DARWin™ EZ-ID™ Software

SPECTRAL SCALARS

Spectral scalars help the geologist understand crystallinity changes, alteration pattern shifts and geochemical conditions. EZ-ID™ supports spectral scalars for Al-OH bands, kaolinite crystallinity (KCl), illite spectral maturity (ISM), chlorite spectral maturity (CSM), Mg-OH bands, Fe-OH bands, Fe^{3}+ (mineral type), Fe^{3}i (mineral intensity), Al-Fe-Mg bands, Alunite bands, Epidote/Chlorite bands, and H2O_W bands.

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—2240nm 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.

KCl

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 KCl 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 H2O feature. The lower the H2O 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.

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

Fe^{3i}
Fe^{3+} minerals such as goethite and hematite have a strong absorption feature near 550nm. The intensity of this feature indicates the abundance of Fe^{3+} minerals in the sample. The higher the Fe^{3i} value the more intense the Fe^{3+} absorption.

Alunite
Wavelength of Alunite feature near 1485nm. This scalar reports the wavelength shift to discriminate between Na-Alunite and K-Alunite. Longer wavelengths near 1490nm indicate Na-Alunite. Shorter wavelengths around 1480nm indicate K-Alunite.

Epidote/Chlorite
Wavelength reported near 1550nm to proxy Epidote composition (epidote/clinozoisite end-members). This scalar reports the wavelength when discriminating between Epidote and Chlorite in a sample. Epidote has a feature near 1550nm, not present with Chlorite.

H2O_W
Wavelength of the H2O feature. This scalar reports the H2O feature in the 1850-2010nm range. Bound water has a wavelength near 1920nm, getting longer for unbound water. Scalar useful for identifying bound vs unbound, clays, micas (nontronite vs saponite, muscovite vs chlorite vs sudoite).

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.

SPECTRAL EVOLUTION
The Future of Field Spectroscopy is Now!

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.