

Corals as High-Resolution Archives of Marine Lead Pollution in the Western North Pacific

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Rapid industrialization has substantially increased anthropogenic metal emissions, with the ocean functioning as a major sink for contaminants. Among these, lead (Pb) is of particular concern owing to its persistence and toxicity. Reef-building corals in tropical shallow waters incorporate trace metals into their aragonitic skeletons, thereby preserving high-resolution geochemical records of past environmental change. Here we reconstruct seasonally resolved marine Pb variability in the western North Pacific using Pb concentrations and isotope ratios measured in *Porites* corals (1975-2010) from Dongsha Atoll (DSA) and Lanyu Islet (LY), near Taiwan.

Pb/Ca ratios display pronounced seasonal variability at both sites 13.3-56.6 nmol/mol at DSA; 20.1-64.1 nmol/mol at LY), with elevated values in winter-spring and reduced values in summer-autumn. Superimposed on this seasonal signal is a long-term decline since the early 20th century, consistent with the progressive phase-out of leaded gasoline in East Asia. Pb isotope compositions ($^{206}\text{Pb}/^{207}\text{Pb} = 1.147\text{-}1.168$; $^{208}\text{Pb}/^{206}\text{Pb} = 2.090\text{-}2.118$) further constrain source contributions. Coupling these geochemical records with atmospheric transport models (HYSPLIT) reveals distinct source regions and transport pathways, providing a spatially and temporally resolved assessment of marine Pb pollution in the western North Pacific.

Keywords: Marine Lead pollution, Heavy metals, Isotopic composition, *Porites* coral, Western North Pacific