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Preface

Tracers of physical and biogeochemical processes, past changes and ongoing anthropogenic impacts: The 43rd International Liege Colloquium on Ocean Dynamics, Liege, Belgium, May 2–6, 2011
A joint Liège Colloquium — Geotraces–BONUS–GoodHope meeting

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The 43rd International Liege Colloquium on Ocean Dynamics (http://modb.oce.ulg.ac.be/colloquium/) gathered a hundred scientists from around the world to discuss new developments and insights related to tracers and proxies (from temperature and salinity to gases and isotopes) with a particular attention on the use of Trace Elements and Isotopes (TEI) as tracers. The colloquium was organized in connection with the Geotraces program (an ongoing international study of the global marine biogeochemical cycles of trace elements and their isotopes, http://www.geotraces.org/) and was the occasion to present the wealth of data collected during large oceanographic expeditions that occurred in connection with the International Polar year. In this framework, particular emphasis was given to the BONUS–GoodHope project, a multi-disciplinary oceanographic cruise that coupled full-depth ocean and atmosphere physical and biogeochemical observations, including trace metals and isotopes (Speich et al., 2008; Speich et al., 2013).

Tracers such as TEI play an important role in oceanography as tools to (1) describe physical processes (e.g. general circulation, meso-scale and sub-mesoscale processes, eddies, vertical transport, injection, aging, ventilation, iso- and diapycnal mixing), (2) investigate biogeochemical cycles (e.g. quantification of primary production, carbon export), energy transfer and trophic pathways (through for instance the development and application of molecular and compound-specific isotope tracers), (3) understand the role of limiting micronutrients regulating ecosystem production and structure (e.g. limitation of primary production, assimilation and regeneration, impact of iron fertilization), (4) reconstruct past ocean conditions, and (5) study the transport and fate of anthropogenic impact (including anthropogenic CO_2) and pollutants.

Progress in measurements (e.g. sample collection, analysis, intercalibration and standardization of TEI), laboratory studies and modeling of TEI are of the most importance to identify the factors that determine the dynamics of TEI: e.g. sources, sinks, impact of physical (including meso-scale and sub-mesoscale) and biogeochemical processes, terrigeneous (riverine and Eolian) inputs as well as the impact of climate induced changes.

The special issue presents a collection of papers dealing with these different thematics. In VanHulten et al. (2013-in this issue) a model of aluminum dynamics in the global ocean is embedded in a circulation and biogeochemical model. Model predictions are compared with the West Atlantic Geotraces cruises of 2010 and 2011. The analysis of model results allows understanding the distribution of aluminum in

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the ocean in relation to physical and biogeochemical processes as well as identifying processes of importance that govern the aluminum dynamics. Racape et al. (2013-in this issue) investigate the anthropogenic carbon changes in the Irminger Basin during the period 1981–2006. With this aim, they compare new $\delta^{13}C_{DIC}$ observations (OVIDE cruises, 2002–2006) with historical data and estimate jointly the oceanic ^{13}C Suess Effect and C_{ant} accumulation. Gaultier et al. (2013-in this issue) propose a technique (based on inverse modeling) to improve the description of mesoscale dynamics by extracting the information on submesoscale processes contained in high resolution satellite images of tracer fields (here sea surface temperature, SST). Currents at mesoscale and larger scales are computed from altimetric observations (based on geostrophy) using the information on submesoscale dynamics extracted from SST. Trevisol et al. (2013-in this issue) evaluate the potential of using the stable oxygen and carbon isotope composition of the Antarctic bivalve *Adamussium colbecki* as suitable archives of water mass properties. The reconstructed $\delta^{18}O$-temperature signal has been found a good proxy of the mean experimental summer temperature. Srinivas and Sarin (2013-in this issue) analyze the atmospheric deposition of mineral dust (Al, Ca, Fe, Mg) and anthropogenic trace metals (Pb, Cd, Cu, Mn, Cr, Co, Ni) to the Bay of Bengal using a large data set collected during field cruises. The content of the marine atmospheric boundary layer in these elements is compared for the winter and spring inter-monsoon seasons and for different locations in the Bay and differences are explained in terms of influence of dominant atmospheric circulation patterns. Prego et al. (2013-in this issue) investigate the biogeochemical patterns of bioactive metals (Cd, Co, Cu, Ni, V and Zn) and Pb in the coastal zone of Cape Finisterre (NW Iberian Peninsula) from observations in sea- and freshwater, in phytoplankton and in the sediment (from the surface sediment until 1 m depth). These data are used to quantify the level of contamination of the area (pristine versus anthropogenically disturbed) and the origin of the metals (terrestrial versus marine). Perianez et al. (2013-in this issue) describe a numerical model to study the behavior and distribution of natural radionuclides (^{226}Ra, ^{238}U) in sediments in the Huelva estuary (SW Spain). A dispersion model of the dissolved and particulate phases of radionuclides is presented and used to understand the dynamics of radionuclides in the estuary (impact of tides, river discharges). The distribution pattern of trace metals in deep-sea hydrothermal biological communities (e.g. polychaete, mussels) is analyzed in Demina et al. (2013-in this issue) and the impact of environmental and biological parameters on their bioaccumulation in organisms is investigated. The bioconcentration factor of trace metals is estimated for some organisms in order to address their potential to play an efficient local deep-water biological filter of the ocean.

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