

# Experimental evaluation of source rock heterogeneities on the TOC threshold in resource evaluation

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## Introduction

Conventionally a TOC=0.5% is widely used as the minimum threshold for effective hydrocarbon expulsion, and that for the unconventional resources (e.g. shale gas and tight oil) is set at 2.0%. It is proposed that due to the heterogeneities of source rocks (layering structure) and the way TOC is classically measured, the currently adopted TOC thresholds may underestimate hydrocarbon resources. To investigate the heterogeneity effect of TOC, a series of artificial core plugs were made as alternating illite and organic-bearing bands with the organic-bearing band having different TOC contents of 0.05%, 0.20%, 0.50%, 1.0% and 2.0%, respectively. Pyrolysis experiments were conducted on the plugs under a constant temperature of 350°C for 72 hours (EasyRo= $\sim$ 1.10%) in a closed alloy reactor.

## Discussion of Results

Pervasive microfractures were observed after pyrolysis, which are induced by hydrocarbon expulsion. The fluorescence intensities diminish away from the organic band. The oil stained in the organic-bearing band is heavier than that in the adjacent illite bands. Oil generated in the organic-rich band with TOC of 0.5%, equivalent to a bulk TOC of 0.25%, can still generate and expel oil into the adjacent illite bands. This indicates that source rocks with bulk TOC of 0.25% still can be effective source rocks as long as heterogeneities are present. Such low TOC values are usually overlooked in resource evaluation.