

Hydrogen gas prior to water to hydrogenate source rock: Proof from hydrogen isotopic composition

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The pyrolysis experiment have proved that hydrogen-bearing matters can both make the product of pyrolysis much more similar to real petroleum [1] and improve the amount of product [2]. These hydrogen-bearing matters include rock, water and hydrogen gas.

Which one is the first hydrogenation matter is critical because there were both water and hydrogen gas [3] in petroliferous basin.

We carried out pyrolysis experiment by Type II kerogen with water and water together with hydrogen gas, respectively. The hydrogen isotopic composition of water is much heavier than that of hydrogen gas, that is, -47‰ V.S. -182‰(VSMOW). The pyrolysis temperature is as high as 500 °C and the enduring time is 48h.

The methane hydrogen isotopic composition character is interesting. The methane generated by kerogen adding water and hydrogen gas has much more lighter hydrogen isotopic value than that by kerogen with water alone.

It takes months to complete the hydrogen isotope fractionation between hydrogen gas and methane under high temperature [4]. Thus, the change of methane hydrogen isotope character was originated from the hydrogenation matters. The hydrogen gas prior to water to hydrogenate source rock, which results in the lighter hydrogen isotopic composition of methane.

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[1]Seewald J S, Benitez-Nelson B, Whelan J K. 1998. *Geochim. Cosmochim. Acta* **62**(9): 1599– 1617. [2] Lewan M D. 1997. *Geochim. Cosmochim. Acta*, **61**(17): 3691– 3723. [3] Sherwood B L, Onstott, T. C., G. Lacrampe-Couloume, et al. 2014, *Nature*, **516**:379-382. [4] Eoghan P. R, Jeffrey S.S, Sean P.S. 2012, *Geochimica et Cosmochimica Acta*, **77**:582-599.