Chemical characterization of marine dissolved and particulate lipids

TAMIHITO NISHIDA[1] AND EIICHIRO TANOUE[2]

[1]Department of Earth and Environmental Sciences, Graduate School of Environmental Studies, Nagoya University, Japan (tamihito@ihas.nagoya-u.ac.jp)

[2]Department of Earth and Environmental Sciences, Graduate School of Environmental Studies, Nagoya University, Japan (tanoue@ihas.nagoya-u.ac.jp)

Lipids are one of the major biochemical components in dissolved (DOM) and particulate organic matter (POM) in seawater. Lipids have been widely used as biomarker to know the origin of POM and sedimentary organic matter. However, chemical characteristics of dissolved lipids have been poorly understood.

The aim of this study is to clarify chemical characteristics of dissolved and particulate lipids in North Pacific waters through a systematic survey of elemental, fatty acid and functional group analyses.

The concentrations of both dissolved and particulate lipids were high in surface waters and decreased with depth throughout the water columns. The concentrations of dissolved lipids were about 15-20 times higher than those of particulate lipids. Contributions of fatty acid-C to lipid-C in dissolved and particulate phases were almost same, 76±5% (± 1SD, n = 82) and 73±8% (± 1SD, n = 32) respectively, regardless of areas and depths. Thus, fatty acids were quantitatively main constituent of dissolved and particulate lipids. Most of fatty acids in dissolved and particulate phases exists in the form of conjugation linked by an ester bond. The main functional groups of dissolved and particulate lipids as determined by ^{1}H-NMR spectroscopy were almost same, namely, fatty acid ester, glycerol, phosphatidylcholine, and phosphatidylethanolamine. Phosphatidylinositol was detected in particulate lipids as a minor component, but not in dissolved lipids. Nevertheless, fatty acid compositions of dissolved lipids remarkably differ from those of particulate lipids, regardless of areas and depths. The n-18:0 fatty acid was a minor or undetectable component in particulate lipid, while it was a major constituent of dissolved lipid.

Our results indicated that dissolved lipid was a mixture of esters (glycerides and phospholipids) without significant chemical modification, but their fatty acids composition were characteristic, lipids esterified with n-16:0 and n-18:0 fatty acids were selectively preserved in dissolved phase. Mechanistic process by which such unique lipids were survived and accumulated in marine environments is proposed.

Cosmogenic nuclides studies from meteorites to the Earth and beyond

DR. KUNIHIKO NISHIIZUMI

Space Sciences Laboratory, University of California, Berkeley, CA 94720-7450 (kuni@ssl.berkeley.edu)

Shortly after the discovery of cosmogenic ^{3}He in iron meteorites, *in-situ* produced ^{36}Cl was detected in terrestrial rock. Cosmogenic nuclides (CNs) were extensively studied in extraterrestrial materials in the 1960-70s. Except for a few heroic initial experiments, studies of *in-situ* produced CNs for terrestrial application were not performed until the mid-1980s. The development of AMS greatly expanded the investigation of CNs in both extraterrestrial and terrestrial materials.

The application of *in-situ* produced CNs to terrestrial materials opened a new window for Quaternary surficial geology. The resulting studies have involved a wide range of geomorphological applications, including the timing of glaciation, the history of erosion, the development of soils and hill slope firms, uplift and incision rates, the timing of volcanic events, and more. These important applications were rapidly and widely implemented by numerous investigators. Although the thickness of the Earth’s atmosphere and the presence of its geomagnetic field make CN production systematics somewhat different from that for extraterrestrial materials, similar CN studies (crater ages, erosion rates, regolith gardening, soil hillslope movement, and cosmic ray intensity changes) had already applied to extraterrestrial materials.

Future work on terrestrial *in-situ* produced CNs requires multi-nuclide measurements, as often performed in studies of extraterrestrial material, in order to obtain correct exposure conditions or to understand complex exposure histories. Although measurement of a single CN provides useful information, a single measurement may lead to a misinterpretation of exposure histories in many geological settings. A second frontier, driven by missions return samples of cometary, asteroidal, or planetary materials, lies in the push to extremely small sample sizes. The investigation of *in-situ* produced CNs in Martian surface materials, such as craters, volcanic, dusts, sediments, or ice caps, will require knowledge of both CN production systematics in extraterrestrial materials and analogous modelling from geomorphological application of terrestrial CNs.

Finally, we continue to need development of a capability of higher-sensitive measurements of a growing range CNs as well as the ability to pursue the possibility of *in-situ* measurement of CNs, especially in space.