VII. Chemical Constituents in the Surface Snow Cover in the Mizuho Plateau-West Enderby Land Area, East Antarctica, 1970 - 1971

Masayo MUROZUMI* and Hiromu SHIMIZU**

1. Introduction

Chemical constituents in the surface snow of the ice sheet collected at six locations in the Mizuho Plateau-West Enderby Land area in 1970 - 1971 by JARE 11 were quantitatively analyzed by the method of isotope dilution mass-spectrometry and atomic absorption at Muroran Institute of Technology, Muroran, Hokkaido. The results obtained up to date are reported in this paper while further analyses are under way.

2. Sampling

Containers of snow samples were prepared as follows by Murozumi in the laboratory of Muroran Institute of Technology: a polyethylene bottle with a capacity of 20 l was cleaned with action, concentrated nitric acid and water, successively; rinsing the bottle sufficiently with redistilled water, air in the bottle was completely replaced with Argon gas; the bottle lidded tightly was kept in a tripple-layered bag of polyethylene; three of these bottles were put together in a wooden box with clean sampling tools. The laboratory where all the work of the preparations were carried out was kept specially air-conditioned.

The sampling of snow was conducted by Shimizu at six locations, shown in Table VII-1 and Fig. A attached to the end of this volume, during the oversnow traverse of JARE 11 in 1970 - 1971. At each sampling station, a snow sample was taken from the very surface snow layer 10 cm in thickness, avoiding chemical contamination as much as possible, and was put in each of three bottles in a box. The sampling site was selected in the windward 100 - 200 m away from the camp, and sampling was conducted from the lee side facing the wind, each time with new tools: a lid opener, a shovel and plastic gloves. The bottle filled with a sample was lidded tightly and put in a new tripple-layered bag of polyethylene and was sealed,

* Muroran Institute of Technology, Muroran.

**The Institute of Low Temperature Science, Hokkaido University, Sapporo.

Table VII-1. Chemical constituents in the surface snow cover of the Mizuho Plateau-West Enderby Land, in ppb (1970 - 1971).

	Date of sampling	Na	K	Mg	Ti	Silicate
S 122	Jan. 18, 1971	53	2.1	13	0.04	8
Mizuho-1	Nov. 17, 1970	14	1.2	2.1	0.01	2
Mizuho-2	Jan. 9, 1971	14	0.88	2.4	0.00	0
Y 135	Nov. 24, 1970	12	1.0	3.0	0.06	12
Y 200	Nov. 27, 1970	14	1.0	2.3	0.03	6
Y 300	Dec. 4, 1971	11	0.56	1.7	0.04	8

again. Three of these samples collected at the same location were kept in a wooden box. All the samples were transported back to Japan by ice-breaker Fuji, then to the laboratory of Muroran Institute of Technology, in a liquid state. A sample in a bottle weighed 6 - 10 kg. The amount of chloride ions dissolved out of the inner wall of the polyethylene bottle would be expected 2 μg for a liquid sample of 30 μg/kg in concentration as regards chloride ions during 1.5 years.

3. Analysis

3.1. Isotope dilution, Ca and K analyses

Calcium and potassium were determined simultaneously in a single aliquot of a sample by the isotope dilution method using ^{44}Ca and ^{41}K enriched tracers. One μg of ^{44}Ca spike in 0.1g of 5% HNO_3 and 0.1 μg of ^{41}K spike in 0.1g of HNO_3 were weighed out in a 30 ml clean teflon beaker. The sample bottle was agitated and 20 g of ice melt were poured directly from it into the teflon beaker and weighed. The mixture was evaporated to 50 μl in a heated steel tank through which filtered high purity nitrogen gas was streaming. A small and strongly acid drop of liquid was transferred to a Ta filament by means of a quartz micropipette. The drop was slowly evaporated to dryness and the filament was inserted into a mass-spectrometer. Potassium was analyzed as K^+, calcium as Ca^+ successively.

3.2. Isotope dilution, Ti analysis

Titanium was determined by the isotope dilution method using a ^{49}Ti enriched tracer. 0.5 μg of ^{49}Ti spike in 0.05 g of 5% HNO_3 was

added to 90 g of the sample. Titanium was analyzed in the mass-spectrometer as TiO^+.

3.3. Atomic absorption, Na, Mg and Ca analyses

Sodium, magnesium and calcium were determined by partially freezing the samples into large amounts of ice and small amounts of concentrated brine and then atomizing this brine directly into the flame of an atomic absorption spectrophotometer. The absorption intensity of the samples was compared with those of standard solutions.

4. Results

Six samples composed of a whole year precipitation showed common chemical properties: an extremely low concentration of chemical constituents similar to the composition of sea salt. The annual precipitation of silicate dusts could be estimated by the use of "Titanium Method" newly developed for this purpose, the amount of them being at the ppb level in weight.

The surface snow cover of this area seems to be homogeneous in chemical properties, while the 20 snow samples collected along the Syowa-South Pole traverse route show some heterogeneity (Murozumi et al., 1972; Kikuchi et al., 1972).

References

Murozumi, M., T. Torii and K. Fujiwara (1972): Sodium, potassium, and magnesium concentrations in polar snows. Report of the Japanese Traverse Syowa-South Pole 1968 - 1969. JARE Sci. Rep., Special Issue, 2, 113 - 114.

Kikuchi, K. and K. Fujiwara (1972): Observation of giant sea-salt particles from Syowa Station to the South Pole. Report of the Japanese Traverse Syowa-South Pole 1968 - 1969. JARE Sci. Rep., Special Issue, 2, 110 - 112.