

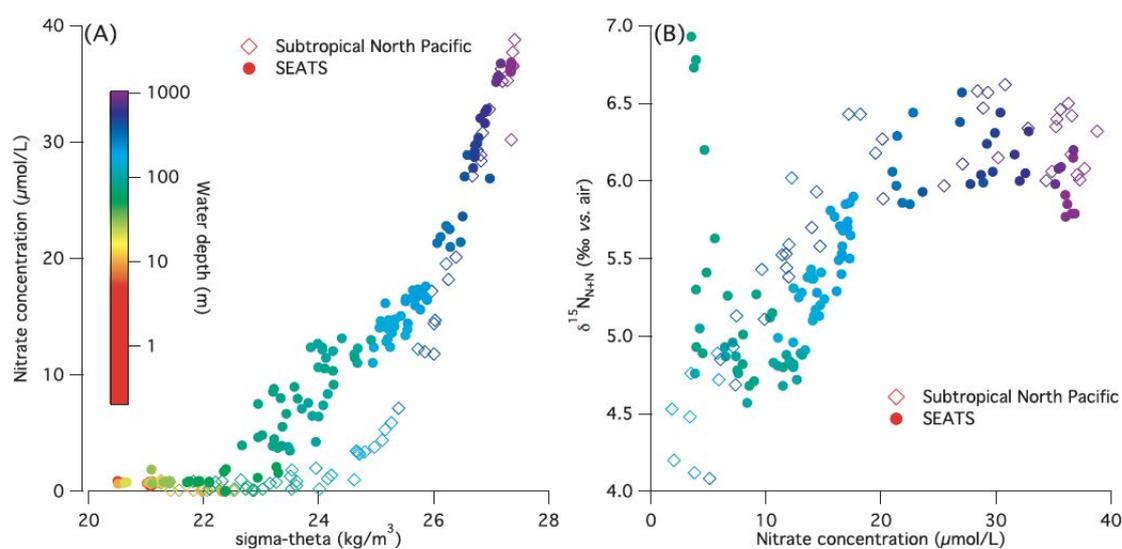
ANNUAL REPORT ON GEOTRACES ACTIVITIES IN CHINA-TAIPEI

May 1st, 2017 to March 30th, 2018

New scientific results

Dr. Haojia Ren at National Taiwan University have set up denitrifier method in conjunction with gas chromatography and isotope ratio mass spectrometry (Thermo MAT 253 plus) for isotopic measurements on N_2O gas. The current sensitivity is 5nmol N, precision is 0.07‰ and 0.1‰ for $\delta^{15}N$ and $\delta^{18}O$ in seawater nitrate samples. They have also set up clean lab for treatment of dissolved and particulate organic nitrogen which would be oxidized into nitrate using persulfate and analysed for $\delta^{15}N$ using denitrifier method.

Dr. Ren's group have analysed seawater samples from open subtropical North Pacific and South China Sea (SCS), in order to better constrain the nitrate $\delta^{15}N$ minimum in the shallow thermocline. The shallow thermocline (i.e. the depth range of 100-200 m) of the modern SCS has much higher nitrate concentration (10-15 μM) than the same water depth or density level in the open subtropical North Pacific (<5 μM ; Figures 1). As a result, lateral exchange of the upper 200 m of the water column with the open western North Pacific has minimal capacity to change the $\delta^{15}N$ of nitrate in this depth range of the SCS. Therefore, the upward decline in nitrate $\delta^{15}N$ observed in the SCS thermocline is probably mostly generated within the SCS.



Dr. Tung-Yuan Ho's group has studied the major source of soluble iron in the surface water of the Northwestern Pacific Ocean and its marginal seas. In addition to metal concentrations and their solubility in the size-fractionated aerosols, Dr. Ho's group also measured Fe isotope ratios in both the total digested samples and the soluble fractions of the size-fractionated aerosols collected daily size-fractionated aerosol samples, including PM 2.5 and PM 2.5-10, at Taiwan Dongsha Atoll Research Station, an ideal location for monitoring seasonal aerosol deposition in the NWPO and its marginal seas. Evidently confirmed by specific metal elemental ratios and characteristic Fe isotopic ratios in the size-fractionated aerosols, Dr. Ho and his group members have demonstrated that the major source of soluble Fe in the surface water originates from anthropogenic aerosols but not lithogenic dusts.

New projects and/or funding

A five year project proposed by Haojia Abby Ren to Taiwan Ministry of Science and Technology (MOST) has been funded. The title of the project is: *Past and Present Evolution of Global Ocean Nitrogen Cycle: Implications from Studies in the Western Tropical North Pacific and South China Sea*. We propose four GEOTRACES cruises and one long-term monitoring station in the WTNP and the SCS to quantify temporal and spatial changes in nitrogen fluxes using nitrogen isotopes. The main objectives of four cruises and station are: 1) to offer routine and reliable measurements of water column nitrate isotope, which could be used to expand modern ocean database and evaluate paleoceanographic proxies; 2) to measure spatial and seasonal changes in N fixation rate, major nutrient and trace element, atmospheric deposition, that could be used to yield insights to the controls of marine N cycle; 3) to quantify and study the dynamics of dissolved inorganic nitrogen, suspended and sinking particulate organic nitrogen, and surface living cells of different phyto- and zoo- planktons as well as detritus in the surface ocean, which will be used to understand the surface N recycling processes in this region with implications for general seasonally stratified oligotrophic surface ocean systems. The GEOTRACES scientific cruises are most likely to be carried out from 2019 to 2022.

GEOTRACES workshops and meetings

- 2018 GEOTRACES SSC meeting and training workshop would be held in Taipei from July 23 to 26, 2018, which is hosted by Tung-Yuan Ho. A GEOTRACES training workshop will be held on 26th at Academia Sinica with topics including the introduction of GEOTRACES and IDP2017, TEI sampling and analysis, and ODV application and operation.

Outreach activities

- “Learning Oceanography by cartoon posters & Q&A with gifts”, October 28, 2017, Academia Sinica Open house, <https://openhouse.sinica.edu.tw/#/>

New publications (published or in press)

- Yang, S.-C., J. Zhang, Y. Sohrin, and T.-Y. Ho (2018) Cd cycling in the water column of the Kuroshio-Oyashio Extension region: insights from dissolved and particulate isotopic composition. *Geochimica et Cosmochimica Acta in press*
- Rodriguez, I. B. and T.-Y. Ho (2018) Trace metal requirements and interactions in *Symbiodinium kawagutii*. *Frontiers in Microbiology* doi: 10.3389/fmicb.2018.00142.
- Rodriguez, I. B. and T.-Y. Ho (2017) Interactive effects of spectral quality and trace metal availability on the growth of *Trichodesmium* and *Symbiodinium*. *PLoS ONE* doi: 10.1371/journal.pone.0188777.
- Haojia Ren, Daniel M. Sigman, Alfredo Martinez-Garcia, Robert F. Anderson, Min-Te Chen, Ana Christina Ravelo, Marietta Straub, George T.F. Wong, Gerald Haug (2017), Impact of glacial/interglacial sea level change on the ocean nitrogen cycle, *PNAS*, 114(33), 6759-6766.

Presentations in international conferences

- Haojia Ren, Ocean fertilization by natural and anthropogenic nitrogen input in the past and present, AOGS Early Career Researcher Distinguished Lecture, Singapore, 2017 (invited talk).

Submitted by Haojia Abby Ren (abbyren@ntu.edu.tw)