Geophysical Research Abstracts
Vol. 14, EGU2012-211, 2012
EGU General Assembly 2012

Raman spectroscopy in provenance studies

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Raman spectroscopy is an innovative tool with tremendous potential in provenance studies, serving as a complement to classical petrographic and mineralogical analysis as well as to other techniques including detrital geochronology. Thorny long-standing problems such as the identification of opaque and weathered grains can be finally addressed. Even more important, the Raman technique allows us to reliably determine silt-sized detrital grains, thus opening up new frontiers in sedimentary petrology. Provenance investigation of suspended load in rivers, distal turbidite deposits, and wind-laid loess becomes possible, with the same precision level reached in quantitative provenance analysis of sand-sized sediments. Raman spectroscopy thus provides us a new user-friendly key to unlock the sedimentary record preserved in ancient clastic wedges, a conspicuous part of which is represented by silty mudrocks. By considering not only the coarse fraction easier to handle and analyse in the laboratory, but the entire sediment flux conveyed through fluvial-deltaic-turbiditic systems, we can better constrain how and to what extent sediment composition is modified physically and chemically during transfer from detrital sources to depositional sinks, and thus calculate sediment budgets more accurately and achieve a deeper understanding of sedimentary processes in general.