Abstract

Microscopic detection of mineral alteration using NIR imaging

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Introduction

Geological investigations of minerals and their associations at sub-millimetre level are typically undertaken using optical microscopic investigations supported by X-ray beam techniques. These accepted techniques and technologies question the value of adapting new measurement methods such as NIR imaging to mineral investigations under the microscope. This investigation explores the potential application advantages and pitfalls in applying NIR imaging to mineralogical investigations under the microscope.

Materials and Methods

Rock samples were prepared by generating a smooth flat surface for imaging. Hyperspectral infrared measurements were undertaken using the sisuCHEMA imaging system configuration. The spectrometer measures between 1000 and 2500 nm at a band spacing of 6-7 nm. End Member selection techniques and classification methods were used to generate mineral distribution maps of the samples. In addition, spectral feature extraction techniques were used to highlight mineral changes in the samples.

Results and Discussion

The hyperspectral NIR mineral maps indicate that alteration products that are responsive in the NIR are mapped in some of the NIR non-responsive mineral phases. Sericite alteration is mapped in the feldspar of the porphyritic intrusive units. In the layer intrusive units prehnite and sericite, alteration is recorded in plagioclase. While some NIR responses can be clearly identified, others are only discriminated in the imagery. These mineral phases do not display characteristic features for identification of the materials present.

Conclusion

NIR hyperspectral imaging has the potential to assist in mineralogical investigations at the sub-millimetre level. The technique is rapid and can easily be undertaken on samples prepared for more detailed mineralogical investigations. These techniques would complement existing methods and provide valuable supportive information to understanding the mineral distributions in the sample and their paragenetic relationships.

Reference paper as:
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