

ANNUAL REPORT ON GEOTRACES ACTIVITIES IN JAPAN

April 1st, 2019 to March 31st, 2020

New GEOTRACES or GEOTRACES relevant scientific results

Zheng et al. (2019) reported the basin-scale and full-depth sectional distributions of aluminum (Al), manganese (Mn), cobalt (Co), and lead (Pb) in the North Pacific during two GEOTRACES-Japan cruises. The surface maximum of the dissolved species is not a common feature for the four elements and that the dissolved species have the lowest concentrations in the Pacific Deep Water as compared to other oceans. These elements showed different physical species and distributions. The labile particulate fraction to total dissolved trace metals was the highest for Al at 0.66 ± 0.31 , and the lowest for Pb at 0.02 ± 0.08 . Further, the distribution of each element is uniquely related to ocean circulation. The total dissolved Al concentration is high in the Equatorial Under Current, the North Equatorial Current, and the Lower Circumpolar Deep Water. Manganese is supplied from reductive sources such as sediments on the continental shelves around the northern boundary. Cobalt is concentrated in the North Pacific Intermediate Water and in the Equatorial Pacific Intermediate Water owing to the combined effects of supply from the continental shelves, biogeochemical cycling, and scavenging. Lead shows a subsurface maximum centred at 35°N and 200 m depth, implying an association with the formation of the Subtropical Mode Water and the Central Mode Water. Although the subsurface Pb maximum in the Atlantic has diminished over the last three decades owing to the ban on leaded gasoline use, it has been sustained in the North Pacific through the growth of other anthropogenic sources in Asia and Russia.

GEOTRACES workshops and meetings organised

- The 2019 SCOR Annual Meeting was held in Toyama, Japan on 23–25 September 2019, hosted by the Japanese SCOR Committee. (Local host: Jing Zhang)
- SCOR/JOS Joint Symposium “Ocean Sciences in Japan: Present and Future” was held on 25 September in Toyama, Japan. Hajime Obata introduced GEOTRACES-Japan activities in this symposium.
- SCOR-GEOTRACES Joint Session, “Biogeochemistry of trace elements and isotopes in the ocean: from GEOSECS to GEOTRACES”(Conveners: Jing Zhang; Hajime Obata; Yuichiro Kumamoto)
- During JOS Annual Meeting (26 September, Toyama), SCOR-GEOTRACES joint session was held. We had 5 invited presentations (Drs. T. A. Chen, M. Fukasawa, M. Hatta, Z. Cao and C. Basak), 12 oral presentations and 6 poster presentations.
- Domestic GEOTRACES session was held during the annual meeting of Geochemical Society of Japan 2019 (September 17 -19, 2019) at the University of Tokyo for pursuing scientific discussion on recent Japanese GEOTRACES studies. We had 15 oral presentations and 5 poster presentations.

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

Nineteen papers were published as shown below.

- Amakawa, H., T. L. Yu, H. Tazoe, H. Obata, T. Gamo, Y. Sano, C. C. Shen and K. Suzuki (2019): Neodymium concentration and isotopic composition distributions in the

southwestern Indian Ocean and the Indian sector of the Southern Ocean. *Chemical Geology* 511, 190-203.

- Zheng, L. and Y. Sohrin (2019): Major lithogenic contributions to the distribution and budget of iron in the North Pacific Ocean. *Scientific Reports*, 9:11652, doi.org/10.1038/s41598-019-48035-1.
- Zheng, L., T. Minami, W. Konagaya, C.-Y. Chan, M. Tsujisaka, S. Takano, K. Norisuye and Y. Sohrin (2019): Distinct basin-scale-distributions of aluminum, manganese, cobalt, and lead in the North Pacific Ocean. *Geochimica et Cosmochimica Acta*, 254, 102-121.
- Wong, K. H., H. Obata, T. Kim, Y. Wakuta and S. Takeda (2019): Distribution and speciation of copper and its relationship with FDOM in the East China Sea. *Marine Chemistry*, 212, 96-107.
- Escobar, M., N. Takahata, T. Kagoshima, K. Shirai, K. Tanaka, J. Park, H. Obata and Y. Sano (2019): Assessment of helium isotopes near the Japan Trench 5 years after the 2011 Tohoku-Oki Earthquake. *ACS Earth and Space Chemistry*, 3, 581–587, doi: 10.1021/acsearthspacechem.8b00190.
- Tazoe, H., T. Yamagata, K. Tsujita, H. Nagai, H. Obata, D. Tsumune, J. Kanda, and M. Yamada (2019): Observation of dispersion in the Japanese coastal area of released ⁹⁰Sr, ¹³⁴Cs, and ¹³⁷Cs from the Fukushima Daiichi Nuclear Power Plant to the sea in 2013. *International Journal of Environmental Research and Public Health*, 16, 4094, doi:10.3390/ijerph16214094.
- Miwa, K., H. Obata and T. Suzuki (2019): Vertical distributions of iodine-129 and iodide in the Chukchi Sea and Bering Sea. *Journal of Nuclear Science and Technology*, doi: 10.1080/00223131.2019.1699189.
- Tanaka, Y., M. Tsujisaka, L. Zheng, S. Takano and Y. Sohrin (2019): Application of NOBIAS Chelate-PA 1 resin to the determination of zirconium, niobium, hafnium, and tantalum in seawater. *Analytical Sciences*, 35, 9, 1015-1020.
- Tsujisaka, M. S. Takano, M. Murayama and Y. Sohrin (2019): Precise analysis of the concentrations and isotopic compositions of molybdenum and tungsten in geochemical reference materials. *Analytica Chimica Acta*, 1091, 146-159.
- Takahashi, H.A., M. Minami, T. Aramaki, H. Handa, Y. Saito-Kokubu, S. Itho and Y. Kumamoto (2019): A suitable procedure for preparing of water samples used in radiocarbon intercomparison. *Radiocarbon*, 61, 1879 – 1887, doi: 10.1017/RDC.2019.104.
- Liao, W.□H., S. Takano, S.-C. Yang, K.-F. Huang, Y. Sohrin and T.-Y. Ho (2020): Zn isotope composition in the water column of the Northwestern Pacific Ocean: The importance of external sources. *Global Biogeochemical Cycles*, 34, e2019GB006379.
- Kanna, N., D. Lannuzel, P. van der Merwe and J. Nishioka (2020): Size fractionation and bioavailability of iron released from melting sea ice in the subpolar marginal sea. *Marine Chemistry*, 221, doi.org/10.1016/j.marchem.2020.103774.
- Yamashita, Y., J. Nishioka, H. Obata, and H. Ogawa (2020): Shelf humic substances as carriers for basin-scale iron transport in the North Pacific. *Scientific Reports*, 10, 4505, doi.org/10.1038/s41598-020-61375-7.
- Mashio, A. S., H. Obata, T. Shimazaki, H. Fukuda and H. Ogawa (2020): Spatiotemporal variations of platinum in seawater in Otsuchi Bay, Japan after the 2011 tsunami. *Science of the Total Environment*, 708, doi:10.1016/j.scitotenv.2019.134659.
- Yoshida, T., S. Nakamura, J. Nishioka, S. B. Hooker, and K. Suzuki (2020): Community composition and photosynthetic physiology of phytoplankton in the western subarctic

Pacific near the Kuril Islands with special reference to iron availability. *Journal of Geophysical Research – Biogeosciences*, doi: 10.1029/2019JG005525.

- Kaizer, J., Y. Kumamoto, M. Molnar, L. Palcsu and P. Povinec (2020): Temporal changes in tritium and radiocarbon concentrations in the western North Pacific Ocean (1993-2012). *Journal of Environmental Radioactivity*, 218, 106238. doi: 10.1016/j.jenvrad.2020.106238.
- Snyder, G.T., Y. Sano, N. Takahata, R. Matsumoto, Y. Kakizaki and H. Tomaru (2020): Magmatic fluids play a role in the development of active gas chimneys and massive gas hydrates in the Japan Sea. *Chemical Geology*, doi:10.1016/j.chemgeo.2020.119462.
- He, Q., X. Wang, H. He and J. Zhang (2020): A feasibility study of rare-earth element vapor generation by nebulized film dielectric barrier discharge and its application in environmental sample determination. *Analytical Chemistry*, 92, 2535-2542, doi: 10.1021/acs.analchem.9b04133
- Takano, S. W.-H. Liao, H.-A. Tian, K-F. Huang, T.-Y. Ho, Y. Sohrin (2020): Sources of particulate Ni and Cu in the water column of the northern South China Sea: Evidence from elemental and isotope ratios in aerosols and sinking particles. *Marine Chemistry*, 219, 103751.

Completed GEOTRACES PhD or Master theses

- Tsujisaka M. (2020) Development of analysis of isotopic compositions of molybdenum and tungsten in sediments and its application to paleoceanographic study on the Japan Sea. PhD Thesis, Kyoto University.
- Kurisu M. (2020) Evaluation of contribution of Fe in aerosols from different sources to the surface ocean based on Fe stable isotope ratio. PhD Thesis, the University of Tokyo.
- Tsuchiya M. (2020) Development of isotopic analysis of Ni, Cu, and Zn and its application to natural water samples in Japan. M.Sc. Thesis, Kyoto University.
- Fujiwara Y. (2020) Development of analysis of isotopic compositions of tungsten in seawater and its application to a vertical profile in the western North Pacific. M.Sc. Thesis, Kyoto University.
- Xu J. (2020) Distribution and organic complexation of cobalt in the marginal seas and coastal area. M.Env. Thesis, the University of Tokyo.
- Shimazaki T. (2020) Distribution and geochemical behavior of anthropogenic rare earth elements in the coastal environment. M.Env. Thesis, the University of Tokyo.
- Noguchi T. (2020) Atmospheric nitrogen deposition on the sub-tropic North Pacific and its impact. M.Sc. Thesis, University of Toyama.

GEOTRACES presentations in international conferences

- Kurisu, M., K. Sakata, M. Uematsu and Y. Takahashi. Estimation of contribution of anthropogenic iron in marine aerosols by iron isotope ratios. SOLAS Open Science Conference, Sapporo (Japan), 22 April 2019.
- Wong, K. H., H. Obata, T. Kim, Y. Wakuta and S. Takeda. Speciation of copper in the East China Sea. SOLAS Open Science Conference, Sapporo (Japan), 22 April 2019.
- Noguchi, T., J. Zhang, W. Guan, B. Chen, M. Zhao, Y. Zhu, J. Ishizaka, T. Matsuno and I. Yasuda. Influence of atmospheric nutrient deposition and phytoplankton species

composition in the western North Pacific subtropical area in winter. SOLAS Open Science Conference, Sapporo (Japan), 22 April 2019.

- Nishioka, J., H. Obata and I. Yasuda. Iron supply from the marginal seas to the North Pacific Ocean. IMBeR Open science conference 2019, Future Ocean 2, Brest (France), 19 June 2019.
- Fujiwara, Y., M. Tsujisaka, S. Takano and Y. Sohrin. Determination of stable isotope ratio of tungsten in seawater using chelate resin column extraction. Goldschmidt 2019, Barcelona (Spain), 21 August, 2019.
- Tsuchiya, M., S. Takano, M. Tsujisaka, S. Imai, Y. Yamamoto and Y. Sohrin. Improved isotopic analysis for Ni, Cu, and Zn and its application to natural water samples. Goldschmidt 2019, Barcelona (Spain), 21 August, 2019.
- Zheng, L., T. Minami, S. Takano and Y. Sohrin. Distribution of scavenged-type trace metals (Al, Mn, Co, and Pb) and Fe in the North Pacific Ocean. Goldschmidt 2019, Barcelona (Spain), 21 August, 2019.
- Escobar M., N. Takahata, K. Shirai, K. Tanaka, T. Kagoshima, H. Obata and Y. Sano. Helium isotopes reveal continuous and intensive degassing in Kagoshima Bay, Japan. Goldschmidt 2019, Barcelona (Spain), 21 August, 2019.
- Kurisu, M., K. Sakata and Y. Takahashi. Iron stable isotope ratios of aerosols from various sources to investigate origins of Fe transported to the North Pacific. Goldschmidt 2019, Barcelona (Spain), 21 August, 2019.
- Che, H. and J. Zhang. Water mass analysis and end-member mixing contribution using coupled radiogenic Nd isotopes and Nd concentrations: Interaction between marginal seas and the Northwestern Pacific. Goldschmidt 2019, Barcelona (Spain), 21 August, 2019.
- Zhang, J., J. S. Zhu, S. Kambayashi, T. Matsuno and E. Tsutsumi, E. Material transport between the marginal seas and Western North Pacific using neodymium and radiocesium isotopes. Goldschmidt 2019, Barcelona (Spain), 21 August, 2019.
- Katzakai, S. and J. Zhang. Impact of climate change on groundwater quality and quantity for three decades: Nutrient and carbon fluxes to the coastal area in Central Japan, Goldschmidt 2019, Barcelona (Spain), 21 August, 2019.
- Kumamoto, Y., M. Aoyama, Y. Hamajima, A. Murata. Measurements of low activity concentration of Fukushima-derived radiocesium in the western subarctic gyre of the North Pacific Ocean in summer 2017. 5th International Conference on Environmental Radioactivity, Prague (Czech Republic), 10 September, 2019.
- Nishioka, J., H. Obata and I. Yasuda. Micro- and macro-nutrient supply from the marginal seas to the North Pacific Ocean and its changing. PICES annual meeting 2019, Victoria (Canada), 22 October, 2019.
- Tsumune, D., F. O. Bryan, K. Lindsay, K. Misumi, T. Tsubono, N. Takahata, H. Obata, J. Nishioka. Distribution of mantle ^3He in the Indian Ocean simulated by an Ocean General Circulation Model. Ocean Science Meeting 2020, San Diego (USA), 17 February, 2020.
- Obata, H., T. Hara and H. Tazoe. Nd isotopic composition and REE concentrations in the Bering Sea and the North Pacific. Ocean Science Meeting 2020, San Diego (USA), 17 February, 2020.
- Escobar, M. T., N. Takahata, H. Obata and Y. Sano. Helium isotopes near the Indonesian Throughflow. Ocean Science Meeting 2020, San Diego (USA), 17 February, 2020.

- Wong, K. H., J. Xu and H. Obata. Contrasting organic complexation of Cu and Co in the East China Sea: by forward and reverse titrations. Ocean Science Meeting 2020, San Diego (USA), 18 February, 2020.
- Norisuye, K., Niigata, Y. Matsubara, H. Obata, E. A. Boyle, T. Gamo and M. Nakagawa. Pb and Pb isotope ratios in the North Pacific: observations during the KH-12-4 GEOTRACES Japan cruise. Ocean Science Meeting 2020, San Diego (USA), 18 February, 2020.
- Fukazawa, T., D. Asanuma, H. Obata, S. Usui, S. Matsuoka and K. Norisuye. Development of a method for determination of dissolved Te species in open ocean water. Ocean Science Meeting 2020, San Diego (USA), 18 February, 2020.
- Asanuma, D., H. Obata, Y. Matsubara, K. Maruyama, K. Norisuye and T. Fukazawa. Development of a method for determination of lead isotope ratios in marine suspended particles. Ocean Science Meeting 2020, San Diego (USA), 18 February, 2020.
- Takano, S, and Y. Sohrin. Distribution of dissolved Ni, Cu, and Zn and their isotopes in the Southern Ocean and the South Pacific Ocean. Ocean Science Meeting 2020, San Diego (USA), 18 February, 2020.
- Tazoe, H., H. Amakawa, K. Suzuki, and H. Obata. Analysis of Nd isotopic composition in seawater by using newly developed solid phase extraction and MC-ICP-MS. Ocean Science Meeting 2020, San Diego (USA), 20 February, 2020.
- Kondo, Y., Y. Sunahara, J. Nishioka, H. Obata, S. Takeda. Distributions of organic Fe-binding ligands in the eastern and western subarctic North Pacific form. Ocean Science Meeting 2020, San Diego (USA), 20 February, 2020.
- Nishioka, J., H. Obata, T. Hirawake and I. Yasuda. Iron supply from the marginal seas and its influence on biological production in the North Pacific Ocean. Ocean Science Meeting 2020, San Diego (USA), 20 February, 2020.

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