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Depositional Environment and Facies in Units 2A, 2B and 2C of The Graben Trend in Arthit Field, North Malay Basin, Gulf of Thailand

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Abstract

This study focused on cores from the Arthit Area. The depositional environment was interpreted to be a tide-dominated shoreline and the facies represent a stacked mouth bar and a variety of tidal sediments. The thin individual mouth bar sands indicate a small fluvial system not more than a few hundred meters across. The small delta system may have generated stacked mouth bar sands that are well-connected over an area of a few km^2 by lobe switching, but they would not have extended the multi-km distance between wells. The tidal sands, although laterally extensive, have poor reservoir properties. Well log patterns correspond to lithology in the cored intervals but the log signatures are not always reliable indicators of depositional environment. They often are recording minor local events and not the regionally significant flooding surface that are parasequence boundaries. This is problematic for well to well correlation over distances of several km and can easily lead to miscorrelation.

Keywords: sandy mouth bars, tidal flat, depositional environment

1. Introduction

The Arthit concessions cover approximately 3933 km^2 and are located on the northwestern margin of the Malay Basin. The basin is an intra-cratonic basin formed by rifting in early Tertiary time, along North-South (N-S) and Northwest–Southeast (NW-SE) oriented normal faults forming a series of asymmetric half grabens.(Figure1)

The study area is the Graben Trend. The graben is bounded on the west by the predominantly east-dipping faults of the Hinge Zone. On the east the graben is bounded by a series of predominantly west-dipping faults. The syn-rift and early post-rift reservoirs thicken considerably in the graben trend.

The main objective of the study is to improve the understanding of the depositional environments in one of the early post-rift reservoir units in the graben trend of the Arthit area and how those environmentsvary laterally and stratigraphically.

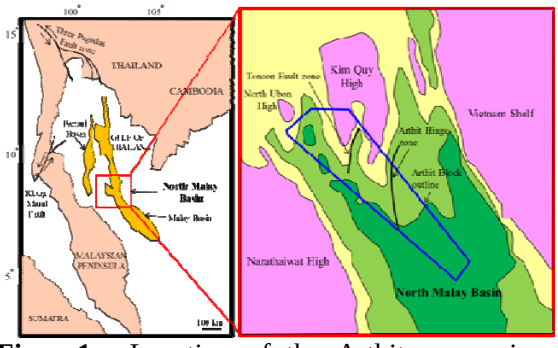

Figure1. Location of the Arthit concession block in the Gulf of Thailand.

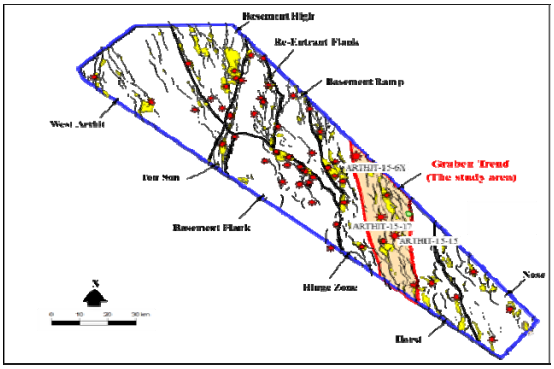

Figure 2. The map shows the study area which is situated in the Graben Trend in the Arthit concession.

2. Methods

Core observation and interpretation were the first steps of data interpretation. The sedimentary structures and trace fossils observed in the core were the key for the interpretation of depositional environments, as well as integrating palynology to validate the interpretations. Core to well log correlations were done to determine how gamma ray log pattern changes in comparative to the cored intervals.

3. Results

A reassessment was done of conventional core from FM2 (which has 3 unitsin this study, 2A, 2B, 2C, from bottom to top). In this revised interpretation most sandier units show evidence of tidal influence as in; Tidal sand flat, Tidal mix flat, Tidal mud flat facies associations (Figure 4,5 and 6). There also is a stacked mouth bar succession (Figure7).

Over, the cores from the 3 studied wells are interpreted as a tide-dominated shoreline. Cores and well logs show a good correlation. As a sandy mouth bar was represented by block-shaped gamma curve, whereas tidal flat was represented by both coarsening and fining upward trends depending on sand and mud proportion, are confuse with channel in fluvial environment.

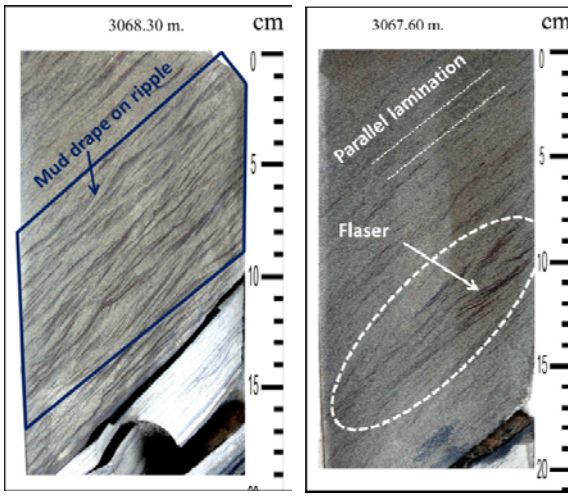

Figure 4. Tidal sand flat

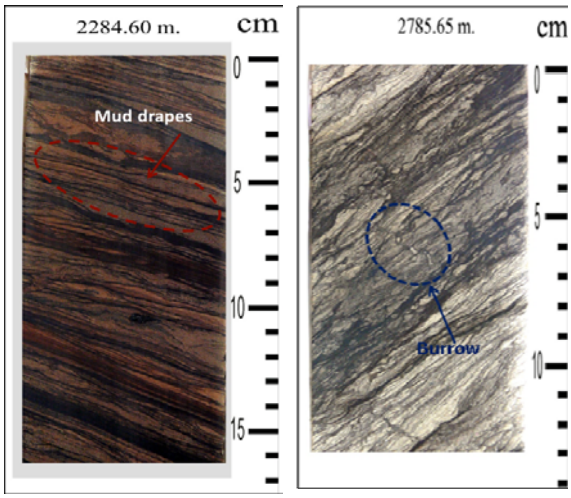

Figure 5. Tidal mixed flat.

4. Discussion

A depositional model of the study area can interpreted from the results of the core studies. There is a sandy mouth bar and found evidence of tide influence. The mouth bar facies suggests that sediments assume their ultimate character after deposition by fluvial processes and subsequent reworking by tidal currents and minor wave influence. Therefore, the overall depositional environment in the study area is a tide-dominated shoreline as shown in Figure 8.

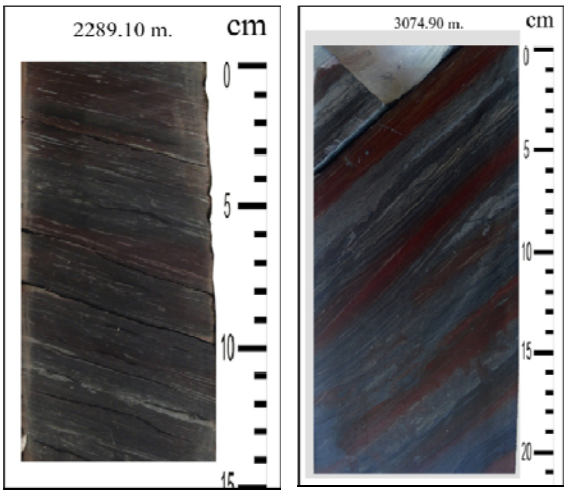

Figure 6. Tidal mud flat.

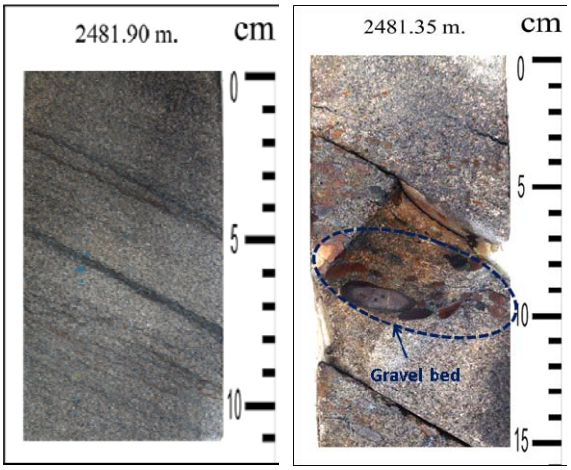

Figure 7. Sandy mouth bar.

The deposits of one mouth bar are 1 – 3 m thick, with the complete succession of stacked lobes totaling 12 meters. The mouth bar sands have good reservoir properties with high porosity and permeability However, the thin individual mouth bars indicate a small fluvial system so one mouth bar almost certainly extended laterally no more than a few hundred meters. The small delta system may have generated stacked mouth bar sands that are well-connected over an area of a few km^2 by lobe switching, but they would not have extended the multi-km distance between wells. The tidal sands, although laterally extensive, have poor reservoir properties.

In this study, vertical well log patterns correspond to lithology in the cored intervals. However, many of the tidal successions fine upward and, without core control, could be interpreted as fluvial successions. Therefore, log signatures are not always reliable indicators of depositional environment so log pattern must be used cautiously wherever mixed environments are possible. In this study, palynology was available only from one well and it proved very useful for defining paleoenvironments; microfossil data can help to resolve depositional environments in areas where log signatures may be unreliable.

The thin, tide-dominated marginal marine successions, and their limited lateral extent, make well-to-well stratigraphic correlation difficult in the study area. Abrupt sand to mudstone transitions can occur with relative water depth changes of only 1 or 2 m so they often are recording minor local events and not the regionally significant flooding surfaces that are parasequence boundaries. This is problematic for well-to-well correlation over distances of several km and can easily lead to miscorrelations.

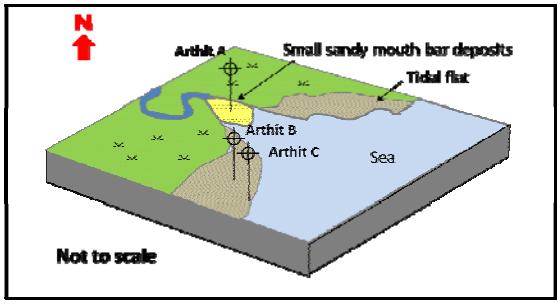

Figure 8. The tide-dominated shoreline depositional environment model for the study area and the relative position of the three Arthit wells.

5. Conclusions

(a) This study classified depositional environments using core. The depositional setting is a tide-dominated marginal marine.
(b) A small mouth bar succession indicates the presence of a small fluvial system.
(c) Well log pattern corresponds to lithology in the cored interval but they are not always reliable indicators of depositional environment because
(d) tidal successions look like fluvial deposits.
(e) It is difficult to distinguish a local flooding surface from a parasequence. Thus, well logs must be correlated cautiously.

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