

Unravelling the Implications of Structural Controls on Mechanical Stratigraphy and Strong Stress Anisotropy; Designing of Customized Solutions for Well Placement as Part of Field Development Kuwait Case Study

Vijaya Kidambi, Chinmaya Pattnaik, Narhari Srinivasa Rao, Neama Al-Ajmi, Musaed Yaseen Makki Al-Dousiri, Dhiresb Govind Rao
Kuwait Oil Company

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Abstract

Kuwait Oil Company is currently engaged in delineation cum development of one of the structurally complex fields situated in northern part of Kuwait, comprising a stack of deep tight naturally fractured carbonate reservoirs and conventional dolomitic reservoirs, as part of the strategy to meet the long term production targets. The operational area encompasses approximately 1800 sq.km covering eight Oil & Gas fields. The gross reservoir section of Oxfordian to Pliensbachian age is about 2200' thick occurring at a depth of over 15000' having as regional top seal Kimmeridgian - Tithonian age evaporites. Incorporating the data obtained from about 150 vertical / deviated well penetrations including more than 25000' of core data, comprehensive and integrated multidiscipline studies have been carried out over the past few years resulting in very good understanding of the Structural evolution of north Kuwait structures along with mechanical stratigraphy and building of robust Sedimentological & Sequence Stratigraphic models for these reservoirs. In this structurally complex field with intense faulting and fracturing, marked principal stress rotation is observed both laterally and vertically with consequent significant challenges in well design and placement. The Pleinsbachian age unconventional reservoir exhibits

inherent mechanical layering as evidenced by the significant well bore breakouts seen on image logs in addition to anisotropy observed from rock mechanical testing. As these unconventional reservoir underlies the conventional Toarcian age dolomitic reservoirs with preferential withdrawal and associated differences in pore pressure, accessing them has become extremely challenging with recent wells having stuck pipe events leading to large NPT and in some cases eventually to sidetracking. This paper discusses the lessons learnt, customized workflows adopted to mitigate the well placement challenges and the significant success in simultaneously developing the conventional reservoirs and appraising the unconventional reservoirs in this complex field.