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Tracing Fe removal in the oligotrophic low-latitude Pacific: Insights from species, isotopes, and burial flux

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Iron (Fe) is a crucial micronutrient that limits primary production in broad regions of the global ocean. Although the sources of Fe in the ocean have been well defined, there is still a lack of systematic understanding of its removal flux in the open ocean. Considering the heterogeneity of the open ocean, different boundary processes (continental margin, atmosphere, and hydrothermal) may have varying impacts on the distribution and removal of Fe. With its diverse hydrographic and sedimentary environments, the oligotrophic low-latitude Pacific serves as a representative region for tracing Fe removal from the deep ocean. In this study, we performed Fe speciation, Fe isotopes, and burial flux analyses using near core-top sediments from multiple sediment cores recovered across the oligotrophic low-latitude Pacific. The Fe species varies significantly along the longitude, the proportion of reactive Fe oxides reaches up to 53% within the east region, indicating the potential influence of hydrothermal venting originating from Eastern Pacific Rise (EPR). Combined with reactive Fe isotopes and burial flux, Fe inputs from the Peru oxygen minimum zone, hydrothermal vents, and Asian dust can be identified. Overall, we demonstrate that coupled flux, species, and isotopic analyses of pelagic sediment would provide critical constraints on the oceanic Fe cycle.