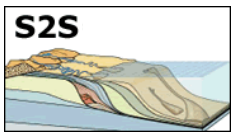
Weathering-Derived Solute Budget for the Fly River, PNG



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Fieldwork conducted in January of 2007 in the Fly River Basin of Papua New Guinea included the collection of water, rock, soil and sediment samples. One goal of this research was to determine the source of the enormous solute fluxes (especially HCO_3^-) delivered to the Gulf of Papua by the Fly River. Because waters derived from the weathering of silicate and carbonate rocks have very different Sr chemistries, Sr concentrations and isotopic ratios have been used to determine the contribution of each endmember to Fly River Basin water samples. Our data show that the lower Fly River reflects a 62% contribution from a silicate-derived endmember (with $^{87}Sr/^{86}Sr = 0.7071$ and [Sr] = 0.02 ppm) and a 38% contribution from a carbonate-derived endmember (with $^{87}Sr/^{86}Sr = 0.7085$ and [Sr] = 0.45 ppm). Because the carbonate-derived endmember contains much more Sr than the silicate-derived endmember, only 7% of the Sr in the lower Fly River is derived from silicates. However, silicate weathering in the Fly River basin produces twice as much HCO_3^- per mol of Sr compared to carbonate weathering. Therefore, 13% of Fly River alkalinity is derived from carbonate weathering, and contributes to long-term sequestration of atmospheric CO_2.

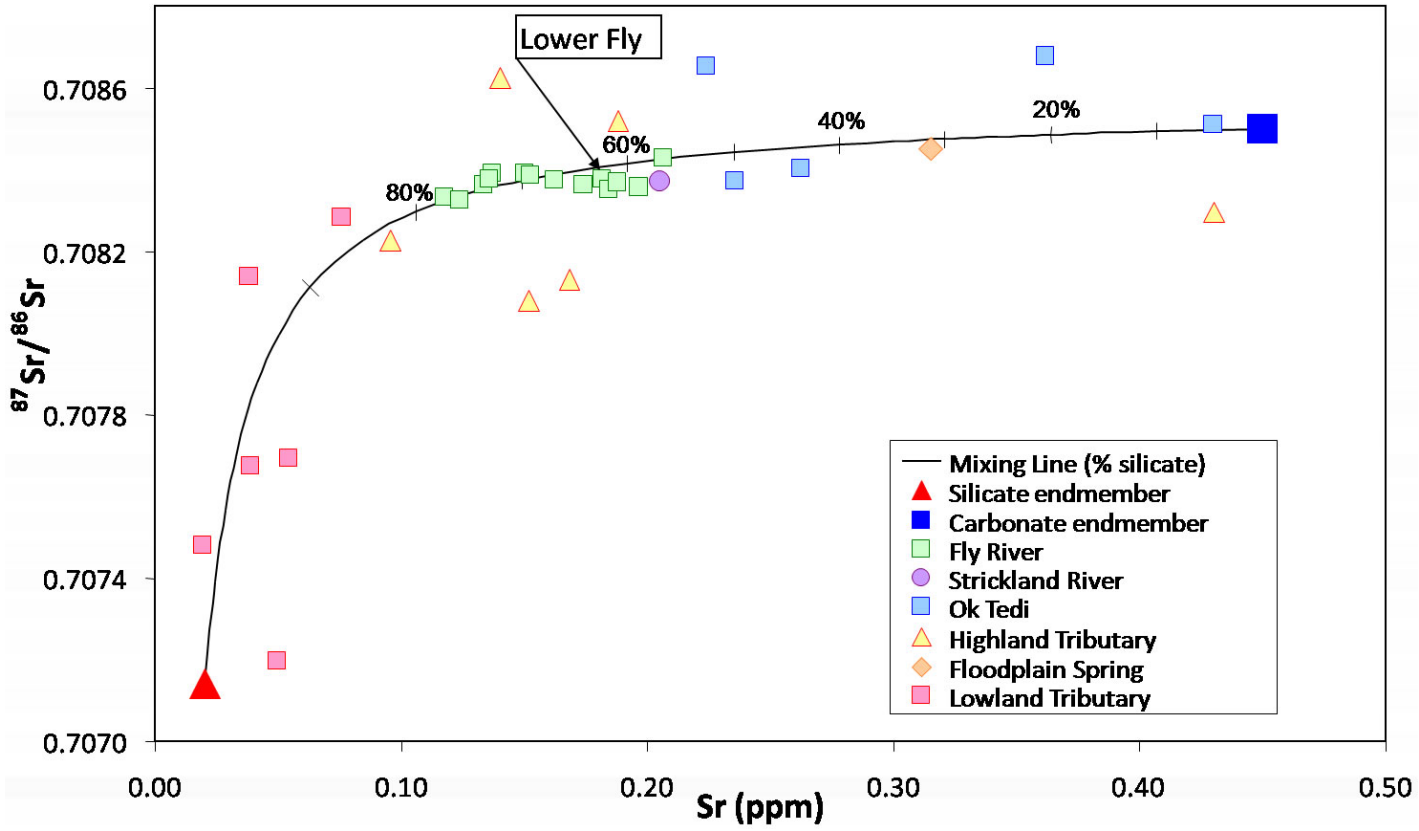

Figure: $^{87}Sr/^{86}Sr$ ratio vs. Sr concentration for water samples from the Fly River and its tributaries. The carbonate- and silicate-derived endmembers represent theoretical water samples produced by the weathering of a single lithology. Water samples collected from the Fly River Basin fall on a mixing line between the two endmembers. The sample marked "Lower Fly" was collected at the farthest point downstream on our transect, and reflects a 62% contribution from the silicate-derived endmember and 38% from the carbonate-derived endmember.