Closure Stress Gradient Estimation of the Marcellus Shale from Seismic Data

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Abstract

The closure stress is the stress needed to hold open a fracture in rock once it has been created. Understanding closure stress is important when developing a gas shale like the Marcellus in the Appalachian Basin. It determines the existence of stress barriers, the extent of the expected drainage area, the type of proppant needed, etc. As such, it affects the completion design and drilling targets. Closure stress is commonly assumed to be equivalent to the minimum horizontal stress and can be calculated using the uniaxial stress equation. This equation has several parameters and has been expanded to account for tectonic strain and anisotropic tectonic strain (Theircelin and Plumb 1994). However, the goal of this presentation is to simplify this equation and limit the parameters to something that can be estimated readily from seismic data. This presentation makes the case that in the Appalachian Basin, estimating Poisson's ratio is sufficient to understand the changes in the stress gradient of the Marcellus shale relative to the surrounding layers both vertically and laterally.