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Sequence Stratigraphy and Sedimentary Environment of the Upper Part of Main Pay Member in Rumaila Oil Field

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SUMMARY

The Main Pay Member in Rumaila oil field has had a very high recovery of OOIP by now. The key study has been focused on the distribution of remaining oil. However, due to the incision of fluvial channel to each other, it is very difficult to reveal the nature of small-scale sequence stratigraphy and sedimentary evolution. This study developed a detailed sequence stratigraphic and sedimentary framework based on integration of the regional geological background, the core description data, the modal data, the palynology and biostratigraphy data and the wire log data. The estuary stratigraphic and facies model fit perfectly with core and log data in the upper part of Main Pay Member. It can explain the reason why sand bodies and shale in AB and C units are continuous in a large scale respectively and the genesis of the unconformity surface between AB and C. The model also explained the evolution process of ancient estuary including the process of delta vanishing, estuary emerging, developing, and vanishing. It is hoped that, the model can help to study the residual oil in the Main Pay Member and to identify the ancient estuary.

Introduction

The Zubair Formation is the most significant sandstone reservoir in Iraq, which is composed of fluvial-deltaic, deltaic and marine sandstones. It covers wide areas of the Arabian Plate including northern Saudi Arabia, Kuwait and most of southern and part of Central Iraq. The Main Pay Member is the main pay in the Zubair Formation in Rumaila oil field. It is the upper sandstone interval in Zubair formation which dominate the southwest margin of Mesopotamian basin in Barremian stage (A. A. M. Aqrawi et al. 2010). The Main Pay Member are subdivided into 5 units, including AB, C, DJ, K and LN in Rumaila oil field. AB, DJ and LN are sandstone intervals, with few thin local impermeable barrier mudstone intervals in them. While C and K are mudstone intervals, which are regionally continuous, and separated the Main Pay Member into three different small reservoirs.

The recovery of OOIP for the Main Pay Member has been very high in Rumaila Oil field by now, and the key study has been focused on the distribution of remaining oil. Therefore, the distribution of local impermeable barriers which greatly control the distribution of remaining oil should be clear. And the distribution of them are mainly determined by sequence stratigraphic and sedimentary distribution. By now, only regional sequence stratigraphic and sedimentary background are available for the Main Pay Member in Rumaila oil field. That is insufficient for the geological description and for the guideline of production.

Furthermore, due to the incision of fluvial channel to each other, it is more complex to reveal the nature of sequence stratigraphy and sedimentary evolution. And these features are at such a scale that they are unable to be resolved by the field wide 3D seismic data.

Materials and Methods

This study is an attempt to develop a detailed sequence stratigraphic and sedimentary framework for the upper part of Main Pay Member which includes unit AB, C and DJ. Due to lack of many essential data, the lower part cannot be included in this study but are conjectured to be similar with the upper part because they are two adjacent stratigraphic sequence in the same order and with similar wire logs. The approach is based on integration of:

1) The regional geological background,
2) The core description data,
3) The modal data,
4) The palynology and biostratigraphy data and
5) The wire log data.

The study also combines the modern estuarine models (Robert W. Dalrymple et al. 1992, G. P. Allen et al. 1993), and takes into consideration the basic concepts of sequence stratigraphy (Octavian Catuneanu 2006, Ashton Embery 2009). Palynology analysis plays a very important role in the study. At last, a stratigraphic and facies schematic model is built up for the upper part of Main Pay Member (Figure 1).

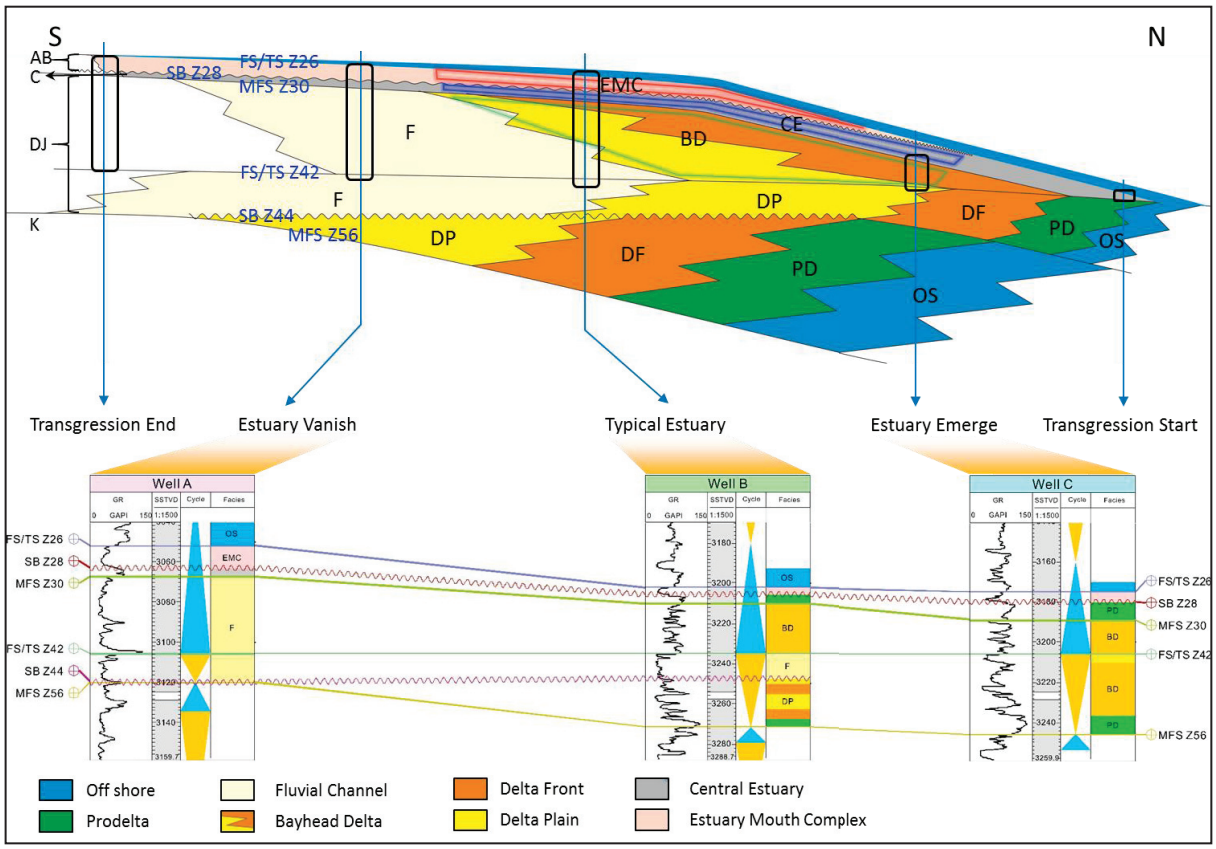

Figure 1 *Stratigraphic and facies schematic model for the upper part of Main Pay Member in Rumaila oil field. The model shows the evolutional process of ancient delta and estuary, including the process of prograding delta transferring into retrograding delta, the process of retrograding delta transferring into estuary, and the process of estuary vanishing.*

Conclusions

1) The upper part of Main Pay Member is deposited in the environment of a combination of delta and estuary in the north and gradually changed into fluvial channel in the south in Rumaila oil field. The prograding delta lies in the bottom of the upper part of Main Pay Member, with the sequence boundary in it as the boundary of Highstand Systems Tract and Lowstand system Tract. The retrograding delta and estuary lies above the sequence boundary, with the maximum regressive surface as the boundary between them.
2) Following the transgression, the retrograding delta gradually withdrew into the fluvial mouth and transformed into bayhead delta. Meanwhile, the prodelta transformed into central basin, which was separated from offshore marine shale by the estuary mouth complex. Between them is the ravinement surface (SB Z28), which is probably wave-dominated.
3) The top surface of Main Pay Member is a high diachroneity surface. It begins at the maximum regressive surface in marine direction in north of Rumaila oil field, and ends at the maximum flooding surface in terrestrial direction in south of Rumaila oil filed.
4) The estuary stratigraphic and facies model fit perfectly with core and log data in the upper part of Main Pay Member. It can explain the reason why sand bodies and shale in AB and C units are continuous in a large scale respectively and the genesis of the unconformity surface between AB and C.
5) The model is based on the slow initial rise sequence stratigraphic model which has not been offered by logs and cores. This model may provide the evidence in support of the slow initial rise sequence stratigraphic model.

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