HYDROCARBON PHASE PREDICTION AND GEOCHEMICAL PROPERTIES OF COALS FROM MALAYSIA AND VIETNAM APPLIED TO 3D BASIN MODELING:

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Since the 80's and 90's coals have been revaluated as potential source rock not only for gas but for oil too (Durand and Paratte, 1983; Bertrand, 1984; Thompson et al., 1985; Cook and Struckmeyer, 1986; Khorasani 1987; Horsfield et al., 1988; David Curry 1994; Wan Hasiah, 1999a, 1999b). More recently in 2014 Sykes et Al. suggested that the inundation of brackish water into the early diagenetic peat forming environment enhanced the bio-resistance of higher plant and other lipids through sulfurization. Therefore, enhancing oil potential by preserving hydrogen richer organic matter.

Tertiary coal deposits in South East Asia have been recognized by many authors as a primary source of both oil and gas in the region (Todd et al.,1997; Mazlan and Abolins, 1999). The aim of this paper is to demonstrate that there are several components that need to be taken into consideration in order to predict hydrocarbon phase from coals.

First, a detailed geochemical characterization of immature to mature coals from both Nam Con Son Basin offshore Vietnam and Sarawak Basin offshore Malaysia is compared and discussed in terms of oil potential. The samples have been analysed by different geochemical methods including: TOC, RockEval, kerogen composition, extraction, carbon isotope, GC and GC-MS. Main results of this phase are that the coals from the two sedimentary basin have different oil potential higher for the Vietnam basins (HI 450 mg HC/g TOC) versus the Sarawak Basin (HI 300 mg HC/g TOC).

Second, a full 3D PVT model has been built for a selected area in the Sarawak Basin with the main goal of predicting hydrocarbon phase from coals at very high temperatures and pressures. The 3D model has been built on a series of highly detailed structural maps (grid space 50 by 50 m). Four coal source rock layers have been considered during the deposition of the sediments relative to the Cycle I (Oligocene in age). From thermal history point of view three different heat flow histories have been tested respectively low, medium and high. The horizontal grid-cell size is 50 x 50 m. With 15 layers, the model comprises a total of 124 million cells. The model can be simulated in 6 hours on a cluster with 20 processors (simulation time can be reduced by sampling the model without necessarily loosing accuracy).

Third, two different set of kinetic reactions for coals from the literature have been tested from hydrocarbon phase prediction point of view (Pepper & Corvi 1995; Di Primio 2006).

Main conclusions are that hydrocarbon phase prediction is possible and can be used to capture the possible end members that can be used to assess the risk of finding economical and producible amount of hydrocarbons in such extreme geological condition.

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