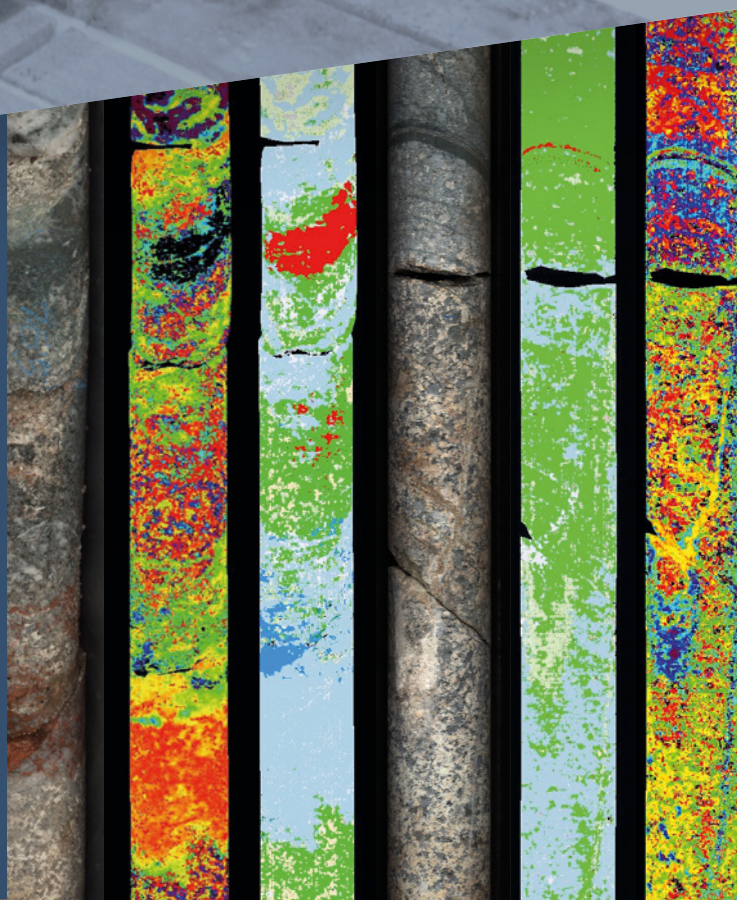
GEO TEK

HYPERSPECTRAL
IMAGING SPECTROSCOPY

Mineralogical Mapping
for **Industry** & **Research**

MINERALS QUANTIFIED

Automatically highlight **key minerals**, and provide information on **both** their **quantity** and **grade** at the **lab** or in **the field**



IF CORE'S WORTH TAKING, IT'S WORTH LOGGING

FULL SPECTRAL DATA ACROSS THE ENTIRE SAMPLE

Hyperspectral Visible Near InfraRed (VNIR) / Short Wave InfraRed (SWIR) reflectance imaging technology generates near continuous data over the entire surface of whole and split/slabbed core samples, plug and chips. Every pixel in a hyperspectral VNIR and SWIR image has a reflectance spectrum, which is interrogated using specialist interpretation software to identify, quantify and map: specific mineral types, mineral chemistry, zones of mineral alteration, liquid and solid hydrocarbons, and contaminants.

Rock chip, cores, pulp & drill **cuttings** logs

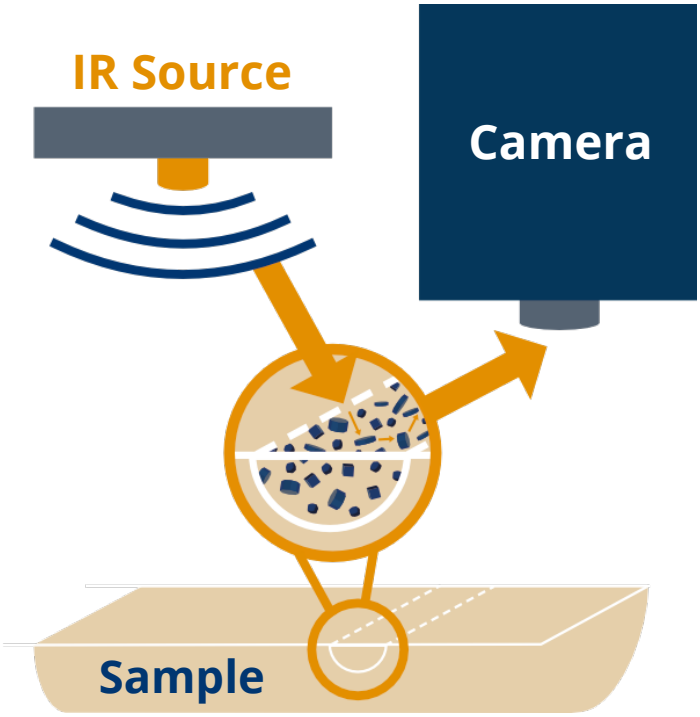
24 hour monitoring of mill feed concentrate

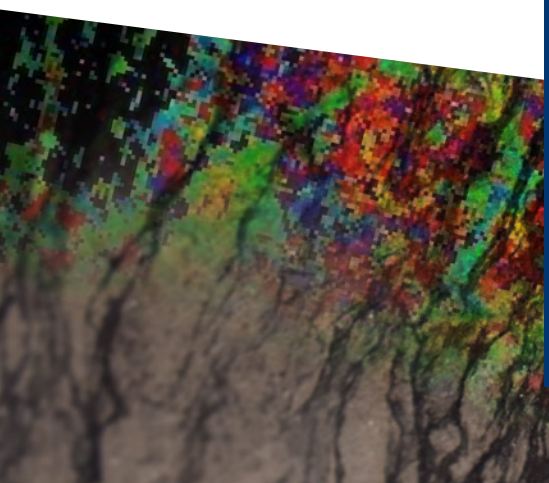
Grade control at underground & surface **mine faces**

METHOD

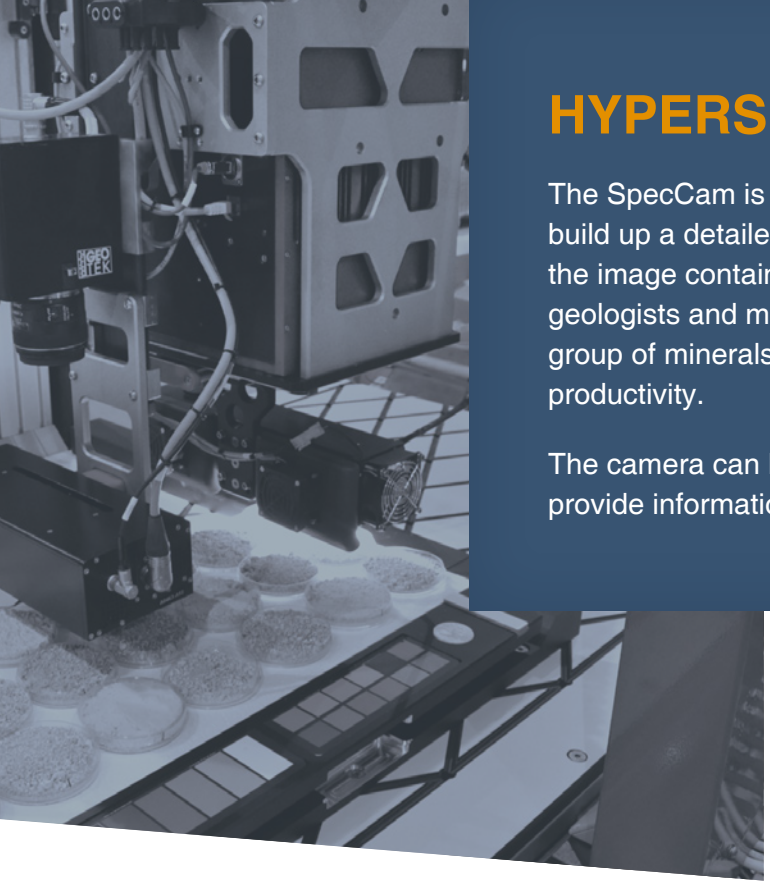
The VNIR picks up spectral variations within the range from 400 nm to 1300 nm, providing information on transition elements such as iron, copper, nickel, and also rare earth elements.

In the SWIR (1300 nm to 2500 nm) the molecular vibrations of crystalline and amorphous minerals (including hydrocarbons) can be measured as absorption features in their reflectance spectra. The exact positions and shape of these features provide important information on precise composition, crystallinity and quantity of the mineral.





Fully supported **interpretation software** with **customisable spectral libraries** and **expert machine learning techniques** are offered with each system to **process and interpret** the spectra



HYPERSPECTRAL MSCL

The SpecCam is a ruggedised imaging spectrometer designed to rapidly build up a detailed, real-time, image of a rock sample. Each pixel in the image contains detailed spectral information that can be used by geologists and mining engineers to identify a specific mineral type or group of minerals, and possible contaminants, with greatly improved productivity.

The camera can be set up to automatically highlight key minerals, and provide information on both their quantity and grade.

GEOTEK SPECCAM 4

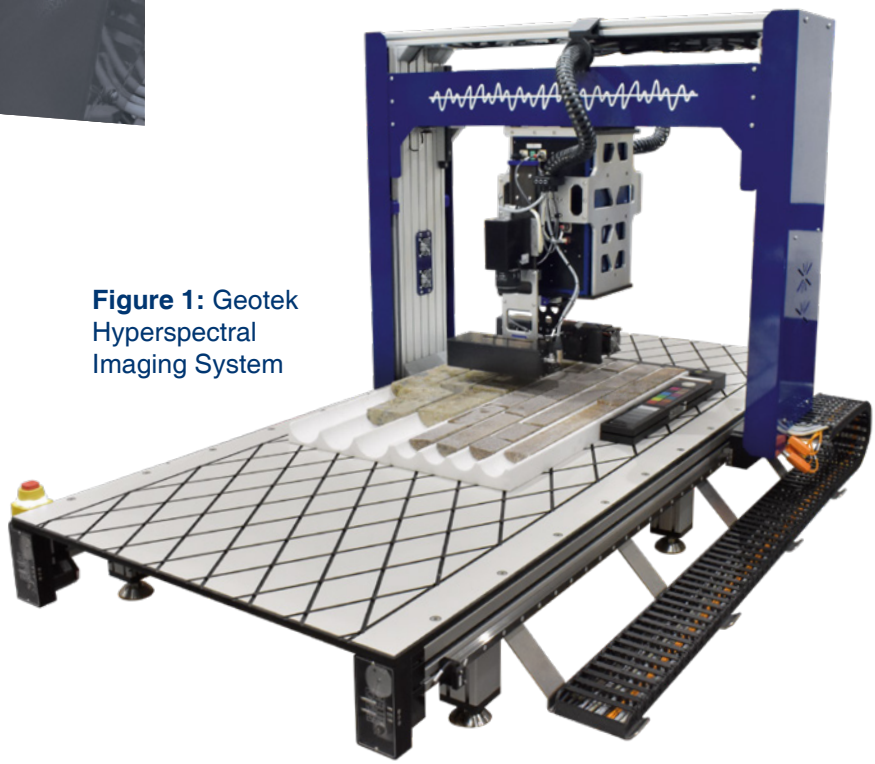


Figure 1: Geotek Hyperspectral Imaging System

MINERALOGICAL IDENTIFICATION:

- Quantify each clay type
- Derive total clay
- Identify Kaolin polytypes e.g. low-high crystallinity, halloysite, dickite
- Determine Fe: Mg ratio of chlorites
- Define subtle changes in compositions
- Serpentine Group
- Sulphates – alunite, jarosite and gypsum
- Identify illite and smectite types
- Amphiboles – actinolite, tremolite, and hornblende
- Identify mica types e.g. paragonite, muscovite, phengite
- Identify different carbonate species such as: calcite, dolomite etc
- Iron oxides, REE's

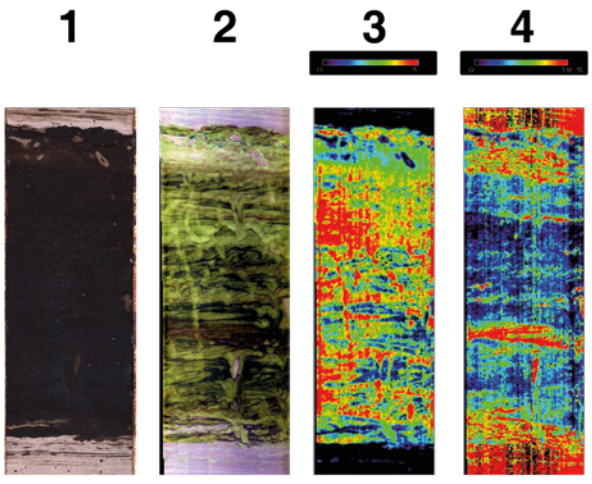
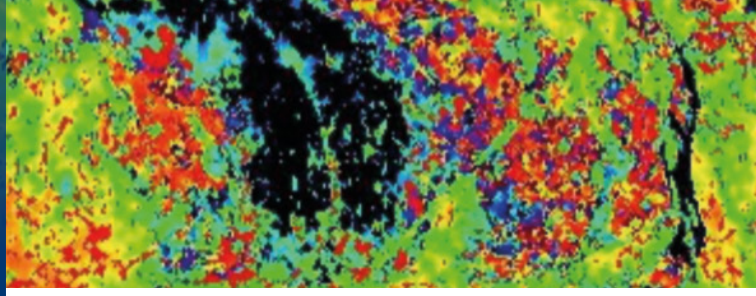


Figure 2:
1. White light core photograph;
2. False colour infrared image;
3. Hydrocarbon composition map;
4. Clay content map



Map **compositional** and **crystallinity changes** to identify **mineral assemblages**, **vectors** and **proximity to mineralisation**, for a variety of deposits including **epithermal, porphyry, SEDEX Pb-Zn-Ag, kimberlite, volcanic-hosted massive sulphide** and **orogenic gold resources**

APPLICATIONS

Oil and Gas

- Determine spatial distribution of liquid and solid hydrocarbons
- Discriminate and semi-quantify polytypes of swelling and non-swelling clays, carbonates and sulphates
- Identify core intervals where mineralogy controls permeability
- Use as a tool to plan for more focused plugging or well planning

Mineral Exploration

- Alteration mineral mapping to identify temperature and chemical zoning
- Provision of mineral abundance and ratios such as: clay fractions, phenocrysts and xenocrysts in kimberlite, breccia and conglomerates
- Distinguish weathering vs alteration clays
- Identification of asbestiform minerals
- Discrimination of serpentine group, micas, kaolin group, chlorite-epidote group and more

Research and Academia

- Determine spatial distribution of minerals at high resolution (0.5 mm x 0.5 mm)
- Discriminate and semi-quantify polytypes of clays, carbonate species and alteration mineralogy and compare against XRF datasets
- Superb spectral resolution (1 nm at 2200 nm) to better distinguish mineralogy species
- Fully supported interpretation software for customised spectral libraries and expert machine learning techniques

SpecCam 4 Technical Specifications

Spectral range offered 400 nm to 2500 nm	Speed ranges between 1 m and 4 m per hour depending of resolution selected
State-of-the-art optical dispersive filter with spectral supersampling. Maximum spectral resolution in SWIR is 1 nm at 2200 nm	Standard image resolution is 0.5 mm^2 x 3 mm (although larger pixel sizes are possible for lower resolution studies)

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