Recent Advances and Future Challenges in Geopressure Prediction

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Abstract

Pre-drill pressure prediction using geophysical data and methods has historically been done using very simple models and has been restricted by overly simplistic estimates of the Earth's velocity field. The advent of the effective stress concept and the pressure prediction methods that developed from that concept led to a much-needed inclusion of fundamental physics into the art of pressure prediction. Geopressure prediction techniques have started incorporating more sophisticated velocity methods such as AVO-based phase mismatch algorithms, tomography and pre-stack inversion. These technologies allow the geophysicist to obtain higher resolution estimates of the velocity field in the subsurface that can significantly improve the results of pressure prediction. These technologies permit more robust analysis of P-wave velocities in the presence of contamination from hydrocarbon effects and non-clastic rocks that have been a problem in the past.

Pressure prediction is especially critical for prospect scale analysis because of the importance of local pressure regimes in establishing fluid migration pathways and reservoir properties. At the prospect scale, pressure prediction can be used to (1) constrain the porosity and pressure regimes surrounding accumulations of hydrocarbons, (2) determine the sealing characteristics of faults, (3) evaluate vertical and lateral seal properties, (4) evaluate the risk of structural effects on pressure in reservoirs, and (5) determine the production drive mechanism for a given reservoir based on its location relative to pressure.