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VIS/NIR Spectroscopy to determine the spatial variation of the weathering degree in Paleogene clay soil - London Clay Formation

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The London Clay Formation (LCF) which underlies much of South-East England is hugely important as a construction medium. However, its geotechnical performance (shear strength, compressive strength, shrink-swell behaviour, etc.) is greatly affected by its degree of weathering. Despite this importance, little attention has been focussed on a robust method to define and measure its degree of weathering. This is perhaps a result of a well-known colour change from bluish-grey to brown that accompanies ‘weathering’ and considered to be the result of oxidisation (Chandler and Apted 1988). Through wide experience, this definition is normally effective, but it is perhaps subjective and reliant on the experience of the investigator and the ability to observe samples or exposures. More objective investigation, typically using SEM is not normally economically feasible or expedient for construction works. We propose a simple, robust method to characterise the degree of weathering in the LCF using reflective or Visible-Near-InfraRed-Spectroscopy (VNIRS). 24 samples were extracted from 2 boreholes drilled in the Hampstead area of London to depths of 12 m within the uppermost Claygate Member of the LCF. VNIRS spectra (350-2500 nm) were measured from all samples and compared with XRD, XRF, SEM and PSD results on the same samples. Results show increased magnitude of absorption features related to clay mineralogy around 1400, 1900 and 2200 nm to a depth of 5 m beneath ground level. Beneath this depth, the absorption features show little variation. SEM analyses show corresponding changes in the degradation of pyrite crystals and individual clay (illite/smectite). These preliminary results show that there is a good potential for VNIRS spectroscopy to determine the variation of weathering in the LCF.