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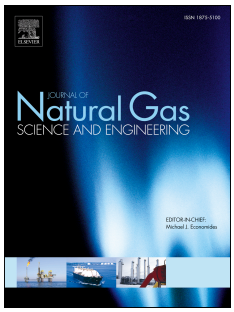

An intelligent approach to brittleness index estimation in gas shale reservoirs: A case study from a western Iranian basin

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An intelligent approach to brittleness index estimation in gas shale reservoirs: A case study from a western Iranian Basin

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Abstract

Brittleness index is one of the key parameters for characterization of unconventional shale gas reservoirs and screening favorable hydraulic fracturing candidates. Brittleness index in shale reservoirs are commonly calculated based on their mineralogical composition or alternatively from dynamic Young's modulus and Poisson's ratio profiles. However, shortage of mineralogical and shear slowness logging data, mainly due to their high costs, may restrict application of these methods in many wells. To overcome this limitation, this paper establishes an intelligent approach to evaluate brittleness from conventional well logs based on data collected from to potential shale gas formations in one of Iranian Basins. The mineralogical analysis (XRD) revealed that both shales are mainly composed of quartz and carbonate minerals and they are highly brittle. Afterward, a rigorous approach, namely adaptive neuro-fuzzy inference system (ANFIS) was employed to develop a robust correlation of brittleness index with conventional well logs. Additionally, a comprehensive statistical and graphical investigation including cross plot analysis, sensitivity analysis by employing a relevancy factor and Leverage approach for outlier data detection was conducted. The results well prooved that the proposed ANFIS model is statistically valid and reliable. Moreover, the developed model were compared to the pre-existing empirical models, yielding the supremacy and superiority of the proposed model over the pre-existing empirical correlations. The model was finally applied to predict brittleness index in the gas shale formations along a well in the study area. Finally, based on estimated brittleness, the potential depth intervals were identified for creation of complex fracture network within gas shale formations.

Keywords: Shale gas; Brittleness index; Hydraulic fracturing; Adaptive neuro-fuzzy inference system