Tuesday, March 16. 2010

Crowne Plaza Hotel - Greenspoint (former Sofitel)
425 North Sam Houston Pkwy E

Social 11:15 AM, Luncheon 11:30 AM

Cost: $31 pre-registered members; $35 for non-members & walk-ups.

To guarantee a seat, you must pre-register on the HGS website and pre-pay with a credit card.
Pre-registration without payment will not be accepted.
You may still walk up and pay at the door, if extra seats are available.

Understanding the Geologic Controls on *Shale Oil Play*: Lessons Learned from the Bakken Formation, Williston Basin, Elm Coulee Field, Montana

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The Bakken Formation in the Williston basin is divided into three informal members: upper, middle and lower. The upper and lower Bakken consist of dark grey to black pyritic and finely laminated mudstones. The middle member of the Bakken is composed of various lithologies including siltstones, sandstones, limestones and dolostones. Total thickness of the Bakken Formation in the Williston basin ranges from 0 to 110 ft, with the upper member ranging from 0 to 30 ft, the middle ranging from 0 to 92 ft, and the lower ranging from 0 to 46 ft.

Due to the simplicity of structural deformation in the Williston basin, the oil generated by the upper and middle Bakken remains in the system.

The upper and lower mudstones are world-class petroleum source rocks with TOC ranging from 8% to 36% wt., with an average of 25% to 28% wt. across large areas of the basin. They can easily be identified by their high radioactive signatures (GR > 200 API). The Bakken was estimated to have generated 200 – 400 billion barrels of low sulfur (< 0.1%), 40 – 45° API gravity oil in place.

The lower Bakken is absent in the Elm Coulee Field. Source of

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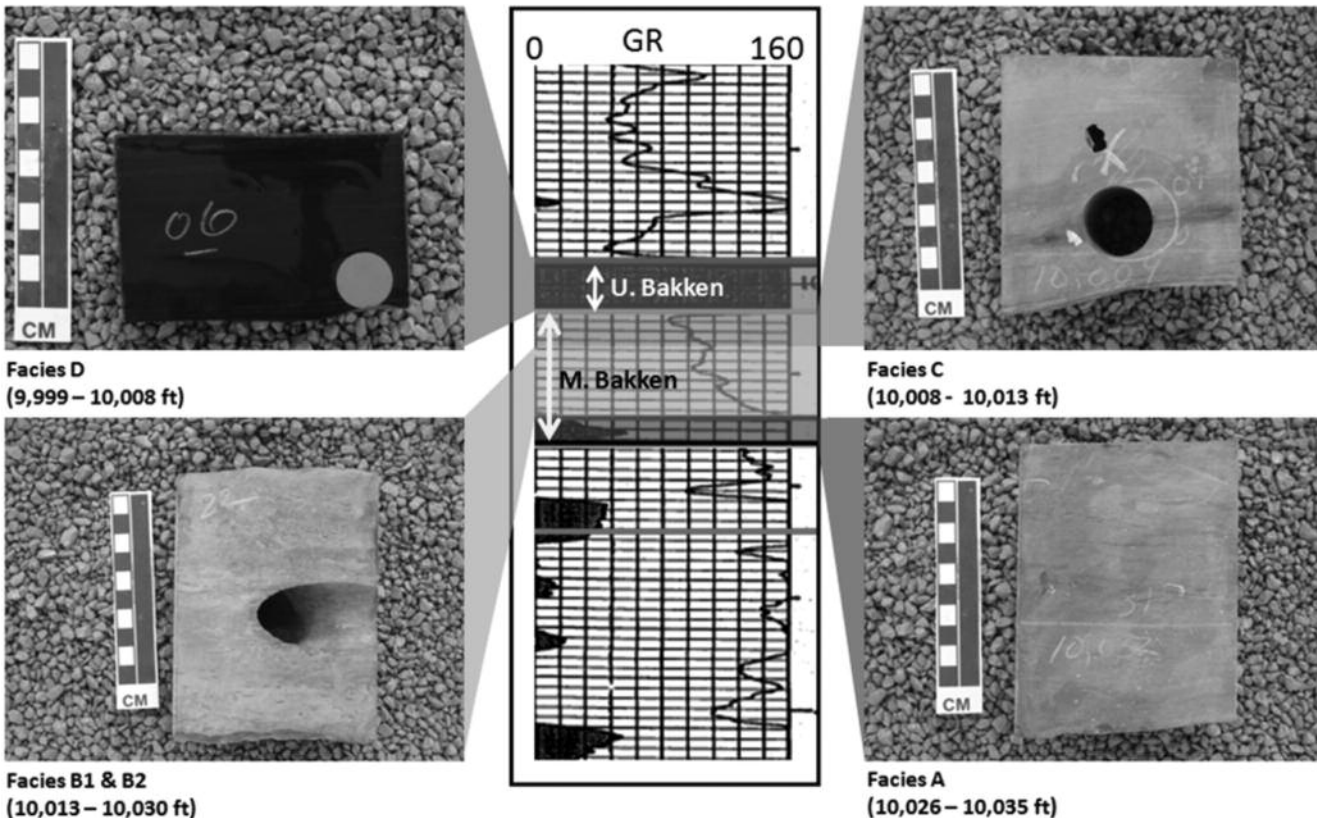

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petroleum in the middle Bakken is primarily from the upper Bakken mudstone with TOC varying from 8% – 15% wt. and estimated initial TOC ranging from 12% – 25% wt. and increasing towards the basin center (northwest to the Elm Coulee).

The total thickness of the Bakken Formation in the Elm Coulee field is from 10 to 50 ft with the middle Bakken ranging from 5 to 45 ft. Low permeability rocks generally characterize the lithologies of the Bakken member overall. The accommodation space for the Bakken in the Elm Coulee field is believed to be developed by the dissolution of the Prairie Formation evaporites to the north of Elm Coulee or by basement related structures or both.

The upper Bakken mudstone is dark-grey to black, hard, siliceous, slightly calcareous, pyritic, and fissile. The mudstone consists of dark organic kerogen, minor clay, silt-size quartz, some calcite and dolomite. The kerogen consists mainly of amorphous material and is distributed evenly throughout the mudstone interval. The middle Bakken in the Elm Coulee Field consists of dolostones with 3 identified lithofacies: calcareous dolo-mudstones, bioturbated dolo-mudstones and arenaceous dolostones. Identified lithofacies represent different rock properties of the middle Bakken. Arenaceous dolostone lithofacies has the greatest porosity and permeability calculated both from core analysis and wireline logs (5% - 10% porosity and 0.05 – 0.2 mD of permeability). The pore network development in the middle Bakken is the function of degree of bioturbation, mineralogical-depositional fabric, and diagenesis. Permeability is highly dependant on intergranular matrix porosity and intragranular dissolution of dolomites, with less of any natural fractures involved, based on core observation in the field.

Due to the simplicity of structural deformation in the Williston basin, the oil generated by the upper and middle Bakken remains in the system. Therefore the Bakken petroleum system is self-sourced. The middle Bakken in this field is oil-saturated. Both fractures and pore network are the important factors in controlling petroleum charge access from the upper Bakken source to the middle Bakken tight reservoir.

The boundaries of the middle Bakken fairway in the Elm Coulee field were defined using porosity from neutron-density logs, with a cutoff of 5%, and true resistivity above 20 Ohm-m. Net thickness of the saturated oil zone within the middle Bakken ranges from 5 to 25 ft. The Bakken in the field is slightly overpressured due to petroleum generation. The over-pressuring and middle Bakken reservoir quality are the important factors in understanding oil production rates in the Elm Coulee field. The middle Bakken is a brittle dolostone, which lends itself to hydraulic fracturing completion. Long-lateral horizontal drilling and multi-stage hydraulic fracturing of the middle Bakken dolostones are keys to success in the Elm Coulee field development area. ■

Biographical Sketch

Aris Pramudito is a geologist working with the BP Arkoma Regional Exploration and Appraisal team. He specializes in unconventional reservoirs, mudrock characterization and petroleum geology. He holds an M.S. degree in Geology from the Colorado School of Mines and a B.E. degree in Geological Engineering from the Bandung Institute of Technology (ITB). He has worked in a number of unconventional and conventional oil and gas plays in the US and had been involved in carbonate reservoir characterization studies in different basins in Indonesia.