

Fracture Strikes in Lenticular Reservoirs: Axis-Parallel, Axis-Normal, or Independent? Considerations for Drilling and Drainage

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A lenticular reservoir containing fractures that strike parallel to the long axis of the lens, and where the resulting fracture-controlled permeability is greatest in that direction, would be efficiently drained by a vertical wellbore. However, if fractures and fracture-controlled permeability are higher in the direction across the short dimension of the lenticular reservoir, a horizontal wellbore with its azimuth along the lens axis might be preferable. Brief references in published studies have suggested both fracture orientations are possible, but spectacular outcrops of sandy to conglomeratic fluvial channels of the Cedar Mesa Formation in east-central Utah suggest a third possibility. The dominant set of natural fractures in these sinuous, lenticular channels strikes parallel to nearby small normal faults regardless of the local channel axis orientation, suggesting that fracture strike is largely independent of lens orientation. Calculations suggest that fracture-forming stresses in sandy, lenticular bodies embedded in muddy strata having different mechanical properties do not deviate more than plus or minus 10% from the trend of the regional stress. Thus for practical purposes, fractures within a sinuous lenticular reservoir would not be expected to deviate significantly from a regional trend. Once the regional fracture trend is defined, the decision of whether to drill horizontally or vertically for best drainage efficiency depends only on the orientation of the lenticular body, or of the local section of sinuous channel within that regional trend.