Prognosis of In-Situ Stress Regime to Assess the Frackability of Najmah/Sargelu Reservoirs: A Case Study from South Kuwait

Aimen Amer[1], Hanan Abu-Hebail[2], Meshal Al-Wadi[2], Hawas Al-Shammari[2], and Ali Yateem[2]

[1]SIS, Schlumberger, Ahmadi, Kuwait.
[2]Kuwait Oil Company, Kuwait, Kuwait.

ABSTRACT

Najmah and Sargelu of Bajocian-to-Kimmeridgian age reservoirs are fractured reservoirs. To enhance the well deliverability of the reservoirs, wellbore fracking is often attempted as a standard practice. A number of challenges are faced in fracking and post-fracking performance of the wells. With varying well performance results in number of wells, it's postulated that a detailed geomechanical and earth stress modeling may attribute to augment the well performance. Despite the light hydrocarbon presence in these formations, bitumen and high quantities of total organic Carbone, up to 25%, can provide a real challenge to our development strategies. During the study geomechanical rock properties from single and multi-stage triaxial testing of 16 samples of Najmah-Sargelu formations, is carried out. Integration of geomechanical properties, derived from lab and openhole logs, indicates that the unconfined compressive strengths of the formations range from 3150-to-25,520psi. The variation in the ranges mentioned earlier is due to the test being conducted on soft and hard rock samples for calibration purposes. CTscan data before and after the tests, provided the necessary quality-check. The mechanical earth model showed a varying in-situ stress regime over Najmah and Sargelu formations. It's inferred that in Najmah Formation, the stress regime changes in relation to the rock competency. However, a predominant reverse regime ($\sigma H > \sigma h > \sigma v$) is confined to competent rocks and the normal stress regime ($\sigma v > \sigma H > \sigma h$) is confined to the softer rocks. The strike-slip regime ($\sigma H > \sigma v > \sigma h$) is found over the transitional zones. In the proximity to faults and if the well is positioned on the crest or at the flank of a structure, further variations in the stress regime may occur. Frackability in Najmah/Sargelu reservoirs is contingent on the varying stress regimes. The findings will aid in designing hydraulic fracking and draw-down pressures. For instance, a standard frac job over the reverse stress regime zone will result in a horizontal fracture development, leaving the vertical reservoir communication intact. Producing the reservoir with high draw-down pressures, can result in caving's and the production of formation solids that include bituminous material.