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Associate Professor

Program: Environmental Science and Technology

Area: Natural Environmental Science

Undergraduate: Dept. of Environmental Science

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### Professional Expertise

My expertise includes marine chemistry, geochemistry, chemical oceanography, analytical chemistry, and inorganic chemistry. Related research themes are shown below:

**(i) Development of analytical techniques for analysis/determination of trace elements and their isotopes in the ocean** Major analytical techniques are solid phase extraction, solvent extraction, atomic spectroscopy (ICPMS, ICPOES etc). My skills include clean CTD multisampling and shipboard oceanic observations as well as those related to laboratory experiments. Recently I have introduced a steady-flow siphonic liquid transport technique, which allows aqueous sample solution to flow through tubing at a given constant flow rate without direct transport by a pump and hence it is free from contamination from pump materials. The technique is useful and economical when we adopt a column separation method and require high-throughput analyses.

**(ii) Investigation of the marine biogeochemical cycles of trace elements and their isotopes in the global ocean** Anthropogenic ultra-trace elements and their isotopes, such as Te, Sn, Bi, Ir and stable Pb isotopes ( $^{204}\text{Pb}$ ,  $^{206}\text{Pb}$ ,  $^{207}\text{Pb}$ ,  $^{208}\text{Pb}$ ) are of my major interest because (a) they are, or may be for some elements, important as signatures of human activity and in evaluating its impact on the marine ecosystem, (b) potentially useful as unique chemical indicators for water mass structures (Pb isotopes) and, probably in some cases, subsurface mode water masses (Bi) and (c) have potential as transient tracers (for some elements) if reliable anthropogenic input function is established and related processes are well understood. Suspended particulate trace elements, such as Al, Mn and Fe are another interested components, because marine particles and the particulate trace metals play an important role in the biogeochemical cycles of various components in the ocean; marine particles (particulate organic matter, dust-derived aluminosilicates, authigenic manganese dioxide fine particles etc) are involved with not only vertical but also horizontal transport of dissolved constituents and solid materials.

My study approach is primarily based on oceanographic observation using a research vessel, analysis of open oceanic waters using reliable high-throughput analytical clean techniques and clarifying the distribution of interested components to quantify factors that control the distribution and biogeochemical cycles of them. I would like to teach students the aforementioned chemistries and hope some of them to be a geoscientist in the future.

### Research Fields of Interest

We are now faced with several environmental problems including global warming, acidification, and environmental pollution by human activities in addition to catastrophic earthquakes, volcanic eruptions and Tsunami attacks. In order to overcome these problems, we must not have only knowledge and techniques about protection from such disasters but also learn basic knowledge of the earth's system more in detail and explore new scientific approaches for describing the earth. Research on the field of marine geochemistry and chemical oceanography is essential to

understand how the ocean has responded to the environmental changes in the past, is doing now or will do in the future. Trace elements and their isotopes (TEIs) play important roles as proxy for past events as well as powerful chemical tracers for physical circulation and biogeochemical cycles in the modern ocean. My research interest covers development of methods for the analysis or determination of several TEIs in the ocean and clarifying their spatial and temporal variations in detail to unravel complex factors of several processes that control their distributions, and find the implication of the results that provides fundamental but more detail information about the earth and oceans.

## Education

2003: Dr. of Science, Graduate School of Science, Kyoto University, Japan

1999: M.S. in Chemistry, Graduate School of Science, Kyoto University, Japan

1997: B.S. in Chemistry, Faculty of Science, Kyoto University, Japan

## Professional Societies and Activities

1. The Geochemical Society (professional membership)
2. American Geophysical Union (regular membership)

## Major Publications

### Papers

- [1] "Determination of bismuth in open ocean waters by inductively coupled plasma sector-field mass spectrometry after chelating resin column preconcentration", *Analytica Chimica Acta* 727, 71-77, 2012.
- [2] "The molybdenum isotopic composition of the modern ocean", *Geochemical Journal* 46, 131-141, 2012.
- [3] "Stoichiometry among bioactive trace metals in seawater on the Bering Sea shelf", *Journal of Oceanography* 67, 747-764, 2011.
- [4] "Strong elemental fractionation of Zr-Hf and Nb-Ta across the Pacific Ocean", *Nature Geoscience* 4, 227-230, 2011.
- [5] "Behaviors of dissolved and particulate Co, Ni, Cu, Zn, Cd and Pb during a mesoscale Fe-enrichment experiment (SEEDSII) in the western North Pacific", *Deep-Sea Research II* 56, 2822-2838, 2009.
- [6] "Precise isotopic analysis of Mo in seawater using multiple collector-inductively coupled mass spectrometry coupled with a chelating resin column preconcentration method", *Analytical Chemistry* 80, 9213-9219, 2008.
- [7] "Spatial and temporal distribution of Fe, Ni, Cu and Pb along 140°E in the Southern Ocean during austral summer 2001/2002", *Marine Chemistry* 111, 171-183, 2008.
- [8] "Multielemental determination of GEOTRACES key trace metals in seawater by ICP-MS after preconcentration using an ethylenediaminetriacetic acid chelating resin", *Analytical Chemistry* 80, 6267-6273, 2008.
- [9] "Dissolved and labile particulate Zr, Hf, Nb, Ta, Mo and W in the western North Pacific Ocean", *Journal of Oceanography* 64, 247-257, 2008.
- [10] "Simultaneous determination of suspended particulate trace metals (Co, Ni, Cu, Zn, Cd and Pb) in seawater with small volume filtration assisted by microwave digestion and flow injection inductively coupled plasma mass spectrometer", *Analytica Chimica Acta* 594, 52-60, 2007.
- [11] "Preconcentration of Zr, Hf, Nb, Ta and W in seawater using solid-phase extraction on TSK-8-hydroxyquinoline resin and determination by inductively coupled plasma-mass spectrometry", *Analytica Chimica Acta* 583, 296-302, 2007.
- [12] "Distribution of bioactive trace metals (Fe, Co, Ni, Cu, Zn and Cd) in the Sulu Sea and its adjacent seas", *Deep-Sea Research II* 54, 14-37, 2007.