

The First Shale Gas Field in Sichuan Basin, Southwestern China: Geologic Characteristics and Structural Controls on Accumulation

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Abstract

The Fuling field is the first commercial shale gas field in China. The first major shale discovery in the Jiaoshiba anticline was made in 2012 in Southeastern Sichuan basin. The shale gas was sourced in an organic-rich Longmaxi Formation shale in the lower Silurian, and established the Fuling shale gas field. To date, a total of more than 100 wells have been drilled in the Jiaoshiba area (approximately 500km²). About 50 wells were completed and tested, with an initial production test rate of 10-50 x 10⁴m³/day. An overpressured gradient was observed. As of September 2014, more than 10×10⁸ m³ has been produced from the Fuling shale gas field.

Longmaxi Formation stratigraphy is relatively straightforward. Wells are typically completed in the upper Ordovician, whose aggregate thickness approaches 260m. Total organic carbon (TOC) content of the Longmaxi ranges from 0.5 to 6.79% by weight, with an average thickness of 89m. Ro value varies from 2.2% to 3.06%. These black shales are silica rich (22.9–80.5%) and contain abundant dolomite and limestone concretions.

Key geologic and technical factors defining the Fuling shale field are similar to other shale-gas plays, including thermal maturity, reservoir pressure, play thickness, porosity, permeability, gas in place, the role of natural fracturing, mineralogy, depth, structural style, and fracability. Among of these factors, the key elements controlling production have the following characteristics:

- The drilling depth is from 2400 to 2750m in the Longmaxi Shale play, with a pressure gradient of 1.4-1.55. The Longmaxi Shale benefits from a significant over-pressured profile in the Jiaoshiba area. The structural setting and style is critical for the forming of natural fracture and pressure maintenance.
- Another key regional component of the emerging Longmaxi Shale play is its relationship to the fault networks. Some faults are strike NE parallel to the basin boundary fault. Some faults are strike south to north and related to basement. These basement faults represent zones of weakness believed to have been reactivated several times during the Mesozoic. In addition, reactivation caused significant structural compression in Jiaoshiba area. It is likely that movement along these faults has continued well into the Quaternary. As the surface expression of several of these major features are clearly apparent on the geological maps.
- The interaction of the two fault systems in Jiaoshiba area and the strike slip layer in the bottom Longmaxi is favorable to achieve a three-dimensional fracture net-work and sustain overpressure.