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Effects of Fluid Pressure on Seismic Responses in Fractured Shale Reservoirs

The potential for subtle traps within the source rock is probably dependent on the pressure regime. Fluid pressure within source rock of Shengli oil field, Eastern China, directly controls fracture deformation and influences rock properties and seismic signatures. For undrained conditions, the decrease in fluid pressure leads to the decrease in crack aspect ratio and is equivalent to an increase in the bulk modulus of fluid. We exam the sensitivity of fluid pressure to the fluid indicator the normal to shear compliance ratio. The results show that the decrease in fluid pressure will make the fluid indicator in oil saturated fractures shift toward water saturated ones. In particular, the effect of large changes of stress on a distribution of vertical cracks may make part of the crack close completely, thus changing the crack density distribution. For the fractured reservoir characterization in Shengli oil field, the lithology controls the azimuthal P-P and P-SV AVO responses and the dolomitic shale has more obvious azimuthal AVO responses than oil shale. The fluid pressure varies the AVO gradients in fracture-off strike directions of P-P and P-SV waves.