

## ANNUAL REPORT ON GEOTRACES ACTIVITIES IN JAPAN

April 1st, 2021 to April 30th, 2022

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

- Zheng et al. (2021) reported on basin-scale full-depth sectional distributions of total dissolvable, dissolved, and labile particulate Cd, Ni, Zn, and Cu along three transects including the GEOTRACES GP18 and GP02. In the North Pacific Ocean, it was indicated that there were strong differences in the relationships between dissolved trace metals and nutrients from those reported in other oceans. Dissolved Cd is influenced by biological processes and water circulation. Although this was also the case for dissolved Ni, Zn, and Cu, these metals were affected by scavenging. The effects of scavenging of the four metals were detected due to the internal formation of the Pacific Deep Water in the North Pacific Ocean and its long residence time. Judging from the stoichiometry among trace metals and major nutrients, scavenging was the important factor that significantly affects the distributions of dissolved Zn, Ni, and Cu, of which the magnitude of influence increases in the order of Cd < Ni, Zn < Cu.

*Citation: Zheng, L., T. Minami, S. Takano, T.-Y. Ho, Y. Sohrin (2021), Sectional distribution patterns of Cd, Ni, Zn, and Cu in the North Pacific Ocean: relationships to nutrients and importance of scavenging, Global Biogeochemical Cycles, 35, doi: 10.1029/2020GB006558.*

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

- Domestic GEOTRACES session was held during the fall meeting of The Oceanographic Society of Japan 2021 (September 13 - 17, 2021) online for pursuing scientific discussion on recent Japanese GEOTRACES studies. We had 10 presentations including those given by 4 students.
- Domestic session entitled “Marine Geochemistry” related to GEOTRACES studies was held during the annual meeting of Geochemical Society of Japan 2021 (September 12 – 26, online and partially in person at Hirosaki University). We had 9 presentations including those by 4 students.

### ***Other GEOTRACES activities***

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

During the past year, Japan GEOTRACES investigators published 25 peer-reviewed journal articles and one article. The underlined first author is the ECR.

#### **Peer-reviewed journal articles**

- Alam, M., M. Tripti, G. P. Gurumurthy, Y. Sohrin, M. Tsujisaka, A. D. Singh, S. Takano, K. Verma (2022), Palaeoredox reconstruction in the eastern Arabian Sea since the late Miocene: Insights from trace elements and stable isotopes of molybdenum ( $\delta^{98/95}\text{Mo}$ ) and tungsten ( $\delta^{186/184}\text{W}$ ) at IODP Site U1457 of Laxmi Basin. *Paleogeography, Palaeoclimatology, Paleoecology*, 587, 110790. DOI: 10.1016/j.palaeo.2021.110790.
- Ikhsani, I. Y., R. Muhammad, J. Xu, K. H. Wong, S. Takeda, H. Obata (2021), Sources and transport of dissolved Mn, Fe, Cu, and Co in a semi-enclosed bay (Ariake Sea) in Japan. *Estuarine, Coastal and Shelf Science*, 259, 107475: doi.org/10.1016/j.ecss.2021.107475.

- Inoue, M., S. Hanaki, H. Kameyama, Y. Kumamoto, S. Nagao (2022), Unique current connecting Southern and Indian Oceans identified from radium distributions, *Scientific Reports*, 12, 1781.
- Kamidaira, Y., Y. Uchiyama, H. Kawamura, T. Kobayashi, S. Otsuka (2021), A modeling study on the oceanic dispersion and sedimentation of radionuclides off the coast of Fukushima. *Journal of Environmental Radioactivity*, 238–239, 106724. doi: 10.1016/j.jenvrad.2021.106724.
- Kumamoto, Y., M. Aoyama, Y. Hamajima, H. Nagai, T. Yamagata, A. Murata (2022), Zonal and vertical transports of Fukushima-derived radiocesium in the subarctic gyre of the North Pacific until 2014. *Journal of Environmental Radioactivity*, 247, 106864.
- Kurisu, M., K. Sakata, M. Uematsu, A. Ito, Y. Takahashi (2021), Contribution of combustion Fe in marine aerosols over the northwestern Pacific estimated by Fe stable isotope ratios. *Atmospheric Chemistry and Physics*. 21, 16027–16050. <https://doi.org/10.5194/acp-2021-460>
- Mashio, A. S., T. Tanimura, H. Hasegawa, S. Takeda, H. Obata (2021), Budgets and sources of dissolved platinum in the inland seas of Japan. *Estuarine, Coastal and Shelf Science*, 253, 107293.
- Misumi, K., J. Nishioka, H. Obata, D. Tsumune, T. Tsubono, M. C. Long, K. Lindsay, J. K. Moore (2021), Slowly Sinking Particles Underlie Dissolved iron transport across the Pacific Ocean, *Global Biogeochemical Cycles*, doi:10.1029/2020GB006823.
- Nakaguchi, Y., A. Sakamoto, T. Asatani, T. Minami, K. Shitashima, L. Zheng, Y. Sohrin (2022), Distribution and stoichiometry of Al, Mn, Fe, Co, Ni, Cu, Zn, Cd, and Pb in the Seas of Japan and Okhotsk. *Marine Chemistry*, 241, 104108. DOI: <https://doi.org/10.1016/j.marchem.2022.104108>.
- Nakajima, M. T. E., N. Takahata, K. Shirai, T. Kagoshima, K. Tanaka, H. Obata, Y. Sano (2022), Monitoring the magmatic activity and volatile fluxes of an actively degassing submarine caldera in southern Japan. *Geochimica et Cosmochimica Acta*, 317, 106–117.
- Nishioka, J., T. Hirawake, D. Nomura, Y. Yamashita, K. Ono, A. Murayama, A. Shcherbinin, Y. N. Volkov, H. Mitsudera, N. Ebuch, M. Wakatsuchi, I. Yasuda (2021), Iron and nutrient dynamics along the East Kamchatka current, western Bering sea basin and Gulf of Anadyr, *Progress in Oceanography*, doi:10.1016/j.pocean.2021.102662.
- Nomura, D., H. Ikawa, Y. Kawaguchi, N. Kanna, T. Kawakami, Y. Nosaka, S. Umezawa, M. Tozawa, T. Horikawa, R. Sahashi, T. Noshiro, I. Kaba, M. Ozaki, F. Kondo, K. Ono, I. S. Yabe, E. Y. Son, T. Toyoda, S. Kameyama, C. Wang, H. Obata, A. Ooki, H. Ueno, A. Kasai (2022), Atmosphere–sea ice–ocean interaction study in Saroma-ko Lagoon, Hokkaido, Japan 2021. *Bulletin of Glaciological Research*, 40, 1–17, doi: 10.5331/bgr.21R02.
- Oka, A., H. Tazoe, H. Obata (2021), Global distribution of rare earth elements in the ocean simulated by an ocean general circulation model. *Journal of Oceanography*, 77, 413–430.
- Otsuka, S., Y. Kamidaira, T. Ikenoue, H. Kawamura (2021), Distribution, dynamics, and fate of radiocesium derived from FDNPP accident in the ocean. *Journal of Nuclear Science and Technology*, 59, 409–423, doi: 10.1080/00223131.2021.1994480.
- Sasaki, Y., H. Kobayashi, A. Oka (2022), Global simulation of dissolved  $^{231}\text{Pa}$  and  $^{230}\text{Th}$  in the ocean and the sedimentary  $^{231}\text{Pa}/^{230}\text{Th}$  ratios with the ocean general circulation model COCO ver4.0. *Geoscientific Model Development*, 15(5), 2013–2033.
- Sato, M., J. Nishioka, K. Maki, S. Takeda (2021), Chemical speciation of iron in the euphotic zone along the Kuroshio Current. *Marine Chemistry*, 233, doi:10.1016/j.marchem.2021.103966.
- Takano, S., M. Tsuchiya, S. Imai, Y. Yamamoto, F. Yusuke, K. Suzuki, Y. Sohrin (2021), Isotopic analysis of nickel, copper, and zinc in various freshwater samples for source identification. *Geochemical Journal*, 55 (3), 171–183. DOI: 10.2343/geochemj.2.0627.

- Tazoe, H., H. Amakawa, K. Suzuki, J. Nishioka, T. Hara, H. Obata (2021), Analysis of Nd isotopic composition in seawater using newly developed solid phase extraction and MC-ICP-MS. *Talanta*, 232, 122435: doi.org/10.1016/j.talanta.2021.122435.
- Tazoe, H., H. Obata, T. Hara, M. Inoue, T. Tanaka, J. Nishioka (2022), Vertical profiles of  $^{226}\text{Ra}$  and  $^{228}\text{Ra}$  concentrations in the western Subarctic Gyre of the Pacific Ocean, *Frontiers in Marine Science*, in press.
- Wong, K. H., H. Obata, I. Y. Ikhsani, R. Muhammad (2021), Controls on the distributions of dissolved Cd, Cu, Zn, and Cu-binding organic ligands in the East China Sea. *Journal of Geophysical Research-Oceans*, 126, e2020JC016997: doi.org/10.1029/2020JC016997.
- Wong, K. H., J. Nishioka, T. Kim, H. Obata (2022), Long-range lateral transport of dissolved manganese and iron in the subarctic Pacific. *Journal of Geophysical Research-Oceans*, 127, e2021JC017652: doi.org/10.1029/2021JC017652.
- Yamada, M., J. Zheng (2021), Temporal trend of  $^{240}\text{Pu}/^{239}\text{Pu}$  atom ratios in water columns in the western North Pacific Ocean and its marginal seas. *Journal of Environmental Radioactivity*, 240, 106737. <https://doi.org/10.1016/j.jenrad.2021.106737>
- Yamada, M., J. Zheng (2021), Distributions of  $^{239}\text{Pu}$  and  $^{240}\text{Pu}$  concentrations and  $^{240}\text{Pu}/^{239}\text{Pu}$  atom ratios and  $^{239+240}\text{Pu}$  inventories in a water column in the eastern Indian Ocean: Transport of Pacific Proving Grounds-derived Pu via the Indonesian Throughflow. *Environmental Science and Technology*, 55(20), 13849-13859. <https://doi.org/10.1021/acs.est.1c03575>
- Yamada, M., S. Oikawa (2022), Biomonitoring of Pu isotopes in liver of North Pacific giant octopus (*Enteroctopus dofleini*) collected off the Rokkasho Nuclear Fuel Reprocessing Plant, western North Pacific margin. *Journal of Sea Research*, 183, 102201. <https://doi.org/10.1016/j.seares.2022.102201>
- Zheng, L., T. Minami, S. Takano, T.-Y. Ho, Y. Sohrin (2021), Sectional distribution patterns of Cd, Ni, Zn, and Cu in the North Pacific Ocean: Relationships to nutrients and importance of scavenging. *Global Biogeochemical Cycles*, 35 (7), e2020GB006558, <https://doi.org/10.1029/2020GB006558>.

#### Non-peer-reviewed article

- Wong, K. H., H. Obata, J. Nishioka, Y. Yamashita, Y. Kondo, T. Kim, A. Mashio, H. Hasegawa (2022), Subarctic Pacific Intermediate Water: An Oceanic Highway for the Transport of Trace Metals in the North Pacific, *Limnology and Oceanography Bulletin*, <https://doi.org/10.1002/lob.10490>

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

- Idha Yulia Ikhsani (2022), “Dynamics of trace metal biogeochemistry in the estuary and open ocean: Studies from Ariake Sea, Bay of Bengal and Eastern Indian Ocean”, Ph.D. Agriculture. Thesis, The University of Tokyo.
- Wiwit (2021), “Copper-binding organic ligands and their relationship with phytoplankton growth in Japanese coastal waters”, Ph.D. Agriculture. Thesis, The University of Tokyo.
- Koki Yamanaka (2022), “Redox status of Fe in the North Pacific Ocean and its adjacent seas”, M. F. Sc. Thesis, Nagasaki University.
- Ryota Hirabayashi (2022), “Mass cycle mechanisms in the Eastern Indian Ocean”, Master’s thesis, Graduate School of Agriculture, Meiji University.

***GEOTRACES presentations in international conferences***

- Chan, C.-Y., L. Zheng, Y. Sohrin (2021), North-south (145°W) and east-west (47°N) sectional distributions of dissolved trace metals during GEOTRACES Japan KH-17-3 cruise in the Pacific Ocean, Goldschmidt2021 Virtual Conference, July 2021.
- Kurisu, M., K. Sakata, M. Uematsu, A. Ito, Y. Takahashi (2021), Estimation of the contribution of combustion Fe in marine aerosols over the North Pacific using Fe stable isotope ratios, PICES-2021 Annual Meeting, October 2021.
- Kumamoto, Y., A. Michio, Y. Hamajima, M. Inoue, S. Nishino, T. Kikuchi, K. Sato (2022), Radiocesium in the western subarctic area of the North Pacific Ocean, Bering Sea, and Arctic Ocean in 2019 and 2020, the 6th International Conference on Environmental Radioactivity (ENVIRA 2021), online, December 2021.
- Tang, C., S. Aoki, Y. Maruo, F. Kondo, S. Komiya, K. Noborio (2021), Methane exchange in the sea-air interface of Indian Ocean, AGU Fall Meeting 2021, 884317, New Orleans & online, December 2021.

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