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Raman spectroscopy of kerogen in diagenesis. A promising thermal maturity tool for conventional and unconventional resources

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Raman spectroscopy has shown in the last year to be a suitable tool for the analyses of carbonaceous material dispersed in sediments. Since the first works that correlate graphite crystallinity with changes in Raman spectra, this technique has been widely used as a geothermometer for metamorphic rocks moving from the epizone to the anchizone. Today there is an increasing interest in the application of Raman spectroscopy as a thermal maturity tool for the analyses of coals or dispersed kerogen in sedimentary rocks. Different correlations have been proposed, but there is no general consensus on fitting procedures and interpretation of Raman bands, in particular at very low maturity stages.

In this work we illustrate the application of Raman spectroscopy on different materials and case histories moving from thermally immature to mid-mature sedimentary successions. In detail new Raman parameters have been correlated with different levels of organic matter maturation and on different kinds of organic matter in two areas characterised by Mesozoic and Cenozoic successions. Two techniques for spectra deconvolution are presented showing how Raman characterization of kerogen can provide quantifiable changes in response to thermal maturation or to macerals composition of the organic matter.

Moreover, we show how Raman spectroscopic analyses provide a powerful tool to discriminate among different organic facies by means of a multivariate analysis of the Raman spectra. This technique provides a new insight on the chemical differences among macerals and could be extensively used in the future for an automated screening of kerogen.