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Using Advanced Spectral Analyses Techniques as Possible Means of Identifying Clay Minerals

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Abstract: Spectral analyses, one of the most advanced remote sensing techniques, were used as a possible means of identifying the mineralogy of the clay fractions that corresponded to the Küçük Menderes Plain, south of İzmir, Turkey. Different spectral processes were used to execute the prospective spectral analyses. The processes include: i. the reflectance calibration of TM images belonging to the studied area, ii. using minimum noise fraction (MNF) transformation and iii. creating the pixel purity index (PPI), which was used to the most "spectrally pure", extreme, pixel in multi-spectral images. Spectral analyses of the clay mineralogy of the studied area were obtained by matching the unknown spectra of the purest pixels to pre-defined (library) spectra providing scores with respect to the library spectra. Three methods, namely Spectral Feature Fitting (SFF), Spectral Angle Mapper (SAM) and Binary Encoding (BE) were used to produce a score between 0 and 1, where the value of 1 equals a perfect match showing the exact mineral type. We were able to identify 4 clay minerals i.e., vermiculite, kaolinite, montmorillonite and illite, recording different scores related to their abundance in the soils. In order to check the validity and accuracy of the results obtained regarding the spectral signatures of the minerals identified, soil samples taken from the same localities were subjected to X- ray analysis. As a result a good correlation was found between the spectral signatures and the X- ray diffractions.

Key Words: Remote sensing, spectral analysis, X-ray diffraction, clay mineralogy.

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