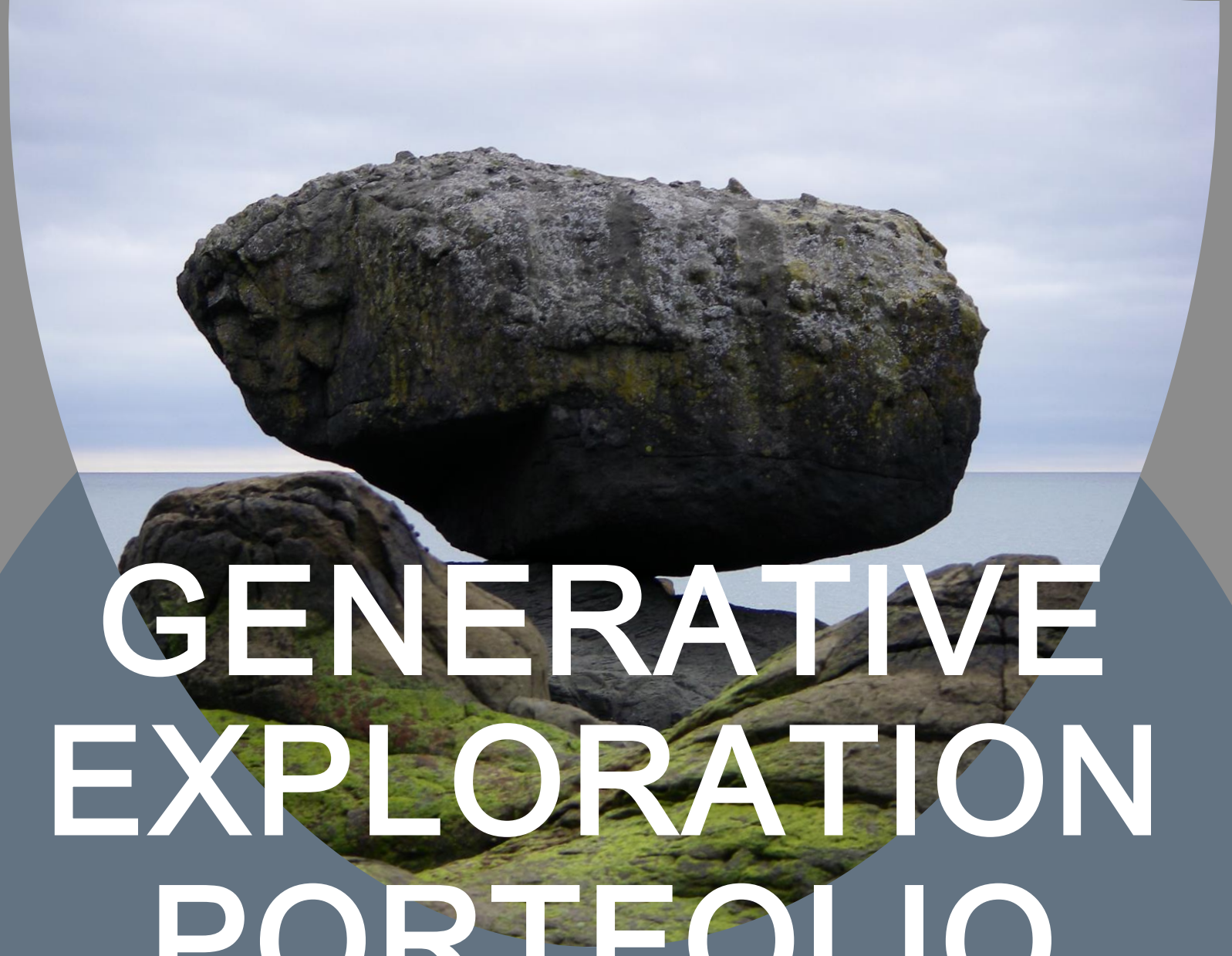


GENERATIVE EXPLORATION PORTFOLIO

DIANA BENZ, PHD

ABOUT MY APPROACH

WORKFLOW OVERVIEW

Integrity → Quality → Integration → Discovery → Interpretation → 4D Mineral Systems Framework

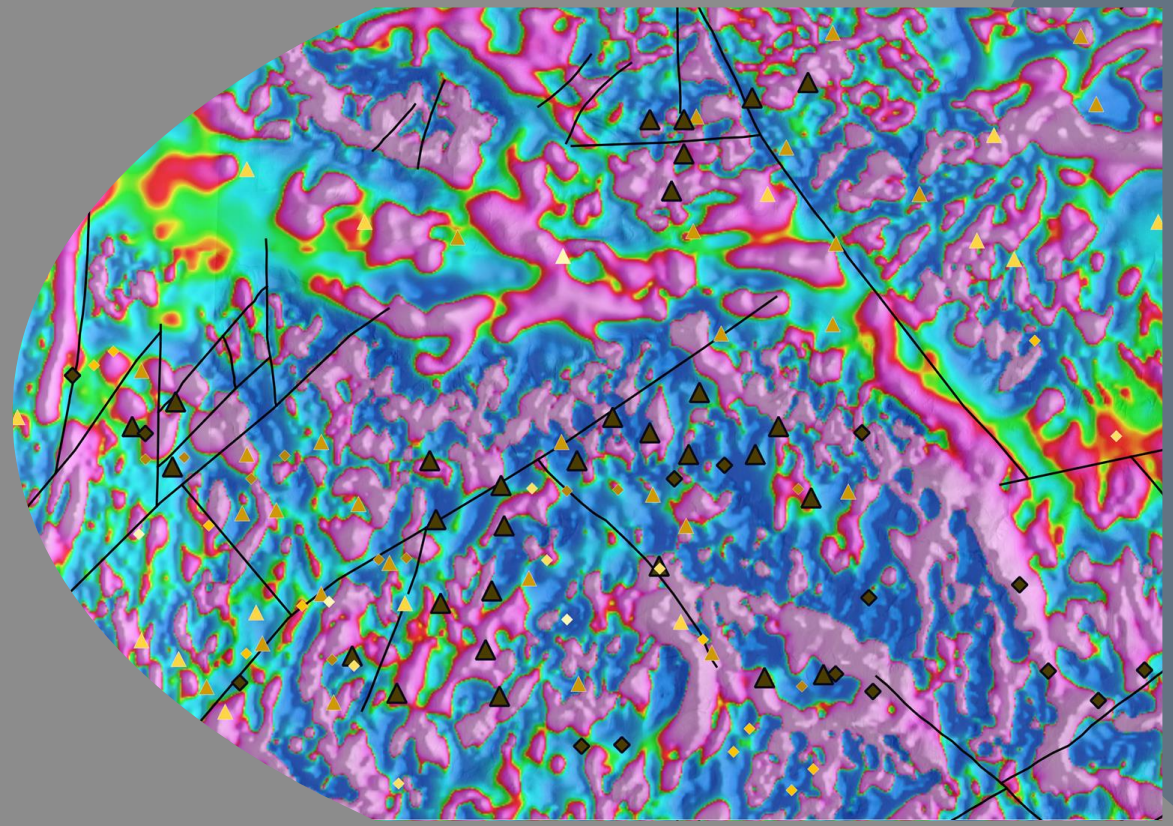
Every mineral system expresses itself through geochemistry. Sometimes it's subtle but it defines the footprint, grade, and metallurgy of a mine.

But that expression only means something when the data is pristine.

That's why my generative exploration workflow begins with data quality, then moves into geochemical signals and footprints.

From there, remote sensing, structure, terrain, land-use constraints, and machine learning are integrated, but the geochemistry remains the anchor at both the beginning and the end of the workflow.

The results are defined targets with probabilities and context — sometimes it's a single track for a normal day's walk — rather than broad areas that follow the most likely geology or structures.



DATA AUDITING

THE BACKBONE OF GENERATIVE EXPLORATION

Project 1 – Automated Data Audit Pipeline (13-Module System with an AI Audit Agent)

QP SUMMARY REPORT 2026-03-10 (v02)

Generated	2026-03-10 02:12
Pipeline	Module 10 - Flag Report Generator

CHECKS PERFORMED

- [M01] Metadata & Provenance
- [M02] Spatial Checks
- [M03] Interval Logic
- [M04] Cross-Table Alignment
- [M05] Assay Metadata Checks
- [M05a] Assay Manipulation / Forensic Checks
- [M06] Missing Data & Logical Errors
- [M07] Textual QA
- [M08] Data Type Enforcement

OVERALL FLAG COUNTS

Total flags	638
CRITICAL	129
ERROR	129
WARNING	142 (of which 104 are BDL/detection-limit analyte flags — informational, no action needed)
INFO	238
Requires DB Manager remediation (excl. BDL)	148

FLAGS BY SEASON AND DATA TYPE

Season 2021 CRITICAL:20 ERROR:1 WARNING:8 INFO:35		
Data type	**Flags**	**BDL**
assays	CRITICAL:5 WARNING:8	
collar	CRITICAL:1 ERROR:1 INFO:4	
coreboxes	CRITICAL:2	
density	CRITICAL:2	
geology	CRITICAL:2 INFO:3	
geotech	CRITICAL:3 INFO:3	
qaqc	CRITICAL:1	

Purpose
Before any interpretation, every dataset enters a 13-module QC pipeline that enforces metadata, logic, consistency, and cross-table alignment.

Summary
I built a modular Python-based QC pipeline that performs 8 categories of checks, including metadata validation, spatial logic, interval consistency, assay forensics, and cross-table alignment. The system automatically identifies critical issues before interpretation, ensuring every analysis begins with pristine, defensible data.

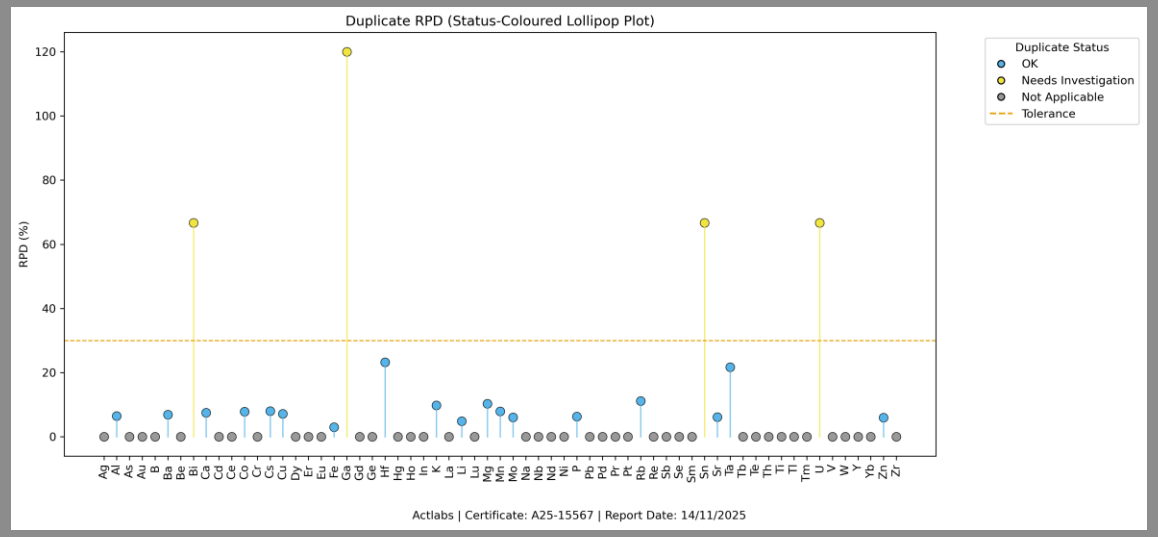
Impact
Ensures QP-ready data integrity before any interpretation.

Examples
GitHub: *Private repository prototype at d-benz*

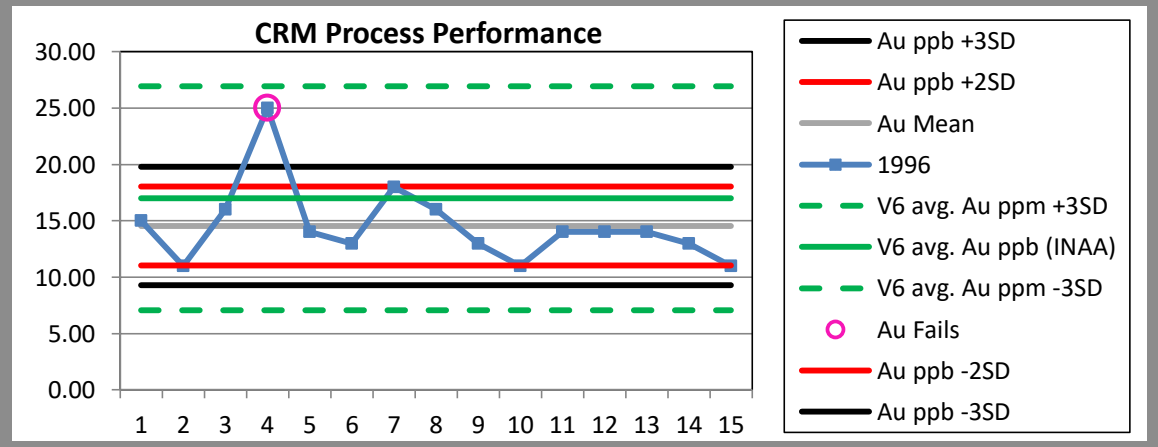
DATA QUALITY

THE FOUNDATION OF GENERATIVE EXPLORATION

Project 2 – Internal & External Laboratory QA/QC Evaluation



Automated Lab Internal QC Evaluation Report from GitHub



External QC Evaluation Report from PhD thesis

Purpose
Automated internal QC reporting helps train users to understand QA/QC and make their own conclusions. External CRM, Duplicate, and Blank evaluations determine the quality & reliability of the data.

Summary
I designed automated workflows to evaluate internal QC trend and duplicates, CRM performance, and external CRM, duplicate, and blank results. Automated tools and manual procedures identify analytical drift, bias, and outliers using statistical thresholds and visual diagnostics, supporting QP-level reporting and audit-ready documentation.

Impact
Knowing the limitations of the data before using it.

Examples
GitHub: *d-benz/Python-LabQAQC*
Report: *YT AR #97116, Page 219*

EXPLORATORY DATA ANALYSIS

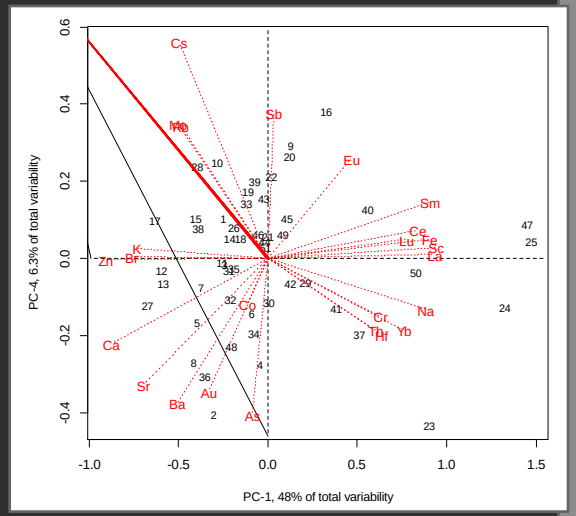
THE BEGINNING OF GENERATIVE EXPLORATION

Project 3 – Geochemical Statistics & Multivariate Analysis

Table 5 Proof 2025 Soil Sample Summary

Note: Below detection limit values were replaced by half the detection limit for each element. Sample PF25SS02 was removed due to the anomalous gold value of 4420 ppb. NA = not applicable, DL= detection limit, Min = minimum, Max = maximum, SD = standard deviation, MAD = mean absolute deviation and CV = coefficient of variation.

Element	Units	Count	DL	% < and > DL	Min	25%	Median (50%)	Mean	95%	99%	Max	St. Dev.	MAD	CV
Ti	pct	9	0.001	0.00%	0.088	0.106	0.107	0.116	0.144	0.145	0.145	0.02	0.00	0.2
S	pct	9	0.25	90.00%	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.00	0.00	0.0
P	pct	9	0.001	0.00%	0.015	0.033	0.044	0.042	0.069	0.073	0.074	0.02	0.01	0.4
Li	ppm	9	0.1	0.00%	3.7	3.9	5.1	5.2	7.1	7.4	7.5	1.30	1.20	0.3
Be	ppm	9	0.1	0.00%	0.2	0.3	0.3	0.3	0.5	0.5	0.5	0.09	0.00	0.3
B	ppm	9	1	60.00%	0.50	0.50	0.50	0.67	1.00	1.00	1.00	0.25	0.00	0.4
Na	pct	9	0.01	0.00%	0.04	0.05	0.06	0.06	0.08	0.08	0.08	0.01	0.01	0.2
Mg	pct	9	0.01	0.00%	0.15	0.18	0.18	0.20	0.28	0.32	0.33	0.05	0.01	0.3
Al	pct	9	0.01	0.00%	0.72	0.94	0.96	1.04	1.43	1.57	1.60	0.25	0.10	0.2
K	pct	9	0.01	0.00%	0.06	0.06	0.07	0.07	0.08	0.08	0.08	0.01	0.01	0.1
Bi	ppm	9	0.02	0.00%	0.07	0.08	0.09	0.09	0.10	0.10	0.10	0.01	0.01	0.1
Ca	pct	9	0.01	0.00%	0.42	0.46	0.48	0.51	0.62	0.63	0.63	0.08	0.05	0.2
Sc	ppm	9	0.1	0.00%	2.3	2.9	3.2	3.2	4.0	4.3	4.4	0.57	0.20	0.2
V	ppm	9	1	0.00%	35	39	41	51	89	104	108	23.19	5.00	0.5
Cr	ppm	9	1	0.00%	10	10	14	13	18	20	20	3.43	3.00	0.3
Mn	ppm	9	1	0.00%	170	204	232	330	778	964	1010	266.29	45.00	0.8
Fe	pct	9	0.01	0.00%	1.29	1.52	1.56	1.94	3.22	3.73	3.86	0.79	0.25	0.4
Co	ppm	9	0.1	0.00%	3.5	3.9	4.2	5.0	8.1	9.1	9.4	1.85	0.60	0.4
Ni	ppm	9	0.1	0.00%	3.8	4.0	4.6	4.9	6.6	7.1	7.2	1.11	0.80	0.2
Cu	ppm	9	0.2	0.00%	5.0	6.5	6.8	7.3	10.0	10.5	10.6	1.75	1.00	0.2
Zn	ppm	9	0.1	0.00%	23.5	27.7	28.2	33.1	48.6	54.2	55.6	9.70	4.00	0.3



Purpose
If grade and tonnage are defined by geochemistry, then geochemistry should guide discovery.

Summary
I evaluate the data, regardless of sample size, using methods developed during my PhD: summary statistics, histograms, QQ plots, and more, then apply robust statistical methods - like univariate distributions, PCA, ANOVA, and multivariate clustering - to reveal geochemical structure and identify pathfinder associations. These analyses support mineral systems interpretation and guide exploration targeting.

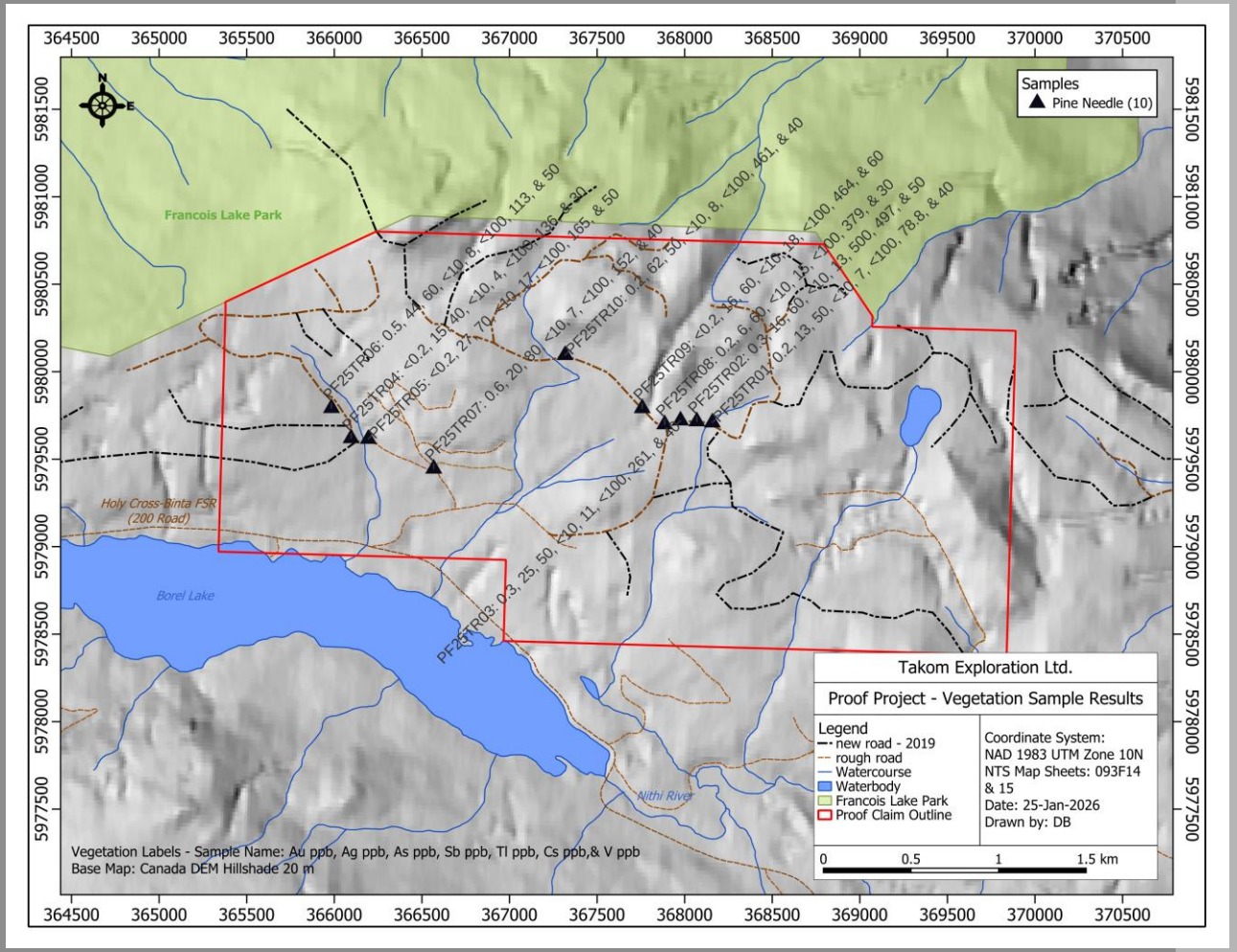
Impact
Pathfinder and commodity footprints supported by quantitative evidence.

Examples
Thesis: *Statistical Analysis & Interpretation of Biogeochemical Data for Metallic Mineral Exploration, page 225*
Proprietary: Grub Staking

DATA COMPILATIONS

THE CORE OF GENERATIVE EXPLORATION

Project 4 – Discovery under Cover: Biogeochemistry



An example of a regulatory-required sample results map featuring labelling

Purpose
Not all mines outcrop at the surface.

Summary
I integrate multi-element vegetation geochemistry with terrain and structural datasets to map surface expressions of mineral systems. These maps highlight pathfinder anomalies and structural corridors, supporting early-stage exploration in glaciated terrain.

Impact
Supports soil-till grid design and strengthens structural and geochemical interpretations through evidence of geochemical leakage.

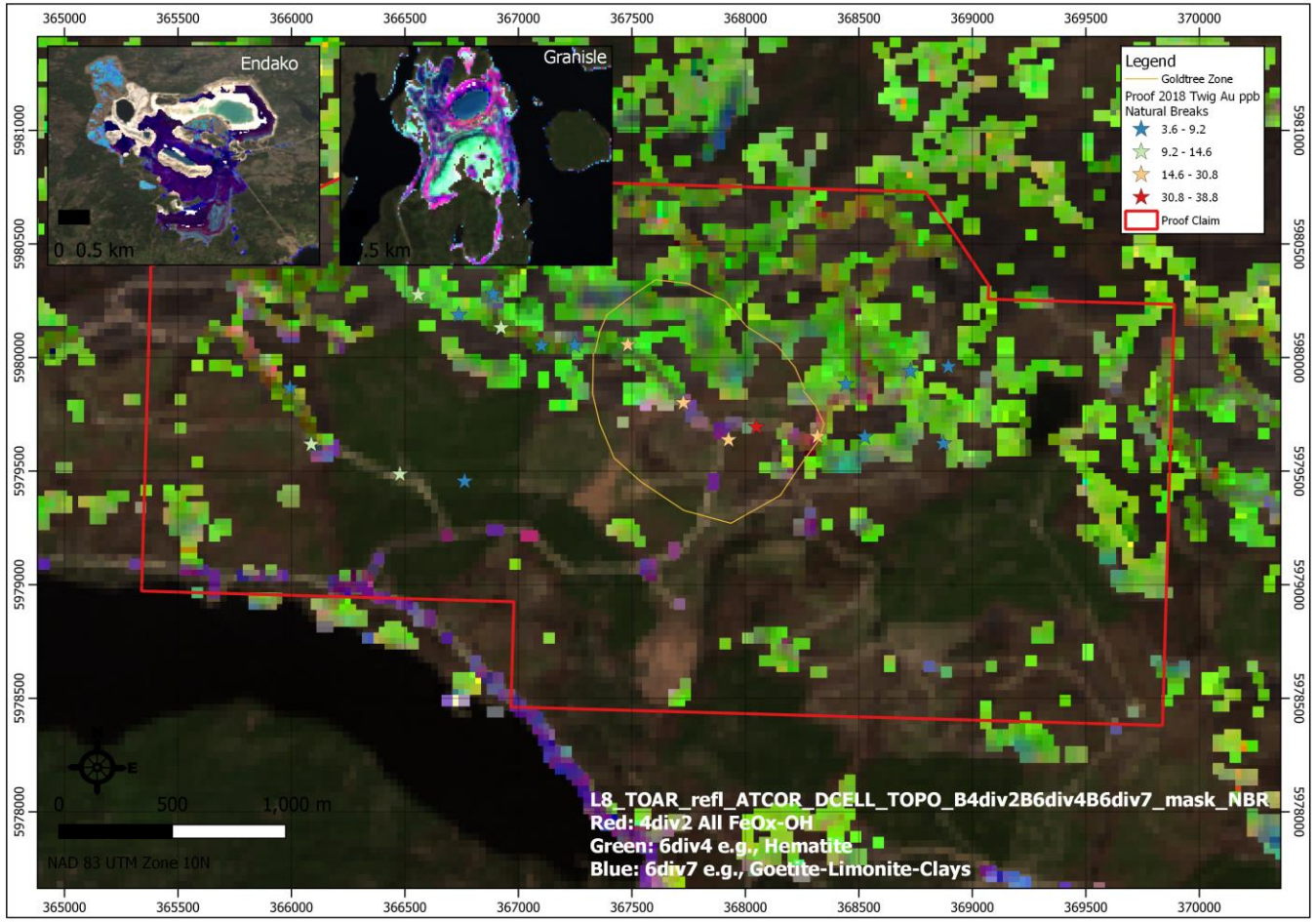
Examples
Project : *Proof Project*
PhD Thesis: *Statistical Analysis & Interpretation of Biogeochemical Data for Metallic Mineral Exploration*

Innovation & Transparency

DATA COMPILATIONS

THE CORE OF GENERATIVE EXPLORATION

Project 5 – Remote Sensing Alteration Mapping



Enhanced Landsat Imagery example from the Proof Project – post wildfire

Purpose
There is so much more pre-competitive data available to use than we realize.

Summary
Using Landsat-8 TOAR and band-ratio composites, I map Fe-oxide, clay, and alteration mineralogy across project areas. These products integrate seamlessly with structural and geochemical datasets to identify prospective zones.

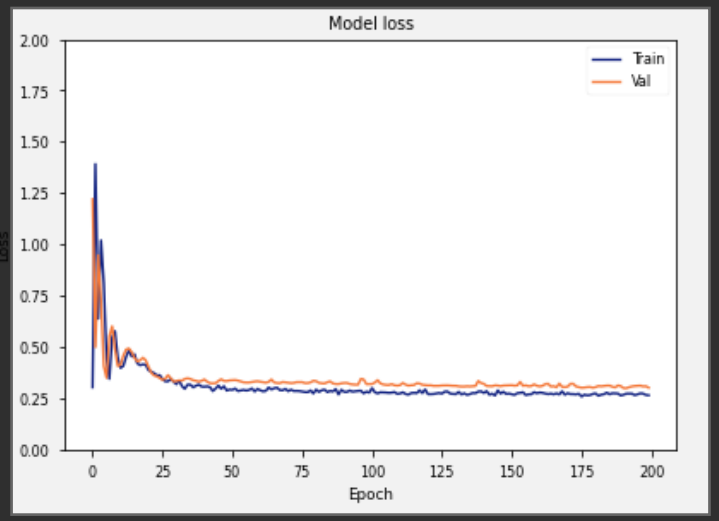
Impact
Increases the partial ‘knowns’ for follow-up and interpretations.

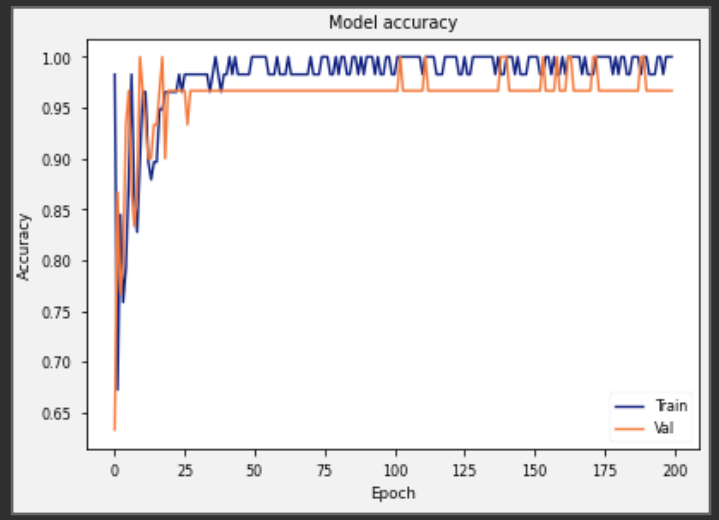
Examples
Report: *Proof Project AR # 39532*
Project: *Nechako Plateau Poster*

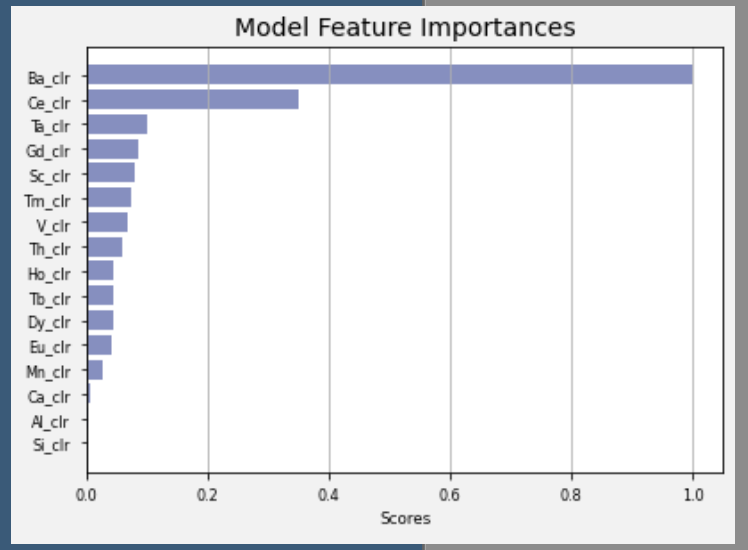
DATA PREDICTIONS

THE RESULTS OF GENERATIVE EXPLORATION

Project 6 – Machine Learning Indicator Mineral Classification







Purpose
As data become more complex we need more complex methods to organize and analyse, but that also retain transparency.

Summary
I developed a convolutional neural network to classify highly diamondiferous versus poorly diamondiferous samples using multi-element geochemistry across five indicator mineral groups. The G10 model achieves ~82% accuracy and highlights key discriminant elements through feature-importance scoring.

Impact
Extends classification beyond conventional bi-variate plots.

Examples
GitHub: *Python-DiamondIndicatorMineral*
Presentation: *SEG 100 Speed Talk ST.025*

INTERPRETATION

THE DEFENSIBILITY OF GENERATIVE EXPLORATION

Project 7 – The 4D Mineral Systems Framework

Geologically, the Project area sits within the Intermontane Belt of central British Columbia, where multiple magmatic and structural events spanning more than 130 million years have created a favourable mineral-systems architecture. It straddles two distinct volcanic units - the Middle Jurassic Hazelton Group to the south and the Late Cretaceous Kasalka Group to the north - separated by over 40 million years of tectonic and magmatic evolution. This juxtaposition provides a 4D framework in which Jurassic structures formed during Hazelton volcanism may have remained permeable for later reactivation during Late Cretaceous intrusive events. This dual-age architecture mirrors regional metallogenic patterns: the Brucejack Gold-Silver Mine (~435 km northwest) represents a Hazelton-hosted, syn-volcanic (~175–170 Ma) epithermal system, whereas the Blackwater Gold-Silver Mine (~85 km south) represents a Kasalka-hosted but post-volcanic (~64 Ma) epithermal system driven by younger plutons (~72 Ma). At Proof, the Holy Cross Pluton (~66 Ma) is a felsic porphyritic intrusion located <1 km from the Project area with local potassic and sericitic alteration. This large igneous body fits naturally into this 4D context as a potential Late Cretaceous heat and fluid source capable of exploiting older Hazelton-age structures underlying the Kasalka volcanic pile. Although potential mineralizing events at Proof remain under investigation, the geological setting is consistent with a hybrid mineral-systems architecture in which Jurassic structural inheritance and Cretaceous magmatic drivers interact to create a favourable environment for epithermal-style fluid flow.

From a mineral-systems standpoint, Proof occupies a structurally favourable position between an intensely altered propylitic unit in the northwest and an intensely altered phyllic unit in the southeast. This alteration gradient, combined with mapped shears, breccias, and magnetic susceptibility contrasts (0.013–0.0417 SI), indicates a long-lived permeability architecture capable of focusing repeated hydrothermal pulses. Regional geophysical datasets reinforce this interpretation: the Project area lies within a NW–SE structural corridor defined by strong magnetic intensity contrasts (–3877 to +500 nT), sharp magnetic edges (–27 to +58 nT/m), and elevated conductivity responses (Tau ~600–845 µs; Z-Off ~500–1500 nT/s). This corridor includes a 1.1-km-wide magnetic edge intersected by narrower north–south structures, interpreted as a major crustal boundary that may have channelled fluids over time. The multi-element biogeochemical signature gold–silver with associated As–Sb–Tl–Cs–V–Se pathfinders, documented between 2018 and 2025, aligns with a possible surface expression of a low-sulfidation epithermal system developed within this inherited, reactivated, and time-integrated structural framework.

Purpose

Generating targets isn't about the best samples — it's understanding the architecture, the drivers, and the defensible reasons behind each choice.

Summary

I constructed a 4D mineral systems model integrating Jurassic and Cretaceous magmatic–structural evolution, geophysics, alteration mapping, and geochemistry. This framework supports exploration targeting in a complex, multi-event terrane.

Impact

Scientifically summarize and defend targets to show why a project is a worthy investment.

Examples

Report: *Proof Project 2025 - confidential*

Source, Transport, Trap, Preservation, & Time

VISUALS

Promotional

REPORTING

GEOCHEMICAL & GEOLOGICAL SURVEY

ON THE

PROOF PROJECT

OMINECA MINING DIVISION

NTS 093F/14 AND 15

53.950° N

125.0129°

OWNER / OPERATOR: DIANA BENZ

CLAIMS WORKED:

1060061

Prepared by: Diana Benz, PhD
Takom Exploration Ltd.

Date: February 15, 2026

Yukon Territory & British Columbia

Examples

BC Reports: *ARIS Search - benz, diana*

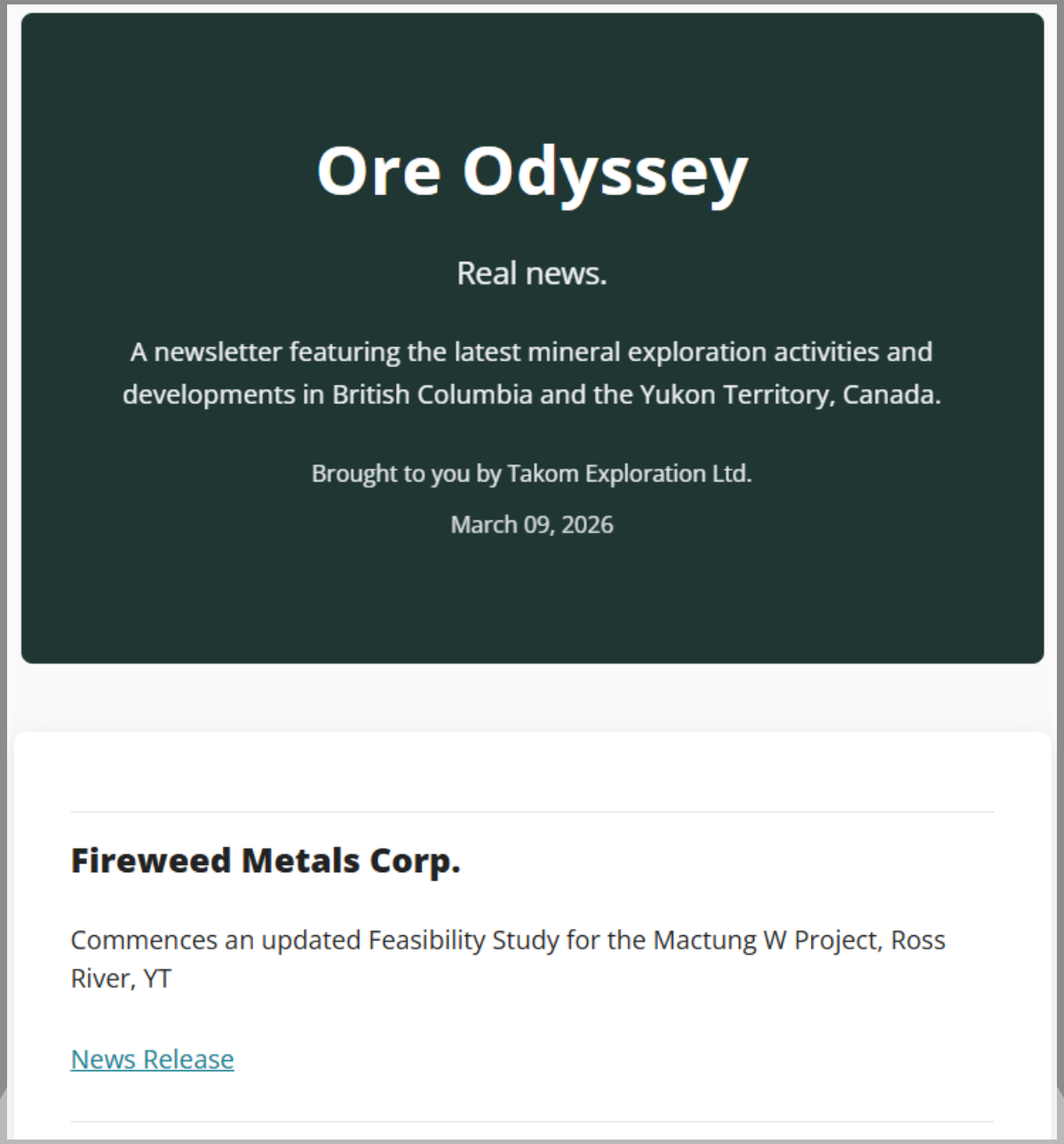
YT Reports: Research Libraries – benz, diana

CONFERENCES

Presentations

Examples

Talks: *Conferences*



Weekday Newsletter

STAYING CURRENT

Newsletters

BC-YT: *Ore Odyssey*

Canada: LinkedIn

Mixed Media Messages: The Ultimate Guide to 'Soil' Sampling for Mineral Exploration

Updated: Jun 23, 2023

One of the many challenges of working in a recently glaciated environment, like the Central Interior of British Columbia, is the accurate identification of 'soil' sample material and its anomalies.

Surface soil sampling in the pine flats of the Blackwater Mine area to ground-truth clay in surface soils for a remote sensing study in 2010. Note the area was logged 6 or 7 years ago, and there is poor soil development.

TECHNICAL REVIEW

Insights Blog

Quarterly: *Articles*

WORKING TOGETHER

- Historical Reviews ♠
- Project Generation ♠
- Data Integrity Audits ♠
- Multidisciplinary Compilations ♠
- ML Feasibility Studies ♠
- Reporting ♠

I work with exploration teams, founders, and junior explorers developing greenfield and brownfield projects who need defensible, multidisciplinary intelligence before committing capital.

My workflow reduces uncertainty, strengthens technical narratives, and supports QP-level decision-making.

Bluesky: @takomexplore

GitHub: d-benz

Blog: Insights

LinkedIn: Diana Benz

Website: www.takomexploration.com