

Particulate trace metal composition in the surface water along the Kuroshio trajectory from Taiwan to Southern Japan: sources and spatial variations

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We measured trace metal composition in the size-fractionated suspended particles collected in the surface water of the Kuroshio region, the section passing the Western Philippine Sea (WPS) and the Okinawa Trough, to investigate the relative contribution of anthropogenic, biogenic, and lithogenic materials in the oceanic region. The elements determined include P, Al, Ti, V, Mn, Fe, Co, Ni, Cu, Zn, Mo, Cd, and Pb. Their elemental ratios in the size-fractionated particles, including the fractions of 0.2~10, 10~60, 60~150, and >150 μm , are compared to known intracellular metal to phosphorus quota, lithogenic metal to Al ratio (M/Al), and metal to Al ratios in aerosols collected in the adjacent oceanic regions. Our results show that the metal to P ratios obtained in the two smaller fractions are one to two orders of magnitude higher than plankton intracellular metal quota, suggesting that the majority of the particulate trace metals can be either extracellularly adsorbed or composed of abiotic particles. The M/Al ratios for most of the metals are also one to two orders of magnitude higher than their lithogenic ratios but are comparable to metal composition observed in the aerosols, suggesting that the trace metals mainly originate from anthropogenic aerosols but not lithogenic materials. In terms of spatial variation, the concentrations of Fe, Mn and Al are elevated at a station next to the ECS margin, indicating the possible lithogenic input from Yangtze river or bottom resuspension. Our results show that anthropogenic material, originating from aeolian and riverine input, is the dominant trace metal source for all of the metals determined in the suspended particles collected in the surface water of the Kuroshio region. For some of the sampling stations, lithogenic material from bottom resuspension or riverine input may still be an important source for Al, Ti, Fe, and Mn. Overall, anthropogenic material is the dominant trace metal source in the particles of the Kuroshio water, originating from the open ocean.