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# Sediment microbial activity facilitates silica sequestration in the coastal river plume systems

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Reverse weathering (RW) reactions, i.e. early diagenetic processes producing authigenic clay in marine sediments, have been shown to be rapid, occurring on the scale of months in deltaic coastal sediments. RW is currently estimated to be ~40% of global oceanic silica burial, and is likely a major, but poorly understood, sink term in the oceanic biogeochemical cycles of Li, Al, K, Fe, Ge. While excellent progress has been made in our understanding of RW during the last two decades, the role of microbes has been overlooked. Sediment microbes (Bacteria, Archaea) are the laborers of early diagenesis, as their metabolic activity facilitates changes to sediment porewater redox conditions and fundamentally alters the pathways in which organic matter can be processed (e.g. aerobic vs. anerobic respiration). Two field experiments were conducted in the Mississippi River (MR) plume during the spring freshet and directly demonstrate a role for sediment microbes in the early phases of RW. Using fresh sediment amended with the radioisotope tracer silicon-32, microbial activity facilitated increased sequestration of silica in both experiments. When microbial activity was significantly reduced (potentially eliminated) in experimental treatments, silica dissolution instead of silica precipitation was favored. These data suggest that microbes exert a previously unknown control on these sediment processes at time scales on the order of hours to days. Such a position for microbes in the marine sediment silica cycle is akin to the role that microbes play in the water column silica cycle, whereby, microbial consumption of diatoms organic barrier (postmortem) facilitates biogenic silica dissolution. Our experiments suggest that without microbial activity, silica dissolution would accumulate dissolved silicate in porewaters to concentrations above saturation and lead to precipitation; furthermore, these data suggest an important role for microbes in maintaining the lower dissolved silicate in porewater than predicted by thermodynamics and sediment silica content.