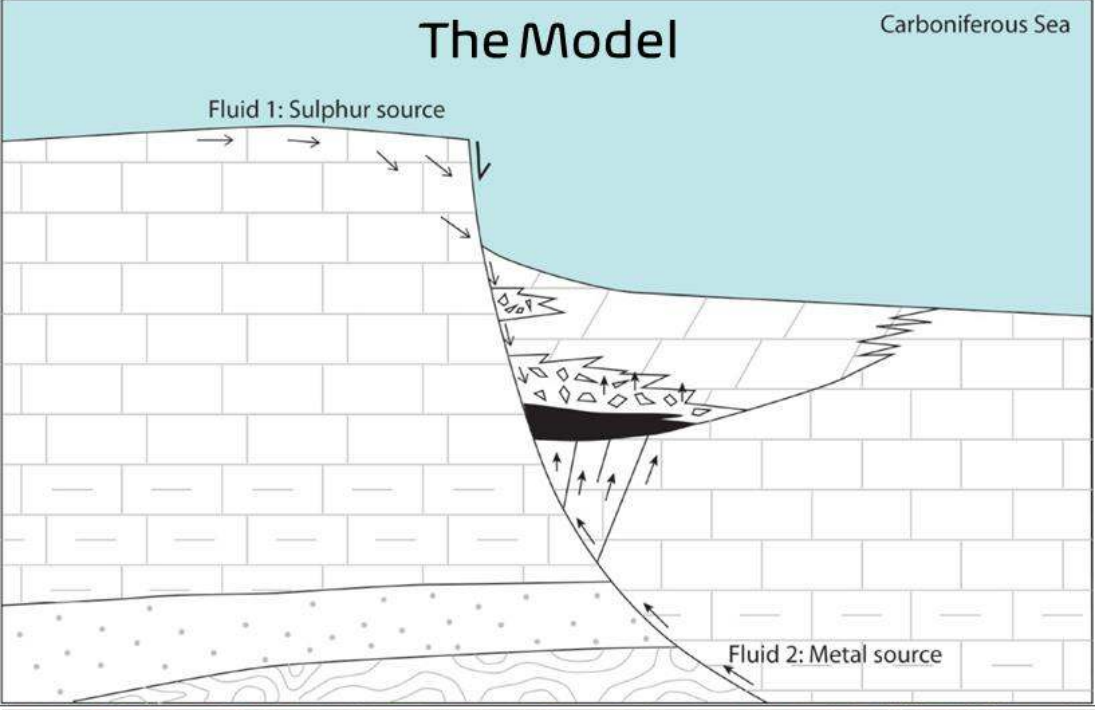
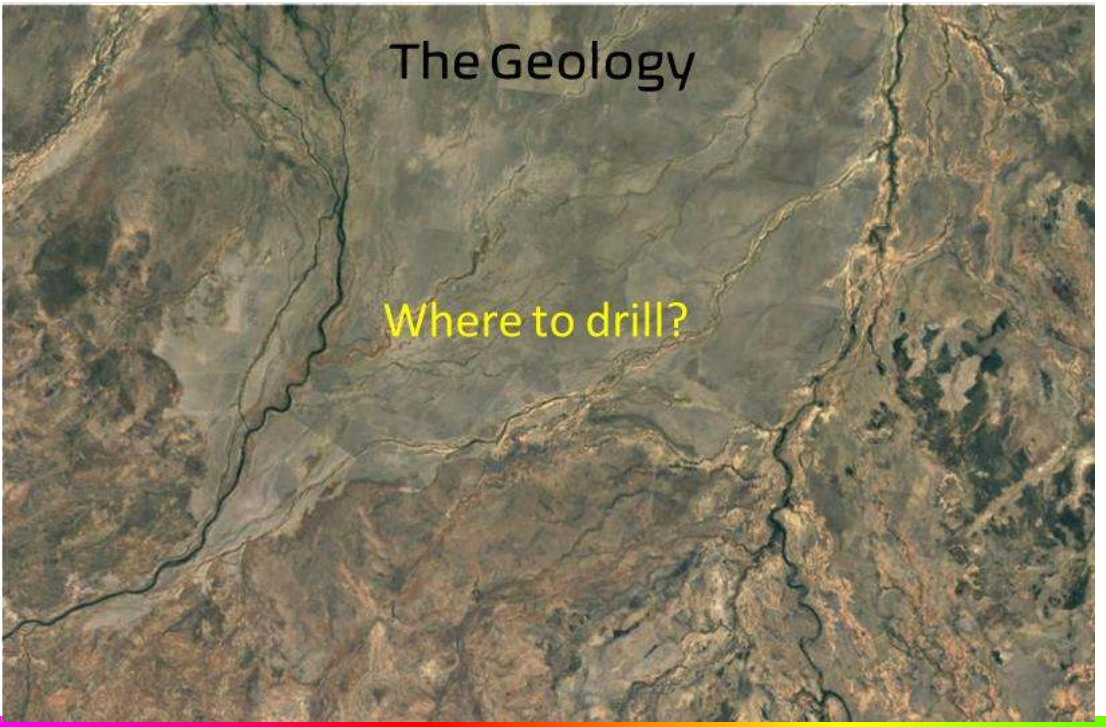
Progress towards the development of a sulfide targeting tool for mineral exploration under cover





MODEL-DRIVEN MINERAL EXPLORAITON: How do we add value to geology?

The target based on the known "model" for mineralisation in the region describes syngenetic mixing of S-rich brine with metal-rich hydrothermal fluids. The mineralisation replaces existing breccias and is semi-conformable with lithologies and lithofacies. Accordingly, model-based targets are particular units, or units of a particular age where breccias or fluid flow termination zones may have formed and where structures are also present that can facilitate fluid flow to the site of deposition.

The problem with models driving exploration under cover, especially early in an exploration program, is that models are not entirely factual, but we can use the models as a guide to exploration as long as we know the limitations and understand the assumptions. Nevertheless, these models, along with often limited geological and other geophysical data, are always used to pinpoint the first drill targets. Geophysics can help by helping test the model prior to committing an expensive drill program, especially if the target areas are under cover.

As geologists, at Adrok we were aiming to genuinely help solve this problem by targeting sulfides.

A semi-hypothetical targeting scenario

A map like this one can be daunting, especially early in an exploration project. Regional and some tenement- scale geophysics such as airborne magnetics, gravity, EM, IP, MT etc may generate a number of great prospective targets but the depth of penetration may be limited, and many broad targets might be generated. Our Chief Geo (Dr Simon Richards) has been in exactly this scenario and understands the frustration, particularly if the target depth is anticipated to be at around 300-500m below the surface.

The number of potential drill targets in the area are enormous as any part of the basin unit may contain sulfides. In this instance, magnetic and gravity information isn't sufficient to delineate sulfides. The targets may be 1->50m thick and at 300-500m depth. This presents an ideal scenario for Adrok as the technique can provide a semi-quantitative sulfide probability map.

Providing an additional layer of confidence to drill in the correct spot is the aim of the technology. This will also provide investors and shareholders confidence that drilling expenditure is reduced, and the highest priority targets are drilled first.

← In this area, how would the planned drilling be prioritized?

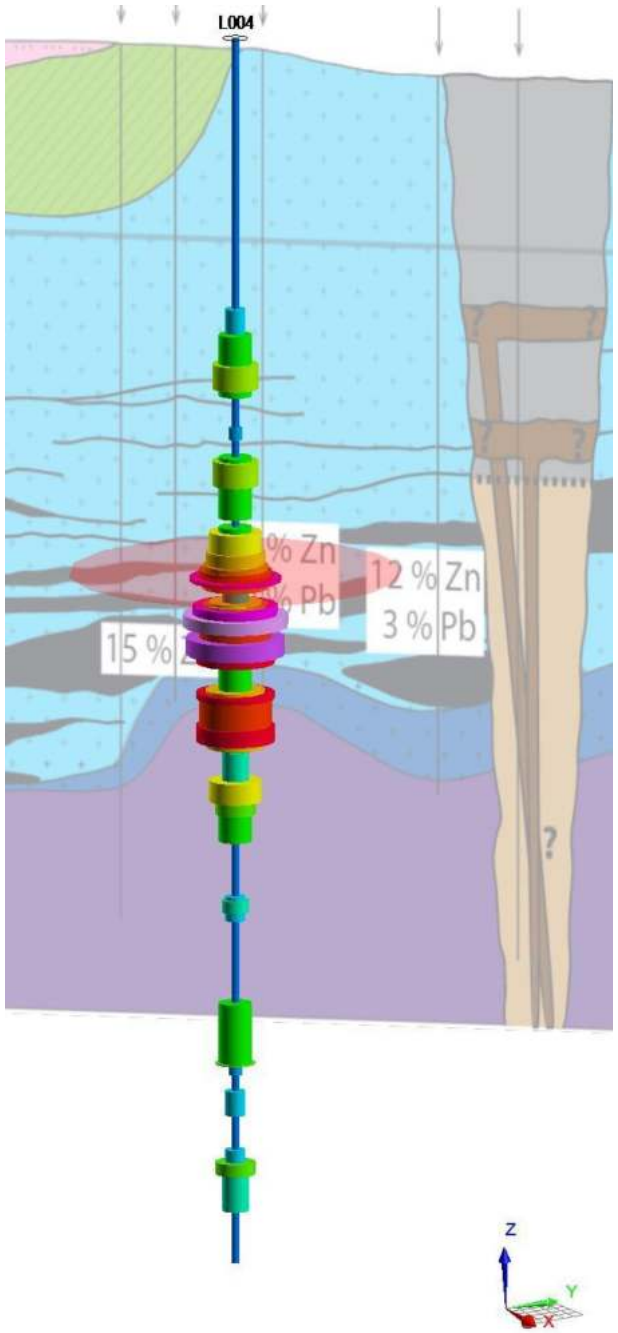
INTRODUCTION

Adrok's Atomic Dielectric Resonance Spectroscopy (ADR) is a pulsed electromagnetic (EM) technology operating in the frequency range of 1-70MHz. Low frequencies enable depth penetration while higher frequencies allow for higher resolution. Adrok collects scans in the field and from the data, can resolve for Energy- and Frequency- Harmonics, Energy intensity of the return pulse (akin to GPR or Seismic reflector intensity), Dielectric properties and frequency and harmonic correlations. All of this data combined can be used to differentiate different materials beneath the surface at depths typically over 1000m (Stove, 2023 - https://www.earthdoc.org/content/journals/10.3997/1365-2397.fb2023068).

Adrok can carry out scans and targeting using shallow or deep settings but for exploration under cover using deep setting, the ideal depth of surveying for Adrok is between ~200m and 2000m beneath the surface but this will depend on the amount of "noise" at the surface and the rock types needed to be propagated.

Depth penetration tests have been completed by almost every client who has used the technology. Teck and UKSTFC Boulby Laboratory range tests in underground mine settings have been published (https://www.adrokgroup.com/news/published-papers). The technology is principally used in the oil industry, however, many minerals/base metals projects have been completed and the combined results from all of these projects are helping Adrok unravel the specific fingerprint or unique response of sulfides and how to read this in the data. Adrok want to provide the exploration industry with a new means of exploring for metals with renewed confidence to drill in the correct location.

Different mineral deposits respond differently and therefore, Adrok has developed two different but complimentary methods. The first based on reflectivity of base metals with high dielectrics (e.g. massive sulfide narrow vein deposits) and a second method based on the frequency and energy harmonic responses that the presence of disseminated sulfides imparts on the signal. The latter is better suited to V(H)MS, SEDEX, Porphyry. Adrok will work with you to determine how best to set up a project to ensure the maximum success. ADR is a geophysical technique, therefore results are not absolutely definitive, however, we are confident that the most recent targeting criteria used to delineate sulfides should be considered as highly reliable. The current technique is similar to a metal detector .



OUTLINE

- Motivation for targeting sulfides.
- An introduction to the ADR technique.
- Proof of concept field testing results.

Method 1

Reflected Energy for massive sulfides.

Method 2

Targeting disseminated sulfides using Adrok's Weighted Sulfide Correlation Criteria (WSCC) Method.

SULFIDE TARGETING UNDERCOVER – why develop this technology?

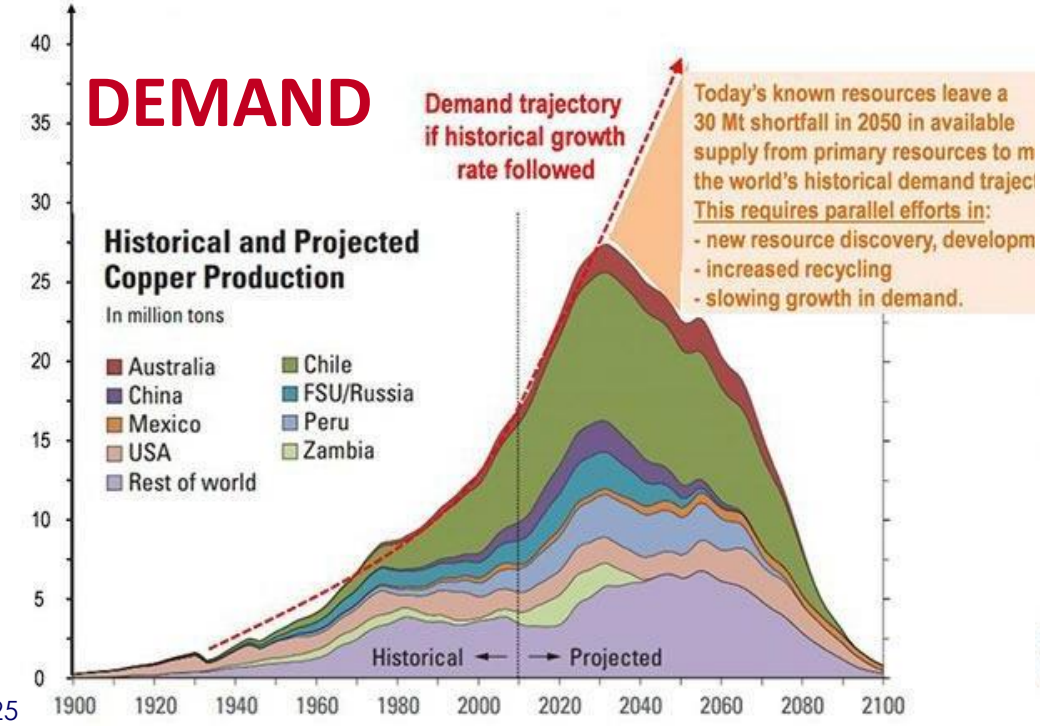
Motivated by:

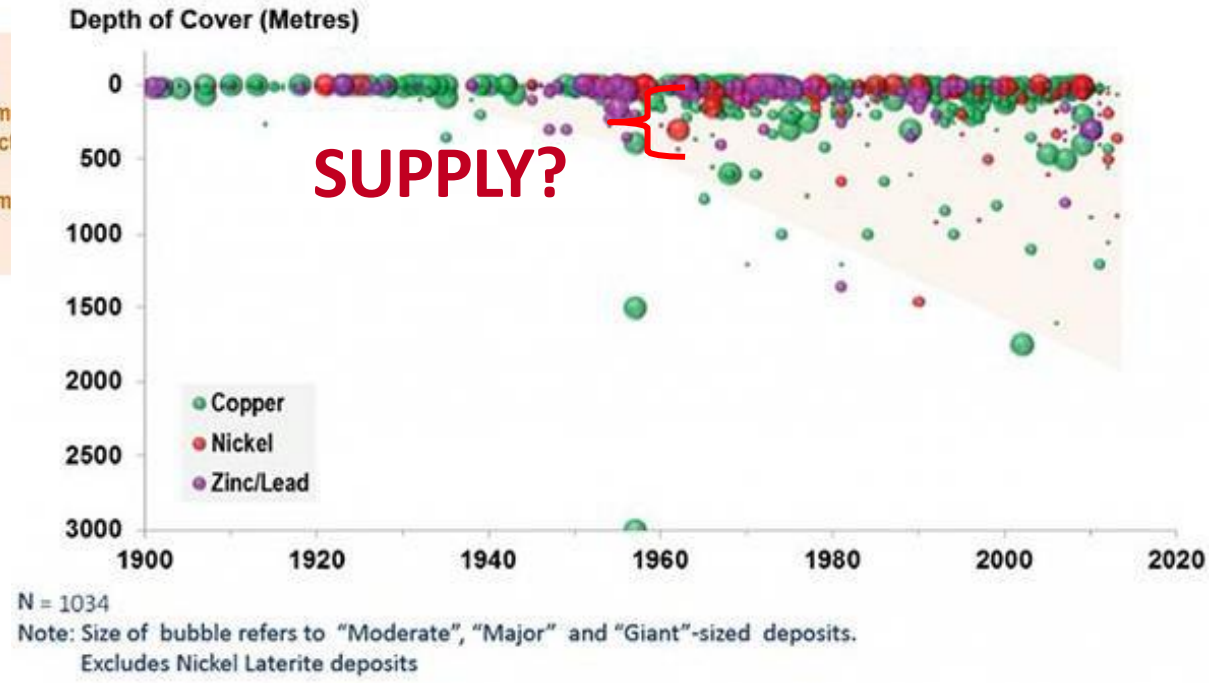
1) Adrok has collaborated on many projects and with mineral exploration companies and to this day, they are requesting a better technique to specifically target sulfides and one that provides a more precise location (X, Y and Z) with a particular focus on obtaining a precise depth to a drill target!

2) The two figures below highlighting the demand for new Tier 1 discoveries. Simply put, the world is running out of metal resources and we need smart technologies to identify new opportunities, particularly under cover.

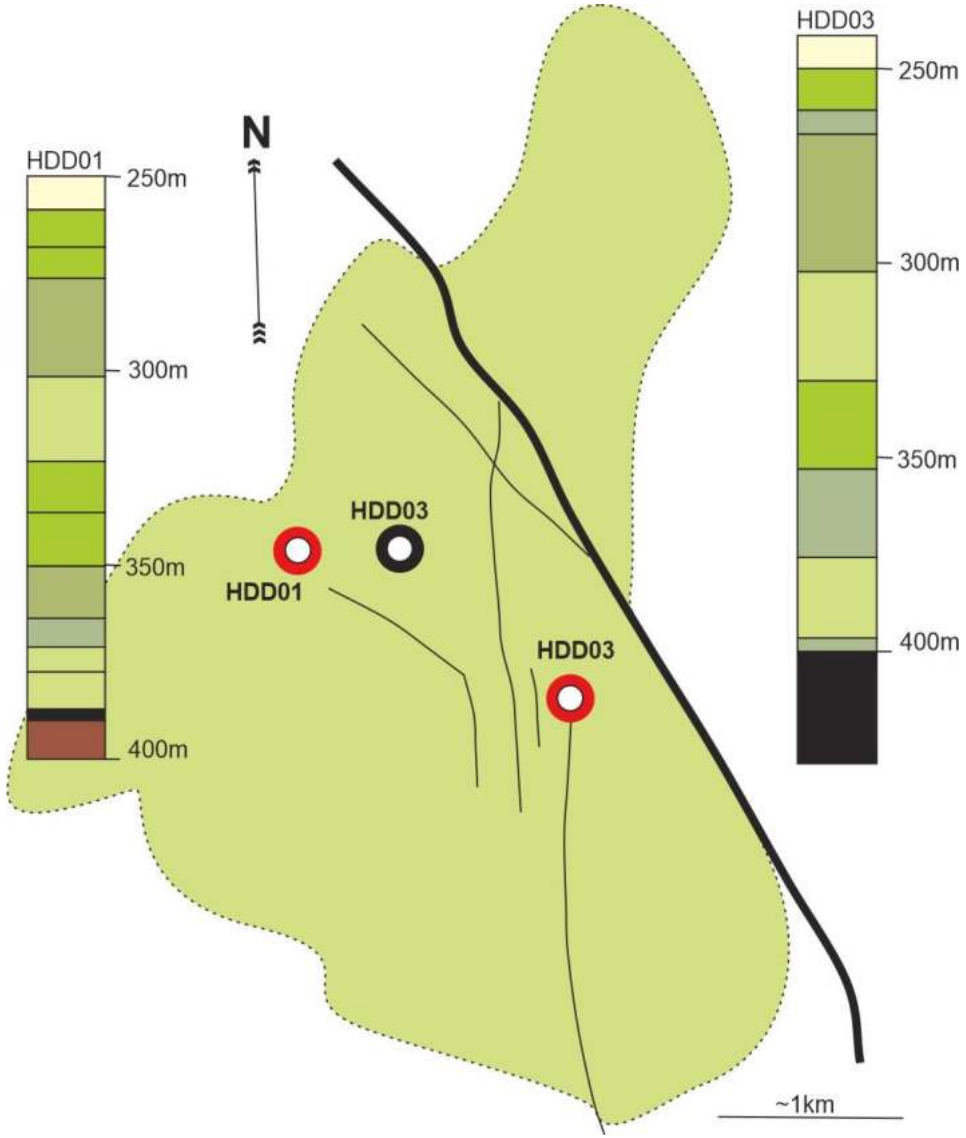
- *Hardware:* Adrok have developed a deep-penetrating data acquisition technique that utilises a conditioned pulsed radar pulse at low frequency (1-70MHz). The hardware enables the measurement of rock properties up to and sometimes over 1000m deep below the surface.
- *Processing:* Adrok have developed a means of helping discriminate sulfide bearing rocks by using a bespoke **Weighted Sulfide Correlation Criteria** (WSCC).

Figures from - Edmund Nickless: Resourcing Future Generations: A global effort to meet the world's future needs head-on, European Geologist Journal 42





Exploration under cover can be difficult



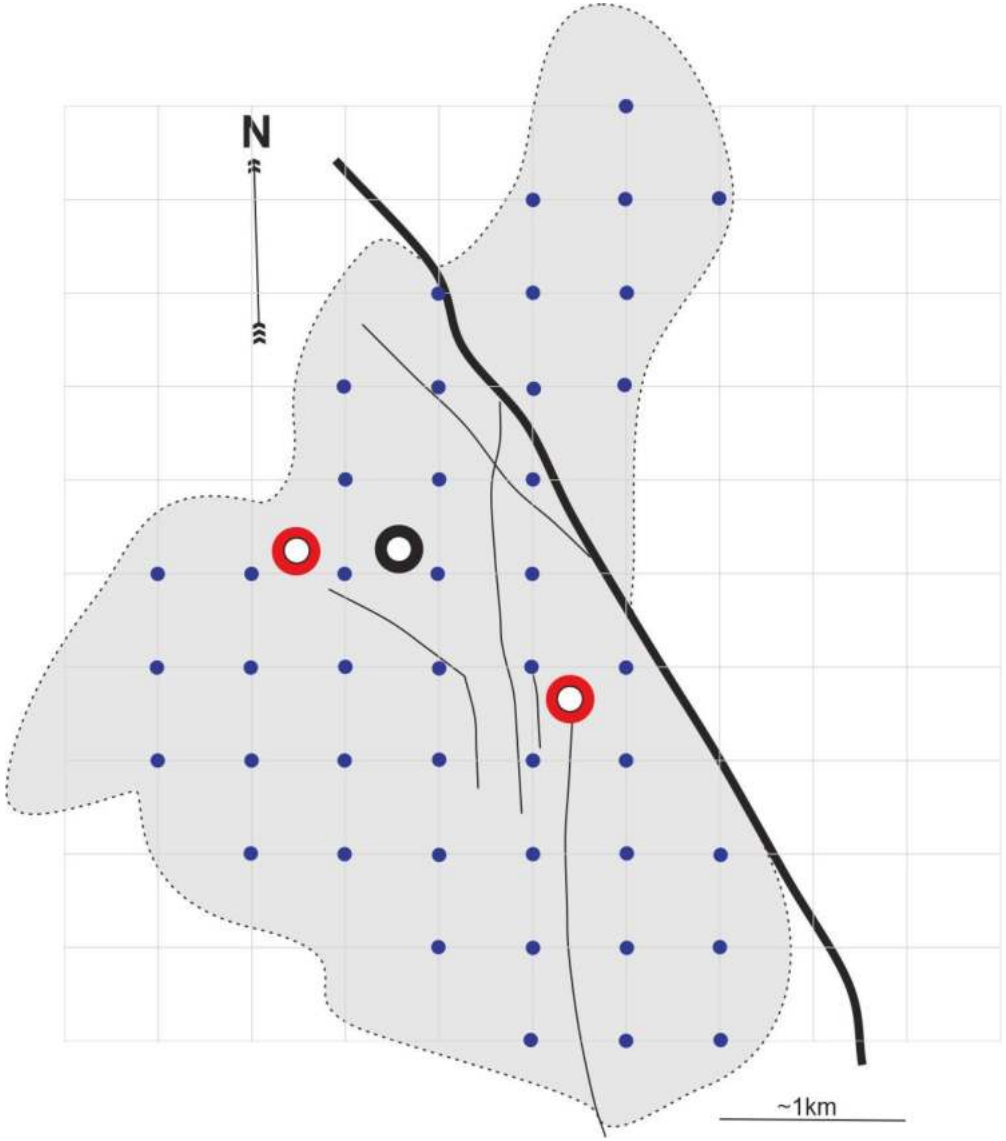
Where to drill next?

A hypothetical scenario but one facing many companies is where to drill to increase chances of finding sulfides. A map like this can be in plan view or cross-section but the concept is the same. With limited time and money to drill at 25m spacing, the targeting has to be much better constrained. Geophysics, particularly ADR can help. We use this scenario throughout the document to show how, using sulfide fingerprinting (our internally derived Weighted Sulfide Correlation Criteria method), we can really hone-in on sulfide rich target areas which in turn can save excessive barren drill holes.

Sulfides present in drilling

Barren drill hole

Exploration under cover can be difficult



Where to drill next?

Grid v's targeted drilling

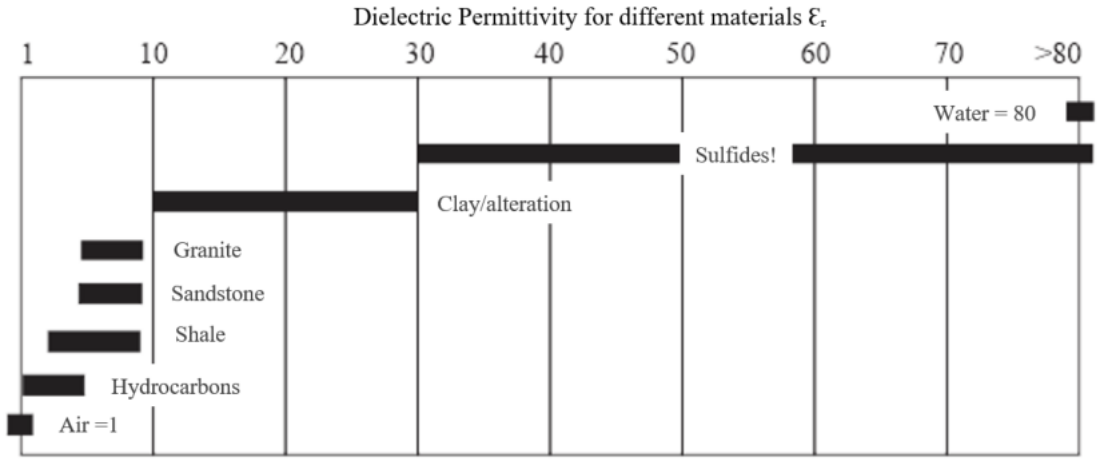
Some companies, even after obtaining geophysical data such as magnetics, gravity, IP or EM, drill on a grid pattern to apparently increase the chances of hitting sulfides. Experience in the exploration industry has given some of the Adrok team the capacity to experience the demands and difficulties of exploration "from the inside". The WSCC tool has been developed to help significantly reduce the risk and chance of drilling barren holes. We will explain how throughout this document

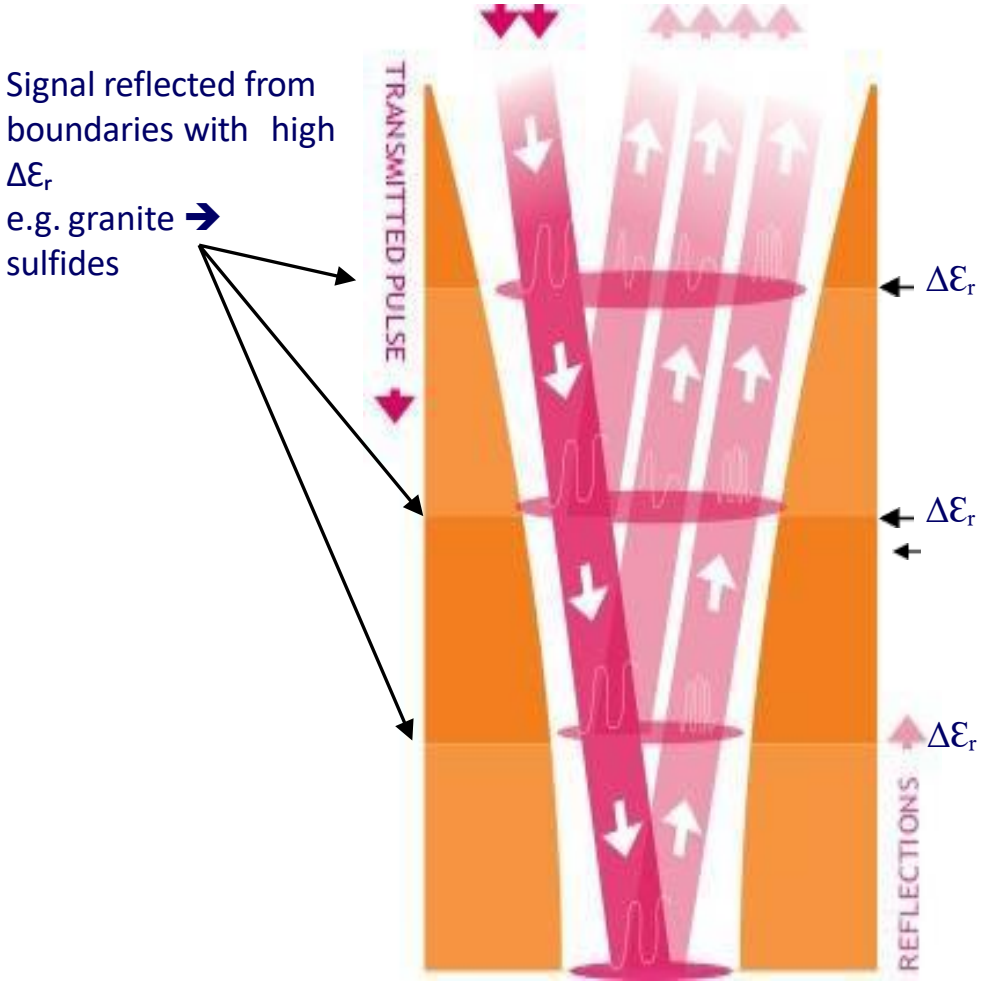
Atomic Dielectric Resonance (ADR)

- There is additional information contained with this documents that explains the practical method in more detail but essentially,
- The field equipment (transmitter and reviver unit shown right) transmits a pulsed broadband of radio waves between 1-70MHz for mineral exploration applications. This is a multi-frequency technique! NOT like ground penetrating radar for example. One of the secrets to Adrok's tool is that it only uses milliwatts of energy but lots of stacked traces. This is NOT a traditional GPR. Both the hardware and software are far more advanced than traditional GPR.

YES! The technology has been through multiple depth-of-penetration tests. Some of these test results are included here and in accompanying documents!

- ADR sends broadband pulses into the ground and detects the modulated reflections returned from the sub-surface structures.
- Reflections returned from changes in Dielectric Permittivity (ε_r)/Dielectric Constant (DC) of materials at depth.

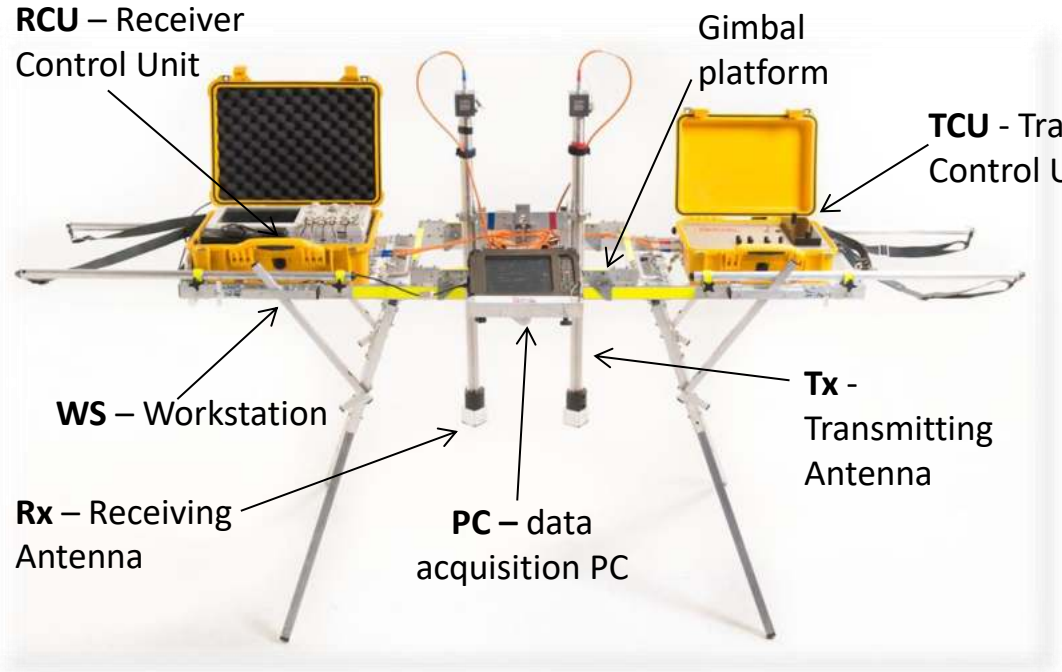




Field equipment

The entire field setup is extremely small and can fit in the back of a regular 4WD vehicle.

- The antennas can be directed down, up, horizontally or in any direction required.
- No site clearing, no heavy machinery and no special permits are required.
- The only impact is walking the equipment in 50-100m transects depending on the survey.
- No land clearance surveys required because there is no disturbance to the land!
- Rapid data collection – usually less than 2 hours per STARE scan (data collected to ~1000m)
- Disciplined and robust processing within days; dependant upon scan types, depth and resolution required



Scan Types

P-scan (profile scan) is planar like a seismic section. Laterally continuous features such as bedding can be interpreted

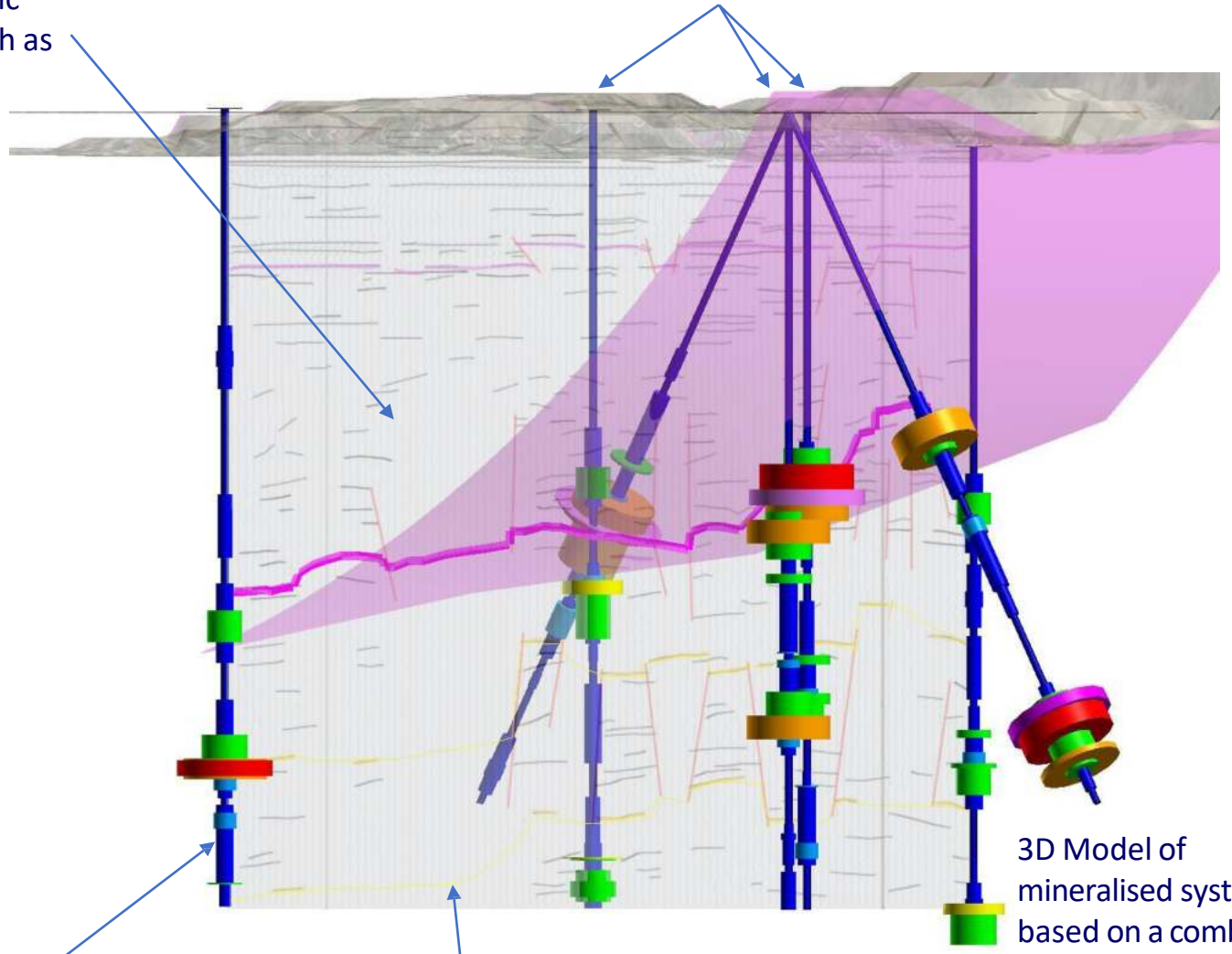
"STARE" refers to Adrok's Stationary, linear scan technique. A STARE, being linear, is like a drill hole in terms of the information gained in return. It will provide a sulfide confidence below the collar.

A "P-scan" is a profile scan where the equipment is walked along a path at the surface and information is collected along that plane. This is similar to a single Seismic Reflection line for example. We can now show sulfide probability on P-scans.

Multiple STARE or P-scans can be used to generate 2.5D geophysical models of the underground but STARE scans provide the greatest amount of information about sulfide presence below the surface.

STARE scans are carried out for most surveys with the addition of one or a few P-scans depending upon the target and desired outcome.
For Citigold for example, we were planning on around 50+ STARE scans to 1000m. This would have provided a pseudo 3D image of the sulfide-zones so we could subsequently target the high-grade zones. We can discuss the best "plan of attack" after discussing the target type.

Vertical and angled STARE scans with sulfide probability responses shown



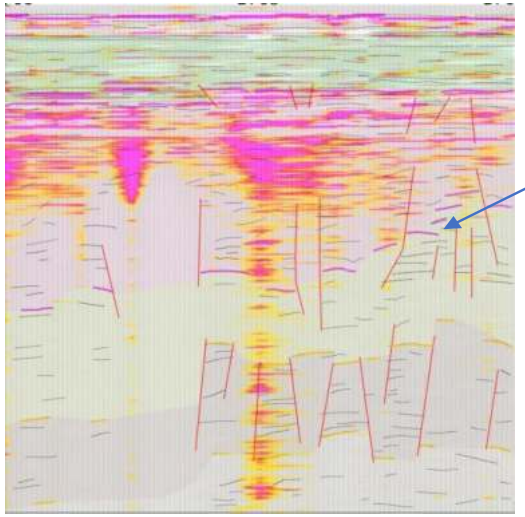
Linear scan (like a digital drill hole)

Profile scan (like a seismic scan)

3D Model of mineralised system based on a combination of ADR scan types and different STARE scan orientations

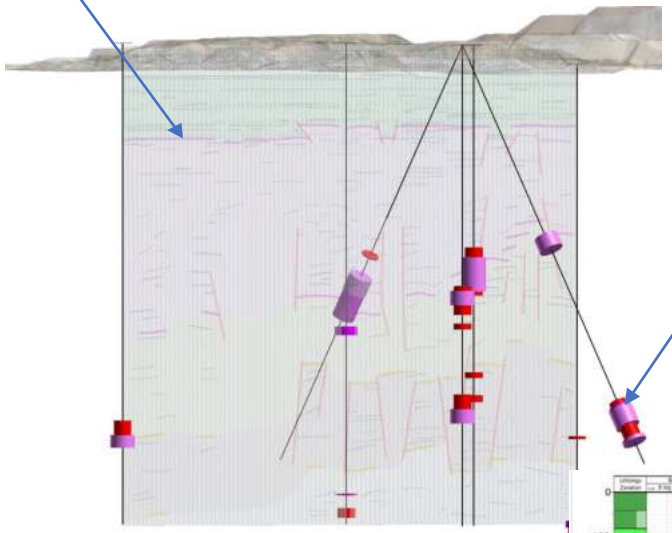
Different scans for different purposes

PROFILE SCANS (P-SCANS)

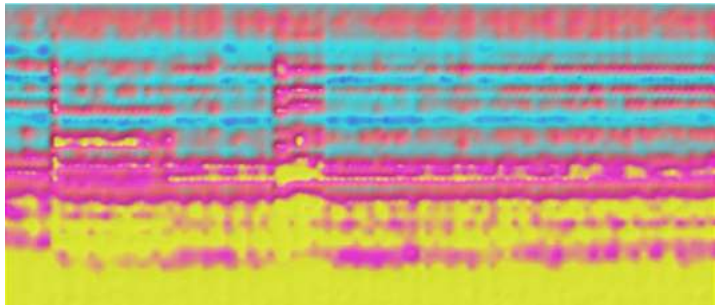


Looking for sulfides and mapping lithologies

Combining linear and planar scans provides a plethora of info

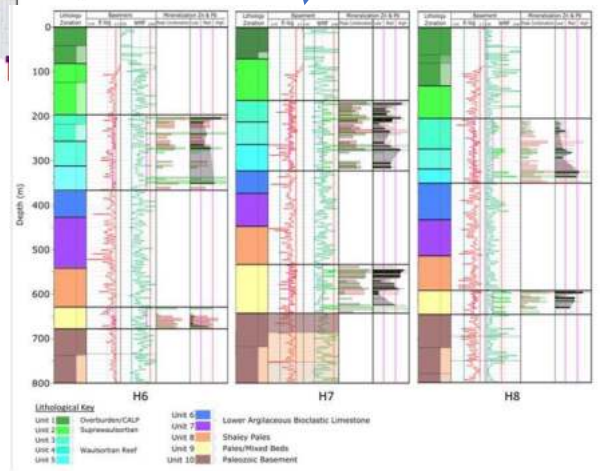


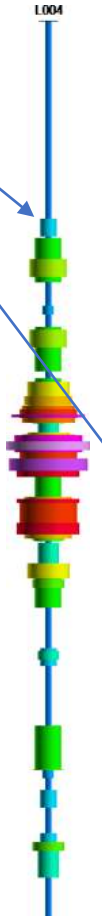
Looking for deep tunnels

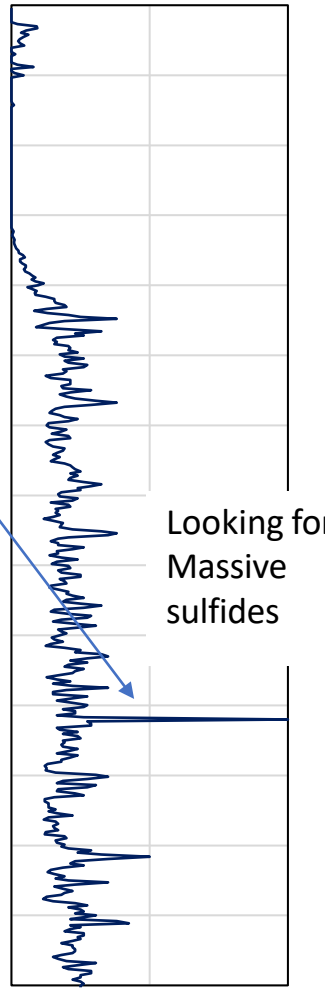


LINEAR SCANS (STARE-SCANS)

Looking for disseminated sulfides







Looking for Massive sulfides

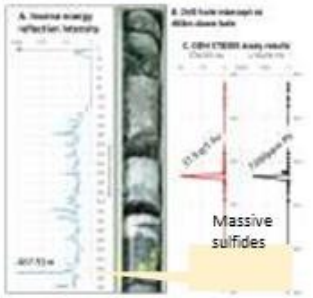
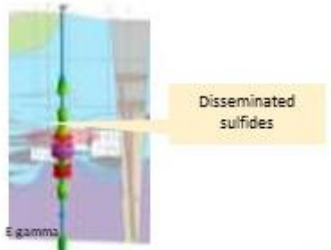
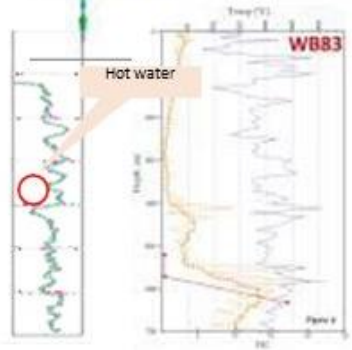
Mapping lithologies between scans (infill predrilling)

Capabilities

One broadband pulsed EM scan can provide a plethora of information for your project!

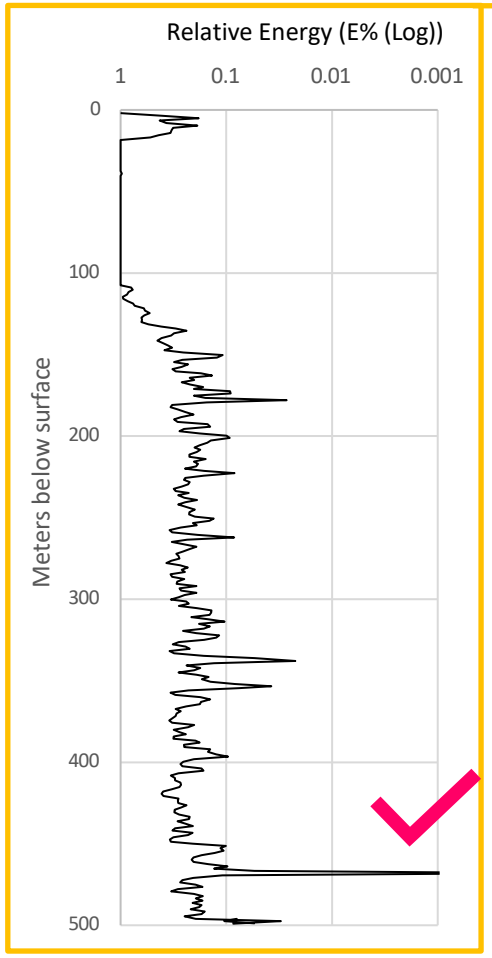
For each planar or linear scan, we collect a suite of data that can be used to extract unique geophysical properties of rocks and liquids beneath the surface.

For example, a single planar survey may target water (aquifers) in the basin cover rocks and sulfides in the basement rocks. Many companies have already taken advantage of this multi- commodity targeting capacity.

Measurement	Target commodity	How and why it works	Deliverable
Dielectric curve (ε)	Principally water and/oil (hydrocarbon) targeting 	Water has a high dielectric permittivity (ε_r80) The relative amount of water found within a rock is typically related to the dialectic value, particularly in basin rocks where host sediments have ε_r<15.	
Energy reflection (E-log)	Massive sulfide targeting 	Massive sulfides represent a good dielectric contrast with host rock types. Accordingly, the highest reflected energy is measured at a sharp dielectric boundary like layers of massive sulfide!	
Energy and frequency harmonics	Lithology variation mapping 	Energy and frequency harmonics can help differentiate different lithological layers because both the boundaries between lithologies and the lithologies themselves show different characteristics in E- and F-harmonics results.	
	Disseminated sulfide targeting 	Key peaks and troughs in energy- and frequency-harmonics have been integrated into a weighted sulfide correlation criteria (WSCC) method specifically developed for targeting disseminated sulfides.	
Energy-gamma and/or Energy & DC function	Geothermal mapping and thermal characterization prior to drilling 	External clients have independently developed a correlative method of matching peaks in geothermal temperatures and peaks in E-gamma results. Accordingly, the E-gamma can be used to map anomalies in geothermal heat such as hot aquifers. Adrok can also use a combination of dielectrics and energy to extract changes in temperature with depth.	

Gold and Massive Sulfides

Transmitter (Tx) sends a pulse of energy toward the target at depth. The pulse is reflected back from boundaries between rocks with contrasting Dielectric Permittivity's (DC). The reflected pulse (like an echo) is measured at receiver (Rx). Granite and sediments for example have DC values of approximately 5-10 whereas sulfides (e.g. Pyrite) have a DC measurement of around 70 or more. The ADR receiver will detect the reflection and the strength of that reflection as a value referred to as Relative Energy and plotted as E%.



RESULTS The chart shows an actual scan carried out over a narrow vein gold and sulfide deposit. The scan is a linear, vertical scan (referred to as a "virtual borehole") taken directly above the target zone. The sulfides are recorded as a strong anomaly in the returned energy signifying a major contrast in the DC of the rocks on either side of the boundary. Drilling after the scan had been completed confirmed that the anomaly identified the granite-sulfide contact. (scan A56, WGS84 55K 425867.16 m E, 7774730.72 m S

Low DC granites (DC = 5-10)

High DC sulfides (DC = >70)

Sulfide target confirmed at ~467m deep in diamond drill hole at test site

SETUP Transmitter (Tx) and Receiver (Rx) field setup. Portable, low energy and can be used virtually anywhere

SURVEY TARGET High grade GOLD (>1 Oz/t Au) , COPPER, SILVER, LEAD AND ZINC

SURVEY PARAMETERS

- Sulfide reflection surveys 1MHz – 70MHz
- Typically >4 scans per day
- Pulse penetration depths up to and over 1000m deep depending on geology
- Training site desirable (vertical drill hole with target sulfide type).
- 3-person field operation

BENEFITS FOR THE ENVIRONMENT including:

Site access by, for example, car, foot, helicopter, ROV to the site where the survey is to be completed. No clearing required; no special permits required as no surface disturbance. Can be used near anthropogenic infrastructure.

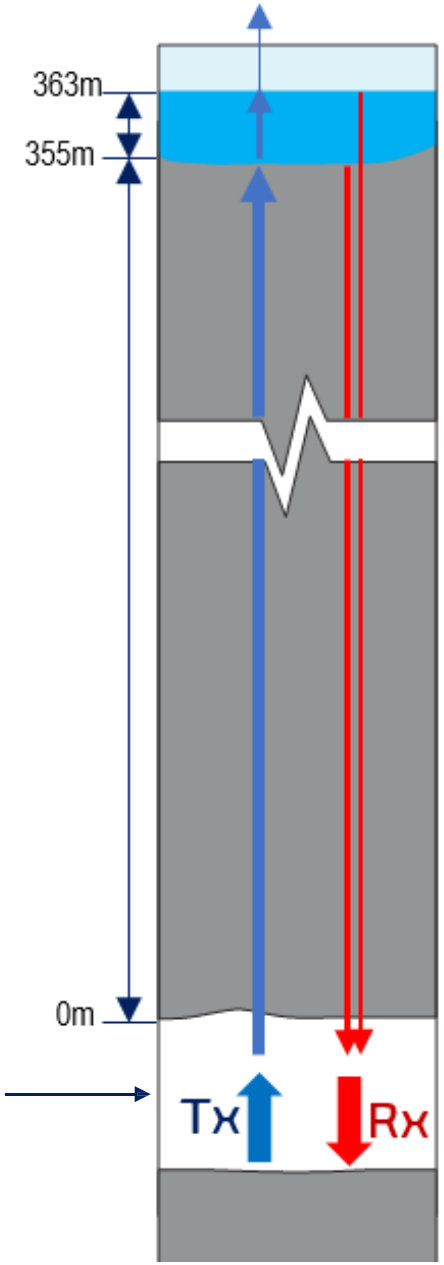
Depth of penetration test carried out by Adrok and Teck

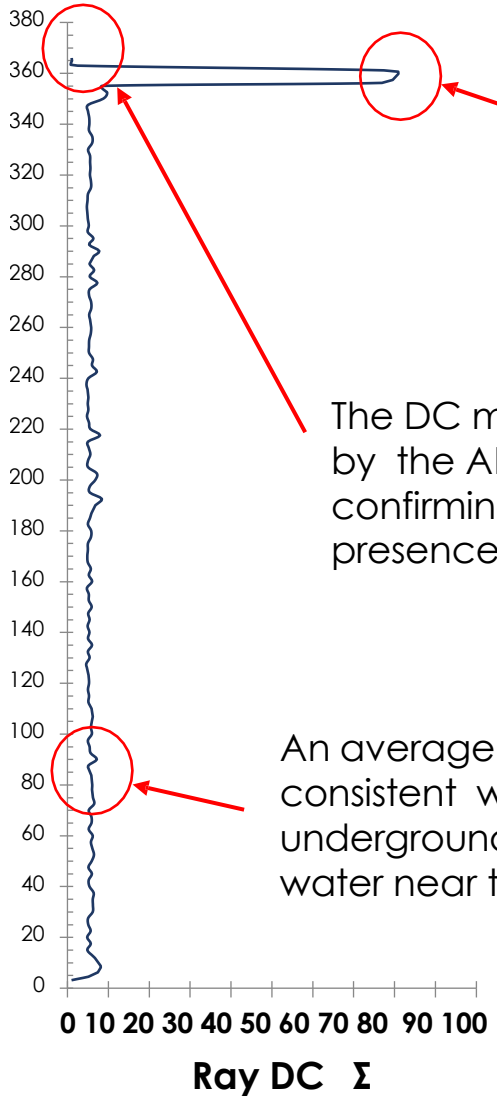
Air Er/DC = 1

Water Er/DC = 80

Rock Er/DC = 5-15

Underground mine level drive ADR equipment pointed upwards





The DC measured by Adrok is 76.9-80.7 confirming the presence of **WATER**

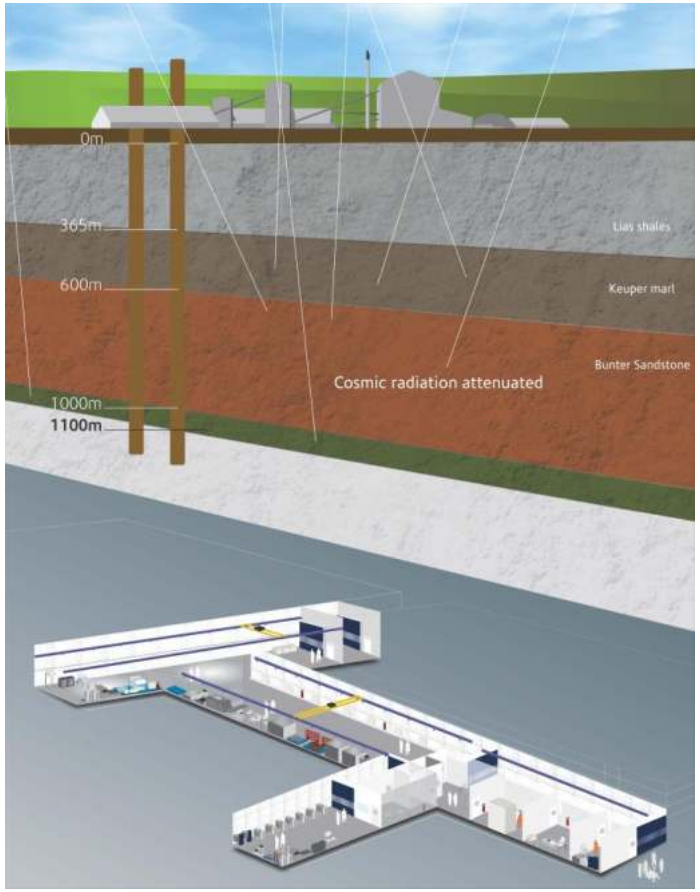
The DC measured by the ADR tool is 1 confirming the presence of **AIR**

An average DC of around 7 is consistent with rock between the underground mine drive and the water near the surface

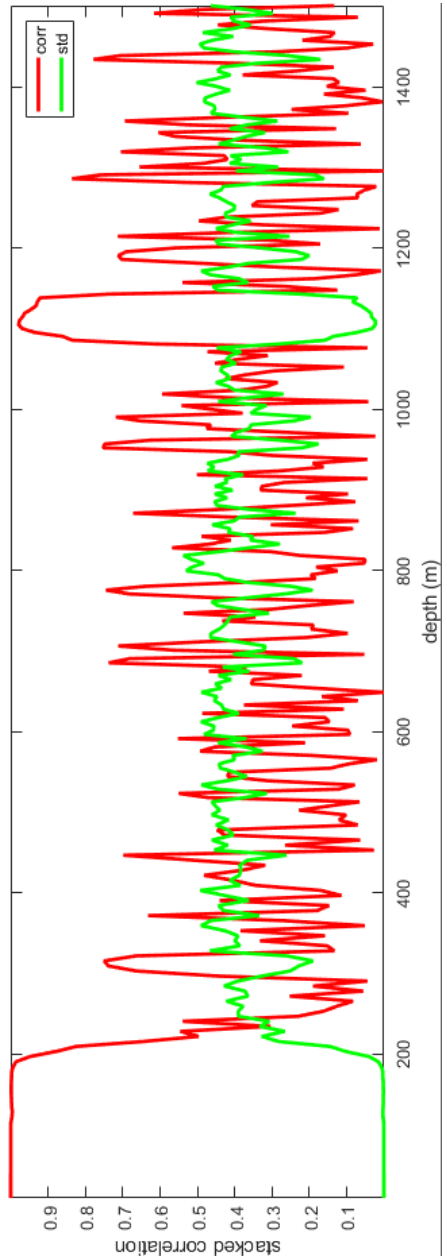
Reference
K. van den Doel, J.Jansen, M.Robinson, G. C. Stove, and G. D. C. Stove (2014) Ground penetrating abilities of broadband pulsed radar in the 1-70MHz range. SEG Technical Program Expanded Abstracts 2014: pp. 1770-1774. SEG Denver 2014 Annual Meeting. DOI

Depth of penetration test at Boulby Laboratory

In this study we use this radar system to detect a reflection from the ground surface from 1100m below the ground using reflection mode scans. The main difference with the previous study is an increase of stacking by three orders of magnitude. Previously we stacked 500 traces, with our current setup we stack almost 500,000 traces. Results show a clear reflection in the full stack near 21,500 ns.



Depth	Rock Layer	ε_r
0 to 365m	Lias Shales	9
365 to 600m	Keuper Marl	8
600 to 1000m	Bunter Sandstone	5
1000 to 1100m	Polyhalites (Potash)	2.5



Reference

G. Stove, K. van den Doel, S. Paling, P. Scovell, T. Edwards (2023) Deep detection range test for a low frequency subsurface radar system (with reviewable data available online). 84th EAGE Annual Conference & Exhibition, Jun 2023, Volume 2023, p.1 – 5 https://doi.org/10.3997/2214-4609.2023101348

https://www.adrokgroup.com/data

Method 1: Reflected Energy

Works well for massive sulfides including deposit styles:

- Orogenic narrow vein massive sulfide and gold
- NI-PGE/layered mafic hosted
- Some VHMS/VMS

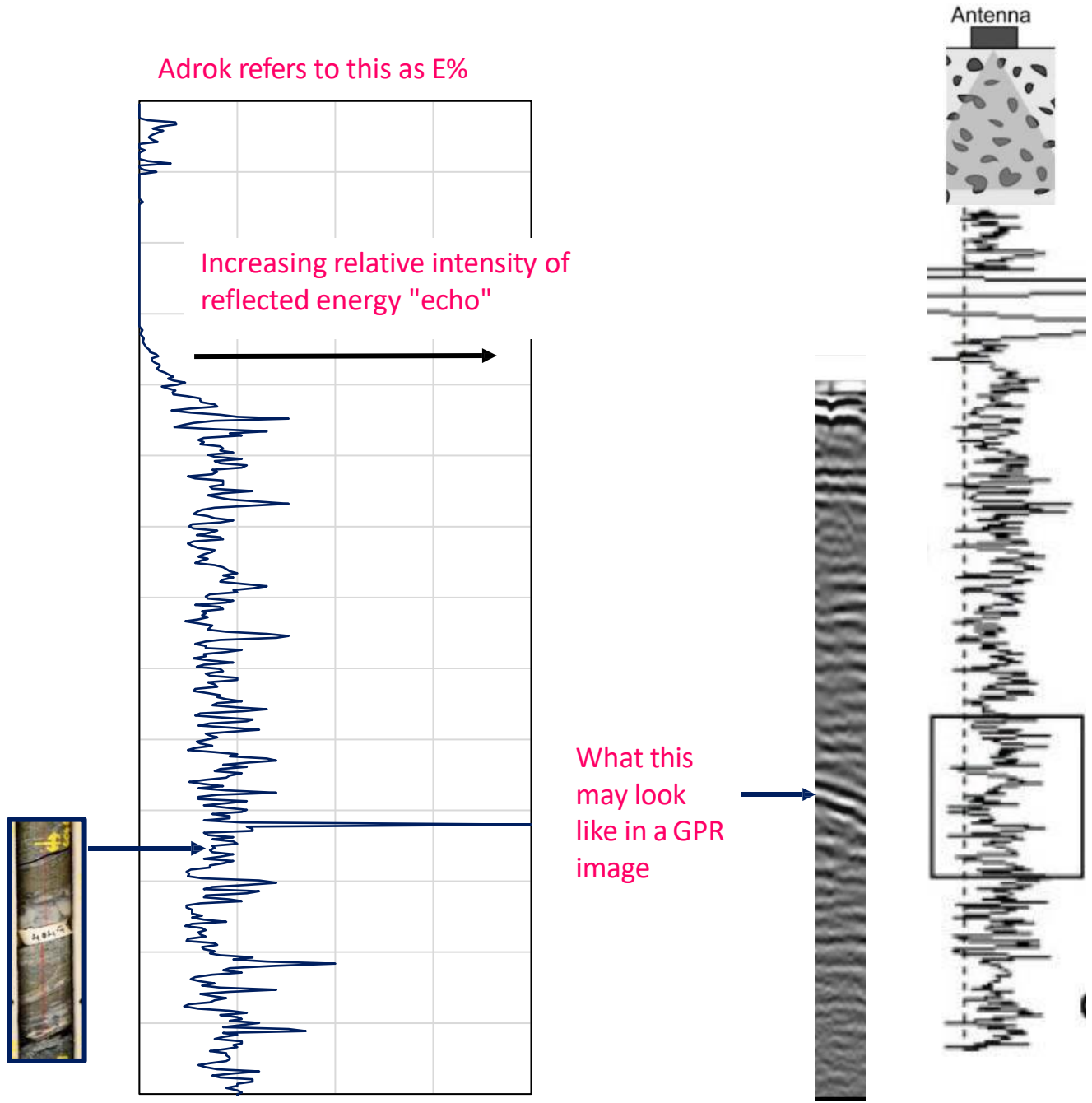
Reflected Energy

Like the previous examples, Adrok also measures reflections and the intensity of these reflections at different depths below the scan location.

Just as in GPR data, where the signal contains high's and low's, the ADR data also exhibits highs and lows but the peak in the energy data represents the strongest reflector in the entire scan. In a homogeneous granite or a pule of metamorphic or sedimentary rocks, the contact between sulfides which have by far the highest permittivity values, will provide the best reflector. Accordingly, in field-based case studies, we consistently "see" the contact between granite and sulfides as a very strong reflector.

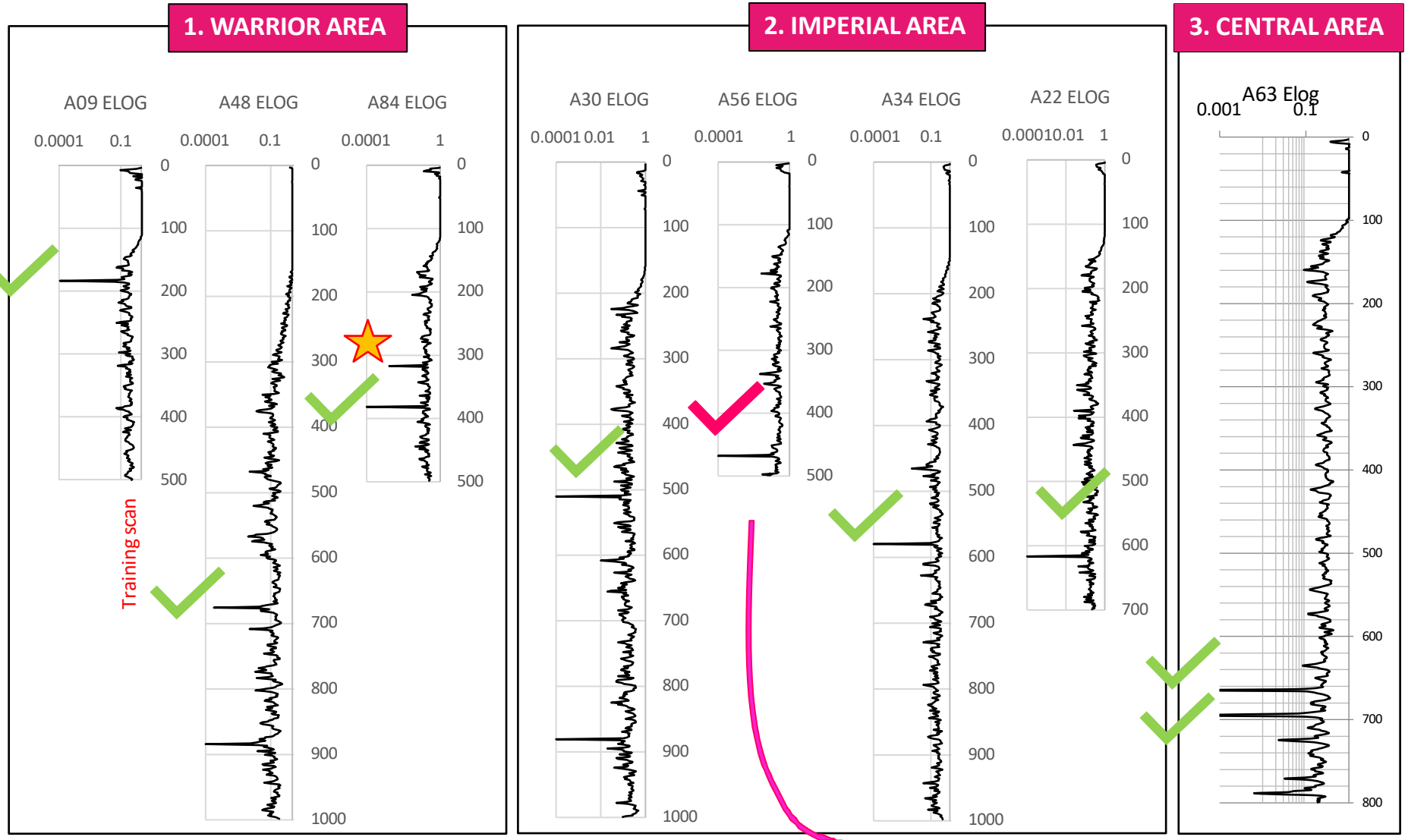
This method worked very well in trials where massive sulfides are present within an orebody.

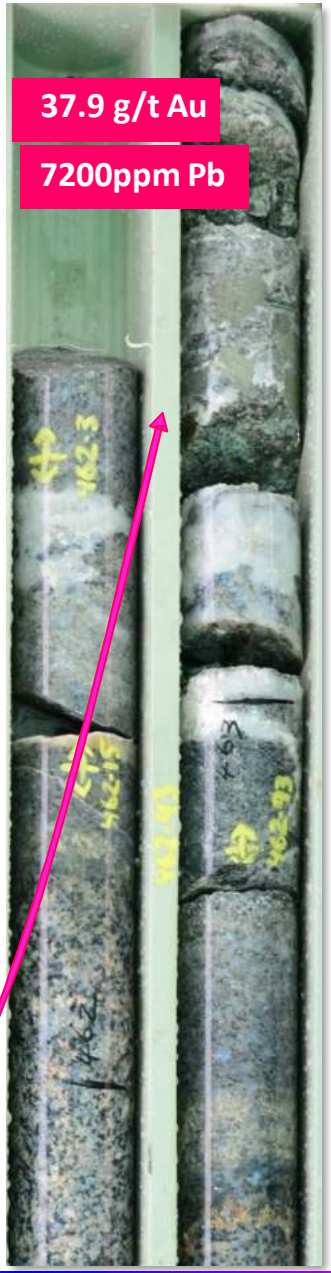
- What we measure and observe in the ADR energy results is almost identical to what we see in GPR images with different layers exhibiting different intensities of reflectivity.
- ADR scans are linear whereas GPR scans are presented as 2D planar results.
- This technique/method worked very well at Charters Towers where two scan were completed, and the ADR targets drilled with positive intercepts in both drill holes.



Tested in Charters Towers (orogenic Au) and demonstrated success with post-survey drilling of anomalies!

DRILL HOLE CT8205 assay results ("A56")





★ Previously unrecognized structure found from ADR results

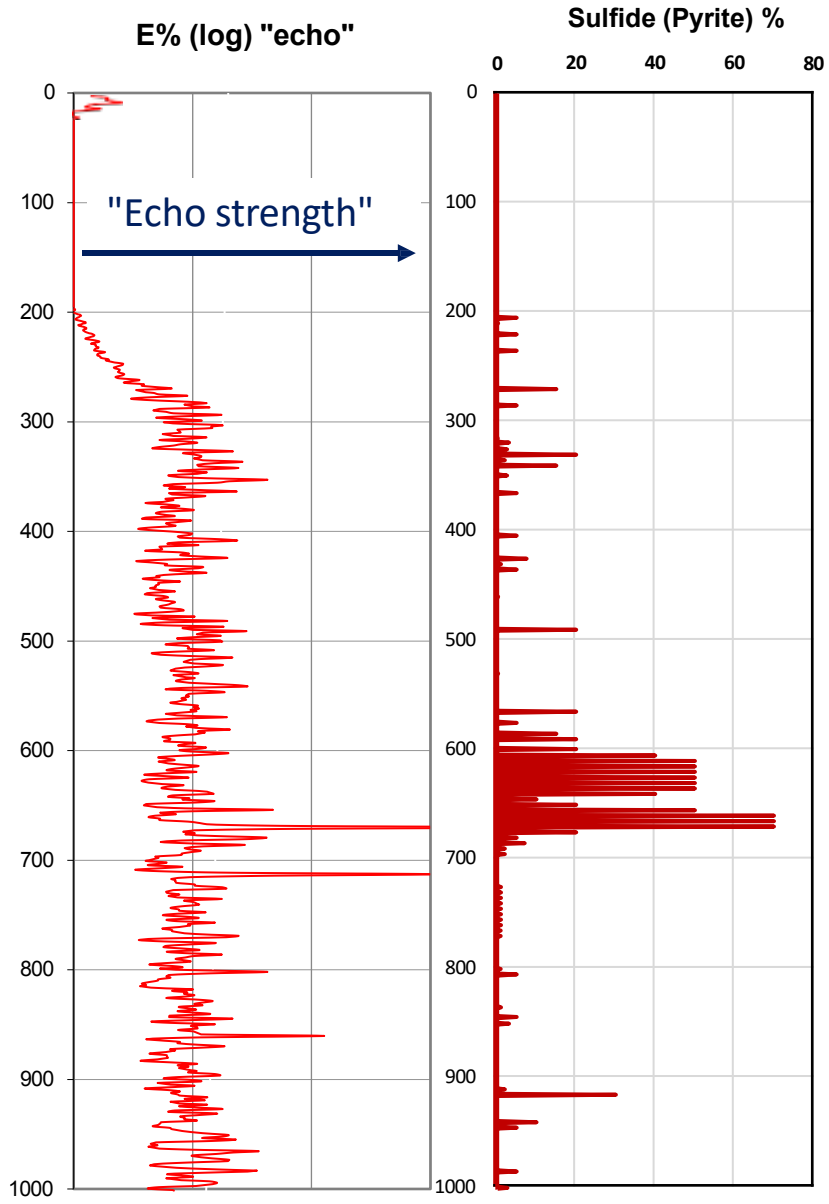
Scan A56 successfully drill tested - drill hole CT8205!

Reflected energy in STARE scans

The boundary between the host-rocks and the sulfides presents a large $\Delta\varepsilon_r$, therefore the boundary acts as a reflector to radar waves. Therefore, an anomaly/echo in the E% signal will only be recorded when the density of sulfides is high.

Demonstrated technique with post-survey drilling of targets identified in ADR including Citigold Pty Ltd and the recent successful targeting of copper-sulfides for Strongbow Exploration Inc. (SBW-TSXV; SBWFF-OTC) Drill hole GWDD-002 announced April 2020.
https://www.adrokgroup.com/case-studies/vol-5-together-we-rock/vol-5-04-cornish-lithium-results

HOWEVER, most mineral exploration is looking for disseminated sulfides!



Targeting gold and massive sulfides in narrow veins/shear zones

Adrok recently completed an ADR survey for a client looking for narrow-vein sulfides. The aim of the survey was to help detect water and sulfide bearing fractures beneath the surface in an area where drilling was carried out after the survey was complete.

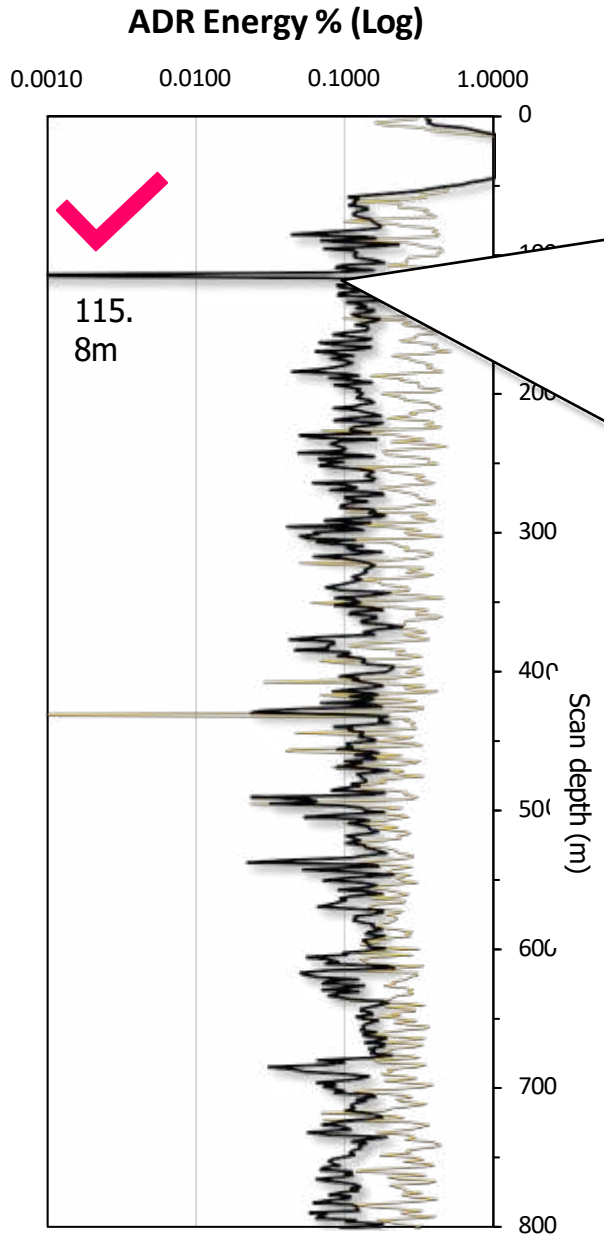
ADROK's pre-drilling ADR Energy results

Energy response depth:
115.8m
ADR results: Maximum energy return from merged returned energy.
Scan angle: 85°–170 from vertical

v

Drill hole assay results

Obtained post-scan Diamond drill hole intercept depth:
90.6m-105.29m
Interval width: 14.69m
Cu: 7.46%
Sn: 1.19%



E% anomaly (<0.01) at 115.8m

A strong anomaly in the combined energy graph (black line) is indicative of a boundary between two layers with contrasting dielectric permittivity values (ε_r) such as meta-sediments and sulfides. Based on results from other studies of narrow vein gold + sulfide deposits (e.g. Charters Towers, Australia), these strong signals in the returned energy signal are likely to be sulfides. Adrok has previously shown that values less than 0.01 in the E% results are indicative of sulfides.

The anomaly found here corresponds well with the diamond drill results released in April 2020 (6 months after the scan as completed)
The E% method has been found to work well for massive sulfides where a strong reflection in energy at a boundary between dielectric materials is present.

This represents another important result for Adrok.

Merged scans

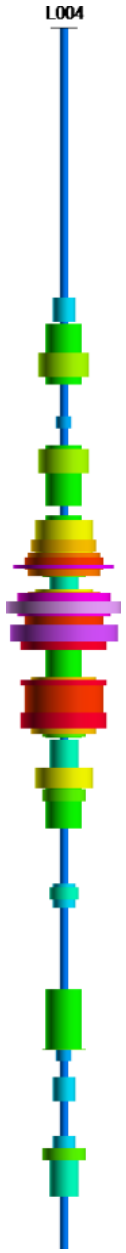
Single scan SII-4

Method 2: Changes in Energy and Frequency

Harmonic results over greater thicknesses (~>10m) for disseminated sulfides including deposit styles:

- Porphyry
- SEDEX
- Some VHMS/VMS
- MVT

Disseminate sulfide targeting



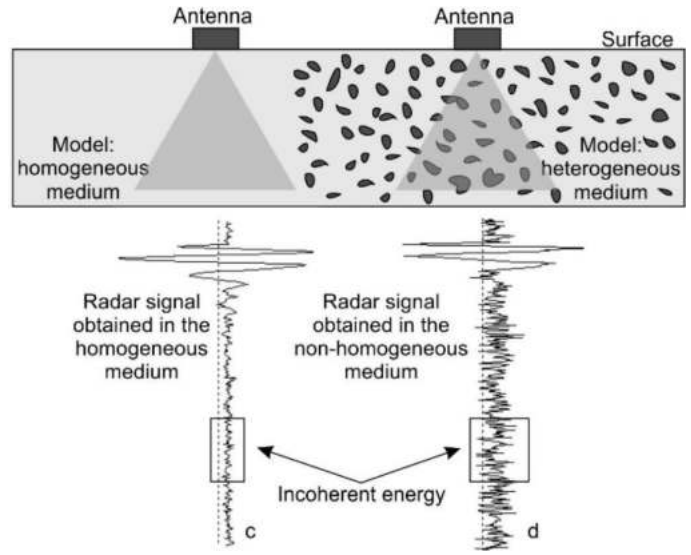
Both methods are pre-drilling targeting techniques

1. Can we see a unique geophysical fingerprint associated with sulfides that helps distinguish them from country rock?

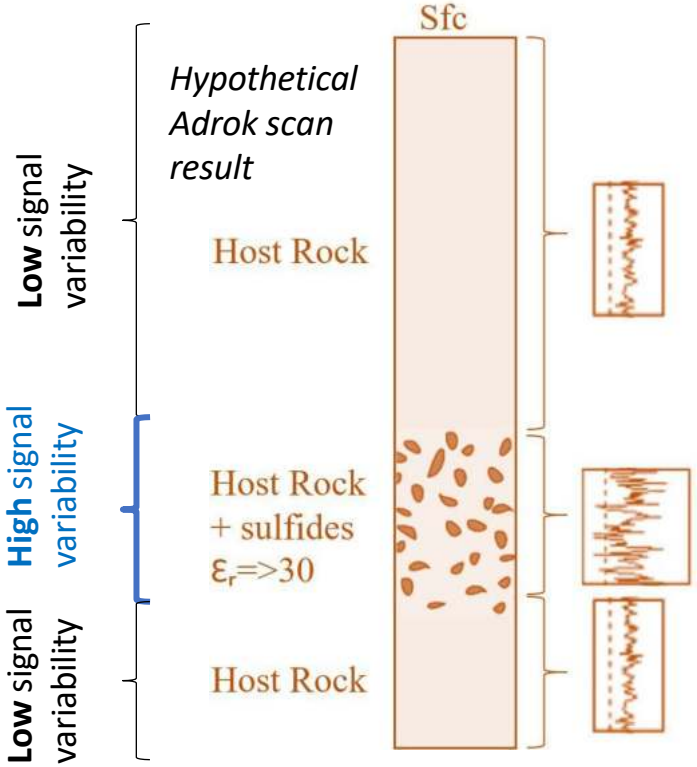
2. Can we help constrain the target area and target depth prior to drilling?

3. Can we provide a sulfide probability map to better inform drill planning?

4. Can we help develop a technique that will enable mineral explorers to drill under cover with much greater confidence?



From Naval et al.,2018

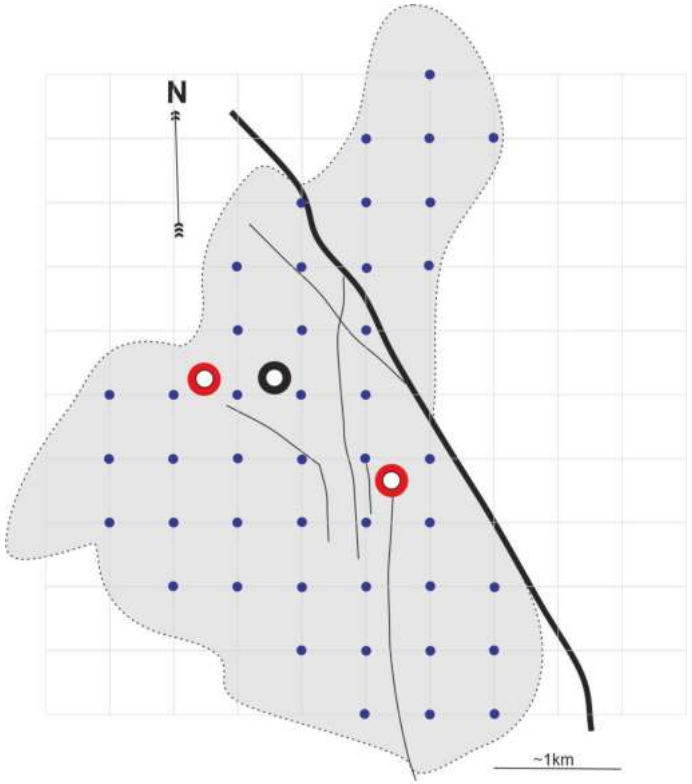


Disseminate sulfide targeting

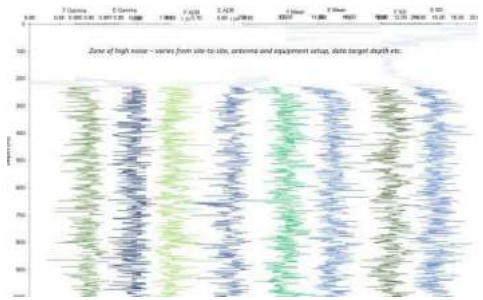
We can use the sulfide targeting tool to now delineate priority drill targets. As described previously, this is a map view but it is directly applicable to any shape min-zone.

The following section describes how we derive the sulfide targeting and we show some examples of it being used in the field to target Pb-Zn mineralisation but its not specific to Pb-Zn, rather these are the examples we presented at the SEG and EAGE conferences.

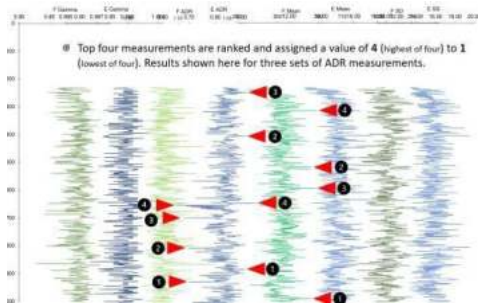
https://www.adrokgroup.com/news/published-papers



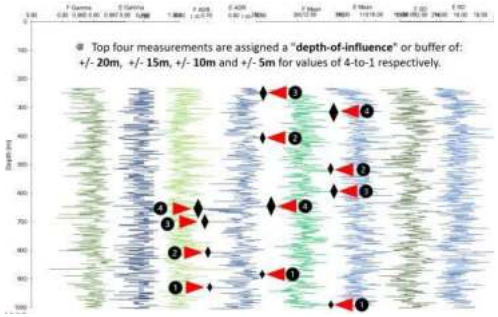
Disseminate sulfide targeting



During a field survey Adrok collects data which is processed and presented as a set of results including the 8 shown in these three pages.
While there are other results such as the return energy (E%) as shwn in the previous "method 1", the set of eight results shown above are used in targeting the disseminated sulfides.
The results are a set of **energy and frequency harmonics** which, as seen here, show a series of peaks and troughs as the EM pulse responds to changes in material dielectric and conductivity properties.
The **same data has been collected by Adrok for over ten years**, therefore Adrok have been able to go back through legacy data collected from the range of deposit types from around the world. This has given Adrok the opportunity to examine each of the signal responses to sulfides and essentially pick-and-choose the responses that correspond with sulfide in drill core.

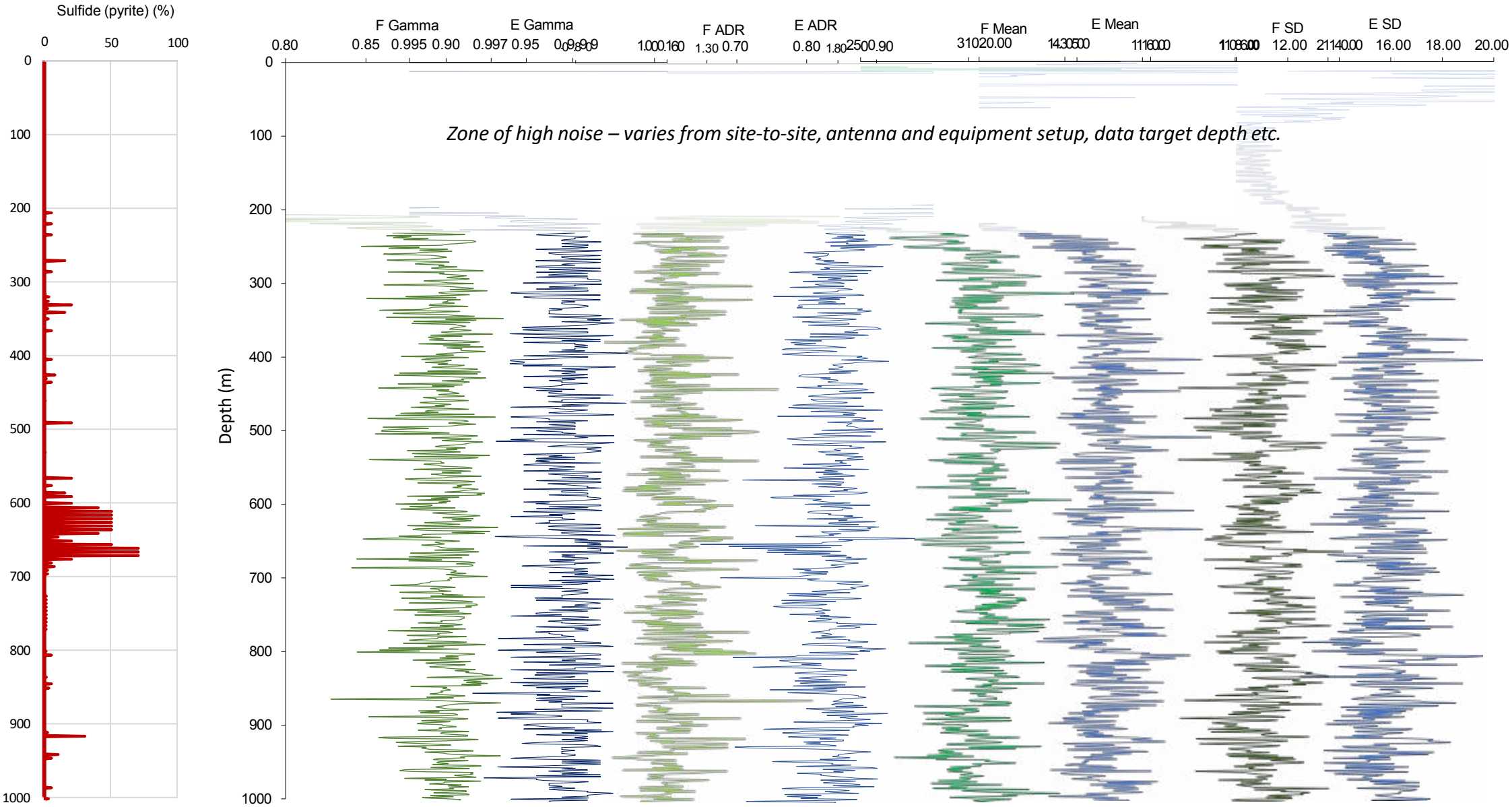


The aim of the technique was also to apply a **quantitative approach to pinpointing sulfides** such that the method is both repeatable but can also be carried out by the client who will get the exact same result.
Presented here is the first step in generating what we refer to as a **weighted sulfide correlation criteria (WSCC) method** for differentiating the presence of sulfides.
The **first part of the process** requires the delineation of the top or lower four values in any scan. Shown here are the results for the four highest and four lowest values in E-ADR and the four highest values in F-mean.
Each of the **peaks and troughs are assigned a value from 4 to 1** with the highest being 4 and the lowest being 1. This gives each peak or trough a value or "weight".



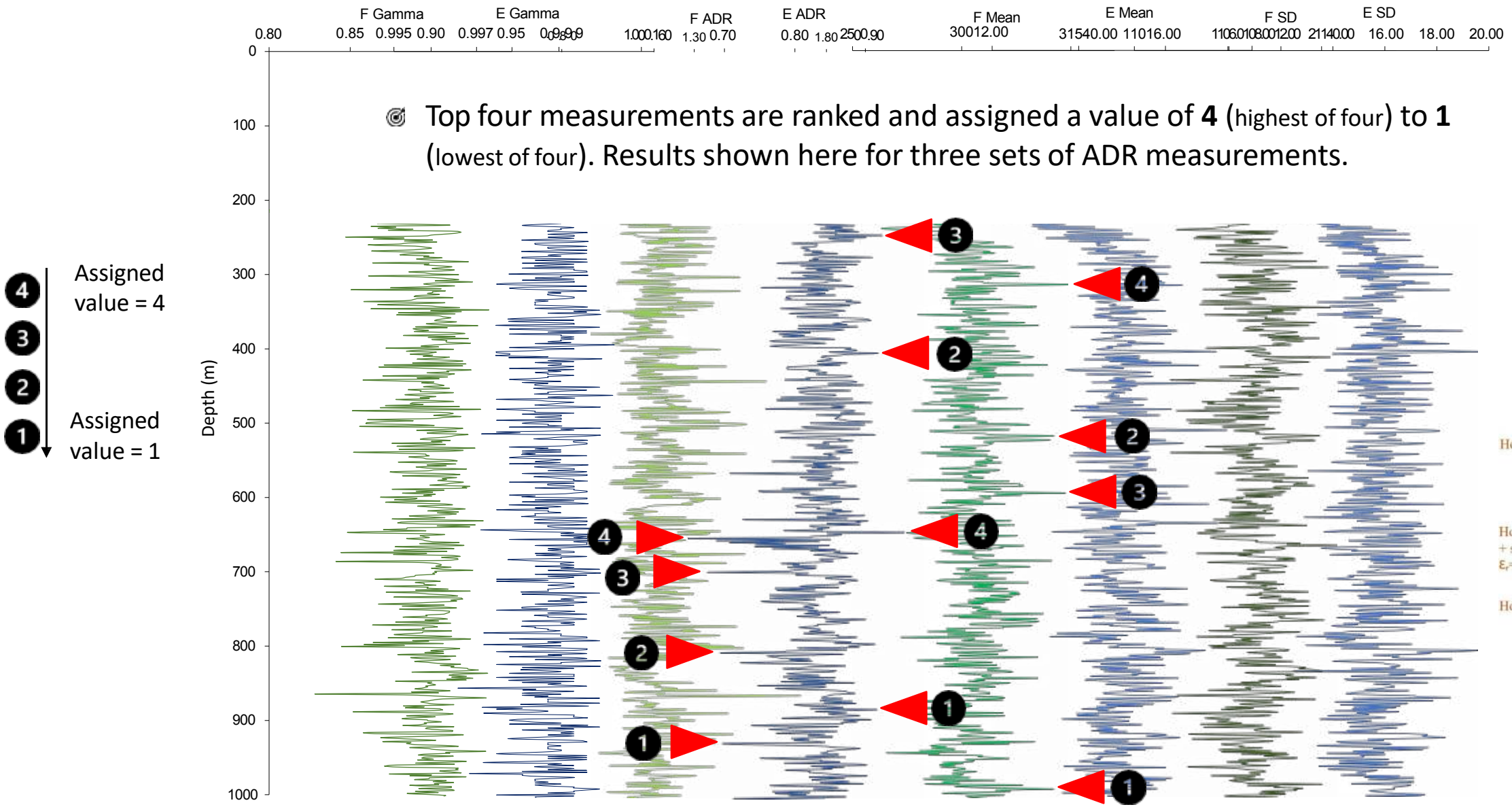
After each peak and trough is assigned a value, it is then assigned a **depth of influence proportional to its weighted value.**
The highest or lowest value is assigned a depth of +/- 20m, 3 is assigned +/- 15 m, 2 +/- 10m and 1 +/-5m.
This is **similar to the methods used in GIS-based targeting** whereby faults or magnetic anomalies for example, will be given a "buffer" of influence. In a GIS-based study, multiple layers of evidence can be stacked to a "score" equivalent to the number of intersecting layers. This is the part of the fundamental basis behind many AI-based mineral target tools. Here, however, we are using geophysical results collected from underground. Where the highest number of correlated criteria occur is likely to be the highest potential for sulfides.

Results - Adrok records and then delivers multiple sets of Energy (E-) and Frequency (F-) results from a single scan



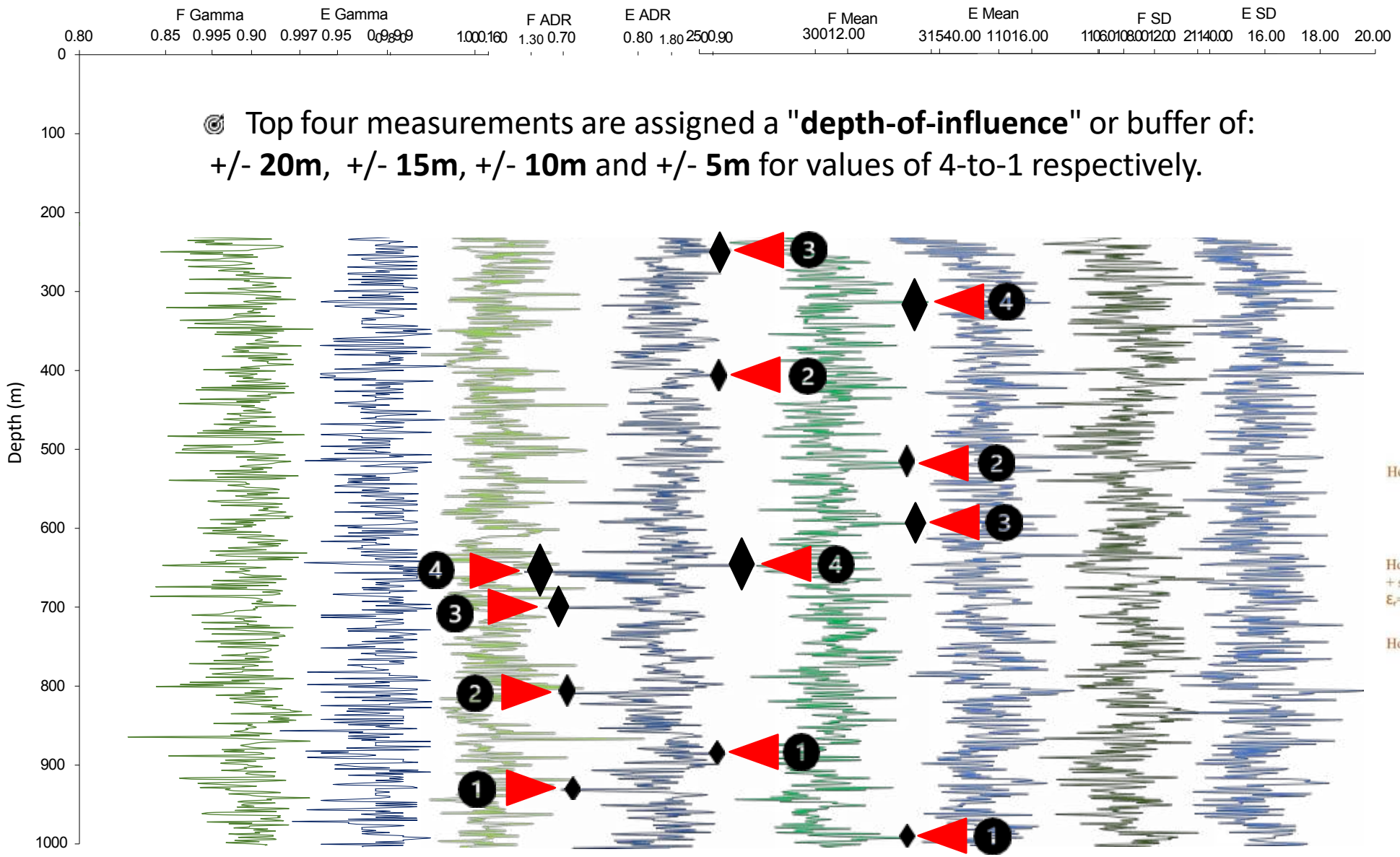
Method 2 – Extracting the sulfide indicators

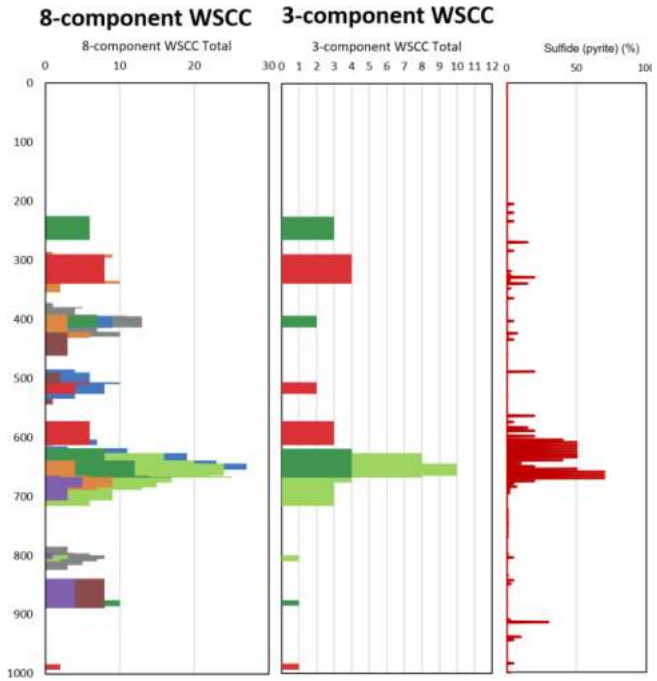
- Top four measurements are ranked and assigned a value of **4** (highest of four) to **1** (lowest of four). Results shown here for three sets of ADR measurements.

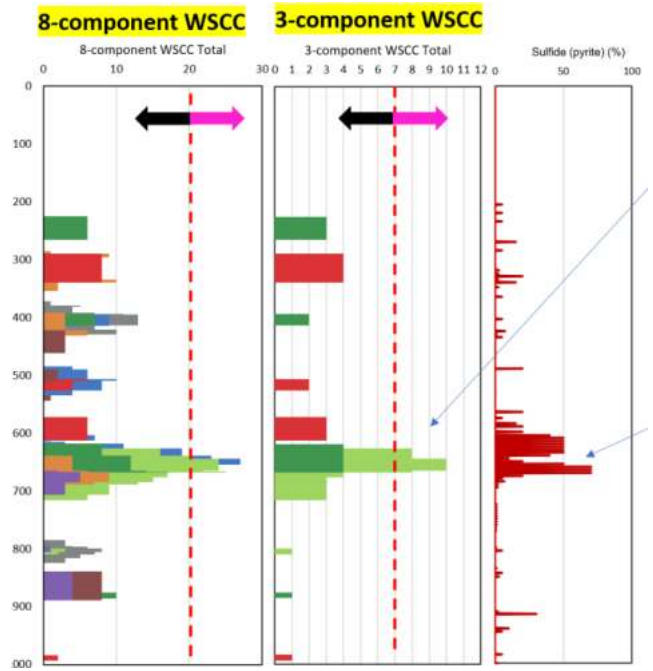


Method 2 – Extracting the sulfide indicators

- Top four measurements are assigned a "**depth-of-influence**" or buffer of: +/- **20m**, +/- **15m**, +/- **10m** and +/- **5m** for values of 4-to-1 respectively.







Once all of the results are collated, overlaid and added for the respective depths, a **final result or SCORE can be obtained**. The highest score represents the highest number of correlation criteria that have been selected for sulfides. Shown here are the results for two variations on the method according to the number of geophysical criteria used.

On the left is the chart showing results when **8 separate criteria** are ranked and then stacked for each given depth. The highest number of overlapping points is located at a depth of around 650m. Each colored bar represents a separate geophysical result. In some instances, there is no overlap between results.

On the right are the results for only **3 criteria**. The only reason for limiting to three is to slightly reduce processing time, but it also acts as a second means of checking the results. The results form the 3-component WSCC also show a peak or high score at 650m depth.

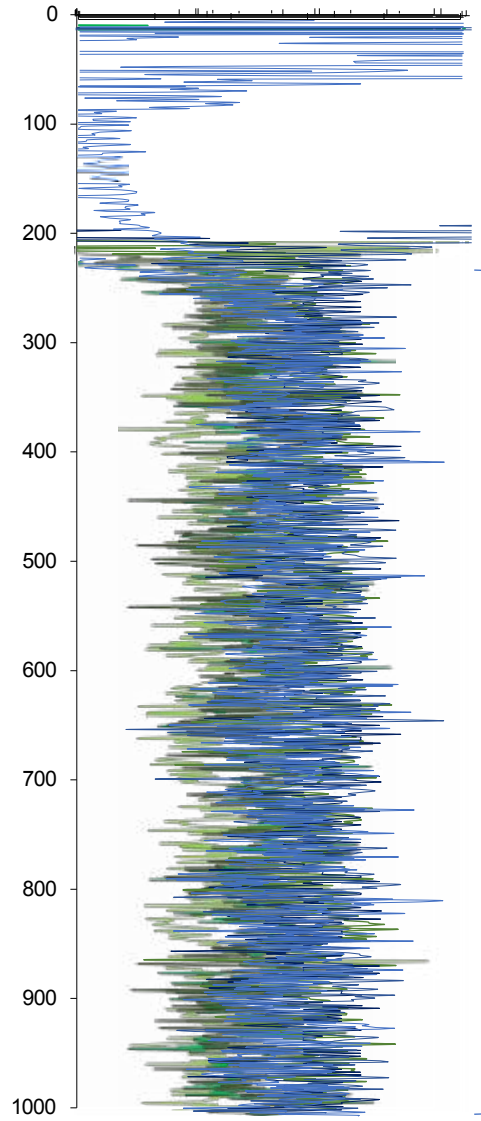
The **results can be directly compared with drill logs** where available. Here the client has provided a drill log showing total sulfide
component in the drill hole located parallel to the scan.

After carrying out a number of internal blind checks and in order to better quantify the technique, Adrok have settled on two specific values for each result. For the **8-compnent WSCC, a value of 20 is used, for the 3-component WSCC, a value of 7 is used** as the minimum value indicative of sulfides. Values below this represent background noise/country rock signals. The reason why sulfides present as higher values is due to the massive difference in conductivity AND dielectrics that they impose on any rock type.

A layered sedimentary sequence may contain significant compositional variation but the change in dielectric property between, for example, siliciclastic, is so small with Er values typically between 4 and 12-15, that the impact on the results are also small. In contrast, the introduction of sulfides has a significant impact, especially if the sulfide content is high over a significant thickness.

And, to reiterate, this method was not developed to detect layers of massive sulfide which are "seen" in the reflected energy signal, rather, this method so far works on sulfide layers over around 7-10m thick but up to at least a hundred meters thick which is more typical of disseminated sulfide bodies.

A simple, repeatable and client-friendly method

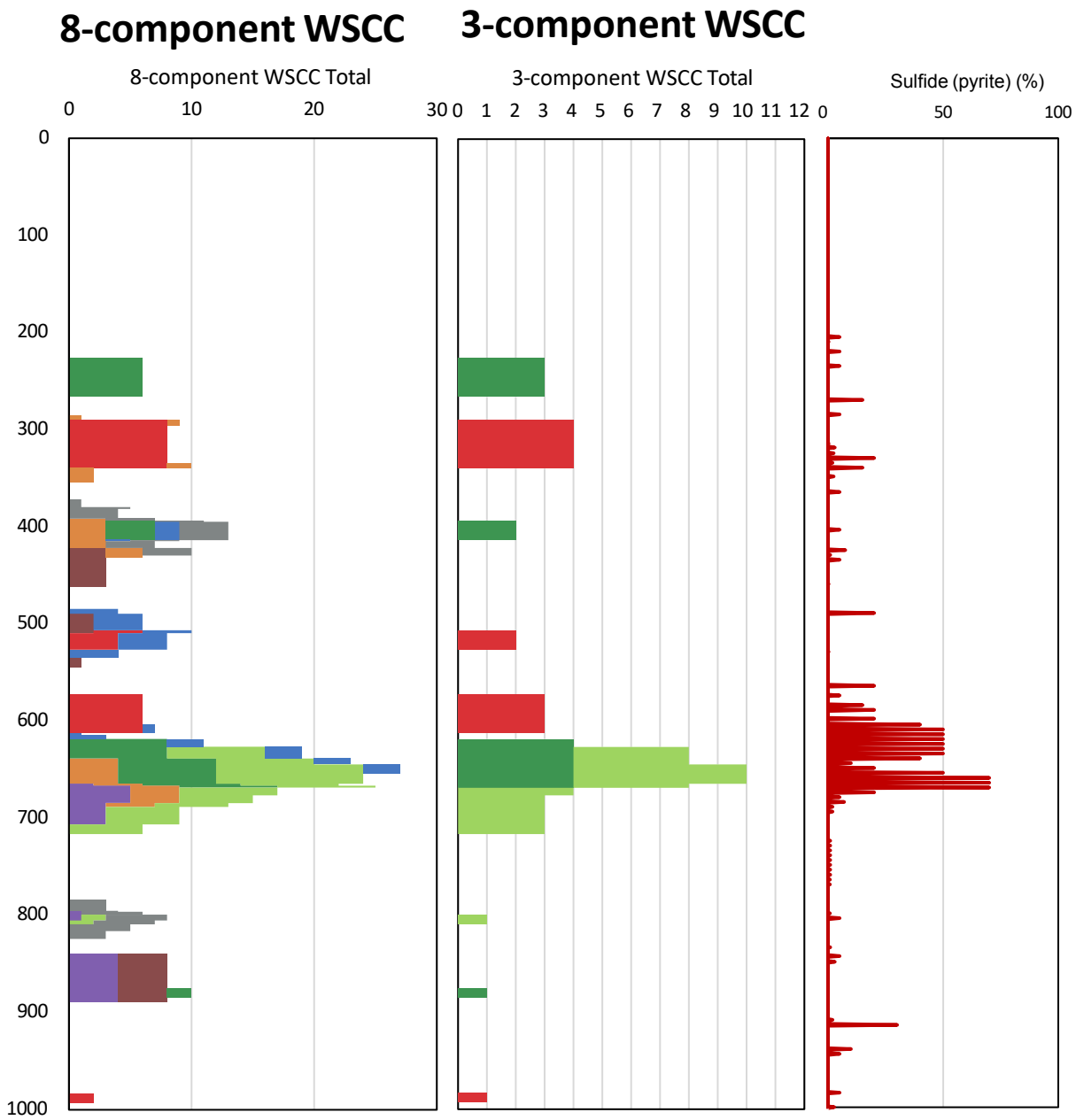


Two different sets of results are used to delineate:

8-component and
3-component WSCC results presented to the right.

Results are stacked to provide a graphical representation of the greatest number of matching criteria for sulfides

Preliminary WSCC target values
So far Adrok are using minimum WSCC values of 20 and 7 to define areas of high sulfide



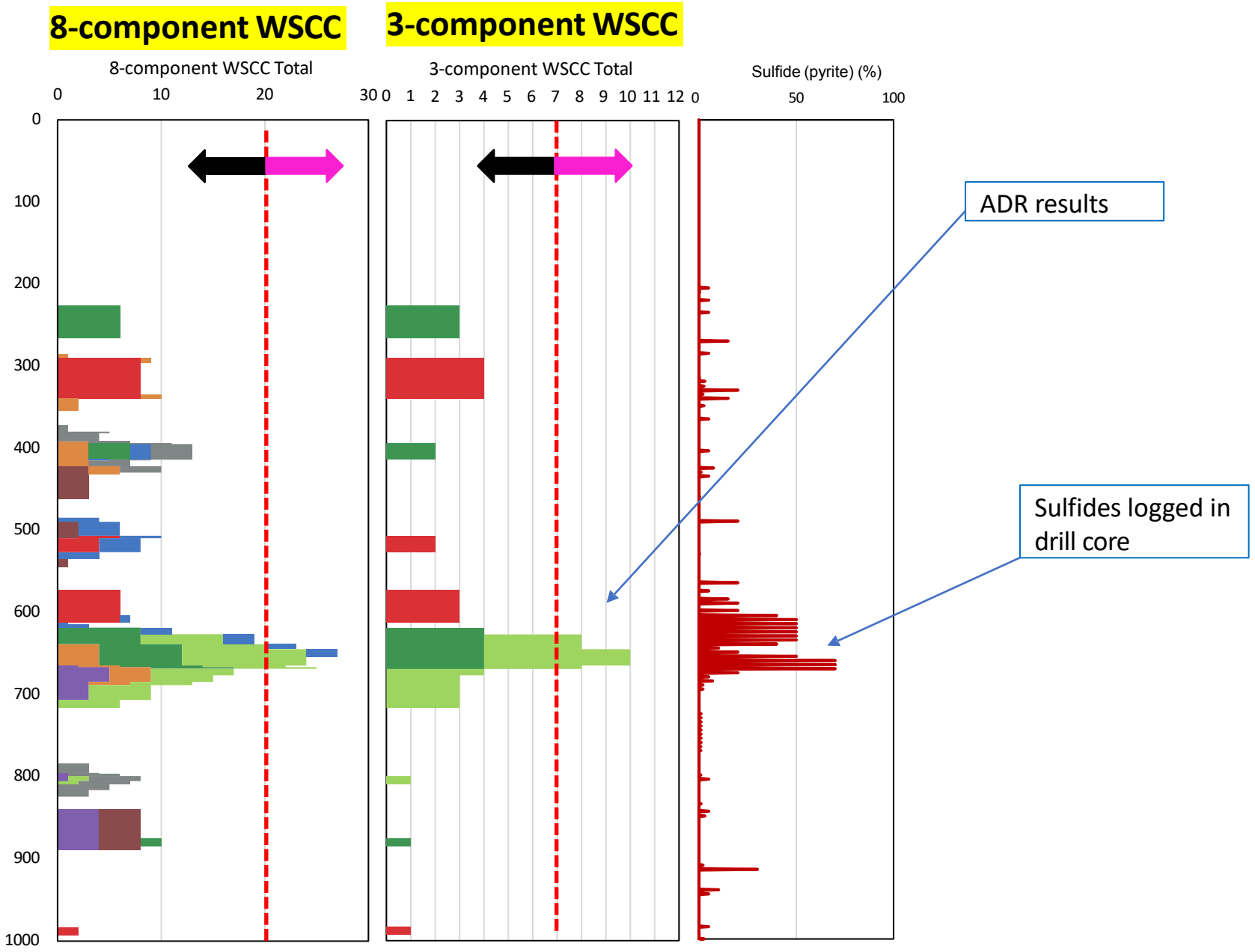
A simple, repeatable and client-friendly method

Preliminary WSCC target values
So far Adrok are using minimum WSCC values of 20 and 7 to define areas of high sulfide

Higher confidence of sulfides

>20 or >7

Lower confidence of sulfides



1. Adrok collects data in the field in the form of linear scans from the surface. Planar (2D) scans can also be carried out if required. Data is plotted relative to depth (Y- axis).

2. The return signal is processed, and the different geophysical responses plotted relative to depth (shown below for seven ADR results only).

3. The resulting signal is characterised by highs and lows (•) that correspond with changes in the geophysical properties of the rocks beneath the surface. After comparing many projects where sulfides are found in the rocks, Adrok has found that, not surprisingly, certain highs and lows in the different sets of results seem only to be characteristic of the results returned from sulfides.

4. When the results are stacked, these characteristic highs, lows and inflections can be extracted at their respective depths. Adrok can use up to 9 different results sets and has found either 8-criteria or 3-critiera best highlight the sulfides. Shown below are results for 7 criteria and some examples of points (highs and lows) that might be used to differentiate sulfides. This is an example only.

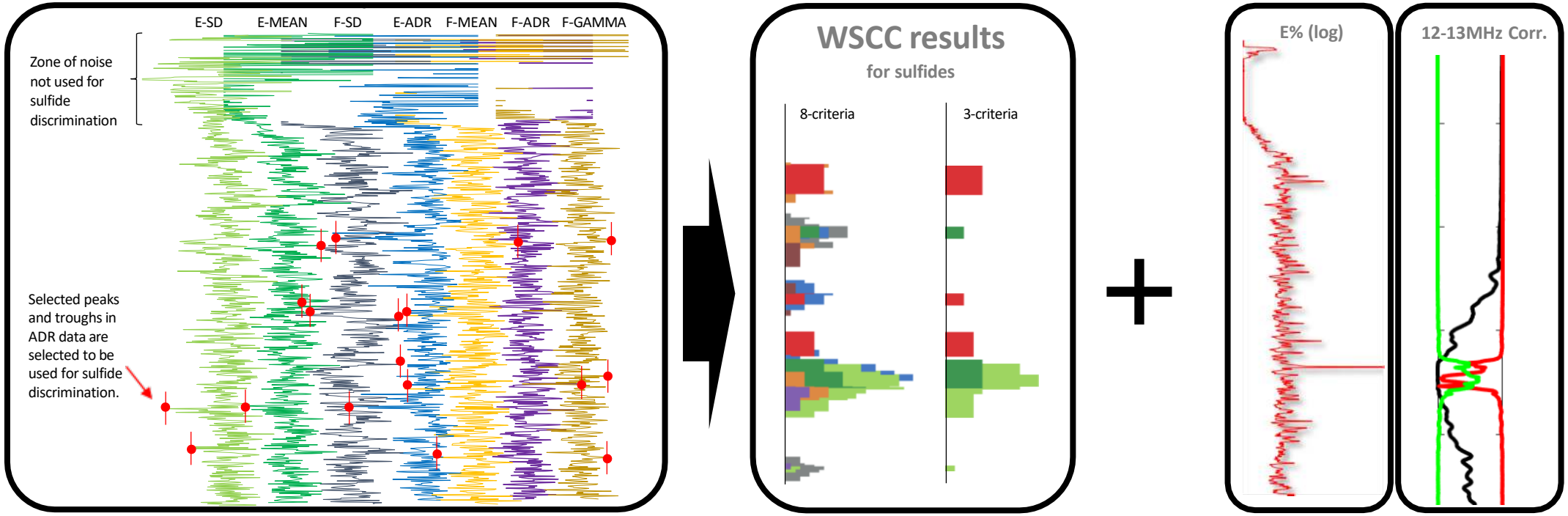
5. Each of the points selected in the results graphs are given a value based on their relative importance. We refer to this as Weighted sulfide correlation criteria (WSCC) based on the similar technique used for spatial weighting of evidential layers. Each point is given a depth-of-influence in addition to a value.

6. The weighted results from steps 1-4 are combined into a single chart by "stacking" data to provide a depth-dependent total value of the WSCC for that scan using 3-8 sets of criteria or layers of evidence.

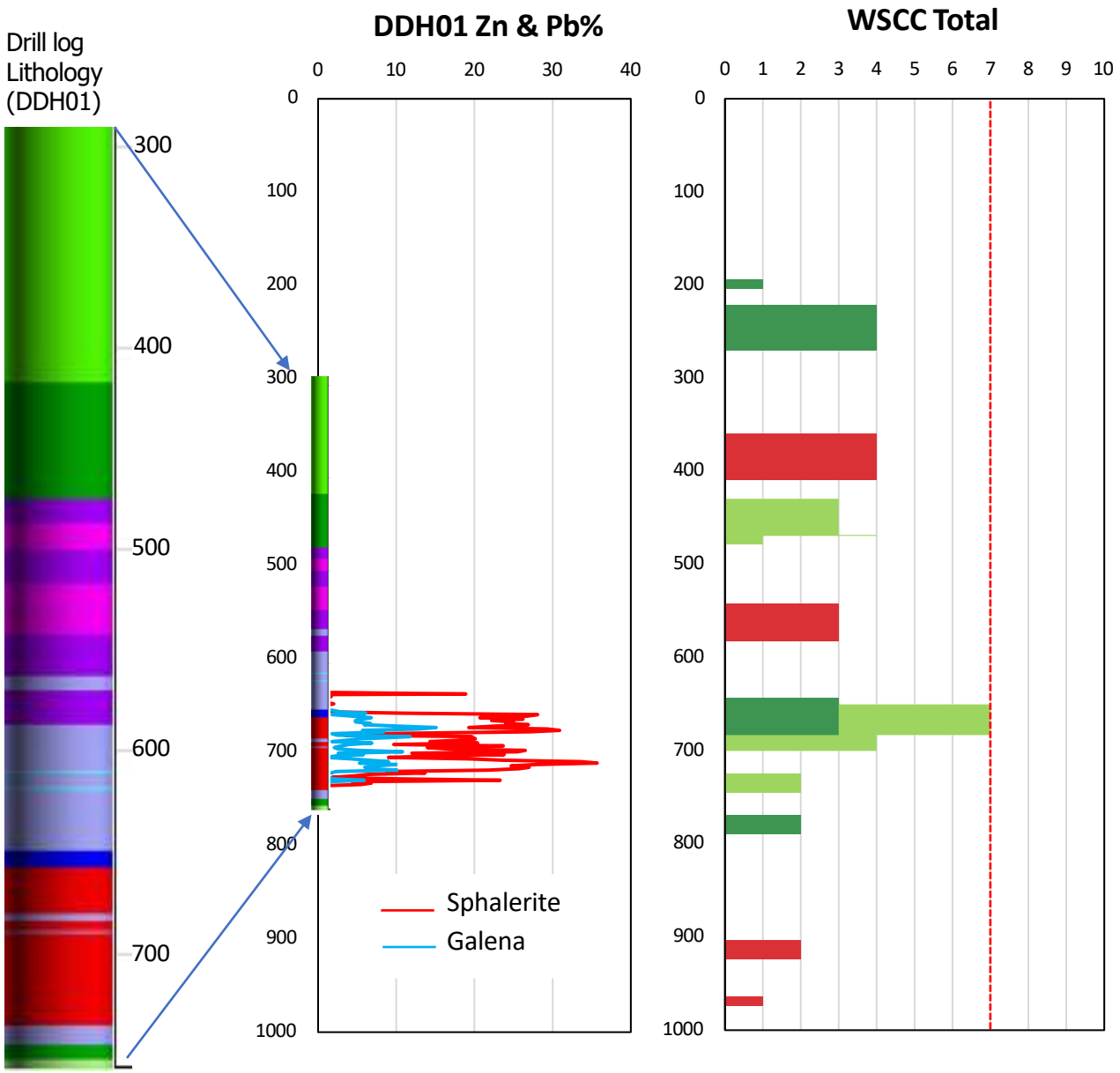
Different colors on the charts below represent different criteria selected from the ADR data

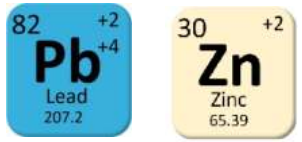
7. The WSCC results can be combined with other ADR-derived datasets including the % return energy (E% (log)) which is shown below. The peak in return energy is proportional to the reflectivity of the boundary between rock types. The reflectivity is dependent upon the different relative dielectric permittivity (ε_r) of the rocks on either side of the contact. Igneous, metamorphic and sedimentary rocks have ε_r of less than 15 but rarely above 10 and averaging around 5-6. Sulfides, however, have ε_r of >30 so the contact between massive sulfides and country rocks tends to give a strong reflection of energy.

8. In addition to WSCC and Energy, Adrok can also process for correlation at different frequencies. Shown here is the correlation chart for 12-13MHz for the same scan as the WSCC result. This adds another layer of confidence to the data interpretation.



Field case study 01 applying the WSCC criteria





CASE STUDY 1 - Pb-Zn

~100m thick disseminated sulfides

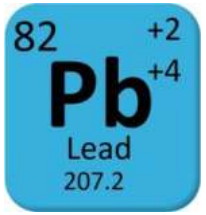
Adrok's 3-component sulfide targeting criteria was suitable for discriminating the location of sulfides at ~690m below the surface. Based on these results the highest potential for sulfides was between 650m and 700m.

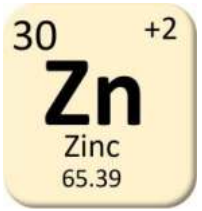
Field case study 02 applying the WSCC criteria

CASE STUDY 2

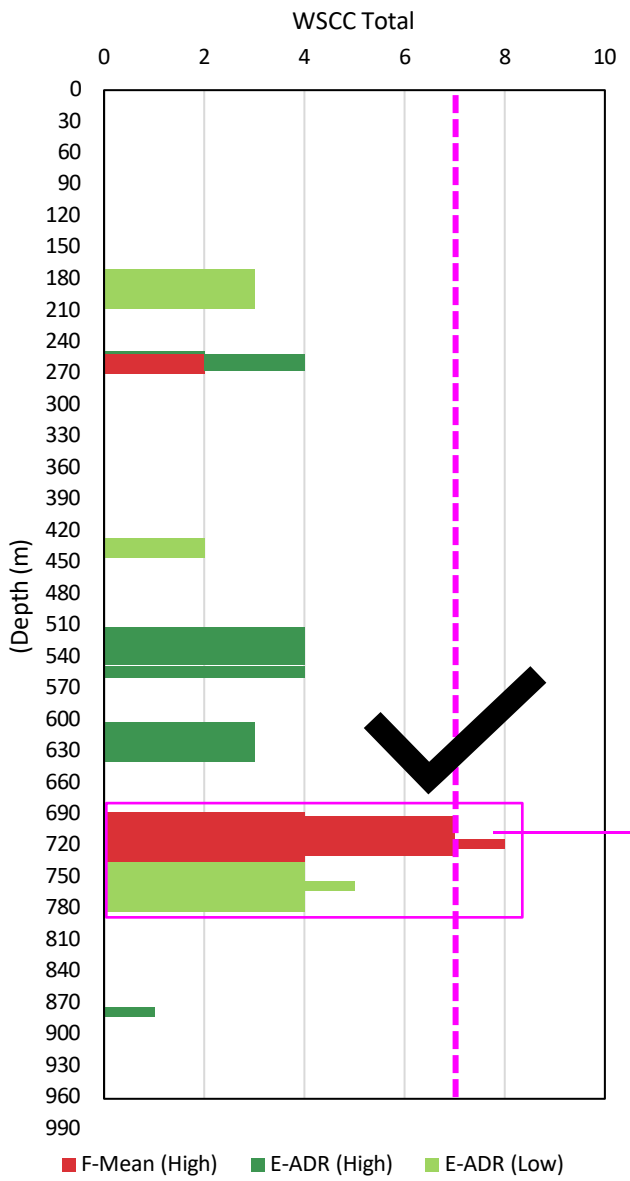
Sulfide (PbS + ZnS) zone located at approximately 680-720m vertically below the surface. STARE02 located approximately parallel to the trace of the drill hole shown in adjacent cross section interpretation provided by client. The WSCC shown was derived using quantitative 3-component result only but there is reasonably good correlation between the WSCC result and the location of the sulfides. Some error should be considered reasonable owing to the dip of the host units.

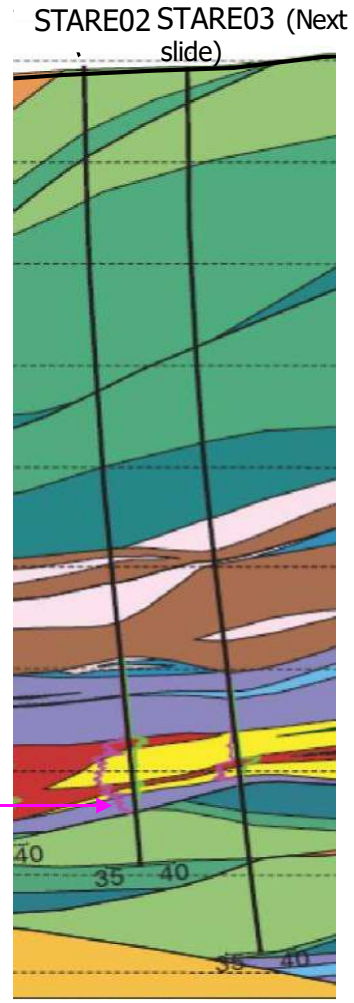
Note that scans are not taken precisely over the top of drill holes and sulfide host units are also variable dipping so some depth error is expected.





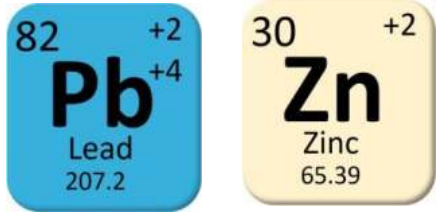
Adrok's 3-component sulfide targeting criteria was suitable for discriminating the location of sulfides at ~720m below the surface. Based on these results the highest probability for sulfides was at 750m





Interpreted cross section provided by client

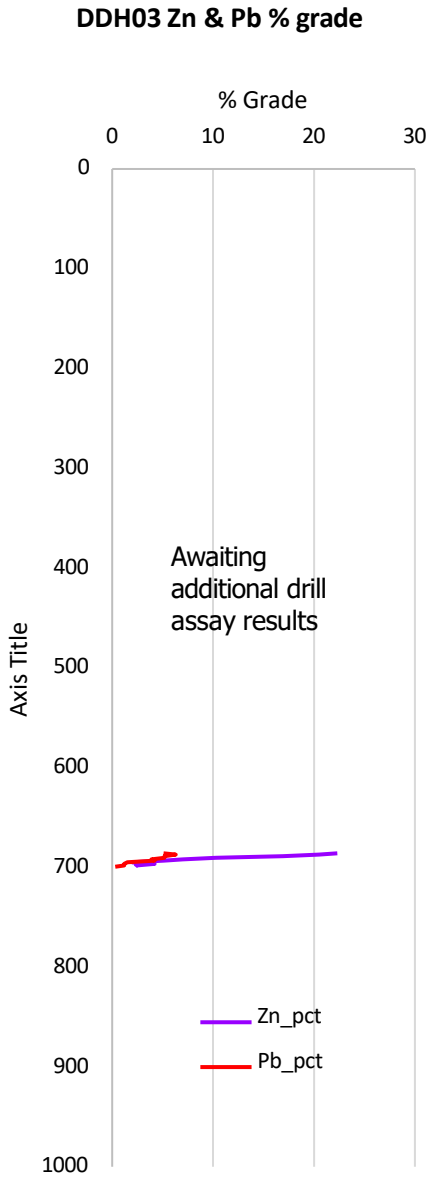
Field case study 03 applying the WSCC criteria

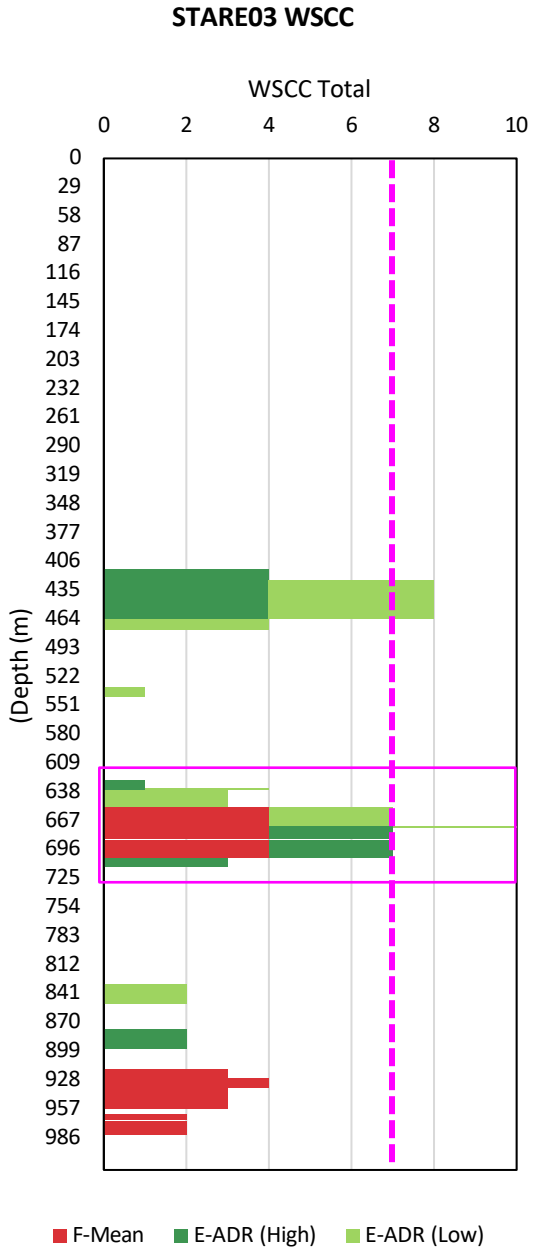


CASE STUDY 3

Sulfide (PbS + ZnS) grade% provided from drill hole results. The section of sulfides (one of the higher abundances of ZnS in the region) matches well with the location of the WSCC criteria. The highest peak (WSCC = 10) at 670m corresponds well with the location of sulfides at 680-700m down hole (the hole is not perfectly vertical and the scan is slightly off-hole in the same area as the previous scan with dipping host rocks.

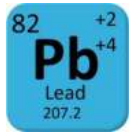
Potential sulfides exist at 435m, however, Adrok do not have the assays for the complete drill hole DDH03.

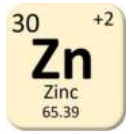


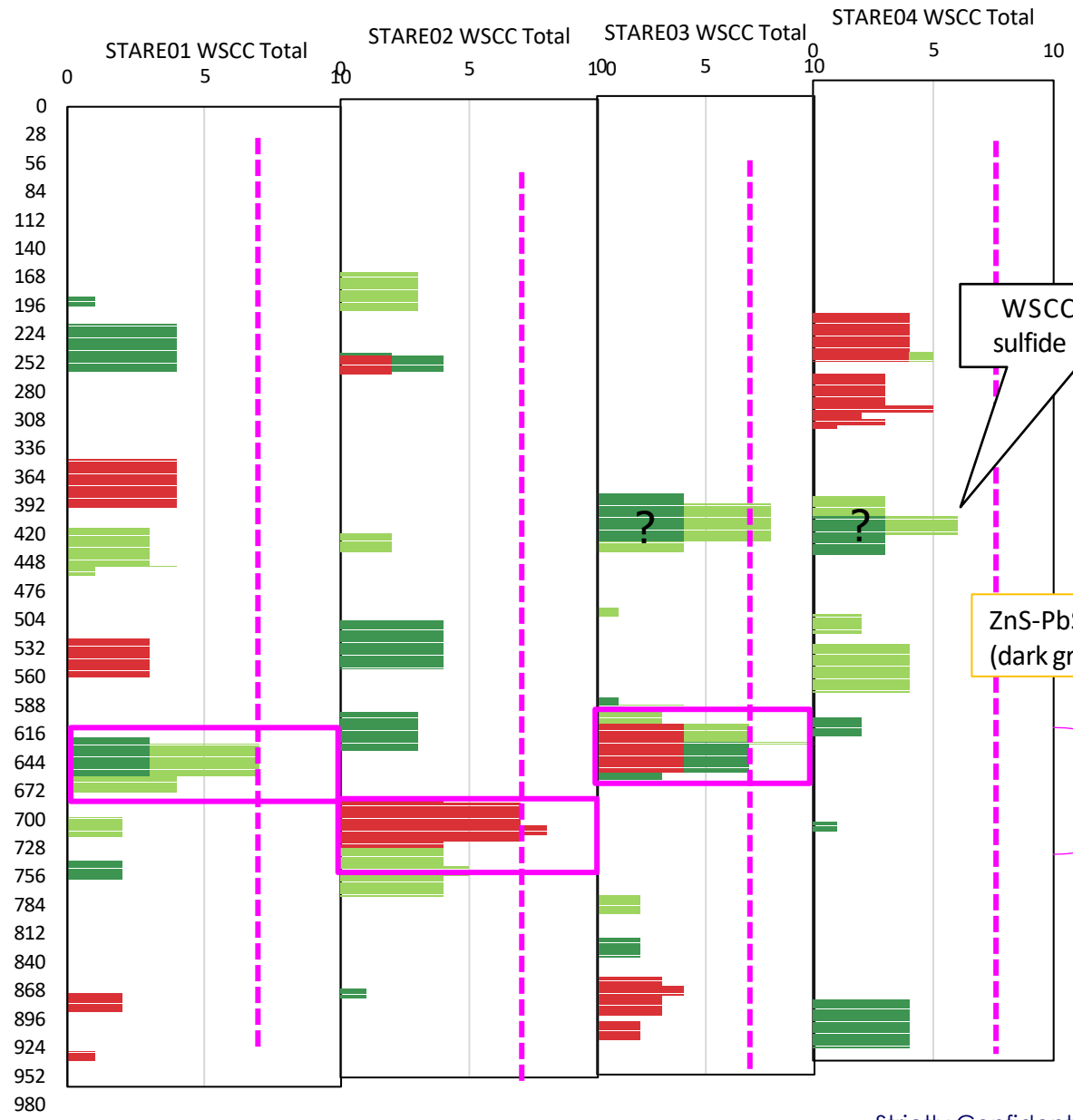


Adrok's 3-component sulfide targeting criteria was suitable for discriminating the location of sulfides at ~680-700m below the surface. Based on these results the highest probability for sulfides was at 670m

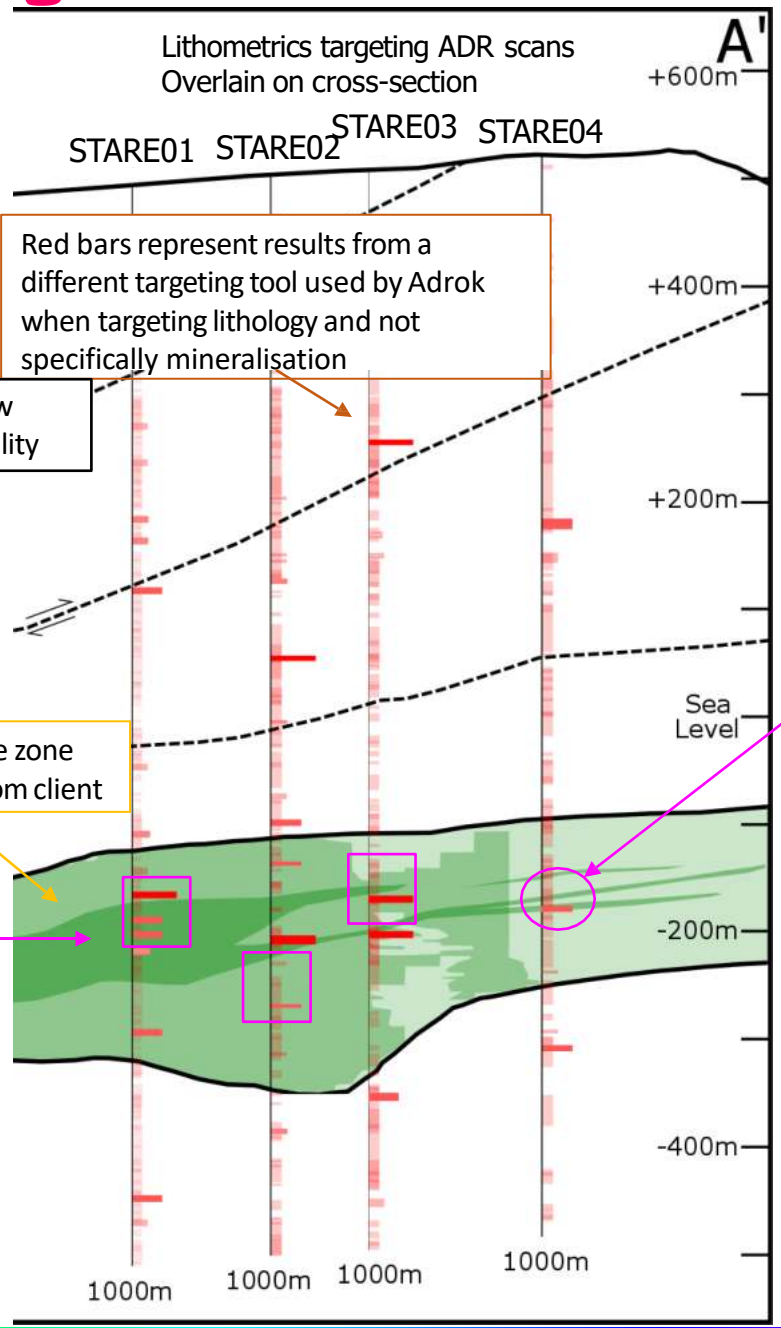
Field case study 04 applying the WSCC criteria







WSCC <7 - Low sulfide probability



Red bars represent results from a different targeting tool used by Adrok when targeting lithology and not specifically mineralisation

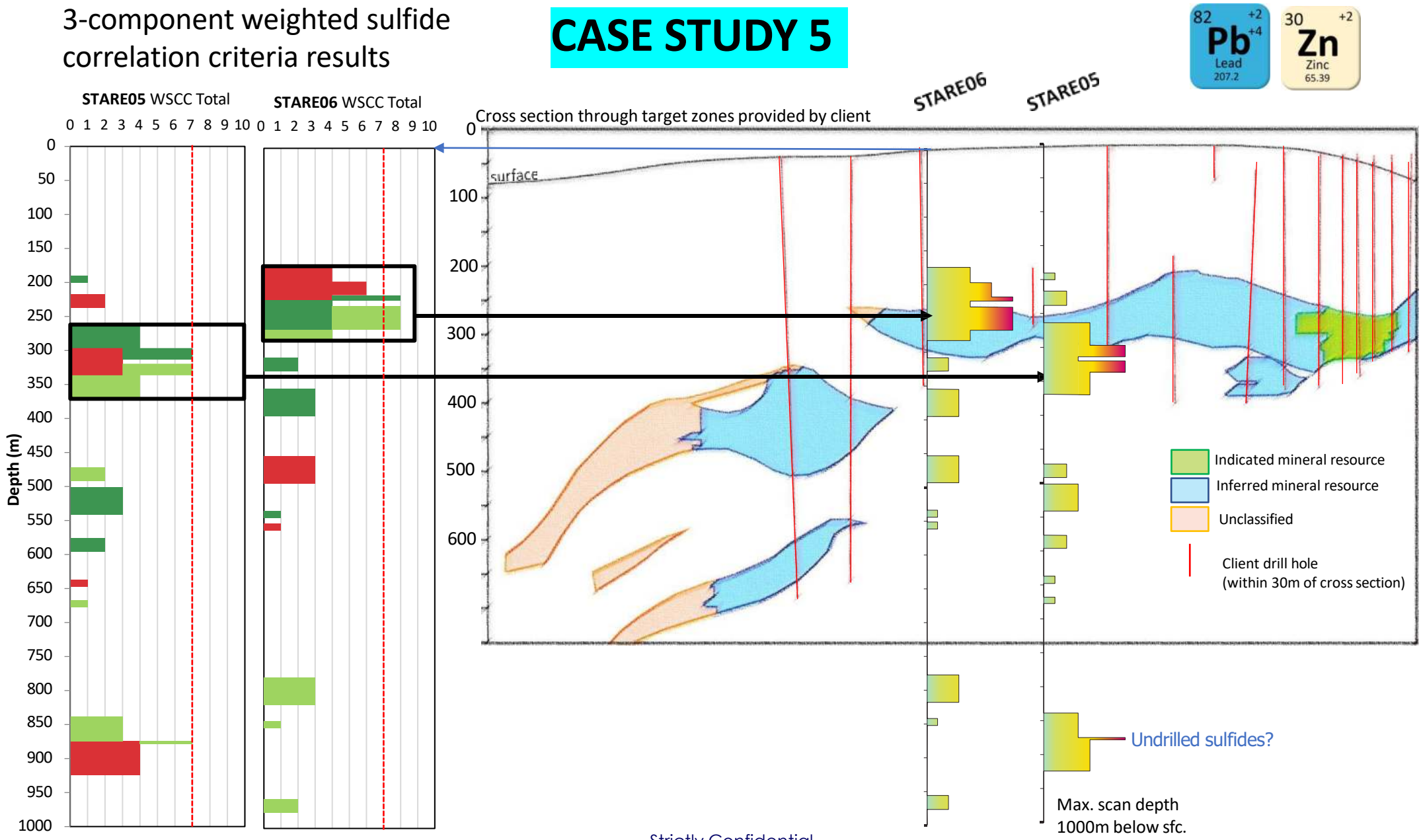
ZnS-PbS sulfide zone (dark green) from client

Little to no sulfide in this zone

Field case study 05 applying the WSCC criteria

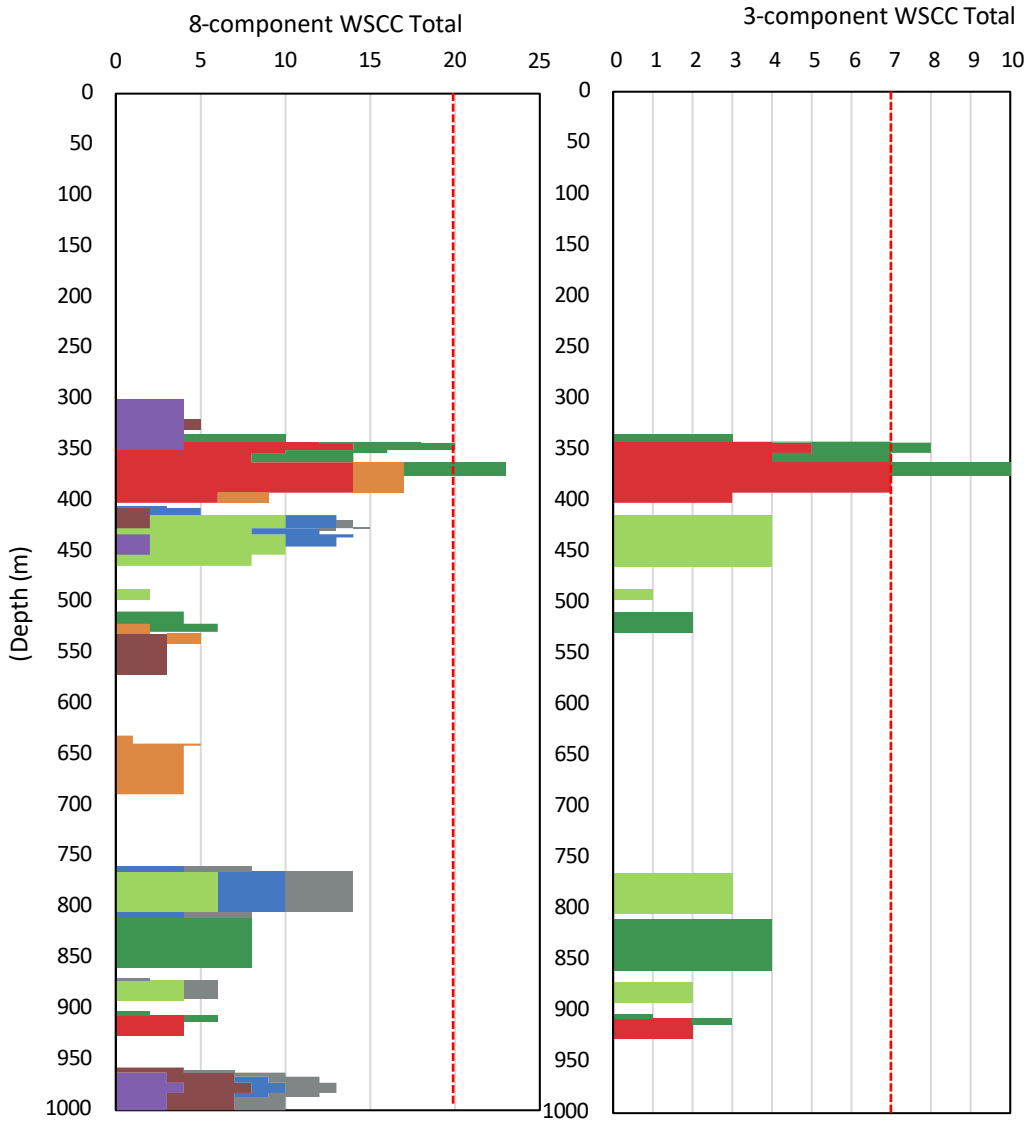
3-component weighted sulfide correlation criteria results

CASE STUDY 5

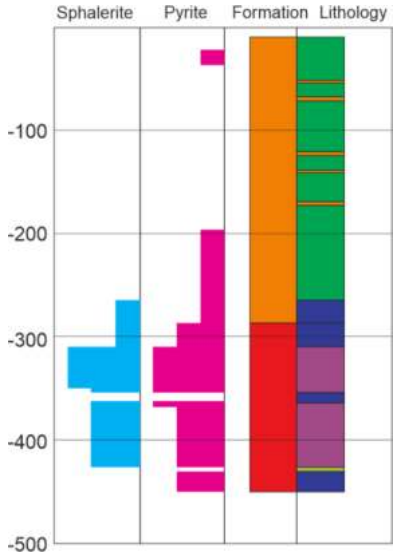


Field case study 06 applying the WSCC criteria

8-component and 3-component weighted sulfide correlation criteria results



Client drill results



Sphalerite ((Zn,Fe)S) and Pyrite (FeS) were logged from drill core.

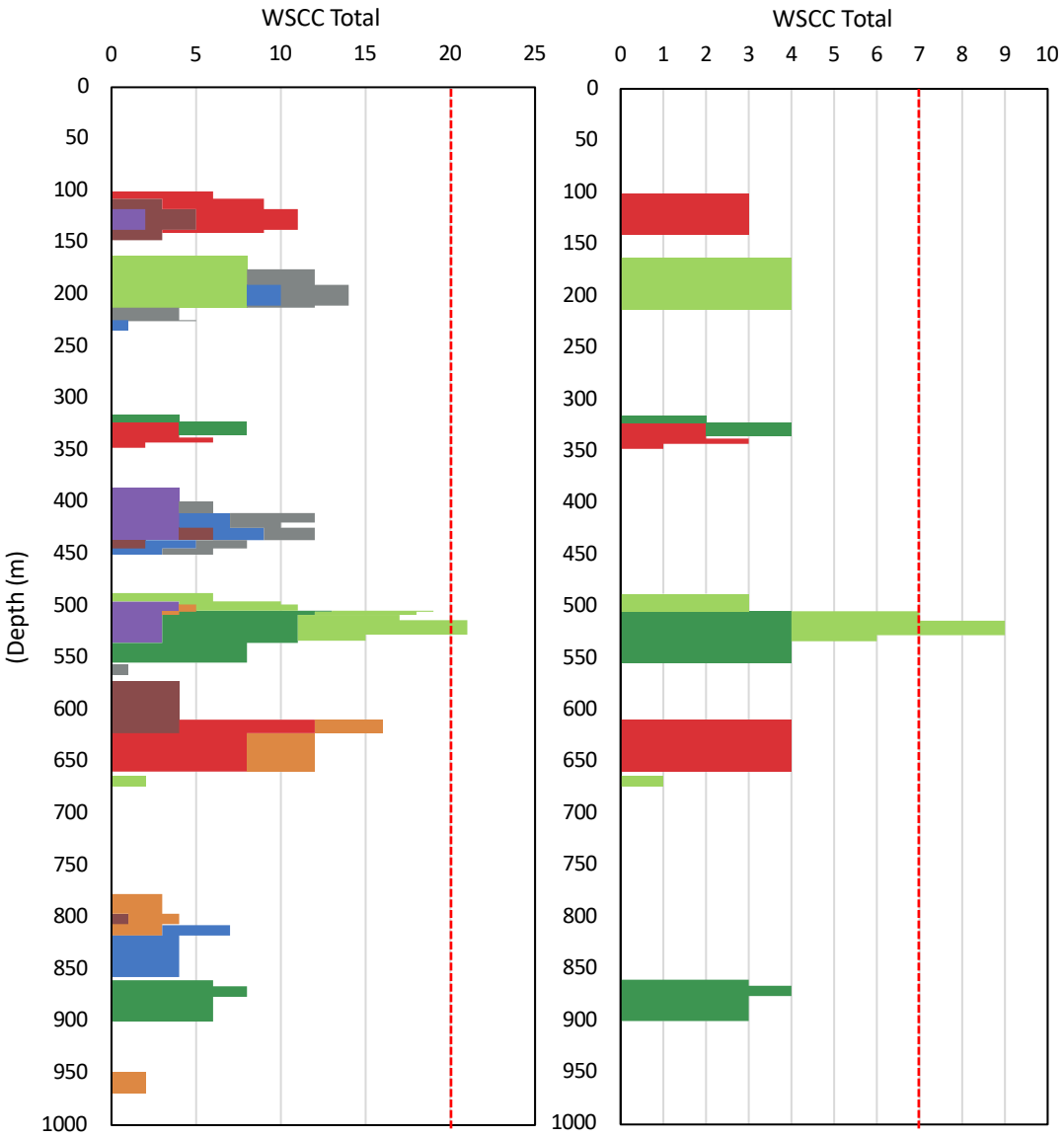
CASE STUDY 6

30 +2 Zn Zinc 65.39

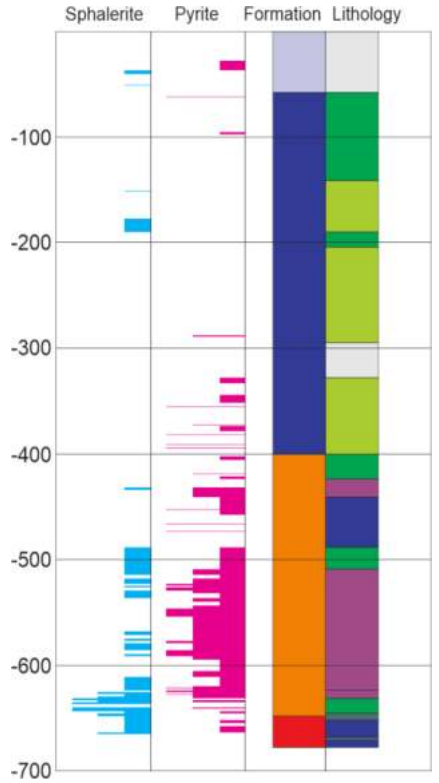
Both the 8- and 3-component sulfide targeting criteria correlates well with the location of sulfides at ~350m below the surface.

Field case study 07 applying the WSCC criteria

8-component and 3-component weighted sulfide correlation criteria results



Client drill results



Sphalerite ((Zn,Fe)S) and Pyrite (FeS) were logged from drill core.

CASE STUDY 7

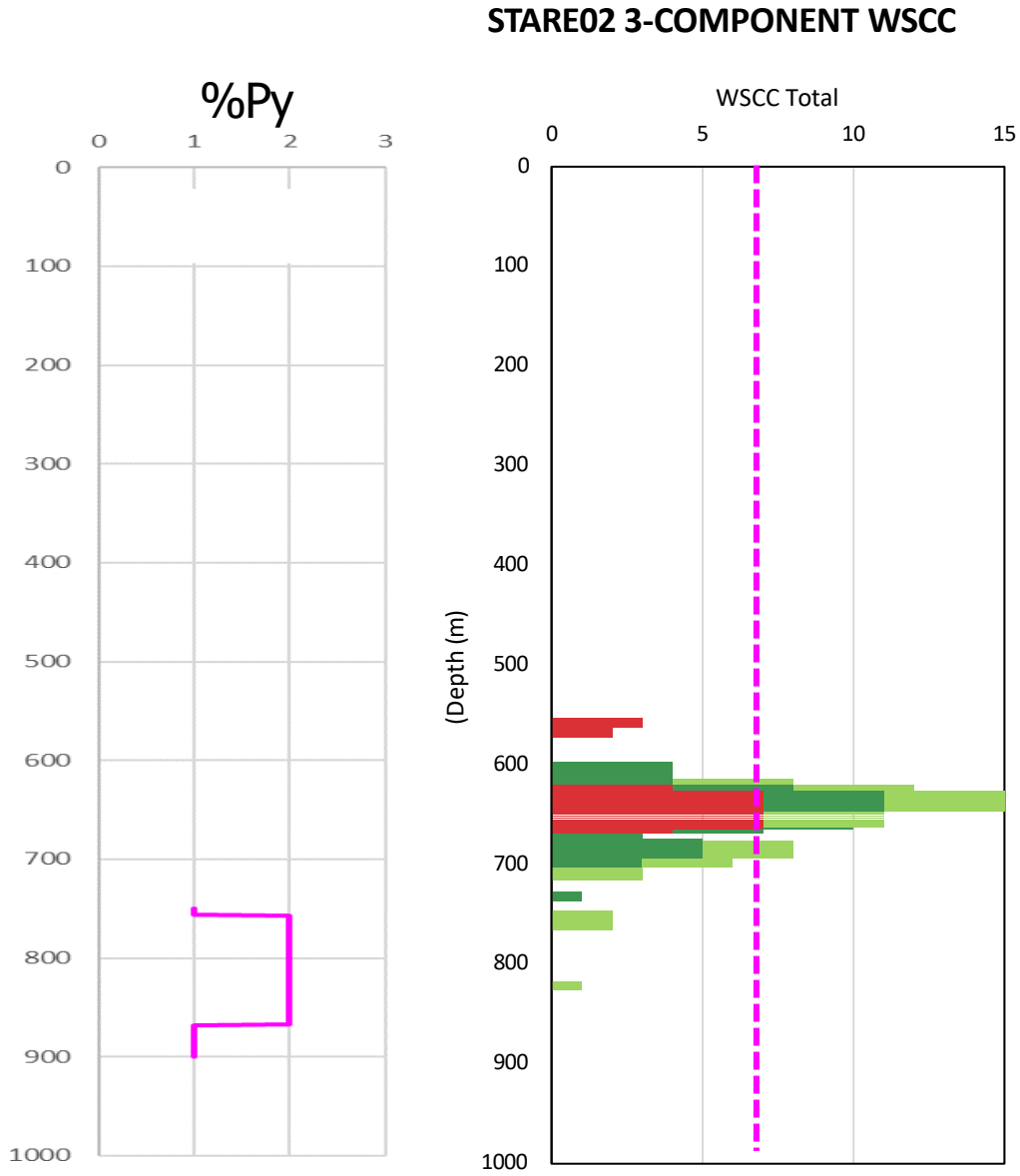
30 +2 Zn Zinc 65.39

Both the 8- and 3-component sulfide targeting criteria correlates well with the top of the sulfide zone at ~500-550m below the surface.

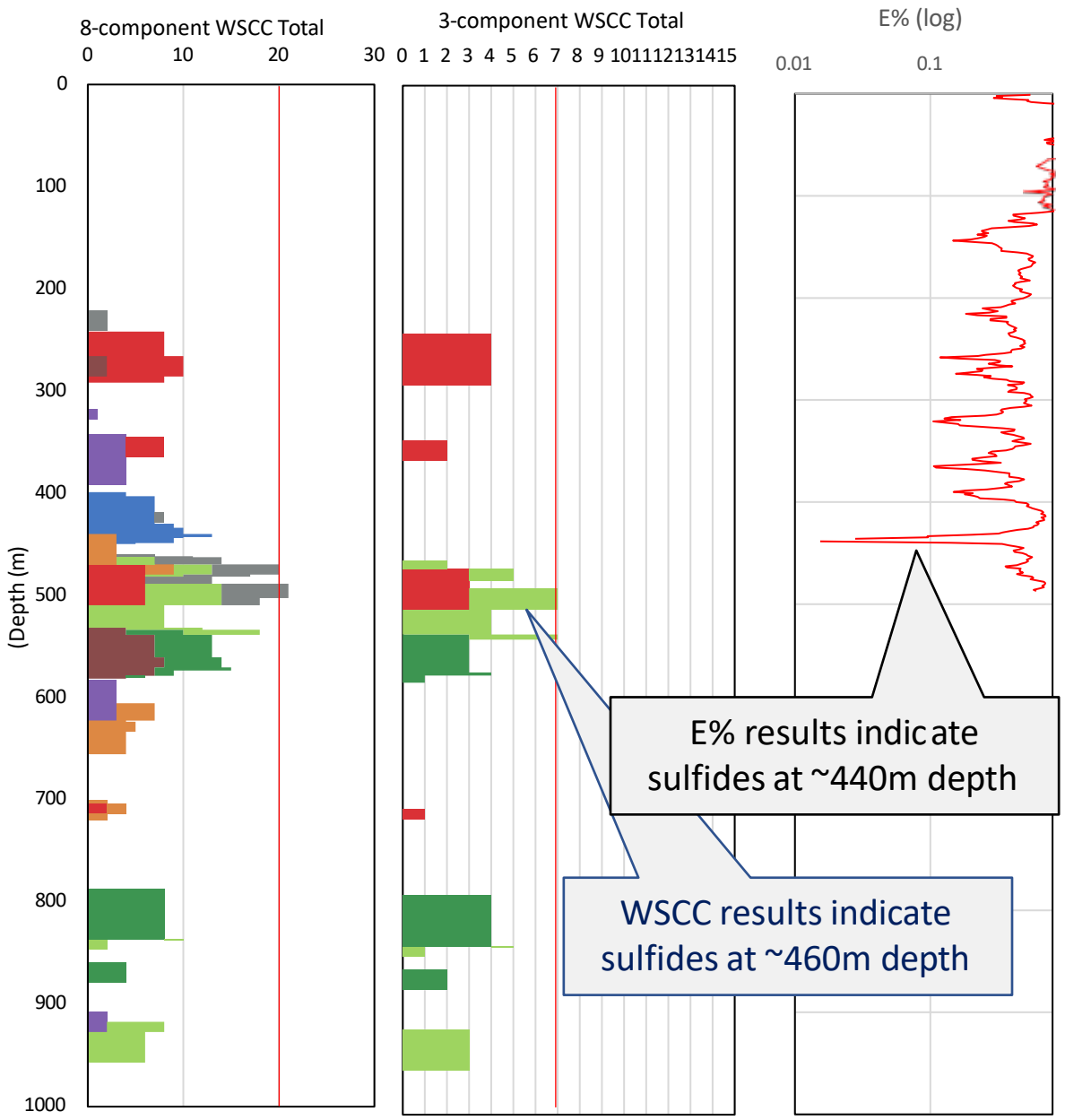
Field case study 08 applying the WSCC criteria

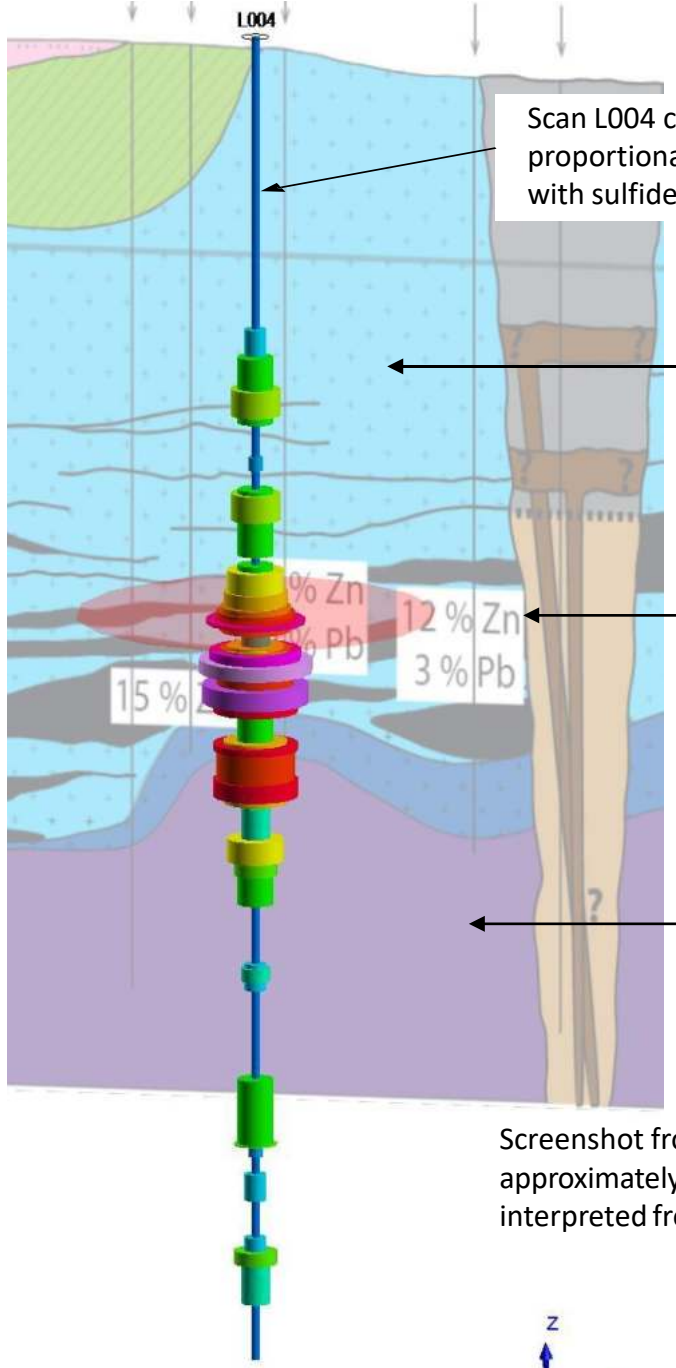
CASE AREA 8

Owing to the very strong response in the WSCC, Adrok are working with the client to determine whether the difference in the depth estimate between the WSCC target and the sulfides in drill core is due solely to the steep dip in the host bedding unit or whether there are other reasons for the mis-match in depth estimates. The sulfides presented are relatively low grade but the WSCC response is extremely strong, therefore we are still chasing the actual drill log results. Adrok are confident that there are additional sulfides present at this location.



Field case study 09





Scan L004 containing WSCC results (diameter proportional to WSCC value). High WSCC corresponds with sulfides identified in drilling at ~450m.

Waulsortian limestone

Pb + Zn Sulfide-bearing breccias identified in drill holes ~450m depth

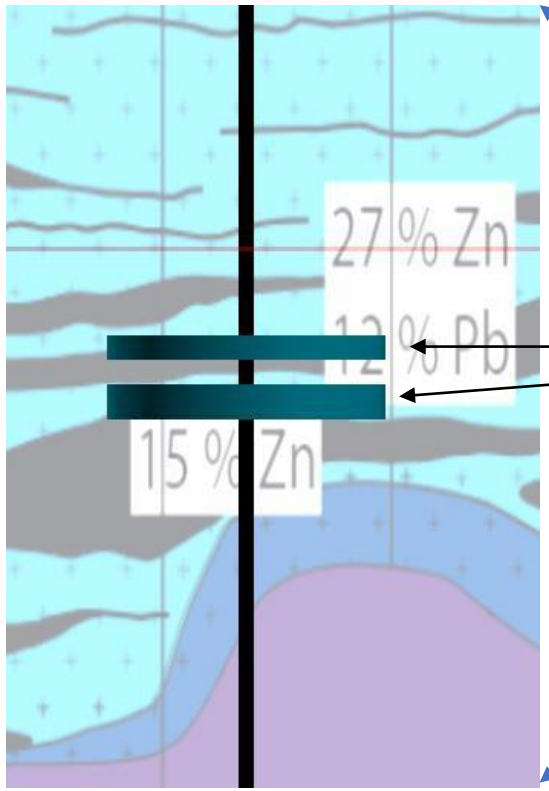
Lower Argillaceous Bioclastic Limestone Formation

Screenshot from 3D model showing a side- view (looking approximately west) across scan L004 and cross section interpreted from drill hole data in the region.

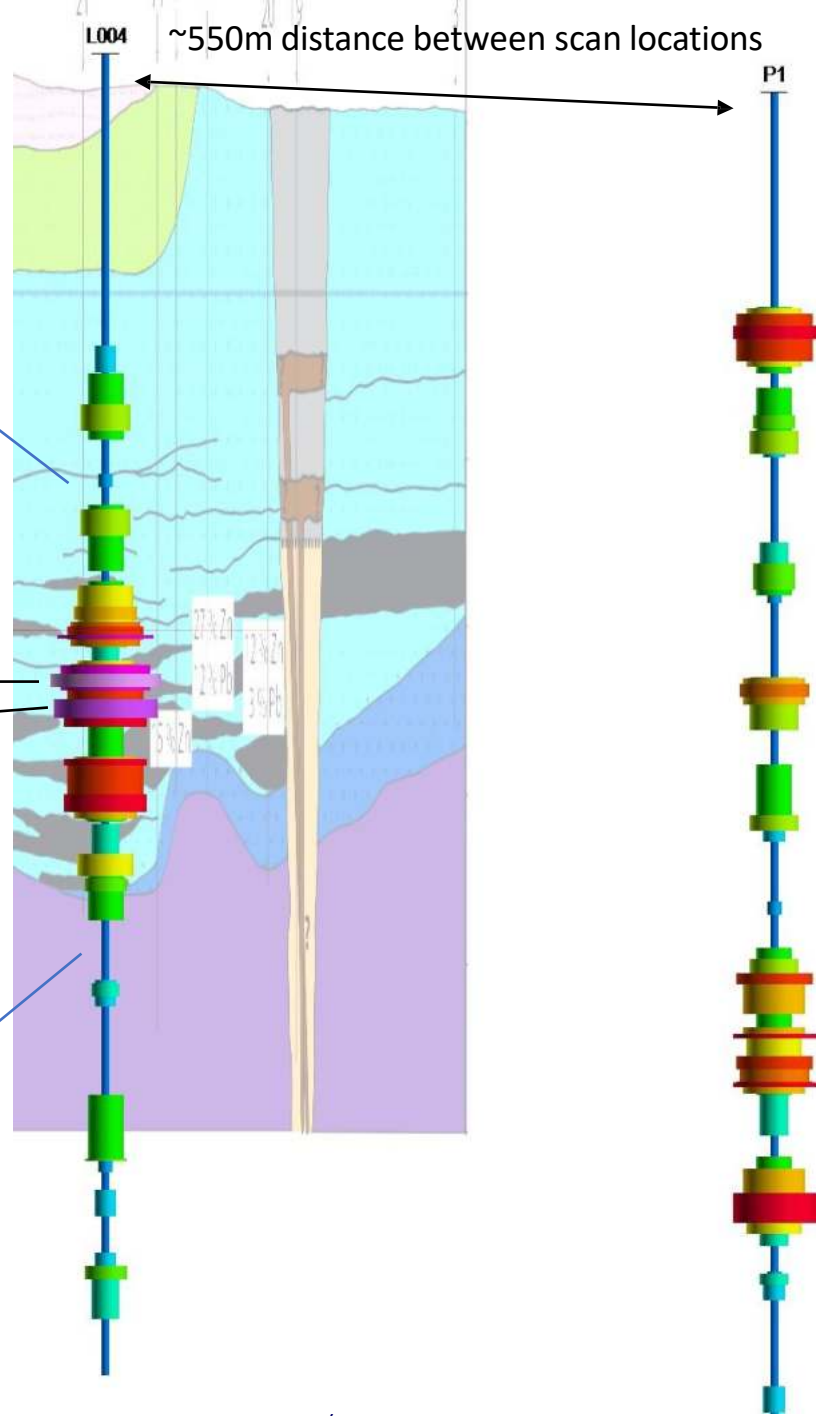
CASE STUDY 9 cont.

No false positive

Section of scan L004 showing only values above 20 in the 8-component WSCC



Looking west

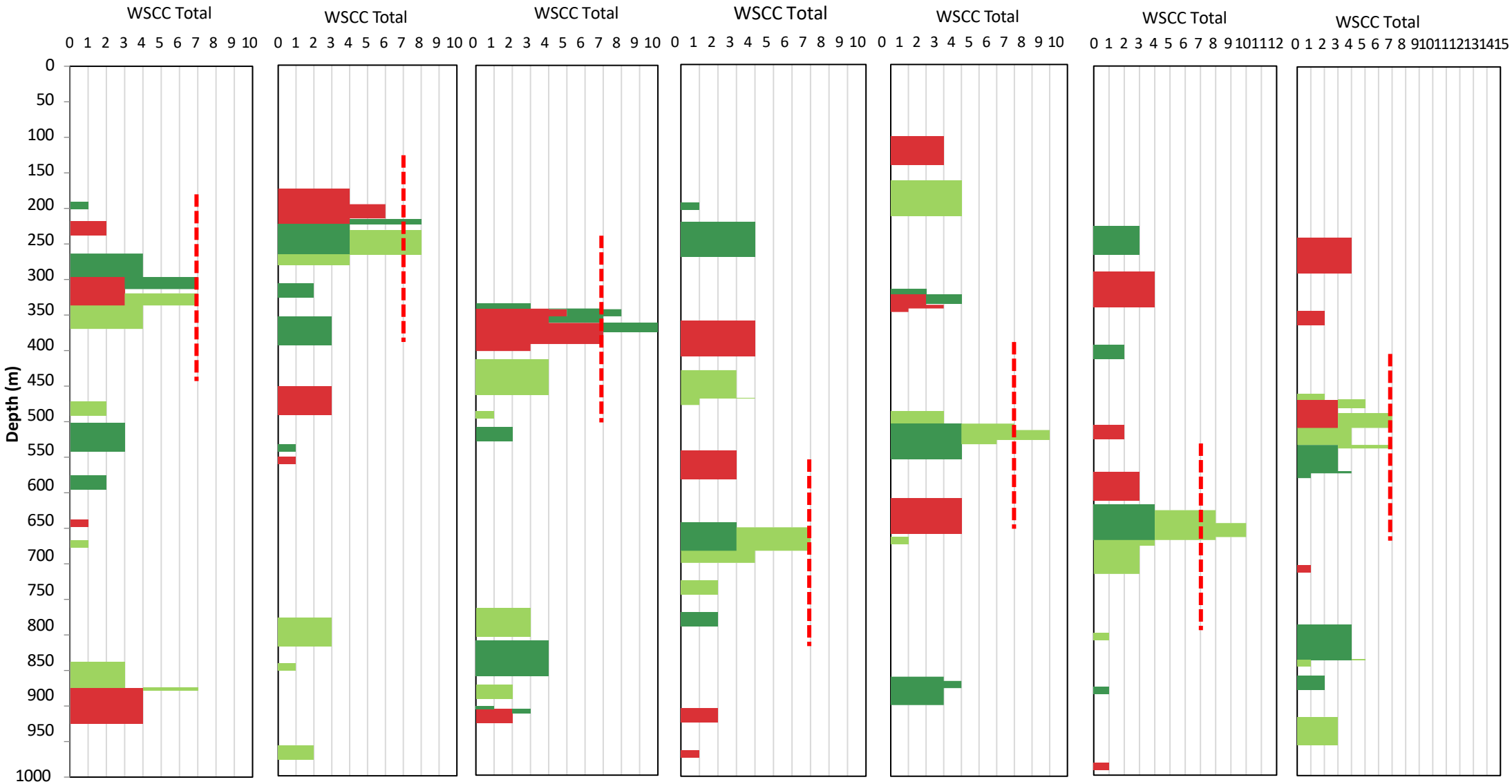


Some scans present with no significant indicators of sulfides

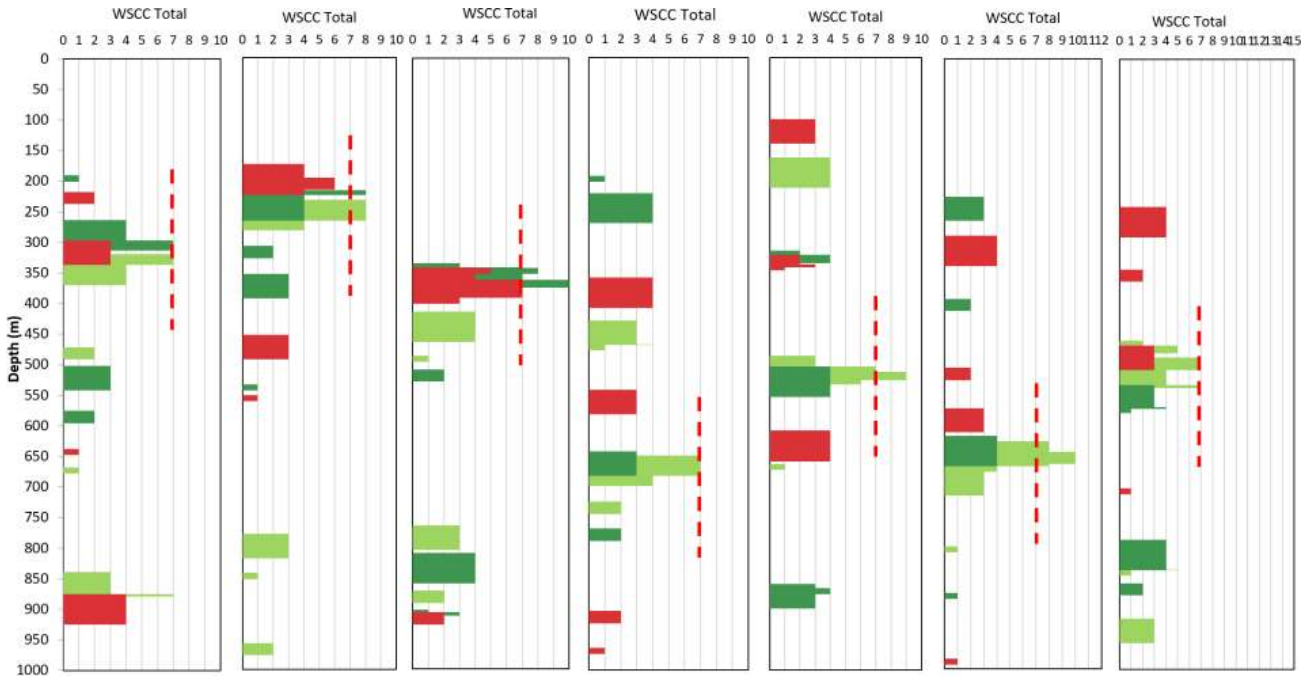
Nearby scan has no WSCC values above 20 in the 8-component WSCC results suggesting a lack of sulfides in this area but there are no drill holes in this area to confirm results.

Summary of some 3C WSCC results

Different depths, different values, different deposits, different host rocks, different shapes of mineralisation, no false positives and 14 SUCCESSFUL responses from 9 case studies from around the world and this is for Zn ONLY!



Results summary

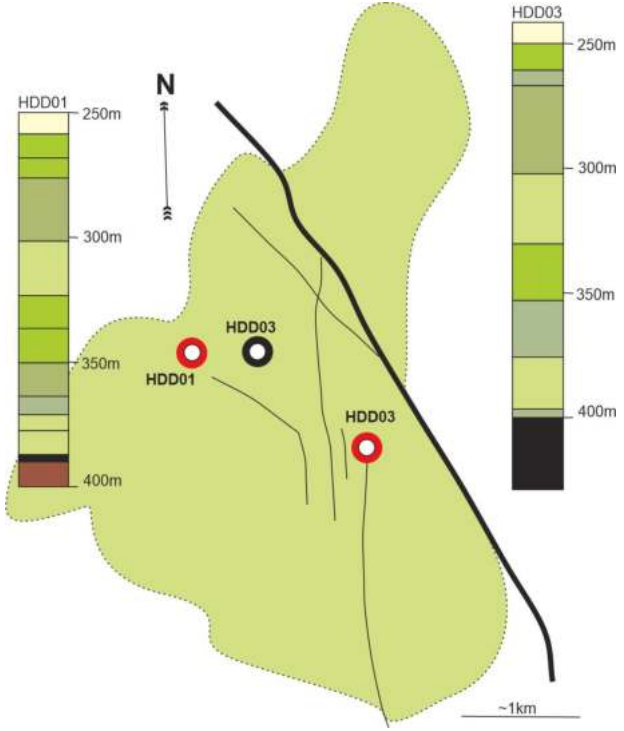


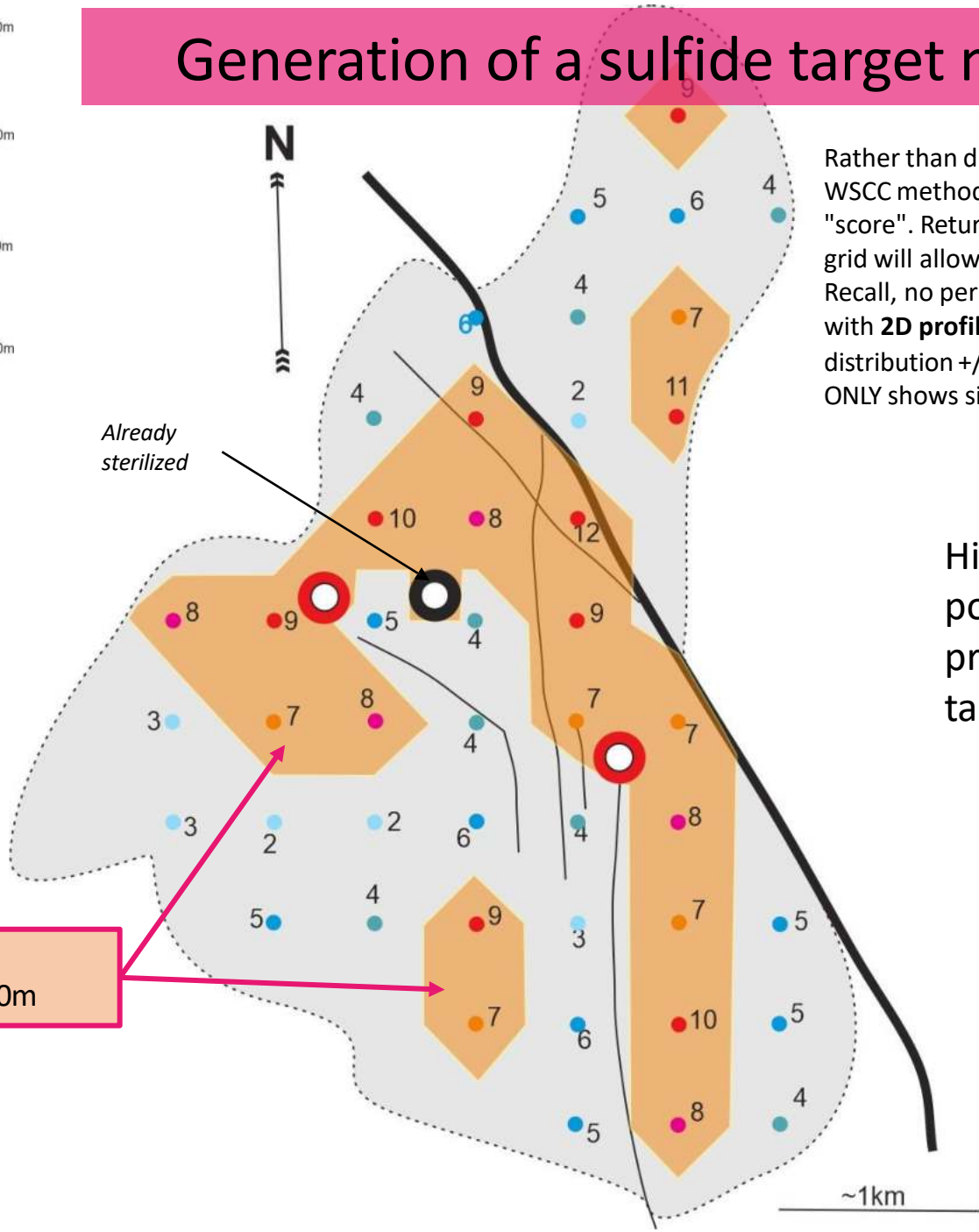
Processed data and/or processed data plus WSCC results can be used to better plan an exploration or resource extension drilling campaign by providing additional information about where and how deep to place drill holes. The WSCC method provides a "score" for sulfides. Areas with the highest scores can be prioritized therefore potentially saving time and money in unnecessary drill holes.

The technique is fast to acquire data (~2 hours per scan) and has little to no impact which makes it extremely environmentally friendly.

- Preliminary results show good correlation from both 8- and 3- component WSCC and sulfides (results presented here for case study areas containing Sphalerite, Galena and Pyrite)
- Results are obtained for a wide variety of depths and in a range of different host-rock types.
- Values of 20 and 7 for 8- and 3-component WSCC results appear to provide good minimum cutoff values for sulfides meaning that ADR is closer to a quantitative method for targeting sulfides.
- Our aim is to fully quantify the specific values in each ADR results for sulfides. This is currently work in progress so watch this space.

Generation of a sulfide target map using WSCC results





Rather than drilling for exploration or to test ambiguous "anomalies", the WSCC method provides a means of ranking areas according tot heir "score". Returning to the hypothetical case below, undertaking a similar grid will allow exploration to be far more focused.
Recall, no permitting, 2hours per scan, can be supercharged if combined with **2D profile scans** to generate a ~2.5D image of sulfide distribution +/- lithology etc! (see next few pages) This example ONLY shows single STARE scans.

High sulfide potential – priority drill targets

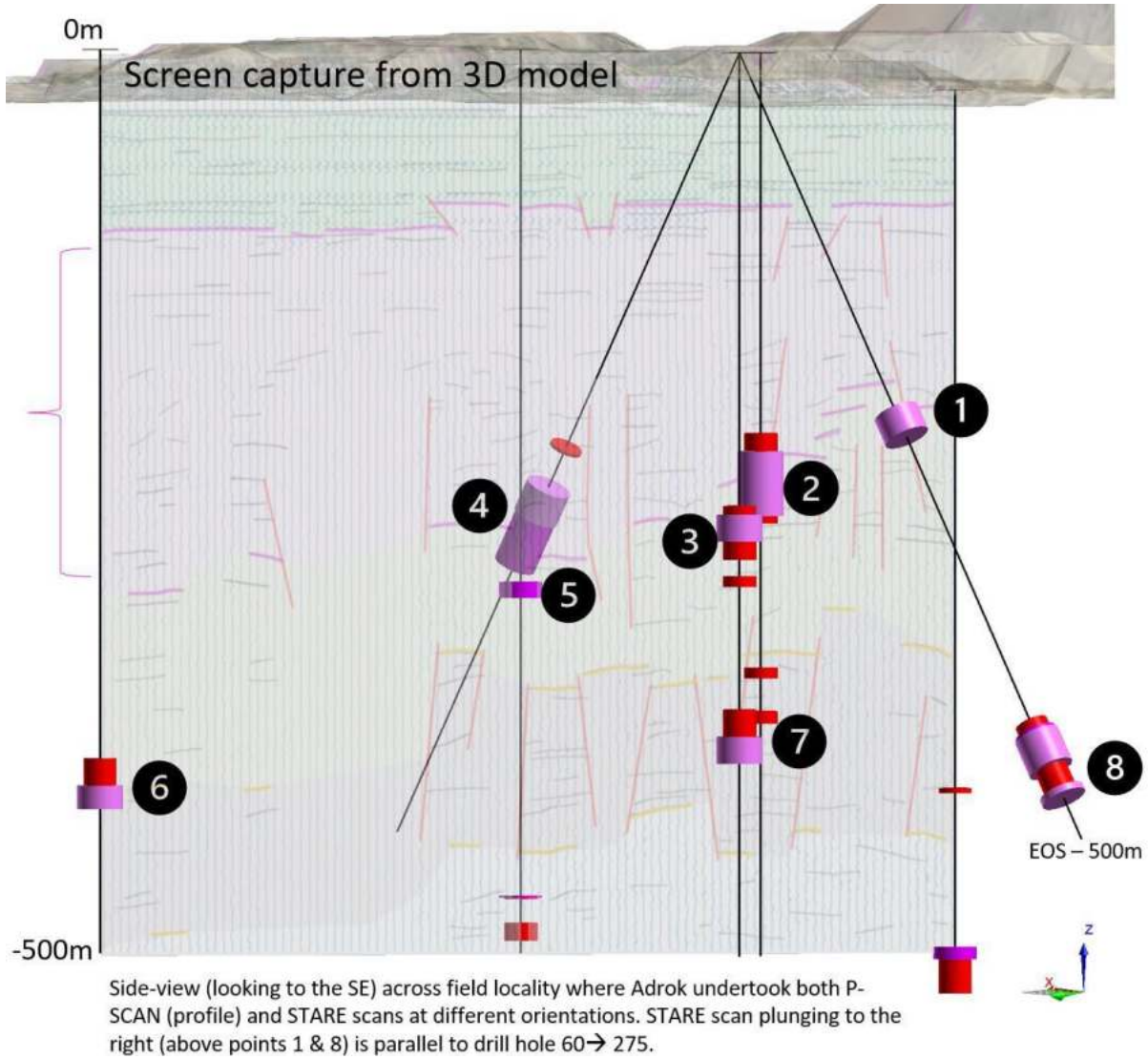
12
11
10
9
8
7
6
5
4
3
2

Low sulfide potential

Sulfide bearing areas based on 3-Compnent WSCC results below 400m

43 sites total

20 sulfide targets
23 low priority targets



Side-view (looking to the SE) across field locality where Adrok undertook both P-SCAN (profile) and STARE scans at different orientations. STARE scan plunging to the right (above points 1 & 8) is parallel to drill hole 60→ 275.

Full size image overleaf:

Case study showing the results from both a **Profile scan (500m long x 500m deep)** and **STARE scans** but the STARE scans here are oriented both vertically and at 60-degree plunge in order to get a better image of the distribution of sulfides at depth.

The Profile scan is a plot of E-mean which has been used to interpret packages of rocks with different geophysical properties. The zone shown in pink is interpreted as a greywacke and is host to the main mineralisation interpreted from the high WSCC results. In particular the lower section of the rock/geophysical package is the area of highest interpreted sulfide content.

Parallel scans show good correlation with WSCC results such as at points 2 and 3 and vertical and angled scans also show good correlation as shown at points 4 and 5.
The high WSCC result shown at point 1 corresponds with sulfides in a 60- degree plunging drill hole which unfortunately was only around 420m long and didn't reach the lower high WSCC at point 8.

No other drilling has been carried out here at this stage.

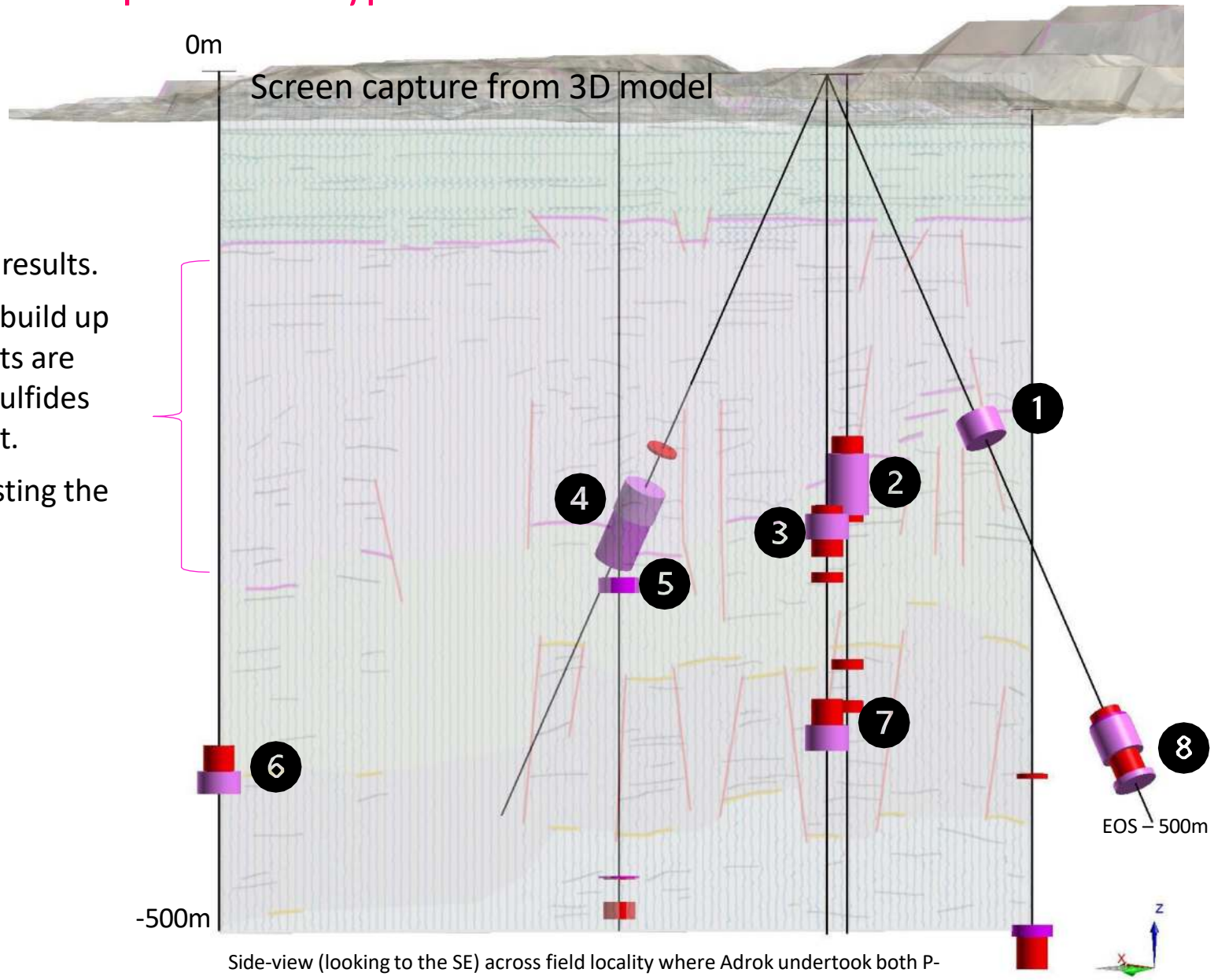
Building models with multiple scans types & scans in different orientations

P-scan showing results for E-mean and interpretation of lithological boundaries and faults

- WSCC results >7 are shown for 3-compnent WSCC results.
- Multiple scans (STARE and P-SCANS) ca be used to build up an "image" of the sub-surface geology. WSCC results are overlain on P-Scan results and indicate that here, sulfides are found predominantly within the greywacke unit.
- Sulfide targets increase in depth to the east suggesting the greywacke also dips to the east.

#1 – corresponds with sulfides in single, west-plunging drill hole. #2-5 sulfides in vertical STARE scans and in E-plunging scan.
#6-8 sulfides identified below any drilling but interpreted to be within a lower greywacke unit below semi-barren mica schists and quartz schists.

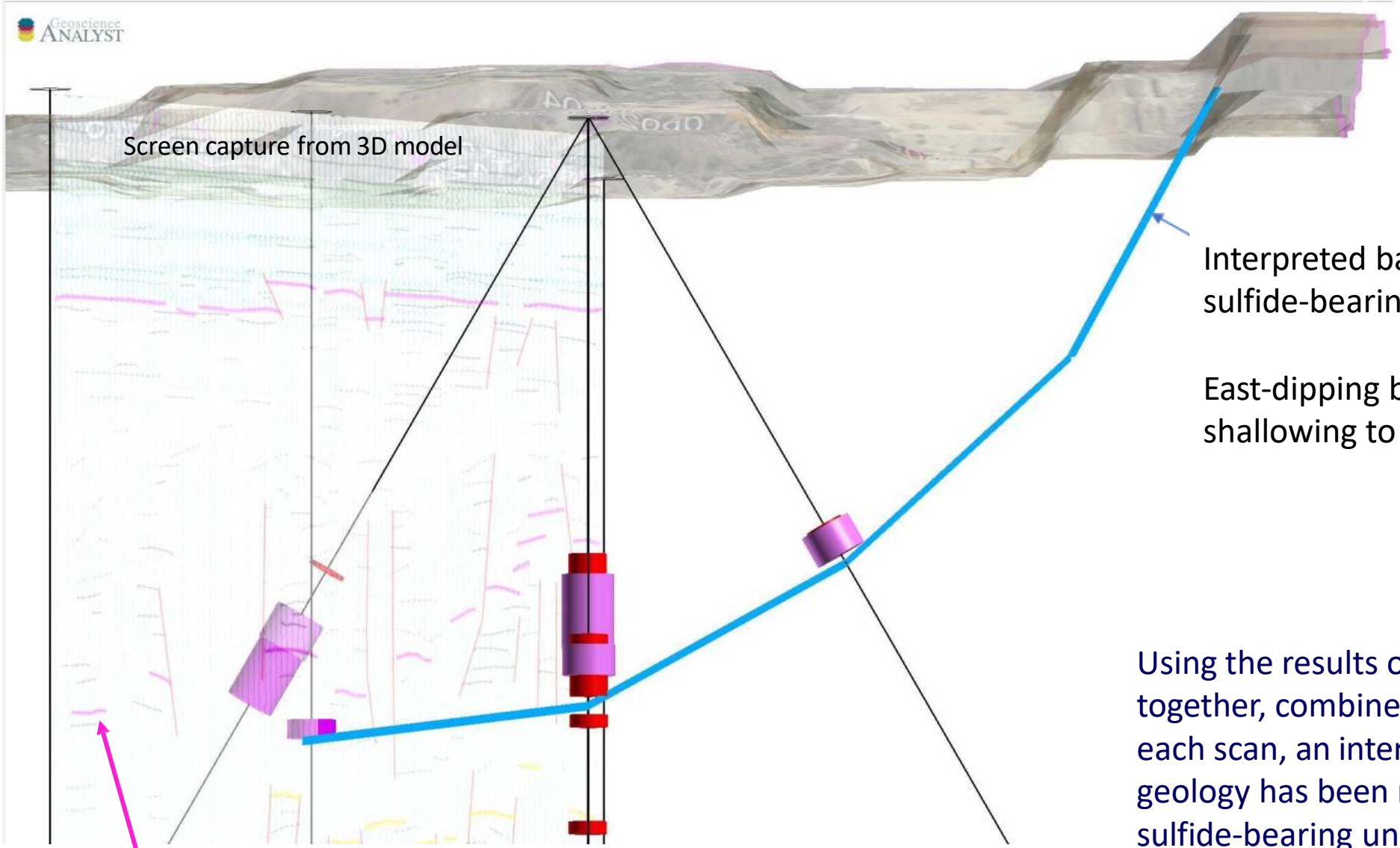
Note - repeatability in #2 & 3 and #4 & 5.



Side-view (looking to the SE) across field locality where Adrok undertook both P-SCAN (profile) and STARE scans at different orientations. STARE scan plunging to the right (above points 1 & 8) is parallel to drill hole 60➔ 275.

East

West



Interpreted base of main sulfide-bearing greywacke unit.

East-dipping bedding shallowing to the east.

Using the results of the two different scans together, combined with the WSCC results for each scan, an interpretation of the sub-surface geology has been made. The base of the main sulfide-bearing unit has been interpreted and shown in blue.

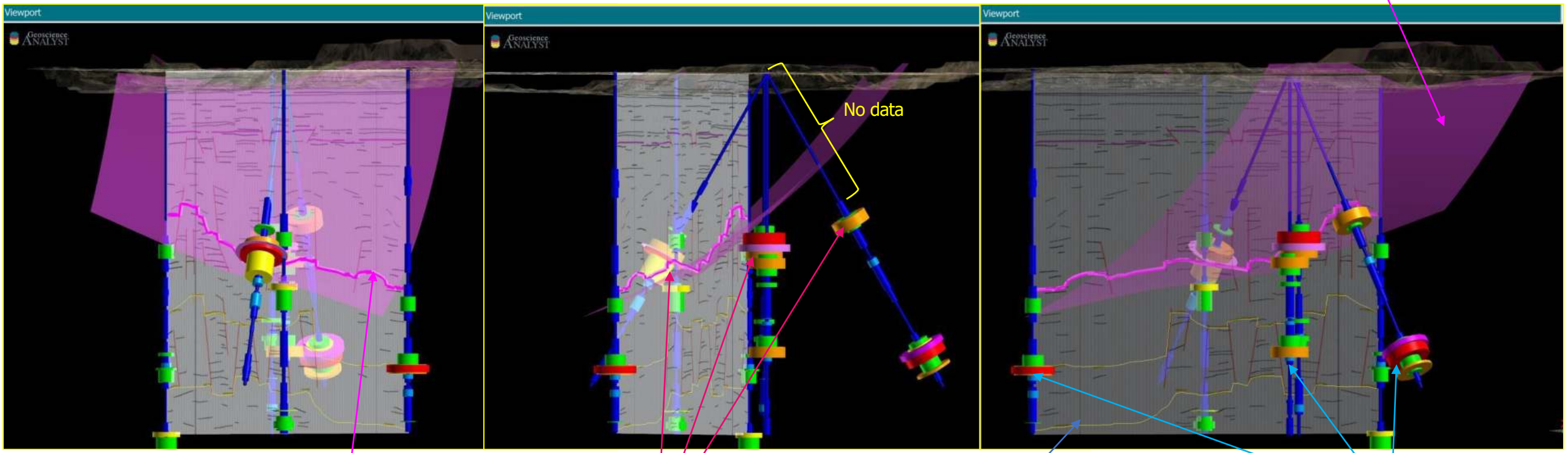
View looking approximately south

Interpreted base of upper greywacke.
Becomes shallower to the south as shown by broken pink line

Screen captures from 3D model created by combining P-scan (profile scans) and STARE scans (vertical linear scans) and WSCC results.

The final model shows the interpreted W-dip of host greywacke (purple semi-transparent surface) and the high sulfide "hits" in the linear STARE scans with sulfides concentrated within the top of the greywacke. Based on these results, we would recommend drilling vertically from ADR scan collar location and a second deeper hole to the east to intercept the high sulfide hit at the bottom of the scan angled to the right on the center screenshot. Adrok are showing that, when combined, the results from P-scans and STARE scan can be used to give a much clearer indication of where to drill target-specific holes. The results presented here can be carried out on a target area prior to drilling and to depth of ~1000m.

West-dipping host greywacke unit (transparent purple) interpreted from combining P-scans with vertical STARE scans



Bedding (S0) interpreted in profile scan (P-Scan) consistent with host greywacke

Primary sulfide occurrences within upper greywacke unit

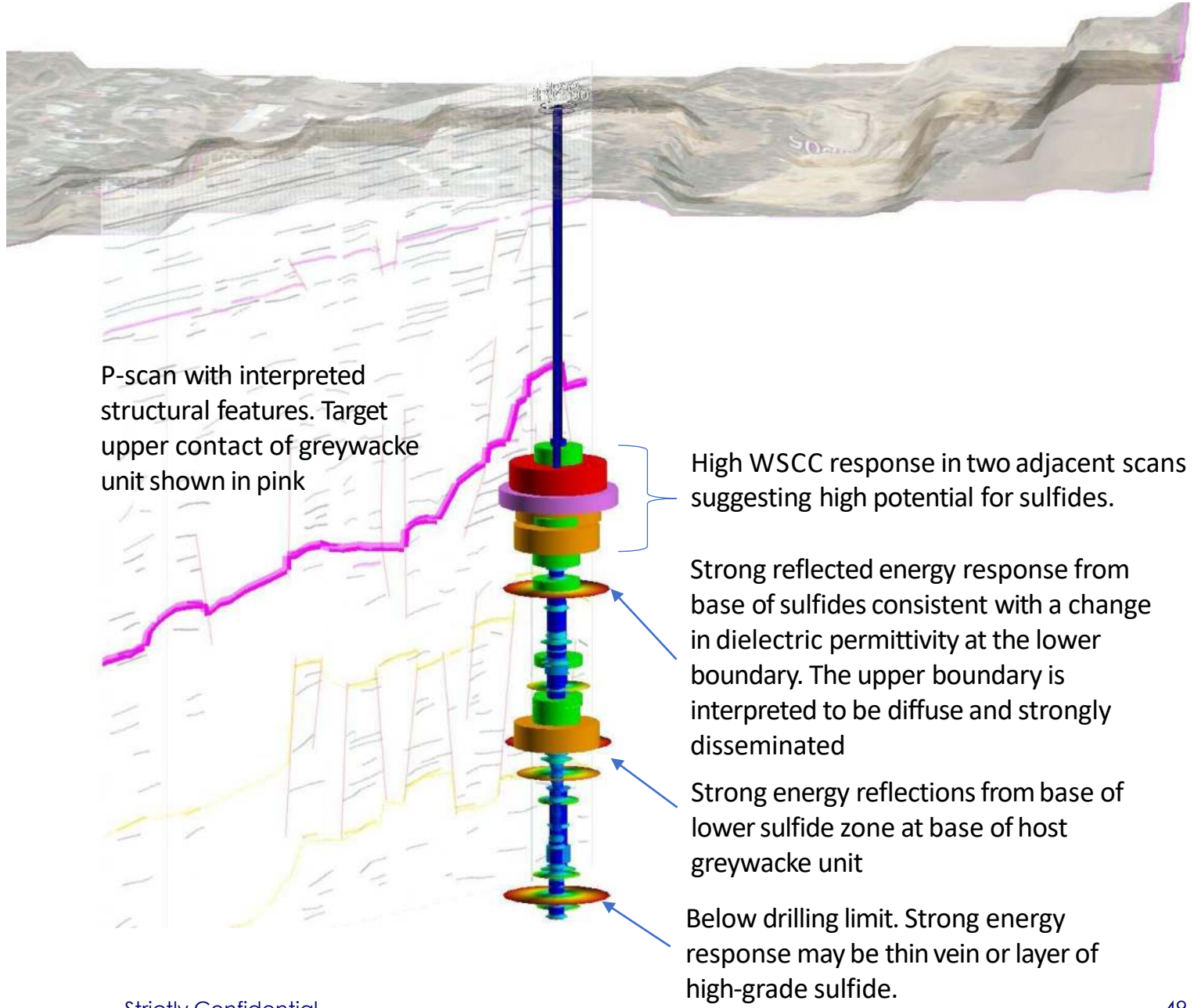
Bedding (2D cross section similar to seismic – yellow lines) and structure (faults – red lines) interpreted from P- Scan

Secondary sulfide occurrences within lower greywacke unit but unconfirmed in drilling as drill hole ended in upper greywacke unit

MULTIPLE CRITERIA TO HELP INTERPRET SULFIDES

Multiple results can be combined to provide a more detailed "image" of the subsurface. When targeting disseminated sulfides, such as those presented in the previous examples, Adrok have found that the WSCC results are the most reliable indicator of sulfide probability. Where layers of high grade or massive sulfides occur either as a separate occurrence, separate deposit style or together with disseminated sulfides, those massive sulfides provide a strong reflection of energy. Accordingly, they appear as peaks in the energy signal. Both data sets are provided at the end of a survey and can, in some cases be used together to provide higher degrees of confidence of sulfides. In this case example, layers of massive sulfide are interpreted to occur within the mostly disseminated sulfides. The energy will reflect from the sharpest boundary and this boundary may be at the base of a package of disseminated sulfides.

Alternatively, the upper contact of the sulfide package may be sharp and provide the best reflector. An example of this is provided overleaf.



Targeting highest grade sulfide zones within lithologically controlled mineralisation

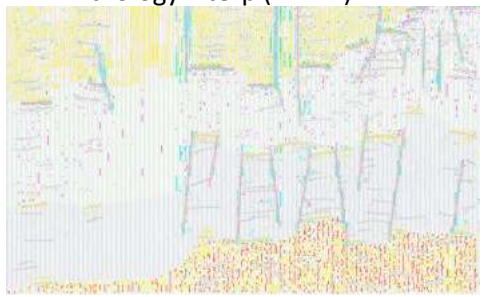
-500m long profile scan

-230m

Sulfide targets defined using vertically (depth) weighted values.

-500m depth

Lithology interp (E-ADR)



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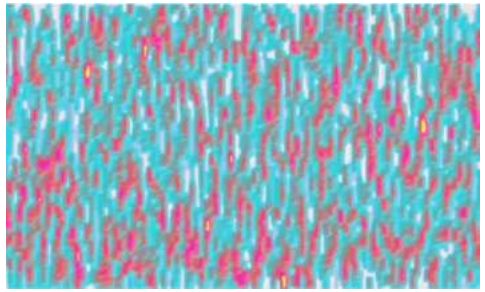
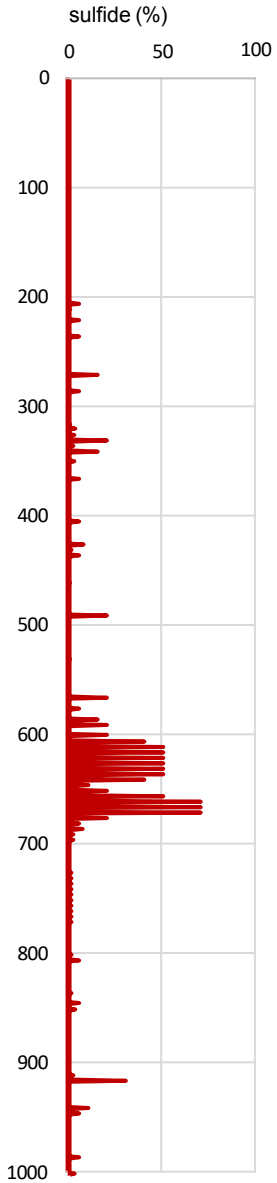
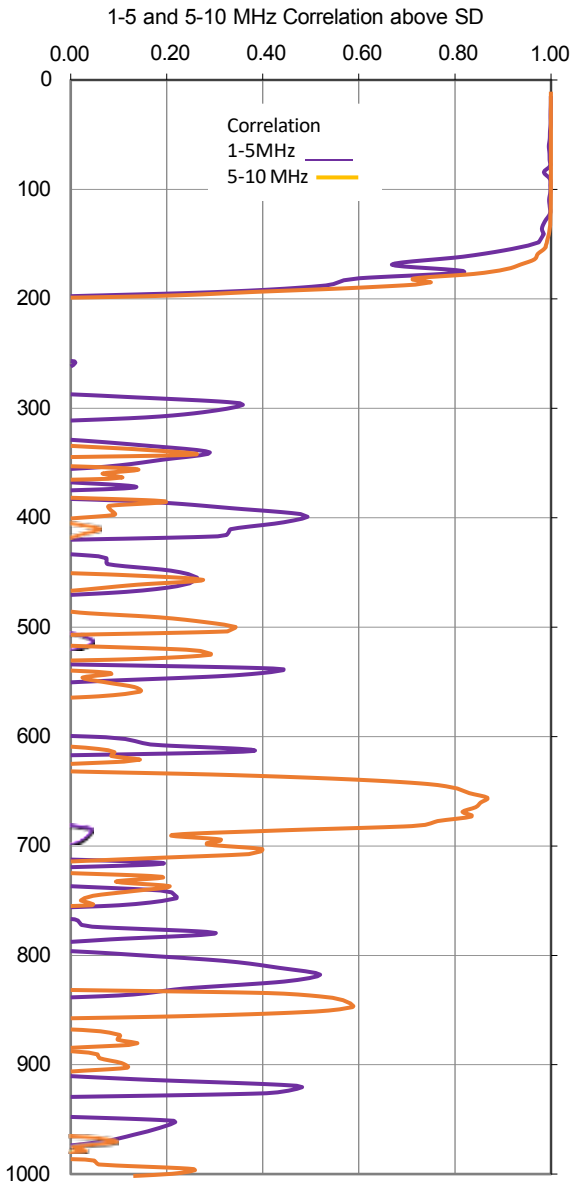
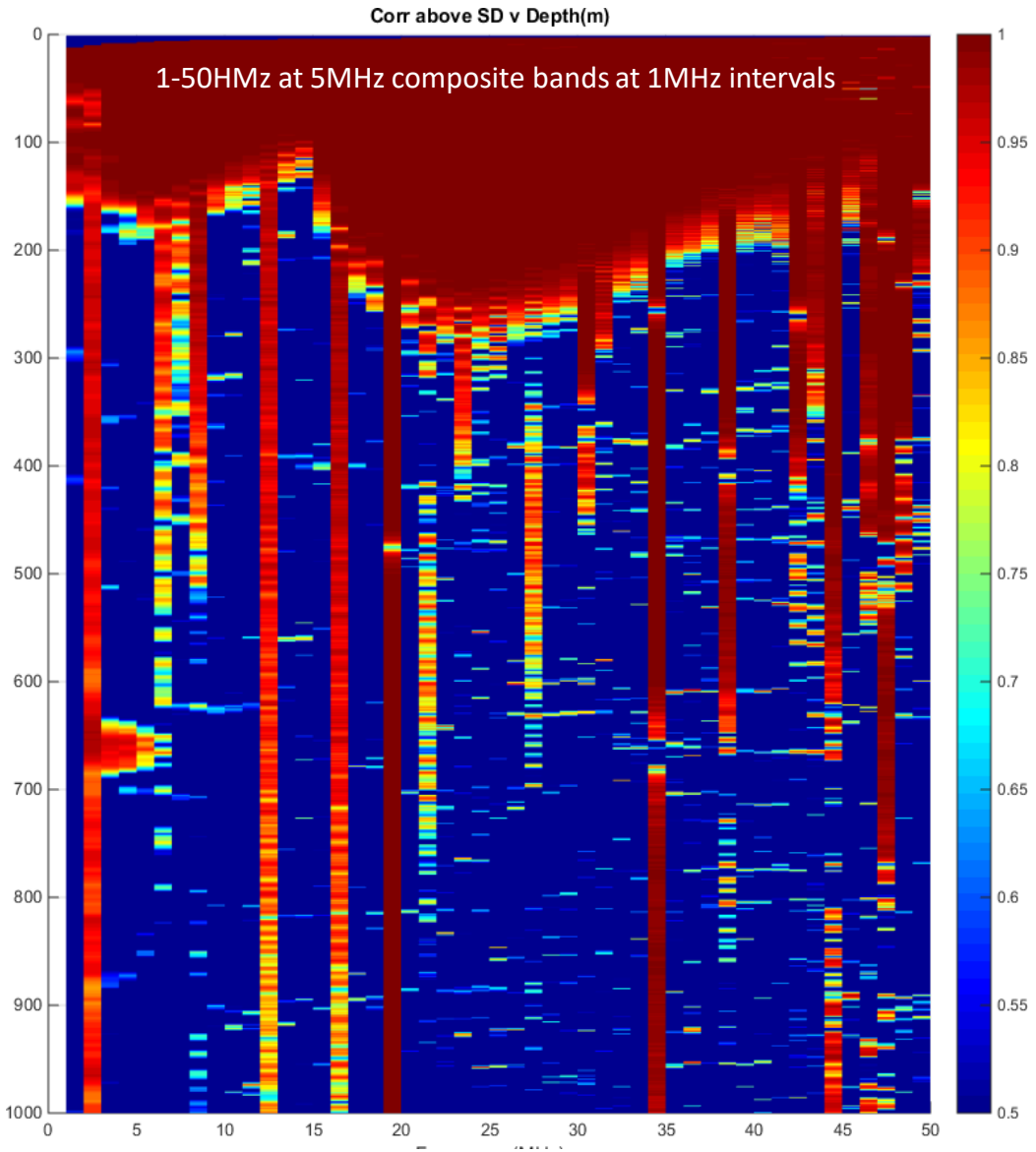


8C-WSCC for sulfide targets shown in yellow

Not just WSCC - Other results pointing to a unique signature for sulfides

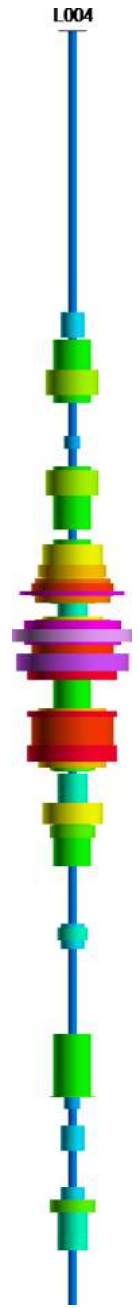






1-50MHz frequency responses (left to right increasing frequency) versus depth. Processed at 5MHz bins at 1MH intervals within increasing frequency

SUMMARY



Adrok have been working with the mineral exploration industry to develop the technology, data processing and interpretation technique to help reduce the risk of mineral exploration drilling, particularly under deep cover where targets are genuinely blind.

- The data acquisition technique utilises a conditioned pulsed radar pulse at low frequency (1-70MHz) to measure rock properties up to and sometimes over 1000m deep below the surface.
- Adrok have, for over more than ten years, been collecting the same data from a wide variety of mineral deposit types (SEDEX, VMS, Porphyry, Orogenic) and have been able to bring together all of these results to explore the possibility of extracting the "**sulfide fingerprint**" from the background noise/signal of the host rocks.
- The aim of this most recent project was to develop a method of **targeting high grade, disseminated sulfides, prior to drilling** which in-turn will help provide explorers with a higher level of confidence when placing the first discovery hole or when extending existing mineral resources. Adrok used a multi-project, iterative processing and stringent evaluation method to extract two initial sets of criteria (see overleaf) that have been tested across multiple projects with a high level of confidence.
- The method, which Adrok has termed "**Weighted Sulfide Correlation Criteria**" (WSCC), uses a combination of up to four high and/or low values from either 8- or 3-datasets collected in the field (i.e. 32 or 12 total criteria respectively). These are termed 8-Compnent WSCC and 3-Component WSCC.
- The WSCC method can be carried out on legacy data, therefore Adrok have internally blind tested the technique on historical datasets where drilling assay or sulfide% values had been provided by clients. We present some of these results here.

Adrok is confident that this represents a major step forward in the use of deep-penetrating radar for the identification of sulfide targets without the need for drilling, thereby significantly reducing time, cost and environmental impact of exploration under cover.

Our Value Proposition becomes part of the solution

ECONOMICAL

We will be reducing exploration costs by up to 90%

CONVENIENT

Faster solution lessening the need for exploratory drilling

ENVIRONMENTALLY FRIENDLY

Harms the environment in no way

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