Each mineral has a unique spectral signature, absorbing or reflecting light at specific wavelengths. Identifying these characteristic wavelengths allows for mineral detection. To extract this information from spectral data, various indicators assess a mineral's spectral profile. One such indicator is Band Depth (BD)[[1]](#footnote-1):

Where is the reflectivity at the wavelength with .  
  
In regions where a mineral strongly absorbs light, reflectance decreases at that wavelength. Band Depth quantifies the extent of this absorption relative to the reflectance of neighbouring wavelengths.  
  
If significant absorption occurs at ​, will be lower than the weighted average of and ​. Since BD is calculated as 1 minus this ratio, minerals exhibiting strong absorption at ​ will have a higher BD(​) value than others.  
  
Gypsum Example  
Gypsum & Alunite exhibit absorption around ), to assess this and as per the BD1750 indicator[[2]](#footnote-2), the reflectance at (​) and () serve as reference points. The spectral graph below highlights this region[[3]](#footnote-3):

A graph with different colored lines

AI-generated content may be incorrect.

Zooming in:

A graph with blue and orange lines

AI-generated content may be incorrect.

If only and ​ were known, the expected reflectance at ​ would be a weighted average:

Given and :

This expected reflectance is represented by the green dot on the blue diagonal line between (1550, 0.7156) and (1815, 0.7011). However, due to additional absorption at , the actual reflectance is lower: , resulting in an elevated Band Depth:

Identifying Minerals  
While the difference may seem subtle, only Gypsum and Alunite exhibit an elevated BD at , confirming their distinctive spectral signatures. This demonstrates how Band Depth analysis enables mineral identification.

A graph of blue lines

AI-generated content may be incorrect.

Similarly, MTRDR data from CRISM contains numerous spectral indicators that help identify minerals on Mars.

1. From section 4.1 / page 11 of - Viviano-Beck, C. E., et al. (2014), Revised CRISM spectral parameters and summary products based on the currently detected mineral diversity on Mars, J. Geophys. Res. Planets, 119, 1403–1431, doi:10.1002/2014JE004627. [↑](#footnote-ref-1)
2. Number 22(?) in table 2, page 16 of - Viviano-Beck, C. E., et al. (2014), Revised CRISM spectral parameters and summary products based on the currently detected mineral diversity on Mars, J. Geophys. Res. Planets, 119, 1403–1431, doi:10.1002/2014JE004627. [↑](#footnote-ref-2)
3. Data is from here: https://crismtypespectra.rsl.wustl.edu/ [↑](#footnote-ref-3)