A New Method to Estimate Paleotemperatures in Deep Petroleum Basin: The Use of RSCM Geothermometer

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A good estimate of the thermal history is critical for the evaluation of the petroleum system. But for the exploration of deep targets, temperatures estimate in sedimentary basins which have undergone high diagenesis or low-grade metamorphism conditions is difficult using routine methods such as illite cristallinity, mineralogy, isotopes, fluids inclusions, vitrinite reflectance and Rock-Eval.

The aim of this study is to extend the applicability of the Raman Spectroscopy of Carbonaceous Materials (RSCM) geothermometer in the range 200-350°C. This geothermometer based on structural evolution of organic matter OM was calibrated in the range 330-650°C by Beyssac et al. (2002) and tested in different contexts.

The samples used for this new calibration come from two different contexts, the Helvetic nappes in Western Switzerland (Glarus Alps) with normal gradient and the Franciscan complex in central California (Diablo Range) with a high pressure gradient. The peak temperatures were estimated by several independent methods (Rahn et al., 19995; Dalla torre and al., 1996).

Our preliminary results show that systematic trends are observed in the evolution of some Raman parameters with increasing maturity grade along both the Swiss and Californian transects. The spectra bands present a variation with temperature increase. Some bands appear (D3 and D4) and evolve with temperature in the range (200-350°C), the classical bands of OM spectra D1 and G evolve too.

To quantify this evolution of Raman spectra, we are currently working on a fitting procedure to identify the reliable parameters. Our calibration is tested in various contexts (e.g. Taïwan and Alps) by confronting our results with other methods (low T thermal chronology).

Key words: Carbonaceous material, RSCM method, Thermal history, deep basin and petroleum system.