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Kerogen: Classification and origin - A case study

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The kerogen type has been classified according to hydrogen index (HI) values and hydrocarbon pyrolysis yields (S2). Type I and Type II kerogen commonly possess HI values more than 300 mg HC/g TOC and may be of either lacustrine or marine origin. Moreover, Type I and Type II kerogen have high pyrolysis yields (S_2) (>15 mg HC/g rock), whereas Type III kerogens have moderate low pyrolysis yields (S_2) (<10 mg HC/g rock). However, the Rock-Eval or Source-Rock-Analyzer (SRA) data (i.e. HI, OI and S_2) does not always accurately represent the types of kerogen present and the types of hydrocarbon that may be generated by the source rocks. This is because mineral matrix within the source rock will influence the Rock-Eval kerogen/ SRA typing result. In addition, sediments with TOC contents of less than 2.0% can result in a significant reduction in the HI. Thermal decomposition of carbonate minerals during the Rock-Eval analysis /SRA can contribute carbon dioxide and increase the oxygenation index (OI) in low TOC sediments. On the other hand the Py-GC analysis can provides us information regarding the quantitative chemistry of the thermal decomposition products of the kerogen. This gives a direct indicator of the kerogen type and types of hydrocarbons that can be generated by the kerogen during the maturation process. Therefore, the application of Rock-Eval kerogen/ SRA techniques can provide more accurate assessments of kerogen type when used in conjunction with pyrolysise gas chromatography (Py-GC) data. The Abu Gabra Formation has clearly been established as a lacustrine deposit. But, the analyzed Abu Gabra samples are plot in the mature zone of Types I and II kerogen to mixed Type II-III kerogens (based on SRA technique). However, pyrolysis GC analysis proved that all the investigated Abu Gabra samples contain homogeneous Type I kerogen that produces mainly waxy oil. This is supported by the abundant liptinitic materials and high atomic hydrogen-to-carbon (H/C) ratio.

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The characteristics of Wufeng-Longmaxi shale gas reservoir in Luochang syncline, South Sichuan basin

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Luochang Syncline is located in the Southeast Depression of Southern Sichuan basin in the upper Yangtze region, formed since Indosinian epoch, developed Lower Cambrian Qiongzhusi and Upper Ordovician – Lower Silurian Wufeng - Longmaxi group two sets of shale. The Wufeng - Longmaxi shale listed as main target layer of Zhaotong national shale gas demonstration area, developed during Guangxi Orogenic Movement. After the events of Indosinian, Yanshanian and Himalayan period, the shale deformation and reformation of the relatively weak, moderate burial, shale gas formation and preservation condition is good, thus the syncline becomes in the upper Yangtze region, South Sichuan shale gas core area of an important part. According to the characteristics of lithology, logging curve properties, mineral composition, organic matter and gas bearing property, and Wufeng - Longmaxi formation shale of the Syncline can be divided into three third-order sequences, three lithologic section, three type facies and four type sub-facies and various microfacies. Overall to deep water shelf facies depositional stage, rich organic shale section (section I) bearing gas is best, and subdivided into I1, I2 and I3, I4, I5 five layer. Integrated analysis of shale physical property and pressure coefficient of the syncline, Zhaotong demonstration area of shale gas mainly is preserved in the central area of the current residual synclinorium main part of deep shelf facies deposition, desserts are mainly enriched in the residual gas reservoir in syncline axial zone, the gas reservoir is vertically divided into the two sets of the bottom Longmaxi and Wufeng formation by Guanyinqiao limestone interlayer, after the combination of fracturing evaluation and single well production test results and evaluation that the construction-production area to the bottom of Longmaxi I3 and 14 laminated shales fracturing transformation and gas recovery effect best.

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