Petrographic and diagenetic studies of the reservoir sandstones of the Malay Basin

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The properties of the Malay Basin sandstones as potential reservoirs, and their characteristics depend on primary depositional facies and burial diagenesis. Petrographic studies and classification using the EPRco format have shown significant differences in the texture and mineralogical content in the samples of different sandstone groups, namely E, I, J and K which are divided by seismic horizons. The older sandstone, group K was deposited in braided stream environment and contains coarse to medium-grained sands. The J sandstone was deposited in brackish to shallow marine environment, associated with well sorted medium-grained sands. The group E and I sandstones, which were deposited in estuarine environment, are fine to very fine-grained and mineralogically consistent, associated with high detrital matrix content.

The original mineral content of the sandstones had influenced the trend of the post-depositional diagenetic changes. Higher primary porosity is generally present in the mature or clean sandstones. Usually, the loss of porosity in these sandstones are mainly due to quartz cementation and precipitation of authigenic clays. The effect of mechanical

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compaction and pressure dissolution on the sandstones were mild, as deduced from the cathodoluminescence studies, where the area of core contacts is minimal and the present interlocking grain boundaries were actually caused by quartz overgrowths. The immature sandstones are associated with either high percentages of detrital clays or unstable rock fragments or both. Mechanical compaction caused the main diagenetic damages resulting in a major loss of intergranular porosity through deformation of ductile grains and formation of allogenic clay matrix. An early loss of porosity and permeability had slowed down or inhibited further diagenetic events, thus explaining the rarity of quartz overgrowths and other cement precipitations in these sandstones.

Secondary porosity generated by the dissolution of grains, especially feldspar grains, played an important role in the contribution to the total porosity. The investigation of grain and pore morphologies using the scanning electron microscope revealed a high percentage of micro-porosity preserved in between the clay matrix and newly formed authigenic clays, especially kaolinite. Other diagenetic changes observed are calcite and siderite cementations as well as formation of glauconite, chlorite and smectite.