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Comparison of Atmospheric CO_2 Consumption of Carbonate Rock Weathering with Silicate Rock One in the Pearl River Basin, China

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Abstract: Atmospheric CO_2 can be absorbed and dissolved in water among karst processes. This process occurs not only in carbonate environments but also in lithological terrain globally. Few analyses, to date, have demonstrated how much atmospheric CO_2 can be absorbed in different lithologies in a river basin. Here, using the Pearl River basin of China as an example, we examine variations in weathering rates to assess the importance of carbonate rock weathering for atmospheric CO_2 fixation. Chemical and strontium isotopic analysis results of water samples collected from 11 stations in the Pearl River quarterly over one year reveal that independent of lithology (carbonate or silicate) HCO_3^-、Ca^{2+}、Mg^{2+} become the main ionic compositions of the river and geological carbon sink processes operate across the river basin. The river ion stoichiometric and flux calculation show that, the carbonate rock weathering rate and atmospheric CO_2 consumption are 28 mm/Ka and 540 x 10^3 mol/km^2/a respectively, which are ~11 and 7 times of that which occurs under silicate rock weathering; carbonate rocks provide the main atmospheric CO_2 sink in the basin. Under ideal climate and geological conditions, mean rock weathering rates and atmospheric CO_2 fixation in the Pearl River basin can reach 30 mm/Ka and 620 x 10^3mol/km^2 respectively. The atmospheric CO_2 consumption value is about 2.6 times of the average value of 60 assessed rivers in the world.

Key words: carbonate rock weathering; silicate rock weathering; atmospheric CO_2 sink; the Pearl River basin, China