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Biosteering in Margham Field, Onshore Dubai - A Case Study on Significant Updating of the Static Model during a UBCTD Campaign

P.R. Marshall (Robertson - A CGG Company) & A. Henderson* (Robertson - A CGG Company)

SUMMARY

Following successful introduction to the Middle East of underbalanced, coil tubing drilling, with biosteering (use of microfossils from cuttings samples to identify individual layers within the reservoir succession by reference to field-specific zonation schemes) as the geosteering method of choice, a campaign was planned for 2006 in the Margham Field, onshore Dubai. The field, discovered in 1982, had been developed by means of conventional drilling of 17 vertical and 2 deviated wells into Lower Cretaceous carbonate reservoirs over a period of more than 20 years. From the outset, it had been understood that the field was tectonically and structurally complex, forming part of the arc of thrust-affected structures that occur to the west of the Oman Mountains. Conventional biostratigraphy had assisted in early interpretation of major faulting in the Tertiary and Upper Cretaceous sections above the reservoirs, but seismic resolution was unable to clarify any degree of faulting within the Lower Cretaceous.

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A static model of the reservoir horizons was built up almost entirely from hard data from the 17 conventional vertical wells. Considerable updating of part of the model was required during and after drilling of the 2 conventional deviated wells, where biosteering had formed part of the integrated geosteering effort. At the start of the UBCTD campaign, however, only two fault interceptions were recognised within the reservoir section and one of these, of considerable stratigraphic displacement, was believed to form part of the field-bounding fault set.

During the UBCTD campaign at Margham, 11 of the 19 conventional wells were re-entered and 48 laterals drilled. Biosteering formed the main real-time geosteering method, supported by drilling and downhole pressure parameters and the GR log trace from the limited (borehole-constrained) LWD suite. Data were obtained from all laterals and continuously used to advise adjustments to steering for planned targets. In addition, starting from the first lateral, many fault interceptions were recognised and interpreted during drilling (amount and direction of vertical displacement from single interceptions; orientation of fault plane from two or more interceptions). From these interpretations, major adjustments to steering and well plan could be advised for each lateral. Even more significantly, as numbers of fault interceptions increased during the campaign, changes could be made to both the static model and the planning of future laterals. By the end of the campaign, not only could a fully revised static model be produced from the biosteering data and interpretations, but also an entirely new understanding of the effects of the major faults on reservoir compartmentalisation. From these came new plans for field utilisation and management.