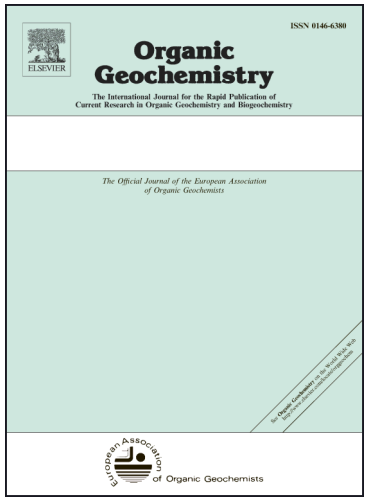

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Innovative fluorescence spectroscopic techniques for rapidly characterising oil inclusions

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Abstract

Two fluorescence techniques for rapidly screening oil inclusion abundances and compositions are presented. The techniques measure emission of trace fluorescence from reservoir grains and their solvent extracts using a spectrophotometer. The first one, called Quantitative Grain Fluorescence plus (QGF+), directly measures dry, disaggregated reservoir grains after a robust cleaning procedure involving solvent, hydrogen peroxide and Aqua Regia or dilute hydrochloric acid (HCl). The second technique measures crushed Inclusion solvent extracts from the grains cleaned for QGF+ using the Total Scanning Fluorescence method (iTSF).

Fluorescence spectra of 43 oil inclusion-bearing samples from seven basins in Australia, Papua New Guinea, SE Asia and China were obtained using QGF+ and iTSF. The fluorescence intensities (QGF+ Index and iTSF Intensity) correlate moderately well to the yields of the total *n*-alkanes obtained by the molecular compositions of oil inclusions (MCI) method, with linear correlation coefficients (R^2) of > 0.6. The QGF+ spectral peaks (λ_{max}) and the iTSF spectral ratio R_1 broadly reflect the thermal maturity or API gravities of the inclusion oils. The fluorescence spectra of the samples display a variety of signatures that can be generally correlated with the *n*-alkane profiles of the inclusions. The QGF+ spectral peak (λmax) and the iTSF R_1 parameter also correlate with thermal maturities derived from biomarkers. Condensates have *n*-alkane maxima at *n*-C_{12} to *n*-C_{14} and corresponding spectral peaks < 420 nm and R_1 values < 2.0. Most of the normal to light oils have a uni-modal *n*-alkane distribution with maxima at around *n*-C_{16} to *n*-C_{23} and corresponding fluorescence spectral peaks around 420–450 nm and R_1 values of 2.0–3.0. Medium to heavy oils have *n*-alkane maxima > *n*-C_{24} and corresponding spectral peaks > 450 nm and R_1 values of > 3.0.

This work demonstrates that the bulk fluorescence spectroscopy methods can be a cost effective rapid screening alternatives to the conventional petrographic (point counting) or offline crushing