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The behavior of dissolved cobalt in the western Bering Sea and transport to the North Pacific

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Introduction

The western North Pacific subarctic zone, including the Bering Sea, exhibits some of the highest rates of primary productivity globally [1]. This region is classified as a High-Nutrients Low-Chlorophyll region, where primary production is constrained by trace metal availability. Recent studies suggest that the high primary production in this area is supported by nutrient inputs from adjacent marginal seas, particularly the Bering Sea [2]. However, the mechanisms governing the transport and distribution of those nutrients remain poorly understood. In this study, concentrations of dissolved cobalt (dCo), a micronutrient required for vitamin B_{12} synthesis, were measured in the western Bering Sea to elucidate their behavior and transport into the North Pacific subarctic zone.

Materials and Methods

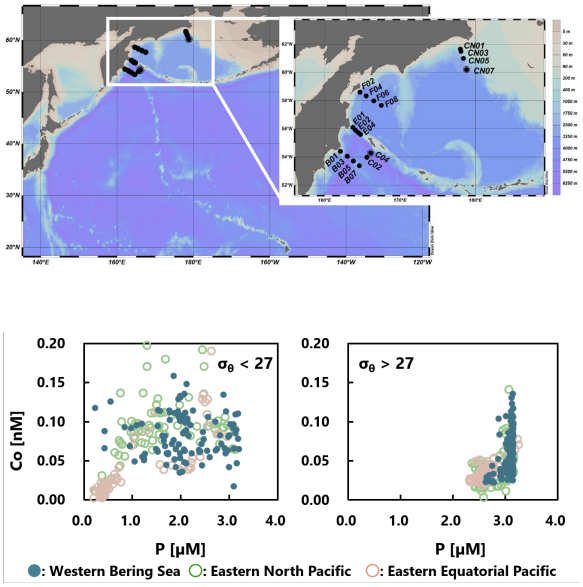
Seawater sampling was conducted along the Kamchatka Peninsula coast from July to September 2018 (Figure 1). Prior to analysis, organic ligands complexed to dCo were decomposed by ultraviolet irradiation, and the sample pH was adjusted to 6. Subsequently, cobalt was preconcentrated and matrix elements were removed via solid-phase extraction using chelating resins functionalized with ethylenediaminetriacetic acid and iminodiacetic acid groups. dCo concentrations were determined by ICP mass spectrometry.

Results and Discussion

Water mass in the western Bering Sea were classified based on potential density into surface water, upper intermediate water, lower intermediate water, and deep water.

dCo from the surface to intermediate waters exhibited a nutrient-type distribution, whereas deep water showed a contrasting scavenged-type distribution. Surface concentration ranged from approximately 0.05 to 0.12 nM, and increased with up to the upper intermediate water. In the lower intermediate water and deep waters, dCo concentrations decreased with increasing , approaching approximately 0.025 nM.

dCo:dPO_4 ratios were examined to elucidate the isopycnal transport of cobalt from the Bering Sea to the North Pacific. dCo:dPO_4 ratios were higher in the North Pacific than the Equatorial Pacific, suggesting that cobalt-rich intermediate waters originating from the Bering Sea contribute to the trace metals inventory in the North Pacific.



Reference

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