ANNUAL REPORT ON GEOTRACES ACTIVITIES IN JAPAN

May 1st, 2022 to April 30th, 2023

New GEOTRACES or GEOTRACES relevant scientific results

Takano et al. (2022) reported the evolution of concentrations and isotope ratios of dissolved nickel (Ni), copper (Cu), and zinc (Zn) from the North Equatorial Current in the western North Pacific to the Kuroshio in the East China Sea, where the inputs of anthropogenic and lithogenic materials through riverine and aeolian pathways are relatively high. The seawater samples were obtained during the GEOTRACES GP06 cruise. The concentrations and isotope ratios for Ni, Cu, and Zn in the deep water of the East China Sea were similar to those of the western North Pacific. The concentrations of Ni, Cu, and Zn in the Changjiang diluted water were significantly higher than those in the surface water of the western North Pacific, suggesting the riverine input. In the Changjiang diluted water, isotope ratios of Ni were lower than the surface water (<150 m) of the western North Pacific. The distribution of concentrations and isotope ratios for dissolved Ni fit with simple mixing among the three endmembers; Changjiang diluted water, Kuroshio surface water, and deep water in the western North Pacific. A mixing model using isotope ratios and concentrations for Ni quantitatively evaluates the sources of dissolved Ni in the East China Sea. The ranges of isotope ratios of Cu and Zn in the Changjiang diluted water were similar to those in the surface water of the Okinawa Trough, but lower than those in the oceanic region, such as the central Pacific. Compared with published data from the global ocean, dissolved Ni, Cu, and Zn in the surface water of this study area were isotopically lighter than in the pelagic regions, indicating that isotopically light Ni, Cu, and Zn are supplied from the continents.

Citation: Takano, S., W.-H. Liao, T.-Y. Ho, Y. Sohrin (2022), Isotopic evolution of dissolved Ni, Cu, and Zn along the Kuroshio through the East China Sea. Marine Chemistry, 243, 104135.

GEOTRACES workshops and meetings organized

- We had a national GEOTRACES symposium on March 9-10, 2023, for promoting scientific discussion on recent Japanese GEOTRACES studies (20 papers were presented). Six 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 March 10, 2023. These symposium and meeting were held in person and partially online hosted by Atmosphere and Ocean Research Institute, the University of Tokyo.
- The domestic session entitled “Marine Geochemistry” related to GEOTRACES studies was held during the annual meeting of Geochemical Society of Japan 2022 (September 7 – 9, online and in person at Kochi University). We had 12 presentations including those by 5 students.

Cruise

One GEOTRACES-section cruise in the western Pacific (GP22) was conducted as KH-22-7 by R/V Hakuho-Maru (June 30 – September 1, 2022; PI: Hajime Obata).

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

During the past year, Japan GEOTRACES investigators published a total of 26 peer-reviewed journal articles. The underlined first author is the ECR.

- 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 (δ98/95Mo) and tungsten (δ186/184W) at IODP Site U1457 of Laxmi Basin. Paleogeography, Palaeoclimatology, Palaeoecology 587, 110790.
- Alam, M. M. Tripti, G. P. Gurumurthy, A. Mohammad, Y. Sohrin, A. D. Singh, T. Radhakrishna, D. K. Pandey, K. Verma (2023), Hydroclimatic conditions and sediment provenance in the northeastern Arabian Sea since the late Miocene: insights from geochemical and environmental magnetic records at IODP Site U1457 of the Laxmi Basin. Geological Magazine 160, 813-829.
- Honda, M., M. Martschini, O. Marchhart, A. Priller, P. Steier, R. Golser, T. K. Sato, K. Tsukada, A. Sakaguchi (2022), Novel ^{90}Sr analysis of environmental samples by Ion-Laser InterAction Mass Spectrometry, Analytical Methods, 28, 2725-2796.
- Horikawa, K., T. Kodaira, J. Zhang, H. Obata (2023), Salinity–oxygen isotope relationship during an El Niño (2014–2015) in the southwestern Pacific and comparisons with GEOSECS data (La Niña, 1973–1974). Marine Chemistry, 249, 104222. https://doi.org/10.1016/j.marchem.2023.104222
- Ikenoue, T., M. Yamada, N. Ishii, N. Kudo, Y. Shirotani, Y. Ishida, M. Kusakabe (2022), Cesium-137 and 137Cs/133Cs atom ratios in marine zooplankton off the east coast of Japan during 2012–2020 following the Fukushima Dai-ichi nuclear power plant accident. Environmental Pollution, 311, 119962. DOI:10.1016/j.envpol.2022.119962.
- Ikhsani, I. Y., K. H. Wong, H. Ogawa, H. Obata, 2023. Dissolved trace metals (Fe, Mn, Pb, Cd, Cu, and Zn) in the eastern Indian Ocean. Marine Chemistry, 248, 104208: doi.org/10.1016/j.marchem.2023.104208.
- Kanna, N., S. Sugiyama, T. Ando, Y. Wang, Y. Sakuragi, T. Hazumi, et al. (2022), Meltwater discharge from marine-terminating glaciers drives biogeochemical conditions in a Greenlandic Fjord. Global Biogeochemical Cycles, 36(11), e2022GB007411.
- Kuwae, M., B. P. Finney, Z. Shi, A. Sakaguchi, N. Tsugeki, T. Omori, T. Agusa, Y. Suzuki, Y. Yokoyama, H. Hinata, Y. Hatada, J. Inoue, K. Matsuoka, M. Shimada, H. Takahara, S. Takahashi, D. Ueno, A. Amano, J. Tsutsumi, M. Yamamoto, K. Takemura, K. Yamada, K. Ikehara, T. Haraguchi, S. Tims, M. Froehlich, L. K. Fifield, T. Aze, K. Sasa, T. Takahashi, M. Matsumura, Y. Tani, P. R. Leavitt, H. Doi, T. Irino, K. Moriya, A. Hayashida, K. Hirose, H. Suzuki, Y. Saito (2023), Beppu Bay, Japan, as a candidate global boundary stratotype section and point for the Anthropocene series, The Anthropocene Review, 10, 49-86.
- Mashio, A. S., A. Ichimura, H. Yamagishi, K. H. Wong, H. Obata, H. Hasegawa (2022), Determination of the sub-picomolar concentration of dissolved palladium in open ocean seawater. Marine Chemistry, 243, 104124: doi.org/10.1016/j.marchem.2022.104124.
- Matsuoka, K., T. Tatsuyama, S. Takano, Y. Sohrin (2023), Distribution of stable isotopes of Mo and W from a river to the ocean: signatures of anthropogenic pollution. Frontiers in Marine Science, 10.
- 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.
- Otosaka S., H. Jeon, Y. Hou, T. Watanabe, T. Aze, Y. Miyairi, Y. Yokoyama, H. Ogawa (2022), A safer preprocessing system for analyzing dissolved organic radiocarbon in

seawater. Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms, 527, 1-6.

- Otosaka, S., Y. Kamidaira, T. Ikenoue, H. Kawamura (2022), Distribution, dynamics, and fate of radiocesium derived from FDNPP accident in the ocean. Journal of Nuclear Science and Technology, 59, 409-423.
- Sakata, K., M. Kurisu, Y. Takeichi, A. Sakaguchi, H. Tanimoto, Y. Tamenori, A. Matsuki, Y. Takahashi (2022), Iron (Fe) speciation in size-fractionated aerosol particles in the Pacific Ocean: The role of organic complexation of Fe with humic-like substances in controlling Fe solubility. Atmospheric Chemistry and Physics, 22, 9461–9482, https://doi.org/10.5194/acp-22-9461-2022
- Sieber, M., N. T. Lanning, X. Bian, S. -C. Yang, S. Takano, Y. Sohrin, T. S. Weber, J. N. Fitzsimmons, S. G. John, T. M. Conway (2023), The Importance of reversible scavenging for the marine Zn cycle evidenced by the distribution of zinc and its isotopes in the Pacific Ocean. Journal of Geophysical Research: Oceans, 128, e2022JC019419.
- Sukigara, C., S. Otosaka, N. Horimoto-Miyazaki, Y. Mino (2022), Temporal variation of particulate organic carbon flux at the mouth of Tokyo Bay. Journal of Oceanography, 79, 1-11.
- Takahashi, H., A. Sakaguchi, K. Hain, A. Wiederin, M. Kuwae, P., Steier, Y. Takaku, S. Yamasaki, K. Sueki (2023), Reconstructing the chronology of the natural and anthropogenic uranium isotopic signals in a marine sediment core from Beppu Bay, Japan, Heliyon, 9, E14153.
- Takano, S., W.-H. Liao, T.-Y. Ho, Y. Sohrin (2022), Isotopic evolution of dissolved Ni, Cu, and Zn along the Kuroshio through the East China Sea. Marine Chemistry, 243, 104135.
- Tazoe, H., H. Obata, T. Hara, M. Inoue, T. Tanaka, J. Nishioka (2022), Vertical profiles of ^{226}Ra and ^{228}Ra concentrations in the western Subarctic Gyre of the Pacific Ocean. Frontiers in Marine Science, 9, 824862: doi: 10.3389/fmars.2022.824862.
- Wang, Y., R. Bi, J. Zhang, J. Gao, S. Takeda, Y. Kondo, F. Chen, G. Jin, J. P. Sachs, M. Zhao (2022), Phytoplankton distributions in the Kuroshio-Oyashio region of the Northwest Pacific Ocean: Implications for marine ecology and carbon cycle. Frontiers in Marine Science, 9, doi: 10.3389/fmars.2022.865142.
- Wong, K. H., J. Xu, Y. Kondo, S. Takeda, A. S. Mashio, H. Hasegawa, H. Obata (2022), Very strong but exchangeable organic ligand of cobalt in the marginal sea. Limnology and Oceanography, 67 (6), 1299-1312, doi: 10.1002/lno.12078.
- Yamada, M., J. Zheng (2022), Enhanced boundary scavenging of ^{241}Am on the continental margin of the East China Sea. Journal of Environmental Radioactivity, 255, 107044. doi:10.1016/j.jenrad.2022.107044.
- Yamada, M., S. Oikawa (2022), ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{241}Am, ^{137}Cs, and ^{210}Pb in seafloor sediments in the western North Pacific Ocean and the Sea of Japan: distributions, sources and budgets. Journal of Radioanalytical and Nuclear Chemistry, 331(6), 2689-2703. doi:10.1007/s10967-022-08332-y.
- Yamashita, Y., J. Nishioka (2023), Dissolved iron concentration and the solubility inferred by humic-like fluorescent dissolved organic matter in the intermediate water in the North Pacific including the marginal seas, Journal of Geophysical Research: Biogeosciences, https://doi.org/10.1029/2022JG007159.
- Zheng, L., T. Minami, S. Takano, Y. Sohrin (2022), Distributions of aluminum, manganese, cobalt, and lead in the western South Pacific: Interplay between the South and North Pacific. Geochimica et Cosmochimica Acta, 338, 105-120.

Completed GEOTRACES PhD or Master theses

- Eita Toyoshima (2023), Distributions and biogeochemical cycles of dissolved Mn, Fe, Cu, Zn and Pb in the eastern South Pacific, M. S. (Environmental Studies), The University of Tokyo.
- Haruka Yamagishi (2023), Establish of Pd analysis method and clarification of vertical distribution in coastal seawater. M. S. (Engineering), Kanazawa University.
- Hayato Kuriyama (2023), Studies on the distribution and origins of Pb stable isotopes in the Sea of Japan and East China Sea. M. S. (Science), Graduate School of Science and Technology, Niigata University.
- Hideo Kanamura (2023), Development and application of isotope ratio analysis of Fe, Ni, Cu, Zn, Cd, and Pb in seawater, M. Sc., Kyoto University.
- Kanako Itoh (2023), Elucidation of elution conditions of platinum from sediments to seawater. M. S. (Engineering), Kanazawa University.
- Kohei Matsuoka (2023), Distribution of stable isotope ratios of dissolved molybdenum and tungsten from a river to the ocean, M. Sc., Kyoto University.
- Kota Isobe (2023), Development of analytical method for palladium, platinum, and gold in environmental water, M. Sc., Kyoto University.
- Li Ziwei (2023), The distribution and behavior of platinum in macroalgae., M. S. (Engineering), Kanazawa University.
- Momoka Imai (2023), Impact of sea ice meltwater on biogeochemical condition in the southern Sea of Okhotsk, M. S. (Environment), Hokkaido University.
- Tsukasa Nakamura (2023), Development of electrochemical methods for selective accumulation and determination of iodide in watersphere. M. S. (Environmental Sciences), Tsukuba University.
- Yuka Shiokawa (2023), Investigation of conditions for sequential extraction of platinum in sediments. M. S. (Engineering), Kanazawa University.
- Yo Nitta (2023), Analytical conditions and behavior of organic complex platinum in coastal seawater. M. S. (Engineering), Kanazawa University.
- Yukiko Kawakami (2023), Dynamics of dissolved vitamin B_{12} in the western North Pacific and adjacent area, M. S. (Fisheries), Nagasaki University.
- Zhou Jiakai (2023), Accumulation of Iron in Sea Ice during Ice Formation, M. S. (Environment), Hokkaido University.

GEOTRACES presentations in international conferences

- Alam, M. et al. (2022), Reconstruction of the late Miocene redox condition in the eastern Arabian Sea at IODP Site U1457 of Laxmi Basin using stable isotopes of molybdenum and tungsten. Goldschmidt 2022, Jul. 16, 2022, Honolulu, USA.
- Imai, M., A. Murayama, K. Ono, Y. Yamashita, K. Suzuki, T. Nakamura, K. I. Ohshima, H. Mitsudera, J. Nishioka (2023), Impact of sea ice meltwater on biogeochemical condition in the southern Sea of Okhotsk, The 37th International Symposium on the Okhotsk Sea & Polar Oceans, Feb. 22, 2023, Monbetsu, Japan.
- Matsuoka, K., Y. Sohrin, S. Takano (2022), Analysis of distribution and sources of Mo and W in the hydrosphere based on concentration and isotope ratios, Goldschmidt 2022, Jul. 14, 2022, Honolulu, USA.
- Otosaka, S. et al. (2023), Origin and transport of dissolved organic matter in the northwestern margin of the North Pacific inferred from radiocarbon signatures. International Conference on Aquatic Science & Technology (i-CoAST) 2023, Jeju, Korea.

- Sakaguchi, A. (2022), Actinide trace amount measurements and the application of such measurements to environmental studies, South Pacific Environmental Radioactivity Association Conference, Nov. 28-30, 2022, Christchurch, NZ. (Key Note speech)
- Sohrin, Y., L. Zheng, C.-Y. Chan (2022), Distinct distributions of aluminum, manganese, cobalt, and lead in the Pacific Ocean. 8th International Symposium on Metallomics, Jul. 12, 2022, Kanazawa, Japan.
- Zhang, Z., T. Nakamura, J. Nishioka (2023), Seasonal mixed-layer dissolved iron variation in the Western Subarctic Gyre, The 37th International Symposium on the Okhotsk Sea & Polar Oceans, Feb. 22, 2023, Monbetsu, Japan.
- Zhou Jiakai (2023), Accumulation of Iron in Sea Ice during Ice Formation, The 37th International Symposium on the Okhotsk Sea & Polar Oceans, Feb. 22, 2023, Monbetsu, Japan.

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