

Synthetic maturity evaluation of source rocks based on spectroscopic measurements and biomarker observations

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Kerogens in petroleum source rocks transform to graphite with increasing maturity. Vitrinite reflectance (Ro) has been widely used to evaluate maturity of kerogens. Raman spectroscopy being applied as a geothermometer has a high spatial resolution compared with Ro measurement and is a nondestructive measurement. In this study, a new maturity indicator applicable to the wide range using Raman spectra, fluorescence spectra, biomarkers, etc. were developed.

Kerogens extracted from cuttings samples from two wells (Shin-Ayukawa AK-1 and MITI Yurioki-Chubu) were put into the resin and polished. Ro, Raman and fluorescence spectra were obtained on kerogens samples. There are two dolerite-intrusions in the depth range of 1500–2000 m in the Shin-Ayukawa well. Ro value reached to 3 %, the maximum value, beneath the intrusions. The intensity ratio of D1- and D2-bands to the fluorescence intensity at 1500 cm⁻¹ (F), (D1+D2) / F showed the positive correlation with Ro values in the range of Ro = 0.2–3 % including immature kerogens which were difficult to evaluate only by Raman spectra. Kerogens affected by the short-term volcanic heat also showed the same correlation. The intensity of fluorescence spectra from Yurioki-Chubu decreased drastically in the ranges of Ro = 0.2 % to 0.4 %. Infrared absorption bands assignable to amides and ethers disappeared in the same range. These results indicate that the change of fluorescence intensity depends on the structure including oxygen and carbon atoms.

The bitumens extracted with an organic solvent were analyzed using GC-MS. CPI was almost 1 in a whole depth. Chain length of *n*-alkanes decreased by the volcanic heat. This result indicates that chain length of *n*-alkanes can be a maturity indicator for overmatured kerogens which were not investigated yet using biomarkers.

This study proposed a new indicator to evaluate the maturity in the wider range (Ro = 0.2-3 %) than the previous studies by combination of the several methods.

Keywords: carbonaceous materials, kerogens, source rocks, spectroscopy, biomarker

