Iron Fertilization of the Eastern Equatorial Pacific linked to Heinrich Stadial Events

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The Equatorial Pacific Ocean is one of three main high-nutrient, low-chlorophyll zones of the global ocean. Within these zones, utilization of the macronutrients phosphate and nitrate during phytoplankton growth is likely limited by the micronutrient iron. Given the Equatorial Pacific's prominent role in biogeochemical cycling of carbon, the variability of the iron supply to the Equatorial Pacific may contribute significantly to the drawdown of atmospheric CO_2 and, therefore, influence global climate change. Although it is well established that the supply of iron to the Equatorial Pacific through the dissolution of mineral aerosol (dust) is greater during glacial periods on Milankovitch timescales, recent research argues against coincident increases in export production [1, 2]. On millennial timescales in the eastern Equatorial Pacific, changes in surface productivity seem to be associated with the timing of either North Atlantic Heinrich Stadial (HS) events or Antarctic Warm Periods, and are thought to be related to changes in nutrient delivery caused by variations in the ventilation of Southern Ocean intermediate waters [3, 4]. Using ^{232}Th fluxes as a proxy for dust fluxes, we show for the first time that increased delivery of dust to the EEP is coeval with virtually all HS events (HS 1-7) during the last glacial period (MIS 2-4). Furthermore, using authigenic U and xsBa fluxes as productivity proxies, we suggest that episodes of increased biological productivity are coincident with each millennial pulse of increased dust flux. We contrast the millennial and orbital variability differences, and suggest an atmospheric role, manifested through shifts in the Intertropical Convergence Zone, for the connection between the low latitude EEP and cold North Atlantic HS events.

[1] Costa et al., 2016, *Nature*, 529, 519-522. [2] Winckler et al., 2016., *Proc. Nat. Acad. Sci.*, 113, 6119-6124. [3] Dubois et al., 2011, *Quat. Sci. Rev.*, 210-223. [4] Kienast et al., 2013, *Paleoceanography*, 28, 663-674.