Difference of $^{87}Sr/^{86}Sr$ ratios between water and rock in basaltic catchments and it implications for the oceanic Sr budget

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The strontium isotopic compositon of seawater is an important tracer for weathering processes and thus global carbon cycle. Basalt weathering may have modulated the seawater $^{87}Sr/^{86}Sr$ ratio as it contribute to a significant portion of the oceanic Sr budget. It is usually assumed that the $^{87}Sr/^{86}Sr$ ratios of youg basaltic rocks and its dissolved weathering product are indentical considering that the difference of the radiogenetically accumulated ^{87}Sr between minerals is small and thus the potential influence of preferential leaching is insignificant. An endmember $^{87}Sr/^{86}Sr$ ratio of ~0.7035 were usally assumed when calculating the contribution of basalt weathering to the oceanic Sr budget. Here we show that the $^{87}Sr/^{86}Sr$ ratio of stream water is much higher than rock based on the basaltic catchments near Nanjing, China. The higher $^{87}Sr/^{86}Sr$ ratio of stream water may be ascribed to the contribution of rainwater and dust. However, these possibilities can be excluded because leaching of fresh rock in lab also produce similarly higher $^{87}Sr/^{86}Sr$ ratio of the dissolved product. We found out that the plagioclase in the rock, which show great low-temperature hydrothermal alteration, has much higher ratios than the bulk basalt. Preferential dissolution of the hydrothermally altered plagioclese may have contributed to the higher $^{87}Sr/^{86}Sr$ ratios of stream water. A global data collection suggestes that the difference of $^{87}Sr/^{86}Sr$ ratios between rock and river water in basaltic catchements is widespread(Fig.1). A higher $^{87}Sr/^{86}Sr$ ratio of basalt weathering would require a higher basalt weathering Sr flux to balance the ocean Sr isotope budget.

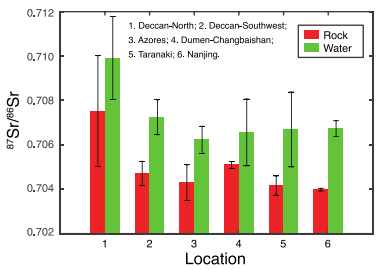

Fig.1 The $^{87}Sr/^{86}Sr$ ratios of basalt and stream water.