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^{210}Po-^{210}Pb disequilibrium in the deep water column of global oceans as a metric for vertical remineralization of biogenic particulate matter

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The disequilibria between the progeny of ^{238}U in aqueous system result from the differences in their nuclear and geochemical properties. Of these, disequilibria between ^{226}Ra ($T_{1/2}$: 1600 yr) - ^{210}Pb (22.3 yr) - ^{210}Po (138.4 d) are the most widely utilized pairs, in particular ^{210}Pb/^{226}Ra (both ^{210}Pb excess and deficient methods). Most of the ^{210}Pb in surface waters of the open ocean in non-polar regions are primarily derived from atmospheric fallout, with ^{210}Po/^{210}Pb activity ratio (AR) of < 0.1. In contrast, most of the ^{226}Ra are derived from vertical advection and diffusion of ^{226}Ra from sediment-water interface. The widely reported ^{210}Pb scavenging residence time is >20 years during which the ^{210}Po and ^{210}Pb are expected to be in secular equilibrium. However, analysis of all published deep-water profiles of ^{210}Po and ^{210}Pb, indicate < 50 % had (^{210}Po/^{210}Pb) AR ratio of 1.0±0.1. A strong affinity of ^{210}Po to particulate organic matter (POM) is well documented and when particulate organic matter, with ^{210}Po/^{210}Pb AR >1.0 sinks, it undergoes remineralization affecting ^{210}Po concentration at relatively higher rate compared to ^{210}Pb, thus affecting $(^{210}Po/^{210}Pb)_T$ AR at discrete depths. The inventory-based K_ds of ^{210}Po and ^{210}Pb are comparable in the deep oceans, although the mean-life of ^{210}Pb is 59 times larger than that of ^{210}Po. Recent data synthesis of published particulate dissolved and total ^{210}Po and ^{210}Pb in the global oceans indicate the inventory-based fractions of particulate (>1 mm) ^{210}Po and ^{210}Pb vary widely between ocean basins, primarily depending on the concentrations of lithogenic components. The inventory-based fractionation factor ($FF_{Po/Pb}$, ratio of the distribution coefficient of ^{210}Po to that of ^{210}Pb) show the pattern: Atlantic >Arctic > Pacific > Antarctica > Indian Ocean. A comparison of the vertical profiles of $(^{210}Po/^{210}Pb)_p$ (Fig. 1), K_ds of ^{210}Po and ^{210}Pb, and fractionation factor in the global ocean basins (N. Atlantic, E. Pacific, W. Arctic, Indian and Antarctic), along with anthropogenic radionuclides (^{137}Cs, ^{90}Sr & ^{239,240}Pu) will be presented. A summary of earlier work and future direction will be discussed.