Weathering processes and source of DIC for two contrasting small watersheds in the subtropical zone China

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Based on analysis of the samples collected from the small watersheds in the southern Jiangxi and central Guizhou Provinces combined with history record of monthly variability in alkalinity for these small watersheds, the following conclusions have been drawn: (1) The Ganjiang River and its tributaries have low total dissolved solids concentrations and the chemical composition of river water is dominated by Na^+, Ca^{2+}, Cl^-, HCO_3^- and Si, which represents that of the river water from the typical silicate rock areas. The rivers in central Guizhou Province have much higher TDS than that of Ganjiang rivers, and the dominant ions are Ca^{2+}, Mg^{2+}, SO_4^{2-} and HCO_3^-, affected by cropping out the high proportion of the carbonate rock. (2) The quantity of CO_2 consumption for the watersheds in the southern Jiangxi and central Guizhou Provinces every year reaches 1.50×10^{10}mol yr^{-1} and 2.06×10^{9}mol yr^{-1}, respectively. (3) The annual chemical weathering rates in the southern Jiangxi and central Guizhou Provinces are 35.73 t/km^2·yr and 86.43 t/km^2·yr, respectively. (4) The values of $\delta^{13}C_{DIC}$ in the catchments of southern Jiangxi and central Guizhou Provinces are -8.35‰ to -13.74‰ (an average of -11.65‰) and -7.40‰ to -11.68‰ (an average of -8.72‰), respectively. At the same time, the tributaries have different $\delta^{13}C_{DIC}$ values because of the different environment and anthropogenic origins. The above-mentioned analysis would be likely to provide some basic investigation for the managing of drainage basins in the small watersheds of the the subtropical zone.

Possible origin of ethane and propane in biogenic gas from the Qaidam Basin

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There are abundant Quaternary biogenic gas resources in the Sanhu region of the eastern Qaidam Basin. In this study, we collected 35 natural gas samples, 11 formation water samples from Sebei 1, Sebei 2 and Tainan gas fields in this region. Gas components and isotopic compositions of carbon, hydrogen and noble gas have been measured. Natural gas is mainly composed of methane, which account for more than 99%. Ethane ranges from 0.048 to 0.081%, and other minor amounts gaseous hydrocarbons can also be determined with dryness coefficient (C_1/C_{1-5}) about 0.999. Isotopic characteristics of carbon and hydrogen of some components are: $\delta^{13}C_1$ values ranging from -61.8‰ to -68.6‰; $\delta^{13}C_2$ values from -40.7‰ to -50.6‰; $\delta^{13}C_3$ values from -31.9‰ to 36.2‰; δD_1 values from -214‰ to -231‰, and $\delta^{13}C_{CO2}$ values in the range of -23.5‰ to -6.3‰.

According to $\delta^{13}C_1/\delta D_1$ diagrammatic display and the relationship of $\delta D_{methane}$ and δD_{water}, it can be seen that microbial methane mainly originates from reduction of carbon dioxide. Methane is regarded as only end products of microbial effect, whereas associated ethane and propane are generally considered as thermogenic origin. However, $\delta^{13}C_2$ for tertiary and Jurassic thermogenic gas in the Qaidam Basin are -20‰ ~ -37.6‰ and $\delta^{13}C_3$ with -16.8 ~ -29.1‰, obviously, $\delta^{13}C_2$ and $\delta^{13}C_3$ values in Sanhu region are lighter than thermogenic gas in the Qaidam Basin. Thus, the presence of ethane and propane in biogenic gas does not represent the mixing of thermogenic gas with bacterial gas, it maybe shows that these heavy gaseous hydrocarbons components are also generated from microbe.

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