LINKING GEOPHYSICS AND GEOLOGY THROUGH BOREHOLE DATA

MINEX CRC PROGRAM 2 & 3

Data from Drilling, National Drilling Initiative

PHD PROJECT

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RESEARCH PROJECT

A common problem in mineral exploration is that data collected within a borehole (from centimetres to hundreds of meters) does not scale to the regional geophysical datasets (from hundreds of meters to hundreds of kilometres) that are primary exploration tools. This makes it difficult to link geophysical data to geological observations and to build three dimensional geological models that are properly informed by geophysics.

The critical link between geology and geophysics is petrophysical data which is rarely collected in the volume or detail required. In this project, geophysical and petrophysical data will be collected from boreholes in a heavily sampled iron ore district for a twofold aim: 1- to develop workflows to link borehole geology to the regional geophysics (seismic and potential field data), 2- to constrain the three dimensional geology based on my understanding of the geophysical signature.

The strategy is to choose an area where there is high density of drillholes from which to acquire a range of borehole geophysics and petrophysics. The chosen field area is on BHP acreage in the Pilbara, where there are existing bore holes and complimentary data and where the MinEx CRC Project 5 team will be conducting seismic acquisition on the in 2021. The focus of this project will be on seismic, magnetic and gravity data and related rock properties along with detailed geological and geochemical logs. Borehole and surface seismic data will be collected by fibre optic distributed acoustic sensing techniques. Existing regional potential field data will be augmented by detailed magnetic and gravity surveys. The data will be integrated and analysed using a range of geostatistical techniques to determine key relationships as a basis for three-dimensional modelling.

In this project, workflows and methodologies will be developed to be broadly applied in mineral exploration. The work will help to overcome a major impediment to the adoption of seismic techniques in hard rock settings, namely the challenge of rationalising seismic data with more commonly used potential field techniques to produce viable and testable geological models.