Source identification of aerosols in East Asia by using metal concentrations measured by inductively coupled plasma mass spectrometry equipped with laser ablation (LA/ICP-MS)

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Recent studies have been concerned with sources and behaviors of atmospheric aerosol because they are possible to associate with serious health hazard such as increasing risks of respiratory diseases (e.g. Lee *et al.*, 2000). In Chinese urban area, a high concentration of aerosol is caused by both anthropogenic sources (e.g. coal combustion) and natural sources (e.g. soil dust). It is very important to identify aerosol sources in order to reduce them.

Chemical mass balance (CMB) receptor model is one of the useful tools to identify aerosol sources. Recently, it has been applied effectively by using chemical compositions of inorganic species such as trace metals (Shu *et al.*, 2001). Concentrations and chemical compositions of aerosol are variable day by day; hence, it is strongly required to observe the daily aerosol behavior for a long-period in order to achieve more precise source identification of aerosols.

This paper reported daily concentrations of trace metals in aerosol in Beijing, China and Rishiri, Japan since March, 2001. Daily concentrations of 15 kinds of metals (^{27}Al, ^{47}Ti, ^{51}V, ^{53}Cr, ^{55}Mn, ^{57}Fe, ^{59}Co, ^{60}Ni, ^{65}Cu, ^{67}Zn, ^{75}As, ^{82}Se, ^{111}Cd, ^{121}Sb, ^{208}Pb) were analyzed by using inductively coupled plasma mass spectrometry equipped with laser ablation sample introduction system (LA/ICP-MS). Details of the LA/ICP-MS analysis were described in Tanaka *et al.* (1998).

All the metal concentrations in aerosols in Beijing, China were several times higher than those in Kawasaki, Japan (Ministry of the Environment, 1997). Especially, As, Al and Ti concentrations in aerosols in Beijing were 10-fold higher than those in Kawasaki. Source identification of aerosols was carried out by using CMB receptor model with the daily concentrations of metals in aerosols. Major primary sources of aerosols in Beijing were estimated as soil dust and coal combustion.

References

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In-situ dehydration of hydrous glasses at high temperature

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Introduction

Water dehydration of magma is essentially important for understanding volcanic processes. In the dehydration process, the water species of OH and H_2O_m (molecular water) migrate and react each other. In order to investigate mechanisms and kinetics of the water dehydration at high temperature, we have performed *in situ* infrared (IR) measurements on hydrous rhyolitic glasses.

Experiment methods

We prepared four hydrous rhyolitic glasses with 0.7 – 4.1 wt% water using an internally heated pressure vessel. These glasses were doubly polished and heated at 475 – 900 °C using a heating stage set on an IR microscope. 40 – 60 successive IR spectra were measured every 90 seconds at constant temperature. The absorbances at 4500 (OH) , 3550 (OH + H_2O_m) and 1630 (H_2O_m) cm^{-1} were determined from the obtained spectra after baseline correction.

Results and Discussion

We carried out 20 runs for 4 samples with 0.7 – 4.1 wt% water. The absorbances of water species decreased with time and the decrease rates were greater at higher temperature.

The ratio of the absorbance at 4500 cm^{-1} to that at 1630 cm^{-1} clearly shows that the OH concentration decreased with the decrease of the H_2O_m concentration. This can be explained by fast reaction of two OH groups to H_2O_m and an bridging exygen. Our results mean that the formation process of the H_2O_m is faster than the transport of the H_2O_m.

The apparent diffusion coefficient of the water (OH and H_2O_m) diffusing-out can be obtained based on experimental data for the 3550 cm^{-1} band. Our experimental data was fitted into the mass – loss equation of a slab (Crank, 1975), yielding the apparent diffusion coefficient of the diffusing-out. The results show that (1) the apparent diffusion coefficient increases with intial water contents, (2) the activation energy of the apparent diffusion coefficient decreases with intial water contents, and (3) the values obtained in this study are consistent with the results by Zhang (1999) and Zhang and Behrens (2000).

References

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