

Unconventional Reservoir Potential of the Brown Shale, Central Sumatra Basin, Indonesia from Outcrop Characterization

Richard Brito

University of Oklahoma

Abstract

The Brown Shale (Pematang Group) is an Eocene-Oligocene sequence of lacustrine mudstones deposited in the Central Sumatra basin (Indonesia). It is the major and aerially extensive hydrocarbon oil and gas source rock in Central Sumatra. The objective of this research was to characterize the Brown Shale from an unconventional re-source perspective; to do this, an outcrop located inside the Karbindo Coal Mine in Central Sumatra Island was studied. The outcrop is a 220m stratigraphic section of the Brown Shale sitting atop 18+m of mineable coal. Data for this study includes: Gamma Ray profile, measured section, facies description, thin sections, SEM, XRD, RockEval, porosity, permeability and palynology. Ten facies (A to J) were described in the Karbindo Coal Mine succession. The Brown Shale section is dominated by calcareous mud-stone, calcareous shale and claystone, with some very thin beds of siltstone and sandstone. TOC values range from 2.51% to 8.56% which are indicative of very good to excellent potential source rock. Measured Vitrinite Reflectance in the coal underneath the Brown Shale section is 0.63% which places this section in the early oil window. The main kerogen type is Type I (lacustrine - oil prone). Calcite and clay minerals (Kaolinite and Illite) are the dominant minerals, with a low proportion of quartz (~20%). Four depositional stratigraphic sequences were interpreted: Sequence #1 corresponds to Balanced-Fill lake type, Sequence #3 and #4 correspond to Overfilled lake type, and Sequence #2 corresponds to the transition between these two lake types. Based on geological and geochemical data, the Brown Shale Formation is a good prospect for unconventional development (horizontal drilling and fracking) in the subsurface. The recommended target zone is the stratigraphic interval from 60m to 80m. This section is represented by the brittle-ductile couplet associated with sequence #2. The brittle zone of this sequence is associated with the high content of quartz, calcite; and low content of clay. The underlying and overlying ductile zones are rich in TOC; especially the overlying zone that contain the highest TOC value in the entire section. It is important to notice this section of the Brown Shale formation in the Karbindo Coal Mine could be used as an analog for the Brown Shale deposits in other, better developed sub-basins in the Central Sumatra Basin.