SUMMARY

A successful case study on a carbonate heavy/extra-heavy oil field is presented and the techniques and challenges behind the production from highly fractured carbonate Bangestan reservoirs are discussed in this study. The field consists of two fractured carbonate reservoir with about 3.6 billions barrels of initial oil in place of 7.5-18º API heavy/extra heavy oil. The oil viscosity at reservoir temperature (139.3 oF) is around 700-800 cp. The pressure is 927 psi at 1119 mdd but heavy oil does not naturally flow to the surface. Based on field conditions and reservoir characterization, it was decided to implement initially cold production by two experimental methods of lifting with no injection but only swabbing and use of PCP (Progressing Cavity Pumps). simulation showed a good match with the further field data when the cold production scenario was employed. The challenges and techniques employed on field pilot including various techniques of production are summarized and optimized production methods of cheaper lifting procedures of heavy oil to surface is described. Consequently lifting heavy and extra heavy oil to surface using PCP is applicable for this field in stage of cold production prior to any expensive and complicated thermal method implementation in future phases of production.
Introduction
Although there is a wealth of information available on the Lower Aptian stratigraphy in the Middle East, very little is as yet known about the Upper Aptian. During this time interval large parts of the eastern Arabian plate became exposed, affecting one of the most prolific carbonate reservoirs in the region (Shuaiba Formation), and sedimentation was limited to the remaining intrashelf basins. The information presented in this paper goes some way to fill this gap in the stratigraphic understanding of the mid-Cretaceous sedimentary system.

Results
Compelling evidence has been found for major fluvial incisions at the top of the Late Aptian Shu’aiba Formation in Block 5, offshore Qatar (Raven et al., in press). Log correlation, horizontal well results and seismic mapping reveal a major east-west trending, meandering, terraced incised valley running across Block 5, with widely distributed subsidiary valleys. Locally, the main valley reaches 8 km wide and has a depth of at least 30 m. Additional evidence for exposure of the Shuaiba Formation comes from numerous clay-filled and, occasionally, sand-filled karst fissures that have been encountered at the top of the Shu’aiba Formation, penetrating at least 25 m below the top surface.

At one location the complete channel-fill was cored and consists of tidally influenced fluvial sandstone deposits, rich in dispersed organic matter, coal and amber, at the base, passing up into tidal estuarine facies and shoreface deposits at the top. The overlying succession consists of a thin sandy interval, rich in glauconite and iron ooids, that blankets the entire Shu’aiba Formation. These deposits are interpreted as a transgressive back-fill systems tract of a major valley system. The overlying glauconitic and iron oolitic sandstones are interpreted as a strongly condensed facies.

The valley-fill sandstones and overlying condensed sheet sandstones are of latest Aptian age and are followed by a stratigraphic hiatus spanning most of the Early Albian. This entire siliciclastic package is interpreted as a latest Aptian depositional sequence that, in both lithological composition and age, is distinct from the overlying marls and carbonates of the Nahr Umr Formation.

The importance of these observations is that they provide proof for (1) unambiguous subaerial exposure of the the Shu’aiba Formation in Block 5, (2) an Early Late Aptian relative drop in sea level of at least 30 m, (3) a latest Aptian sea level rise of a similar magnitude, and (4) a condensed phase, probably sea level stillstand, during the Early Albian. Since relative sea level fluctuations of this magnitude are likely to have a regional expression, the here established relative sea level curve provides a reference for the Arabian plate.

The palaeogeographical implication of these observations is that the Bab Basin was separated from the siliciclastic sources in the north-west area. Incised river systems providing siliciclastic sediments traversed, however, this palaeogeographical barrier in a south-east and northeast (Pink et al., 2008) direction. In addition, the iron-rich, condensed siliciclastic facies show a remarkable lithological resemblance and occur at a stratigraphically comparable position as the ‘Burgan Sand’ equivalent reported from coastal Fars. This may suggest the presence of a regional condensed stratigraphic interval along a shallow shelf covering at least the cited areas.
Conclusions
The following conclusions are drawn:
1. Proof is provided for a significant fall and rise of sea level, with an amplitude in the order of 30 meters, on the Arabian plate during the Late Aptian.
2. This sea level fluctuation has significant implications for the facies distribution during the Late Aptian, with notably the karstification and valley incision affecting the exposed carbonate platforms, and the mobilization of siliciclastics form the hinterland.
3. This reference sea level curve may be used as a guide to study the Late Aptian geological history at other locations on the Arabian plate.

References
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