ANNUAL REPORT ON GEOTRACES ACTIVITIES IN CHINA-TAIPEI

May 1st, 2021 to April 30th, 2022

New GEOTRACES or GEOTRACES relevant scientific results

- Nitrogenase is vulnerable to O_2 and oxidative stress generated in photosynthesis. However, *Trichodesmium* carries out nitrogen fixation and photosynthesis simultaneously and possesses the capability to bloom in the surface water. Chen et al. (2022) demonstrates that nickel superoxide dismutase reduces oxidative stress generated during photosynthesis in *Trichodesmium*, and thus protects its nitrogen fixation process under high light conditions.
- Although aerosol sizes are highly associated with the solubilities and the deposition fluxes of aerosol Fe in the surface ocean, systematic studies for the association of the solubilities and fluxes have been limited. Using five size-fractions of dry aerosols collected at two islets in the East China Sea, Hsieh et al. (2022) found that either single or two averaged deposition velocities (fine/coarse) used in most of previous studies significantly overestimate dissolvable Fe fluxes. Aerosol sizes are essential parameters to accurately estimate the solubility and the fluxes of aerosol dissolvable Fe to the ocean.
- Bluefin tuna (BFT) is an apex predatory, long-lived, migratory pelagic fish that is widely distributed throughout the world's oceans. These fish have very high concentrations of neurotoxic methylmercury (MeHg) in their tissues, which increase with age. Tseng et al. (2021) shows that Hg accumulation rates (MARs) in BFT as a global pollution index can reveal global patterns of Hg pollution and bioavailability in the oceans and further reflect both natural and anthropogenic emissions and regional environmental features. Overall, MARs provide a means to compare Hg bioavailability among geographically distinct populations of upper trophic level marine fish across ocean subbasins, to investigate trophic dynamics of Hg in marine food webs, and furthermore, to improve public health risk assessments of Hg exposure from seafood.

GEOTRACES or GEOTRACES relevant cruises

- Scheduled Legend cruise to the Western Philippian Sea, August 2022 (9 days)
- Scheduled NORI cruise to the Western Subtropical North Pacific, August 2023 (18 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, pending)
- Grant Title: The role of Ni on photosynthesis and nitrogen fixation in *Trichodesmium*, funding source: MOST (2022/08-2025/07, pending)
- Grant Title: The Depositional Fluxes and Impacts of Natural & Anthropogenic Aerosols in the Northwestern Pacific Ocean: Academia Sinica Thematic Research Program Proposal (2023/01-2025/12, pending).

New GEOTRACES or GEOTRACES-relevant publications (published or in press) (Please identify those publications acknowledging SCOR funding and for these publications include the number of PhD or postdoc students involved, if possible)

Chen, C.-C., I. B. Rodriguez, Y.-L. L. Chen, J. P. Zehr, Y.-R. Chen, S.-T. D. Hsu, S.-C. Yang, and T.-Y. Ho*(2022) Nickel superoxide dismutase protects nitrogen fixation in *Trichodesmium*. *Limnology and Oceanography:Letters* doi: 10.1002/lol2.10263

Li, H.-T., S. Tuo, M.-C. Lu, and T.-Y. Ho* (2022) The effects of Ni availability on H_2 production and N_2fixation in a model unicellular diazotroph: the expression of hydrogenase and nitrogenase. *Limnology and Oceanography* doi: 10.1002/lno.12151

Hsieh, C.-C., H.-Y. Chen, and T.-Y. Ho* (2022) The effect of aerosol size on Fe solubility and deposition flux: A case study in the East China Sea. *Marine Chemistry* doi: 10.1016/j.marchem.2022.104106

Liao, W.-H., S. Takano, H.-A. Tian, H.-Y. Chen, Y. Sohrin, and T.-Y. Ho* (2021) Zn elemental and isotopic features in the sinking particles of the South China Sea: the implications to its sources and sinks. *Geochimica et Cosmochimica Acta* doi: 10.1016/j.gca.2021.09.013.

Hsieh, Y.-T., Geibert, W., Woodward, E.M.S., Wyatt, N.J., Lohan, M.C., Acterberg, E.P., and Henderson, G.M. (2021) Radium-228-derived ocean mixing and trace element inputs in the South Atlantic. *Biogeosciences*, 18, 1645-1671.

Hsieh, Y.-T., Bridgestock, L., Scheuermann, P.P., Seyfried, Jr., W.E., Henderson, G.M. (2021) Barium isotopes in mid-ocean ridge hydrothermal vent fluids: a source of isotopically heavy Ba to the ocean. *Geochimica et Cosmochimica Acta*, 292, 348-363.

Ruo-Mei Wang, Chen-Feng You, Chuan-Hsiung Chung, Kuo-Fang Huang, Ya-Ju Hsu, (2022) Uranium isotopes in a subtropical mountainous river of Taiwan: Insight into physical and chemical weathering processes, *Journal of Hydrology*, 607, , 127481, ISSN 0022-1694, https://doi.org/10.1016/j.jhydrol.2022.127481.

Huei-Ting Lin, Hong-Wei Chiang, Tsai-Luen Yu, Marcus Christl, Juan Liu, Kristine DeLong, and Chuan-Chou Shen, (**2021)** 236U/238U Analysis of Femtograms of 236U by MC-ICPMS, *Analytical Chemistry*, *93* (24), 8442-8449, DOI: 10.1021/acs.analchem.1c00409

Su-Cheng Pai, Yu-Ting Su, Mei-Chen Lu, Yalan Chou, and Tung-Yuan Ho, Determination of Nitrate in Natural Waters by Vanadium Reduction and the Griess Assay: Reassessment and Optimization, *ACS ES&T Water* **2021** *1* (6), 1524-1532, DOI: 10.1021/acsestwater.1c00065

Tseng, C.-M.*, S.-J. Ang, Y.-S. Chen, J.-C. Shiao, C. H. Lamborg, X. S. He, and R. Reinfelder (2021) Bluefin tuna reveal global patterns of mercury pollution and bioavailability in the world's oceans. *PNAS*, 118 (38) e2111205118.

Ho, P.-C., Okuda, N., Yeh, C.-F., Wang, P.-L., Gong, G.-C. and Hsieh, C.-h. (2021) Carbon and nitrogen isoscape of particulate organic matter in the East China Sea. Progress in Oceanography, 197, 102667 (https://doi.org/10.1016/j.pocean.2021.102667).

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