Atmospheric transport of natural and anthropogenic substances from East Asia over the NW Pacific

M. UEMATSU[1,2], H. HATTORI[1,2] AND M. MINAKAWA[3]

[1] Ocean Research Institute, The University of Tokyo, Tokyo, Japan (uematsu@ori.u-tokyo.ac.jp)
[2] Japan Science and Technology Corporation, Saitama, Japan
[3] National Research Institute of Fisheries Science, Yokohama, Japan (minmas@nrifs.affrc.go.jp)

Introduction

Aeolian dust and gaseous and particulate pollutants from the Asian continent are transported eastward over the North Pacific, especially in spring. These natural and anthropogenic materials in the atmosphere can influence regional and global climate by altering the Earth's radiative balance. It is important to idetify the continental substances and their sources comprising the marine aerosols. During the 2002 IOC western North Pacific cruise, we conducted atmospheric sampling of aerosol and gaseous components on board R/V Melville from May 1 to June 5.

Results and discussion

Three pronounced atmospheric transport events were observed during the cruise. The first dust event occurred near the Japanese main island (30-35˚N, 140-150˚E) having the highest Al concentration (an indicator of mineral dust particle) of 1200 ng m^{-3} from May 4 to 8. The second dust event was found north of Station KNOT (44-50˚N, 155-167˚E) from May 12 to 14. The third event was a rather weak dust episode but it was associated with a high concentration of elemental carbon (EC) from 45˚N to 33˚N along the line of 171˚E.

Particulate Al in coarse mode comprised over 80% of the total Al during the first and second dust events, while a portion of fine mode Al increased up to 45% in the third event. Mineral particles are likely modified by interaction with anthropogenic substances during transport, especially nitrogen compounds under dry condition.

In the aerosol samples, ^{210}Po (half-life of 138.4d) together with other measured natural radionuclides, like ^{210}Pb and ^{7}Be, was extremely high during the third event, while ^{210}Pb corresponded well with the mineral dust concentration. The ratio of ^{210}Po/^{210}Pb (over 3.5) on May 19 suggests that the excess ^{210}Po was associated with the high EC event. The ratio of EC/Total Carbon on the third event was higher than the first and the second events. This sporadic atmospheric event was identified as a pronounced smoke from the Siberian region by the satellite images, the source of which may be forest fires.

Various atmospheric emissions over the Asian continent may affect the chemical and physical properties of the remote marine atmosphere over the North Pacific.

Multiple sulfur isotopes of Early Archean hydrothermal deposits from Western Australia

YUICHIRO UENO[1], DOUGLAS RUMBLE[2], SHUHEI ONO[2], GUIXING HU[2], AND SHIGENORI MARUYAMA[3]

[1]Department of Earth Science and Astronomy, The University of Tokyo, Tokyo, Japan. (ichiro@esa.c.u-tokyo.ac.jp)
[2]Geophysical Laboratory, Carnegie Institute of Washington, Washington DC 20015, USA.
[3]Department of Earth and Planetary Sciences, Tokyo Institute of Technology, Tokyo, Japan.

Sulfur isotopes have been widely used as tracers in the study of igneous, sedimentary, hydrothermal and biological processes on the Earth. Recent discovery of mass-independent sulfur isotope fractionations in pre-2.3 Ga sedimentary rocks provided new insights into the Earth's early sulfur cycle [1]. It has been hypothesized that photo-dissociation of SO_2 gas in the O_2-poor early atmosphere produced the mass-independent fractionation in ^{33}S, thereby yielding a negative Δ^{33}S value of the Archean seawater sulfate [2]. One of the most fundamental and unsolved questions is how the atmospheric signature has been preserved in the rock record. In order to understand the processes of preservation, we must investigate geological and petrographical distributions and variations of the ^{33}S anomalies. Such investigation has potential to reconstruct the formation processes of the minerals and rocks. We performed multiple sulfur isotope analyses by a new laser fluorination microprobe, using an excimer laser for in situ spot analyses of sulfide minerals, and by chemical extraction-fluorination for disseminated pyrite and sulfate minerals by the procedure developed by Hu et al. (in press) and Ono et al. (in press). Analyzed samples are from the ~3.5 Ga North Pole area, Pilbara craton, Western Australia. The samples are well characterized by detailed field mapping and petrographic observations (Ueno et al., in press). In this area, sulfide and sulfate minerals occur in various rock types such as bedded chert, bedded barite, synsedimentary veins of hydrothermal origin, and basaltic greenstones. Thus, the North Pole area is one of the best study fields for the sulfur cycle in Early Archean hydrothermal system. The $\delta^{34}S_{CDT}$ values of individual pyrite grains in a single chert bed are variable, ranging from +0.8‰ to +1.8‰. All pyrites, however, have $\Delta^{33}S = -0.32 \pm 0.04$‰, which are distinct from those of bedded and vein barites in the study area ($\Delta^{33}S = \sim -1.0$‰; [1, 3]). This indicates the presence of two different sulfur sources. Nevertheless, millimeter scale heterogeneity of δ^{34}S with homogeneous Δ^{33}S values suggests secondary mass-dependent fractionations.

References

[1] Farquhar et al. 2000, *Science* 289, 756-758;
[2] Farquhar et al. 2001, *JGR* 106, 32829-32840
[3] Runnegar 2001, *Goldschmidt2001 abst.*, 3859