Biogeochemical Processes and Ocean Flux in the Western Pacific
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Edited by H. Sakai and Y. Nozaki

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Preface

This volume contains results obtained through the priority area research program entitled "Ocean Fluxes—Their Role in the Geosphere and Biosphere" which was funded by the Ministry of Education, Science and Culture, Japan for a 3-year period from 1991 to 1993 fiscal year. The major objectives of the program were to increase our knowledge on the global biogeochemical cycling of biophile elements such as carbon, nitrogen and phosphorous, and their associated elements within the ocean, and on its temporal changes through interactions across the major oceanic boundaries with land, atmosphere and seafloor. These can be regarded as a part of Japanese contribution to the international Joint Global Ocean Flux Study (JGOFS).

The field program started in April, 1991 and ended in March 1994 with great success, particularly in the Western Pacific (see Fig. 1). The coordination office was located at the Ocean Research Institute (ORI), University of Tokyo, and the following personnel served as members of the Steering Board;

Hitoshi Sakai (chairman) Yamagata University
Yoshiyuki Nozaki ORI, University of Tokyo
Shin-ichiro Noriki Hokkaido University
Masayuki Takahashi Botany, University of Tokyo
Isao Koike ORI, University of Tokyo
Nobuhiko Handa Nagoya University
Keisuke Taira ORI, University of Tokyo

More than one hundred scientists almost exclusively from the universities were involved in the program. They were grouped and worked together under the following four core fields.

A01. Flux of Terrestrial Materials to the Ocean

Terrestrial materials transported by monsoonal winds and rivers to the surface ocean play a significant role in the geochemical cycling of materials in the ocean. The nature and flux of Asian dust and photochemical reactions, biological and abiological transformation occurring in the sea were investigated by measuring organic and inorganic substances and radioactive tracers. The relative importance of lateral transport of lithogenic particles from continental slopes to the ocean interior and the primary vertical flux from the surface ocean has also been studied by using a series of sediment traps.
A02. Biological Production and Export Flux of Particles

Primary production, food webs, and sinking of biogenic debris are important processes that transfer carbon from the surface ocean to the deep sea. This transfer of carbon by "biological pump" shows strong seasonality and local nutritional variability. The international field studies were carried out at the eutrophic and oligotrophic sites of the western North Pacific for understanding the physical and biogeochemical processes that affect the ocean productivity and the vertical flux of particulate matter. A new floating buoy system was developed for the time-series observation of physical and biogeochemical parameters in the surface ocean.

A03. Flux of Materials at the Tectonically Active Ocean Bottom

The island arc-trench-back arc basin system is a unique feature of the western Pacific where many spots of hydrothermal vent field and cold seepage exist (see Fig. 2). Fluxes of chemical constituents in hydrothermal fluids and seep waters appear to be important in the global balance of materials in the ocean. Investigations on the
Fig. 2. The sites of submarine hydrothermal system and cold seepage in the Western Pacific.

fluids and deposits were undertaken in the tectonically active areas by using JAMSTEC submersible, “Shinkai 2000” and ROV “DESMOS” from R. V. Hakuho-Maru. An in situ monitoring system has also been developed to obtain continuous records of chemical parameters in such deep-sea environments.

A04. Ocean Circulation and its Effect on Ocean Flux of Materials

Physical processes that govern the state of oceans are undoubtedly very important in the biogeochemical cycling. In particular, nutrient supply to the surface mixed layer from underneath the thermocline through diffusion and winter convection is a primary control in biological productivity. A section study of CTD-hydrographic survey along 165°E and a series of moored current meter measurements were carried out to characterize the dynamic aspects that affect ocean flux in the western North Pacific.
The papers submitted to this volume were reviewed, and revised according to the reviewer's comments. Although this book contains 40 papers in somewhat broad interests and different styles, it represents only a part of this research program. Besides this, some results have already appeared in journals and others will be published in the near future. It is hoped that these contributions, altogether, will facilitate future research regarding the role of the ocean on the global climate change.

Thanks are expressed to all the scientists who participated in this program, the contributors to this volume and the reviewers. Financial support for this publication was provided by the Ministry of Education, Science and Culture, Japan to Y. Nozaki at the University of Tokyo. Secretarial and administrative assistance provided by Ms. K. Hasegawa is also gratefully acknowledged.

July 7, 1995

Yoshiyuki Nozaki
ORI, Univ. of Tokyo
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Contents

Preface ........................................................................................................................................ v
Editorial Acknowledgements ..................................................................................................... ix

Chapter I. Air-Sea Exchange Processes and Flux
Chemical composition of marine aerosols over the Central North Pacific—Results from the 1991 cruise of Hakurei Maru No. 2
UEMATSU, M., KAWAMURA, K., IBUSUKI, T. and KIMOTO, T. ............. 3
Estimation of mineral aerosol fluxes to the Pacific by using environmental plutonium as a tracer
NAKANISHI, T., SHIBA, Y., MURAMATSU, M. and HAQUE, M. A. ....... 15
Land-derived lipid class compounds in the deep-sea sediments and marine aerosols from the North Pacific
KAWAMURA, K. ........................................................................................................ 31
Iron and manganese in the atmosphere and oceanic waters
NAKAYAMA, E., OBATA, H., OKAMURA, K., ISSHIKI, K., KARATANI, H.
and KIMOTO, T. ................................................................................................................ 53
Laboratory estimation of CO₂ transfer velocity across the air-sea interface
KOMORI, S., SHIMADA, T. and MURAKAMI, Y. .............................................. 69
Dissolution of calcareous tests in the ocean and atmospheric carbon dioxide
NOZAKI, Y. and OBA, T. ....................................................................................... 83
Calcium carbonate production and carbon dioxide flux on a coral reef, Okinawa
OHDE, S. ....................................................................................................................... 93

Chapter II. Geochemical Processes in Seawater
Generations of carbonyl sulfide and hydrogen peroxide in the Seto Inland Sea—Photochemical reactions progressing in the coastal seawater
FUJIWARA, K., TAKEDA, K. and KUMAMOTO, Y. ......................... 101
Speciation of organoarsenical compounds in the hydrosphere
SOHRIN, Y., HASEGAWA, H. and MATSUI, M. .............................. 129
Chemical speciation of selenium in natural waters
NAKAGUCHI, Y., KOIKE, Y. and HIRAKI, K. .......................................... 139
The concentration distribution and chemical form of arsenic compounds in sea water
TANAKA, S. and SANTOSA, S. J. ................................................................. 159

The rare earth elements and yttrium in the coastal/offshore mixing zone of Tokyo Bay waters and the Kuroshio
NOZAKI, Y. and ZHANG, J. ................................................................. 171

The tetrad effect in seawater; a long dispute and an analytical approach to the confirmation of the effect
AKAGI, T. and MASUDA, A. ................................................................. 185

Detection, characterization and dynamics of dissolved organic ligands in oceanic waters
TANOUE, E. and MIDORIKAWA, T. ............................................................... 201

Chapter III. Primary Production and Other Biological Processes

Nitrate assimilation and new production in open ocean
KANDA, J. ......................................................................................... 227

Primary production and community respiration in the subarctic water of the western North Pacific
ODATE, T. and FURUYA, K. ................................................................. 239

Effects of a seamount on phytoplankton production in the western Pacific Ocean
FURUYA, K., ODATE, T. and TAGUCHI, K. .............................................. 255

Marine colloids: Their roles in food webs and biogeochemical fluxes
NAGATA, T. and KOIKE, I. ................................................................. 275

Regional and seasonal variations of biomass and bio-mediated materials in the North Pacific Ocean
YANADA, M. and MAITA, Y. ................................................................. 293

Nitrogen and carbon stable isotopic ecology in the ocean: The transportation of organic materials through the food web
SUGISAKI, H. and TSUDA, A. ............................................................. 307

The role of carnivorous zooplankton, particularly chaetognaths in ocean flux
TERAZAKI, M. .................................................................................. 319

Seasonal changes in deep-sea benthic foraminiferal populations: Results of long-term observations at Sagami Bay, Japan
KITAZATO, H. and OHGA, T. ............................................................... 331

Chapter IV. Particle Flux and Sediment Geochemistry

Spatial variation of Al flux in the North Pacific observed with sediment trap
NORIKI, S., IWAI, T., SHIMAMOTO, A., TSUNOGAI, S. and HARADA, K.  345
Spatial and temporal variation of $\delta^{15}$N in sinking particles in deep waters: Its implication for the origin and transport of particulate organic matter

NAKATSUKA, T., HANNA, N. and IMAIUZUMI, S. ........................................... 355

$^{230}$Th and $^{231}$Pa distributions in surface sediments off Enshunada, Japan

TAGUCHI, K. and NARITA, H. ................................................................. 375

Remobilization of transition elements in pore water of continental slope sediments

KATO, Y., TANASE, M., MINAMI, H. and OKABE, S. ............................... 383

Geochemistry of pore waters from a bathyal Calyptogena community off Hatsushima Island, Sagami Bay, Japan

MASUZAWA, T., NAKATSUKA, T. and HANNA, N. ................................. 407

Chapter V. Submarine Hydrothermal Processes

Wide variation of chemical characteristics of submarine hydrothermal fluids due to secondary modification processes after high temperature water-rock interaction: a review

GAMO, T. ..................................................................................................... 425

Geochemistry of phase-separated hydrothermal fluids of the North Fiji Basin, Southwest Pacific

ISHIBASHI, J. ............................................................................................ 453

Chemical modeling of seawater-rock interaction: Effect of rock-type on the fluid chemistry and mineral assemblage

CHIBA, H. .................................................................................................. 469

Hydrothermal mineralization in the Mid-Okinawa Trough

NAKASHIMA, K., SAKAI, H., YOSHIDA, H., CHIBA, H., TANAKA, Y.,
GAMO, T., ISHIBASHI, J. and TSUNOGAI, U. ......................................... 487

Iron-rich smectite formation in the hydrothermal sediment of Iheya Basin, Okinawa Trough

MASUDA, H. .............................................................................................. 509

Formation and alteration of organic compounds in simulated submarine hydrothermal vent environments

KOBAYASHI, K., KOHARA, M., GAMO, T. and YANAGAWA, H. .......... 523

Localized heat flow anomalies in the middle Okinawa Trough associated with hydrothermal circulation

KINOSHITA, M. ......................................................................................... 537

Chapter VI. Modeling and Physical Oceanography

Material transport models from Tokyo Bay to the Pacific Ocean

YANAGI, T. ................................................................................................. 563
Climate and weather effects on the chlorophyll concentration in the northwestern North Pacific
  Sugimoto, T., Tadokoro, K. and Furushima, Y. ........................................ 575

Ecosystem models for the three regional problems in the Northern Pacific
  Kishi, M. J. and Kawamiya, M. ................................................................. 593

A review on the subtropical mode water of the North Pacific (NPSTMW)
  Hanawa, K. and Suga, T. ................................................................. 613

Flow distribution at 165°E in the Pacific Ocean
  Kawabe, M. and Taira, K. ................................................................. 629

Determination of monthly mean sea surface temperature from 1981 to 1990 by the NOAA-AVHRR in the equatorial Pacific
  Kishino, M. ................................................................. 651

Author Index .................................................................................................. 661

Subject Index .................................................................................................. 663