CERAMAH TEKNIK TECHNICAL TALK

Hydrocarbon retention in clastic reservoirs of NW Borneo - Examples of hydrocarbon trap, reservoir, seal and implications on hydrocarbon column length

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Franz is an industry geoscientist. He joined the oil industry with a PhD on mixed clastic and carbonate sequences. During his more than 30 years of industry exposure, he dealt with geophysical and regional geology challenges in Africa, Brazil, the Middle East, and SE Asia. He taught petroleum science as department head for 3.5 years in Curtin Sarawak. He believes that geological insight can only be attained through fieldwork exposure. Since 2015, Franz works as a consultant and trainer.

Abstract: Estimating the length of hydrocarbon is a tricky matter, given it requires a solid understanding of, in particular, reservoir and seal properties.

In our work (with Dr. Jong) we looked up empirical reservoir and seal data from Sarawak and Sabah, and devided these in three success patterns:

1. *Deepwater claystone seal + deepwater turbidite reservoir + gas + overpressure*

In this scenario there is little or no retention risk in relation to top seal, as long as seals are sufficiently lithified to withstand buoyancy pressure.

2. *Deepwater claystone seal + deepwater turbidite reservoir + oil + hydrostatic*

In this case oil is preferentially retained, whilst gas is removed via a regional aquifer possibly leading to small gas accumulations in updip direction.

3. *Shallow marine clay + topset reservoir + hydrostatic + oil (gas more rarely)*

In shelfal, but essentially subtidal settings, relatively thin and often bituminous clay sequences can potentially hold back significant oil and gas columns. This setting, however, is also characterized by frequent reservoir discontinuity, such that hydrocarbons are located in (at least on production scale) isolated lenses.

In conclusion, column length is a derivative of several factors affecting the integrity of a hydrocarbon trap. The presence of an effective and laterally continuous top seal is perhaps the most important enabler; relatively thin top seal can be surprisingly efficient. Contiguity of hydrocarbon reservoirs, with isotropic reservoir characteristics can be a positive factor for the development of longer hydrocarbon columns. Moreover, the overall sand-to-shale ratio is critical. Hydrocarbon columns tend to be longer in clay prone environments (sand to clay juxtaposition is here more likely; and a better fault seal due to good SGRs). On the other hand, hydrocarbon columns tend to be short in shallow marine to deltaic settings given discontinuity of reservoirs, abundance of sand and poor fault sealing. Therefore, both POS of volume and POS of long columns is far higher than in turbidite reservoir/seal associations compared to shallow marine shelfal settings.

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