NOTES AND CORRESPONDENCE

Aerosol Zn: As an Indicator of Long Range Transport of Volcanic Ejecta of Mt. St. Helens

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On May 18, 1980, a major pyroclastic eruption occurred from Mt. St. Helens volcano in Washington, U.S.A., which caused a more than 12 km rise of volcanic clouds and a loss of substantial part of the mountain itself (EOS, 1980). This eruption was one of the several largest worldwide eruptions in this century.

It is of interest to know the effect of volcanic ejecta on the atmospheric environments. Up to now, little is known on the effect of volcanic eruption on the minute components of global atmospheric aerosols.

In this short report, the authors intend to present some of the interesting phenomena caused by the fallout from the volcanic ejecta of Mt. St. Helens observed at Tsukuba, Japan. A detailed report will be given later in elsewhere.

During the continuous study of the content of metallic elements in aerosols near the surface at Tsukuba Science City, Ibaraki Pref., the central part of the Pacific side of the Honshu Island, Japan, an abrupt increase of zinc content in the surface air was observed on June 4 to 5, 1980, 50 times higher than that of usual level. Following one to two months, rather high level of zinc content in the surface air was continued. These facts strongly suggested the first arrival and the after effect of the fallout from the volcanic cloud which derived from the big eruption on May 18, 1980 of Mt. St. Helens.

Aerosol in the surface air was filtered through glass fiber filters (Toyo GB-100R, nominal efficiency of $0.3\ \mu\text{m}$ particle is 99.99%) using a high volume air sampler at a flow rate of $1,000\ \text{l min}^{-1}$ for 24 or 48 hours. The atmospheric dust collected on the filter was subjected to the analysis of metallic elements. The determination of iron, manganese, copper and zinc was carried out by means of non-destructive X-ray fluores-

cence spectrometry. Calibration was done using X-ray fluorescence calibration standards of MicroMatter Co. and atomic absorption spectrometry after dissolution of the samples.

The content of metallic elements in the surface air at Tsukuba during the period of June to August, 1980 is shown in Fig. 1. On June 4 and 5, an abrupt increase of zinc content in the surface air up to $7.1\ \mu\text{g m}^{-3}$ was observed whereas usual content of zinc in the air at Tsukuba ranged from 0.04 to $0.35\ \mu\text{g m}^{-3}$ with the average value of $0.1 \pm 0.05\ \mu\text{g m}^{-3}$.

One to two days after, the concentration of iron, manganese and copper in the air also increased about two times higher than usual. It is

Fig. 1 Zn, Fe, Cu and Mn contents in the air near the ground at Tsukuba, Japan. (June to August, 1980).

difficult to explain these increment of the concentration of the metallic elements in the surface air whether antropogenic or natural sources.

According to the result of observation on the amount of stratospheric aerosols by means of Lidar system in our institute, significant increase of back scattering coefficient was observed during the period May 27 to June 4, 1980 at 12 km and it decreased rapidly after this period.

Similar results were given at Fukuoka, Kyushu and at Nagoya, Honshu, Japan at the same period. At Nagoya (Iwasaka and Hayashida, 1981), the maximum Lidar echo was observed on June 3, 1980. The period of the abrupt increase of zinc in the surface air at Tsukuba is in good accordance with those of Lidar observations.

The detailed report will be given later in elsewhere, but other evidences can be briefly described as follows: 1) The result of determination of other volatile elements such as Se and Sb also showed a pronounced peak at the same time. 2) Furthermore, the ratios of these volatile elements in aerosols at the abrupt high content of Zn is in good accordance with those of Mt. St. Helen plume. 3) Air trajectory at 500 mb also supports the arrival of Mt. St. Helens tephra.

Recently, Boutron (1980) reported the vertical distribution of metallic elements in Antarctic ice core and pointed out the good correlation between the layers of high content of zinc and some other metallic elements in the core samples and the age of large volcanic eruptions in last two to three centuries. There is no significant enrichment of zinc in volcanic ash in the plume and in the local fallout originated from Mt. St. Helens (Vossler et al., 1981). However, enrichment of some of the volatile elements such as zinc, antimony, selenium and bromine in volcanic aerosols are reported by Mroz and Zoller (1975) and also it is well known that fractionation of zinc compounds from other metallic elements due to their high volatilities occurs during the calcination process. Then, it is attributable that the abrupt increase of zinc content in the

surface air observed at Tsukuba on June 4 and 5, 1980 might be due to the fallout from the volcanic ejecta of Mt. St. Helens.

As to the concentration of iron, manganese and copper in the surface air, a little higher values were observed than usual on June 6 and 7, 1980. Two days delay of arrival of the maxima of these elements in the air compared with that of zinc is also one of the interesting problems to study further.

After this period of high concentration of zinc in the surface air, a little high level of zinc content in the surface air was observed during the period of July 1 to August 10, 1980. These results are in good agreement with those of Lidar observation on the atmospheric aerosols of which the dust layer may be originated from Mt. St. Helens in upper atmosphere spread out and dispersed from 6 to 18 km in July, 1980.

In conclusion, zinc in the surface air might be considered as a useful indicator for the geochemical effect of the volcanic ejecta scattered into atmosphere on the global scale.

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エーロゾル中の亜鉛：セントヘレンズ火山噴出物の 長距離輸送の一指標について

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