Research Inventy: International Journal of Engineering And Science
Vol.4, Issue 01 (January 2014), PP 20-26
Issn (e): 2278-4721, Issn (p):2319-6483, www.researchinventy.com

Application of high resolution sequence stratigraphy in Fuyu reservoir of Yumin area

Haifeng Chen[1], Xixin Wang[1], Shuangfang Lu[2], Dianshi Xiao[2]

1 Northeast Petroleum University The formation mechanism of oil and gas reservoir and resource evaluation Heilongjiang Province key laboratory, Daqing, Heilongjiang, China, 163318
2 China University of Petroleum (Hua Dong), Qingdao, Shandong, China, 266001

ABSTRACT: *The stratigraphy, high-resolution sequence stratigraphy is based, and based on core, logging and seismic data synthetically, the organic combination of seismic data and drilling data analysis, there are one long-term cyclic sequence boundaries(SB1), and two lake flooding surface(FS1 & FS2)be distinguished in the study area. Then combined with sedimentary cycle characteristics, the study area may be divided into two long-term cycles (the equivalent of three grade sequence), and six mid-term cycles (the equivalent of four grade sequence) and 17 short term cycles (the equivalent of five grade sequence), which structure high resolution sequence stratigraphy of Fuyu reservoir in Yumin area, and lay the foundation for the study of sedimentary microfacies and the study of accumulation rule.*

KEYWORDS: *Yumin area Fuyu reservoirin High resolution sequence stratigraphy Stratigraphic framework*

I. INTRODUCTION

Yu Min area is located in the southeastern Songliao Basin in the territory of Zhaoyuan County of Heilongjiang Province, whieh across a secondary tectonic unit the central depression area and the southeast uplift area, and across the two tectonic units Sanzhao sag, Chaoyanggou terraces and Changchunling anticline belt, area to achieve 3-D seismic full coverage, area 547km2. At present the main production layer of Yumin area is Fuyu reservoir, proven reserves and control reserves are distribution in the Western Yumin nose structure and Eastern mint sets nose structure two three-level structure,the district has drilled 125 test pit- test well, Which was the industrial oil and gas layer 49, low yield oil and gas layer 16, which shows the area has great potential of exploration and development;

With further exploration and development, the original layer division scheme has beenunable to meet the needs, so launched the high precision and high resolution sequence stratigraphic division and correlation. The research is based on the high resolution sequence stratigraphy as basic principles, withwell logging and high resolution seismic data as the means, improve the resolution of sequence stratigraphic analysis by using the precise sequence stratigraphic division and correlation technology,analysis of the interface recognition method and sequence stratigraphy of the accumulation mode in Fuyu reservoir of Yumin area from many angles, and point out the relationship between the main sequence and the main interface and oil and gas accumulation, and provide the basis for the subsequent deposition, reservoir, reservoir evaluation and favorable block development.

II. THE MAIN SEQUENCE BOUNDARY IDENTIFICATION

The establishment of high-resolution sequence stratigraphic framework, first is must in the studied section internal identifying sequence boundary, including unconformity surface (or the

corresponding integrated surface), flooding surface sedimentary transform surface and larger scale. The formation of the sequence boundary represents the existence of different scale erosionunconformity and sedimentary discontinuity, the upper and lower strata lithology, sedimentary facies, in combination with well logging curves, the seismic reflection characteristics have specific response, these responses can be independent or more together as a good sign recognition of sequence boundaries. But in the actual judgment sequence boundaries, generally do not simply according to the abnormal change in one information to identify, but also on the seismic, logging curve, drilling section of lithology, lithofacies characteristics to find as much evidence, in order to divideaccurately[1-5].

In this paper, by using the principles and methods of analysis of high resolution sequence stratigraphy, making full use of previous in this block stratigraphy research results, to stratigraphy, sequence stratigraphy based, comprehensive utilization of core, logging and seismic data, seismic dataand drilling data of organic combination of comprehensive analysis, so as to ensure thereliability of sequence boundary identification. there are one long-term cyclic sequence boundaries(SB1), and two lake flooding surface(FS1 & FS2)be distinguished in the study area.,the study area may be divided into two long-term cycles(the equivalent of three grade sequence), and six mid-term cycles(the equivalent of four grade sequence) and 17 short term cycles(the equivalent of five grade sequence). Complete high resolution sequence stratigraphic classification scheme in Fuyu reservoir of Yumin area are shown in table 1-1.

Table 1：High resolution sequence stratigraphic division in Fuyu oil layer of Yumin area

stratigraphic unit			Reser-voir	Reser-voir group	sand group	layer	Reflec-tion interf-ace	sequence division			
Tong	group	section						short cycles	mid term cycles	long term cycles	main inter-face
	Qingshan kou Formation	Qingyi section					T_2				FS2
lower Creta-ceous	Quantou Formation	Quansi section	Fuyu Reser-voir	FI	FI_{top}	FI1	T_{2y1}	SSC17	MSC6	LSC2	SB1
						FI2		SSC16			
					FI_{mid}	FI3		SSC15	MSC5		
						FI4		SSC14			
						FI5		SSC13			
					FI_{bot}	FI6		SSC12	MSC4		
						FI7		SSC11			
		Quansan section		FII	FII_{top}	FII1	T_{2y1a}	SSC10	MSC3		
						FII2		SSC9			
					FI_{Imid}	FII3	T_{2-1s}	SSC8	MSC2	LSC1	FS1
						FII4		SSC7			
						FII5		SSC6			
				FIII	$FIII_{top}$	FIII1		SSC5			
						FIII2		SSC4			
					$FIII_{mid}$	FIII3		SSC3			
						FIII4		SSC2	MSC1		
					$FIII_{bot}$	FIII5		SSC1			

A The sequence boundary SB1 interface characteristics

Sequence boundary SB1 is in the bottom of layer FⅡ2 of Fuyu reservoir, as the datum plane down to the base level rising transition surface, the equivalent of seismic reflection interface T_{2y1a}.

The seismic reflection characteristics, SB1 is located in the T_2 axis of reflection in the following fourth imaginary axis, in the region can be continuous tracking contrast, is a conformable contact with the next overlying strata (Fig.1).

The lithologic features, interface on large river development, river incision effect is obvious,the bottom of common scour surface, containing gravel, bottom-up lithology combination forfine sandstone, siltstone and fine sandstone siltstone silty mudstone and mudstone, thedistributary channel sand body in multi period superimposed, lateral migration often leads tosedimentary sequence development incomplete. Interface for long purple and purple redmudstone, the thickness of up to a

few meters to tens of meters (Fig. 2).

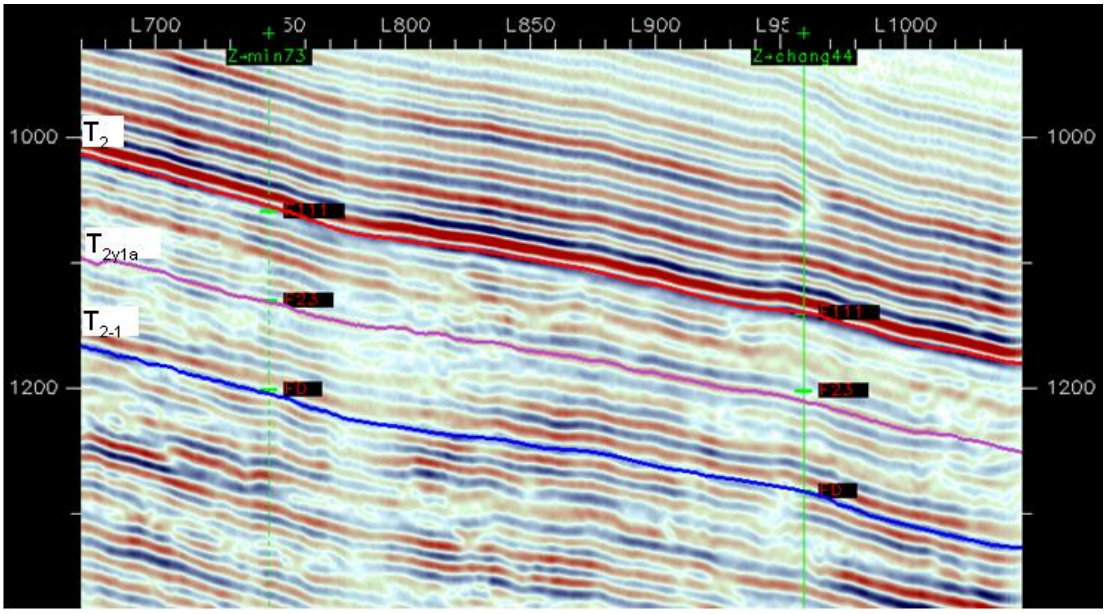
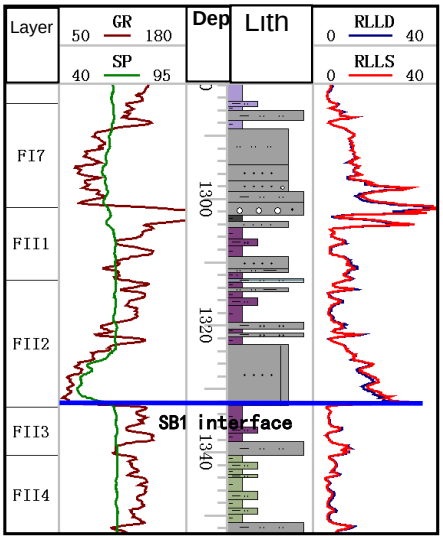
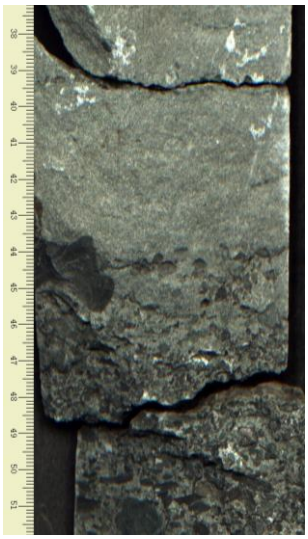


Fig. 1：SB1、FS1、FS2 interface characteristics of seismic reflection



A Min 72 well



b the bottom of channel scour surface, gravel（Min 72well，1301.51m）

Fig. 2: SB1 interface electrical characteristics of rocks

Log response characteristic is obvious, the interface from the bottom up, from low value tohigh resistivity, natural gamma ray value mutation from high value to low value mutation,acoustic travel time from high value to low value mutation (Fig.2a, Fig.3).

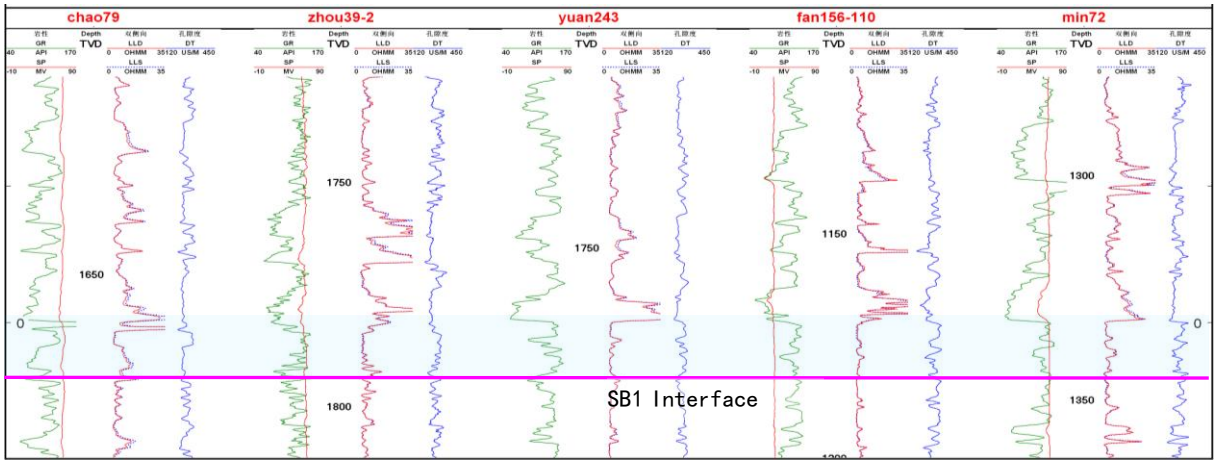


Fig.3: SB1 interface the characteristics of logging curves

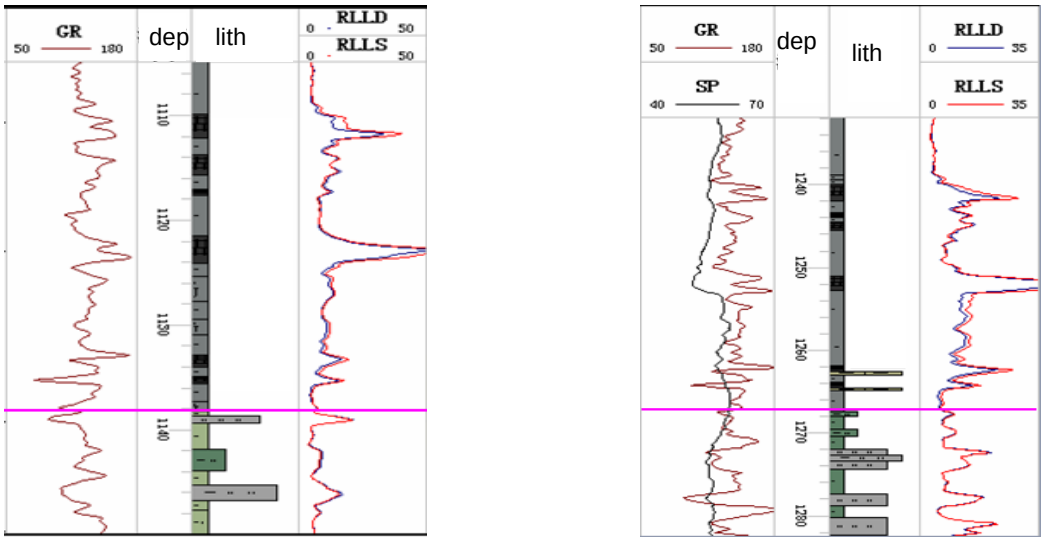
B Identification of major flooding surface interface

(1) The lake flooding surface, FS2 interface characteristics

Lake FS2 is equivalent to the top face of the Fuyu reservoir, the quansi section and Qingyi section aformation interface, as the base level rising to falling of datum conversion surface, corresponding to the T_2 seismic reflection axis.

The seismic reflection characteristics, the lake flooding surface, FS2 (T_2) showed strong reflection interfaces most clear, continuous, the stable, it has two stable phase axis, is an important symbol of interface region sequence boundary tracing, closed, contact with theoverlying strata belong to the integration (Fig.1).

The lithologic features, interface on a three set of green development of inferior oil shale,lithology combination for the formation of deep lake semi deep lake environment in shale, marl and poor oil shale, mudstone color is dark gray or black; sand mudstone interface for deltaic sedimentary environment in the formation of interbedded, with gray green mudstonedominated (Fig. 4).



a Min70 well b Min 60well

Fig.4: FS2 interface electrical characteristics of rocks

Log response, interface on logging curve is shown as "high gamma, high acoustic" features,corresponding to the three sets of oil shale is electrically curves presented 3 "rack shapedspikes; interface" under the logging curve shows as "low gamma, low wave" feature. At the interface of acoustic time curve showed mutation characteristics. (Fig.4, Fig.5).

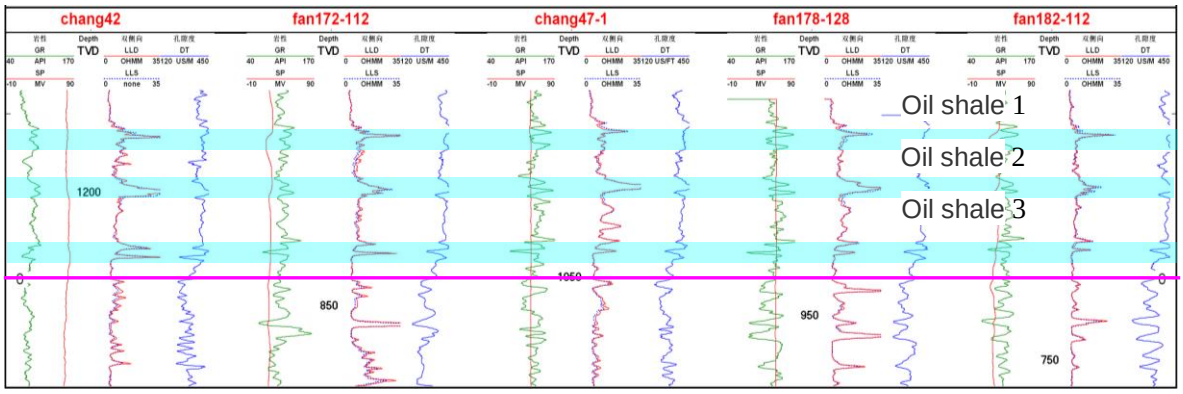
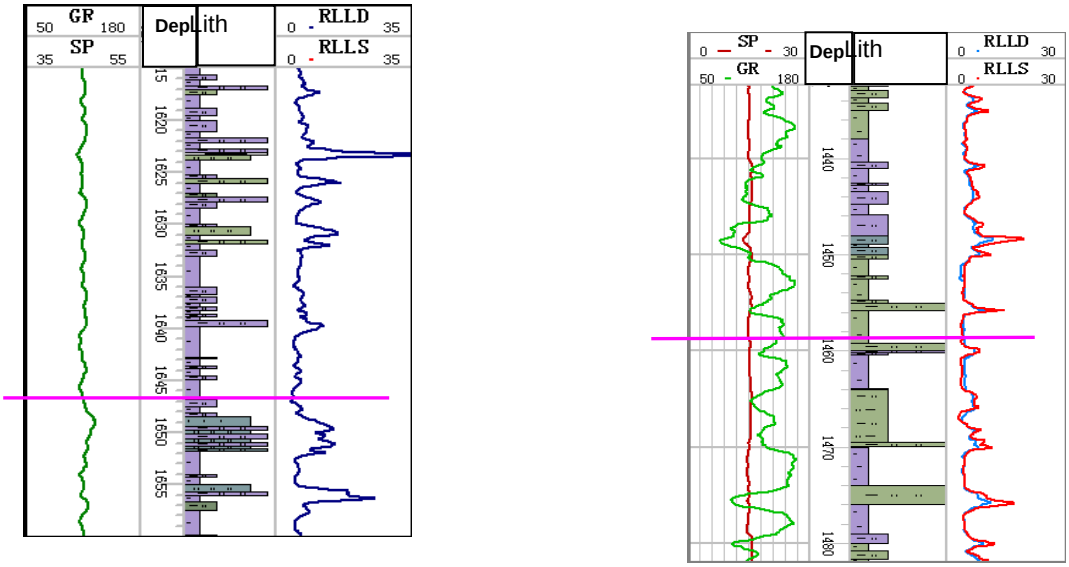


Fig.5: the logging curves characteristics of FS2 interface

(2) The lake flooding surface, FS1 interface characteristics

Lake FS1 corresponding bottom interface of Fuyu reservoir, as the base level rising to falling of datum conversion surface, equivalent to the seismic reflection interface T_{2-1}. The lake flooding surface, FS1 interface (T_{2-1}) for continuous reflection interface, medium low amplitude, the more stable, the basic continuous tracking contrast, contact with the overlyingstrata belong to the integration (Fig.1). The lithologic features, interface are usually developed several m to tens of m thick mudstone, mudstone area south of color to purple red, gray green, north gradually transition to green; interface under constant development of mini distributary channel deposition (Fig. 6). Log response curve obviously, electrical interface mutation in bottom-up by high amplitude comb combination for low amplitude straight section (Fig.6, Fig.7).



a south shore line（Chang 46 well）　　b north shore line（Chao 91well）

Fig.6: FS1 interface electrical characteristics of rocks

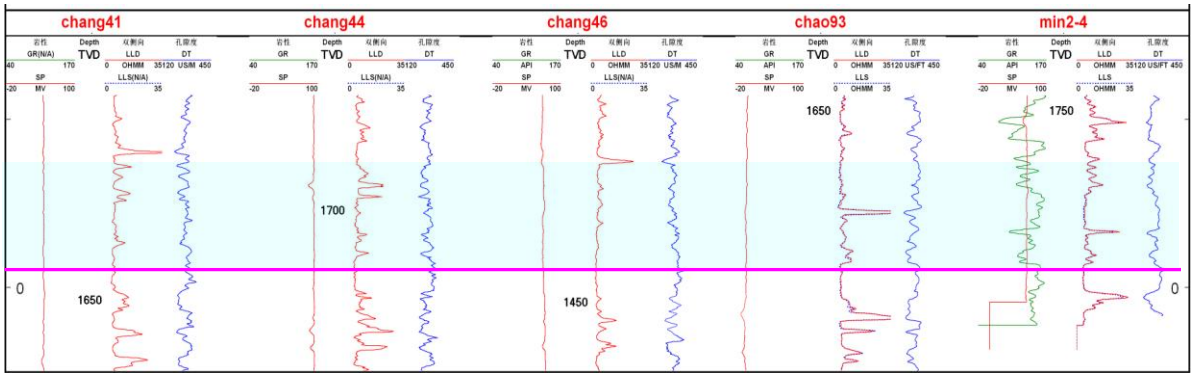


Fig.7: FS1 interface characteristics of logging curves

III. WELL SEISMIC SEQUENCE STRATIGRAPHY

Logging data of high vertical resolution, can identify 0.4m even more thin stratum, so use oflogging curve for stratigraphic division and explain the fine, but its lateral resolution is low, so some people say that logging is "a peephole view ". Although the vertical resolution of seismic data is relatively low, but the lateral continuity is better, can be a large range of continuously tracking. The logging and seismic together, play their respective characteristics, the sequence stratigraphic division and correlation and interpretation, it is a kind of method is reliable and effective[6]. Therefore, using seismic and logging data dividing and contrasting long-term cycles;longitudinal resolution ability by using logging data, has been identified in the long-term andmedium-term cycles within the short-term cycle division and contrast (Fig.8).

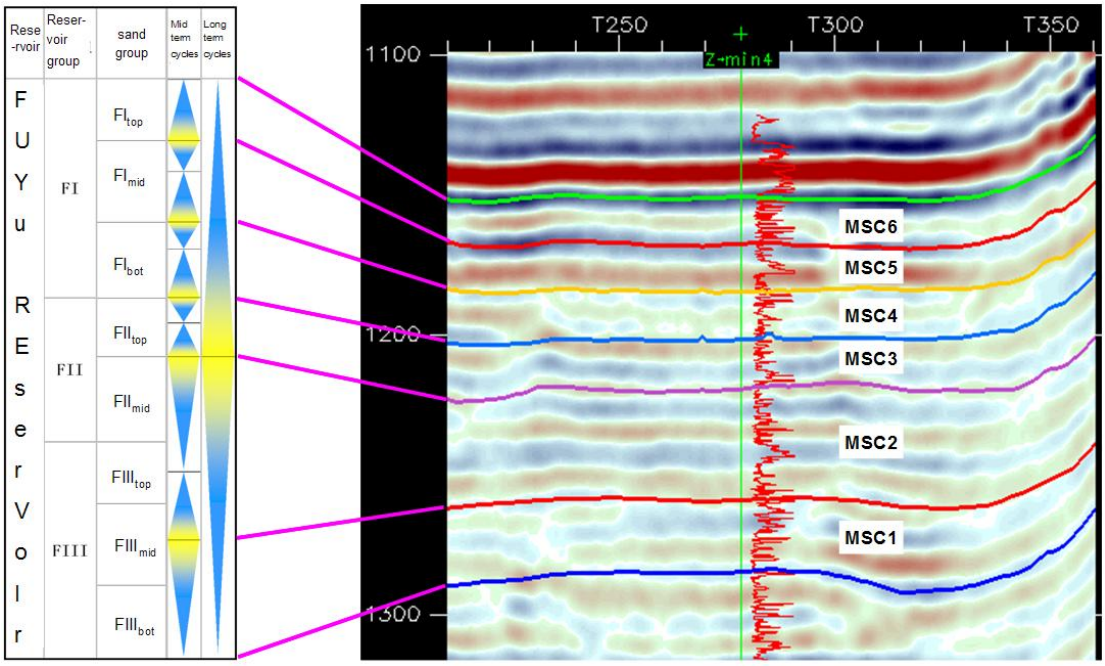


Fig.8: Well seismic stratigraphic division （Min 4 well）

IV. THE RELATIONSHIP BETWEEN SEQUENCE INTERFACE, FLOODING SURFACE AND OIL-GAS

The sandstone of sequence boundary is developed, the lake flooding surface for intensive zone, shale, can be used as a partial cover layer, if the communication source of oil and oil source is sufficient to form good reservoirs. In the study area, positive cycle from bottom to topsand body gradually becomes poor, the distributary channel, mouth bar, sheet sandmicrofacies are distributary channel micro facies evolution between the reverse cycle, just the opposite.Study area FII bottom boundary sequence boundaries SB1, LSC2 and LSC2 interface forlong-term cycles, upper and lower sandstone reservoir, can be used as a long-term cycle,LSC2 elevated semi cycles top interface for Lake FS2, green a bottom boundary, themudstone are very developed, is the very good cover, if the destination layer communicationoil source and overpressure, it is easy to produce oil and gas reservoirs. This development situation of gas oil and ran very well.

V. CONCLUSION

A Well log and seismic data of high resolution sequence stratigraphy can improve sequence classification accuracy.B In Fuyu reservoir of Yumin area identified one long-term cyclic sequence interface(SB1), two lake flooding surface (FS1 and FS2). According to the characteristics of the cycle, thestudy area is divided into 2 long term cycles (the equivalent of three grade sequence), 6 middle term cycles (equivalent to four order sequence) and 17 short-term cycles (the equivalent of five grade sequence). C The study area near the sequence boundary is often good reservoir, Lake flooding surface is good cover layer.

REFERENCES

[1] Zhang Mingxue, Jiang Bo, Wen Ruixia. Application of sequence stratigraphy in North Qijia Area. Petroleum Geology& O il Field Developm ent in Daq ing[J], 2006,25(5):24-26.

[2] Wang Yulin. Sequence stratigraphic analysis on the upper palaeozoic in jinan area. Henan Petroleum[J]，2003,17（5）：1-2.

[3] D e n g H o n g w e n, W a n g H o n g lia n g, L i X iz h e. Identificatin and correlation techniques of sequence stratigraphic base-levels and their application. Oil & Gasgeology[J]，1996,17(3)：177-184.

[4] Emery D, Myers K J. Sequence stratigraphy [M]. Ox ford, UK:Blackwell Science Ltd, 1996. 111- 133.

[5] Cross T A. S tratigraphic controls on reservoir attributes in continental strata[J]. Geoscience Frontiers, 2000, 7 (4) : 322 ~ 350.

[6] Lie Weifang, Yu Xinghe, Sun Qinhua, Teng Tuanyu, Pan Jianguo. Sub-layer correlation by step control well-to-seismic integration [J]. Geophysical prospecting for petroleum,2006,45(6):597-601.