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The Gas Accumulative Characteristics and Distribution of Deep Tight Gas in Kuqa Foreland Depression of Tarim Basin

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The Late Cretaceous Bashijiqike Formation is a lithic-rich, tight gas sandstone reservoir in Kuqa field, Tarim basin. The Bashijiqike has measured porosities of less than 9% and permeabilities that are generally less than 0.1 md. This is the result of significant mechanical and chemical compaction, precipitation of carbonate cements and authigenic clays, and deep-burial cementation by quartz. Despite the poor reservoir quality of this tight-gas sandstone, some breakthroughs are obtained in recently exploration activities.

It is not uncommon that deep (>6km [approximately 19,500ft]) tight gas sandstone reservoirs are widespread in Kuqa foreland depression. To correctly research the deep tight gas, more reservoir parameters (including temperature, pressure, reservoir type, and so on) were used based on more reservoir geology principles (including petroleum geology, reservoir engineering and organic geochemistry, and so on). Our results indicate that:

The content of methane is higher (more than 95%); the non-hydrocarbon content is lower besides hydrothion, aridity coefficient ($C_1/(C_1\text{-}C_5)$) more than 0.97, and the aridity coefficient become gradual larger from Dabei area to Keshen area, and the nature gas constitutes of Dabei area conforms to that of Keshen area. Ethane carbon isotope usually becomes weight (>-28‰), that is the characteristic of humic nature gas. Based on the corrected methane carbon isotope, the maturity (Ro) of nature gas was higher (average more than 1.3% with the maximum as high as 3.17%), which demonstrates the gas origin from source rock that is post-mature. Base on the correlation diagram of ln (C_1/C_2) with respect to ln(C_2/C_3), it can be obtained that the gas origin from the kerogen cracking of humic type (Fig.1).Formation water type is calcium chloride($CaCl_2$), and it shows acidity, the total mineralization is higher, which demonstrates the high quality seal of tight gas sandstone reservoir. The diversity of inorganic ion shows hydrodynamic system is different in Keshen area and Dabei area.

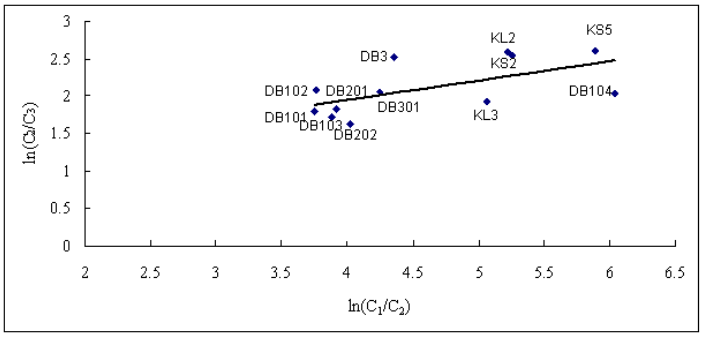

Fig.1 The correlation diagram of ln (C_1/C_2) with ln (C_2/C_3) of nature gas in Kuqa foreland depression

According to the core physical property measurement and well log interpretation technology, we find that the porosity and permeability of reservoir were quite low, it falls precisely in the range of extra-low porosity and extra-low permeability. And grounded on the information of

outcrop, core, imaging logging (FMI) and petrographic thin section, the reservoir type can be regarded as fracture-pore ones. The deep reservoir has high pressure-ultra-high pressure on the basis of the correlation diagram of pressure and depth. Anticline and fault-anticline are of vital importance among gas reservoir types; the following is fault block.

Based on the fluid inclusion homogeneity temperature, the trap was largely filled by the gas that origin from Jurassic source rock in Kuche period, and it belongs to accumulation in later period (Since 3-2Ma) in Keshen area; Dabei area has two accumulation stages with one Kangcun period (about 8Ma) and other since Kuche period (since 3Ma). The latter was of crucial importance for the tight gas reservoir forming, which also belong to forming in later period. This explains why some area produces gas and other area produces oil, or both in Kuche foreland depression.

To integrate the burial, thermal and hydrocarbon generation histories of soure rock, Kuqa foreland depression have three different accumulating areas of hydrocarbon. The first is the paleostructure area where the oil was accumulated into trap in early period, and the gas was accumulated in later period (which analogous to KL2).The second is also the paleostructure area where the oil was accumulated into trap in early period, and the gas was accumulated in later period; however, the trap was subjected to ruin owing to the influence of discordogenic fault of tectogenesis, therefore the trap was empty. The third is the non-paleostructure area in which only the gas was accumulated in later period, for which reason the reservoir only captured the finally dry gas (extro-high mature).

To sum up all the above study results, I have presented the gas distribution regularity in Kuqa foreland depression: the diversity of accumulation stages and process give rise to the difference of fluid characteristics (Fig.2).

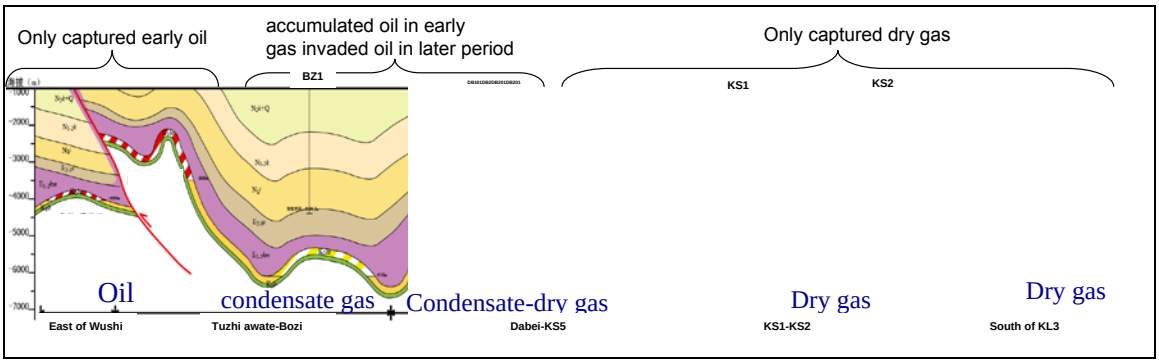

Fig.2 The comprehensive figure of gas characteristics and each reason of deep reservoir in Kuqa foreland depression of Tarim basin