Characteristic And Distribution of the Turbidite Trap in Late Miocene – Pliocene in The Center Of Nam Con Son Basin, Offshore Vietnam

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Abstract

Nam Con Son Basin is one of the biggest Cenozoic basins in Vietnam, predicted a major gas potential resources of Vietnam. In order to improved the efficiency of research on the hydrocarbon exploration activities in the Nam Con Son basin, especially with the stratigraphic traps which has been being discovered and developed in the recent years, the purposes of the research is to clarify the forming characteristics, and distribution of the stratigraphic traps (turbidite fan) in the centre of Nam Con Son basin, from which proposed the process and research methodology this subject in the centre of Nam Con Son basin in particular, and in the surrounding areas where have similar geological conditions.

Data used in the case study consists of the summarises the regional geological studies, the elements that effected the formation of the Nam Con Son basin, and the geophysical studies as: 3D seismic PSTM, well-log data of exploration, appraisal and production wells in the centre of Nam Con Son basin.

This case study is: (i) to bring out more clearly the characteristics and distribution of the stratigraphic traps in Nam Con Son basin in general, the characteristics and distribution of the late Miocene - Pliocene turbidite in the centre of Nam Con Son basin; (ii) to contribute improving the methodological hydrocarbon exploration and evaluate (preliminary) the total hydrocarbon recoverable reserves of the late Miocene - Pliocene turbidite in the centre of Nam Con Son basin; (iii) to improve the efficiency of research on the hydrocarbon exploration activities in the Nam Con Son basin in the coming period; (iv) to orient the exploration activities for the late Miocene - Pliocene turbidite in Nam Con Son basin, and in other similar sedimentary basins of Vietnam.

The work was carried out in the research including:

- Analysis borehole geophysical data of exploration, appraisal and production wells in the centre of the Nam Con Son Basin to provide quantitative indicators for turbidite characterization (thickness, sand/clay ratio, porosity, permeability...);

- Methodology to research the stratigraphic traps (turbidite) on the basis of the theory of the sequence stratigraphy and seismic sequence stratigraphy;
- The basis of selecting seismic attributes for turbidite; Interpretation of 3D seismic data and analysis of 3D seismic attributes for turbidite;
- Application of artificial neural network (ANN) on the basis of integrated result of the seismic attributes analysis and borehole geophysical analysis to determine the distribution of the late Miocene – Pliocene turbidite in the centre of the Nam Con Son basin.

Synthesize research results lead to some conclusions as follows:

- The stratigraphic trap of the late Miocene – Pliocene age in the centre of the Nam Con Son basin is turbidite, was created after the post-rift stage, in deep sea environment. Source material was transported from the mainland (western) with the sea-bed's sudden change of depth, the sediments deposited from a turbulent flow as turbidite fan, where the transition zone between the edge and the deep-sea waters, (in the zone between the shelf and shelf slopes).
- Over the time and the sediment accumulation in the centre of the Nam Con Son basin, the late Miocene turbidite fan has more coarse-grained size, the percentage of sand / clay greater, thickness thicker (reservoir better) than the Pliocene turbidite.
- The orientation of the shelf-break line to the East of the basin, and the slope angle more and more gently, associated with the relative sea level slowing down (in late Miocene) at the end of the Lowstand System Tract (LST) and associated with the low rate of sea level decrease (in late Miocene) and then switch to the steady state (in Pliocene), then move on to the first period of sea-level rise (after Pliocene), led to turbidite fan formed during the late Miocene have got a size distribution smaller, located near the foot of shelf slopes than the turbidite fan formed during the Pliocene. Size distribution of turbidite fan was delineated for the central region Nam Con Son basin on the basis of the seismic attribute analysis combined with well log analysis.
- The component of the turbidite sand is from medium to well rounded and sorted grain, the relative distribution turbidite from a few square kilometers to less than 20 square kilometers, the net pay of a few tens of centimeters to several meters up to an individual two dozen meters (especially 25m). The characteristics of turbidite were also statistically quantified: thickness, ratio sand /clay, porosity, permeability... on the basis of well analysis (log, core, cutting sample…), and classified by net-pay, net to gross, porosity, and permeability… based on the well-log analysis and core analysis.