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Interpretation of sonic logs in low-velocity hot oil sands

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Summary

P-wave velocity (V_P) of unconsolidated or poorly consolidated gas bearing sands at low effective pressures can be very low compared to consolidated sandstones. V_P of these sediments can be even lower than brine compressional velocity which is around 1550 m/s depending on the temperature, pressure and salinity of the water. Oil sands as the name suggests, are poorly consolidated sands which have a very weak frame.

Theoretically, in conventional sonic logging of low velocity formations, monopole tools will measure the p-wave velocity of the mud (i.e. logging fluid) which is close to 1550 m/s. It should be noted that in this case, due to Snell's law no shear wave can be created at wellbore interface since mud compressional velocity is definitely higher than formation shear velocity. Dipole sonic logging can overcome this difficulty by creating flexural movements along borehole walls.

When Steam Assisted Gravity Drainage (SAGD) process is utilized to produce oil, velocities inside and in proximity of the steam chamber can be very low. The knowledge of how velocities change with temperature is of great importance in seismic monitoring of SAGD production.

Sonic logs from the wells that have been drilled into high temperatures have been examined and showed a significant difference between common and true interpretation. The challenges of interpretation and its effects on the outcome of seismic characterization will be discussed.

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