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Development Sedimentary Concept – An Overlooked Opportunity In Bentayan Structure, North Palembang Sub-Basin, South Sumatra Basin

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Abstract. Bentayan's structure is one of the major structures in PT. Pertamina EP, whose daily production at July 2019 reached 1,649.2 BOPD. This production is the largest one in the southern part of Pertamina EP Asset 1 (Jambi, Lirik, Ramba). Bentayan is also one of the structure with a large area that extends from South East (SE) to North West (NW) which until now has only been one-third produced. Building concept is carried out on this field, in order to get new opportunities, especially in the two-thirds of the Bentayan Structure. Sediment concept of Bentayan, especially TAF, was formed at the Late Oligocene age, dominated by precipitated sandstone deposits with repeated shale and coal rocks, which are either delta or fluvial deposits. The formation of TAF itself can be divided into two characteristics, its lower TAF and upper TAF, which in lower TAF conditions can be seen once the pattern of the fluvial channel sediment pattern and above TAF is the deltaic sediment system with the influence of waves. The formation of the precipitate was allegedly from the North - North East provenance, which is a high named Sembilang high and Merang High. In determining a reservoir tank at a structure, the zonation division on TAF is divided into 4 (four) zones, namely A layer, B layer, C layer and E Layer. In the four zonations it has a special character from the High Stand System Tract condition, where the fluvial deposit dominate the Lower TAF and the Delta Front deposits are above it. Channels formed on lower TAF intersect with other channels and cause the channel pattern that is formed to be unpredictable due to amalgamation due to the intersection of each channel as reservoir tanks in these conditions. This is an advantage in developing structural properties through a development drilling mechanism, although having the same reservoir pressure value in the reservoir C Layer (TAF) is due to the individual permeability barrier by reason of the presence of shale in highstand system tract conditions This new sedimentation concept will generate a new opportunity to add new reserves, 1.33 MMSTB in the wild area. Even still able to open Giant Prospect with high opportunities in NW section of working area. It can be believed that the presence of hydrocarbons with this Potential is flanked by two large fields, first one is Grissik Field (the largest gas producer in Indonesia) and second one is Bentayan Existing Field (Cumulative Production of 29,676 MSTB). The optimization of the field will be carried out with the latest concept so that the optimal development process and method can be obtained.

Keyword: sediment concept, High Stand System Tract, amalgamation, optimal development process

1 Introduction

Bentayan structure is one of the oil and gas Field in the North Palembang sub-Basin, South Sumatra Basin. The Bentayan structure is located in the North Palembang subbasin in the South Sumatra Basin. Located as far as ± 129 Km from the Palembang City and as far as ± 160 Km from the Jambi City. (Figure. 1).

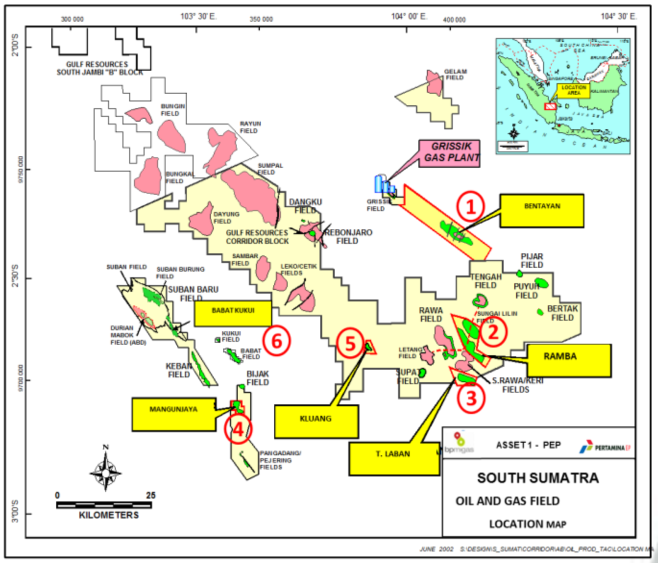

Figure. 1 Working Area, PT. Pertamina EP Asset 1.

Bentayan structure is one of the main structures at PT. Pertamina EP, whose daily production in July 2019 reached 1,649.2 BOPD and now in November 2019 it has reached 2,002 BOPD. The increase in production was due to Drilling and Workover activities after changing the concept of field development (Figure. 2)

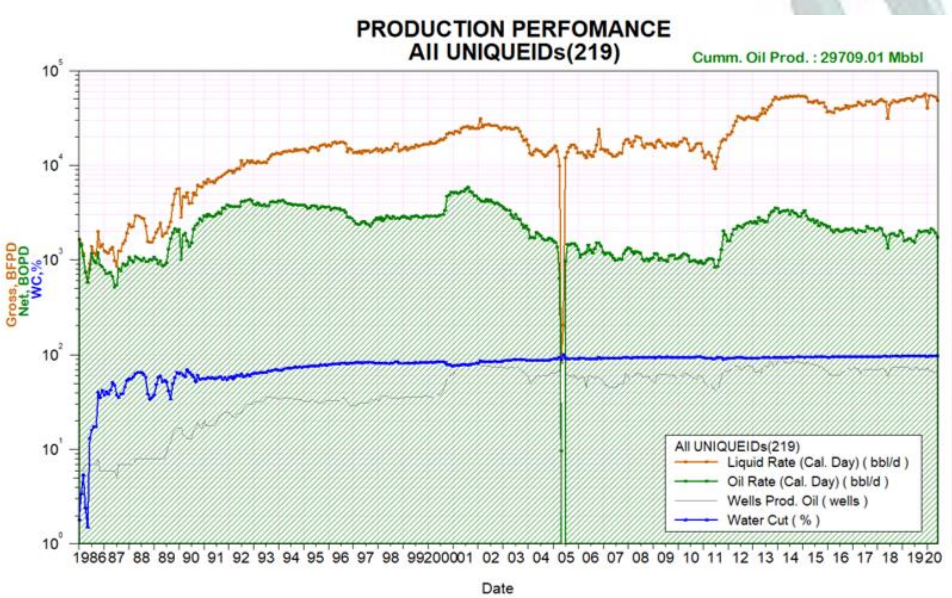

Figure. 2 Production Perforamance of Bentayan Structure.

Bentayan structure from the beginning until 2018 still uses lithostratigraphy concept, and the concept is used to determine the layer zone in Bentayan Structure. The concept of lithostratigraphy starts to be changed to the concept of sequence stratigraphy, to select the reservoir zones based on facies and the Environment of detection.

The initial start of using the concept of sequence stratigraphy begins with the renovation and Formation architecture in the Fluvial System to Deltaic System depositional environment, from these results determine the division of facies details in order of sequence stratigraphy.

2 Methodology

Combination of Core Data and well data are needed in integration of Architectural interpretation the Talang Akar Fm. From the construction of sediment deposition architecture in the Talang Akar Fm is used as the basis for drawing the marker to find out the distribution of facies in all the Bentayan structure wells. Then facies modeling is used as a reference for zoning determination which has never been carried out in a workover manner and determining development drilling placement. After facies modeling, then selecting candidates to do facies distribution with stratigraphy order sequence correlation control is used as the selection of workover well candidates. Mapping from making facies of this model aims to develop workover as well as reference to the determination of drilling proposals as a follow-up. Development of new concepts carried out in this field, in order to obtain opportunities that have not been seen, both in the existing one-third area and especially in the two-thirds of the North – West area of the Bentayan Structure. The construction of this concept includes sedimentology and stratigraphy, namely how the existing reservoirs are distributed and deposited, how the facies develop from South – East to North – West. How the sediment deposition model from provenance to the opportunity get on hydrocarbon reserves. In developing the concept of determining reservoir distribution, correlation markers are carried out based on a very detailed sequence of architectural chronology, separating 3rd Order to 5th Order. The sequence is a cycle made up of genetically related strata units (sequences and track systems) that are limited. The case study in the Bentayan structure, from regional strata units based on the deposition of Telisa Fm is the boundary between the regression system and the transgression system, where Talang Akar Fm is a highstand deposit product, then leads to a younger strata unit, Fm. Telisa is a lowstand deposit product (Figure. 3).

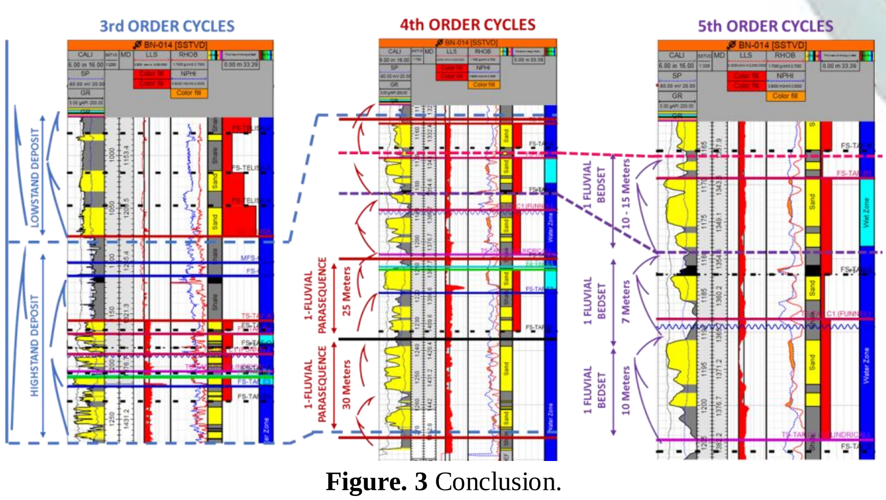

Figure. 3 Conclusion.

The existing reservoir of the Bentayan structure is dominated in Talang Akar Fm, which is a part of 3rd Order (Sequence), which is then subdivided into 4th Order (Para-Sequence Sets with strata unit thickness of 25 - 30 meters (TAF-A, TAF-B, TAF-C & TAF-E). In the next sequence is divided into 5th order (Bed-Set) with a thickness of about 5-15 meters, to form parts of the TAF-A layers (TAF-A, TAF-A1, TAF-A2, etc.), TAF-B Layers (TAF-B, TAF-B1, TAF-B2, etc.), TAF-C Layers (TAF-C, TAF-C1, TAF-C2, etc.) and the TAF-E Layers (TAF-E, TAF- E1, TAF-E2, etc. (Figure. 4)

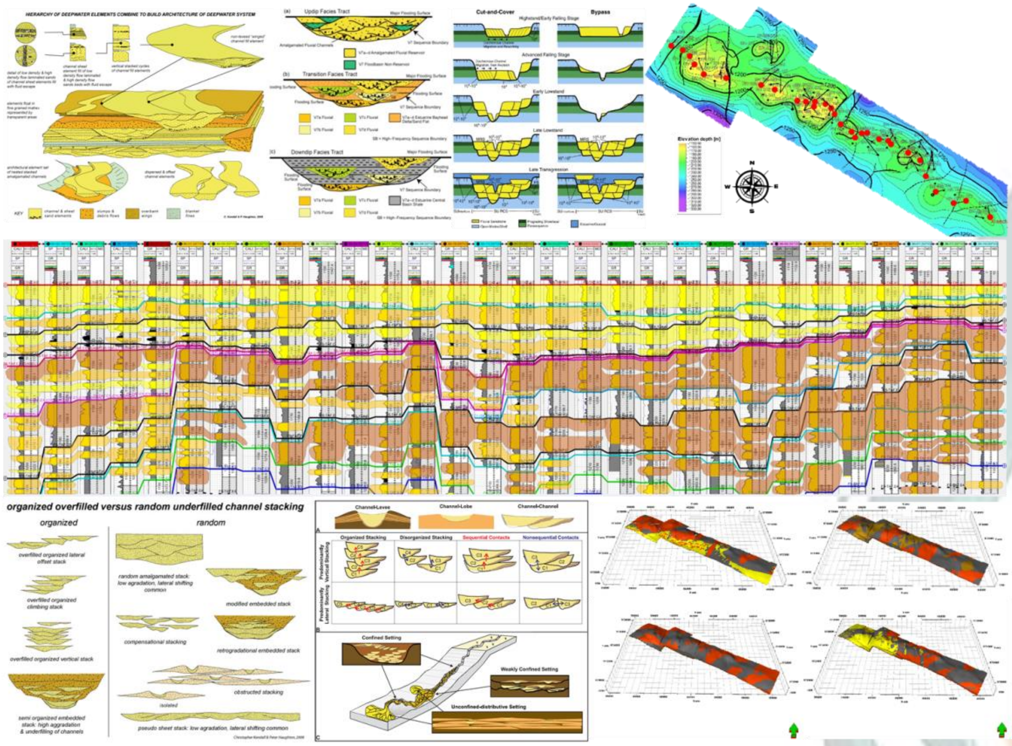

Figure. 4 Well stratigraphy correlation prove from fluvial system to deltaic system (3rd Order Fluvial Sequence u to 4th Order Fluvial Parasequence and stacking deposited 3rd Order Deltaic Sequence up to 4th Order Parasequence)

3 Conclusion

The distribution of each order sequence stratigraphy in the Bentayan structure helps to process the distribution of zoning in each reservoir tank, in this division is only aided by pressure data that is well distributed in the TAF-A Layer, TAF-B Layer, TAF-C Layer and TAF-E Layer ranging from 1400 to 1500 psi, the correlation process in sequence stratigraphy is quite complicated. in this division is only aided by pressure data that is well distributed in the TAF-A Layer, TAF-B Layer, TAF-C Layer and TAF-E Layer ranging from 1400 to 1500 psi, the correlation process in sequence stratigraphy is quite complicated. The complexity of the correlation process can be overcome by determining the key markers that are determined in the process of making architectural concepts from 3rd Order, 4th Order to 5th Order. The division markers can explain how the depositional sequence starts from the fluvial Parasequence set at the TAF-E Layer, followed by the Fluvial Parasequece set at the TAF-C Layer, then followed by deltaic Parasequence at the TAF-A and TAF-B layers.

Stacking patterns ranging from Fluvial Genetic Units to Deltaic Genetic Units, some of the sediment is mixed because the accommodation space in the area is not suitable by influx sediment, so that stacking occurs when the product channels of fluvial genetic units accumulate randomly, as a result the process of amalgamation occurs in the fluvial system (Figure. 4) however, in the deltaic genetic unit condition, some channels do not undergo active deposition processes, due to the presence of deltaic genetic unit deposits and the start of transgressive conditions in the TAF-B to TAF-A layers (Figure. 5).

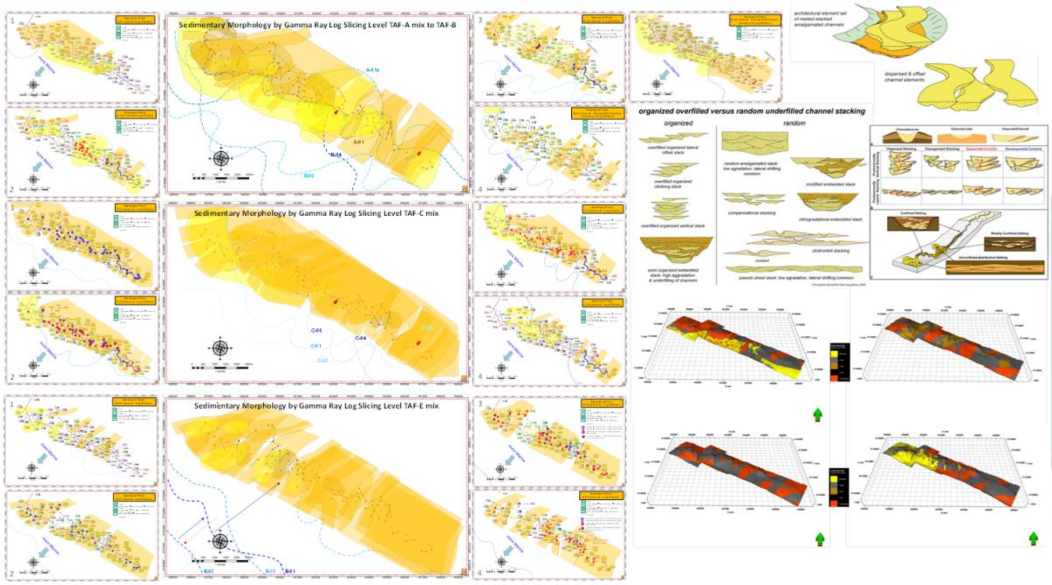

Figure. 5 Sedimentary Morphology by Gamma Ray Log Slicing in Level TAF-A to TAF-E shows variety of classes. Some of them give major influence in term of permeability barrier.

The uniqueness of the Bentayan structure does not stop there., with a very heavy oil character (19° – 20° API) and oil viscosity of 10 – 11 cp in reservoir conditions, sediment fluvial genetic units especially in TAF-C the phenomenon of non-absorption between oil fluids in each tank reservoir due to the presence of a personal permeability barrier in the body of each channels, even though the permability conditions very good shape (200mD to 1000mD). The personal permability barrier is caused by the process of forming of the channels in fluvial genetic units until deltaic genetic units undergo a shifting sediment supply process because each channel intersects by each other and forms facies of the point bar, channel bar, and talweg side bar.

Understanding the Paleomorphology as the facies habitat, were useful to define the preliminary model, grid separation and reservoir geometry. The unique paleomorphology act as the main control for the depositional Environtment of Talang Akar formation. There is a strong dependency of particular facies with the hydrocarbon generation to the reservoir. The Fluvial System to Marine System Reservoir in Bentayan can still be developed further because the process of sediment accomodation is very varied because the process of fluvial sedimentation and deltaic deposits is very active (Figure. 6)

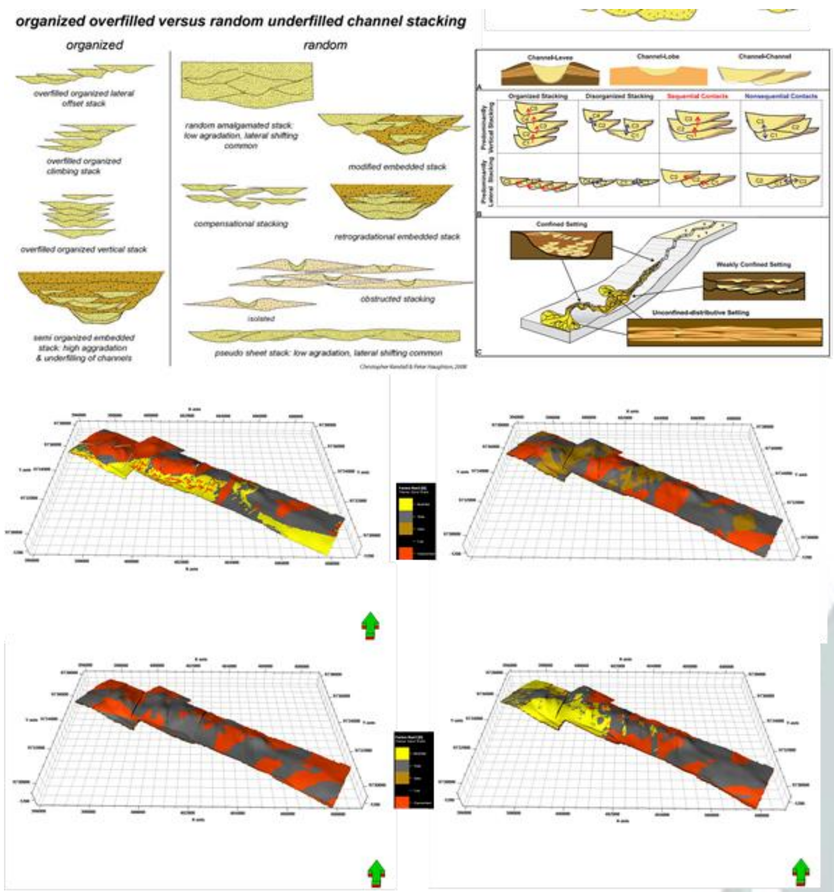

Figure. 6 The Fluvial System to Marine System Reservoir applied to facies model according to the sedimentary block model.

Sequence Stratigraphy Method classification shows variety of classes. Some of them give major influence in term of permeability barrier. Reservoir behavior and pressure data are the best way to verify the differences, moreover as tools whether to separate or to merge the reservoir unit. The methods to classify the facies were very helpful on this field, especially in detecting the stratigraphic variation and its capacity for hydrocarbon trapping.

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