

## ANNUAL REPORT ON GEOTRACES ACTIVITIES IN JAPAN

May 1st, 2024 to April 30th, 2025

### ***New GEOTRACES or GEOTRACES relevant scientific results***

Kurisu et al. (2024) investigated Fe stable isotope ratios ( $\delta^{56}\text{Fe}$ ) in bulk and size-fractionated marine aerosol particles in the subarctic North Pacific on Japanese GEOTRACES cruise GP02 (Summer 2017) to clarify the relative contribution of combustion and natural Fe in both marine aerosol particles and surface seawater. A negative correlation was observed between the aerosol  $\delta^{56}\text{Fe}$  signatures and the enrichment factors of Fe and other elements dominated by anthropogenic sources, such as Pb and Cd, in these coastal regions, suggesting the presence of Fe supply from high-temperature combustion sources, such as coal combustion and metal smelting. The results demonstrate that soluble aerosol Fe from combustion is equivalent to natural dust Fe in these coastal regions. In contrast, the aerosol particles in the pelagic regions were near crustal  $\delta^{56}\text{Fe}$  in all particle size fractions, indicating the dominance of natural Fe. The relationships among the fractional Fe solubility, major ion concentration, Fe species, and  $\delta^{56}\text{Fe}$  indicated that combustion Fe contributes to an increase in Fe solubility in the coastal regions, whereas the atmospheric processing of mineral dust during transport is more important in the pelagic regions of the North Pacific. The dissolved Fe in the surface seawater at 10 m depth had a consistently higher  $\delta^{56}\text{Fe}$  than that of the simultaneously collected water-soluble aerosol Fe. The pattern of elevated  $\delta^{56}\text{Fe}$  in the surface seawater corresponds to decreasing Fe concentrations and can be approximated by Rayleigh fractionation, suggesting that these elevated surface  $\delta^{56}\text{Fe}$  values reflect biological uptake. New Fe fluxes from both the atmosphere and deeper depths are limited, at least in summer, compared to the biological uptake in the open ocean of the subarctic North Pacific.

*Citation: Kurisu et al. 2024. Source and fate of atmospheric iron supplied to the subarctic North Pacific traced by stable iron isotope ratios. Geochimica et Cosmochimica Acta, 378, 168 - 185. doi: 10.1016/j.gca.2024.06.009.*

### ***GEOTRACES workshops and meetings organized***

- The domestic session entitled “Marine Geochemistry” related to GEOTRACES studies was held during the annual meeting of Geochemical Society of Japan 2024 (September 18 – 20, in person at Kanazawa University). We had 9 oral and 9 poster presentations.
- We had a national GEOTRACES symposium on December 9-10, 2024, for promoting scientific discussion on recent Japanese GEOTRACES studies (22 papers were presented). Seven students presented their original results. We also had a business meeting as a GEOTRACES sub-committee meeting under the national SCOR committee (Science Council of Japan) on December 10, 2024. These symposium and meeting were held in person and partially online hosted by Atmosphere and Ocean Research Institute, the University of Tokyo.

### ***Prize***

- The JOS Prize, the Prize of the Oceanographic Society of Japan, was awarded to Dr. Jun Nishioka (Institute of Low Temperature Science, Hokkaido University) in September 2024.
- The Oceanchemistry Encouragement Prize was awarded to Dr. Naoya Kanna (Atmosphere and Ocean Research Institute, The University of Tokyo) in April 2025.

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

During the past year, Japan GEOTRACES investigators published a total of **15** peer-reviewed journal articles. The underlined first author is the ECR.

- Chan, C.-Y., L. Zheng, and Y. Sohrin, 2025. The behaviour of nickel, copper, zinc, and cadmium in the subarctic Pacific Ocean: East–West differences. *Journal of Oceanography*, doi: 10.1007/s10872-025-00746-y.
- Cheng, Y., P. Cai, H. Chen, Yuan, L., X. Jiang, and S. Zhang, Y. Chen, Y. Luo, and Y. Sohrin, 2024. Nitrate and silicate fluxes at the sediment–water interface of the deep North Pacific Ocean illuminated by <sup>226</sup>Ra/<sup>230</sup>Th disequilibria. *Geochimica et Cosmochimica Acta* 2024, 383, 81-91. doi: <https://doi.org/10.1016/j.gca.2024.08.008>.
- Deng, H., K. Suzuki, I. Yasuda, H. Ogawa, J. Nishioka, 2025. Phytoplankton community structure in relation to iron and macronutrient fluxes from subsurface waters in the western North Pacific during summer. *Biogeosciences*, 22, 1495-1508. <https://doi.org/10.5194/bg-22-1495-2025>.
- Deng, W., J. Zhang, S. Zhu, K. Horikawa, T. Endoh, T. Matsuno, Y. Kondo, M. Inoue, S. Nagao, Origins of low-oxygen bottom water influenced by tide and ENSO on the outer-edge shelf of East China Sea: multi-chemical tracer approaches, *Journal of Geophysical Research: Oceans*, doi: <https://doi.org/10.1029/2024JC020917>.
- Isaji, Y., K. Sugie, N. F. Ishikawa, N. O. Ogawa, K. Matsumoto, C. Yoshikawa, H. Obata, M. C. Honda, and N. Ohkouchi, 2025. Distributions of heme B and its implications on Fe biogeochemistry in the eastern Indian Ocean and the western Pacific Ocean. *Progress in Earth and Planetary Science*, 12, 14. doi: 10.1186/s40645-025-00689-4.
- Kanna, N., K. Tateyama, T. Waseda, A. Timofeeva, M. Papadimitrakaki, L. Whitmore, H. Obata, D. Nomura, H. Ogawa, Y. Yamashita and I. Polyakov, 2025. Spatial distributions of iron and manganese in surface waters in the East Siberian Arctic Seas. *Biogeosciences*, 22, 1057–1076. doi: 10.5194/bg-22-1057-2025
- Kurisu, M., K. Sakata, J. Nishioka, H. Obata, T. M. Conway, H. R. Hunt, M. Sieber, K. Suzuki, T. Kashiwabara, S. Kubo, M. Takada, and Y. Takahashi, 2024. Source and fate of atmospheric iron supplied to the subarctic North Pacific traced by stable iron isotope ratios. *Geochimica et Cosmochimica Acta*, 378, 168 - 185. doi: 10.1016/j.gca.2024.06.009.
- Matsuzaki, K.M., T. Itaki, Y. Kubota, K. E. Lee, I. Motoyama, T. Sagawa, K. Horikawa, M. Murayama and H. Obata, 2025. Review of radiolarian microfossils as a tool for reconstructing sea surface temperature of the past in the Northwest Pacific. *Progress in Earth and Planetary Science*, 12, 35. <https://doi.org/10.1186/s40645-025-00706-6>.
- Lee, Y. P., K. H. Wong, H. Obata, M. Z. Kamsah, and M. H. Rasidi, 2025. Copper speciation in a tropical mangrove forest of Southeast Asia. *Marine Chemistry*, 270, 104510. doi: 10.1016/j.marchem.2025.104510.
- Obata, H., A. Mase, T. Gamo, J. Nishioka and K. Okamura, 2024. In-situ analysis of sub-nanomolar level of Fe(II) in open-ocean waters. *Analytical Sciences*, 40, 2017–2025. doi: 10.1007/s44211-024-00637-0.

- Okazaki, Y., J. Onodera, K. Tanizaki, F. Nishizono, K. Egashira, A. Tomokawa, T. Sagawa, K. Horikawa and K. Ikehara, 2024. Silicoflagellate assemblages in the North Pacific surface sediments: an application of the modern analog method to reconstruct the glacial sea surface temperature in the Japan Sea. *Progress in Earth and Planetary Science*, 11, 62. <https://doi.org/10.1186/s40645-024-00661-8>.
- Otsuka, S., Y. Hou, M. Wakita, Y. Yamashita, J. Nishioka, H. Obata, Y. Miyairi, Y. Yokoyama, and H. Ogawa, 2024. Origin and transport of dissolved organic matter in the northwestern margin of the North Pacific inferred from radiocarbon signatures. *Journal of Coastal Research*, 116, 181-185. doi: 10.2112/JCR-SI116-037.1.
- Wong, K. H., K. Nishitani, H. Obata, H. Fukuda, H. Ogawa, F. A. Idrus, F. A. Mohamad, A. S. Mashio and H. Hasegawa, 2024. Simultaneous determination of picomolar level of dissolved silver with other key trace metals in seawater samples using solid phase extraction and isotope dilution methods. *Marine Chemistry*, 262, 104396. doi: 10.1016/j.marchem.2024.104396.
- Yamada, Y., A. Ebihara, H. Fukuda, S. Otsuka, S. Mitarai, and T. Nagata, 2024. Functions of extracellular polymeric substances in partitioning suspended and sinking particles in the upper oceans of two open ocean systems. *Limnology and Oceanography* 2024, 60, 1101-1114. doi: 10.1002/lno.12554.
- Zheng, L., T. Minami, S. Takano, and Y. Sohrin, 2024. Distributions of cadmium, nickel, zinc, copper, and iron in the western South Pacific Ocean: Local sources of the nutrient-type trace metals. *Marine Chemistry*, 263-264, 104411. doi: <https://doi.org/10.1016/j.marchem.2024.104411>.

***Completed GEOTRACES PhD or Master theses (please include the URL link to the pdf file of the thesis, if available)***

- Tohru Fukazawa (2024), Development of a method for determination of ultra-trace Te(IV) and Te(VI) in open ocean waters and the relationship between meridional section distribution of Te species in the eastern Indian Ocean and its oceanographic properties. PhD (Science), Niigata University
- Yuta Iwamoto (2024), Geochemical Characteristics of Particulate Iron in the Atmosphere and the Sea Ice in the Southern Sea of Okhotsk. M. S. (Environ. Sci.), Hokkaido University
- Izumi Ishizaki (2024), Impact of copper toxicity on pigment Composition in phytoplankton. M. S. (Engineering), Kanazawa University
- Inhee Kim (2024), Distributions and biogeochemical cycles of Fe, Mn, Cu, Zn in the Western North Pacific. M. S. (Sci), The University of Tokyo
- Nozomi Komura (2024), Development of analytical method for precious metal elements in copper alloys recycled from industrial waste. M. S. (Engineering), Kanazawa University
- Fuki Nagai (2024), Behaviour of trace metals in suspended particles in the Sea of Okhotsk and western North Pacific Ocean. M. S. (Environ. Sci.), Hokkaido University
- Aoi Nishi (2024), Development of analytical method for ultra trace rhodium in freshwater and elucidation of its concentration distribution. M. S. (Engineering), Kanazawa University
- Keisuke Nishitani (2024), Distribution and behavior of dissolved silver and other key trace metals in the eastern Indian Ocean. M. S. (Engineering), Kanazawa University
- Akihiro Takamura (2024), Evaluation of thiols as biomarker for copper toxicity in marine Phytoplankton. M. S. (Engineering), Kanazawa University

***GEOTRACES presentations in international conferences***

- Deng, H., A. Murayama, I. Yasuda and J. Nishioka, 2024. Comparison of silicate and nitrate supply ratio from the intermediate layer to surface between the Sea of Okhotsk and the western North Pacific, The 21th Pacific-Asian Marginal Seas (PAMS) Meeting, May 13-15, 2024, Southern Marine Science and Engineering Guangdong Laboratory (Zhuhai)
- Matsuoka, K., S. Takano, S. Kawagucci, T. Toki, and Y. Sohrin, 2024. Isotope ratio anomalies of dissolved Mo and W caused by hydrothermal activities around subduction zones, the Izu Ogasawara Arc and the Okinawa Trough. Goldschmidt2024, Chicago, USA, Aug 2024.
- Takano, S., K. Sakata, and Y. Sohrin, 2024. Isotope ratios of trace metals in the atmospheric aerosols collected at the station facing the Japan Sea. Goldschmidt2024, Chicago, USA, Aug 2024.
- Yunoki, K, S. Takano, and Y. Sohrin, 2024. Removal and supply of trace metals (Fe, Ni, Cu, Zn, Cd, and Pb) in seawater caused by hydrothermal activities of the Izu-Bonin-Mariana Arc. Goldschmidt2024, Chicago, USA, Aug 2024.

Submitted by Yoshiko Kondo (yoshikondo@nagasaki-u.ac.jp)