ABSTRACT
Shale reservoirs are being actively exploited in several tectonically stressed regions around the world. These tectonic settings often mean that the development of these fields requires an adequate quantification of the in situ principle stress magnitudes and their orientation. Achieving this goal can be complicated by the heterogeneous, inelastic, and/or anisotropic mechanical properties of these shales and the associated vertical and lateral variation in pore pressure and stress through the target zones and bounding intervals. For these reasons, the commonly used techniques of determining stress state from mini-frac type data and using this data to calibrate log derived stress profiles may be misleading unless certain additional factors are measured and considered. We present some case study workflow examples from productive shales in tectonically stressed settings where a more rigorous analysis of the injection test data and of the shale petrophysical properties has allowed an improved, more accurate assessment of stress state. In particular, utilizing well testing theory in the analysis of mini-frac data has given us additional understanding of hydraulic fracture behavior in some tectonically stressed shales. Horizontal fracture growth through shear activation of bedding-parallel fabric can be a preferred fracture propagation mechanism in these shales and this behavior can be diagnosed by this improved workflow. Anisotropic mechanical fabric of these shales can be measured in core more regularly and more efficiently due to recent instrumentation advances. These improvements allow for a more accurate distinction between the impact of rock fabric anisotropy and of stress induced acoustic anisotropy on modern sonic logging tool response.

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