



Automated processing of Raman spectra from organic carbon to investigate sedimentary processes

R. Sparkes (1), N. Hovius (1), A. Galy (1), R.V. Kumar (1), and O. Beyssac (2)

(1) University of Cambridge, Earth Sciences, Cambridge, United Kingdom (robert.sparkes@cantab.net), (2) IMPMC, CNRS-Université Pierre et Marie Curie

Raman Spectroscopy can be used to assess the structure of naturally occurring carbonaceous materials (CM), which exist in a wide range of crystal structures. The sources of these geological and environmental materials include rocks, soils, river sediments and marine sediment cores, all of which can contain carbonaceous material ranging from highly-crystalline graphite to amorphous-like compounds. In order to fully characterise a geological sample and its intrinsic heterogeneity, several spectra must be collected and analysed in a precise and repeatable manner. Here we describe a suitable processing and analysis technique.

We show that short-period ball-mill grinding does not introduce structural changes to semi-graphitised material and allows for easy collection of Raman spectra from the resulting powder. Two automated peak fitting procedures are defined which allow for rapid processing of large datasets. Lorentzian peaks are fitted to five peaks characteristic of very disordered CM, three Voigt peaks are fitted to highly-graphitised material, with the right procedure chosen and applied automatically. Peak area ratios and peak width (FWHM) measurements are used to classify each spectrum and allow easy comparison between samples.

By applying this technique to samples collected in Taiwan following typhoon Morakot, and to Cretaceous and Tertiary sediments from the southern flank of the Pyrenees, sources of carbon to offshore sediments have been identified. Carbon eroded from different areas of Taiwan can be seen mixed together and deposited in the offshore flood sediments, and both graphite and amorphous-like carbon have been recycled from terrestrial to marine deposits. Using spectra collected from a CM found in a wide range of sedimentary facies from two time periods during the Pyrenean uplift, a trend towards exposure and erosion of graphite from the metamorphic basement can be seen. The practicality of these applications illustrates the potential for this technique to be deployed to sediment sourcing problems in a wide range of geological settings.