

# Local controls on marine silicate weathering and alkalinity production in surface sediments from the Argentine Basin

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Marine silicate weathering is a potentially widespread geochemical process along continental margins, which generates alkalinity and buffers carbon dioxide (CO<sub>2</sub>) in sedimentary porewaters. We present geochemical data from the Argentine Basin documenting the onset of marine silicate weathering (MSiW) in surface sediments. Decrease in pore-water <sup>87</sup>Sr/<sup>86</sup>Sr indicate contributions of volcanogenic strontium (Sr) (<sup>87</sup>Sr/<sup>86</sup>Sr ~ 0.7065) originating from the alteration of sediments sourced from the Northern Patagonia and Buenos Aires provinces. At four sampling locations, we observe differences in the magnitude of <sup>87</sup>Sr/<sup>86</sup>Sr decrease with depth alongside contrasting dissolved inorganic carbon (DIC), total alkalinity (TA), and d<sup>13</sup>C-DIC trends. This variation indicates spatial heterogeneity in the timing and intensity of MSiW within the Argentine Basin. Further north in the basin (sites 13809 and 13852), there is a stronger <sup>87</sup>Sr/<sup>86</sup>Sr signal, and DIC and TA are more closely correlated with each other with depth. Further, d<sup>13</sup>C-DIC values are more negative, approaching -40‰, indicating that at least a fraction of the carbon originated from methanogenesis. Sediments further south (sites 13820 and 13864) show a weaker <sup>87</sup>Sr/<sup>86</sup>Sr signal, a decoupling of DIC and TA below the sulfate methane transition, and more positive d<sup>13</sup>C-DIC, which only decreases to -20‰. These data likely indicate that MSiW is less pervasive at the southern sites, generating less alkalinity. Local differences in the Argentine Basin likely reflect different sediment sources and the role of the dynamic Brazil-Malvinas Confluence on organic carbon accumulation. Possibly, finer and more reactive sediments are preferentially transported northward where higher primary productivity results in a larger organic carbon flux allowing a more rapid onset of methanogenesis and MSiW. In contrast, sediments in the southern Argentine Basin have been transported along slope via contouritic currents from the Northern Patagonia Region and likely host less reactive silicate minerals and more recalcitrant organic matter. Dynamic currents and multiple depositional pathways into marine basins need to be considered when evaluating the role of early diagenesis on MSiW and its effect on total alkalinity and on the CO<sub>2</sub> buffering capacity of sedimentary porewaters. Global sedimentary alkalinity budgets should therefore include local heterogeneities when considering carbonate diagenesis and marine pH buffering.