Clay squirt: Local flow dispersion in shale-bearing sandstones

Clay squirt: Local flow dispersion in shale-bearing sandstones

Dispersion of elastic-wave velocity is common in sandstone and larger in shaly sandstone than in clean sandstone. Dispersion in fluid-saturated shaly sandstone often exceeds the level expected from the stress-dependent elastic moduli of dry sandstone. The large dispersion has been coined clay squirt and is proposed to originate from a pressure gradient between the clay microporosity and the effective porosity. We have formulated a simple model that quantifies the clay-squirt effect on bulk moduli of sandstone with homogeneously distributed shale laminae or dispersed shale. The model predictions were compared with the literature data. For sandstones with dispersed shale, agreement was found, whereas other sandstones have larger fluid-saturated bulk modulus, possibly due to partially load-bearing shales or heterogeneous shale distribution. The data that agree with the clay-squirt model indicated nonuniform pore pressure in the high-frequency regime and uniform pore pressure in the low-frequency regime. Therefore, our model showed that clay-squirt dispersion can attain a sufficient magnitude to explain much of the large dispersion observed in shaly sandstone.

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