

## **Mechanisms of Shale Gas Storage in Marine Shales with Complex Evolution Histories: A Case Study from Sichuan Basin, SW China**

**Li Zhuo, Song Yan, Jiang Zhenxue, Ji Wenming, Tang Xianglu, and Gao Xiaoyue**

State Key Laboratory of Petroleum Resources and Prospecting

### **Abstract**

The mechanisms of shale gas storage in marine shales in Sichuan Basin; SW China with complex evolution histories is rarely discussed. Shale core samples were collected from shale gas wells drilled in the Sichuan basin and methane sorption capacity (MSC) and its geological controls and burial history were investigated using High-pressure adsorption experiments and Basin modelling. MSC was measured at pressure up to 20 MPa and temperature at 30°C, 40°C, 50°C, 60°C, and 70°C. The controls of organic matter content, maturity, mineralogical compositions and reservoir conditions (temperature and pressure) on MSC were discussed. The total organic carbon contents (TOC) range from 0.54 wt % to 4.23 wt %. The thermal maturities, as inferred from Rock-Eval Analysis, are over matured. The mineral compositions of the samples are dominated by clays (36 – 57 wt %) and quartz (40 – 74 wt %). The MSC of moisture-equilibrated and dry shale samples show a positive correlation with TOC contents and BET surface areas. No relationship was observed between the clay contents and MSC. The MSC increases with increasing pressure and decrease with increasing temperature. A computational scheme has been developed to calculate the MSC as a function of TOC content, temperature and pressure based on Langmuir sorption isotherm function and to simulate the free gas contents through PVT phase modeling and porosity evolution. Two models are proposed to restore the variation of adsorbed gas, free gas and total gas content over geologic time as a function of burial history. Free gas can be well preserved in shales (e.g. well JY-1) with relatively slow uplift and erosion. Loss of free gas during quick uplift and erosion (e.g. well YC-1) can result in low total gas contents. Gas preservation is the vital issue for successful marine shale gas exploration in China.