WA Branch

An Investigation Of Seismic Amplitude Versus Offset (AVO), Computer Modelling And Field Data From The Kaimiro Field, Onshore Taranaki

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The Kaimiro Field is located in the onshore Taranaki Basin and contains oil and gas in thinly bedded turbidite reservoirs of the Miocene Mt. Messenger Formation. On seismic sections, amplitude anomalies appear to be partly related to the presence of hydrocarbon bearing sands.

A joint study was undertaken by Petrocorp Exploration Ltd and the Institute of Geological and Nuclear Sciences (IGNS) with the objective to predict hydrocarbon type in the Kaimiro Field from seismic data. Normal incidence modelling has shown in the past that CMP stacked seismic data cannot discriminate between the combined effects of changes in porosity, reservoir thickness, hydrocarbon type and hydrocarbon saturation. A study of the amplitude variation with offset was therefore undertaken.

Rock velocity data and fluid property data from the Kaimiro Field were used to create one dimensional reservoir models on which seismic AVO effects were measured from synthetic gathers.

Horizontal and vertical component traces were calculated at a 20 m interval for offsets up to 2900 m. AVO measurements were limited to vertical component data (as recorded by a geophone) for offsets up to 1200 m which is the maximum offset of the field seismic data.

The effect of different pore fluids (gas, oil and water) and scale of reservoir was investigated and shows that the zero offset reflection amplitudes from oil and gas filled sands are about 1.5 and 2.2 times those of water filled sands. Oil filled sands had a rate of amplitude decrease with increased offset similar to water filled sands but the amplitude from gas filled sands decreased more rapidly with offset.

In parallel with the theoretical modelling approach, prestack gathers from seismic lines across the Kaimiro Field were analysed for AVO effects. The AVO displays show that a distinctive pattern occurs across the Kaimiro field. At the Kaimiro well locations the AVO pattern is characterised by high amplitudes on the near offsets and a decreasing amplitude with offset. In the areas away from wells (where no hydrocarbons are expected) the near offset amplitudes are low and vary little with increasing offset. No major differences are seen between the Kaimiro-1 (oil) and Kaimiro-4 (gas) well locations suggesting that simple AVO analysis may not be able to discriminate between hydrocarbon types on the Kaimiro data.