## Geological characteristics and accumulation mechanisms of the "continuous" tight gas reservoirs of the Xu2 Member in the middlesouth transition region, Sichuan Basin, China

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**Abstract:** "Continuous" tight gas reservoirs are those reservoirs which develop in widespread tight sandstones with a continuous distribution of natural gas. In this paper, we summarize the geological features of the source rocks and "continuous" tight gas reservoirs in the Xujiahe Formation of the middle-south transition region, Sichuan Basin. The source rocks of the Xu1 Member and reservoir rocks of the Xu2 Member are thick (Xu1 Member: 40 m, Xu2 Member: 120 m) and are distributed continuously in this study area. The results of drilled wells show that the widespread sandstone reservoirs of the Xu2 Member are charged with natural gas. Therefore, the natural gas reservoirs of the Xu2 Member in the middle-south transition region are "continuous" tight gas reservoirs. The accumulation of "continuous" tight gas reservoirs is controlled by an adequate driving force of the pressure differences between source rocks and reservoirs, which is demonstrated by a "one-dimensional" physical simulation experiment. In this simulation, the natural gas of "continuous" tight gas reservoirs moves forward with no preferential petroleum migration pathways (PPMP), and the natural gas saturation of "continuous" tight gas reservoirs is higher than that of conventional reservoirs.

**Key words:** Geological characteristics, accumulation mechanism, "continuous" tight gas reservoir, Xu2 Member, middle-south transition region, Sichuan Basin

## **1** Introduction

"Continuous" tight gas reservoirs are those reservoirs which develop in widespread tight sandstones with a continuous distribution of natural gas (Gautier et al, 1995; Schmoker, 1999; 2002; 2005). The global resource of "continuous" tight gas reservoirs is great, meaning that they have huge exploration potential (Gautier et al, 1995; Schmoker, 1999; 2002; 2005; Klett and Charpentier, 2003; Klett and Schmoker, 2004; Cook, 2004; Crovelli, 2004). The American production of "continuous" tight gas reservoirs in 2007 reaches  $0.5 \times 10^{12}$  m<sup>3</sup>, accounting for 1/6 of the overall natural gas production (Pollastro, 2007). Therefore, it is important to enhance the research into exploration and development of "continuous" tight gas reservoirs. These reservoirs are characterized by the following aspects: 1) the source rocks primarily contain type III kerogen and are distributed continuously; 2) the reservoir rocks are distributed continuously and have low porosity and permeability; 3) these reservoirs commonly consist of large volumes of sandstones pervasively charged with gas; 4) the sources rocks are close to sandstones and most of these reservoirs are not directly dependent on the buoyancy of gas in water for their existence.

There are rich natural gas resources in the Xu2 Member in the middle-south transition region, Sichuan Basin, China. Several big natural gas fields such as Hechuan, Tongnan and Anyue whose reserves are all over  $0.1 \times 10^{12}$  m<sup>3</sup> have been found in recent years. The exploration results show that each drilled well in the Xu2 Member in the study area is capable of producing at least some gas, but the production characteristics of the drilled wells can vary significantly  $((0.001-200)\times 10^3)$  $m^{3}/d$ ). Many geologists have carried out their studies of the Xujiahe Formation in this area (Zhang and Zhang, 2002; Zou et al, 2008; Yang et al, 2006; Guo et al, 1996; Deng, 1992). In summary their results show: 1) the lower source rocks in the Xu1 Member are close to the upper sandstones in the Xu2 Member; 2) there are large volumes of sandstones pervasively charged with gas and which cannot be represented in terms of individual, countable pools delineated by down-dip water contacts. All the characteristics are different from those of conventional natural gas pools.

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