Simultaneous increase in planktonic-benthic carbon isotope gradients and phosphorus deposition in sediments from the Caribbean (ODP Site 999) provide evidence for increased nutrient delivery and organic carbon burial during Miocene volcanic ash events

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The mid-Miocene experienced a a positive carbon (C) isotope shift and climate optimum known as the Monterey Excursion, which progressed into a global cooling trend during the late Miocene. A possible mechanism for the cooling is volcanic ash deposition in marine waters, leading to increased nutrient supply, export productivity, organic C burial, and atmospheric carbon dioxide drawdown. We test the hypothesis that mid- to late Miocene volcanism in the Caribbean served as an external source of nutrients, causing a local increase in export productivity and organic C deposition. Here we compare benthic and planktonic foraminiferal $\delta^{13}C$ and biologically reactive phosphorous (P, the sum of oxide bound, authigenic, and organic P) measured across volcanic ash layers deposited during the mid-Miocene (~16.5 Ma) and late Miocene (~9.6 Ma) in the Caribbean basin (ODP Site 999, Core 46X and Core 18X). Across both ash events, P concentrations increase. Coincident with the increase in P during the late Miocene ash event is a peak in the planktonic to benthic foraminiferal $\delta^{13}C$ gradient measured from the same samples. We interpret the sequence of events as indicating that ash deposition associated with explosive volcanism was a source of nutrients in the Caribbean Basin, causing increased export productivity and organic C burial at this time. The open Panamanian gateway may have aided in nutrient dispersion to the circum-Pacific. We speculate that volcanic ash deposition played an important role in the middle to late Miocene cooling trend and associated carbon isotope excursion.