GEOLOGY PAPER 19

TYPICAL PORE PRESSURE REGIMES IN THE MALAY BASIN – INSIGHT FOR OTHER BASINS GLOBALLY

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The Malay Basin is a Tertiary trans-tensional rift basin located in offshore Peninsular Malaysia and is one of the most prolific hydrocarbon-producing basins in Southeast Asia. Over 12 km of fine-grained Tertiary sediments were deposited during the last 35 Ma, leading to development of overpressure in the deeper parts of basin (Hoesni et al., 2003). On the Basin Flank (Resak-Beranang – Regime A), reservoir sediments are normally pressured to depths in excess of 3.0km, on account of a high sand/shale ratio. Beneath Regime A sediments, a strong pressure transition zone is expected (e.g. Beranang-1; Mohamad et al., 2006), with attendant challenges for pre-drill prediction and safe well planning. Shale-prone sediments, both shallow (e.g. on continental slopes) and deep (e.g beneath Regime A) which have been isolated from fluid escape by low-permeability shales correspond to Regime B, which is characterised by having high overpressures. Pressure prediction in Regime B characterised by Well LA-3, works satisfactorily if reservoirs are limited in their vertical relief and/or there are no open faults connecting stacked or cross fault reservoirs.

Where temperatures exceed approximately 100-120°C additional pressure generation mechanisms commonly involve clay mineral diagenesis and hydrocarbon generation reactions are present (Regime C). These processes influence rock properties, notably porosity, thereby requiring modification to the standard rock property-effective stress relationships used to predict pore pressures. In the Malay Basin the depth these isotherms are shallow due to the high geothermal gradient of 45-60°C/km

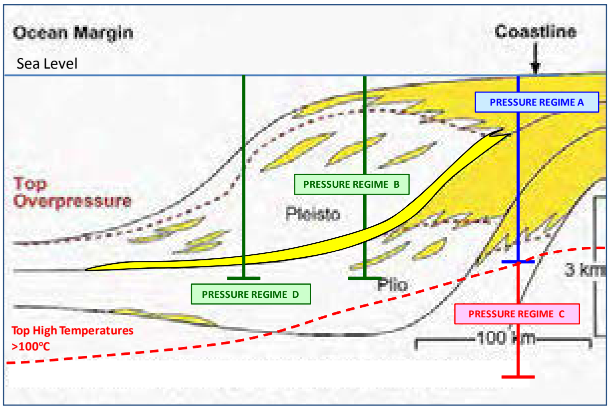

Figure 1: Location of Pressure Regimes A-D in a typical deltaic environment.

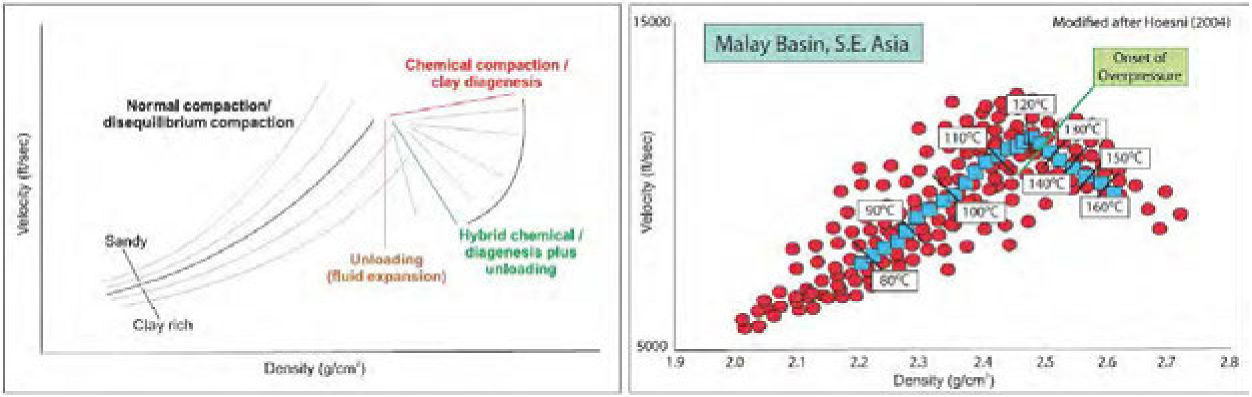

Figure 2: Secondary overpressure generation mechanisms typical of Regime C can be detected using velocity and density analysis (Modified after Hoesni, 2004).

(Madon, 2007). Finally where reservoirs are connected within the delta (perhaps laterally draining to the surface, or confined within low-permeability sediments but with high relief) lateral fluid movements once again render traditional approaches to shale-based pore pressure prediction more challenging. Regime D can therefore be found at any depth range. The range in fluid pressures in parts of the Malay Basin at the same depth (and in reservoirs of the same age) suggests that Regime D is likely in this Basin.

Although it is vital to be aware that there is no short-cut to accurate fluid pressure prediction, these Regimes are observed in many environments world-wide including Tertiary Deltas such as the Niger Delta and Gulf of Mexico.

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