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Raman Spectroscopy: an essential tool for future IODP expeditions

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The scientific drilling of oceanic sedimentary sequences plays a fundamental part in provenance studies, paleoclimate recostructions, and source-to-sink investigations (e.g., France-Lanord et al., 2015; Pandey et al., 2015). When studying oceanic deposits, Raman spectroscopy can and does represent an essential flexible tool for the multidisciplinary approach necessary to integrate the insight provided by different disciplines. This new user-friendly technique opens up an innovative avenue to study in real time the composition of detrital mineral grains of any origin, complementing traditional methods of provenance analysis (e.g., sedimentary petrography, heavy minerals; Andò and Garzanti, 2014). Raman spectra can readily reveal the chemistry of foraminiferal tests, nannofossils and other biogenic debris for the study of ecosystem evolution and paleoclimate, or the Ca/Mg ratio in biogenic or terrigenous carbonates for geological or marine biological applications and oil exploration (Borromeo et al., 2015). For the study of pelagic or turbiditic muds, which represent the bulk of the deep-marine sedimentary record, Raman spectroscopy allows us to identify silt-sized grains down to the size of a few microns with the same precision level required in quantitative provenance analysis of sand-sized sediments (Andò et al., 2011). Silt and siltstone also represent a very conspicuous part of the stratigraphic record onshore and usually preserve original mineralogical assemblages better than more permeable interbedded sand and sandstone (Blatt, 1985). Raman spectra can be obtained on sample volumes of only a few cubic microns by a confocal micro-Raman coupled with a standard polarizing light microscope using a 50× objective. The size of this apparatus can be easily placed onboard an IODP vessel to provide crucial information and quickly solve identification problems for the benefit of a wide range of scientists during future expeditions.

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