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All figures are expressed in Australian dollars unless stated otherwise.
A modern mining company
Exploration Process

Mineral exploration in 2019

// The exploration process is iterative and takes time. More money doesn’t necessarily help.
// We generate vast amounts of data that does not always result in discovery.
// The low hanging fruit in the best jurisdictions appears to have been picked.

– Trade sovereign/social/security risk for exploration risk? Make discoveries but maybe not mines.
– Go deeper/Undercover
  Increase exploration spend and capital intensity.
– Study Harder?
  Ascend from explorer, to specialist, to oracle – does this help or hinder?
Gawler IOCG Research

We know a lot about Gawler IOCG’s ... but maybe we are a little too smart!

/ Increasingly model-driven exploration.

/ Increasingly difficult to identify and rationalise targets which don’t fit the OZ Minerals IOCG model.

/ Bias pulls our attention to well-known prospects – we avoid new frontiers.

/ By searching for the exact features of our detailed exploration model, are we making a new discovery more difficult?

/ Enter the Explorer Challenge
Explorer Challenge

Thinking Differently – were all low hanging fruit actually picked?

/ Terabytes of collected data isn’t valuable if it isn’t being put to work.

/ Tapping into a global ideas market ensures diversity of thought.

/ Insight and ideas from outside the mining industry empowers a shared, sustainable future.

/ Human-centred approach creates opportunities for unusual partnerships and genuinely unique exploration methodology.
What is Machine Learning

Why it changes how we work

/ A branch or subset of Artificial Intelligence focused on systems that learn from environment (e.g. data!).

/ Data can be Unsupervised (unlabelled) and/or Supervised (labelled)

/ A method of data analysis that automates analytical model building through algorithms that iteratively learn without being explicitly programmed.

/ Key aim in Machine Learning is to build a model that is general; will behave intelligently in totally new environments (e.g. with new data).

https://xkcd.com/1838/

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What is Machine Learning

Why it changes how we work

/ Massive assay dataset at Mt Woods: 100s of holes with 60+ elements assayed every metre = millions of data points.

/ Traditionally used IoGAS (Excel on steroids) to plot assay results from one element against another (2-3 elements at one time) and break them into groups (clusters).

/ Machine learning takes process to an extreme level; dozens of elements used to create clusters – not only assay data. Can incorporate geophysical data, geology etc to create new clusters to potentially give indications of “Near Miss” situations.
Machine learning is not appropriate when:

/ A target value can be determined by using simple rules, computations, or predetermined steps that can be easily programmed.
/ When the scale of the data is small.
/ If you don’t have many variables.

Simple statistics or human made rules can produce better results in these situations.

Machine learning is most appropriate when:

/ There are lots of variables.
/ Large scale of data.
/ Many variables will influence the prediction (classification).
/ The rules or factors are complicated, overlapping and need to be finely tuned.

We can use machine learning algorithms to determine the rules from the data.
Explorer Challenge

Main challenge

/ 3 months, 5TB of data, >1000 participants from 60 countries

/ 37 models and 400+ targets generated, $1 million awarded

/ A faster, valid exploration strategy with lower cost to target generation

/ Exciting new ideas, perspectives, models and methodologies – not just impacting exploration but raising questions throughout the business.

/ Consensus targets are independent, multidisciplinary, diverse and valid and so build confidence.

/ Biggest challenge now is keeping an open mind!
Explorer Challenge
Selecting Drill Targets

/ Initial attempts at selecting first phase of drill targets resulted in geological bias – targets discarded

/ Applying the consensus approach

– Areas identified by highest density of groups.

/ Consideration of existing drilling results and exclusions zones.

/ Target location accuracy.
Drilling of top 6 consensus targets.

Live streaming of XRF drill data to 3 groups

- Drill hole predictions
- Near real time decision support

Further drilling of additional targets to take place in 2020. Combination of both consensus and individual team targets.
Explorer Challenge

How has this changed our exploration strategy?

/ Working with several Explorer Challenge groups to refine exploration programs elsewhere.

/ Data science and machine learning provide validation and feedback on predictions and models; different to the traditional thinking in geological terms.

/ How crowdsourcing can be applied to finding exploration targets and other business challenges.

/ Pushing beyond the boundaries of what is normal in mining; application of different thinking to complex problems.
Explorer Challenge
Open data accelerates industry wide innovation

/ Demonstrate the economic opportunity in solving problems.
  
  – 3+ companies were created because of the Explorer Challenge.

/ Decisions can be made in shorter time frames – more people can work on the data at any one time.

/ Other industries have tools, techniques and methodologies that can be applied to mineral exploration which we can leverage through sharing data.

/ Australia is uniquely placed to drive this innovation with our world class public datasets.

Caldera Analytics (Team Guru) - Winners
Explorer Challenge

What does the Explorer Challenge and Machine Learning mean for the exploration industry?

/ Crowd approach – be faster and smarter
  – Speed and knowledge diversity.

/ Consensus
  – Combine models to build confidence in targets.

/ Demonstrated cases where data science can take advantage of large open datasets.

/ AI/Machine Learning is in its infancy for exploration targeting, open data will accelerate the industry learning.

/ May affect the way we collect and record data

/ Machine Learning not a silver bullet but to be used together with traditional exploration techniques
The future of mineral exploration