The variations of carbon isotope composition of methane released from gas field water and its geological significance

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By means of the methods of natural degassing and vacuum water-heating degassing, step by step degasification on gas field water from gas pools of coal-formed and sapropelic gases in Sichuan Basin. Comparative studies had been carried out on methane carbon isotope composition between water-released gas and free gas. It is found that, no matter what kind of gas pools, the $\delta^{13}C_1$ from gas field water is obviously less negative than that of free gas. Step by step degassing studies show that the $\delta^{13}C_1$ value of gas from gas field water became less and less negative as the gas released from water gradually. It indicates that the gas field water has obvious fractionation on methane carbon isotope composition. The water soluble gas resource in the world are very rich. In the process of gas accumulation, if the reservoir experienced substantial tectonic uplift, much gas may release from the water and then the free gas pool may propobly formed, or the released gas can mix with the gas in existing gas pool, so that the $\delta^{13}C_1$ in the gas reservoir will become less negative, such as the Weiyuan gas and Anyue gas fields in Sichuan Basin. Along the direction of formation water migration, the gases release from water gradually, and the $\delta^{13}C_1$ value in gas reservoir may have less negative trend along water migration direction, such as Hetianhe gas field in Tarim Basin. In Hetianhe gas field, the gas field water migrated from east to west which made the $\delta^{13}C_1$ value less negative in the west part than the east. In addition, if the $\delta^{13}C_1$ value is obviously less negative in some pools, it may show that the gas in these pools has mixed with considerable water-released gas from formation water.