Important roles of marginal seas and intermediate water for micro- and macro-nutrients circulation in the North Pacific

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The North Pacific is recognized as an end of the deep ocean conveyor belt circulation, and has been vaguely perceived as a place where deep high nutrient water rises to the surface. Details of the mechanism by which macro-nutrients are supplied from the deep layer to the surface layer, however, have not been properly described. Additionally, basin-scale micro-nutrient (iron) supply process for controlling biological production in this high nutrient region is still not completely understood. Here we report basin scale micro- and macro-nutrients circulation in the North Pacific. We compiled observed dissolved iron and nutrients dataset with other water properties in the North Pacific, as well as in the marginal seas and around the island chains. Judging from the isopycnal analysis of the dataset, a zonal gradient of dissolved iron concentration in the subarctic Pacific is constructed by iron rich water propagating from the Okhotsk Sea intermediate waters to the wide area of the upper-intermediate waters on the western North Pacific. While, high macro-nutrient water is discharged from the Bering Sea and spread in wide density range of the intermediate layer of the whole subarctic area. Two to three orders higher upward turbulent fluxes of the macro-nutrients were observed around the marginal sea islands chains, indicating that a part of macro-nutrients are supplied to surface and are returned and pooled to the intermediate layer through the biological production and microbial degradation of organic substances. These results highlighted an important roles of the marginal seas and the intermediate water for circulating micro- and macro-nutrients at the end of ocean conveyor belt.

Keywords: micro- and macro-nutrients circulation, marginal seas, North Pacific intermediate water

