

Evaluating Natural, Healed and Induced Fractures Unique to Shale Gas Wells

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Summary

Borehole imaging in shale gas wells presents unique challenges compared to imaging conventional wells. Natural and induced fractures can have superficially similar responses in both vertical and horizontal wells but with some care, it is possible to differentiate between them. Induced fractures are especially complex in horizontal wells where they result from a variety of geometrically conflicting stresses, leading to complex and often contradictory shapes and orientations. Natural fractures have their own complexities because typical shale gas reservoirs have a variety of materials that can fill (heal) open fractures. These fill materials have electrical image signatures ranging from highly resistive (silica, calcite and anhydrite) to highly conductive (pyrite, clays) and so it is not always trivial to differentiate natural open fractures from sealed fractures. Many of the reservoirs show a history of minor block faulting that introduces a further layer of complexity. Borehole stability concerns have forced some operators to switch from water-based mud systems to invert and so several questions loom:

- How can we differentiate between induced and natural fractures in horizontal shale gas wells?
- Which of the features peculiar to shale gas wells can be measured correctly by oil-based image tools?
- Which oil-based image tools do the best job?