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Experimental VNIR reflectance spectroscopy of gypsum dehydration: Investigating the gypsum to bassanite transition

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Abstract

The spectral behavior of gypsum dehydration in the visible to near-infrared (350–2500 nm) wavelength range was investigated by partially dehydrating the four main habits of gypsum (alabaster, satin spar, selenite, and massive) to form bassanite. Powdered samples of gypsum dehydrated at 100–115 °C and hand samples dehydrated at 115–130 °C, coinciding with a peak in mass (water) loss in the samples. As gypsum dehydrates, its characteristic H_2O absorption bands at 1443 and 1945 nm shift to shorter wavelengths. Band depths and widths of absorptions at ~1200, 1400–1600, 1750, 1945, 2100–2200, and ~2400 nm all decrease with increasing temperature. The samples also underwent visible changes upon dehydration, both at the macroscopic and microscopic level, becoming very friable with an increase in fine grains. No consistent relationship was observed between dehydration temperature and grain size or habit. The samples were monitored for up to 20 months after dehydration, during which time none rehydrated to form gypsum. While the transition from gypsum to bassanite is very abrupt, bassanite does not readily rehydrate to form gypsum again in ambient conditions, and therefore may not be as unstable as previously thought by terrestrial occurrences of bassanite being predominantly restricted to hyperarid climates.

Keywords: Gypsum, bassanite, reflectance, spectroscopy, dehydration, sulfate, visible, near-infrared