Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37037

Characterizing lithium transfer and isotopic signatures in plankton exposed to natural rich Li environment

ARBIA JOUINI[1], NATHALIE VIGIER[1], CHLOE TILLIETTE[2], VALÉRIE CHAVAGNAC[3], CEDRIC BOULART[4], FABIEN LOMBARD[2], ZOE MERIGUET[5], MARYLINE MONTANES[6], CECILE GUIEU[2] AND SOPHIE BONNET[7]

[1]Laboratoire d'Oceanographie de Villefranche (LOV) - IMEV - CNRS - Sorbonne Université
[2]Laboratoire d'Océanographie de Villefranche sur Mer
[3]CNRS
[4]UMR 6539 - LEMAR
[5]Laboratoire d'Océanographie de Villefranche (LOV), Institut de la Mer de Villefranche (IMEV), CNRS, Sorbonne
[6]Laboratoire d'Oceanographie de Villefranche (LOV) - IMEV - CNRS- Sorbonne Université
[7]Aix Marseille Université, CNRS/INSU, Université de Toulon, Mediterranean Institute of Oceanography (MIO)

Lithium (Li) is a powerful tracer in environmental and biological systems, notably in silicate weathering through its isotopic composition (δ^7Li) and as an emergent contaminant through its accumulation in living organisms. Seawater influenced by volcanic and hydrothermal inputs are strongly enriched in Li relative to open-ocean seawater. (e.g. [1]). The magnitude of enrichment varies depending on the geodynamic context, and is accompanied by lower δ^7Li values (~8‰) compared to background seawater (~31‰), providing a natural setting to investigate Li transfer to marine plankton.

During the TONGA expedition (South Pacific, November 2019), seawater and plankton were collected along an east-west transect above one active shallow submarine volcano and a newly formed volcanic island due to volcanic activity. Surface waters and two plankton size fractions (35-200 µm and >200 µm) were collected. Plankton data shows a significant Li enrichment (from 7 to 70 µg g^{-1} dry weight) near eruptive volcanism at the Simone volcano site, reaching up to 120 µg g^{-1} near submarine hydrothermal sites at Volcano 1. Secondly, we observe that most plankton δ^7Li values are lower than ambient seawater with δ^7Li ranging from 22.90 ± 0.3 ‰ to 30.25 ± 0.5 ‰ (2SD). These results suggest active transfer of volcanic/hydrothermal Li to planktonic communities. To evaluate potential biological influences on Li distribution, taxa identified from imaging analyses were grouped into five functional trophic categories (autotrophs, microzooplankton, mesozooplankton, carnivorous/gelatinous taxa, and particulate debris).

Principal Component analyses reveal size-dependent patterns of Li distribution within plankton communities. In the 35-200 µm fraction, Li concentrations are inversely related to total biovolume and partially associated with autotrophic dominance. In contrast, in the >200 µm plankton, Li concentrations align with total biovolume and carnivorous/gelatinous taxa. δ^7Li variability does not strongly track biological gradients in either fraction and instead correlates with Fe/Li and Mn/Li ratios in plankton (for 35-200 µm), suggesting a first order environmental control dictated by volcanic/hydrothermal activity at these locations.

This study provides new constraints on Li distribution in plankton exposed to Li-rich volcanic/hydrothermal inputs and highlights the need for further investigation of the mechanisms controlling Li bioaccumulation and isotopic signatures in marine ecosystems.