Improved Fracture Characterization Through Customized Workflows Leading to Optimal Well Placement and Perforation Strategy in Developing Deep Tight Carbonate Reservoirs — A Kuwait Case Study

Chinmaya Pattnaik[1], Vijaya Kumar Kidambi[1], Rao Narhari Srinivasa[1], Neama Hussain Abdullah Al-Ajmi[1], Abdullah Motar Al-Anzi[1], Christian Staffelbach[2], Jeff Barbe[2]

[1]Kuwait Oil Company; [2]CORIAS

9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

In the northern part of Kuwait encompassing approximately 1800 sq.km, eight Oil & Gas fields are being appraised and developed comprising a gross stack of 2200' thick deep tight fractured Oxfordian - Pliensbachian carbonate reservoirs occurring in the depth range of 15000'. Comprehensive and integrated multidiscipline studies have been carried out over the past few years incorporating the data obtained from about 160 well penetrations including more than 30000' of core data, resulting in very good understanding of the Structural evolution of north Kuwait structures along with robust Fracture Characterization and Sedimentological & Sequence Stratigraphic models for these reservoirs. In particular, as part of Fracture Characterization, comprehensive review of the results of Core Reorientation Study has been carried out encompassing the eight fields and the stack of conventional and unconventional tight carbonate reservoirs. These studies indicate that the fields in northern part of Kuwait have experienced various tectonic movements and developed four sets of tectonic fractures with strikes of N-S, NE-SW, E-W, and NW-SE directions respectively. The distribution of these fractures is plotted statistically on histograms for different type of natural fractures and induced fractures by orientation family and field wise. The core observation has been also compared to borehole images

at the same depth intervals. In the Oxfordian-Callovian age unconventional reservoir, the partially open fractures and the open fractures show homogeneous distribution with main NE-SW strike and a secondary N-S strike direction, with dips almost close to vertical. The cemented fractures show a greater dispersion, with a predominance of the NE-SW and NW-SE direction. However, tectonic stylolites have a major NW-SE direction. In the Toarcian age conventional reservoir, the main direction of the partially and open fractures is NE-SW, with dips close to the vertical and the tectonic stylolites show a great dispersion. The field wise histograms and rose diagrams of induced fractures for both formations show a strong degree of clustering of these fractures in NE-SW strike direction, which is similar to the one observed generally in the region. This paper discusses the customized workflows incorporating fracture characterization, Coriolis Data and Dynamic data leading to optimal well placement and perforation strategy in developing these challenging deep tight fractured carbonate reservoirs.

AAPG Datapages/Search and Discovery Article # 91200 © 2020 AAPG Annual Convention & Exhibition Online, Sept. 29- Oct. 1.