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Thermal Infrared Hyperspectral Imaging for Mineralogy Mapping of Geological Outcrops.

Stephane Boubanga Tombet, Alexandrine Huot, Frédérick Marcotte, and Martin Chamberland
Telops, Research, France (stephane.boubanga@telops.com)

Remote sensing systems are largely used in geology for regional mapping of mineralogy and lithology mainly from airborne or spaceborne platforms. Earth observers such as Landsat, ASTER or SPOT are equipped with multispectral sensors but suffer from relatively poor spectral resolution. On the contrary the existing airborne and spaceborne hyperspectral systems are capable of acquiring relatively narrow spectral bands, beneficial for detailed analysis of geological remote sensing data. However, for vertical outcrops those platforms are inadequate options since their poor spatial resolutions (meters to tens of meters) are unsuitable for detailed field studies. Here we demonstrated that field-based approaches that incorporate thermal infrared hyperspectral technology with about 40 nm spectral resolution and tens of centimeters spatial resolution allows efficient mapping of mineralogy and lithology of vertical cliff sections. We used Telops, lightweight and compact passive thermal infrared hyperspectral research instrument for field measurements in Juracement carbonate mine. The obtained hyperspectral data were analyzed using Temperature emissivity separation algorithms to isolated the different contributions of self-emission and reflection associated with different carbonate minerals. The lithological maps derived from measurements were found to be very consistent with the expected results. Our proposed approach highlights the benefits of this type of field-based lightweight hyperspectral instruments for routine field applications such as in mining, engineering, forestry or archaeology.