Quantification of Kosa in sediment cores from the five lakes surrounding Mt.Fuji, central Japan by EPMA

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A method of SEM-EDX has been developed for the identification of individual Si-rich particles (quartz) derived from Kosa aerosol. The origins of individual quartz particles in sediment cores from the Five Lakes surrounding Mt.Fuji, central Japan, were clearly identified by differences of the distribution areas of (Na2O+K2O)/SiO2(%), which were determined by SEM-EDX. The Kosa particles were not only successfully discriminated from Japanese plutonic and volcanic rocks, but also could be evaluated fractionally to loess and desert sand. It was found that the present Kosa flux to Japanese island is mainly not loess but desert sand. The variation of the Kosa flux during the last 100 years indicated that the Kosa contribution have gradually decreased.

The chemical composition and the discriminating methods of Asian dust storm particles (Kosa) have been studied by many investigators using bulk analysis, but the information obtained was only for average compositions. Therefore, strict evaluation not only of the contribution of Kosa aerosol but also of the origins of individual particles, is not easy for atmospheric aerosol or core sediment, which consist of complicated multi-component mixtures. The aim of this paperis to establish new method for quantification of Kosa contribution in sediment cores.

A method of scanning electron microscopy-energy dispersive X-ray micro analysis (SEM-EDX) has been developed for the identification of individual Si-rich particles (quartz) derived from Kosa aerosol (Kyotani and Koshimizu, 2001). The particles with size below 10um were analyzed and the elemental composition was directly determined by SEM-EDX using a standardless-based correction program without polishing the particle surface. The relationship between the sum of the contents of alkaline elements and the content of SiO2 in individual Si-rich particles having SiO2 content over 80% was used as an effective indicator for the discrimination of the origin. The distribution of (Na2O+K2O)/SiO2(%) in individual Si-rich particles from real atmospheric aerosol showed a sharp and clear seasonal variation. It was found that the distribution area of (Na2O+K2O)/SiO2(%) was closer to those in the China loess and desert sand in spring time compared to those of the non-Kosa aerosol, the distribution could be successfully used as an effective indicator to identify the Kosa particles and to investigate transportation of the Kosa aerosol.

The method developed was applied to sediment cores from the Five Lakes surrounding Mt.Fuji, central Japan. The origins of individual quartz particles were clearly identified by differences of the distribution areas of (Na2O+K2O)/SiO2(%) and/or (MgO+CaO)/SiO2(%), which were determined by single-particle analysis by SEM-EDX. The Kosa particles were not only successfully discriminated from Japanese plutonic and volcanic rocks by the method, but also could be evaluated fractionally to loess and desert sand because the distribution areas of (Na2O+K2O)/SiO2(%) in them showed a significant difference. It was found that the present Kosa flux to Japanese island is mainly not loess but desert sand. Furthermore, the quantification of quartz derived from Japanese igneous rocks was also achieved. The quantification of Kosa contribution to sediment cores was carried out and the variation of the Kosa flux during the last 100years indicated that the Kosa contribution have gradually decreased. The advantage of the present method is the ability to determine absolutely the Kosa particles in sediment cores. These results suggested that the present method can be used sufficiently for the elucidation of the aridity in the eastern Asia.

Reference

Kyotani,T. and Koshimizu,S.(2001),Bull. Chem. Soc. Jpn.,74(4), in press.