Chemical and isotopic approach on an algae bloom in the Hongfeng Lake, Southwest China

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The trigger mechanism and normalization of precaution indicators for algae bloom in freshwaters remains a challenge to scientific communities. Here, we present a chemical and isotopic approach on an algae bloom in the Hongfeng Lake (a man-made drinking-water reservoir), based on a high-frequency sampling (daily to weekly) during a period from August to December of 2007. The measured parameters includes: water temperature, pH, dissolved oxygen, chlorophyll α, NH_3-N, total N, total P, algae biomass, dissolved inorganic carbon (DIC) content and carbon isotope composition ($\delta^{13}C$), and C/N ratio of algae biomass. The particulate organic matter was completely supplied by algae bloom, as indicated by its low C/N ratio (5.1-7.7). The DIC cycles were rapidly driven by the algae bloom. Its content displayed a highly negative correlation with its $\delta^{13}C$ value (Fig. 1). At the initial stage of algae bloom, the carbon source for algal photosynthesis was atmospheric CO_2, but at the remained stages it was provided by the oxidation of organic matter. The algae bloom was N-limited, not P-limited. This is in contrast to the fact that the eutrophication of most freshwater lakes is P-limited. The main factor to control the evolution of algae bloom was water temperature, as it was highly correlated with pH, NH_3-N, total N, algae biomass, DIC and $\delta^{13}C_{DIC}$.

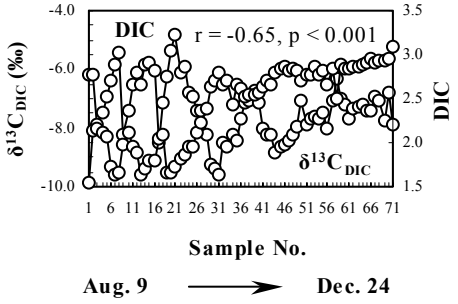

Figure 1: The negative correlation between DIC and its $\delta^{13}C$ value.

Determining groundwater recharge based on isotope concentration varying with pumping process

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Introduction

The Hexian iron mine is situated in Anhui province, east China. The iron deposit is distributed along the contact zone between Middle Triassic carbonate rock and volcanic rocks. The hydrogeological condition of the mineral deposit very complexity due to such three groundwater systems as unconfined groundwater in Quaternary porous aquifer, confined fissure water in Middle-upper Triassic sandstone, and confined karst water in Middle Triassic carbonate rock. Based on isotopic hydrogeology theory, this study focuses on the recharge of confined groundwater.

Sampling and Results

Our sampling and analysis, combined with the existed local geological information, can be summarized concisely into the following steps: (1) one background sample of unconfined groundwater was taken from Quaternary porous aquifer; (2)continuous pumping tests were carried out respectively in fissure aquifer and karst aquifer, the pumping time was more than 48 hours; (3) after 10 minutes pumping, the background groundwater sample was taken; (4) one water sample was taken every hour after 30 minutes pumping and one water sample every two hours after 8 hours pumping; (5) oxygen and hydrogen stable isotopes in groundwater samples were measured; (6) based on the variations of isotope concentration during each well pumping process and combining the isotope concentration in background sample of each aquifer, groundwater recharge sources of each aquifer were analyzed.

The results shows that: (1) recharge capability of confined fissure water is poverty, pumping water mainly rely on fissure-aquifer dewatering after 4 hours pumping; (2) confined karst water can get continuous recharge from unconfined groundwater during pumping; (3) the hydraulic connection between fissure water and karst water is weak.

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