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HYPERSPECTRAL MINERAL MAPPING OF THE TRANSVAAL BANDED IRON FORMATIONS, SOUTH AFRICA, WITHIN THE SCOPE OF THE ENMAP MISSION

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ABSTRACT:

The Banded Iron Formations (BIF's) of the Transvaal Supergroup in the Northern Cape, South Africa, are spectroscopically characterized. During a field campaign the spectral surface characteristics of the world renowned 2.5 - 2.4 Billion years old Banded Iron Formations of the Kuruman and Griquatown Formations and the connected Iron Mineral Deposits are acquired with field instruments covering the wavelength region from 0.4 to 15 µm. This study is focused on the spectral assessment of the mineralogy and mineralization potential of the BIF's in the scope of a planned hyperspectral flight campaign of the same wavelength region. The cross-validation potentiality using the VNIR-SWIR and TIR wavelengths range to enhance mineral identification and semi-quantification is discussed. Therefore insitu data of weathered surfaces and exposed rocks were acquired in parallel. The mineralogy and chemistry analyses of representative surface rock samples are undertaken and cross validation with fresh rock mineralogy and chemistry is presented. Mineral diagnostic spectral features of the individual wavelength region are mathematically described and extracted. An arithmetic and Boolean logic based combination of multiple spectral features are applied to identify iron oxides, to differentiate quartz versus chert as well as to distinguish carbonates. The results are validated by independent geochemical and mineralogical analyses. These data sets facilitate the development and assessment of new methods for hyperspectral data analyses in remote sensing of modern exploration and exploitations applications. The investigation is seen in the context of the hyperspectral space borne mission EnMAP. Results and methods are transferred to the spectral specification of the EnMAP instrument.