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Mesoscale eddies' impact on cobalamin distributions in the eastern subtropical North Atlantic

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Eddies are major oceanographic features found nearly everywhere in the global ocean [1], yet their impact on the distribution of micronutrients remains poorly understood [2]. In general, the transport of water masses into or out of the photic zone by eddies is controlled by their rotation direction (cyclonic or anticyclonic) [3]. While previous studies have examined the impact of eddies on macronutrient distributions, the effect of these mesoscale features on the concentrations of essential coenzymes, such as cobalamins, has never been investigated. Here, we report the distribution of four forms of vitamin B_{12} (adenosyl, methyl, hydroxy, and cyano cobalamins) in three eddies -two anticyclonic (Anaga and Bentayga) and one cyclonic (Nublo)- sampled in the Eastern Subtropical North Atlantic-Canary Eddy Corridor. Samples were collected from the surface to a depth of 1000 m during two oceanographic campaigns conducted four months apart. This sampling scheme was designed to assess how cobalamin concentrations change as eddies mature. During the first sampling, the two recently formed eddies, Anaga and Nublo, exhibited higher concentrations of all four vitamin B_{12} forms compared to the second sampling, when the more mature eddy, Bentayga, was observed. In Anaga and Nublo, an active form of cobalamin (adenosyl; AB_{12}) was more abundant, accounting for 40-60% of the total B_{12} pool at most sites and depths, suggesting higher active consumption. In contrast, in Bentayga, an inactive form (hydroxycobalamin; HB_{12}) dominated, comprising 60-100% of the total dissolved B_{12} pool at most sites and depths, likely due to decomposition and reduced consumption of B-vitamins. Additionally, the highest concentration of dissolved cobalamin was found at a depth of 1000 m (22.61 pM adenosyl B_{12}, 9.14 pM methyl B_{12}) in eddy Anaga, suggesting vertical transport from the surface layers, where synthesizers are found. These results underscore the significant role of eddies in shaping the distribution and forms of vitamin B_{12} in marine environments.

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[3] Mahadevan (2016), *Annual Review of Marine Science* 8, 161-184