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Geochemical Characterization for Identification of Hydrocarbon Generation: Implication of Unconventional Gas Resources

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Abstract : This research will address the processes of geochemical characterization and hydrocarbon generation process occurring within hydrocarbon source and/or reservoir rocks. The geochemical characterization includes organic-inorganic associations that influence the storage capacity of unconventional hydrocarbon resources (e.g. shale gas) and the migration process of oil/gas of the petroleum source/reservoir rocks. Kerogen i.e. the precursor of petroleum, occurs in various forms and types, may either be oil-prone, gas-prone, or both. China has a number of petroleum-bearing sedimentary basins commonly associated with shale gas, oil sands, and oil shale. Taken Sichuan basin as a selected basin in this study, the Sichuan basin has recorded notable successful discoveries of shale gas especially in the marine shale reservoirs within the area. However, a notable discoveries of lacustrine shale in the North-Este Fuling area indicate the accumulation of shale gas within non-marine source rock. The objective of this study is to evaluate the hydrocarbon storage capacity, generation, and retention processes in the rock matrix of hydrocarbon source/reservoir rocks within the Sichuan basin using an advanced X-ray tomography 3D imaging computational technology, commonly referred to as Micro-CT, SEM (Scanning Electron Microscope), optical microscope as well as organic geochemical facilities (e.g. vitrinite reflectance and UV light). The preliminary results of this study show that the lacustrine shales under investigation are acting as both source and reservoir rocks, which are characterized by very fine grains and very low permeability and porosity. Three pore structures have also been characterized in the study in the lacustrine shales, including organic matter pores, interparticle pores and intraparticle pores using x-ray Computed Tomography (CT). The benefits of this study would be a more successful oil and gas exploration and higher recovery factor, thus having a direct economic impact on China and the surrounding region. Methodologies: SRA TOC/TPH or Rock-Eval technique will be used to determine the source rock richness (S1 and S2) and Tmax. TOC analysis will be carried out using a multi N/C 3100 analyzer. The SRA and TOC results were used in calculating other parameters such as hydrogen index (HI) and production index (PI). This analysis will indicate the quantity of the organic matter. Minimum TOC limits generally accepted as essential for a source-rock are 0.5% for shales and 0.2% for carbonates. Contributions: This research could solve issues related to oil potential, provide targets, and serve as a pathfinder to future exploration activity in the Sichuan basin.

Keywords : shale gas, unconventional resources, organic chemistry, Sichuan basin
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