Silicate and Carbonate Weathering in the Mighty Mekong River Basin

K.E. RELPH[1]*, E.T. TIPPER[1], M.J. BICKLE[1], D.R. PARSONS[2], S.E. DARBY[3], R.A.J. ROBINSON[4]

[1] Dept. Earth Sciences, University of Cambridge, Cambridge CB2 3EQ, UK (*correspondence ker42@cam.ac.uk)
[2] School of Environmental Scienecs, University of Hull, Hull, HU6 7RX, UK (d.parsons@hull.ac.uk)
[3] Geography and Environment, University of Southampton, Southampton, SO17 1BJ, UK (s.e.darby@soton.ac.uk)
[4] Earth & Environmental Sciences, University of St. Andrews, KY16 9AL, UK (rajr@st-andrews.ac.uk)

The magnitude of the global total CO_2 flux from silicate and carbonate weathering remains uncertain because major rivers are inadequately sampled. The Mekong is the worlds 12th largest river by discharge [1]. Despite its global significance, published chemical weathering rates are contradictory and isotopic data is sparse. To better constrain the chemical weathering fluxes in the Mekong we collected water samples from 18 tributaries and the Mekong main channel in Laos and Cambodia in 2014, 2016. These were analysed for $^{87}Sr/^{86}Sr$ isotopes and major cations and anions. These samples, time series data collected between 1985 and 2000 by the Mekong River Commission and published data from China, are used to characterise 1) the geochemical and hydrological signatures, 2) the carbonate and silicate weathering rates and 3) the carbon (HCO_3^-) flux of the Mekong basin. The magnitude of the chemical inputs from rainfall and weathering of silicates, carbonates and evaporates have been calculated by a forward deconvolution assuming cation ratios of the weathering inputs given by [1]. The upper (Tibet to Northern Thailand), middle (Laos) and lower (Cambodia) regions of the Mekong vary in size, discharge and weathering signatures. The upper Mekong transports 34% of the total carbon flux, 31% of the carbonate, 36% of the silicate carbon fluxes but only 20% of the basin discharge. The middle Mekong contributes 49% of the discharge, 44% of the carbonate and 32% of the silicate carbon fluxes. The lower Mekong contributes 31% of the discharge, 32% of the silicate carbon flux but only 15% of the carbonate carbon flux. The Mekong transports comparable amounts of CO_2, via carbonate weathering, to the Brahmaputra and the Ganges but silicate weathering in the Mekong is ~10% of that in the Ganges and ~40% of that in the Brahmaputra, as estimated by [1]. $^{87}Sr/^{86}Sr$ isotopic ratios increase during the monsoon potentially reflecting a radiogenic contribution from northeast Cambodia which contrasts with the unradiogenic carbonate-dominated signals from the Tibetan plateau.

[1] Gaillardet, Dupré, Louvat, & Allegre (1999), *Chemical Geology*, 159 (1), 3-30.