Characteristic of Fluid Inclusion of the Xujiahe Formation in the Central Sichuan Basin, China

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The Sichuan Basin is an inner plate basin at the west of Yangzi Plate. It is a large petroliferous basin with marine carbonate deposition and terrestrial clastic deposition. Its gas bearing area can reach $18\times10^4 km^2$, and the gas proven reserves, gas fields number and gas production are all the No.1 in China[1,2].

In our project we chose more than 80 samples of fluid inclusions from tight sandstone reservoirs of Xujiahe Formation in 28 wells, all of which are located in gas bearing intervals from gas fields in middle Sichuan area. The conclusions are as follows□

1.In the center of the Sichuan Basin, the maturity of source rock in the Xujiahe Formation is not high, with Ro value ranging from 0.8% to 1.2%. However, the gas reservoirs nowadays show characteristics of high gas-oil ratios and low condensate oil content (3.8~91.9g/m^3 on average). There are abundant gas hydrocarbon inclusions developed in the reservoir, with few liquid hydrocarbon inclusions, which shows that the coal measures have given priority to gas.

2.In the fluid inclusion group, the CH_4 accounts 79.62~96.42%, and C_2H_6 is about 10%, the content of C_3H_8 ranges from 3% to 5%. As to the carbon isotope of CH_4, $\delta^{13}C_1$= -44.59~-39.31‰, $\delta^{13}C_2$= -24.82~-28.05‰, $\delta^{13}C_3$= -21.39‰, $\delta^{13}C_4$= -22.05~-20.2‰, $\delta^{13}Cco_2$= -9.14~-13.86‰. The gas component and isotope in fluid inclusions coincide with the carbon isotope in the gas reservoirs today, showing that the gas hydrocarbon in the fluid inclusions can represent the residue gas in the gas reservoirs. The residue gas is mainly formed and preserved in the late stage.

3.The He and Ar associated with natural gas are positively related in content. $^{40}Ar/^{36}Ar$ and $^3He/^4He$ also has a positive correlation. He and Ar isotopic composition analysis shows that, R/Ra ratio is less than 0.5, the majority of 0.1 or less , reflecting the crust was stable then, no deep large faults or deep-source gas mix, the natural gas was mainly from the shallow crust.

[1]Dai Jinxing(1997) *et al* Formation conditions and distribution laws of giant gas fields in China: 184-198. [2] Dai Jinxing (2007) *et al*, *Natural Gas Geoscience*, **18**(4): 473-484

Li isotopes in zircon: Effects of Li substitution and kinetic fractionation

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In situ SIMS (Secondary Ion Mass Spectrometry) analysis of Li isotopes in zircon shows potential for studying the origin of crustal magmas. However, it is controversial whether δ^7Li in zircon reflects the magmatic sources of the zircon, or was modified by later processes. To understand Li behaviour in magmatic systems, δ^7Li and Li abundance have been investigated in whole-rock samples and zircon crystals of several standards (Temora, Plesovice, Qinghu) as well as two A-type granites from Suzhou (aluminous A-type granite) and Taohuadao (peralkaline A-type granite), east China. The measured δ^7Li values range from -12 to -1‰ for Temora, and -4 to -1‰ for Qinghu; in both cases δ^7Li is weakly correlated with ppm Li, indicating a relatively slow rate of Li diffusion. However, Plesovice (δ^7Li = -4 ~ +3‰) and M257 (*in situ* zircon Li isotope standard, δ^7Li = 2.1±1‰) show no sign of diffusion. This suggests that the Li diffusion rate might be controlled by the trace-element composition of zircon. Large variations in Li abundance (up to 10 ppm) and δ^7Li values (26‰) have been measured in zircons from per-alkaline and more aluminous A-type granites samples. The Li abundance in zircon from the Suzhou pluton is 10x to 100x higher than in the Taohuadao pluton. The measured δ^7Li values from Taohuadao range from -21 to 2‰ and are positively correlated with ppm Li, while the δ^7Li values of Suzhou range from -7 to +7‰ and correlate negatively with Li content. In contrast, the whole-rock lithium concentrations and isotope ratios show a more narrow range (+2 to 5‰). The possible explanation for the large variations in Li and δ^7Li values in zircon is that the diffusion of Li is controlled by different substitution mechanisms that involve other trace elements, resulting in kinetic fractionation of the Li isotopes. However, Li abundances in zircon could be a petrogenetic tracer to identify different sources of A-type granites.

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