

Cycling of nutrients and trace metals in subterranean estuaries of the Kona Coast, Hawaii

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A major concern to the health of coral reefs is the delivery of terrestrially-derived constituents from submarine groundwater discharge (SGD). Along the arid Kona Coast of Hawaii, groundwater discharge is the predominant vector for material transport to the coastal ocean. This study reports on the delivery and biogeochemical transformations of trace element and nutrient loadings from a suite of mixing experiments using two contrasting groundwater endmembers. One set was performed using 'pristine' groundwater from a nearby lava tube, while the other set was conducted using groundwater collected downstream from a waste water treatment plant (WWTP). Groundwater endmembers were mixed with local open ocean seawater to construct salinity gradients. Mixtures were filtered through 0.45 or 0.02 μm filters to examine the potential role of colloids on trace metals. Trace metal concentrations were nearly identical between the filtered aliquots, indicating that colloidal transport of trace metals is not a major factor in the delivery from local subterranean estuaries, consistent with low suspended particulate matter (SPM) in the GW endmembers. Nutrients exhibit conservative behavior across the salinity gradient but nutrient concentrations were less than or equal to concentrations from mixing alone, suggesting removal from the WWTF effluent as the GW moves downslope. A comparison between the two mixing gradients illustrates that the chemical composition of SGD is controlled by mixing with WWTF effluent, ambient GW, and SW, and natural nutrient removal processes.