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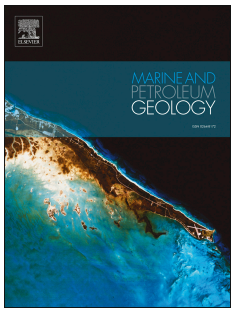

The upper thermal maturity limit of primary gas generated from marine organic matters

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The upper thermal maturity limit of primary gas generated from marine organic matters

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Abstract: Elemental composition and chemical structure of 16 kerogen samples concentrated from marine source rocks with maturity levels ranging from 0.65 %R_o to 3.3 %R_o were determined. Pyrolysis experiments of seven samples selected from the 16 kerogen samples were conducted in a gold tube system to clarify the process and determine the upper thermal maturity limit for primary gas generation from marine organic matter (OM). The variation of the H/C atomic ratio of the marine OM appears to evolve through three phases with increasing maturity, including a drastic decreasing phase before 1.3 %R_o, a moderate decreasing phase from 1.3 to 2.0 %R_o and a gradual decreasing phase above 2.0 %R_o. The evolution of the chemical structure measured by FTIR indicates that most oxygen containing functional groups in marine OM appear to be released prior to 0.8 %R_o. Aliphatic groups were still detected in the sample with a maturity of 3.0%R_o, but disappeared in the sample with a maturity of 3.3 %R_o. The variation of aliphatic groups *VS* aromatic rings (I_1) displays a similar three stage pattern as the variation of H/C atomic ratio with increasing maturity. A step-by-step heating method in kerogen pyrolysis experiments was adopted to preclude secondary gas generation. The pyrolysis experimental results for samples with different maturities proved that generally the maximum yield of primary gas generated by the marine OM was not more than 140 ml per gram of total organic carbon (TOC). Only 1.16 ml/g TOC of hydrocarbon gas was generated by the sample with the maturity of 3.3 %R_o. Thus, it can be rationally inferred that the upper thermal maturity limit for gas generation from the marine OM may be around 3.5 %R_o. Nevertheless, the main maturity range for the primary gas generation is suggested to be below 2.0 %R_o. The yield of primary gas generated at the maturity range above 2.0%R_o takes up 10% of maximum yield of the primary gas generated by the marine OM.

Keywords: Marine source rock; Primary gas; Upper thermal maturity limit; Chemical structure; Step-by-step Pyrolysis

1. Introduction