

Late Yanshanian sedimentary facies of late Yanshanian succession of eastern Yihezhuang salient, Jiyang depression, Bohai Bay basin, China

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Abstract: The sedimentary facies the late Yanshanian succession of eastern Yihezhuang salient in Jiyang depression, which was a pre-Cenezoic inland rift basin, were studied in order to improve the success rate of locating hydrocarbon reservoirs. Based on previous study, the sedimentary facies got identified in late Yanshanian succession in the study area through seismic profiles, well logs and cores. This study enhanced the sedimentary facies analysis to inland tectonically active basins, and would be helpful to predict reservoirs and carry on the second startup of petroleum resources in pre-Cenezoic residual basins.

Introduction

The study of the relative influence of climate, base-level change and tectonism on sedimentation is at the cutting-edge of basin analysis[1-3]. Being the most important geological event since Mesozoic in Eastern China[4], Yanshan movement could affect sedimentation pretty much, so the sedimentary facies of Yanshanian succession, including late Yanshanian succession which is a inland rift basin, will be pretty complex[5].

From the above, it can be concluded that the sedimentary facies in pre-Cenezoic inland rift basin is of much interest, so this study takes the late Yanshanian succession (J₃) in eastern Yihezhuang salient as an example to carry out this research.

Geological background

Yihezhuang salient was located in the north of Jiyang depression, and got separated from Zhanhua sag with Yinan fault in south and Yidong fault in east as boundaries, respectively, close to Chezhen sag in the west and north with transitional slopes (Fig. 1). The Mesozoic succession in eastern Yihezhuang salient got severely denudated, with only Jurassic system developed (Table 1).

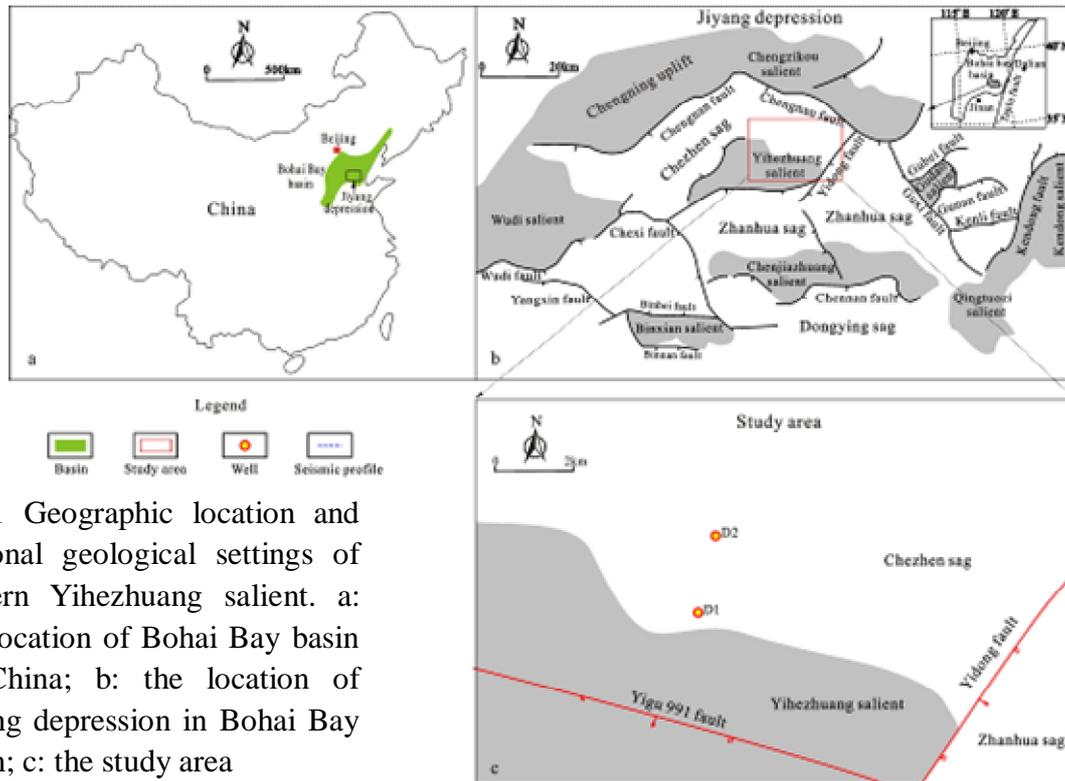


Fig.1 Geographic location and regional geological settings of eastern Yihezhuang salient. a: the location of Bohai Bay basin in China; b: the location of Jiyang depression in Bohai Bay basin; c: the study area

Table 1 The stratigraphic division and basin filling evolution of the Yihezhuang salient, Jiyang depression, Bohai Bay basin (Modified after Zhang et al., 2009)

Geologic age	Strata	Sequence boundary	Sequence division	Sequence order	Tectonic stage		
Cenozoic	Rift basin, sepetated with underlying strata by unconformity-Tr						
Mesozoic	Late Jurassic	Mengyin Formation	Tr	SQ-J ₃ My	III	I	LEYSM
	Middle Jurassic	Santai Formation	Tgm	SQ-J ₂ St	III	I	Yanshanian/MEYSM
		Upper member of Fangzi Formation	Tmz2	SQ-J ₁ Fz ₂	III		
	Early Jurassic	Lower member of Fangzi Formation	Tmz3	SQ-J ₁ Fz ₁	III	Early Yanshanian	
Paleozoic	Craton, seperated with overlying strata by unconformity-Tg					IDM	

LEYSM = late episode of Yanshan movement; MEYSM = main episode of Yanshan movement; IDM = Indosinian movement

Material and methods

Large number of geology data, geophysical data and researching results, especially drilling data with high density and the three-dimensional seismic profiles with high resolution covering most of the study areas, have been accumulated after many years of exploration and development, which provided profitable conditions for researching in this study.

Sedimentary facies

In study area, the sedimentary facies were delineated by analyzing seismic profiles (Fig. 2), boreholes and well logs (Fig. 3), and seismic attribute (Fig. 4).

In Fig. 2a, there can be observed wedge-shaped body with internal progradation reflection, in front of which, dentate interaction with parallel reflection representing lacustrine mudstone deposition was developed. Respectively, in Fig. 2b, there can be observed three lenticular bodies showing chaotic seismic reflection different with the around parallel reflection, which was the cross

section of fan delta deposition [6].

In Fig.3, vertical multiple superposition of bell-shaped well logs representing fan delta plains were recognized in Well D1, respectively, vertical superposition of funnel-shaped well logs representing delta front were recognized in Well D2. Fan delta plain was dominated by conglomerate and sandstone reflection with oxide color and poorly sorted. However, the fan delta front could be assumed to mainly develop well sorted sandstone, which could form the favorable reservoirs in the study area [7].

Fig.4 showed the RMS attribute of late Yanshanian sedimentation, which presented the shape of fan distributed respectively in north and south. Especially the shape in north, there developed three bodies obviously, which coincided with the three bodies in Fig.2b very well [8].

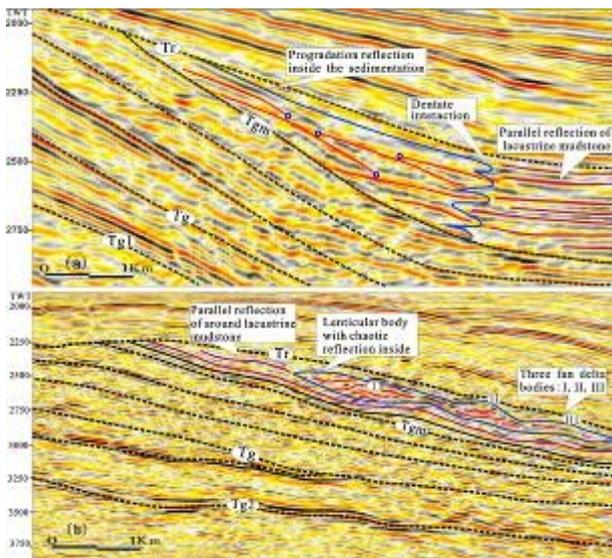


Fig.2 Seismic reflection of fan delta deposited during late Yanshanian in study area

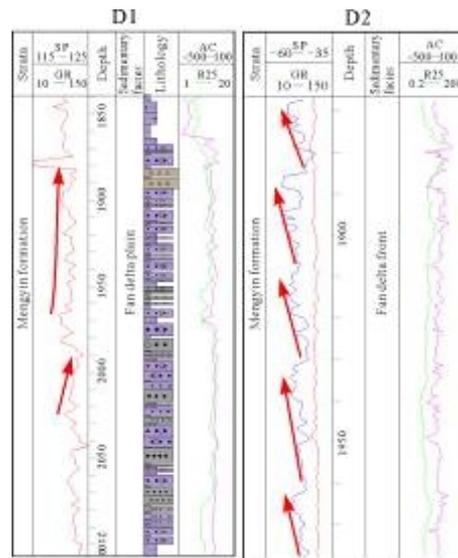


Fig.3 Sedimentary cycles of fan delta in study area

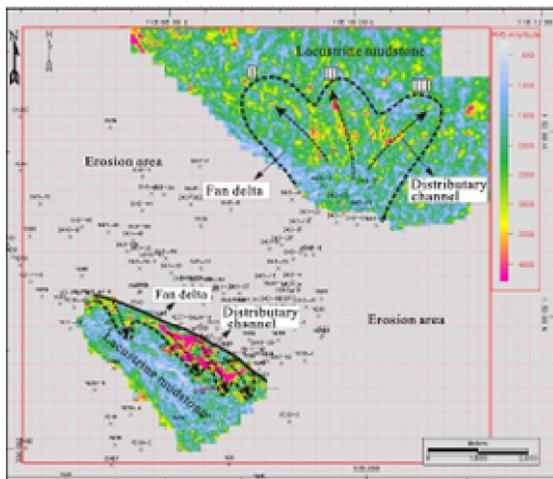


Fig.4 Seismic attribute of late Yanshanian in eastern Yihezhuang salient

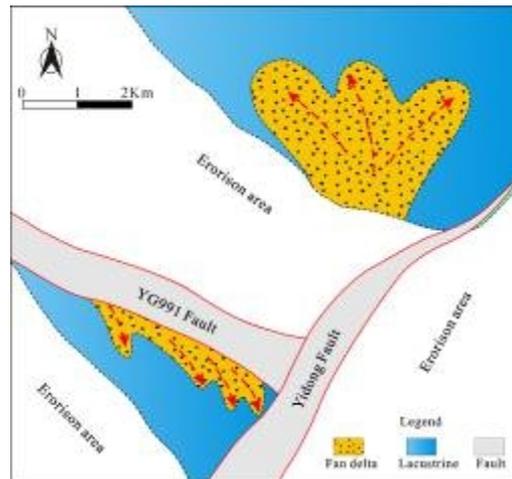


Fig.5 Sedimentary facies of late Yanshanian in eastern Yihezhuang salient

Complemented with previous research, the seismic profiles, borehole data and seismic attribute contributed to recognizing fan delta deposited in study area (Fig.5).

Conclusions

During late Yanshanian, there developed fan deltas in study area. In delta plain, the sedimentation presented Positive cyclic sedimentation, respectively, in delta front, the sedimentation presented Reverse cyclic deposition.

The delta front mainly consisted of sand-bodies, which were fine-grained and well-sorted, so it can form the favorable reservoirs in study area.

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