

^{PS}Dynamic Changes of Palaeotopography and Their Control on the Migration of Delta Lobe - Research on Liaoxi Low Uplift of Bohai Gulf Basin, China*

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Abstract

The control of palaeotopography on the distribution of sandbodies has been well studied in continental rift-subsidence basin, while the research on the dynamic changes of palaeotopography caused by unbalanced tectonic movement in the sequence framework and their control on the migration of delta lobe are quite few. This paper discusses how it works by taking Liaoxi low uplift of Bohai Gulf Basin in China as an example. Liaoxi low uplift is controlled by the north-southward boundary fault, with two sags on both sides of the uplift. Traditionally, it is regarded that there is no deposition from west because of the obstruction of the boundary fault, and the reservoir of Dongying Formation is constructed by the delta that is distributed along the slope north-southward. But new evidence indicates that the north-southward delta is pseudomorphism resulting from the lateral migration of three east-westward delta lobes. The three lobes correspond with three topographic lows which are controlled by three adjusting belts from north to south due to the unbalanced movement of the boundary fault of low uplift. Further study based on high resolution sequence analysis shows that the movement of boundary fault is unbalanced horizontally and spatially. The lateral migration of delta lobes in different system tracts is controlled by the dynamic changes of Palaeogene affected faults. During low system tract of Dongying Formation, the growth index of boundary fault in the north accommodation zone is low, while those of the middle and south are high. So it is easy for sediment migrating from west to the uplift through the north least-active accommodation zone, and it is blocked in the middle and south zones. As a result, deltas are well developed in the northern part and less developed in the mid-southern part of the uplift. During transgressive system tract, the fault growth index of middle accommodation zone is low and deltas are dominantly developed in this area and less developed in the other two accommodation zones. During high system tract, the fault growth index in middle-south zones are low, correspondingly deltas are well developed in these areas. The deltas are controlled by the dynamic changes in time (sequence position) and space (palaeogeomorphology) of the provenance. The detailed study of the delta migration can not only help to discover the main controlling factors of petroleum accumulation, but also identify the exploration direction of subtle reservoir.

Dynamic changes of Palaeotopography and their control on the migration of delta lobe Research on Liaoxi low uplift of Bohai Gulf Basin, China

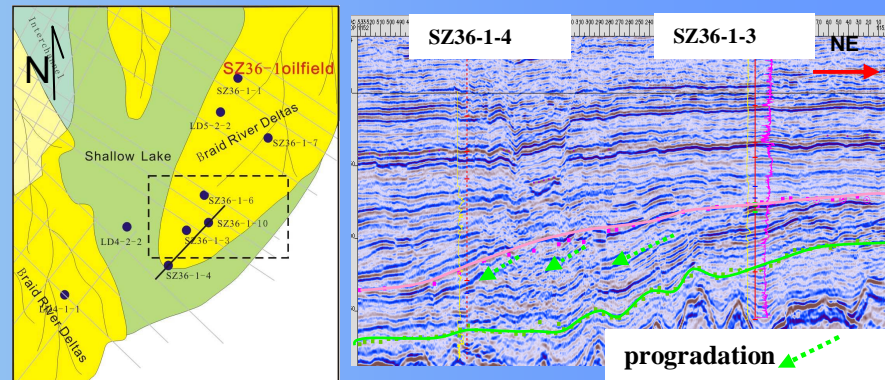
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Abstract

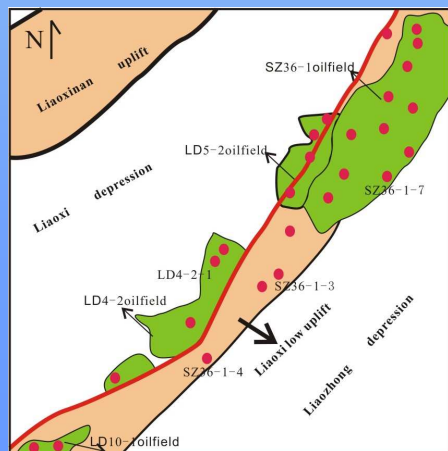
The control of palaeotopography on the distribution of sandbodies has been well studied in continental rift-subsidence basin. While the research on the dynamic changes of palaeotopography caused by unbalanced tectonic movement in the sequence framework and their control on the migration of delta lobe are quite few. This paper discusses how it works by taking Liaoxi low uplift of Bohai Gulf Basin in China as an example. Liaoxi low uplift is controlled by the north-southward boundary fault, with two sags on both sides of the uplift. Traditionally, it is regarded that there is no deposition from west because of the obstruction of the boundary fault, and the reservoir of Dongying Formation is constructed by the delta that is distributed along the slope north-southward. But new evidence indicates that the north-southward delta is pseudomorphism resulting from the lateral migration of three east-westward delta lobes. The three lobes correspond with three topographic lows which are controlled by three adjusting belts from north to south due to the unbalanced movement of the boundary fault of low uplift. Further study based on high resolution sequence analysis shows that the movement of boundary fault is unbalanced horizontally and spatially. The lateral migration of delta lobes in different system tracts is controlled by the dynamic changes of palaeogeography affected by faults. During low system tract of Dongying formation, the growth index of boundary fault in the north accommodation zone is low, while those of the middle and south are high. So it is easy for sediment migrating from west to the uplift through the north least-active accommodation zone, and it is blocked in the middle and south zones. As a result, deltas are well developed in the northern part and less developed in the mid-southern part of the uplift. During transgressive system tract, the fault growth index of middle accommodation zone is low and deltas are dominantly developed in this area and less developed in the other two accommodation zones. During high system tract, the fault growth index in middle-south zones are low, correspondingly deltas are well developed in these areas. The deltas are controlled by the dynamic changes in time(sequence position) and space(palaeogeomorphology) of the provenance. The detailed study of the delta migration can not only help to discover the main controlling factors of petroleum accumulation, but also identify the exploration direction of subtle reservoir.

2. Traditional cognition of sedimentary facies



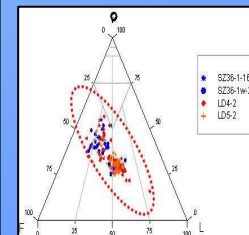
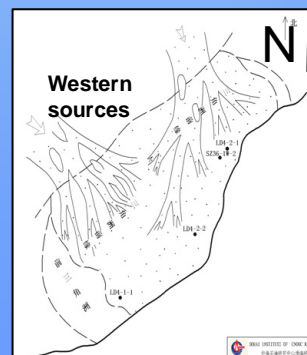
Traditionally, it is regarded that the reservoir of Dongying Formation is constructed by the delta that is distributed along the slope north-southward. There is no deposition from west because of the obstruction of the boundary fault.

1. Geological setting

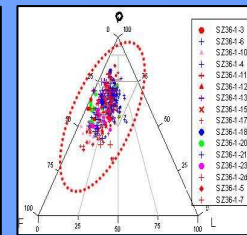


The regional structural location of middle-south Member of Liaoxi Low-uplift: The west of it is Liaoxi depression and Liaoixinan uplift, the east of it is Liaozhong depression. There are three oilfield in the Liaoxi Low-uplift.

3. New cognition of sources



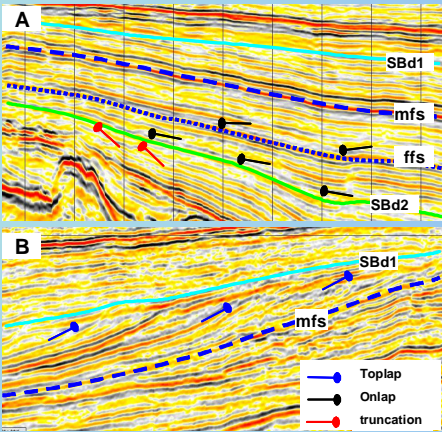
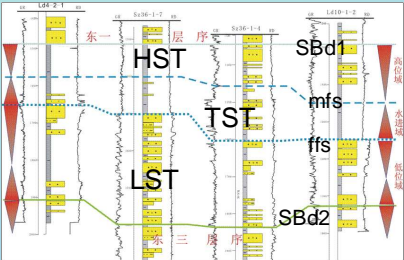
high maturation sandstone in west of fault



low maturation sandstone in east of fault

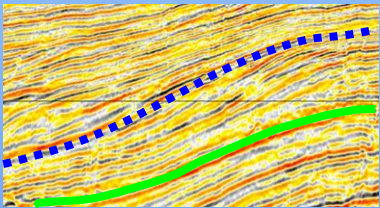
Along with the development of oilfield, basic geological data become more and more complete. New data indicated the source maybe come from west! The north-southward delta above-mentioned maybe a pseudomorphism resulting from the lateral migration of east-westward delta lobes.

4、New research–Sequence analysis

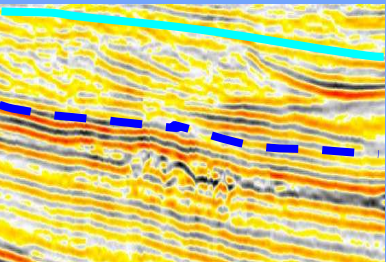


From the systematic study of tectonic-sequence stratigraphy of Paleogene Dongying Formation in the central and south section of Liaoxi low uplift, the high-resolution sequence stratigraphy framework is established and Dongying group is divided into three 3rd-order sequences. The LST ,TST and HST can be recognized effectively in the Dong 2 sequence based on multi-well and seismic reflection features of system tracts boundaries .

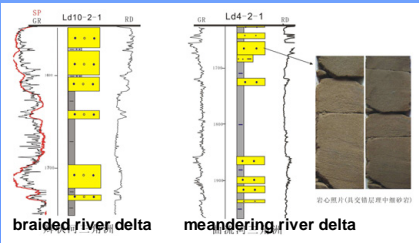
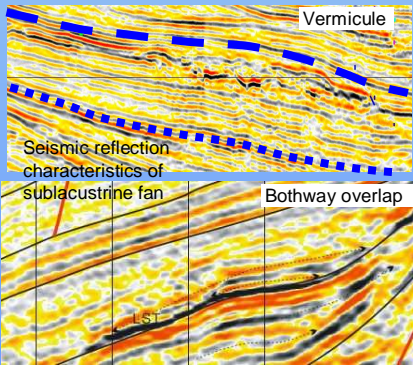
5、New research--Sedimentary characteristics



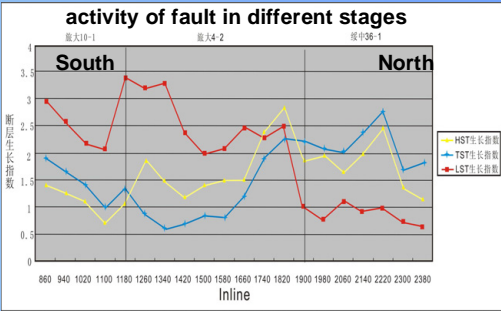
Sedimentary characteristics of braided river delta



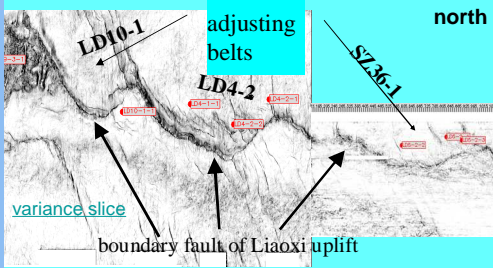
Sedimentary characteristics of meandering river delta



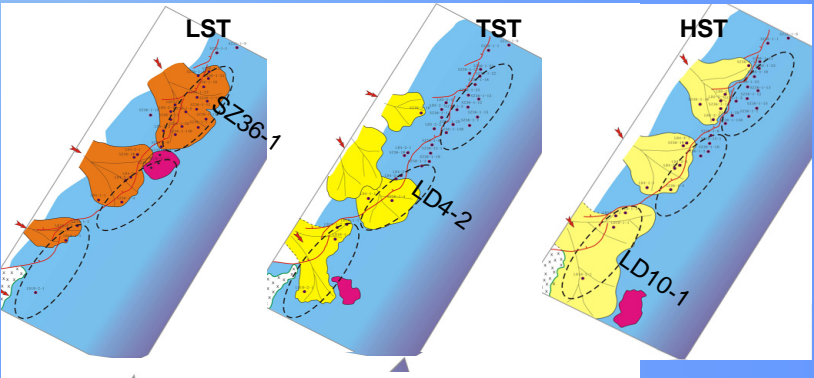
6、New research–Dynamic changes of palaeotopography



Analysis shows that the movement of boundary fault is unbalanced horizontally and spatially. There are three adjusting belts where the activity of fault is low from north to south in the boundary fault of low uplift and the activity of fault in three adjusting belts are different in different system tracts.



7、New research–The control on the migration of delta lobe



During LST of Dongying formation, the growth index of boundary fault in the north accommodation zone is low, while those of the middle and south are high. So it is easy for sediment migrating from west to the uplift through the north least-active accommodation zone, and it is blocked in the middle and south zones. As a result, deltas are well developed in the northern part and less developed in the mid-southern part of the uplift. During TST, the fault growth index of middle accommodation zone is low and deltas are dominantly developed in this area and less developed in the other two accommodation zones. During HST, the fault growth index in middle-south zones are low, correspondingly deltas are well developed in theses areas.