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The origin of the green color of variscite

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ABSTRACT

The color of variscite from three different localities (Pannecé, France; Sarrabus, Sardinia; Ervedosa, Portugal) and metavariscite from Utah was investigated by diffuse reflectance and EPR spectroscopy. These samples contain low levels of transition elements such as V, Cr, and Fe, the relative concentration of which varies with origin, although they remain in the wt% range. The presence of peculiar antiresonance features indicates that octahedral Cr^{3+} ions are responsible for the absorption bands that cause the green coloration of variscite and metavariscite. Trivalent iron ions, which give only a weak absorption band in some samples, and V^{3+} ions do not contribute to the green coloration of the samples from these locations. The crystal-field splitting and B Racah parameter of Cr^{3+} in variscite and metavariscite are 1590 and 657 cm^{-1} and 1610 and 575 cm^{-1}, respectively. These values indicate a weak crystal field and an important Cr-O covalence. Electron paramagnetic resonance spectra show the presence of minor amounts (300–500 ppm) of vanadyl groups substituted for Al. The absence of V^{3+} indicates that variscite and metavariscite formed in an oxidizing environment.