

Chemical weathering, atmospheric CO₂ consumption, and the controlling factors of a small silicate watershed in subtropical zone

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Hydrochemistry of a small subtropical watershed, the Xishui River draining mainly gneisses and amphibolites is systematically investigated. By collecting samples from source area to river mouth in summer and winter, we discuss temporal and spatial variations of major ion concentrations. An inversion model is used to evaluate different contributions from atmospheric input, anthropogenic activities and rock weathering (silicate, carbonate, and evaporite), and calculate chemical weathering and atmospheric CO₂ consumption rates in the catchment.

The results show: (1) Major ion concentrations in summer are mostly higher than those in winter except for Si, which indicates that influence of intensive weathering, agricultural activities, and acid rain in summer exceeds dilution effect. (2) Contributions from atmospheric input are 13.2 % and 7.8 % in winter and summer, respectively. Anthropogenic activities provide only 2.4 % and 4.2 % major ions to the Xishui River, which has a slight influence on the hydrochemistry. Contributions from silicate weathering are 52.1 % and 48.7 %, and carbonate weathering are 28.4 % and 24.2 %. Therefore, though area of carbonate rocks only accounts for < 5 % of the drainage area, it has an important contribution to major cations in the Xishui River. Contributions from evaporite are 3.8 % and 15.1 % in winter and summer, indicating that influence of temperature on evaporite dissolution is more noticeable. (3) Silicate weathering rates are 0.64–4.44 t/km²y and 4.1–21.2 t/km²y in winter and summer, respectively. The atmospheric CO₂ consumption rates resulted from silicate weathering are 0.31–2.1×10⁵ mol/km²y and 1.94–10.2×10⁵ mol/km²y in winter and summer. The rates in the Xishui River are remarkably lower than those in small watersheds which had higher temperature and rainfall in tropical zone, and are higher than those in small watersheds had similar rainfall but lower temperature in central Europe and eastern France, indicating that temperature may be the most important factor influenced the chemical weathering rates in silicate watersheds.

Physiology, mineralogy and Fe isotope fractionation of Fe(II) oxidation by a marine photoferrotroph - Implications for the deposition of Precambrian BIFs

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Anoxygenic photoferrotrophs are capable of photosynthetic Fe(II) oxidation in the absence of oxygen. Because of this ability they were suggested to be involved in the precipitation of oxidized iron minerals in Banded Iron Formations (BIFs) prior to the presence of significant amounts of O₂ on Earth. Although photoferrotrophs are thought to be important for Fe(II) oxidation in ancient oceans, previous studies related to BIFs have focused on freshwater strains [1]. However, marine geochemistry differs from freshwater probably strongly affecting anoxygenic Fe(II) oxidation and consequently the mineralogy and Fe isotope composition of the Fe(III) minerals produced. In this study we therefore quantified cell growth, Fe(II) oxidation rates, Fe isotope fractionation and mineralogy of Fe(III) precipitates during Fe(II) oxidation by the marine photoferrotroph *Rhodovulum iodolum*. We found that the maximum Fe(II) oxidation rate was slower than determined for the freshwater strains. The crystalline Fe(III) oxyhydroxides goethite and lepidocrocite were produced in contrast to the poorly crystalline ferrihydrite that is typically produced by the freshwater strains. During Fe(II) oxidation, the Fe(III) precipitate enriches in the heavier Fe isotopes while the aqueous Fe(II) becomes lighter, consistent with the trend observed for freshwater strains but with a significantly smaller fractionation factor than determined for the freshwater strain *Thiodictyon* F4 [2]. Our experiments demonstrate that anoxygenic phototrophic Fe(II) oxidation shows distinct differences in marine settings compared to experiments done under freshwater conditions and will ultimately allow us to better understand their role in the deposition of oxidized Fe minerals in Precambrian Banded Iron Formations.

[1] Hegler *et al.* (2008) *FEMS Microbiol. Ecol.* **66**: 250-260.

[2] Croal *et al.* (2004) *Geochim. Cosmochim. Acta* **68**: 1227-1242.