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ANALYSIS OF THE SPECTRAL RESPONSE (V-NIR) APPLIED TO THE STUDY OF CLAYS IN SEDIMENTARY MATERIALS

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The study is focused on the relationship between mineralogy and the spectral response produced by the sedimentary materials that are rich in clays located in the northwest area of the Duero Basin, in the province of León (Spain).

For that purpose, samples were taken on the top soil surface from the different sedimentary units. We separated the fraction smaller than 4 mm in order to study it by X-ray diffraction and characterize both its mineralogy in bulk-rock and its clay minerals content through oriented aggregates of the fraction smaller than 2 μm (in normal environment, solvating with ethylene glycol and heating at 550 ºC for two hours).

We measured the spectral response (V-NIR) in the laboratory on different grain-sizes (bigger and smaller than 4 mm and on the powdered sample). Differences in porosity and the presence of interlayer water or hydroxyl groups in the clays will affect the spectral response, generating quantifiable absorption features in certain wavelengths. The alteration processes suffered by the sediments, which produced textural and compositional changes, will also be reflected in the absorption features of the reflectance spectral curves both in the visible and the near infrared.

The absorption features produced in the spectral curves at the wavelengths of 1.4 and 1.9 μm are mainly related to the vibrations of the hydroxyl groups and the water molecules. These absorption features are not detected or have a low intensity when we only have structural OH^-, producing absorption features at the wavelengths of 2.2 - 2.4 μm, related to the combination of basic modes of tension (O-H) and flexion (Metallic ion-O-H) (Hunt & Salisbury, 1970). The proportion of the different types of clays present in the samples obtained by X-ray diffraction has been compared to the data obtained by laboratory reflectance spectroscopy. Thus, the samples with a high chlorite/illite content produce low absorption features at 1.4 and 1.9 μm, related to the low molecular water content in these samples. However, they have two absorption features at 2.34 and 2.46 μm, typical of mica group (Clark et al., 1990). The opposite happens in the samples with a high vermiculite/smectite content, which have intense absorption features at 1.4 μm and mainly at 1.9 μm. The electronic processes that produce absorptions in the visible are related to the charge transitions between electronic levels of different energy, as with the ferrous/ferric ion, present in surfaces of alteration of sedimentary materials (Hunt & Ashley, 1979).

All the mineralogical differences seen in the studied sediments will allow us to subsequently map, with the aid of satellite images, the geological units with different geochemistry and mineralogy.

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