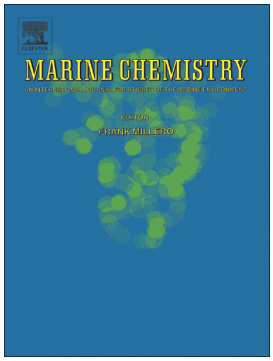

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Radium-228 as a tracer of dissolved trace element inputs from the Peruvian continental margin

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Abstract

Continental margins play a central role in the composition of seawater by being an important source of trace element essentials to the functioning of the ocean ecosystems. Here, we measured long-lived radium isotopes (^{226}Ra, ^{228}Ra) along a zonal transect at 12°S (US GEOTRACES GP16) in the eastern tropical South Pacific Ocean. We used ^{228}Ra to quantify the trace element and isotope (TEI) fluxes (DMn, DFe, and DCo) delivered from the Peruvian continental i) shelf and ii) slope. First, elevated ^{228}Ra activities were measured in surface water over the entire transect (~8500 km), evidence that the continental shelf is an important source of sediment-derived TEIs not only to coastal areas, but to central Pacific Ocean waters. Modeled ^{228}Ra shelf fluxes combined with water column dissolved TEI/^{228}Ra ratios were used to quantify the shelf-ocean input rates (normalized to shelf-area) for DMn ($3.3x10^3$ µmol m^{-2} y^{-1}), DFe ($1.5x10^3$ µmol m^{-2} y^{-1}), and DCo ($1.0x10^2$ µmol m^{-2} y^{-1}). Second, co-occurring plumes of ^{228}Ra, DFe, and DMn extended over 1800 km from the margin at 1000-2500 m depth, indicative of a continental slope sediment TEI input to the intermediate water column. The ^{228}Ra gradient allowed us to derive an effective horizontal eddy diffusion coefficient (K_h) of 46 m^2 s^{-1}, which in