

ANNUAL REPORT ON GEOTRACES ACTIVITIES IN CHINA-TAIPEI

May 1st, 2022 to April 30th, 2023

New GEOTRACES or GEOTRACES relevant scientific results

- Aerosol dissolvable metals are considered to be readily bioaccessible so that their input would influence the growth and composition of marine phytoplankton and affect elemental cycling globally. However, it is highly challenging to measure or estimate reliable deposition fluxes of aerosol dissolvable metals in the ocean partially due to the impacts of complicated processes involved in pre- and post-deposition of aerosols. Hsieh et al. (2023, Marine Chemistry) have collected lithogenic dust from major Chinese deserts and size-fractionated aerosols from the East China Sea (ECS) to study the variations of their dissolvable metals by using three operationally defined leaching protocols (ultrapure water, buffer, and Berger leaches). In addition to the extremely high solubilities observed for anthropogenic type elements, they found variations for solubilities of lithogenic type elements (Ti, Al, Fe) increase with increasing sizes by the three leaching treatments. Without knowing the size specific information (mass and solubility), their observations indicate that the deposition fluxes of lithogenic type elements would be significantly overestimated.
- The wind-driven meridional overturning circulation between the tropical and subtropical oceans is important for regulating decadal-scale temperature fluctuations in the Pacific Ocean and globally. An acceleration of the overturning circulation can act to reduce global surface temperature as ocean stores more heat. The equatorward low-latitude western boundary current represents a key component of the meridional circulation cell in the Pacific and a major source of water mass for the Equatorial Undercurrent, yet long-term observations of its transport are scarce. Chen et al. (2023, Nature Geoscience) demonstrate that the $^{15}\text{N}/^{14}\text{N}$ ratio recorded by *Porites* spp. corals in the western tropical South Pacific is sensitive to the exchanges of water masses driven by the western boundary transport. Using a 94-year coral record from the Solomon Sea, they report that the $^{15}\text{N}/^{14}\text{N}$ ratio declined as the global surface temperature rose. The record suggests that the South Pacific western boundary current has strengthened in the past century, and it may have contributed to the reported strengthening of the Equatorial Undercurrent. In addition, the $^{15}\text{N}/^{14}\text{N}$ record shows strong decadal variability, indicative of weaker equatorial Pacific upwelling and stronger western boundary transport when the eastern equatorial Pacific is in the warm stage of the Pacific Decadal Oscillation.

GEOTRACES or GEOTRACES relevant cruises

- On-going cruise in the Western Subtropical North Pacific, July 07 to August 05, 2023
- Scheduled NORI cruise to the Western Subtropical North Pacific, March 2024 (18 days)
- Scheduled Legend cruise to the Western Philippian Sea, August 2024 (15 days)

New projects and/or funding

- Grant Title: Anthropogenic aerosol trace metal marine biogeochemistry, funded by Academia Sinica (2021/01-2025/12, 5M NTD per year)

- Grant Title: Aerosol Fe biogeochemical cycling in the Northwestern Pacific Ocean (II): phase transformation and field validation, funding source: MOST (2022/08-2025/07, 2M NTD per year)

New GEOTRACES or GEOTRACES-relevant publications (published or in press)

- Hsieh, Chih-Chiang, Chen-Feng You, and Tung-Yuan Ho. "The solubility and deposition flux of East Asian aerosol metals in the East China Sea: The effects of aeolian transport processes." *Marine Chemistry* (2023): 104268.
- Chen, WH., Ren, H., Chiang, J.C.H. et al. Increased tropical South Pacific western boundary current transport over the past century. *Nat. Geosci.*(2023). <https://doi.org/10.1038/s41561-023-01212-4>
- Chen, T.-Y., Chen, C.-L., Chen, Y.-C., Chou, C. C.-K., Ren, H., and Hung, H.-M.: Source apportionment and evolution of N-containing aerosols at a rural cloud forest in Taiwan by isotope analysis, *Atmos. Chem. Phys.*, 22, 13001–13012, <https://doi.org/10.5194/acp-22-13001-2022>, 2022.
- Ekka, S. V., Liang, Y. H., Huang, K. F., Huang, J. C., & Lee, D. C. (2023). Riverine molybdenum isotopic fractionation in small mountainous rivers of Taiwan: The effect of chemical weathering and lithology. *Chemical Geology*, 620, 121349.
- Liao, W. H., Planquette, H., Moriceau, B., Lambert, C., de Gesincourt, F. D., Laurenceau-Cornec, E., ... & Gorgues, T. (2023). The effect of temperature on the release of silicon, iron and manganese into seawater from resuspended sediment particles. *Geochimica et Cosmochimica Acta*, 351, 1-13.

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