

Stratigraphic and Facies Distribution of Upper Triassic Braid-deltas in Zhenbei Area, Ordos Basin

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Abstract

This paper takes Zhenbei area in Ordos Basin as the research target describes the sedimentary characteristics, associated systems and reservoir distribution of Zhenbei braid-deltas in the upper Triassic Chang 7 Member. This study shows that the main reservoir types of Chang 7 Member are the subaqueous distributary channel and turbidity deposition, which are closely related to the changes of the sediment supply and the paleotopography.

Keywords

Braided Delta, Turbidite, Stratigraphy, Chang7 Member, Ordos Basin.

1. Introduction

The Zhenbei area located in the northern-western part of the Ordos basin, is bounded by the Tianhuan depression to the west and the Yishan slop to the east (Fig 1). It covers an area of approximately $8 \times 10^3 \text{ km}^3$. During the late Triassic, the Ordos basin was a stable craton depression. There are fewer faults developed in this area. Its feeder systems are mainly from the southwest and the west of the Ordos basin [1].

2. Facies Association

According to the analysis of cores and logging facies, seven facies are identified in the Zhenbei delta, including braided channels, flood plain muds, subaqueous distributary channels, mouth bars, sheet sands, turbidite sands and lacustrine muds. The vertical successions of the seven facies represent the typical braided delta-turbidite depositional system.

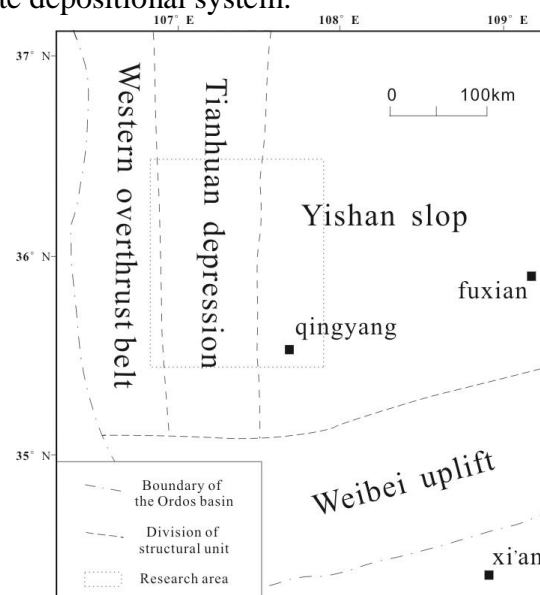


Fig. 1 Location of study area

2.1 Braided Delta Plain

Braided delta plain is widely developed and the most important part in the Zhenbei braided delta. Braided channels can be tens of meters thick, characterized by superimposed thinning-upward channelized units. Each unit has an erosional surface, is 3–6 m thick and is often marked by a lag deposit (Fig 2A). Flood plain muds thickness range in 1-10 m, formed during flooding, occur at the top of the braided channels.

2.2 Braided Delta Front

Compared with the normal delta front, the Zhenbei braided delta front is narrowed distributed along the shoreline. Subaqueous distributary channels are the extension of braided channels underwater. The thicknesses range from 2–5 m. Subaqueous distributary channels are characterized by less or no superimposing channel and a sharp contact with dark lacustrine mudstone (Fig 2B). Mouth bars and sheet sands occupy large volumes in the Zhenbei delta front.

2.3 Shallow Lake

Fluvial incision and continued accumulation of sediments result in unstable ramps along the basin margins, and a series of landslides occurred along the ramp [2].

The turbidity deposits, located in front of the mouth bars and sheet sands, primarily consist of turbidity channels and turbidity sheet sands. Turbidity channels consist mainly of Chang7 Member thickness reaches 10 m, characterized by superimposed turbidity channel (Fig 2C). Turbidity sheet sands mainly consist of embedded thin sand and mud (1–3 m). Lacustrine deposits comprise dark claystone and mudstone.

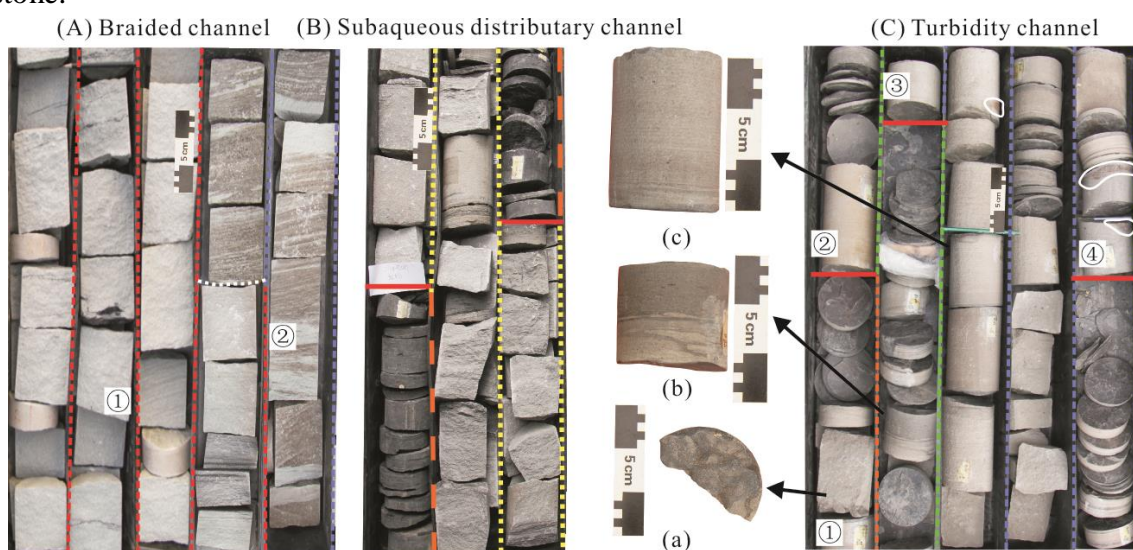


Fig. 2 Core successions of representative facies of braid delta in Chang 7 Member. (A) Two units of superimposed braided channel with an erosional contact (2726.8-2730.3 m, H54); (B) subaqueous distributary channel (dotted line) with a sharp contact with dark lacustrine mudstone (dashed line) (2171.2-2173.6 m, L193); (C) four periods of superimposed turbidity channel. Typical structures are load (a), deformation (b), block (c), and floated gravel (white circle).

3. Stratigraphic Correlation

Galloway (1989) pointed that the most reliable correlation markers are widespread mudstone section [3]. The Chang 7 Member can be divided into two units, the falling cycle and the rising cycle. Each unit can be further divided into several subcycles by the inter-mud (Fig 3).

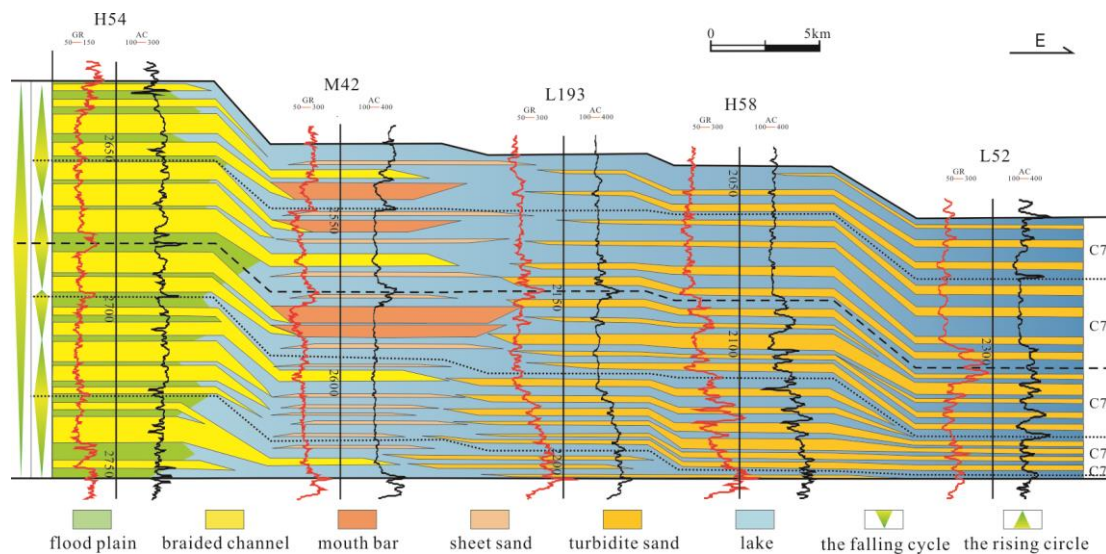


Fig. 3 Stratigraphy and facies correlation in vertical section of source

3.1 The Falling Cycle

As the delta progrades, the degree of superimposition of braided channels increases. The mouth bars and sheet sands partly superimpose on the turbidity deposits. The turbidity deposits primarily consist of turbidity channels and turbidity sheet sands.

3.2 The Rising Cycle

Because of the landward migration of the deposition center, the degree of superimposed channels decreases, whereas the thickness of floodplain muds increases. Subaqueous distributary channels and mouth bars are poorly developed. The turbidity deposits are not very developed than that of the falling cycle.

4. Reservoir Distribution

Using the current residual thickness and decompaction and paleobathymetric corrections, the paleotopography of the ramp in the Zhenbei area was reconstructed [4]. The Zhenbei delta can be typed in steep-gradient delta by Postma (1990) and Lemons and Chan (1999) [5-6].

In the early Chang 7 Member, the braided delta plain area is the smallest, especially in the C7₅ period, characterized by isolated channel and flood plain muds. Subaqueous distributary channels are relatively narrow, and the size of the mouth bars and turbidity deposits get small accordingly (Fig 4A). With the increase of the sediment supply, the area occupied by the braided delta plain becomes higher and reaches the maximum in the C7₃ period. Owing to the frequent swing, channel sandbodies are widely distributed and sheet-shaped both in the delta plain and at the delta front. Mouth bars and sheet sands occupy large volumes in the delta front. The turbidity deposits, located in front of the mouth bars and sheet sands, are widely developed (Fig 4B). The braided delta plain area becomes smaller and smaller in the C7₂ and C7₁ period. The isolated channels and flood plain muds increase. Mouth bars and turbidity deposits are less developed (Fig 4B/A).

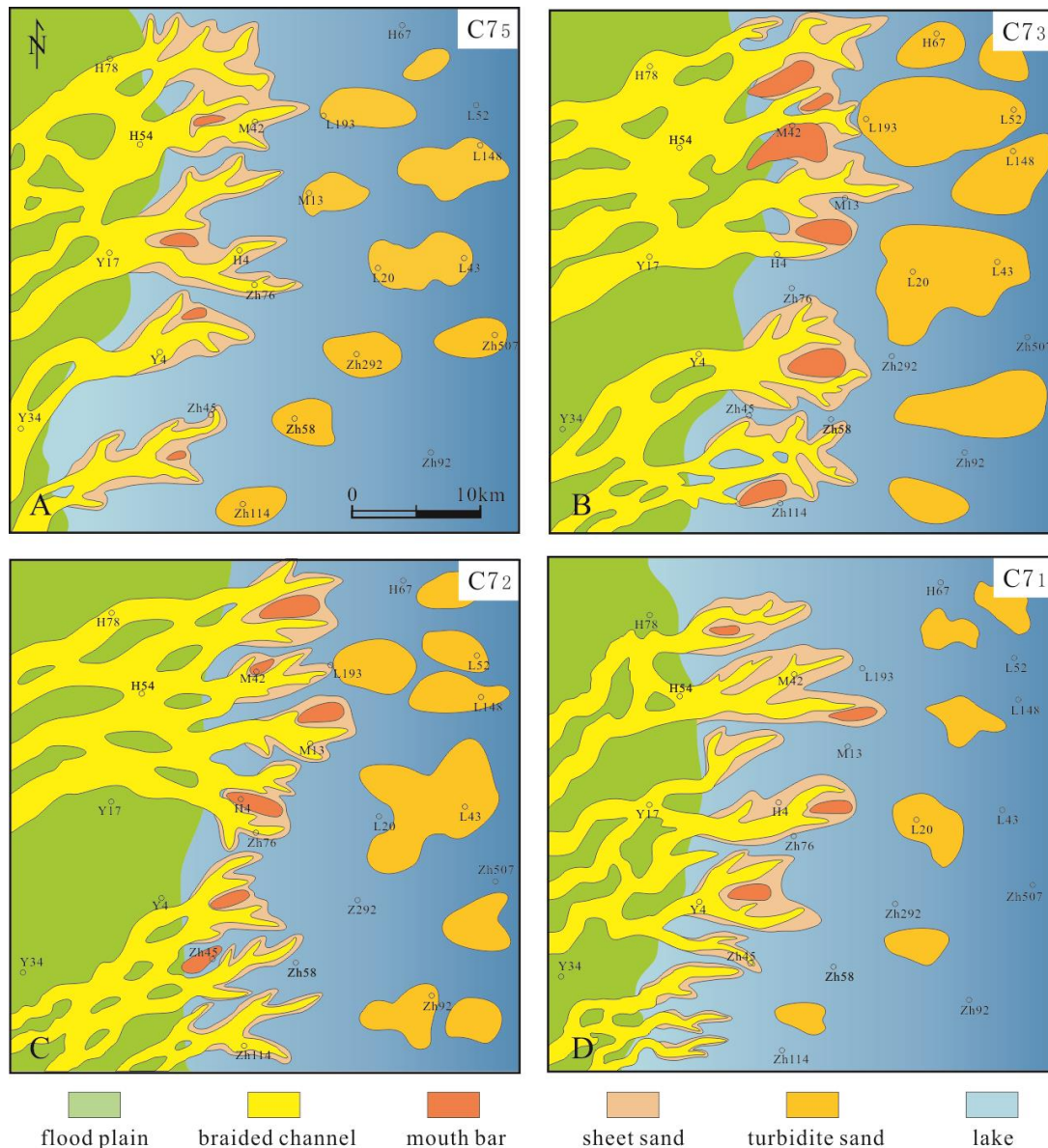


Fig. 4 Facies distribution of the Chang 7 Member in Zhenbei area

Based on the above analyses and exploration practice, the main reservoir types of Chang 7 Member are the subaqueous distributary channel and turbidity deposition, which are closely related to the changes of the sediment supply and the paleotopography.

5. Conclusion

1. The Zhenbei delta of the upper Triassic Chang 7 Member is a typical steep-gradient braid-delta-turbidite system, contained braided delta deposits, turbidite sands and lacustrine deposits.
2. The Chang 7 Member could be divided into two units and each unit can be further divided into several subunits by choosing stable mud sections.
3. The main reservoir types of Chang 7 Member are the subaqueous distributary channel and turbidity deposition, which are closely related to the changes of the sediment supply and the paleotopography.

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