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Earth observation from AHS (Airborne Hyperspectral Scanner) data: spectral response of landforms

Eduardo García-Meléndez¹, Montserrat Ferrer-Julilà¹, Gonzalo Frías¹, Elena Colmenero-Hidalgo¹, Antonio Espin de Gea², Mónica Reyes², Francisca Carreño², Juncal A. Cruz³, Arturo Bascones¹, and Inés Pereira¹

¹Research Group Environmental Geology, Quaternary and Geodiversity (QGEO), Universidad de León (Spain)

²Centro Tecnológico del Mármol, Piedra y Materiales. Cehegín (Spain)

³Facultad de Ciencias Geológicas, Universidad Complutense de Madrid (Spain)

Imaging spectrometry, also known as Hyperspectral imaging (HSI) or imaging spectroscopy has been established as a robust technology for remotely mapping the distribution of spectrally active materials at the surface of the Earth. The main objective of this work is the application of imaging spectroscopy techniques for the earth surface observation based on landform development related to the presence of clay minerals. The study area is located in the Cenozoic Tagus sedimentary basin in Central Spain, an area particularly interesting because of the presence of clay minerals of economic interest and with the potential to generate expansive soils. This area conforms a landscape characterized by gentle sloping terrains with an almost complete absence of outcrops, except for the staircase structural surfaces conditioned by horizontal bedding and resistance of the alternating lithologies made of gypsum, clays, limestones and dolostones, outcropping in the left margin of the Guatén stream valley extending in a N-S direction. Image processing procedures have been developed aiming to detect mineral associations related to specific landforms with hyperspectral imagery. Spectral Angle Mapping (SAM) algorithm has been applied to the image data set for mineral mapping. Conventional aerial photointerpretation provides the spatial distribution of landform mapping units. GIS overlay operations crossing the mineral and landform units maps depict the relationships between clay minerals and landforms. The results allow the observation of differences in the distribution of minerals depending on the lithology and origin of each landform. Thus, while in the geomorphological units of fluvial origin montmorillonite is the clay mineral that occupies most of their surface, in the relatively steep slopes that articulate the structural surfaces, the spectral response is varies depending on the lithological types. Regarding the landforms of anthropic origin, the mining dumps show an spectral response associated with the mined ore (stevensite, paligorskite, sepiolite). Lastly, in eluvial formations, their mineral distribution is always linked to their lithological nature.

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