



DARWIN EZ-ID™

# SPECTRAL SCALARS

*Spectral scalars are used to inform a geologist's understanding of crystallinity changes, alteration pattern shifts and geochemical conditions. EZ-ID supports spectral scalars for Al-OH bonds, kaolinite crystallinity (KCI), illite spectral maturity (ISM), chlorite spectral maturity (CSM), Mg-OH bonds, Fe-OH bonds, Fe3i (mineral type), Fe3i (mineral intensity), and Al-Fe-Mg bonds.*

## Al-OH

The Al-OH absorption feature at the 2200nm wavelength position provides an indication of geochemical conditions at the time of alteration. The feature varies between 2160—2240 wavelengths. The feature indicates the presence of aluminum hydroxide in the sample. The 2200nm feature is essential in identifying white micas and the shift from approximately 2198nm to 2219nm indicates a change from muscovite to phengite. The presence of acid in the mica pushes the identification toward muscovite; neutral pH is indicative of phengite. As the minerals alter from smaller to higher percentages of aluminum, essentially from the clay illite to the mica sericite to muscovite, the change can be seen and measured as a spectral shift at the 2200nm wavelength. This type of alteration path is a fine indicator of proximity to an ore zone.

## KCI

High kaolinite crystallinity usually indicates the formation of kaolinite under high temperature and mostly hydrothermal origin while low crystallinity indicates kaolinite that forms at surface conditions due to weathering processes. Kaolinite crystallinity influences the shape of the Al-OH feature. The KCI scalar provides an approximate indication of the temperature of formation for the kaolin group minerals. Increasing scalar value indicates increasing crystallinity.

## ISM

Provides an approximate indicator of the temperature of formation for illite minerals. The result of the calculation is reflective of the crystallization temperature and is used to assess metamorphic grade. As metamorphic grade increases, smectites will convert to illite in return converting to muscovite and other micas. Changes in geothermal conditions are reported by the Illite Spectral Maturity (ISM) scalar as the illite dehydrates into micas. Illite has an ISM from 2 – 4, below 2 is an indication of smectite; above 4 is an indication of muscovite.

## CSM

Chlorites show a great chemical variability, mainly ranging between the Mg end-member (Clinochlore) and the Fe end-member (Chamosite). The Chlorite Spectral Maturity (CSM) scalar indicates the temperature of formation by linking the Mg-Fe chlorite evolution to the change in the H<sub>2</sub>O feature. The lower the H<sub>2</sub>O content the higher the CSM value. Lower metamorphic grade chlorites form at lower temperatures and are typically Mg-rich chlorites with the Mg-OH feature at wavelengths shorter than 2350nm and the Fe-OH wavelength near 2250nm. The higher the value, the lower the grade of metamorphic chlorite.

## Mg-OH

A feature positioned near 2350nm indicates geochemical conditions at the time of alteration. The variations in the position of this feature indicate the presence of fluids at alteration. The 2350nm feature indicates the presence of magnesium hydroxide in the sample.

## Fe-OH

A feature positioned near 2260nm indicates geochemical conditions at the time of alteration, especially the presence of fluids at alteration. The 2260nm feature indicates the presence of iron hydroxide in this sample.

## Fe3i

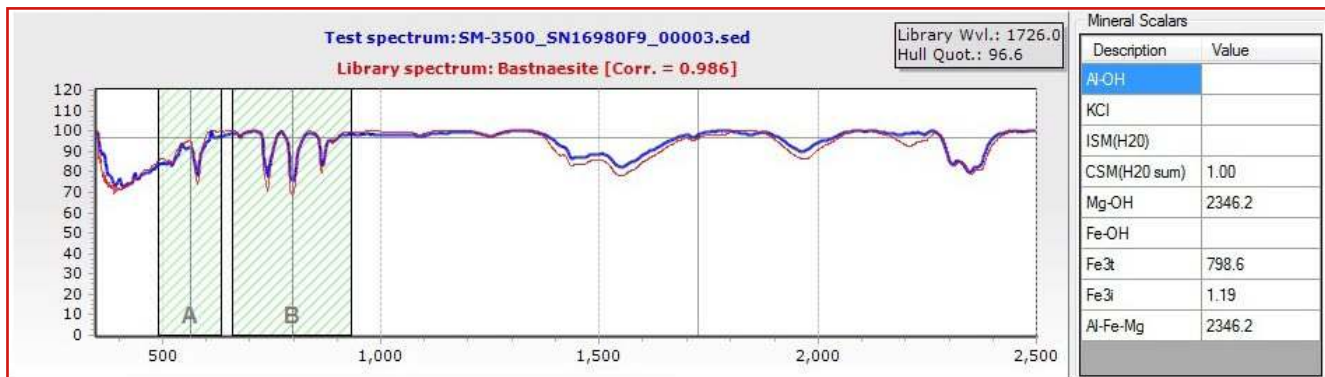
Used primarily to identify the type of Fe<sup>3+</sup> mineral in the sample, hydroxide-type Fe<sup>3+</sup> minerals typically have Fe3t values greater than 900nm; oxide-type Fe<sup>3+</sup> minerals have values less than 900nm. This can be used to identify if the sample has goethite or hematite in it.

## Fe3i

Fe<sup>3+</sup> minerals such as goethite and hematite have a strong absorption feature near 550nm. The intensity of this feature indicates the abundance of Fe<sup>3+</sup> minerals in the sample. The higher the Fe3i value the more intense the Fe<sup>3+</sup> absorption.

## Al-Fe-Mg

Reports the wavelength of the deepest absorption feature of Al-OH, Fe-OH, and Mg-OH. Features are centered in the 2160-2370nm range.



Use scalars in conjunction with EZ-ID's spectral library to gain additional information from your sample. Scalars make an alteration shift easier to spot and they provide geochemical information.