

Geochemical, Physical Properties and Shale Gas Prospects of the Wufeng-Longmaxi Marine Shale in Nanchuan, Southeast Margin of the Sichuan Basin

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Thick marine shales occur in the Wufeng Formation (O_{3w}) and the Lower Longmaxi Formation (S_{1l}) of Nanchuan District of Chongqing Province, which is located at southeast margin of the Sichuan Basin. In geological times of Late Ordovician and Early Silurian, the sedimentary environment and tectonic settings of Nanchuan used to be similar to those of the Jiaoshiba shale gas field in Fuling District of Chongqing Province, which is located in the Eastern Sichuan Basin. However, geochemical characteristics and physical properties of the Wufeng-Longmaxi marine shales in Nanchuan are rarely reported in previous studies. In this study, a well about 100 m deep was drilled at Sanquan town of Nanchuan District and the geochemical characteristics of the Wufeng-Longmaxi shales, such as total organic carbon content (TOC) and mineral compositions, together with physical properties including porosity, specific surface area, pore volume and pore-size distribution were measured. The results indicated that geochemical characteristics and physical properties of the Wufeng-Longmaxi shales varied with ancient sedimentary environment. Deep-water shelf facies were more conducive to the accumulation of organic matter and excess silica. Katian, Hirnantian in the Wufeng Formation, Rhuddanian in the Longmaxi Formation (TOC > 2%, clay < 40%) were mainly high-quality shale intervals.

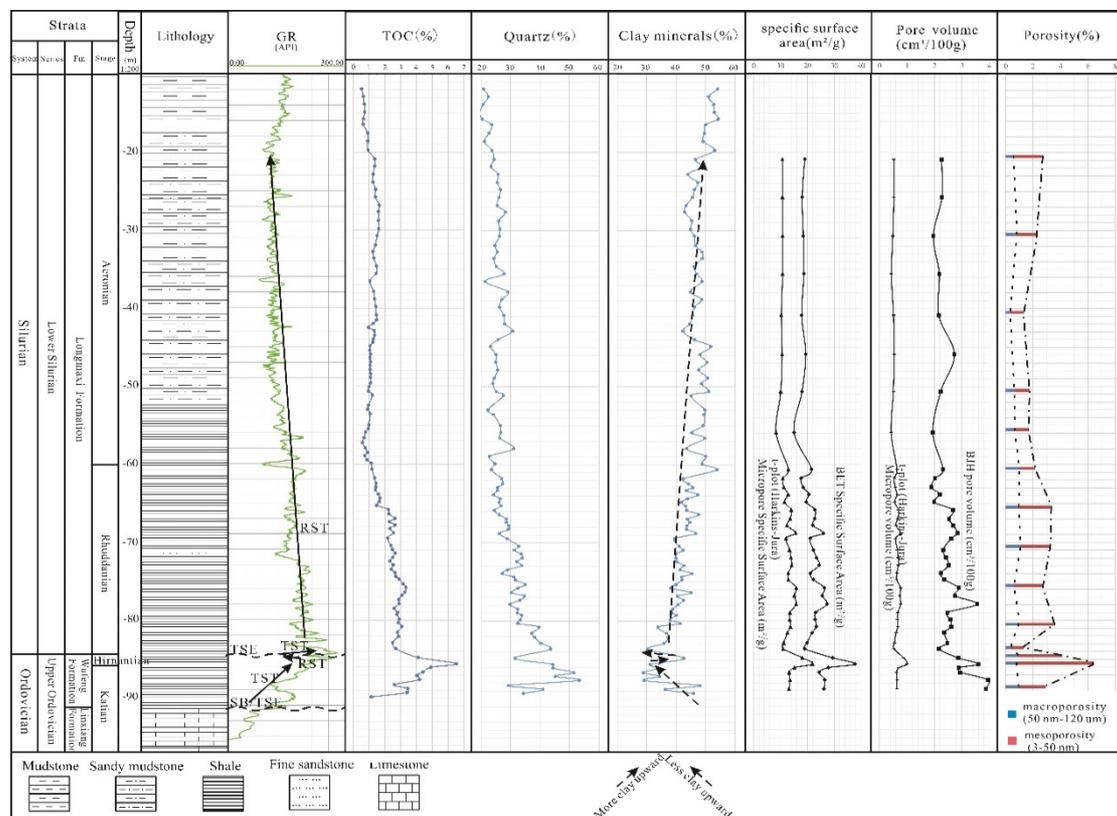


Fig. 1. A comprehensive histogram of Well SY-1 logs, lithology, geochemical parameters and

physical properties.

High quality TOC, quartz and brittle mineral contents, excess silica, high porosity and better kerogen type are mainly developed in TST and the early stages of RST. Figure 1 shows that the variation curves of the quartz contents and TOC are basically similar to those of API. But there is a negative relationship between API values and clay contents. Variations in porosity were mainly related to changes in TOC in that high TOC shales usually have high pore volume and high surface area. However, the coarse mesopore (25-50 nm) volume and macropore (>50 nm) volume of shale samples in Katian and Hirnantian can be significantly reduced when they were filled by bitumen though these shale samples have very high TOC values. FE-SEM imaging suggests that the coarse mesopore (25-50 nm) volume and macropore (>50 nm) volume of shale samples near interlayer sliding scratches were influenced by tectonic movements.

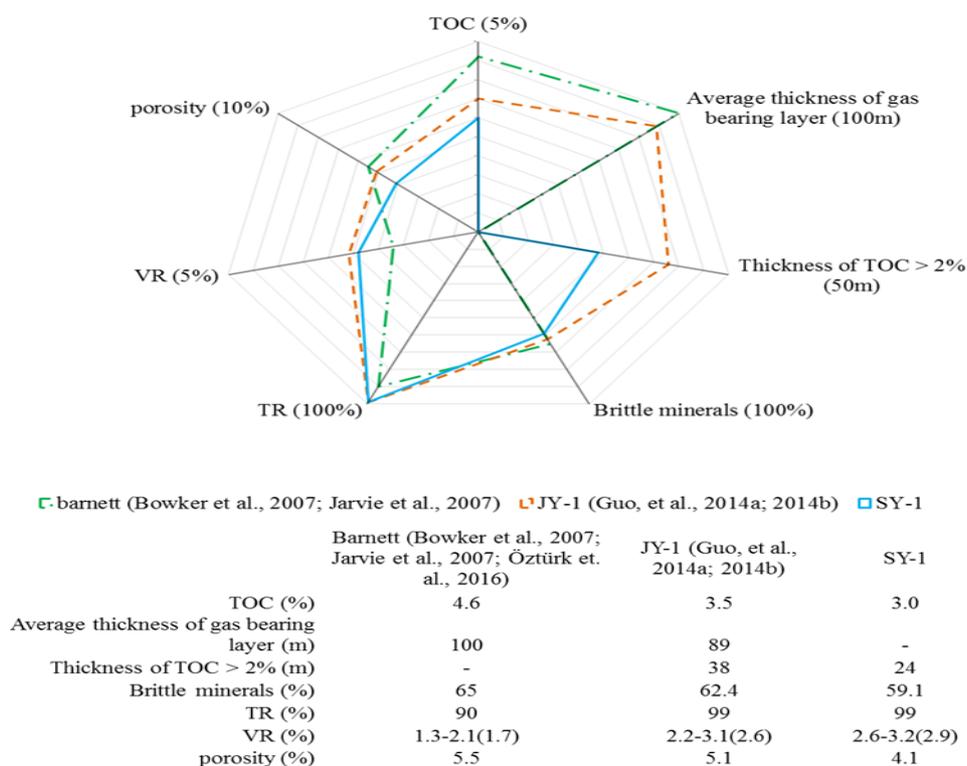


Fig. 2. Parameters reflecting resource potentials for the Wufeng-Longmaxi shales from Well SY-1, Well JY-1, and the US Barnett shales in Newark East field.

Most geochemical characteristics and physical properties of Wufeng-Longmaxi shales in Nanchuan were similar to but no better than those in Jiaoshiba shale gas field (Fig. 2). However, TOC values of shales in both Nanchuan and Jiaoshiba were significantly lower than those of the Barnett shales in Newark East field.

References:

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