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Realistic Pore pressure Prediction in Challenging Environments

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Summary

Modern day oil exploration is pushing operators into harsher and more difficult drilling environments in deepwater in search of hydrocarbon reserves. Characterized by features like thick salt sheets and non clastic lithology the difficulties for drilling operations are greatly increased in these environments.

Shale based pore pressure prediction methodology was developed in the 60's and is based on young clastic sediments under cool temperatures. However, this approach does not address these more challenging environments, nor issues high temperature sediments and regions exposed to fluid migration/transfer and lateral drainage. These fluid-related phenomena are manifest in structurally complex regions, such as areas of growth faulting, and overpressure transfers to up-dip or shallower sections and during sedimentation. Porosity-effective stress models require adaption in areas of elevated temperatures (>120°C) and sometimes render conventional shale-based pore pressure prediction impossible. The complex geology, burial history and shale diagenesis-driven fluid pressure mechanisms pose significant challenges for pore pressure prediction.

We discuss a prudent approach to pore pressure prediction for well planning and drilling in these difficult environments, where high pore pressures and variable fracture gradients with subsurface reservations are encountered.