Sr isotope geochemical studies on rivers of South India: Evidence for high CO_2 consumption rates on chemical weathering of silicates

J.K. PATTANAIK*, S. BALAKRISHNAN, R. BHUTANI AND P. SINGH

Department of Earth Sciences, Pondicherry University, Pondicherry 605014, India
(*correspondence: jitendra.bapi@gmail.com)

Study of silicate weathering has attracted much interest as it sequesters atmospheric CO_2 over geological timescales [1]. Rivers draining volcanic terrains and tectonically active mountain chains were studied extensively as high rates of chemical weathering is observed in these areas which result in more CO_2 consumption [2, 3, 4, 5]. Whereas, this study is focused on Kaveri, Palar and Ponnaiyar rivers draining the Dharwar Craton (DC) and Southern Granulitic Terrain (SGT) of south India to estimate their weathering rates, which experience tropical bimodal monsoonal climate.

The Kaveri, Palar and Ponnaiyar rivers of south India were sampled during NE monsoon of the year 2005 and SW monsoon of 2006. The dissolved major ions, trace elements and $^{87}Sr/^{86}Sr$ ratios of river waters were measured. Using average annual flow, total drainage area and major ion concentrations of these rivers chemical weathering rates, annual fluxes of different ionic species to the ocean and CO_2 consumption rates were calculated after deducting atmospheric input. The final specific chemical denudation rate (silicate + carbonate) estimated for these basins ranges from 1.3 to 13 tons/km^2/y. During SW monsoon upper reaches draining Archean granitoid gneisses and greenstone belts of DC receive abundant rainfall and result in high $^{87}Sr/^{86}Sr$ ratio, whereas, during NE monsoon lower $^{87}Sr/^{86}Sr$ ratios were found in the rivers due to weathering of granulites and gneisses of the SGT that are exposed in lower and middle reaches.

The estimated CO_2 consumption rates vary between 3.49 – 8.48 × 10^5 mol km^{-2} a^{-1} in the main stream of Kaveri. The upper limit of CO_2 consumption rate of the Kaveri basin is close to the the area-weighted CO_2 consumption rate for the Deccan basalt, i. e. 0.36 × 10^6 moles km^{-2} y^{-1} [2]. CO_2 sequestered due to silicate weathering in this basin is 20.00 to 23.13 × 10^9 mole y^{-1} which represents 0.22 – 0.26 % of global CO_2 drawdown of 8700 × 10^9 mole y^{-1} [3]. Thus, CO_2 drawdown estimated for the Kaveri basin covering 0.044 % global drainage area is ~5.5 times higher than the global average consumption rate per unit area. This could be due to enhanced chemical weathering of silicate rocks under tropical humid climate.

[1] Edmond (1992) *Science* **258**, 1594. [2] Das *et al*. (2005) *GCA* **69,** No. 8, 2067–2084. [3] Gaillardet *et al*. (1999) *CG* **159**, 3-30. [4] Dessert *et al*. (2001) *EPSL* **188**, 459 – 474. [5] Galy & France (1999) *CG* **159**, 31–60.

Aerosl impacts on marine phytoplankton

ADINA PAYTAN*, KATHERINE MACKEY[1], EMILY REISTETTER[1] AND CLIFFTON BUCK[1]

IMS, UCSC, 1156 High Street, Santa Cruz, CA 95064
(*correspondence: apaytan@ucsc.edu)
(kmackey@stanford.edu, ereistetter@ucsc.edu, cbuck@ucsc.edu)

Atmospheric deposition (AD) of trace elements and nutrients to the ocean can significantly modify seawater chemistry and influence oceanic productivity. However, mounting evidence suggests that the response of phytoplankton to AD depends on the chemical composition of the aerosols and varies across different phytoplankton species. The goal of this study was to determine if metals from AD influence phytoplankton community structure in the subtropical Atlantic Ocean (Sargasso Sea). We analyzed metal concentrations in Bermuda aerosols to identify major metals constituents (Fe, Cu, Zn, Ni), and tested whether these metals are toxic to phytoplankton. Using different amounts of dust or pure metals, we performed incubation experiments with natural phytoplankton assemblages from the Sargasso Sea to identify threshold toxicity levels for these metals. Laboratory-based culture experiments with phytoplankton from different taxonomic groups helped identify species that were most sensitive to each metal. Variance in susceptibility to metal toxicity was identified among different taxa, suggesting that aerosol metal deposition could potentially alter patterns of marine primary production and phytoplankton community structure.