Spring Creek Mine Redevelopment: Geology-Driven Mine Design in a Structurally Complex New Zealand Coal Deposit

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Keywords: Spring Creek, Geology, Mine Design

ABSTRACT

Spring Creek Mine, near Greymouth on the West Coast of New Zealand, offers a redevelopment opportunity defined as much by its geological complexity as by its coal quality. The Main Seam of the Rewanui Coal Measures is thick, steeply dipping, and heavily faulted- a structural environment familiar across New Zealand mining operations. At Spring Creek panel layout is an iterative, geology-first process rather than one suited to conventional automated approaches.

Historically worked by hydro mining, the deposit presents a fundamental methodology challenge under modern operating conditions. While hydro mining performs well in thick seam recovery, it generates large open goaf voids, and under current gas management standards the risk of gas plug accumulation at the goaf edge is no longer considered acceptable. A conventional continuous miner layout has therefore been developed, incorporating bottom-coaling extraction strategies, with panel geometry controlled at every step by the interpreted fault framework, seam dip, and coal quality.

The geological foundation for this work is a legacy dataset compiled by Solid Energy, comprising approximately 520 diamond drillholes, around 60% with downhole geophysics and ply-level coal quality data. Reinstatement and remodelling of this dataset in Maptek GeologyCore enabled structured domain-based workflows for seam correlation and structural interpretation, extracting considerably greater value from the data than was achievable using earlier methods. A HARP (Horizontal Axis Rotation Projection) approach was then applied in Vulcan to honour ply-based quality data within the steeply dipping geometry, generating a quality block model across the Main Upper and Main Lower seams.

The lower recovery associated with conventional extraction placed greater emphasis on coal quality, as the full seam thickness cannot be recovered. Roadways were therefore positioned to preferentially intersect low ash and low sulphur domains, targeting zones where coal quality approaches the requirements for high-value silicon metal manufacturing. A key characteristic of Spring Creek coal is that these quality targets may be achievable without coal washing, potentially simplifying downstream processing and improving project economics.

This paper presents the integrated workflow as a practical approach to conventional mine design in structurally complex deposits, demonstrating how domain-driven geological modelling and coal quality integration can directly inform mineable panel selection, improve product quality control, and support modern extraction strategies in New Zealand coal operations.

Exploring Block and Grid Modelling Philosophies in Stratiform Geology

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Keywords: Modelling frameworks, Stratiform geology, Discretisation

ABSTRACT

Geological models underpin Mineral Resource estimation, mine planning, and operational decision making. While three dimensional block models are widely adopted across the mining industry, two dimensional grid based approaches remain common in stratiform and layered deposits. Although both approaches draw on the same underlying data, they are built on different assumptions about continuity, variability, and scale. These philosophical differences can influence how geologists conceptualise the subsurface and communicate confidence.

This presentation takes an exploratory look at how modelling frameworks shape geological interpretation. Rather than comparing specific software or estimation workflows, the discussion focuses on how discretisation choices reflect different assumptions about vertical resolution, lateral continuity, and mining selectivity. The aim is to examine how their underlying philosophies guide the way geologists frame uncertainty and interpret geological patterns.

Conceptual examples will be used to illustrate how these modelling philosophies influence the way seam geometry, tonnage distribution, and confidence are approached and communicated. These examples serve as a basis for considering where each framework aligns—or misaligns—with geological context and decision requirements.

Ultimately, the presentation encourages more deliberate consideration of modelling approach as a component of resource governance. By reflecting on the strengths, limitations, and interpretive philosophies embedded within block and grid models, the discussion highlights the importance of aligning modelling frameworks with both geological reality and the decisions the model is intended to support.

Risk-Informed TSF Dam Raising Adjacent to Active Open Pit Mining: A Case Study from Rosebel Gold Mine

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Keywords: TSF, Dam, Blast

ABSTRACT

The simultaneous development of tailings storage facility (TSF) dams and active open pit mining introduces elevated geotechnical risk, particularly where pit-dam separation distances are limited. At Rosebel Gold Mine in Suriname, progressive TSF dam raising has been undertaken with minimum distances locally reduced to approximately 40 m between the pit crest and the downstream dam toe. This paper presents a risk-informed engineering approach adopted to safely manage TSF construction under these constrained conditions.

Dam stability was evaluated using limit equilibrium analyses under static, pseudo-static, and staged construction loading scenarios. Target minimum factors of safety of ≥1.5 (static) and ≥1.1 (pseudo-static) were applied in accordance with ANCOLD guidance. Sensitivity analyses assessed the influence of elevated pore pressures and reduced shear strength during construction sequencing and wet-season conditions.

Blasting-induced vibration from adjacent pit operations was assessed through site-specific monitoring and blast design optimisation. Conservative peak particle velocity (PPV) thresholds of 2.5–5 mm/s at the dam crest were established based on material properties, foundation conditions, and consequence classification. Controlled blasting techniques, including reduced charge weights per delay and modified blast geometries, were implemented to maintain compliance. Real-time vibration monitoring verified performance and supported adaptive operational control.

Dam raising was executed using downstream construction methods with enhanced QA/QC controls, including lift thickness, moisture conditioning, and compaction requirements. A performance-based monitoring program incorporating vibrating wire piezometers, vibration sensors, and routine inspections was integrated within a Trigger Action Response Plan (TARP) framework.

This case study demonstrates that TSF dam raising in close proximity to active mining can be safely achieved through conservative design criteria, vibration control, and continuous monitoring, supporting alignment with GISTM principles.

Lithium Exploration in the Central Whirinaki Basin, Taupō Volcanic Zone

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Keywords: Lithium, Clay, HARSH

ABSTRACT

The hydrothermally altered, rhyolitic sediment-hosted (HARSH)-style lithium (Li) deposit model has primarily been developed from exploration drilling and detailed geochemical characterisation of the McDermitt Caldera Thacker Pass Li deposit in Nevada, USA. The Taupō Volcanic Zone (TVZ) has several of the key components necessary for a successful HARSH-style Li mineral system: rhyolitic rocks as a source of Li; caldera lakes in faulted, graben structures hosting fine-grained, clay-rich lacustrine sediments; hydrothermal alteration that may form Li-bearing illite and smectite clays; and Li enrichment within discrete organic-rich lacustrine layers identified in historical boreholes.
In 2023, 13 diamond drillholes were drilled in the Central Whirinaki Basin to test Li targets derived from integrated interpretation of regional geological mapping, surface geochemical and geophysical datasets, and unsupervised clustering (machine learning), supported by a local ground gravity survey.

Drilling predominantly intersected volcaniclastic sediments (lapilli tuff and ash tuff), siliciclastic lacustrine sediments, and mixed units exhibiting characteristics of these lithologies, with minor fluvial/deltaic units and volcanic flows. Lithium concentrations were generally low (1.8–171 ppm), with most samples containing <50 ppm.

The limited extent and thickness of fine-grained, clay-rich lacustrine units in the Central Whirinaki Basin suggests limited and potentially short-lived lake development. In addition, geochemical data from the Whirinaki drilling indicate little to no pervasive clay alteration (e.g. illite-smectite) associated with hydrothermal processes. This lack of hydrothermal fluid flow may represent a significant limitation on the transport and concentration of Li within the system.

Although a HARSH-style Li mineral system was not identified in the Central Whirinaki Basin, larger caldera lake systems elsewhere in the TVZ are more likely to host well-developed fine-grained, clay-rich lacustrine sequences, rather than multiple smaller lakes or floodplain swamps. Additionally, rhyolitic rocks across the broader TVZ region are moderately enriched in Li. Thus, the potential for a HARSH-style Li mineral system within the TVZ remains.

Canoe Creek Mineral Resource Estimate, Barrytown.

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Keywords: Heavy Mineral Sands, Machine Learning, SEM

ABSTRACT

TiGa Minerals and Metals Limited (now Tāiko Critical Minerals Limited) commissioned RSC to prepare an MRE for the Canoe Creek Block within its Barrytown Project, West Coast, New Zealand.

The Barrytown Project is a coastal heavy mineral (HM) sands deposit located ~30 km north of Greymouth. Ilmenite, garnet, zircon, gold, and associated HM have been concentrated into a series of beach strandlines at Barrytown.

In 2025 TiGa drilled 263 aircore (AC) drillholes, and 13 sonic drillholes on the Canoe Creek Block. Data from these drillholes form the basis of the MRE. Samples were obtained from the 45-µm to 2-mm fraction of 1-m-interval samples from the AC drilling and lithology-based sample intervals in sonic drilling. Pulverised samples were analysed by portable X-ray fluorescence (pXRF) to produce a multi-element geochemical dataset. A representative sub-set of 104 samples were analysed by laboratory XRF analysis to quality control the pXRF data; the same samples were also analysed by scanning electron microscopy (SEM), and sink-float analysis.

The abundance of ilmenite, garnet, and zircon were derived from linear regression models, trained on mineral abundances measured by SEM-based automated mineralogy, and geochemical data from pXRF analysis.

The HM abundance was estimated using ordinary kriging for the background domains. Within a high-grade sand domain, HM abundance was estimated using kriging with variance of measurement error which factors in the higher confidence in the sonic samples. The Mineral Resource was reported at a cut-off abundance of 1% ilmenite (in situ) and within a particle size range of 45 µm to 2 mm.

This contribution focusses on the geology of the project, the process to determine mineralogy from geochemical data, and impact of the bias between AC and sonic drillhole samples on the MRE.

The Operational learnings from the two largest Mokomoko relocations in New Zealand - at Macraes Gold mine

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Keywords: Mokomoko, Salvage, Wildlife Authority

ABSTRACT

OceanaGold's Macraes Operation successfully conducted the two largest mokomoko salvage and relocation efforts in New Zealand during the 2025/26 mokomoko season (October–March). Both Salvages were conducted under a Wildlife Act Authority (WAA) issued by the Department of Conservation (DOC). An authority is required under the Wildlife Act 1953 for any activity that may disturb, capture, or require the relocation of native wildlife. These Authorities set conditions and require consultation with iwi to ensure adverse effects are appropriately managed. A Wildlife Authority is required in addition to the respective resource consents which authorise mining and associated activities, such as the clearance of mokomoko habitat. Across the two projects: Coronation North Project and the Continuity Consents Project, more than 8,000 mokomoko were relocated to a protected covenant east of the Macraes mining operations.

The scale of these projects made them both operationally and scientifically challenging, which meant adapting methods to ensure the best outcomes. A collaborative approach was taken with both iwi and DOC allowing methods to be assessed and adapted in real time as challenges were faced. A wide range of trapping techniques, and salvage approaches were employed throughout both salvage efforts. This paper evaluates which methods proved most effective and examines the practical and regulatory challenges of operating under a WAA, whilst aiming to achieve the best possible ecological outcomes practical within operational constraints. The discussion draws on insights from the on ground operational team, who worked alongside iwi and ecologists/herpetologists over a combined 15 weeks of intensive search effort. The findings provide practical guidance for future large scale lizard salvages within varied habitats and operational environments. These two projects are a demonstration of how positive outcomes can be achieved for mokomoko populations and operations.

Low-Impact Seismic Source Energy Testing for Mineral Exploration: A Case Study from the McArthur Basin

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Keywords: Low-impact seismic acquisition, Mineral exploration, Seismic sources

ABSTRACT

Seismic methods are increasingly being considered as a complementary tool for mineral exploration, offering improved structural resolution compared to traditional geophysical techniques. A key barrier to broader adoption, however, remains uncertainty around optimal source energy requirements, cost efficiency, and environmental impact.

A controlled field trial in the McArthur Basin, Australia, tested the effectiveness of varying seismic source energy levels for imaging mineral prospectivity.

A 2D seismic line was acquired over the Matherson Creek Anticline using three distinct weight-drop sources, each with significantly different energy outputs, hence the same line was acquired three times. The dataset enabled a direct comparison of source performance in terms of signal penetration, resolution, and interpretability within a Proterozoic sedimentary sequence known to host mineralisation.

The results demonstrate that even the lowest energy source tested produced coherent, interpretable reflection data to depths exceeding 2km, with no significant loss of structural resolution relative to higher energy sources.

Notably, the seismic data revealed deep-penetrating fault systems and amplitude anomalies within the Barney Creek Formation, interpreted as potential pathways and indicators of hydrothermal mineralisation. These features provide critical targeting information for drill program design - highlighting the value of seismic methods in reducing exploration risk.

The findings confirm that low-energy, low-impact seismic acquisition can deliver high-quality subsurface imaging in suitable geological settings, significantly reducing operational footprint and cost. This has important implications and great benefits for mineral exploration in environmentally sensitive or logistically challenging regions.
This case study supports the broader adoption of tailored, low-impact seismic methodologies as an effective tool for mineral exploration targeting, without compromising data quality.

From Trials to Success: Leveraging Vegetation for Safe and Stable Mine Landforms

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Keywords: Integrated Mine Closure, Rehabilitation Performance, Risk Mitigation

ABSTRACT

The closure of challenging mine landforms, such as mine rock stockpiles (MRS) and tailings storage facilities (TSFs), requires a fundamental shift in how we view revegetation. Traditionally treated as a secondary biodiversity goal, vegetation is increasingly recognised as a functional engineering component essential for achieving chemical and physical stability. This presentation highlights how proactive revegetation design can act as a key driver for reducing net percolation through evapotranspiration and ensuring long-term erosion control.

We demonstrate how site-specific trials provide the baseline data necessary to bridge the gap between engineering and ecology using three case studies:

- A 17-year "autopsy" of cover system trials at an iron ore mine: this reveals how mature root systems evolve and influence the performance of different cover materials over decades.
- Growth media alternatives: these trials quantify how specific substrates impact long-term rehabilitation success.
- Functional vegetation groups: a comparison of grasses versus shrubs to determine how specific species can be leveraged to manage water balance and minimise potential acid mine drainage (AMD).

By integrating these trials with active operations, mining companies can identify scalable, science-based solutions that enhance closure certainty and optimise long-term expenditure and reduce long-term liability management. To maximise the contribution of vegetation to closure outcomes, the industry is encouraged to move toward early interdisciplinary collaboration and proactive, multi-year studies. This presents an opportunity for the sector to move beyond traditional rehabilitation and embrace revegetation as a critical, performance-driven partner in successful mine closure. By integrating ecological functionality with engineering precision, we can deliver resilient, high-performing landforms that provide lasting value for the environment and the community.

He Anga Whakamua: Māori Enterprise, Co-design, and Next-Generation Ore pathways for a sustainable Minerals Future.

Dion Peita

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Keywords: Co-Design, Māori Enterprise, Intergenerational Wellbeing

ABSTRACT

Aotearoa - New Zealand stands at a critical juncture in how we understand, extract, and steward our mineral resources. Increasing expectations around environmental responsibility, social license, and long-term regional prosperity require new models of partnership and innovation. This presentation shares emerging insights from Next-Generation Ore (NGO)—a multi-year, MBIE-funded research programme—and its dedicated Māori enterprise stream, He Anga Whakamua. This work explores how iwi, researchers, and industry can co-design approaches to resource development that embed tikanga, enable equitable decision-making, and strengthen intergenerational wellbeing.

Drawing on co-development engagements in Te Tai Tokerau, Waikato–Hauraki, and Te Waipounamu, the presentation highlights three key themes:

- Co-design as a technical and social innovation. Māori leadership is reshaping upstream exploration, data governance, and early-stage feasibility pathways in ways that improve certainty, reduce conflict, and elevate local priorities.
- Māori enterprise as a driver of regional economic resilience. Strategically aligned Māori businesses and Rūnanga-owned entities are increasingly positioned to influence mineral value chains—from environmental monitoring and rehabilitation services to future-facing technologies and workforce capability.
- Enabled by an applied business development lens, He Anga Whakamua intentionally focuses on translating research insights into investable opportunities, partnership models, and scalable enterprise pathways that support iwi aspirations while creating shared value for the minerals sector.
- Reframing ‘sustainable futures’ in the minerals sector. He Anga Whakamua identifies practical frameworks that integrate Mātauranga Māori with engineering and geoscience, enabling more responsible resource decisions and pathways that honour place, culture, and long-term stewardship.

This presentation will offer reflections, early findings, and provocations for how the minerals sector can work with Māori in ways that enhance trust, unlock innovation, and shape a responsible and sustainable future for Aotearoa - New Zealand.

Stream rehabilitation: what, how and when

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Keywords: AMD, Macroinvertebrates, Fish

ABSTRACT

Stream rehabilitation is increasingly incorporated into mining proposals and the conditions of existing operations, yet there is often limited agreement about what rehabilitation is intended to achieve, how success should be measured, and when rehabilitation can reasonably be considered complete. In New Zealand, neither "rehabilitation" nor "restoration" is clearly defined in the Resource Management Act, leaving the ecological endpoint to be interpreted in the context of statutory objectives and the characteristics of the affected streams.

This presentation considers a practical framework for defining and assessing stream rehabilitation in mining environments. It distinguishes between returning a stream to a former state and restoring it to a functional state, recognising that the latter does not necessarily require replication of pre-disturbance conditions. Establishing an appropriate reference condition is therefore fundamental. Reference streams, and information collected before disturbance where available, provide the ecological context against which recovery can be assessed and help avoid imposing generic or unrealistic targets.

A functional stream ecosystem is supported by interacting physical, chemical and biological components. Three key elements are considered: water quality, water quantity and habitat. Water quality assessment needs to account for the contaminants associated with the particular activity, as well as natural background concentrations and modifying factors that influence contaminant toxicity. Flow regime, including both high and low flows, helps determine the character of the stream and the organisms it can support. Habitat provides the physical template required for ecological communities to establish and persist.

Biological communities provide an important measure of whether physical and chemical conditions are translating into ecological health and function. Macroinvertebrates are particularly useful because they integrate exposure to multiple stressors, are relatively sedentary and diverse, and include taxa with a wide range of environmental tolerances. However, generic biological indices may not be appropriate for all mining-related effects. Indicators should reflect the stressors affecting the particular stream; for example, indices developed for nutrient enrichment may be less informative where metals and acidity are the principal stressors.

Finally, rehabilitation should not be considered complete simply because water quality, flow and habitat meet their physical targets. Biological recovery may lag behind physical rehabilitation because recolonisation depends on dispersal and the availability of suitable source populations.

Successful stream rehabilitation therefore requires a clearly defined reference condition, assessment of water quality, flow and habitat, appropriate biological measures, and realistic expectations about the timing of ecological recovery.

Ordinary Kriging and Coal Quality Estimation – not so Ordinary!

Eden Sinclair

Manager Domestic Resources - Bathurst Resources

ABSTRACT

The coal deposits of the Buller Plateaux are widespread and variable. However, they have been studied and modelled for generations. Rank trends steeply from east to west across the Plateaux driving volatile matter and coking parameters. Ash and sulfur concentrations vary independently, in line with primary depositional or secondary mineralisation pathways.

Modern modelling methods allow large exploration datasets to be incorporated. Traditionally Bathurst and BT Mining have utilised inverse distance techniques to build both the structure model and the coal quality model. Coal quality has generally been estimated in limited passes. The 'proximate' variables of inherent moisture, ash, volatile matter and fixed carbon have been estimated concurrently, along with additional parameters such as sulfur, calorific value, and maximum vitrinite reflectance (Romax).

Inverse distance has traditionally been used as a deterministic spatial interpolation method to estimate values at unsampled locations based on a weighted average of surrounding known data points as it is straightforward to understand and implement and quick to run. The user does not have to make statistical assumptions about the deposit and is generally robust in its outputs.
But is there a better way?

This talk discusses the geostatistical properties of different coal quality parameters and the use of ordinary kriging to estimate coal quality at the Buller Plateaux Continuation Project sub project areas of Mt Frederick South and Escarpment Extension and the differences noted between results obtained via inverse distance functions.

Ordinary kriging is a geostatistical interpolation method that predicts coal quality values at unobserved locations based on the spatial geostatistical correlation of surrounding sample data. It operates by assigning weights to known samples based on a variogram model, which defines the spatial continuity of the coal quality parameter, rather than relying solely on distance. Unlike simpler interpolation methods, ordinary kriging provides an unbiased estimate with minimum variance by optimizing these weights, offering a way to estimate coal quality and also assess the confidence of the predictions.
Kriging variance, efficiency and slope outputs from the ordinary kriging estimation have been used to determine resource classification of the deposit, transitioning away for the traditional distance-based determinations required for inverse distance estimations.

New Developments in Copper Heap Leaching

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Professor – UBC

Keywords: Copper heap leaching, SX-EW, Chalcopyrite, Primary sulphide ores

ABSTRACT

Global demand for copper continues to grow while average ore grades decline and concentrate impurity levels increase. Much of the future copper supply is expected to originate from large porphyry deposits dominated by primary sulfide minerals, particularly chalcopyrite. Conventional processing of these ores relies on comminution, flotation and smelting. As ore grades decrease, this flowsheet becomes increasingly energy-intensive and capital-intensive, while also facing growing constraints related to concentrate impurities and smelter capacity.

Heap leaching followed by solvent extraction–electrowinning (SX–EW) represents a lower-energy route for copper production and already accounts for a significant portion of global output from oxide ores and secondary sulfides. However, industrial heap leaching has historically been limited by the slow leaching kinetics and/or passivation behaviour of chalcopyrite, which prevents efficient extraction of copper from primary sulfide ores under conventional conditions.

Recent technological developments are renewing interest in extending heap leaching to primary sulfide resources. A range of catalytic and engineered leaching approaches have been proposed to overcome chalcopyrite passivation and enable copper dissolution under near-ambient conditions. These developments create the potential to process low-grade primary sulfide ores using existing heap leach–SX–EW infrastructure.

The ability to treat primary sulfide ores through heap leaching could significantly alter future copper production strategies. Brownfield heap leach operations may be able to expand production using existing pads, solution management systems and SX–EW circuits, reducing capital intensity and accelerating project development. This presentation reviews the drivers behind renewed interest in sulfide heap leaching, outlines the limitations of current heap operations, and discusses emerging technological approaches that could enable direct leaching of chalcopyrite-bearing ores.

Magma-fluid-host rock interactions in the Ferrar large igneous province, Antarctica – implications for NZ mafic intrusion systems.

Emily Froehlich[1], Michael Rowe[2], James Muirhead[3], Zoe Armstrong[4], Ayrton Hamilton[5]

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Keywords: Alteration, Hydrothermal, Antarctica

ABSTRACT

The emplacement of Large Igneous Provinces (LIPs) represent some of Earth's most significant magmatic events. This study examines the factors controlling magma-fluid-host rock interactions in mafic intrusion systems to better constrain hydrothermal alteration processes and their implications for volatile transfer. This is particularly relevant to the mineral and hydrocarbon exploration industry. Due to the absence of active LIPs, the degree and extent of hydrothermal alteration from LIP emplacement is poorly understood. The Ferrar LIP in the McMurdo Dry Valleys, Antarctica, features exceptional exposures, providing a rare opportunity to investigate magmatic plumbing architecture, fluid pathways, and alteration at outcrop scales that are rarely accessible in New Zealand. Petrographic analysis of doleritic intrusions and sedimentary host rocks has identified several secondary alteration minerals, including clays, carbonates, sulfides and chlorites, indicative of changing hydrothermal conditions. Ongoing XRD, SEM, EMPA and stable C, O and H isotopes will further constrain fluid and carbon sources, and pressure-temperature conditions throughout the plumbing system. To assess the applicability of these findings, petrographic analyses will be compared with those of the Puhipuhi mafic volcanic system in Northland, New Zealand, which is a potential mineral exploration target. This will determine whether similar alteration assemblages and hydrothermal processes are present, despite differences in emplacement conditions. This work contributes to an improved understanding of the development and operation of hydrothermal systems associated with mafic intrusions and provides a framework for interpreting alteration patterns and fluid/volatile movement in partially exposed settings.

Biochar Adsorption for Heavy Metal Removal from Synthetic Water Systems Representative of Mining Conditions

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Keywords: Wastewater treatment metals

ABSTRACT

Mining wastewater is characterised by elevated concentrations of dissolved heavy metals such as copper (Cu^{2+}) and zinc (Zn^{2+}), generated through geochemical processes including sulphide mineral oxidation and acid formation. These contaminants pose significant environmental risks and require effective treatment prior to discharge. Adsorption using biochar has gained increasing attention as a cost-effective and sustainable treatment method due to its high surface area, porous structure, and abundance of functional groups capable of binding metal ions. However, despite extensive research on adsorption performance, limited attention has been given to optimising operational parameters such as adsorbent lifespan and replacement timing.

This study investigates the performance of biochar for the removal of heavy metals from aqueous solutions under batch conditions, with a focus on determining the optimal replacement time of the adsorbent. Synthetic wastewater representative of mining conditions is used to evaluate adsorption behaviour under controlled laboratory settings. Key parameters including initial metal concentration, contact time, and adsorption capacity are analysed to assess system performance. Adsorption isotherms and kinetic models are applied to characterise the equilibrium and rate behaviour of the system, providing insight into the dominant mechanisms governing metal removal.

A central aim of this research is to establish a performance-based framework for determining when biochar should be replaced to maintain treatment efficiency. By analysing the relationship between adsorption capacity, removal efficiency, and contact time, the study identifies critical thresholds at which adsorbent performance declines. This provides a more practical approach to system operation compared to fixed or arbitrary replacement schedules.

The findings contribute to improving the applicability of adsorption processes in mining wastewater treatment by linking laboratory-scale performance to operational decision-making. This research supports the development of more efficient and reliable treatment strategies, particularly in systems where maintaining consistent removal performance is essential.

North Rough Ridge Gold Mineralisation

George Osborn

Lead Author - University of Otago

Keywords: Gold, Mineralisation, High-Grade-Schist

ABSTRACT

This research and mapping project investigates the possibility and distribution of gold deposits within fluvial deposits that overlie high-grade schists at North Rough Ridge in Central Otago, New Zealand. The main focus is to understand how the local schist and surrounding sediments control the concentration, transport and deposition of gold deposits. Field observations will be used, such as structural mapping and sediment sampling of the metamorphic schist and the overlying soft sediment deposits, including sediment thickness, thin section analysis, grain size distribution and gold deposit frequency.

A key aim of the project is to identify the geological controls that influence the formation of one of the most expensive and precious metals in the world. High-grade Otago schist is well known for having highly suitable amounts of gold mineralisation, from which erosion can release this gold that can be transported to fluvial depositional environments.

The findings of this research are relevant to the minerals industry because gold deposits are an important exploration region for economic businesses, including jewellery, electronics, aerospace and technological advancements. Central Otago, along with the West Coast, was once the pinnacle of the New Zealand gold rush, with many deposits being unused today, including North Rough Ridge. Improved understanding of spatial variability and how these processes work, to expose these gold deposits, can help pinpoint other locations where gold-rich deposits may be frequent. This research project may help assist in identifying the ideal depositional environments and improve the prediction of gold distribution within the mining companies of New Zealand. Ultimately, this project can contribute to refining and improving the accuracy of potentially economic gold deposits within high-grade metamorphic regions globally.

Fast-track for mining. How it works and lessons from OceanaGold's Waihi North project

Alison Paul[1], Hamish Harwood[2]

OceanaGold[1], Simpson Grierson[2]

Keywords: Fast-track, consenting, Waihi North

ABSTRACT

The Fast-track Act represented a game-changing shift in processing consents and other approvals in New Zealand. It has unlocked important mining, aggregate, infrastructure, and energy projects in its first year of being in force.

This presentation would provide analysis and reflections on what the Fast-track process is and how it is working for mining projects through the lens of first-hand experience from OceanaGold's successful Waihi North Fast-track application. The Waihi North project was the first mining project to be considered under the regime.

The session would cover the key differences between a Fast-track process and standard processes, and how the Fast-track process works in practice.

It will provide first-hand reflections and lessons from the Waihi North process, which will be valuable to persons in the industry that are thinking about opportunities that may be available under the Fast-track Act, or are currently using the process.

The presentation will be by Alison Paul, Senior Vice President Legal and Public Affairs of OceanaGold and Hamish Harwood, Senior Associate at Simpson Grierson.

From Geological Data to Operational Confidence: Practical Data Governance for Mining Geology Across the Mine Value Chain

Henry Dillon

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Keywords: Data Governance, Traceability, Decision Confide

ABSTRACT

Mining geologists sit close to many of the decisions that shape day-to-day operational performance. However, the data behind those decisions often still moves through copied files, disconnected systems, and informal handovers. In practice, this can make it difficult to know which version is current, what has changed, who changed it, and whether the data in use is the right basis for the next decision.

Confident operational decisions start with well-governed geological data. This presentation makes that case from a mining geology perspective, arguing that versioning, traceability, and clearer control are not administrative extras, but practical ways to replace informal file-based governance with a system that makes geological data status, history, and approval easier to trust.

For mine geologists, that trust comes from being able to see which data is current, what has changed, who made the change, what is approved, and how geological information has evolved before it is used in modelling, planning, reconciliation, and operational decision-making. Practical data governance such as versioning, traceability, recoverability, ownership, and controlled data flow, underpins the mining decision chain, where geological interpretations shape outcomes from resource models through to production.

In that environment, teams need more than available data; they need data they can trust and decisions they can understand in context.

A staged approach strengthens existing desktop geology workflows, improving reconciliation, tightening cross-team handoffs, and producing decision-ready geological information.

Getting Coupled – How a groundwater model and a water balance model get together for final void pit lake predictions

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Keywords: Water, Closure, Efficiency

ABSTRACT

Mining operators' rehabilitation costs can be reduced by minimising a mining site's residual risk liability. For open cut mines, this means predicting the long-term behaviour of water in residual mining voids (i.e., pit lakes) after closure because of the risk of pit lakes acting as sources of contamination of groundwater.

Pit lake formation is most often governed by a mixture of groundwater and surface water processes. However, these two water flow regimes act at different timescales, which is reflected in the fact that surface water models use minute-to-daily timesteps whilst groundwater models apply weekly-to-multiannual timesteps. For many closure pit lake level predictions, water balance models (simulating surface water) and groundwater models are run iteratively but separately. For example, a GoldSim water balance model simulates pit-surface water interaction and passes predicted results to the groundwater model. The groundwater model applies those results as boundary conditions and passes predicted groundwater-pit results back to the water balance model. This cycle is iterated until water balance and groundwater simulation results converge.

We present a python-based tool which encompasses the groundwater and water balance models and conducts the iterations automatically. The presentation will give examples for applications in complex site settings, including sites with multiple voids.

Emerging New Flotation Technologies for Gold extraction from Sulphides Ores – A critical Review

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Keywords: Gold, Sulphides, Froth flotation

ABSTRACT

Owing to the depletion of high-grade and free-milling gold ores, the gold mining industry is into the zone of low-grade, finely disseminated ore bodies. These ore bodies are complex with the gold often occurring as sub-micron inclusions in matrices of sulphides and in some cases as accessory mineral mainly in copper ores, these often requiring a froth flotation step in the gold extraction chain. Consequently, new technologies have evolved over time for optimum gold recovery from such complex gold-sulphide ores without compromising economic aspects or environmental considerations. This review closely looks at the technological advances particularly in the froth flotation domain and in the context of flowsheet design, flotation reagents synergy and flotation machines. It briefly covers the current practices with some highlights on future perspectives.

Development of a Long-Term Passive Treatment System for Iron and Arsenic in Mine Water, Snowy River Mine, West Coast, New Zealand

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Keywords: Mine-water, Geochemistry, Passive-treatment

ABSTRACT

Elevated iron and arsenic levels are present in mine water from the historic Blackwater Mine and current Snowy River Mine due to gold mining. This water eventually ends up in the local river system after treatment.

Current passive and active treatment systems are in place at Snowy River Mine to treat the water before it is discharged into Snowy River. This project aims to develop a fully passive treatment system that can be transitioned to at Snowy River Mine post-closure, that can sustainably treat the mine water from both Snowy River Mine and Blackwater Mine long-term.

The end goal is to achieve the most effective system, by forming and analysing an accurate profile of the water's initial chemical and physical parameters, through sampling and testing. This will involve Inductively Coupled Mass Spectrometry (ICP-MS), X-Ray Fluorescence (XRF), microscopy, and chromatography. This is followed by modelling and testing different approaches and adjustments to the treatment system with water balance models and field and/or lab trials.

Following the results of the initial water parameters, a treatment system will be designed which aims to adsorb arsenic onto precipitated iron through oxidising systems. These include but are not limited to vertical flow reactors, oxygenating cascades, aerobic wetlands, and settling ponds. Sulphate-reduction to form sulphide minerals may also be considered as an alternative solution if pH and sulphate concentrations differ from what is currently expected.

The end result of this project will be a long-term, sustainable and low-cost passive treatment system that effectively removes contaminants, allowing the mine water to be safely discharged, meeting consent criteria in the post-closure phase to ensure local ecosystems are protected.

Innovation and Discovery Trends

Keenan Jennings

Chief Exploration Officer, OceanaGold Corporation

Keywords: Innovation Discovery AI

ABSTRACT

The careful and thoughtful deployment of innovative techniques is a leading indicator to discovery. As we continue to seek new resources to meet burgeoning societal demands, the next wave of innovation is here, but will it deliver results? Relentless data collection and harvesting of historical data repositories are the fuel dumps for the increasing application of Artificial Intelligence as part of the Discoverer's toolkit. But is this the right engine? What else is needed? As we step into this brave new world, what are the questions we need to be asking ourselves?

Oxygen isotope geochemistry as a discriminant of origin and thermal-fluid conditions in New Zealand scheelite deposits

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Keywords: Scheelite isotope geochemistry

ABSTRACT

Scheelite ($CaWO_4$) deposits in Aotearoa New Zealand occur across a range of geological settings and so offer an opportunity to examine the diversity of tungsten mineralising systems using oxygen isotope geochemistry. This study presents $\delta^{18}O$ data from quartz and scheelite mineral separates from six scheelite mineralised sites, Bateman Creek, Barrytown, Canaan Downs, Round Hill, Glenorchy, and Kirwans Hill, to constrain the nature and origin of mineralising fluids and to evaluate whether O-isotopes can effectively discriminate between different styles of tungsten mineralisation.

Quartz-scheelite oxygen isotope thermometry reveals a broad range of equilibration temperatures and calculated $\delta^{18}O_{water}$ value compositions across the deposits. Kirwans Hill scheelite crystallised at the highest temperatures (~350-525 °C) with calculated $\delta^{18}O_{water}$ values of +2 to +7‰, consistent with dominantly magmatic-hydrothermal fluids. In contrast, scheelite at Canaan Downs formed at lower temperatures (~190-250 °C), with calculated $\delta^{18}O_{water}$ values extending to negative values (as low as ~ −3.5‰), indicating significant incursion of meteoric water. Barrytown, Glenorchy, Round Hill, and Bateman Creek yield intermediate temperatures and near-zero to slightly positive $\delta^{18}O_{water}$ values, suggesting variable mixing between meteoric and/or magmatic and metamorphic fluid end-members.

Plotting $\delta^{18}O$ values of co-existing quartz versus scheelite further highlights systematic differences between deposit groups, with Kirwans Hill and Canaan Downs occupying distinct low quartz $\delta^{18}O$ value fields, while Round Hill and Glenorchy define a higher $\delta^{18}O$ value quartz cluster. Together, these data demonstrate that oxygen isotopes are an effective tool for distinguishing fluid source and mineralising style across New Zealand's scheelite occurrences, with implications for regional exploration targeting.

Where to from here? How do we navigate a safe passage as we deal with changing currents, jagged rocks and the luring call of sirens?

Kit Wilson

Communications Manager (NZ) OceanaGold

ABSTRACT

This presentation will address the issue we all face: how do we ‘do the business’ in an increasingly complex world in which change seems to be the only constant? How do exploration juniors, developing mine sites and established operations identify issues, liaise with multiple stakeholders, manage expectations and include all of this into a recipe which works? And how do we ‘keep the faith’ while doing all of this?

The Future of OceanaGold's Macraes Operation, New Zealand's Largest Gold Mine

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Keywords: Tailings, Macraes, Growth

ABSTRACT

Gold price has significantly increased from approximately USD2,600 /oz in December 2024 to approximately USD4,600 in December 2025. The increase in gold price has led to a review of options for the future of Macraes Operation.

Macraes Operation survived low gold price days of sub USD500 /oz by innovative practices that reduced operating costs. These practices included filling pits with waste rock or tailings to reduce truck hauling costs and Tailings Storage Facility (TSF) construction costs. These practices allowed Macraes to thrive at low gold prices and enabled OceanaGold to be what it is today, a profitable company with four producing assets.

To present day mining engineers and geologists these practices would seem counterproductive especially when the material has to be relocated to make way for expanding pits. However, this is what has made Macraes withstand the low gold price pressures back then to be able to survive for 36 years and finance OceanaGold's purchase of the other assets.

With the current gold price rise, the operation is facing a challenging task of re-mining tailings that were deposited into a pit that has potential to increase Macraes Life of Mine. This paper discusses the methods that were assessed, leading to the selected remining method.

Storage to Liability: Managing Long-Term Risk

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Keywords: Environmental liability, Waste management, Contaminated land

ABSTRACT

Environmental liability does not stay fixed. It changes over time as regulations evolve and scientific understanding improves. What was acceptable practice yesterday can become a significant environmental liability today.

Based on recent New Zealand experience with contaminated land assessments, this presentation explores how environmental liability develops over time through the way materials are stored, contained, or applied in the environment, and how these can shift from routine management into long-term responsibility. Practical examples relevant to the mining and resource sector activities include:

- The National Environmental Standard (NES) for Storing Tyres Outdoors (NES STO), which came into force in 2021, introduced stricter requirements that have changed previous stockpiling practices. Operators may need to obtain consents and update practices to meet safety and environmental expectations, including fire prevention protocols, separation distances, and regular site inspections.
- Landfills that met past standards, along with hazardous material storage on mine sites, are increasingly recognised as ongoing environmental risks. The NES for Assessing and Managing Contaminants in Soil to Protect Human Health (NESCS) sets out requirements for identifying, assessing, and managing these risks, often requiring site investigations and forward planning.
- Emerging contaminants like per- and polyfluoroalkyl substances (PFAS) indicate that materials once considered low risk can become significant concerns as new knowledge develops. At mine sites, PFAS are commonly associated with the use of aqueous film-forming foams (AFFF) for fire training and industrial wastewater streams. Additionally, biosolids used for mine rehabilitation as a form of beneficial reuse are also now under increasing scrutiny due to potential PFAS contamination.

The presentation encourages operators to consider how current practices may be viewed in the future, and how long-term environmental risk can be better managed to enable smarter decisions and sustainable outcomes.

A Probabilistic Screening Tool for Long-Term Pit Lake Water and Load Balance Estimation

Leonardo Navarro-Valdivia, Ryan Burgess, Paul Weber

Keywords: Mine closure, Pit lake, Water balance, Monte Carlo simulation, Python

ABSTRACT

Anticipating the filling behaviour and long-term water quality of pit lakes is essential for effective mine closure planning and environmental management. Although sophisticated deterministic and probabilistic models are available (e.g. GoldSim), the industry also requires practical, high-level screening tools for the rapid assessment of long-term risks associated with pit lakes. To address this gap, a probabilistic water and load balance tool was developed to facilitate efficient preliminary pit lake assessments. This approach allows environmental and closure professionals to conduct robust preliminary assessments independently, thereby reducing the reliance on external resources.

The underlying computational engine calculates net volume changes by integrating direct precipitation, evaporation, catchment runoff, groundwater exchange, and active pumping. The tool features a modular architecture, allowing the water balance to be computed and calibrated independently. Once the hydraulic parameters are established, a secondary load balance module can be toggled on. This couples the hydraulic flows with specific geochemical source terms (e.g.,constituent concentrations or mass loading rates) for each individual component, alongside contributions from pit wall rock weathering. The model employs a fourth-order Runge-Kutta (RK4)numerical method to handle stage-volume-area relationships and track cumulative constituent mass.

Optimised for rapid screening rather than granular simulation, the tool operates on a monthly timestep, assumes a well-mixed water column, and utilizes a repeating annual climate cycle, thereby optimising computational demands and simplifying user inputs.
To address the uncertainties inherent in long-term forecasting, a Monte Carlo simulation framework is integrated into the engine. By assigning statistical variances to key hydrological-hydraulic parameters as well as the geochemical source terms for each component, the model executes numerous iterations to produce probabilistic filling and concentration trajectories. This methodology captures statistical confidence intervals from the 5th to the 95th percentiles for lake elevations, individual flux volumes, and resultant water quality concentrations.

While the tool is designed for future cloud-based deployment via a web interface to provide cross-platform accessibility, it is currently implemented as an open-source repository for local execution. This approach ensures immediate usability for environmental professionals while providing a foundation for automated, web-hosted reporting.

Long Tails, Big Elephants: What Rank-Size Distributions Reveal About District Potential

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Keywords: Rank-size distribution, Epithermal Gold, Exploration Potential

ABSTRACT

Assessing exploration potential at a district scale remains challenging, particularly where datasets span long histories of mining and evolving exploration methods. This study applies rank–size (Zipf) and Pareto scaling analysis to a compiled dataset of gold endowment across the Hauraki–Coromandel district to examine how sampling biases and temporal changes in exploration influence interpretations of mineral potential.

The resulting distribution is strongly heavy-tailed, with a small number of deposits contributing the majority of total ounces. However, the dataset is dominated by historical mining records, which preferentially sample shallow, surface-accessible portions of epithermal systems. Modern exploration provides a contrasting set of observations: at Martha, contemporary mining and reinterpretation have substantially increased recognised endowment without new surface discovery, while Wharekirauponga represents a significant addition derived from modern drilling beneath limited surface expression.

The persistence of linear scaling in the upper portion of the distribution suggests a robust heavy-tailed endowment model. However, sparse modern drilling coverage — particularly beneath cover and at depth — indicates that the dataset represents a censored sample of the underlying population.

This study demonstrates how integrating statistical scaling with an understanding of observational bias provides a more robust framework for assessing exploration potential in well-endowed epithermal districts.

Paleohydrologic evolution of epithermal gold-silver deposits of the Hauraki Goldfield, New Zealand

Mark Simpson

ABSTRACT

Epithermal deposits of the Hauraki Goldfield have produced >12.7 Moz Au and >55.9 Moz Ag and several preserve evidence for evolving paleohydrology. At the Waihi vein system (>8.9 Moz Au), preferred 40Ar/39Ar dates for vein adularia from Martha (6.16 ± 0.06 Ma) and Favona (6.05 ± 0.08 Ma) veins indicate near synchronous formation. However subtle age differences may reflect lateral migration of fluid upflow by ~1 km during mineralisation.

At Favona, localised east dipping silica sinter that overlie hydrothermal breccias occurs between 115 and 65 m relative current sea level (m RSL) and formed at the paleosurface. In contrast, the depth estimates for platy calcite-hosted fluid inclusions at Favona indicate formation beneath a higher paleowater table at ~260 m RSL. A similar mismatch occurs at the Broken Hills deposit (>25 Koz Au), where silica sinter at 220 m RSL directly overlies veins that, based on quartz-hosted fluid inclusions, formed beneath a comparatively higher paleowater table at ~340 m RSL. At both Favona and Broken Hills, the most likely interpretation is that veins formed first, and sinters developed later following syn-hydrothermal erosion.

At the Karangahake deposit (0.95 Moz Au), quartz-hosted fluid inclusions indicate two paleowater table elevations: ~900 m RSL for quartz stockwork veins (best fit), and ~600 m RSL for the Maria and Crown/Welcome veins. At nearby Rahu, calcite-hosted inclusions indicate a comparatively shallower paleowater table at ~440 m RSL. Silica sinter at Ascot defines a former paleosurface at 135 m RSL. However, fluid inclusions in quartz crystals lining cavities within the sinter indicate formation beneath a paleowater table at ~430 m RSL, like that estimated for Rahu. The ~400 m depth difference between Karangahake and Rahu-Ascot suggests structural offset between the two areas. In addition, the paired depth estimates for Karangahake (~900 and ~600 m RSL) and Ascot (~430 and 135 m RSL) imply ~300 m of burial during hydrothermal activity. Such telescoping could explain the exceptional >650 m vertical extent of mineralisation at Karangahake. Collectively, these results demonstrate that detailed reconstruction of hydrologic, burial, and structural evolution is critical for interpreting epithermal systems, and that recognition of migrating fluid upflow and/or telescoping has important implications for mineral exploration.

Closing The Loop: Leveraging Real-Time Telemetry for Proactive Environmental Compliance at OceanaGold

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Keywords: Real-time Telemetry, Environmental Compliance, Operational Efficiency

ABSTRACT

As the mining industry emphasizes Sustainable Futures, having reliable, real-time data has become essential. OceanaGold is a modern gold mining company operating in New Zealand, the United States and the Philippines, with a strong commitment to responsible mining, environmental stewardship and long-term community relationships. Across their New Zealand operations, including the Waihi North Project and the restoration work at Reefton, high-quality monitoring supports both operational decisions and regulatory requirements, while helping maintain a strong Social License to Operate.

This presentation shares the work delivered through the collaboration between OceanaGold and Cirro. Cirro is a team of monitoring and instrumentation specialists who source, install and maintain field instrumentation and telemetry hardware. Together, the teams have created and expanded monitoring networks to create clear and dependable data pathways from field sensors to the people who rely on that information.

The programme covers many different mining applications including groundwater and surface water systems, pit and underground environments, geotechnical and deformation monitoring, air quality, climate and water quality sensors and tailings facilities. This involves deploying resilient hardware in remote areas such as Wharekirauponga (WKP), building reliable telemetry links and integrating a wide mix of sensors such as piezometers, inclinometers, flow meters and weather stations into a single digital environment using diverse communication protocols.

By connecting reliable field instrumentation with clear, real-time visualisation tools, the system reduces field exposure and helicopter-dependency, supports consent compliance and helps teams respond proactively to changing conditions. This transition has delivered significant efficiencies in terms of field time and reduced operational costs. This presentation concludes with a discussion on how transparent, real-time data can support a digital-first future for monitoring in mining.

From strength to function: optimising fibre-reinforced shotcrete for high-convergence underground conditions

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Keywords: Low-cement shotcrete, Fibre-reinforced ground support, Underground mining optimisation

ABSTRACT

In highly convergent underground mining environments, shotcrete performance is critical for maintaining ground stability. Conventional mix designs typically rely on high cement contents to achieve strength and durability. This study presents a two-year optimisation programme demonstrating that high-performance fibre-reinforced shotcrete can be achieved with reduced cement content without compromising safety, while maintaining structural integrity and improving application-specific performance.

A structured trial programme progressively reduced cement content while maintaining rheology and application consistency. Mix performance was evaluated through panel and cylinder testing at 7-, 14-, and 28-day intervals, supported by in-situ assessment of workability, adhesion, and sprayability. Compressive strengths of 60–80 MPa were consistently achieved across reduced-cement mixes, exceeding standard specifications. Importantly, no increase in brittleness or loss of structural performance was observed, confirming stable material behaviour. Operational performance remained consistent, with strong adhesion, good workability, and minimal rebound across varying conditions.

Optimisation prioritised practical constructability rather than fibre reduction, focusing on a mix that could be reliably produced and applied across multiple operators, equipment, and variable rock mass conditions. A reduced fibre content of 5 kg per 4 m³ was adopted as a targeted “crust” mix for application over existing ground support, including mesh. This improved penetration and direct reinforcement contact, forming a dense, shell-like layer that enhanced confinement and load transfer in high-convergence zones.

These results demonstrate a significant advancement in shotcrete optimisation, showing that fibre-reinforced systems can be tailored to specific ground support functions while reducing material demand. Lower cement content delivered annual cost savings of approximately $50,000 without additional admixtures. The optimised mix also improved spray consistency, thickness control, and application efficiency, resulting in more uniform coverage and reduced variability across operators and equipment.

Ore Sorting Technology Trials at the Snowy River Gold Mine

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Keywords: Ore sorting pre-concentration, Lithology-driven fragmentation, Narrow-vein gold optimisation

ABSTRACT

Gold mineralisation at the Snowy River Mine is hosted in narrow quartz veins within the Birthday and Christmas Reef structures, with waste rock comprising Greenland Group sedimentary turbidite sequences. The contrasting physical properties of these lithologies produce variable fragmentation during blasting, resulting in good liberation of ore-bearing quartz from waste rock and lithology-specific particle size distributions.

This study investigates whether lithology-driven differences in material characteristics can be used to upgrade run-of-mine (ROM) feed by reducing waste dilution. Two trials were conducted. The first assessed whether particle size variation between gold-bearing ore and waste could be exploited through screening to remove coarse waste material from mill feed. The second evaluated ore sorting technology to distinguish and separate ore from waste based on physical material characteristics.

Initial trials on representative ROM material screened to 20–60 mm and processed using a secondary laser sorter demonstrated clear visual separation. Results confirmed that both particle size distribution and luminescent response can effectively differentiate ore from waste, supporting the viability of combined screening and sorting as a pre-concentration strategy.

Incorporating ore sorting ahead of milling presents an opportunity to upgrade existing stockpiles and enable alternative processing pathways prior to mill construction. It also supports improved economics in marginal development areas by remove dilution material and lowering processing costs. Additionally, improved feed quality may enhance downstream efficiency and reduce energy consumption.

These findings demonstrate a practical approach to selective processing in narrow-vein deposits, highlighting the potential to improve grade control, operational flexibility, and overall project value through the integration of screening and ore sorting.

Mineral opportunity analysis of intrusion-related mineralisation in New Zealand

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Keywords: Intrusion-related mineralisation; prospectivity; mineral system; exploration targeting

ABSTRACT

Intrusion-related mineral systems are an important exploration target globally; however, their potential in New Zealand has received comparatively less attention relative to other deposit types. This has been due in part to limited geological mapping resolution, incomplete subsurface interpretations and exploration datasets, and the diverse geological characteristics of intrusion-related mineral systems. This study provides an overview and assessment of datasets that can support mineral prospectivity analysis, exploration targeting, and regional assessments of mineral potential.

Spatial analyses were undertaken using recently released geological mapping products with national exploration geochemical databases to evaluate their usefulness in identifying indicators of intrusion-related mineralisation. The study assesses the effectiveness of these datasets to recognise permissive geological environments and pathfinder geochemical signatures and identifies those most suitable for prospectivity mapping. It also identifies key data gaps where further investment would most improve exploration targeting. The results demonstrate how integrated geoscience datasets can be applied to evaluate mineral opportunity at regional and national scales. This work contributes to the development of a mineral systems framework for intrusion-related mineralisation in New Zealand and provides a foundation for future prospectivity analyses.

Re-inventing safety foundations to enable smarter risk decisions during the transition to production: Snowy River Mine

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Keywords: Safety leadership foundations, Risk-based decision-making, Frontline safety conversations

ABSTRACT

The Snowy River Gold Mine (SRGM) in New Zealand is transitioning to production - a critical phase marked by increased operational complexity and an evolving risk profile. Work becomes more repetitive, new personnel integrate with experienced teams, and production pressures intensify. While traditional safety activities including audits, inspections, and verifications remain essential and aligned with International Council on Mining and Metals (ICMM) requirements, they often provide limited insight into how work is performed, how risk is understood and how frontline decisions are made, weakening shared understanding and decision quality.

This paper presents a re-invented safety foundations approach designed to strengthen risk-based decision-making during this transition. The approach uses a simple digital application to enable structured, non-confrontational safety conversations through a targeted question set. Central to this is guided conversation that builds risk awareness, helping workers recognise hazards and understand what to look for through discussion embedded in everyday tasks, rather than relying solely on formal instruction. Rather than replacing existing assurance processes, the approach complements them by promoting open dialogue, shared learning, and trust.

Leaders and supervisors are supported to explore task execution, changing conditions, and real-time decision-making in response to emerging risks in a manner that reflects how work is done. The digital format reduces administrative burden, supports psychological safety, and reinforces a consistent language for risk across teams.

The approach is in early implementation at SRGM. Results from a prior pilot operation indicate improved consistency in safety interactions, increased workforce participation in risk discussions, and greater confidence in frontline decision-making. These outcomes demonstrate that meaningful safety improvements can be achieved without complex or resource-intensive programmes, highlighting strong potential for effective application at SRM during the transition to steady-state production operations.

Overview of Paleozoic–Mesozoic plutonism and related mineralisation, Aotearoa New Zealand

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Keywords: granite, pluton, mineralisation

ABSTRACT

Pluton emplacement in Te Riu-a-Māui Zealandia spanned much of the Paleozoic and Mesozoic (ca. 500–80 Ma) and was episodic in different parts of the continent. Cambrian–Early Cretaceous plutons are common within the Western Province basement and are collectively referred to as the Tuhua Intrusives. Plutons are uncommon in the Permian–Early Cretaceous Eastern Province basement and overlying late Early Cretaceous–Quaternary Zealandia Megasequence.

The Tuhua Intrusives are classified geographically into five batholiths (Median, Karamea, Paparoa, Hohonu, Rangitoto) and, more significantly, into petrogenetic suites that group plutons of similar mineralogy, geochemistry and age. Twelve plutonic petrogenetic suites have been recognised. From oldest to youngest these are the Jaquiery, Bonar, Karamea, Paringa, Ridge, Tobin, Foulwind, Longwood, Darran, Tarpaulin, Rahu, and Separation Point suites. Late Cretaceous–Neogene plutons are minor components of the intraplate Horomaka and subduction-related Whakaari supersuites.

These suites provide a framework that links plutonism with tectonic setting and metallogenesis. Petrogenetic suites show broad associations with mineralisation styles including, for example, porphyry Mo systems associated with the high-level Early Cretaceous adakitic I-type Separation Point Suite. However, despite this recognised metallogenic potential, known intrusion-related mineralisation in Aotearoa New Zealand has yielded limited economic production to date, reflecting both subtle fertility indicators and under-exploration of plutonic rocks.

Recent synthesis of existing and new geologic, geochemical and geochronologic data through the Earth Science New Zealand's Pluton Map project has refined the spatial and petrogenetic framework of plutonism, improving the intrusion-related mineral exploration knowledge base and highlighting key data gaps that, if addressed, will better support targeted exploration.

Prospects for antimony refining in New Zealand

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Keywords: Antimony, Stibnite, Refining

ABSTRACT

There is significant interest in antimony as a potential co-product from prospective New Zealand gold mines. Stibnite – mineral antimony sulfide – is associated with gold bearing quartz across Aotearoa, mined intermittently through to the 1940s (Christie, 2011). Today, antimony is a critical mineral with high supply risk, with over 90% of annual production from China, Russia, or aligned states (Klochko, 2026).

Conventional stibnite processing is no longer practical in New Zealand. Relying on high temperature roasting to volatilise gaseous antimony trioxide, this process is both carbon intensive and generates gaseous arsenic trioxide and sulfur dioxide. This waste gas stream is highly toxic, relying on scrubbers to remediate the gas with a high risk of dust emissions. Alternative leaching methods also face challenges given the similar chemistry of antimony and arsenic (Ling, 2024). Avoiding solubilisation of arsenic – and the technoeconomic penalty of wastewater remediation – remains unsolved.

As part of the newly funded MBIE Endeavour Programme “Next-generation ore: towards sustainable mining for regional prosperity and societal resilience”, new processes for vapour-free, highly selective routes to antimony refining will be developed. This presentation summarises the current state for antimony processing in a New Zealand context, and the key challenges to overcome for a technoeconomically and environmentally viable process flow.

Implementing Digital Logging Systems - Why it's Important and Lessons Learned

Nicola Stephen

Keywords: Digital Geological Logging, Data Quality and Standardisation, Implementation Lessons Learned

ABSTRACT

With geological data underpinning critical real-world decisions in both mining and exploration, many teams still rely on paper-based or siloed data collection systems that limit the value of the data. What does it actually take to move to digital logging and is it worth it?

This presentation will share practical experiences from implementing digital logging systems across multiple projects, including exploration and mining. It will explore the benefits of going digital, including improved data consistency, real time validation and more efficient workflows from field to database. It will also touch on the problems and pitfalls of user adoption in field environments and integration with existing geological workflows.

This presentation will offer an honest experience-based perspective of digital logging approaches with insights that can be applied regardless of the tools being used.

Potential for scheelite as a by-product from orogenic gold deposits in New Zealand

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Keywords: Scheelite, Orogenic Au deposits, Ore characterization

ABSTRACT

With growing demand for critical metals and calls for more efficiency and sustainability of mining, processing of by-product metals at active production sites is becoming more attractive. The presence of scheelite associated with orogenic gold deposits in the South Island of New Zealand has been known since the deposits' discoveries; however, as a by-product the scheelite distribution and resources have not always been documented. Until recently, scheelite recovery has not been seen as economic, which limited systematic study of scheelite resources across the orogenic gold deposits. As part of the Next-generation ore project, we are surveying available literature and databases to catalogue potential tungsten resources, and performing new sampling at old and active mine sites to characterize scheelite-bearing material for potential processing and re-processing and recovery of W. Scheelite-bearing tailings from a historic tailings site and from the active Macraes Au deposit are characterized using detailed petrography and LA-ICP-MS analysis in terms of paragenesis and W and REE content. This will help in understanding during which step of the ore processing it is optimal to economically extract scheelite.

Stop Burying the Data

Paul Burton

Chief Executive - Cirro

Keywords: Data, Monitoring, Decisions

ABSTRACT

Mine owners, consultants and contractors rely on geotechnical data to support safety-critical and operational decisions, yet that data is often fragmented across reports, spreadsheets, and monitoring systems. Over the life of a mine, this can make it difficult to maintain confidence in assumptions, retain knowledge, and interpret ground behaviour in context.

This presentation considers the role of standardised geotechnical datasets in providing a consistent foundation for understanding ground conditions, and how this can be complemented by instrumentation and monitoring as mining activities progress. This discussion explores how better-connected data can support clearer insights and more defensible decisions.

Tailings Repurposing - A new mining industry gaining significant momentum

Paul Greaney

GHD Pty Ltd

ABSTRACT

Instead of storing mine waste in complex and vulnerable tailings dams, miners are looking to convert waste into valuable minerals, chemicals and construction materials, mostly utilising existing infrastructure, whilst making a profit doing so. Some progressive miners are already realising the benefits …

Whilst some mines already use ‘reprocessing’ to reclaim minerals from tailings, ‘repurposing’ is an emerging practice of converting mine waste into construction materials, such as geopolymers, aggregates and engineered soils. If you extract the precious, critical and strategic metals, as well as the chemicals that were used in the processing, you're basically left with a quarry. Now you can make low-cost, low-carbon concrete (including pre-cast), as well as soil for land reclamation and aggregates for road construction. With the forecast demand for concrete is clearly showing an undersupply scenario in the coming decades, we have the perfect conditions to rehabilitate mines and make a profit doing so. It’s good for the local environment and the numbers stack up!

Limited tailings storage capacity can also constrain production. It’s a difficult decision for miners to slow down production due to their tailing's impoundment areas approaching capacity, especially given current prices for such commodities as copper and gold. Tailings repurposing deals with this constraint and may mitigate the need to build new impoundments. Tailings repurposing also removes the risk of acid mine drainage and mitigates dam failures. It also means that when a mine closes, there could be another 20 years’ worth of repurposing production to support the local economy and communities with jobs.

The ultimate goal is to have repurposing systems installed at the same time as a new mine is built, so you have virtually no tailings and no waste. And when it comes time to close the mine, the biggest liability is already gone. This would be a great legacy to leave the next generation, compared to the alternative!

Ettringite Formation in Mine-Impacted Waters

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Principal Environmental Geochemist - Mine Waste Management[2]

Keywords: Ettringite, water treatment

ABSTRACT

This paper reviews the process of ettringite formation in mine-impacted waters that are elevated in sulfate due to sulfide mineral oxidation. Two water types are assessed including acid rock drainage (ARD) and neutral metalliferous drainage (NMD).

Ettringite ($Ca_6Al_2(SO_4)_3(OH)_{12}\cdot 26H_2O$), a calcium-based aluminium sulfate mineral, forms at elevated pH ~12.0 – 12.5 (Zahedi & Mirmohammadi, 2022) where sufficient sulfate, calcium, and aluminium are present in solution.

Ettringite formation can be problematic (e.g., scaling in ARD affected waters) or beneficial (treatment of NMD affected waters) and examples are provided.

Minerals Exploration Limited (ASX/NZX: MEX): Brownfields Gold Exploration in New Zealand's Hauraki Epithermal and Otago Orogenic Goldfields

Peter Zitnan

Geologist - Otagold Limited

Keywords: Epithermal Au-Ag, Hauraki goldfield, Exploration

ABSTRACT

Minerals Exploration Limited (ASX/NZX: MEX) is an Australian-listed junior explorer pursuing brownfields gold exploration across four projects in New Zealand's North and South Island gold belts. This presentation outlines the company's strategic positioning, project portfolio, and near-term exploration activity.

MEX's flagship asset is the Waitekauri Gold Project, a 58 km² located in the prolific Hauraki Goldfield, just 8 km west of OceanaGold's Waihi mine (10 Moz Au) and 4.5 km southwest of the high-grade WKP discovery (2.2 Moz Au @ 14.3 g/t). The project sits on the same NE/SW mineralised structural trend as three other major Au deposits - Golden Cross, Karangahake and WKP. Mineralisation style is low-sulphidation epithermal, hosted in bonanza-grade Au-Ag quartz veins typical of the Coromandel Volcanic Zone. Historical underground channel sampling at the Jubilee prospect returned grades including 13 m @ 80 g/t Au and 24 m @ 45 g/t Au, with historical production averaging 48 g/t Au+Ag. Recent rock chip assays by MEX returned up to 70 g/t Au with abundant banded quartz boulders discovered in Scotia Creek catchment assayed 5-27.5 g/t Au.

On the South Island, MEX holds the Invincible Au-W (164 km²) and Oturehua Au (32.4 km²) orogenic gold projects in the Otago Goldfields, both proximal to major operating mines and carrying historical production records. Invincible targets gold- and tungsten-bearing veins on the TZ3–TZ4 schist contact, the same structural setting as OceanaGold's Macraes (+8 Moz Au) and Santana Minerals' Bendigo-Ophir (2.2 Moz Au). Oturehua's Golden Progress Mine produced an estimated 15–20 koz at 48.8 g/t Au. A fourth permit application at Waiorongomai adds further brownfields exposure within the same Hauraki structural corridor.

Improving Geotechnical Confidence at Waihi North Using Datarock Core

Phil Greville

Keywords: Geotechnical, AI, Waihi

ABSTRACT

Datarock provides production-ready, explainable AI solutions for geological and geotechnical data collection through Datarock Core, Datarock Chip and Datarock Televiewer, supported by specialist consulting services. These tools help improve the speed, scale and consistency of subsurface data acquisition, enabling more reliable datasets for technical decision-making.

Reliable and consistent geotechnical data is fundamental to mine design, ground support selection and risk management, yet many mining projects rely on datasets collected over extended periods, often with variability in logging practices and data quality. This can introduce uncertainty into rock mass characterisation and increase reliance on conservative engineering assumptions.

This abstract outlines a case study from OceanaGold's Waihi North project, a technically and socially complex development involving underground access in proximity to environmentally sensitive areas. In this context, improving the quality, consistency and coverage of geotechnical data is critical to support defensible engineering decisions.

Datarock Core, an automated photo logging platform, was used to analyse current and historical drilling. The approach enabled rapid geotechnical interpretation across a larger volume of drill core, with outputs validated against existing geotechnical logs. This increased spatial coverage of key geotechnical parameters, improved consistency between historical and newly acquired data, and reduced reliance on assumptions in areas of limited data.

The project demonstrates the practical application of AI-assisted geotechnical logging in a complex mining environment and highlights key considerations for implementation, including validation, data integration and workflow adoption. These findings provide insight into how similar approaches can be applied to enhance geotechnical confidence and decision-making across the mining industry.

Choose Your Words Carefully: Lessons and Data Driven Models for Contaminant Decay in Mine Seep Water

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Keywords: Contaminant decay, Modelling, Seep chemistry

ABSTRACT

Water that percolates through waste rock stacks (WRSs) in mines often leaches contaminants such as metals and acidity. To avoid breaching environmental consent conditions, when this water seeps out at the surface downgradient of a WRS it may require treatment to remove these contaminants prior to being allowed off-site.

The decrease in contaminant concentrations occurs slowly, typically over 10's to 100's of years, which means that elevated concentrations continue to be present in the seep water past the active period of a mine. Successful mine closure planning needs to account for how long such water may need to be treated. Hence, estimates of contaminant concentrations well into the future are required. The rate of concentration decay is a more concise way of expressing future estimated contaminant concentrations and so is used when discussing closure plans.

Decay rates are commonly discussed using very similar terminology for technically distinct concepts. There is room for misunderstanding both in how authors present their numbers and in how stakeholders understand them. It is therefore very easy to conflate concepts and to compare numbers that are in fact not comparable.

A recent and ongoing project has been gathering data from seeps across Stockton Mine, combining this with data from historical reports, and this data is being collated to provide updated predictions of contaminant decay rates. Several human, business, and data related factors can drive the selection of a decay model, and in this project no one model stands out as a clear best choice.

This presentation demonstrates lessons learned by looking at some well-used contaminant decay rates for Stockton Mine and re-evaluating them using a consistent methodology. It then shows the complexity of decision making for a decay model even when solely data-driven and presents an argument for the selection of the most suitable model(s).

Sams Creek gold deposit: an intermediate-sulfidation epithermal gold system, hosted by a peralkaline granite dike, West Nelson, New Zealand

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Keywords: Gold, Intermediate-sulfidation, Epithermal

ABSTRACT

The c. 1-million-ounce Sams Creek gold deposit is hosted in a c. 320 Ma ferroan peralkaline granite dike that intrudes Ordovician metasedimentary rocks of the Takaka Terrane. Ar-Ar dating of amphibole from least-altered granite yields a forced plateau age of 326 ± 1.8 Ma. Thin alkaline lamprophyre dikes along the granite margins may represent a parental magma of the Sams Creek granite. The granite is enriched in LREE, Zr, Nb, and U, with lesser enrichment in HREE, and lacks primary magmatic zircon, consistent with suppressed zircon saturation in peralkaline melts. The granite and associated lamprophyre record multiple deformation and hydrothermal events. Four stages of alteration and associated mineralisation are recognised: (1) a magnetite-carbonate□biotite□chalcopyrite assemblage, (2) quartz-carbonate-pyrite veinlets, (3) arsenopyrite-pyrite-quartz-siderite □ graphite veins, and (4) gold/electrum bearing arsenopyrite-pyrite-quartz-galena-chalcopyrite-sphalerite veins. Stage 3-4 sericite alteration yields an Ar-Ar age of 122 □ 10 Ma, consistent with a U-Pb age of 114 ± 6 Ma from hydrothermal zircon, indicating Early Cretaceous mineralisation. Aqueous fluid inclusions with salinities of 1.4 to 8.6 wt% NaCl equiv. and □34S values of +5 to +10‰ in sulfides support a magmatic fluid component. Mineralisation characteristics are comparable to an intermediate sulfidation, epithermal-style magmatic-hydrothermal system, with similarities to the Porgera gold deposit, Papua New Guinea. New geochronological constraints reveal a ~200 Myr gap between granite emplacement and gold mineralisation, demonstrating that the Sams Creek system is not directly related to emplacement of the host intrusion. Mineralisation instead reflects a Cretaceous magmatic-hydrothermal event plausibly linked to 128-114 Ma Separation Point Suite magmatism. A large magnetic anomaly below the Sams Creek deposit has been interpreted as a buried pluton.

Controls on gold and arsenic mineralization along the Cap Burn Fault, east Otago

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Keywords: Au–As mineralisation, Structural controls, Otago Schist

ABSTRACT

The Cap Burn Fault is a ~10 km-long, northeast-trending normal fault which separates upper greenschist facies TZ4 schist from a block of lower greenschist facies TZ3 schist on the NE margin of the Otago Schist. The fault lies along strike with the Footwall Fault bounding the Hyde-Macraes Shear Zone which hosts the >10Moz Au Macraes mine and the Thomson Gorge Fault which truncates the mineralized Rise and Shine deposit (>2 Moz Au). Anomalous gold and arsenic in Cap Burn rock chips and soils (>0.6 g/t Au and 425 ppm As), drill core (up to 1.6 g/t Au, >10000 ppm As) and RC chips (1.26 g/t Au) are reported in the higher grade schist on the southwest side of the fault. Drillhole CBN0011 is the deepest diamond drill hole drilled to date (219m) and intersected gold grades up to 1.2 ppm (1.6g/t); however, the structural and lithologic controls on mineralization remain poorly constrained. This study investigates whether mineralization is controlled by fault-related extensional brittle structures or more ductile shearing comparable to that observed within the Hyde-Macraes Shear Zone. An integrated analytical approach is applied, combining detailed drill core logging with Scanning Electron Microscopy with Energy Dispersive Spectroscopy (SEM–EDS) and Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS). These methods will be used to characterize mineral assemblages, define a mineral paragenesis, and determine trace element distributions within any auriferous sulfides. The results will provide new insights into the structural and lithological controls on Au–As mineralization along the Cap Burn Fault and contribute to improved exploration targeting.

Water ingress into mine waste storage facilities: how to estimate a key closure liability

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Keywords: Closure, mine water, net percolation

ABSTRACT

Acid and Metalliferous Drainage (AMD) from Mine Waste Storage Facilities (MWSFs) is one of the largest risks a mine project can pose to the downstream receiving environment and society. Understanding the water ingress, or Net Percolation (NP), into a MWSF is critical to estimating AMD impacted seepage collection and treatment requirements to manage impacted water responsibly.

Although conceptually simple at first glance, reliably estimating NP can be challenging, with a number of factors potentially influencing water ingress into MWSFs. Ultimately, reliable estimates of NP will best inform mine water management requirements for a given mine.

In this talk, the author will provide an overview of methods available to estimate NP into MWSFs, highlighting strengths and weaknesses of each method.

Water Resource Management in Mining: Integrating Multi-Criteria Decision Analysis (MCDA), Probabilistic Water Balance Models, and Climate Risk, for Strategic Outcomes

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Senior Consultant[1], Associate Consultant[2]

Keywords: Water Management, Water Balance, Climate Risk

ABSTRACT

This paper outlines a framework that integrates GoldSim-based Water Balance Model (WBM) with a Multi-Criteria Decision Analysis (MCDA) logic to balance competing objectives, operational reliability, regulatory compliance and social responsibility for the Mining Industry.
A core component of this approach is the quantification of climate risk by integrating the MCDA with probabilistic water balance modelling. By using WBMs, mining operations gain a clearer understanding of their water capacities and can better future-proof their sites against climate change and operational water risks.

The framework moves beyond historical averages toward stochastic modelling by simulating hundreds of potential climate sequences. This enables operations to quantify and compare risk across dry and wet scenarios, supporting more resilient planning and decision-making.

By applying the MCDA framework, the mining industry can formally structure decision problems, such as water allocation and discharge priorities, by explicitly weighing criteria such as regulatory compliance, operational reliability, and social accountability. This ensures that operational demands are met while transparently fulfilling secondary obligations, such as supply agreements.
A core pillar of the minerals sector is ensuring that the mine's technical performance is known and that responsible practices are clearly recognised by stakeholders. These tools enable non-specialist stakeholders to navigate the decision-making process with clearly defined potential outcomes.

By transforming complex hydrological data into understandable, risk-based outcomes, this integrated approach supports the New Zealand industry’s commitment to Te Tiriti o Waitangi and responsible resource development. It provides a robust, transparent base for stakeholders and the site to understand infrastructure investment and long term planning needs, helping ensure the industry remains resilient in a changing global climate.

Simple Models, Smarter Decisions: Understanding Prediction Reliability for Better Mine Dewatering Outcomes

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Intera Geosciences[1,2], Colorado School of Mines[3]

Keywords: Uncertainty, Risk analysis, Mine dewatering,

ABSTRACT

Dewatering predictions are typically delivered using a single calibrated parameter set providing– one drawdown, one cost, one design. Yet multiple interpretations of the same pumping-test data can fit the observations equally well, and each implies a different outcome. Focusing on a single solution, rather than the range of plausible outcomes misrepresents costs and obscures uncertainty that drives financial and operational risk. Presenting only the "best" estimate tells managers nothing about how reliable that prediction is – information critical to those setting budgets, scheduling production, and weighing investment decisions.

We show how a straightforward analytical model, coupled with a Bayesian statistical framework, gives managers something a single-answer prediction cannot: a clear view of the range of plausible outcomes and how much confidence to place in a given forecast. Building on Benson et al. (2026), we carry that understanding of uncertainty through to what decision-makers care about – drawdown, energy use, and operating cost. A volume–price risk analysis answers questions directly relevant to planning: "what is the probability we stay within budget at this pumping rate?"

To make this accessible, we present a proof-of-concept interactive dashboard that visualises cost, risk and production trade-offs. Grounded in Bayesian probability, the approach updates as new data arrive – such as additional pump tests or revised dewatering designs – improving reliability over time and keeping the analysis as a living decision-support tool, not a static report. Advances in AI-assisted tooling make this workflow easier to implement than ever.

Adopting this approach requires a shift in mindset: towards quantifying how reliable our predictions are rather than presenting a single answer as though it were certain. Managers often weigh financial and safety risk probabilistically; groundwater management predictions should offer the same transparency. The tools are straightforward and ready; the opportunity is to put them to work across the mine life cycle.

Scaling up Exploration at the Macraes Gold Project

Sean Aldrich

ABSTRACT

The Macraes Gold Project, New Zealand, is a mature, world-class orogenic gold system with more than 35 years of continuous production. By the end of 2025, over 1.2 million metres from surface exploration and resource infill drill holes had been completed across the project since the 1980s. Recent strengthening in the gold price environment has enabled an expanded exploration programme, with approximately 90,000 m of drilling planned across Macraes Gold Project during 2026 and 2027.

Near-mine brownfields exploration during 2026 has focused on known open-pit-amenable down-dip mineralisation at Coronation, Coronation North and the Southern Pit–Innes Mills (SPIM) area. A further priority has been the conversion and definition of mineral resources down-dip of the Golden Point Underground, with drilling also planned to test a nearby Innes Mills underground target.

Shallow mineral resources have also been defined at Nunns through reverse-circulation drilling. Open-pit targets remain a key focus, with SPIM and Coronation–Coronation North offering the best potential for near-surface resource definition. Drilling programmes from late 2026 through 2027 will additionally target the Golden Bar, Ounce and Stoneburn prospects.

The 2026-27 exploration programmes reflect a focused strategy to leverage geological maturity and data density at Macraes to deliver near-term resource growth and longer-term mine life extension.

Critical Minerals as Byproducts of New Zealand Gold Deposits: Economic, Environmental and Community Value

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Keywords: Critical minerals, Gold, Value creation

ABSTRACT

New Zealand's orogenic gold deposits are well established as the country's primary metalliferous resource, generating over NZD $840 million in production value in 2024. However, these deposits host a suite of critical minerals — notably antimony (Sb) and tungsten (W) — that represent a largely untapped source of multi-dimensional value beyond their immediate market price.

New Zealand's 2025 Critical Minerals List identifies Sb and W among the elements with genuine domestic production potential, both occurring in association with gold mineralisation across the Otago Goldfields and Reefton belt. Antimony, predominantly as stibnite and sulfosalt phases, and tungsten as scheelite in early quartz veining, are present at grades that warrant serious resource evaluation. At Macraes, for example, scheelite-enriched domains have been documented at grades exceeding 1,000 ppm W, with block-scale estimates suggesting hundreds of thousands of tonnes of potentially extractable W ore along a mineralised corridor exceeding 25 km.

The value proposition for extracting these byproducts extends well beyond commodity revenue. Economically, integrating Sb and W recovery circuits into existing processing infrastructure offers a relatively low-capital route to diversifying income streams, reducing exposure to gold price volatility. Environmentally, elements such as Sb — a smelter penalty and potential environmental contaminant — become a resource rather than a liability when recovered; this simplifies tailings management and long-term site remediation. New Zealand's high proportion of renewable electricity generation further positions domestic critical mineral production as among the lowest-carbon available globally.

From a community and national perspective, developing a domestic critical mineral supply chain strengthens New Zealand's strategic self-sufficiency, supports skilled employment in existing mining regions, and generates Crown royalties — all without the need to establish entirely new mining footprints.

This paper presents the case for a systematic, science-led approach to characterising and unlocking critical mineral byproduct potential within New Zealand's active and prospective gold mining operations.

Development of the Auld Creek Gold and Antimony Project

Simon Delander

Vice President - Rua Gold

Keywords: Gold, Antimony, Underground mine

ABSTRACT

Presentation on the progress of the development of the Auld Creek Gold and Antimony Project near Reefton on the South Island, will cover ore body, consenting, environment, PEA / PFS and project overview. Auld Creek is New Zealand's largest known gold antimony (Sb) resource and if successful in Fast track the mine could commence in 2028.

Real-Time Adaptive Mine Planning: Closing the Drill–Model–Optimisation Loop with Dynamic Block Modelling and Starlink-Enabled RC Logging

Simon E Robinson

Keywords: Dynamic model, Leapfrog, Optimisation

ABSTRACT

Advances in connectivity, data integration, and modelling workflows are enabling a step change in how geological information is captured and applied during active drilling campaigns.

This presentation explores a real-time, adaptive mine planning approach that closes the traditional drill–model–optimisation loop by integrating live RC logging data, dynamic geological modelling, and downstream optimisation processes.

By utilising Starlink-enabled connectivity on RC rigs, geological logging data can be transmitted from the drill site in near real time, allowing the geological model to be updated continuously as drilling progresses. This capability transforms drill programmes from static designs into adaptive systems, where drill hole placement, spacing, and orientation can be optimised dynamically in response to emerging geological information.

The workflow is extended through the use of a dynamic block model that updates automatically as new assay results are received. Incremental model updates provide earlier insight into grade distribution, geological continuity, and uncertainty, supporting more informed drill design decisions and reducing the lag between data acquisition and interpretation. Ultimately, this dynamic block model becomes a live input to mine planning and pit optimisation, enabling earlier evaluation of value, improved targeting, and more responsive mine designs.

The presentation highlights the technical architecture, practical considerations, and potential value gains of real-time adaptive mine planning, with a focus on improving decision-making speed, drilling efficiency, and overall project outcomes in exploration and early-stage mining environments.

Column leach test data from the Otago Schist

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Keywords: Column leach testing, Otago Schist, Macraes, Bendigo-Ophir

ABSTRACT

This paper provides a comparison of column leach testing (CLT) data for waste rock from the Macraes Gold Mine and the Bendigo-Ophir Gold Project, both orogenic gold deposits located in the Otago Region of New Zealand.

CLT are used to compliment environmental geochemical investigations on mine rock and waste materials. The CLT provide information on sulfide oxidation rates, neutralisation rates, metal solubility, and the leaching behaviour of the test materials under oxidising conditions; invaluable data for use in understanding the potential seepage quality from waste rock stacks.

Mineralisation for these deposits is associated with shallow dipping shear zones within greenschist facies Otago Schist host rock. Representative material selected from Otago Schist waste rock has been run for a minimum of 10 months with resulting leachate analysed for pH, acidity, alkalinity, major anions and cations, and a selection of dissolved and total trace metals /metalloids.

Compositional variation of the Otago Schist and mineralisation processes for the two deposits is evident from CLT data and has implications for the identification of potential constituents of concern across deposits within the same host rock / mineralisation style.

Rua Gold: Exploration update on the Reefton Goldfield

Simon Henderson

COO - Rua Gold

Keywords: Orogenic Gold, Stibnite, Exploration

ABSTRACT

Rua Gold provides an exploration update on the company's work in the Reefton Goldfield, a 35 x 15 km belt of Ordovician-age greenschist metasediments of the Greenland Group. Gold mineralisation is orogenic with deposits in and around steeply dipping N to NE-trending shear zones that cut across the hinges of earlier folds.

Historical mining in the Reefton Goldfield started in 1872, producing over 2 million ounces of gold, mostly from shallow underground workings. Many of the historic workings also contained significant stibnite mineralisation but were preferentially mined for gold leaving behind stibnite-rich shears and veins. Antimony, classified as a critical mineral in NZ, is primarily extracted from stibnite, and now to be seen as a valuable secondary resource in many of these deposits.

Rua Gold tenements cover 95% of the Reefton Goldfield and is actively exploring both past targets with high grade historic productions and new green-field targets. Here, Rua Gold presents an update on exploration on several of these targets, including Auld Creek, Alexander River, Big River, Kirwans Hill, and Supreme.

A major focus lies on the Auld Creek project, where exploration has revealed a combined Au and Sb resource of ~200k oz AuEq, well on the way of becoming a project of national importance. The major drilling program taken out in 2026 defines the resource at depth and with high enough certainty to allow for consideration for the Fast Track consenting process. Work in other projects includes extensive soil sampling, collection of UAV magnetics, and exploration drilling, to identify initial targets and grow historic resources.

Rua Gold: Exploration update on EP60950 Glamorgan

Soenke Stern

Geologist - Reefton Gold

Keywords: Epithermal Gold, Exploration, Drilling

ABSTRACT

Rua Gold provides an exploration update on the company's work in EP60950 Glamorgan. Glamorgan lies within the Hauraki Goldfield, an area with >50 epithermal gold-silver deposits. In the Hauraki Goldfield, epithermal mineralisation is hosted in Miocene and Pliocene andesitic-rhyolitic lavas and ignimbrites and focused in steeply dipping quartz veins. Since the 1860s, the mines of the Hauraki district have produced >15 Moz gold and >60 Moz silver. Much of this was produced in the Martha Goldmine in Waihi, at the south of the district, with >10 Moz gold produced and >2.1 Moz resources. North of Waihi, the Wharekirauponga (WKP) deposit contains a resource >2.2 Moz gold and is currently actively being prepared for a large-scale Au-Ag underground mine. Rua Gold's Glamorgan permit lies <3 km north of WKP.

Within the last two years, Rua Gold has collected >4000 soil samples and >100 rock-chip samples, carried out extensive geological mapping, conducted an ultra-detailed UAV magnetic geophysical survey, and collected CSAMT geophysical data during two separate surveys. This has led to the identification of three highly prospective targets across the permit, at which drilling is planned to commence in late 2026. The drill site consenting process has involved extensive archaeological and environmental studies as part of access applications to government agencies on local, regional, and national scale.

Here, Rua Gold aims to provide an update on the exploration at Glamorgan within the last 12 months, including the complex consenting process for exploration on DOC land in the Coromandel.

Macraes Processing - Integrated advanced process control and mine to mill optimisation

Tom Guy

OceanaGold - Macraes

Keywords: Processing, AI, Optimisation

ABSTRACT

At the OceanaGold Macraes gold operation, an integrated approach combining advanced process control and mine to mill optimization has significantly improved stability and performance in the processing plant's grinding circuit.

The Macraes processing plant's large grinding circuit – comprising SAG and ball mills – had faced typical challenges of feed variability, frequent disturbances, and throughput–recovery trade offs that demanded constant operator intervention. To address these issues, a Rockwell Automation Pavilion8 model predictive control (MPC) system was successfully implemented on the grinding circuit, seamlessly integrated with existing control systems. Commissioned in a phased manner with strong operator engagement, the MPC has improved circuit stability, reduced variability in key parameters (e.g. grind size), and increased average throughput – all contributing to more consistent gold recovery with significantly less manual control input.

In parallel, a complementary digital initiative – the NTWIST mine to mill platform – is being deployed to optimize upstream blending and feed scheduling. NTWIST provides visibility of grade on the ROM stockpiles and decision support across the mine to mill interface, aiming to reduce feed variability by blending different ore sources and aligning feed characteristics with plant parameters. While still in progress, early NTWIST trials at Macraes have demonstrated potential for more consistent feed grades, translating into improved grinding circuit performance, reagent optimisation and additional recovery gains.

This case study highlights how the synergy of advanced process control and upstream optimization can drive substantive improvements in plant performance. Key lessons include the importance of phased implementation, cross department collaboration, and strong change management in integrating these digital tools into continuous operations.

Structural Geological Mapping of the Disused Gold Workings in the Maerewhenua Area

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Keywords: Structural, Geology, Mineralisation

ABSTRACT

The research objectives of this project include creating a geological map of the Maerewhenau area, presenting findings and writing a geological report. These will be accomplished by undertaking structural mapping, focusing on the disused Maerewhenua gold workings by tying them into the surrounding geology. In conjunction with accomplishing the objectives, skills found throughout the mineral industry will be applied to complete the project.

Conducting structural explorative mapping of the disused gold workings will contribute to the understanding of mineralisation of alluvial gold deposits of the Maerewhenua area. Mapping historic gold workings provides potential insight into unworked, deeper gold deposits. The structural mapping allows practice of skills that can be transferred into the industry, like recording field measurements, creating and digitising field maps, writing geological reports, and presenting data. This project combines practical training in industry practices and improves the geological knowledge of the historic gold workings in Maerewhenua.