

Stable Carbon Isotope Biogeochemistry and Anthropogenic Impacts on Karst Ground Water, Zunyi, Southwest China

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Received: 17 January 2008 / Accepted: 4 June 2008 / Published online: 20 June 2008
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Abstract Natural and anthropogenic impacts on karst ground water, Zunyi, Southwest China, are discussed using the stable isotope composition of dissolved inorganic carbon and particulate organic carbon, together with carbon species contents and water chemistry. The waters can be mainly characterized as $\text{HCO}_3\text{-Ca}$ type, $\text{HCO}_3 \cdot \text{SO}_4\text{-Ca}$ type, or $\text{HCO}_3 \cdot \text{SO}_4\text{-Ca} \cdot \text{Mg}$ type, according to mass balance considerations. It is found that the average $\delta^{13}\text{C}_{\text{DIC}}$ values of ground waters are higher in winter (low-flow season) than in summer (high-flow season). Lower contents of dissolved inorganic carbon (DIC) and lower values of $\delta^{13}\text{C}_{\text{DIC}}$ in summer than in winter, indicate that local rain events in summer and a longer residence time of water in winter play an important role in the evolution of ground water carbon in karst flow systems; therefore, soil CO_2 makes a larger contribution to the DIC in summer than in winter. The range of $\delta^{13}\text{C}_{\text{DIC}}$ values indicate that dissolved inorganic carbon is mainly controlled by the rate of carbonate dissolution. The concentrations of dissolved organic carbon and particulate organic carbon in most ground water samples are lower than 2.0 mg C L^{-1} and 0.5 mg C L^{-1} , respectively, but some waters have slightly higher contents of organic carbon. The waters with high organic carbon contents are generally located in the urban area where lower $\delta^{13}\text{C}_{\text{DIC}}$ values suggest that urbanization has had an effect on the ground water biogeochemistry and might threaten the water quality.

Keywords Stable carbon isotope · Ground water · Carbonate weathering · Anthropogenic impacts

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