

## Characteristics of Pore Pressure and Effective Stress Changes in Sandstone Reservoir Due to Hydrocarbon Production

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**Abstract :** Preventing hazardous events during oil and gas operation is an important contribution of accurate pore pressure data. The availability of pore pressure data also contribute in reducing the operation cost. Suggested methods in pore pressure estimation were mostly complex by the many assumptions and hypothesis used. Basic properties which may have significant impact on estimation model are somehow being neglected. To date, most of pore pressure determinations are estimated by data model analysis and rarely include laboratory analysis, stratigraphy study or core check measurement. Basically, this study developed a model that might be applied to investigate the changes of pore pressure and effective stress due to hydrocarbon production. In general, this paper focused velocity model effect of pore pressure and effective stress changes due to hydrocarbon production with illustrated by changes in saturation. The core samples from Miri field from Sarawak Malaysia were used in this study, where the formation consists of sandstone reservoir. The study area is divided into sixteen (16) layers and encompassed six facies (A-F) from the outcrop that is used for stratigraphy sequence model. The experimental work was firstly involving data collection through field study and developing stratigraphy sequence model based on outcrop study. Porosity and permeability measurements were then performed after samples were cut into 1.5 inch diameter core samples. Next, velocity was analyzed using SONIC OYO and AutoLab 500. Three (3) scenarios of saturation were also conducted to exhibit the production history of the samples used. Results from this study show the alterations of velocity for different saturation with different actions of effective stress and pore pressure. It was observed that sample with water saturation has the highest velocity while dry sample has the lowest value. In comparison with oil to samples with oil saturation, water saturated sample still leads with the highest value since water has higher fluid density than oil. Furthermore, water saturated sample exhibits velocity derived parameters, such as poisson's ratio and P-wave velocity over S-wave velocity ( $V_p/V_s$ ) The result shows that pore pressure value were reduced due to the decreasing of fluid content. The decreasing of pore pressure result may soften the elastic mineral frame and have tendency to possess high velocity. The alteration of pore pressure by the changes in fluid content or saturation resulted in alteration of velocity value that has proportionate trend with the effective stress.

**Keywords :** pore pressure, effective stress, production, miri formation

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