VEXRAD

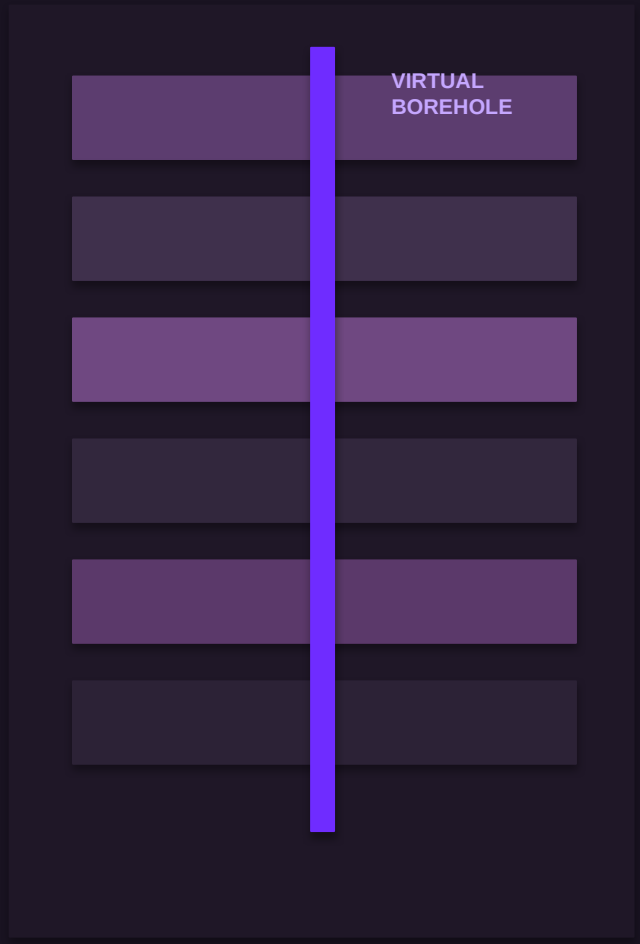
SUBSURFACE EVIDENCE

Case Studies & Validation

Real field programmes. Independent comparisons. Evidence-led subsurface decisions.

Critical Minerals • Geothermal • Water

Together We Rock — the VEXRAD case-study collection



WHY THIS COLLECTION EXISTS

The drill is the test.

A Virtual Borehole is most useful when it changes a decision before drilling — where to drill, what interval to test, which target to rank higher, or where uncertainty remains.

1 PREDICT

Acquire ADR data from surface and create a depth-referenced interpretation.

2 TEST

Compare the interpretation with drilling, assays, logs, known geology or other independent evidence.

3 CLASSIFY

Keep the result and its limitations visible: Validated, Grounded, Candidate or Known Null.

The pages that follow are strongest where prediction and ground truth can be seen side by side.

CONTENTS

A portfolio built around evidence.

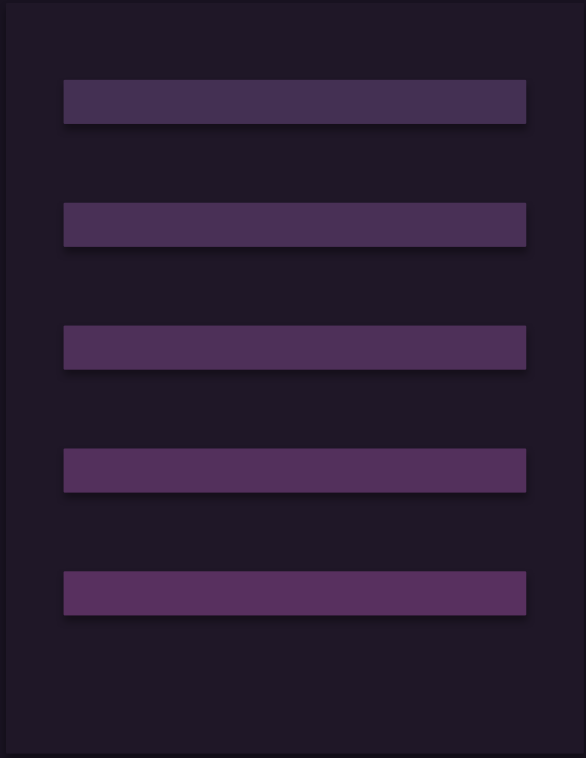
01	**CRITICAL MINERALS**	Australia Gold • Pend Oreille • Red Dog • Bluebush • Windy Lake • Pyhäsalmi • Saskatchewan Potash • Roughrider • Goldboro • Northern Lithium • Ireland Lithium Pegmatite • Finland Gold / OTSO
02	**GEOTHERMAL**	Wairakei, New Zealand • Weardale / NE England
03	**WATER**	Scottish Water / Terregles

VALIDATED = compared with independent ground truth. CANDIDATE = promising evidence requiring further independent validation.

01

Critical Minerals

Pre-drill targeting, drill-controlled correlations and transferability tests across gold, sulphides, potash, uranium and lithium.



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Not one validation story — three.

Prediction → drill

Charters Towers and Northern Lithium matter because the interpretation exists before the physical drilling comparison.

Drill-controlled correlation

Pend Oreille and Bluebush put ADR responses directly beside known sulphide intervals and, importantly, null behaviour.

Transferability

Red Dog asks whether sulphide criteria developed elsewhere can retain value in a different geological setting.

Collectively, these cases test whether ADR can add useful evidence before the next expensive physical investigation.

INSIGHTS & EVIDENCE

VEXRAD

VALIDATED

Australia Gold

Narrow-vein gold lodes located from surface, beneath a town, where nine other geophysical methods had failed.

Charters Towers, North Queensland · Citigold Corporation Ltd · Survey 2013

37.9 g/t Au

assayed from CT8205 — a hole drilled to test an ADR anomaly, after the survey was delivered

< 2 m

between the pre-drill pick and the projected intersection of the target structure

9

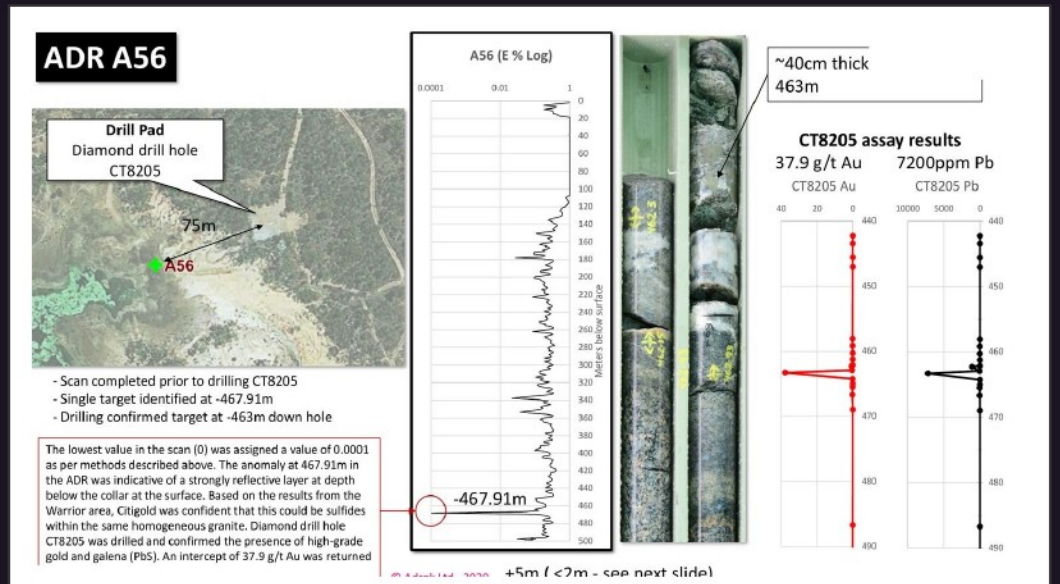
virtual boreholes processed across three ore-bearing structures

THE CHALLENGE

Sulphide pods under a metre thick, past 400 m depth, beneath a country town. Borehole radar, magnetics, TEM, DCIP, MT and seismic all failed to define a target; down-hole IP returned a 52% anti-correlation with the mineralisation in core.

A PREDICTION REGISTERED BEFORE THE TEST

Adrok had one drill core to calibrate on and no information about where the sulphides were. At A56 even Citigold's geologists knew of no mineralisation, and the E07 geometry was poorly constrained. ADR called a single anomaly at 467.91 m. CT8205 was then drilled to test it and cut ~40 cm at 463 m. Cased and logged afterwards, neither magnetic susceptibility nor conductivity resolved the sulphides ADR had found from surface.



Scan A56, pre-drill. The single energy anomaly at 467.91 m, and the CT8205 core — drilled afterwards to test it — showing the ~40 cm sulphide intercept with its gold and lead assay spikes.

What ADR predicted

What the drill found

AND ACROSS THE OTHER SCANS

A30, also drilled after the survey, found a footwall structure that was not on the map. A63 matched two known intercepts to within a metre at ~700 m. ADR returns depth and structure, not grade, and errors ran from under a metre to about 12 m.

Fieldwork by Adrok Ltd, September 2013, for Citigold Corporation Ltd. Reported in ASEG Extended Abstracts 2015 and in a 2020 trial report. VEXRAD Ltd carries the ADR technology forward.

INSIGHTS & EVIDENCE

VEXRAD

VALIDATED

USA Lead–Zinc

Pb–Zn sulphide zones identified from surface and compared directly with mine drill logs in Washington State.

Pend Oreille Mine, Washington State, USA · Zn–Pb sulphides · Proof-of-concept survey

500–550 m

massive sulphides in MX03 align with the highest WSCC response

6

virtual boreholes acquired: 5 from surface and 1 underground

1 blind

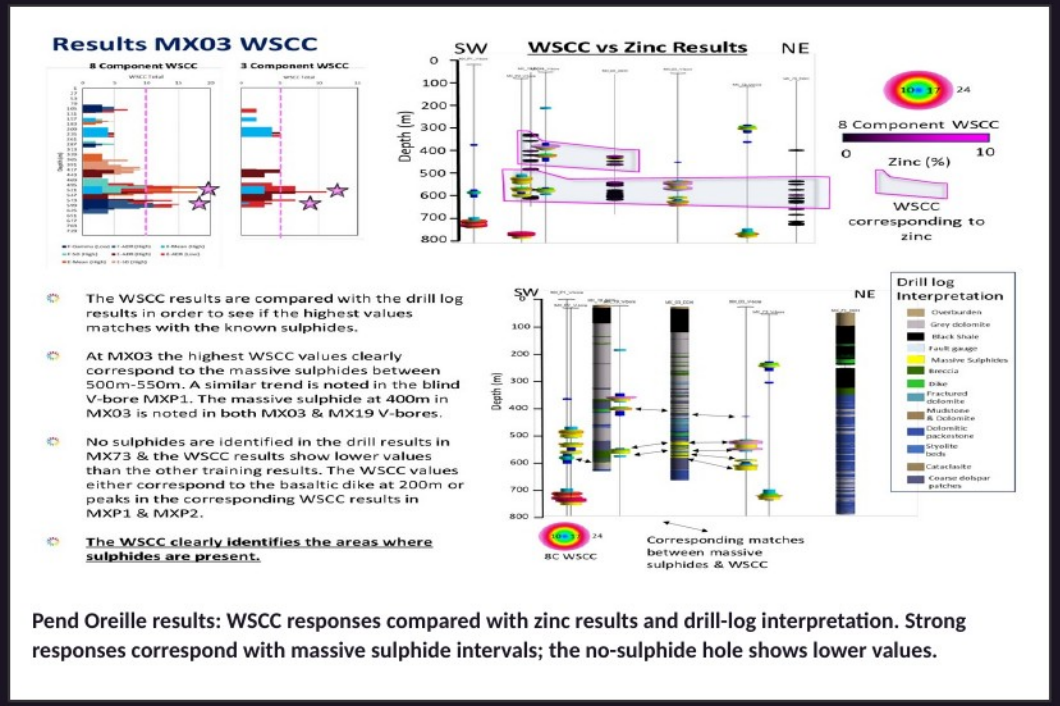
prospect V-bore MXP1 showed a similar sulphide response trend

THE CHALLENGE

Test whether ADR could identify subsurface Pb–Zn sulphide zones from ground level in the structurally complex Metaline district, then compare the response with known drill geology.

A DIRECT COMPARISON WITH DRILL CONTROL

WSCC outputs were compared with drill logs. At MX03, the strongest values correspond to massive sulphides between 500–550 m; the ~400 m sulphide is also expressed in MX03 and MX19.



Pend Oreille results: WSCC responses compared with zinc results and drill-log interpretation. Strong responses correspond with massive sulphide intervals; the no-sulphide hole shows lower values.

BLIND AND NULL-CASE BEHAVIOUR

Blind V-bore MXP1 showed a similar trend to MX03. At MX73, where drilling recorded no sulphides, WSCC values were lower than the sulphide-bearing training results — useful discrimination as well as detection.

What ADR indicated

What drill logs showed

Self-funded ADR proof-of-concept at Pend Oreille Mine, Washington State. Source: Adrok case-study summary supplied by VEXRAD. VEXRAD Ltd carries the ADR technology forward.

VEXRAD

VALIDATED

USA Zinc–Lead — Red Dog

Multi-evidential ADR criteria transferred from Australia and tested against Red Dog sulphide mineralisation.

Red Dog district, Alaska, USA · Zn–Pb sulphides · Comparative validation study

~700 m sulphide/mineralised zone identified by transferred criteria

5 scans analysed across Red Dog mine and surrounding prospects

650–700 m correlation identified the interpreted pyrite-rich Fe-sulphide zone

THE CHALLENGE

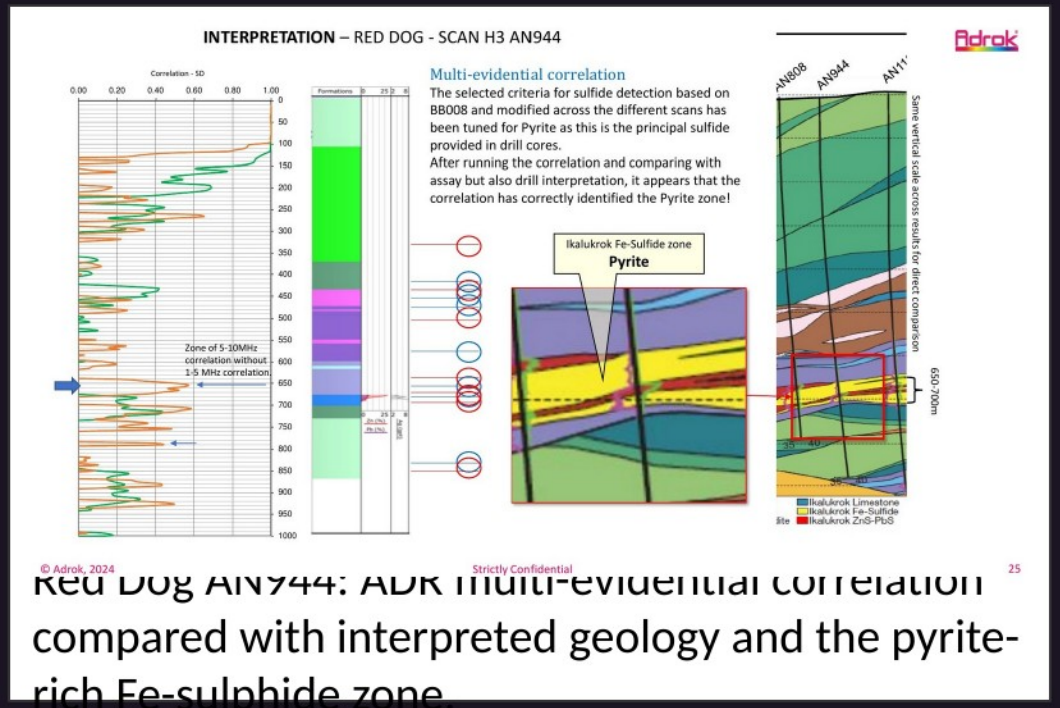
Test whether sulphide-targeting criteria developed at an unrelated Australian prospect could transfer to Red Dog without site-specific training.

TRANSFERRED CRITERIA, INDEPENDENT TEST

Five Red Dog scans were analysed using Energy, Frequency and correlation criteria developed at Bluebush. AN810 was successfully associated with the mineralised zone at about 700 m.

MULTI-EVIDENTIAL CORROBORATION

At AN944, the combined criteria identified two candidate zones; comparison with assay and geological interpretation showed the stronger 650–700 m response coincided with a pyrite-rich Fe-sulphide zone.



Red Dog AN944: ADR multi-evidential correlation compared with interpreted geology and the pyrite-rich Fe-sulphide zone.

What ADR indicated — What drill logs showed

Public Adrok case study, reprocessed 2024. VEXRAD Ltd owns the case-study copyright and carries the ADR technology forward.

VEXRAD

VALIDATED

Australia Zinc — Bluebush

ADR energy and frequency responses compared directly with drill-core sulphide abundance in a deep mineralised interval.

Bluebush prospect, Australia · Zn-bearing sulphides · Drill-controlled processing study

600–700 m
principal sulphide-rich interval in drill hole BBDD054

~675 m
strong Energy % Log response aligned with the major sulphide interval

1–50 MHz
frequency bands examined to develop a sulphide-response fingerprint

THE CHALLENGE

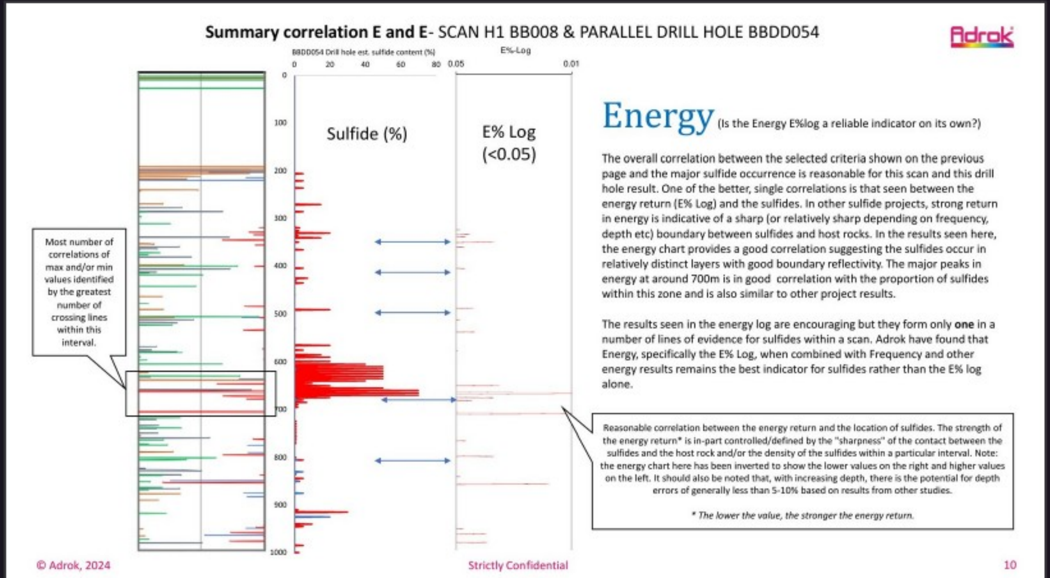
Separate the sulphide response from host-rock effects and establish criteria that could be transferred to unrelated prospects.

DRILL-CONTROLLED RESPONSE

Scan BB008 was compared with parallel drill hole BBDD054. Energy and frequency responses showed reasonable correlation with the major pyrite–sphalerite interval at roughly 600–700 m.

FROM SINGLE SIGNAL TO WEIGHTS OF EVIDENCE

The study concluded that Energy % Log is useful but strongest when combined with frequency and other energy measures. These combined criteria became the basis for testing sulphide targeting at Tekeli, Maya and Red Dog.



Summary correlation E and E- SCAN H1 BB008 & PARALLEL DRILL HOLE BBDD054
Adrok
BBDD054 Drill hole est. sulfide content (%)
E%-Log
Sulfide (%)
E% Log (<0.05)
Most number of correlations of max and/or min values identified by the greatest number of crossing lines within this interval.
Energy (Is the Energy E%log a reliable indicator on its own?)
The overall correlation between the selected criteria shown on the previous page and the major sulfide occurrence is reasonable for this scan and this drill hole result. One of the better, single correlations is that seen between the energy return (E% Log) and the sulfides. In other sulfide projects, strong return in energy is indicative of a sharp (or relatively sharp depending on frequency, depth etc) boundary between sulfides and host rocks. In the results seen here, the energy chart provides a good correlation suggesting the sulfides occur in relatively distinct layers with good boundary reflectivity. The major peaks in energy at around 700m is in good correlation with the proportion of sulfides within this zone and is also similar to other project results.
The results seen in the energy log are encouraging but they form only one in a number of lines of evidence for sulfides within a scan. Adrok have found that Energy, specifically the E% Log, when combined with Frequency and other energy results remains the best indicator for sulfides rather than the E% log alone.
Reasonable correlation between the energy return and the location of sulfides. The strength of the energy return* is in-part controlled/defined by the "sharpness" of the contact between the sulfides and the host rock and/or the density of the sulfides within a particular interval. Note: the energy chart here has been inverted to show the lower values on the right and higher values on the left. It should also be noted that, with increasing depth, there is the potential for depth errors of generally less than 5-10% based on results from other studies.
* The lower the value, the stronger the energy return.
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compared with drill-estimated sulphide content; the strongest response occurs around the major sulphide interval.

What ADR indicated — What drill logs showed

Legacy Adrok field/data study, reprocessed 2024. VEXRAD Ltd owns the case-study copyright and carries the ADR technology forward.

INSIGHTS & EVIDENCE

VEXRAD

VALIDATED

Canada Deep Sulphides

Deep sulphide/PGM targeting in the Sudbury mining district, compared with nearby drilling and assay data.

Windy Lake, Sudbury, Ontario · Ni–Cu–PGM setting · Deep-target study

1.25–1.50 km

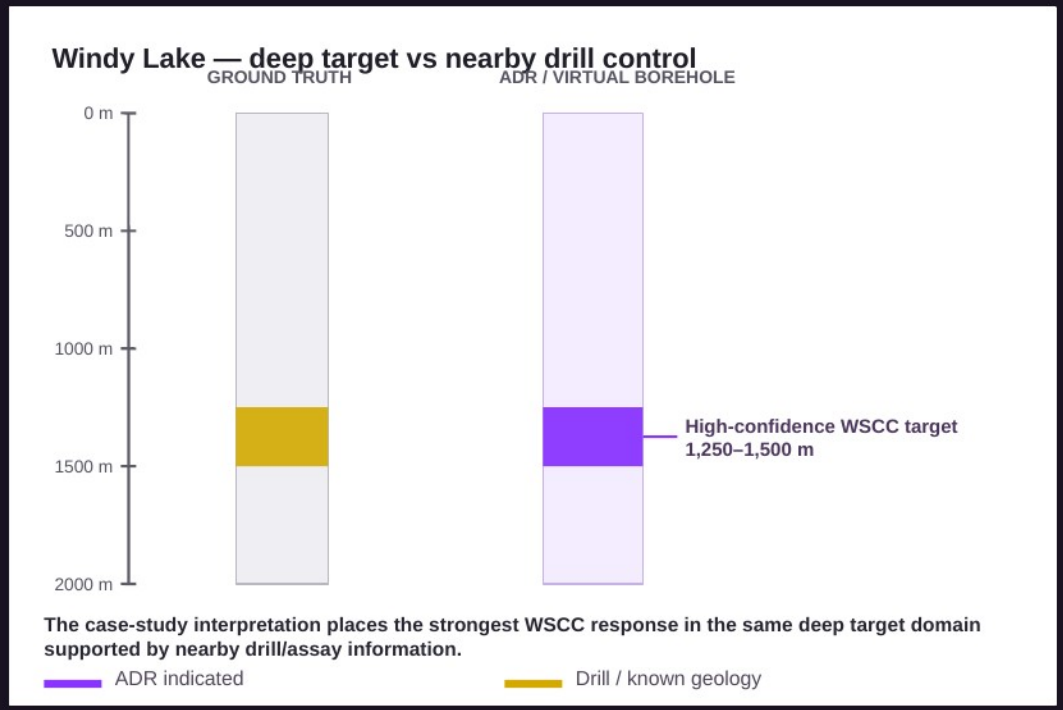
high-confidence WSCC target interval identified beneath Windy Lake

7 V-bore lines

VB07–VB12 interpreted alongside nearby drill control WWL-009

Drill + assay

target zone compared with nearby drilling and nickel-grade information



THE CHALLENGE

Test whether ADR mineralisation criteria could identify deep sulphide targets in the geologically complex Sudbury Igneous Complex setting.

DEEP TARGET IDENTIFIED

Weighted Sulphide Correlation Criteria (WSCC) highlighted a high-confidence target zone between approximately 1,250 and 1,500 m below ground level.

GROUND-TRUTH COMPARISON + 3D INTERPRETATION

The interpreted target was compared with nearby drilling/assay results and incorporated into a 3D geological interpretation consistent with an embayment-style setting associated with the Sudbury Igneous Complex.

INSIGHTS & EVIDENCE

VEXRAD

VALIDATED

Finland Copper–Zinc

Copper–zinc sulphide targeting around the Pyhäsalmi VMS system, with ADR responses compared against client drill data.

Pyhäsalmi, Finland · Cu–Zn VMS · First Quantum Minerals programme

6 V-bores

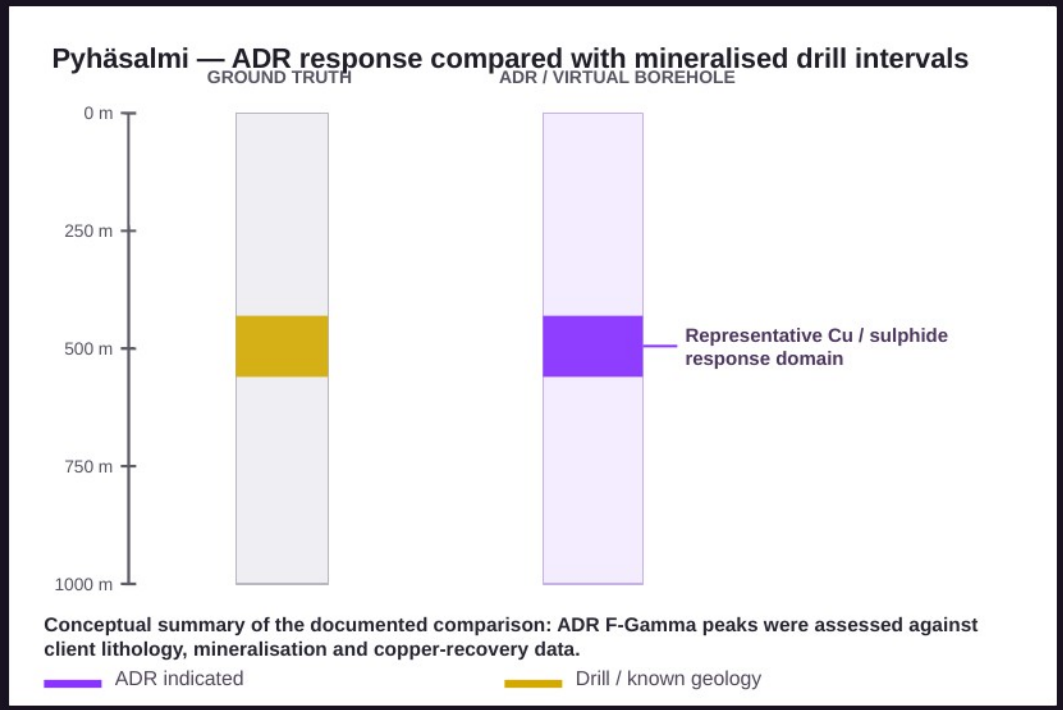
surface Virtual Boreholes acquired around the established mine setting

≤ 1 month

reported processing period following field acquisition

2 key holes

H1 (PUR) and H2 (162) used for detailed comparison with training data



THE CHALLENGE

Identify remaining volcanogenic massive sulphide mineralisation in a mature mine environment where historic workings, angled drilling and residential surface constraints complicate exploration.

MINERALISATION RESPONSE

In the two detailed comparisons, F-Gamma responses correlated with client training data. Peaks were associated with copper and pyrrhotite mineralisation; in H1 the maximum F-Gamma peak occurred at the main chalcopyrite mineralisation.

WHY IT MATTERS

The programme demonstrates a low-impact surface approach in a constrained brownfield setting. Interpretation must account for spatial separation between vertical ADR scans and angled drill holes, which increases with depth.

INSIGHTS & EVIDENCE

VEXRAD

VALIDATED

Canada Potash

Virtual Boreholes used to delineate deep evaporites and identify potash mineralisation in Saskatchewan.

Tugaske, Saskatchewan · Potash / evaporites · Gensource Potash setting

13 V-bores

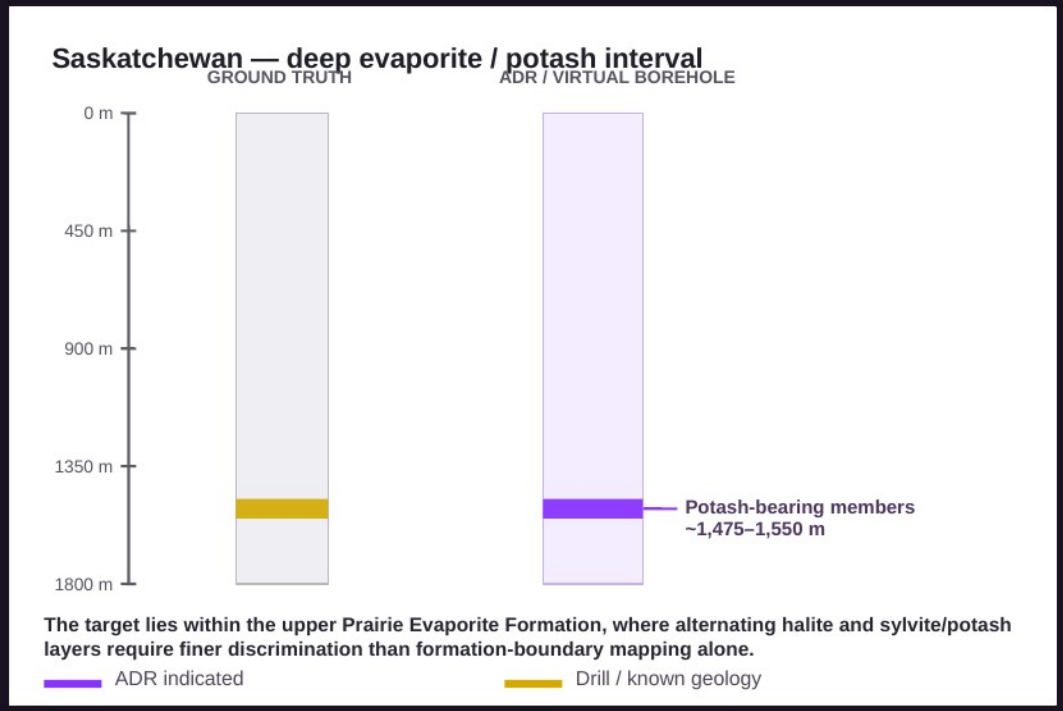
field data acquired across the Saskatchewan survey area

1 week

reported acquisition time for all 13 Virtual Boreholes

~1.5 km

Prairie Evaporite target depth; potash members occur near 1,475–1,550 m



THE CHALLENGE

Go beyond mapping the broad evaporite package and investigate whether ADR could differentiate halite from thinner sylvite/potash members before further drilling.

LITHOLOGY + POTASH INTERPRETATION

Two V-bores, H1 (C1) and H2 (C2), were analysed in detail. Integrated ADR interpretation identified broad lithological changes, constrained halite and potash zones, and established lithology relationships against training data.

EVIDENCE OUTCOME

The case study reports potash mineralisation identified in both analysed V-bores, with signatures correlating with the supplied training data. Additional training holes were recommended to further refine the classification database.

INSIGHTS & EVIDENCE

VEXRAD

CANDIDATE

Canada Uranium

A training-and-test ADR programme over the Roughrider uranium deposit in the Athabasca Basin.

Roughrider, Saskatchewan · Uranium · Athabasca Basin field test

13 V-bores

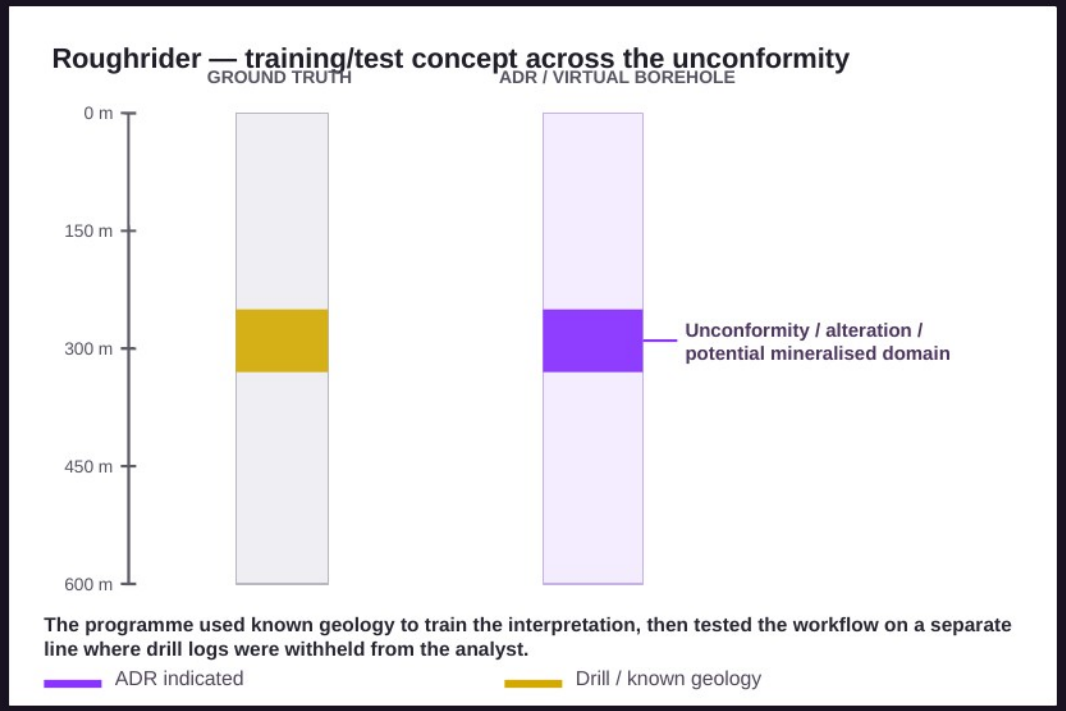
stare scans acquired with WARR data during the field programme

10 days

survey completed from a floating platform on McMahon Lake

Blind test

Line B drill logs were withheld from the ADR interpretation workflow



THE CHALLENGE

Evaluate whether ADR could map the unconformity, structures, alteration and potential uranium mineralisation in the complex Athabasca Basin environment.

TRAINING → TEST WORKFLOW

Line A was used as the training section using five drill logs. Line B was treated as the test section: four drill logs existed but were withheld from the interpretation. P-Scan filtering, dielectric response and harmonic signatures were integrated in a three-step workflow.

PROMISING — BUT DELIBERATELY CLASSIFIED CANDIDATE

Mineralised test blocks correlated well with the high-grade training block while a non-mineralised block correlated poorly. The original study explicitly states that many more correlations are required for statistical confidence, so VEXRAD presents this as promising candidate evidence rather than proven direct uranium detection.

INSIGHTS & EVIDENCE

VEXRAD

VALIDATED

Canada Gold — Goldboro

Repeatable mapping of quartz-vein targets in a structurally controlled gold system in Nova Scotia.

Goldboro, Nova Scotia · Gold / quartz veins · Orex Exploration training-data study

2 V-bores

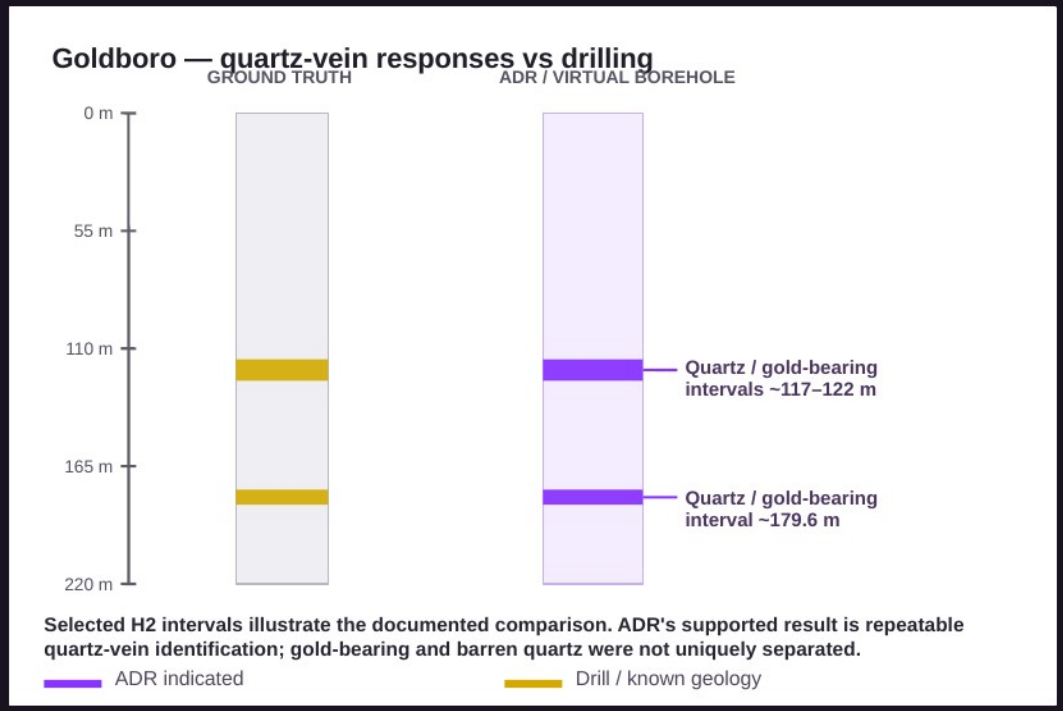
OSK11-01 and OSK11-02 analysed against supplied drilling/training data

117–180 m

thin gold-bearing quartz-vein intervals documented in the H2 comparison

Repeatable

energy, frequency-harmonic and E-log responses repeatedly matched quartz veins



THE CHALLENGE

Test whether ADR could identify quartz veins, lithological changes and repeatable subsurface responses in the Goldboro system using client drilling data for training.

QUARTZ VEINS IDENTIFIED

Frequency, energy-harmonic and E-log responses produced matches to quartz veins hosted in the greywacke–argillite sequence. The two Virtual Boreholes produced consistent and repeatable responses, with depth differences sometimes a few metres.

IMPORTANT LIMITATION — QUARTZ, NOT GOLD GRADE

Some mapped quartz veins were gold-bearing, including thin H2 intervals at 117.20 m, 122.30 m and 179.60 m. The study explicitly concluded that ADR did not distinguish gold-bearing quartz from non-gold-bearing quartz. The defensible VEXRAD use case is therefore pre-drill vein/structure targeting, not direct gold-grade prediction.

INSIGHTS & EVIDENCE

VEXRAD

VALIDATED

UK Lithium Brine

Pre-drill Virtual Borehole interpretation compared directly with the subsequent physical drill result.

North East England · Northern Lithium · Pre-drill → Drill → Compare

Pre-drill

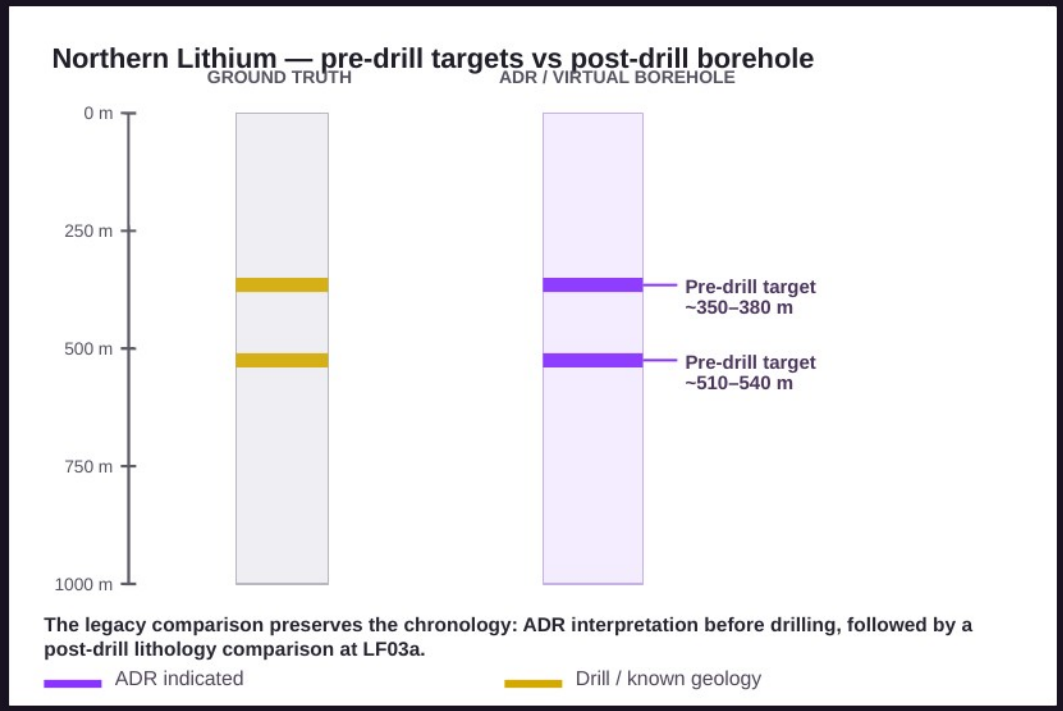
LF03a zonation and target interpretation completed before drilling

Post-drill

the same location was re-plotted against the physical borehole lithology

~350–540 m

two highlighted pre-drill E-Gamma target intervals shown in the archived comparison



THE CHALLENGE

Reduce uncertainty ahead of drilling for lithium-bearing geothermal brines by predicting subsurface zonation and fluid-related target intervals from the surface.

PREDICTION BEFORE THE DRILL

The archived LF03a pre-drill panel records ADR Correlation Method, E-log, weighted mean frequency, E-Gamma, dielectrics and zonation to 1,000 m, with highlighted target intervals around ~350–380 m and ~510–540 m.

THEN COMPARE WITH REALITY

After drilling, the LF03a interpretation was re-presented with physical borehole lithology alongside the ADR tracks. This is a commercially important evidence format for VEXRAD: make the subsurface interpretation first, then compare it with what the drill actually encountered.

INSIGHTS & EVIDENCE

VEXRAD

CANDIDATE

Ireland Lithium Pegmatite

A lithium-pegmatite exploration example retained as candidate evidence pending stronger independent ground-truth documentation.

Ireland · Lithium-bearing pegmatite exploration · Evidence review

Pegmatite

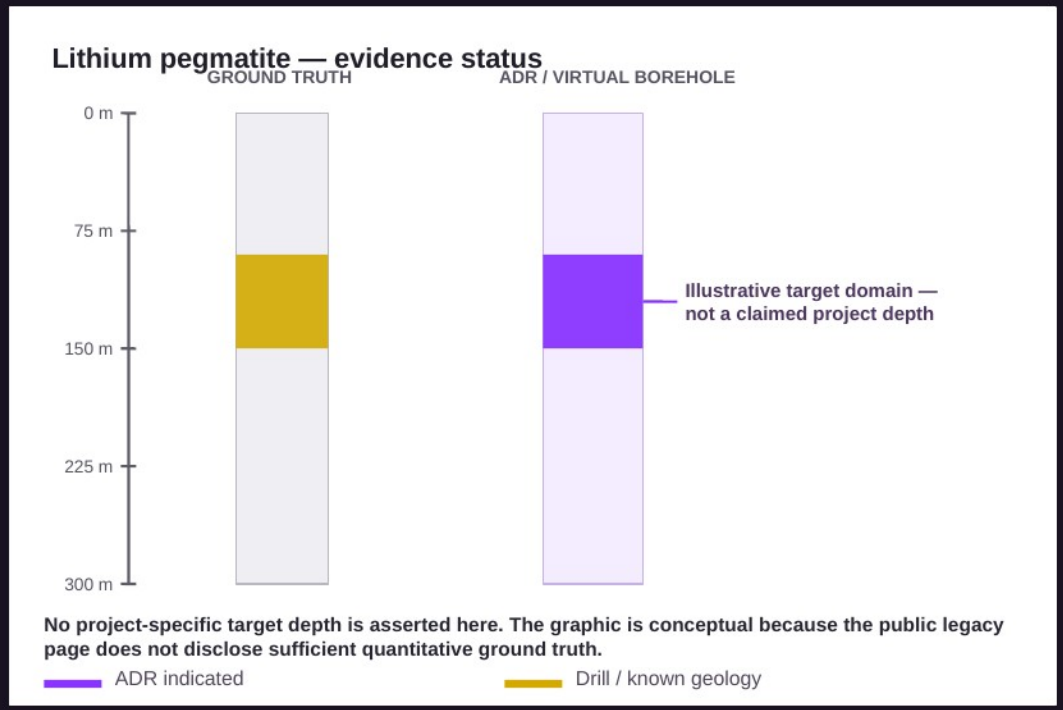
target lithology associated with spodumene / petalite mineral systems

ADR

legacy material presents the technology as capable of identifying lithium-bearing pegmatites

Evidence gap

public case-study page does not provide drill/assay depths or a quantified blind comparison



THE CHALLENGE

Assess whether ADR responses can help discriminate lithium-bearing pegmatite targets from surrounding host rocks in prospective Irish geological settings.

WHAT THE ARCHIVE SUPPORTS

The legacy case-study page describes Ireland's lithium-pegmatite potential and states that ADR can identify lithium-bearing pegmatites. It does not, on the public page, provide the drill intersections, assay table, target depths or blind-test statistics needed for a stronger validation claim.

VEXRAD EVIDENCE POSITION

Accordingly this slide is intentionally classified Candidate. It is useful as an application example, but VEXRAD should only upgrade it to Grounded or Validated when the underlying project report demonstrates an independent pegmatite / lithium comparison.

INSIGHTS & EVIDENCE

VEXRAD

CANDIDATE

Finland Gold — OTSO

Finnish gold exploration example retained as candidate evidence pending verification of the underlying ADR project report.

Finland · Gold exploration · OTSO legacy case-study archive

Finland

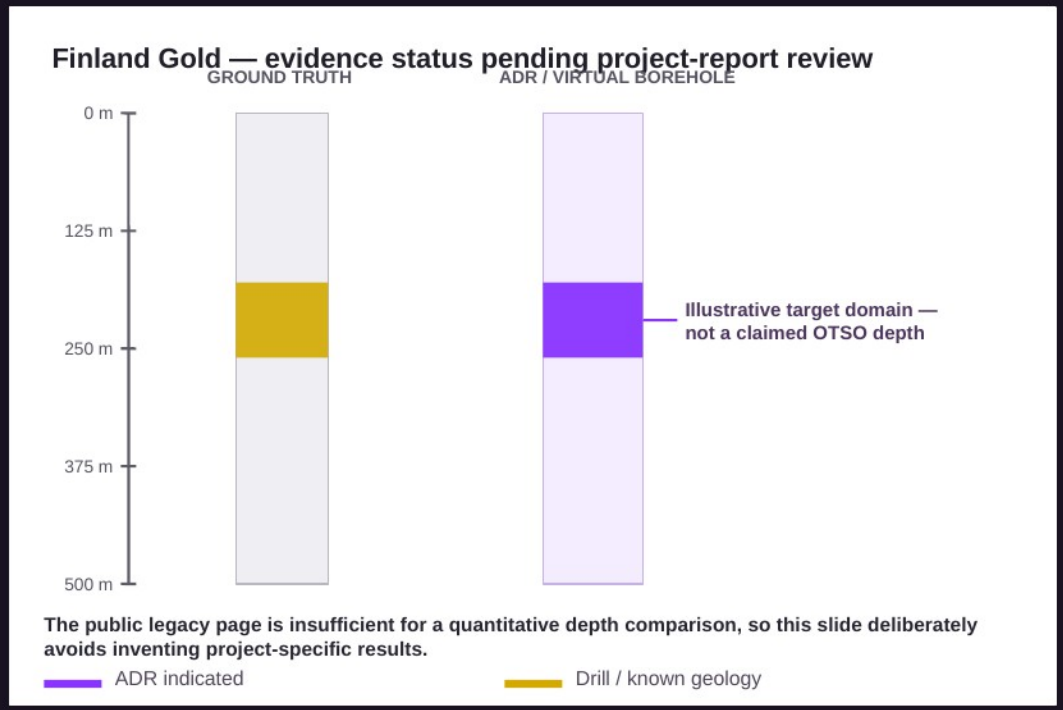
legacy Volume 7 includes a dedicated Gold (OTSO) project entry

Project PDF

the page links to an 'ADR Geophysical Exploration in Finland' report

Evidence check

public HTML does not expose the project's quantitative drill/assay comparison



THE CHALLENGE

Evaluate whether ADR can contribute subsurface targeting information within Finnish hard-rock gold exploration settings.

WHAT IS CURRENTLY VERIFIABLE

The legacy archive confirms a dedicated Finland Gold (OTSO) case-study entry and links to the project PDF. The accessible public page provides regional gold-exploration context but does not expose scan counts, target depths, assay values or prediction-versus-drill statistics.

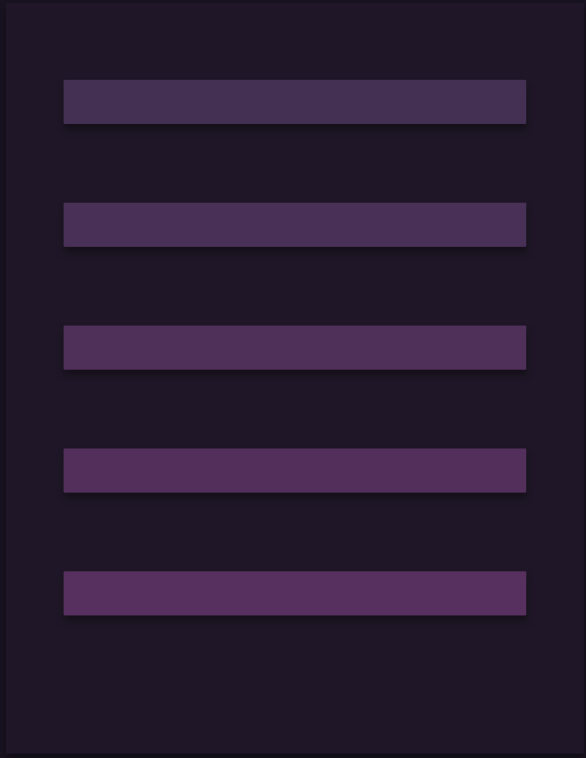
VEXRAD EVIDENCE POSITION

This is therefore classified Candidate rather than Validated. The next evidence step is to recover and review the linked project PDF; only claims supported by that report should be promoted onto the VEXRAD website.

02

Geothermal

Contrasting geothermal settings help test whether ADR responds to real subsurface differences rather than forcing every site into the same pattern.



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GEOTHERMAL

Contrast is useful evidence.

Wairakei and Weardale represent very different geothermal systems. A mature high-enthalpy volcanic field should not look like a moderate-gradient UK granite/fracture setting — and the interpretation should preserve that contrast.

WAIRAKEI

High-enthalpy reference: thermal response compared with known temperature and steam behaviour.

WEARDALE

Lower-gradient UK setting: localised thermal targets compared with borehole evidence.

INSIGHTS & EVIDENCE

VEXRAD

VALIDATED

New Zealand Geothermal

ADR thermal response tested in the high-enthalpy Wairakei–Tauhara geothermal system against known well temperature and steam information.

Wairakei, New Zealand · Contact Energy pilot · High-enthalpy geothermal

~125 °C/km

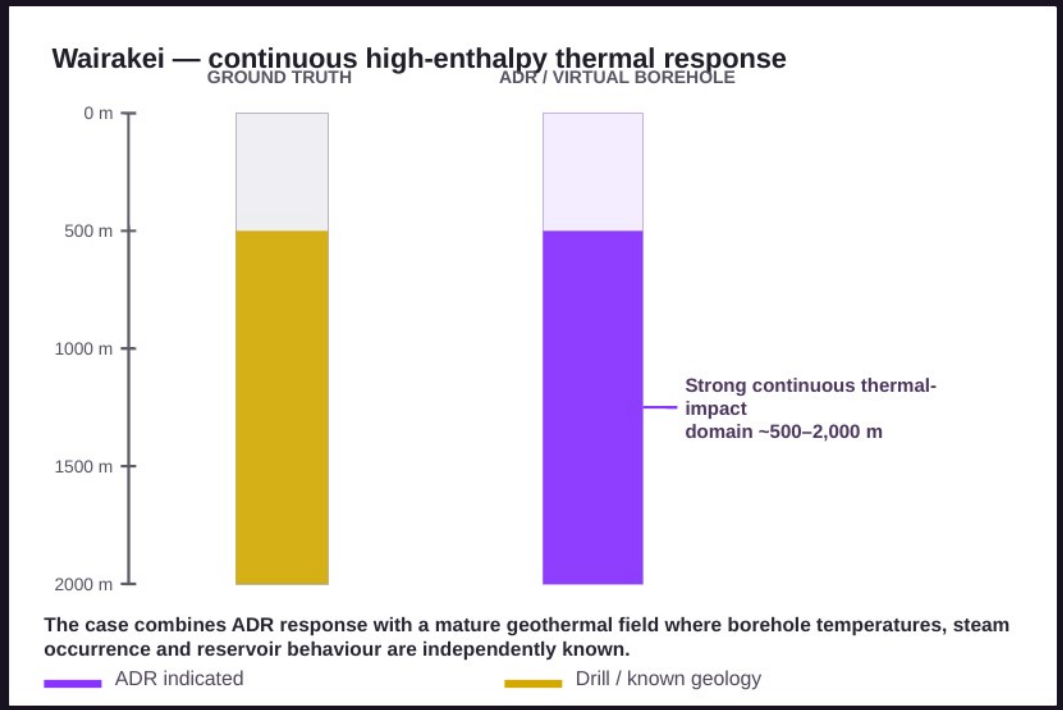
ADR-reported geothermal gradient for the Wairakei comparison

500–2,000 m

strong, continuous E-Gamma thermal-impact response reported

Up to 248 °C

known Wairakei-Tauhara underground-water temperatures cited in the field study



THE CHALLENGE

Test whether ADR could recognise thermal behaviour, steam-related response and major subsurface changes in a proven volcanic geothermal field.

KNOWN HIGH-ENTHALPY TEST SITE

At WK271, ADR dielectrics were plotted against client lithology and temperature data. The study reports dielectric troughs where temperature dropped and peaks where steam was known to occur. Additional Wairakei sites were analysed using dielectrics, harmonics, energy response and WMF.

STRONG THERMAL CONTRAST

Later UK–New Zealand comparison work reports a strong, continuous Wairakei E-Gamma thermal signature from roughly 500–2,000 m and an ADR gradient of ~125 °C/km, contrasting with the more localised lower-enthalpy Weardale response.

INSIGHTS & EVIDENCE

VEXRAD

VALIDATED

NE England Geothermal

Localised ADR thermal targets compared with borehole evidence in the Weardale / northern England geothermal province.

Weardale, NE England · Granite / fracture-hosted geothermal · Borehole comparison

~38 °C/km

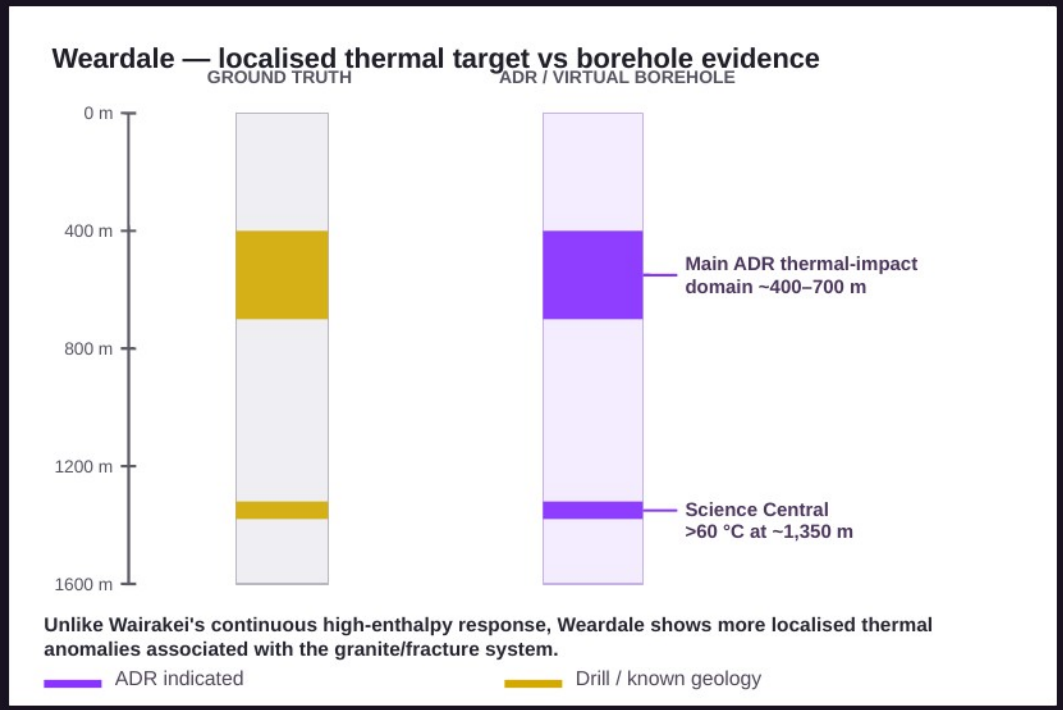
ADR-reported geothermal gradient for the Weardale comparison

~411 m

Eastgate borehole hot saline influx reported at a corresponding ADR thermal target

>60 °C

Science Central borehole temperature cited at ~1,350 m



THE CHALLENGE

Determine whether a low-impact surface survey could recognise localised geothermal anomalies in a moderate-gradient UK setting rather than a volcanic high-enthalpy field.

BOREHOLE-LINKED THERMAL TARGET

ADR E-Gamma interpretation shows its strongest shallow thermal-impact targets at roughly 400–700 m. The Eastgate borehole encountered a hot saline influx at ~411 m, reported as correlating with the ADR thermal target.

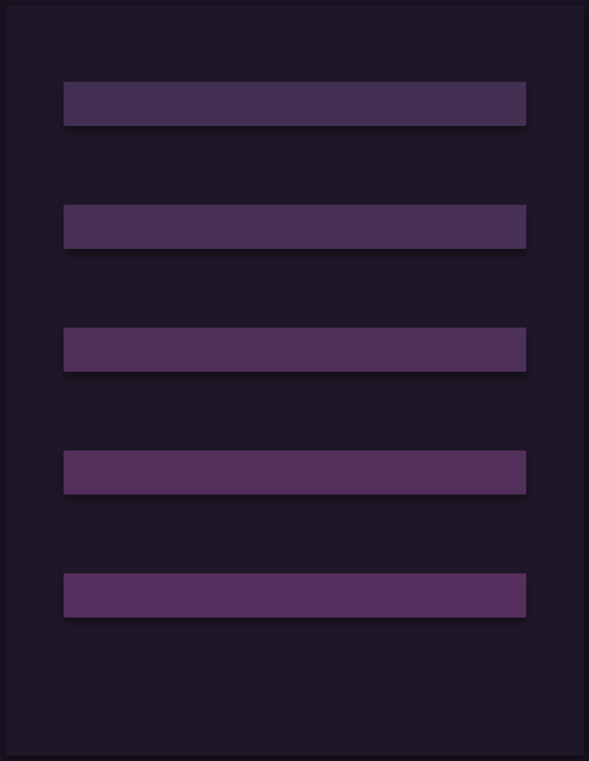
REGIONAL CONSISTENCY

The wider NE England comparison reports a geothermal gradient of ~38 °C/km and cites >60 °C at ~1,350 m in the Science Central borehole as consistent with ADR troughs. The evidence supports pre-drill thermal targeting, while temperature estimates remain calibration-dependent.

03

Water

Known aquifer intervals provide a practical ground-truth test for depth-referenced surface measurements.



VEXRAD

GROUNDWATER

Depth matters more than rhetoric.

The Terregles case is useful because the comparison is tangible: two known fractured aquifer intervals can be placed alongside ADR dielectric and weighted-mean-frequency responses across three closely linked Virtual Boreholes.

The commercial question is simple: can surface intelligence help rank water targets before committing to drilling?

INSIGHTS & EVIDENCE

VEXRAD

VALIDATED

Scotland Groundwater

Known aquifers identified from the surface and correlated across three Virtual Boreholes at Terregles.

Terregles, Dumfries, Scotland · Groundwater · Scottish Water downhole control

58–68 m

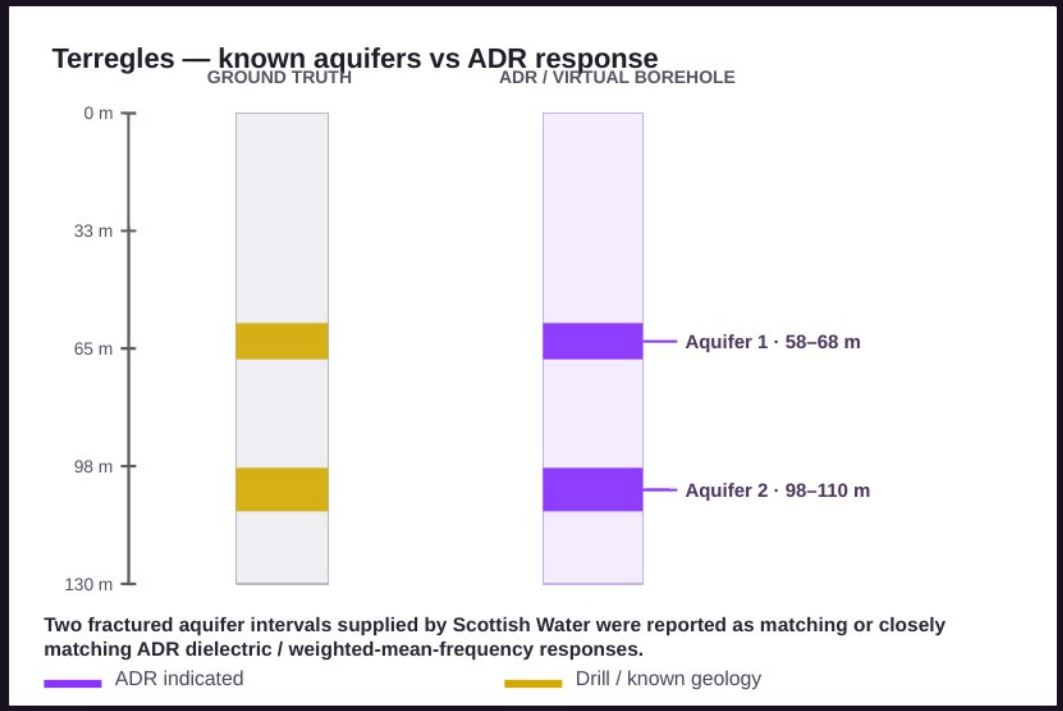
first known fractured aquifer interval supplied in downhole information

98–110 m

second known fractured aquifer interval beneath the survey site

~1–2 m

reported offset between ADR interpretation and known aquifer/fracture zones



THE CHALLENGE

Demonstrate whether ADR could identify known water-bearing fracture networks and repeat the interpretation across multiple closely spaced surface scans.

DIRECT COMPARISON WITH DOWNHOLE DATA

High dielectric responses and peaks in Weighted Mean Frequency matched or closely matched the two known aquifer intervals identified in Scottish Water downhole logs.

REPEATABILITY ACROSS SCANS

The interpretation was applied across three closely linked V-bores (TS1–TS3), producing a mini 3D view in which the two water-bearing zones were interpreted at corresponding depths across the survey area.

Legacy ADR Terregles survey, Dumfries (2012), compared with Scottish Water downhole logs. Case-study archive and rights held by VEXRAD Ltd.

VEXRAD

Evidence before assertion.

The strongest VEXRAD story is not a single spectacular anomaly. It is a repeatable discipline: acquire from surface, interpret by depth, compare with independent evidence, retain nulls and limitations, and use the result to improve the next decision.

REDUCE UNCERTAINTY

Add another evidence layer before expensive drilling.

RANK TARGETS

Focus physical investigation where multiple lines of evidence agree.

LEARN FROM THE DRILL

Use each physical borehole to improve interpretation and future survey design.

VEXRAD

SEE BEFORE YOU DRILL.

Start with the evidence. Then decide what deserves a drill hole.

VEXRAD PROJECT FIT CHECK

Critical Minerals • Geothermal • Water

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