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**Coalbed Methane and Production Water of Fuxin Basin, Northeast China: Chemical and Isotopic Geochemistry**

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Gas composition,  $\delta D$  and  $\delta^{13}C$  of coalbed methane; chemical composition,  $\delta D$  and  $\delta^{18}O$  of production water from Liujia block, Fuxin basin were analyzed in this study. TDS (total dissolved solids) of production water is low (1601 to 2384 mg/l) and exclusively  $NaHCO_3$  type.  $\delta D$  (-85.3 to -78.9 per mil),  $\delta^{18}O$  (-10.9 to -9.9 per mil), TDS of production water have a narrow range. The isotopic values of water from production wells, mine, river plot below the global meteoric water line (GMWL) on a line near but above the values of present-day water. The results indicate that all the water comes from meteoric water and has the similar distillation.  $\delta D$  (-258.8 to -230.41 per mil) and  $\delta^{13}C$  (-52.7 to -44.7 per mil) of coalbed methane plot on the thermogenic area of Whiticar's CD diagram(Fig.1). High  $C_1/C_{2+}$  ratio (above 3000) and  $\delta D_{CH_4-D_{H_2O}}$  diagram show that  $CO_2$ -reduction secondary biogenic gas mixed with thermogenic gas(Fig.2).  $\delta^{13}C$  (-22.6 to -18.6 per mil) of coalbed dioxide indicates that the mixing amount of biogenic gas is low. Three stages of coalbed methane accumulation is put forward: (1) In early Cretaceous, the original low mature ( $Ro=0.5$  to  $0.61\%$ ) thermogenic gas accumulated in the Fuxin group coal; (2) The basin is uplift and the sedimentary rock is eroded in late Cretaceous; (3) Diabase intrudes the coal-bearing strata in Tertiary and highly permeable contact zone is developed. Thermogenic gas from the contact metamorphic coal and deep strata, secondary biogenic gas from meteoric water along the contact zone, mixed with original low mature thermogenic gas.

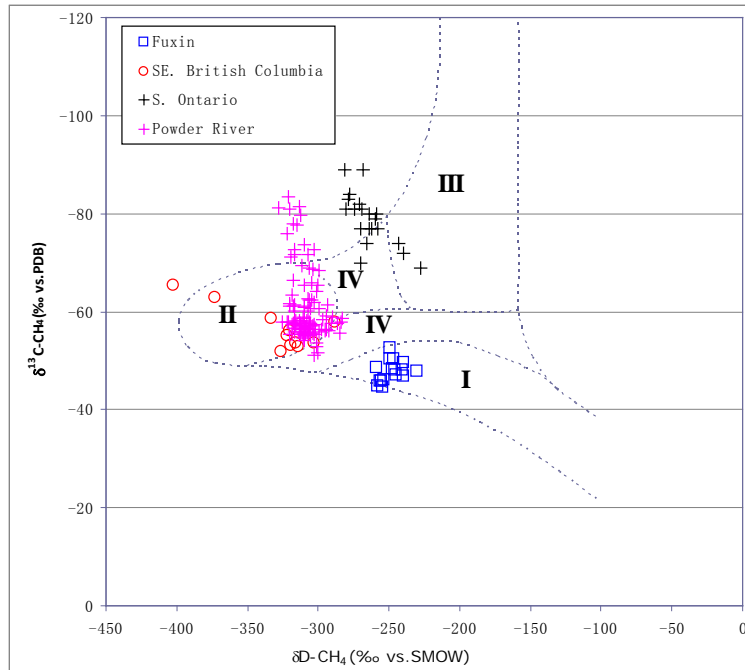


Fig.1: Whiticar's CD diagram for coalbed methane showing compositional fields for gases of various origins (Whiticar, 1996, 1999).

I-thermogenic gas; II-bacteria methyl type fermentation gas; III-bacteria carbonate reduction gas; IV-mixed and transition gas. Data of SE British Columbia and S. Ontario from Aravena et al. (2003, 1995) and Powder River from Flores et al. (2008) are used for comparison.

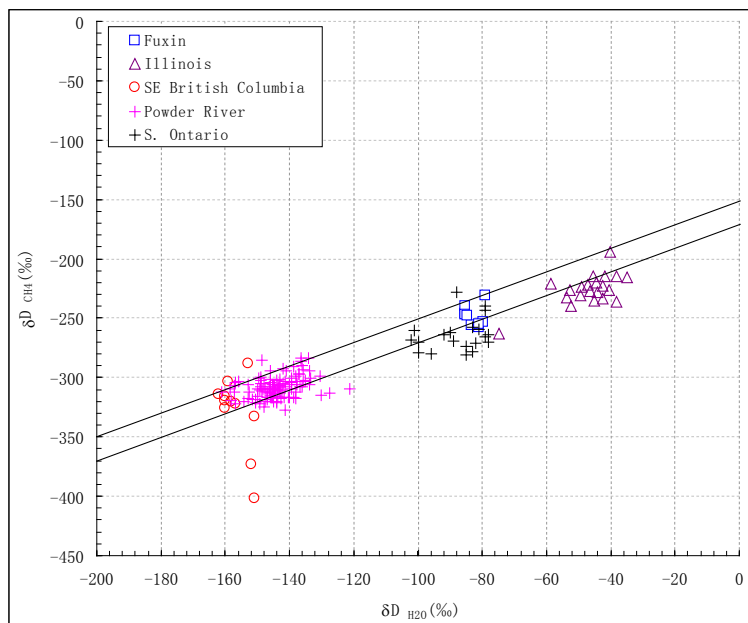


Fig.2: Diagram of  $D_{CH_4}$  of coalbed methane versus  $D_{H_2O}$  of production water. Data of Illinois (from Coleman et al., 1988), SE British Columbia and S. Ontario (from Aravena et al. 2003, 1995) and Powder River (from Flores et al., 2008) are used for comparison.

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