REFLECTANCE SPECTROSCOPY

Background

Short wave infra-red (SWIR) reflectance spectroscopy is used to distinguish clay minerals in rock specimens, and is a potential way of characterising or detecting alteration mineral distributions surrounding an ore body. Cameco Australia have up until recently has used a PIMA II (Portable Infrared Mineral Analyser) that facilitates rapid and low-cost acquisition of reflectance spectra.

For further information on PIMA http://www.intspec.com%5c/

The next generation in spectral acquisition instrumentation used by Cameco is the Terraspec instrument from Analytical Spectral Devices Pty Ltd in Boulder Colorado, USA. The Terraspec is a compact, portable instrument with a spectral range from 350nm (visible light) to 2500nm (near infra-red) using three separate detectors. Spectra acquisition is via a fibre-optic sampling probe and the collection of reflected light from a sample, from the internal transmitted light source within the probe.

For further information of ASD Terraspec http://www.asdi.com/

Method

Preparation

All rock samples are dried thoroughly prior to spectral analysis, typically 2 or 3 days in sunlight. For outcrop samples and drill core, a flat, cut surface of the rock is typically used for the analysis. For the PIMA instrument, percussion or RAB drill chips are placed in a special, glass petri dish for analysis.

Taking Readings

PIMA Instrument

Pima SP Acquisition V2.2 by Integrated Spectronics is used with the PIMA II instrument. The instrument is calibrated prior to use, and the calibration fos files are saved as a reference to record any instrument drift. A typical spectral reading takes around 30 seconds. Poorer quality spectra, as indicated by the acquisition software, may require repeat readings with higher integration or noise reduction. This is a slower process, but may result in higher quality spectra. Typically dark rock samples will produce poor quality spectra, even using higher integration settings.

At the discretion of the geologist, more than one reading may be taken from different sections of a single surface or drill sample. This may be in order to characterise, for example, an alteration selvedge. All spectra are saved as *.fos files.

Terraspec (ASD) Instrument

Spectral collection is quite rapid with the ASD, with a full spectral scan each 0.1 seconds; typically 30 spectral scans are averaged for each reading. The resultant spectral file requires the three individual spectrum from each detector to be spliced together to form a continuous full range reflectance

spectrum. This splice correction is performed using ASD "RS^3" software. The spliced spectral file is then exported to text file format (ASD file *.txt) able to be read by The Spectral Geologist Software for mineral matching and viewing.

Data processing

ASD text and *.fos files are read by TSG Professional V 4.0 (The Spectral Geologist) software developed by AusSpec International Pty Ltd. TSG includes a spectral recognition mineral-matching algorithm, TSA (The Spectral Assistant) V 5.0. TSA yields up to two matched mineral species for each spectra, and the relative percentage-based proportions of each mineral. The mineral-matching algorithm uses the spectral range from 1300 to 2500nm for mineral matching with the internal TSA library. Full spectral range (350nm – 2500nm) mineral matching is possible for customised libraries within TSG.

For further information on Ausspec's TSG http://www.ausspec.com/

Within TSG, several scalars are used to calculate parameters, for example AlOH crystallinity, kaolinite crystallinity, water features, and signal-to-noise ratios.

All resultant data is stored within a centralised SQL data store.