

Vp/Vs Ratio of a Heavy Oil Reservoir from Canada

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Abstract

It is well known, especially for heavy oil projects, that Vp/Vs is a very good lithology discriminator. In this paper we provide a Vp/Vs ratio volume based on AVO analysis and simultaneous inversion using only the PP component. The new results are compared with the previous results based on the travel time measurements on the vertical and radial components of the multicomponent records (Lines et al., 2005).

The area for this project is a heavy oil field (oil sands of the Devonian-Mississippian Bakken Formations) near Plover Lake, Saskatchewan. In this study we analysed Nexen's 3D-3C seismic survey, acquired by Veritas DGC and processed by Sensor Geophysical.

We performed AVO analysis followed by simultaneous inversion on pre-stack time migrated gathers in order to derive P impedance, S impedance, density and Vp/Vs volumes. The inversion approach accounts for the petrophysical relationship that exists between: 1. P impedance and S impedance and 2. P impedance and density. It provides a significant improvement over separate inversions of the two AVO attributes P- and S-wave impedance reflectivity, particularly for Vp/Vs ratio estimates. Additional rock properties, such as rigidity and incompressibility were derived from P impedance and S impedance (Goodway et al., 1997).

The Vp/Vs volume from simultaneous inversion compared very well with the similar volume obtained from a previous study. The Vp/Vs results for the Sparky/Waseca-Torquay interval show similar general features. The new volume, based on simultaneous inversion produces Vp/Vs ratio values with a vertical resolution of 2ms (sampling rate) whereas the previous results from travel times are just averaged over 60 ms (Sparky – Torquay interval). The new results are sharper and offer more details in identification of the sand and shale.