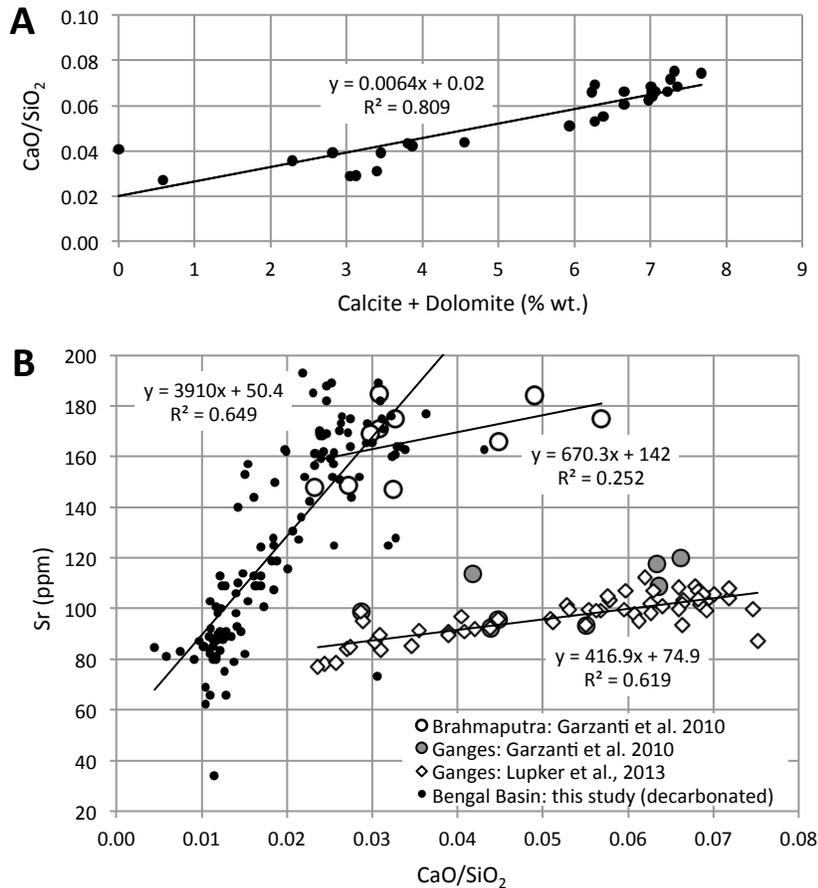
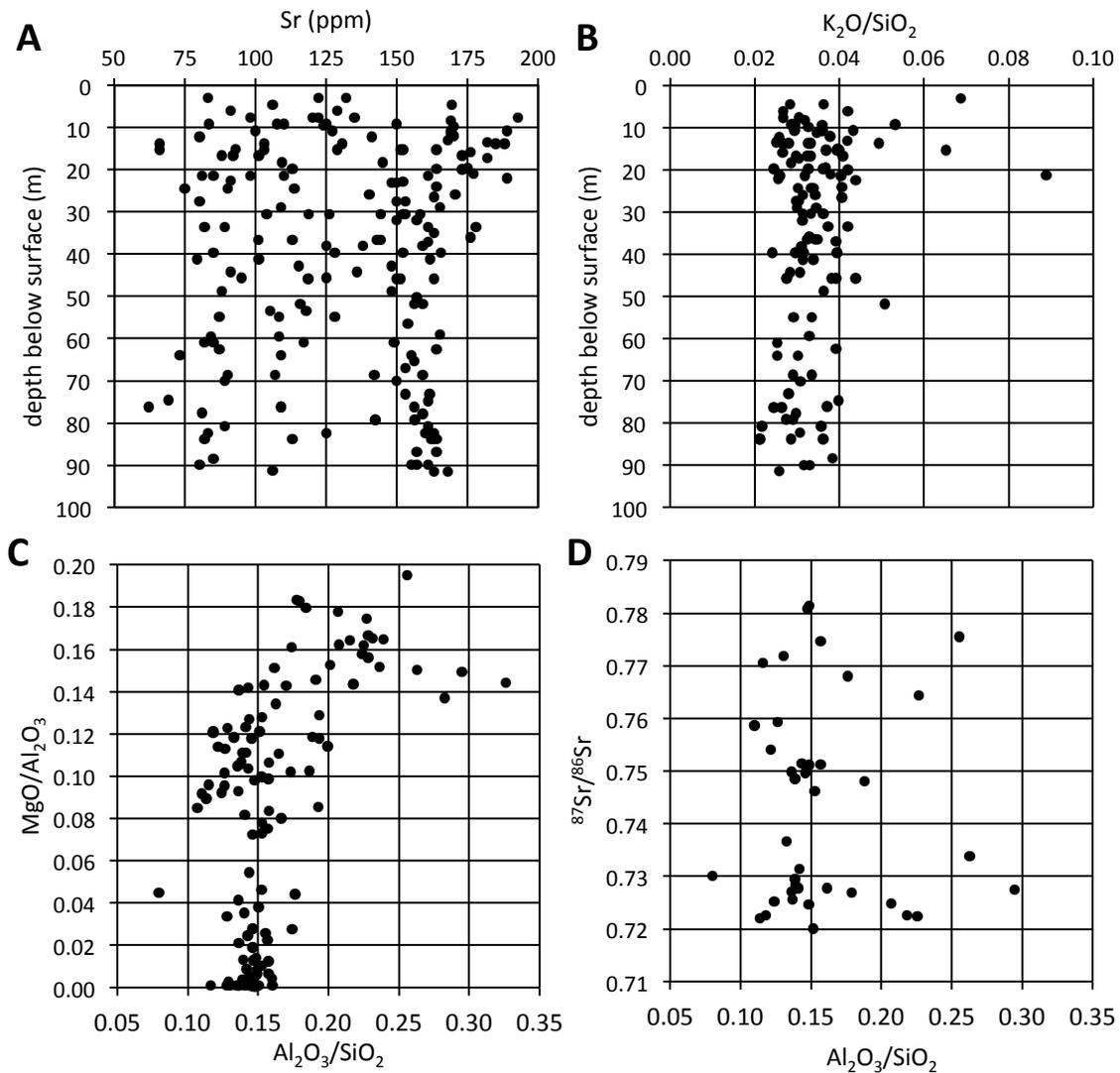


**Figure S1.** Mineral abundances and Sr contributions from the detailed geochemical sediment budgets determined by Garzanti et al., 2010. (A) The calculated contribution of different minerals to bulk [Sr] in Ganges and Brahmaputra sediment. Note that feldspars and lithics comprise >90% of the contributed [Sr] values. Epidote yields an important secondary contribution. (B) Calculated abundance of Sr-bearing epidote and Ca- and Na-plagioclases for the bedload and suspended load of the Ganges and Brahmaputra rivers. Note the greater abundance of epidote and Ca-plagioclase for Brahmaputra sediment, accounting for its higher [Sr] relative to Ganges sediment.



**Figure S2.** (A) Total detrital carbonate versus CaO/SiO<sub>2</sub> for Ganges sediment (data from Lupker et al., 2010). Regression of the data shows that Ganges sediment may generally be considered carbonate-free at CaO/SiO<sub>2</sub> of ~0.02. (B) Plot of CaO/SiO<sub>2</sub> versus [Sr] for Ganges and Brahmaputra sediments compared with Bengal basin samples from this study. Note that the Lupker et al. (2010) and Garzanti et al. (2010) data are not decarbonated, whereas those for the Bengal basin have been decarbonated by combustion at 650°C for 48 hours, followed by acetic acid leaching at 80°C. Results from plot (A) show that Ganges sediment with CaO/SiO<sub>2</sub> less than ~0.02 may be considered carbonate free, and (B) all low-Sr samples from this study (e.g., Ganges type) have CaO/SiO<sub>2</sub> < 0.02. The high-Sr data from this study (e.g., Brahmaputra type) do reach CaO/SiO<sub>2</sub> values of 0.02-0.04, but this would be expected given the greater abundance of Ca-plagioclase in Brahmaputra sediment (Garzanti et al., 2010). Carbonates are also generally low in Brahmaputra sediment, and the coincidence of our high-Sr data with Garzanti et al.'s (2010) low CaO/SiO<sub>2</sub> Brahmaputra sediments is consistent with our assertion that samples from this study are effectively carbonate-free following treatment.



**Figure S3.** (A) Sr concentration vs. depth (as a proxy for age) for the Bengal basin dataset. The absence of correlation or trends associated with depth suggests limited change in feldspar weathering through the Holocene. (B) K<sub>2</sub>O/SiO<sub>2</sub> vs. depth, which similarly shows no correlation or trend, supports that weathering influences have not changed strongly during the Holocene. (C) MgO vs. Al<sub>2</sub>O<sub>3</sub>/SiO<sub>2</sub> reveals that some samples are depleted in Mg and suggests that biotite dissolution has occurred in some of the finest grain sizes. (D) Despite some evidence for biotite loss, Al<sub>2</sub>O<sub>3</sub>/SiO<sub>2</sub> vs. <sup>87</sup>Sr/<sup>86</sup>Sr for the same data shows that even for the finest samples measured, grain size is not a primary control on Sr isotopes, and therefore, preferential dissolution of biotite has not altered the isotope signature of these sediments.

## Supplementary Data Tables