

## **Data-Driven methods and applications in mineral exploration**

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The mineral industry plays a significant role in the world's economy and prosperity. After hundreds of years of mineral exploration, base and critical metal deposits that have an obvious surface expression have largely been discovered. Future mineral discoveries are expected to lie beneath non-prospective cover. To facilitate exploration, new data technologies and tools are being used to collect and use geochemical and mineralogical data. With increasing data volume and variety, overcoming challenges for efficient data processing and data integration becomes increasingly valuable for modelling in mineral exploration. Here we discuss methods for efficiently integrating geoscience data from different sources and building models to assist mineral exploration.

With early-stage exploration in covered terranes, soil geochemistry and mineralogy data can provide subtle mineralization signatures of potential orebodies. Clay minerals within soil samples can adsorb a variety of metals, such as gold and some base metals; as they tend to dominate the fine fraction, they can be mechanically concentrated and analyzed to boost mineralization signals (UltraFine+). At a later stage with more targeted exploration, mining companies are drilling tens of thousands of cores each year and performing routine hyperspectral core scanning to extract mineralogical information. Although they can provide larger-scale and higher-coverage geological information than assay geochemistry and quantified mineralogy, the high-dimension and large size hyperspectral data can present a significant hurdle for processing and building models.

In this presentation, we will provide an overview of how two projects, UltraFine+ and Rosetta, integrate data from various sources, extract useful information, and build predictive models. After integrating raw spectra, geochemistry, lithology, and geospatial data, we can apply a range of unsupervised, semi-supervised and supervised models to find clusters and correlations and make predictions, which aids and expedites decision making in mineral exploration.