Disentangling Marine Sedimentary Signals in Reactive Silicon Pools using Stable Isotopes

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Silicon isotopes ($\delta^{30}Si$) in sediment biogenic silica (bSi) are widely used as a paleoproxy for marine silicic acid usage by pelagic diatoms. Despite the growing body of work that uses bSi $\delta^{30}Si$ signals, there is a lack of $\delta^{30}Si$ data on other reactive pools of Si in sediments. This oversight misses valuable information on early diagenetic products, e.g. Si products quantified using a two-step acid and alkaline digestion process, and potentially biases existing sedimentary bSi $\delta^{30}Si$, which only quantified bSi fractions not altered by diagenesis. For the first time, we quantified $\delta^{30}Si$ values for operationally defined reactive Si pools in Mississippi River plume sediments. By comparing the $\delta^{30}Si$ signal of these reactive Si pools from the two-step digestion, to a traditional alkaline-only digestion of sedimentary bSi, we can theoretically disentangle the Si sources for each operational pool (e.g. Si in metal oxides, authigenically-altered and unaltered bSi). $\delta^{30}Si$ was ~ 4‰ different between the Si liberated in acid vs. alkaline digestions. There was also an analytically resolvable difference between the $\delta^{30}Si$ for unaltered- and authigenically-altered bSi. These data offer independent confirmation for the existence of marine authigenic clays. This is also a proof of concept for using a higher throughput $\delta^{30}Si$ approach for quantifying the mass of such clays in marine sediments vs. the laborious (albeit powerful) examination of natural silicon radioisotopes in these chemical leaches.