

## Abstract

Swelling soils are a major geological hazard worldwide and their identification is a major concern. Swelling is due to the presence of clay minerals with a potential to accommodate water within their crystal structure. Three common groups, namely smectite, illite and kaolinite, have been identified as indicators of high, moderate and low swelling potential soils where in abundance. This study assessed the potential of spectral data as a tool to recognize the presence of these minerals in soils of varying swelling potential collected from the Antequera area of southern Spain, with the aim of establishing spectral parameters that would in future be applied in remote sensing applications for mapping swelling soils. The coefficient of linear extensibility (COLE) and the linear extensibility ( $LE_{rod}$ ), which are established methods for assessing swelling potential and tentative clay mineral allocation, were used as the controlling methods to classify the soils into swelling potential groups and to assign them to dominant clay mineral types. Several spectral parameters were identified as giving a good basis for assigning the soils to domination by either of these clay minerals, and thus to a swelling potential class based on their diagnostic assignment to hydroxyl (OH) and molecular water vibrational processes in clay minerals. The parameters consisted of asymmetries (1400 nm and 2200 nm) that were strong in the presence of the more ordered kaolinite, wavelength position and depth at 1900 nm in abundant smectites, first and second derivative peaks at or near the molecular water feature and the unique presence of absorptions at 2170 nm and 2340 nm in abundant kaolinite and illite. The results show the potential for using reflectance spectroscopy as a tool in the classification of soils into domination by these indicator minerals and thus into swelling potential classes. However, high organic matter and the presence of moisture were found to affect area and depth intensities and would require consideration in such applications.