Elemental Analysis of Yellow Sand by PIXE

II. 4 Elemental Analysis of Yellow Sand by PIXE

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The earth's climate is closely related to the regional distribution and the elemental composition of aerosols (the air borne fine grain particles) in the atmosphere due to their optical properties namely the scatterings or absorptions for the radiation. From the elemental analysis point of view for samples of extremely small amount, the PIXE analysis is a quite effectual method as well known. Thus, the aerosol samples collected as a part of "KOHSA" project organized for the period of April 22 to May 11 in 1982 were analyzed by PIXE with 3-MeV proton beam from the CYRIC Cyclotron.

The samples were collected onto the nuclepore filters of pore size of 0.08 μm in dia. (by NOMURA Micro Science Co., Ltd.) by air pumping at the Nagasaki University campus. The amount of air intake for each sampling was about 1 m^3 in average. The 12 such samples and 1 blank filter for the background observation were irradiated by the 3-MeV 0.1 μA proton beam of about 2 mm in dia. Fig. 1 shows the results of induced X-ray measurements for 8 aerosol samples and the filter. From the figure we know that the nuclepore filter was quite suitable for the PIXE analyses since no serious disturbing element was observed except for a very weak emission line from chromium.

Fig. 2 shows the time variations of the optical thickness for specific elements calculated from the strength of the K_α emission lines. The amounts of ion and silicon increase in the period of 3 to 7 May, 1982, comparing with the amount of sulfur. This obviously indicates the aerosols due to the "KOHSA" event are quite different from the aerosols in normal periods in material composition. The other instruments such an aureole meter or a polar nephelometer for measuring the radiation scattering cross sections of aerosols are not sensitive to determine the material composition of aerosols than the PIXE method. Thus, in future problem, we suggest that the observations of the PIXE spectra of aerosols for various atmospheric conditions, sampling locations and sampling periods should be a tool for revealing more detailed relations between the nature of the aerosols and the earth climate.

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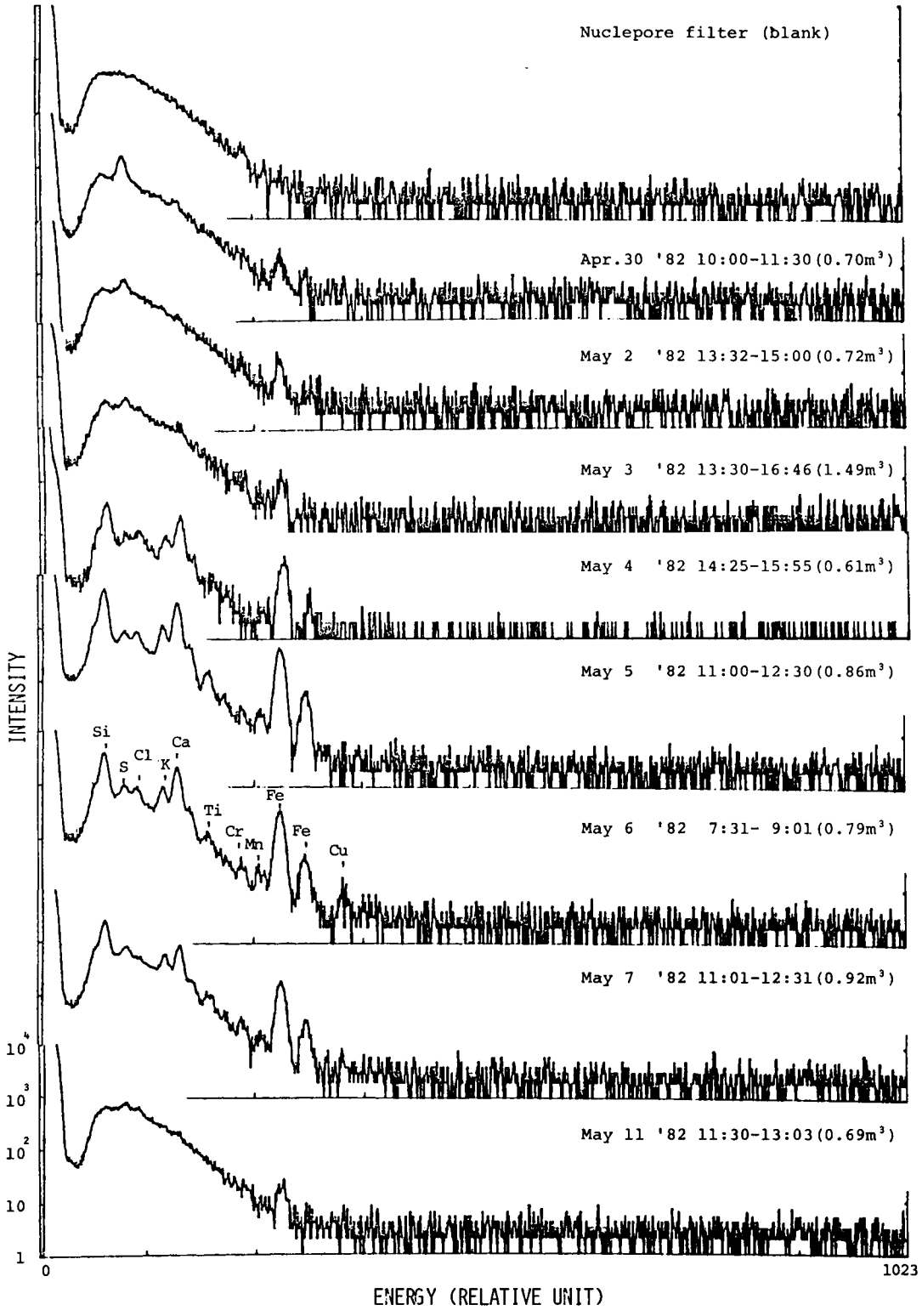

Fig. 1. Induced X-ray spectra for 8 aerosol samples and blank filter. The data and time of sampling and the amount of air intake for each sample is also indicated.

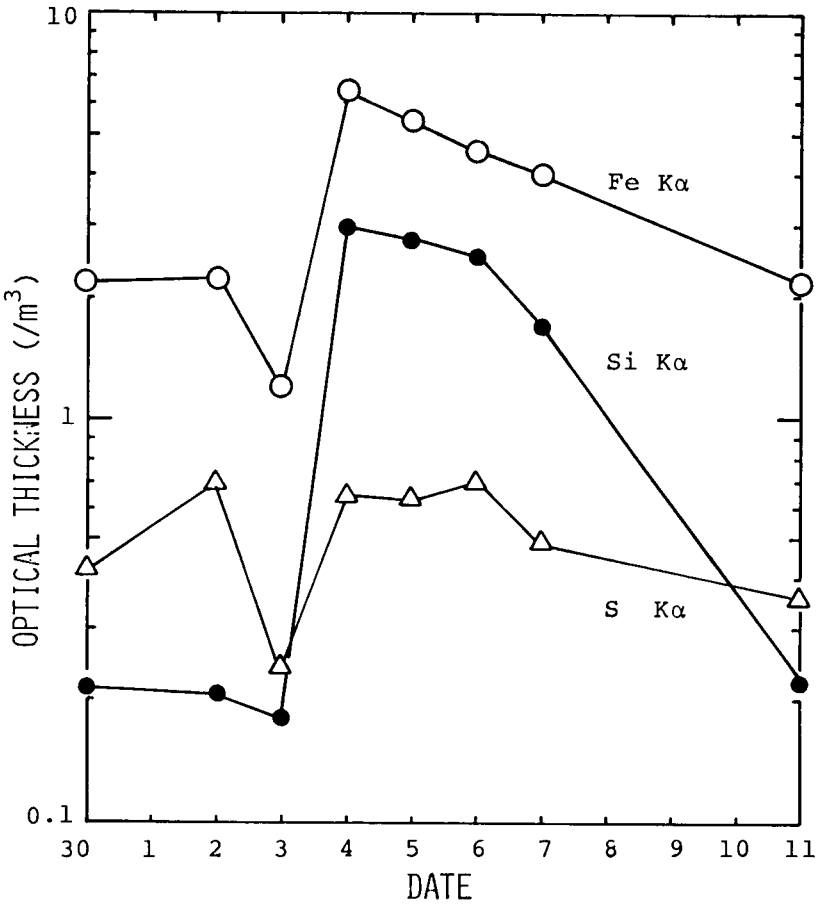

Fig. 2. Calculated optical thickness per unit air mass (1 m^3) for specific elememts (Fe, Si and S) from the strength of the K_α emission lines as a function of the sampling data.