Sequence Stratigraphy and Diagenesis of the Mauddud Formation (Burgan Field, Kuwait): A Combined Impact on the Distribution of Reservoir Properties

Omran Alzankawi[2], Laila Hayat[2], Benoit Vincent[1], Joanna Garland[1], Pete Gutteridge[1], and Sarah Thompson[1]

[1]Cambridge Carbonates Ltd., Solihull, West Midlands, United Kingdom.
[2]KOC, Ahmadi, Kuwait.

ABSTRACT

Introduction The Mauddud Formation in the Burgan field and neighboring areas was studied in order to: (1) perform a sequence stratigraphic study, (2) perform a diagenetic study, and (3) to produce paleogeographical maps and reservoir quality maps. The ultimate objective was to discuss the relative impact of depositional architecture and diagenesis on the distribution of reservoir properties. Method Several methods were engaged in this study, including core logging (910ft from 26 wells at 1:50), petrographic qualitative and quantitative analysis of 113 stained and impregnated thin sections, and the integrated reappraisal of an extensive database of plug Routine Core Analysis (RCAL). Results and Conclusions Most of the limestone lithofacies defined in the Mauddud Carbonate Member display mud-supported textures, with skeletal grains, and especially green algae and orbitolinids, grain-supported textures being extremely rare. The sequence stratigraphic interpretation shows that the Mauddud Carbonate Member corresponds to the regressive phase of a 3rd order sequence, composed of 2 successive parasequences, M1 and M2. The regressive part of M1 corresponds to a NE progradation of shallow marine deposits over deeper facies. The M2 transgressive phase corresponds to a limited flooding with a SW retrogradation of the depositional facies belts. Finally, the regressive part of the M2 parasequence corresponds to the extension of inner platform settings throughout the study area. The top Mauddud is a key sequence boundary, with a karst system developed at the Late Albian, when the Burgan area experienced a significant uplift prograding from the SW to the N-NE. Sedimentary facies, with the dominance of mud-supported textures, together with diagenesis, are responsible for the high proportion of microporosity within the matrix and grains in the Mauddud, which is confirmed by RCAL data, with porosity reaching up to 35% or more, but permeability never exceeding 100mD. Porosity maps generated for the M2 parasequence show a consistent pattern of increase of porosity from NE to SW close to the uplifted area. This confirms the impact of the Late Albian subaerial exposure and associated meteoric diagenesis on the distribution of reservoir properties, with possible preservation and enhancement of micrite microporosity. Acknowledgments We would like to acknowledge KOC for having supported this project and for the authorisation of publication.