Integrated spaceborne HSI and field spectrometry for mapping different limestone facies, NE Kohat, Pakistan

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The evolution of remote sensing technology emerged as an efficient tool in geological investigation, particularly for mineral exploration and lithological mapping. The availability of numerous bands in the spaceborne hyperspectral imaging (HSI) is being adopted widely for such geological surveys. This study focuses on the capability of EnMap (i.e., hyperspectral satellite sensor) to differentiate different spectral facies of limestone outcrop. While the diagnostic spectral behavior for all carbonates remains consistent, certain elements either produce their own spectral features or influence the spectral response of carbonates. The two carbonates unit outcropped in the area are Kohat and Shekhan limestone. Field work was carried out across selective traverse, to observe on- ground textural behavior, collecting samples for petrology and geochemical analysis, and also to collect spectral data. Field investigation shows that both the limestone exhibits variety of textural and spectral behavior. Although the textural and spectral records of both units show identical behavior, but the iron related reflection curve in the region between 580-900 nm is more common in the Shekhan Limestone. The petrographic observations also confirm the relative higher percentage of oxidized mineralization in Shekhan Limestone. The Spectral Angel Mapper (SAM) classification successfully mapped these spectral facies, utilizing the image pixel's spectra as standard. The final classified map shows that the spectral facies are independent of stratigraphic order or age. The ferric facies are mapped in both the Kohat and Shekhan limestone, which is also observed in field spectral data. Additionally, field spectral records indicate ferric behavior for Kohat limestone at some locations, although it is prominent in Shekhan Limestone.