

SPECTRAL EVOLUTION

Identifying Chlorite in Porphyry Deposit Exploration

The identification of chlorite can be used to calculate distance from an ore body in porphyry deposits. Chlorite identification is a useful tool for exploration in propylitic alteration zones. Propylitic alteration can include several sub-zones:

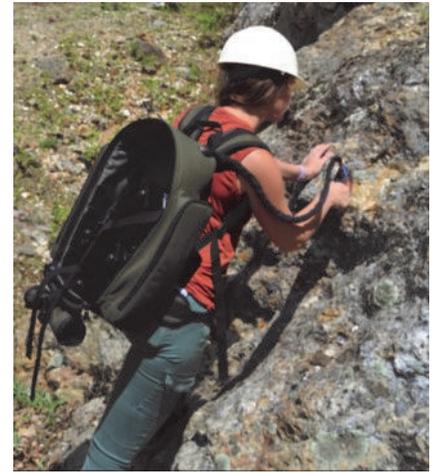
- ◆ Inner high temperature— actinolite, epidote, chlorite
- ◆ Intermediate—epidote, chlorite, calcite
- ◆ Distal—chlorite, calcite, hematite

Chlorite has distinctive absorption features around 2250nm by Fe-OH and 2340nm by Mg-OH. The specific wavelength position of Fe-OH absorption feature varies with Fe and/or Mg content. Mg-rich chlorite is generally between 2245 and 2255 nm, whereas Fe-rich chlorite tends to be around 2265 nm. The Mg-OH wavelength for chlorite rich in Mg is around 2330 nm and for Fe-rich chlorite is 2365 nm.

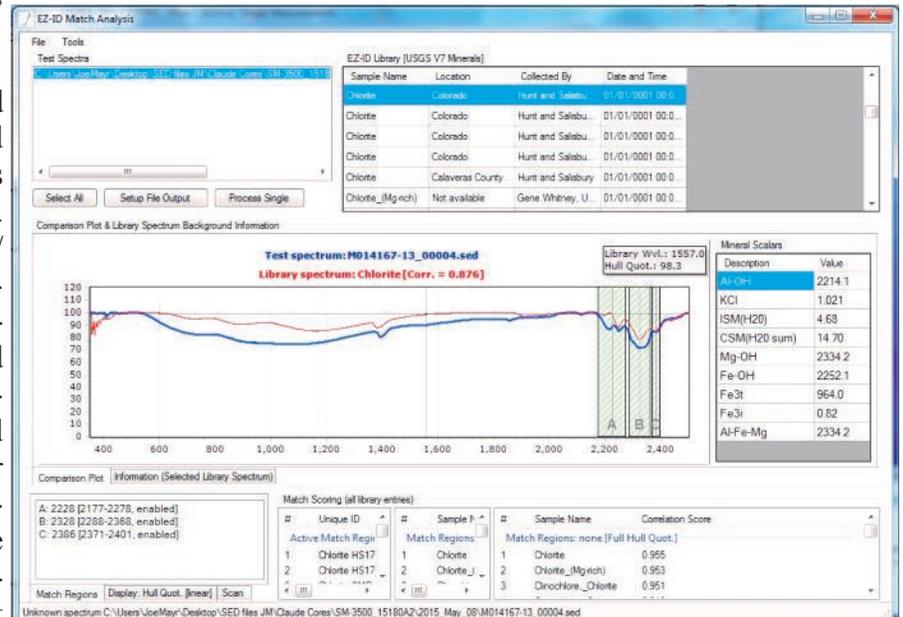
The depth of the absorption features at these wavelengths also varies. The deeper the absorption feature, the more Mg in the sample.

Chlorite can be identified in the field using an oreXpress oreXplorer and oreXpert spectrometer that covers the spectral range from 350-2500nm. The oreXpress offers high resolution/high sensitivity, the oreXplorer offers higher resolution, while the oreXpert is the highest resolution field instrument available. They are designed for field use with a rugged and durable chassis, battery power for a full day of scanning and a backpack for portability. They can be equipped with a 3mm spot size Mini-probe or a 10mm spot size contact probe to provide consistent illumination for scanning your samples. A benchtop probe with sample compactor is also available for chips and powder samples.

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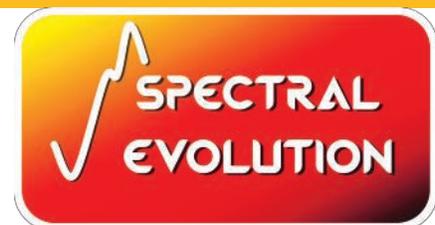


The oreXpress, oreXplorer and oreXpert are rugged field spectrometers for identifying minerals in situ.



Chlorite sample matched to the USGS library in EZ-ID.

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These spectrometers are available with EZ-ID mineral identification software and access to three mineral spectral libraries: the USGS library and the optional SpecMIN and GeoSPEC libraries for a total of 2600 spectra of over 1100 minerals. EZ-ID allows a geologist to perform un-mixing of minerals in a sample using match regions to focus on different absorption features for different minerals. These match regions can be saved as pre-sets for exploring for similar mineral assemblages. EZ-ID also includes scalars. Spectral scalars can enhance the geologist's understanding of crystallinity changes, alteration pattern shifts and geochemical conditions.

EZ-ID supports spectral scalars for Al-OH bonds, kaolinite crystallinity (Kx), illite spectral maturity (ISM), chlorite spectral maturity (CSM), Mg-OH bonds, Fe-OH bonds, Fe3t (mineral type), Fe3i (mineral intensity), and Al-Fe-Mg bonds.

In this sample the scalars indicate there is some kaolinite, illite and iron. The Chlorite Spectral Maturity (CSM) value indicates less bound water in this sample for a low metamorphic grade. The Mg-OH scalar is reported whenever an Mg-OH bond is discovered in the spectra. Low metamorphic grade chlorites show features at shorter 2350nm wavelengths due to the high magnesium content. Chlorites formed from hydrothermal alteration have absorption features at longer than 2350nm wavelengths. This sample is a low metamorphic grade chlorite.

There is also a scalar for Fe³⁺ that indicates hydroxide-type Fe³⁺ minerals typically have Fe3t values greater than 900nm; oxide type Fe³⁺ minerals have values less than 900nm. So this sample contains the hydroxide type of Fe³⁺.

The higher the Fe3i value the more intense the Fe³⁺ absorption.

The Al-Fe-Mg scalar reports the wavelength of the deepest absorption feature of these three and can provide an indication of geochemical conditions.

Description	Value
Al-OH	2214.1
KCl	1.021
ISM(H2O)	4.68
CSM(H2O sum)	14.70
Mg-OH	2334.2
Fe-OH	2252.1
Fe3t	964.0
Fe3i	0.82
Al-Fe-Mg	2334.2

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