

## Multiple approaches to investigate the source of gallium in the subtropical North Pacific

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Gallium can be used as a tracer of dust input to the ocean, with a longer residence time than other dust-derived metals. Because of this, gallium distributions integrate the effect of dust inputs over longer timescales, and can be used to track the effect of dust influenced water masses as they circulate in the ocean. There is a subsurface maximum of gallium in the intermediate waters of the subtropical North Pacific, as observed on the GEOTRACES GP15 and IOC 2002 cruises. We investigated the source of this feature using two techniques, including the AIBECS/OCIM2 model [1,2], and an OMPA water mass deconvolution [3]. These analyses yielded similar (but not identical) results suggesting a connection to the surface ocean in the Western Pacific. Direct comparisons between these techniques are challenging to make, given multiple sources of uncertainty and relatively complex analyses, but Monte Carlo simulations can be used to evaluate the degree of agreement between the two approaches. These results suggest an origin of the gallium features from Asian dust plumes during mode water formation. These connections are informative for studies of Pacific mode water circulation, and to help evaluating the results of commonly used analytical approaches.

[1] Pasquier, B., Primeau, F., & John, S. (2022), AIBECS.jl: A tool for exploring global marine biogeochemical cycles. *Journal of Open Source Software*, 7(69), 3814-3821.

[2] DeVries, T., & Holzer, M. (2019), Radiocarbon and Helium Isotope Constraints on Deep Ocean Ventilation and Mantle  $^3\text{He}$  Sources. *Journal of Geophysical Research: Oceans*, 124(5), 3036–3057.

[3] Lawrence, R. M., Shrikumar, A., Le Roy, E., Swift, J. H., Lam, P. J., Cutter, G., & Casciotti, K. L. (2022), Water mass analysis of the 2018 US GEOTRACES Pacific Meridional Transect (GP15), *Earth and Space Science Open Archive*, <https://doi.org/10.1002/essoar.10510438.1>.