

Coupling between chemical weathering and erosion in basaltic catchments

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The dominant control of climate (e.g., temperature) on the rate of basalt dissolution is very different from the erosional control of chemical weathering that has been observed in catchments of other lithologies. Deciphering the role of erosion on chemical weathering of basalt, however, is difficult due to the lack of proxy for a catchment-scale erosion rate as the absence of quartz in basalt disables application of the widely used method of cosmogenic ¹⁰Be nuclide concentration. Here we show that the dust load in a basaltic field near Nanjing, China, may be used to constrain the erosion rate. The Nd and Sr isotopes of the soil and sediments in the basaltic field show a binary mixing between dust and debris of basalt rock (Fig. 1). Assuming a constant background dust load among catchments, the proportion of dust in the sediment can reflect the relative rate of erosion. Higher erosion would produce lower dust, and vice versa. Application of the new technique confirms a positive correlation between erosion rate and average catchment slope. The rate of erosion also show strong correlation with chemical weathering flux. We propose that the erosional influence on chemical weathering is evident only in small catchments. Difference in average slope and thus erosion rate may be largely reduced in large-scale due to the very similar geomorphy of the basaltic fields.

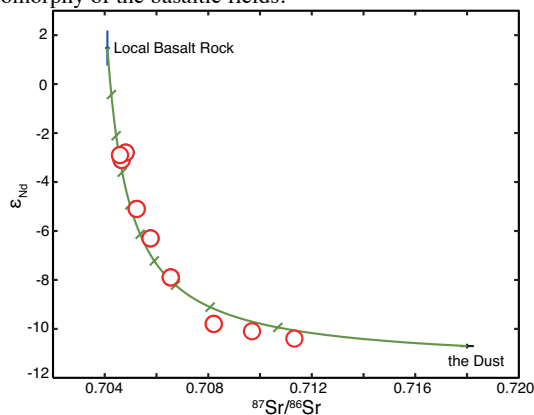


Fig. 1. Cross plot between the Nd and Sr isotopic composition of soil and sediment samples. The binary line is in 10% steps.