ABSTRACT

Carbonates are strange rocks to most exploration geophysicists although they hold more than half of the world’s petroleum reserves. Geophysical applications in carbonate reservoirs, however, are less mature and abundant than those associated with clastic reservoir. Carbonate reservoirs are notoriously more difficult to characterize than siliciclastic reservoirs. Compared to siliciclastic reservoirs, carbonate reservoirs offer unique geophysical challenges with respect to reservoir characterization. These include: (1) tight rock fabric resulting in problematic and not widely accepted rock physics models; (2) greater heterogeneity due to rapid vertical and lateral facies variation; (3) lower seismic resolution due to higher velocities; and (4) physical and chemical alterations causing fracturing and diagenesis.

In this paper, we analyzed the seismic rock physics of Parigi carbonate in West Java. The samples was collected in Palimanan, Cirebon, West Java, near carbonate mining of cement industry. These carbonates samples are believed as hydrocarbon reservoir’s rock due to the existence of oil seeps surrounding the collected sample’s area. Carbonates samples are predicted as reef carbonate and it is dominated by calcite mineral. The dominant porosity is vuggy porosity and mixed by intercrystaline porosity of dolomite.

We measured sonic velocities on carbonates rocks in various stages of diagenesis to reveal the relationships between pore fluid type, pore type, velocity and elastic parameters. The apparatus for these laboratory experiments, constructed by Wisfı Laboratory is called as SeisCore, consists of an oil-filled pressure vessel that contains the high frequency of sonic transmitter-receiver pair with piezoelectric transducers and the sample. Miniplug samples of one inch (2.5 cm) diameter and 1–2 inches in length were positioned between two piezoelectric transducers and sealed from the confining oil in the pressure vessel. Confining and pore-fluid pressures were chosen independently to simulate most accurately insitu stress conditions of buried rocks. The confining pressure were varied between 50 and 3000 psi. Then at constant confining pressure, the pore-fluid pressure was varied between 50 and 3000 psi and resulting in an effective pressure of up to 2950 psi. The pair of transducers generates one compressional wave signal (VP) and two polarized shear wave signals (VS1, VS2) at central frequencies close to 10 KHz.

Some pore fluid types were injected to the samples. The measurement showed that the velocity of P waves in dry (gas) saturated condition were lower than ones in brine saturated condition. In the other hand, the velocity of S waves in brine saturated condition were lower than ones in dry (gas) saturated condition. Therefore by this phenomena, we conclude that Gassman theory is not quite valid when implemented in carbonates rock especially in Parigi carbonate rock. Some crossplots of elastic parameters are presented also in this paper to show the influences of pore fluid to the Parigi carbonate rock.

INTRODUCTION

During the past 50 years, many scientists would like to relate between properties of rocks and seismic