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GEOCHEMICAL AND GEOMECHANICAL RESPONSES OF CANEY SHALE TO FRACTURING FLUID COMPOSITIONS AND RESERVOIR CONDITIONS

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Advancement in unconventional recovery technologies has unlocked considerable petroleum resources that were previously economically unrecoverable. However, hydraulic fracturing (HF) still requires continuous improvement. One challenging aspect of HF is adverse geochemical and geo-mechanical interactions between rocks and fluids when not optimized to match formation and reservoir conditions. During HF, differences in chemical compositions of fracturing fluids, formation fluids, and formation trigger series of geochemical reactions, which adversely impact petrophysical properties of the formation. Presence of high confining pressures in the subsurface complicate these interactions and creates a complex web of interactions that affect both chemical and mechanical properties of the formation. Though much work has been done in characterizing geochemical and geomechanical responses of formations to HF fluids, not many of these studies integrate the two broad responses under varied conditions to obtain a comprehensive characterization of the formation's response

To investigate the geochemical and geo-mechanical responses of formation to varied fluid composition and pressure-temperature conditions, we target the Caney Shale of South Central Oklahoma Oil Province. Two sets of experiments are conducted and compared. Core and powder samples of Caney Shale are respectively subjected to core-flooding and batch reactor experiments under varied conditions of confining pressure, temperature and with/without clay stabilizer treatments. Geotechnical evaluations are undertaken by correlative SEM, EDS, Raman toolset whilst ICP-MS is used for elemental analyses. Geochemical and geomechanical responses of the Caney Shale due to the varied treatments are thus characterized.

Results indicate the effectiveness of clay stabilizers and that potassium chloride functions as a better clay stabilizer relative to choline chloride under conditions investigated. The release of elements such as Ca, Al, Si, Mg, Na and Fe into solution suggests significant geochemical interactions. Changes in microstructural and mechanical properties as well as presence of proppant embedment also confirms the geomechanical impact of HF fluids on formation. This work gives insight on potential strategies to mitigate adverse impacts of HF on subsurface formations and optimization of fracturing fluid compositions for effective hydraulic fracturing in the Caney Shale.

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