GEOPHYSICS POSTER 6

METHODS IN ESTIMATING VISCO-ELASTIC PROPERTIES FOR GAS CLOUD IMAGING : A MULTICOMPONENT SEISMIC AND ROCK PROPERTIES ANALYSIS

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The presence of gas cloud in the Malay Basin has always been a topic to be discussed when it comes to imaging the subsurface. Gas cloud has caused compression (P-waves) data acquired to suffer from poor data quality due to higher attenuation of P-waves, wavefront distortion which caused by low velocity distribution within the gas bodies and transmission losses. Converted shear wave (P-S waves) data from multicomponent acquisition allows images to be obtained that are unobstructed by the gas and/or fluids (Thomsen et. al 1997, Granli et. al 1999). In addition, rock properties can be uniquely determined from the compressional and shear data, allowing for improved reservoir characterization and lithologic prediction. This paper will discuss method for determining the optimal parameters of the velocity (V) and density (ρ) within the gas cloud for further input into P-S waves imaging.

One of the methods in determining the parameters is by the generation of rock properties models to understand how the gas cloud modifies the visco-elastic properties of rocks such as Vp, Vs, ρ, Qp and Qs (Chaveste, 2007). This method starts with well log modeling and inversion to estimate moduli of rock constituents that incorporates Batzle, Wang and Gassmann equations (Kumar, 2006). It then can be used to model logs for different rock conditions such as porosity (Φ), lithology and fluid saturation (see Figure 1). Through Athy's equation, the reconstruction of P-wave and S-wave velocities and density trends can be done to predict the normal compaction trends and quality factor (Q).

Through rock properties model, the Vp/Vs ratio can be estimated for both measured and modeled logs (Figure 2). The estimation of Vp/Vs is crucial in order to predict the Common Conversion Point (CCP) of the P-S waves. This information can be used to QC the P-S data processing by migrating the CCP; updip if the ratio is low, or downdip if the ratio is high. Figure 3 illustrates the positioning of the CCP events and Figure 4 shows its respective P-S impulse response.

The absorption parameters of the gas cloud could also be estimated through attenuation modeling. Well-log information in addition to VSP-data, could be used for quality factor (Q-factor) estimation. Sonic velocities measured at frequencies above the seismic signal band, usually around 12 kHz, when computed together with synthetic seismogram, and adjusting the time shift between the two type of data, can be used to estimate the Q-factor (Arnim, 2003). The estimation of Q-factor is important in determining if the multicomponent acquisition and processing of PS data would result in better imaging of the reservoirs. The smaller absorption of the S-wave, the higher resolution and better quality P-S waves data can be recorded.

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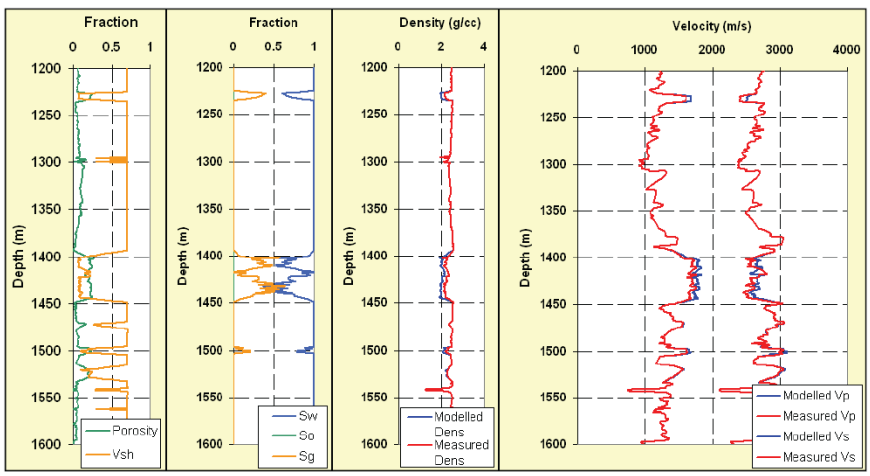

Figure 1: Petrophysical evaluations and the modeling of visco-elastic properties.

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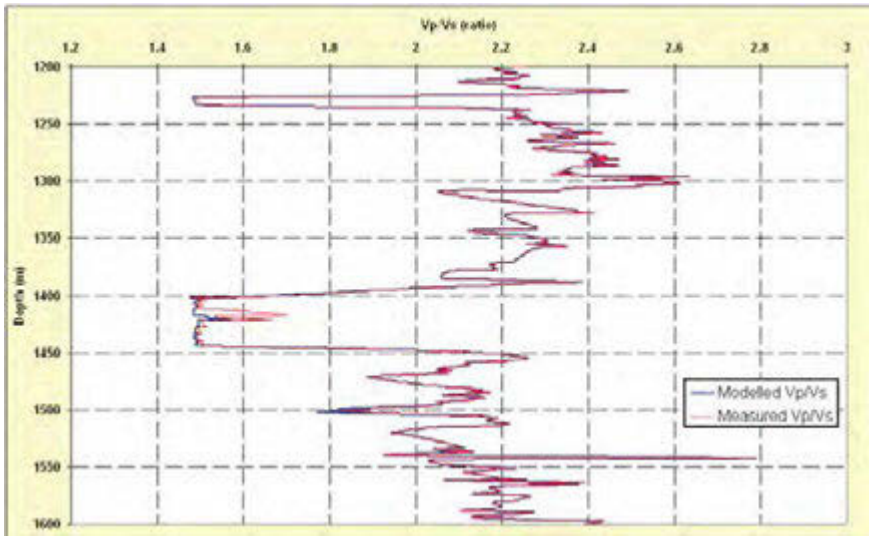

Figure 2: The measured and modeled Vp/Vs ratio.

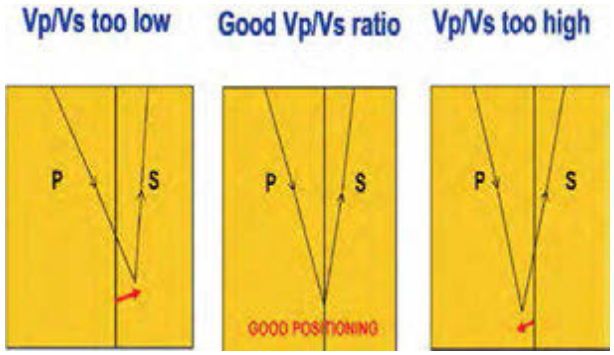

Figure 3: Estimating the position of Common Conversion Point (CCP) from Vp/Vs ratio.

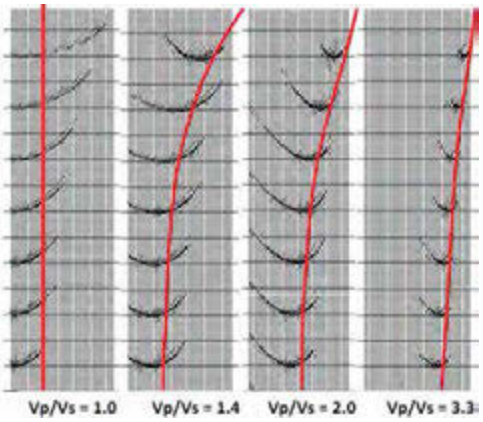

Figure 4: P-S impulse response.