Goldschmidt 2021 Abstract
https://doi.org/10.7185/gold2021.7744

The zinc isotope composition of late Holocene open-ocean marine sediments

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Existing constraints on the isotopic composition of Zn burial in the modern ocean are based on a handful of studies from marine locations characterised by either intense organic matter accumulation (e.g. the Californian and Mexican margins) or intense oxygen depletion (e.g. the Cariaco Basin and Black Sea). New Zn isotope data have been collected from a globally distributed array of late-Holocene age sediments that accumulated in the open ocean in upwelling zones (Namibian margin, West African margin, Arabian margin, Californian margin, Peruvian margin) and in deep-marine non-upwelling zones (Southern Ocean, Indian Ocean, North and South Atlantic Oceans, South China Sea). The mean authigenic isotopic composition of Zn in the entire dataset is only slightly lower than modern deep-ocean water (~0.50 ‰). Upwelling zones have greater authigenic enrichments of Zn and higher Zn isotope compositions than non-upwelling sites although the uncertainties of the latter overlap. The amount of Zn in the investigated sediments cannot be fully accounted for by organic matter burial (using Zn/C ratios) or oxyhydroxide burial (using Zn/Fe and Zn/Mn ratios) and the burial of ZnS may therefore be required to balance the sedimentary Zn budget, even in non-upwelling settings. The new data indicate that open-ocean marine sediments track the deep-ocean Zn isotope composition to within 0.1–0.2 ‰, except in areas where isotopically distinct Zn fractions dominate the authigenic Zn budget.