Combined cathodoluminescence hyperspectral imaging and wavelength dispersive X-ray analysis of minerals

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ABSTRACT

The usefulness of cathodoluminescence (CL) in mineralogy and petrology is largely due to its high sensitivity to variations in the chemical compositions of minerals. Difficulty in interpretation of CL images, however, often limits their use beyond the identification of growth zones, which are then analyzed using other, more readily quantifiable, techniques. The use of scanning electron microscopy (SEM) CL in hyperspectral imaging mode, combined with simultaneously acquired X-ray composition mapping, extends the technique by allowing the separation of spectral features and their correlation with elemental composition. In this paper, we describe the use of such measurements in conjunction with multivariate statistical analysis to automatically identify and characterize zones in calcite and zircon. We demonstrate that this novel combination of techniques significantly increases the effectiveness of CL as a diagnostic tool for Earth science applications.

Keywords: Cathodoluminescence, hyperspectral, principal components, calcite, zircon, X-ray microanalysis