Hydrogen isotope geochemistry of giant gas field in Ordos Basin

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The Ordos Basin is located in north-central China, is China's second-largest sedimentary basin, which contains the largest amount of gas fields with proved geological reserves over 100 b m^3 in China. 60 natural gases are sampled in Sulige, Yulin and Zizhou gas fields, and hydrogen analysis is carried out for all the natural gas samples. Our research results have shown that the gases in this basin are generally coal related gases with heavy hydrogen isotopic compositions [1-4]. However, the hydrogen isotopic distribution is different from each gas fields. In Sulige gas field, the δD_{CH4} value of natural gas is -180‰ ~ -167‰, δD_{C2H6} value ranges from -165‰ to -149‰, and δD_{C3H8} ranges from -166‰ to -146‰; The δD_{CH4}, δD_{C2H6}, δD_{C3H8} values of natural gas in Yulin gas field are -174~-168‰, -160~-143‰, -152~-132‰, respectively; The δD_{CH4}, δD_{C2H6}, δD_{C3H8} values of natural gas in Zizhou gas field are -169~-160‰, -158~-137‰, -152~-129‰, respectively. Hydrogen isotope values become heavier from east to west (Sulige -Yulin - Zizhou), namely the maturity of the natural gas increased gradually, and is consistent with that the maturity of Carboniferous-Permian source rocks become higher from east to west. This fully reflect the ralationship between hydrogen isotope values and the maturity of the natural gas.

From the aspect of hydrogen isotope series of CH_4, C_2H_6, C_3H_8 ralationships, the study shown that the hydrogen isotope series of Yulin and Zizhou gas fields increased gradually, the δD_{C2-1} values and δD_{C3-2} values greater than 5‰, exhibited a positive sequence; The δD_{CH4}, δD_{C2H6} of Sulige gas field exhibited a positive sequence, however, majority of gases showed a reverse sequence with δD_{C2H6}, δD_{C3H8} values, the δD_{C3-2} values lessr than -5‰, consistent with the C_2H_6, C_3H_8 carbon isotope series. This indicates that the natural gas of Sulige gas field is mixed with different maturity natural gas.

In summary, the hydrogen and carbon isotopic characteristics all showed that the natural gas in Ordos Basin is coal related gas, the hydrogen isotopic values can well reflect the maturity of natural gas.

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Industrial bio-heap leaching of uranium ores in a uranium mine

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Bioleaching have been widely thought as a commercial and environment friendly technique to recover metals from the low grade ores [1]. Through bio-leaching, uranium leaching yields can be increased, acid consumption can be reduced, and the leaching period can be shorten, as a result, lowering the production costs and raising the economic efficiency. In recent years, with the low grade uranium ores increasing in China, it is difficult and low efficiency to extract uranium from this kind of ores by traditional techniques. Therefore, bio-leaching, as a prospected technique which can lower down the production costs greatly, has been favoured by some of the Uranium Mines. Especially at the moment of energy crisis, it is very important to develop bio-leaching to the industrial production for the low grade uranium ores.

In this study, a 4, 315 tons of uranium minerals heap was biult in a Uranium Mine in southern China. The average chemical uranium grade of the minerals is 0.186%, mineral particle size is -6mm. A consortia with ferrous and sulfur oxidized acidiphiles was used to irrigate the heap after 30 days acidified with sulfuric acid solution. After 120 days, the leaching rate of 92.63% was obtained. Comparing to the conventional heap, leaching rate of the test heap increased about 3%, leaching period shortened 30-40 days and the acid consumption reduced about 2%. After the bio-heap leaching, the uranium content of slag is 0.0137%, which is lower than the conventional heap. Consequently, this industrial test of bio-heap leaching can be applied in this Uranium Mine and other Uranium Mines.

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