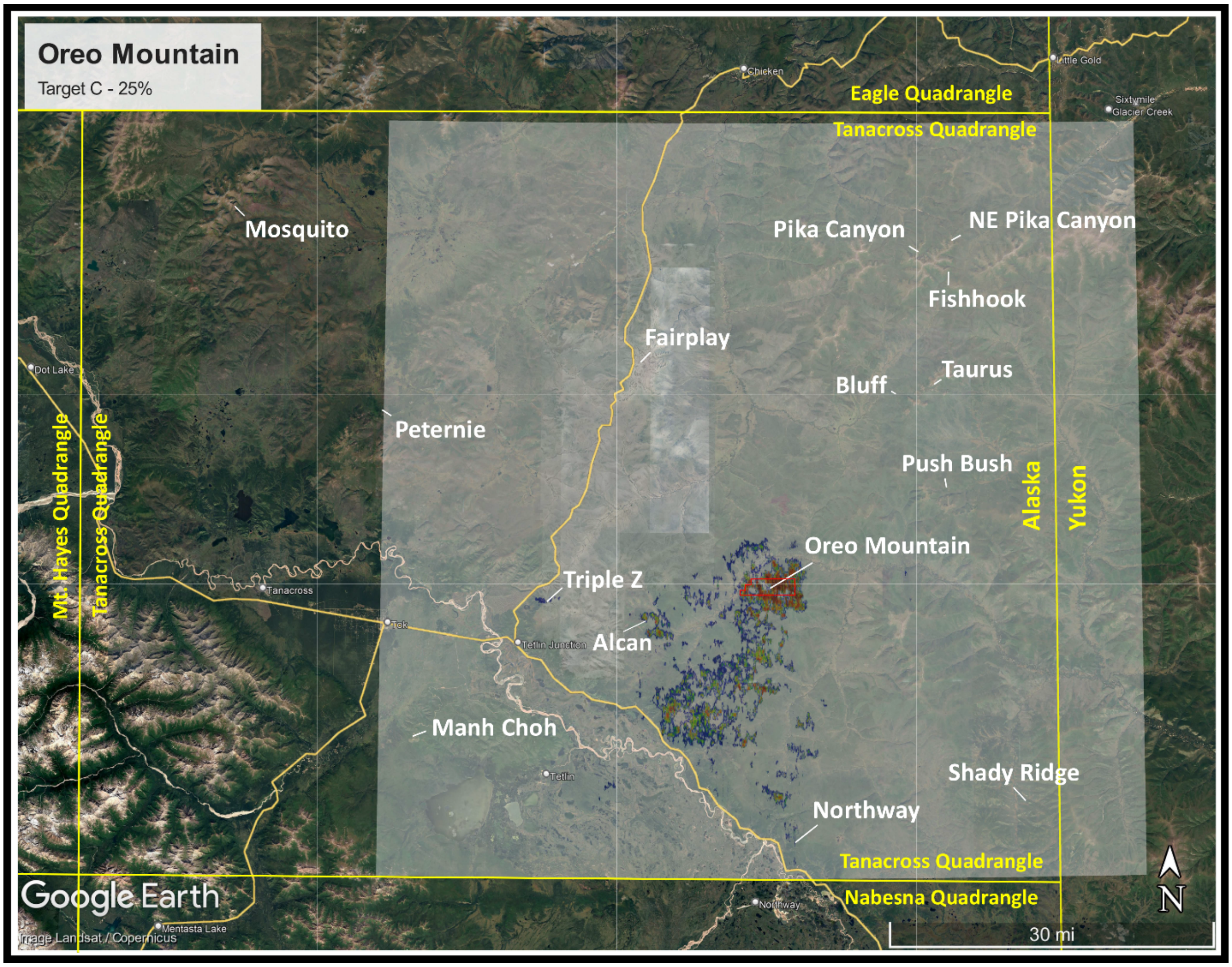


Figure 2. ASTER thermal infrared (TIR) scene with 2024 TargetC image projected onto Google Earth image, showing location of Oreo Mountain claim block and select other ±72 ma porphyry and porphyry-related prospects and deposits in the Tanacross (1:250,000 scale) Quadrangle.

Mineral Exploration on Alaska Mental Health Trust Land conducted by the Trust Land Office

Author: Dr. Karsten Eden, Chief Geologist, Trust Land Office

The Trust Land Office (TLO) exclusively manages approximately one million acres of Alaska Mental Health Trust (Trust) land and other non-cash assets to generate revenue for funding of services and programs for Trust beneficiaries. Decisions approving use of Trust lands and resources are made solely in the best interest of the Trust and its beneficiaries in line with Trust principles and the Alaska Mental Health Enabling Act. For most of the Trust land, no geoscientific baseline information is available that allows for a determination and evaluation of mineral potential and occurrence of mineral deposit types. TLO's mandate is to generate revenue through mineral development, therefore, TLO needs a clear understanding of the mineral potential of Trust land to make the best possible business decisions. Mineral development is key for future revenue generation. For that reason, TLO has been conducting mineral investigations on Trust land, ranging from reconnaissance sampling to advanced mineral exploration to generate the necessary information and demonstrate mineral resource potential to accelerate mineral development. The strategy of demonstrating mineral potential will significantly increase the marketability of Trust land which will lead to further exploration, and ultimately to deposit development.

The Icy Cape Gold and Industrial Heavy Minerals Project demonstrates TLO's strategy where reconnaissance sampling, airborne magnetic surveys and applied research have led to delineation of prime drill targets and through subsequent drilling to the discovery of numerous prime gold and industrial mineral prospects. One of these prospects, Grinder, is currently being further developed through resource definition drilling and bulk sampling.

The Icy Cape Gold and Industrial Heavy Minerals Project is a unique and extraordinarily large volume placer gold and industrial minerals sands exploration project. The Project is located in the Gulf of Alaska near Icy Bay about 75 miles northwest of Yakutat and encompasses about 48,000 acres (75 sq. mi.) of which about half is underlain by glacial and nearshore marine placer-heavy-mineral-bearing sediments. These sediments extend to depths of over 200 feet throughout the Property whereas rock basement is shallow (tens of feet) near Cape Yakataga in the west.

Since 2015 the Project has focused on gold extraction with garnet, and other heavy minerals as co-products. Incrementally, the Project collected stratigraphic framework and resources assessment drill-core samples in 2017 and 2018, and the TLO identified four main prospects for follow-up exploratory drilling.

The Grinder Prospect was selected for further development and resource definition drilling. The Grinder drill hole plan was designed based on interpretation of newly acquired innovative 3-dimensional aeromagnetic gradient exploration survey data to maximize the effectiveness of resource development drill hole locations and create a NI43-101-compliant indicated gold and garnet resource estimate. Resource definition drilling has been completed and bulk samples have been collected for metallurgical testing.

Besides Icy Cape, TLO has been investigating gold and platinum placer potential on Trust land on Kodiak Island and has started reconnaissance sampling and geological mapping campaigns on Trust land throughout the State.

ENVIRONMENT

Jeremy Littell – USGS

- Title of talk: **Alaska Climate Futures: Projections and Potential Impacts**
- Outline of talk
  - Climate changes projected for Alaska and the Arctic over the next century are among the fastest on the planet.
  - Alaska, however, is a big and geographically diverse place, so these changes and their consequences vary considerably across different regions of the state
  - The impacts of these changes are already evident, and new and surprising ones emerge regularly. We expect this to continue, and we expect surprises.
  - Developing climate futures for use in decision making requires close attention to the uncertainties inherent in projecting climate as well as the risks users face
  - The projections available to the climate services practitioner community are evolving quickly - highlight some tools that allow increased access and advice on what to do if those don't meet needs
- Whether or not the talk may be shared on the AMA website
  - The slides may be shared.

Alaska Climate Futures: Projections and Potential Impacts
Author: Jeremy Littell, USGS

Alaska's climate has changed rapidly over at least the last five decades, with statewide annual average temperature increasing +4° F between 1970 and 2023, or two and a half times the global rate. Alaska average winter warming is over twice the summer rate. Precipitation trends are more variable, but winter increases are significant in much of the state. Snowfall in winter is generally increasing, but spring snowfall is decreasing and average melt dates are generally earlier. These trends vary around the state, with more rapid changes in temperature and precipitation in northern and northwest Alaska but more rapid changes in snowpack in southern and southeast Alaska. Areas with historically dependable permafrost have increasing active layer depts and more thaw collapses. These trends are projected to continue, but the projected size of the changes depends on current and future greenhouse gas concentrations in the atmosphere. Uncertainty in climate projections comes from several sources, natural climate variability, understanding of and ability to model the climate system, and, ultimately, greenhouse gas emissions. The impacts of these projected climate changes affect Alaska in profound ways. Resources and infrastructure that underpin the state's historical resilience will be challenged by increases in permafrost thaw, fire activity, extreme precipitation and flooding, hazards such as landslides, and changing coastal processes that expose communities extremes that were historically rare or absent. These impacts are already evident, and preparation and adaptation can decrease the risks of future impacts.

Cost-effective Strategy for Investigating Permafrost at Remote, Northern Mine Sites

Robin McKillop

Introduction and Rationale

Permafrost definition and distribution - N America and Alaska (maps)

Permafrost temps – rising; not all permafrost responds the same (spatial and temporal variability in permafrost response) (temp plots from AK)

Effects and Implications - reduced strength, thaw consolidation, frozen soil creep, new water pathways, thermokarst, etc (photos)

Need to consider climate change now, for later benefit

Strategic/tailored investigation

Stepwise investigation - start desktop/lower cost, then field recon, then more intensive (e.g., drilling, instrumentation)

Casino Mine Project case study - illustrating approach

Thermal modelling – tool to estimate future change in permafrost. Coupled thermal-hydraulic and thermal-mechanical models

Need to begin data collection sooner rather than later (time element)

Applications of permafrost investigation in mining

Surface and groundwater system (important for proper design of mine water management system)

Mine pit design; rock and overburden

Access road/power

Mine facilities – tailings (slurry and drystack faciities) etc mine waste facility

Closure

Cost-effective Strategy for Investigating Permafrost at Remote, Northern Mine Sites

Authors: Robin McKillop, SLR Consulting, Dave Sacco, SLR Consulting, Vincent Fricaud, SLR Consulting, and Christopher Stevens, Northern Permafrost Consulting

Climate change is accelerating the thaw of permafrost and opening pathways for groundwater, with consequences for existing and proposed mine infrastructure. A cost-effective strategy for investigating permafrost at remote, northern mine sites is critical to sustainable mine development, operations and closure. We use illustrative examples from mine projects in Alaska, Yukon and beyond to showcase how access to a diverse suite of tools and analytical techniques allows investigations to proceed in a phased manner, taking full advantage of desktop sources of information and lightweight field equipment to keep up-front costs and footprints of disturbance to a minimum. We are able to preliminarily map permafrost and its associated thaw sensitivity based on interpretation of high-resolution aerial photography, satellite imagery, and topographic data. We use portable geophysical survey equipment (e.g., GPR, ERT) and various configurations of lightweight drills (e.g., Talon, ShockAuger) to validate and refine the mapping, collect core samples from the active layer and upper permafrost, and install ground temperature sensors (thermistors) for longer-term monitoring. For site-specific applications, we leverage various software packages (e.g., TEMP/W) to model existing and future ground temperature and permafrost conditions. We demonstrate how a phased and multi-disciplinary strategy for investigating permafrost in association with mine infrastructure provides flexibility and avoids unnecessarily costly and logistically challenging solutions.

The Rusting of Arctic Rivers: Assessing metal seeps from thawing permafrost in aquatic ecosystems

Authors: Michael P. Carey, Jonathan A. O'Donnell, Joshua C. Koch, Carson Baughman, Kenneth Hill, and Brett A. Poulin, U.S. Geological Survey

Rapid warming of the Arctic is driving abrupt shifts in watershed hydrology and biogeochemical cycling, with unforeseen consequences for aquatic ecosystems. Over the past decade, more than 75 streams and rivers in Alaska's Brooks Range have changed from clear to orange across a broad region of remote wilderness. Time-series analyses of Landsat imagery indicate that the onset of discoloration coincided with a period of abrupt warming, deep snowpack, and permafrost thaw. Compared to nearby clearwater streams, orange streams were more acidic, turbid, and had higher concentrations of sulfate, iron, and trace metals (e.g., copper, nickel, cadmium). Together, these observations suggest that permafrost thaw is likely enhancing chemical weathering of sulfide minerals by re-routing subsurface flow paths through deeper strata and allowing for the oxidation of previously frozen mineral deposits that contain sulfide minerals (e.g. pyrite). The subsequent transport of metals to surface waters has important implications for aquatic life, drinking water quality, and subsistence fisheries in the region. Initial findings document a loss of macroinvertebrate and resident fish biodiversity, likely due to bottom-up effects on the food web and habitat degradation.

Critical Metals and their role in the green energy, transportation and AI driven future

Author: Rick Van Nieuwenhuyse, Contango Ore

There are two globally important political dynamics going on at the moment that are specifically effecting metals and metal supply chains: 1) worldwide government driven mandates to de-carbonize our energy and transportation systems; and 2) hostilities in the Ukraine and Middle East which are creating east versus west military alliances and perhaps a New World Order. Both dynamics will mean the world will need more metals..... a lot more metals. This presentation will describe what metals are considered critical and what makes them critical. We will then look at the challenges to source and develop secure supply chains for these critical metals. Finally, we will look at how the United States government is addressing the issue of critical metal supply and specific to Alaska - where do we fit in?

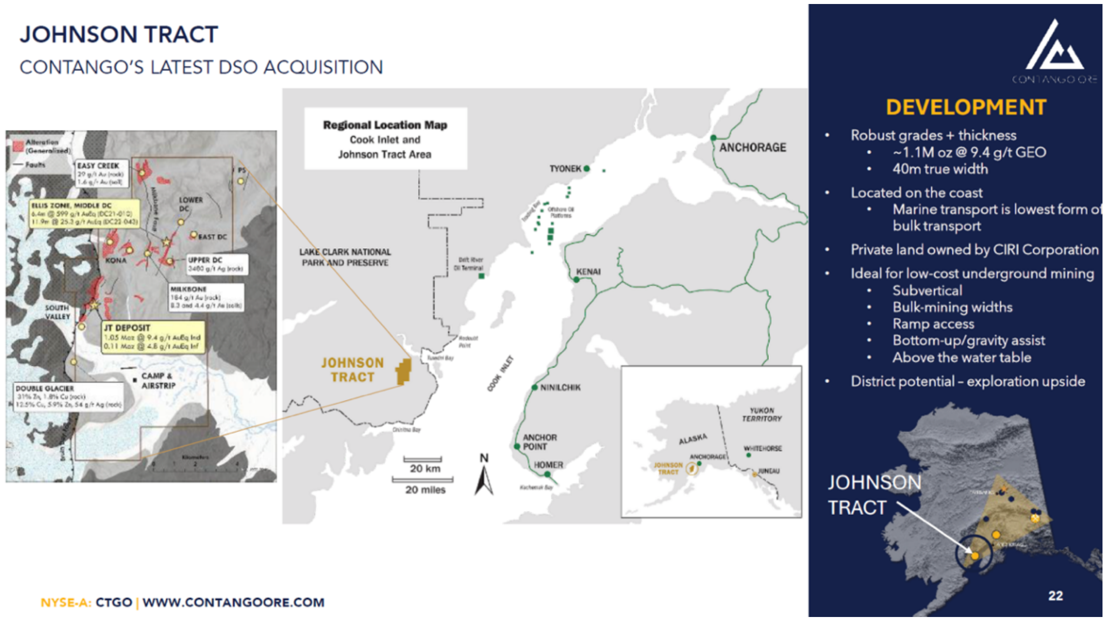
ADVANCED EXPLORATION

Building Alaska's Next Gold Mine – Update on Contango Ore Johnson Tract Project
Author: D. Larimer and N. Steeves, Contango Ore

On May 2nd, 2024, Contango Ore announced the proposed acquisition of HighGold Mining. This acquisition brings the advanced-stage Johnson Tract deposit alongside Contango Ore's Manh Choh and Lucky Shot deposits, resulting in three high-quality deposits with long-term upside potential.

The Johnson Tract project lies within the Early Jurassic Talkeetna Formation of the Alaska Peninsular Terrane, located 200 km southwest of Anchorage, on the western side of Cook Inlet. The 21,000-acre property includes the high-grade JT Deposit and at least nine (9) other mineral prospects over a 12-kilometer strike length. The project area is conveyed to Cook Inlet Region, Inc. (CIRI) under the terms of the Alaskan Native Claims Settlement Act (ANSCA) and the Cook Inlet Land Exchange. The JT deposit forms a tabular, high-angle silicified body of stockwork quartz-sulfide veins and breccia surrounded by a broader zone of anhydrite alteration. The mineralized body consists of quartz, pyrite, sphalerite, chalcopyrite, galena, anhydrite, barite, and native gold. A late 5–10 m thick steeply southeast-dipping brittle fault bounds the deposit to the east and juxtaposes the deposit and strongly altered host rock on the west side with a relatively unaltered dacite quartz-feldspar porphyry intrusion on the east side. Approximately 100–200 m of normal east-side down displacement is inferred along the fault but lateral offset is unknown. Current data suggests mineralization is coeval with volcanic stratigraphy and the deposit formed sub-seafloor in a shallow marine environment. Elsewhere on the property, more classic epithermal veins outcrop and several targets indicate the potential for a larger regional porphyry system. The Resource Estimate published in 2022 contains 3,489 Tonnes at 5.3 g/t Au, 6.0 g/t Ag, 0.56% Cu, 0.67% Pb, and 5.21% Zn, totaling a gold equivalent grade of 9.38 g/t AuEq and 1,053k AuEq Ounces at an Indicated Category. This resource is subvertical and averages 40 m horizontal with, which is ideal geometry for low-cost G mining. Initial metallurgical tests indicate that locked cycle flotation yields very high-quality copper, zinc, lead, and gold concentrates produced at a coarse primary grind with very good metal recoveries, low impurities, and negligible penalty elements.

Stop by the core shack booth to see this polymetallic ore body in core and talk to Contango Project Geos!


JOHNSON TRACT
CONTANGO'S LATEST DSO ACQUISITION
Regional Location Map
Cook Inlet and
Johnson Tract Area
LAKE CLARK NATIONAL
PARK AND PRESERVE
JOHNSON
TRACT
ANCHORAGE
TYONEK
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JUNEAU
EASY CREEK
ELLIS ZONE, MIDDLE DC
LOWER
DC
EAST DC
KONA
UPPER DC
MILKBONE
SOUTH
VALLEY
JT DEPOSIT
CAMP &
AIRSTRIP
DOUBLE GLACIER
DEVELOPMENT
Robust grades + thickness
~1.1M oz @ 9.4 g/t GEO
40m true width
Located on the coast
Marine transport is lowest form of
bulk transport
Private land owned by CIRI Corporation
Ideal for low-cost underground mining
Subvertical
Bulk-mining widths
Ramp access
Bottom-up/gravity assist
Above the water table
District potential – exploration upside
JOHNSON
TRACT
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NYSE-A: CTGO | WWW.CONTANGOORE.COM

The Whistler Gold-Copper Exploration Project - The Road to Rediscovery

Author: Logan Boyce, Senior Geologist – Americas, U.S. GoldMining

The Whistler Gold-Copper Exploration Project is located 100 miles northwest of Anchorage, Alaska comprising 377 State claims covering an aggregate area of 53,700 acres. Exploration drilling has defined three gold-rich porphyry deposits (Whistler, Raintree, and Island Mountain). The Whistler Project was first discovered and explored by Cominco in the late 1980's and subsequent advances in the exploration of the project occurred under Kennecott, Geoinformatics, and Kiska from 2003 to 2011. Exploration activities ceased following the industry downturn in 2012, and the project was dormant until being revived by U.S. Goldmining in 2023.

U.S. Goldmining is building upon the body of work completed by the previous explorers by focusing on the development of a robust geological model supported by targeted drilling. The results of these efforts include the best-ever drill hole on the property WH23-03 returning 652.5m at 1.00 g/t AuEq, and a significant update to the mineral resource estimate for the project with a combined endowment (Whistler, Raintree, and Island Mountain) of:

- Indicated Mineral Resource*: 294 Mt at 0.68 g/t AuEq (0.42 g/t Au, 0.16 % Cu, 2.01 g/t Ag) for 6.48 Moz AuEq (3.93 Moz Au, 1,024 Mlbs Cu, 18.99 Moz Ag); and,
- Inferred Mineral Resource*: 198 Mt at 0.65 g/t AuEq (0.52 g/t Au, 0.07 % Cu, 1.81 g/t Ag) for an additional 4.16 Moz AuEq (3.31 Moz Au, 317 Mlbs Cu, 11.52 Moz Ag)

*Additional details of the mineral resource estimate are set forth in the S-K 1300 Report titled "S-K 1300 Technical Report Summary Initial Assessment for the Whistler Project", Effective Date 12 September 2024 and Date of Issue 7 October 2024, a copy of which is available under the Company's profile at www.sec.gov.

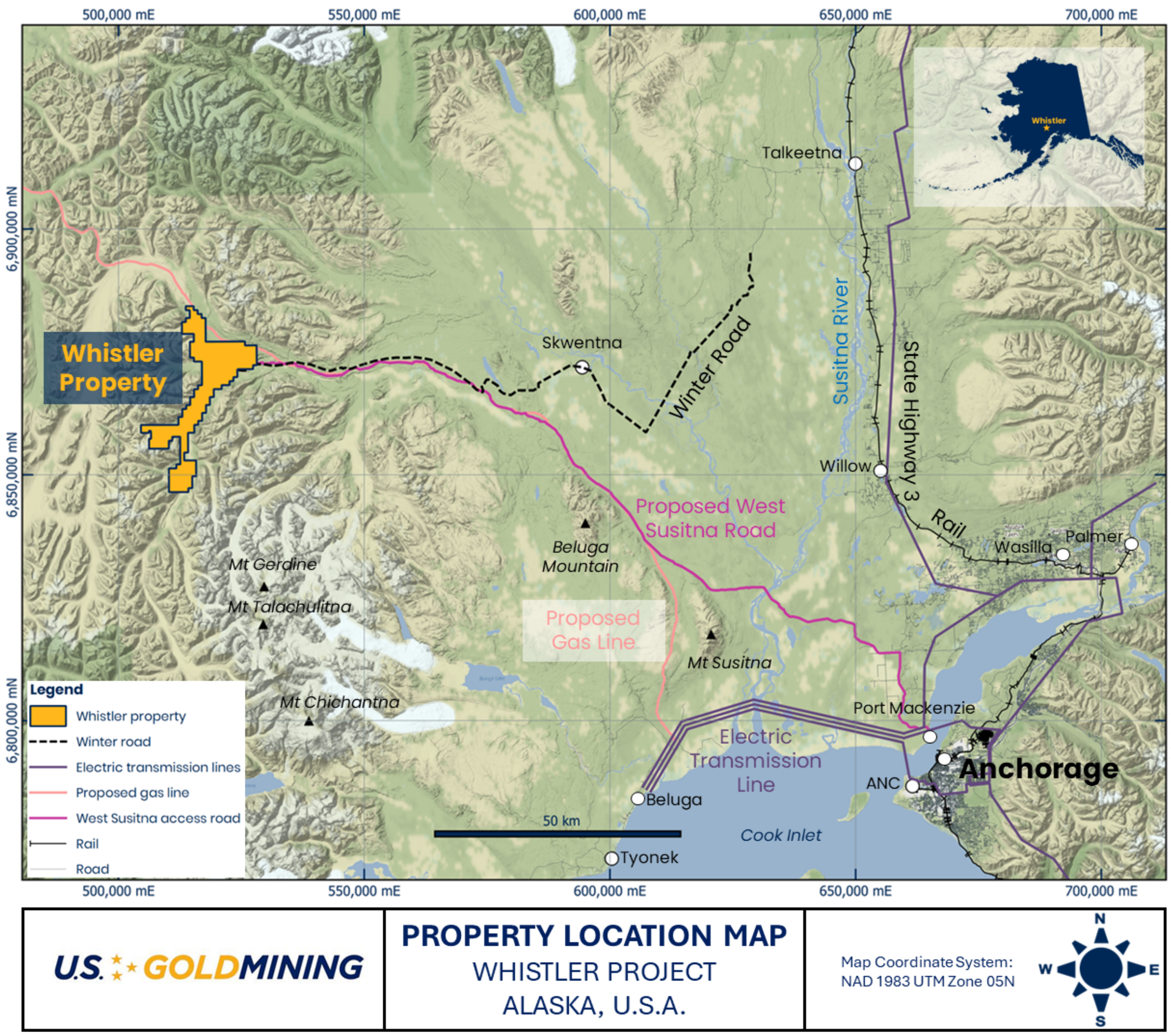
Numerous porphyry targets analogous to the Whistler deposit have been defined by airborne magnetic modeling, induced polarization chargeability and resistivity modeling, and geological modeling of lithology, alteration, veining, and mineralization reinterpreted from historic drilling and surface geology that had not been previously unified.

The Whistler claims are predominantly underlain by Jurassic-Cretaceous flysch sediments of the Kahiltna Assemblage, which are intruded by the Whistler Igneous Suite ("WIS") comprising diorite and monzonite intrusive rocks dated at approximately 76 Ma and overlain by equivalent extrusive assemblages consisting of calc-alkaline basalt-andesite.

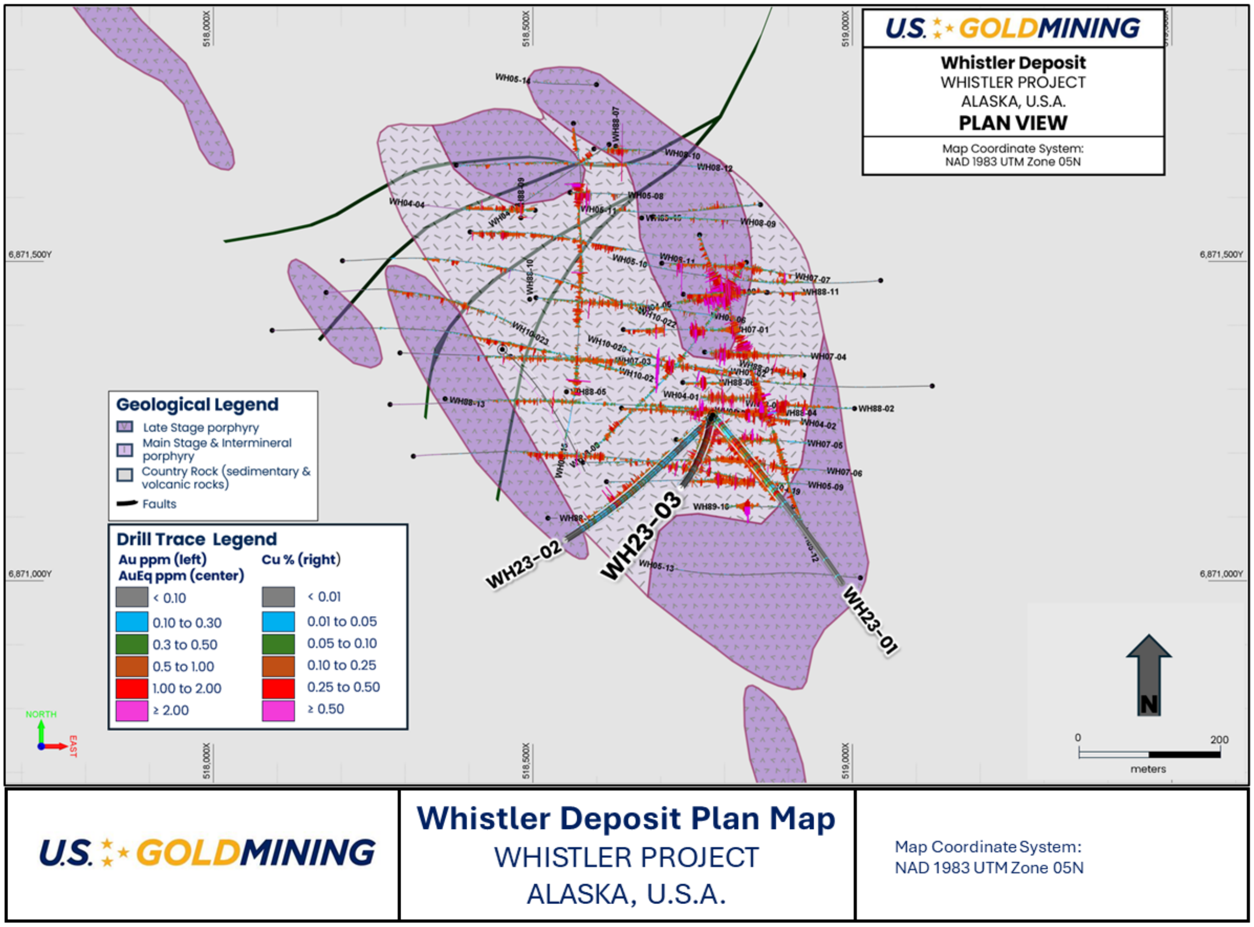
The Whistler Deposit is hosted within the Whistler Intrusive Suite, a composite suite of diorite stocks and dykes with clear cross-cutting relationships that divide the suite broadly into an early Main Stage Porphyry ("**MSP**"), a later Intermineral Porphyry Suite ("**IMP**") and a late intrusive phase referred to as Late Stage Porphyry ("**LSP**"). Gold and copper mineralization is characterized by abundant disseminated sulphide and quartz + sulphide vein stockworks (including classic porphyry diagnostic 'A', 'B', 'D', and 'M' type veins), and potassic alteration which is variably overprinted by later phyllic alteration. The early-stage MSP suite is most strongly altered, veined and mineralized, with the IMP being less intensely altered and veined but remaining consistently mineralized, and the late or post-mineralization LSP generally being below cutoff grade or unmineralized.

In October 2024 U.S. Goldmining completed Phase 2 of a two-year drilling campaign with the objective of exploring the wing-span potential and optimizing the existing mineral resources identified at Whistler and Raintree, in addition to updating the mineral resource estimate towards potentially initiating a preliminary economic assessment ("PEA") in 2025. During that campaign the company drilled over 6,200 m resulting in the best-ever intercepts on the project, with additional assay results from 2024 drilling pending.

Based on re-logging of historical drill core and the 2023-2024 drilling results, the Company is continuing to advance the Whistler Deposit geological model, including adjustments to the geometry, extents and continuity of the MSP and IMP suites, which serves to focus ongoing exploration and delineation drilling on opportunities to expand mineralization where the potentially mineralized porphyry phases remain under-explored. In addition, the technical team has identified the presence of a robust core of higher-grade mineralization within the deposit that correlates with intense alteration and veining within the MSP. Optimizing the geological model to improve confidence in the delineation of the MSP was a key focus of the 2024 drilling program as it will improve confidence in distribution and continuity of higher-grade zones within the Whistler deposit. Other programs driving the development and understanding of the project include drill core relogging, hyperspectral alteration characterization, structural and vein measurements from oriented core, surficial geology mapping and geochemical sampling, till sampling, and geometallurgical testwork (ongoing).



Project location map in relation to Anchorage, including the proposed West Susitna Access road.



Plan view map of the Whistler Deposit showing the geological interpretation of the Whistler Intrusive Suite and highlighting the location of 2023 drilling used in the October 2024 MRE update.

Update on the Estelle Project

Author: Chris Gerteisen, Nova Minerals

Nova Minerals is a gold, antimony and critical Minerals exploration and development company focused on advancing the Estelle Project, comprised of 514 km2 of State of Alaska mining claims, which contains multiple mining complexes with decades of future mine life producing multiple commodities across a 35 km long mineralized corridor of over 20 advanced prospects, including two already defined multi-million ounce gold resources, and several drill ready antimony prospects. The project is located 150 km northwest of Anchorage, Alaska, USA, in the prolific Tintina Gold Belt, a province which hosts a >220 million ounce (Moz) documented gold endowment and some of the world's largest gold mines and discoveries. The belt also hosts significant antimony deposits and was a historical North American Antimony producer.

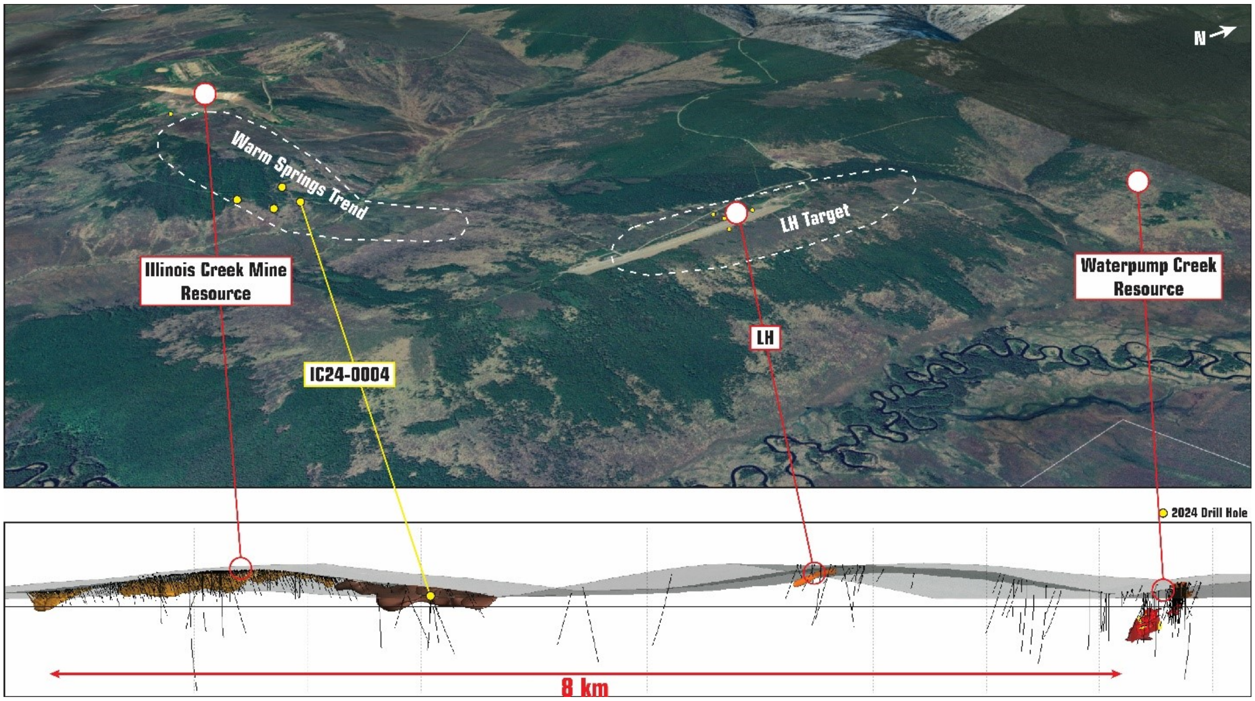
The Illinois Creek Project: A New Discovery in an Emerging CRD District

Author: Sage Langston-Stewart, Western Alaska Minerals

The Illinois Creek District located in west-central Alaska, approximately 250 miles west of Fairbanks was originally discovered in the 1980's by Anaconda and is home to five evolving mineral projects containing gold, silver, copper, lead, and zinc within Western Alaska Minerals (WAM) exploration land tenure. Recent focus has been on the high-grade sulfide mineralization at Waterpump Creek (WPC), which an initial high-grade Ag-Pb-Zn resource was released early in 2024, and the potential extensions to WPC.

The 2024 drilling targeted two areas, the Warms Spring and LH prospects, which are along the trend between the proximal Au-Ag resource of the past producing Illinois Creek (IC) oxide deposit and the high-grade Ag-Pb-Zn WPC sulfide resource. Nine drill holes (2,883 m) were completed within the Warm Spring target and discovered a major extension of the Illinois Creek system ~1.4 km southeast of the IC deposit. Seven of the drill holes intersected multiple pulses of mineralization including massive to semi-massive pyrite associated with gold, copper, and local silver mineralization, recrystalized ankerite associated with sphalerite (zinc) and galena (lead) mineralization, and extensive gossan (oxide). The mineralization is hosted within an intense silicification and brecciation zone that is 10x the size of Waterpump Creek, thus defining a large CRD hydrothermal system. The LH drilling (four holes totaling 1,347 m) intersected a few gossanous breccia intervals, but no significant sulfide manto mineralization. This drilling, along with extensive trench mapping, shows that the LH mineralization is more likely vertically oriented and higher in the CRD system than Waterpump Creek and the high grade manto target is deeper than originally anticipated.

In addition to the 2024 drilling, WAM completed an airborne SkyTEM electromagnetic survey in collaboration with the State of Alaska as part of a larger regional survey in Western Alaska. A total of 605-line km was flown at 200m north-south and 400m east west line spacings for WAM exclusively over areas (and orientations) not covered by the 2023 3D IP survey over the Waterpump Creek trend and the 2022 widely spaced CSAMT survey in the Warm Springs target area. The laterally constrained (LCI) resistivity inversions from the survey are effective in resolving the structural framework of the CRD system by identifying major aquitard fluid traps and pre-, syn-, and post mineralization faults. The 2024 drill results coupled with the new geophysical modelling and geological understanding for the district has delineated exciting targets for a successful 2025 drilling season.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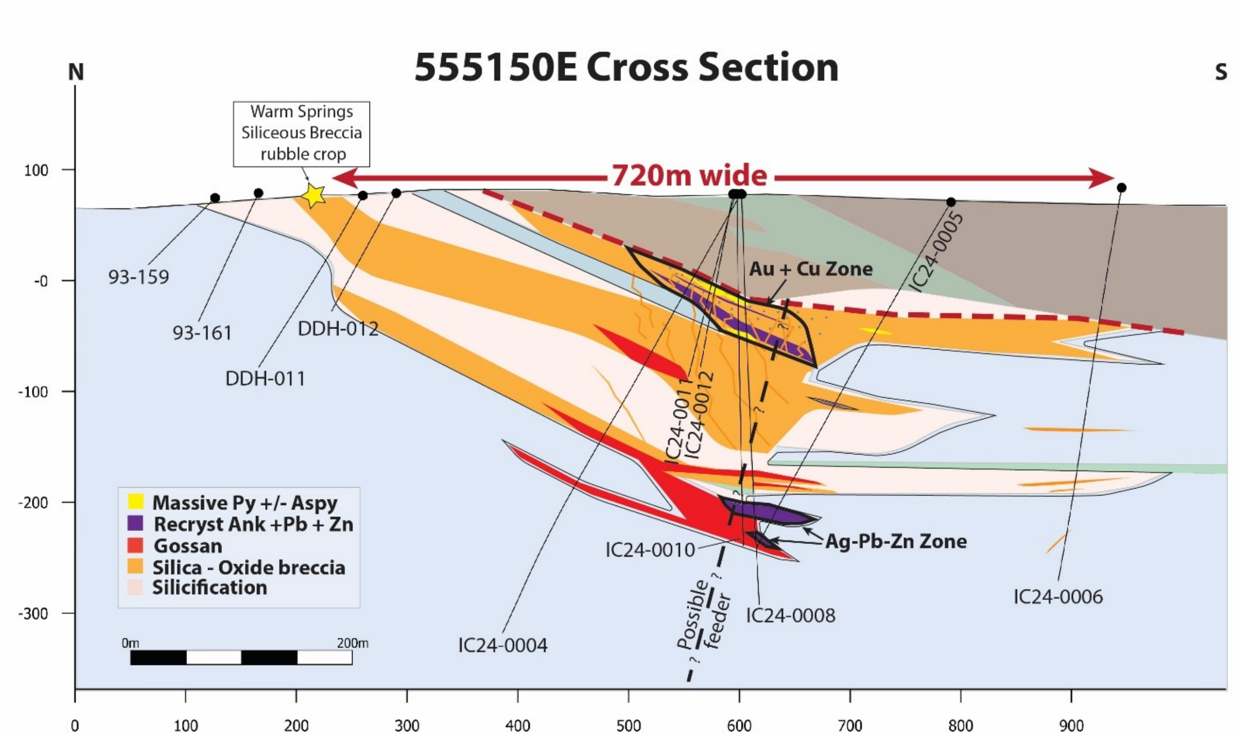
Warm Springs Trend
LH Target
Illinois Creek Mine Resource
Waterpump Creek Resource
LH
IC24-0004
2024 Drill Hole
8 km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DDH-011
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IC24-0005
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Massive Py +/- Aspy
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Silica - Oxide breccia
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Talk Title: Graphite Creek – Technical Advances

Author: Kirsten Fristad, Graphite One

There has never been a greater need for critical minerals in the United States. Graphite is a key component of the lithium-ion batteries used in vehicle and grid-scale electrification and is predominantly supplied by China. With the USGS 2021 designation as "the largest graphite deposit in the United States", Graphite One's Graphite Creek deposit has the potential to meet the United States' growing graphite needs for many generations to come. Graphite One plans to develop an open pit mine and processing facility at Graphite Creek located 40 miles North of Nome. The mine will produce a graphite concentrate which will be shipped to a secondary treatment plant in Ohio. The secondary treatment plant will further purify the graphite so it can be used for many products, not the least of which includes anodes for electric car batteries.

The Graphite Creek Project has advanced significantly in technical understanding in the last several years and a Feasibility Study is currently underway. Recent field seasons have comprised geotechnical, hydrogeologic, geologic, environmental, and cultural studies with a focus on data collection needed for the feasibility study and permitting. This talk will highlight field activities completed to date and the technical advancements resulting from this work.

MINES AND ADVANCED PROJECTS

Concentrate! Lessons from Cleanup Around a Cons Storage Building

Author: Jennifer Stoutamore, Senior Environmental Engineer, Hecla Greens Creek Mining Company

Greens Creek Mine is a polymetallic underground mine located on Admiralty Island, 18 miles west of Juneau, Alaska. It has been operating since 1989 with facilities that include the underground mine, mill operations, waste rock storage locations, roads, a dry stack tailings pile, port facilities and a concentrate storage building. Greens Creek is the largest silver mine in the United States and in 2023 the mine produced 51.5 thousand tons of zinc, 19.6 thousand tons of lead, 9.7 million ounces of silver, and 60.9 thousand ounces of gold. The mine is the first to operate within a national monument and is held to the highest environmental standards.

The Concentrate Storage Building (CSB) is designed to store concentrates before loading for transportation via vessel. Building design led to minute amounts of concentrate to slowly progress outside of the building. Tracking of concentrates outside the building has also been identified as a contributor. An inspection led to a fine from the EPA and characterization and cleanup of impacted soils. To prevent future contamination of soils around the CSB, Greens Creek has sealed the building siding and is in the process of implementing access restrictions and improved boot cleaning controls.

Cleanup of zinc and lead contamination in soil outside of the CSB falls under 18 AAC 75 (Oil and Other Hazardous Substances Pollution Control). Greens Creek therefore teamed with a local environmental consulting company to complete characterization and cleanup of the area adjacent to the CSB and under the oversight of the Alaska Department of Environmental Conservation. Many of the initial activities associated with the project, such as sealing the building envelope and initial soil characterization, occurred during COVID. This resulted in stop-gap response to move cleanup efforts forward. Materials and contractors were difficult to bring on Site during this time, resulting in Greens Creek Staff taking on many of the initial cleanup responsibilities. In 2022 the mine retained a local environmental consultant to conclude cleanup efforts.

Characterization of the Site was completed in 2023, and additional cleanup activities occurred in September of this year. Laboratory results indicate there are small areas that require additional excavation, and we are currently coordinating disposal of excavated soils and additional excavation. Cleanup logistics were challenging, with difficult and limited work areas available. All these efforts resulted in the need to find outside the box solutions to problems such as supply and equipment availability, insufficient areas to store soils while awaiting laboratory results and transport, and improved controls and procedures to prevent future contamination events.

Minimizing sampling errors and analysis of duplicate samples at Greens Creek underground silver mine

Author: Shane Bonanno, Hecla Greens Creek Mining Company

Sampling and assaying rocks is the primary method for determining metal content of potentially economic ores in the minerals industry and is used both in exploration and mining.

Gy, in his theory of sampling, outlines at least eight sources of error in sampling, all of which can be attributed to primary sampling and secondary sampling before the final analytical errors occur. All eight types of sampling error are controlled by three sources: material properties, sampling equipment, and sampling procedures. Production geologists, as the trained personnel typically responsible for sampling in the mine production environment, have control over two of these factors: sampling equipment and procedures. In Gy's words, "In order for a sample to be considered representative, it must first be considered correct." In other words, the sampling methodology itself minimizes each of the sampling biases and only then can reproducibility be established through quantitative analysis of samples. Best practices will be informed in primary sampling by the minimization of increment delineation error (biases created by delimiting the sample area incorrectly). and increment extraction error (biases related to how the material within the lot is selected).

This presentation will review the face sampling process as implemented at Greens Creek silver mine and apply analysis of duplicate samples to determine reproducibility of assay data. This study aims for ten to twenty percent standard deviation as its threshold for reproducibility with the purpose of operational guidance and model reconciliation in mind. Three characteristic faces will be chosen to demonstrate the varying levels of heterogeneity encountered within the deposit, and appropriate sampling procedures will be identified to demonstrate the minimization of sampling biases.

Duplicate sample analysis demonstrated a high level of reproducibility in all analytes for our face samples, indicating that the sampling methodology is acceptable. Further work can be done to minimize sampling errors through training of sampling personnel in best practices.

Dawson Gold and Silver Mine Update, Mining of a Low-Angle Vein System, and 2025 Gravity Mill Enhancements

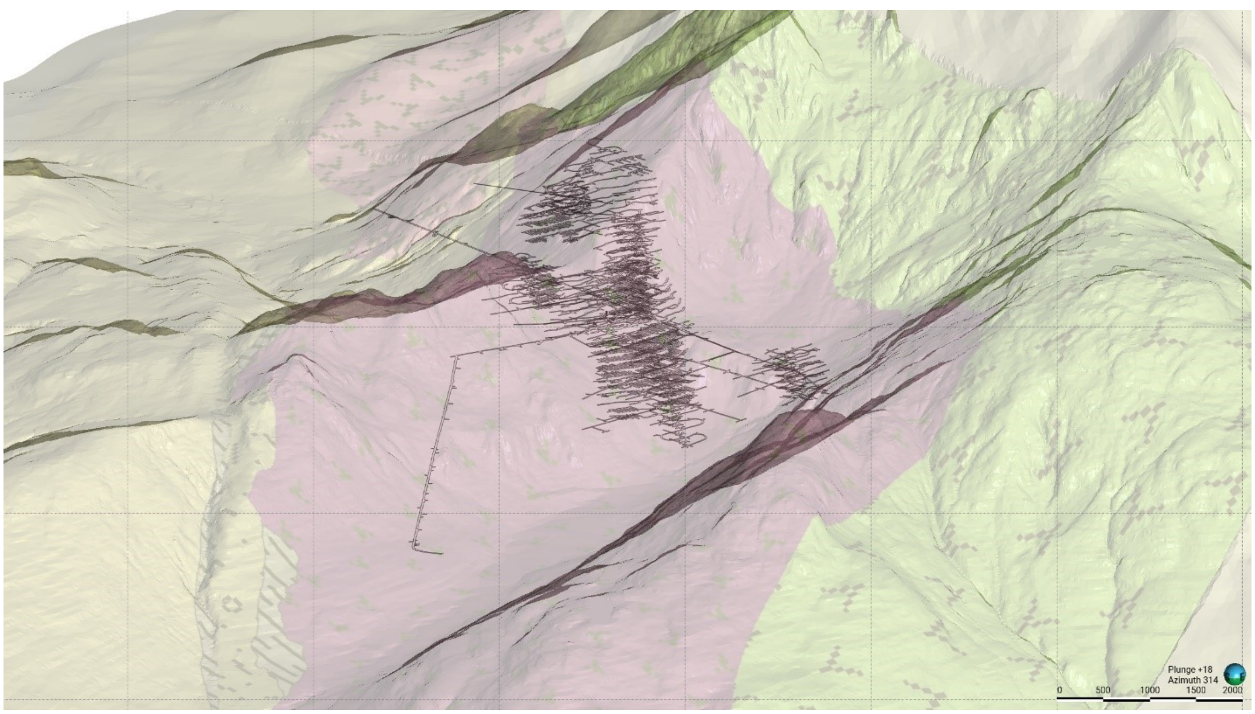
Author: Robert Fithian, General Manager

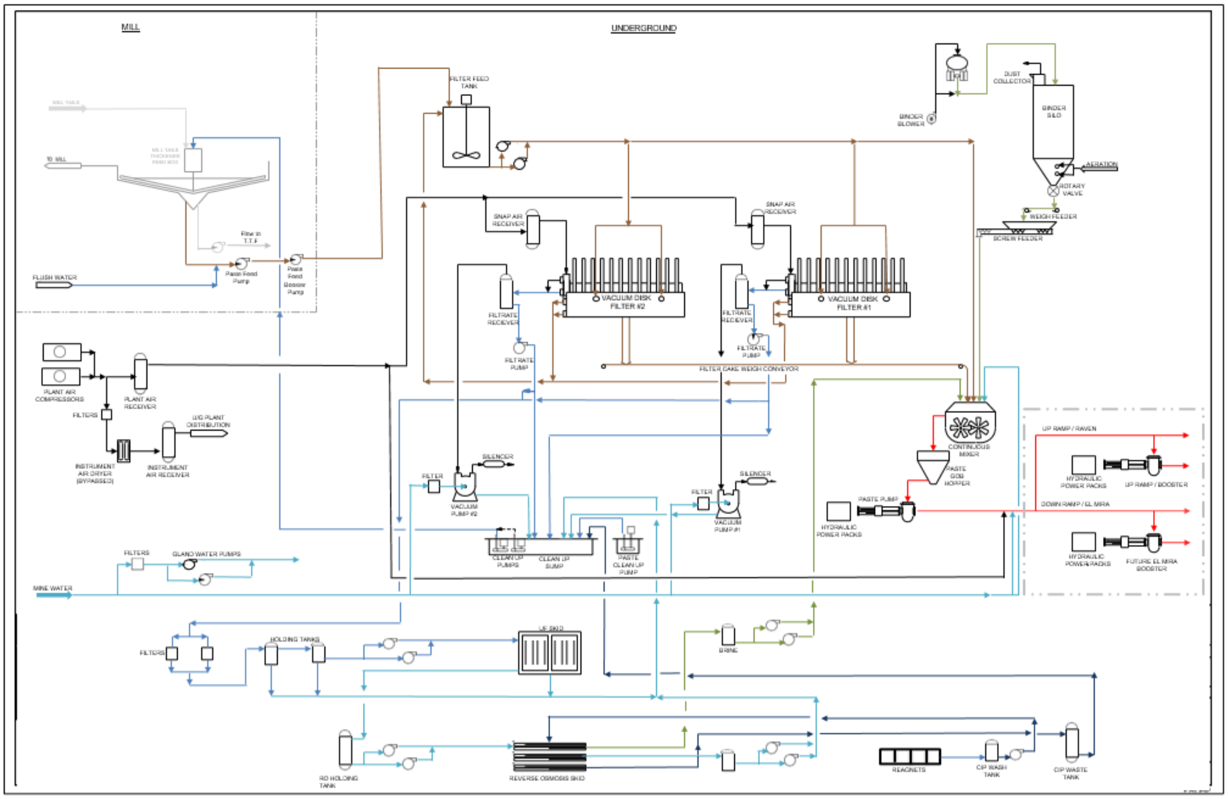
This will be a three part presentation:

- Overview of ongoing underground mine exploration development and production mining.
- Comparison of room and pillar mining methods within a low angle vein system.
- Planned enhancements to a gravity mill circuit.

Up-Hill Mining Backfill Challenges: When Gravity Is Not On Your Side.
Author: Emilien Charbonneau, Project Engineer III, Cœur Alaska Kensington Mine

Backfill is an essential step in mining. Each mine adopts its own backfill method based on cost, rock composition, orebody location, mine life, and mining method. When it comes to paste backfill, industry best practice is to build the paste plant above the orebody and use gravity as the primary force, Coeur Alaska's Kensington mine, located in Southeast Alaska, doesn't have this option. The mine entrance is at 900ft above sea level with most of the paste being placed up-ramp from the paste plant – as high as 2,795ft above sea level. To accommodate this unconventional approach, positive displacement (PD) pumps are used to deliver the paste up-ramp. With one main pump and two booster stations, backfilling activities at Kensington are complex and have faced multiple challenges. Pipe improvements, pressure surges, pump reprogramming, water hammer and flushing challenges have been tackled to increase the reliability, performance, and overall reach of the system. By investigating the hydraulic system, pipe geometry, pigging and admixture, we have been able to reduce the discharge pressure by 20% and prevent a large capital investment on a 3rd booster station.




MILL
UNDERGROUND
TO MILL
Flow to T.T.F
FLUSH WATER
Paste Feed Pump
Paste Feed Booster Pump
FILTER FEED TANK
SNAP AIR RECEIVER
FILTRATE RECIEVER
FILTRATE PUMP
VACUUM DISK FILTER #2
VACUUM DISK FILTER #1
FILTER CAKE WEIGH CONVEYOR
BINDER BLOWER
DUST COLLECTOR
BINDER SILO
AERATION
ROTARY VALVE
WEIGH FEEDER
SCREW FEEDER
PLANT AIR COMPRESSORS
PLANT AIR RECEIVER
FILTERS
U/G PLANT DISTRIBUTION
INSTRUMENT AIR DRYER (BYPASSED)
INSTRUMENT AIR RECEIVER
SILENCER
FILTER
VACUUM PUMP #2
VACUUM PUMP #1
CLEAN UP PUMPS
CLEAN UP SUMP
PASTE CLEAN UP PUMP
CONTINUOUS MIXER
PASTE GOB HOPPER
PASTE PUMP
HYDRAULIC POWER PACKS
UP RAMP / RAVEN
UP RAMP / BOOSTER
DOWN RAMP / EL MIRA
FUTURE EL MIRA BOOSTER
GLAND WATER PUMPS
MINE WATER
HOLDING TANKS
UF SKID
BRINE
RO HOLDING TANK
REVERSE OSMOSIS SKID
REAGNETS
CIP WASH TANK
CIP WASTE TANK

Manh Choh: A Legacy of Sustainable Progress in Interior Alaska

Author: Meadow Riedel, External Affairs Manager, Kinross Alaska

Join us as we explore the transformative journey of the Manh Choh mine, a project grounded in community collaboration, innovation, and sustainability. Celebrating its first year of operation, Manh Choh is founded in responsible mining, supporting local economies and creating opportunities for the Native Village of Tetlin. This presentation highlights the mine's significant milestones, from its groundbreaking to its first gold pour, and emphasizes Kinross Alaska's enduring commitment to education, local business partnerships, and community development. Discover how this legacy project not only boosts Alaska's economy but also preserves cultural heritage for future generations.

The Next 81 Years

Author: Ethan Trickey, Usibelli Coal Mine

Usibelli Coal Mine is the longest continually operating mine in Alaska. Since 1943 Usibelli has provided coal to Interior Alaska. The mine currently supplies 100 percent of the in-state demand for coal. This presentation will highlight Usibelli's first 81 years through the discussion of technical advancements. Mr. Trickey will dive into the upcoming major events for the coal mine including moving the dragline — Alaska's largest piece of mobile land equipment. The dragline is affectionately named the *Ace in the Hole* and is Usibelli's crown jewel. The Ace in the Hole will move from its current location out to Usibelli's newest mining area, Jumbo Dome, approximately 13 miles away. Moving the dragline will be a monumental task that requires extensive analysis, logistical planning, and expert execution. Mr. Trickey will share how Usibelli is planning for the move, as well as how the mining practices at Jumbo Dome differ from earlier mining areas. Finally, he will highlight Usibelli's environmental stewardship, focus on continuous improvement, reclamation activities, and safety practices.

Pogo Project, Alaska: "Geology and New Gold Discovery"

Author: Paul Hohbach, Manager, Principal Geologist Generative North America: Northern Star Resources

The Pogo Project in Alaska, USA harbours one of the world's flagship high-grade reduced intrusion related gold deposits. Mined grades average 7 to 17 grams per ton gold. At the Pogo project, new gold deposits hosting over one million-ounces of gold are being discovered near the junction of the Goodpaster River and Liese Creek. The current, known mineral endowment exceeds 10Moz of gold.

This paper will highlight several new developments in the understanding of the Pogo geology. This includes, the presence of different deposit types within the same space; multi-element geochemical patterns, the role of geophysical studies and most importantly "What is a Pogo-type deposit?". New work in collaboration with USGS Geologists will be shown. Pogo-type gold deposits formed within important structures and are intimately-proximal to felsic to intermediate intrusion complexes. However, there is very little actual "Diorite" near-surface at the project. New deposits that have been recently drilled at the Pogo Project will be noted.

In Early to Mid Cretaceous time, thrusts carrying pieces of seafloor sliced through cooling amphibolite-grade metamorphic units that were derived from Paleozoic sediments. Numerous felsic to intermediate intrusions rose along steeply-dipping WNW shear zones. During later deformation, circa 105.5Ma, and proximal to the Goodpaster Batholith intrusions, enormous amounts of quartz flooded upwards multiple times and laterally into shallowly-dipping re-activated thrust sheets. Multiple episodes of compression and intrusions localized multi-ounce gold grades in the hanging walls of these gently-dipping structures. Relaxation led to extensional movements that opened high-angle conjugate faults and re-fractured quartz veins many times. "Clots" of native gold, bismuth, and tellurides were deposited in the most-valuable lodes. We interpret, based on new USGS age dates, that these mineralizing events occurred approximately at 105.5Ma within the proto-Tintina Mineral Belt, at depths of 8 to 10 kilometers.

Another phase of deformation took place starting around 95Ma; post-mineral granodiorite, and tonalite to diorite intrusions used the same WNW structural corridors as mineral-related intrusions. Parts of existing gold lodes were consumed; dip-slip post-mineral movements along thrust sheets offset lodes and older faults. Barren quartz-diorite dykes filled transverse faults between northeast-striking, strike-slip faults with left-lateral displacements. A second distinct phase of low-tenor, quartz-carbonate gold mineralization may have taken place at this time.

Paleocene and younger movements related to the Tintina Belt stresses caused right-lateral strike slip movements on older WNW shears and left-lateral stress-release movements along NE post-mineral faults. A number of small-displacement structures further offset the lodes and rock units. Deposits of loess and sand, derived from Pleistocene glaciation blew-westwards. Recent talus now mantles much of Pogo's terrain.

Pogo Optimization and Successes: 2024 Operational Update

Author: Michael Eckert, General Manager, Northern Star Resources

The Pogo Gold Mine is located approximately 90 miles southeast of Fairbanks, Alaska and is situated in the Tintina Gold Province. The operation, which commenced production in 2006, has significant underground workings, a Carbon-in-pulp processing plant and dry-stack tailings storage facility. Pogo has poured over 5 million ounces of gold to date and controls some 42,200 acres of mining and exploration leases.

Northern Star acquired the Pogo Mine in September 2018. Over the subsequent 4 years, Northern Star conducted a significant refurbishment and expansion of the operation. This involved transitioning mining methods to high-speed jumbo development and Longhole open stoping, expanding the mill to 1.45M ton per annum, and numerous fleet and infrastructure upgrades to support the expanded operation. Pogo now has ~660 Northern Star employees plus contractors, a 6.7Moz Mineral Resource and 1.5Moz Ore Reserve, and is set up for production into the next decade. This discussion provides an operational update and highlights recent successes achieved by the Pogo team.

TRACK TWO

POLICY

Supplemental Notice of Public Scoping For Possible Updates And Revisions To Water Management Regulations – Extension Of Comment Period
Alaska Department of Natural Resources

On August 1, 2024, the Department of Natural Resources (DNR, Department) began a scoping process to ask the public for input on updating certain water management regulations in 11 AAC 93. The purpose of this supplemental notice is to extend the public comment period for an additional 60 days. The original public comment period was scheduled to run from August 1 to August 30, 2024. The new deadline for public comments is now 5:00 p.m. on October 29, 2024. As explained below, the Division of Mining, Land and Water (DMLW) has also added supplemental background materials to the scoping project website at https://dnr.alaska.gov/mlw/water/regrevision/.

The Department is considering updating the regulations implementing AS 46.15.145 Reservations of water: 11 AAC 93.141, 11 AAC 93.142 (Content of application), 11 AAC 93.143, 11 AAC 93.144, 11 AAC 93.145, Adjudication of applications 11 AAC 93.146 (Issuance of a certificate of reservation of water), and 11 AAC 93.147 (Review of a reservation of water).

The Department is undertaking this scoping process to ask the public for their ideas and suggestions before the Department undertakes the task of drafting any specific proposed regulations for public review. Written input must be received no later than 5:00 p.m. on October 29, 2024. At such time DNR undertakes revisions to these regulations, there will be an additional timeframe to provide public comments on the proposed regulations.

Background Information
In January 2021, the Department publicly noticed proposed changes to a variety of water management regulations in 11 AAC 93. The Department received numerous comments on regulations concerning reservations of water and decided to advance only the administrative changes (adopted in June 2024). The public can view these newly adopted regulations at: https://aws.state.ak.us/OnlinePublicNotices/Notices/View.aspx?id=215679.

This scoping notice picks up where the Department left off and looks specifically at reservations of water. The current reservation of water regulations are available here: https://www.akleg.gov/basis/aac.asp#11.93

What information is DNR requesting?

The purpose of this notice is to ask the public for their input before the Department undertakes the task of revising the reservation of water regulations. Specifically, the Department is interested in ideas that will provide an efficient, consistent, and cost-effective water reservation process to encourage the development of state water for its highest and best use consistent with the public interest.

The public is encouraged to provide specific wording to be changed, added, or removed from the current reservation of water regulations. When providing information, please be as specific as possible. For example, if the information is from a published study, please provide a copy of the study or a complete reference citation so DNR staff can obtain a copy for consideration. Specifically, we invite the public to respond to the following prompts:

11 AAC 93.142 (Content of application)

· Should additional information be required to justify the need for a reservation of water?

· What types of data and methodology?

11 AAC 93.146 (Issuance of a certificate of reservation of water)

· Should only State resource agencies, such as DNR or Alaska Department of Fish and Game, hold the certificate of a reservation of water?

· Who should hold a certificate of a reservation of water?

11 AAC 93.147 (Review of a reservation of water)

· Are the review requirements clear and adequate?

How will DNR use the information I provide?

The Department will carefully review all input, including responses to the above prompts, received during this scoping period. Information provided to the Department will be subject to inspection, copying, and distribution as public records under Alaska Statute 40.25.110 – 40.25.220. Do not include information that is not appropriate for public consumption.

At such time DNR undertakes revisions to these regulations, there will be an additional timeframe during which the public may provide comments on the proposed regulations.

How do I submit information or feedback to DNR?

Send information to:

By mail: Alaska Department of Natural Resources Division of Mining, Land & Water Program Support Section
550 W. 7th Avenue, Suite 1070
Anchorage, AK 99501-3579

By DMLW Comment Portal: Public Comment Topics – Division of Mining, Land, and Water (alaska.gov)

By email: dnr.water.regulation@alaska.gov

Please note that information provided will be subject to inspection, copying, and distribution as public records under Alaska Statute 40.25.110 – 40.25.220.

Submit written comments by 5:00 pm on October 29, 2024.

The State of Alaska, Department of Natural Resources, complies with Title II of the Americans with Disabilities Act of 1990. If you are a person with a disability who needs special accommodation to participate in this process, please contact the Division of Mining, Land and Water at 907-334-2683 no later than October 19, 2024, to ensure that any necessary accommodations can be provided.

How can I find more information?

Website

Visit the DNR website for background information and links to current statutes and regulations: https://dnr.alaska.gov/mlw/water/regrevision/

Public Meeting

DNR hosted a public meeting on August 12, 2024, from 4:30-6:30 p.m. at the Atwood Conference Center Room 102/104 in Anchorage (Robert B. Atwood Building, 550 West 7th Avenue, Anchorage, AK 99501).

The meeting included a brief presentation by DNR followed by a question-and-response session and an opportunity for participants to submit feedback. The meeting recording and presentation are posted here: https://dnr.alaska.gov/mlw/water/regrevision/

Additional Materials for Review

The Department has posted supplemental materials relating to past phases of this regulations project at the project website: https://dnr.alaska.gov/mlw/water/regrevision/

Update on MSHA's New Ruling Affecting Miners

Authors: Scott Crosser and Dena Lythgoe, USI Insurance

This presentation will cover a new MSHA ruling concerning mobile equipment and employees. We anticipate each owner that attends will be able to check off one of the MSHA requirements that will be coming forth for 2025 regarding investigation of technology.

The new regulations coming from MSHA: https://www.federalregister.gov/documents/2023/12/20/2023-27640/safety-program-for-surface-mobile-equipment

In short there are seven components to the rule that need to be followed:

1. Require that the written safety program include actions the operator will take to identify and analyze hazards and reduce the resulting risks related to the movement and operation of surface mobile equipment.
2. Require that the written safety program include actions the operator will take to develop and maintain procedures and schedules for routine maintenance and non-routine repairs for surface mobile equipment.
3. Require that the written safety program include actions the mine operator will take to identify currently available and newly emerging feasible technologies that can enhance safety and evaluate whether to adopt them.
4. Require that the written safety program include actions the operator will take to train miners and other persons at the mine necessary to perform work to identify and address or avoid hazards related to surface mobile equipment.
5. Require the responsible person to evaluate and update the written safety program for the mine at least annually, or as mining conditions or practices change that may adversely affect the health and safety of miners or other persons, as accidents or injuries occur, or as surface mobile equipment changes or modifications are made.
6. Requires operators to consult with miners and their representatives in developing and updating the safety program.
7. Requires that the operator make available a copy of the written safety program for inspection by authorized representatives of the Secretary, miners, and their representatives.

Towards Sustainxable Mining (TSM) Initiative

Author: Paul Hebert, Vice President, Communications, Mining Association of Canada

This presentation by Mining Association of Canada will be an opportunity to learn and discuss about Canada's Towards Sustainable Mining (TSM) initiative allowing mining companies to turn high-level environmental and social commitments into action on the ground.

At the same time, it provides communities with valuable information on how operations are faring in important areas, such as community outreach, tailings management and biodiversity.

Mining sector in Canada leads one of the highest sustainability standards globally by making the TSM initiative mandatory for all MAC members for their Canadian operations. TSM has also been adopted by 12 other countries around the world.

Don't Get Rejected – Best Practices for Location Sketch Maps

Authors: Ramona Monroe, Shannon Bleicher, Andrea Jacuk, Stoel Rives LLP

Establishing a valid mineral location involves a discovery, posting of the location notice, and recording the certificate of location. Under the existing mining regulations, the certificate of location must include a map showing particular features and attributes of the claims and surrounding lands. Submitting a map that fails to meet the regulatory requirements can result in the certificate being rejected. This presentation will cover the regulatory requirements for location sketch maps, common mistakes that can lead to a map being rejected, and best practices for preparing location maps to ensure your maps do not get rejected.

Remember! Andrea will be available in the Trade Show Lounge to notarize your AOL documents!

Tuesday: 9:00 am – 10:00 am

Wednesday: 9:30 am – 10:30 am

Thursday: 9:00 am – 10:00 am

Alaska's Energy Challenges

Moderator: Dan Graham

Presenters: Dan Graham, Frank Paskvan, Justin Seavey, Enstar Natural Gas Company, Mary Ann Pease

This session will cover energy security for Alaska and energy availability for Alaska's current and potential future mines. Participants will discuss:

- Current conditions – how much energy do Alaska mines consume currently, how much is available and where does it come from, and what do mines need for success (availability, reliability, and cost certainty)
- The Current Railbelt Energy Grid: Facts about the current Railbelt energy status and Alaska's energy costs and options for expanding the system to keep up with future demand
- Interior energy infrastructure, coal's role in providing reliable and affordable energy to Alaska yesterday, today and tomorrow
- Southcentral natural gas looming shortage –Enstar provides natural gas to electric utilities as well as for heating buildings in southcentral Alaska. The current supply contracts fall short of current demand within the next 2 years. Enstar conducted a study on how to best fill the deficit and will present the results of that work.
- Micro-Nuclear power and storage options for rural Alaska: an update on Westinghouse's eVinci micronuclear reactors and future solutions for remote mines.
- Q&A from audience and presenters

CORE SHACK AND PROSPECTORS TENT

Golden Summit Project
Freegold Ventures Limited

The road-accessible Golden Summit is a 30-minute drive from Fairbanks, Alaska. Exploration by Freegold between 2011 and 2013 defined a significant resource; a new interpretation proposed in 2019 fully realized the project's potential to host higher grades. Since 2020, over 100,000 metres have been drilled. An updated mineral resource was completed in September 2024.

Cut-off Au g/t	Classification	Au g/t	Tonnes	Ounces
OXIDE				
0.15	**Indicated**	**0.49**	**59,414,000**	**937,000**
0.15	**Inferred**	**0.45**	**3,252,000**	**47,000**
PRIMARY				
0.5	**Indicated**	**1.08**	**346,304,000**	**12,050,000**
0.5	**Inferred**	**1.04**	**308,311,000**	**10,306,000**
UNDER PIT				
0.75	**Indicated**	**1.29**	**2,867,000**	**119,000**
0.75	**Inferred**	**1.34**	**22,900,000**	**986,000**

Mineral Resources for the primary resources are reported at a cut-off grade of 0.50 g/t gold and constrained within an open pit shell using a gold price of US$1,973/ounce, US$2.50/t mining cost, US$14/t processing cost, US$2.00/t G+A, 72% gold recovery, and a 45° pit slope. Tonnes and ounces rounded to the nearest thousand.

- Located a 30-minute drive from Fairbanks, Alaska
- Since 2020 over 100,000 metres have been drilled at Golden Summit — resulting in a significant resource growth
- Paved highway road access

- High Tension power line located 7 km away
- Existing labour force and supply centre in Fairbanks

The 2020 -2022 program focused on delineating deeper, higher-grade mineralization. Drilling continues to focus on further expanding and defining the higher-grade Cleary Vein System (CVS). The CVS is interpreted to be a broader zone of higher-grade mineralization, which encompasses the down-dip extent of the higher-grade vein zones found within the historic Cleary, Colorado, Wackwitz, and Wyoming veins and their broader enveloping stockwork zones. The CVS extends west of the Cleary Hill Mine, workings through to the Dolphin Intrusive. The program successfully demonstrated the potential for more extensive and higher-grade gold mineralization on the project at depth.

The 2023 program confirmed the potential to expand the resource along strike to the west within a 1.5-kilometre-long gold-in-soil geochemical anomaly at potentially shallower depths. It highlighted the potential to increase the overall resource grade by further expansion drilling. Significant mineralization, including broad zones of higher-grade mineralization, was consistently intersected during the 2023 drill program. One of the highest-grade intercepts was seen in hole GS2333, located 250 meters west of the main Dolphin area. This hole intersected multiple zones with over 2 g/t of gold over a significant width (2.12 g/t over 197.3m) within a broader interval of 1.76 g/t Au over 276.5 meters. Mineralization is still open up-dip, down-dip, and to depth. The up-dip projection of GS2333 coincides with a strong surface gold-in-soil anomaly, part of a 1.5km soil anomaly to the west of Willow Creek. It's worth noting that soil anomalies have been helpful in identifying areas of potential mineralization at Golden Summit since the area was not glaciated.

The 2024 program is testing the potential for additional mineralization west of the current resource, where a solid gold-in-soil geochemical anomaly has been outlined. The gold-in-soil anomaly extends over 1.5 km west of the current resource. In addition, holes for additional metallurgical test work have been completed. Drilling remains ongoing, with significant number of assays still to be reported.

The Whistler Gold-Copper Exploration Project - The Road to Rediscovery
Logan Boyce, Senior Geologist – Americas U.S. Goldmining Inc.

The Whistler Gold-Copper Exploration Project is located 100 miles northwest of Anchorage, Alaska comprising 377 State claims covering an aggregate area of 53,700 acres. Exploration drilling has defined three gold-rich porphyry deposits (Whistler, Raintree, and Island Mountain). The Whistler Project was first discovered and explored by Cominco in the late 1980's and subsequent advances in the exploration of the project occurred under Kennecott, Geoinformatics, and Kiska from 2003 to 2011. Exploration activities ceased following the industry downturn in 2012, and the project was dormant until being revived by U.S. Goldmining in 2023.

U.S. Goldmining is building upon the body of work completed by the previous explorers by focusing on the development of a robust geological model supported by targeted drilling. The results of these efforts include the best-ever drill hole on the property WH23-03 returning 652.5m at 1.00 g/t AuEq, and a significant update to the mineral resource estimate for the project with a combined endowment (Whistler, Raintree, and Island Mountain) of:

- Indicated Mineral Resource*: 294 Mt at 0.68 g/t AuEq (0.42 g/t Au, 0.16 % Cu, 2.01 g/t Ag) for 6.48 Moz AuEq (3.93 Moz Au, 1,024 Mlbs Cu, 18.99 Moz Ag); and,
- Inferred Mineral Resource*: 198 Mt at 0.65 g/t AuEq (0.52 g/t Au, 0.07 % Cu, 1.81 g/t Ag) for an additional 4.16 Moz AuEq (3.31 Moz Au, 317 Mlbs Cu, 11.52 Moz Ag)

*Additional details of the mineral resource estimate are set forth in the S-K 1300 Report titled "S-K 1300 Technical Report Summary Initial Assessment for the Whistler Project", Effective Date 12 September 2024 and Date of Issue 7 October 2024, a copy of which is available under the Company's profile at www.sec.gov.

Numerous porphyry targets analogous to the Whistler deposit have been defined by airborne magnetic modeling, induced polarization chargeability and resistivity modeling, and geological modeling of lithology, alteration, veining, and mineralization reinterpreted from historic drilling and surface geology that had not been previously unified.

The Whistler claims are predominantly underlain by Jurassic-Cretaceous flysch sediments of the Kahiltna Assemblage, which are intruded by the Whistler Igneous Suite ("WIS") comprising diorite and monzonite intrusive rocks dated at approximately 76 Ma and overlain by equivalent extrusive assemblages consisting of calc-alkaline basalt-andesite.

The Whistler Deposit is hosted within the Whistler Intrusive Suite, a composite suite of diorite stocks and dykes with clear cross-cutting relationships that divide the suite broadly into an early Main Stage Porphyry ("**MSP**"), a later Intermineral Porphyry Suite ("**IMP**") and a late intrusive phase referred to as Late Stage Porphyry ("**LSP**"). Gold and copper mineralization is characterized by abundant disseminated sulphide and quartz + sulphide vein stockworks (including classic porphyry diagnostic 'A', 'B', 'D', and 'M' type veins), and potassic alteration which is variably overprinted by later phyllic alteration. The early-stage MSP suite is most strongly altered, veined and mineralized, with the IMP being less intensely altered and veined but remaining consistently mineralized, and the late or post-mineralization LSP generally being below cutoff grade or unmineralized.

In October 2024 U.S. Goldmining completed Phase 2 of a two-year drilling campaign with the objective of exploring the wing-span potential and optimizing the existing mineral resources identified at Whistler and Raintree, in addition to updating the mineral resource estimate towards potentially initiating a preliminary economic assessment ("PEA") in 2025. During that campaign the company drilled over 6,200 m resulting in the best-ever intercepts on the project, with additional assay results from 2024 drilling pending.

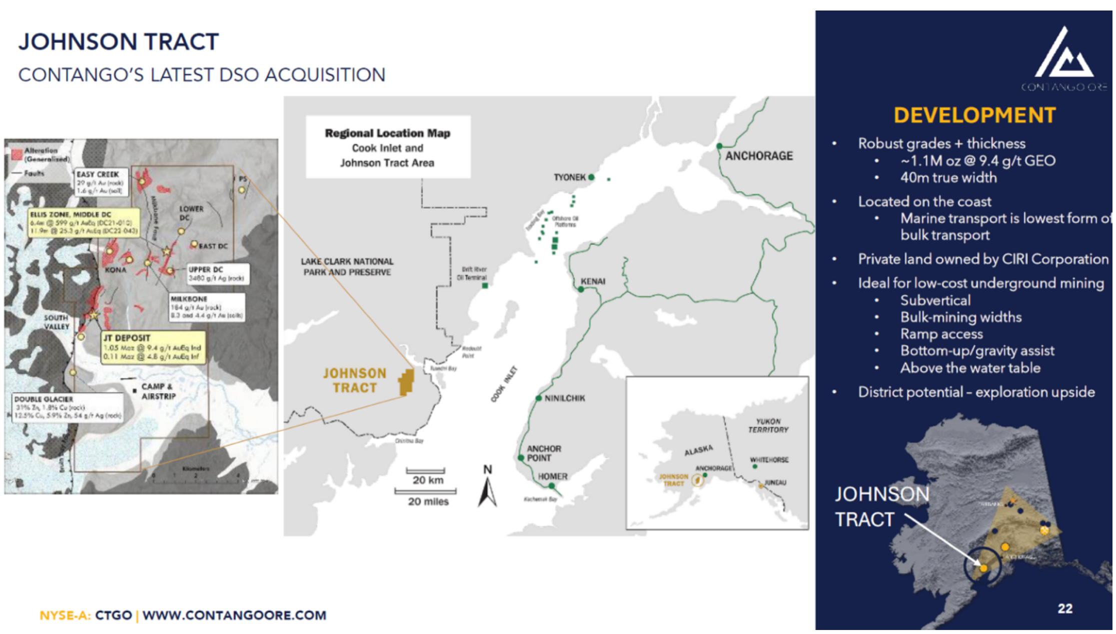
Based on re-logging of historical drill core and the 2023-2024 drilling results, the Company is continuing to advance the Whistler Deposit geological model, including adjustments to the geometry, extents and continuity of the MSP and IMP suites, which serves to focus ongoing exploration and delineation drilling on opportunities to expand mineralization where the potentially mineralized porphyry phases remain under-explored. In addition, the technical team has identified the presence of a robust core of higher-grade mineralization within the deposit that correlates with intense alteration and veining within the MSP. Optimizing the geological model to improve confidence in the delineation of the MSP was a key focus of the 2024 drilling program as it will improve confidence in distribution and continuity of higher-grade zones within the Whistler deposit. Other programs driving the development and understanding of the project include drill core relogging, hyperspectral alteration characterization, structural and vein measurements from oriented core, surficial geology mapping and geochemical sampling, till sampling, and geometallurgical testwork (ongoing).

Contango Ore – Johnson Tract Project

On May 2nd, 2024, Contango Ore announced the proposed acquisition of HighGold Mining. This acquisition brings the advanced-stage Johnson Tract deposit alongside Contango Ore's Manh Choh and Lucky Shot deposits, resulting in three high-quality deposits with long-term upside potential.

The Johnson Tract project lies within the Early Jurassic Talkeetna Formation of the Alaska Peninsular Terrane, located 200 km southwest of Anchorage, on the western side of Cook Inlet. The 21,000-acre property includes the high-grade JT Deposit and at least nine (9) other mineral prospects over a 12-kilometer strike length. The project area is conveyed to Cook Inlet Region, Inc. (CIRI) under the terms of the Alaskan Native Claims Settlement Act (ANSCA) and the Cook Inlet Land Exchange. The JT deposit forms a tabular, high-angle silicified body of stockwork quartz-sulfide veins and breccia surrounded by a broader zone of anhydrite alteration. The mineralized body consists of quartz, pyrite, sphalerite, chalcopyrite, galena, anhydrite, barite, and native gold. A late 5–10 m thick steeply southeast-dipping brittle fault bounds the deposit to the east and juxtaposes the deposit and strongly altered host rock on the west side with a relatively unaltered dacite quartz-feldspar porphyry intrusion on the east side. Approximately 100–200 m of normal east-side down displacement is inferred along the fault but lateral offset is unknown. Current data suggests mineralization is coeval with volcanic stratigraphy and the deposit formed sub-seafloor in a shallow marine environment. Elsewhere on the property, more classic epithermal veins outcrop and several targets indicate the potential for a larger regional porphyry system. The Resource Estimate published in 2022 contains 3,489 Tonnes at 5.3 g/t Au, 6.0 g/t Ag, 0.56% Cu, 0.67% Pb, and 5.21% Zn, totalling a gold equivalent grade of 9.38 g/t AuEq and 1,053k AuEq Ounces at an Indicated Category

Stop by the core shack booth to see this polymetallic ore body in core and talk to Contango Project Geos!



Elliott Creek Prospect 2024

Wrangell Saint Elias at Elliott Creek Incorporated

Nick Begich Sr.
Email: drnick@alaska.net, Phone: 1-907-854-9912

The Property consists of 802 acres of **patented federal** mining claims. We are seeking partners that have interests in creating a project that might include mining, historic reclamation, tourism, hydroelectric generation and other opportunities that will capitalize on the natural aspects of the property. We enjoy a strong working relationship and signed agreements with both Ahtna and Chitina native corporations who are our boundary neighbors.

WSEECI has consolidated the properties within the Elliott Creek valley, bringing together all privately held land under a single entity. Property history is referenced throughout public literature, inventoried by the National Park Service, and supplemented by many additional original documents held by WSEECI. Access agreements and road permitting is completed. Road construction began in 2024 with completion planned for the summer of 2025.

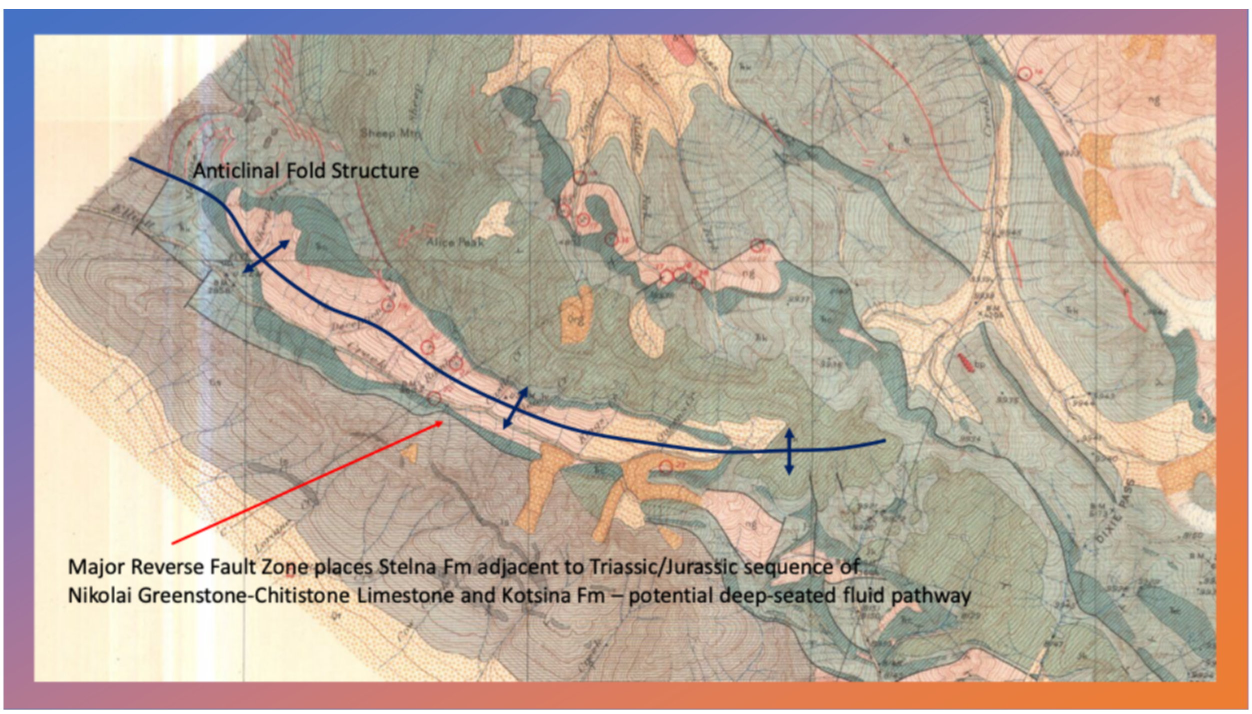
Assays and Field Work. Preliminary investigation of the WSEECI property was conducted by SRK in 2009, and additional sampling since. As part of its continuing work on the property original monuments have been located along with trenches, tunnels and other workings. Approximately 1,500 feet of the underground development have been explored with as much remaining to be examined. A bulk sample was collected for use in additional testing. Over 200 grab samples and continuous chip samples have been collected by WSEECI since 2008, yielding assay results of **between 2% and 18% copper** with additional **silver**, and **gold** as further CuEq drivers.

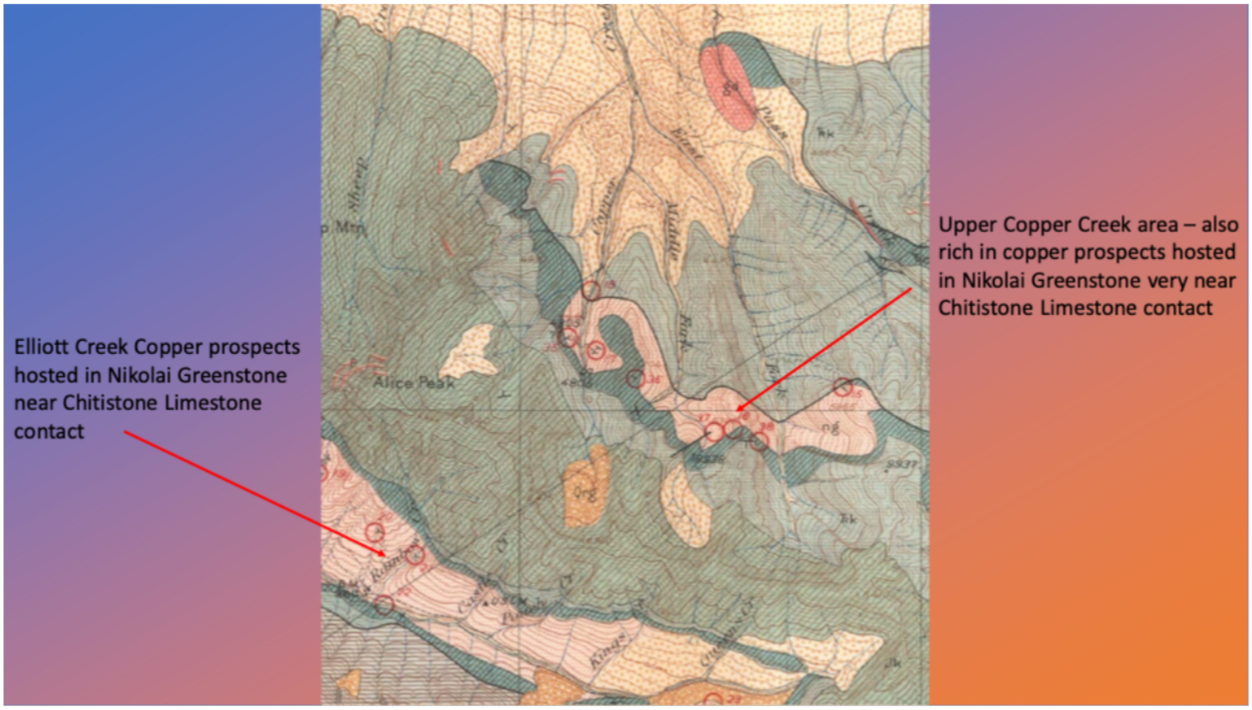
Geology. The mineralization at Elliot Creek has been identified as basaltic, hydrothermal copper. These deposits include native Cu-Ag and copper-sulfide mineralization occurring as veins and disseminations in amygdaloidal flows, tuffs, breccias, conglomerates and in places sandstones. Mineralization is found in the Nikolai Greenstone below the Chitistone Limestone. Mineralization is described by Moffet et al., (1923) as structurally controlled occurring along fracture planes and faults. Copper minerals also occur as disseminations proximal to fractures and faults. Copper minerals include bornite, chalcopyrite, cuprite, covellite and chalcocite. The geology of Elliott Creek provides the ingredients for a remarkably environmentally friendly mining operation, should one be engaged. Extensive limestone deposits as well as concomitant calcite complement an ore profile exceptionally low in deleterious elements.

2024 Highlights. The company began constructing the access road into the property. Ten and a half miles of an existing 17b easement was improved for access by standard vehicles. Two miles of additional new road was constructed as a part of a private easement. The remainder of road construction into the property is planned for 2025. This season GPS Incorporated was hired to locate additional monuments with all targets reached within scheduled time allowing for the location of several additional monuments. Ten acres was spun out of the property and Elliott Development LLC was formed for the purpose of building a permanent camp and lodge facility to accommodate up to 24 people to facilitate tourism and the other activities on the property. An initial historic reclamation project has been planned, outlined and funding for preservation is being pursued prior to any industrial activities

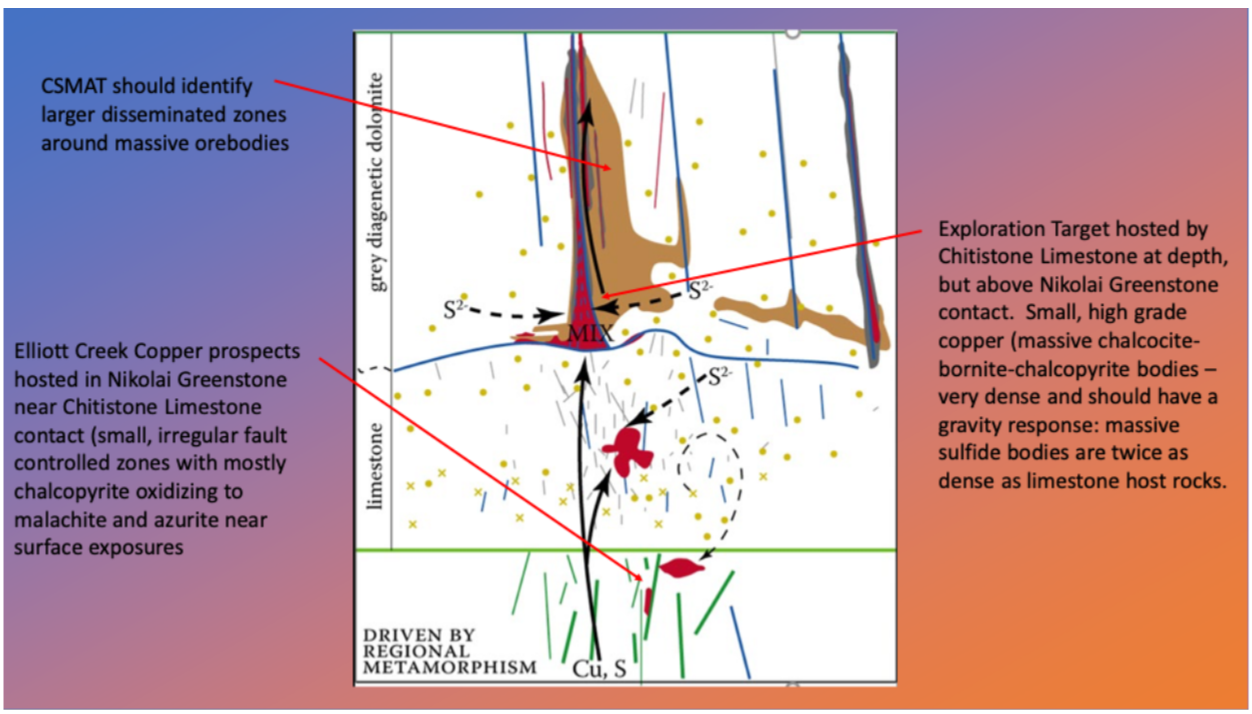
Next Steps include completion of the preliminary access road in 2025. Continue to advance the tourism aspects of the property while the infrastructure is built to support all future activities for the property. WSEECI is seeking partners capable of contributing toward efforts advancing these holdings to their highest and best use. WSEECI is moving forward with surface estate improvements including road construction, driveways, camp structures, historical artifacts removal and preservation and property sampling.

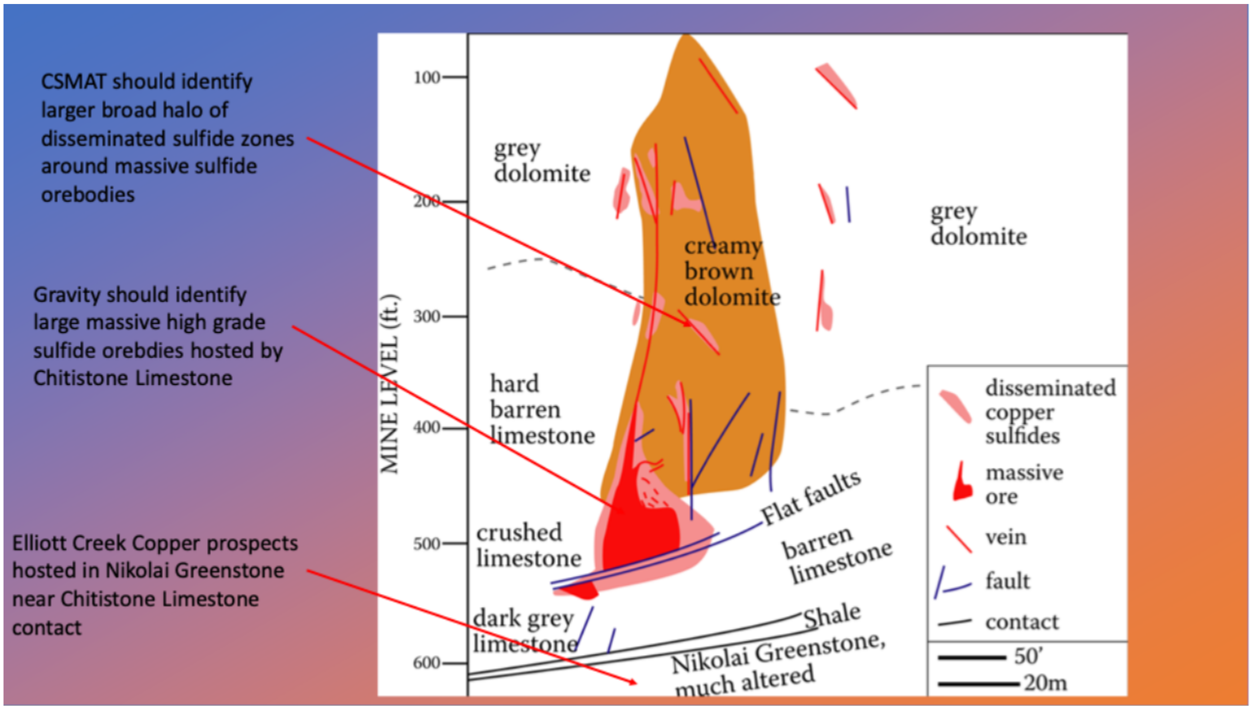
Elliott Creek Prospect 2024





Elliott Creek Prospect 2024




CSMAT should identify larger broad halo of disseminated sulfide zones around massive sulfide orebodies
Gravity should identify large massive high grade sulfide orebdies hosted by Chitistone Limestone
Elliott Creek Copper prospects hosted in Nikolai Greenstone near Chitistone Limestone contact
MINE LEVEL (ft.)
100
200
300
400
500
600
grey dolomite
creamy brown dolomite
grey dolomite
hard barren limestone
crushed limestone
Flat faults
barren limestone
dark grey limestone
Shale
Nikolai Greenstone, much altered
disseminated copper sulfides
massive ore
vein
fault
contact
50'
20m

Thermal (Long-wave) InfraRed Remote Sensing for Porphyry Exploration at the Oreo Mountain Cu-Mo-Ag-Au Prospect, East-Central Alaska

David Hedderly-Smith, Ph.D., PG, QP – D.A. Hedderly-Smith & Associates

The Oreo Mountain prospect is a Cu-Mo-Ag-Au porphyry system located in east-central Alaska, approximately 40 miles east of Tok, Alaska, and 15 miles north of the Alaska Highway. Work to date has identified a large (5-mile by 2-mile), strong copper, molybdenum, lead and silver soil anomaly corresponding to an aeromagnetic high surrounding a sharp aeromagnetic low associated with resistivity lows. Six short drill holes in 2019 identified porphyry-type mineralization and alteration in calc-alkaline intrusive rocks, but nothing that would denote a discovery. Since that work the Alaska Division of Geological and Geophysical Surveys has published a 1:100,00-scale reconnaissance geologic map of the area, greatly enhancing the area's geologic understanding.

The traditional role of satellite remote sensing in mineral exploration has been to map regional geological structures through the synoptic view provided by the satellite. Initially this work focused on identification of linears and structures. The arrival of multispectral imagery and the spectral unmixing interpretation paradigm has allowed quantitative estimates to be made of the various minerals in the scene. Early satellite imagery (*c.f.*, NASA's Landsat 1 [1972]) sampled the visible and near infrared spectrum; Landsat 4 (1982) through Landsat 7 (1999) added two short-wave infrared and a single, lower-resolution, thermal (long-wave) infrared band. In more recent decades a proliferation of remote sensing satellites from numerous countries and agencies have filled the sky. Many of these have capabilities well beyond those of the early Landsat and other pioneer efforts.

In 2024 a remote sensing study of much of the eastern two-thirds of the Tanacross 1:250,000-scale Quadrangle, including the Oreo Mountain area, was commissioned utilizing visible/near infrared (VNIR), short-wave infrared (SWIR), long-wave or thermal infrared (LWIR or TIR) and synthetic aperture radar (SAR) data collected by three satellite systems: Sentinel-2, ASTER and ALOS-1. The study focused for the most part on the remote sensing systems with penetrative ability, the ASTER TIR bands.

The ASTER thermal (TIR) or long-wave (LWIR) infrared survey and interpretation of high-resolution hyperspectral satellite imagery over the Oreo Mountain property and surrounding area returned some very interesting results. ASTER is a cooperative effort between the Japanese Ministry of Economic Trade and Industry (METI) and the U.S. National Aeronautics and Space Administration (NASA) and was launched in 1999. It consists of three separate instrument subsystems, which provide observation in three different spectral parts of the electromagnetic spectrum, including three bands of VNIR (15-meter resolution), 6 bands of SWIR (30-meter), and 5 bands of TIR (90-meter resolution). ASTER data is available in the public domain (*i.e.*, it's free!).

Data from the five ASTER bands in the thermal (TIR) or long-wave (LWIR) infrared region were accessed and processed to generate several georeferenced images. The algorithm that developed one of the images — named TargetC — was designed to target pixels in the ASTER scene with spectral signatures in the five TIR bands that corresponded to the signatures of the pixels over high-copper soil sample locations on a 370+ sample grid of soil samples over the Oreo Mountain prospect collected by Kennecott Exploration in 2018 (Figure 1).

Not too surprisingly, the resulting image highlighted the area of copper-enriched soils at Oreo. However, it also identified adjacent areas outside of the existing soil grid and claim block as potential "areas of interest" at and near Oreo Mountain and highlighted (although generally not as strongly) other areas of known copper mineralization and other areas known to contain anomalous soil geochemistry in the general area. The survey identified Contango ORE's Triple Z prospect and Cities Service's historic Alcan prospect to the west of Oreo Mountain, and Doyon's Northway prospect to the south, as well as other prospects and areas of soil anomalies identified in other, earlier reconnaissance efforts. The targeting also identified other areas to the south of Oreo that would appear to warrant follow up. Notably, however, the TargetC image did not identify several other known porphyry occurrences in the northern half of the scene, including both Taurus and Bluff, recently explored by Kenorland Minerals, Freeport-McMoRan and Antofagasta Minerals. (Figure 2).

Nonetheless, while the science behind this is not yet thoroughly understood, the apparent identification of the copper-rich portion of the Oreo Mountain prospect and other prospects in the southern half of the ASTER scene suggests good potential for utilization of thermal infrared band data in mineral exploration in Alaska and the Canadian north. This appears to be, in effect, geochemistry from space. The analysis of the TIR bands detected something likely associated with the copper mineralization at Oreo Mountain. It could be longwave infrared radiation from the copper (or associated metal) minerals themselves or derivatives of those minerals, or perhaps some alteration of the spectral signature of the local vegetation caused by metals absorbed from the soils, or something else.

From an exploration perspective, it is not 100% critical that the cause of the spectral response be known. What is important to note is that other areas with similar spectral responses can be identified and investigated with ground follow-up. From a prospect-level standpoint, the Oreo Mountain hyperspectral analysis developed complimentary data that should be valuable in the further exploration and development of the prospect and adjacent area at a relatively minimal cost.

The hyperspectral data for ASTER and several other satellite systems is available for download in the public domain, so the costs are low – essentially the consultant's fees for downloading the data, processing it and completing a report.

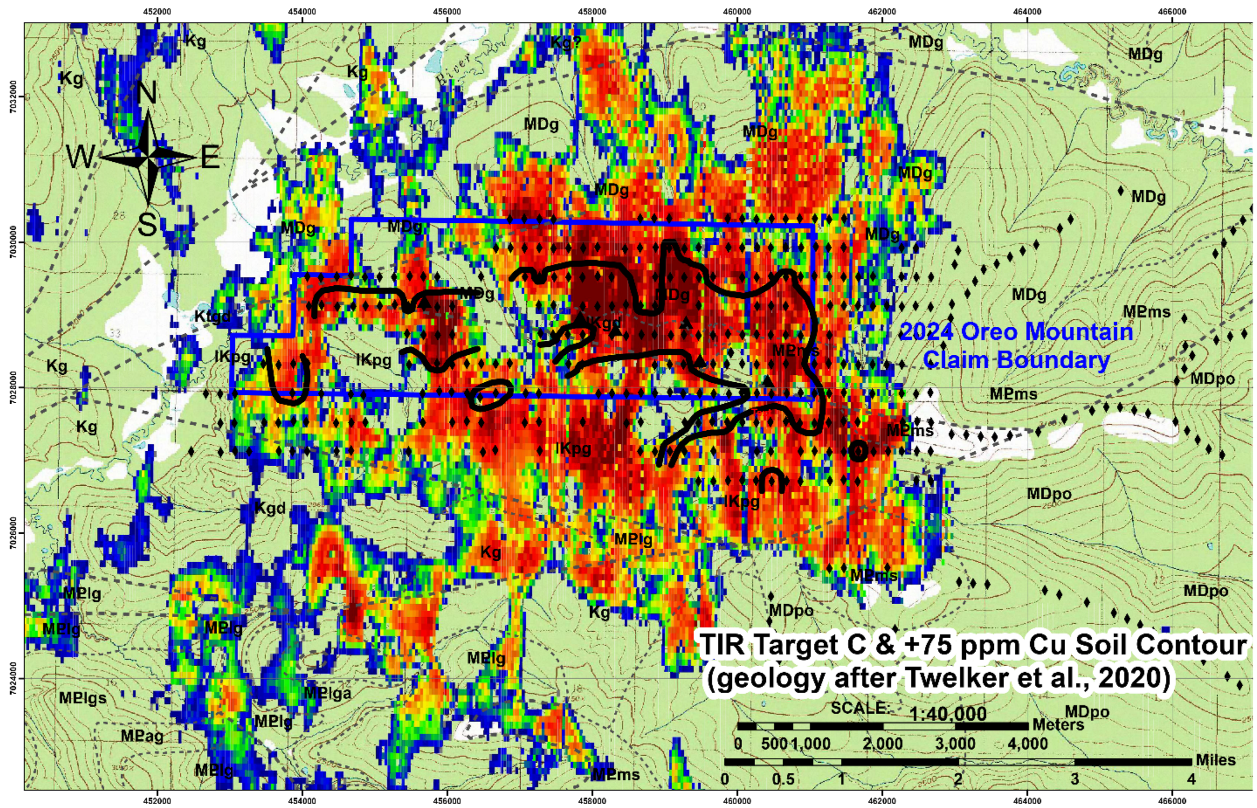


Figure 1. 2024 ASTER thermal infrared (TIR) TargetC analysis overlain on the +75 ppm Cu contour from 2018 Kennecott Exploration soil grid and geology from Alaska DGGS. Small black diamonds indicate Kennecott soil sample locations.

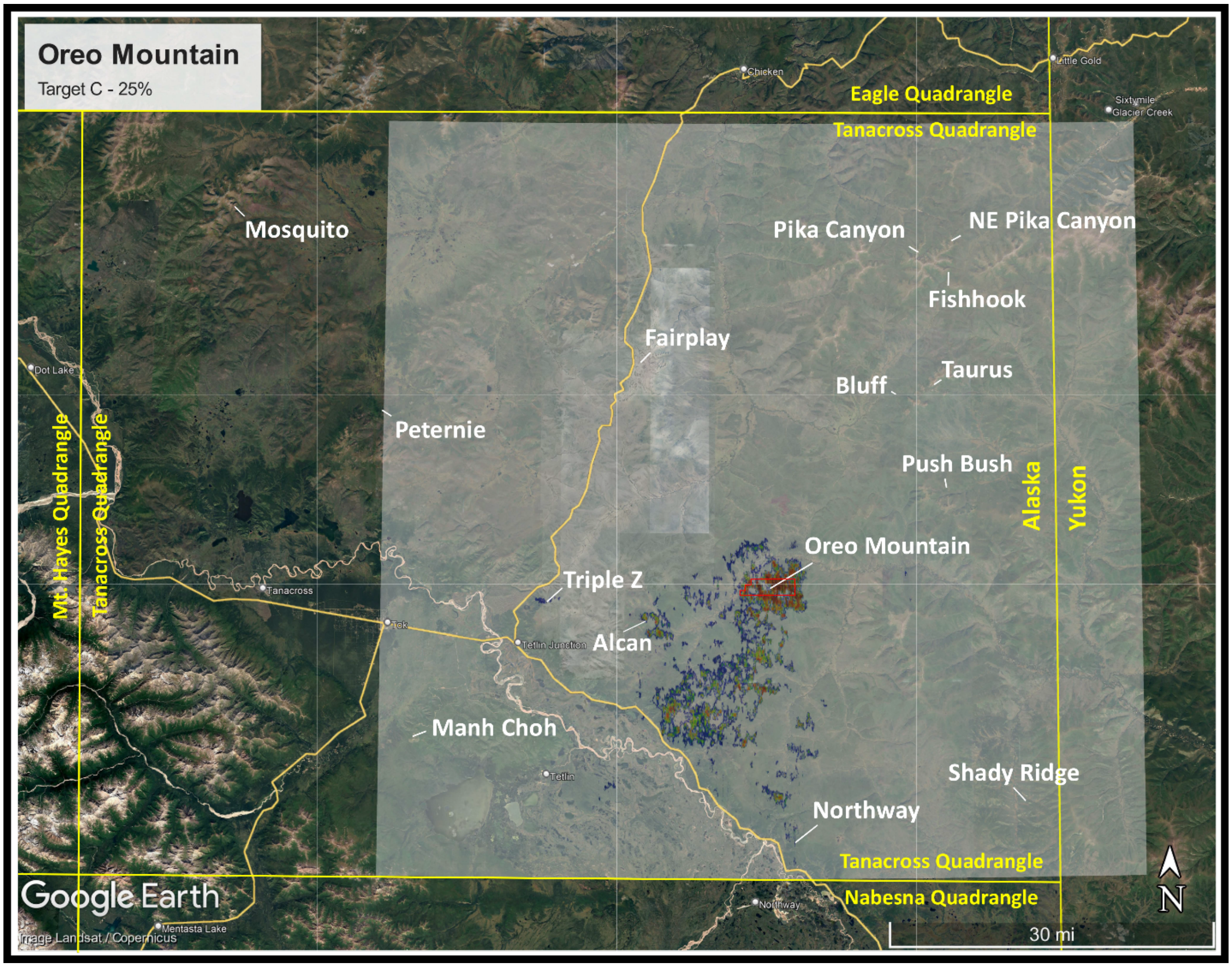


Figure 2. ASTER thermal infrared (TIR) scene with 2024 TargetC image projected onto Google Earth image, showing location of Oreo Mountain claim block and select other ±72 ma porphyry and porphyry-related prospects and deposits in the Tanacross (1:250,000 scale) Quadrangle.

Polar X, Alaska Range Project

Caribou Dome 2024 Drilling program

Polar X is an advanced ASX-listed mineral explorer and developer (ASX: PXX) with rapidly growing high-grade Copper, Gold and Silver projects in USA.

Polar X is focused on developing its Alaska Range Project in the Clearwater Mountains in central Alaska where the company holds 116 Km2 of state mining claims across the Caribou Dome and Stellar Projects.

The Caribou Dome Project is located approximately 250km northeast of Anchorage in Alaska, USA. It is readily accessible by road – the Denali Highway passes within 20km of the Project and from there a purpose-built road provides direct access to the historic underground development at the Project.

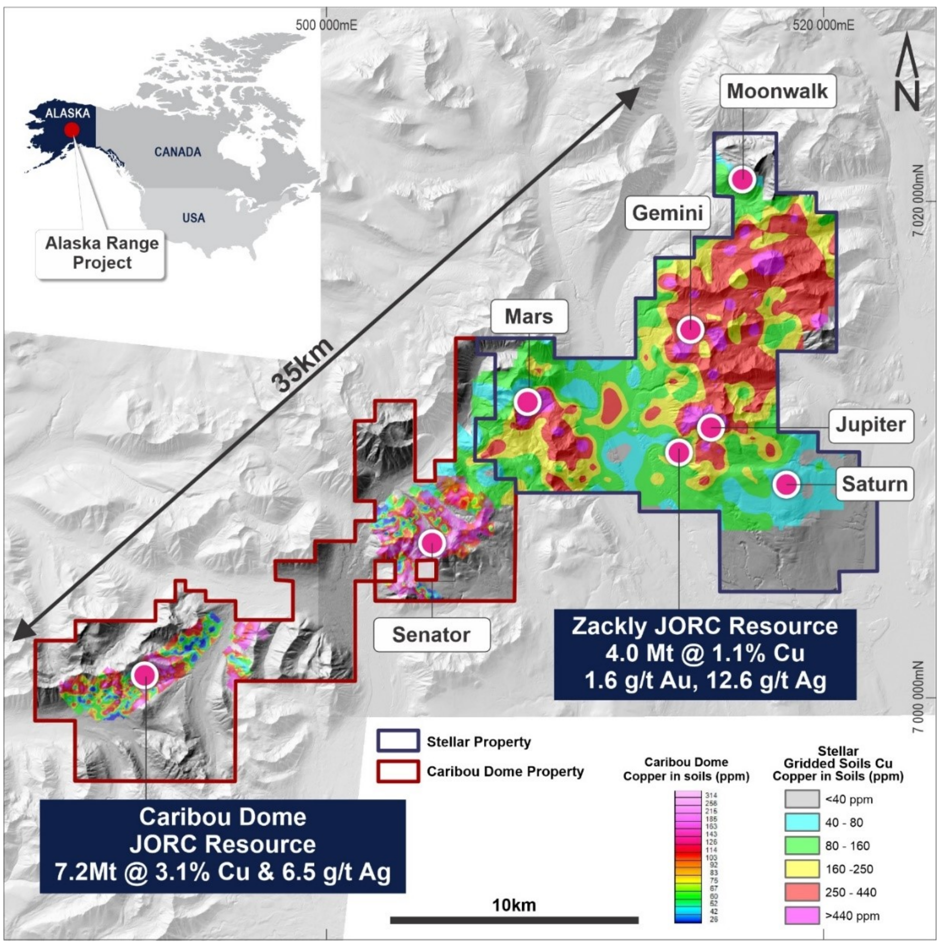


Figure 1: Location Map showing Caribou Dome within the Alaska Range Project.

Copper mineralization was discovered at Caribou Dome in 1963. The mineralization consists of nine deformed lenses of volcanic sediment-hosted fine grained massive sulphides comprising chalcopyrite and pyrite. Copper mineralization has been delineated over approximately 700m of the strike and is open below the current 300m resource depth. Caribou Dome's Mineral Resource was updated in June 2023 to 7.2Mt @ 3.1% copper and 6.5 g/t silver

The property comprises two mineral resources at Caribou Dome and the Zackley deposit which hosts 4.4 Mt at 1.1% Cu and 1.6g/t Au. Both deposits are currently included in a favourable scoping study for the development of the project.

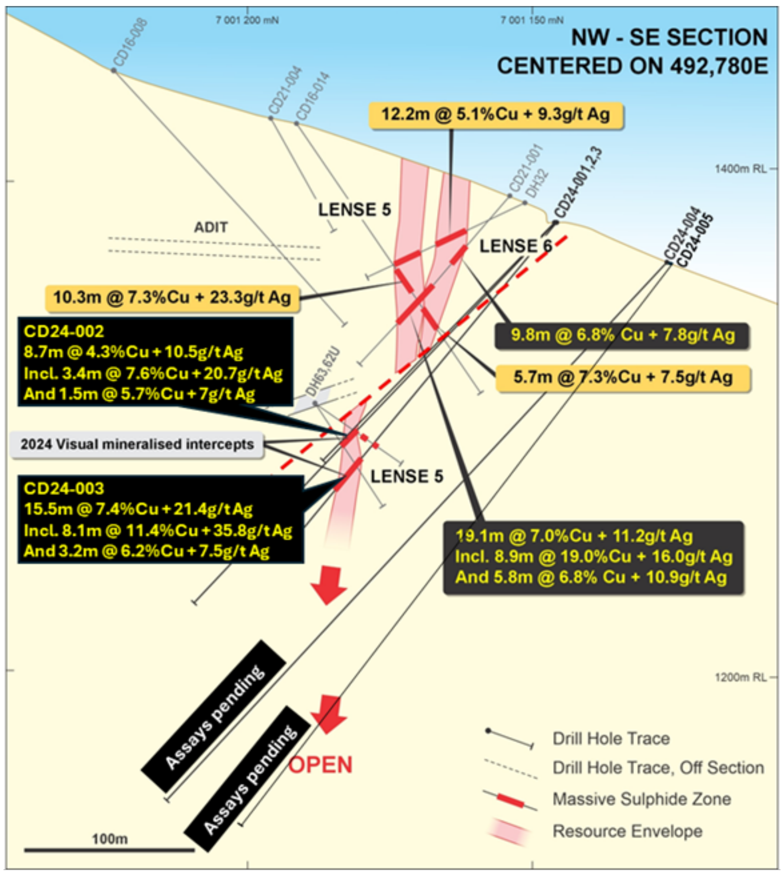


Figure 2: Cross section for holes CD24-001 to CD24-005. Holes CD24-004 and CD24-005 intersected visible copper mineralization in the down dip extension of mineralization announced for CD24-003, with assays expected later this month. The copper mineralization remains open at depth.

During 2024 Polar X completed a 1063m – 5-hole drilling program designed to test the down dip continuity of previously defined high grade mineralized at the Caribou Dome deposit. The drilling program confirmed mineralization to a depth of 300 below surface and extended mineralization significantly below previously modelled resources.

The highlight of the program was Hole CD24-003 which intersected 15.5m @ 7.4% copper and 21.4 g/t silver that included 8.1m @ 11.4% copper and 35.8 g/t silver and 3.2m @ 6.2% copper and 7.5 g/t silver. Hole CD24-002 intersected 8.7m at 4.3% copper and 10.5 g/t silver, including 3.4m @ 7.6% copper and 20.7 g/t silver and 1.5m @ 5.7% copper and 7.0 g/t silver.

The copper and silver grades intersected in both holes are significantly higher than the average resource grade for Caribou Dome of 3.1% copper and is hosted within Lenses 5 and 6 that contain very high copper grades from surface (see Figure 2). Figure 2. Cross section for holes CD24-001 to CD24-005. Holes CD24-004 and CD24-005 intersected visible copper mineralization in the down dip extension of mineralization observed for CD24-003, with assays expected later this month. The copper mineralization remains open at depth.

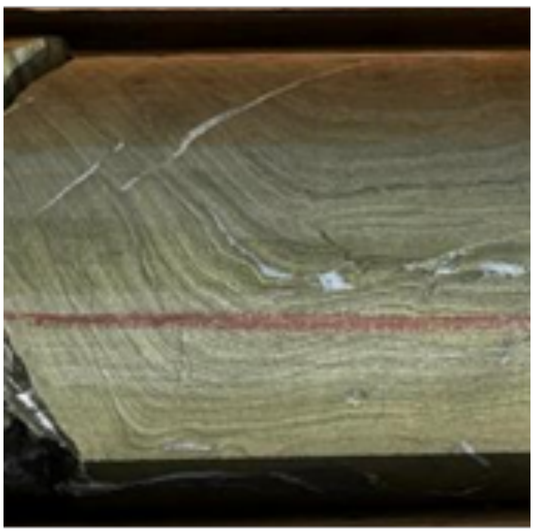


Figure 3: Finely laminated massive iron and copper sulphides at 126.0m depth in drill hole CD24-003, within interval that assayed 15.5%Cu + 22.6g/t Ag

Figure 4: CD24-002 at 119.8m; laminated massive sulphides, predominant brassy chalcopyrite thinly interbedded with pyrite with white carbonate veins (assayed 13%Cu + 21.1 g/t Ag).

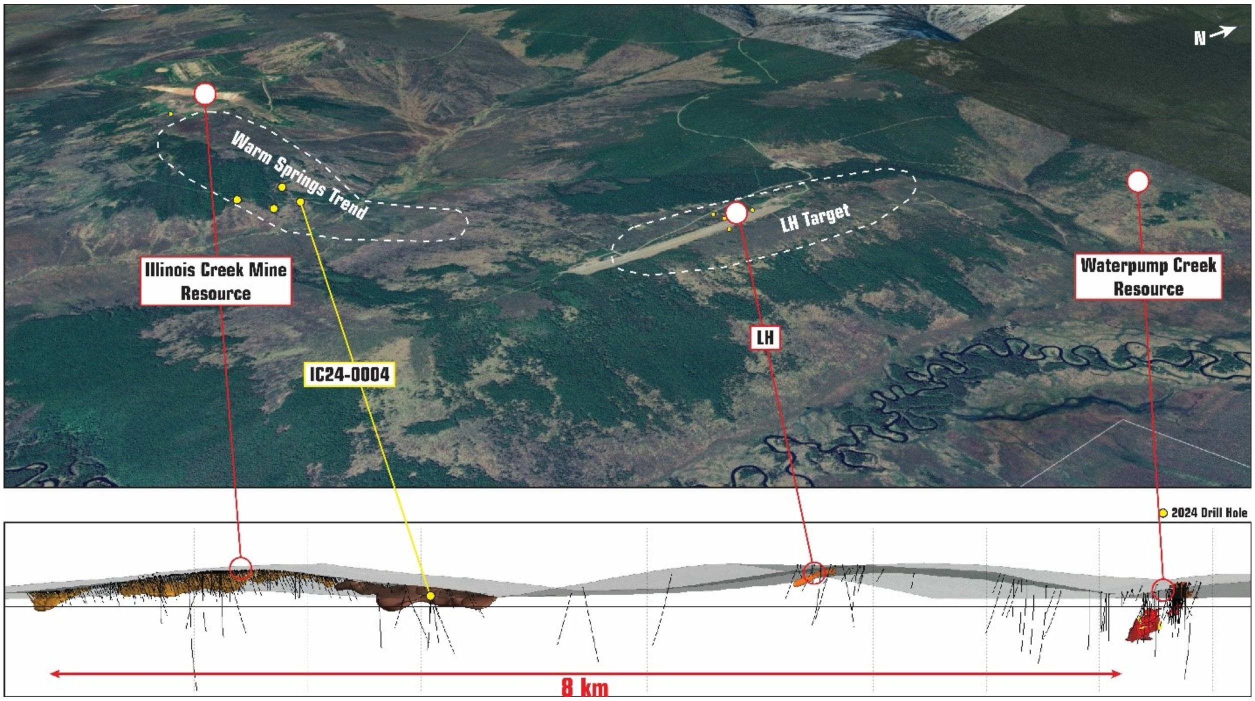
The Illinois Creek Project: A New Discovery in an Emerging CRD District

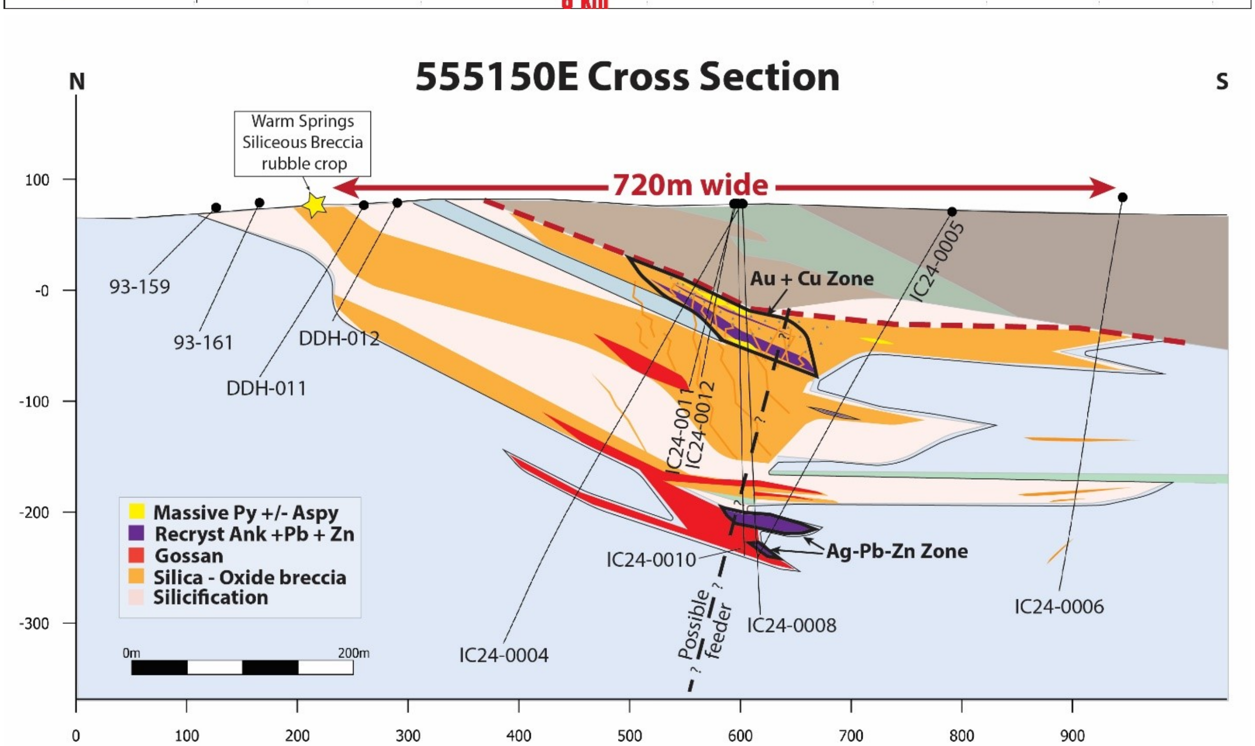
Sage Langston-Stewart, Western Alaska Minerals

The Illinois Creek District located in west-central Alaska, approximately 250 miles west of Fairbanks was originally discovered in the 1980's by Anaconda and is home to five evolving mineral projects containing gold, silver, copper, lead, and zinc within Western Alaska Minerals (WAM) exploration land tenure. Recent focus has been on the high-grade sulfide mineralization at Waterpump Creek (WPC), which an initial high-grade Ag-Pb-Zn resource was released early in 2024, and the potential extensions to WPC.

The 2024 drilling targeted two areas, the Warms Spring and LH prospects, which are along the trend between the proximal Au-Ag resource of the past producing Illinois Creek (IC) oxide deposit and the high-grade Ag-Pb-Zn WPC sulfide resource. Nine drill holes (2,883 m) were completed within the Warm Spring target and discovered a major extension of the Illinois Creek system ~1.4 km southeast of the IC deposit. Seven of the drill holes intersected multiple pulses of mineralization including massive to semi-massive pyrite associated with gold, copper, and local silver mineralization, recrystalized ankerite associated with sphalerite (zinc) and galena (lead) mineralization, and extensive gossan (oxide). The mineralization is hosted within an intense silicification and brecciation zone that is 10x the size of Waterpump Creek, thus defining a large CRD hydrothermal system. The LH drilling (four holes totaling 1,347 m) intersected a few gossanous breccia intervals, but no significant sulfide manto mineralization. This drilling, along with extensive trench mapping, shows that the LH mineralization is more likely vertically oriented and higher in the CRD system than Waterpump Creek and the high grade manto target is deeper than originally anticipated.

In addition to the 2024 drilling, WAM completed an airborne SkyTEM electromagnetic survey in collaboration with the State of Alaska as part of a larger regional survey in Western Alaska. A total of 605-line km was flown at 200m north-south and 400m east west line spacings for WAM exclusively over areas (and orientations) not covered by the 2023 3D IP survey over the Waterpump Creek trend and the 2022 widely spaced CSAMT survey in the Warm Springs target area. The laterally constrained (LCI) resistivity inversions from the survey are effective in resolving the structural framework of the CRD system by identifying major aquitard fluid traps and pre-, syn-, and post mineralization faults. The 2024 drill results coupled with the new geophysical modelling and geological understanding for the district has delineated exciting targets for a successful 2025 drilling season.


N
Warm Springs Trend
Illinois Creek Mine Resource
IC24-0004
LH Target
LH
Waterpump Creek Resource
2024 Drill Hole
8 km


555150E Cross Section
N
S
Warm Springs Siliceous Breccia rubble crop
720m wide
Au + Cu Zone
Ag-Pb-Zn Zone
Possible feeder
93-159
93-161
DDH-011
DDH-012
IC24-0004
IC24-0005
IC24-0006
IC24-0008
IC24-0010
IC24-0011
IC24-0012
Massive Py +/- Aspy
Recryst Ank +Pb + Zn
Gossan
Silica - Oxide breccia
Silicification
0m
200m
100
-0
-100
-200
-300
0
100
200
300
400
500
600
700
800
900

Continued Positive Exploration at Kensington Mine

Sam Kilfoyle, Kristin Kulikoff, Jacqueline Mendenhall, and Trevor Nelson, Coeur Alaska - Kensington Mine

Coeur Alaska's Kensington Mine is located approximately 45 miles north-northwest of Juneau, Alaska. The property sits within the Berners Bay Mining District, at the northern-most edge of the Juneau Gold Belt. The Juneau Gold Belt is a 120-mile-long, 10-mile-wide structural zone hosting several major gold producers. Coeur Alaska has mined over 1,400,000 ounces from the property since beginning commercial production at Kensington in 2010.

The property lies to the west of the Coastal Megalinament, situated between the Wrangellia terrane and the Treadwell formation of the Gravina belt. The deposits are modeled as low-sulfide, mesothermal, gold-quartz veins with strict structural controls. The deposits have reportedly been restricted to a Cretaceous diorite intrusion, known as the Jualin diorite, which intrudes the Triassic basalts of the Wrangellia terrane and lies unconformably against the Gravina belt.

The Kensington mine consists of multiple deposits including the Kensington, Elmira, Raven, Johnson, and numerous other prospective vein zones. The vein systems are generally shear hosted veins or vein packages composed extensional vein arrays, sheeted extensional veins, and stacked, en-echelon, shear veins. The main deposits of the Kensington Mine strike to the north-northwest and dip moderately to the east. The mineralogy of the deposits varies between gold tellurides, most commonly calavarite ($AuTe_2$) and petzite (Ag_3AuTe_2), associated with pyrite-rich zones at Kensington, and coarse free gold (Au) commonly associated with galena, sphalerite, tennantite, and pyrite at Jualin.

In the upper area of the Kensington deposit, previously outlined zones appear to be converging into single, wider mineable areas. Additionally, several potentially new, high-grade sub-parallel zones are being delineated in the hanging wall of both Kensington Main and Zone 30B and 30C.

In the lower area of the Kensington deposit, the recently outlined Zone 50 has grown significantly along strike and down dip, resulting in the development of additional exploration drifts to facilitate expansion and infill drilling before year-end 2024. Additional targets include Zone 10, Zone 10 Hanging Wall, and the Lower Kensington Sulfide Unit.

The Elmira vein system shares similar vein style and mineralization characteristics with the Kensington deposit, lying 2,500 feet east of Kensington. At the Elmira deposit, the Main and South zones have now been connected through infill drilling, and expansion drilling is intersecting multiple wider zones to the south. The Johnson vein system, lying 500 feet east of Elmira, remains a drill target.

Ongoing exploration builds upon previous drill programs, surface and underground geochemistry, surface and underground mapping, geophysical surveys, oriented core, and compilation of historic data. The program is focused on developing a stronger geological interpretation of the district, growing producing deposits, and outlining potentially economic zones. This rigorous approach is driving new interest in known prospects and is focused on driving the additional discovery necessary to unlock the potential of underexplored areas of the Berners Bay Mining district.

MELOZITNA RIVER, CRITICAL MINERAL ALLUVIAL PROJECT

Interim Overview of Rare Metal Potential and Current Field Investigations

James C. Barker, AIPG, jcbarkergeo@gmail.com, Jerry C. Jewell, PE, jewellacci@aol.com, Goldstone Resources, LLC

INTRODUCTION, LOCATION & HISTORY

The Melozitna region in west-central Alaska is known for anomalous radioactivity, elevated levels of thorium and an unsuccessful history of prospectors exploring for uranium (source: Reports by the Atomic Energy Commission). A large plutonic body, known as the Melozitna pluton (Figure 2), features extensive concentrations of rare metals and minerals. The pluton is considered as part of the Ruby batholith. Alluvial deposition is now found to include both heavy and light rare earth minerals and features significant percentages of HREE and neodymium as well as niobium, tantalum, tin, tungsten and zircon, all contained in resistate minerals.

The Melozitna pluton is further characterized by multiple phases of intrusive activity. Perhaps a hundred or more smaller circular features attest to numerous past intrusive events. The complex array of intrusive rocks are the apparent source of the abundant rare metal-heavy mineral concentrations and at least one apparent, though yet unevaluated, lode opportunity (the Apron prospect).

Goldstone Resources holds a contiguous block of 31 -160 acre, Alaska State unpatented mineral claims along about 40 km of the valley of the Little Melozitna River. The claims are located in accordance to State regulations. The alluvial gravels are exposed in gravel bars, cutbanks along the Melozitna River and floodplain terrace faces that expose the ancient meanders of the river which are mostly now tundra and scrub forest covered. Samples from these features were collected from 104 locations. That portion of each sample passing the #20 mesh sieve was processed by panning to a consistent stage of partial concentration described as "black pancake". The partially concentrated samples were submitted to ALS USA for metallurgical assay using ALS Procedure ME-MS81h. The summarized assay results are presented below in Table 1.

TABLE 1

AVERAGE MINERAL GRADES

IN 104 FIELD CONCENTRATED (PANNED) SAMPLES

Light Rare Earths						Heavy Rare Earths + Y								
La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Y
ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
1,709	3,643	451	1,567	301	8	208	30	156	29	82	12	78	12	748

Calculation				High Field Strength Elements (HFSE)								
HREE+Y	TREE+Y	HREE+Y	Nd	Hf	Nb	Rb	Sn	Ta	Th	U	W	Zr
ppm	ppm	as % of TREE+Y	as % of TREE+Y	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
1,355	9,034	15%	17%	361	580	91	1,879	51	805	135	242	10,717
				Number of samples								
				61	61	104	104	61	104	104	104	104

1.) Yttrium (Y) is included in our REE program because of its normal affiliation in nature and its common physical characteristics with the rare earth elements.

2.) All 14 Rare Earth elements listed above, plus (Y), were present in every test sample.

3.) All analyses and calculations involve only the nonmagnetic fraction of each sample. (It is noted that a substantial percentage of the heavy mineral concentrate is ilmenite [titanium O2] and a minimal amount of magnetite.)

POSTER SESSION

Fluid Inclusion Analysis of Auriferous Type 2 and Type 3 Veins Across the Estelle Pluton Complex

Elizabeth Freeman, and Dr. Claudia Cannatelli

University of Alaska Anchorage

The Late Cretaceous Composite suite of the western Alaska Range hosts the Estelle Gold Project, which is located approximately 150 km northwest of Anchorage in the Alaska Range and consists of twenty identified prospects. The current project is classified as a reduced intrusion-related gold system (RIRGS) and hosts primarily auriferous sheeted quartz veining. The north-south trending ore bodies consist of the Korbel Main deposit which contains the bulk of the mineral resource with the higher-grade RPM deposit to the south. A 2011 ore characterization study conducted by Flagg (2014), suggests that two vein types are associated with mineralization, and three fluid inclusions assemblages (FIAs) were identified (Flagg, 2014). Fluid inclusions (FIs) are small droplets of fluid trapped in minerals during their growth or along fractures that develop and heal after the crystal has formed. (Randive et al.,2014). FIs represent an invaluable tool in mineral exploration due to their ability to provide constraints on temperature-pressure conditions and ore fluid genesis. The scope of this study aims to utilize FIAs to decipher and compare salinity, temperature, and pressure conditions that influenced mineralization. Current preliminary petrography results from the Train, RPM North, and RPM South prospects include zonation of primarily subhedral hornblende and feldspar grains which are indicative of the disequilibrium of the magmatic system during mineral formation. In addition to consistent zonation of minerals across the southern portion of the pluton, alteration products like sericite and chlorite were observed and the alteration intensity was determined for each thin section. This methodology ensures that the microthermometry and LA-ICPMS study analyses are performed on well-preserved and unaltered fluid inclusions. Currently, three-phase (aqueous, vapor, solid) primary fluid inclusions were observed in the quartz grains of the RPM North and South samples but appeared deformed and therefore not suitable for the study. Future work includes a comprehensive analysis of trace element geochemistry and microthermometry of FIs that will aid in the understanding of the ore fluid genesis of the Mount Estelle pluton, and potentially refine exploration models for IRGS deposits.

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Randive, Kirtikumar & Hari, K.R. & Dora, M.L. & Malpe, D.B. & Bhondwe, Abhijeet. (2014). Study of Fluid Inclusions: Methods, Techniques and Applications. Gondwana Geological Magazine. 291. 19-28.

Examples of structural analysis applied to short range planning and ore control of a structurally complex underground cut and fill mine operation.

Bernard Guest Ph.D

Production Geologist II, Hecla Greens Creek Mining Company, Juneau Alaska

bguest@hecla-mining.com

In an operating mine, routine structural analysis provides a useful method for augmenting a rigorous mine planning process. Much of this planning is conducted by engineers and geologists integrating geologic mapping and production face mapping, drilling and sampling data with a production block model developed from the exploration and delineation drilling programs and face geology. The resolution and accuracy of this block model is strongly dependent on the drill hole data density, which at Greens Creek polymetallic mine on Admiralty Island Alaska is 25 feet to 75 feet. While indispensable to our rigorous planning process that integrates all of the available data, drilling at this spacing still cannot capture the intense, smaller-scale deformation present. This can result in a small gap between model predictions, our detailed plan and the geology at the face. Bridging this gap requires high quality geology done continuously round by round at the heading scale. Routine structural analysis provides a useful tool for 1) evaluating block model predictions, allowing geologists to plan future lifts with higher confidence, 2) steering headings onto specific ore controlling structures for higher ore/waste extraction ratios and 3) for evaluating the feasibility of new headings and panels within a lift.

This presentation will discuss examples of simple structural analysis applied to these three use cases. In the 486J lift in the SW ore zone, mine geologists identified a structure that was not captured by the block model, leading to the recognition and mining of multiple unplanned high-grade ore panels. It also resulted in a new interpretation for the 486K lift above, which will be mined in the coming months. In the 188C lift, in the NWW ore zone, detailed mapping of structures in the B and C lifts allowed for the efficient steering of the heading through a series of plunging folds, enabling us to mine a straight path while staying in ore. Not only did this increase the ore/waste ratio of the heading, it was far easier for the mining group to execute. Finally, in the 128D lift, the block model, and thus the mine plan called for mining through waste to a distant ore pod. The geology review of this mine plan recognized that the modeled ore pod was located on the sheared limb of a fault propagation fold, suggesting that ore in this zone would be faulted and highly attenuated. This was confirmed using geologic data from the lift above which revealed that our previous efforts mining this sheared fold limb had results that were less than ideal, leading to the planned mining being put on hold.

The geology at Greens Creek is such that even our detailed and rigorous planning process cannot capture all the small-scale complexities in the ore body. Routine structural analysis provides a useful tool for finetuning our planning to maximize mine performance.

Critical Minerals in Alaska Placer Deposits and Southeast Alaska Mineral Systems

By Sue Karl[1], Isabell Harris[2], Fred Transburg[3], and Chris Jenkins[4]

Critical minerals are vital to the economy and national security of the United States owing to their fundamental role in technology and vulnerability supply disruption. The U.S. Geological Survey is conducting several investigations in Alaska to evaluate critical mineral resource potential. Preliminary results for three of these projects are described here.

Areas that have critical mineral concentrations have been identified in Alaska by prospectivity analysis using geochemical, geophysical, and mineral occurrence datasets. The next step is to evaluate critical mineral availability, which includes a need to develop multidisciplinary techno-economic workflows for critical mineral recovery. Legacy and active placer tailings contain unknown amounts of critical minerals that remain after precious metals have been extracted. This study identifies the critical mineral contents of placer tailings from different mineral systems and is researching efficient, practical, and economically feasible methods for extracting these critical minerals. Preliminary results from chemical analysis and mineral identification of multiple size and density fractions from 1/5 cubic yard bulk samples in a pilot study at Flat in the Iditarod gold placer district show that many critical minerals reside in various tail and concentrate fractions smaller than ¼ inch. Forty-four samples have been collected from some of the best-producing placer deposits in each of the major mineral systems in Alaska. Sample processing and chemistry are in progress.

In southeast Alaska, magmatic REE mineral systems contain alkaline intrusions enriched in rare earth elements (REE) and high field strength elements (HFSE) such as niobium, tantalum, and zirconium that extend for the entire 800 km length of southeast Alaska, and range in age from Ordovician to Quaternary. These enriched alkaline igneous rocks include the Devonian syenites of the Sitkoh Bay-Trocadero Peninsula suite, Jurassic peralkaline granites of Bokan Mountain, Dotson ridge, and Dora Bay, Miocene rhyolite domes of the Admiralty volcanics, and Quaternary rhyolite domes on Suemez and Revillagigedo Islands. Trace element geochemistry and neodymium isotopic analyses indicate regional mantle metasomatism in the Neoproterozoic affected the alkalinity of igneous rocks in the Alexander terrane of southeast Alaska throughout the Phanerozoic. Our current investigation is focused on previously unstudied syenites of Permian age at Sukkwan, Klawok, Thorne Bay and Ratz Harbor and radioactive REE-HFSE-iron-carbonate veins and alkaline dike swarms of unknown age near Salmon Bay on Prince of Wales Island.

Also extending for the entire 800 km length of southeast Alaska, mid-Cretaceous ultramafic rocks are the standard for zoned Alaska-type ultramafic rocks, a model that was defined decades ago. These rocks are part of the mafic magmatic mineral system. These ultramafic rocks occur in discrete complexes from Klukwan to Duke Island. The contemporaneous mafic-ultramafic complexes are mostly not zoned, and show striking differences in size, lithology, rock texture, and mineral potential. The intrusions contain a variety of critical minerals, including platinum group elements, cobalt, chrome, nickel, titanium, and vanadium. Trace element geochemistry and isotopic analyses are informing paragenesis of Fe-Ti-V oxides and Ni-Cu-PGE sulfides and contributing to updating the sources, evolution, and resource potential of ultramafic rocks in southeast Alaska.

[1] Alaska Science Center, U.S. Geological Survey, Anchorage, AK, skarl@usgs.gov

[2] Colorado School of Mines, Golden, CO

[3] Bureau of Land Management, Anchorage, AK

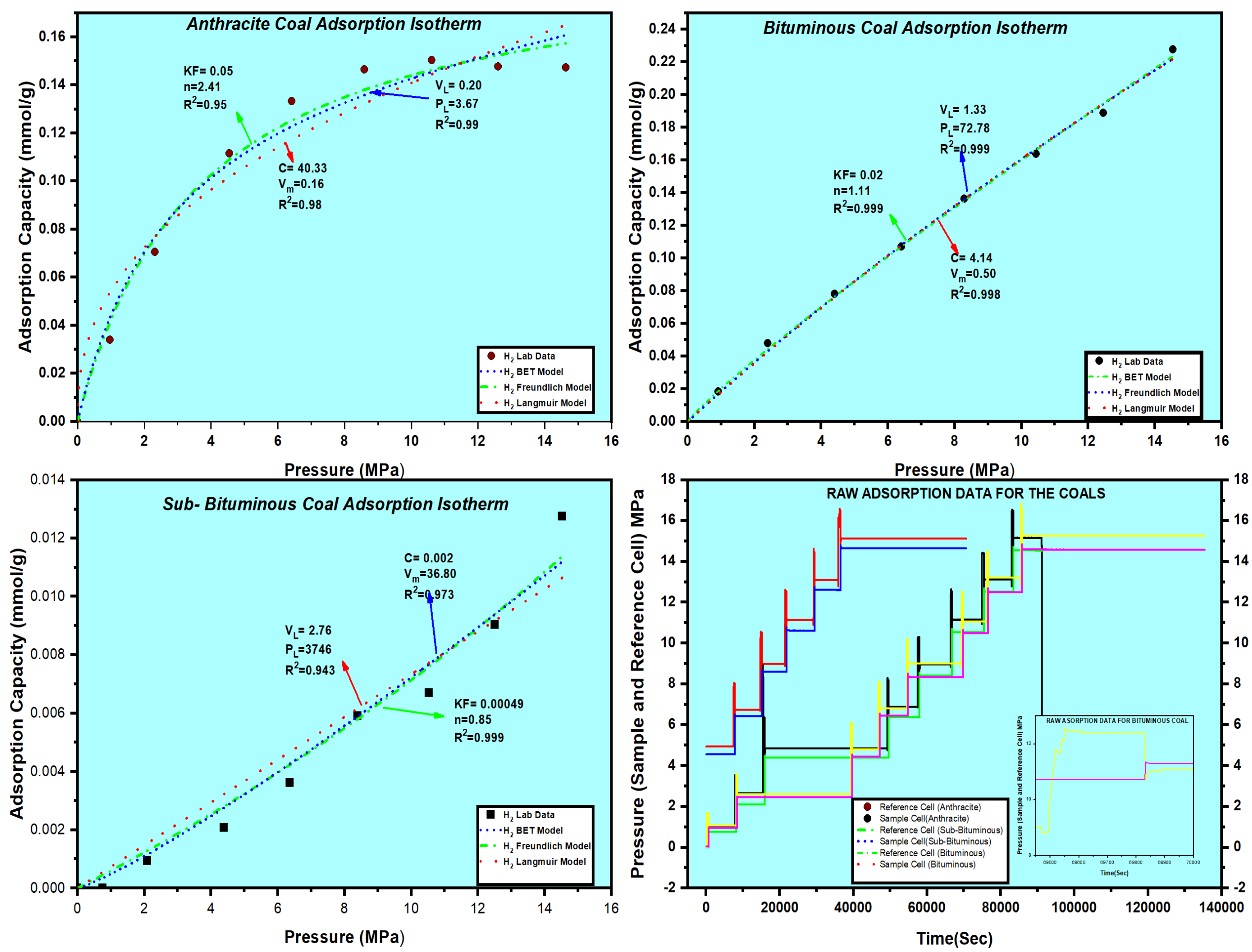
[4] Geology, Minerals, Energy, and Geophysics Science Center, U.S. Geological Survey, Spokane, WA

Hydrogen Storage Potential in Coal Seams

Jabel Atta Kwaw[1] and Long Fan[1]
[1]Department of Mining and Mineral Engineering, University of Alaska, Fairbanks, USA
*Long Fan: Tel *+1-907-474-6675* Email: *lfan3@alaska.edu*

The drive towards net zero of CO_2 emission has seen hydrogen which is the most abundant and a key constituent of water and hydrocarbons gaining attention. However, the uncertainties in ensuring the stable supply of energy all year round impact the effectiveness of this energy transition drive. Viable options to push the energy transition and ensure the supply of hydrogen all year round include the storage of hydrogen underground (subsurface geological formation). Depleted oil and gas reservoir, Salt Caverns, and Aquifers have been extensively discussed in the literature for the storage of hydrogen but research and data on coal seams are scarce. Hence, this work was undertaken to measure the hydrogen storage potential of coals and understand the mechanism behind the storage. The experimental set up consisted of a reference cell to control gas measurement to the sample cells, and two sample cells that housed the samples. A Syringe pump feeds the gases to the references, three pressure transducers (ranging from 0 – 35 MPa with the accuracy of 10 Pa) for pressure monitoring, a water bath to control temperature and data acquisition system. Different rank coals, namely, Anthracite, Bituminous and Sub-Bituminous each of 50g were tested. The sample was pulverized to 60 (250 microns) – 80 (177 microns) mesh and oven-dried in a vacuum oven for 24 hrs at the temperature of 80 ^{o}C. Before the hydrogen adsorption test, helium, which is a non-adsorbing gas, was used to determine the volume of the matrix in the sample cell that will be exposed to the hydrogen. The adsorption capacity of the coal samples was tested at a constant temperature of 30 ^{o}C with pressure range from 0.76 MPa to 15.17 MPa. The manometric method whereby the adsorption or desorption of gas is determined by simply monitoring the pressure drop was adopted. With reference to the Ideal Gas Law, the difference in moles was used to determine the amount of gas adsorbed at each pressure increment. The isotherms for the different coal ranks were acquired. By fitting the isotherms with the Langmuir, BET and Freundlich models, the Langmuir model provided a better fit for the Anthracite Coal and the Bituminous coal, whilst Freundlich gave a better fit for the Sub-Bituminous Coal. Based on the assumptions made in these models, the results suggest that the Anthracite and the Bituminous have a homogeneous surface whilst the Sub-Bituminous Coal could have a heterogeneous surface. For

all the different coal ranks, the hydrogen adsorption capacity for Bituminous Coal is the highest with 1.33 mmol/g, followed by the Anthracite coal at 0.20 mmol/g and the Sub-Bituminous Coal at approximately 0.01 mmol/g. The results clearly showed the superiority of Bituminous Coal in potential selection as a candidate for the storage of hydrogen in Coal seams due to its high adsorption capacity. The difference in the hydrogen adsorption capacity can be attributed to characteristics of the coal ranks. This result provides insights into efficient coal type selection when designing hydrogen storage in coal seams.



Supercritical REE Extraction from Coal Ash: Understanding Adsorption-Desorption Mechanisms of SC-CO_2 in Coal and Coal Ash

Zakiya Konda Nurudeen [1] and Long Fan [2]

Department of Mining and Mineral Engineering, University of Alaska, Fairbanks, USA
* ong Fan: Tel (907) 474 6675 email: lfan3@alaska.edu

Technologies for clean energy frequently require rare earth elements (REEs). Neodymium, for instance, has been used for electric vehicles and wind turbines. Dysprosium, gadolinium, praseodymium, samarium, and neodymium have been utilized in computers and cell phones.

Numerous procedures, including alkaline roasting, acid leaching, fractional separation, ion exchange, and solvent extraction, are used in modern industrial REE extraction operations. However, these methods still require improvement. Coal ash makes up 5–20 % of feed coal, and it has shown promise as a valuable resource for rare earth elements (REEs), with concentrations ranging from 270 to 1480 parts per million (ppm).

A supercritical fluid (SCF) is any compound at a temperature and pressure above the critical point. Examples include nitrogen, carbon dioxide, xenon, and argon. Supercritical Fluid Extraction (SCFE), with the carbon dioxide method gaining traction as an eco-friendly alternative to conventional extraction methods, offers practical benefits and emerges as a favorable solvent (critical temperature, $T_c = 31.1°C$ and critical pressure, $P_c = 7.38$ MPa) due to its stability, high solvability, non-flammability, affordability, recyclability, and widespread usage underscore its environmental friendliness.

In previous studies, supercritical carbon dioxide combined with tributyl phosphate and nitric acid (TBP-HNO_3) is an effective solvent for selectively extracting REEs from coal ash. To increase the purity of REEs in our collected solutions, a multistage stripping process was utilized to separate them from impurities. This has demonstrated and revealed the unique ability of supercritical fluids to selectively solubilize and enhance the interaction between REEs in coal ash and complexing agents (TBP-HNO_3). Further, involving supercritical CO_2 in the extraction system significantly increased the concentration.

Building on the groundwork laid earlier, this work examines the adsorption and desorption of coal materials to comprehend their surface chemistry and how CO_2 interacts with coal and coal ash during the supercritical phase, essential to maximizing the recovery of rare earth elements. We hypothesize that the application of supercritical CO_2 is directly related to its physicochemical properties. Its high diffusion and low viscosity values provide the desired penetration power in the solid matrix of the coal ash. Additionally, this work aims to close the gap between the adsorption-desorption properties of coal materials and the SC-CO_2 extraction method using TBP-HNO_3. In this study, three types of fresh coal samples, anthracite, bituminous, and sub-bituminous coal, with size fraction of 60 – 80 mesh and 80g mass of each coal sample, were experimented for void volume measurements at intervals of 8 minutes while adsorption-desorption kinetics at 6-hour intervals with pressures ranging from 200 to 2000 psi at a constant temperature of 40 ℃. It is observed from the kinetics data that the adsorption rate and the effective diffusivity increase with increasing pressure. Combining knowledge from the two research studies, we propose that optimizing REE extraction will be more accessible by knowing the mechanisms behind the interactions between supercritical CO_2 and coal and coal fly ash matrices, enhancing SC-CO_2 diffusivity and reagent efficiency. These initial results will offer further information to support the development of an environmentally friendly REE extraction process.

Datasets for a multi-resource approach to mineral resources

Wang, Bronwen, Bender, Adrian, Goldman, Margaret, Ellefson, Karl, Carey, Michael, Koch, Josh, Baughman, Carson, Poulin, Brett, O'Donnell, Jon

Mineral assessments typically focus on discovered and undiscovered mineral resources. However, additional components such as non-mineral resources, environmental parameters, and social assets and vulnerabilities are also important considerations for a host of stakeholders that may include land managers, industry, policymakers, and the public. The goal of our work is to integrate the geologic, environmental, and societal factors associated with mineral resources into a multi-resource integrated assessment (MRIA). A MRIA is a structured approach to interdisciplinary and collaborative analysis for evaluating multiple, often spatially overlapping, physical and biological resources, and societal characteristics. In this presentation we highlight ongoing baseline work needed for a MRIA focused on discovered and undiscovered mineral resources in Alaska. Our initial work includes 1) data acquisition through geochemical reanalysis of stream sediment and geochemical data integration, 2) delineation of legacy mine disturbance footprints, and 3) acid generation potential from pyrite oxidation. We expand on each of these three efforts below.

Data availability often limits the scope and nature (e.g. qualitative vs quantitative) of assessments. Chemical reanalysis of archived samples using a standardized multi-element package provides an internally consistent, but often spatially limited, geochemical dataset. Combining the reanalyzed datasets with other published data typically results in a mixed-method dataset wherein individual elemental concentrations may have been determined by multiple analytical methods. Mixed-method datasets are challenging to work with, partly because of varying sensitivities of different analytical methods. We are developing a data-leveling method to minimize effects of both bias due to analytical method and potential outlying data. We illustrate the method using a case study of arsenic concentrations in the Yukon-Tanana Upland in eastern interior Alaska.

A new geospatial dataset of outlining land surface disturbance and waste at legacy mining sites in Alaska has been developed for use in assessing the resource potential of legacy mine waste. The constituent outlines reflect ≤1:20,000-scale visual interpretation of ≥37 cm resolution Maxar satellite imagery within 10 km of point locations archived in the U.S. Geological Survey Alaska Resource Data File (ARDF). Over 700 km^2 of land surface disturbance and waste piles totaling about 240 km^2 at more than 500 sites were mapped. This dataset complements a recently published global map that depicts areas of active mining in Alaska, is the first dataset to explicitly delineate mine waste landforms (e.g., tailings piles), and is an important step in evaluating the resource potential of mine waste in Alaska.

Pyrite is common in mineralized rock and oxidation of pyrite is a common source of acidic drainage. Iron-stained outcrops and stream reaches are arguably the most visually apparent product of pyrite oxidation and have long been an indicator of mineralized ground. Heavy iron staining, typical of pyrite oxidation, occurs throughout the Brooks Range, for example, along Hue Shale outcrops and adjacent creeks in the eastern Brooks Range. Acid generating and acid neutralizing potential of mineralized systems are important considerations in understanding the vulnerability of the landscape to change. Recently "rusting" has been observed at sites along creeks in the eastern Brooks Range with no record of ongoing iron transport in steam waters. Pyrite and iron staining in sediments in the general area where the current "rusting" is observed is documented in published geologic studies. Investigations into the causes of the "rusting" and the ecological response are ongoing and will be a valuable case study coupling the acid generating potential of a geologic system with the ecologic response.