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Carbon isotope fractionation mechanism and influencing factors of coalbed methane

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The carbon isotope of coalbed methane (CBM) is more extensively distributed and lighter in composition than that of the normal natural gas, which may be influenced by the isotope fractionation during CBM desorption-diffusion. Through collecting coal samples of different maturity for canister desorption, carbon isotope fractionation mechanism and influencing factors during gas desorption was analyzed. The results show that observed fractionations are caused by faster diffusion of $^{12}CH_4$ relative to $^{13}CH_4$. The damage of coal structure during gas desorption may influence the isotope fractionations. The pore structure of coal varies with maturity, which has impact on the isotope effects during diffusion transport of gas, and the effects are larger for more mature coal. Due to the impact on isotope effects of the fracturing, the $\delta^{13}C_1$ values of gas collected in well head change irregularly in the initial stage. When determining the sources of coal gas, the $\delta^{13}C_1$ values of gas that desorbed at the time when half of the potentially available gas had been desorbed from coal are representative, which can be confirmed by the relationships between carbon isotope changes of methane and the percentage of methane desorbed from coal sample. For unconsolidated coal samples, the unusual figures should be eliminated before the other data are analyzed.