

Is That Frac Job Really Breaking Rock? Or Just Pumping Down a Pre-existing Plane of Weakness: The Integration of Geomechanics and Hydraulic Fracture Diagnostics

Enderlin, Milton ²; Mullen, Mike ¹; Tamayo, Cristia ¹ (1) Halliburton, Denver, CO. (2) Gearhart, Frot Worth, TX.

With all that horsepower sitting on location shaking the ground while pumping a frac job, it is really hard to imagine what the fracturing treatment is doing down hole. Is it breaking rock, exposing fresh new surfaces in a linear elastic mode or is it just opening and reactivating pre-existing planes of weakness in the reservoir? Let's consider the implications of both scenarios. If the rock is failing down pre-existing planes of weakness in the rock, the frac job will tend to stay in the weakened zone without growing through weak shale barriers. This could explain why most of the frac models show poor containment in tight sands yet tracer logs show good frac containment. How about Microseismic surveys during frac treatments? They tend to see a rather large stimulated reservoir volume and shorter lengths than is modeled. If the fracture treatment is breaking rock linear elastically, the created fracture will tend to be more like what is modeled in current frac simulation models.

So how do you tell if you are opening and reactivating a pre-existing weakness in the rock or breaking the rock? A novel concept to judge is integrating the geomechanically determined stress state of the rock with hydraulic fracture diagnostics. By comparing the estimates of minimum horizontal stress from both disciplines one can determine which type of fracturing one is doing. This leads to an improved post stimulation diagnostic analysis and trouble job analysis.