Oil Sands Forming Model and Character in the Northwest Edge of the Junggar Basin, China

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ABSTRACT

The Junggar Basin has the basic conditions for giant oil-sand mine to form and it is the hot point for exploration & development of oil sands. Multi-layer source rocks deposited in The Manas Lake Depression have produced abundant hydrocarbon in the course of multi-phase tectonic movement and they were the source of oil sands. Many unconformities formed also in the course of multi-phase tectonic movement were the main pathway of lateral movement of hydrocarbon and the well-developed abnormal faults were the main vertical pathway. The sands bodies of fluvial facies in alluvial fans in front of the Zhair Mountain offered a very favorable reservoirs for oil-sand mine. Hard biodegradation make the viscosity of hydrocarbon heavier and heavier. The hydrocarbon seized on the surface of sands, and then oil sands were formed. The peculiar characters of the northwest edge of the Junggar Basin make the oil sands occur at the compressive side of the basin. And the lateral distribution of oil sands mine is bigger and the scale is smaller relatively. The fault’ openness, fossil landscape, sedimentary facies, oil viscosity etc. have controlled the abundance and distribution of oil sands.

KEY WORDS: Oil sands; sources rock; tectonic movement; compressive basin; biodegradation.

INTRODUCTION

Oil sands were firstly developed in Canada commercially, and the exploration & development of oil sands in Canada is on the front of the world. Alberta is one of the oil-sand rich area and developing oil sands most successfully (Flach, 1984). The oil produced from oil sands was about 48.1 million tons in 2002, 72.8 million tons in 2006. The bitumen resources in oil sands are about 5.97 trillion tons in China, according to the result of the New Around Nationwide Petroleum Resources Assessment (Jia, 2006). The oil sands resources in the Northwest Edge of Junggar basin is similar to that in Alberta of Western Canadian Sedimentary Basin and in Orinoco of Eastern Venezuela Basin, because they are all compressive basins.

The favorable conditions for large oil sands reservoir to accumulate

The Alberta in Canada and the Orinoco in Venezuela are the oil-sand richest area (Flach, 1984; Wei, 2006). The tow areas are very similar and respectively locate in the Western Canadian Sedimentary Basin and in the Eastern Venezuela Basin. Both of the tow basins are foreland basins (Dusseault, 2001). The Western Canadian Sedimentary Basin locates in front of the Rocky Mountain and pinches out against the Canadian Shield igneous rocks (Dan, 2001). The Eastern Venezuela Basin locates in front of the Sierra Orientate and pinches out to the south against the igneous rocks of the Guyana Shield (Francisco, 1997).

The geologic characteristics of the tow foreland basins have determined the gathering and distributing similarity of bitumen in Alberta and Orinoco. The Cretaceous shale deposited in the axis of basin is the main source rock. Because of the thrust of the Rocky Mountain, the Cretaceous source rock became mature with the depth becoming deeper and deeper. At the same time, the hydrocarbon from source rock begins to migrate up with the gradient caused by compressing before Rocky Mountain (Guy, 2001). A major conduit for northeast directed fluid migration was the pre-Cretaceous unconformity, a complex karstic surface that has had a major effect on basin hydrodynamics (Anfort, 2001). Lower Cretaceous Mannville McMurray formation and Clearwater formation controlled the oil sands accumulation (Demaison, 1977). The Clearwater marine shale overlies the McMurray and is a very perfect cap (James, 1977; Steve, 2006). The oil sands gathering conditions in the Eastern Venezuela Basin and the Western Canadian Sedimentary Basin are analogous. The viscosity and density changed to higher and heavier at shallower position on the cratogene side of the basin, caused by biodegradation, and then oil sands were formed.

The Oil Sands Accumulating Conditions in the Northwest Edge of Junggar Basin

The oil-sand forming was mainly controlled by the long-lasting