Influence of fluid activities on preservation conditions of shale gas in the Niutitang Formation in Southeastern Chongqing

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In this paper, field desorption and nitrogen isotope of shale gas and homogenization temperature and salinity of fluid inclusions in quartz, calcite veins were used to conduct comparative studies on gas content, compositions and sources of shale gas in the Lower Cambrian Series Niutitang Formation in Southeastern Chongqing and its adjacent areas in Sichuan Basin. The results showed that the homogenization temperature of fluid inclusion in the quartz vein in the Southeastern Chongqing was distributed in 89 °C -188.5 °C, and the salinity was in 0.6 % -27 % NaCleq. However, the homogenization temperature distribution of fluid inclusions in calcite veins was in the range of 104 °C-244 °C, with salinity ranging between 0.5 % and 26 % NaCleq, showing great variation range. This is mainly because that the target layer may be affected by fluid activities during the burial and uplifting of strata. The active fluid in the burial process may be the formation water sealed in the strata, however, that in the uplifting of strata can possibly be the brine water mixed by the meteoric water and residual sealed formation water. It is discovered in the analysis of coupling between fluid activity period and history of hydrocarbon generation and expulsion, the late fluid activity at the horizon was after the end of large-scale hydrocarbon generation, therefore the fluid activity may have a greater influence on the preservation of shale gas reservoirs. The shale gas sample is rich in N2, which contains nitrogen isotope range of -5 ‰ ~ 0 ‰. Combined with geological background in the study area, it is believed that the N2 present in shale might be mixed with atmospheric nitrogen. At specific period in geological history, the shale in the Niutitang Formation in the study area may be connected to the atmosphere. The atmospheric precipitation was mixed with the high salinity brine in the formation in different proportions, resulting in great variation in the salinity of fluid inclusions.

Keywords: Niutitang Formation, Shale gas, Southeastern Chongqing, Preservation conditions, Fluid history analysis