ANNUAL REPORT ON GEOTRACES ACTIVITIES IN CHINA-BEIJING

April 1st, 2019 to April 30th, 2021

New GEOTRACES or GEOTRACES relevant scientific results

- Surface and profile samples were collected from the western NPSG during the GPpr15 summer and winter cruises with an underway fish-towing system and a GEOTRACES standard rosette sampling system. The concentrations of dissolved Fe (dFe) were measured by a chemiluminescence-based FIA method onboard with solid phase extraction.
- The surface distribution of dFe in the western NPSG is shown in Figs. 1 and 2. Among all the surface samples, dFe varied from 0.10 to 0.36 nmol/L with higher concentrations in winter. The concentration of dFe was higher in the Kuroshio-affected area close to the Luzon Strait (0.2-0.3 nmol/L) and the area north of 20°N (0.2-0.36 nmol/L), whereas it was low between 126-140°E along the 20°N (~ 0.1 nmol/L).



Figure 1. Surface distribution of dFe in the western NPSG during GPpr15-summer cruise.



Figure 2. Surface distribution of dFe in the western NPSG during GPpr15-winter cruise.

• The vertical distribution of dFe in the western NPSG is shown in Figs. 3 and 4. In general, dFe showed a typical nutrient-type profile with a minimum concentration in the surface layer and maximum concentration in the intermediate waters. An enhanced dFe maximum was observed in the intermediate waters at Station M35 during summer, likely attributable

to the NPIW from the high latitude. Such dFe maximum also appeared in the intermediate waters at Stations K11a, K12a and K13a, which may be associated with the input from the island sediment and seamount sediment.



Figure 3. Vertical distributions of dFe in the 20 °N, 155 °E and 10 °N sections observed in the western NPSG area during GPpr15-summer cruise.



Figure 4. Vertical distributions of dFe in the 150 °E, 155 °E and 10 °N sections observed in the western NPSG area during GPpr15-winter cruise.

GEOTRACES or GEOTRACES relevant cruises

• GEOTRACES-GPpr15 summer cruise (Jul 3 to Aug 22, 2020; Chief Scienctists: Xin Liu, Weifang Chen, and Yongming Huang; R/V: Tan Kan Kee/Jiagen)

During the cruise, we conducted 20 clean CTD casts at 14 stations and collected trace metal clean surface waters from towed fish at 162 underway stations. Using in situ pump, we obtained 89 particle samples for trace metal concentration measurements at 9 stations. In addition, regular CTD casts at 17 stations were conducted for determining others physical (salinity, currents, turbulence, etc), chemical (DO, DIC, POC, macro-nutrients, etc), and biological (chlorophyll a, pigments, flow cytometry and molecular samples etc.) parameters (Fig. 5). We also did incubation experiments to quantify primary production, nitrogen fixation rate, bacterial production and respiration, zooplankton grazing rate, etc.



Figure 5. Sampling stations of the GEOTRACES-GPpr15 summer cruise.

• <u>GEOTRACES-GPpr15 winter cruise</u> (Dec 23, 2020 to Feb 7, 2021; Chief Scienctists: Zhimian Cao, Ruifeng Zhang, and Kuanbo Zhou; R/V: Tan Kan Kee/Jiagen)

During the cruise, we conducted 14 clean CTD casts at 10 stations and collected trace metal clean surface waters from towed fish. Particle samples for trace metal concentration measurements were collected at 8 stations using in situ pump. In addition, regular CTD casts at 13 stations were conducted for determining others physical (salinity, currents, turbulence, etc), chemical (DO, DIC, POC, macro-nutrients, etc), and biological (chlorophyll a, pigments, flow cytometry and molecular samples etc.) parameters (Fig. 6). We also did incubation experiments to quantify primary production, nitrogen fixation rate, bacterial production and respiration, etc.



Figure 6. Sampling stations of the GEOTRACES-GPpr15 winter cruise.

New projects and/or funding

- NSFC-Excellent Young Scientist Fund: Marine biogeochemistry of Si and Ba isotopes and their role in the oceanic carbon cycling, ¥1.2M, 2021-2023, PI: Zhimian Cao
- NSFC-General Fund: The behaviour of Fe in hydrothermal fluid dilution process in the western Indian Ocean: using δ56Fe as a tracer, ¥560K, 2021-2024, PI: Li Li

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

- Cao Z., Li Y., Rao X., Yu Y., Hathorne E.C., Dai M., Frank M. (2020). Constraining barium isotope fractionation in the upper water column of the South China Sea. Geochimica et Cosmochimica Acta, 288, 120-137.
- Zhang Z., Cao Z., Grasse P., Dai M., Kuhnert H., Gledhill M., Chiessi C.M., Doering K., Frank M. (2020). Dissolved silicon isotope dynamics in large river estuaries. Geochimica et Cosmochimica Acta, 273, 367-382.
- Li L., Zhen X.T., Wang X.J., Ren Y.J., Hu L.M., Bai Y.Z., Liu J.H., Shi X.F. (2020) Benthic trace metal fluxes in a heavily contaminated bay in China: does the sediment become a source of metals to the water column? Environmental Pollution, 257, 113494.
- Li W., Sunda W.G., Lin W., Hong H., Shi D. (2020) The effect of cell size on cellular Zn and Cd and Zn-Cd-CO2 co-limitation of growth rate in marine diatoms. Limnology and Oceanography 65, 2896-2911.
- Liu, J., Yu, X., Chen, X., Du, J., Zhang, F. (2021) Utility of radium quartet for evaluating porewater-derived carbon to a saltmarsh nearshore water: Implications for blue carbon export. Science of The Total Environment, 764: 144238.
- Wang, J., Du, J., Qu, J., Bi, Q. (2021) Distribution of Pu isotopes and 210Pb in the Bohai Sea and Yellow Sea: Implications for provenance and transportation. Chemosphere, 263, 127896.

- Wang, J., Du, J., Zheng, J., Bi, Q., Ke, Y., Qu, J. (2021) Plutonium in Southern Yellow Sea sediments and its implications for the quantification of oceanic-derived mercury and zinc. Environmental Pollution, 266, 115262.
- Wang, X., Chen, X., Liu, J., Zhang, F., Li, L., Du, J. (2021) Radon traced seasonal variations of water mixing and accompanying nutrient and carbon transport in the Yellow-Bohai Sea. Science of The Total Environment, 784: 147161.
- Zhang, F., Wang, J., Bi., Q., Du, J. (2021) 90Sr in seawater of the East China Sea: Inventory, new potential source, and environmental implications. Science of the Total Environment, 764: 144266.

There are 5 ECRs involved in the publications above.

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