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Summary of Structural Characteristics and Evolution of Sinian System in Sichuan Basin

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Abstract: Sichuan basin is experienced polycyclic tectonic movement and multi-type basin superimposed then formed more than 20 hydrocarbon bearing series, so became a large superimposed petroliferous basin. Sinian system in the basin is one of the oldest hydrocarbon-bearing series also the earliest series found large gas reservoir (weyuan gas reservoir). As we known, the sinian system in the bottom of sichuan basin which formed long time ago and buried depth. The ancient hydrocarbon bearing serie experienced polycyclic tectonic movement .How to impact of sinian system Oil and gas geological conditions in deep basin by all previous tectonic movement that is the key to the evaluation of the oil and gas resource potential. Based upon this, I am from the perspective of tectonic evolution to to discussing the different tectonic movement how to influence the oil and gas accumulation conditions of sinian system, and meanwhile discuss about hydrocarbon source condition, reservoir condition and oil and gas accumulation and enrichment how to impact hydrocarbon accumulation, and then points out that where is the sinian system favorable zones for oil and gas exploration.

Keywords: Sichuan basin, Sinian system, Structural evolution, Tectonic movement, Hydrocarbon reservoir type.

OUTLINE OF REGIONAL GEOLOGICAL SETTING

Sichuan basin is experienced polycyclic tectonic movement and multi-type basin superimposed then formed more than 20 hydrocarbon bearing series, so became a large superimposed petroliferous basin[1]. Sichuan basin is superimposed basin above the Yangtze craton basement[2, 3]. The area is about 18 x 104 km^2. The basin sedimentary strata is completed, the total thickness about 6 000 ~ 12 000 m. The upper sinian - middle triassic is marine sediments, dominated by carbonate rocks, about 5, 000 m. Sinian system about 300 ~ 1 200m, including the Tuoshantuo formation and the Dengying formation, which the Dengying formation is predominated with algal dolostone and grain dolostone, the Tuoshantuo formation is predominated with sand-mudstone.

TECTONIC MOVEMENT

Sichuan basin experienced multiple phase tectonic movement which sichas obvious control effect on formation and transformation of hydrocarbon reservoi. Through the seismic, logging, core data and combined with field outcrop Investigation,We can take a further investigation on structural evolution how to control of the reservoir formation and trap modification.The results showed that: five time's tectonic movement in sichuan basin control hydrocarbon accumulation process in the sinian system[4].

Tongwan movement

The Jinning movement formed the Yangze continental block. In Sinian and early Cambrian, Tongwan movement was dominated by regional uplifting and subsidence, which is form of large scale uplift, denudation, and performance for parallel unconformity contact between strata. Then, under the background of denudation planation, sinian system strata was deposited including a set of grey - black carbonaceous shale and sand shale clip lens containing manganese sandy limestone.in the area of the Tuoshantuo formation and the Dengying formation group. The basin peripheral thickness is bigger. From the point of lack of strata absence and contact relationship to analysis, Tungwan movements have three episodes. Tungwan movement, I episodes, happened at late of secondary deposition in the Dengying formation and in the west of Yangze block is manifested as parallel unconformity contact in the Deng-2 and Deng-4. Tongwan movement Ⅱ episodes happened at end of the Dengying formation, characterized as Deng-4 disconformity contact to the Cambrian system. Tung wan movement Ⅲepisdes take place in end of Maidiping formation of early Cambrian, characterized as Qiongzhusi formation parallel unconformity contact with Maidipingformation.

Caledonian movement

Caledonian movement is totally different form Tungwan movement. During the late ordovician - early

silurian , upper Yangtze block early, Caledonian movement has obviously characteristic of compressive folding and orogenesis. Orogeny occurred between the Yangze block and Cathaysian plate, which formed the "Jiangnanancientl land" and east of Sichuan -west of Xiangxi foreland basin". Compressive folding function in sichuan basin formed the Leshan-Longnvsipaleohigh. The most distinguishing feature of the leshan-longnvsipaleohigh is the Permian and underlying palaeozoic group- sinian system different strata which present unconformity contact. It formed the structural setting of the hydrocarbon enrichment belts in the Sinian strata.

Hercynian-Indosinian movement

During the Hercynian-Indosinian period, the Sinian experienced tectonic movement dominated by overall subsidence, the early paleohighs were inherited and developed and the Sinian-Cambrian source rocks went into peak oil generation stage, leading to the development of large paleo-oil pools on the paleohighs. During Permian-MiddleTriassic period, the sichuan basin has experienced two tectonic movement, primarily mannifested as uplift effect. The Dongwu movement in the late of early Permian, dominated by regional uplift and eroded strata thickness is small. In the Indosinian movement at the end of the Triassic forming the Kaijiang-Luzhoupaleo high and layer of axis of palohigh is eroded much more, such as Luzhou area Leikoupo group was denuded out and part of the Jialing river strata also suffered from erosion. The two tectonic movements have little effect on the Sinian structural pattern, and maintained the late Silurian ancient tectonic framework. During the this period, in the Leshan-Longnvsipaleohigh, due to the buried depth increases, sinian system and lower Cambrian organic material thermal evolution of organic matter for the second time to peak oil phase, oil and gas migrated to the top of the uplift belt and the slope. During the Hercynian-Indosinian period, the Sinian experienced tectonic movement dominated by overall subsidence, the early paleohighs were inherited, and the Sinion-Cambrian source rocks went into peak oil generation stage, leading to the development of large paleo-oil pools on the paleohighs.

Late Yanshanian-Himalayan period

Late Yanshanian-Himalayan period was the critical stage for the adjustment of hydrocarbon reservoirs in the Sinia strata. Yanshan - Himalayan movement makes hydrocarbon enrichment region formed. Indosinian movement of the late Triassic, sichuan basin had ended the craton depression of marine sedimentation, entered the stage of foreland basin evolution. The late Yanshan movement of the end Cretaceous and Himalayan movement, under the influence by Zhou Yuanshan basin fold and thrust effect, structural was deformation intensely. The east of Huayingshan fault area formed the high and steep structure in east of Sichuan. Longmen mountain and front of Micang mountain-DaBa mountain formed fold thrust belts. Relatively weak tectonic deformation in the central of Sichuan Basin, but Influenced by "resurrection" action in deep fracture formed high angle twist - compression fault.

HYDROCARBON RESERVOIR TYPE AND TECTONIC EVOLUTION OF THE PALEOHIGH

Sinian system in sichuan basin has the basic conditions forming large gas fields: large inherited palaeohigh provide the condition of hydrocarbon generation and accumulation and develop a variety of structural reservoirs[5].

Inherited palaeo structure

The palaeostructure is in a relatively stable tectonic high position from the oil formation and crack to the presen. Due to the effect of the late tectonic movement and the structure trap big, palaeostructure is always the favorable area of hydrocarbon accumulation. Hydrocarbon accumulation has experienced the process of ancient reservoir- oil cracking-hydrocarbon accumulation, and formed the structural reservoir and lithologic - structural reservoir.

Early Slope - Late Anticline Structure

This structure was in the south slope zone of Leshan-Longnvsi paleo high before the late Triassic. This structure in the time of Himalayan was become the highest position and the biggest closed anticline traps on paleo high. Gas accumulation has experienced the ancient reservoir-oil cracking-uplift and adjustment process, formed the anticline structure of gas reservoir.

Early-stage Anticline Structure - Late-stage Slope Structure

The structure has been at the high position of Weyuan - Ziyang ancient trap in the time of main oil generating period (Permian - middle Triassic epoch) before the ancient reservoir cracking. During the Himalayan period, Ziyang area become northwest of Weyuan anticline large monoclinal structure. Gas accumulation has experienced the ancient reservoir-oil cracking-uplift and adjustment process, forming lithologic gas reservoir.

Inheritance of Slopes

Inheritance slopes are are largely range of distribution on both sides of the ancient uplift. The area has been in the ancient uplift slope area from the main oil generating period (Permian - middle triassic epoch) to before the ancient reservoir cracking (late Triassic) then to now, the reservoir condition, hydrocarbon source rock condition and preservation conditions are similar to inherited palaeo structure, stratigraphic - lithologic gas reservoirs easily formed On the migration and accumulation of oil and gas channel

CONCLUSIONS

1. Sichuan basin experienced polycyclic tectonic movement that good control of the Sinian system gas accumulation: 3 episodes of Tongwan movement has created the Dengying group of the two sets of karstic reservoir are the widespread distribution. The Caledonisn movement resulted in the form the Leshan-Longnvsi Paleohigh, which is the structural setting of the hydrocabon enrichment belts in the Sinionstrate. The Hercynian-Indosinaian period is the main source of Cambrian hydrocarbon source rocks of early Sinian system-late Cambrain and in the ancient uplift and slope belt formed large ancient reservoir. Late Indosinian-early Yanshan epoch, oil cracking genarate the gas and in-situ accumulation. Late yanshan-Himalaya period, the ancient gas reservoir was adjustment and formed multi-type gas reservoir distribution pattern of today.

2. In sichuan basin, reservoir forming condition of Sinian system is well and high potential for exploration. The Leshan – Longnvsipaleo highsinian system is favorable zones for natural gas enrichment.. Due to the karsticsinian of system reservoir with strong heterogeneity, palaeo high slope belt also can develop stratigraphic-lithologic trap and good accumulation conditions. It is also worthy of exploration areas.

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