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Short-time Scale Carbon Cycles in Karst Processes and Their Carbon Sink Effect

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High-resolution monitoring data and case studies from southwest China karst region indicated that carbonate rock dissolution with the involvement of organisms no longer is a slow geological process as regarded it is, and responds sensitively to land-use pattern change. Changes in vegetation patterns could improve the size of karst carbon sinks; for example, in typical karst depression area the carbon sink was 3 times higher in primary forest than in secondary forest soil and 9 times higher than under shrubland, equating to an increase from 5.71–7.02 t/km².a to 24.86–26.17 t/km².a from cultivated land or shrub to secondary forest and to primary forest, respectively.

On the other hand, dissolved inorganic carbon (DIC) resulted from karst processes could be transformed to organic carbon by photosynthesis (bio-pumps) of aquatic vegetations in spring-fed rivers or lakes, thus forming a net carbon sink. For example, results from high resolution data logger monitoring and high-frequency sampling in an underground stream-fed river(Guancun) in Guangxi, Chinas howed that all of the chemical parameters from two downstream monitoring stations show diel variation over the monitoring period, suggesting that plant activity in the river has a strong influence on water chemistry of the

river. The comparison of the input fluxes from the groundwater with the output fluxes of HCO₃⁻ estimated at the downstream monitoring station during the high-frequency sampling period shows a strong decrease of HCO₃⁻, indicating that the river is losing inorganic carbon along its flow path. The loss is estimated to be about 1,152 mmol/day/m of HCO₃⁻ which represent about 94.9 kg/day of inorganic carbon along the 1,350 m section of the Guancun River, about 9 times higher than the result from the Ichetucknee River, Florida, USA. It means that HCO₃⁻ entering the river from karst underground stream was either consumed by plants or trapped in the authigenic calcite and thus constitutes a natural sink of carbon for the Guancun karst system. This also suggests that carbon sink caused by photosynthetic process of subaquatic vegetation in southern China karst area is much higher, and thus cannot be neglected in the estimation of karst carbon sink, especially in large karst rivers with abundant subaquatic vegetation.

Accordingly, karst processes are actively involved in global carbon cycle over various time scales, and disturbed easily by human activities. Meanwhile, it could be regard as an interventional geological process-driven carbon cycle, and contribute to CO₂ emission reduction.

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