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# Reliability of poroelastic equation in determination of minimum horizontal stress in sedimentary basins: implication of tectonic strain

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Minimum horizontal stress ($S_{hmin}$) magnitude, normally one of the three principal stresses, provides vital information in various stages of petroleum development such as hydraulic fracture design, wellbore stability analysis, and sand production prediction. Mini-frac or leak-off tests (LOT) are considered to be the technique used to measure $S_{hmin}$ magnitudes directly in the formation. Still, other than being time-consuming and costly, LOT does not give a continuous $S_{hmin}$profile. A conventional alternative is to use a linear poroelasticity equation derived based on the assumption of uniaxially strained basins, which provides minimum horizontal stress magnitude ($S_{hmin}$) as a function of vertical stress, pore pressure and Poisson's ratio ($\nu$). In this study, we inspect the reliability of poroelastic equation-based calculation by comparing measured data of $S_{hmin}$, pore pressure with log-based minimum horizontal stress magnitude in 6 major sedimentary basins worldwide. For calculation of $S_{hmin}$ via the equation, we assume $\nu$ of 0.25 and Biot's constant of unity. The comparison shows that the predicted $S_{hmin}$ values generally underestimate the measured values by a range between 4% and as high as 29% depending on the regions. The wide variation of horizontal stress may imply unpredictable complications in the stress states in the sedimentary basins. Besides, we also collect the data of maximum horizontal stress magnitudes and Young's modulus to estimate local tectonic strains, which are responsible for additional stresses over the induced horizontal stresses. The result reveals that the tectonic strain magnitudes are not consistent with the difference between measured and calculated values in minimum horizontal stress. Our results suggest that rock mechanical property such as Young's modulus is a more dominant factor that controls tectonic stress.